June 23, 1925. 1,543,201

I. C. BELL

PUMPING APPARATUS

Filed July 21, 1924 2 Sheets-Sheet 1

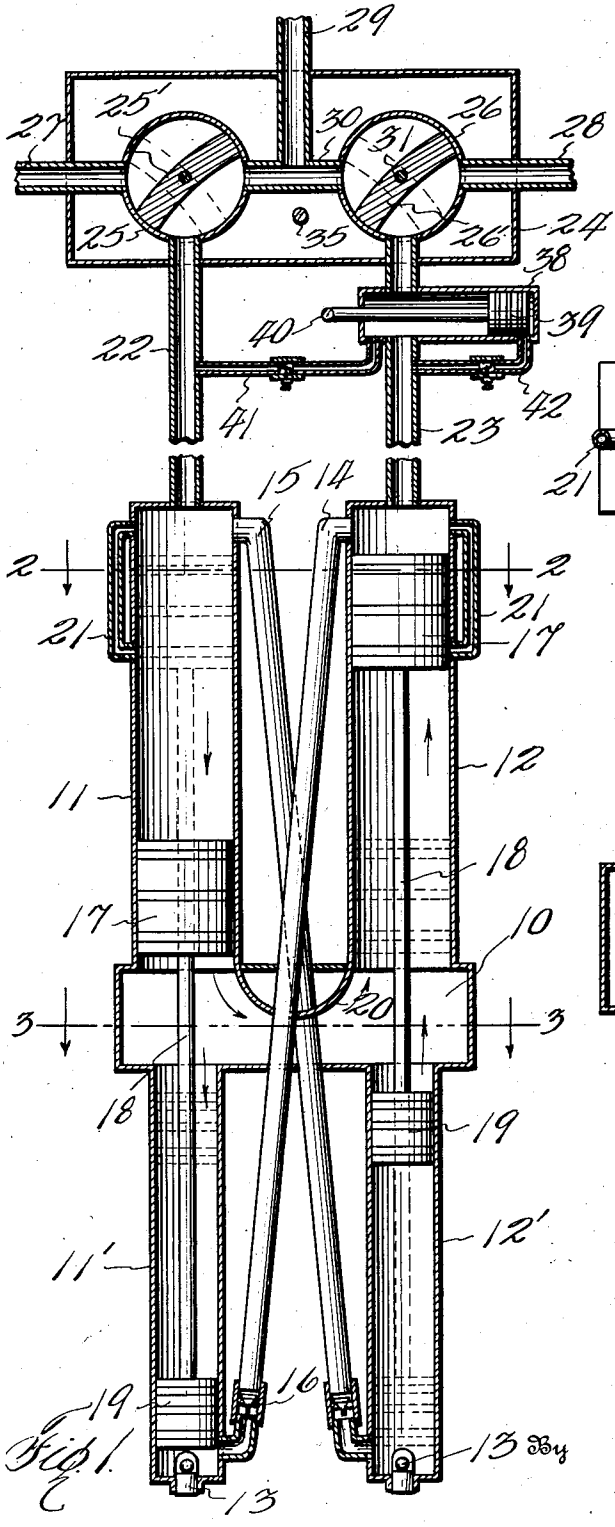


Fig. 1.

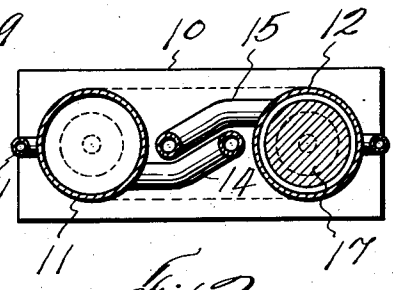


Fig. 2.

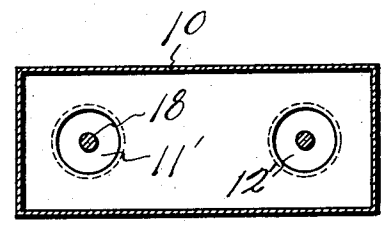


Fig. 3.

