No. 643,156. Patented Feb. 13, 1900.

M. W. QUICK.

PLANT FOR OPERATING MOTORS.

(Application filed Oct. 19, 1898.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

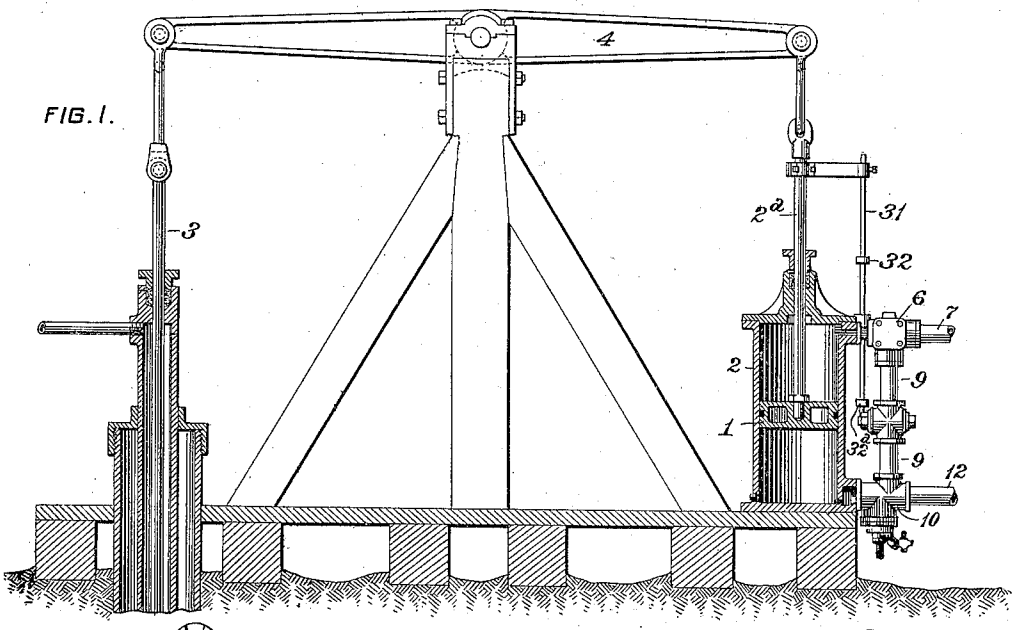


FIG. 2.

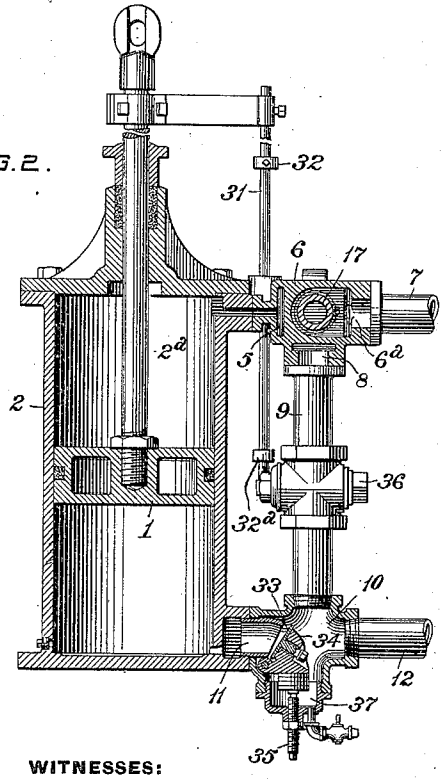
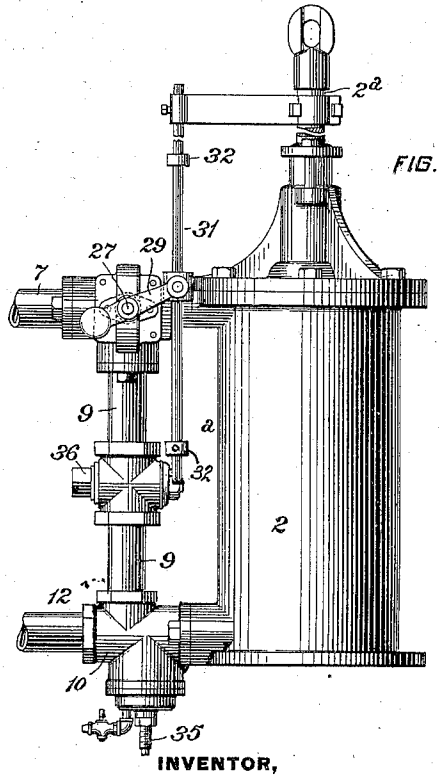


FIG. 3.



