July 18, 1939. H. L. BANCROFT 2,166,111

PUMP

Filed May 9, 1938

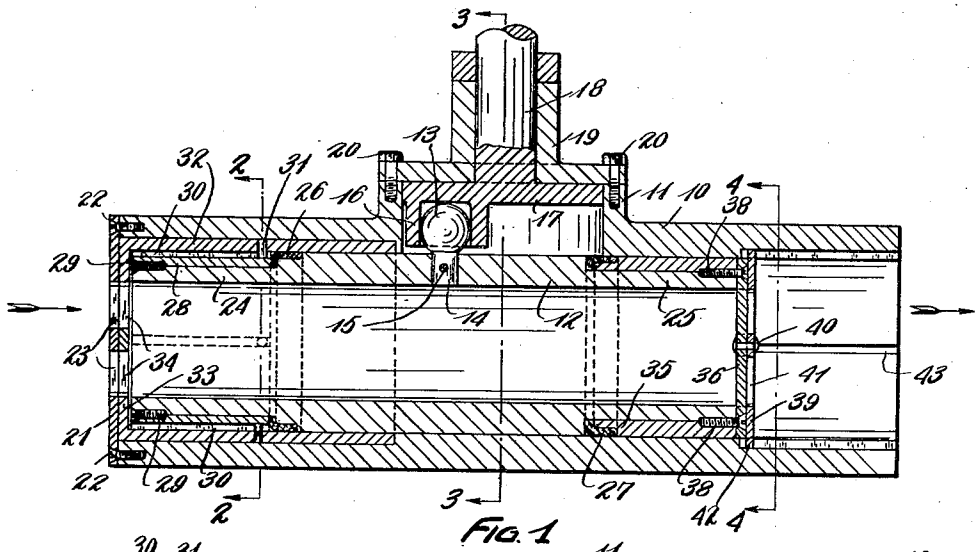


FIG. 1

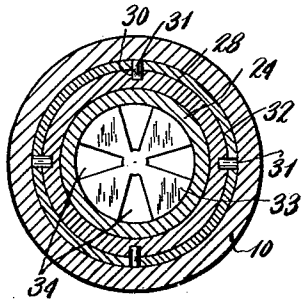


FIG. 2

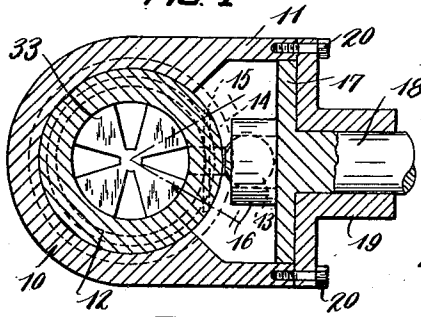


FIG. 3

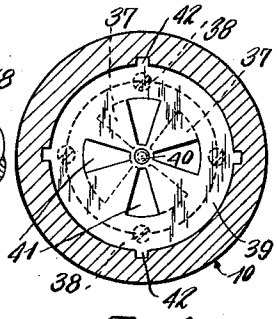


FIG. 4

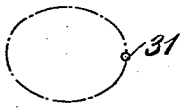


FIG. 5

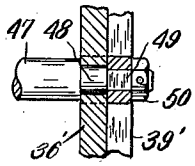


FIG. 7

FIG. 6

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PUMP

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8 Claims. (Cl. 103—157)

This invention relates to improvements in pumps, and has reference particularly to novel valving means for pumps of the class in which the plunger has a compound motion of reciprocation and oscillation.

One of the objects of the invention is the provision of simple and effective means for actuating the valves of a pump of the character stated.

Other objects and features of novelty will appear as I proceed with the description of those embodiments of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawing, in which

Fig. 1 is a longitudinal central sectional view of a pump embodying the invention.

Figs. 2, 3 and 4 are cross sectional views taken substantially on the line 2—2, 3—3 and 4—4 of Fig. 1.

Fig. 5 is a diagram illustrating the path of movement of a point on the plunger of the pump.

Fig. 6 is a view similar to Fig. 1 illustrating another embodiment of the invention.

Fig. 7 is a fragmental view on a larger scale showing the valve mounting at one end of the plunger in the Fig. 6 modification.

