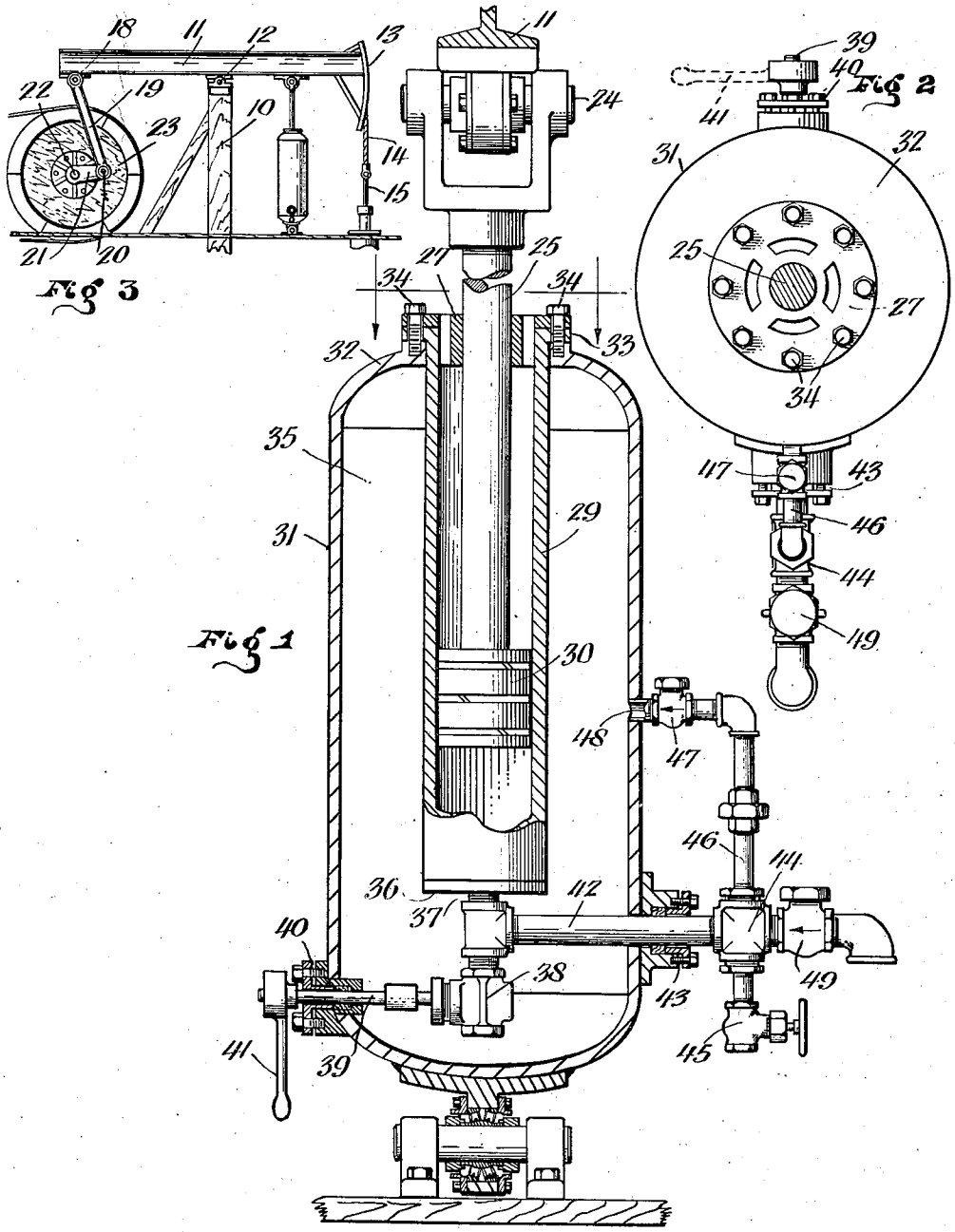
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FLUID COUNTERBALANCE

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FLUID COUNTERBALANCE

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The present invention relates generally to fluid counterbalancing devices for oil well pumping apparatus and other uses, particularly that type of air balancing devices used in connection with deep wells, in which a power-actuated walking beam is oscillated vertically in respect to its sampson post, and in which a counterbalance is necessary to equalize the otherwise unequal power demands during the up and down strokes of the pump rods.

The invention is more particularly an air balance for the walking beam, deep well type of oil pump, though it may be capable of other uses, and depends for its effectiveness upon the movement of a piston, in normal operation, against a substantially constant volume of air under pressure which acts to uniformly retard movement of the piston in one direction and similarly assist in the movement of the piston in the opposite direction.

