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W. P. BRETT

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DEEP WELL PUMPING MECHANISM

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Fig. 1.

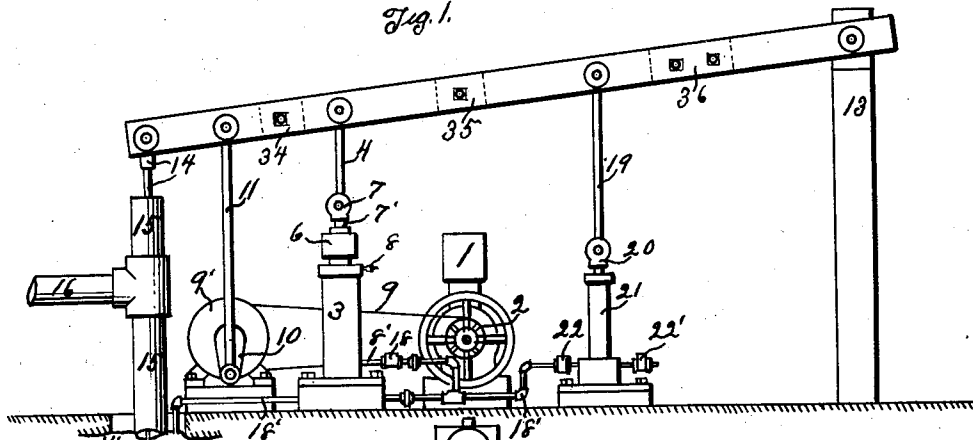


Fig. 2.

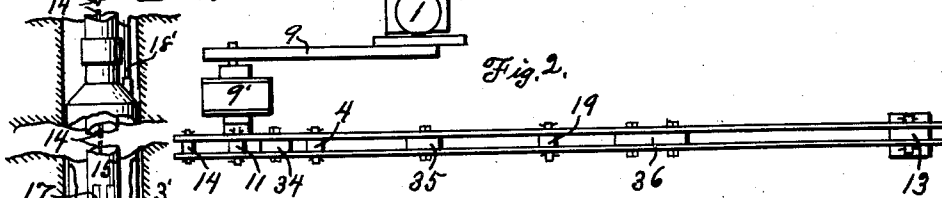


Fig. 4.

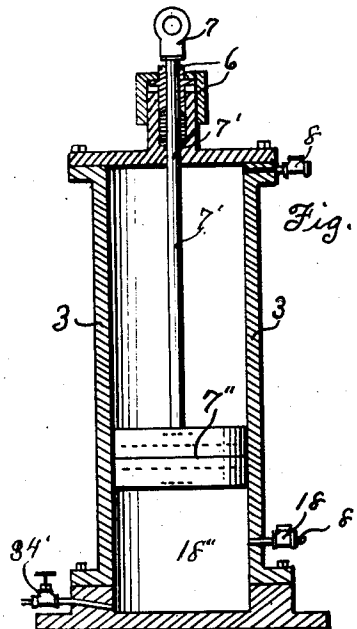
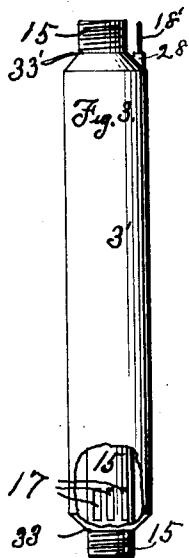
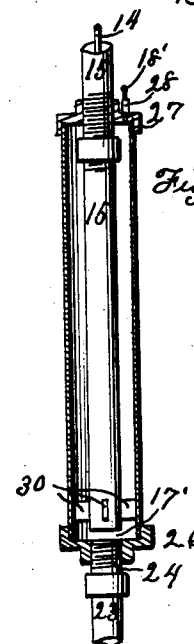


Fig. 5.



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DEEP-WELL PUMPING MECHANISM.

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My invention relates to improvements in deep well pumping mechanism comprising what is generally known as a single stroke cylinder pump, by means of which liquids may be raised by the upward stroke of a vertically reciprocating piston actuated by a crank; and the objects of my improvement are, first, to provide means for causing a continuous flow of the liquid being pumped, from the immediate vicinity of the pump cylinder to the point of discharge; second, to provide a means for equalizing the load on the crank so that both the up and down strokes will require a substantially equal impelling force; third, to provide means for effectually utilizing the force expended in the down stroke to carry the full weight of the reciprocating mechanism and a part of the column of liquid that is being raised by the up stroke of the pump piston; and, fourth, to utilize the cushioning effect of compressed air to eliminate shock on the pumping mechanism and to equalize the load on the source of power during the operation of the reciprocating mechanism.