Referring now to Figs. 1 to 4 inclusive, the casing of the pump is shown at 10. It is cylindrical in form for the most part, but midway between its ends it is provided with a lateral extension 11, which is also cylindrical in form about an axis at right angles to the axis of cylinder 10. The bore of cylinder 10 receives a hollow plunger 12 which is adapted to have a compound motion of reciprocation and oscillation in the cylinder. This motion may be imparted to the plunger conveniently by mechanism of the character illustrated herein, consisting of a ball 13 formed integral with a post 14 which is set radially into the cylindrical plunger 12 and secured therein by a pin 15. The ball is received in a cylindrical socket 16 formed eccentrically upon a circular plate 17 which rotates within the extension 11, the plate being carried concentrically upon a shaft 18 journaled in a bracket 19 which is mounted at the outer end of extension 11 by means of screws 20 or the like. Shaft 18 may be driven from any suitable power source, preferably an electric motor, not shown.

At the intake end of the pump, cylinder 10 is closed partially by a circular plate 21 that is fastened to the cylinder by screws 22 or the like. In this plate there are a series of segment shaped openings 23 evenly spaced around the center of the plate.

The plunger 12 has reduced end portions 24 and 25, and suitable ring packings 26 and 27 are mounted on the plunger at the junction of these reduced end portions with the central portion of greater thickness. 28 is a sleeve which fits over the reduced portion 24 and serves to clamp the packing 26 in place. This sleeve is secured to the plunger by suitable means, as by a series of screws 29 which serve to hold the sleeve against both rotative and longitudinal movements. In the outer surface of this sleeve there are formed a series of longitudinal grooves 30, which are adapted to slidably receive pins 31 that are carried by a cylindrical skirt 32 formed preferably integral with a valve plate 33, the latter having a series of segment shaped ports therein adapted to register with the openings 23 in the plate 21. Cylinder 10 is counterbored to receive skirt 32 flush with the inner surface of the rest of the cylinder, and its length is such that the valve plate 33 is held in engagement with plate 21. Skirt 32 can turn in the cylinder, and it does turn along with valve plate 33 during the operation of the pump, being driven by the pin and groove connection with plunger 12.

At the delivery end of the pump the reduced portion 25 of the plunger is surrounded by a sleeve 35, the purpose of which is to clamp packing ring 27 in place. This end of the plunger is partially closed by a plate 36 provided with a series of segment shaped openings 37. This plate and the sleeve 35 are both fastened to the plunger by screws 38.

A valve plate 39 is carried by the plunger in engagement with plate 36, these two plates being connected together at the center only by means of a headed pivot 40. Valve plate 39 has formed therein segment shaped valve ports 41 which are adapted to register with the openings 37 in plate 36. Suitable means are provided for preventing rotation of plate 39 as it reciprocates with the plunger. As herein illustrated this means consists of tongues 42 on the plate running in longitudinal grooves 43 cut into the inner surface of the cylinder.

In the operation of the pump the socket 16 revolves in a circle. The axis of the plunger has a straight line movement. The movement of any point of the plunger between its axis and the ball 13 is elliptical, the proportions of the ellipse varying between a straight line and a circle. The ellipse described by the movement of a pin 31 is substantially like that illustrated in Fig. 5. Hence the movements of valve plate 33 are controlled in accordance with the Fig. 5 ellipse. This produces a rapid turning movement of the valve plate

at each end of the plunger movement, which is of course important because the opening and closing movements of the valve should occupy a relatively small part of the cycle. The valve plates 33 and 39 are oppositely set, that is valve 33 is open while valve 39 is closed and vice versa.

As shown in Fig. 1, the suction stroke of the pump is about to begin. As the ball 13 travels through the next 180° of its movement a charge of fluid is drawn into the plunger, which is closed at its right hand end. At the end of this stroke both valves change, the charge is trapped in the pump by the closed valve 33, and part of it is forced out of the plunger through the open valve 39. Since the length of the plunger is greater than the length of its stroke the plunger will of course not be completely emptied on the return stroke.

