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2,335,355

PRODUCING EQUIPMENT FOR WELLS

Filed Sept. 11, 1939

3 Sheets-Sheet 1

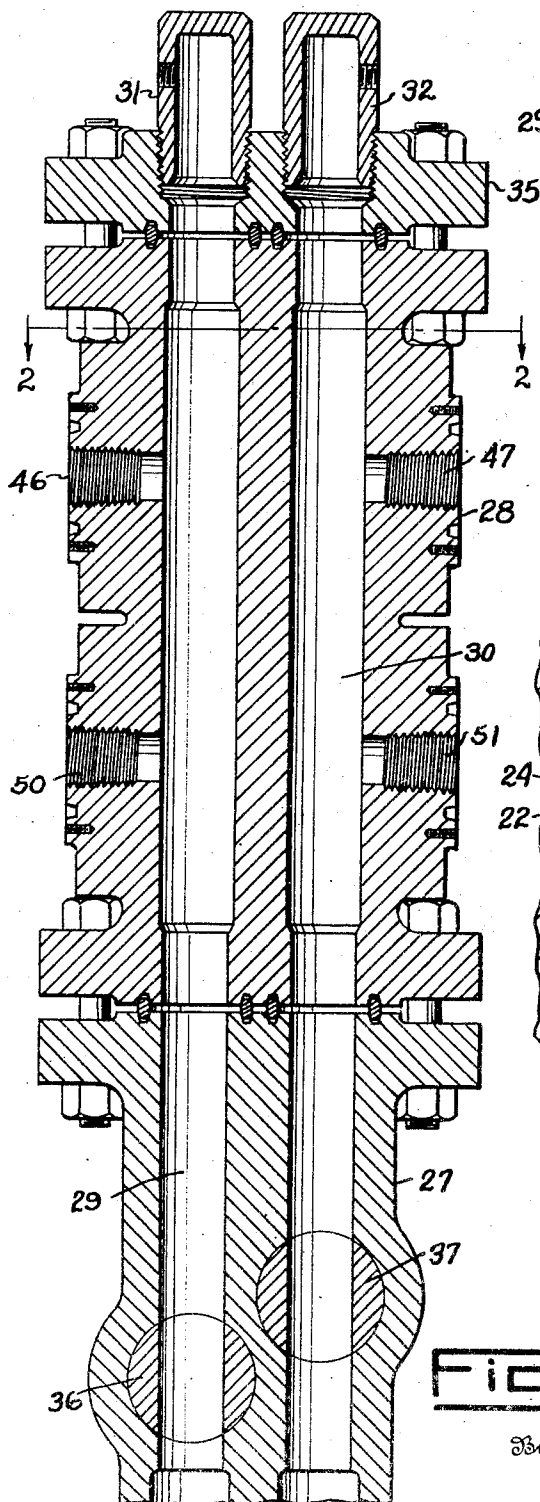


Fig. 1.

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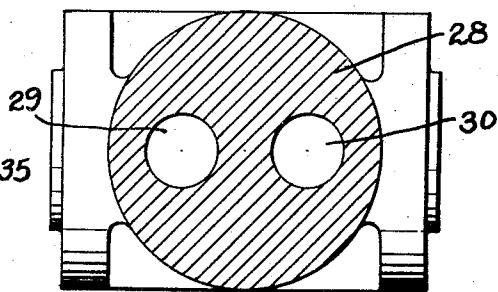


Fig. 2.

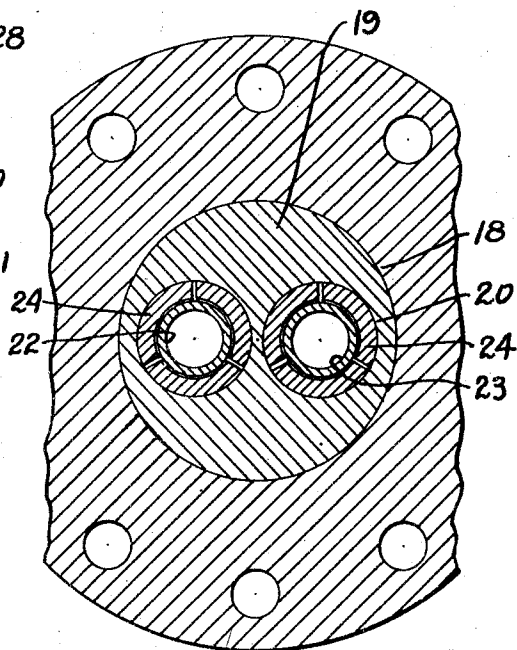


Fig. 4.

