Feb. 22, 1927. 1,618,337

F. D. HOFFMAN

PUMP

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Fig. 1.

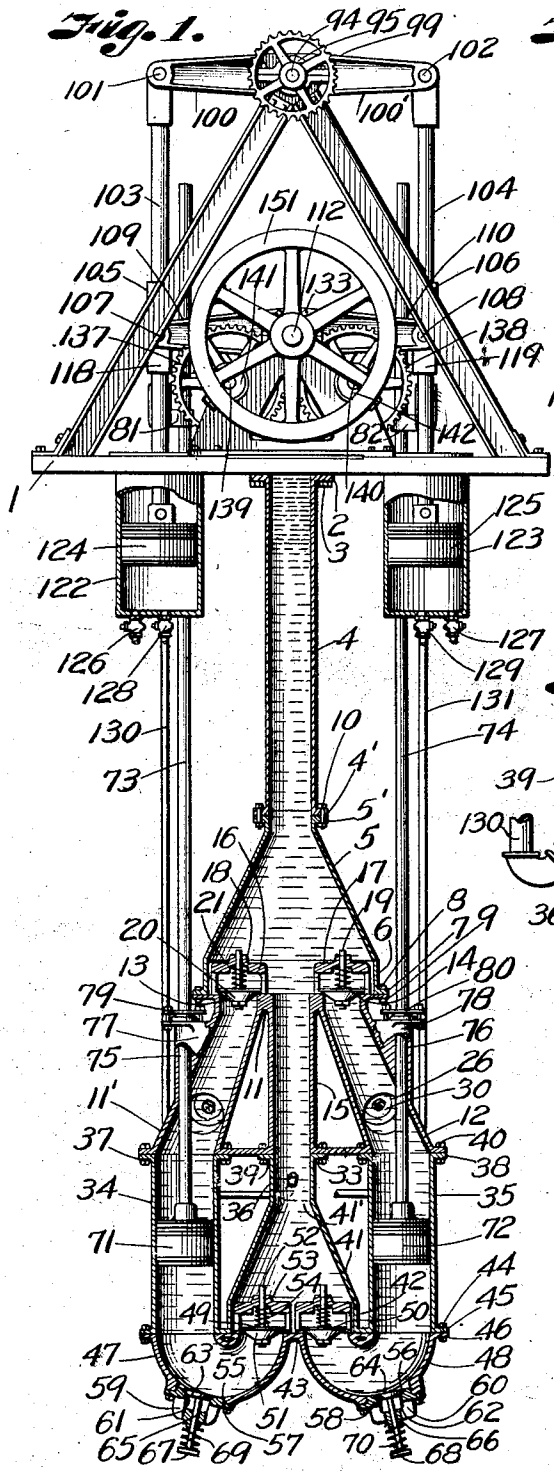


Fig. 2.

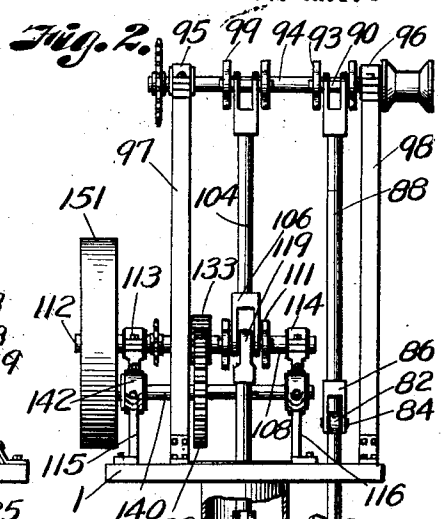
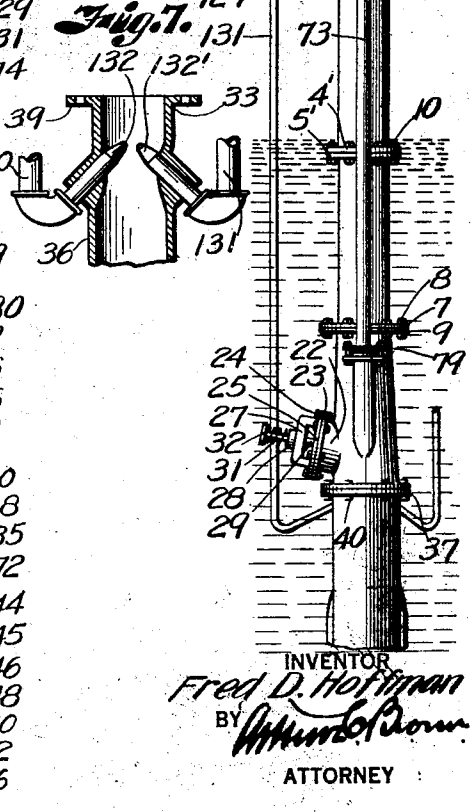


Fig. 7.



