May 3, 1932. R. O. ANDERSON 1,856,860

STILL

Filed Nov. 1, 1927 2 Sheets-Sheet 1

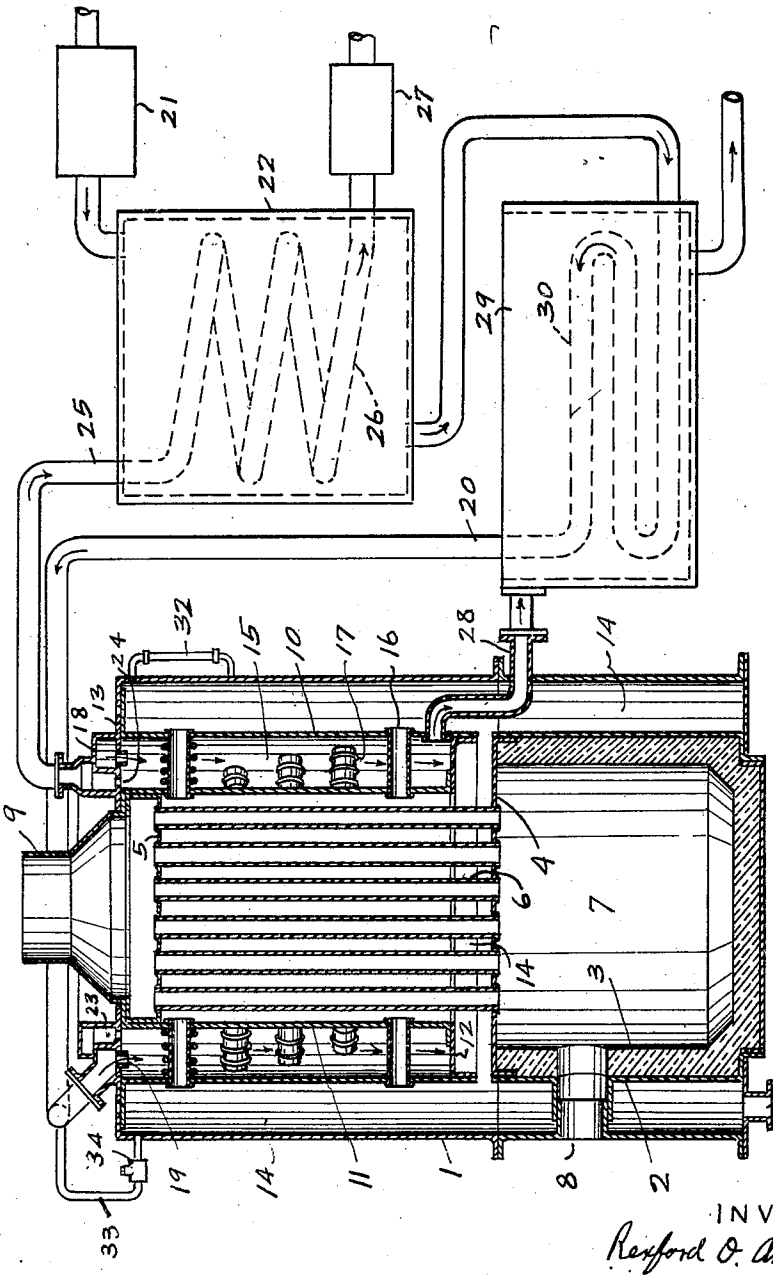

Fig. 1.

INVENTOR
Rexford O. Anderson
By Hardway & Father
ATTORNEYS

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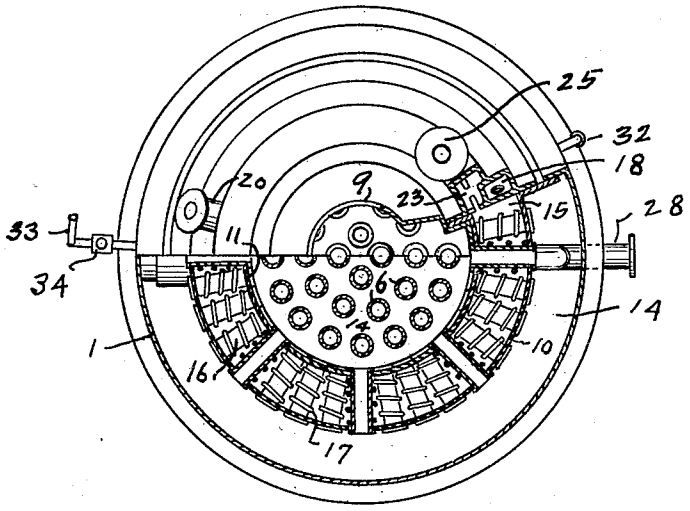

Fig. 2.