For uniform efficiency in operation, one end of a cylinder, in which the above-mentioned piston functions, is in open two-way communication with an air receiver or storage tank, and some means, frequently a nearby air compressor, must be present by which to initially establish the necessary pressure in the tank or receiver. Initially, in this sense, includes each start of operations after any appreciable shut down for well operations during which the pumping unit remains inactive. Usually such compressors require considerable time to build up the necessary pressure and, of course, must be mounted and connected as separate apparatus.

It is the primary object of the present invention to provide an air balance wherein the working cylinder may be isolated with respect to the tank as regards two-way open communication, and channels opened thereto, one of which provides a valved passageway to atmosphere, and the other of which provides a valved communication with the tank. In this manner, during the initial movements of the walking beam at the start of operations, the piston, connected thereto and moving in the working cylinder, may be caused to act as a compressor of air in advance thereof, and thus quickly and easily establish the requisite working pressure in the tank or receiver.

A further object of the invention is the provision of a working arrangement of parts whereby the above is possible at the end of the working cylinder which is normally in open two-way communication with the receiver or tank, and by means capable of ready manipulation externally of the cylinder and of a nature calculated to insure great length of useful life and continuous efficiency throughout such life.

With the above in mind, the invention may be better understood and more thoroughly appreciated in the course of the following detailed description and by reference to the accompanying drawing, which forms a part of this specification, and in which,

Figure 1 is a vertical sectional view, through the air balance constituting the invention, certain of the parts being broken away, and certain thereof appearing in elevation.

Figure 2 is a sectional top plan view, the section being taken on line 2—2 of Figure 1, and,

Figure 3 is a diagrammatic view, showing the practical scheme of use of the invention, on a substantially reduced scale.

Referring more particularly to the diagram of Figure 3 of the above drawing, 10 indicates a portion of the Samson post upon which the walking beam 11 is mounted. A pivot pin 12 attaches the walking beam 11 to the Samson post 10 and permits free oscillating movements of the former. At one end of the walking beam is a horse head 13 to receive the reins 14 commonly connecting the same with the polish rod 15. It will be understood that the polish rod 15 extends downwardly into a well tubing in practise to provide for the operation of the pump plunger.

At a point in the length of the walking beam, a pivot pin 18 is mounted to receive the end of a pitman rod 19. This rod is connected by a wrist pin 20 with a crank 21 which is mounted upon a shaft 22 driven by a pulley 23. The pulley 23 receives its power for the power actuation of the walking beam 11, from any suitable source of power, not shown, and it is to be understood that other forms of driving connections or mechanism may be used, since the present showing is, in this respect, for purposes of illustration only.

For the above reason a simple usual form of mechanism has been diagrammatically illustrated, the walking beam being of the simple lever type. However, other types may be used requiring power to be applied thereto, for example, at a point between the horse head 13 and the Samson post 10.

Supported by the walking beam 11, as better seen in Figure 2, at a point between the horse head 13 and the Samson post 10, is a pivot 24 to which the upper end of a piston rod 25 is connected, such rod extending downwardly to opera-

tively connect the cushioning or balancing unit 26 with the walking beam.

The rod 25 depends through a guide member 27 and this member is mounted in the otherwise open upper end of the working cylinder 29. Member 27 may take the form of a slotted cap as in Figures 2 and 3, the slots being sufficient to permit of the passage of air freely into and out of the upper end of the cylinder. This cap member 27 forms an effective guide for the piston rod 25 as it reciprocates within cylinder in accordance with the up and down movements of the walking beam, to bring about similar movements of the piston 30 at the lower end of the rod.

The cylinder 29 is mounted within a tank or receiver 31, the head 32 of the tank receiving a flanged shoulder 33 of the cylinder, and the connection being made by cap screws 34 passing through a portion of the guide member 27 and flange 33 of cylinder 29, into the tank wall, so that the cylinder is thus held in position to seal the upper end of the tank, with the cylinder depending into the tank to form a pressure holding chamber 35 in the tank around the cylinder.

The lower end of the cylinder 29 is provided with a head 36 having an opening therethrough to which is attached a pipe 37. This pipe extends downwardly from the closed base of the cylinder and normally opens into the lower portion of the tank 31 through the main control valve 38 which, when open, provides for two-way communciation through pipe 37, between the compression space of the cylinder below the piston 30 and the lower portion of the tank. By reason of this valve 38 the operator may establish, regulate and interrupt flow of air between the above mentioned spaces.

Since the main control or master valve 38 is, as above described, within the lower portion of the tank 31, its manual control is provided for by means of a control stem 39 which, as plainly seen in Figure 1, projects laterally through a stuffing box 40 in the tank wall and has, exteriorly of the tank, a control handle or lever 41. This lever is shown in full lines in Figure 2 in a position wherein the master valve 38 is open, and in dotted lines in Figure 3 in a position wherein the master valve is closed.

