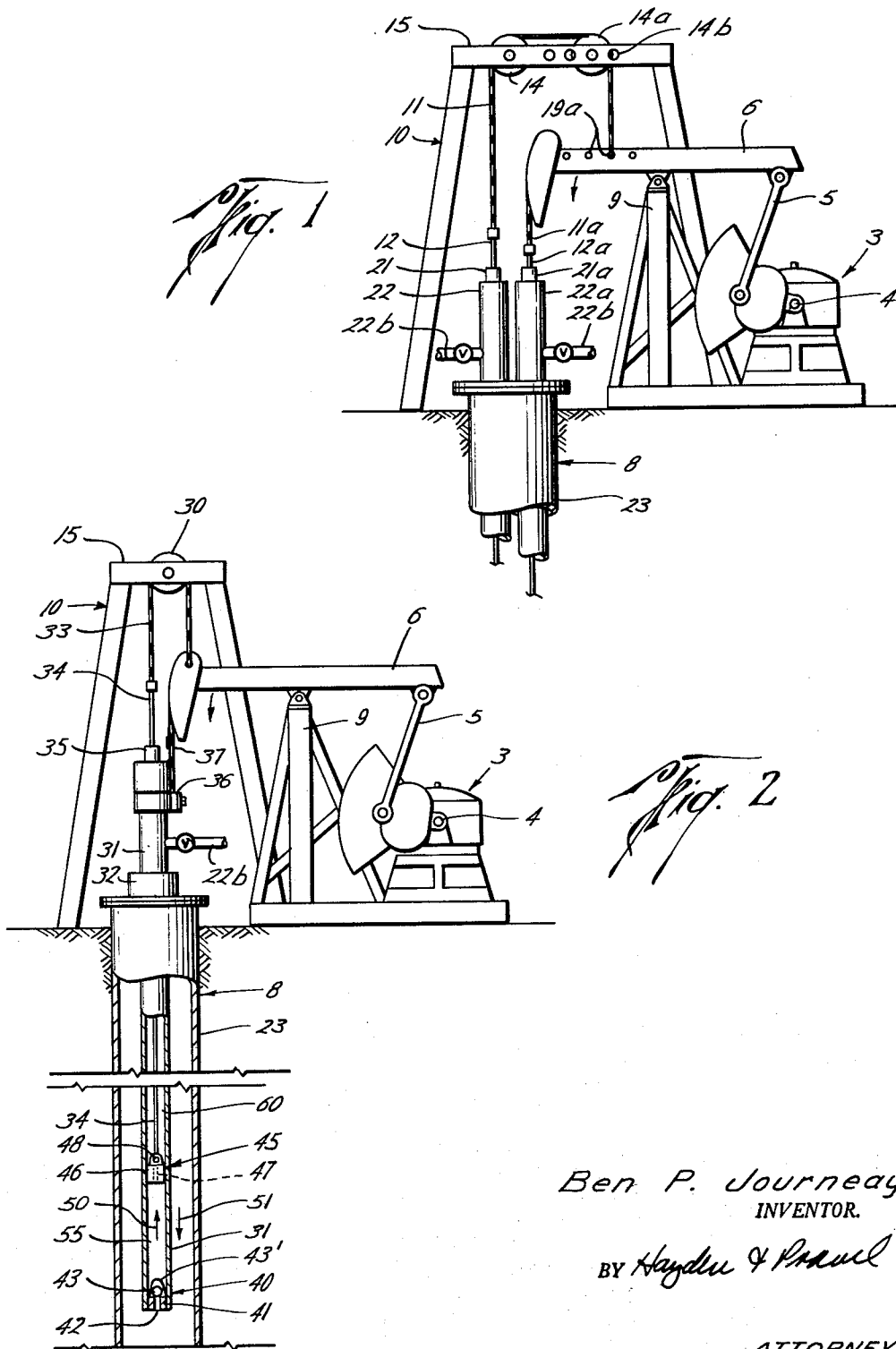


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ARRANGEMENT FOR USE IN CONNECTION WITH
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ARRANGEMENT FOR USE IN CONNECTION WITH THE PUMPING OF OIL AND GAS WELLS

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2 Claims. (Cl. 74-41)

The present invention relates to an arrangement for use in connection with the pumping of oil and gas wells, and particularly to an arrangement for pumping liquid from oil and gas wells.