Rexford O. Anderson INVENTOR.

BY Hardway & Cathey.

ATTORNEYS.

Patented May 3, 1932 1,856,860

UNITED STATES PATENT OFFICE

REXFORD O. ANDERSON, OF HOUSTON, TEXAS

STILL

Application filed November 1, 1927. Serial No. 230,245.

This invention relates to new and useful improvements in a still.

One object of this invention is to provide an apparatus of the character described specially constructed for the distillation of crude petroleum, and primarily intended for the purpose of conserving the lighter fractions of crude oil which are usually lost, by evaporation, between the oil producing wells and the refinery.

Another object of the invention is to provide an apparatus of the character described that is compact, self contained, and portable, to the end that it may be dismembered, without loss of parts, and moved from place to place and re-erected between a well or wells and the first storage tanks, the scene of its operation.

A further feature of the invention is to provide an apparatus of the character described embodying a vaporizing chamber, equipped with circulating tubes through which a heating fluid may be circulated, and a header, into which the supply line is connected, and which is perforated, forming, in effect, a nozzle by means of which the crude petroleum, is delivered, in drops, or small streams, onto the heated tubes, and permitted to trickle down over them from the upper to the lower thereby exposing a greater proportion of the oil being treated, to the heating surfaces, than would be the case were the crude oil delivered into the vaporizing chamber in a mass, to the end that rate of heat transfer will be greatly increased.

A still further feature of the invention is to provide an apparatus, as above described, and for the purposes stated, which embodies means for relieving the vapors, generated in the vaporizing chamber, from said chamber, and means for relieving the unvaporized stock oil from said chamber, as well as means effective to spray the incoming crude oil through the outgoing vapors, thus effecting the scrubbing of said vapors and returning the undesired fractions, from said vapor, into the still and thence out with the unvaporized stock.

A still further feature of the invention resides in the provision of an apparatus, whereby a novel process of distillation, hereinafter described and claimed, may be carried out.

With the above and other objects in view this invention has particular relation to certain novel features of construction, operation and arrangement of parts an example of which is given in this specification and illustrated in the accompanying drawings, wherein:—

Figure 1 shows a side elevation of the complete apparatus partly in section, and

Figure 2 shows a partial plan view thereof, partly in section.

Referring now more particularly to the drawings, wherein like numerals of reference designate similar parts in each of the figures the numeral 1 designates the outer shell and the numeral 2 designates an inner shell within the lower part of said outer shell and spaced from the walls thereof. The inner shell may be lined with a suitable heat resisting lining 3, which may be composed of fire brick, or the like. The upper end of the inner shell supports a lower tube sheet 4 and mounted in the upper part of the outer shell there is an upper tube sheet 5 and the lower and upper tube sheets support the lower and upper ends of the boiler tubes 6.

Within the inner shell there is a furnace 7 provided with the usual manhole 8, between the outer and inner shells, and having leak-proof joints therewith. The heated air from the furnace, together with the flames of combustion, will pass up through the tubes 6, the smoke and products of combustion passing out through the smoke stack 9, at the top of the still.

Fitted into the upper part of the outer shell there is an independent unit comprising the outer and inner spaced walls 10, 11 the outer of which is spaced from the outer shell 1 and the inner of which surrounds and is spaced from the tube 6. The space between the outer and inner walls 10 and 11 is closed at the bottom by the bottom plate 12 and at the top by the common top plate 13, forming also the top of the still. There is thus formed the main chamber 14, through which is cir-

culated the heat conveying fluid, and the vaporizing chamber 15.

The vaporizing chamber 15 has the radially extending baffle-tubes 16 therein whose ends are anchored to the respective walls 10, 11, and open to the chamber 14.

The baffle tubes 16 preferably have roughened surfaces to give more surface area to facilitate the vaporization of the hydrocarbon trickling thereover and these roughened surfaces may be provided by wrapping the tubes with wire 17. The baffle tubes are preferably arranged in tiers, one above the other, and the tubes of each tier may be arranged in staggered relation with respect to the tubes of adjacent tiers so that the fluid dripping from one tube will fall onto a tube beneath.

