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TREATMENT OF HYDROCARBONS

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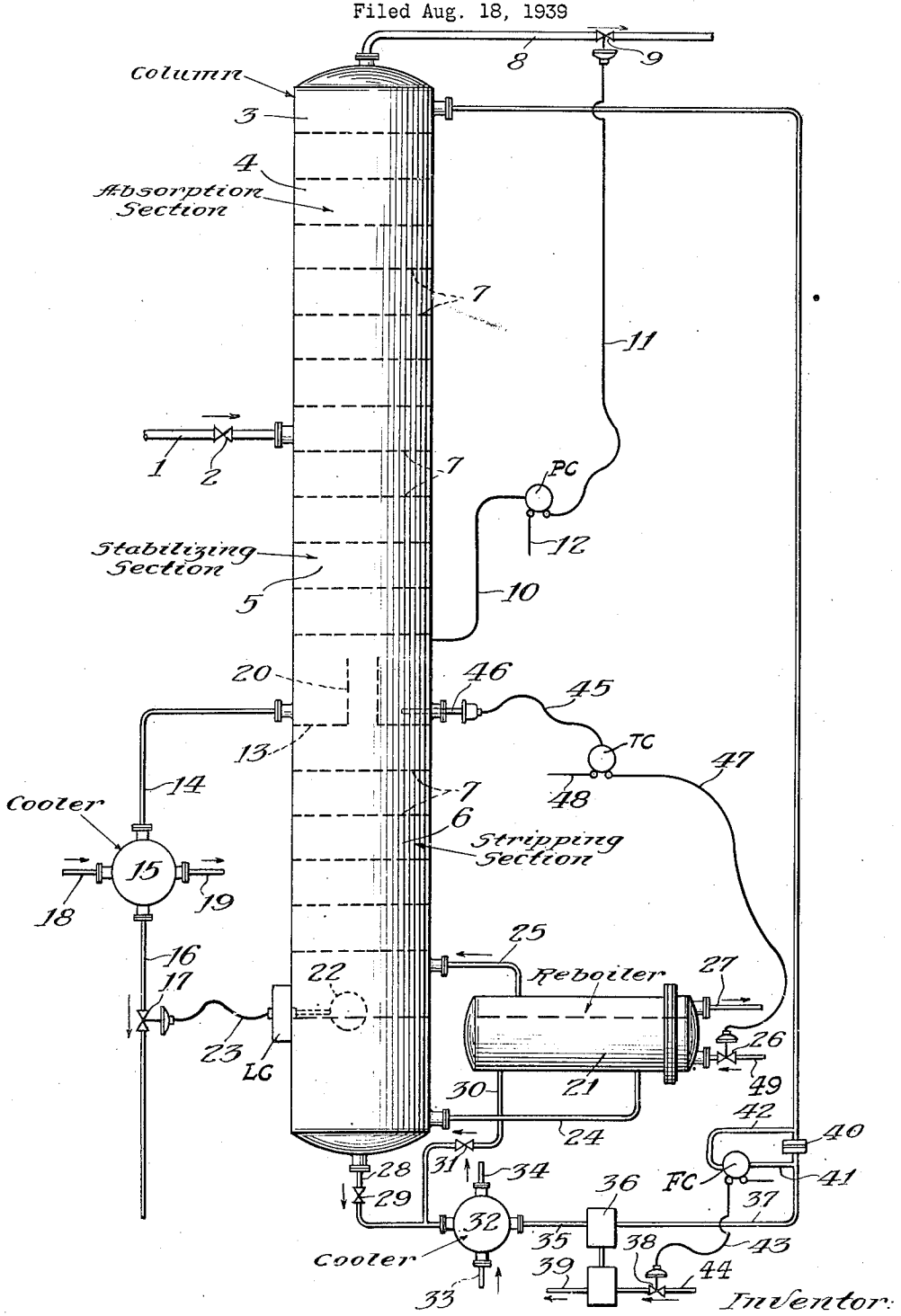

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TREATMENT OF HYDROCARBONS

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4 Claims. (Cl. 196—8)

The invention relates specifically to an improved method and means of separating normally liquid and normally gaseous hydrocarbons from a mixture thereof such as, for example, light overhead distillate and gases resulting from a cracking operation, whereby to recover a stabilized distillate product of the desired vapor pressure and gases substantially free of normally liquid fractions.

The invention provides a single distilling and fractionating column which performs the functions of a stabilizer, absorber and stripper, the stabilized product being withdrawn from an intermediate point in the column beneath the stabilizing section and above the stripping section, regulated quantities of the stripped distillate being cooled and supplied to the upper section of the column for use therein as absorber oil and the supply of heat for effecting said stripping being controlled in response to minor variations in the temperature at said intermediate point in the column from which the stabilized product is withdrawn.

