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C. H. McNEESE ET AL

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BOTTOM HOLE CHOKE

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Fig. 1.

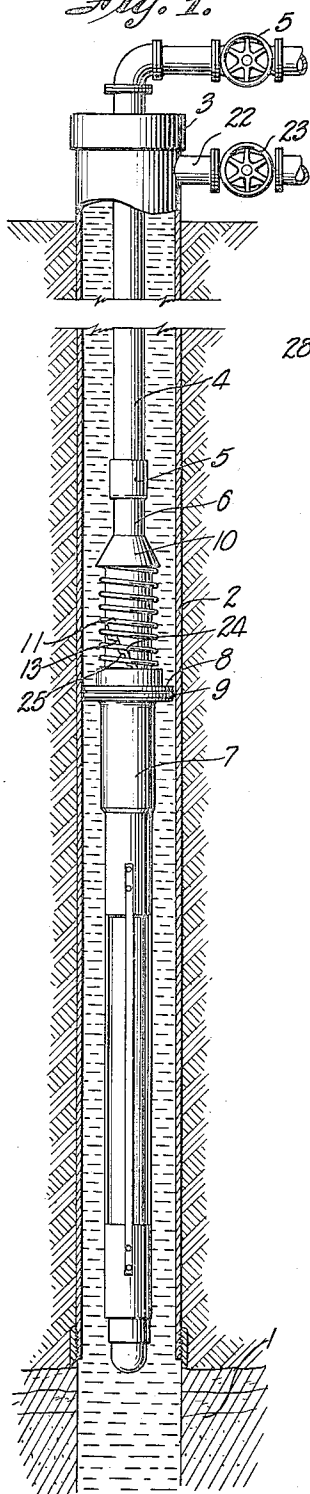


Fig. 2.

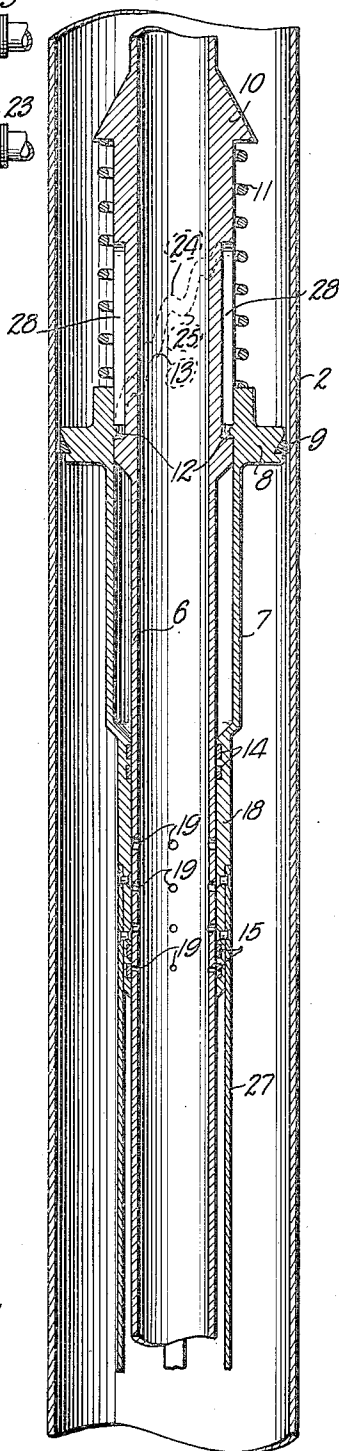


Fig. 3.

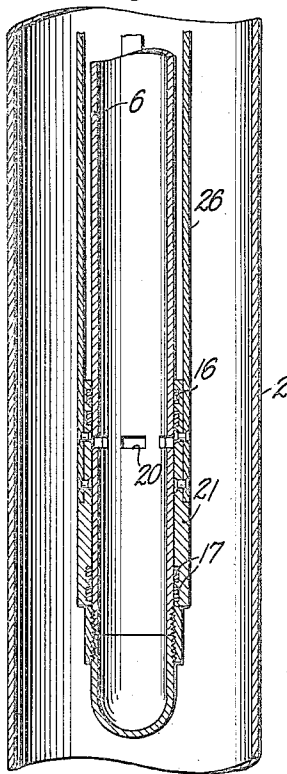
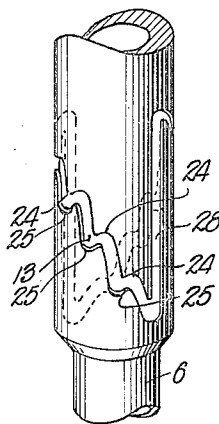


Fig. 4.



