Sept. 25, 1934. J. M. HEWGLEY 1,974,868

APPARATUS FOR CONTROLLING THE FLOW OF OIL WELLS

Filed June 23, 1932. 3 Sheets-Sheet 1

FIG. 1.

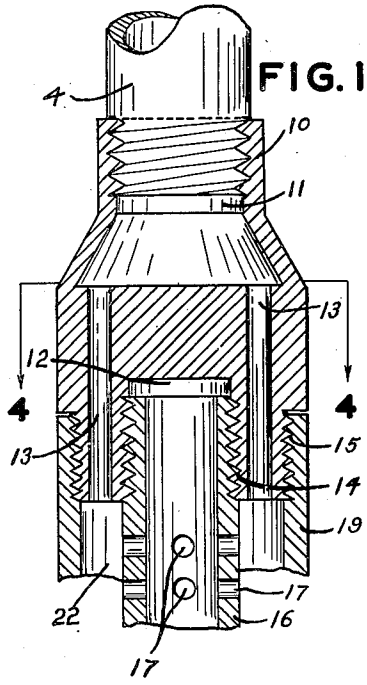


FIG. 3.

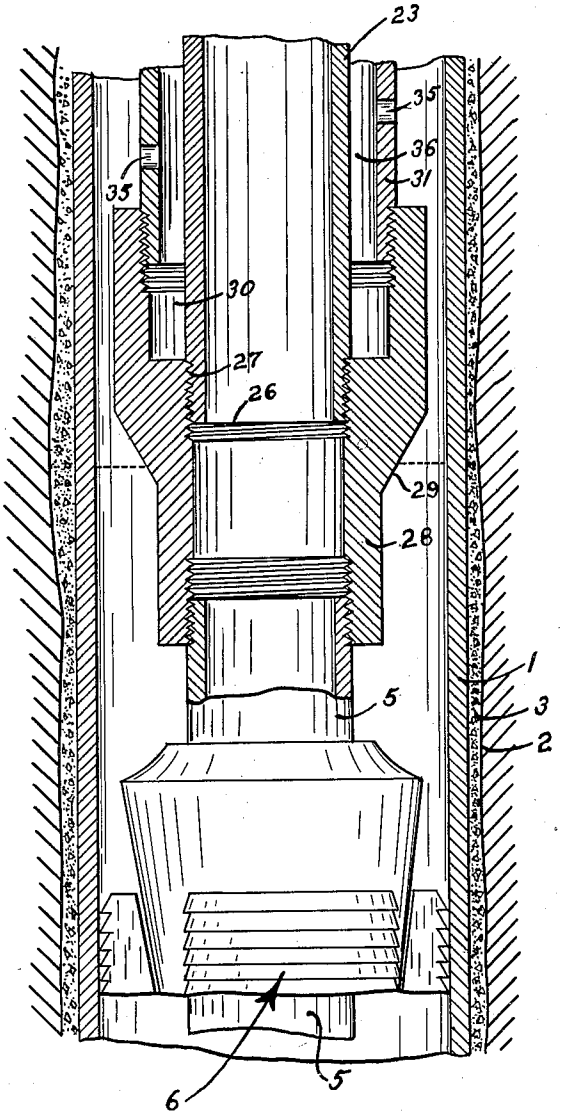


FIG. 4.

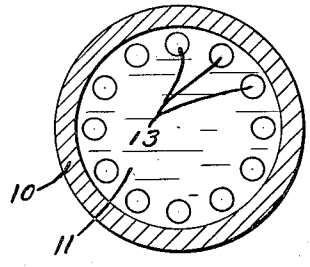
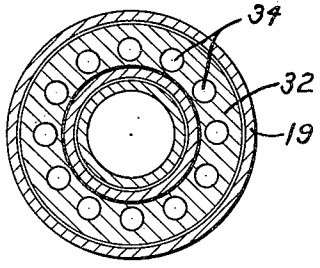


FIG. 5.



