

973,353.

Patented Oct. 18, 1910.

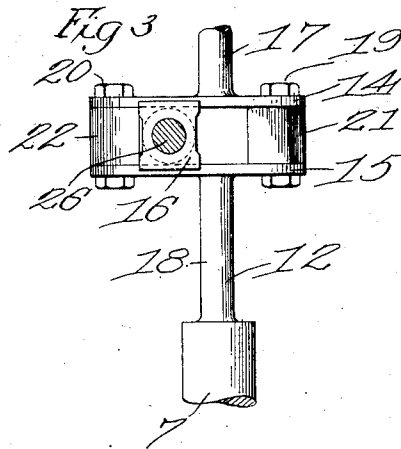
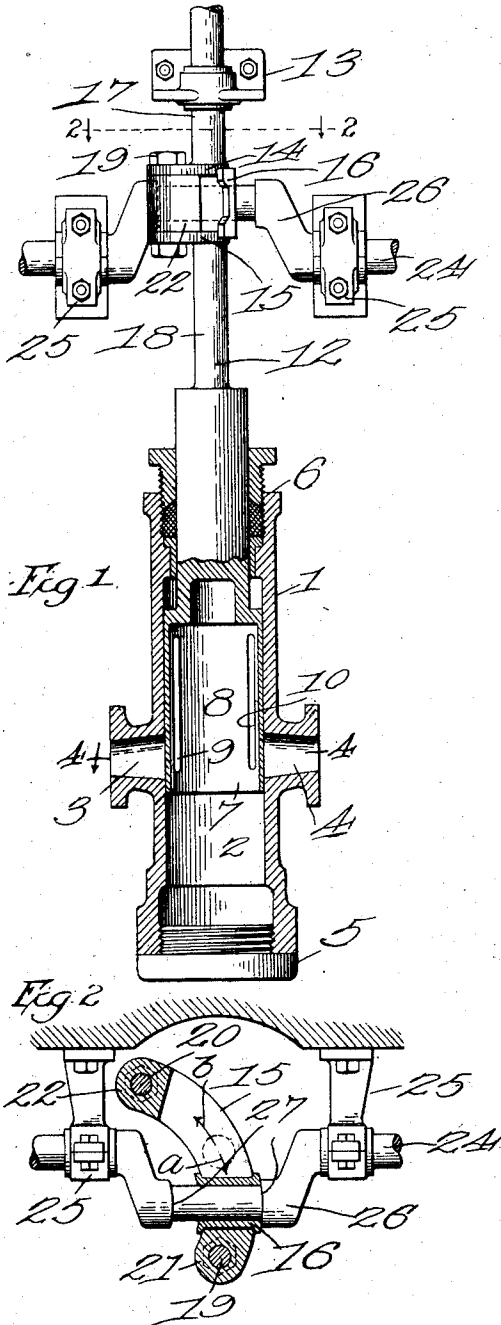
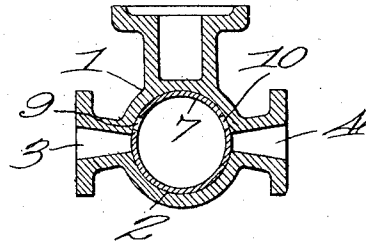


Fig. 4.



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UNITED STATES PATENT OFFICE.

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VALVELESS PUMP.

973,353.

Specification of Letters Patent.

Patented Oct. 18, 1910.

Application filed February 26, 1910. Serial No. 546,153.

To all whom it may concern:

Be it known that I, ARIYA INOKUTY, a subject of the Emperor of Japan, residing in the Province of Tokyo, Japan, have invented a certain new and useful Improvement in Valveless Pumps, of which the following is a specification.

This invention relates to improvements in valveless pumps of that class including a casing providing a cylinder, and a plunger-piston operating in said cylinder, the cylinder and plunger-piston having inlet and discharge ports adapted to be brought into and out of registry.

One of the principal objects of the invention is to provide means for oscillating the plunger-piston during its reciprocating movement to bring its ports into and out of registry with the cylinder ports thereby wholly avoiding the use of valves.

In one embodiment of the invention where the plunger-piston is reciprocated by a crank, in which case the speed of reciprocation of the piston from one limit of its movement to the other will vary, the invention provides for a full open registry of the ports at the maximum speed of the piston with a gradual closing movement during the decreased speed whereby undue frictional resistance of the passing liquid is substantially wholly avoided.

The invention has other objects and novel features which will be more fully described in connection with the accompanying drawing and will be more particularly pointed out and ascertained in and by the appended claims:

In the drawing:—Figure 1 is a longitudinal vertical sectional view of a valveless pump embodying the main features of my invention. Fig. 2 is a sectional view on line 2—2 of Fig. 1. Fig. 3 is a horizontal section on line 3—3 of Fig. 1. Fig. 4 is a sectional view on line 4—4 of Fig. 1.

Like numerals of reference designate similar parts throughout the different figures of the drawing.