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3 Sheets-Sheet 2

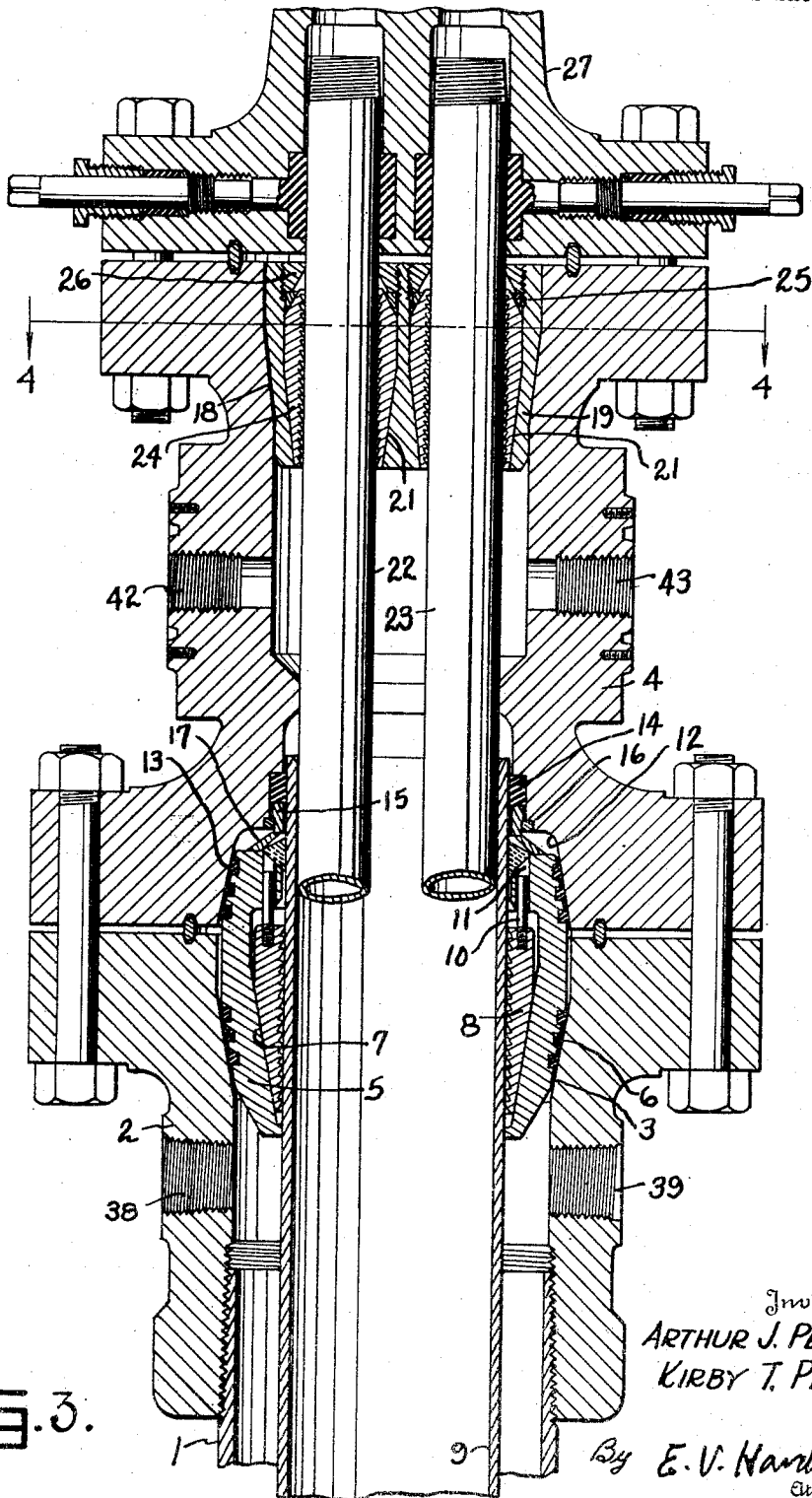


Fig. 3.

