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METHOD OF CONTROLLING DEPHLEGMATION

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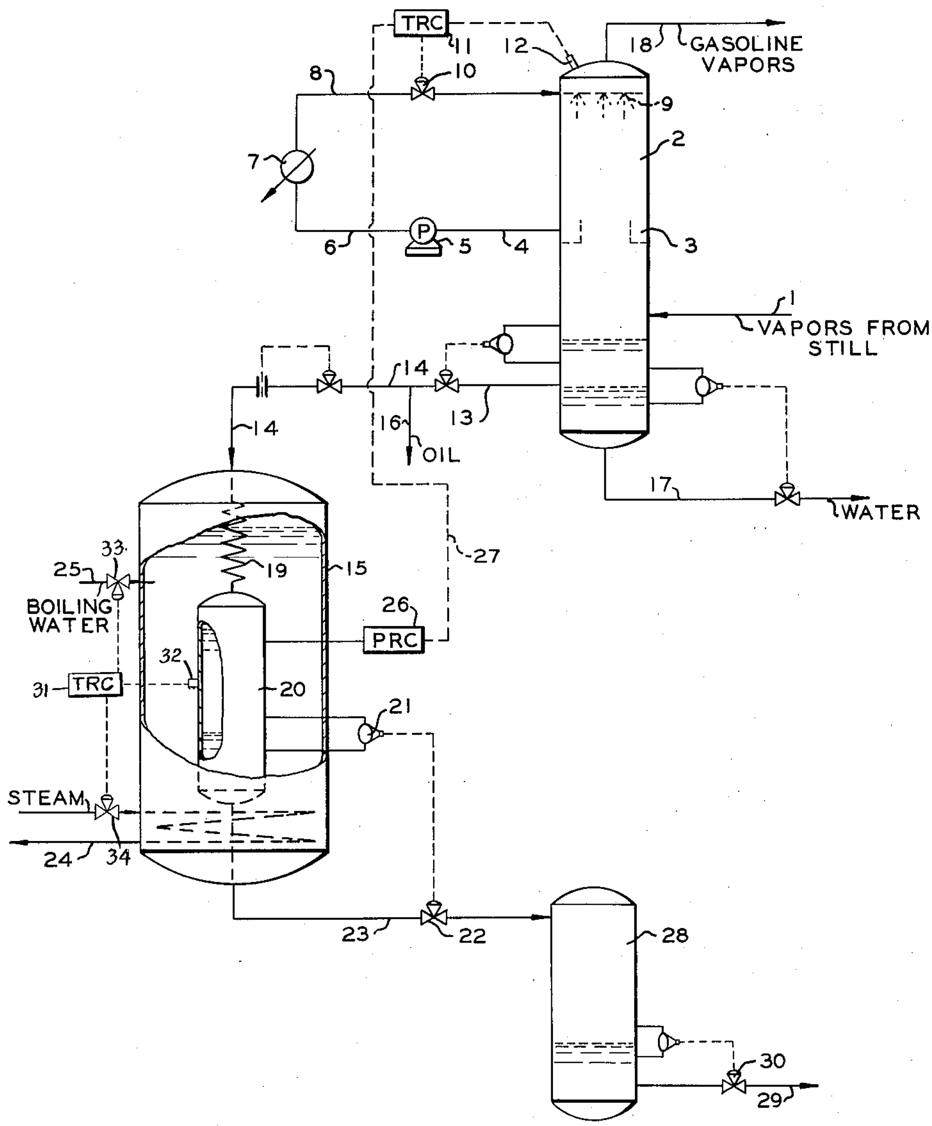

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METHOD OF CONTROLLING DEPHLEGMATION

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2 Claims. (Cl. 208—341)

This invention relates to a dephlegmator control and method. In one of its aspects, the invention relates to a method and means for the recovery of hydrocarbon or gasoline vapors such as natural gasoline vapors from an absorber oil by dephlegmating said vapors in a tower employing a reflux stream fed to the top of said tower responsive to the temperature at the top of said tower, measuring the vapor pressure of at least a portion of the kettle product from said tower and resetting the control of the reflux stream responsive to said vapor pressure. In another of its aspects, the invention provides means and method substantially as described wherein kettle bottoms are removed, passed through a temperature-adjusting zone constantly maintained at a given liquid level in a vapor pressure sensing zone following which the vapor pressure is used to reset the tower top temperature control.

