March 23 , 1926. 1,577,917

D. G. LORRAINE

METHOD AND APPARATUS FOR SEPARATING GAS AND OIL

Filed Sept. 11, 1923

Fig. 3.

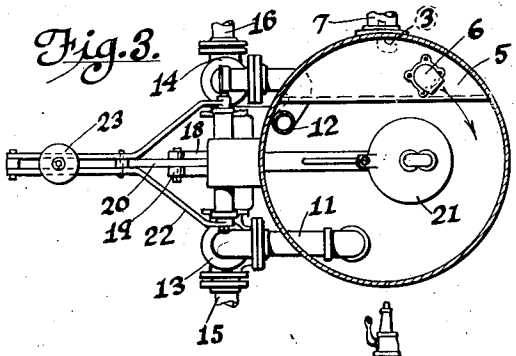


Fig. 2.

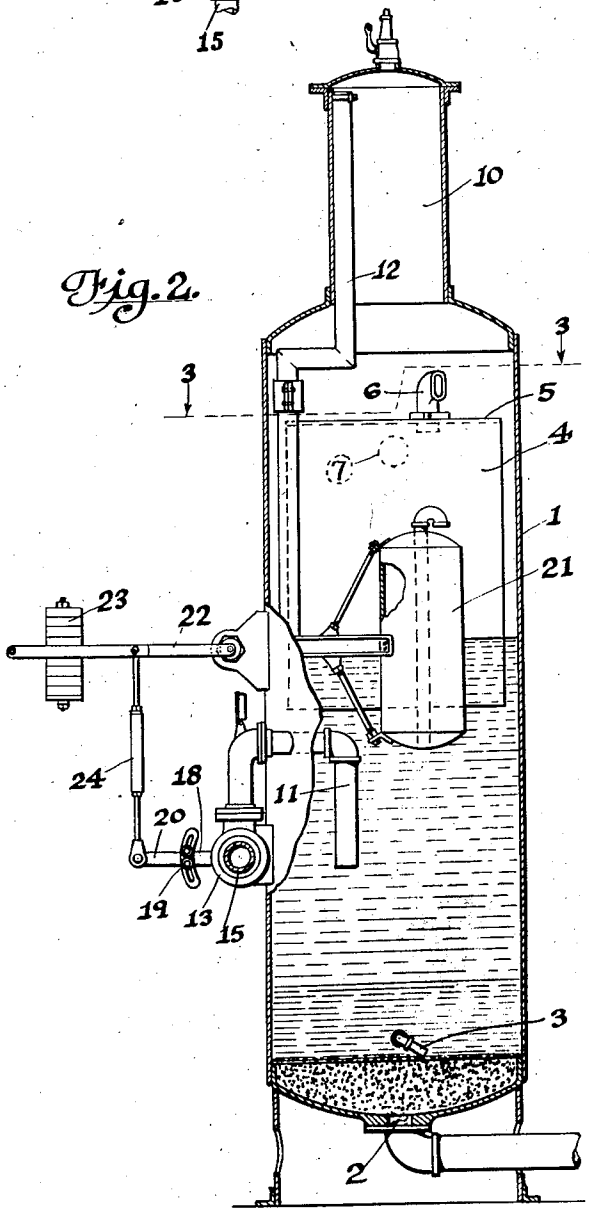
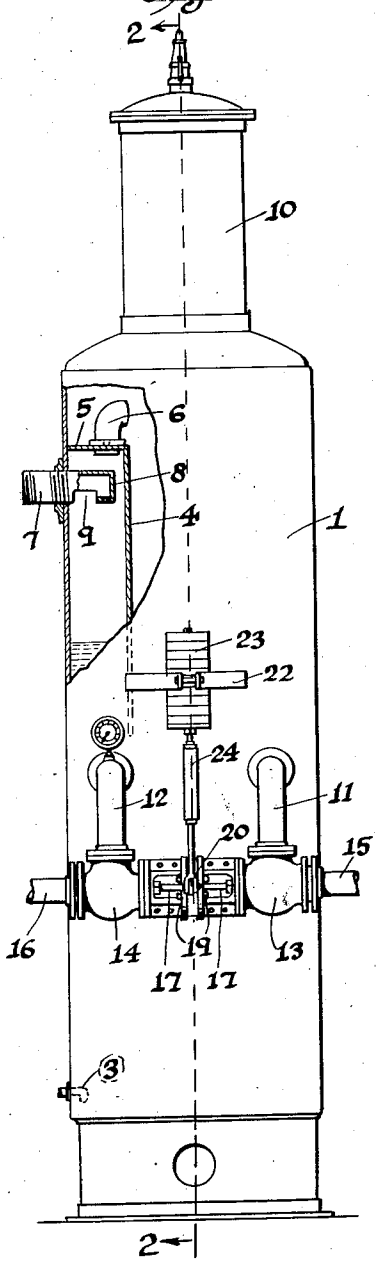


Fig. 1.



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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR SEPARATING GAS AND OIL.

Application filed September 11, 1923. Serial No. 662,072.