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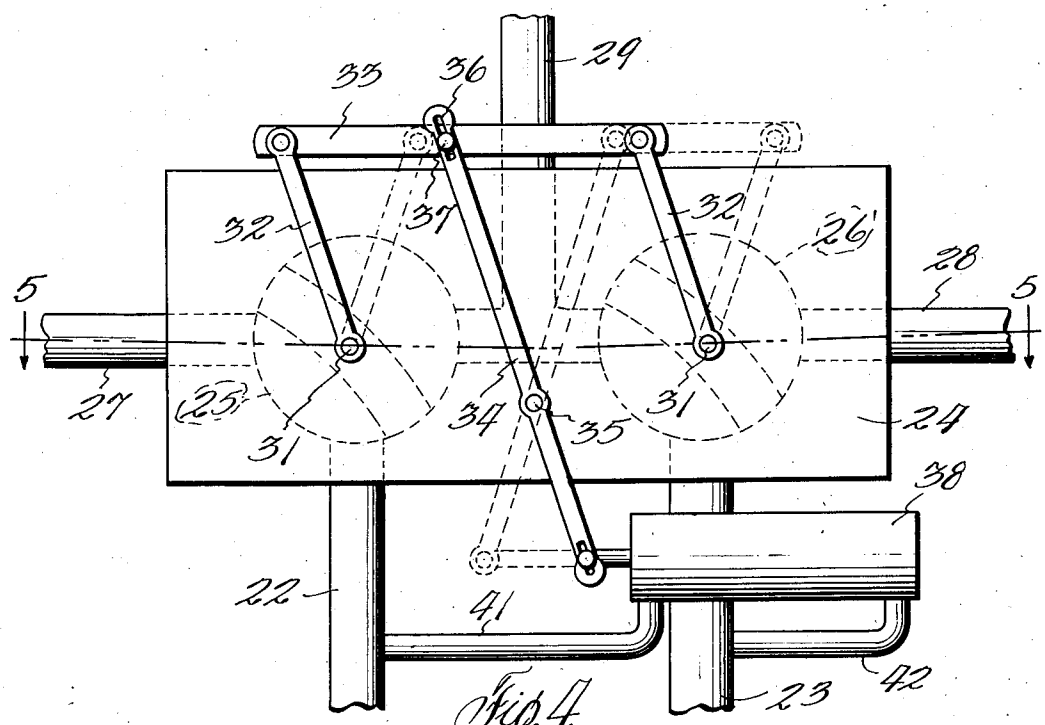


Fig. 4.

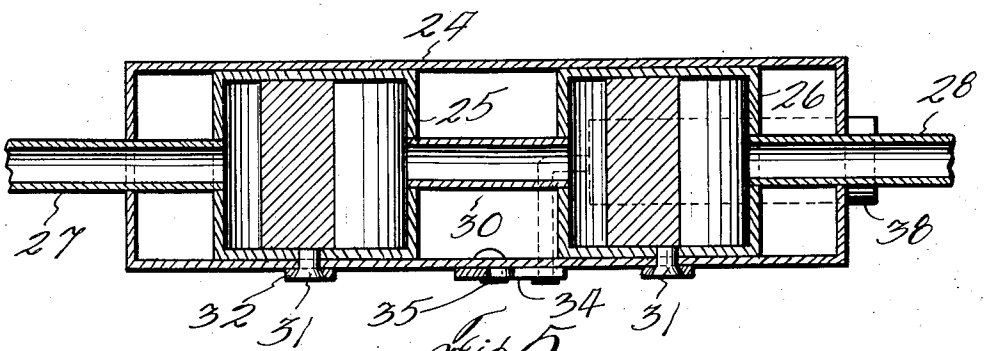


Fig. 5.

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Patented June 23, 1925. 1,543,201

UNITED STATES PATENT OFFICE.

IVAN C. BELL, OF DALLAS, TEXAS, ASSIGNOR TO THE GUIBERSON CORPORATION, OF DALLAS, TEXAS, A CORPORATION OF DELAWARE.

PUMPING APPARATUS.

Application filed July 21, 1924. Serial No. 727,307.

To all whom it may concern:

Be it known that I, IVAN C. BELL, citizen of the United States of America, residing at Dallas, in the county of Dallas and State of Texas, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a specification.

This invention relates to new and useful improvements in pumping apparatuses.

The invention has to do with that type of pumping apparatuses wherein the liquid is elevated by a fluid pressure instead of being displaced by a plunger.

The object of the invention is to conserve the applied power necessary to lift the liquid by employing balanced columns of liquid; whereby a low pressure will operate the apparatus.

A further object is to reduce lost motion and to utilize substantially all of the applied power.

Another object is to provide an apparatus for elevating any liquid such as oil, water and the like with any fluid pressure such as steam, air and the like.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Fig. 1 is a diagrammatical vertical sectional view of an apparatus exemplifying the invention,

Fig. 2 is a cross-sectional view on the line 2—2 of Fig. 1,

Fig. 3 is a cross-sectional view on the line 3—3 of Fig. 1,

Fig. 4 is an enlarged view of the valve controlling head, and

Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 4.

