April 14, 1936. R. S. McKEEVER 2,037,426

OIL AND GAS SEPARATOR

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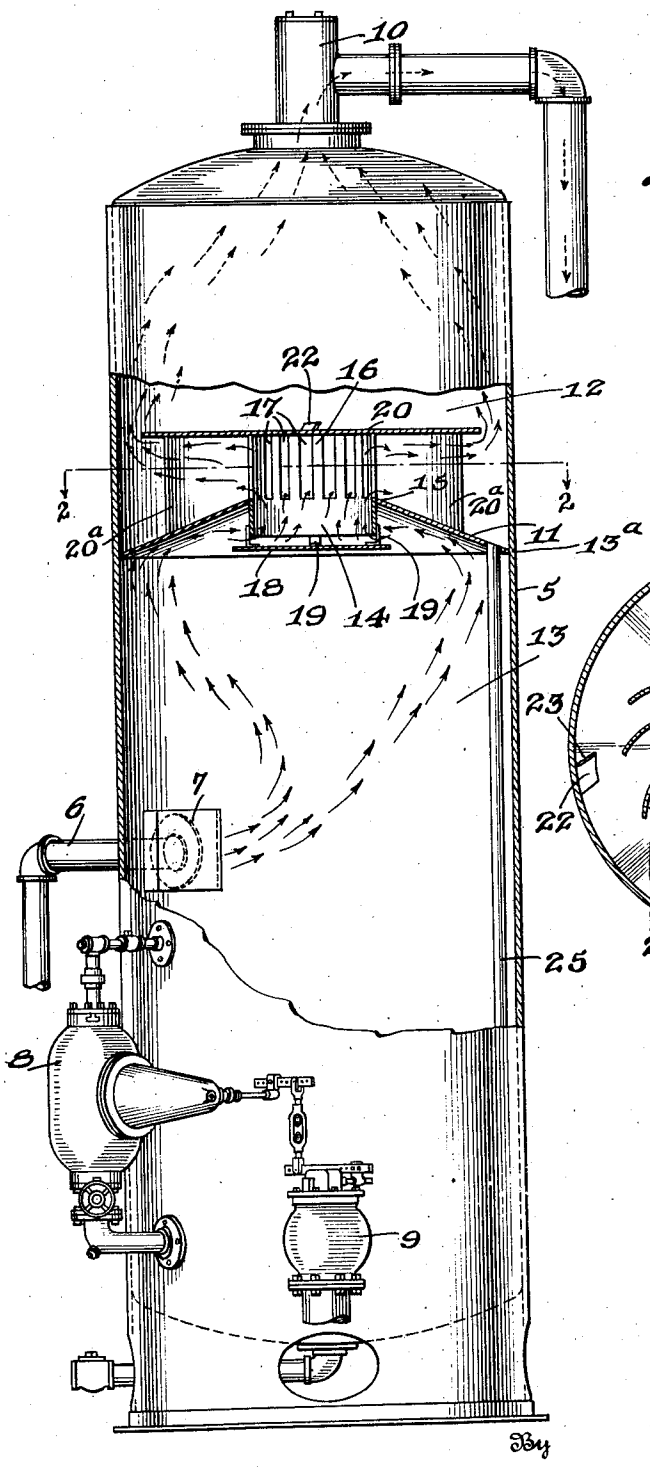
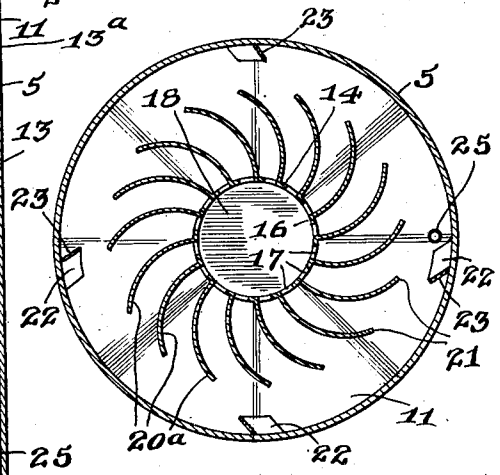


Fig. 1.