To all whom it may concern:

Be it known that I, DAVID G. LORRAINE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Methods and Apparatus for Separating Gas and Oil, of which the following is a specification.

This invention relates to a method and apparatus for separating the oil and gas, and removing the sand and water from the flow from an oil well.

It is the object of the invention to cause the oil to settle and thereby permit the gas to separate, and to agitate the released gas so as to separate any oil remaining mixed therewith, while maintaining the volume of oil in a quiescent state, so as to prevent churning and frothing thereof.

It is a further object of the invention to withdraw the sand and water as it settles in the oil maintained in a state of rest, and while the separated gas is being agitated for thorough cleaning thereof.

It is a still further object of the invention to employ the gas which readily separates from the flow, for the purpose of agitating the entire volume of gas which is released from the oil.

It is a still further object of the invention to so agitate the volume of gas rising from the oil, as to separate by centrifugal action, any oil remaining mixed therewith.

The invention will be readily understood from the following description of the accompanying drawings, showing the preferred form of apparatus constructed in accordance with the invention, and in which:

Fig. 1 is a front elevation, partly broken away, of the improved separator.

Fig. 2 is a vertical section on the line 2—2 of Fig. 1.

Fig. 3 is a horizontal section on the line 3—3 of Fig. 2.

The separator comprises a closed casing 1 having a sand discharge 2 at the bottom thereof; and in order to facilitate removal of sand a flush pipe 3 extends into the casing above the sand discharge, and forms a nozzle inclined downwardly and extending circumferentially of the casing, so that the flushing fluid will cause a rotary movement in the bottom of the casing to wash out all of the sand.

A transverse vertical partition 4 is arranged in the upper portion of the casing at one side thereof, the sides of said partition meeting the side wall of the casing to form a space separated by said partition from the main portion of the casing. This space is closed at its top by a horizontal partition 5 extending from partition 4 to the casing wall. The partition 4 extends downwardly to about midway of the height of the casing, and the side space formed by the partition is open to the main portion of the casing below said partition.

A pipe 6 is mounted in an opening in partition 5, so as to communicate with the side space formed by partitions 4 and 5, the upper end of said pipe projecting above partition 5 and terminating in a horizontal nozzle which is circumferentially disposed with relation to the wall of casing 1. The nozzle opening is preferably horizontally restricted as shown in Fig. 2.

The space in back of partition 4 is an inlet passageway for the flow from an oil well, a pipe 7 extending through the casing wall and into said space near the top thereof. The portion of the pipe extending into the casing is horizontally disposed and has a closed end 8, with a lateral opening 9 in the underside of the pipe in spaced relation from said closed end, so that oil will collect in the closed end of the pipe beyond the lateral opening to form a cushion for the flow through the pipe.

As the flow from an oil well enters the inlet passageway through pipe 7, the lighter gas which immediately separates from the heavier constituents of the flow, will rise in back of partition 4 and be discharged through nozzle 6 into the upper portion of the main casing, which is a gas chamber; and the remainder of the flow will gravitate through the inlet passageway to the lower part of the main casing which forms a settling chamber.

In the settling chamber the heavier sand and water mixed with the flow, will settle below the oil which is maintained in a quiescent state, and the gas mixed with the oil will rise to the gas chamber in the upper portion of the main casing.

The gas discharged through nozzle 6 into the gas chamber, will cause rotary movement of the entire volume of gas passing through said chamber, so as to separate by centrifugal action, the oil remaining mixed with the gas, and the oil thus liberated will return

to the settling chamber, while the clean gas is collected in the dome 10 at the top of casing 1.

The sand which settles below the oil in the bottom of casing 1, may be washed out through opening 2, by a flushing fluid discharged through nozzle 3.

It will thus be seen that while the gas in the upper portion of casing 1 is agitated for scrubbing the same, and the sand in the bottom of the casing is similarly agitated for withdrawal thereof, the intermediate volume of oil in the casing is permitted to remain in a quiescent condition, so as to prevent frothing thereof, and allow the complete separation of the gas, and settlement of the sand and water.

An oil outlet pipe communicates with the settling chamber, and a gas outlet pipe is open to dome 10 and extends downwardly inside of casing 1, said oil and gas outlet pipes 11 and 12 extending outwardly through the casing wall in horizontal alinement.

Valves 13 and 14, mounted upon the exterior of casing 1, are connected to pipes 11 and 12, and oil and gas discharge pipes 15 and 16 are in turn connected to said valves. The valves have operating shafts 17 in horizontal alinement, and rock arms 18 are connected to said shafts, said rock arms being fixed by an adjustable connection 19 to an actuating arm 20.

The level of the oil in casing 1 controls the movement of arm 20, for opening and closing the valves and thereby regulating the discharge of oil and gas. As an instance of this arrangement, a float 21 is mounted in casing 1 upon a rock arm 22 projecting outwardly through the wall of the casing, the outer end of said rock arm being preferably counter-weighted as shown at 23, and connected by a link 24 to the actuating arm 20.