INVENTOR
Fred D. Hoffman
BY
ATTORNEY

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F. D. HOFFMAN

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Fig. 3.

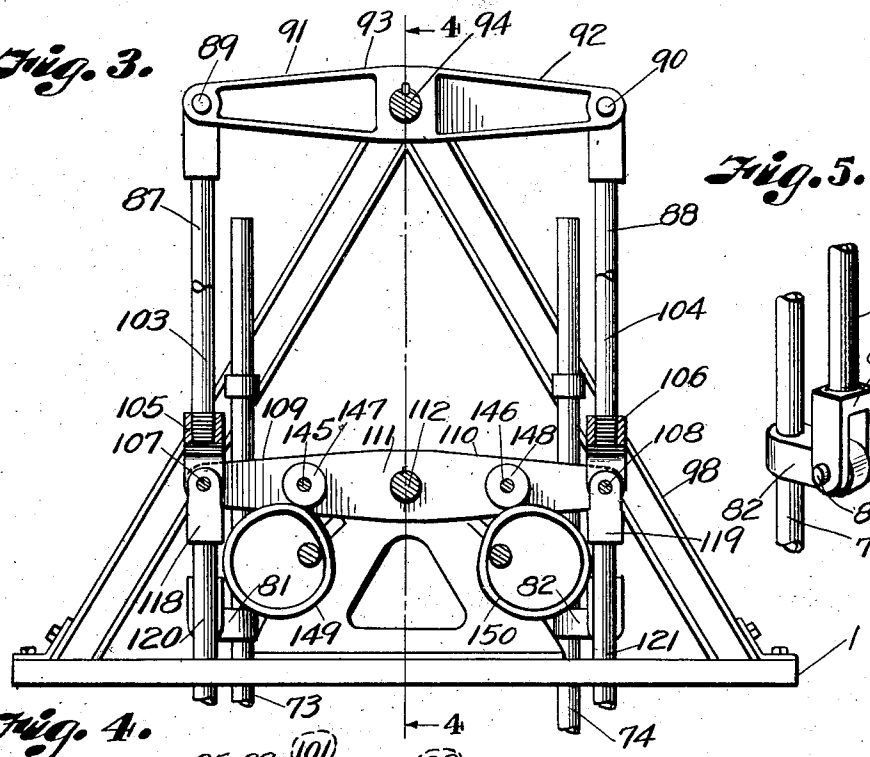


Fig. 5.

Fig. 4.

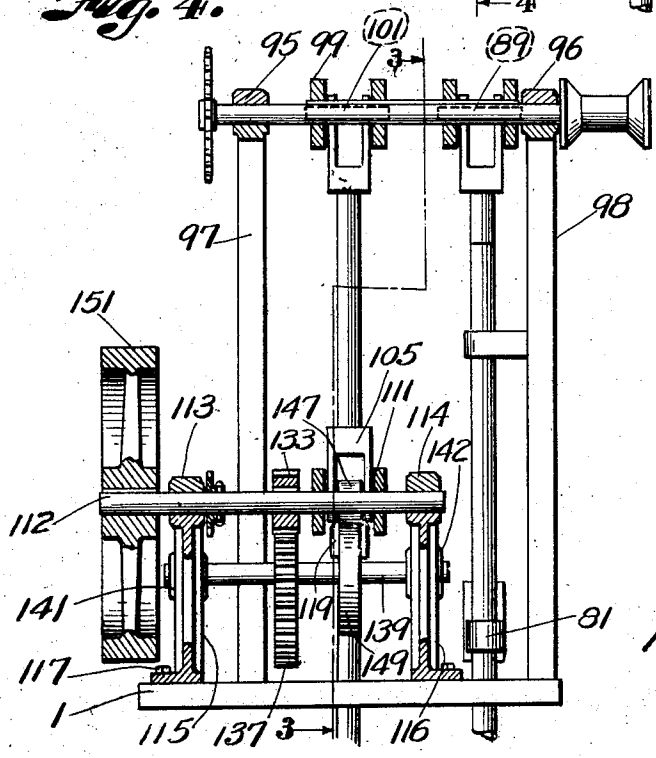
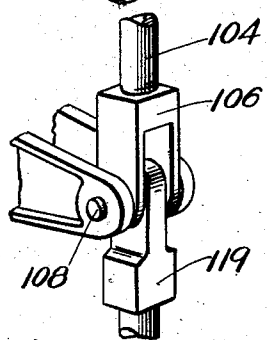


