March 25, 1941. C. A. COMBS 2,236,332

WELL CONTROL EQUIPMENT

Filed July 7, 1939 2 Sheets-Sheet 1

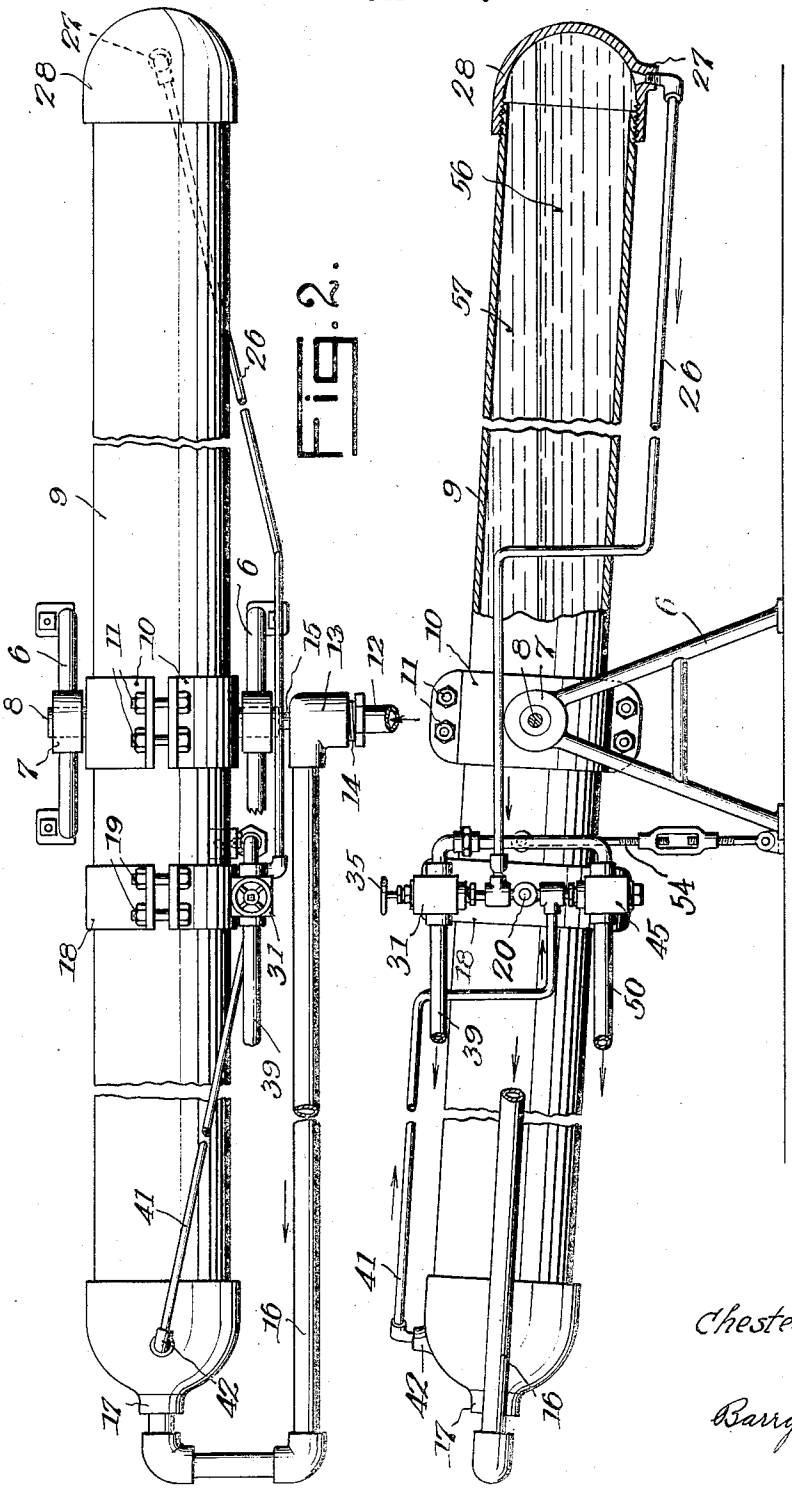


Fig. 2.

