Jan. 18, 1966 J. N. WILLIAMS 3,229,640

VARIABLE CAPACITY RECIPROCATING PUMP

Filed Jan. 27, 1964

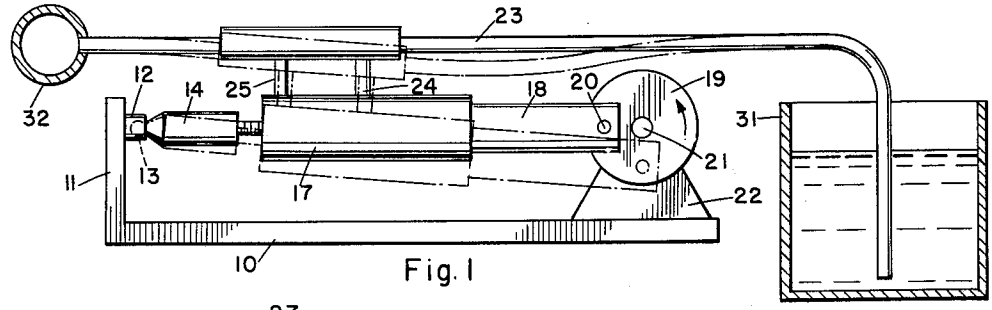


Fig. 1

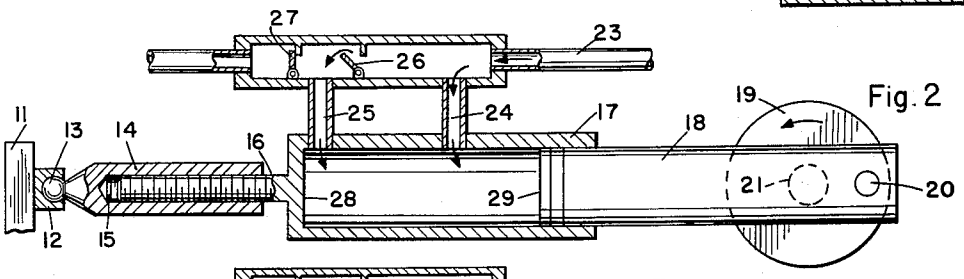


Fig. 2

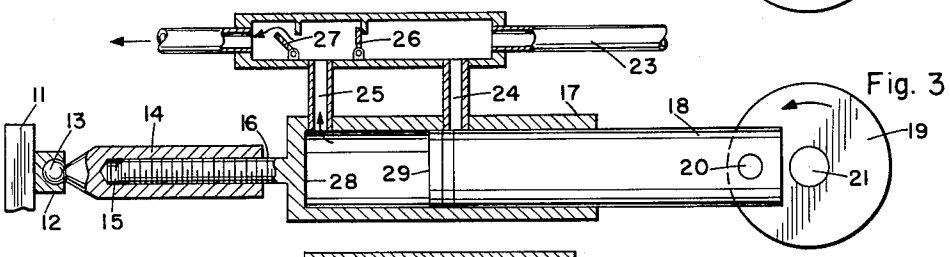


Fig. 3

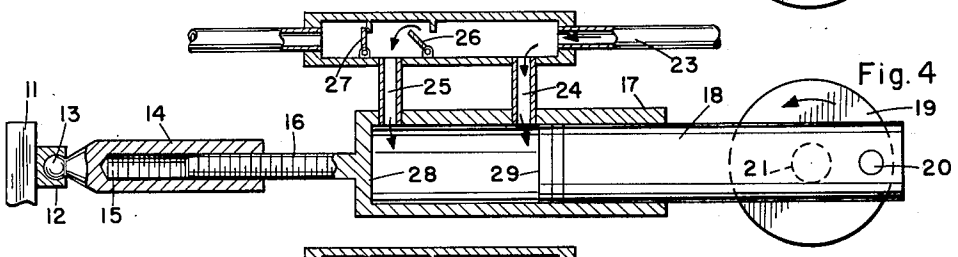


Fig. 4

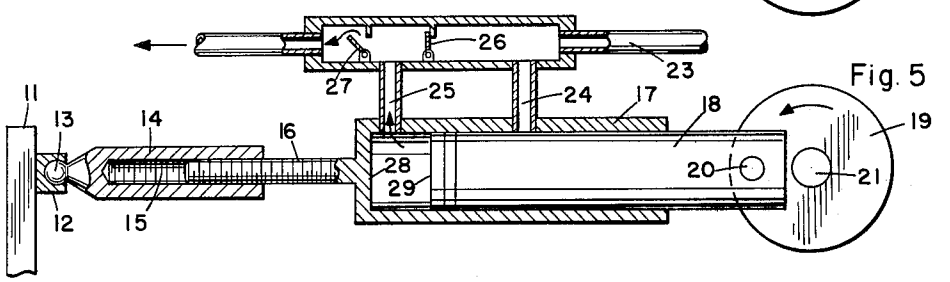


Fig. 5

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VARIABLE CAPACITY RECIPROCATING PUMP

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4 Claims. (Cl. 103—37)

This invention relates generally to pumps and more particularly to a variable-capacity reciprocating pump in which means are provided to adjust the cylinder relative to the piston to vary the volume of fluid discharged on each stroke of the piston.

It is, therefore, the principal object of this invention to provide a variable-capacity reciprocating pump having improved means to vary the effective stroke of the piston.

It is a further object of this invention to provide a variable-capacity reciprocating pump having improved means for varying the effective stroke of the piston while the pump is in operation.

It is a further object of this invention to provide an improved variable-capacity reciprocating pump which utilizes a by-pass port between the cylinder and inlet side of the pump to determine the effective capacity of the pump.

Finally, it is an object to provide a variable-capacity reciprocating pump of the aforementioned character which is simple and convenient to use and which will give generally efficient and durable service.

With these and other objects definitely in view, this invention consists in the novel construction, combination and arrangement of elements and portions, as will be hereinafter fully described in the specification, particularly pointed out in the claims, and illustrated in the drawing which forms a material part of this disclosure and in which:

FIGURE 1 is a side elevation view of the invention and

FIGURES 2, 3, 4 and 5 are longitudinal sectional views of the invention on an enlarged scale with the adjusting mechanism and piston in various operating positions.

