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2,284,255

CHOKE

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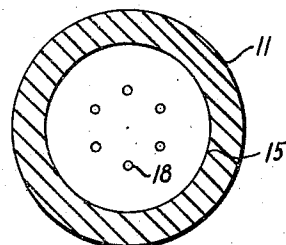
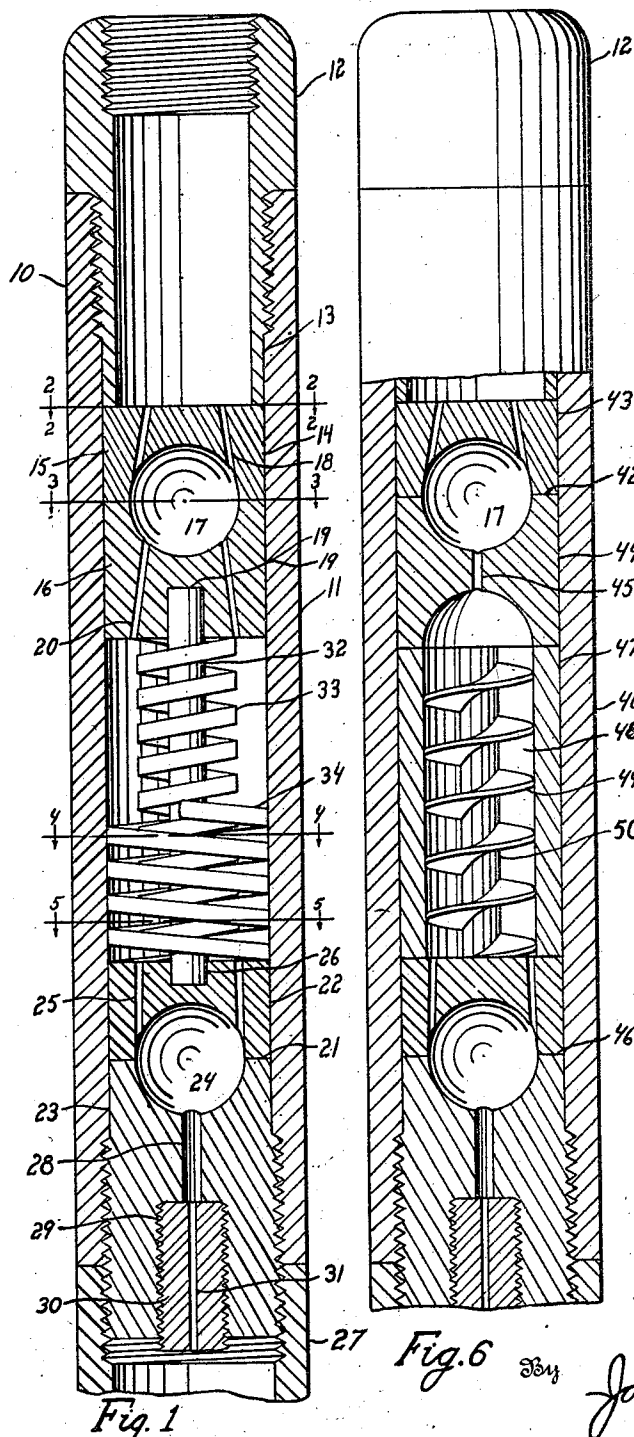


Fig. 2

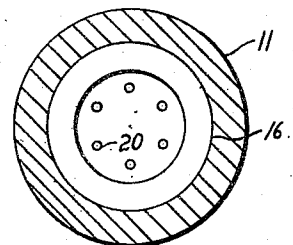


Fig. 3

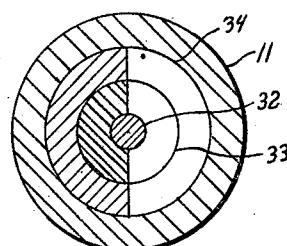


Fig. 4

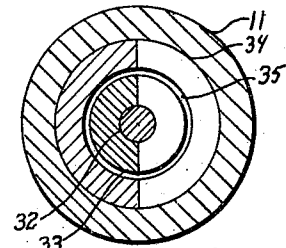


Fig. 5

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CHOKE

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This invention relates to new and useful improvements in chokes.

An important object of this invention is to provide an improved type of choke, wherein the flow of fluid is retarded.

A particular object of the invention is to provide an improved choke, wherein the fluid passing through said choke is retarded, and the gas and oil, which are retarded, are forced to admix with each other, whereby the gas absorbs a large quantity of oil.