WITNESSES:

Chas. F. Miller

F. M. Dapper

INVENTOR,

Miles W. Quick

by Dennis S. Wolcott

Att'y.

No. 643,156. Patented Feb. 13, 1900.

M. W. QUICK.

PLANT FOR OPERATING MOTORS.

(Application filed Oct. 19, 1898.)

(No Model.) 2 Sheets—Sheet 2.

FIG. 4.

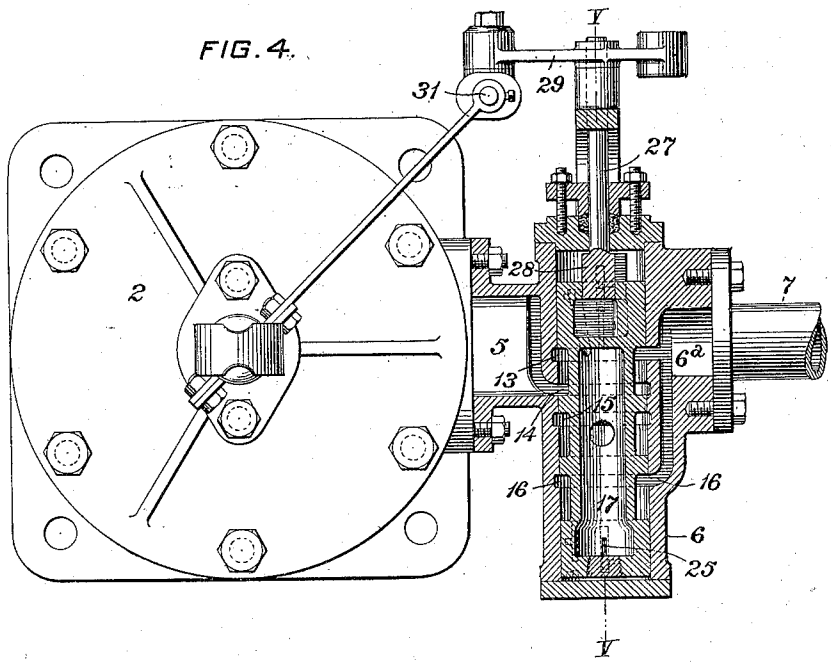


FIG. 5.

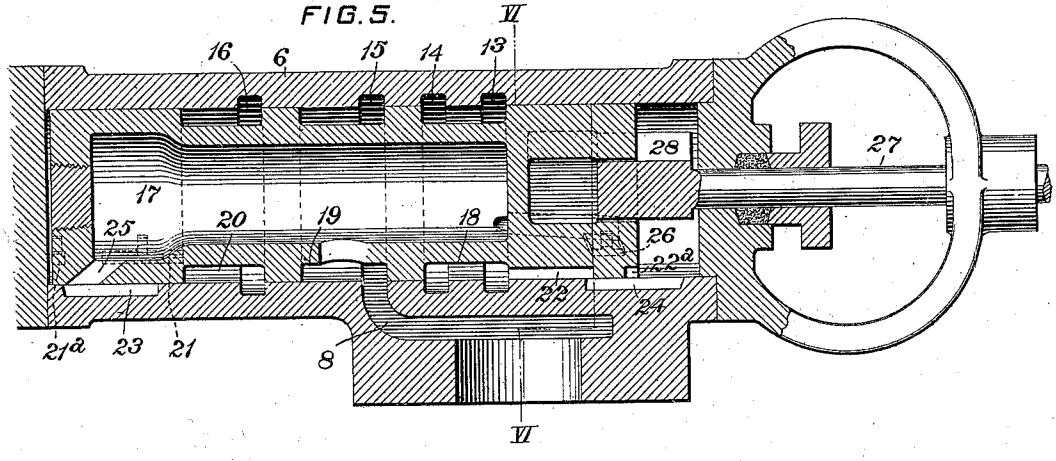
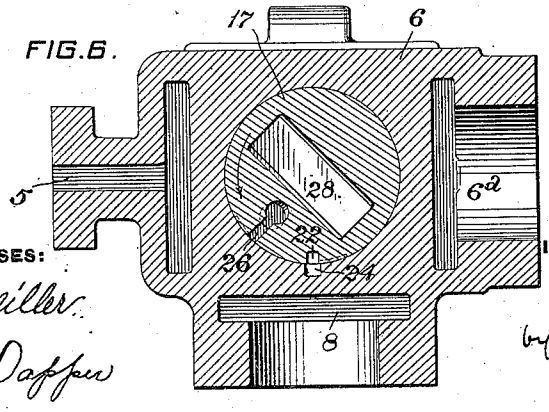


FIG. 6.