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

Fig. 1 is a side view of the mechanism above the ground and a mixed side and sectional view of a well with pump therein, parts broken away; Fig. 2, partial plan or top view of the walking beam, engine and inclosed gear reduction transmission, showing their relative position on the ground; Fig. 3, an enlarged view, parts broken away, of the lower part of the water discharge pipe and the surrounding encasement forming an air chamber; Fig. 4, an enlarged sectional view of a special load equalizing air cylinder; and Fig. 5, an enlarged sectional view of a modified form of air chamber.

Similar numerals refer to similar parts throughout the several views.

In Figures 1 and 2, 1 is an oil or gas engine and is adapted to actuate the crank 10 by means of the belt 9 and the inclosed gear reduction transmission 9'. The lever or walking beam 12 is pivoted to the upper end of the post 13 and is adapted to be reciprocated by the pitman 11 which is pivotally connected to it and the crank 10, and by means of the sucker rod 14 and the connecting links 4 and 19 this lever 12 is adapted to actuate the water pump 23, the air pump 21 and the special air load equalizing de-

vice 3 described more in detail herein below.

23 is a deep well pump cylinder secured to the lower end of the water line or discharge pipe 15. 14 is a sucker rod carrying piston 31 which carries an upwardly opening valve 32 common to single stroke pumps. 3' is an air reservoir surrounding the water line just above the pump 23. The slots or openings 17 in the lower part of the water line provide a means for the free flow of liquids from the water line into and out of the lower part of the air chamber or reservoir 3'.

18' is an air line or pipe for carrying compressed air from the air pump 21 to the air reservoir 3'. 3 is a special load equalizing air cylinder (see Figs. 1 and 4) provided with the two check valves 8 and 18, 8 allows air to pass out of the upper end of the cylinder and valve 18 admits compressed air from the air pump 21 through the branch pipe 8'. The piston 7'' is practically air tight and allows substantially no air to pass by or through it and is arranged to reciprocate in the upper part of the cylinder without clearance at the upper end and with a very large clearance space 18'' below the piston at the lower end of its stroke. This large clearance-space constitutes a load equalizing air chamber.

With this arrangement of parts the movement of the piston 7'' will cause a vacuum above and compress the air below it on its downward stroke. The air pressure in the air lines 8' and 18', the air reservoir 3' and in the lower part of the air cylinder 3 is substantially the same when the piston 7'' is at the upper end of its stroke and this pressure is automatically maintained and the pressure is determined or fixed by the weight and inertia of the column of water in the discharge line 15. The air pump 21 is arranged to pump a reasonable surplusage of air over and above the amount necessary to compensate for absorption and small leakage and maintain a full volume of compressed air in both the reservoir 3' and the lower part of the cylinder 3; this surplusage of air will escape through the openings 17 into the lower part of the water line 15 and thus will assist in raising the water so that substantially no power is wasted in pumping this surplusage. The water is raised by the upward movement of the lever 12 and the air is compressed by the downward movement and thus it is that the load is

equally divided between the two strokes, the water and air cylinders being properly proportioned to attain that end.

The vacuum and compressed air in the cylinder 3 assist very materially in raising the water in the water line thus relieving the engine and transmission mechanism of substantially one half of the load of raising the water in the water line 15. By this arrangement of parts of the mechanism and by reason of the resilience and cushioning action of the air in the air chamber 3' there will be substantially a continuous flow of water through the water line 15 during the operation of the pumping mechanism and this continuous flow of water relieves the pumping mechanism of the heavy shock load that is common and so destructive to all reciprocating single stroke deep well pumps. The high speed at which this pump may be run makes it practically impossible to suddenly overcome the inertia of the heavy column of water in the water line 15 which moves at substantially only one half as fast as the upward speed of the piston 31 in the water cylinder 23 when the cylinder and discharge pipe are of same diameter.

This high speed of the piston acting against the slower movement of the water in the water line above the openings 17 causes substantially one half of the amount of water discharged at each of the working strokes of the pump to pass through the openings 17 into the lower part of the air chamber 3' thus causing a slight increase of pressure in the air chamber which during the down stroke of the piston in the water cylinder, will cause the discharge of this surplussage of water from the air chamber 3' into the water line thus maintaining the continuous upward flow of the column of water above the openings 17 in the water-line 15.