The invention can best be described and explained in conjunction with the accompanying diagrammatic drawing which represents an elevational view of one specific form of apparatus incorporating the features of the invention and in which the improved process herein provided may be conducted.

Referring to the drawing, the charging material, which comprises a mixture of normally gaseous and normally liquid hydrocarbons such as, for example, distillate and gases from the receiver of a cracking system, not shown, is supplied through line 1 and valve 2 to column 3 at a point therein between the upper absorption section 4 and the intermediate portion or stabilizing section 5.

Each section of the column 3 contains a plurality of suitable contacting means such as bubble trays, packing or the like, represented in the drawing by the dotted lines indicated by reference numeral 7, whereby intimate contact between ascending vapors and gases and descending liquids is obtained.

The vaporous components of the charge, together with vapors from the lower sections of the column, pass upwardly from the point of introduction of the charging material into absorption section 4 wherein they are brought into intimate countercurrent contact with absorber oil which is supplied to the upper portion of this section, as will be later described. Absorption of substantially all of the normally liquid components and at least a portion of the heavy normally gaseous fractions from the vapors supplied to the absorption section is accomplished in this zone and the remaining unabsorbed gases which are substantially free of normally liquid components are removed from the upper portion of the column through line 8 and valve 9. Valve 9 is employed to control the pressure maintained within the column and, although this may be a hand-controlled valve, it is preferably, as in the case here illustrated, an automatic control valve of any suitable conventional form actuated through any conventional form of pressure controller PC in response to minor variations in the pressure within the column. The pressure controller here illustrated represents an air-actuated type which is connected through conduit 10 to a suitable intermediate point in the column and through line 11 to valve 9 which, in this instance, is a diaphragm type control valve. Compressed air is admitted to the pressure controller from an external source through line 12.

The enriched absorber oil and the liquid components of the charge pass from the point of introduction of the latter downwardly into the stabilizing section 5 of the column wherein they are freed of a portion of their dissolved gases, including substantially all of the gases having less than 4-carbon atoms to the molecule, by contact with relatively hot ascending vapors and gases from the lower section of the column.

An accumulating tray 13 is provided between the stabilizing and stripping section of the column upon which tray a pool of stabilized distillate is collected, the stabilized product being removed from this pool to storage or elsewhere, as desired, through line 14, cooler 15, line 16 and valve 17. Cooler 15 may be of any conventional form and, in the case here illustrated, represents a heat exchanger to which a suitable cooling medium is supplied through line 18 and removed through line 19.

Stabilized distillate from the pool thereof on tray 13 overflows through the vapor riser and down-pipe 20 into the lower or stripping section of the column wherein it is substantially freed of remaining dissolved gases by contact with the ascending vapors generated, as will be later described, in reboiler 21. A substantial body of the stripped distillate accumulates in the bottom of the column and a float 22 operates the liquid level controller LC which is connected to valve 17 through line 23 to maintain a substantially constant level of liquid in this zone.

To vaporize light fractions of the distillate col-

lected at the bottom of the column and provide heat for stripping, a reboiler 21 is provided in the case here illustrated although, when desired, open steam may be employed for reboiling by introducing the same into the pool of liquid at the bottom of the column by well known means, not illustrated, or a suitable closed coil, not shown, may be immersed in the liquid and a heating medium, such as steam or hot oil, passed therethrough to provide heat for reboiling and stripping. The reboiler here shown is supplied with liquid from the body thereof at the bottom of the column through line 24 and the vapors evolved in the reboiler are returned therefrom through line 25 to the lower portion of the column. A suitable heating medium, such as steam, hot oil or the like is supplied to reboiler 21 through line 49 in regulated quantities controlled by valve 26, passes through the reboiler in indirect heat transfer relation with the liquid supplied thereto from the bottom of column 23 to effect reboiling and partial vaporization of the latter and is discharged from the reboiler through line 27. When desired, the heat exchanger type of reboiler here shown may be replaced by a heating coil in a suitable furnace setting or the like, in which case the heating medium employed is combustion gases generated in the same or a separate heater.

