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J. C. MORRELL

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RECOVERING CONDENSABLE VAPORS FROM INCONDENSABLE GAS

Filed Nov. 25, 1929

2 Sheets-Sheet 1

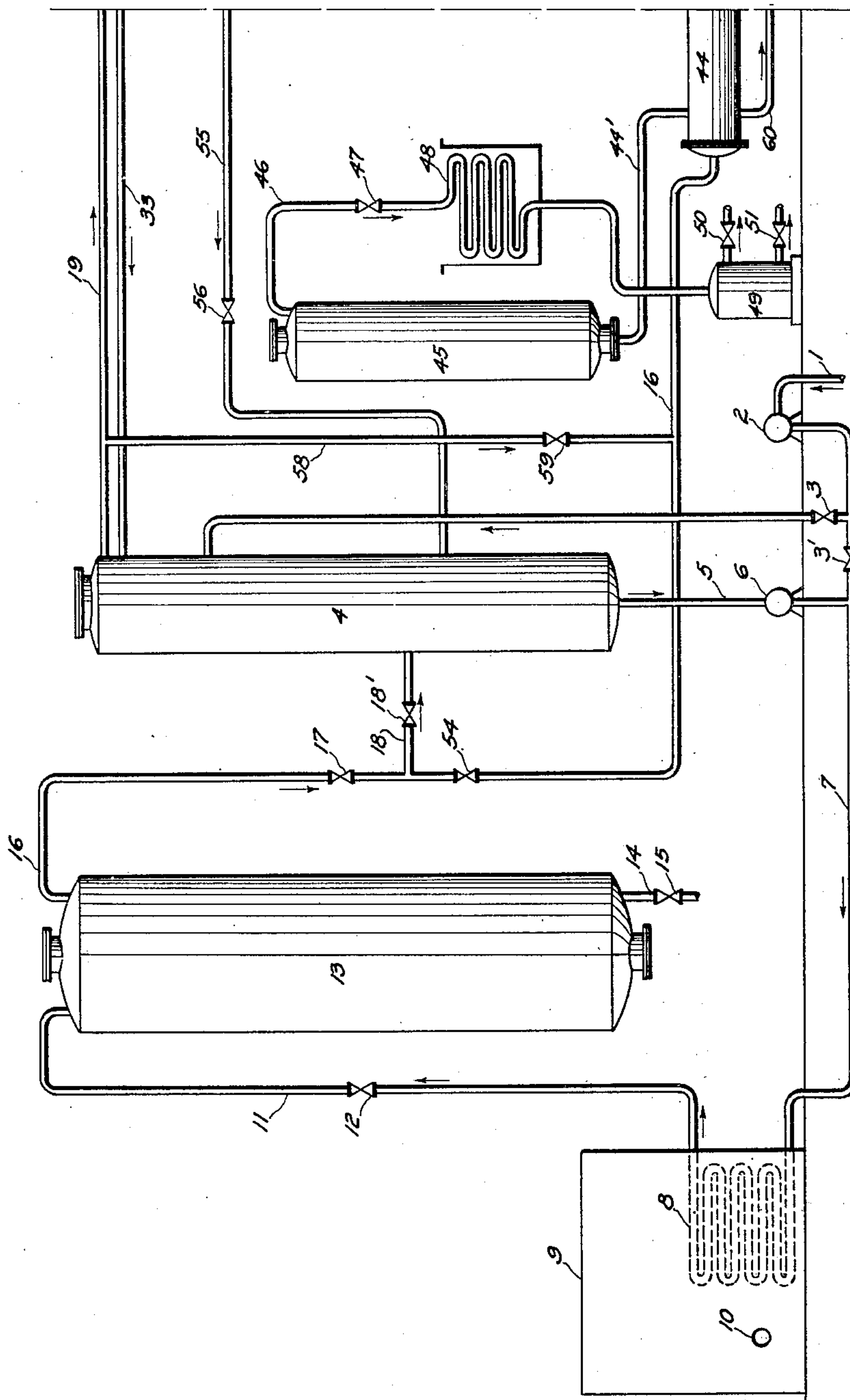


FIG. 1

INVENTOR
Jacque C. Morrell
BY Frank L. Belknap
ATTORNEY

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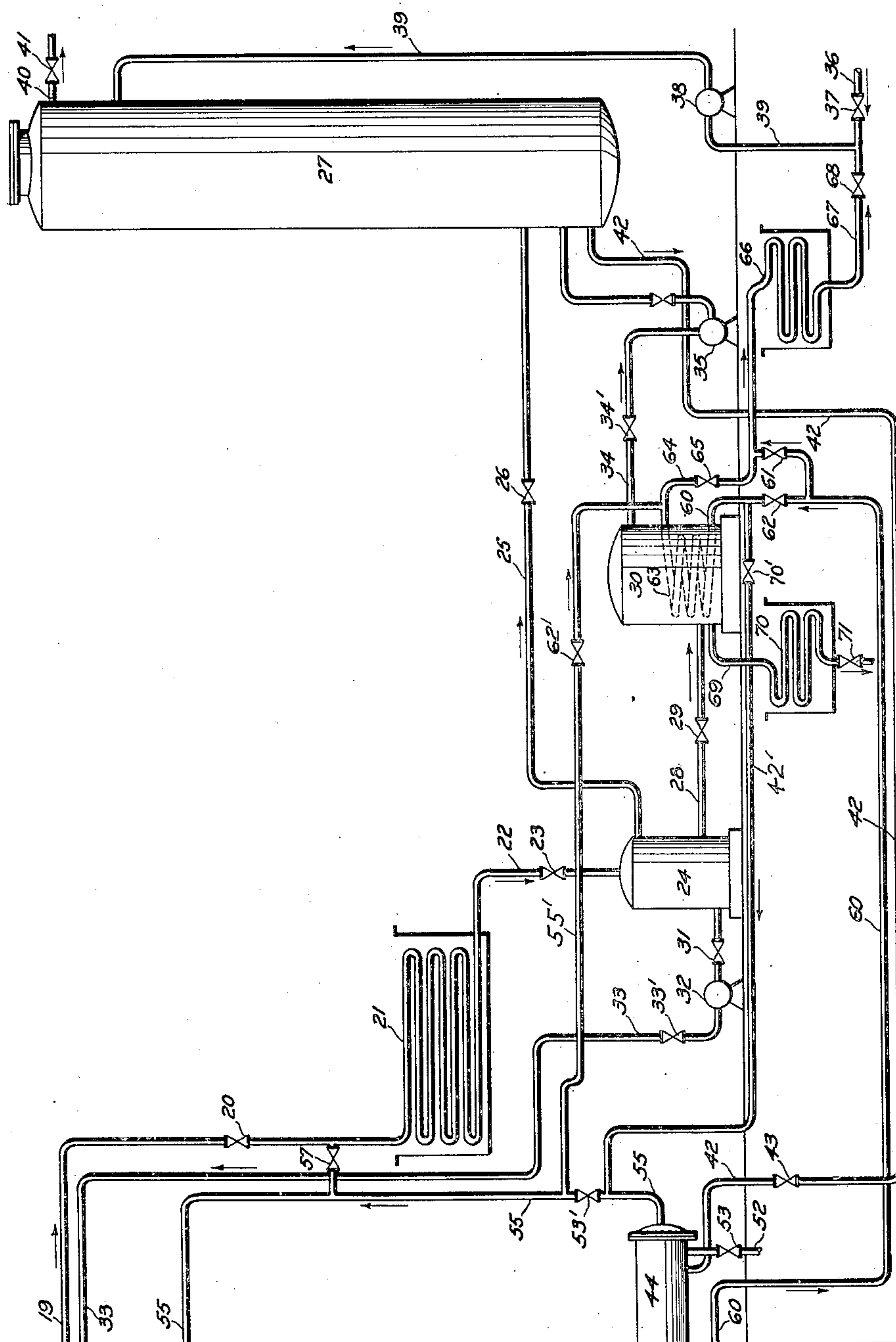


FIG. 2

INVENTOR
Jacque C. Morrell
BY Frank L. Belknap
ATTORNEY

UNITED STATES PATENT OFFICE

JACQUE C. MORRELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO UNIVERSAL OIL PRODUCTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF SOUTH DAKOTA

RECOVERING CONDENSABLE VAPORS FROM INCONDENSABLE GAS

Application filed November 25, 1929. Serial No. 409,437.

This invention has for its purpose the removal of gasoline from the incondensable gases produced in the cracking of oils; the stabilization of the pressure distillate, and the removal of gasoline or condensable materials from the gases produced during this stabilization, as well as from the gases evolved from the pressure distillate when the pressure thereon is reduced.