Fig. 1.

Chester A. Combs.
INVENTOR.

Barry & Cyr
ATTORNEYS.

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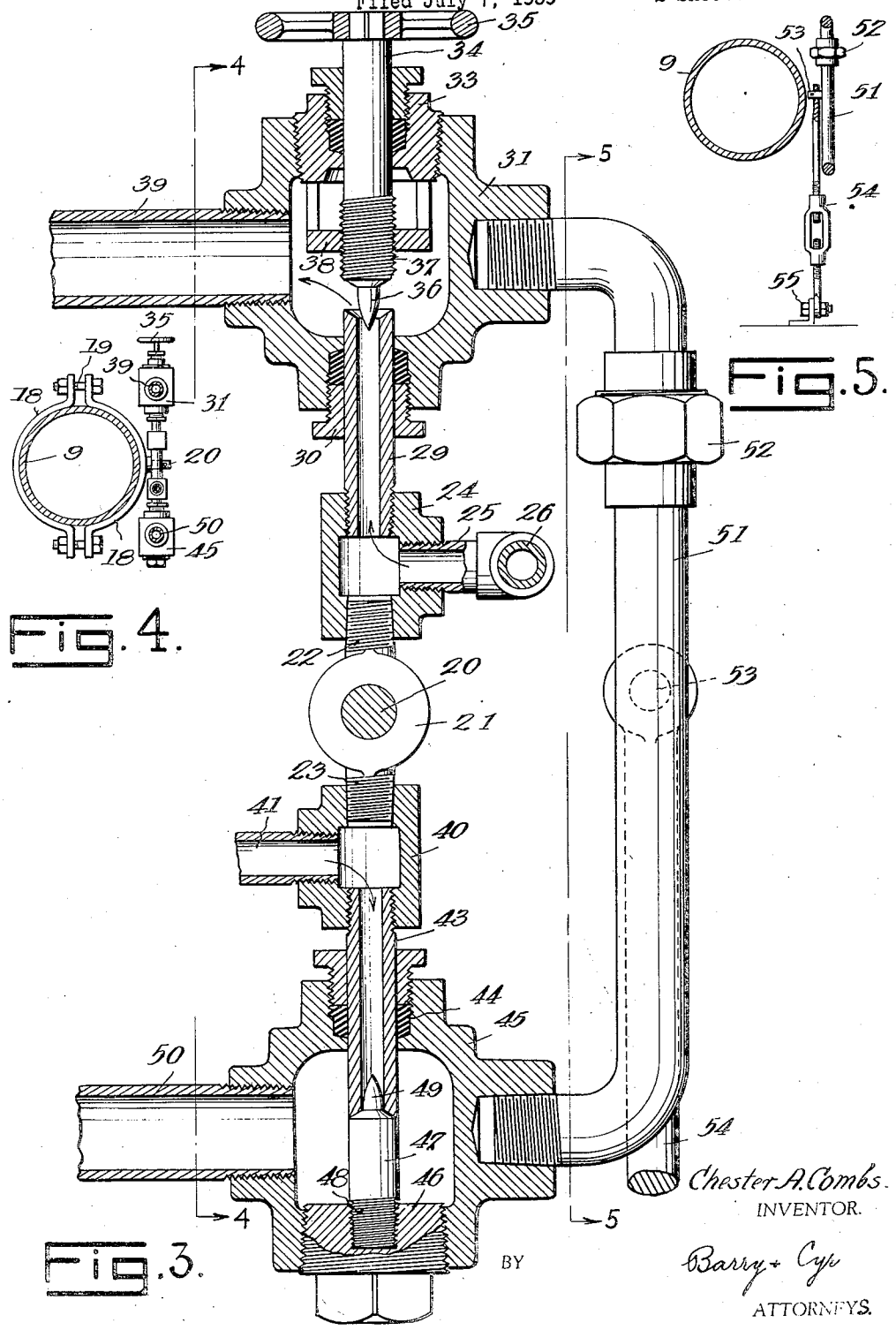


Fig. 3.