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3 Sheets-Sheet 3

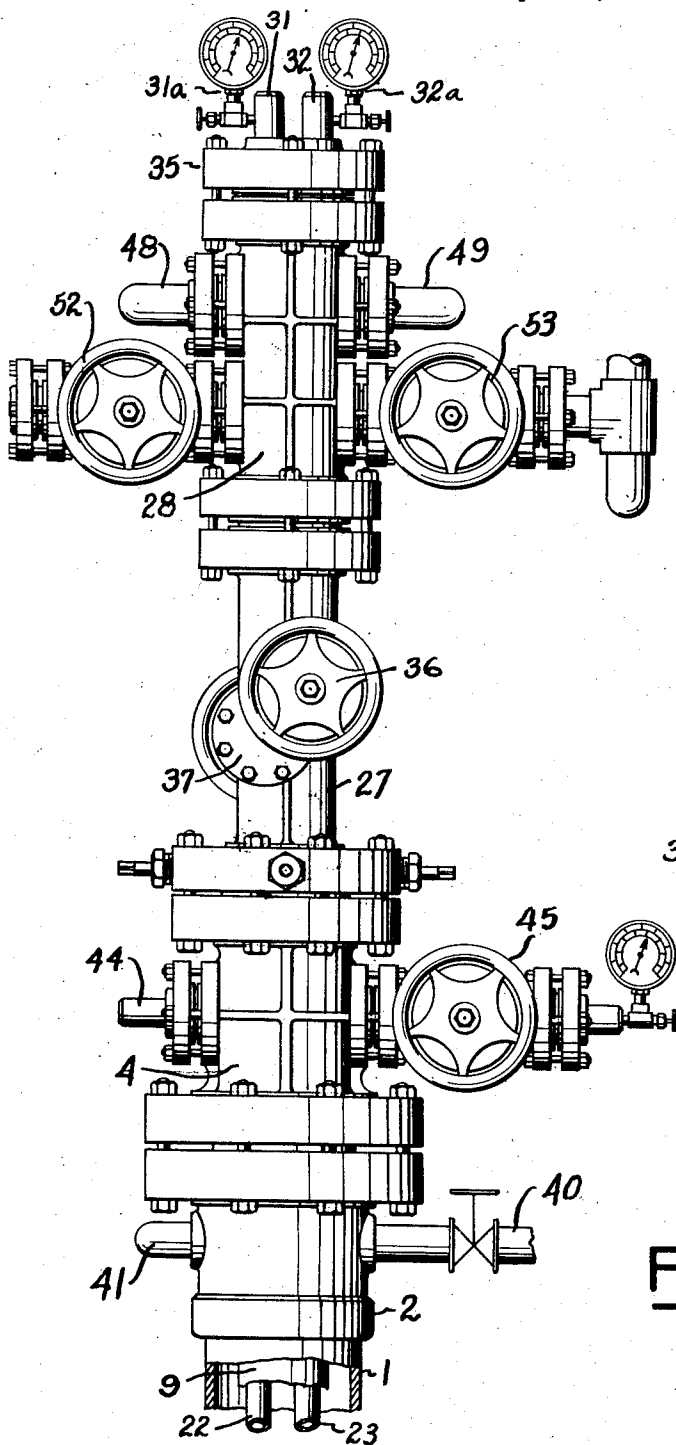


Fig. 5.

