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[54] **WELL PUMP AND THE METHOD OF PUMPING**

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[52] **U.S. Cl.** **166/313,** 166/68, 417/121

[51] **Int. Cl.**.....**E21b 43/00,** F04b 23/02

[58] **Field of Search**.....166/314, 68; 417/121, 122, 137, 144, 145

[56] **References Cited**

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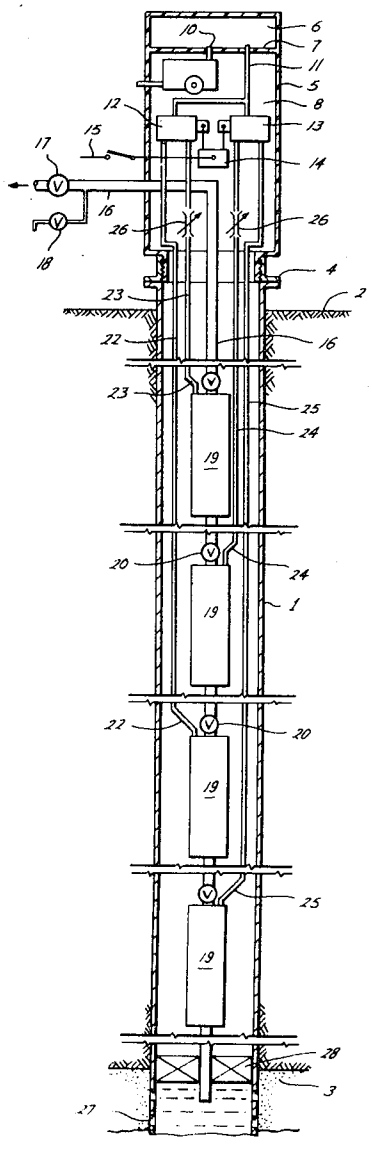
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[57] **ABSTRACT**

A pump for use in wells having a production string in which is mounted pressure tanks into which an air flow is directed in an alternating cycle to pressurize and exhaust said tanks and the novel method of pumping fluid from a well by alternately pressurizing and exhausting air from alternate chambers at timed intervals and on preregulated cycles.