In the commercial cracking processes in common use the pressure distillate is usually a very unstable product, having dissolved in it a relatively large quantity of non-condensable gas, which in handling escapes, carrying with it substantial percentages of the valuable condensable hydrocarbons. Moreover, the non-condensable or fixed gases released from the high pressure receiver usually contain certain percentages of condensable materials. The escaping vapors from the pressure distillate as well as the fixed gases are normally passed through an absorption plant in refineries employing the cracking process. This procedure involves the use of auxiliary equipment entirely apart from the cracking plant, and requires special and more or less expensive heating means for recovery of the gasoline absorbed.

In the improved method of operation which is the main object of this invention I am able to use the heat available in the cracking plant for the recovery of the absorbed gasoline which of course will have the additional effect of more economical operation of the cracking plant by reducing the quantity of condensing and cooling water required therein.

Fig. 1 and Fig. 2 together constitute a diagrammatic side elevational view of an apparatus in which my process may be carried out. Raw oil is supplied through line 1, pump 2, and valve 3 to dephlegmator 4, where it aids in partial condensation of the vapors entering the dephlegmator through line 18. The reflux condensate therefrom, together with the pre-heated raw oil, passes out of the bottom of dephlegmator 4 through line 5 and by means of pump 6 and line 7 is charged to heating coil 8, valve 3' being

closed. This heating coil is located in furnace 9, which may be heated by burners, not shown, through port 10. Any suitable form of furnace capable of heating the oil to the desired cracking temperature may be employed. The heated oil then passes out through line 11, controlled by valve 12, to reaction chamber 13, from which the unvaporized residue may be withdrawn through line 14, controlled by valve 15.

The vapors from reaction chamber 13 are removed through line 16, controlled by valve 17, and introduced, wholly or in part, to dephlegmator 4 through line 18, controlled by valve 18'. Vapors from the dephlegmator discharge through line 19, controlled by valve 20, to condenser 21. The condensate and incondensable gas will pass out through line 22, controlled by valve 23, to receiver 24. The incondensable gas from the latter may be released through line 25, controlled by valve 26, to a bottom section of absorber 27. The condensate from receiving drum 24 passes by means of line 28 and valve 29 to a stabilizing drum or low pressure distillate receiver 30. A portion of the condensate may, however, be returned through valves 31, pump 32, line 33 and valve 33' to the top of dephlegmator 4 to facilitate fractional condensation therein.

A heating means is provided in stabilizing drum 30 as hereinafter described. Vapors from drum 30 discharge through valve 34' and line 34, in which may be interposed a pump 35, if required, to the bottom of absorber 27. Absorbing oil is supplied to the top of absorber 27 through line 36, valve 37, pump 38 and line 39, and in passing down through the absorber will strip the fixed gases of their condensable gasoline content. The fixed gases then pass out through line 40, controlled by valve 41, and may be used for fuel or other purposes.

The enriched absorbing fluid is discharged from the bottom of absorber 27 through line 42, controlled by valve 43, to a heat-exchanger-vaporizer 44, in which is disposed a heating means hereinafter described. The absorbed gasoline is vaporized in and passes

out from vaporizer 44 through line 44' into fractionating tower 45 in vapor form and out through line 46, controlled by valve 47, to condenser 48, and finally to receiver 49.

5 The pressure on the latter may be controlled by valve 50 and the absorption gasoline withdrawn through valve 51 for blending with naphtha or heavier gasoline.

10 In order to facilitate the vaporization of the absorbed gasoline from the absorption oil, steam may be introduced through line 52 and valve 53, although in many instances this procedure will not be necessary.

15 Heat is supplied to vaporizer 44 in either one of two ways; first, by passing a certain portion of vapors from the reaction chamber 13 through line 16 and valve 54 in indirect contact with the absorbing oil in vaporizer 44 by means of tubes. The cooled and partially
20 condensed vapors then pass out from vaporizer 44 through valve 53' line 55, and valve 56 (valve 57 being closed) back to dephlegmator 4. The other means of heating will be to pass the vapors from dephlegmator 4 through line 58 and valve 59 (valve
25 54 in line 16 being closed) and then in indirect heat exchange relation with the absorbent oil in vaporizer 44. The cooled and partially condensed vapors then pass out
30 through valve 53' line 55 and valve 57 (valve 56 being closed) to condenser coil 21. The stripped absorption oil is discharged from vaporizer 44 through line 60, and by closing
35 valve 61, and opening valve 62 may pass through a coil 63 in stabilizing drum 30, emerging from the coil through line 64, valve 65, and, if necessary, through a cooler 66 for recirculation through line 67, valve 68, pump
40 38 and line 39, back to the top of the absorbing drum 27. In this manner the pressure distillate is freed of its excessively light fractions by vaporization thereof.

