

Jan. 3, 1928.

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R. FLEMING

METHOD AND APPARATUS FOR CONTINUOUSLY CONDENSING OIL CRACKING STILL VAPORS

Filed Nov. 19, 1920

2 Sheets-Sheet 1

Fig. 7.

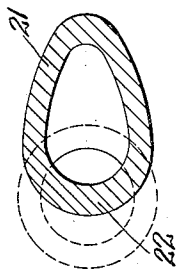


Fig. 5.

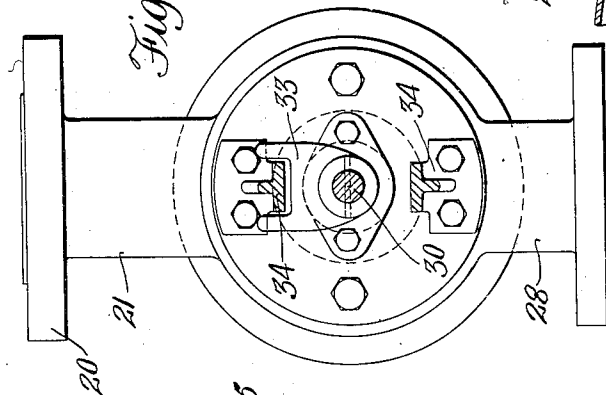


Fig. 6.

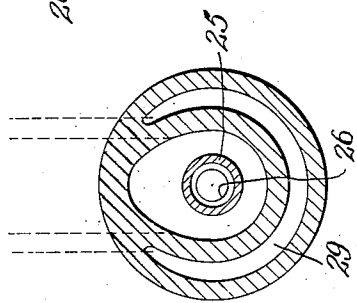


Fig. 1.

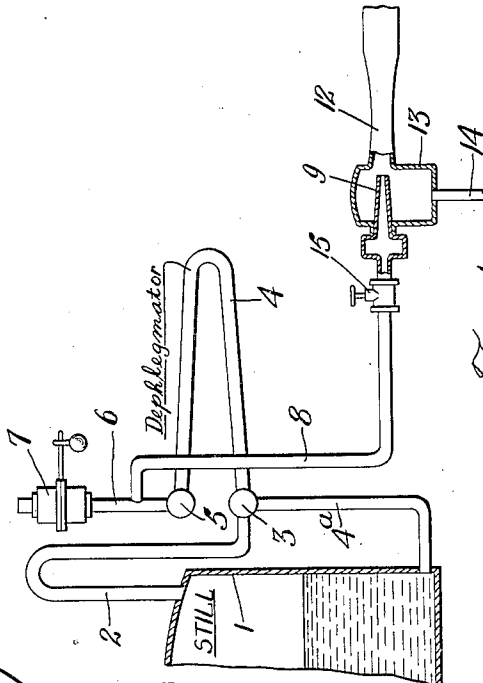
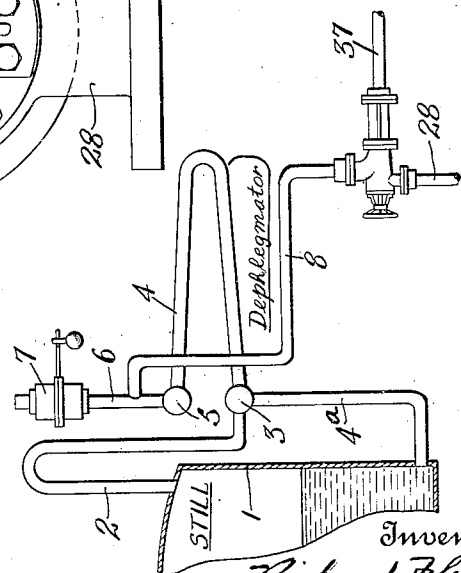


Fig. 2.