Fig. 2.



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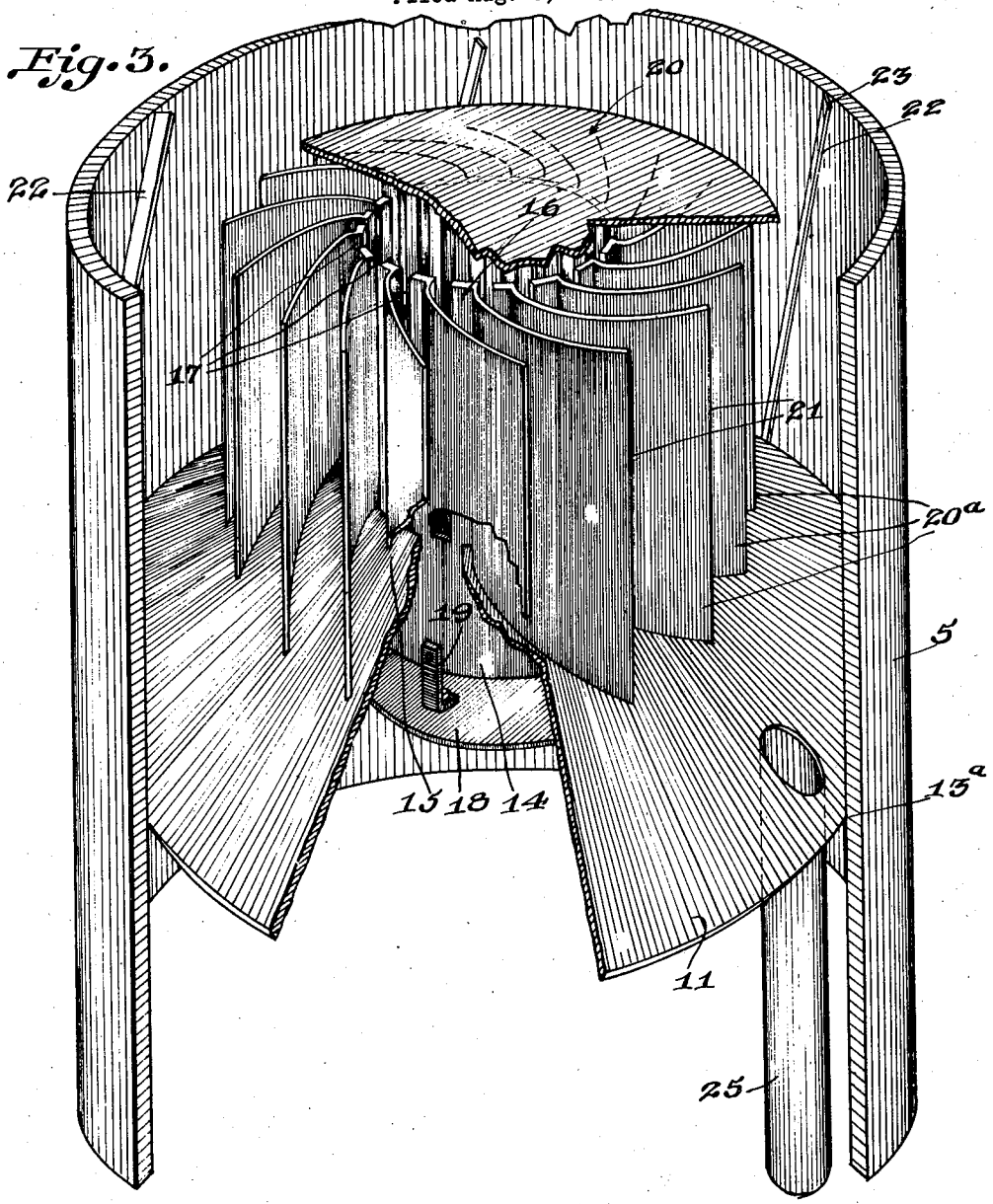
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Fig. 3.