In the pumping of liquid from oil and gas wells, one of the most common forms of pumping means includes a sucker rod string which extends down into the tubing that is positioned in the well bore, and a power source on the earth's surface is connected to a reciprocating member adjacent the top of the well bore. The reciprocating member, normally termed a "walking beam" or merely "beam," is adapted to reciprocate up and down in a vertical plane, and it is connected to the upper end of the sucker rod string so as to alternately lift the sucker rod string up and then permits the rods to fall down, due to the weight of the rods.

The sucker rod string is provided with a suitable piston and valving arrangement in the lower end of the tubing whereby reciprocating of the sucker rod causes well fluids to be moved up the tubing for subsequent discharge therefrom at the earth's surface.

Oil and gas wells being produced at the present time may have more than one producing strata or formation from which the well fluids flow into separate tubing strings. As a means of conservation of natural resources, proration is practiced in various parts of the oil and gas producing areas of the United States at the present time. This necessitates that only a certain amount of production be taken from any particular well or from various formations in any particular well.

It is therefore desirable to provide a pumping arrangement for wells which may be varied so that if the well contains more than one producing formation, the production from the various formations may be varied in relationship or independently of the flow or the amount of liquid pumped, if any, from any other producing formation in the well bore.

The present invention provides a pumping arrangement which accomplishes this function in that it provides a means whereby the amount of oil pumped from a particular formation in a well bore may be varied or changed independently of the flow occurring or the amount of liquid pumped from any other producing formation in the well bore.

Still another object of the present invention is to provide a pumping arrangement to more efficiently pump oil from a well bore.

Yet a further object of the present invention is to provide a pumping arrangement for pumping oil and gas from well bores wherein the walking beam of the pumping unit at the earth's surface is connected so as to reciprocate members extending into the well bore upon each movement thereof, to thereby more efficiently operate the pumping unit while pumping oil from the well bore.

Yet a further object of the present invention is to provide a pumping arrangement for pumping oil from a well bore wherein a plurality of members may be reciprocated in a single well bore upon each upstroke or downstroke of the walking beam whereby the amount of oil produced from any particular formation of a well bore may be varied independently of the oil being pumped from any of the other formations.

Other objects and advantages of the invention will be-

2

come more readily apparent from a consideration of the following description and drawings wherein:

FIG. 1 is a side view showing an embodiment of the present invention connected to two sucker rods extending down into their respective tubing which is positioned in a well bore in the earth's surface; and

FIG. 2 illustrates another alternate embodiment of the present invention.

In FIG. 1, a pump actuating unit 3 includes the power source on the earth's surface and also includes the crankshaft 4 and connecting rod 5 which is in turn connected to a beam 6. The unit 3 also includes a Samson post or upstanding member 9 which supports the walking beam 6 above the well 8 and adjacent thereto at the earth's surface, and such arrangement accommodates reciprocation of the beam 6. The power source of the pump actuating unit 3 is adapted to move the beam 6 up and down in a vertical plane, the beam 6 being positioned over the well designated generally at 8, which is to be pumped in the manner above described.

A frame designed generally at 10 is also mounted on the earth's surface adjacent the well bore, or attached to the pump actuating unit 3, whereby suitable connecting means such as a chain 11 or the like may be connected to the upper end of a sucker rod string 12 for pulling the sucker rod string 12 up in the well 8 as will be described in greater detail hereinafter. Generally, a rod called a polish rod is connected to the upper end of the sucker rod string, and the polish rod reciprocates through the stuffing box 21 on the upper end of the tubing. A second reciprocable member, which in the embodiment shown in FIG. 1 consists of a sucker rod string 12a, is connected directly to the beam 6 by a wire rope or chain 11a for reciprocation of the sucker rod 12a in the well 8 upon movement of the beam 6 as will be described in greater detail hereinafter. The string 12a also is provided with a polish rod at its upper end for sealably reciprocating the stuffing box 21a.