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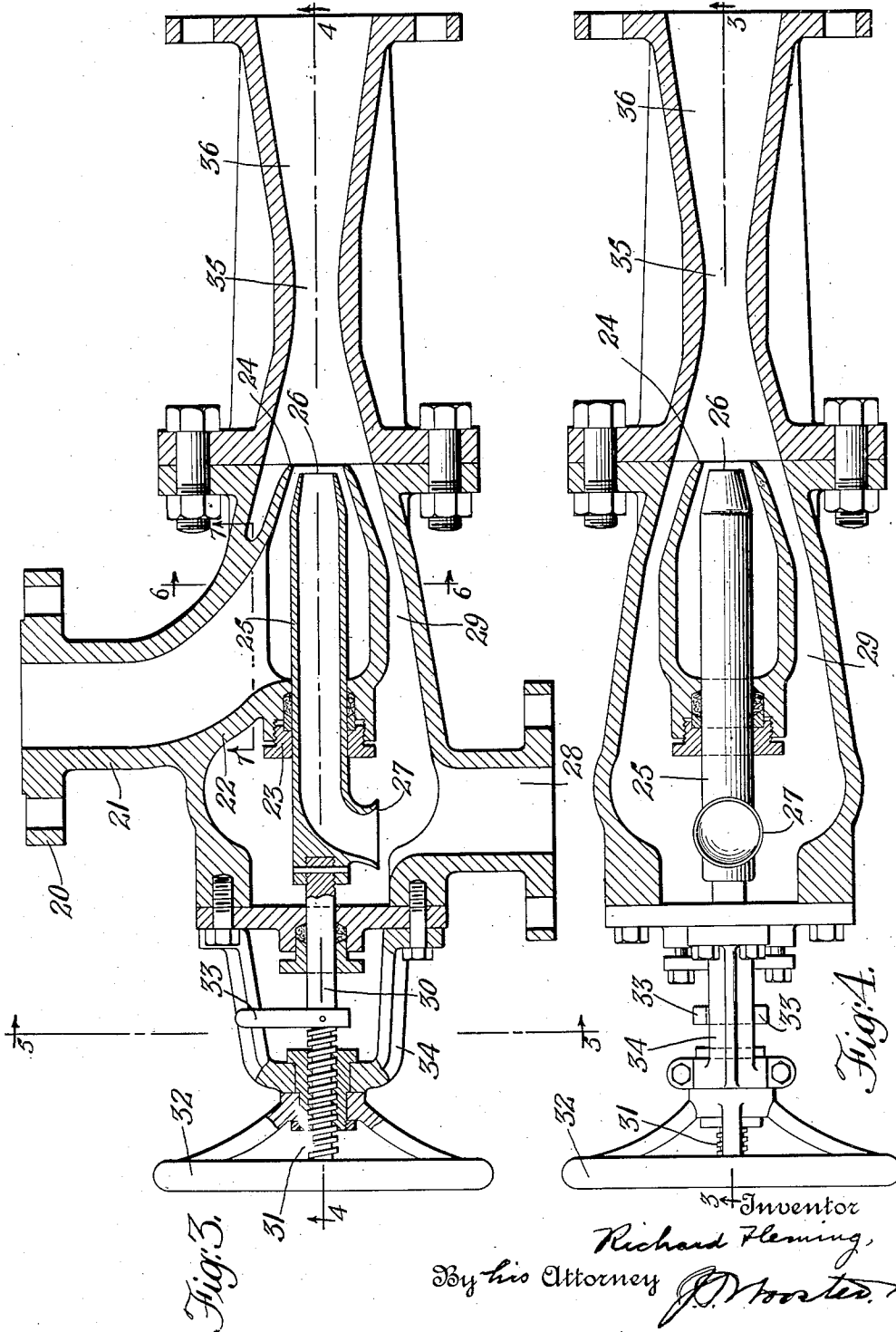
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METHOD AND APPARATUS FOR CONTINUOUSLY CONDENSING OIL CRACKING STILL VAPORS

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE.

RICHARD FLEMING, OF WESTFIELD, NEW JERSEY.

METHOD AND APPARATUS FOR CONTINUOUSLY CONDENSING OIL-CRACKING STILL VAPORS.

Application filed November 19, 1920, Serial No. 425,044, and in Great Britain November 26, 1919.

This invention relates to method and apparatus for continuously condensing oil cracking still vapors, and has for its objects to enable oil cracking still vapors to be economically and rapidly condensed in a continuous manner, without requiring a large investment for a condensing plant, nor involving serious losses in permanent gases and unsaturated hydrocarbons.