Fig. 6.



INVENTOR

Fred D. Hoffman.

BY

Arthur C. Dorn

ATTORNEY

Patented Feb. 22, 1927. 1,618,337

UNITED STATES PATENT OFFICE.

FRED D. HOFFMAN, OF KANSAS CITY, MISSOURI.

PUMP.

Application filed December 7, 1925. Serial No. 73,710.

My invention relates to pumps and more particularly to one adapted for delivering water from a shallow well, ditch or other body for irrigation purposes or for any purpose and in any location wherein a large volume of water is to be delivered in a continuous stream by a short lift, the principal object of the invention being to effect the pumping action with a minimum expenditure of mechanical power.

In accomplishing this and other objects of the invention I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings wherein:

Fig. 1 is a side elevation of a pump embodying my improvements, parts being broken away and in section for better illustration.

Fig. 2 is a front view of the pump, the visible air pump cylinder being broken away as in Fig. 1.

Fig. 3 is a vertical section of a part of the pump head on the line 4—4 of Fig. 4, particularly illustrating the cams for operating the walking beams.

Fig. 4 is a vertical section on the line 4—4, Fig. 3.

Fig. 5 is a detail perspective view of the water pump rod connection.

Fig. 6 is a detail perspective view of the double rod connection with the main walking beam.

Fig. 7 is a detail sectional view of a portion of the pump barrel, illustrating the injector nozzles.

Referring more in detail to the drawings:

1 designates the platform of a pump head, located over the body of water in which the pump is adapted to operate and from which is suspended, by a flange 2 and bolts 3 or the like, a pipe 4, through which water is delivered from the pump to the surface, the upper portion of the pipe being omitted, as it may lead through the pump head in any suitable manner and to any desired location.

The pipe 4 extends to near the level of the water in the well, and suspended from its lower end is an inverted, conical-shaped hood 5 having a ring-shaped lower end 6 provided with an outstanding flange 7, the upper end of the cone and the lower end of the pipe 4 having outstanding flanges 4′ and 5′ connected by bolts 10 to firmly attach the parts together, a gasket (not shown) being preferably interposed between the flanges to form a water tight joint, the narrow outlet at the top of the hood forming a Venturi throat in which the flow of water is restricted in its travel to the pipe 4. Suspended from the base of the hood 5, by bolts 8 which extend through the hood flange 7 and a flange 9 at the top thereof, is a spider 11, comprising downwardly diverging, upwardly constricted tubular legs 11′ and 12 having ports 13 and 14 opening into the base of the hood 5, and an intermediate tubular conduit 15 opening to the hood 5 between the ports 13 and 14 of the legs 11′ and 12. Above the ports 13 and 14 are spiders 16 and 17 each comprising a guide 18 for a valve stem 19 carrying a valve 20 adapted to seat over and close the port 13 or 14 and normally, yieldingly retained in its seat to close communication between the tubular leg and the interior of the hood by a spring 21 which bears against the guide 18 and against the top of the valve to normally, yieldingly retain the valve closed.

On each of the legs 11′—12 is an elbow 22 having a flange 23 at its outer end. Attached to the flange 23 by bolts 24 is a plate 25 having a central port 26. On the outer face of the plate 25 is a spider 27 carrying a central guide 28 for a valve stem 29 which extends through the port 26 and carries a valve 30 which seats outwardly against the port 26 and is normally, yieldingly held in closed position by a spring 31 which bears against the guide 28 and against a button 32 on the outer end of the stem, the valve being inwardly opening as described in order to provide intake for liquid from the well under the conditions hereinafter described.