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APPARATUS FOR CONTROLLING THE FLOW OF OIL WELLS

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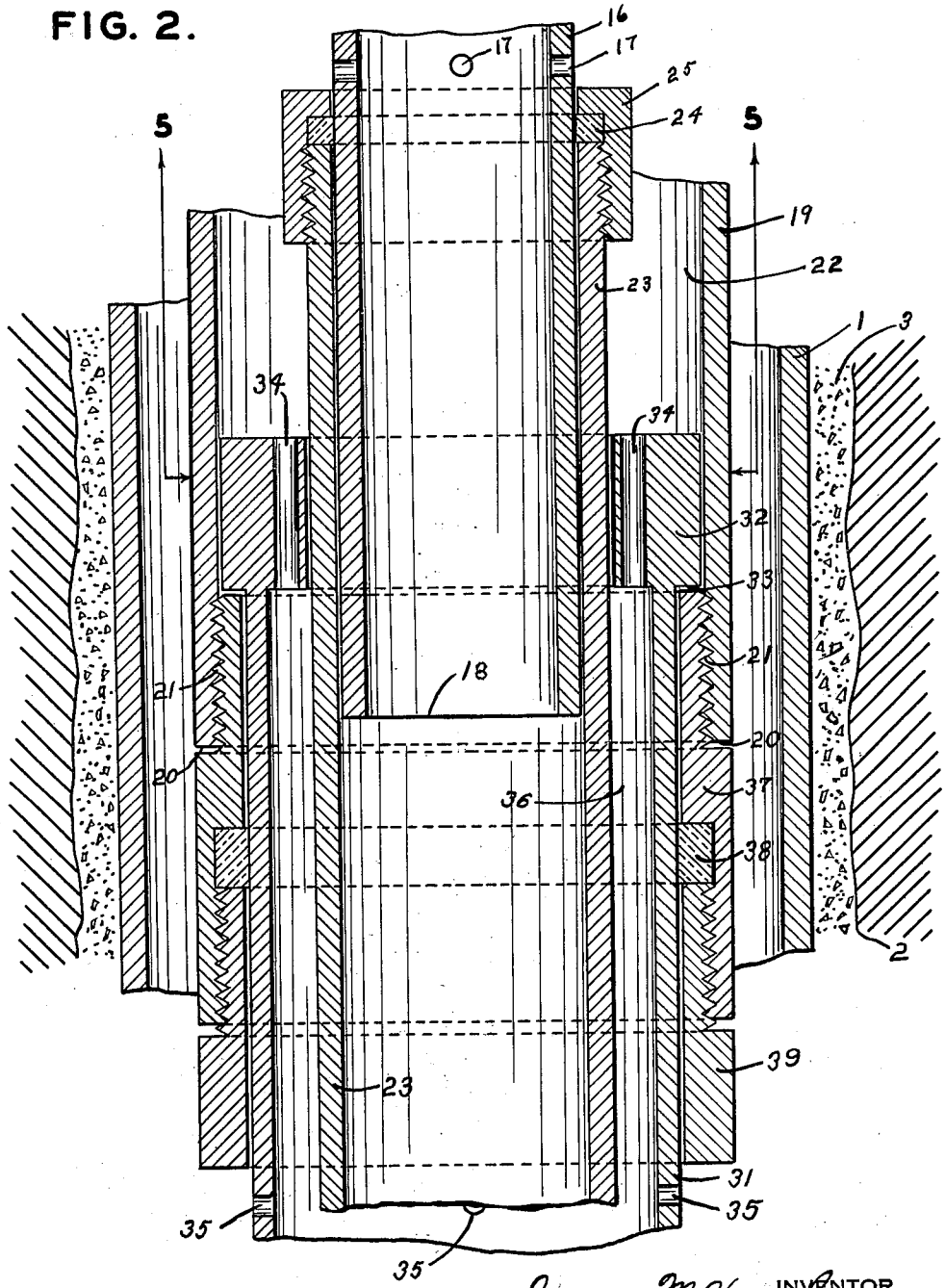
FIG. 2.