In my application, Ser. No. 224,443, filed March 23, 1918, patented December 23, 1919, #1,325,368, and in division thereof filed December 6, 1919, Ser. No. 343,051, patented October 25, 1921, No. 1,394,987, the broad subject matter of this invention is disclosed, wherein the vapor line of a pressure cracking still leads to a nozzle constructed to maintain the desired cracking pressure and also to continuously discharge the cracked vapors at a high velocity into water, and this application is a continuation in part of said applications.

The further object of this invention is to provide improvements in the condenser, whereby the aperture can be readily adjusted to maintain the desired still pressure, as by a needle, and also to provide means for water cooling the needle. The invention is shown diagrammatically in the accompanying drawings, wherein,

Figure 1 is an elevation partly in section of the divisional and continuation portions of this invention, taken from the aforesaid applications,

Figure 2 is a diagram partly in section of a plant embodying the specifically different form of condenser,

Figure 3 is a section on an enlarged scale on the line 3—3 of Figure 4,

Figure 4 is a section on the line 4—4 of Figure 3,

Figure 5 is a section on the line 5—5 of Figure 3,

Figure 6 is a section on the line 6—6 of Figure 3, and

Figure 7 is a section on the line 7—7 of Figure 3.

Referring first to Figure 1, 1 represents a portion of a cracking still having the vapor line 2 leading to a union 3 which is connected by pipe 4* to the bottom of the still to return any heavy constituents which condense in pipe 2, and also the union 3 is connected to dephlegmator 4 which leads to a

union 5 to a vertical pipe 6 having a safety valve 7 and by vapor line 8 to the nozzle 9, the latter being constructed to hold the still pressure and to discharge the vapor at high velocity into a mixing passage 12, leading from casing 13 and supplied with water by pipe 14. 15 is a shut off valve.

In Figure 2, the parts are the same except for the details of the condenser and water cooling arrangements now to be described with reference to the improved form of condenser shown in detail in Figures 3—7.

Referring to Figure 3, the vapor line 8 is connected to the flange 20 of a casing 21 varying in cross section from round to oval in order to give freest flow of vapor, as shown in Figure 7. This casing 21 has at one side a diaphragm 22, provided with a stuffing box 23, and at the other side leads to a vapor nozzle 24. Passing through the stuffing box 23 is a hollow needle 25 preferably also formed with a restricted aperture as at 26, so as to form an annular vapor nozzle around and inside of which water can flow. The needle slides through the stuffing box and at its rear end carries a bell mouth 27 which receives the water through inlet 28, the water also flowing in passage 29 around the outside of nozzle 24. The needle is reciprocated by a rod 30 having a screw 31 operated by a handle 32, 33 being guide lugs sliding on bracket 34 and preventing the needle from turning.

In front of the nozzle 24 the exterior of the passage is cone shaped narrowing as shown to the throat 35, and thence expanding again at 36 and being connected to an ordinary pipe 37 which leads the mixture of gas, condensed vapor and water to suitable separating tanks or other means not shown.

This invention is applicable for condensing pressure cracking still vapors both in cases where the water supplied through pipe 28 is under pressure and where not under pressure, as it has been found in actual practice that the sudden fall of temperature and volume of the gases and vapors due to the direct contact with the water is so great as to entrain the water and draw it along in ample volume for condensing purposes, this effect being sufficient to lift the water an appreciable height.

The cracking pressure will vary according

to the particular process used up to several hundred pounds per square inch, but in practice I have condensed vapors from stills running at from 50 to 150 pounds pressure with uniformly good results in avoiding losses due to permanent gases and unsaturated hydrocarbons and the yield of usable gasoline or light liquid fractions has been appreciably greater where this invention has been used than under the same cracking conditions using previous forms of coil condensers. In addition, the plant investment is less, and practically no operating labor is required, whereas considerable superintendence and operating labor is required in coil condenser plants to periodically draw off the gases and condensate, maintenance, temperature control, etc. Moreover, a purifying operation is saved by having the condenser water carry purifying materials for treating the vapors and condensate during and after condensation, or in the settling tank to which the water, gases and condensate flow from the condenser. The shut off valve will ordinarily be used for cutting off the condenser, but if desired the condenser needle can be used for this purpose, as well as for varying the vapor nozzle area. While an ordinary valve set to discharge the vapor at high velocity through a narrow opening into the water could be used, the hot vapors tend to have a scoring action on the valve and seat necessitating frequent adjustments and repairs, but the water cooled needle and the annular vapor discharge with the parts water cooled prevent this. By having the vapor discharged in an annular jet, it is further assured that the mixing and condensation will be effected at the maximum rate with the water both inside and outside the jet. The rate of condensation is so great owing to the high velocity of the vapors and direct instantaneous contact with the water, with rapid loss of heat and reduction of volume, that the complex molecules of the cracked fractions have little or no tendency to break down into simpler gas or unsaturated more or less unstable hydrocarbon molecules, as in cases where the rate of condensation with reduction of temperature and volume, is slower.