Suspended from the spider 11 is a lower spider 33 comprising barrels 34 and 35 which communicate with the tubular legs 11′ and 12 and a neck 36 which communicates with the hollow standard 15, the spider 33 having flanges 37, 38 and 39 surrounding the barrels and the standard respectively, and whereby the lower spider is secured to the upper one by means of bolts 40; suitable gaskets or packing being interposed between the upper and lower parts to seal the line of communication between the barrels and the upper spider legs and between the upper and lower members of the hollow standards. Slightly below its upper end the standard 36 is broadened out into an inverted cone-shaped hood 41 forming a Venturi

throat 41′ and at its lower end is provided with an annular ring 42. Suspended from the lower spider is a cap member 43 connected with the spider 33 by bolts 44 which extend through flange 45 on the spider and flanges 46 on the cap member; suitable packing or gaskets being interposed between the members to seal the joint.

The cap member 43 comprises separate necks 47 and 48, the channel of the first communicating with the chamber of the barrel 34 and having a port 49 opening to the interior of the hood 41, the channel of the neck 48 communicating with the chamber of the barrel 35 and having a port 50 also communicating with the interior of the hood 41. Each of the ports 49 and 50 is normally closed by an outwardly opening valve 51 having a stem 52 guided in a spider 53 mounted on the rim of the neck 47 or 48 and yieldingly held to its seat by a spring 54 which bears against the top of the valve and against the bottom of the spider 53.

In the bottom of each of the necks 47 and 48 is an opening 55 or 56 covered by a plate 57 or 58, preferably comprising the base of a valve spider 59 or 60.

In the plates 57 and 58 are ports 61, 62 normally closed by valves 63 and 64 on stems 65, 66, which extend through the guides on the ends of the spider, carrying buttons 67, 68 on their outer ends. Surrounding the stems 65, 66 and interposd between the buttons 67, 68 are the springs 69 and 70 to yieldingly retain the valves closed.

Located in the respective barrels 34 and 35 are pistons 71 and 72, having rods 73 and 74 extending upwardly through openings 75 and 76 in bosses 77 and 78 on the spider legs 11′ and 12 and through packing glands 79 and 80 on the tops of the bosses. The rods 73 and 74 extend up through the platform 1 of the pump head and are, near their upper ends, provided with lugs 81 and 82, which are pivotally connected through pins 83 and 84 with the yokes 85 and 86 on links 87 and 88 having heads at their upper ends, pivotally mounted on pins 89 and 90 on the arms 91 and 92 of a double walking beam 93, which is keyed on a shaft 94 journaled in bearings 95 and 96 at the apexes of the inverted V-shaped standards 97 and 98 on the platform 1. Also keyed on the shaft 94 preferably by the same spline that serves the walking beam 93 is another double walking beam 99, the opposite arms 100 and 100′ of which carry pins 101 and 102 on which are pivotally mounted the links 103 and 104. The lower ends of the links 103 and 104 carry yokes 105 and 106 which are pivotally connected, by pins 107 and 108, with the ends of the arms 109 and 110 of a third double walking beam 111, axially mounted on a shaft 112 which is journaled in bearings 113 and 114 on standards 115 and 116 secured to the platform 1 by bolts 117. Also pivotally mounted on the pins 107 and 108 on the ends of the arms of the walking beam 111 are heads 118 and 119 of rods 120 and 121, which extend down through the platform 1 into air pump cylinders 122 and 123 that are suitably suspended beneath the platform; the ends of the rods 120 and 121 that are located within the cylinder being connected with pistons 124 and 125 so that when the walking beams are in operation the pistons will be reciprocated oppositely in their respective cylinders, drawing air into the cylinders through the automatic valves 126 and 127 and exhausting air from the cylinders through the valves 128 and 129; all of the valves being located in the bottoms of the cylinders. The valves 128 and 129 are connected with pipes 130 and 131 leading respectively to the nozzles 132 and 132′, (Fig. 7), located within the hollow standard 15 and directed upwardly therein so that air discharged through the pipes from the air pumps will jet upwardly within the standard and tend to draw liquid from the hood 41 through the Venturi throat and force it upwardly through the standard into the hood 5.

