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PROCESS AND APPARATUS FOR TREATING PETROLEUM OIL

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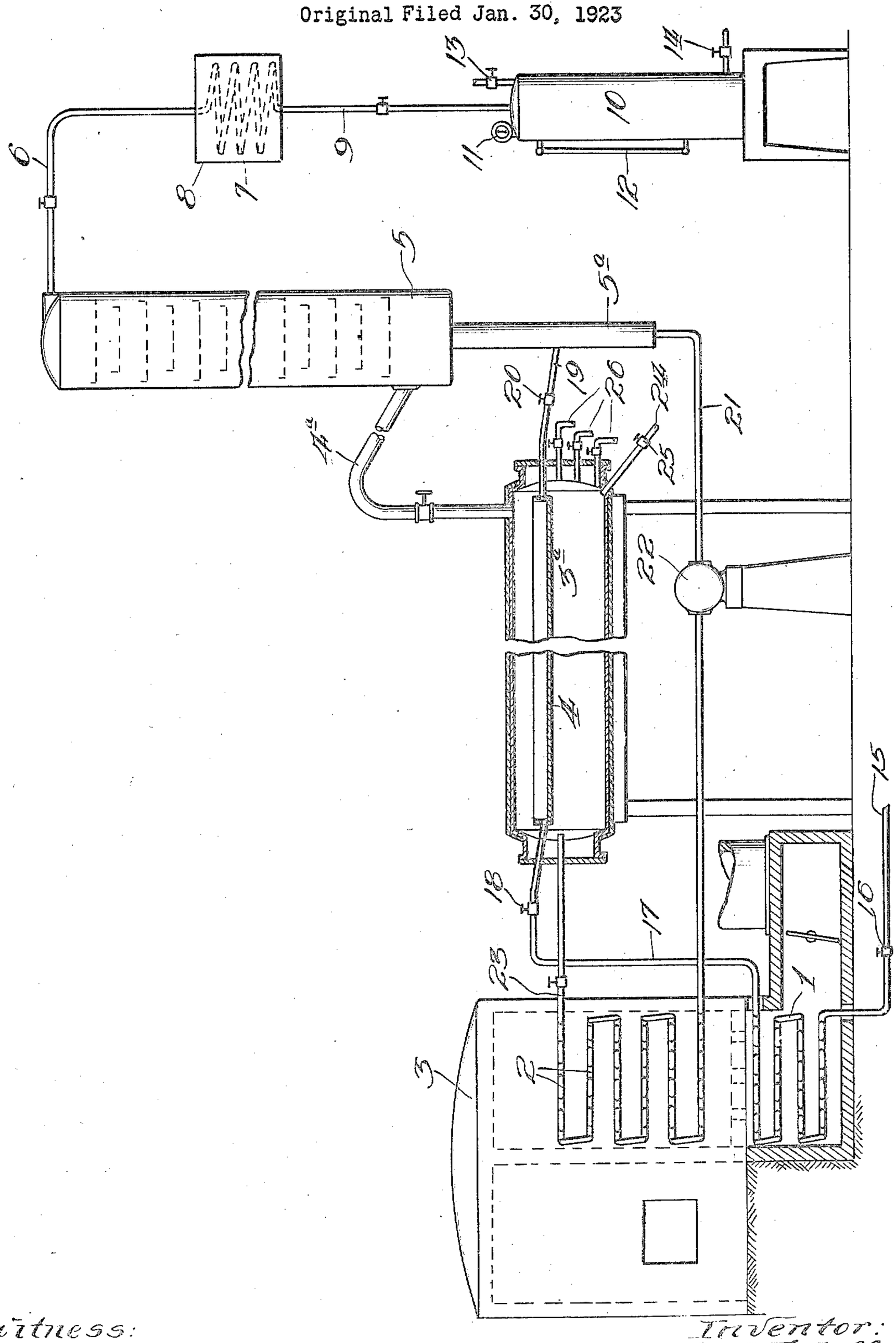

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PROCESS AND APPARATUS FOR TREATING PETROLEUM OIL.

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This invention relates to improvements in a process and apparatus for treating petroleum oil, and refers more particularly to the converting of relatively high boiling point oils into oils of a lower boiling point.