The heat conducting fluid, or medium, in the chamber 14, and between the tubes 6 will be heated by said tubes and will rise and pass outwardly through the tubes 16 and heat them and a circulation of the heating fluid will be set up throughout the chamber 14, and the vaporizing chamber will be heated thereby to the temperature required.

The upper end plate 13 is provided with an annular fluid inlet chamber 18, which is provided with suitable outlet openings 19, above the chamber 15, thus forming, in effect, an annular nozzle through which the oil to be treated is discharged in fine streams, or drops, onto the tubes 16, beneath. An inlet line 20 enters the chamber 18 and incorporated therein there is a force pump 21 and a heat exchanger casing 22. This inlet line 20 is connected with the well or other source of supply.

The upper end plate 13 also has an annular vapor outlet chamber 23, which has suitable inlet ports 24 and connected with the vapor outlet chamber 23 there is a vapor outlet line 25 which is formed into a coil 26 in the casing 22 and incorporated into said line 25 there is a pump 27 which maintains a partial vacuum in the chamber 15.

Leading from the lower part of the vaporizing chamber 15 there is an outlet oil line 28, which is formed with a heat exchanger casing 29 through which the inlet line 20 passes and in which said inlet line is formed into a coil 30.

The chamber 14 may be filled, through the inlet 31, with a liquid which will not be vaporized by the required temperature of approximately 300° F., to which the oil to be treated is to be subjected. The level of the liquid in the chamber 14 may be determined by the use of a conventional gauge, as 32.

The oil to be treated passes in through the line 20, passing through the heat exchangers 22, 29 where it is partially heated, and enters the chamber, 18, and thence trickles down, in fine streams, or drops, successively over the baffle-tubes 16 by which the desired fractions are vaporized. The vapors pass upwardly, through the incoming streams of oil, enter the chamber 23, and pass out through the line 25 in the coil 26 of which it is condensed. The unvaporized portion of the stock oil is taken off through the line 28 through the exchanger 29, in which it assists in heating the incoming oil passing through the coil 30 and is thence delivered to the storage tanks.

By passing the oil to be treated through the heat exchangers 22, 29, to increase its temperature and then spraying it into the chamber 15 and through the vapors passing out from said chamber the incoming oil will wash said vapors and bring them to the right temperature, and by doing so will condense the vapors of any grade of oil, not desired, that may have been vaporized by having been brought to a temperature in excess of that necessary to vaporize the grade of oil desired. This operation of washing the vapors of a liquid, while in the operation of distillation, with the same, or other, liquid held at the temperature at which the vapors are desired cuts out and condenses the vapors not wanted, and in so doing comprises a fractionating condensation process.

In order to relieve the chamber 14 from excess pressure, that may be caused by the vaporization of the fluid therein, there is a relief line 33 connected into the top of said chamber 14 and also connected into the line 20 and controlled by the back pressure valve 34.

While I have shown what I now consider the preferred form of the invention it is obvious that mechanical changes may be made therein and equivalents substituted for the parts shown and I hereby reserve the right to make such mechanical changes and modifications as may be found desirable so long as I do not depart from the principle of the invention as comprehended within the scope of the appended claims.

What I claim is:—

1. A device of the character described comprising an annular vaporizing chamber, means for circulating a heating medium around said chamber circumferentially, baffle tubes disposed across said chamber said means being open at both ends to said heating medium, means for spraying a fluid to be treated into said chamber and onto the tubes therein, means for removing the vapors from said chamber and means for removing the unvaporized fluid from said chamber.

2. A device of the character described comprising an annular vaporizing chamber, means for circulating a heating medium around said chamber circumferentially, baffle tubes through said chamber open at both ends to permit the circulation of said medium therethrough in either direction, means for delivering a liquid hydrocarbon into said chamber above said tubes to effect the flow of

the hydrocarbon downwardly over the tubes and the fractional vaporizing thereof, means for taking off the vapors from the top of the chamber and means for removing the unvaporized hydrocarbon from the bottom of said chamber.

