Dec. 23, 1958 J. J. SOCHOR 2,865,470

PROCESS FOR TREATING GAS CONTAINING FLUID

Filed April 8, 1955 2 Sheets-Sheet 1

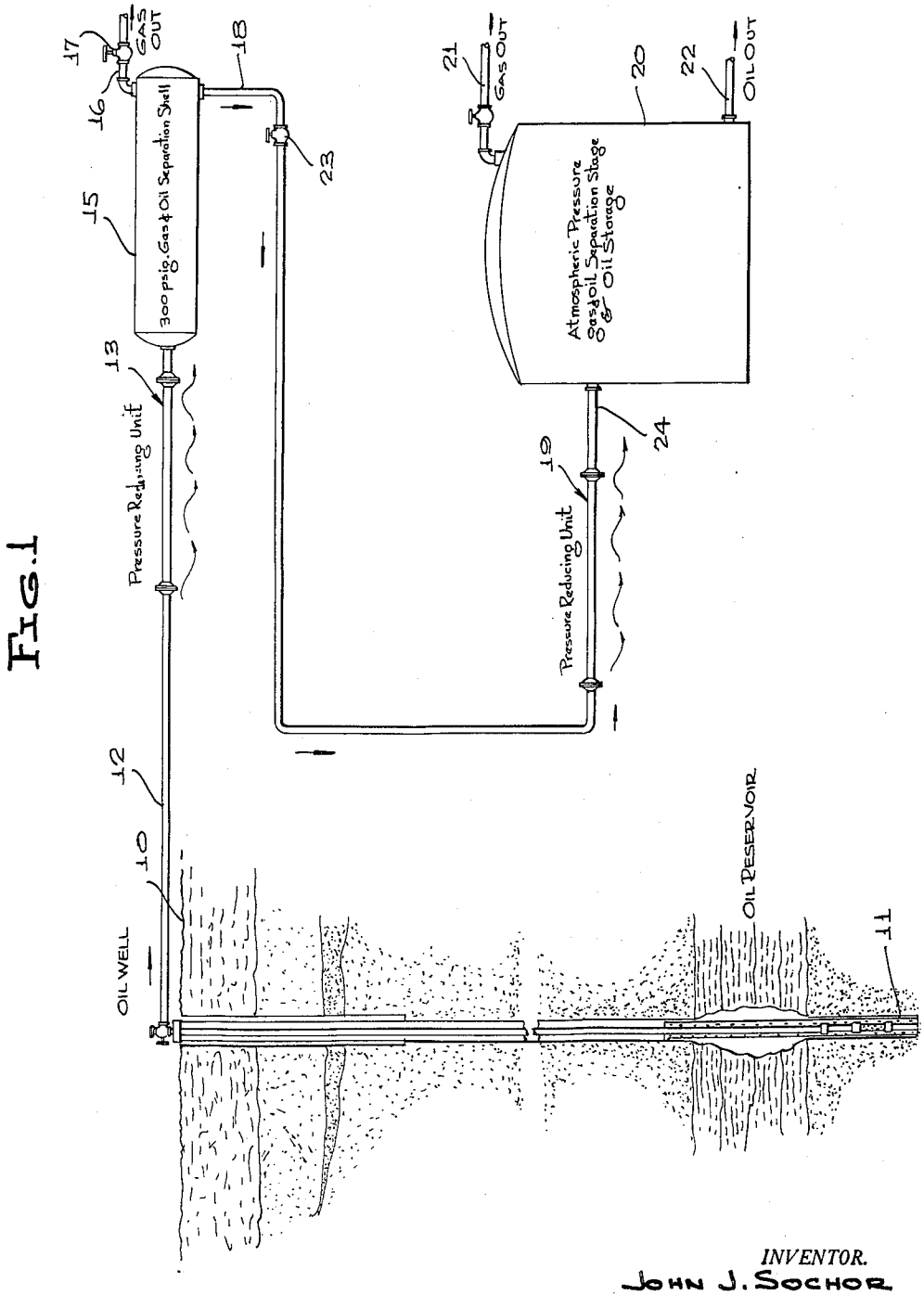


Fig. 1

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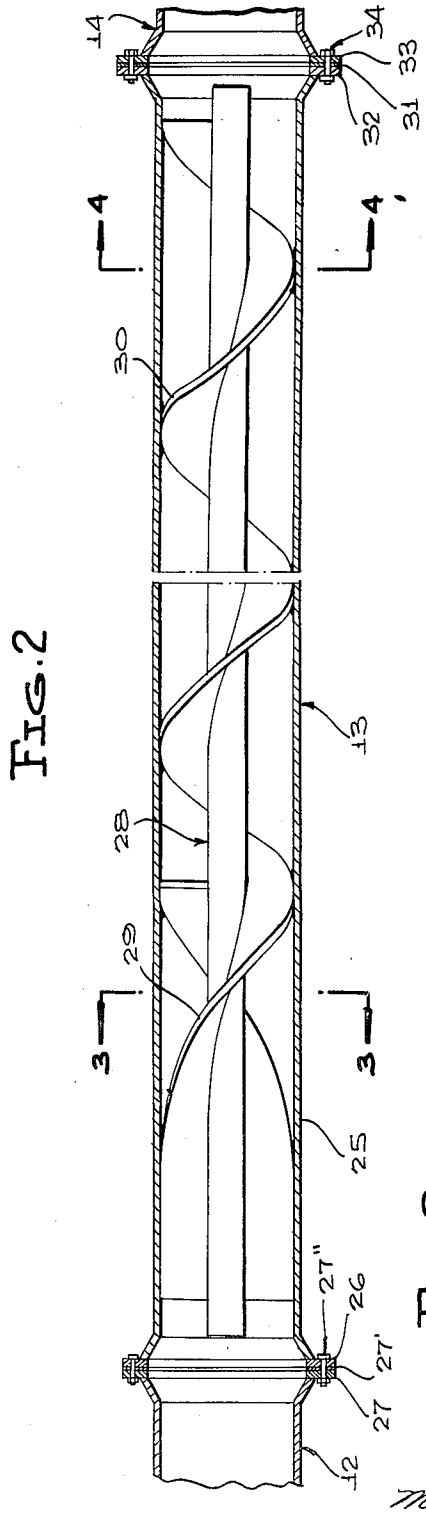


FIG. 2

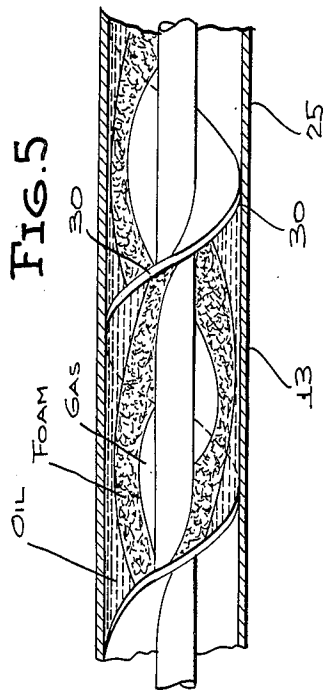


FIG. 5

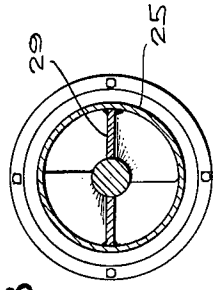


FIG. 3

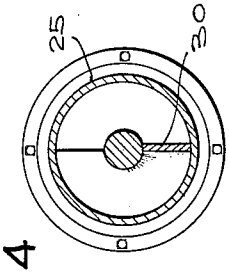


FIG. 4

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PROCESS FOR TREATING GAS CONTAINING FLUID

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1 Claim. (Cl. 183—114.5)

This invention relates to a process for treating gas containing fluid under pressure above atmospheric pressure.

An object of the present invention is to provide a process for treating gas containing fluid under pressure above atmospheric pressure in which the gas and liquid constituents thereof are sharply separated into gas and liquid fractions respectively as the pressure is reduced.

Another object of the present invention is to provide a process for treating gas containing fluid under pressure above atmospheric pressure in which such fluid is separated into gas and liquid fractions with the liquid fraction containing most of the low boiling constituent and the gas fraction having a small amount of the latter named constituent associated therewith.

A further object of the present invention is to provide a process for treating gas containing fluid under pressure above atmospheric pressure which is positive in action, simple in execution, commercially practical, and more efficient than previously proposed processes.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a diagrammatic view of the apparatus employed in carrying out the process of the present invention.

Figure 2 is an enlarged sectional view of one of the pressure reducing units of the apparatus of Figure 1.

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 2.

Figure 5 is a fragmentary sectional view of the unit of Figure 2 illustrating the zone division and the separated fractions in such divisions.