Referring now particularly to FIGURE 1 of the drawing, it will be seen that this invention consists of an elongated base member **10** having an upstanding abutment **11** on one end thereof. The base member is shown for purposes of illustration only as being horizontally disposed and it is to be understood that it may be oriented at any desired angle. Fixedly secured to the abutment **11** is a supporting cup **12** in the center of which is located a spherical recess receiving the ball end **13** of adjusting member **14**. An internally threaded recess **15** is provided in the end of adjusting member **14** opposite the ball end **13**. Recess **15** receives an adjusting screw **16** that extends beyond the closed end **28** of cylinder **17**.

A piston **18** having a head **29** is reciprocably mounted in cylinder **17**. Any suitable means may be utilized for this purpose. As here shown piston **18** is connected to eccentric pin **20** on a flywheel or crank disc **19**. The flywheel or crank disc **19** is rotated by shaft **21** mounted on support **22** and driven by any suitable source of power.

A horizontally disposed fluid supply and discharge conduit **23** which may be in the form of a flexible pipe, is mounted above the cylinder **17**. As will be clearly seen in FIGURE 1 this conduit extends from a supply reservoir **31** to a discharge or outlet pipe **32**. Two constantly open ports connect the supply conduit **23** with cylinder **17**. A by-pass port **24** extends between conduit **23** and cylinder **17** intermediate the ends thereof. A combined inlet and outlet port **25** connects the cylinder with the conduit **23** adjacent the head **28** of cylinder **17**. A check valve **26** is positioned in conduit **23** between ports **24** and **25** and is adapted to close upon increase of pressure in cylinder **17**. A check valve **27** is positioned in conduit **23** between

port **25** and discharge pipe **27** and is adapted to open as pressure is built up in cylinder **17**.