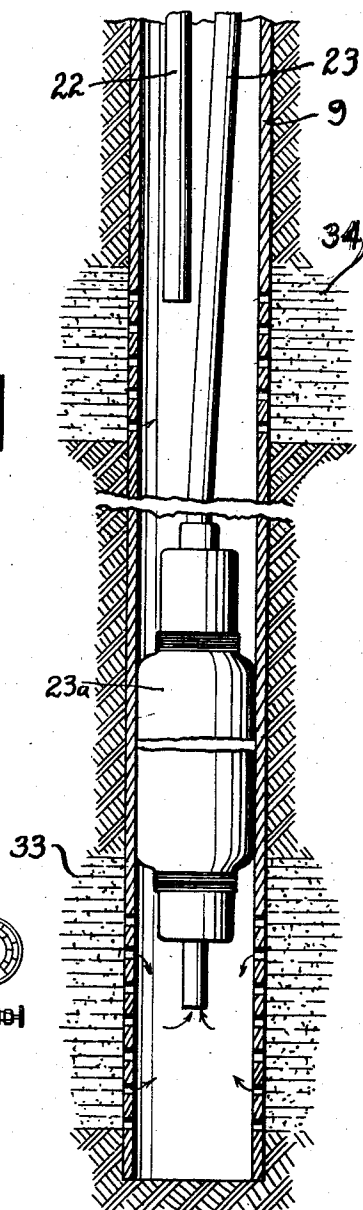


Fig. 6.

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PRODUCING EQUIPMENT FOR WELLS

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Application September 11, 1939, Serial No. 294,232

5 Claims. (Cl. 166—15)

This invention relates to producing equipment for wells.

An object of the invention is to provide equipment of the character described whereby oil or gas may be produced either simultaneously or alternately from producing strata of a well at different levels.

At the present time in producing minerals, such as oil or gas, the well is equipped to produce only from a single producing stratum. If production is obtained from another stratum at a different level, it is usually necessary to drill an additional well to reach said other stratum. With the present equipment herein described, a single well may be drilled through an upper and a lower producing stratum and production obtained from both strata at the same time, or from either stratum to the exclusion of the other.

It is another object of the invention to provide producing equipment of the character described whereby oil and gas may be produced from either stratum and, if desired, the gas so produced may be returned into the other stratum to maintain the pressure therein and to avoid the waste of gas, all as more specifically hereinafter explained.

The invention also comprehends a novel type of well head for supporting a plurality of tubing in the same well.

The invention also embodies a novel combination of well head and Christmas tree whereby the operator may control the production and select the stratum from which the production is to be maintained and by means of which the gas produced from high pressure area may be returned into the well and into a producing stratum having a lower pressure.

With the above and other objects in view, the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows fragmentary vertical sectional view of the control valve casing showing the Christmas tree body mounted thereon.

Figure 2 shows a cross-sectional view taken on the line 2—2 of Figure 1.

Figure 3 shows a fragmentary vertical sectional view of the casing head and the tubing head assembled therewith showing a fragmentary portion of the valve casing.

Figure 4 shows a fragmentary cross-sectional view taken on the line 4—4 of Figure 3.

Figure 5 shows a side elevation of the assembled well head, and

Figure 6 shows a side elevation partly in section of the lower end of the tubing and packer assembly.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a well casing to the upper end of which the casing head 2 is attached. The casing head has the inside downwardly converging seat 3 and bolted onto the casing head there is the tubing head 4. Mounted on the seat 3 there is an adapter 5 having the surrounding seal rings 6 forming a fluid tight seal with the seat 3. Within the adapter is the downwardly converging seat 7 to receive the wedge shaped slips 8, which surround the upper end of the producing string 9 which extends down into the well. The upper end of the adapter is inwardly thickened so as to closely surround the string 9 to which it is welded as shown in Figure 3. The slips 8 have the upwardly extended guide pins 10 which work in suitable aligned bearings 11 in said inwardly thickened portion of the adapter as also shown in Figure 3. The lower end of the tubing head 4 is provided with an annular downwardly flared seat 12 which receives the upper end of the adapter 5 and surrounding said upper end and counter-sunk therein are the seal rings as 13 which form a fluid tight seal between the upper end of the adapter and the seat 12.

