W. L. MORROW.

PUMP.

APPLICATION FILED FEB. 24, 1915.

1,201,073. Patented Oct. 10, 1916.

Fig. 1

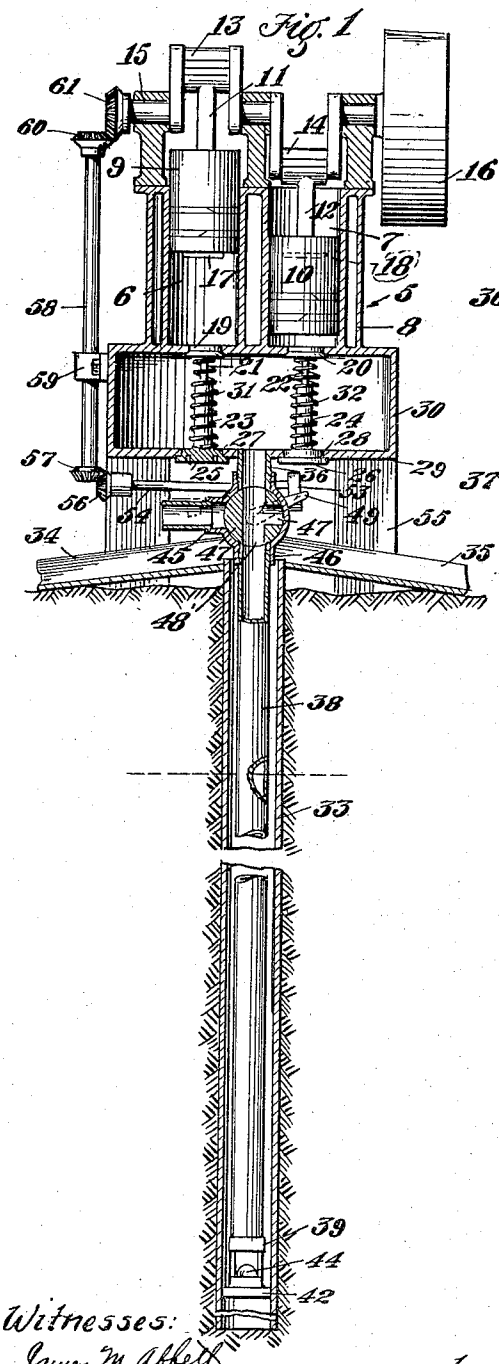


Fig. 2.

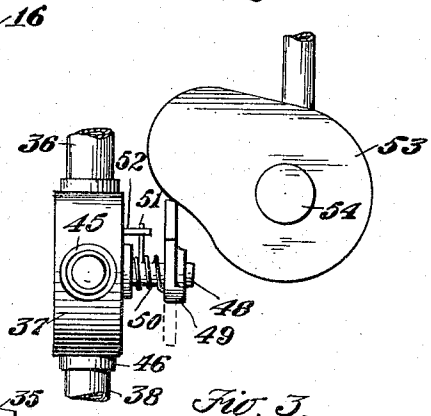


Fig. 3.

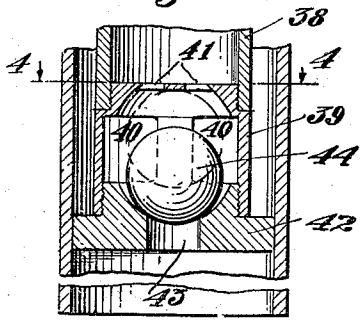
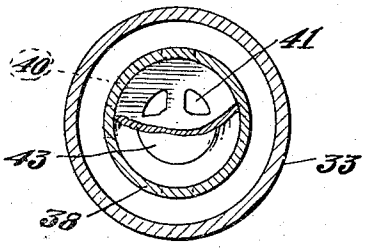


Fig. 4



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UNITED STATES PATENT OFFICE.

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PUMP.

1,201,073. Specification of Letters Patent. Patented Oct. 10, 1916.

Application filed February 24, 1915. Serial No. 10,237.

To all whom it may concern:

Be it known that I, WILLIAM L. MORROW, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Pumps, of which the following is a specification.

This invention relates to improvements in pumps, and particularly pumps adapted to force water from deep weels by air pressure.

It is an object of this invention to provide a pump in which an air piston acts upon a column of liquid in the well casing to discharge the same from the casing.

It is another object of this invention to provide a pneumatically operated pump with an air compressor which continuously forces air into a reservoir serving to supply air to an air piston for forcing the liquid from a well.