Reboiled and stabilized distillate is removed either from the body thereof in the lower portion of the column through line 28 and valve 29 or from the body thereof in reboiler 21 through line 30 and valve 31 and supplied to cooler 32, wherein its temperature is reduced to the desired degree by indirect heat exchange with a suitable cooling medium supplied to cooler 32 through line 33 and removed therefrom through line 34. The cooled substantially gas-free distillate passes from cooler 32 through line 35 to pump 36 by means of which it is fed in regulated quantities through line 37 to the upper portion of column 3 to serve as absorber oil in absorption section 4. In the particular case here illustrated, pump 36 represents a steam pump driven by steam supplied thereto through line 44 and valve 38 and discharged therefrom through exhaust line 39. Valve 38 controls the speed of the pump which is preferably maintained substantially constant in order to supply a constant quantity of absorber oil to the column. This is accomplished, in the case here illustrated, by providing an orifice plate 40 in line 37 with conduits 41 and 42 on opposite sides thereof leading to any conventional type of flow controller FC which, in turn, is connected to valve 38 through line 43 and regulates the supply of steam to pump 36 in response to minor variations in the rate of flow through line 37. Flow control FC, in this particular instance, represents an air-operated type of controller.

As a special feature of the invention, instead of following the conventional practice of controlling the supply of heating medium for accomplishing reboiling and stripping in response to variations in the temperature prevailing in the reboiler or in the stripping section, I control the supply of heating medium in response to minor variations in the temperature prevailing at the intermediate point in the column wherein the stabilized distillate accumulates and from which it is removed. By this improved practice, I maintain the temperature of the stabilized product removed from the column substantially constant and thereby maintain its vapor pressure at a substantially constant value. This is a more direct and positive method of maintaining the stabilized product at a substantially constant vapor pressure than directly controlling the reboiling and stripping temperature and by its use the vapor pressure of the stabilized distillate product is controlled within closer limits.

In the case here illustrated, the improved method of controlling the vapor pressure of the stabilized distillate product is accomplished by a temperature controller TC which communicates through line 45 with a suitable temperature sensitive device such as pyrometer 46 immersed in the pool of liquid collected on tray 13. The temperature controller motivates valve 26 in line 49 through line 47 and thereby controls the supply of heating medium to the reboiler in response to minor variations in the temperature of the pool of stabilized distillate collected on tray 13. In the particular case here illustrated, the temperature controller is air-actuated and connected to a suitable source of compressed air, not shown, through line 48. Valve 26, in the case here illustrated, is an air-actuated type of automatic control valve.

It will be understood, of course, that the invention is not limited to the specific form of apparatus illustrated in the drawing and the invention specifically contemplates the use of any conventional form of control instruments such as, for example, electrically operated controllers in place of any or all of the air operated controllers and hydraulically or electrically operated control valves in place of the air operated valves.

I claim as my invention:

1. A process for separating normally gaseous and normally liquid hydrocarbons from a mixture thereof which comprises introducing the mixture to a column at a point a substantial distance below the top thereof, scrubbing vapors and gases with absorber oil in the upper portion of the column above said point, permitting enriched absorber oil and liquid components of said mixture to descend through an intermediate portion of the column below said point and in this intermediate portion of the column stabilizing the liquid to remove dissolved gases therefrom, removing a portion of the thus stabilized liquid from said intermediate portion of the column and passing the remainder thereof downwardly through the lower portion of the column wherein it is stripped of lighter components by countercurrent contact with ascending vapors formed as hereinafter set forth, reboiling the thus stripped remainder of said stabilized liquid by heat exchange with a heating medium and passing resultant vaporized portions thereof upwardly through the lower portion of the column as said ascending vapors, controlling the supply of heating medium to the reboiling step in response to temperature variations at a point in said intermediate portion of the column adjacent the point of withdrawal of said portion of the stabilized liquid therefrom, and supplying at least a portion of the reboiled liquid to the upper portion of the column as said absorber oil.

2. The process as defined in claim 1 further characterized in that said stripped remainder of the stabilized liquid is reboiled outside the column by indirect heat exchange with the heating medium and resultant vapors returned to the lower portion of the column.

3. An apparatus of the character described comprising a vertical column, means for introducing a mixture of normally gaseous and normally liquid hydrocarbons to the column at a point substantially below the top thereof, means

for withdrawing liquid from an intermediate point in the column substantially below the first-named point, means for passing additional liquid downwardly through the lower portion of the column below said intermediate point, reboiling means for the liquid accumulating in the bottom of the column and means for passing vapors therefrom upwardly through said lower portion of the column, means for controlling the supply of heat to said reboiling means in response to temperature variations adjacent said intermediate point of the column, and means for supplying liquid from the reboiling means to the upper portion of the column above the first-named point.

4. The apparatus as defined in claim 3 further characterized in that said reboiling means is disposed outside the column and is of the indirect heat exchange type.

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