Countersunk into the tubing head 4 and closely surrounding the upper end of the string 9 there is a seal ring 14. A gland 15 is fitted within the tubing head against the lower side of the ring 14 and is locked therein against downward movement by the surrounding locking ring 16. When the parts are assembled a downwardly flared compression ring 17 is seated on the adapter and in turn supports the gland 15 whereby to maintain the packing 14 under compression to maintain the required seal about the pipe string 9. The producing string may be adjusted to any required depth in the well and supported therein by the slips 8.

The upper end of the tubing head 4 has a downwardly converging inside seat 18 to receive a novel type of adapter 19 shown more clearly in Figures 3 and 4. This adapter is of a general cylindrical form, but is externally tapered downwardly to conform to the taper of and fit on to the seat 18. The adapter has a plurality of vertical bores 20. The number of said bores depending on the number of strings of tubing to be used in the well, two being shown. The lower end of each bore 20 is tapered downwardly forming the

seat 21. The numerals 22, 23 designate the strings of tubing through which the oil or gas is produced from the well and delivered to the surface. The strings of tubing are maintained suspended by means of the downwardly tapering slips 24 on the seats 21.

When the tubing has been lowered into the well to the desired location and the slips 24 inserted into place on the seats 21, hold down wedge rings as 25 are seated on the upwardly tapering upper ends of said slips and the glands 26 are then screwed into the upper ends of the bores 20 against said wedge rings to secure the slips in place. The tubing is suspended in the well and secured therein by said slips before the valve casing 27 is mounted on the tubing head.

The lower end of the tubing 23 is extended beneath the lower end of the tubing 22 and a conventional type of packer 23a is mounted on said extended end. In installing the equipment in a well having a lower producing stratum as 33 and an upper producing stratum as 34, it should be so installed that the packer 23a will be located between said strata and expanded so as to form a seal to separate the producing strata. It will be noted from Figure 6 that the producing string is perforated opposite the respective producing strata. Production may thus be carried on from the well through both tubings 22, 23, if desired.

When the tubing have been positioned in the well and secured in the desired position, the valve casing 27 may be mounted and secured on the tubing head 4 as shown in Figures 3 and 5, and the Christmas tree body 28 is then mounted and secured on the valve casing, the assembly being shown more accurately in Figures 1 and 5. The valve casing 27 and Christmas tree body have the fluid passageways 29, 30, leading upwardly there-through whose upper ends may be closed by the caps 31, 32 provided with tapped holes to receive the pressure gauges 31a, 32a illustrated in Figure 5. The joints between the tubing head and casing head and between the valve casing and the tubing head and Christmas tree are sealed with conventional annular seal rings as shown and the upper end of the Christmas tree body is formed with a detachable cap plate 35 into which the closure caps 31, 32 are threaded.

Seals may be formed around the upper ends of the tubing 22, 23 within the lower end of the valve casing 27 by any suitable type of sealing means. The type of sealing means illustrated in Figure 3 is substantially the same as that disclosed in our co-pending application for Well head, filed on the 26th day of May, 1939, under Serial No. 275,924, now Patent No. 2,312,476, granted March 2, 1943.

The passageways 29, 30 are controlled by any suitable type of valves as 36, 37, mounted in the casing 27. A preferred type of valve for this purpose is disclosed in our co-pending application for Valve assembly, filed July 22, 1939, under Serial No. 285,834, now Patent No. 2,219,271, granted October 22, 1940.

The casing head is provided with oppositely disposed tapped holes 38, 39 for the connection of a valve controlled flow line as 40 thereto. In case a single flow line 40 is used, the other tapped hole may be closed by a plug 41. Fluid from the casing 1 may be drawn off through the line 40.

The tubing head 4 is provided with tapped holes 42, 43, one of which, when not in use, may be closed by the plug 44 and valve controlled flow device 45 may be connected into the other tapped hole of the tubing head.

The Christmas tree body is provided with the

upper tapped holes 46, 47 into the respective channels 29, 30 and which are normally closed by the plugs 48, 49, and said Christmas tree body is also provided with the lower tapped holes 50, 51 leading into said channels 29, 30, for the attachment of the flow connections 52, 53 thereto.

