J. ASTROM.

DIFFERENTIAL PUMP.

APPLICATION FILED MAR. 17, 1913.

1,128,089. Patented Feb. 9, 1915.

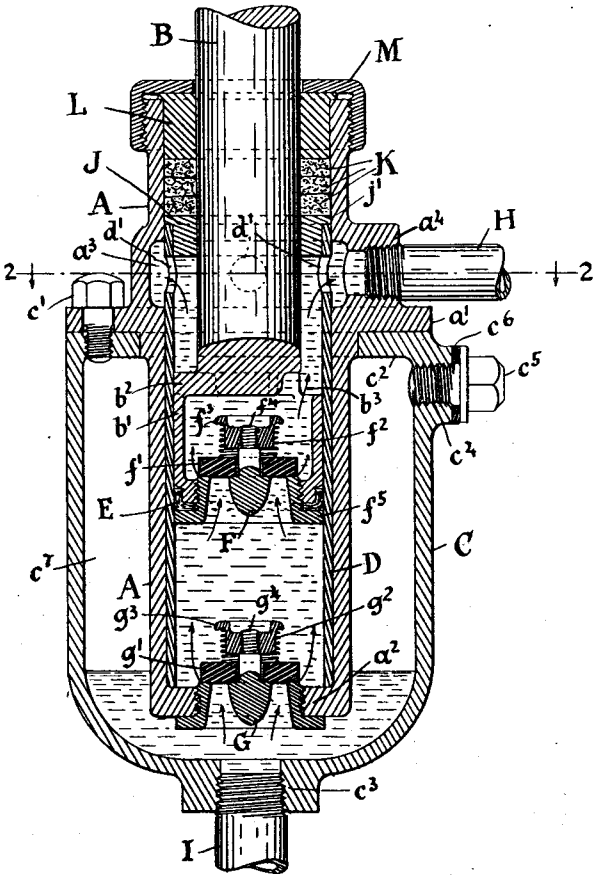

Fig. 1

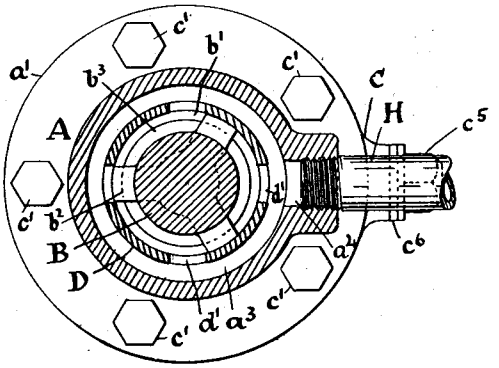

Fig. 2

Witnesses

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DIFFERENTIAL PUMP.

1,128,089. Specification of Letters Patent. Patented Feb. 9, 1915.

Application filed March 17, 1913. Serial No. 754,680.

To all whom it may concern:

Be it known that I, JOHN ASTROM, of Fort Wayne, Indiana, have invented a Differential Pump, of which the following is a specification.

The present invention relates to pumps, more particularly pumps of that class which are only single action as regards the intake but double action as regards the discharge, in other words, reciprocating pumps which discharge water at each stroke but only take it in at every other stroke. Such pumps are commonly called differential pumps.

The object of my invention is to improve the design of this class of pumps, more particularly for small pumps of this class, by making them simple and easy to construct and giving them a high efficiency.

I further aim to provide means for equalizing the flow of the intake-water into the pump, thereby reducing sudden variations in velocity superinduced by the fluctuation in the intake.

My invention consists in the constructions and combinations hereinafter more particularly described and set forth in my claims.

For the better understanding of my invention I have illustrated the same in its most improved form in the accompanying drawings, wherein—

Figure 1 is a longitudinal section of the complete pump, and Fig. 2 a transverse section thereof on the plane 2.

The piston-rod and pipes are shown in part elevation in Fig. 1 and the discharge-pipe in Fig. 2.

The reference letters refer each to the same part in each figure of the drawings.

The pump comprises a generally cylindrical barrel or casing A, preferably made in a single casting; a piston B reciprocating in said barrel and carrying a hollow head b' on its lower end, preferably formed integral therewith; a cup-shaped vessel C into the upper end of which the barrel A descends and to which it is secured in an air-tight manner by means of cap-screws c' passing through flanges a', c^2 respectively on the barrel and vessel; and other elements to be described presently. Between the barrel A and the piston-head b' is inserted a cylindrical liner D which fits the barrel snugly so as to remain in place therein. The piston-head b' has a water-tight fit with this liner, which may be packed, if desired, by means of a cup-leather E held in place between the bottom end of the piston-head and the flange f^5 of the valve F which screws thereinto as shown. The piston-head b' is a substantially cylindrical shell connected to the piston B by radial spokes b^2, of which there may be any number (three are shown in the drawing), thus leaving ports b^3 between them through which the water passes in going to discharge which is on the upper side of the piston-head.