It will be noted that the master valve 38 is spaced some distance below the lower end of the cylinder 29 leaving room for the connection of the inner end of a pipe 42 to the pipe 37 above the valve 38.

The pipe 42 extends through the lower portion of the tank 31 and externally through the tank wall, through a stuffing box 43, and its inner end is thus in communication with the compression space within the cylinder 29. The outer end of pipe 42 is connected with a four-way coupling or union 44, the lower leg of which union connects with a bleeder valve 45. By means of this bleeder valve, which is of course manually controlled, and with the master valve 38 closed, pressure may be permitted to discharge from the cylinder below piston 30 when it is desired, for instance, to lower the walking beam after its power actuation has been stopped.

The upper leg of the coupling or union 44 connects with a pipe 46 which carries a check valve 47 connected in turn through a pipe 48 with the tank 31. It will be understood that this check valve 47 opens toward the tank only. The remaining outer leg of the union 44 is connected with a short pipe having therein a check valve 49 which opens inwardly or toward the union only, and thus provides for ingress only of air, the outer end of the pipe being open to the atmosphere.

It will, then, be obvious from the foregoing that in order to initially establish the requisite pressure in the tank 31, the operator will close the master valve 38, thus isolating the piston cylinder 29 from said tank as regards the full open communication in normal operation between these parts.

After closure of the main valve 38 as above, the first upward movement of the adjacent end of the walking beam 11 elevates the piston 30, causing air to be drawn into the lower (now otherwise closed end) of the cylinder 29 through the inwardly opening check valve 49, from atmosphere. During the next downward movement of the beam 11, during which piston 30 is forced downwardly, the air previously drawn into the lower end of the cylinder 29, is forced out through pipe 43 and then through pipe 46 (since valve 49 closes against outflow of air) and into the tank or receiver 31 through check valve 47.

By reason of the foregoing it becomes an easy matter to quickly and effectively establish the requisite operating pressure within the tank or receiver 31, and when this has been accomplished, all that is necessary for the operator to do is to open control valve 38 and the parts are ready for normal operation. Obviously during normal operation, pressure holds the check valves 47 and 49 in tightly closed inactive positions.

Furthermore, should the walking beam be stopped, as for respacing the pump rods, it may be lowered if desired under pressure control, by closing the main control valve 38 and then opening valve 45 slightly to bleed a portion of the pressure from cylinder 29 beneath its piston 30, sufficient to allow beam 11 to lower to the desired point. If, then, the beam is to be raised to its former position, it is simply necessary to slightly open the main control valve 38 and thus let into cylinder 29 below piston 30 sufficient pressure for this purpose from the tank or receiver 31.

Obviously should it be desirable or necessary to increase the working pressure in cylinder 29 and communicating tank or receiver 31 at any time during normal operation, it is merely necessary for the operator to close the control valve 38 and permit the piston 30 to function as a compressor during a few strokes of the beam 11, in the same manner as that above described incident to the initial provision of working pressure.

Having thus fully described my invention, what I claim is:

1. In a pumping apparatus of the type including a power-actuated, vertically oscillating walking beam, an air counterbalance consisting of an air pressure receiving tank, a cylinder supported for rocking movement, a piston within said cylinder, a piston rod extending upwardly from said piston through the upper end of the cylinder and pivotally connected to the walking beam, a conduit normally establishing free, two-way communication of air pressure between the lower portion of the cylinder and the tank for normal action of such pressure upwardly against the piston, means for closing said conduit to isolate the cylinder from normal communication with the tank, a second conduit leading from the lower portion of the cylinder and having branches leading to the atmosphere and to the tank, and check valves in said branches to thus form one-way

passages for air into the cylinder and from the cylinder into the tank.

2. In a pumping apparatus of the type including a power-actuated, vertically oscillating walking beam, an air counterbalance consisting of an air pressure receiving tank, a cylinder supported for rocking movement, a piston within said cylinder, a piston rod extending upwardly from said piston through the upper end of the cylinder and pivotally connected to the walking beam, a conduit normally establishing free, two-way communication of air pressure between the lower portion of the cylinder and the tank for normal action of such pressure upwardly against the piston, means for closing said conduit to isolate the cylinder from normal communication with the tank, and connections forming valved one-way air passages into the lower portion of the cylinder from the atmosphere and from the said lower portion of the cylinder into the tank, whereby the piston acts to compress air into the tank during the period free two-way passage of air between the cylinder and tank is cut off.

3. In a pumping apparatus of the type including a power-actuated, vertically oscillating walking beam, an air counterbalance consisting of an air pressure receiving tank, a cylinder supported for rocking movement, a piston within said cylinder, a piston rod extending upwardly from said piston through the upper end of the cylinder and pivotally connected to the walking beam, a conduit normally establishing free, two-way communication of air pressure between the lower portion of the cylinder and the tank for normal action of such pressure upwardly against the piston, means for closing said conduit to isolate the cylinder from normal communication with the tank, a second conduit leading from the lower portion of the cylinder and having branches leading to the atmosphere and to the tank, a check valve in one of said branches opening toward the cylinder, and a check valve in the other branch opening toward the tank.

