May 10, 1932. N. S. OLSEN 1,857,394

VAPOR CONDENSATION

Original Filed April 9, 1927

Fig. 2.

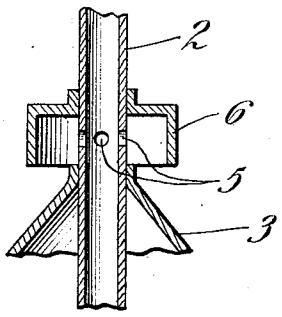


Fig. 1.

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UNITED STATES PATENT OFFICE

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VAPOR CONDENSATION

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The present invention relates to improvements in the art of reflux condensation or fractionation of vapors from distilling processes, and relates more particularly to a process wherein the vapors are caused to pass through a plurality of relatively thin sheets or films of liquid in an apparatus provided with means for forming said sheets or films.

In the cracking of hydrocarbon oils as practiced to-day, one of the essential features of the process resides in the efficient dephlegmation or fractionation of the vapors so as to secure a separation of the sufficiently cracked vapors (which are condensed and collected as gasoline) from those which are insufficiently cracked. These latter during dephlegmating action are condensed, being too heavy for the desired product, which condensed product or reflux condensate is preferably returned to the heating zone for retreatment together with fresh charges of charging stock.

The object of the present invention is to so dephlegmate the heated vapors in a dephlegmator that they are caused to pass through sheets or films of heavier condensate which does not vaporize at the temperature necessary to keep the overhead products desired in vapor form. An incidental object of the present invention resides in so regulating the temperature maintained within the dephlegmating zone as to obtain overhead vapors of the desired gravity.

In the drawings:

Fig. 1 is a diagrammatic elevational view, partly in vertical section, illustrating the invention; and

Fig. 2 is an enlarged fragmentary, vertical sectional view, illustrating a particular arrangement of baffles and apertures in the central pipe.

Referring more in detail to the drawings, 1 designates the shell of a conventional type of dephlegmator or reflux condenser, inside of which and extending upwardly from the bottom, and preferably in the center thereof, is a pipe 2 on which are mounted at spaced intervals in the height thereof inverted cup-shaped or cone-like baffles 3, the base of the cone lying in a plane below the apex thereof. A cooling medium may, if desired, be supplied to the pipe 2 through the inlet line 2′ having valve 3′. The side walls of each cone project downwardly and outwardly from the supporting pipe 2, terminating in a curved annular edge 4 which is preferably given an upward flare in relation to the upper surface so as to deflect a film or sheet of oil flowing downwardly on the surface of the cone into substantially a horizontal flow across the intervening gap 4′ between the outer edge of each cone and the wall 1.

Immediately above each cone the pipe 2 may be provided with perforations 5 spaced below the flange 6. A vapor line 7, controlled by valve 7′, extends from the top of the dephlegmator and communicates with the usual condenser, not shown. At the bottom a reflux leg 8 regulated by a valve 8′ communicates with the reflux pump 9, which latter is connected to the return line 10, controlled by valve 10′, communicating with the charging line to a suitable cracking tube, not shown.

To the return line 10 is connected a by-pass line 11, having interposed therein pump 11′ and valve 19, which line 11 communicates with the return line 20 in which is interposed a valve 17. This return line 20 communicates with the lower portion of the pipe 2.

A by-pass line 12′, in which is interposed a valve 13′, communicates with the cooling coil 12 mounted in a suitable condenser box through which the reflux may be by-passed, by closing valve 17, for the purpose of cooling same. A return line 14′, having interposed therein valve 15′, connects the cooling coil 12 with the return pipe 20. The cooling coil 12 is submerged in a bath of cooling liquid, such as cooler charging stock or water, the amount of which is regulated by valves 13 and 14 on the lines 15 and 16, respectively.