As the air pump 21 works on the down stroke it will be seen that the air from it will be forced in at the time of the lightest pressure in the air chamber and thus it is seen that the air pressure in the air reservoir 3' is sufficient at all times to maintain a substantially continuous upward movement of the heavy column of water above the openings 17. The air chamber or reservoir 3' (see Fig. 3) is preferably constructed of two pieces of pipe or tubing of which the smaller and inner one is a few inches longer than the outer shell or tube; this outer shell or tube is swaged so as to make a close sliding fit to the inner tube which is provided with the openings 17 and threads at the ends for making connections with the pump cylinder below and the water line above. The two tubes are welded together at the points 33 and 33' so as to be absolutely air tight, and the coupling 28 is welded in so as to make an air tight con-

nection for the air line 18'. In the modified form of reservoir shown in Fig. 5 the construction is made up entirely of standard pipe and fittings and the inner pipe or water line is not continuous through the outer pipe but is made in sections separated a short distance apart to form the opening 17' which serves the same purpose as 17 in Figure 3, and the part 15 is held central and in line with the lower part 24 by means of the lugs 30 which are welded to the pipe 15 and are free to move therewith and rotate in the outer pipe. The walking beam or lever 12 is preferably constructed of two side bars firmly bolted together with suitable spacing blocks as shown at 34, 35 and 36 in Fig. 2.

In Fig. 4, 7 is a bifurcated end of the piston rod 7' which carries the piston 7'' at its lower end and 18'' is the clearance space for the compressed air which when piston 7'' is at lower limit is equal to substantially three times the pressure in the air chamber 3' when the air space or clearance 18'' is one third of the displacement space inclosed in the air cylinder 3. This heavy pressure of air assisted by the vacuum above the piston exerts a heavy upward pressure on the lever or beam 12 to assist just when the load is heaviest.

When in operation the minimum air pressure in the lower part of the cylinder 3 will be slightly above the average pressure in the air chamber 3' which has a fluctuating pressure caused by the flow of water in and out of the lower part in response to the respective strokes of the piston 31 (see Fig. 1) and the maximum air pressure in this chamber will force air through the branch pipe 8' and the check valve 18, into the cylinder 3 thus making the minimum pressure in cylinder 3 nearly equal to the maximum pressure in the reservoir 3', so that at all times during the operation of the mechanism there will be sufficient upward pressure to carry the weight of the reciprocating parts of the mechanism, and substantially one half of the weight of the water in the discharge pipe 15, the different parts being properly proportioned to attain that end.

I claim:

1. The combination, in deep well pumping mechanism, of a water pump cylinder, an air compressor, a load equalizing air cylinder, an air receiver or reservoir, a water discharge pipe leading from said water pump, an air line leading from said air compressor into said air receiver, an opening or port leading from the lower part of the said air receiver into the said water discharge pipe adjacent to said water pump cylinder, and a one way air duct leading from the said air receiver into one end of said load equalizing air cylinder.

2. The combination, in deep well pump-

ing mechanism, of a water pump cylinder, an air pump cylinder, a water discharge line, an air chamber surrounding the said water discharge line adjacent to the said water pump cylinder, a load equalizing air cylinder, pistons in the said cylinders, and means for alternating the working strokes of the said pistons in the said water cylinder and the said air cylinders, and an air conduit leading from said air pump cylinder into the said load equalizing cylinder and the said water discharge pipe or line.

3. The combination, in deep well pumping mechanism, of a water pump having a vertically arranged water discharge line, an air chamber surrounding the lower portion of the said water discharge line, reciprocating mechanism for operating the said water pump, an air pump adapted, with its connections, to force compressed air into and through the said air chamber and said water discharge line, and an air cylinder with connections adapted to exert a continuous upward pressure on the said reciprocating mechanism.

4. The combination, in deep well pumping mechanism, of a water pump cylinder, a water discharge pipe, an air reservoir surrounding the said water discharge pipe adjacent to said pump cylinder, a load equalizing air cylinder, and an air pump adapted to force compressed air into the said load equalizing cylinder and through the said air reservoir.

5. The combination, in deep well pumping mechanism, of a single stroke pump, a load equalizing air cylinder, a piston adapted to reciprocate within said air cylinder and to cause a vacuum in one end and to compress and retain compressed air in the other end, and means for alternating the heavy working strokes of the said pump and air cylinder pistons.

6. The combination, in deep well pumping mechanism, of a water pump, a load equalizing air cylinder, a compensating air pump, a discharge pipe for the said water pump, an air chamber surrounding the said discharge pipe adjacent to the said water pump, and air lines leading from said compensating air pump into the said air chamber and load equalizing air cylinder.

7. The combination, in deep well pumping mechanism, of a reciprocating member, a water pump adapted to be actuated by said member, a load equalizing air cylinder, a piston adapted to reciprocate in the said air cylinder, and means for maintaining a fluctuating air pressure on one side of said piston with a minimum pressure in excess of atmospheric pressure during the operation of the said pumping mechanism.