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APPARATUS FOR CONTROLLING THE FLOW OF OIL WELLS

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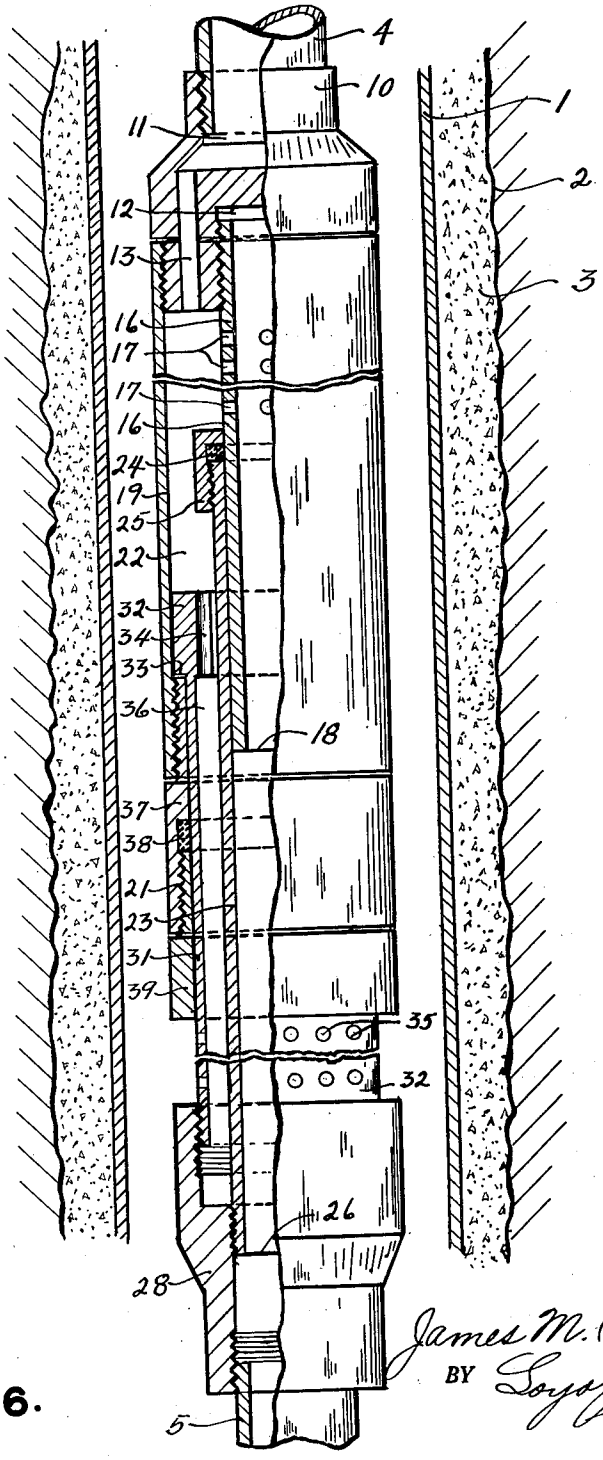

FIG. 6.

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UNITED STATES PATENT OFFICE

1,974,868

APPARATUS FOR CONTROLLING THE FLOW OF OIL WELLS

James M. Hewgley, Oklahoma City, Okla.

Application June 23, 1932, Serial No. 618,845

12 Claims. (Cl. 103—234)

My invention relates to apparatus for adjustably controlling the flow of oil and gas from wells, and more particularly to apparatus of this class which will function at the bottom or adjacent the normal level of oil in a well.

In order to curtail the waste of gas pressure in an oil bearing stratum, it has been found extremely desirable to control the relative percentage of free gas which is permitted to flow with the oil from a well. It is the prime object of this invention to provide a device which will positively control from a position at the bottom of a well, or at the level at which the oil normally stands in a well, the ratio of free gas to the oil which is taken from the well, and at the same time to provide a means for adjustably controlling at such point in a well the amount of flow of such mixed oil and gas, and also a means for shutting in the well entirely, if desired.

It will be obvious that there will be less fire hazard if the flow of a well is controlled from a point deep within the well. Also that the logical place to control the ratio of free gas and oil is at a point deep within the well because the unused free gas is thus confined within or adjacent the oil and gas producing stratum and below the normal oil level in the well, and for this reason acts as a means for assisting in boosting the oil to the earth's surface instead of acting as a detriment to production, as is the case when the ratio is controlled by apparatus located adjacent the top of the well.

Other objects of my invention are to provide a device of this class which is new, novel, practical and of utility; which even though located a considerable distance below the earth's surface may be controlled from the earth's surface; which will be positive in action; which will be comparatively cheap to manufacture, and simple to install; which is durable; and, which will be efficient in accomplishing all of the purposes for which it is intended.

With these and other objects in view as will more fully appear, my invention consists in the construction, novel features, and combination of parts hereinafter more fully described, pointed out in the claims hereto appended and illustrated in the accompanying three-sheet drawings, of which:

Figure 1 is a vertical sectional view of the upper portion of the device;

Fig. 2 is a similar view of the middle portion, drawn to a larger scale;

Fig. 3 is a vertical sectional view of the lower portion;

Fig. 4 is a horizontal section taken along the line 4—4 of Fig. 1;

Fig. 5 is a horizontal section taken along the line 5—5 of Fig. 2, and,

Fig. 6 is an elevational view of the device, partially in section.