6 Claims, 2 Drawing Figures



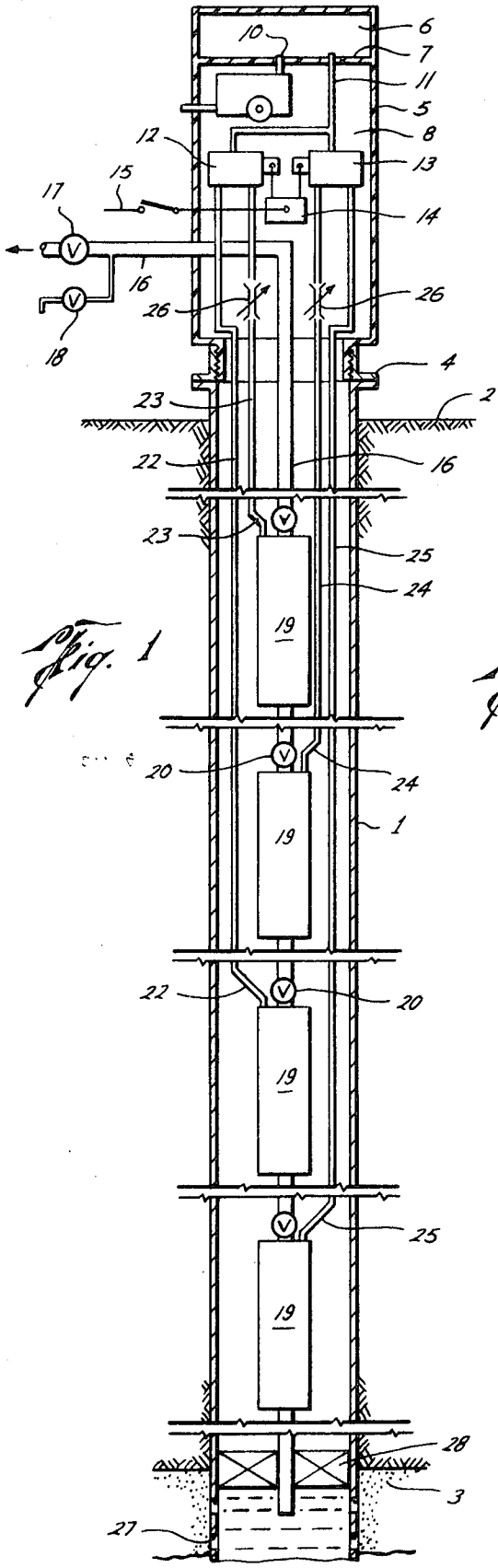


Fig. 1

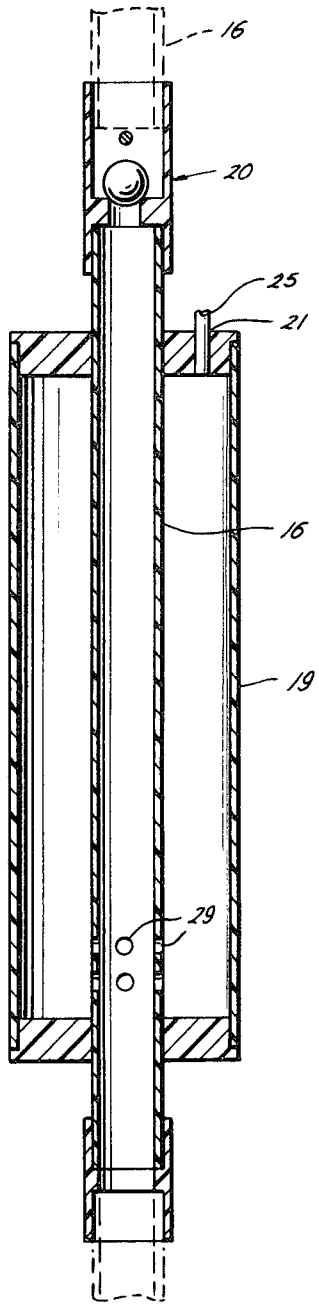


Fig. 2

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WELL PUMP AND THE METHOD OF PUMPING

SUMMARY OF THE INVENTION

A pump for lifting fluids from a well having a production string made up of a series of air chambers in flow connection and having means for introducing air into and exhausting air from alternate chambers and means for reversing the air flow in pre-regulated cycles, and means for placing said pump in actuation at predetermined time intervals and the method of pumping fluid from wells by pressurizing and exhausting alternate chambers in flow connection, and reversing the flow of pressure at a preregulated rate and timing the pump actuation at predetermined intervals.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a well bore and well head in cross section.

FIG. 2 is an enlarged, elevational view of a pressure chamber.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, the numeral **1** designates a well casing mounted in a well bore and extending from the ground surface **2** to the production formation **3.** A collar **4** is mounted on the upper section of the casing **1** and the well head housing **5** is diametrically reduced at one end and externally threaded to be received by the internal threads of the collar **4.** The upper portion of the head housing **5** forms an air storage chamber **6,** having the partition **7** separating the storage chamber **6,** from the lower chamber **8.** An air compressor and motor **9** is mounted in the chamber **8** and has the line **10** leading into the chamber **6.** An air discharge line **11** leads from the chamber **6** and into the valves **12, 13** which are controlled by the recycling control **14,** powered through the supply line **15,** leading from a suitable source of power (not shown). A production tubing **16,** having a valve **17** and a tester bleed off **18,** extends through the housing **5** and extends into the well casing. At spaced intervals in the production tubing and mounted on said tubing are the pressure chambers, as **19, 19,** and a back pressure valve, such as the ball and cage **20,** are mounted in the production tubing immediately above each pressure chamber. An air passageway **21** is formed in the upper end of each chamber **19** into which one of the respective air lines **22, 23, 24, 25,** are mounted. In one of the lines leading from each of the valves **12, 13,** is a restricted orifice, as **26, 26,** which may be of the adjustable type, to provide means for varied restriction of flow therethrough.

