

May 2, 1939.

H. U. GARRETT

2,156,429

BOTTOM HOLE CONTROL CHOKE

Filed April 26, 1937

2 Sheets-Sheet 1

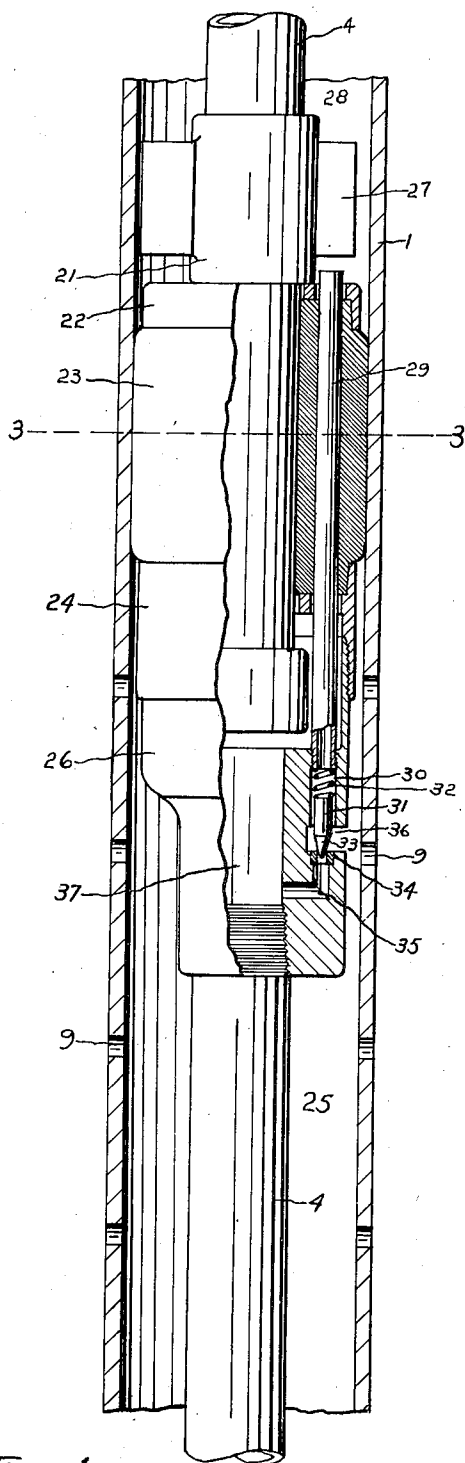


FIG. 1

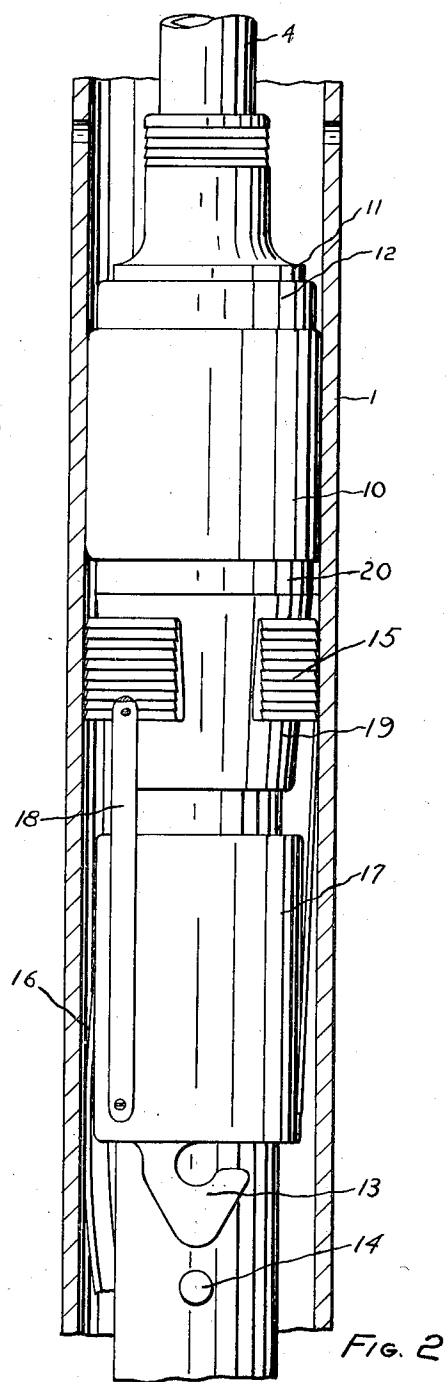


FIG. 2

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2 Sheets-Sheet 2

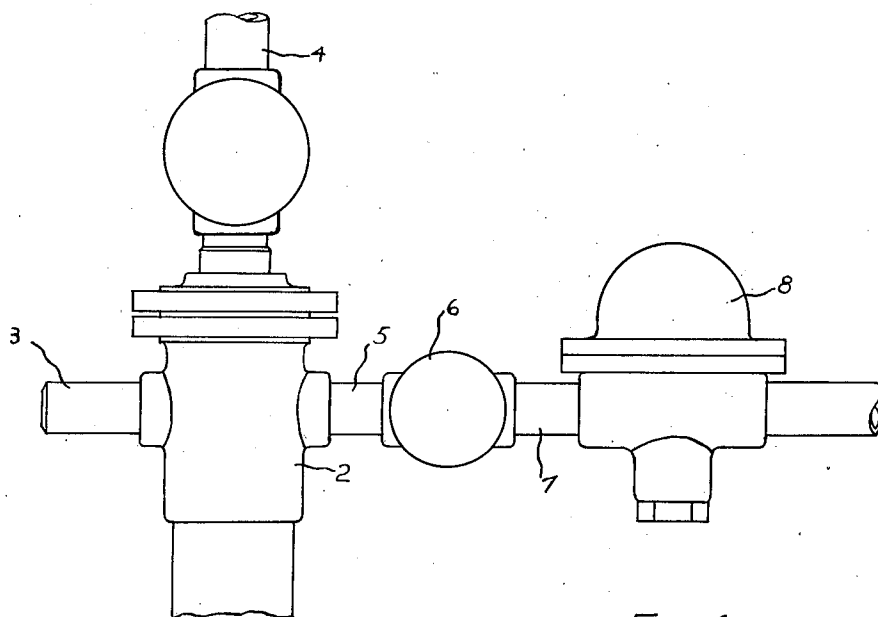


FIG. 4

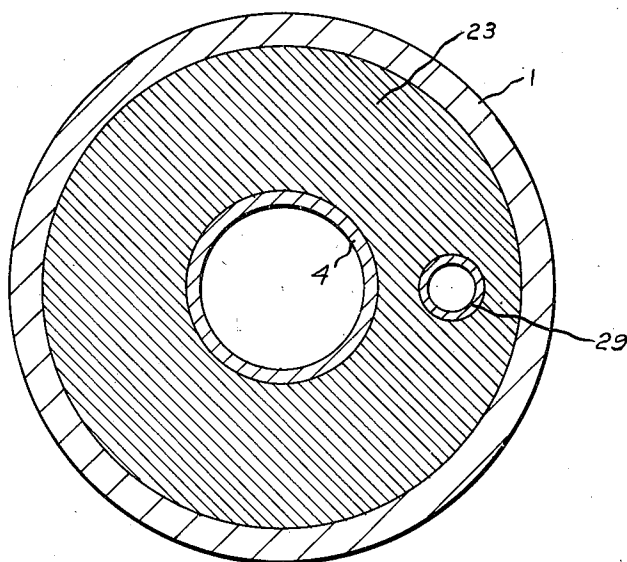


FIG. 3

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BOTTOM HOLE CONTROL CHOKE

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11 Claims. (Cl. 166—2)

In producing oil wells there is frequently a gas stratum above the sand containing the oil, which gas stratum may be under very high pressure. I propose to utilize this pressure by puncturing the casing and providing a valve communicating with the flow line, which valve is operated by the gas pressure admitted into the casing through the said holes. In practice I find it advisable to place packers above and below the perforations made in the casing, thereby forming a pressure chamber between the said packers, into which chamber the gas from the stratum passes through the said holes and thence through the said valve into the flow line.