The modification of Figs. 6 and 7 is very similar in construction to the first described form of the invention. The principal distinction resides in the fact that an additional valve is provided for the plunger and located at the left or intake end thereof. The left end of the plunger is partially closed by a plate 45 provided with segmental openings, this plate being secured to the plunger by screws 29'. A valve plate 46 with segmental ports adapted to register with the openings in plate 45 is mounted within the plunger to have a bearing on the inner wall thereof. This valve plate 46 is held in engagement with plate 45 by an axial rod 47 which extends throughout the length of the plunger and has a reduced part 48 of circular cross section which extends through a circular central opening in plate 36', similar to plate 36 of the first described form of the invention. A valve plate 39', similar to plate 39, has a central square opening which receives a squared part 49 of the rod 47, the plate 39' being held in contact with the plate 36' by a nut 50 threaded onto the threaded extremity of rod 47. Plate 39' has a tongue and groove connection with the cylinder, the same as in the case of plate 39. Accordingly plate 39' is prevented from turning during the reciprocation and oscillation of plate 36', and because of the non-rotatable joint between plate 39' and rod 47 valve plate 46 is also prevented from turning. The valves at the two ends of the plunger work together and in opposition to the valve at the intake end of the cylinder. For a long lift pump this modification of the invention is preferable to that first described because the suction chamber is relatively short, being merely the space between the valve plate 33 and the plunger plate 45, which is substantially the length of the stroke of the plunger. The operation of this form of pump otherwise is the same as that of the first described form.

Having thus described my invention, I claim:

1. In a pump or the like, a cylinder, a plunger mounted in said cylinder, means for imparting a compound reciprocating and oscillating movement to said plunger, valve means for one end of said cylinder fixed against longitudinal movement, and means actuated by the plunger for imparting movement to said valve around the axis of the cylinder.

2. In a pump or the like, a cylinder, a plunger mounted in said cylinder, means for imparting a compound reciprocating and oscillating movement to said plunger, valve means in one end of said cylinder, said valve means having a cylindrical skirt set into the cylinder flush with the inner surface thereof, means preventing movement of the valve means longitudinally of the cylinder, and interconnecting means between said plunger and skirt permitting relative longitudinal movement and preventing relative rotational movement.

3. In a pump or the like, a cylinder, a plunger mounted in said cylinder, means for imparting a compound reciprocating and oscillating movement to said plunger, valve means carried by the cylinder at one end thereof, said valve means comprising a cylindrical skirt set into the cylinder flush with the inner surface thereof and held against longitudinal movement, and a pin and groove connection between said skirt and plunger, the groove running parallel to the axis of the cylinder, whereby the oscillating motion only of the plunger is communicated to said valve means.

4. In a pump or the like, a cylinder, a plunger mounted in said cylinder, means for imparting a compound reciprocating and oscillating movement to said plunger, a disk valve at one end of said plunger held against relative movement axially of the plunger, and tongue and groove means between the valve and cylinder for preventing oscillating motion of the valve disk.

5. In a pump or the like, a cylinder, a hollow plunger mounted in said cylinder, means for imparting a compound reciprocating and oscillating motion to said plunger, a disk valve at each end of said plunger, means connecting said valves together and preventing relative rotation thereof, and means at one end of the plunger for preventing oscillating motion of said valves relative to said cylinder.

6. In a pump or the like, a cylinder, a hollow plunger mounted in said cylinder, means for imparting compound reciprocating and oscillating motion to said plunger, a disk valve at each end of said plunger, an axial bar rigidly connecting said valves together so as to prevent relative rotation and relative axial movement, said cylinder having a longitudinal groove therein and one of said valves having a tongue running in said groove, whereby both of said disk valves are held against oscillating motion.

7. In a pump or the like, a cylinder, a plunger mounted therein having a flow passage therethrough, means for imparting a compound reciprocating and oscillating motion to said plunger, a disk valve carried by the cylinder, a disk valve carried by the plunger, means actuated by the plunger to impart an oscillating motion to said cylinder valve, and means associated with the cylinder for holding said plunger valve against oscillation.

8. In a pump or the like, a cylinder, a plunger mounted therein having a flow passage therethrough, means for imparting a compound reciprocating and oscillating motion to said plunger, a disk valve carried by the cylinder, a disk valve carried by the plunger, a tongue and groove connection between the plunger and said cylinder valve for oscillating the latter and a tongue and groove connection between the cylinder and said plunger valve for holding the latter against oscillation.

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