Fig. 4.

Fig. 5.

Chester A. Combs.
INVENTOR.

BY Barry & Cyp
ATTORNEYS.

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WELL CONTROL EQUIPMENT

Chester A. Combs, Conroe, Tex., assignor of fifty per cent to Julius C. Foretich, Conroe, Tex., and fifty per cent to Mrs. J. C. Shelton

Application July 7, 1939, Serial No. 283,292

7 Claims. (Cl. 210—51)

This invention relates to improvements in well control equipment, and more particularly to novel means for controlling the flow of fluid from oil wells, especially those producing water along with the oil or along with the oil and gas.

One of the objects of the invention is to provide a water and oil separator responsive to differences in the weights of water and oil to automatically release the water separated from the oil and the oil separated from the water.

Another object is to furnish an oil and water separator including a pivotally mounted tank of sufficient capacity to receive the flow from a well and adapted to tilt according to relative weights of water and oil in the opposite end portions thereof to automatically and alternately release the water and oil from the apparatus.

A further object is to supply a simple and relatively inexpensive separator, and yet one which will be exceedingly effective for the purpose for which it is designed.

A still further object is to provide separating means of durable construction, and one which will operate for long periods of time without getting out of order.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings,

Fig. 1 is a side elevation, partly broken away and partly in vertical section, of my improved separating apparatus.

Fig. 2 is a top plan view of the same, partly broken away.

Fig. 3 is an enlarged vertical sectional view, partly in elevation, of the valve structure of the apparatus.

Fig. 4 is a sectional view on the line 4—4 of Fig. 3, and on a reduced scale.

Fig. 5 is another sectional view, taken on the line 5—5 of Fig. 3, but with the additional showing of parts arranged below the structure illustrated in Fig. 3.

Referring to the drawings, 6 designates any suitable type of supports, such as A-shaped legs provided at their upper ends with bearings 7 in which oscillate trunnions 8, secured to an elongated closed separating tank 9 in any preferred way. For example, each trunnion may be rigidly united with a half collar 10, and these collars may be clamped to the medial portion of the tank by means of bolts 11 or the like.

The trunnions are placed near the middle of the tank, but the oil or left end of the tank is structurally heavier by about half the difference of the weight of water in the lower portion of the tank and of the oil in the upper portion. The left end may be slightly weighted by any suitable means, not shown. The tank always tilts more or less toward the water or right end of the tank, as indicated in Fig. 1.

The flow from the well is conveyed to the separator by means of a conduit 12 coaxial with the trunnions and connected to an L-shaped union 13 by any suitable swivel coupling 14. The union is fixed to one of the trunnions as indicated at 15.

A pipe 16 places the union in communication with the oil end of the tank and is secured to the central portion of said oil end by a nipple 17 or the like which is arranged at one end of the tank.

The valve structure for releasing the water, oil or oil and gas is mounted on the tank to the left of the trunnions or toward the oil end of the tank. For example, half collars 18 may be clamped on the tank by means of bolts 19 or the like, and one of these collars has a trunnion 20 projecting therefrom which is best illustrated in Figs. 3 and 4. A collar 21 is journaled on the trunnion and has upwardly and downwardly projecting threaded arms designated respectively, 22 and 23. Arm 22 has a threaded connection with a T-union 24 connected to a laterally projecting nipple 25 that is connected by a pipe 26 to a nipple 27 at the lower portion of the water or right end 28 of the tank.