In carrying out the process of this invention, the substance to be treated may be any gas containing fluid under pressure above atmospheric pressure, for example, a condensate or fluid under pressure above atmospheric pressure having either natural or artificial gas associated with or dissolved in the condensate or fluid, or crude petroleum oil as it is received at the ground level from the well. In the showing of Figure 1, the gas containing fluid under pressure above atmospheric pressure is crude petroleum oil, such oil as it is received at the ground level **10** from the well **11** being caused to flow through a conduit **12** into a pressure reducing unit **13** in which the flowing oil is separated into a liquid fraction and a gas fraction. The separated gas and liquid fractions are discharged from the pressure reducing unit **13** into a conduit **14**, and are conveyed by the conduit **14** into a confined collection space or closed shell **15**. The gas fraction is withdrawn from the shell **15** through the pipe **16** connected in communication with the top of the shell, the pipe **16** being provided with a valve **17** for controlling the discharge of the gas fraction therefrom. The liquid fraction is withdrawn from the shell **15**

through the conduit **18** and is conveyed through the conduit **18** into a second pressure reducing unit **19** in which a further gas fraction is separated from the liquid fraction. The conduit **18** is provided with a valve **23** for controlling therein the flow of the liquid fraction. The liquid fraction containing the further gas fraction is discharged from the pressure reducing unit **19** into a second confined collection space or storage receptacle **20** through a pipe **24**. The gas fraction is withdrawn from the receptacle **20** through the pipe **21** connected in communication with the top of the receptacle **20**, and the liquid fraction is withdrawn from the receptacle **20** through the pipe **22**.