Another object of the invention is to provide a control means on the surface of the ground whereby the pressure above the uppermost packer may be regulated. In practice I find it advisable to form a by-pass around the said valve so that the trapped gas in the said chamber will pass into the casing above the upper packer. The regulator on the surface of the ground affords a means of regulating the pressure in the casing above the upper packer so that there will be a differential in pressure in the casing above the upper packer from the pressure existing in the chamber between the said packers. I consider it an important object of the invention to bleed off or diminish the pressure above the upper packer so as to control the said valve. Heretofore it has been the custom to introduce gas under pressure from the surface so that it will unseat a valve and permit the gas pumped in to pass into the flow line. I reverse this operation by utilizing the gas in the said stratum instead of pumping air or other gases into the casing, and in the construction shown in this application I partially exhaust the gases to atmospheric pressure in the casing above the upper packer instead of introducing gas therein from a pump or other means.

I also provide a gate valve whereby the exhaustion of gas above the upper packer may be stopped so that the pressure above and below the upper packer will be equalized. In this case a spring will seat the valve and prevent the introduction of gas into the flow line.

The lower packer may be omitted in case it is desired to utilize the gas in the oil, and in this case the perforations in the casing would not be required. The oil and gas would now unseat the valve so that both the oil and the gas therein would flow through the valve passage.

These and other objects of the invention will appear in the detailed specification and claims which follow. In the drawings, Fig. 1 illustrates

a portion of the casing, the upper packer, and a portion of the flow line, certain of the parts being shown in cross-section. Fig. 2 is a similar view of the lower packer and associated parts, it being understood that the parts shown in Fig. 1 are above the parts shown in Fig. 2. Fig. 3 is a cross-sectional plan view on the line 3—3 of Fig. 1. Fig. 4 is a side elevational view of the control mechanism above the ground.

In the drawings, 1 represents the casing, which terminates in a casing head 2 above the ground. The casing head 2 is provided with a conventional plug 3, and through the casing head passes a conventional flow line 4, which extends downwardly through the casing to the bottom of the well. Extending laterally from the casing head 2 is a pipe 5 to which is attached a gate valve 6. Extending from the gate valve 6 is a pipe 7, extending to a regulator 8, which may be of any conventional type, which may be set to regulate the pressure in the casing, for the said regulator communicates with the chamber between the casing 1 and the flow line 4. All of the parts above mentioned, with the exception of the casing and the flow line, are above the ground, and it is of course understood that the casing and the flow line extend downwardly through the well.

If there is a known stratum containing high pressure gas, the casing 1 should be punctured in a well known manner, forming a plurality of holes 9 adjacent to the said stratum, so that the gas in the said stratum can pass through the holes 9 into the casing 1. Below the said holes I position a packer, hereinafter referred to as the lower packer 10. The structure of the lower packer is shown in Fig. 2 and need not be described in detail, for it is conventional. It might be briefly stated, however, that there is a valve 11 secured to the flow line which, when the packer is being lowered in the well, is above its valve seat 12, and the hook 13 receives the pin 14, holding the slips 15 in their lowermost position. When the lower packer has reached the point where it is desired to set the same, the flow line 4 is rotated so as to remove the pin 14 from the hook 13, and when the flow line is then lowered slightly, the springs 16 engage the inner side walls of the casing, thereby holding the collar 17 against downward movement, and the links 18 move the slips 15 upwardly on the cone 19 so that they engage and grip the inner walls of the casing. As the flow line moves further downwardly, the valve 11 moves against its valve seat 12 and compresses the resilient packer 10 against the collar 20, carried by the cone 19, thereby

packing off the part of the casing above the packer from that below the same.

When the lower packer is set, the flow line 4 between the lower packer and the upper packer 23, now to be described, is held against further downward movement so that the collar 21, carried by the lowermost part of the upper part of the flow line 4, moves against the collar 22 compressing the said packer into engagement with the inner side walls of the casing. The upper packer 23 is positioned above the perforations 9 so that there is a gas chamber 25 formed between the said packers and communicating, through the holes 9, with the gas in the stratum. The collar 24 is screw threaded, as shown in Fig. 1, to a collar 26, which is screw threaded on the section of the flow line between the said packers. A guide 27 is secured to the collar 21 so as to relieve the upper packer from undue friction by properly centering the same while it is being introduced in the casing.