A further object of the invention is to provide an improved choke, wherein the well stream is forced to flow at a uniform rate and pressure, whereby turbulence within the producing formation is substantially eliminated, and any salt water present in said formation is allowed to reach a quiescent state thereby preventing said salt water from flowing up the well bore.

A still further object of the invention is to provide an improved device having reduced openings, whereby the fluid passes through a small opening and is then introduced into a larger opening where it is agitated, breaking up the globules of the gas and oil and repeating this operation so that the gas absorbs a large portion of the oil particles and an atomized oil and gas fluid results.

A further object of the invention is to provide an improved device, wherein the flow of the fluid through said device is such that the gas will be retarded, and the oil will mix more freely therewith, thereby resulting in reduction in the gas free and an increase in oil in the mixture which results.

An important object of the invention is to provide an improved choke which is so constructed and has passages therein of sufficient diameter as to allow oil to flow therethrough in adequate quantities, and at the same time offers the required resistance to impede the flow of gas through the said choke and thereby create a back pressure on the producing formation and allow a liquid level to be built up within the well bore.

A still further object of the invention is to provide an improved choke, wherein a well fluid is caused to flow in counter-current, concentric, upwardly, spiral paths, which results in two opposed upwardly directed streams, whereby the action of each stream is to impede or "cushion" the flow of the other stream, thereby choking back the gas into the well formation.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawing, in which an example of the invention is shown, and wherein:

Figure 1 is a vertical transverse sectional view of a device constructed in accordance with the invention.

Figure 2 is a horizontal cross sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a horizontal cross sectional view taken on the line 3—3 of Figure 1.

Figure 4 is a horizontal cross sectional view taken on the line 4—4 of Figure 1.

Figure 5 is a horizontal cross sectional view taken on the line 5—5 of Figure 1.

Figure 6 is a transverse vertical sectional view of another form of the invention.

The numeral 10 designates a choke which may be connected in a string of tubing, as is the usual practice in the oil industries, or may lie positioned in any suitable location when or where choke is desired. The choke includes a tubular sleeve or housing 11 which has its upper and lower ends open and internally screw-threaded. A box 12 is in screw-threaded engagement with the upper end of the sleeve and has its upper end internally screw-threaded, so that it may be attached to a string of tubing (not shown). Depending from its lower end, below the externally screw-threaded opening, is a collar 13. Abutting the lower edge of the collar is a split circular block or body 14, which snugly engages the inner walls of the sleeve 11. The numeral 15 designates the upper portion of the block, and the numeral 16 the lower portion. The two portions of the block have hemispheres milled out in their abutting faces to provide concaved areas so as to form a central chamber 17 in the body when the two faces are in contact. The portion 15 is provided with a plurality of inclined passages 18 which communicate between the bore of the box 12 and the chamber 17, said passages entering the chamber tangentially around the concaved area. The portion 16 of the block 14 has a central recess 19 on its lower exposed end. A plurality of inclined passages 20 are also provided in the portion 16 and are so arranged that they lie in the same radius from the center of said block but are so inclined that the discharge therefrom will be directed against the concaved area of the upper portion of chamber 17. This discharge is intended to strike the concave area above the elevation of the lower ends of the passages 18. It is pointed out that fluid passing upwardly must

flow through said passages and chamber, as said block snugly engages the inner walls of the sleeve 11. A split circular block 21 is disposed below the block 14 and is located near the lower end of the sleeve 11, said block snugly engaging the inner wall of said sleeve. The block 21 is formed of an upper portion 22 and a lower portion 23, the abutting faces of the two portions having hemispheres provided therein so as to form a central chamber 24 similar to the chamber 17. A plurality of vertical passages 25 are provided in the upper portion 22 of said block and are so arranged as to lie in a circle about the vertical axis of the block. Said passages extend from the upper surface of the portion 22 and have their lower ends communicating tangentially with the chamber 24. The upper surface of the portion 22 is provided with a central recess 26, while the lower portion 23 of the block 21 is elongated and has its lower portion externally screw-threaded, so as to engage within the lower end of the sleeve 11. The lower end of the portion 23 extends below the lower edge of the sleeve 11, so that a screen 27 (not shown) or any other suitable structure may be attached thereto. A central axial opening 28 is provided in the portion 23 of the block 21 and communicates with the chamber 24, said opening having its lower portion 29 enlarged and internally screw-threaded, so that a suitable flow bean 30 may engage therein. Said bean is provided with the usual axial opening 31 therein. Confined between the portion 16 of the block 14, and the portion 22 of the block 21, is an elongate rod 32 which has its upper end engaging in the recess 19 of the portion 16 and its lower end engaging within the recess 26 of the portion 22.

