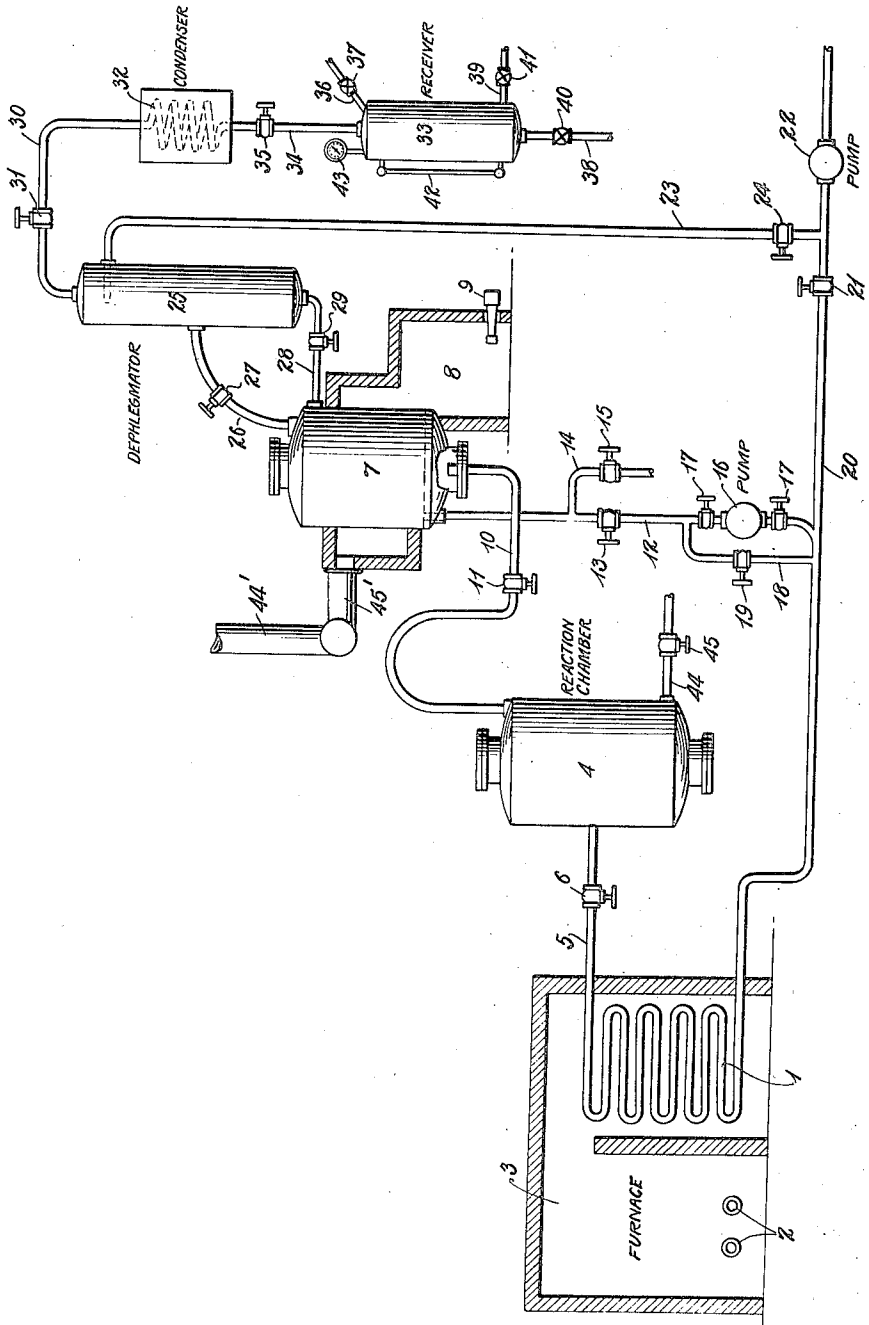
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PROCESS AND APPARATUS FOR TREATING HYDROCARBONS

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PROCESS AND APPARATUS FOR TREATING HYDROCARBONS

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This application is in part a continuation of application Serial Number 567,034, filed June 9, 1922, which has eventuated into Patent No. 1,627,436.

