No. 795,465. PATENTED JULY 25, 1905.

F. C. WEBER.

PUMPING APPARATUS.

APPLICATION FILED DEC. 17, 1904.

Fig. 1.

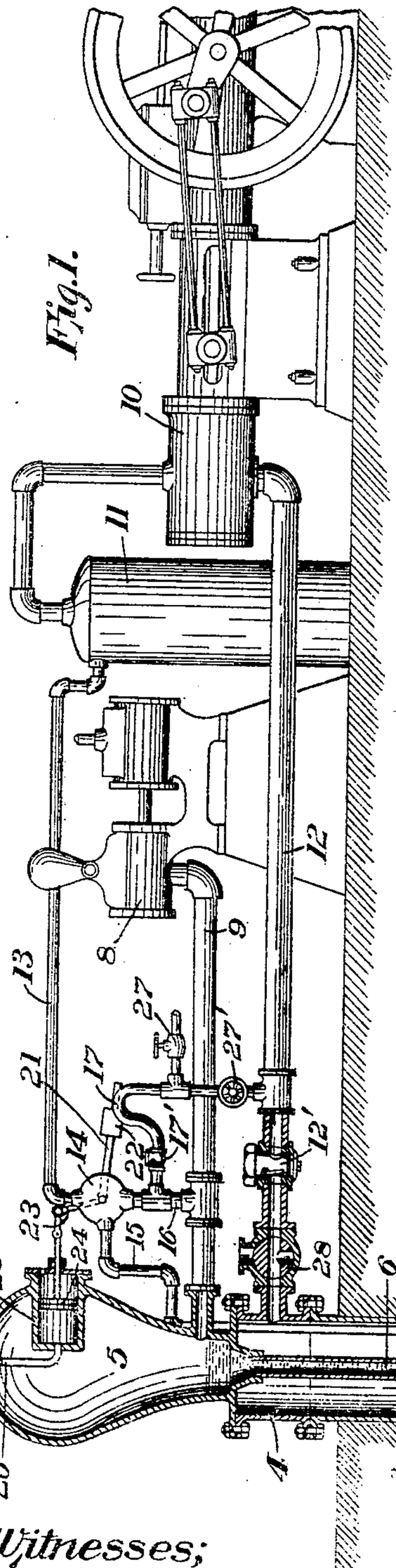
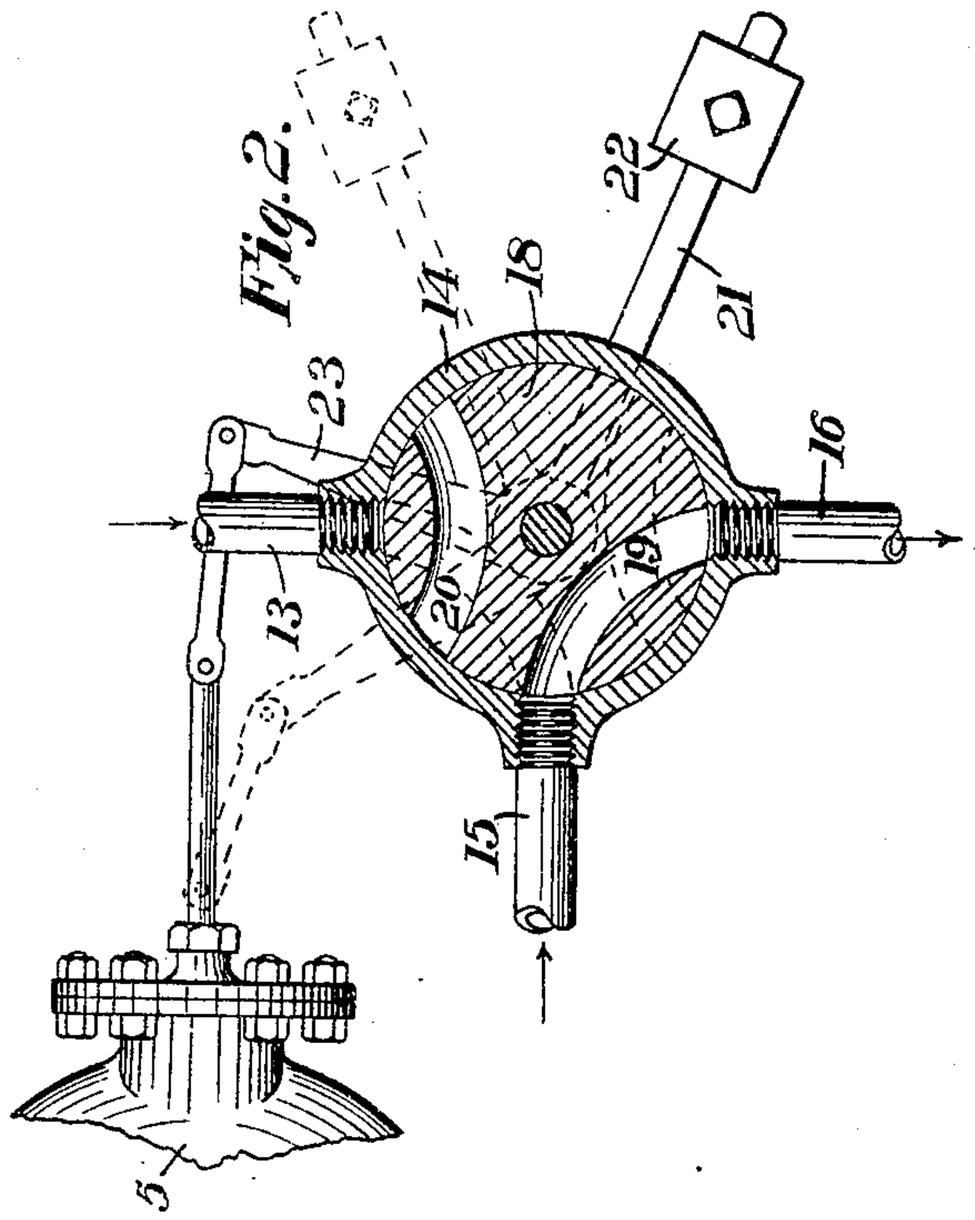
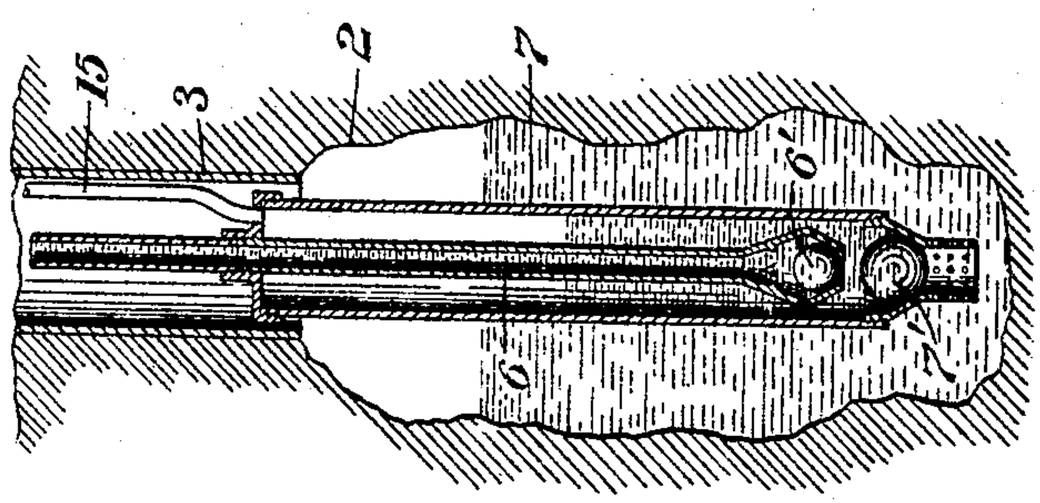