The unit **13**, Figures 2, 3, and 4, comprises a tube **25** which has one of its ends provided with a flange **26**. The adjacent end of the conduit **12** is likewise provided with a complemental flange **27** which is connected in tight sealing engagement with the flange **26** by means of a gasket **27'** and bolt and nut assemblies **27''**. The other end of the tube **25** is provided with a flange **32** which is connected in tight sealing engagement to a flange **33** on the adjacent end of the conduit **14** by means of a gasket **31** and bolt and nut assemblies **34**. Positioned within and fixedly secured to the tube **25** is a helix **28**, the portion of the helix adjacent the flange **26** being of the double type **29** and the remaining portion being of the single type **30**. It is to be noted that the peripheries of the respective convolutions of the helix **28** contact the inner wall of the tube **25**. The oil entering through the conduit **12** flows around the convolutions of the double type helix **29** and thence around the convolutions of the single type helix **30**. As the oil flows from the conduit **12** into the tube **25** this causes the oil to flow in a confined spiral path and as it flows through such path it is subdivided successively into temporary confined zones, the zones being formed by adjacent convolutions of the helix **28**. The confined zones are in turn subjected to both centrifugal force and progressively decreasing pressures between the initial pressure of the crude oil and atmospheric pressure to separate the oil into a liquid fraction and a gas fraction, the centrifugal force being caused by the rotation of the helix and the decreased pressures being caused by the formation of the temporary confined zones. The separation of the oil in adjacent zones into liquid and gas fractions is graphically illustrated in Figure 5, and shows that in such separation there is a foam between the liquid fraction and the gas fraction.

The unit **19** is of the same structure as that of unit **13**, and in this unit **19** the liquid fraction flowing from the conduit **18** is also treated in the same manner as described in connection with the unit **13**, namely, caused to flow in a further spiral path, caused while flowing through the further spiral path to be subdivided successively into temporary confined zones, the zones subjected in turn to both centrifugal force and progressively decreasing pressures between the initial pressure of the liquid fraction and atmospheric pressure to separate a further gas fraction therefrom.

The oil as it is received at the ground surface from the well **11** may be of a pressure of from atmospheric to several thousand pounds per square inch and would normally be flowed to the pressure reducing unit **13** at a pressure less than and not exceeding 600 pounds per square inch. In the reducing unit **13** the pressure of the fluid or oil is progressively dropped in the temporary confined zones to an intermediate pressure of, for example, 300 pounds per square inch, depending on the initial pressure of the fluid or oil entering the unit **13**, the fluid gas-liquid ratio, and the prevailing marketing conditions for the resultant gas. At this pressure of 300 pounds per

square inch, the separated liquid and gas fractions are discharged into the shell **15**. The liquid fraction discharged from the vessel **15** is progressively dropped in pressure in the unit **19** to about atmospheric pressure, and the liquid fraction containing the separated further gas fraction being discharged at or near atmospheric pressure into the second collection space or receptacle **20**.

By the process of this invention above described, the separated liquid fraction contains most of the low boiling liquid constituents such as the butane-hexane containing constituent with only a small amount of the latter named constituent associated therewith.

Having thus described the invention what is new and desired to be secured by Letters Patent is:

In a process for separating the liquid and gaseous constituents of a high pressure petroleum well stream, the steps of, flowing the entire well stream from a well through a conductor at high velocity, causing the well stream to undergo a continuous progressive pressure drop at a substantially uniform rate by flowing the entire well stream from the conductor into a helical path without any appreciable reduction in velocity, then flowing the well stream from the helical path into a conventional oil and gas separator while reducing the pressure upon the well stream, withdrawing separated gas from the separator, causing the entire remaining well stream to undergo a further continuous and progressive pressure drop at a substantially uniform rate by flowing the entire remaining well stream from the separator in a second helical path at high velocity, both said paths being elongate and generally rectilinear and of much greater length than diameter, the paths being of substantially constant diameter whereby the well streams are caused to flow therethrough at substantially constant high velocities, subsequently discharging the well stream into a second oil and gas separator at near atmospheric pressure, and withdrawing separated gas and liquid from the second separator.

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