A helical spring 33 slidably engages around the rod 32 and is confined between the blocks 14 and 21. It is pointed out that said spring is wound in a clock-wise direction. It is pointed out that the lower outer end of the spring overlays a portion of the exposed openings of the passages 25 on the upper surface of the portion 22. Another helical spring 34, which is wound in a counter-clock-wise direction, slidably engages around the spring 33 and also slidably engages the inner wall of the sleeve 11. The spring 34 is also confined between the blocks 14 and 21. The lower convolutions of the springs 33 and 34 have their adjacent faces cut away so as to provide a flow space therebetween and form an annular opening 35 (Figure 5), which permits fluid to flow upwardly from the passages 25 and continue its flow out into the spaces between convolutions between the springs. Thus, a portion of said fluid will enter the spaces between the convolutions of the outer spring 34 and follow the same upwardly in a counter-clock-wise direction, while a similar portion of the fluid will enter the spaces between the convolutions of the inner spring 33 and follow said spring upwardly in a clock-wise direction. As will be seen in the drawing, the spaces of the outer spring and the spaces of the inner spring intersect a number of times in their upward course. Thus, the two streams flowing upwardly through the spaces of the two springs will repeatedly contact each other while flowing counter-currently, thereby allowing each stream to oppose the flow of the other stream. This action on the part of the two streams causes the flow to be impeded and increases the resistance the choke offers to the well stream, whereby the choke tends to restrain the flow of gas from the formation while compelling the oil to mix with

the flowing gas. As will be noted in the drawing, the spaces between the convolutions of the springs 33 and 34 are of substantial cross-sections and depend on the counter-current flow of the split streams to furnish the resistance necessary to choke back the gas.

In operation the choke 10 is set within the well bore in the usual manner. Fluid containing gas and oil will flow up through the opening 31 of the bean 30, obviously being retarded by said opening, and pass into the opening 28 from where it will flow into the chamber 24, thereby causing the fluid to be agitated. It is pointed out that after the fluid has been flowing through the device for a period of time, the chamber 24 may or may not acquire and retain a constant liquid level depending on the rate of flow. Thus, fluid flowing into said device through the opening 28 must pass through the chamber 24 and the liquid therein, whereby oil particles present will be broken up and intermixed or atomized in the gas of the fluid. The mixture passes from the chamber 24, up through the passages 25, and through the opening 35 between the two springs. The fluid then continues its flow up through the springs 33 and 34, passing along the convolutions of said springs, as has been explained hereinbefore to effect a further admixing. When said fluid has reached the top of the springs, it will enter the passages 20 and the chamber 17, where it will again be agitated. It then passes from the chamber 17, to the passages 18, to the bore of the box 12, and up through the well tubing. It is pointed out that the chamber 17 will be full of fluid in a similar manner as chamber 24, and, obviously, fluid passing therethrough will be submitted to an atomized action, whereby oil present and globules will be carried in the gaseous phase.

After the device has been set in the well bore for a period of time, it will tend to build up a higher liquid level within said formation by reason of its choking and condensing action. Where the gas and oil are atomized a solid liquid column is not formed above the device and as a result the flow from the well is not retarded and the gas therefore carries a larger percentage of oil from the well so that the gas/oil ratio is reduced.

In Figure 6 there is shown a modified or another form of the invention. The construction of this form is identical to that shown in Figure 1, with the exception of the springs 33 and 34 and the blocks 14 and 21. Block 14 is replaced in the modified form by a block 42, which includes upper and lower portions 43 and 44 respectively. The upper portion 43 is identical to the portion 15 of the block 14. The lower portion 44 is formed with hemispheres cut in its upper and lower surfaces, the upper hemisphere being in vertical alinement with the hemisphere formed in the portion 43, thereby completing the spherical chamber 17. An actual passage 45 communicates between the upper and lower hemispheres in the portion 44. A block 46 is identical to the block 21 shown in the first form. A liner 47 is confined between the blocks 42 and 46 and slidable within the sleeve 40. Said liner is provided with a large central opening 48. A helical guideway 49 is slidable within said opening and surrounds an actual shaft 50. Said guideway is suitably secured to said shaft and to said liner, thereby being securely held against any movement.

In operation the device operates in an identical manner as the device shown in Figure 1. Fluid

would pass up through the beam, into the lower spherical chamber, and through the passages, and contact the exposed surfaces of the helical guide, where it would follow the paths of said guide; and as can be seen, said fluid will be whirled about the shaft 50. It would then strike the hemisphere located in the lower surface of the portion 44 of the block 42 from where it would pass upwardly through the opening 45 and the spherical chamber 17, and through the passages of the portion 43, out into the bore of the tubing. In this particular structure, the flow of fluid will not be retarded to the extent that the fluid would in the first form. It has been found desirable to use this form on lower pressure wells where the gas or oil ratio is small.