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2,037,426

OIL AND GAS SEPARATOR

Roy S. McKeever, Tulsa, Okla., assignor to Smith Separator Corporation, Tulsa, Okla., a corporation of Oklahoma

Application August 9, 1935, Serial No. 35,520

10 Claims. (Cl. 183—2.7)

This invention relates to improvements in oil and gas separators and more particularly to an apparatus for separating gas from oil after the latter leaves an oil well.

The primary object of the invention is to provide improved means arranged within the shell of a separator for causing gas to automatically release entrained oil globules as well fluids pass through the shell or casing.

With the foregoing object 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 of an oil and gas separator partly broken away to illustrate my improvement.

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

Fig. 3 is an enlarged perspective view partly broken away, of the portion of the oil and gas separator containing my improved separating means.

In the drawings, 5 designates a fluid-tight casing of an oil and gas separator provided with an inlet pipe 6 by which a mixture of oil and gas is introduced into a medial portion of the casing. The inlet pipe 6 preferably terminates within the casing in a centrifugal or tangential nozzle 7, which has not been illustrated in detail but may be of the type shown in U. S. patent No. 1,779,023, dated October 21, 1930. A conventional float control 8 is arranged at one side of the tank and acts to control the outlet valve 9 through which oil is discharged from the tank. Gas passes out of the top of the tank by way of the outlet fitting 10. All of these parts are of known construction and I have simply illustrated them to show a workable embodiment of my invention.

An annular partition 11 dividing the interior of the casing into upper and lower chambers 12 and 13, is preferably formed of a frusto-conical shaped imperforate sheet of metal having its outer edge secured at 13a by welding or the like to the inner surface of the shell.

A chimney 14 extends through the central portion of the partition and the inner annular edge of the partition is preferably welded to the outer surface of the chimney to form a fluid-tight joint.

A portion of the chimney extends downwardly from the central portion 15 of the partition and is imperforate while the upper portion 16 projects upwardly above the partition and is provided with a multiplicity of vertically elongated slots 17.

In order to prevent fluid in the chamber 13 from directly entering the lower end of the chimney, a baffle 18 is provided. This baffle is preferably formed of a circular blade of greater diameter than the chimney and it is held in spaced relation to the lower edge of the latter by means of brackets 19 which may be suspended from the chimney.

A cover plate 20 closes the upper end of the chimney and it is preferably formed of a circular baffle plate of considerably greater diameter than the chimney but of less diameter than the interior of the cylinder or casing.

Spiral wings or blades 20a are positioned between the cover plate and partition and project outwardly from the chimney. Each of these blades has a horizontal top edge engaging the undersurface of the cover plate 20. The lower edge of each wing slants downwardly and outwardly and snugly engages the substantially conical upper surface of the partition 11. The inner vertical edge of each wing coincides with an edge of one of the vertical slots, and the outer edges of the wings are spaced apart a greater distance than their inner edges whereby the velocity of the fluid flowing through the flaring passageways between the vanes, will be decreased as the fluid travels toward the wall of the tank.

It will be noted that the cover 20 is substantially flat and projects outwardly beyond the outer edges 21 of the wing.

Abutment blades or vanes 22 are fixed on the inner surface of the shell immediately above the partition 11 and they form channels 23 arranged at about 45° angles to the vertical so as to catch liquid directed onto the inner surface of the shell by gas passing between the spiral wings, and the liquid so gathered, falls onto the upper surface of the partition plate 11 and is directed into the bottom portion of the casing by one or more down pipes 25.

In operation it will be understood that the admixed oil and gas enters the side of the separator shell through the nozzle 7 which is positioned below the partition 11. The oil having more mass than the gas tends to fall to the bottom of the separator due to the action of gravity, and it can be discharged through the float control valve 9. The gas, however, has a tendency to rise and it carries a quantity of oil in suspension and in direct solution from the main body of oil. The purpose of my improvements is to remove

this quantity of oil from the mixture and solution with the gas. The gas with oil in suspension and solution will be hereinafter referred to as rich gas. As said gas rises, it comes into contact with the umbrella shed or substantially conical baffle plate 11, which due to the shape of its undersurface tends to guide the rich gas toward the axis of the separator. However, as the lower portion of the chimney 14 is imperforate, the rich gas must now descend before it can enter the lower end of the chimney through the space between the plate 18 and the chimney. Of course, any liquid "knocked out" of the rich gas by impact with the chimney, gathers on the surface of the latter and drops onto the plate 18 from which it will descend into the bottom of the separator.