A chamber 28 is formed between the flow line 4 and the casing 1 above the upper packer. Since the chamber 25 is directly exposed to the gas in the stratum, it might properly be called a pressure chamber, and since the chamber 28 extends upwardly through the casing 1 and outside of the flow line 4 and communicates with the regulator 8, the said chamber 28 might be considered as a control chamber.

A small pipe 29, forming a by-pass, extends from the control chamber 28 downwardly through the collar 22, the packer 23, the collar 24, and into the collar 26, and communicates with a channel 30, extending through the said collar. A valve 31 is positioned in the said channel 30, and is somewhat smaller than said channel so that gas may flow around said valve. Between the lowermost portion of the said pipe 29 and above the said valve 31 is a spring 32, tending to push the said valve downwardly and to seat the conical valve stem 33 on the valve seat 34. The valve seat 34 is formed on the upper end of an L-shaped passage 35, extending from a passage way 36, extending from the pressure chamber 25, and the said passage 35 communicates with the interior of the flow line or with the bore 37 in the collar 36, which forms a part of the flow line.

The oil normally flows from the bottom of the well upwardly through the flow line 4 to some point above the upper packer. Let us assume that the pressure in the oil well is not sufficient to cause the oil to flow to the surface, but that a gas stratum is found which contains a pressure of x pounds. This pressure which passes through the holes 9 passes upwardly around the sides of the valve 31, through the channel 30 and pipe 29, into the control chamber 28, and if the gate valve 6 were closed it would only be a matter of time until the pressure in the chambers 25 and 28 would be equalized, and the spring 32 would close. If, however, the gate valve is opened and the regulator is set to a pressure sufficiently below x pounds to enable the pressure in the chamber 25 to unseat the valve 31 against the tension of the spring 32, the gas from the pressure chamber 25 would flow through the channel 35 into the flow line, thereby aerating the oil in the flow line and causing the oil to flow to the surface. The amount that the valve will be opened would be altogether dependent upon the differential in pressure between the chambers 28 and 25. The pressure in the chamber 28 can never exceed that in the chamber 25, for the only pressure in the chamber 28 is the pressure that

has been caused by the passage of gas from the chamber 25 into the chamber 28. If the pressure should be equal, the spring 32 will of course close the valve altogether. If the pressure in chamber 25 should be only very slightly greater than that in chamber 28, the valve would be unseated very little, so that a very small quantity of gas could pass into the flow line. If, however, the pressure in chamber 25 should greatly exceed that in chamber 28, the valve would be completely opened, allowing a large quantity of gas to flow into the flow line. The regulator 8 therefore serves as a means to regulate from the ground surface the amount that the valve 31 will be opened or closed.

Particular attention is called to the fact that I regulate the valve 31 not by introducing pressure into the chamber 28 from a pump, but by allowing the gas therein to be partially evacuated, and the amount of this evacuation is controlled by the regulator 8.

If there is a considerable gas pressure in the oil and it is desired to use the bottom hole pressures, the holes 9 may be eliminated, and the lower packer may be omitted. It would then be necessary to plug the bottom of the flow line 4 so as to force the oil and gas to pass upwardly through the pressure chamber 25, unseating the valve, and both the oil and the gas would then pass through the channel 35 into the flow line. The amount of this flow would be regulated by the degree that the valve was opened, and this in turn would be regulated by the regulator 8. In either case, therefore, I govern the valve 31 by setting the regulator 8 to any point desired.

I, therefore, have provided a proficient bottom hole control choke, which is controlled entirely from the surface of the ground. In using the words bottom hole control choke I do not, of course, mean to define the exact position of the packers relative to the bottom, for obviously the packers could be positioned wherever a gas stratum is found, provided the oil will flow to a point above the said packers so that when the gas is introduced, it will aerate the oil.