The operation may be described as follows:

Heated vapors, for instance, from a suitable concurrently operating distilling or cracking process, enter the dephlegmator through line 18, controlled by valve 18′. During the ascent of the vapors in the dephlegmator, they are caused to have a back and forth travel due to the baffles 19′ mount-

ed on the interior of the dephlegmator wall, whereby their ascent is retarded and the necessary time provided for an intimate contact between the vapors and cooling medium. Those vapors remaining uncondensed after passage through the dephlegmator, which comprise those of a predetermined desired boiling point range, pass out through the vapor outlet pipe 7 which communicates with a conventional type condenser and receiver, not shown. The heavier fractions of the vapors, due to the temperature maintained inside the dephlegmator, are condensed and fall to the bottom of the dephlegmator in the form of so-called reflux, being withdrawn therefrom through the reflux leg 8 and directed through pump 9 and line 10 to the cracking zone to be retreated. All or a portion of the reflux may be diverted through the by-pass line 11 by the obvious manipulation of the valves shown, and passed through the line 20 into the pipe 2. Before entering the pipe 2, the reflux, in whole or in part, may be diverted and passed through the cooling coil 12 by obvious manipulation of the valves shown.

The reflux being introduced to the pipe 2 is forced upwardly through the pipe to the perforations 5 where it passes out of the pipe 2 onto the downwardly directed baffle or flange 6, forming a uniform film or sheet flowing downwardly along the top surface of the cone-like baffles 3. When the reflux reaches the outer lower edge of the cone 3 at the point 4, its direction of flow is so altered by the particular shape of said edge that it is caused to be deflected across the gap 4′ between the edge of the cone 3 to the inner wall of the dephlegmator in the form of a thin film or sheet. The vapors being introduced through the vapor inlet 18 are caused to pass through these sheets or films of liquid at the edge of each cone baffle 3 and be washed or scrubbed by same to free them from undesirable entrained liquids. The temperature maintained in the dephlegmator regulates the amount of vapors which are permitted to be discharged into the vapor line 7 by condensing those which will not remain in vapor form at that temperature. Thereby the gravity and boiling point range of the products passing overhead is governed. By obvious regulation of the valve 17, with the cooling coil 12 in operation, any desired temperature may be easily obtained and very uniformly regulated.

The advantages of the present invention should be obvious to those skilled in the art from the foregoing description. It may be emphasized, however, that by the present invention there is substantially no friction such as sometimes occurs in processes where vapors are forced to pass upwardly and then downwardly through pools of oil, the friction being so great that the capacity soon becomes limited. By causing the vapors to pass through the moving sheets or films of cooling liquid, I am enabled to secure a more thorough washing with a lesser number of washings.

I have illustrated a dephlegmator in which three cone-like baffles 3 have been shown. It is obvious, of course, that this number may be increased, depending upon the extent to which dephlegmation is desired.

I claim as my invention:

1. A dephlegmator comprising a shell having vapor inlet and outlet and a liquid outlet, a vertical pipe mounted within said shell provided with liquid discharge ports, means for returning regulated portions of reflux from said shell to said vertical pipe, baffles adjacent said liquid discharge ports having edges terminating adjacent the interior wall of said shell, and secondary baffles adjacent said discharge ports for directing the liquid discharged through the ports onto said first mentioned baffles.

2. A dephlegmator comprising a shell having vapor inlet and outlet and a liquid outlet, a vertical pipe mounted within said shell provided with liquid discharge ports, means for returning regulated portions of reflux from said shell to said vertical pipe, baffles adjacent said liquid discharge ports having edges terminating adjacent the interior wall of said shell, annular depending secondary baffles adjacent said discharge ports for directing the liquid discharged through the ports onto said first mentioned baffles.

3. Apparatus for the treatment of cracked hydrocarbon oil vapors to separate sufficiently cracked portions amenable to refining for use as a motor fuel from insufficiently cracked portions which are condensed as reflux condensate, comprising in combination, a shell, means for introducing vapor mixture to the lower portion of the shell, means for taking off sufficiently cracked products from the upper portion of the shell, means for withdrawing liquid condensate from the lower portion of the shell, a vertically extending pipe within said shell, a plurality of baffles mounted on said pipe in spaced relation and flared outwardly, depending flanges mounted on said pipe intermediate said baffles, means for projecting radial streams of cooling liquid from said pipe against said flanges, to descend therefrom along said baffle surfaces, and annular flanges mounted on said shell intermediate said baffles for giving the ascending vapors a back and forth travel.

In testimony whereof I affix my signature.

NEAL S. OLSEN.