45 It will be understood, of course, that any desired degree of heat for stabilizer 30 may be obtainable by manipulation of valves 61, 62 and 65; normally only a relatively small portion of the hot, stripped absorption oil will pass through coil 63, although I do not
50 wish to limit myself to this particular type of operation, and I may find it necessary, under certain conditions, to pass all or any part of the absorption oil through coil 63. Vapors may also pass through coil 63 from line
55 19 through valve 57, lines 55, 55', valve 62' and return through valve 70' line 42' back into line 55. Valves 53', 62', 62 and 65 are control and by-pass valves. In like manner by means not shown heat from the vapors entering vapor line 16 may be utilized. The
60 stabilized pressure distillate from stabilizer 30 will pass out through line 69 to cooler 70 and finally to storage or for chemical treatment through valve 71.

65 It will thus be seen that I have devised an improved method whereby a very stable

distillate is obtainable from the cracking process, the non-condensable gases stripped thoroughly of their condensable constituents, and the condensables recovered in an efficient manner by the use of the heat and
70 pressure of the cracking system proper.

As an example of the operation of my process, a 20 gravity reduced Midcontinent crude oil was supplied to the cracking unit and
75 processed with a transfer temperature of 900° F. and pressure on the receiving drum of 200 pounds. A yield of 68% of pressure distillate was recovered, having a gravity of 57.5 and an initial boiling-point of 115° F. This distillate was chemically treated and
80 rerun with a loss of only 2%. A 3.5% yield (based on the raw oil) of a 73 gravity absorption gasoline was recovered by the process, having an initial boiling point of 75 and an end point of 280° F. This material,
85 after caustic washing, was blended with a heavy 50 B6. naphtha into a gasoline meeting U. S. motor specifications. The incondensable gases in this operation from the absorber contained only 0.05 gallons per 1000
90 cubic feet of condensables by the charcoal method.

In another operation, in a similar cracking unit not employing my improved process for
95 stabilization, operating upon the same charging stock, 67% of pressure distillate was obtained, having a gravity of 59 and an initial boiling point of 95° F. Upon treatment and rerunning this material lost 5%. Also the
100 non-condensable gases from the unit contained 0.75 gallon gasoline per 1000 cubic feet. Comparison of these two operations shows the advantages my improved operation has in the cracking of hydrocarbon oils.

I claim as my invention:

105 1. The method of recovering condensable vapors from the incondensable gases of an oil cracking process which comprises scrubbing the gases with an absorption menstruum in a scrubbing zone, passing the menstruum in indirect heat exchange relation
110 with cracked vapors formed in the cracking process to thereby volatilize the absorbed hydrocarbons therefrom, passing the heated and denuded menstruum in indirect heat exchange with pressure distillate formed in the cracking to vaporize the more volatile portions thereof and supplying the latter to
115 said zone, and utilizing the denuded menstruum to scrub additional quantities of gas.

120 2. The method of treating the incondensable gas and pressure distillate formed in the cracking of hydrocarbon oil which comprises scrubbing the gas with an absorption menstruum in a scrubbing zone, heating the menstruum to vaporize absorbed hydrocarbons
125 therefrom, passing the heated and denuded menstruum in indirect heat exchange relation with the pressure distillate thereby distilling lighter fractions of the latter and
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cooling the menstruum, introducing the vaporized lighter fractions to said zone for contact with the menstruum therein and recycling the cooled menstruum to said zone.

5 3. A process for stabilizing pressure distillate obtained in the cracking of hydrocarbon oils which comprises heating the same to distil lighter fractions thereof, absorbing the vaporized lighter fractions in an absorption menstruum, heating the menstruum to
10 separate the absorbed lighter fractions, utilizing the heated and denuded menstruum in the heating of said pressure distillate thereby cooling the menstruum, and subsequently re-
15 turning the menstruum into absorption relation with additional lighter fractions vaporized as aforesaid.

4. A process for stabilizing pressure distillate obtained in the cracking of hydrocarbon oils which comprises heating the same to
20 distil lighter fractions thereof, absorbing the vaporized lighter fractions in an absorption menstruum, heating the menstruum by heat exchange with vapors formed in the
25 cracking operation to separate the absorbed lighter fractions, utilizing the heated and denuded menstruum in the heating of said pressure distillate thereby cooling the menstruum, and subsequently returning the menstruum into absorption relation with additional lighter fractions vaporized as aforesaid.
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In testimony whereof I affix my signature.
JACQUE C. MORRELL.

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