Among the objects of the invention are to provide a process in which oils of different characteristics are separately treated and permitted to vaporize in a common retort while being maintained in separate bodies; to provide a process in which selected portions of the unvaporized oils together with the reflux condensate will be retreated in the hottest portion of the heating stage; to provide a process which is preferably operated under substantial pressure, and in general to provide a process and apparatus of the character referred to.

The single figure is a diagrammatic side elevational view of the apparatus. Referring to the drawings at 1 and 2 are shown separate heating coils mounted in side fired furnace 3, the coil 1 being positioned in the coolest part of the heating chamber through which the partially expended gases pass. At 3^a is shown an expansion or vaporizing chamber having positioned therein a shallow pan or tray 4. Connected with the chamber 3^a by vapor line 4^a is dephlegmator 5 which in turn is connected by line 6 to water condensing coil 7 positioned in a condensing box 8. The discharge end of the coil is connected by line 9 to receiver 10 which is equipped with a pressure gauge 11, liquid level gauge 12, pressure relief valve 13 and a liquid drawoff valve 14.

Returning now to the treatment of the oils charged to the system, crude oil or oil containing a considerable quantity of relatively volatile constituents is charged through the line 15 controlled by the valve 16 and is circulated through the coil 1 wherein it is raised to a conversion temperature, or to a temperature at which the lighter fractions are separated.

This heated oil passes from the coil 1 through the pipe 17 controlled by the valve 18 into the shallow pan 4 positioned in the upper portion of the chamber 3. In this pan the oil is collected, and having a relatively large surface exposed for evaporation is relieved of its light volatile fractions.

Conversion is further facilitated by heat rising from the oil body contained in the lower portion of the chamber, as will hereinafter be explained.

The unvaporized products are drawn off from the pan 4 through the line 19 controlled by the valve 20 and are directed to the lower leg 5^a of the dephlegmator 5. The volatile fractions which are released from the oil pass off through the vapor line 4^a and are subjected to a refluxing action in the dephlegmator 5. In this column there is separated out the heavier or higher boiling point fractions which drain down into the leg of the dephlegmator and collect with the unvaporized oil drawn off through the line 19. These combined products are recycled through the drawoff pipe 21 and pump 22 being charged to the coil 2 mounted in the heating chamber of the furnace. These oils being of a more refractory character, are subjected to a higher temperature to produce the desired conversion.

The discharge line or transfer line 23 from the coil 2 connects with the chamber 3^a and introduces the heated oil into the lower portion of the chamber 3^a where it collects in a body below the pan 4.

The temperature of this oil is higher than the temperature of the oil in the pan, and as a consequence there is transferred to the oil in the pan 4 considerable heat which increases the distillation thereof.

The chamber 3^a is equipped with a drawoff line 24 controlled by a valve 25 and try-cocks 26 for ascertaining the liquid level in the chamber.

The vapors evolved from the two oil bodies, that is the oil body contained in the lower portion of the chamber and that positioned in the pan 4 pass off through the common vapor line 4^a, and are dephlegmated in the refluxing column 5 from which the separated reflux is recycled as explained. The dephlegmated vapors rise to the top of the column and pass over into the water condenser, thence to the receiver where they are collected as liquid distillate.

The pressure on the system may be controlled by the valves interposed in the lines connecting the separate stages, or uniform pressure maintained on the entire system by means of valve 13 on the receiver.

By means of the process explained, the crude oil may be first topped to relieve it of its low boiling point fractions by circulation

through the coil 1, and the unvaporized products recycled and cracked under substantial pressure in the coil 2 and vaporizing chamber 3a.

The presence of the oils of different character during their conversion in the chamber 3a, and the combination of the vapors during the dephlegmating and condensing action produces a blended distillate which contains the desirable portions of the top crude and the cracked heavier products. Control may be had upon the system to regulate the character and quantities of the different fractions to produce the distillate desired.

A thermometer or other temperature registering device may be inserted in the top of the dephlegmator in order to register at all times the temperature of the vapors passing over to the receiver.

By treating Mid-Continent crude and rerunning it in the manner explained, a good quality distillate having a gravity of from 48° to 52° Baumé was obtained, while pressures ranging from 50 to 200 pounds and temperatures from 700° to 900° F., in the cracking coil tube were maintained.

