Nov. 20, 1928. 1,692,131

W. L. MARTIN

WELL FLOWING DEVICE

Filed Sept. 8, 1927

Fig. 1.

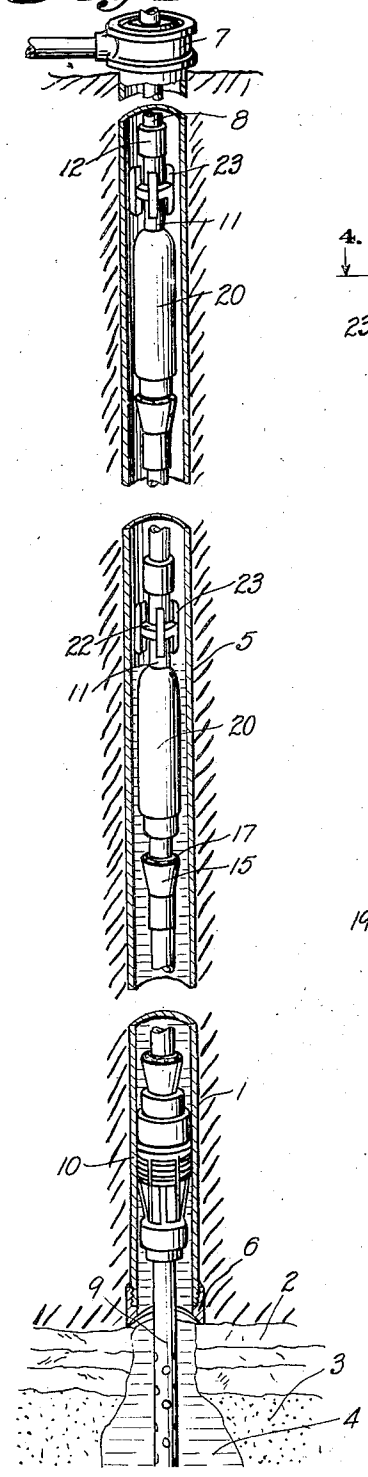


Fig. 2.

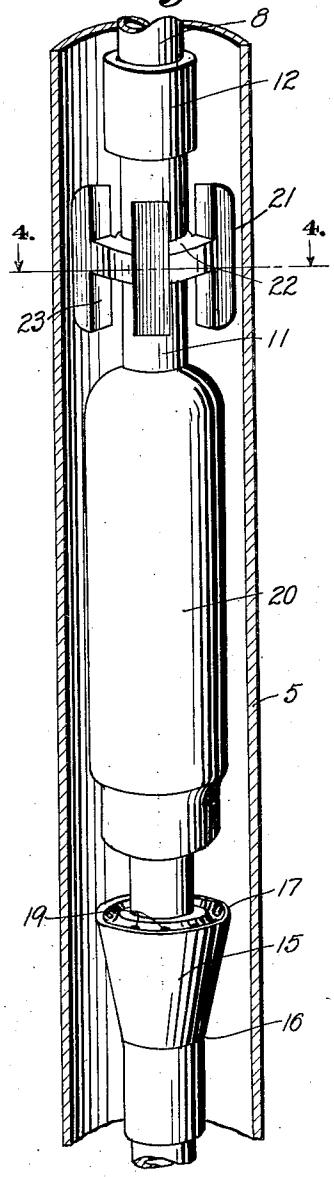


Fig. 3.