The lower end of the production tubing extends into the screen **27,** through the usual packing **28.** In each chamber **19,** adjacent the lower end thereof, are flow passageways **29** into the production tubing.

In operation, the well is first engineered to determine the rate of flow into the screen area, and the weight of the production. With this information at hand, the operator sets the timing means (not shown) to actuate and deactivate the pump at intervals providing the maximum production, and sets the recycling unit **14** to control the valves **12, 13,** to provide a continuous flow of production until the fluid in the screen area is exhausted. The valves **12, 13** pressurize alternate chambers **19,** the air flowing into the chamber being pressurized, through the lines **24, 25,** forcing the fluid in the

chamber through the passageways **29** and up the production tubing, past the back pressure valve **20** into the chamber **19** above, which is being exhausted, the air in the chambers last mentioned escaping through the lines **22, 26.** The restricted orifices are in the lines leading to the uppermost chambers, and the delay in raising lifting pressure caused by these restricted orifices, will give the lowermost chambers a chance to have received a supply of pressure and the movement upwardly in each of the pressurized chambers will be at approximately the same time. An adjustment of the orifices may be necessary to tune the operation to a smooth constant flow. Upon lapse of the predetermined time for emptying the pressurized chambers, the recycling unit will reverse the flow of air, pressurizing the now filled compartments and exhausting the ones to be filled.

When the supply of production fluid in the screen area has been depleted, the timing device will deactivate the pump until the necessary time interval to permit the area to again be filled from the formation, when the pump will again be actuated and the pumping process repeated.

While four pressure chambers are shown, it is obvious that as many as are necessary may be employed, with taps off of the respective air lines. The air storage chamber **6** may be provided with the usual gauge to assure maintainance of the necessary supply of pressure to actuate the pump.

The method herein taught consists of engineering a well, determining the rate of flow into the screen area and the weight of the production fluid, adjusting the timing mechanism accordingly, and adjusting the recycling mechanism to move the air from the storage tank into the respective chambers, restricting the flow to the uppermost members to permit a time delay in the actuation of the said last mentioned chambers so that the movement of the production fluid upwardly in the production tubing will be simultaneous, and deactivating the pump when the predetermined time interval has lapsed, to permit refilling of the screen area.

Where gas is present from another strata, or from any other outside source, it may be substituted for the air hereinbefore referred to.

What we claim is:

1. In a pump, a production tubing in a well casing, a plurality of pressure chambers in said tubing at spaced intervals, a source of supply of pressure, pressure lines leading from said source of supply to said pressure chambers, selectively adjustable timing mechanism for actuating the valves controlling the flow of pressure and to pressurize alternate chambers and simultaneously exhaust the other chambers.

2. The device defined in claim **1** having adjustable means in a portion of said pressure lines restricting the flow of pressure therethrough.

3. The device defined in claim **1** wherein each of said pressure chambers have a section of production tubing extending through the longitudinal axis thereof, and have passageways in said production tubing adjacent the lower ends thereof, for the passage of production fluid into and out of said chambers, and back pressure valves in said tubing adjacent the upper end of each of said chambers.

4. The device defined in claim **1,** having means for controlling the flow of production fluid from said pro-

duction tubing and means for taking a sample of the production fluid flowing therethrough.

5. The method of pumping production fluid from a well consisting of engineering the well to determine the rate of flow from the formation and the weight of the production fluid, timing the activation of the pump to the time interval indicated, by use of such calculations, forming a production tubing having pressurized chambers at spaced intervals therein and pumping pressure

to alternate chambers in said tubing and simultaneously exhausting the remaining chambers, reducing the flow of pressure to the uppermost chambers to permit the required pressure build up in the lower chambers.

6. The device defined in claim **1** wherein said source of supply of pressure is gas from another formation than that from which the production fluid is being produced.

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