Fig. 2.





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PUMPING APPARATUS.

No. 795,465. Specification of Letters Patent. Patented July 25, 1905.

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To all whom it may concern:

Be it known that I, FREDERICK C. WEBER, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of pumping apparatus wherein a head of gas or air is utilized for lifting a column of oil, water, or other liquid; and the primary object is to provide improved means for effecting an intermittent application of the fluid-lifting head or pressure.

The invention as here shown embodies a fluid-chamber from which the fluid is expelled by a head of gas or air applied intermittently; and a further purpose of the invention is to provide for utilizing the expansive energy of the high-pressure gas or air remaining in the chamber at the completion of each lifting operation.

In the preferred adaptation of the invention the fluid-lifting gas or air pressure is maintained by a compressor, and when the apparatus is utilized for well-pumping another object of the invention is to accelerate the inflow of oil or water from the oil or water bearing rock or other strata by causing the compressor to draw its supply from the well.

Other and further objects of the invention, with the advantages incident thereto, are fully set forth in the following description, reference being had therein to the accompanying drawings, wherein—

Figure 1 is an elevation, partly in section, of well-pumping apparatus embodying my invention, a portion of the well being shown. Fig. 2 is a detail view of the valve mechanism.

Referring to the drawings, 2 designates an oil or water well, and 3 is the casing extending to the top of the well and closed by head 4. Mounted on this head is air-chamber 5, which provides an air-space at the upper end of fluid-discharge tube 6, the latter extending upward through casing 3 and opening into the bottom of said chamber, as shown. At or near the bottom of the well the discharge-tube 6 extends into and nearly to the bottom of fluid or receiving chamber 7, having inwardly-opening inlet-valve 7′. At the lower extremity of tube 6 is a similar valve 6′. A pump 8 has its intake-pipe 9 connected to the lower portion of chamber 5.

10 is a compressor for maintaining air or gas under pressure in tank or receiver 11, the compressor feed-line 12 being here shown extending from casing-head 4 and provided with check-valve 12′. A pipe 13 connects receiver 11 with valve-case 14, and a pipe 15 extends from the valve-case to the upper portion of chamber 7, while another pipe 16 connects the valve-case with pump-intake 9. A pipe 17 branches from pipe 16 to compressor-intake 12, said pipe having check-valve 17′ opening toward the compressor.

Within valve-case 14 is valve 18, having two ports 19 and 20. Secured to the stem of the valve and adapted to turn therewith is arm 21, carrying an adjustable weight 22, while another and preferably shorter arm 23 is connected to piston 24 of cylinder 25. The cylinder is here shown formed in one side of air-chamber 5 and closed at its inner end, with the short pipe 26 extending from said end to the upper portion of the chamber, and hence above the level ever attained in said chamber by the fluid being pumped.

Assuming that discharge-tube 6 has been filled with fluid to the level of pump-intake 9, the operation is as follows: Pump 8 withdraws air or gas from chamber 5, to which it is directly connected, also from chamber 7, to which it is then connected by pipes 16 and 15, through valve-port 19, the valve at such time being in the position shown in full lines in Fig. 2. A partial vacuum (termed in the art a "vacuum") is thus created in said chambers, causing an inward or upward flow of oil through valves 7′ and 6′, chamber 7 being thereby filled or nearly filled. The vacuum created simultaneously in cylinder 25, which communicates with chamber 5 through pipe 26, causes piston 24 to move inward under atmospheric pressure and turn valve 18, notwithstanding the resistance of weighted arm 21, which is thus raised. As soon as the vacuum-pressure in chamber 5 is sufficient to thus operate piston 24 and valve 18 the latter assumes the position indicated in dotted lines in Fig. 2, with port 20 in register with pipes 13 and 15, thus making a direct connection between receiver 11 and the upper portion of intake-chamber 7 at the bottom of the well. Under the head or pressure of gas or air thus

admitted to chamber 7 the fluid therein is forced upward through valve 6′ and tube 6 into chamber 5, from which it is withdrawn by the pump through pipe 9. When the fluid-level in chamber 7 has been thus lowered sufficiently to admit air or gas into the lower extremity of tube 6, the air or gas rises in bubbles through the column of fluid in said tube and entering chamber 5 breaks the vacuum therein and in cylinder 25, with the result that piston 24 no longer resists the downward pull of weighted arm 21, and the valve again assumes the position shown in full lines in Fig. 2, with high-pressure pipe 13 closed and port 19 again in register with pipes 15 and 16.