This invention relates to improvements in process and apparatus for treating hydrocarbons, and refers more particularly to a process and apparatus for obtaining lower boiling point products from heavy oils by subjecting the latter to the action of heat and pressure.

My invention relates specifically to a process and apparatus for the treatment of oil under heat and pressure wherein the vapors are forced to pass through the heated liquid in a secondary still before passing out through the vapor line, and provides for a process wherein the liquid through which the vapors are forced to pass, may consist of the reflux condensate collected in a still inside or outside the primary distilling apparatus, and one in which this reflux liquid, if desired, may be kept separate from the liquid in the primary distilling apparatus, or subjected to approximately the same heat and pressure as the liquid in the primary still for redistillation.

The single figure in the drawing is a side elevational view, partly in section, of an apparatus in which the process can be carried out.

Referring in detail to the drawing, 1 designates the primary heating coil or tubes which may be heated by means of the burner 2 in the fire box 3. This heating coil 1 is connected with the reaction chamber 4, by means of a transfer line 5, provided with a valve 6. Beside the heating coil 1 and reaction chamber 4, and outside thereof, is positioned a still or chamber 7 which is mounted in a combustion chamber 8 provided with a burner 9, whereby heat can be applied to all or a portion of the sides of the still or chamber 7. The lower portion of the still 7 and the upper part thereof are preferably outside the heating zone. The chamber or still 7 is preferably of a similar diameter and size with the chamber 4. Extending from the bottom of the still or chamber 7 is a line 10 controlled by valve 11, which leads to a point near the top of the reaction chamber 4. The still or chamber 7 is also provided with a draw-off line 12, controlled by valve 13, and provided with branch line 14, controlled by valve 15. Pipe 14 is connected to a receptacle or tank not shown. The line 12 connects to a pump 16, controlled by valve 17, which pump 16 may be by-passed through line 18, controlled by valve 19. By manipulating the valves 13 and 15, if desired, the liquid flowing from the still 7 may be directed to the main body of oil to be treated, through the heating coil 1 or this liquid can be evacuated from the system into storage.

The heating coil 1 is provided with a charging line 20 controlled by valve 21 on which is interposed a raw oil charging pump 22. This charging line 20 is also provided with a branch 23, controlled by valve 24 through which charging stock may be directed to the top of a reflux condenser or dephlegmator 25. To the top of the still or chamber 7 is attached a vapor line 26 controlled by valve 27 which connects to the dephlegmator or reflux condenser 25, the bottom of which is in turn connected to the still or chamber 7 through another line 28 controlled by valve 29. The top of the dephlegmator 25 is connected through line 30, controlled by valve 31, to a condenser 32 which in turn connects to a receiver 33 through line 34 controlled by valve 35. The receiver 33 is provided with pressure relief pipe 36 controlled by valve 37, and with the liquid drawoff lines 38 and 39, controlled by valves 40 and 41. Liquid level gauges 42 and pressure gauge 43 are also provided on the receiver.

The combustion chamber or furnace 8 surrounding the secondary still 7 is connected to a stack 44′ by means of flues 45′.

The operation of the process is as follows: Raw oil may be charged by means of a pump 22 into the heating coil where it is heated to a conversion temperature, and the hot oil passed through line 5 into reaction chamber 4. The reaction chamber 4 is provided with residuum drawoff 44 controlled by valve 45 wherethrough the unvaporized constituents of the oil separated in chamber 4 can be evacuated. The vapors form and gather in

the upper space of the reaction chamber 4 and are forced into the pipe 10 entering into the bottom of the secondary still 7. These vapors pass up through the secondary still 7 and into the vapor line 26, and thence into the reflux condenser or dephlegmator 25 where they are subjected to partial condensation and fractionation by the usual method well known, and the uncondensed vapors from the dephlegmator 25 pass through line 30 into condenser 32 and thence the distillates and the gas pass through receiver 33. The valves 24, 27, and 45 and the pump 22 allow a vapor pressure to be generated and thereafter maintained throughout the entire system. When the pressure has reached the desired operating pressure, valve 36 is used to regulate the same.