It is a still further object to provide a pump operated by pneumatic pressure with a reservoir, and a relief valve mechanism for intermittently admitting compressed air to act as a piston upon a volume of water, then cutting off the source of air pressure and connecting the air piston chamber to the atmosphere.

I attain these objects by the mechanism illustrated in the accompanying drawing, in which:

Figure 1 illustrates my pump mechanism installed in a well, with the well and parts of the mechanism shown in vertical section. Fig. 2 shows the timing mechanism for my air relief valve. Fig. 3 is a vertical section through the foot valve. Fig. 4 is a horizontal section taken on line 4—4 and with the conduit of the valve cage partly broken away.

More specifically, 5 indicates an air pump casing provided with pump cylinders 6 and 7 disposed vertically and having a cooling jacket 8. Mounted within pump cylinders 6 and 7 for reciprocation therein are pistons 9 and 10 to which are attached piston rods 11 and 12. Piston rods 11 and 12 carry at their ends bearings 13 and 14 for engagement with cranks on crank shaft 15. On the end of crank shaft 15 is secured a driving pulley 16. The inlet ports for the air compressor comprise open ports 17 and 18 in the walls of the pump cylinders and are disposed at a point adjacent the upper end of the piston stroke. At the lower end of pump cylinders 6 and 7 are mounted check valves 19 and 20 carrying valve stems 21 and 22 which are disposed in guide sleeves 23 and 24. Guide sleeves 23 and 24 are secured to caps 25 and 26 and are preferably integral therewith. Caps 25 and 26 close openings 27 and 28 in lower wall 29 of the air reservoir 30. Disposed over sleeves 23 and 24 are spiral springs 31 and 32 abutting the ends of the valves 19 and 20, and at the other end the caps 25 and 26 respectively. Such an air valve construction permits ready access to the valves and removal of the springs as caps 27 and 28 may be removed and the springs 31 and 32, as well as valves 19 and 20 removed through the apertures 27 and 28.

In the well is mounted a well casing 33, and mounted upon the surface of the ground at the upper end of the casing 33 are discharge troughs 34 and 35. Connected to the lower wall 29 of reservoir 30 is a short pipe 36 to which is attached a valve casing 37 having nipples 45 and 46 disposed at 90 and 180 degrees thereto.

Attached to the valve casing 37 by means of nipple 46 and in line with the pipe 36 is a pipe 38 and at the lower end thereof is secured a valve cage member 39 which is cylindrical in form, and has the same diameter as the pipe 38. It has ports 40 in the sides and ports 41 in the crown, such that pipe 38 and the annular space between pipe 38 and casing 33 are always in free communication.

Secured to the lower end of valve cage member 39 preferably by threads, is a valve seat 42 which tightly fits within the well casing 33, sealing the same. Valve seat 42 is provided with a port 43 controlled by valve 44. Valve casing 37 is provided with an air relief port connected to nipple 45 leading to the atmosphere. Mounted within valve casing 37 is an oscillating valve 47 having a bore 48′ diametrically disposed therein, and a second bore radially disposed and at right angles thereto. Valve 47 is fixedly secured to a stub shaft 48 having on its end and spaced from the casing an arm 49. Mounted on shaft 48 between arm 49 and casing 37 is a spiral spring 50 secured to the arm and to the valve casing, such that it tends to hold the arm in one position. Laterally extending from shaft 48 is a pin 51 disposed to engage a stop pin 52 which is secured to valve casing 37. Disposed to engage arm 49 is a cam member 53 fixedly

secured to a shaft 54. Shaft 54 is mounted in bearings on the frame 5 of the air compressor, and carries at its end a beveled gear 56 which meshes with a beveled gear 57 mounted on a shaft 58, disposed at right angles to shaft 54 and carried in bearing 59 secured to the reservoir 30. At the opposite end of shaft 58 is a beveled gear 60 meshing with a gear 61 which is secured to the crank shaft 15.

The air pipe 38 must have a volume slightly greater than the volume of annular chamber or the volume of water displaced. For illustration, a 10″ casing would require a 9½″ air pipe to insure the displacement of the volume of water in the casing and air conduit.