In operation, the piston **18** is reciprocated with a fixed length of stroke under control of the flywheel or crank disc **19** and pin **20**. With reference to FIGURE 2, piston **18** is shown at the end of the suction stroke with the cylinder full of the material to be pumped. Valve **27** will be closed while valve **26** will be open. On the pressure stroke material in the cylinder **17** will be returned to the reservoir **31** through by-pass port **24** until the piston has travelled to the left a sufficient distance to cover this port. Further movement of the piston will force the material out port **25**. This material will be under a pressure head sufficient to open valve **27** and close valve **26** thereby forcing material into conduit **23** and outlet pipe **32**.

FIGURE 3 shows the piston at the end of the pressure stroke. It will be readily apparent that the volume of the pump on this stroke is equal to the area of the piston multiplied by the effective stroke, which is the distance between the edge of the port **24** and the end **29** of the piston at the end of the pressure stroke. In this position the pump is operating at minimum capacity.

Turning now to FIGURES 4 and 5 it will be seen that the effective stroke of the piston has been changed by changing the position of the by-pass port **24** with respect to the end of the piston. This is accomplished by rotating the adjusting member **14** relative to the adjusting screw **16** to force the cylinder **17** to the right. At the beginning of the pressure stroke, FIGURE 4, the piston **18** is very close to the by-pass port **24** so that very little material will be returned to the reservoir **31** at the start of the pressure stroke. FIGURE 5 shows the piston at the end of the pressure stroke adjacent the head **28** of cylinder **17**. It will be seen that the effective stroke of the piston, and, therefore the capacity of the pump is much greater when in the position shown in FIGURE 5 than in the position shown in FIGURE 3. The capacity of the pump may be varied between the two positions shown by merely turning the adjusting member **14** the desired amount. This adjustment may be accomplished when the pump is operating as well as when it is idle.

It is to be understood that the improved pump herein described is not limited for use with liquids. It is suitable for use with gases or a slurry formed of a mixture of solids and liquid.

It is understood that minor variation from the form of the invention disclosed herein may be made without departure from the spirit and scope of the invention, and that the specification and drawings are to be considered as merely illustrative rather than limiting.

I claim:

1. A variable-capacity reciprocating pump comprising:
an elongated base member;
a fixed abutment on one end of said base member;
an adjusting member connected to said fixed abutment;
a cylinder having an open and a closed end;
means connecting said adjusting member and cylinder for relative longitudinal movement therebetween;
a piston having a head slidably mounted in said cylinder;
means on the other end of said base member to reciprocate said piston;
a supply and discharge conduit coextensive with said cylinder;
a combined inlet and outlet port adjacent the closed end of the cylinder connecting said cylinder with said conduit;
a by-pass port intermediate said closed and open end of said cylinder connecting said cylinder with said conduit;

a check valve positioned in said conduit on the outlet side of said combined inlet and outlet port; and

a check valve positioned in said conduit between said combined inlet and outlet port and said by-pass port, the capacity of said pump being adjustable by movement of said cylinder relative to said last mentioned means.

2. The combination of claim 1 in which said supply and discharge conduit is flexible.

3. A variable-capacity reciprocating pump comprising;

an elongated base member;

a fixed abutment including a spherical recess on one end of said base member;

an internally threaded adjusting member having a spherical nose located in said spherical recess;

a cylinder having an open and a closed end;

a threaded stud extending from the closed end of said cylinder and cooperating with said threaded recess;

a piston having a head slidably mounted in said cylinder;

means on the other end of said base member to reciprocate said piston;

a supply and discharge conduit coextensive with said cylinder;

a combined inlet and outlet port adjacent the closed end of said cylinder connecting the cylinder with said conduit;

a by-pass port intermediate said closed and open end of said cylinder;

a check valve positioned in said conduit on the outlet side of said combined inlet and outlet port; and

a check valve positioned in said conduit between said combined inlet and outlet port and said by-pass port, the capacity of said pump being adjustable by rotating the adjusting member relative to the stud to change the distance between the closed end of the cylinder and the piston head.

4. The structure of claim 3 in which said supply and discharge conduit is flexible.

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LAURENCE V. EFNER, *Primary Examiner.*