I claim as my invention:

1. In an apparatus for treating petroleum oil, the combination with separate heating means positioned in a furnace, a vaporizing chamber containing means therein for maintaining the liquid introduced from each separate heating means in separate bodies during vaporization, dephlegmating and condensing means connected to the vaporizing chamber, and means for recycling the reflux condensate and the unvaporized portions of one of said bodies from the vaporizing chamber for retreatment in one of said heating means.

2. A process of treating hydrocarbon oil, consisting in heating the oil to a conversion temperature, in maintaining the oil in a shallow body in a conversion stage, in recycling the unvaporized portions from said shallow body for retreatment under higher temperature conditions than the initial treatment, in passing the recycled heated oil to said conversion stage and in maintaining it in a separate body therein, in dephlegmating the vapors issuing from both of said oil bodies, in condensing the resulting vapors and in collecting the resulting distillate.

3. A process of treating oil, consisting in passing the oil in a coil through a heating zone, wherein the oil is heated to a conversion temperature, in discharging the products of conversion from said coil into a vaporizing zone, wherein they are maintained in a relatively shallow body, in continuously withdrawing the unvaporized oil from said shallow body, in returning it to a separate coil wherein it is subjected to a higher temperature than that to which it was subjected in the initial coil, in discharging the oil from said second coil, into said vaporizing zone and in maintaining it in a separate body therein, in dephlegmating the vapors issuing from both of said oil bodies, in returning the reflux condensate resulting from such dephlegmation to said second coil to be treated therein together with the unvaporized portions of oil withdrawn from said shallow oil body, in condensing the vapors resulting from the dephlegmation and in collecting the resulting distillate.

4. A process of treating hydrocarbon oil, consisting in heating the oil in a primary heating zone to a conversion temperature, in passing the heated oil to a conversion chamber wherein it is maintained in a relatively shallow body, in withdrawing the unvaporized oil from said shallow body, in returning it under an applied pressure to a secondary heating zone wherein it is subjected to a higher temperture than that maintained in said primary heating zone, in passing the oil from said secondary heating zone into said conversion chamber and in there maintaining it in a separate body, in commingling the vapors issuing from both of said bodies of oil, in dephlegmating the commingled vapors, in returning the resulting reflux condensate to said secondary heating zone for retreatment therein, in condensing the vapors resulting from such dephlegmation and in collecting the resulting distillate.

5. A process for treating hydrocarbon oil, consisting in heating a stream of charging oil to a conversion temperature, in then delivering the heated oil to a conversion zone wherein it is maintained in a shallow body, in simultaneously heating a separate stream of oil to a higher temperature than that to which the first stream is subjected, in collecting heated oil from said second stream in a body wherein it is maintained in heat transfer relation, but out of physical contact with the oil in said shallow body, in taking off vapors evolved from both of said bodies of oil for dephlegmation and condensation.

6. A process for treating hydrocarbons, consisting in passing charging oil through a heating coil wherein it is raised to a conversion temperature, in transferring the heated oil from said coil to an enlarged reaction zone wherein the oil accumulates in a shallow body, in simultaneous passing a second stream of oil through a second heating coil wherein said second stream of oil is raised to a higher temperature and the oil passing through said first heating coil, in collecting oil from said second heating coil in a body separated from but in heat transfer relation with the oil in said shallow body, in taking off vapors from both of said bodies of oil for dephlegmation and condensation and in uniting reflux condensate separated from the vapors and liquid oil withdrawn from said shallow body of oil to form the stream of oil passed through said second coil.

7. A process for cracking hydrocarbon oils comprising separately heating independent streams of oil to relatively higher and lower temperatures, independently delivering the oil heated in said streams to a reaction zone, maintaining the separately heated oils in independent bodies in said reaction zone, taking off converted products from said reaction zone, maintaining a superatmospheric pressure on the oil undergoing treatment in the process.

8. A process for cracking hydrocarbon oils comprising separately heating independent streams of oil to relatively higher and lower temperatures, independently delivering the oil heated in said streams to a reaction zone, maintaining the separately heated oils in independent bodies in said reaction zone, subjecting commingled vapors evolved from said independent bodies of oil to reflux condensation, and uniting the reflux condensate separated from the vapors with the oil being heated in one of said streams.

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