WITNESSES:

Chas. F. Miller.

F. M. Dapgett

INVENTOR,

Miles W Quick

by Dennis S. Wolcott

Att'y.

UNITED STATES PATENT OFFICE.

MILES W. QUICK, OF TITUSVILLE, PENNSYLVANIA.

PLANT FOR OPERATING MOTORS.

SPECIFICATION forming part of Letters Patent No. 643,156, dated February 13, 1900.

Application filed October 19, 1898. Serial No. 693,974. (No model.)

To all whom it may concern:

Be it known that I, MILES W. QUICK, a citizen of the United States, residing at Titusville, in the county of Crawford and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Plants for Operating Motors, of which improvements the following is a specification.

The invention described herein relates to certain improvements in apparatus for pumping oil-wells. In Letters Patent Nos. 595,205 and 595,206, dated December 7, 1897, two systems for pumping wells by means of motors at each well and connected to a central power plant are shown and described. In one of the systems the motors at the wells—*i. e.*, cylinders and pistons—are operated to raise the pump-rods by a fluid which is placed under a pressure higher than atmospheric pressure by the central plant. In the other system the motors at the well are operated by atmospheric pressure, the cylinders of the motors being connected to a central exhaust plant, whereby a vacuum can be produced on one side of the piston of the cylinder, so that atmospheric pressure on the opposite side of the piston will shift the latter to raise the pump-rods.

As is well known among oil producers, the oil will flow into some wells with sufficient rapidity to keep the pump-barrel constantly full, although the pump may be making from twelve to fifteen strokes or more per minute. The capacity of other wells is so limited that the pumps cannot be efficiently run faster than one or two strokes or slower per minute.

The object of the present invention is to provide for the automatic regulation of the number of strokes of the pumps in accordance with the producing capacity of the wells; and in general terms the invention consists in the construction and combination, substantially as hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view, partly in elevation and partly in section, of the pumping apparatus at each well. Fig. 2 is a sectional elevation of the motor-cylinder and its valve mechanism. Fig. 3 is a side elevation of the motor-cylinder. Fig. 4 is a top plan of the cylinder and a sectional plan of the valve mechanism. Figs. 5 and 6 are sectional views, the planes of section being indicated, respectively, by the lines *v v*, Fig. 4, and VI VI, Fig. 5.

In the practice of my invention the piston 1 of the motor-cylinder 2 is connected in any suitable manner to the pump-rod 3, extending down into the well to be pumped. A convenient form of such connection consists of the pivotally-mounted walking-beam 4, having its ends connected, respectively, to the piston-rod 2^a and pump-rod 3. When the motor is connected, as shown, to the pump-rod, the upper end of the cylinder 2 is connected by a port or passage 5 to the valve-chamber 6, which is also connected by a port 6^a and pipe 7 to a suitable source of fluid under pressure, as a centrally-located air-compressor. (Not shown.) The valve-chamber is also connected by a port 8 and pipe or passage 9 to an exhaust-chamber 10, which is connected to the lower end of the cylinder 2 by a port or passage 11 and has an outlet which is preferably connected by a pipe 12 to the inlet of the air-compressor. The inner wall of the valve-chamber is formed with grooves or recesses 13, 14, 15, and 16, the grooves 13 and 16 being in communication with the inlet-port 6^a and the intermediate grooves 14 and 15 connecting, respectively, with the port 5, leading to the cylinder 2, and with the exhaust-port 8. The piston-valve 17 within the valve-chamber is provided with grooves or recesses 18, 19, and 20, so arranged with relation to the grooves or recesses in the wall of the valve-chamber that when the valve is at one end of its stroke the groove or recess 18 will connect the ports 5 and 6^a, thereby admitting fluid under pressure to the cylinder, and when shifted to the opposite end of its stroke the groove or recess 19 will connect the ports 5 and 8, so as to permit the flow of fluid-pressure from the cylinder. It is preferred to effect the longitudinal movements of the valve by means of fluid-pressure; but its movement may be effected in other ways, which will readily suggest themselves to those skilled in the art. To effect the longitudinal movement of the valve by fluid-pressure, longitudinal grooves 21 and 22 are formed in the valve, extended, respectively, from the peripheral grooves 18 and 20 toward the ends