Various changes, alterations and modifications may be made in the size, shape and arrangement of the herein described elements within the scope of the appended claims.

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

1. A choke including, a tubular body, an insertable plug located near the upper end of said body having flow passages therein and a central chamber communicating with said passages, a plug located near the lower end of said body having a plurality of flow passages therein said plug being provided with a central spherical chamber communicating with said flow passages, and means confined between the said plugs for whirling and agitating a fluid passing therethrough.

2. A choke including, a tubular body, an insertable plug located near the upper end of said body having flow passages therein and a central chamber communicating with said passages, a plug located near the lower end of said body having a plurality of flow passages therein said plug being provided with a central spherical chamber communicating with said flow passages, and means disposed in the body intermediate the plugs for converting the well stream flow through the choke into separate streams and bringing said streams into contact with each other for retarding the flow of the well stream through the choke whereby the streams are agitated and admixed so that gas and solution are released.

3. A choke for wells including, a body having a chamber therein, said chamber being provided with a concave upper end, said body having a restricted inlet passage leading to the lower portion of said chamber, whereby a well fluid admitted to said chamber will be deflected and agitated therein by engaging the concave end and converting the oil to the gaseous phase, said body having a restricted outlet leading from an area below the upper portion of said chamber for retarding the escape of fluids from said chamber, whereby the ratio of oil to gas is increased.

4. A choke including, a housing, a plurality of spaced bodies each having a chamber therein, each chamber being provided with a concave upper end, each of said bodies having a restricted inlet passage leading to the lower portion of the chamber therein, whereby a well fluid may be admitted to said chamber and agitated therein, each of said bodies having a restricted outlet leading from the upper portion of said chamber for releasing the escape of fluids from said chamber, whereby the ratio of oil to gas is increased.

5. A choke including, a body having a chamber therein, said chamber being provided with a concave upper end, said body having a restricted inlet passage leading to the lower portion of said chamber, whereby a well fluid may be admitted

to said chamber and agitated therein, said body having a plurality of restricted outlets leading from the concave portion of said chamber for releasing the escape of fluids from said chamber, whereby the ratio of oil to gas is increased, and another agitating means provided above said body.

6. A choke including, a body having a chamber therein, said chamber being provided with a concave upper end, said body having a restricted inlet passage leading to the lower portion of said chamber, whereby a well fluid may be admitted to said chamber and agitated therein, said body having a plurality of restricted outlets leading from the concave portion of said chamber for releasing the escape of fluids from said chamber, whereby the ratio of oil to gas is increased, and another agitating means provided below said body.

7. A choke including, a plurality of bodies each having a chamber therein, each chamber being provided with a concave upper end, each of said bodies having a restricted inlet passage leading to the lower portion of the chamber therein, whereby a well fluid may be admitted to said chamber and agitated therein for mixing the oil into the gaseous phase, each of said bodies having a restricted outlet leading from the concave portion of said chamber for releasing the escape of fluids from said chamber, whereby the ratio of oil to gas is increased.

8. A device for controlling the gas-oil ratio of the flow from a well comprising a housing, an entry choke therein, a barrier in said housing, an atomizing chamber in said barrier, a plurality of entry passages in said barrier leading to said chamber, a plurality of passages leading from said chamber on thru said barrier, said first and second passages being out of alignment to effect a turbulence in said chamber.

9. A device for controlling the gas-oil ratio of the flow from a well comprising a housing, an entry choke therein, a barrier in said housing, an atomizing chamber in said barrier, a plurality of entry passages in said barrier leading to said chamber, a plurality of passages leading from said chamber on thru said barrier, said first and second passages being out of alignment to effect a turbulence in said chamber, said sets of passages being inclined relative to the axis of said housing.

10. In a well flowing device having a housing, means therein to atomize the oil and the gas being produced so that the vapor resulting therefrom will more readily flow from the well at a lower gas-oil ratio, said means including a chamber having a concave area therein, inlet passages to said chamber directed to discharge against said area, and outlet passages from said chamber leading from said area at a location below the elevation which receives the discharge of the inlet passages.

11. The combination in a well of a well tubing having a control device thereon including a housing, an entry choke therein adjacent the lower end, a barrier in said housing above said choke, an atomizing chamber in said barrier, entry passages thru the barrier to said chamber, discharge passages from said chamber thru said barrier whereby gas and oil entering said chamber will be turbulated so as to discharge into the tubing as a vapor which will tend to rise in the tubing.