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BOTTOM HOLE CHOKE

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2 Claims. (Cl. 166—2)

Our invention relates to bottom hole chokes, and more particularly to a device adapted to be used in connection with eduction tubing of an oil well to control the eduction flow.

5 In a flowing well, gas pressure in the formation forces oil upwardly through the eduction tubing of an oil well to the surface. As long as the gas pressure is sufficient, the oil will be what is known as a "flowing well". When this pressure is exhausted the well must be pumped involving considerable expense and labor.

10 With a view of conserving the natural reservoir of gas in a producing formation, valves or choke devices have been installed at the bottom of the string of eduction tubing. In general these valves or choke devices reduce the pressure of the gas in the formation so that the smallest quantity of gas necessary to force the oil out of the well will be employed. It has been clearly demon-
15 strated that there is a saving in reservoir energy by the use of bottom hole chokes. The greatest problem has been to develop an economic method of adjusting a bottom hole choke which will meet with operating conditions, which vary with each individual well.

25 There is a great deal of gas in solution in the oil under the pressure conditions existing in the formation. When this pressure is released at the surface, this gas is free and has no part in lifting the oil out of the well. The object of bottom hole choke devices is to expand this gas near the bottom of the well in order to maintain an effective gas lift and lower the gas-oil ratio.

30 The choke devices now obtainable or known to the art are difficult to insert and to adjust. After the known chokes have remained in a well for sometime, difficulties in fishing them out when necessary, due to the salting up of the well, entail considerable loss of time and expense.

40 One object of our invention is to provide a bottom hole choke which may be placed in a well and remain there until such time as it is necessary to install pumping equipment.

45 Another object of our invention is to provide a choke which may be adjusted to any desired restriction without the necessity of employing any mechanical device or tool which must be operated between the surface and the choke.

50 Still another object of our invention is to provide a bottom hole choke for a well which may be completely closed at the bottom of the tubing when it is desired to renew or change the surface valve group, sometimes referred to as the "Christmas tree".

55 A further object of our invention is to provide

a bottom hole choke in which the flow of oil through the eduction tubing may be closed adjacent the bottom of the well, removed from the well head, thus creating a safety factor in event of fire.

5 A further object of our invention is to provide a bottom hole choke in which the oil well eduction tubing may be closed at the bottom when taking bottom hole pressures, enabling the insertion of the pressure bomb. After the bomb
10 is inserted at the bottom of the well, the tube may be closed at the surface and the choke opened so that the static pressure conditions at the bottom of the well may be easily determined.

15 A still further object of our invention is to provide a bottom hole choke which is simple in its construction and operation.

Other and further objects of our invention will appear from the following description.

20 In the accompanying drawing which forms part of the instant specification and are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

25 Fig. 1 is a diagrammatic cross sectional view of an oil well fitted with a device embodying our invention.

Fig. 2 is a sectional view on a larger scale of the upper portion of our bottom hole choke.

30 Fig. 3 is a sectional view similar to that shown in Fig. 2 of the bottom portion of our bottom hole choke.

Fig. 4 is a perspective view of a detail.

Referring now to the drawing, the producing formation is represented diagrammatically in Fig. 35 1 by the reference numeral 1. The well is provided with a casing 2 fitted with a casing head 3 and eduction tubing 4. The oil is adapted to flow out of the eduction tubing to the surface under the control of a valve or valves 5 forming what is known as the "Christmas tree". Our device is adapted to be secured to the eduction tubing 4 by any suitable means, as for example, a union 5.

45 The device in general comprises a housing 6 over which is telescoped as sleeve 7, formed with an integral piston 8 of slightly less diameter than the casing in connection with which it is to be used. A piston ring 9 is carried by the piston 8 forming a seal between the interior walls of the casing and the piston 8. The upper end
50 of the housing 6 is provided with an annular lug 10 against which a spring 11 is seated. The lower end of the spring 11 engages the upper end of the sliding sleeve 7 and urges it down-
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wardly. The sleeve 7 is formed with lugs 12 which are positioned in a pair of cam grooves 13 of identical shape and oppositely disposed, which cam grooves are formed in the upper end of housing 6.