I realize that many changes may be made in the specific form in the invention, shown by way of illustration herein, and I desire to reserve to myself the right to make all changes which may fairly fall within the spirit of this invention as expressed in the appended claims. Having now described my invention, I claim:

1. In combination, a casing perforated adjacent a gas stratum, a flow line, an upper packer and a lower packer carried by said flow line, means whereby said lower packer may be set below the perforations and the upper packer above the said perforations, forming a pressure chamber between said packers, and manually controlled means to govern the introduction of the trapped gas in the pressure chamber into the oil in the flow line.

2. In combination, a casing perforated adjacent a gas stratum, a flow line, an upper packer and a lower packer carried by said flow line, means whereby said lower packer may be set below the perforations and the upper packer above the said perforations, forming a pressure chamber between said packers, and means controlled from the surface of the ground to govern the introduction of the gas in the pressure chamber into the oil in the flow line.

3. In combination, a casing perforated adjacent a gas stratum, a flow line, an upper packer and a lower packer carried by said flow line, 75

means whereby said lower packer may be set below the perforations and the upper packer set above the perforations, the space between the flow line and casing above the upper packer forming a control chamber, the space between the said packers and the flow line and casing forming a pressure chamber, and means whereby the differential in pressure in the said chambers will control the introduction of gas from the pressure chamber into the flow line.

4. In combination, a casing, a flow line, a packer carried by the flow line, a regulator to regulate the pressure of gas in a control chamber between the flow line and casing and above the packer, the space below the packer and the flow line and casing forming a pressure chamber, there being a passage way between the pressure chamber extending into the flow line and a valve to control the opening to said passage, said valve being controlled by the differential in pressure in said chambers to regulate the amount of gas that may pass through said passage way.

5. In combination, a packer, a flow line carrying said packer, a casing through which said flow line extends, the space between the flow line and casing above the packer forming a control chamber and the space below the packer forming a pressure chamber, there being a passage way from said pressure chamber into said flow line, and means, governed by the differential in pressure in said chambers, to govern the amount of gas that may pass through said passage way.

6. In combination, a packer, a flow line carrying said packer, a casing through which said flow line extends, the space between the flow line and casing above the packer forming a control chamber and the space below the packer forming a pressure chamber, the pressure chamber being in communication with the gas in a stratum in the well, there being a passage way from said pressure chamber into said flow line, and means, governed by the differential in pressure in said chambers, to govern the amount of gas that may pass through said passage way.

7. In combination, a flow line, a packer thereon having a control chamber above and a pressure chamber below the same, the packer having a by-pass extending therethrough and communicating with the said chambers so that the pressure in the chambers will at all times tend to be equalized, adjustable means to control the pressure in the control chamber, and a valve means to govern the introduction of gas from the pressure chamber into the flow line.

8. In combination, a flow line, a packer thereon having a control chamber above and a pressure chamber below the same, the packer having a by-pass extending therethrough and communicating with the said chambers so that the pressure in the chambers will at all times tend to be equalized, adjustable means to control the pressure in the control chamber, there being a passage way extending from the pressure chamber into the flow line, and a valve means to control the amount of gas that may pass through said passage way.

9. In combination, a flow line, a packer thereon having a control chamber above and a pressure chamber below the same, the packer having a by-pass extending therethrough and communicating with the said chambers so that the pressure in the chambers will at all times tend to be equalized, adjustable means to control the pressure in the control chamber, there being a passage way extending from the pressure chamber into the flow line, a valve normally tending to close said passage way and being controlled by the differential in pressure in said chambers.

10. In combination, a flow line, a packer thereon having a control chamber above and a pressure chamber below the same, the packer having a by-pass extending therethrough and communicating with the said chambers so that the pressure in the chambers will at all times tend to be equalized, adjustable means to control the pressure in the control chamber, there being a passage way extending from the pressure chamber into the flow line, a valve having its opposite ends exposed to the pressure in said chambers respectively, so that it is controlled by the differential in pressure in said chambers.

11. In combination, a flow line, a packer thereon having a control chamber above and a pressure chamber below the same, the packer having a by-pass extending therethrough and communicating with the said chambers so that the pressure in the chambers will at all times tend to be equalized, adjustable means to control the pressure in the control chamber, there being a passage way extending from the pressure chamber into the flow line, a spring pressed valve having its opposite ends exposed to the pressure in said chambers respectively, so that it is controlled by the differential in pressure in said chambers.

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