In actual practice the cross sectional area of the chimney 14 is slightly greater than ten per cent of the cross sectional area of the separator shell and the area of the long vertical slots 17 is substantially equal to the cross sectional area of the chimney. The purpose of the chimney is to increase the velocity of the rich gas passing through the separating means and precipitate the oil from the rich gas into small droplets. Some of these droplets on coming into contact with any of the surfaces of the device adhere thereto and drain off.

The baffle plate 18 is of greater diameter than the chimney and it acts to spread and diffuse the rich gas upon entering the separator, preventing the rich gas from channeling to a concentrated stream from the inlet of the separator direct to the cylinder. The curved stationary wings or spiral blades 20*a* direct the gas from its straight or diffused line of propagation to a centrifugal line or to a whirling motion. The precipitated droplets have the same velocity as the rich gas upon entering the vane passageways through the long vertical slots in the chimney and as the vanes have a greater spread from the chimney outwardly, the velocity of the gas as it approaches the free edges of the vanes decreases, but as the droplets have greater mass and therefore, greater momentum, they are carried by the combined forces of velocity and centrifugal force, set up by the vanes, through the gas to the surface of the vanes and shell of the separator. As the droplets contact with the shell they are still in a whirling motion and this quantity of fluid or oil gathered in this manner is stopped and directed down to the top of the umbrella shed 11 by means of the fluid channels 23. Of course, the liquid collected in this way is directed by the pipe or pipes 25 into the bottom of the shell.

The dry gas liberated of the oil rises to the top of the shell and it discharges through the pipe 10.

While I have disclosed one embodiment of my invention in such manner that the construction and advantages thereof may be readily understood by those skilled in the art, it is manifest 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. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a partition plate positioned in the tank between the inlet and outlet, a chimney extending through the central portion of the partition plate and having upper and lower portions, the upper portion of the chimney above the partition plate being slotted, a substantially flat cover plate closing the upper end of the chimney and projecting outwardly beyond the outer surface of the chimney, and spiral vanes extending outwardly from the upper portion of the chimney and positioned between said cover plate and said partition plate for causing rich gas flowing from the chimney through the slots of the latter to flow toward the inner surface of the tank in spiral directions, the outer edges of said vanes being spaced apart a greater distance than the inner portions thereof.

2. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, an annular frusto-conical plate positioned in the tank between the inlet and the outlet, a chimney extending through the central portion of the partition plate and having upper and lower portions, the upper portion of the chimney above the plate being slotted, a substantially flat cover plate closing the upper end of the chimney and projecting outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and positioned between said plates for causing rich gas flowing from the chimney through the slots of the latter to flow toward the inner surface of the tank in a non-radial direction, and a pipe for conducting liquid from the outer edge portion of the partition plate into the bottom of the tank.

3. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a substantially frusto-conical partition plate positioned in the tank between the inlet and outlet, a chimney extending through the central portion of the partition plate and having an upper portion positioned above the partition plate and provided with elongated substantially vertical slots, a substantially flat cover plate closing the upper end of the chimney and projecting outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and positioned between said cover plate and said partition plate for causing rich gas flowing from the chimney through the slots of the latter to flow toward the inner surface of the tank in a spiral direction, and a baffle plate positioned below the central portion of the partition plate and spaced from the chimney to prevent rich gas from directly entering the chimney from the portion of the tank below the partition plate.

4. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a partition plate positioned in the tank between the inlet and outlet, a chimney extending through the central portion of the partition plate and having an upper portion arranged above the plate and provided with outlet slots, a substantially flat cover plate closing the upper ends of the chimney and projecting outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and positioned between said plates for causing rich gas flowing from the chimney through the slots of the latter to flow toward the inner surface of the tank in spiral directions, the outer edges of certain vanes being spaced apart a greater distance than the inner portions thereof, and other vanes arranged on the inner surface of the tank above the partition plate for directing liquid collecting on the inner surface of the tank toward the partition plate.

5. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a partition plate positioned in the tank between

the inlet and outlet, a chimney extending through the central portion of the partition plate and having upper and lower portions, the upper portion of the chimney above the partition plate being slotted, a substantially flat cover plate closing the upper end of the chimney and projecting outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and positioned between said cover plate and said partition plate for causing rich gas flowing from the chimney through the slots of the latter to flow toward the inner surface of the tank in spiral directions, the lower portion of the chimney below the central portion of the partition plate being imperforate.

6. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a partition plate positioned in the tank between the inlet and outlet, a chimney extending through the central portion of the partition plate and having upper and lower portions, the upper portion of the chimney above the partition plate being slotted, a cover plate closing the upper end of the chimney and projecting outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and positioned between said cover plate and said partition plate for causing rich gas flowing from the chimney through the slots of the latter to flow toward the inner surface of the tank in spiral directions, the lower portion of the chimney below the central portion of the partition plate being imperforate, and a baffle plate positioned below and spaced from the chimney to prevent rich gas from directly entering the chimney.

7. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a substantially frusto-conical plate positioned in the tank between the inlet and outlet and dividing the interior of the tank into upper and lower chambers, a chimney extending through the central portion of the partition plate and having upper and lower portions, the upper portion of the chimney above the partition being provided with parallel elongated substantially vertical slots, a substantially flat cover plate closing the upper end of the chimney and extending outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and having their upper ends engaging the cover plate and their lower ends engaging the partition plate, and a pipe for leading liquid from the upper surface of the partition plate to the lower portion of the tank.

8. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a substantially frusto-conical plate positioned in the tank between the inlet and outlet and dividing the interior of the tank into upper and lower chambers, a chimney extending through the central portion of the partition plate and having upper and lower portions, the upper portion of the chimney above the partition being provided with parallel elongated substantially vertical slots, a substantially flat cover plate closing the upper end of the chimney and extending outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and having their upper ends engaging the cover plate and their lower ends engaging the partition plate, means for leading liquid from the upper surface of the partition plate to the lower portion of the tank, the lower portion of the chimney extending downwardly below the central portion of the partition plate, and a baffle plate arranged below and spaced from the chimney to prevent rich gas in the lower chamber from directly entering the chimney.

9. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, a partition plate positioned in the tank between the inlet and outlet, the upper surface of said plate being of substantially frusto-conical shape, a chimney extending through the central portion of said plate and having an upper portion extending above said plate, the upper portion of the chimney being provided with a circumferential series of parallel substantially vertical slots, means closing the upper end of the chimney and including a plate portion projecting outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and engaging said plate portion and said partition plate for causing rich gas flowing through the slots of the chimney to flow toward the inner surface of the tank in spiral directions, means on the inner surface of the tank above the partition plate for guiding liquid gathering on the inner surface of the tank toward said partition plate, baffle means at the lower end of the chimney to prevent rich gas from directly entering the chimney, and means for conveying liquid gathering on the partition plate, into the bottom portion of the tank.

10. In an oil and gas separator, a tank having a lower mixture inlet and an upper gas outlet, an imperforate partition plate positioned in the tank between the inlet and outlet, a chimney extending through the central portion of the plate and having upper and lower portions, the upper portion of the chimney above the partition plate being slotted, a substantially flat imperforate cover plate closing the upper end of the chimney and projecting outwardly beyond the outer surface of the chimney, spiral vanes extending outwardly from the upper portion of the chimney and positioned between said cover plate and said partition plate for causing rich gas flowing from the chimney through the slots of the latter to flow toward the inner surface of the tank in spiral directions, the outer edges of the vanes being spaced apart a greater distance than the inner portions thereof to form flaring passageways between the vanes, the surfaces of the vanes being unobstructed to allow free flow of the fluid outwardly through said passageways, and means associated with the lower portion of the chimney to prevent rich gas from directly entering the chimney from the portion of the tank below the partition plate.

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