It will be noted that the connecting means 11 extends over a movable member 14 supported in the top 15 of the frame 10. The movable member 14 may assume any form, and as shown in the drawings, assumes the form of a rotatable sprocket, pulley, or drum adapted to receive the chain 11 thereover. A second movable sprocket, pulley, or drum 14a is also mounted in the top 15 of the frame 10 so that the chain 11 may be connected vertically downwardly from the top 15 of the frame 10 with the beam 6 in one of the openings designated generally at 19a. It is also noted that the sprocket, drum, or reel 14a may be moved to various locations in the top 15 of the frame 10 by reason of the openings 14b spaced longitudinally along the top 15. Thus, the drum 14a may be moved to any of the openings 14b in order to drop the chain 11 vertically from the top 15 of the frame 10 to one of the openings or holes 19a in the beam 6 for connection therewith. The position of the drum 14a on the top 15 of the frame 10 and the point at which the chain 11 is connected with the beam 6 determines the length of the stroke of the sucker rod 12 as it reciprocates in the well bore 8.

It can be appreciated that a suitable arrangement for moving sprocket 14a to various locations other than openings 14b could be employed. Similarly, suitable means could be substituted for openings 19a, such means being movably supported on the walking beam 6 to enable the connecting means 11 to be connected thereto at various locations.

The sucker rod string 12a is connected directly to the end of the beam 6 by any suitable means such as a wire rope, chain 11a or the like which is adapted to extend upwardly and may be connected to the beam by any

suitable means well known in the art such as by welding or by a clamp or the like.

It is noted that the sucker rod string 12 extends through the stuffing box or packing gland 21 which is mounted on the upper end of the tubing 22 by means of the polish rod hereinbefore referred to. Similarly, the sucker rod string 12a by means of its polish rod extends through the stuffing box or packing gland 21a and into its tubing 22a. The tubing strings 22 and 22a extend down into the well bore 8 and are surrounded by another metal tubular member designated the casing 23. The tubing 22 and 22a provide a means for collecting well fluids from producing formations in the well bore, and the sucker rod strings 21 and 21a are each provided with a pumping mechanism on their lower end so that when the sucker rod strings 12 and 12a are reciprocated, the well fluids are moved up their respective tubing to be discharged through the discharge conduits 22b provided in each of the tubing strings 22 and 22a. The construction of the pump mechanism on the sucker rod is well known in the art.

In the form of the invention illustrated in FIG. 1 of the drawings, it is to be noted that the present invention is constructed and arranged so that it may be used in conjunction with a well bore 8 where there are two separate producing formations. The tubing string 22 communicates at its lower end with one of the producing formations, and the tubing string 22a communicates with the other producing formation in a manner well known in the art so that it is believed unnecessary to give a detailed description of the manner of communicating the tubing strings at their lower ends with their respective producing formations.

It can be appreciated that as the walking beam or beam 6 is reciprocated so that it moves down, the sucker rod string 12a is allowed to move down due to its weight, and simultaneously the sucker rod string 12 is pulled upwardly by reason of the pull which is exerted thereon by chain 11 as chain 11 is pulled down by the beam 6. The stroke of the sucker rod 12 is determined by the position of the drum 14a and the position of the connection of the chain 11 with the beam 6 as previously described hereinabove. Therefore, the movement of the beam 6 as above described is used simultaneously to pump oil from two separate producing formations in the same well bore.

Also, it should be noted that such arrangement enables the amount of oil produced through the tubing string 22 to be varied, and varied independently of the amount of liquid produced from tubing string 22a. For example, by changing the position of drum 14a on the top 15 of frame 10 and by changing the position of the connection of chain 11 in the openings 19a of beam 6, the stroke of the sucker rod 12 is changed. Thus, the amount of oil pumped up through tubing string 22 can be regulated or varied, and it can be varied independently of the amount of flow or the amount pumped through the tubing string 22a. The chains 11 and 11a are connected to sucker rod strings 12 and 12a by any suitable clamp means, or by welding.