It is understood that various changes in the form, proportion, size, shape, weight, and other details of construction within the scope of my invention may be resorted to without departing from the spirit or broad principles of my invention, and without sacrificing any of the advantages thereof; and it is also understood that the drawings are to be interpreted as being illustrative and not restrictive.

Like characters of reference designate like parts in all of the figures.

One practical embodiment of the invention, as illustrated in the drawings, follows:

The reference numeral 1 indicates a usual well casing rigidly disposed within a well, the walls of which are indicated by the reference numeral 2. The casing 1 extends from the earth's surface downwardly to the oil and gas producing stratum, not shown, and at some point in the well, usually directly above the producing stratum, the space between the casing 1 and the walls 2 is filled with cement 3 which prevents the escape of oil or gas except through the casing. The device embodying this invention is designed to be attached between sections 4 and 5 of a usual string of production tubing, the lower section 5 of which is provided with any desired type of tubing hanging mechanism, the whole of which is indicated by the reference numeral 6, and which is no part of this invention. The hanging mechanism must be such that it will contact the inner walls of the casing 1 and will support the production tubing at any desired point therein, and such that it may be caused to function as desired from a point above the earth's surface. As there are several types of tubing hanging mechanism now in use which function satisfactorily for my purpose, it is not deemed necessary to further describe in detail the mode of its operation. The section of tubing 4 is attached in a usual manner to other similar sections, not shown, which extend upwardly to the earth's surface and which combine to make up the tubing string.

The device consists substantially of a supporting head 10 which is threadedly attached at its upper end to the lower end of the section 4 of tubing, (Figs. 1 and 6). The head 10 is a substantially cylindrical casting having an upper axial bore 11 and a lower axial bore 12, and a plu-

rality of smaller spaced bores 13 communicating therebetween. The lower end portion of the head 10 is provided with interior threads 14 and exterior threads 15, and to the interior threads 14 is connected a depending tubular member 16 having a plurality of longitudinally spaced rows of transverse through perforations 17 extending therearound. The lower end of said member 16 is indicated by the reference numeral 18, and for some distance above the lower end 18 the member 16 is free of said perforations 17. The exterior of the member 16 is machined perfectly smooth for a purpose later explained hereinbelow. The exterior threads 15 of the head 10 receive the upper end of a solid walled tubular member 19 the lower end 20 of which is provided with interior threads 21, (Figs. 2 and 6). It may be seen that the spaced vertical bores 13 of the head 10 communicate between the space bounded by the tubular members 16 and 19, which is indicated by the reference numerals 22, and the upper bore 11 of the head. It may be stated here that the combined area of the vertical bores 13 equals approximately the area of the upper bore 11 of the head, and the combined area of the transverse perforations 17 should also equal approximately the area of the bore 11.

Slidably disposed around the member 16 within the space 22 is provided a sleeve 23, the upper end of which is equipped with a packing ring 24 held in place by a packing nut 25. The lower end 26 (Fig. 3) of the sleeve 23 is engaged by interior threads 27 carried by a substantially cylindrical centrally bored coupling member 28 the lower end of which threadedly engages the upper end of the section 5 of tubing. The upper portion of the coupling 28 is enlarged as shown at 29 and the upper portion of its bore is also enlarged as shown at 30.

Threadedly engaged at its lower end by the upper end of the coupling 28 is provided a second sleeve 31 which surrounds the sleeve 23 and the bore of which forms a continuation of the enlarged portion 30 of the bore of the coupling 28. The upper end of the sleeve 31 is abruptly enlarged as shown at 32 and the enlargement forms an annular exterior shoulder 33. The enlarged portion 32 is provided with a plurality of spaced vertical bores 34 which communicate between the space 22 and the space 36 bounded by the sleeves 23 and 31. The sleeve 31 is provided with a plurality of spaced rows of transverse through perforations 35 the office of which is more fully described hereinbelow.

The enlarged portion 32 of the sleeve 31 lies within the space 22 and is held against removal therefrom by a bushing 37 the lower portion of which is equipped with a packing ring 38 which contacts intimately the smoothly machined exterior surface of the sleeve 31, and which is held in place by a packing nut 39.

It will be understood that in actual construction the plurally perforated tubular member 16 and the solid walled tubular member 19 will extend downwardly for a considerable distance before reaching their respective lower ends, and this will provide ample space for a considerable number of rows of the transverse perforations 17. Also that the sleeves 23 and 31 extend downwardly for a considerable distance before reaching the coupling 28, thus providing space for the provision of a considerable number of the transverse perforations 35 in the sleeve 31.