3. An apparatus of the character described including an annular vaporizing chamber, having tubular baffles therethrough, a circulation chamber surrounding the vaporizing chamber, a liquid heating medium in the circulating chamber provided to be circulated about the vaporizing chamber and through said baffles, a nozzle around the upper part of the vaporizing chamber through which a hydrocarbon may be fed downwardly over said baffles, an inlet line terminating in said nozzle, a vapor outlet chamber in communication with said vaporizing chamber, an outlet line connected with said vapor outlet chamber, a discharge line leading out from the lower part of said vaporizing chamber.

4. An apparatus of the character described including an annular vaporizing chamber, having tubular baffles therethrough, a circulation chamber surrounding the vaporizing chamber, a liquid heating medium in the circulating chamber provided to be circulated about the vaporizing chamber and through said baffles, a nozzle around the upper part of the vaporizing chamber through which a hydrocarbon may be fed downwardly over said baffles, an inlet line terminating in said nozzle, a vapor outlet chamber above and in communication with said vaporizing chamber, an outlet line connected with said vapor outlet chamber, a discharge line leading out from the lower part of said vaporizing chamber, a heat exchanger incorporated into said inlet line and through which said vapor outlet line passes.

5. An apparatus of the character described including an annular vaporizing chamber, having tubular baffles therethrough, a circulation chamber surrounding the vaporizing chamber, a liquid heating medium in the circulating chamber provided to be circulated about the vaporizing chamber and back and forth through said baffles, a nozzle around the upper part of the vaporizing chamber and through which a fluid may be fed downwardly over said baffles, an inlet line terminating in said nozzle, a vapor outlet chamber above and in communication with said vaporizing chamber, an outlet line connected with said vapor outlet chamber, a discharge line leading out from the lower part of said vaporizing chamber, a heat exchanger incorporated into said discharge line and through which said inlet line passes.

6. An apparatus of the character described including an annular vaporizing chamber, having tubular baffles therethrough, a circulation chamber surrounding the vaporizing chamber, a liquid heating medium in the circulating chamber provided to be circulated about the vaporizing chamber and back and forth through said baffles, a nozzle around the upper part of the vaporizing chamber through which a hydrocarbon may be fed downwardly over said baffles, an inlet line terminating in said nozzle, a vapor outlet chamber above and in communication with said vaporizing chamber, an outlet line connected with said vapor outlet chamber, a discharge line leading out from the lower part of said vaporizing chamber, a heat exchanger incorporated into said inlet line and through which said vapor outlet passes, and a heat exchanger incorporated into the discharge line through which said inlet line passes.

7. An apparatus of the character described including an outer shell and an inner shell within the lower part thereof and spaced from the walls of the outer shell, a lower tube sheet supported on the inner shell and an upper tube sheet spaced above said lower tube sheet, tubes whose upper and lower ends are anchored to the upper and lower sheets respectively said inner shell inclosing a furnace from which the tubes lead, and independent unit in the upper part of the outer shell and comprising outer and inner spaced walls said outer wall being spaced from the outer shell and the inner wall surrounding said tubes and upper tube sheet, lower and upper plates closing the space between said outer and inner walls and thus inclosing a vaporizing chamber between said walls, baffle tubes whose ends are anchored to said respective walls and which are open throughout, an annular fluid inlet chamber having outlet openings into the upper part of the vaporizing chamber, an inlet line entering said inlet chamber, an annular vapor outlet chamber having outlet ports leading from said vaporizing chamber, a vapor outlet line leading from said vapor outlet chamber and a drain outlet line leading from the lower part of vaporizing chamber.

8. An apparatus of the character described including an outer shell, an inner shell within the lower part thereof and spaced from the walls of the outer shell, tube supports, one above the other, tubes whose upper and lower ends are anchored to said upper and lower supports respectively, said inner shell inclosing a furnace above which the tubes are located and from which said tubes lead, an independent unit around the tubes and comprising outer and inner walls spaced apart, the outer wall being spaced from the outer shell, means closing the space between said outer and inner walls, said means being spaced apart and thus inclosing a vaporizing chamber between said walls, baffle tubes whose ends are anchored to said respective walls and which are open throughout, a fluid inlet

chamber having outlets opening into the upper part of the vaporizing chamber and through which fluid may be discharged onto said baffle tubes around said vaporizing chamber, an inlet line entering said inlet chamber, a vapor outlet chamber having outlet ports leading from said vaporizing chamber, and a vapor outlet line leading from said vapor outlet chamber.

In testimony whereof I have signed my name to this specification.

R. O. ANDERSON.