In other words, it is possible that the stabilizing effect on the molecular structure is due to the exceedingly rapid reduction of a volume of vapor to a very much smaller volume of liquid condensate, which is equivalent to applying a pressure with simultaneous cooling much greater than is attainable in any condenser, and that the reason present day coil type of externally cooled condensers produce so much gas and unsaturated hydrocarbons is that the rate of condensation is relatively so slow as not to prevent the molecules from dissociating. In the foregoing discussion, I refer to the

gases and unsaturated hydrocarbons produced by faulty condensation, or condensation losses, and not to those produced as such in the cracking still, which latter vary with the process and the materials used, and the conditions of pressure and temperature, and from time to time. Even as to the latter or still losses, I believe that this invention effects a gain in the recovery of unstable constituents which are condensable with this invention but dissociate and become incondensable in the usual forms of condensers.

Various modifications and changes may be made in the specific construction herein described without departing from the scope of the appended claims.

What I claim is:

1. The combination with a pressure oil cracking still, of a pressure vapor line having an adjustable vapor discharge nozzle, and means for interiorly and exteriorly supplying water to condense the vapor discharged from said nozzle by direct contact adjacent the nozzle.

2. The combination with an oil still, of a vapor nozzle connected thereto, means for supplying water interiorly and exteriorly of said nozzle to condense the vapor discharge from said nozzle by direct contact adjacent the same, and a discharge passage shaped to increase the velocity of the water and condensate where much of the condensation occurs.

3. The method of condensing pressure cracked still vapors, which consists in discharging the vapors in a jet in contact with water interiorly and exteriorly of the jet.

4. A condenser for cracked oil vapors comprising a casing having a connection for a vapor line leading to a nozzle, a water jet surrounding the vapor nozzle, means for supplying water to the interior of the nozzle, and a discharge passage for the mixture of water and condensate.

5. The combination with a pressure oil cracking still, of a vapor line terminating in a nozzle, means for supplying water to the interior of the nozzle, and means for varying the nozzle discharge area.

6. In a liquid jet type of oil vapor condenser, the combination with an interior passageway, of a concentric passageway of decreasing diameter surrounding the interior passageway, means for passing a cooling liquid through one passageway and a rapidly moving stream of cracked oil vapor through the other passageway, and a third passageway in which said cooling liquid and oil vapor are adapted to be mixed by direct contact while in rapid motion.

7. The combination with an oil cracking still, of an oil vapor condenser having means for directly mixing the still vapors with water, and comprising a valve for regulating

the velocity of vapor flow through the condenser, and means for cooling said valve with the condensing water.

5 8. An oil vapor condenser comprising in combination an internal oil vapor passageway of decreasing diameter, a second and substantially concentric passageway of decreasing diameter for a condensing liquid surrounding said internal passageway, and a
10 third passageway in which said oil vapor and condensing liquid are adapted to be brought into direct contact while moving at a rapid rate.

15 9. The combination with a decomposing still, of a vapor nozzle, a needle valve there-

in controlling the discharge of said nozzle, means for supplying water through said needle valve and into the discharge from said nozzle, a water jet around said nozzle, a chamber for mixing the water with the
20 condensed vapor from the nozzle, and a stuffing box through which said needle valve passes, arranged to be cooled by the water passing through said needle valve and around said nozzle.

25 Signed at Martinez, in the county of Contra Costa, and State of California, this 10th day of November, A. D. 1920.

RICHARD FLEMING.