Referring to Fig. 1 with the air valve 47 in the position shown, air which is contained in the air reservoir 30 is discharged into the conduit 38, and acts upon the column of liquid therein to force the liquid downward. Valve 44 is seated by the pressure and seals the lower part of the well casing from the upper. The compressed air acting as a piston upon the top of the water column in conduit 38 forces the liquid out of conduit 38 and into the annular space, causing the liquid therein to rise and overflow into troughs 34 and 35. During this discharge operation crank shaft 15 has been continuously revolving and through meshing gears 61, 60, shaft 58, gears 57, and 56, and shaft 54, cam member 53 is caused to revolve and move arm 49 with the valve 47 into position at 90 degrees to that shown in Fig. 1, wherein the bore 49 is connected to bore 48 and thence through pipe 46 to the atmosphere, relieving the pressure on the water. At the same time pipe 36 is sealed by the valve 47. Water enters through valve 44 and around it into conduit 38, and also into the chamber surrounding conduit 38. The ball 44 rests on the top of valve cage 39, but does not close conduit 38.

The timing of valve 47 is determined by factors which include the dimensions of the chamber between pipe 38 and casing 33, the pressure and velocity, so that the inertia of the column of water assists in discharging the latter and drawing in a new increment of water. As there are no valves or obstructions in the discharge chamber, the opening of the air valve permits the water remaining in the discharge pipe to return, then oscillate back toward the discharge, at which time the air valve admits compressed air to further discharge liquid. The discharge chamber between pipe 38 and casing 33 thus forms a play chamber in which the water may oscillate.

What I claim is:—

1. In a pump, the combination of means providing a source of compressed air, a receptacle for liquid to be pumped, an inlet valve for liquid in said receptacle, an unobstructed discharge conduit of less volume than said receptacle having a free connection therewith forming a play pipe, an air conduit connected to said receptacle and means, an air valve disposed in said conduit having a port leading to said means, a port leading to a source of low pressure, and a timing mechanism for continuously operating said air valve to alternately connect said receptacle to said source of compressed air and said source of low pressure.

2. In a pump, the combination with a well casing, of means providing a source of relatively high pressure, a conduit connected to said means extending into said well casing and freely spaced therefrom to form therebetween an unobstructed play pipe, the volume of said conduit being relatively greater than the volume of said pipe, an air valve having a port connected to said means and a port connected to a source of relatively low pressure, a valve seat mounted below the lower end of said conduit tightly fitting said casing and having a port connected to the lower part thereof, a valve mounted in said cage to control the last named port opening, and a timing mechanism for continuously operating said valve to alternately connect said conduit to said source of high pressure and to said source of low pressure.

3. In a pump, the combination with a well casing, of means providing a source of relatively high pressure air, a reservoir for receiving compressed air, a conduit connected to said reservoir extending into said well casing and freely spaced therefrom to form a free unobstructed play chamber, the volume of said conduit being relatively greater than the volume of the chamber formed between said conduit and well casing, an air valve having a port connected to said reservoir, and a port connected to a source of relatively low pressure, a valve seat mounted below the lower end of said conduit tightly fitting said casing and having a port connected to the lower part of the casing, a valve mounted in said cage to control the last named port opening, and a timing mechanism for continuously operating said air valve to alternately connect said conduit to said source of high pressure and said source of low pressure.

4. In a pump, the combination with a well casing, of an air compressor, a reservoir for receiving compressed air, a conduit connected to said reservoir extending into said well casing and freely spaced therefrom to form a free unobstructed chamber, the volume of said conduit being relatively greater than the volume of the chamber formed between said conduit and well casing, an air valve adjacent said air reservoir having a port connected to said reservoir and a port connected to a source of relatively low pres-

sure, a valve cage attached at the crown thereof to said conduit and open to said conduit, said valve cage having a ported seat tightly fitting said casing, a ball valve arranged in said cage to engage said seat, and a timing mechanism connected to said air valve for continuously operating the latter to alternately connect said conduit to said source of compressed air and said source of low pressure.

5. In a pump, the combination with a well casing, of an air compressor, a reservoir for receiving compressed air, a conduit connected to said reservoir extending into said well casing and freely spaced therefrom to form a free unobstructed chamber, the volume of said conduit being relatively greater than the volume of the chamber formed between said conduit and well casing, a rotary air valve connected to said conduit having a port communicating with said air reservoir, and a port communicating with a source of relatively low pressure, means for continuously rotating said valve, a valve cage attached at the crown thereof to said conduit and open thereto, said valve cage having a port seat tightly fitting said cage, and a ball valve arranged in said cage to engage said seat.

In witness that I claim the foregoing I have hereunto subscribed my name this 15th day of February, 1915.

WILLIAM L. MORROW.

Witnesses:
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MARGUERITE BATES.