Another nipple 29 forming the female member or active member of a water discharge valve, has a smooth exterior extending slidably through a packing gland 30 in a valve casing 31. The latter is provided at its upper end with a removable plug 33 which functions as a guide for a valve stem 34 having a hand wheel 35 and a needle or inactive member 36, the latter cooperating with the upper end of the nipple 29 to control the discharge of water from the tank. The valve stem has a threaded portion 37 threadedly engaging a spider 38 carried by the plug 33 to cause raising or lowering of the valve stem when the hand wheel 35 is turned in the desired direction.

Water is discharged from the casing 31 through a conduit 39 and may be lead to any suitable place of storage or disposal.

Another T, 40 is secured to the arm 23 and is connected by a pipe 41 to a nipple 42 arranged

at the top of the oil or left end of the tank for conveying oil from the tank to the T 40.

Another nipple or active member 43 extends downwardly from the union 40 and slides in a packing gland 44 carried by a valve casing 45. A threaded plug 46 closes the lower end of the latter and carries a valve stem 47 having its lower end adjustably connected to the plug by any suitable means such as threads 48. A metering pin or active member 49 at the upper end of the stem cooperates with the nipple 43 to control the discharge of oil or oil and gas from the separating tank.

A pipe 50 connected to the casing 45 is employed to convey the oil or oil and gas to any suitable point of storage or the like.

The valve casings 31 and 45 are connected together by a rod 51 having an adjustable joint 52 interposed therein which permits adjustment of the valve casings toward and away from one another, and also facilitates dismantling or repair of the valve structures.

The rod 41 has a laterally projecting pintle 53 connected by a turnbuckle structure 54 (Fig. 5) to a bracket 55 fixed to the foundation on which the structure operates; and by adjusting the turnbuckle, the valve casings 31 and 45, and the parts which they support, can be raised or lowered in unison.

It will be noted from Fig. 3 that the enlarged or inner ends of the needles 36 and 49 are adapted to abut against ends of the tubes 29 and 43 respectively, to limit the tilting movement of the tank. In other words, the parts 53 and 54 being substantially fixed in position, prevent movement of the valve casings 31 and 45, but the tubes 29 and 43 can move upwardly and downwardly slightly with the left portion of the tank during rocking of the latter. It will therefore be understood that the rocking motion of the tank is relatively slight or just enough to allow the valves to alternately open and close.

In operation, the flow from the well will pass through 12, 13, 16 and 17 into the central portion of the oil end of the tank, and as such tank has sufficient capacity to receive the flow from the well, the liquids will stratify therein, the water passing to the bottom of the tank, as indicated at 56, and the oil floating on the water, as indicated at 57. As soon as sufficient water accumulates, it will tend to pass to the left of the trunnions 8, and thereby place more weight in the left end portion of the tank. Consequently, the tank will move slightly in a counter-clock-wise direction, and this will cause the pintle 20 to move downwardly and close the oil outlet valve 43, 49, but to open the water discharge valve 29, 36. Due to the pressure existing in the tank (substantially well pressure), the water will be forced through 27, 26, 25, 24, 29, 31 and 39 to storage or the like.

As soon as a sufficient amount of water has been released, it is obvious that the water level will fall and the tank will then turn slightly in a clock-wise direction, so as to raise the pintle 20 and the nipples 43 and 29. This will result in closing the water discharge valve and opening the oil or oil and gas discharge valve 43 and 49, with the result that the oil or oil and gas will be discharged through 42, 41, 40, 43, 45 and 50.

From the foregoing it is believed that the construction, operation and advantages of my invention may be readily understood by those skilled in the art, and I am aware that changes may be made in the details disclosed, without departing from the spirit of the invention, as expressed in the claims.

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

1. A separator of the character described, comprising a support, an elongated closed tank mounted at its medial portion upon said support to rock upon a horizontal axis, oil and water discharge valves having portions mounted on said tank in spaced relation to said axis, means for supporting the other portions of said valves from a stationary support, a passageway for leading water from one end portion of the tank to the water discharge valve, a passageway for leading oil from the other end portion of the tank to said oil discharge valve, and means for introducing a well flow into said tank.