The inner intermediate surface of the sleeve 7 is provided with packing rings 14 and 15 to prevent the oil from leaking up between the sleeve and the housing. All other parts of the piston may be loose fitting except the lower end of the sleeve 7, which is also provided with packing rings 16 and 17. Adjacent the intermediate portion 18 of the sleeve, the housing is provided with a plurality of perforations 19. In the position shown in Fig. 2, the intermediate portion 18 of the sleeve covers the openings 19.

The lower portion of the housing 6 is provided with ports 20, normally covered by the lower portion 21 of the sleeve 7.

In operation, the parts being in position shown in Fig. 2, no communication between the formation and the eduction tubing obtains. The casing above the piston 8 is packed. It will be noted that the casing is provided with an outlet pipe 22 provided with a valve 23. Should valve 23 be opened, pressure above the piston 8 is relieved so that pressure existing in the formation acting upon the under side of piston 8 will move the sleeve 7 upwardly carrying with it the lugs 12 which ride in the cam groove 13. The lugs will be caught at the reentrant portions 24 which serve to limit the upward movement of the sleeve against the action of the spring under the influence of pressure in the well. When the valve 23 is closed, the pressure gradually equalizes by leakage past the piston ring 9 and the spring 11 will force the sleeve downwardly seating the lugs in lower reentrant portion 25 of the groove, depending upon the position of the lugs 12 in the cam groove. It will be seen that by alternately opening and closing valve 23 the sleeve 7 may be raised progressively. As the sleeve is raised, the intermediate portion 18 of the sleeve will uncover the ports 19, permitting the oil to flow into the eduction tubing and out of the well. The depending portion of the housing 6 acts as a sump in which a pressure bomb may be placed, and as a trap in which sand, sediment and the like will collect. When the sleeve 7 reaches the upper groove, the lower portion of the sleeve 21, which is secured to the sleeve proper by extension members 26, will uncover the port 20 so that a flushing out effect of the sand and the like can be had.

To take the pressure in the well by means of a pressure bomb, the sleeve is permitted to occupy the position shown in Fig. 2. This can be accomplished by successively opening and closing valve 23 until the lugs enter the vertical portions 28 of the grooves 13. The spring 11 will then, when the pressure is equalized upon the closing of valve 23, move the sleeve to the position shown in Fig. 2, closing the eduction openings 19. The bomb may

be then readily deposited into the lower portion of the housing 6, the valve 5 closed and the valve 23 operated to open the ports 19 permitting the registration of the pressure at the bottom of the well.

It will be observed that we have accomplished the objects of our invention. We have provided a bottom hole choke which is easily moved to various positions whereby the amount of choke can be easily adjusted without removing the choke device from the bottom of the well. The device may be operated to completely stop the flow of oil out of the well at a point adjacent the bottom of the well, and may be easily operated from the surface without mechanical connection with the surface, as has been the case of the prior art.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of our claims. It is further obvious that various changes may be made in details within the scope of our claims without departing from the spirit of our invention. It is, therefore, to be understood that our invention is not to be limited to the specific details shown and described.

Having thus described our invention, what we claim is:

1. In an oil well having a casing, eduction tubing within said casing, a port in said eduction tubing, a sleeve valve controlling said port, a piston for actuating said sleeve valve, said piston being positioned in the annular space between said casing and said tubing, a cam for controlling the position of said valve, a cam groove for said cam, and means operable from the surface for varying the pressure in said annular space above said piston for causing said valve to move through an amplitude determined by said cam and cam groove.

2. In an oil well having a casing sealed at the surface against escape of fluid, eduction tubing within the casing forming an annular passageway therewith, a port in said eduction tubing, a valve controlling said port, an annular piston positioned in said passageway, means operatively connecting said piston to said valve, fluid pressure entrapped in the casing outside the eduction tubing and above the annular piston, a spring normally urging said piston downwardly whereby said fluid pressure and spring together move said valve to closed position, means operable at the surface for venting said annular passageway above said piston to relieve the fluid pressure acting on top of said piston whereby formation pressure below the piston will move said valve toward open position against the action of said spring and the relieved fluid pressure above the piston.

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