The air or gas under pressure remaining in chamber 7 at the completion of the operation just described is thus conducted through pipe 16 and branch pipe 17 into the receiver-intake 12, thus utilizing the expansive energy of said air or gas and effecting a marked economy in the operation of the apparatus. After chamber 7 has been thus drained and the suction of pump 8 again exceeds the suction of compressor-intake 12 check-valve 17′ closes further communication through pipe 17. The high-pressure air or gas entering compressor-intake 12 from chamber 7 is prevented from passing to the well-casing by check-valve 12′. If it is not desired to preserve this high-pressure air or gas, it may be exhausted to the atmosphere by opening valve 27 and closing valve 27′.

As pump 8 operates continuously, it again creates vacuums in chambers 5 and 7 as soon as the fluid has been discharged from the one and the high-pressure air or gas withdrawn from the other, and the above-described operation is repeated, thus causing the fluid to flow intermittently. Weight 22 may be variously adjusted for the purpose of causing the apparatus to operate under or through the medium of various vacuum-pressures in chambers 5 and 7, as conditions may require. It will be understood that when starting the above-described operations will be repeated without producing an outflow of fluid from the pump until discharge-tube 6 has been filled to the level of pump-intake 9.

With compressor-intake 12 connected to the well-casing the gas or air within the well-cavity is so rarefied as to induce a copious inflow of fluid from the oil or water bearing strata. This arrangement further provides for utilizing gas when the latter exists, and as the metallic parts of the apparatus are less subject to corrosion from gas than from air a further economic advantage will be apparent. However, the compressor may be caused to draw from the atmosphere by turning three-way valve 28.

In the above-described embodiment of the invention the apparatus is thoroughly automatic, it being only necessary to maintain the pump, also the compressor or other means for obtaining the requisite air or gas pressure. The valve mechanism is of simple construction, and the means provided for its operation is thorough and efficient.

While the apparatus is here shown and described in connection with well pumping, it may be utilized wherever fluids are to be pumped or elevated. The invention may be variously constructed and arranged or assembled without departing from the spirit and scope thereof as defined by the appended claims.

I claim—

1. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, an air-chamber, means for varying the pressure in the air-chamber, and means controlled by variations of pressure in said air-chamber for subjecting the surface of the fluid in the fluid-chamber to air-pressure.

2. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, an air-chamber having a controlled air-inlet, means for exhausting air from the air-chamber, and means controlled by variations of pressure in said air-chamber for subjecting the surface of the fluid in the fluid-chamber to air-pressure.

3. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, means controlled by the level of the fluid in the fluid-chamber for admitting air to the air-chamber, and mechanism controlled by variations of pressure in said air-chamber for subjecting the surface of the fluid in the fluid-chamber to air-pressure.

4. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, an air-chamber adapted to receive air passing upward through the discharge-tube, means for withdrawing air from the air-chamber, and mechanism controlled by variations of pressure in said air-chamber for subjecting the surface of the fluid in the fluid-chamber to air-pressure.

5. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, an air-chamber having an air-inlet, means for withdrawing air from the fluid-chamber and air-chamber simultaneously, and mechanism actuated by variations of pressure in the air-chamber for stopping the withdrawal of air from the fluid-chamber and for simultaneously subjecting the surface of the fluid in said fluid-chamber to air-pressure.

6. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, an air-chamber adapted to receive air passing upward through the discharge-tube, means for withdrawing air from the fluid-chamber and air-chamber simultaneously, and mechan-

ism actuated by variations of pressure in the air-chamber for stopping the withdrawal of air from the fluid-chamber and for simultaneously subjecting the surface of the fluid in said fluid-chamber to air-pressure.

7. Pumping apparatus comprising a receiving-chamber having a valved inlet, a discharge-tube for the chamber having an outlet and an air-space above the outlet, means for withdrawing air from said space, a valve for admitting air under pressure to the receiving-chamber, and means actuated by variations of air-pressure in said air-space for operating said valve.