2. A separator of the character described, comprising a support, an elongated closed tank mounted at its medial portion upon said support to rock upon a horizontal axis, oil and water discharge valves having portions mounted on said tank at one side of said axis, means for supporting the other portions of said valves from a stationary support, a passageway for leading water from one end portion of the tank to the water discharge valve, a passageway for leading oil from the other end portion of the tank to said oil discharge valve, and means for introducing a well flow into said tank, the last mentioned means comprising a swivel joint coaxial with said axis, and a conduit for leading the flow from said joint to the last mentioned end portion of said tank.

3. A separator of the character described, comprising a support, an elongated closed tank mounted at its medial portion upon said support to rock upon a horizontal axis, oil and water discharge valves having substantially stationary portions and movable portions, means for mounting the movable portions upon the tank at one side of said axis, means for supporting the substantially stationary portions of said valves in a position relatively stationary to the movable portions of the valves, the last mentioned means including an adjustable element for use in moving the substantially stationary portions of the valves toward and away from one another, a passageway for leading water from one end portion of the tank at the opposite sides of said axis to the water discharge valve, a passageway for leading oil from the other end portion of the tank to said oil discharge valve, and means for introducing a well flow into said tank.

4. A separator of the character described, comprising a support, an elongated closed tank mounted at its medial portion upon said support to rock upon a horizontal axis, discharge valves having cooperating movable portions and substantially stationary portions to control the discharge of liquids of different weights from the tank, means operatively connecting the valves at one side of said axis to said tank for causing said movable portions of the valves to move responsive to movements of the tank, means for supporting the substantially stationary portions of said valves in a position stationary relative to said movable portions, the last mentioned means including an adjustable element for simultaneously and bodily adjusting the substantially stationary portions of the valves relatively to the movable portions of the valves, a passageway for leading a heavy liquid from one end portion of the tank to one of said valves, a passageway for leading a lighter liquid from the other end portion of the

tank to the other valve, and means for introducing a mixture of light and heavy liquids into said tank.

5. A separator of the character described, comprising a support, an elongated closed tank mounted at its medial portion upon said support to rock upon a horizontal axis, liquid discharge valves having movable female portions, valve casings and substantially stationary male portions, the male portions cooperating with the female portions to control the discharge of liquids of different weights from the tank, means connecting the female portions to the tank at one side of said axis whereby the female portions move in response to movements of the tank, means for supporting the valve casings and male portions in a stationary position relatively to said female portions, a passageway for leading a heavy liquid from one end portion of the tank to one of said discharge valves, a passageway for leading a lighter liquid from the other end portion of the tank to the other one of said discharge valves, and means for introducing a mixture of light and heavy liquids into said tank.

6. A separator of the character described, comprising supporting means, an elongated closed tank mounted at its medial portion upon said supporting means to rock about a horizontal axis, oil and water discharge valves having cooperating movable female portions and substantially stationary male portions, means pivotally mounting said female portions on the tank at one side of said axis, means for supporting the male portions in a stationary position relatively to the female portions, a passageway for leading water from one end portion of the tank at the opposite side of said axis to the water discharge valve, a passageway for leading oil from the other end portion of the tank to said oil discharge valve, and means for introducing a well flow into said tank.

7. A separator of the character described, comprising supporting means, an elongated closed tank mounted at its medial portion upon said supporting means to rock about a horizontal axis, oil and water discharge valves having cooperating movable female portions and substantially stationary male portions, means pivotally mounting said female portions on the tank at one side of said axis, means for supporting the male portions in a stationary position relatively to the female portions, a passageway for leading water from one end portion of the tank at the opposite side of said axis to the water discharge valve, a passageway for leading oil from the other end portion of the tank to said oil discharge valve, and means for introducing a well flow into said tank, the last-mentioned means comprising a swivel joint arranged coaxial with said horizontal axis, and a conduit connecting said swivel joint with the last-mentioned end portion of the tank.

CHESTER A. COMBS.