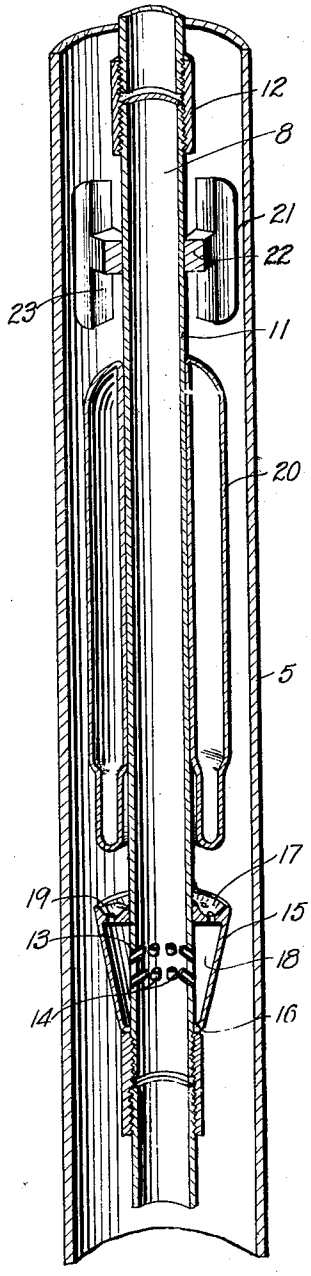
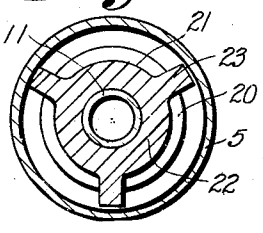


Fig. 4.



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UNITED STATES PATENT OFFICE.

WILBERT L. MARTIN, OF TULSA, OKLAHOMA.

WELL-FLOWING DEVICE.

Application filed September 8, 1927. Serial No. 218,206.

My invention relates to apparatus for flowing wells by air or gas pressure and more particularly to apparatus of that character for use in wells having sufficient rock pressure to maintain a column of oil of considerable depth within the well; the principal object of the invention being to automatically control communication between the well and tubing at various elevations to provide for delivery of oil from the well to the tubing at various levels of oil in the well, and thereby avoid waste of energy incident to ramming of all of the oil from the top of the well column through the bottom of the tubing or lift of all of the oil in the tube column.

In accomplishing this and other objects of the invention I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of an oil well equipped with my improved apparatus, the well and its casing being in central vertical section.

Fig. 2 is an enlarged detail perspective view of one of the valve units, the well casing being in vertical section.

Fig. 3 is a central longitudinal section of a valve unit and its enclosing well casing.

Fig. 4 is a transverse section on the line 4—4, Fig. 2.

Referring more in detail to the drawings:

1 designates an oil well, extending through cap rock 2 into oil sand 3 and terminating in the usual shot pocket 4, the well being lined with casing 5 supported by the usual shoe 6 on the cap rock 2 and equipped with an ordinary casing head 7. 8 designates tubing extending through the well and terminating in a strainer joint 9 within the shot pocket. Mounted on the tubing 8 near the bottom of the well is a packer 10 for sealing the lower portion of the well from the sand stratum and confining the air or gas employed for flowing the well, and thereby avoiding back pressure that might interfere with natural flow of the oil from the sand.

Interposed in the tubing 8 at various points throughout the lower length of the tubing, preferably at around two hundred foot intervals, are valve joints 11, of the same diameter as the tubing 8 and coupled thereto by threaded collars 12. The lower end of each of the valve joints 11 is provided with apertures 13 preferably arranged in annular series and inclined upwardly and inwardly so that oil admitted from the outside of the tubing will be directed upwardly through the interior channel. Nipples 14 are preferably located in the apertures 13 and extended into the tubing to effect delivery of the oil in concentrated jets.

Surrounding the apertured portion of the valve joints is a housing 15 preferably of inverted frustro-conical shape and spaced from the outer wall of the tubing by a flange 16 at the lower end of the housing and a flange 17 at the upper end thereof, to form a chamber 18 around the apertured portion of the tubing and within the housing. The flange 17 is provided with ports 19 and concaved to form a female valve seat.

Slidably mounted on the valve joints 11 about the housing 15 is a float 20, preferably formed of sheet metal and having an elongated hollow ring having an interior diameter adapted to fit snugly but in sliding relation to the tubing and an exterior diameter sufficient to provide an annular air chamber of a capacity for floating the structure without interfering with flow of well fluid and air through the well. The lower end of the float 20 is reduced in diameter to fit within the concave seat 17 of the housing 15 and serve as a valve for co-operation with the ports 19 in controlling flow of fluid from the tubing to the casing and vice versa.

Attached to the valve joint 11 above the upper limit of travel of the float 20 is a bracket 21, comprising a ring 22 attached to the tubing and spider arms 23 which engage the casing to center the tubing and serve as a stop for the float.