It is to be further specifically noted that the invention as shown in FIG. 1 of the drawings is shown as functioning in connection with only two producing formations. In some well bores, there may be a plurality of producing formations, as many as five, six, or seven, or even more. In such event, it can be appreciated that if desired the present invention may be constructed and arranged so as to simultaneously pump oil from any or all of the various formations in one well bore. Also, the present invention enables the amount of pumping from each formation to be varied independently of the amount of pumping action on the other formation or well bores, except the formation or well bore connected directly to the end of walking beam 6 so as to be directly pumped

thereby. Where more than two separate producing formations are encountered, it can be appreciated that a suitable connecting means such as that as illustrated at 11 and a suitable movable member such as illustrated by the sprocket, drum, or reel 14 and 14a should be provided for each separate sucker rod string in order that the amount of movement of the sucker rod connected therewith can be varied or changed independently of the movement of the other sucker rod string which extends into the well bore.

In FIG. 2 of the drawings, a modification of the invention is illustrated wherein the pump actuating unit with a power source is again illustrated by the general numeral 3 and also includes the crank 4 and connecting rod 5 which is in turn connected to the beam 6. The pump actuating unit 3 also includes the Samson post, or vertical support 9 so as to position the beam 6 in proper relation to the well designated generally by the numeral 8, and to accommodate reciprocation of the beam 6.

Also, a frame 10 is provided on which is supported a movable member 30 shown as being in the form of a rotatable sprocket, drum, or reel. It will be noted that the well is provided with a casing 23 which extends downwardly into the well 8 and receives the tubing 31 therein. A stuffing box 32 on the top of the casing 8 seals off between a polished joint of tubing which is connected at the upper end of the tubing string 31 and the casing 23 to inhibit leakage of fluid between the tubing string 31 and casing 23 as the tubing 31 is reciprocated in the casing 23 as will be described in greater detail hereinafter. It will be noted that suitable connecting means such as a chain as illustrated by the numeral 33 is connected to one end of the beam 6 as illustrated in FIG. 2 of the drawings and extends over the sprocket, drum, or reel 30 in the top 15 of the frame 10 to be connected to the sucker rod 34 which extends through the packing gland or stuffing box 35 on the top of the tubing string 31. The tubing string 31 is provided with a suitable clamp as designated generally by the numeral 36 which extends thereabout and engages the wire rope or chain 37 whereby the tubing string 31 is connected directly to the beam 6 as illustrated in FIG. 2 of the drawings.

A suitable pumping arrangement is connected to operate on the lower end of the sucker rod string and tubing string. Any suitable arrangement which functions by reciprocation of the sucker rod string may be employed with the present invention. One suitable pumping arrangement will be described hereinafter, but it can be appreciated that the present invention is not limited to the particular form of pumping arrangement employed. The pumping arrangement described herein is given for purposes of illustration only.

A standing valve is illustrated generally by the numeral 40 at the lower end of the tubing string 31, such standing valve comprising the closure 41 in tubing 31 with the port 42 through the closure 41 for the passage of well fluids from the producing formation in the well 8. The ball check valve 43 is carried in cage 43' and is adapted to control flow through the port 42 as will be described in greater detail. Connected to the lower end of sucker rod 34 is a valve means designated generally by the numeral 45 and termed a traveling valve. The traveling valve includes the plunger 46 which sealably engages the tubing 31 and is provided with a port 47 therethrough and a ball check valve 48 in a cage similar to cage 43' for controlling flow through the port 47 and plunger 46 as will be described in greater detail hereinafter. It can be appreciated that when the beam 6 in FIG. 2 moves downwardly in a vertical plane, the sucker rod 34 is pulled upwardly as represented by the arrow designated by the numeral 50, and simultaneously with this upward movement, the tubing string 31 due on its weight, moves downwardly as represented by the arrow 51 in FIG. 2.

As the tubing string 31 moves downwardly, ball check

5

valve 43 moves off port 42 in the lower end of the tubing 31 whereupon well fluids from the producing formation may pass through the port 42 to collect in the chamber 55 of the tubing string 31. As the movement of the beam 6 is reversed so that the tubing string 31 is pulled upwardly and the sucker rod 34 falls downwardly in the tubing string 31, the ball valve 43 then closes off port 42 to trap the fluid in chamber 55, and simultaneously, the ball 48 in traveling valve 45 opens the port 47 of plunger 46 so that the fluids collected in chamber 55 may pass upwardly therethrough into the portion 60 of the tubing string 31 above the plunger or piston 46.