In the drawings the numeral 10 designates a transverse manifold from the top of which vertical cylinders 11 and 12 respectively extend upwardly; while vertical cylinders 11′ and 12′ depend from the bottom of the manifold. The upper and lower cylinders are axially alined and while the lower cylinders are of less diameter, they are concentrically disposed with relation to the upper cylinders. Each lower cylinder has a check valve 13 in its bottom which is otherwise closed. Liquid conducting pipes 14 and 15 respectively extend from the lower ends of the lower cylinders to the upper ends of the upper cylinders, in crossed relation. The pipe 14 extends from the cylinders 11′ to the cylinder 12; while the pipe 15 extends from the cylinder 12′ to the cylinder 11. The pipes 14 and 15 each have a check valve 16 at their lower ends.

In each upper cylinder is a piston head 17 connected by a piston rod 18 with a piston head 19 in the lower cylinder thereunder. The pipes 14 and 15 and the rods 18 pass through the manifold. A deflector 20 is disposed in the manifold between the cylinders 11 and 12. At the upper end of each upper cylinder is an exterior by-pass pipe 21, having its ends entering the cylinder. Each pipe is long enough to by-pass fluid from above to below the head 17, when the latter reaches the upper end of its stroke. The purpose of the by-pass pipe 21 is to supply liquid below head 17 and thus maintain a solid column of liquid between the heads. Unless some means was provided for restoring the liquid which leaks past the piston rings, the solid column and balance would be lost. Also these by-pass pipes afford means for initially filling the cylinders between the heads 17 and 19.

The parts 17, 18 and 19 will be referred to as pistons and these pistons work oppositely, that is one is up when the other is down. The check valves 16 work oppositely to the intake check valves 13. Upon the upstroke of a piston its valve 13 is opened to take in fluid, while its valve 16 is closed. Upon the down stroke of a piston its valve 13 is closed and its valve 16 is opened. It will be seen that when a check valve 16 is closed, its conductor pipe will be full of fluid and when fluid is forced out of a lower cylinder by the down stroke of the piston it will be displaced through the pipe 14 or 15 into the top of the upper cylinder, with which the pipe is connected.

Also upon the down stroke of a piston the excess of fluid from one upper cylinder will be forced through the manifold to the other upper cylinder, the excess being due to the greater capacity of the upper cylinders. From this it will be seen that the pistons are balanced and only enough pressure need be applied on the down stroke to displace the fluid.

From the top of the cylinder 11 a pipe 22 extends upwardly, while a pipe 23 extends upwardly from the cylinder 12. These pipes enter a valve housing 24. The pipe 22 connects with the bottom of a two-way valve case 25; while the pipe 23 connects with the bottom of a two-way valve case 26. A discharge pipe 27 leads from the case 25, while a similar pipe 28 leads from the case 26. A fluid pressure supply pipe 29 has branches leading to the cases and entering at points spaced apart about ninety degrees.

In the case 25 is a rotatable gate 25′ and a similar gate 26′ is mounted in the case 26. The discharge pipes lead from the cases at substantially ninety degrees from the entrance of the pipes 22 and 23. The gates have their shafts 31 connected with arms 32 exteriorly of the housing (Fig. 4). These arms have their upper ends pivoted to a connecting bar 33, whereby they are swung in unison. A shifting lever 34 is fulcrumed on a stud 35 on the side of the housing 24 and has a slot 36 at its upper end receiving a headed pin 37.

As is shown in Fig. 1 the elevating fluid under pressure supplied from the pipe 29 enters the valve cases 25 and 26. The gate 26′ cuts off the escape of the fluid from the case 26, but permits the elevating liquid from the pipe 23 to discharge through the pipe 28. The fluid under pressure from the case 25 passes into the pipe 22, the discharge 27 being cut off by the gate 25′. The fluid pressure depresses the piston in the cylinders 11 and 11′.

When the piston starts down as described the valve 13 at the bottom of the cylinder 11′ is closed and the valve 16 is opened, thus the liquid below the head 19 in said cylinder is forced out through the pipe 14 into the top of the cylinder 12. The liquid below the head 17 in the cylinder 11 fills the cylinder 11′ above the head 19 as the piston descends, but as the capacity of the cylinder 11 is considerably greater than that of the cylinder 11′, there will be an excess or surplus of liquid which will be displaced into the manifold and the cylinder 12. This displacement will be sufficient to counterbalance the piston in the cylinders 12 and 12′, which will be elevated in proportion to the descent of the first piston.