With the valve 36 open and the valve 37 closed, fluid may flow from the upper stratum 34 through the tubing 22 and out through the Christmas tree connection 52; with both the valves 36, 37 open, the fluid may flow from both strata 33 and 34 and out through the Christmas tree connections 52, 53, or the valve 36 may be closed and the valve 37 opened and production thus obtained from the lower stratum 33 only.

On the other hand while oil is being produced from a stratum through one tubing a certain amount of gas may also escape. If it be desired to do so said gas may be returned into the other stratum through the other tubing, or through the string 9, thus preventing the waste of said gas and repressuring the stratum to which the gas has been returned. For example, while oil or gas is being produced from the lower stratum 33, which is usually of higher pressure than that of the upper stratum 34 the plug 48 may be removed and a return gas line connected into the tapped hole 46 and the gas being delivered through the tubing 23 may be collected and returned through the tubing 22 into the upper stratum 34, the valve 36 at this time being open; or such gas return line may be connected into the tapped hole 43 and the gas returned through the string 9 into the stratum 34. This return of gas to the stratum 34 may be continued until the pressures in the two strata are equal whereupon the valve 36 may be closed and production continued through the tubing 23 until the pressure in the stratum 33 is exhausted. Thereupon the valve 36 may be opened and the oil and gas produced through the tubing 22 and the gas under pressure may then be returned into the stratum 33 through the tubing 23, the valve 37 at this time being open and the return gas line connected into the tapped hole 47. Thus while producing oil from either stratum the excess gas may be returned into the other stratum alternately as hereinabove explained until the excess gas from both strata is exhausted.

As hereinabove indicated, when the tubing 22, 23 are being lowered into place in the well, the valve casing 27 and the Christmas tree will not yet have been installed on the tubing head, but instead thereof a blowout preventer will be installed on the tubing head of a type to permit the lowering of the two strings of tubing there-through and to guard against the gas blowout while the tubing are being lowered. A suitable blowout preventer for this purpose is disclosed in our co-pending application. When the tubing have been lowered to the desired place and anchored in the tubing head, said blowout preventer will be removed and the valve casing 27 with the Christmas tree thereon will be mounted on the tubing head as shown in Figure 5.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What we claim is:

1. In producing equipment for wells a casing head, a tubing head thereon, means in the tubing head for engaging and supporting separate flow tubes suspended in the well, a valve casing on the tubing head, a Christmas tree body on the valve casing, said valve casing and Christmas tree body having separate channels leading from the

respective flow tubes upwardly therethrough and valve controlled flow lines connected with the respective channels.

2. In well producing equipment a casing head, a tubing head thereon, separate means in the tubing head for supporting separate flow tubes suspended in the well, a valve casing on the tubing head, a Christmas tree body on the valve casing, said casing and body having channels therethrough leading from the respective tubes, valve controlled conduits communicating with said channel.

3. In well producing equipment a casing head, a tubing head thereon, separate means in the tubing head for supporting separate flow tubes suspended in the well, a valve casing on the tubing head, a Christmas tree body on the valve casing, said casing and body having channels therethrough leading from the respective tubes, valve controlled conduits communicating with said channel, and valves in the valve casing for opening and closing said conduits.

4. In well producing equipment a casing head,

a tubing head thereon, separate means in the tubing head for supporting separate flow tubes suspended in the well, a valve casing on the tubing head, a Christmas tree body on the valve casing, said casing and body having channels therethrough leading from the respective tubes, valve controlled conduits communicating with said channels and a valve controlled conduit leading outwardly from the tubing head.

5. In well producing equipment a casing head, a tubing head thereon, separate means in the tubing head for supporting separate flow tubes suspended in the well, a valve casing on the tubing head, a Christmas tree body on the valve casing, said casing and body having channels therethrough leading from the respective tubes, valve controlled conduits communicating with said channels, valves in the valve casing for opening and closing said conduits, and sealing means in the valve casing around the tubes.

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