8. The combination, in deep well pumping mechanism, of a water pump, a load equalizing air cylinder, an air pump, and

means for effecting the cooperative action of the said water pump, air cylinder and air pump for equalizing load and eliminating shock in the pumping of water.

9. The combination, in deep well pumping mechanism, of a water pump cylinder, a water discharge pipe, a load equalizing air cylinder, an air receiver having open communication with said water discharge pipe adjacent to the said water pump cylinder, an air compressor adapted to compress air into said air receiver, and means for conducting air from said receiver into the said load equalizing air cylinder.

10. The combination, in deep well pumping mechanism, of a water pump, a load equalizing air cylinder, a piston in said air cylinder, an air chamber surrounding and having open port leading into the lower part of said discharge pipe, an air conduit extending from said air cylinder to said air chamber, and motor actuated means for alternating the heavy working strokes of the said water pump and said air cylinder piston.

11. The combination, in deep well pumping mechanism, of a pump, a motor for actuating said pump, a supply of compressed air, and a load equalizing air cylinder adapted to receive air from the said compressed air supply, recompress it, and use it repeatedly for equalizing the draft or load on said motor during its actuation of the said pump.

12. The combination, in deep well pumping mechanism, of a pump, actuating means for said pump, a load equalizing air chamber, a shock alleviating air reservoir, means for utilizing compressed air in said chamber to equalize the load on said pump actuating means, and means for utilizing compressed air in said reservoir to alleviate shock on said pump and its actuating parts.

13. The combination, in deep well pumping mechanism, of a pump, a load equalizing air cylinder, a piston adapted to reciprocate in said cylinder and to simultaneously cause a partial vacuum in one end and to move against a full cylinder of confined compressed air in the other end of said cylinder, another piston for said pump, and means for alternating the working strokes of said pistons.

14. The combination, in deep well pumping mechanism, of a pump cylinder, a pump piston, a load equalizing air chamber adapted to retain its full volume of compressed air, a reciprocating member adapted to cause fluctuations in pressure and volume of said retained compressed air, and means for alternating the working strokes of said piston and member.

15. The combination, in pumping mechanism, of a pump comprising a working barrel, a piston and a discharge pipe or water line; reciprocating mechanism for actuating

said piston, a load equalizing air chamber, and means for maintaining a minimum air pressure in the said air chamber approximately equal to the water pressure in said
5 discharge pipe adjacent the said working barrel during the operation of said piston.

16. The combination, in pumping mechanism, of a pump cylinder, a piston in said cylinder, a water discharge conduit leading
10 from said cylinder, a load equalizing air chamber, and means for maintaining an air pressure in said load equalizing air chamber in excess of atmospheric pressure during the operation of said mechanism.

17. The combination, in pumping mechanism, of a pump cylinder, a piston, a water discharge pipe, a load equalizing air chamber, and means for maintaining a fluctuating
15 air pressure in said chamber equal to or greater than the minimum water pressure in said pump cylinder during the operation of the said pumping mechanism.

18. The combination, in pumping mechanism, of a single stroke pump cylinder, a
25 piston adapted to reciprocate in said cylinder, a discharge pipe leading from said cylinder, a load equalizing air chamber, a motor and connecting means for actuating said piston, and means for causing the compression and expansion of air in said air
30 chamber to coact with said piston in equalizing the load on said motor during the operation of said pumping mechanism.

19. The combination in pumping mechanism

of a single stroke pump, a motor for
35 actuating said pump, a load equalizing air cylinder, and means for utilizing a partial vacuum in said air cylinder for equalizing the load on said motor during its actuation
40 of said pump.

20. The combination, in deep well pumping mechanism, of a pump, actuating means
45 for said pump, a shock alleviating air reservoir, a load equalizing air chamber, means for supplying compressed air to said reservoir and chamber, and means for utilizing the compression and expansion of the air in
50 said reservoir and chamber for the alleviation of shock on said pump and the equalization of the load on said actuating means.

21. The combination, in deep well pumping mechanism, of a pump, a load equalizing
55 air chamber, a reciprocating piston in a part of said air chamber, and means whereby said piston may be made to move against compressed air throughout the full length of
60 its stroke.

22. The combination in deep well pumping mechanism, of a single acting pump, a
65 load equalizing air chamber, a piston adapted to reciprocate in a part of said chamber, means for causing said piston to move against compressed air throughout the full length of its stroke in one direction, and means for alternating the working strokes
of the said pump and piston.

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