Assuming that a well served by my improved apparatus has sufficient natural pressure to maintain a column of a thousand foot depth within the well and that the tubing is equipped with the valve sections at spaced intervals and with a packer at the bottom of the well, the operation is as follows:

Oil entering the well from the sand flows through the strainer section into the tubing and upwardly past the packer to the first valve housing. There it escapes through the apertures 13 into the housing chamber and out through the ports 19, lifting the valve upwardly along the tubing and maintaining the valve in elevated position as long as the level of the well column is above that of the valve seat, the column rising in the well and in the tubing until it reaches the next higher valve which is opened, by lifting the float, and so

on until the column reaches the limit of height to which the oil can be raised by the natural rock pressure.

When the well is to be flowed, air or gas is admitted to the casing under pressure and rams the oil downwardly in the casing, the oil in the upper part of the tubing passing through the housing ports of the higher valve section in the well column into the housing chamber, thence through the apertures in the tubing to the interior of the tubing. As oil continues to be forced from the well into the tubing and to the top of the well, the level of the column in the casing is reduced and the float at the top of the column lowers with it until, when the level of the column has passed below the top of the housing, the float seats over the ports in the housing and closes said ports to seal them and exclude the pressure medium from the tubing. Pressure of the air or gas on the top of the column then forces the oil through the successively lower valves, the valves in turn closing as the level of the column descends until all of the oil has been finally removed from the casing and all of the valves closed. The pressure may then be discontinued to permit the well to refill, when the operation just described may be repeated by renewing the supply of air to the well.

It is apparent that with this arrangement of valves the oil can be flowed with a much lighter pressure than if it were necessary to displace the entire column through the bottom of the tubing and that the opening and closing of the valves is automatic and successive first as the column fills and then as it is forced from the well.

It is further apparent that a series of wells equipped with the flowing apparatus may be controlled from a single station, gauges on the air lines indicating condition of the wells to an operator so that he may turn the air on and off according to conditions in the wells.

What I claim and desire to secure by Letters Patent is:

1. In combination with well tubing having an apertured portion, valve mechanism controlling flow through said apertured portion, including a housing forming a chamber about the apertured portion and having a valve seat, and a float co-operative with said seat for controlling flow to the tubing through said chamber.

2. In combination with well tubing having an apertured portion, valve mechanism controlling flow through said apertured portion, including a housing forming a chamber about the apertured portion and having a cupped valve seat at its upper end, and a float slidable on the tubing above the housing and having a valve member co-operative with said seat.

3. In combination with well tubing having an apertured portion, a housing forming a chamber about said apertured portion and having a seat at its upper end provided with ports, and a float slidable on the tubing above the housing including a valve member co-operative with said seat to control flow to the tubing through said chamber.

4. In combination with well tubing having an apertured portion, a housing forming a chamber about said apertured portion and having a concave seat at its upper end provided with ports, and a float slidable on the tubing above the housing including a convex valve member co-operative with said seat to control flow to the tubing through said chamber.

5. In combination with well tubing having an apertured portion, a housing forming a chamber about said apertured portion and having an annular seat at its upper end provided with ports, and a float slidable on the tubing above the housing including an annular valve member co-operative with said seat to control flow to the tubing through said chamber.

6. In combination with well tubing having a series of upwardly and inwardly directed openings, a housing forming a chamber about said openings and provided with an upwardly facing valve seat, and a float surrounding and slidably mounted on said tubing and having a reduced extension on its lower end co-operative with said valve seat for controlling flow to the tubing through said chamber.

7. In combination with well tubing having an apertured portion, a housing of inverted cone shape forming a chamber about said apertured portion and having a seat at its upper end provided with ports, and a float slidable on the tubing above the housing including a valve member co-operative with said seat to control flow to the tubing through said chamber.

8. In combination with well tubing having a series of upwardly and inwardly directed openings, nipples in said openings projecting into the tubing, a housing forming a chamber about said openings and provided with an upwardly facing valve seat, and a float surrounding and slidably mounted on said tubing and having a reduced extension on its lower end co-operative with said valve seat for controlling flow to the tubing through said chamber.

In testimony whereof I affix my signature.

WILBERT L. MARTIN.