As the heavier vapors are condensed in the dephlegmator 25 they are returned through the line 28 into the secondary still 7 where they are subjected to redistillation by means of heat of the combustion gases passing around said still in combustion chamber 8. The liquid remaining in still 7 can pass out therefrom through line 12, the valve 13 being opened and valve 15 on line 14 being closed, and it may again be returned into the heating tubes 1 through pump 16 or through its by-pass 18 by proper manipulation of the valve shown. Or, if desired, the liquid from still 7 can be directed to storage through line 14, valve 15 being opened and valve 13 being closed. As vapors pass from reaction chamber 4 through line 10 into secondary still 7 they are forced to bubble up through the liquid in the secondary still 7, thus cleansing the vapors from heavier fractions and allowing the lighter vapors to pass to the dephlegmator 25, forming a better product. The secondary still 7 being in an independently heated zone is maintained at a constant high temperature and it will be seen that the reflux liquid from dephlegmator 25 is further cracked and the vapors therefrom forced back through the dephlegmator, condenser, or receiver without the condensate from said vapors admixing with the contents of the primary heating coil 1 and reaction chamber 4. This is a desirable feature and it does not destroy the characteristics of the liquid residues in the reaction chamber 4 which may be drawn off continuously through pipe 44.

If desired, a portion of or all the raw oil charged through pump 22 can be passed through line 23 by proper manipulation of valves 21 and 24 into the dephlegmator 25 and used therein to assist the fractionation of the vapors. Some portions of the raw oil may be vaporized in said dephlegmator if the raw oil contains fractions suitable therefor.

The unvaporized raw oil passes out of dephlegmator 25 with the reflux condensate, through pipe 28, secondary still 7, and draw-off line 12 wherethrough it may be directed by pump 16 into primary heating zone 1.

As an illustrative run of my invention, the oil in the heating coil 1 is heated to a temperature of say 850° F., and the contents of the secondary still 7 are maintained at approximately the same temperature or slightly lower.

The system is preferably maintained under substantially equalized pressure throughout, say 100 to 500 pounds, more or less, it being understood that sufficient drop in pressure occurs to permit the materials to advance through the apparatus. Yields of from 50 to 70% commercial gasoline may be obtained under such conditions.

However, differential pressures can be maintained on the various parts of the system as, for instance, the pressure on the independently heated reflux chamber 7 can be substantially lower than the pressure on the reaction chamber 4.

I claim as my invention:

1. A process of cracking hydrocarbon oil, consisting in subjecting the oil to cracking conditions of temperature and pressure, taking off vapors and subjecting them to dephlegmation, collecting the reflux condensate in a separate pool, subjecting such pool to cracking conditions independently regulated relative to the main cracking operation and causing the vapors generated by the main cracking operation to pass through said pool of reflux condensate in physical contact therewith prior to their dephlegmation.

2. A process according to that defined by claim 1 further characterized in that the raw charging stock before reaching the main cracking zone is compelled to pass through said reflux pool.

3. A process according to that defined by claim 1 further characterized in that the raw oil to be treated is brought into heat interchange relation both with the vapors undergoing dephlegmation and with the reheated reflux pool.

4. In an apparatus for cracking hydrocarbon oil, the combination with a cracking tube and expansion chamber, of a dephlegmator and condenser, a chamber for collecting reflux condensate interposed between the expansion chamber and dephlegmator means for passing vapors from the expansion chamber through the reflux condensate collected in the second mentioned chamber and thence into the dephlegmator, means for independently heating said last mentioned chamber and means for returning predetermined portions of reflux condensate unvaporized in said independently heated chamber to said cracking tube.

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