While any suitable means may be employed for operating the walking beam I prefer that shown in the drawings, consisting of a pinion 133 fixed on the shaft 112 and meshing with gear wheels 137 and 138 on separate shafts 139 and 140 journaled in bearings 141 and 142, on the standards 115 and 116, the gear wheels being located on opposite sides of the pinion and consequently rotating in the same direction when the pinion is active.

Mounted between the arms of the double walking beam 111 at opposite sides of the shaft 112 are pins 145 and 146, carrying rollers 147, 148 engaged by similar cams 149 and 150 arranged oppositely and fixed on shafts 139 and 140 which carry the gear wheels 137 and 138.

The shaft 112 is operable from a band wheel 151 from any suitable source of power.

Assuming the parts to be constructed and assembled as described, with the pump located in a well or other body of liquid, the operation is as follows:

Rotation of the shaft causes the gear wheels 137 and 138 to rotate in the same direction so that the cams 149 and 150 acting on the opposite ends of the walking beam 111, rock the beam and reciprocate the links 103 and 104 in opposite directions, rocking the walking beam 99 to oscillate the shaft 94 and rock the walking beam 93 so that the pump rods 73 and 74 are reciprocated oppositely to simultaneously reciprocate the pistons 71 and 72 in the respective pump barrels. Reverse operation of the pistons causes

liquid to be taken into the lower end of one of the pump members while liquid is being delivered from the opposite end of the other pump member to the delivery conduit, reversal of the pistons inducing reversal of intake and discharge so that there is a continuous flow of liquid from the pump into the delivery conduit.

Simultaneously with the operation of the liquid pump as described, the air pump rods 120 and 121 are raised and lowered in opposite relation to provide a continuous flow of air into the hollow standard 15 to draw liquid from an open pump outlet through the Venturi throat 41 and deliver it into the hood 5 of the main conduit 4, thereby inducing flow of the liquid through the delivery conduit.

With the arrangement described, there is simultaneous intake to the pump from the upper intake of one barrel and the lower intake of the other barrel and exhaust from the lower outlet of the first barrel and upper outlet of the second barrel to provide a continuous supply to both barrels and an even continuous flow through the delivery conduit; the air jets acting as boosters for the liquid and relieving the pump of part of its mechanical work.

It is apparent that with apparatus constructed as described, a continuous flow of liquid may be produced with a minimum expenditure of power and in a continuous stream.

What I claim and desire to secure by Letters Patent is:

1. In a pump, a delivery conduit, a pair of double acting pump members, each having separate outlets in communication with the delivery conduit, means for operating the pump members simultaneously in opposite directions, a pair of air pumps in communication with the delivery conduit, and means connected with the pump operating means for operating the air pumps.

2. In a pump, a delivery conduit, a plurality of separate pump barrels, each having communication at its opposite ends with the delivery conduit at spaced points in the conduit, outwardly opening valves controlling communication between the barrels and the delivery conduit, inwardly opening intake valves at opposite ends of the barrels, pistons operable in the barrels, actuating means for operating the pistons oppositely, air pumps having separate communication with the delivery conduit to direct fluid pressure medium into said conduit in the direction of delivery flow, and operative connection between the air pumps and the piston operating means to effect continuous flow of fluid from the pump barrels to the delivery conduit and a continuous flow of pressure medium to said conduit for supplementing pumping action of the pistons.

3. In a pump, separate barrels, each having primary and secondary outlets and an intermediate piston chamber, each barrel having an inlet between the piston chamber and each of the outlets, the outlet and inlet at each side of the piston having normally yieldingly closed oppositely opening valves, a conduit having direct communication with the primary outlets of both of the barrels, and indirect communication with the secondary outlets of both of the barrels, a walking beam, pistons in the barrel cylinders operably connected with said beams, air pumps operably connected with the said walking beam and communication between the air pumps and the delivery conduit.

4. In a pump, a plurality of barrels having valved inlets and outlets, and a delivery conduit in communication with the outlets, pistons operable in said barrels, a primary shaft, a walking beam on said shaft operably connected with the pistons, a pair of secondary shafts operably connected with the primary shaft, cams on the secondary shafts, a second walking beam operable by said cams, piston rods, a third walking beam operably connected with the second beam, air pumps having communication with the delivery conduit, and means operable by the third walking beam for actuating the air pumps.

In testimony whereof I affix my signature.

FRED D. HOFFMAN.