Upon the next cycle of movement of beam 6, the plunger 46 moves upwardly as the sucker rod 34 is pulled upwardly by chain 33, and the tubing string 31 moves downwardly due to its weight. This upward movement causes the fluid in the portion 60 of tubing string 31 collected above plunger 41 to move upwardly at the same time that a new charge of liquid is moved into the chamber 55 of the tubing string 31 above the standing valve 40. Thus, when the sucker rod string 34 is next lowered, the traveling valve 45 opens and the fluid then collected in chamber 55 passes upwardly therethrough into the portion 60 of the tubing string 31 above plunger 46.

This procedure is continuously repeated and the liquids are pumped up the tubing string 31 to be discharged through the discharge line 22b.

It can be appreciated that the above arrangement provides a more efficient pumping system for an oil well in that as the walking beam 6 moves downwardly, the tubing 31 is permitted to fall, and an additional quantity of liquid is discharged from the well 8 into the chamber 55 of the tubing string 31 whereupon it may then be moved on up through the traveling valve 45 when the sucker rod string 34 is next lowered.

The connecting means 11 and 11a in FIG. 1 as well as the connecting means 33 in FIG. 2 of the drawings will be of suitable construction so that proper reciprocation of the sucker rods connected therewith will be effected upon reciprocation of the beam 6.

By employing the pump actuating unit 3 and frame structure 10 as shown in FIG. 1 with the tubing string 31 and sucker rod string 34 of FIG. 2, the amount of movement of sucker rod 34 can be varied independently of the stroke of the tubing string 31. The string 31 in this arrangement would be connected to the end of the beam 6, as is the sucker rod string 12a of FIG. 1, and the sucker rod string 34 of FIG. 2 would be connected to the beam 6 through the chain 11 as is the sucker rod string 12 of FIG. 1.

The polish rods and polish section of tubing string are employed to maintain a seal as they reciprocate through their respective stuffing boxes, and are merely polished rods, or a polished exterior surface on the tubing string section to accomplish this result.

Broadly, the present invention relates to a pumping arrangement for oil and gas wells, and includes an arrangement whereby a plurality of members may be re-

6

ciprocated within one well bore, with the amount of reciprocation of one or more members being variable.

What is claimed is:

1. An arrangement for use in connection with the pumping of oil and gas wells wherein a sucker rod string is reciprocated within a tubing string for removing well fluids through the tubing including a pump actuating unit positioned on the earth's surface adjacent the well to be pumped, said pump actuating unit including a beam reciprocable in a vertical plane, a frame associated with said pump actuating unit, said beam being pivotally supported in said frame, a movable member on said beam, means connected to said beam and extending over said movable member in said frame, a sucker rod string extending upwardly from the well which is to be pumped, said sucker rod string being connected at its upper end to said means which extends over the movable member, a second reciprocating member, additional means connected to said beam and connected directly to said second reciprocating member in said well whereby when said beam moves up or down, both of said connecting means are moved up and down, said connecting means extending over said movable member and connected to said beam being adjustable to varying positions provided on said beam to thereby change the length of the stroke of the sucker rod string connected therewith.

2. An arrangement for use in connection with the pumping of oil and gas wells wherein a sucker rod string is reciprocated within a tubing string for removing well fluids through the tubing including a pump actuating unit positioned on the earth's surface adjacent the well to be pumped, said pump actuating unit including a beam reciprocable in a vertical plane, a frame associated with said pump actuating unit, said beam being pivotally supported in said frame, a movable member on said beam, means connected to said beam and extending over said movable member in said frame, a sucker rod string extending upwardly from the well which is to be pumped, said sucker rod string being connected at its upper end to said means which extends over the movable member, a second reciprocating member, additional means connected to said beam and connected directly to said second reciprocating member in said well whereby when said beam moves up or down, both of said connecting means are moved up and down, and means to adjust said connecting means supported on said frame and said connecting means connected directly to said beam to thereby adjust the length of the stroke of the sucker rod string.

References Cited in the file of this patent

UNITED STATES PATENTS

431,442	Cook	July 1, 1890
1,064,359	Middendorf	June 10, 1913
1,501,226	Malbaff	July 15, 1924
1,548,623	Mayberry	Aug. 4, 1925
2,175,947	Teeple	Oct. 10, 1939