The construction as thus described provides for efficiently separating the gas from oil, by maintaining a volume of the oil in a state of rest, so that the gas is free to rise therefrom, while agitating the gas which is thus separated, by means of that portion of the gas which readily separates from the oil, in order to thoroughly clean all of the gas, and prevent churning and frothing of the oil.

It will be apparent that various changes may be made in the construction, combination, and arrangement of parts as thus described, without departing from the spirit of the invention.

What is claimed is:

1. The method of separation which consists of tapping a volume of a flow, permitting the lighter constituents to rise therefrom, causing rotary agitation of said separated lighter constitutents, and controlling discharge of said separated lighter constituents proportional to the volume of said flow.

2. The method of separation which consists of trapping a volume of a flow without appreciable agitation thereof, permitting the heavier constituents to settle and the lighter constituents to rise therefrom, and causing rotary agitation of said separated lighter constituents by circumferentially introducing a portion thereof into the main volume of said separated lighter constituents while maintaining the heavier constituents in a quiescent state.

3. The method of separation which consists of trapping a volume of a flow for initial separation of the heavier from the lighter constituents which readily rise therefrom, maintaining said heavier constituents in a quiescent state to permit all of the lighter constituents to rise therefrom, and circumferentially introducing said portion of the lighter constituents which initially separates from the flow into said body of lighter constituents which subsequently rise from the heavier constituents, for causing rotary agitation of the entire volume of said separated lighter constituents and discharge of the heavier constituents therefrom into the body of heavier constituents maintained in a quiescent state.

4. A separator comprising a settling chamber having a flow inlet, a gas chamber above and open to said settling chamber, and a conduit provided with a nozzle having a vertically elongated horizontally restricted opening discharging into said gas chamber above said flow inlet and circumferentially of the vertical axis thereof so as to cause rotary agitation in said gas chamber.

5. A separator comprising a settling chamber having a flow inlet adapted for maintaining the flow in said settling chamber in a quiescent state, a gas chamber open to said settling chamber, and a nozzle communicating with said flow inlet and extending upwardly therefrom throughout its length and discharging into said gas chamber above said flow inlet so as to cause rotary movement in said gas chamber.

6. A separator comprising a settling chamber having a flow inlet adapted for maintaining the flow in said settling chamber in a quiescent state, a gas chamber open to said settling chamber, and a conduit open to said flow inlet and extending upwardly therefrom throughout its length and discharging into said gas chamber circumferentially thereof above said flow inlet so as to cause rotary agitation in said gas chamber.

7. A separator comprising a settling chamber having a flow inlet adapted for maintaining the flow in said settling chamber in a quiescent state, an annular gas chamber open to said settling chamber, and

a nozzle discharging circumferentially into said gas chamber above said flow inlet.

8. A separator comprising a settling chamber having a flow inlet passageway, a gas chamber distinct from said passageway and open to said settling chamber, and a conduit open to the upper portion of said passageway and discharging into said gas chamber so as to cause rotary movement therein.

9. A separator comprising a settling chamber having a flow inlet, a gas chamber separated from said flow inlet and open to said settling chamber, and means for introducing a portion of said flow into said gas chamber so as to cause rotary agitation therein.

10. A separator comprising a settling chamber having a flow inlet, a gas chamber above and open to said settling chamber, and a conduit communicating with said flow inlet and extending upwardly therefrom throughout its length, said conduit having a nozzle provided with a vertically elongated horizontally restricted opening discharging into said gas chamber above said flow inlet.

11. A separator comprising a settling chamber having a flow inlet, a gas chamber above and open to said settling chamber, a conduit provided with a nozzle discharging into said gas chamber above said flow inlet so as to cause rotary movement in said gas chamber, and a flushing pipe discharging into the lower portion of said settling chamber so as to cause rotary movement therein.

12. A separator comprising a tank having a vertical partition terminating short of the bottom of said tank and forming a space at the side of said tank closed to the main portion thereof at the top of said partition and open to the main portion of the tank below said partition, a flow inlet in said side space, and a conduit open to the upper portion of said side space and discharging into the upper part of said main portion of the tank so as to cause rotary movement therein.

13. A separator comprising a tank having a flow inlet spaced between the upper and lower ends of said tank, a liquid seal between the flow inlet and the lower end of the tank, and a conduit open to the upper portion of said flow inlet and discharging into the upper portion of the tank above said flow inlet.

14. A separator comprising a tank having a vertical partition terminating short of the bottom of said tank and forming a space at the side of said tank closed to the main portion thereof at the top of said partition and open to the main portion of the tank below said partition, a flow inlet in said side space, and a conduit open to the upper portion of said side space and discharging into the upper part of said main portion of the tank.

15. A device of the character described comprising a settling chamber, a gas chamber, a flow inlet, a liquid seal between the flow inlet and the settling chamber, and a passageway for the lighter constituents of the flow open to the flow inlet above the liquid seal and discharging circumferentially into the gas chamber.

In testimony whereof I have affixed my signature to this specification.

DAVID G. LORRAINE.