of the valves. These grooves 21 and 22 are arranged in different radial planes an angular distance apart corresponding to the rotation imparted to the valve, as hereinafter described. By the rotation of the valve the grooves 21 and 22 are brought alternately into register with grooves 23 and 24, formed in the inner wall of the valve-chamber adjacent to its ends, as clearly shown in Fig. 5. These grooves do not extend to the heads of the valve-chamber, and in order to connect them with the spaces between the ends of the valve and the heads of the valve-chamber notches 21^a and 22^a are formed at the ends of the valve in line with the grooves 21 and 22, as shown in Fig. 5. In order to exhaust the air from the ends of the valve-chamber, ports 25 and 26 are formed in the valve in such manner as to connect alternately the axial opening in the valve with the grooves 23 and 24 in the wall of the valve-chamber. The port 25 at one end is arranged in line with the groove 22 at the opposite end of the valve and the port 26 in line with the groove 21. The axial opening in the valve is in constant communication with the exhaust-port 8 by a port 27 in the valve. It will be understood by reference to Figs. 5 and 6 that if the valve be shifted in the direction indicated by the arrow in Fig. 6 the port 26 will be brought into register with port 24, thereby permitting exhaust from the right-hand end of the valve-chamber. The same movement will bring the groove 21 and notch 21^a into register with the groove 23, thereby permitting fluid under pressure to flow from the inlet-port 6^a through grooves 16, 21, and 23 and notch 21^a to the left-hand end of the valve-chamber and shift the valve to the right.

The rotation of the valve is effected by a stem 27, provided with a head or enlargement 28, projecting into a recess in the end of the valve, as shown in Figs. 4 and 5. A lever 29 is secured to the outer end of the stem, and on its outer end is loosely mounted a sleeve 30. A rod 31, which is connected to the piston-rod 2^a, passes loosely through the sleeve and is provided with adjustable shoulders 32 and 32^a, adapted to strike against the sleeve, and thereby shift the valve on its axis. While this construction of valve mechanism has been found to be especially effective, any other form or construction of valve mechanism adapted to be controlled by the movements of the piston to control the flow of fluid to and from the cylinder may be employed for that purpose.

The connection between the vacuum-chamber 10 and the cylinder is controlled by a valve which is constructed to remain normally open, so as to allow an unobstructed flow of fluid from the cylinder, and adapted to remain open during the flow of fluid to the cylinder unless such flow should be rapidly or suddenly increased by reason of a quick movement of the piston. While any construction of valve mechanism adapted to operate in the manner stated may be employed, the form shown is preferred. This valve consists of a disk 33, pivotally mounted in such relation to the port or passage 11 that when moved to its seat flow of fluid-pressure to the cylinder is prevented. This valve is held normally open by any suitable means—as, for example, by a weight 34, secured to its outer face, as shown in Fig. 2. By increasing or decreasing the weight 34 the pressure or rapidity of flow of fluid necessary to close the valve can be regulated. The normal flow of fluid to the cylinder, which will vary under conditions, as hereinafter stated, can be regulated by means of a screw 35, by which the position of the valve in relation to its seat can be adjusted.

The rapidity of exhaust from the cylinder may be regulated by a plug or other suitable form of valve in the pipe 9. In order to prevent the valve 33 from being clogged by oil or by the freezing of condensed fluid, a trap 37, provided with a valved outlet-pipe 37^a, is formed in the vacuum-chamber 10, as shown.