As illustrated, the pump comprises a casing 1 providing a cylinder 2, having an inlet port 3, and a discharge port 4. The lower end of the cylinder is closed by a plug 5 and the upper end is provided with a suitable stuffing box or packing gland 6. It will be understood however that the invention is not limited to this specific form of pump. A plunger-piston 7 is disposed in said cylinder

and is preferably hollow at its lower end, as indicated at 8. The piston 7 is provided with an inlet port 9, adapted to register with port 3, and also a discharge port 10, adapted to register with port 4. The upper end 11 of the plunger-piston projects through the gland 6 and is provided with a rod 12 which projects through a suitable bearing 13.

An arcuate member is connected with the plunger-piston, and as shown, said member comprises segmental elements 14 and 15, between which is slidably mounted a cross-head 16. Conveniently the rod 12 is divided into sections 17 and 18 and the segmental element 15 is formed integral with the section 18 while the element 14 is formed integral with the section 17. The segmental elements 14 and 15 are conveniently connected by bolts 19 and 20 and are held in proper spaced relation by spacing blocks 21 and 22.

It will be seen from the foregoing that the arcuate member is connected with the piston in such a manner that the longitudinal center or neutral points of the arcuate member coincides with the longitudinal axis of the plunger piston and that the arcuate member is disposed in a plane at right angle to the longitudinal axis of the piston.

In the construction shown, the means for reciprocating the piston is in the form of a crank shaft 24, mounted in suitable bearings 25, and provided with a crank 26. The crank 26 is disposed in a plane at right angles to the longitudinal axis of the plunger piston and projects through and between the elements 14 and 15 of the arcuate members, with the longitudinal axis of the shaft portion intersecting the axis of the plunger-piston. The cross head 16 is bored to receive the crank 26 and is provided with flanges 27 to allow for the requisite amount of sliding movement of the cross head 16 with respect to the crank 26 if such movement is necessary.

When the crank 26 is in the position shown in Fig. 1, with the cross head 16 in a neutral position with respect to the arcuate member, downward movement of the crank 26 in a clockwise direction will impart similar movement to the plunger-piston and will advance the cross head in the direction of the arrow *a* (Fig. 4.) thereby shifting the plunger piston so as to gradually bring the port 9 into register with the ports 3. It

will be understood however that when the plunger piston is in the uppermost or lowermost position neither ports 9 nor 10 will be in registry with corresponding cylinder ports. Upon beginning of downward movement of the crank, the port 9 will be gradually shifted into a registering position with the port 3, and when the plunger piston is in an intermediate position the port 9 will be in full registry with the port 3, and the cross head 16 will be at the limit of its movement in the reverse direction to that shown in Fig. 4. The remaining travel of the plunger-piston downwardly will be accompanied by the rearward movement of the cross heads 16 in the direction of arrow *b* gradually putting port 9 out of registry with port 3. The downward movement of the plunger-piston will force the liquid out through port 9 and port 3, owing to the fact that port 10 is out of register with port 4. It will be noted that the ports 9 and 10 are elongated so as to maintain a registered relation with their corresponding ports when the plunger-piston is reciprocated.

With the plunger piston in its lowermost position, and the crank in a similar position, the cross head will occupy a neutral position in the arcuate member and upward movement of the crank will cause the cross head to travel in the direction of the arrow *b* to the extreme position shown in Fig. 4. Upon upward movement of the crank the port 9 will be shifted farther out of registry with the port 3 and the port 10 will be gradually shifted into registry with the port 4 and such upward movement of the plunger-piston will draw the liquid into port 4 and into the cylinder 2. Full registry of the port 10 with the port 4 will be effected when the plunger-piston has reached its intermediate position and when the plunger has reached the position shown in Fig. 1

the port 10 will be shifted out of registry with the port 4.

I claim:—

1. In a valveless pump, the combination with a cylinder and a plunger-piston, said cylinder and piston being provided with inlet discharge ports, an arcuate member connected with said plunger-piston, a crank for operating said plunger-piston, and means slidably connecting said crank with said arcuate member.

2. In a valveless pump, the combination with a cylinder and plunger-piston provided with inlet and discharge ports, of an arcuate member connected with said plunger-piston and disposed at right angles with respect to the longitudinal axis thereof, and a crank for reciprocating said plunger-piston and connected with said arcuate member to oscillate said plunger-piston.

3. In a valveless pump, the combination with a cylinder and a piston provided with inlet and discharge ports, an arcuate member connected with said piston and disposed at right angles with respect to the longitudinal axis thereof, a crank disposed at right angles to the longitudinal axis of said piston, and means operatively connecting said arcuate member with said crank for reciprocating and oscillating said piston.

4. In a valveless pump, the combination with a cylinder and a plunger-piston each provided with inlet and discharge ports, of an arcuate member rigidly connected with said piston, a cross head slidably supported on said arcuate member, and a crank connected with said cross head.

In testimony whereof I affix my signature in presence of two witnesses.

ARIYA INOKUTY.

Witnesses:

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