8. Pumping apparatus comprising a receiving-chamber having a valved inlet, a discharge-tube for the chamber having an outlet and an air-space above the outlet, means for withdrawing air from said air-space, a valve for admitting air under pressure to the receiving-chamber, and valve-actuating means communicating with said air-space and constructed and arranged to open said valve upon reduction of air-pressure in said air-space and to close the valve upon the admission of air thereinto.

9. Pumping apparatus comprising a receiving-chamber having a valved inlet, a discharge-tube extending from the lower portion of said chamber and having an outlet and an air-space above the outlet, means for withdrawing air from said air-space, a valve for admitting air under pressure to the upper portion of the receiving-chamber, a cylinder in communication with said air-space, and a piston in the cylinder operatively connected to said valve.

10. Pumping apparatus comprising a receiving-chamber having a valved inlet, a discharge-tube for the chamber having an outlet and an air-space above the outlet, means for withdrawing air from said space, a valve for admitting air under pressure to the receiving-chamber for the purpose of forcing fluid therefrom into and through the discharge-tube, valve-actuating mechanism connected to said air-space and constructed and arranged to open the valve under the vacuum-pressure in said air-space and to close the valve upon the entrance of air rising thereinto through the discharge-tube.

11. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, an air-chamber adapted to receive air passing upward through the discharge-tube, a pump for exhausting air from said air-chamber, a source of air under pressure connected to the receiving fluid-chamber, a normally closed valve for controlling said connection, a cylinder communicating with the air-chamber, a piston in the cylinder operatively connected to said valve and adapted to be actuated by vacuum-pressure in the cylinder to open the valve, the valve being adapted to close automatically when the vacuum in the air-chamber is broken by the entrance of air through the discharge-tube.

12. Pumping apparatus comprising a fluid-chamber, a discharge-tube for the chamber, a pump communicating with the discharge-tube, an air-chamber open to the pump-intake and adapted to receive air passing upward through the discharge-tube, a compressor, a valve adapted in one position to place the outlet of the compressor in communication with the fluid-chamber and in another position adapted to close said communication and place said fluid-chamber in communication with the intakes of the compressor and pump, and valve-actuating mechanism adapted to be operated by the making and breaking of a vacuum in said air-chamber.

13. Pumping apparatus comprising a receiving-chamber having a valved inlet, a discharge-tube extending upward from the lower portion of the chamber and having a valved lower end, an air-chamber at the upper end of said tube, a pump for withdrawing air from the air-chamber, a cylinder communicating with the air-chamber, a piston adapted to be operated in the cylinder by vacuum-pressure in the air-chamber, a source of air under pressure connected to the upper portion of the receiving-chamber, a counterweighted valve for controlling said connection, and an operative connection between said valve and the cylinder-piston.

14. Pumping apparatus comprising a well-casing closed at its upper end, a discharge-tube extending upward therethrough, an air-chamber open to the upper end of the tube, a pump having its intake connected to the lower portion of the chamber, a compressor having its intake connected to the well-casing, a receiving-chamber at the lower end of the discharge-tube having a valved inlet, pipe 15 extending from the receiving-chamber, a receiver supplied from the compressor, a valve adapted in one position to place the receiver in communication with pipe 15 and in another position adapted to close said communication and open communication between pipe 15 and the intake of the pump.

15. Pumping apparatus comprising a receiving-chamber having a valved inlet, pipe 15 extending from the upper portion of said chamber, a discharge-tube extending from the lower portion of said chamber, an air-chamber at the upper end of the discharge-tube, a pump having its intake connected to the air-chamber, a valve-case to which the upper end of pipe 15 is connected, pipe 16 connecting the valve-case and the pump-intake, a compressor having an intake provided with a check-valve,

pipe 13 connecting the compressor and said valve-case, pipe 17 connecting pipe 16 with the compressor-intake, a valve within the valve-case adapted in one position to place pipes 15 and 16 in register and in another position adapted to close said communication and open communication between pipes 13 and 15, and valve-actuating means adapted to be operated by the making and breaking of a vacuum in said air-chamber.

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

FREDERICK C. WEBER.

Witnesses:

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