4. An air balance for that type of pumping apparatus having a power-actuated, vertically oscillating walking beam, said balance comprising an air pressure storage tank, a cylinder normally in open two-way communication at its lower end with said tank, a piston in said cylinder normally exposed to pressure from the tank, a rod extending upwardly from the piston and operatively connected at its upper end to the walking beam, means for cutting off said open communication between the cylinder and tank, and a valved means forming air passageways between the lower portion of the cylinder and atmosphere, and between the lower portion of the cylinder and the tank, whereby the piston functions as a compressor actuated by the walking beam when normal open communication between the cylinder and tank is disrupted.

5. An air counterbalance for that type of pumping apparatus including a power-actuated, vertically oscillating walking beam, said counterbalance comprising an air pressure receiving tank pivoted at its lower end to a fixed base, a cylinder associated, and movable, with said tank, a piston within the cylinder, a rod extending upwardly from the piston through the upper end of the cylinder and operatively connected at its upper end with the walking beam, a conduit normally establishing free, two-way communication for air pressure between the lower end of the cylinder and the tank, a control valve in said conduit for closing the same, a second conduit connecting the compression end of the cylinder and the tank, a check valve in said second conduit for permitting flow of air from the cylinder to the tank only, and an air inlet valve connecting with said second conduit through which air may be taken into the compression end of the cylinder, said valves of said second conduit being normally held in closed positions by air pressure in the cylinder and tank, and being effective only when the control valve of the first conduit is closed.

6. An air counterbalance for that type of pumping apparatus including a power-actuated, vertically oscillating walking beam, said counterbalance comprising an air pressure receiving tank pivoted at its lower end to a fixed point, a cylinder associated, and movable, with said tank, and normally in open communication at its lower end therewith, a piston in said cylinder normally exposed to air pressure from said tank, a manual control valve for disrupting communication between the cylinder and the tank, a conduit connecting the compression end of the cylinder and the tank, a check valve in said conduit permitting flow of air from the cylinder to the tank only, and normally held in inactive closed position by pressure with the tank, an inlet check valve to the said conduit permitting air to be drawn into the cylinder, and normally held in inactive closed position by air pressure within the cylinder, and a manual bleeder valve also in said conduit for relieving pressure in the cylinder alone when said control valve is closed.

7. An air balance for that type of pumping apparatus having a power-actuated, vertically oscillating walking beam, said balance comprising an air pressure receiving and storing tank, a cylinder normally in open, two-way communication at its lower end with the tank, a piston in said cylinder normally exposed to pressure from the tank, a rod extending upwardly from the piston and operatively connected at its upper end to the walking beam, means for cutting off said open communication between the cylinder and tank, and means effective when said communication is cut off, to draw atmospheric air into the cylinder and discharge such air into the tank, under actuation of the piston by the walking beam.

8. An air balance for that type of pumping apparatus having a power-actuated, vertically oscillating walking beam, said balance comprising an air pressure receiving and storing tank, a cylinder normally in open, two-way communication at its lower end with the tank, a piston in said cylinder normally exposed to pressure from the tank, a rod extending upwardly from the piston and operatively connected at its upper end to the walking beam, means for cutting off said open communication between the cylinder and tank, and means effective when said communication is cut off, to draw atmospheric air into the cylinder and discharge such air into the tank, under actuation of the piston by the walking beam, while the beam is moving, and to bleed pressure from the cylinder alone when the walking beam has been stopped.

9. An air balance comprising a cylinder, a piston movable therein, a rod extending from said piston through one end of the cylinder, an air tank with which the other end of the cylinder is normally in open communication to expose the piston to tank pressure, means for manually cutting off normal communication between the cyl-

inder and tank to thus isolate the cylinder from tank pressure, and connections between the cylinder, tank and atmosphere and effective during such isolation of the cylinder, whereby the latter functions upon power operation of its piston, to take in and compress external air and force such air into the tank.

10. In a pumping apparatus of the type including a power-actuated, vertically oscillating, walking beam, an air balance comprising an air pressure receiving and storing tank, a cylinder depending within the tank and normally in open two-way communication at its lower end with the tank, a piston in said cylinder normally exposed to pressure from the tank, a rod extending upwardly from the piston and operatively connected to the walking beam, valve means extending into the tank for cutting off said open communication between the cylinder and the tank to thus isolate the cylinder, and valved means extending into the tank and into connection with the cylinder for bleeding pressure from the latter when isolated, without reducing pressure in the tank.

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