The operation of my improved pumping apparatus when employed in connection with a vacuum system, as described in Letters Patent No. 595,205, is as follows, the several parts of the apparatus being in the position shown in the drawings—*i. e.*, the pump-rods being raised and the regulating-valve 33 open to permit the escape of fluid from the lower end of the cylinder: As soon as the piston reaches the lower limit of its stroke or approaches thereto one of the collars or shoulders, as 32, on the rod 31 will strike the lever 29, so as to shift the valve 17 axially, thereby opening the exhaust-ports at one end of the valve-chamber and opening the inlet-ports at the opposite end, so as to shift valve 17, and thereby cut off the flow of fluid-pressure to the cylinder and connect the same to the exhaust-port 8. If the well produces with sufficient rapidity to keep the pump-barrel full, no regulation of the downward movement of the pump-rods and upward movement of the piston actuated by said rods is necessary other than that effected by the liquid in the well. In a well of such capacity the liquid being at nearly a constant height will buoy up the piston of the pump-barrel, and thereby prevent such a rapid movement of the piston in the motor-cylinder as would affect the regulating-valve 33. In other words, the movement of the piston of the motor-cylinder when actuated by the descending pump-rods in a rapidly-producing well would be so slow that the inflowing fluid would not affect the valve 33, the latter being so weighted or otherwise yieldingly held as to hold it open under such conditions as against the inflow of fluid caused by the upward movement of the piston.

It is characteristic of the movement of the pump-rods in wells which do not produce with sufficient rapidity to maintain a nearly constant height of liquid in the pump-barrel of

the well that the downward movement of the pump-rods until the piston of the pump-barrel strikes the fluid is rapid, resembling a plunging movement. This plunging through the unfilled space in the pump-barrel, the extent of which is dependent upon the rapidity of flow of liquid in the well, will produce a similar quick plunging movement or jump of the piston of the motor-cylinder. This jump of the piston 1 will produce a vacuum in the lower end of the cylinder, and thereby cause an inrush of fluid past the regulating-valve 33. This sudden movement of the fluid will shift the valve 33 to its seat, and thereby check any inward flow of fluid into the cylinder, so that the further upward movement of the piston will be resisted by fluid-pressure on top of the same.

As it is not desired to wholly prevent or check the complete downward movement of the pump-rod, the regulating-valve 33 or its seat is left rough or unfinished or otherwise so constructed as to permit when the valve is seated a slow flow of fluid from one end of the cylinder to the other, or provision may be made for effecting the same approximate equalization of pressures on opposite sides of the piston by any other means known in the art whereby the portions of the cylinder on opposite sides of the piston may be connected.

As soon as the dropping pump-rods cause the motor-piston to complete its reverse stroke the valve 17 is shifted, admitting fluid to the pressure side of the piston. The resultant lifting stroke of the piston increases the density of the fluid in the vacuum end of the cylinder and the automatic or governing valve 33 is opened and not again closed until by successive lifting strokes the accumulated product gathered in the bottom of the well is exhausted, and the working or pump barrel does not fill. The weight of the descending pump-rods, increased by the superincumbent weight of liquid in the well-tubing, which is supported by the movable or working valves in the pump-barrel, causes a rapid or plunging movement of the piston, and fluid violently rushes into the vacuum end of the cylinder and closes the automatic valve 33 by reason of a reversal of the unequal pressures on its opposite sides. This valve may also be so adjusted that after being closed by the violent inrush of air or other fluid it will leave its seat when the superincumbent liquid supported by the pumping-valves reaches and is supported by that which is taken in and partially fills the pump-barrel, and the vacuum on the vacuum side of the piston is proportionately reduced.

It will be readily understood from the foregoing that by regulating the inflow of fluid to the vacuum side of the piston 1 its upward movement, as actuated by the pump-rods, can be accurately controlled.

It is characteristic of my improvement that only the downward movement of the pump-rod is regulated, the upward or liquid-lifting movement being the same, regardless of the rapidity of production in the well. In other words, it is the purpose of my invention to so control or reduce the movement of the motor-piston during the dropping of the pump-rods as to allow ample time for oil or other liquid to gather in the well in sufficient quantities to fill the pump-barrel without in any manner impairing the rapidity of the lifting stroke.

I claim herein as my invention—

1. The combination of a motor-cylinder, a piston therein connected to a pump, a motive-fluid supply to one side of the piston, a valve controlling the admission and exhaust of said fluid, a controlling-fluid supply to the other side of the piston, and means controlled by the movement of the pump-piston for varying said supply, substantially as set forth.

2. The combination of a motor-cylinder, a piston therein connected to a pump, a motive-fluid supply to one side of the piston, a valve controlled by the piston for controlling admission and exhaust of said fluid, a controlling-fluid supply to the other side of the piston, and a valve adapted to be shifted by fluid-pressure for controlling the flow of fluid into the opposite end of the cylinder, substantially as set forth.

In testimony whereof I have hereunto set my hand.

MILES W. QUICK.

Witnesses:
S. A. SMALL,
A. MANDELL.