In the lower end of the barrel A is fitted the intake-valve G, which is screwed into the bottom-flange a^2 thereof as shown. Both the intake- and discharge-valves open upward and may be of any preferred type adapted to the purpose, those shown being ordinary pump-valves having rising and falling closure-disks f' and g' held in place by springs f^2 and g^2 which rest against heads f^3 and g^3 screwed on to the central posts f^4 and g^4 of the valves.

Near its upper end the liner D is formed with a plurality of apertures or ports d', which open into an annular chamber or recess a^3, formed on the inside of the barrel A, and herein termed the discharge-chamber. On one side of this chamber is an opening a^4, into which screws the discharge-pipe H, into which pipe the water is delivered.

The intake-pipe I is screwed into the lower end of the cup-shaped vessel C which has a reinforced threaded aperture c^3 for that purpose. At one side of the vessel C is placed, where the pump is to be used on an intake of less than atmospheric pressure, a threaded aperture c^4 which is closed by a screw-plug c^5, under which may be a sealing-gasket c^6. This plug c^5 is termed the priming-plug for reasons which will presently appear. The upper end of the liner D is closed by a bushing J which has a flange j' extending over said upper end, the bushing itself fitting inside the liner. Over this is placed packing K, which is pressed into place by the gland L fitting into the upper end of the barrel A and pressed down by the gland-nut M.

It will be readily seen that the reciprocation of the piston B causes the water to pass upwardly through the valve F at each downstroke of the piston, while the valve G remains closed, and at the same time to deliver a part of said water, corresponding to the

volume of the increased portion of the piston B within the cylinder, into the discharge-chamber a^3 and thence through the discharge-pipe H; while on the up-stroke the valve F remains closed, discharging an additional volume of water into the chamber a^3 and pipe H, and at the same time drawing water inwardly through the valve G from the vessel C. The volume of water delivered on the up and down-strokes will be equal or unequal according as the area of the piston is equal or unequal to half the area of the piston-head, as is true of differential pumps in general.

The action of the vessel C is to equalize the flow of the intake by providing an air-cushion or air-chamber c^7. Where the flow of the water is under pressure it will, of course, flow into the chamber C above the lower end of the barrel A until it has compressed the air in the chamber c^7 to a volume corresponding with the intake-pressure, if the pump is at rest, and the increased draft of water into the pump on the up-stroke of the piston will draw on this extra supply of water and not force it to flow at a high speed through the pipe, thereby avoiding unnecessary friction-loss of power which would occur in a small pipe. Where the pump is to be used for suction, this will also be true, as the pump will first draw from the chamber c^7 enough air to effectively seal the lower end of the barrel A with water, consequently the pump is to a certain extent, self priming; but it may also be specially primed by removing the plug c^5 and after partially filling the chamber c^7 with water, replacing said plug so as to seal the chamber. The air in the chamber c^7 will then work under a vacuum corresponding with that of the suction.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination of an upright pump-barrel provided with a bore of uniform size from end to end and having in its upper portion an annular recess around the bore thereof and a discharge passage leading from said recess, a cylindrical liner fitting in the bore of said barrel and extending above said recess so as to cover the latter and having one or more ports or apertures formed therein to pass the water therethrough, an upwardly discharging intake-valve closing the lower end of said barrel, a piston reciprocating coaxially in said barrel and smaller than the bore of said liner and carrying a hollow head having the same diameter as the bore of said liner, an upwardly discharging valve mounted in said head, a stuffing-box closing the upper end of said barrel, and a cup-shaped vessel into which the lower end of said barrel depends; said vessel being connected in an air-tight manner to said barrel and having a water-intake passage-way at its lower end and an air-aperture at its upper end, said air-aperture being provided with an air-tight closure.

2. In a differential pump, the combination of a single-piece barrel having a straight cylindrical bore of uniform diameter throughout extending from end to end except for an inturned flange at the lower end, and having at an intermediate point near the top an annular recess provided with an outlet; in combination with a straight cylindrical liner fitted neatly in said bore, and having ports opposite said recess forming in conjunction therewith an annular receiving-chamber, the lower end of said liner resting against said flange; an inwardly opening valve fitting within said flange and closing the bottom of said barrel; a piston carrying a hollow head and containing a valve and operating within said liner, a closure-block bored to receive said piston and resting upon the upper end of said liner, and a stuffing box disposed within the upper end of said barrel and resting upon said closure-block.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

JOHN ASTROM.

Witnesses:
C. W. KUHNE,
SOPHIA HEINE.