In operation, oil may ascend through the tubing section 5 and the tubular member 23 into the tubular member 16, whence it will escape into the space 22 through the transverse perforations 17. At the same time gas may pass through the transverse perforations 35 in the sleeve 31 into the space 36, thence upwardly through the bores 34 into the space 22. As heads of gas pressure form within the spaces 36 and 22, they will force the oil upwardly through the vertical bores 13 in the head 10, and thence upwardly through the tubing string.

The amount of flow may be controlled by raising or lowering the tubing string while the section 5 of the tubing remains stationary. This movement will cause the packing rings 24 and 38 to simultaneously close off respectively the flow through perforations 17 and 35, and as the rows of perforations 17 and 35 are spaced equaly to each other, a constant ratio of oil and gas may be had. Should the string of tubing be lowered sufficiently to bring the ring 24 above the uppermost row of the perforations 17 and sufficiently to bring the ring 38 below the lowermost row of the perforations 35, the flow will be effectually shut in.

It may be seen that the size of the perforations 17 and 35 may be varied with relation to each other in the construction of the device and that by so varying the dimensions or fluid capacity of the perforations, the ratio of the oil and gas may be varied to suit the condition existing in each well or in each producing stratum.

It will be understood that the space above the device between the tubing string and the casing will be packed off or closed in any desired manner, thus preventing inadvertent escape of gas around the tubing string.

From the foregoing description it may be seen that the device will effectually maintain the desired ratio of gas and oil regardless of the volume at which the well is being produced, and consequently will conserve the gas by preventing its inadvertent escape. Also that the volume of production can positively be controlled at a subteranean point from a position above the surface of the earth.

Obviously the invention is susceptible of embodiment in forms other than that which is illustrated in the accompanying drawings and described herein, and is applicable for uses and purposes other than as detailed, and I therefore consider as my own all such modifications and adaptations and other uses of the form of the device herein described as fairly fall within the scope of my invention.

Having thus described my invention, what is claimed and desired to be secured by Letters Patent, is:

1. A device adapted to be attached between sections of a string of production tubing positioned in a cased well by usual tubing hanging mechanism therebelow, embodying a pair of spaced, concentrically positioned tubular members rigidly attached to and depending from the lower end of a tubing section thereabove with only the space therebetween communicating with the bore of said section, the inner one of said members having a plurality of spaced rows of transverse perforations therethrough, and a pair of spaced, concentrically positioned sleeves rigidly attached to and upstanding from the upper end of a tubing section therebelow, the bore of said section communicating only with the bore of the inner sleeve, said sleeves intimately telescoping with the respective inner and outer tubular members, the outer sleeve having a plurality

of spaced rows of transverse perforations, the space between said sleeves communicating with the space between said tubular members.

2. Organization as described in claim 1, and means for sealing between the tubular members and the sleeves.

3. Organization as described in claim 1, and resilient packing rings for sealing between the tubular members and the sleeves.

4. Organization as described in claim 1, in which the first and the last mentioned rows of perforations are similarly spaced vertically.

5. Organization as described in claim 1, and means for limiting the relative movement of said tubular members with relation to said sleeves.

6. Organization as described in claim 1, in which the first mentioned perforations are different in size than the last mentioned perforations.

7. Organization as described in claim 1, in which the first mentioned perforations are larger in diameter than the last mentioned perforations.

8. In a device for controlling the flow of oil and gas wells at a point in the well below the earth's surface, a string of production tubing within the well, a chamber communicating between the well and the interior of the tubing, means operable from the earth's surface for controlling the flow of a first fluid from the well into said chamber, and means also operable from the earth's surface for controlling the flow of a second fluid from the well into said chamber.

9. Organization as described in claim 8, in which the flow of the two fluids are changed simultaneously and in direct proportion to each other.

10. In a device for controlling the flow of oil and gas wells at a point in the well below the earth's surface, a string of production tubing within the well, a chamber communicating with the interior of the tubing, means for controlling the flow of a first fluid into said chamber by altering the position of the tubing, and means for simultaneously controlling the flow of a second fluid into said chamber when the amount of flow of the first fluid is altered.

11. In a device for controlling the flow of oil and gas wells at a point in the well below the earth's surface, a string of production tubing within the well, a chamber attached to and communicating between the well and the tubing, means for controlling the flow of a first fluid into said chamber by the movement of the tubing longitudinally, and means for controlling the flow of a second fluid into said chamber by said movement.

12. Organization as described in claim 11, in which the flow of the two fluids is changed in direct proportion to each other.

JAMES M. HEWGLEY.