As the piston in the cylinders 12 and 12′ is elevated it will displace the fluid above the head 17 in the cylinder 12 as well as the liquid entering from the pipe 14. This liquid will be elevated in the pipe 23 and discharged from the pipe 28. While the piston in the cylinder 11 is descending the pipe 15 having been previously filled, will be so held. While the piston in the cylinder 12′ is rising it will draw in liquid through the valve 13 in the bottom of said cylinder. At all times a solid body of liquid will be present on both sides of the piston heads 17 and 19 and they will counterbalance. The pipes 22 and 23 will also be filled. Thus any displacement of the liquid will also move the pistons and only enough pressure is required to overcome the balance to elevate the liquid.

When the piston reaches the top of the cylinder 12 the gates must be shifted to transfer the pressure to the pipe 23. To accomplish this automatically, I provide a horizontal pressure cylinder 38 having a piston 39 and a piston rod 40 pivoted to the lower slotted end of the lever 34. The left hand end (Fig. 1) of the cylinder is connected with the pipe 22 by a pipe 41; while a pipe 42 connects the pipe 23 with the right hand end of the cylinder. Each of the pipes 41 and 42 includes a spring pressed pressure valve 43.

As is shown in Fig. 1 the piston head 39 is at the left hand end of the cylinder 38. The pipes 41 and 42 are small and the fluid entering said pipes will unseat the valves 43 at a predetermined pressure. So long as liquid is being elevated in the pipe 23 at full capacity the pressure in the pipes 41 and 42 will be substantially equal and the piston will be held in the cylinder 38 as is shown, but when the pressure in the pipe 22 becomes greater at the end of the up stroke of the piston in the cylinder 12, the fluid from the pipe 41 will enter the right hand end of the cylinder 38 and displace the piston head 39, thus shifting the lever 34 and valves.

It is pointed out that the pipes and cylinders of the pump need not be arranged as shown in the drawings and any suitable and operable arrangement may be made as the conditions of the well may require.

What I claim, is:

1. In a balanced fluid column pumping apparatus, a pair of vertical containers connected for displacing fluid intermediate their ends from one to the other and also connected for displacing fluid from the lower end of each to the upper end of the other, and oppositely disposed pistons, one of the pistons being suspended in one container and the other piston being disposed in the other container, said pistons being counterbalanced by the fluid in the containers.

2. In a balanced fluid column pumping apparatus, a pair of vertical containers each containing a column of fluid balanced by the column of fluid in the other container, each container having a discharge outlet at its upper end, and means for displacing the fluid from one column to the other to elevate the fluid in the last named column.

3. In a balanced fluid column pumping apparatus, a pair of vertical containers each containing a column of fluid balanced by the column of fluid in the other container,

means for displacing the fluid from one column to the other to elevate the fluid in the last named column, and means for conducting the fluid to be elevated from the bottom of one column to the other column at a point above where the fluid is displaced from one container to the other.

4. In a balanced fluid column pumping apparatus, a pair of vertical containers each containing a column of fluid balanced by the column of fluid in the other container, means for displacing the fluid from one column to the other to elevate the fluid in the last named column, and means for alternately supplying fluid under pressure to the containers.

5. In a balanced fluid column pumping apparatus, a pair of vertical containers each containing a column of fluid balanced by the column of fluid in the other container, means for displacing the fluid from one column to the other to elevate the fluid in the last named column, means for conducting the fluid to be elevated from the bottom of one column to the other column at a point above where the fluid is displaced from one container to the other, and means for supplying fluid under pressure to the containers.

6. In a balanced fluid column pumping apparatus, a pair of vertical containers, a manifold connection between the containers at their central portions, a pipe leading from the bottom of each container to the top of the other container. a check valve at the bottom of each pipe, and a check valve at the bottom of each container.

7. In a balanced fluid column pumping apparatus, a pair of vertical containers, a manifold connection between the containers at their central portions, a pipe leading from the bottom of each container to the top of the other container, a check valve at the bottom of each pipe, a check valve at the bottom of each container, and pistons working in each container.

8. In a balanced fluid column pumping apparatus, a pair of upper cylinders, a pair of lower cylinders, each upper cylinder being connected with one of the lower cylinders, each upper cylinder having a greater capacity than its lower cylinder, a piston in each cylinder, the upper and lower pistons being rigidly connected, a connection between all the cylinders at the junction of the upper and lower cylinders, a pipe leading from the bottom of each cylinder to the top of the other cylinder, a check valve at the bottom of each pipe, and a check valve at the bottom of each lower cylinder.

9. In a balanced fluid column pumping apparatus, a pair of vertical containers each containing a column of fluid balanced by the column of fluid in the other container, a piston operating in each container and supported by the column of fluid therein, there being a connection between the containers below the lower ends of the strokes of the pistons, and means at the upper end of each container for supplying fluid below the piston at the upper end of each stroke.

In testimony whereof I affix my signature.

IVAN C. BELL.