Since this invention is particularly adapted to the recovery of natural gasoline vapors, it will be described in connection therewith.

It is now known to dephlegmate gasoline containing vapors obtained from a stripping still in which the gasoline is stripped from an absorber oil. The vapors unavoidably contain some absorber oil. Also, due to variation in conditions or compositions of feed, the stripper effluent vapors vary in composition from time to time. This results either in removing overhead with gasoline vapors from the dephlegmator, absorber oil which then constitutes a loss of oil from the system, or in returning with the dephlegmator oil bottoms to the stripper for reuse as a "lean" oil which is so rich in gasoline to reduce materially the throughput of the stripper.

It has occurred to me that the vapor pressure of the absorber oil will vary quite readily detectably with variations in the still vapors fed to the dephlegmator. Further, it has occurred to me that detecting said vapor pressure will permit control of the dephlegmator tower top temperature responsive to said vapors which in turn will avoid loss of absorber oil overhead with the gasoline or return of gasoline with the absorber oil bottoms to the stripper.

It is an object of this invention to provide an improved dephlegmator control and method. It is another object of this invention to provide an improved method and apparatus for recovery of hydrocarbon vapors such as natural gasoline vapors from an absorber oil.

Other aspects, objects and the several advantages of this invention are apparent from a study of this disclosure, the drawing and the appended claims.

According to this invention, there are provided a method, and means, for recovery of vapors from an absorber oil which comprises passing vapors containing some of said absorber oil into a dephlegmator or fractionation column, controlling a reflux to the top of said column responsive to the temperature at the top of said column, detecting the vapor pressure of absorber oil bottoms from said column and resetting the control of the tower top temperature responsive to variations in said vapor pressure.

In the drawing, there is shown diagrammatically a specific embodiment of the invention as it is applied to the recovery of natural gasoline from stripper still vapors containing said gasoline and unavoidably some absorber oil.

Referring now to the drawing, gasoline vapors from a stripping still containing some absorber oil unavoidably removed from the stripping still with the gasoline vapors enter by way of pipe **1** to dephlegmator **2**. In dephlegmator **2** conditions are adjusted to dephlegmate the vapors to knock down or remove from them the said absorber oil. This is accomplished by removing from tray **3** by way of pipe **4** and pumping by way of pump **5**, pipe **6**, cooling condenser **7** and through valve control pipe **8** to spray **9** in the top of the tower a controlled amount of water. Thus, valve **10** in pipe **8** is controlled by temperature recorder controller **11**, which in turn is responsive to the tower top temperature detected at **12** and to the control of the invention.

According to the invention the oil phase at the foot of the dephlegmator is removed by way of pipe **13** and passes in part by way of pipe **14** into vapor pressure detecting device **15**. The remainder of the oil phase is returned by way of pipe **16** to the stripper still. Also, water is withdrawn from dephlegmator **2** by way of pipe **17** and gasoline vapors are taken overhead by pipe **18**. Returning now to vapor pressure detecting device **15**, the oil phase enters cooling coil **19** and passes into the top of chamber **20** wherein the liquid level is maintained by way of controller **21** and valve **22** in pipe **23**. Still another heating coil **24** is provided for temperature adjustment. It is advantageous to adjust the temperature of the oil in vessel **20** to the boiling point of water. To this end, boiling water or water near its boiling point is introduced into the space surrounding coil **19** by way of pipe **25**. By adjusting amounts of water and/or steam introduced, the temperature of the vapor in space **20** can be maintained constant. Temperature controllers are advantageously employed for this purpose. Temperature-recorder-controller **31** responsive to temperature sensing element **32** can control one or both of valves **33** and **34** to adjust the water and/or steam in lines **25** and **24**, respectively. Pressure recorder controller **26** which is operatively connected to vapor space **20** passes a signal by way of pipe **27** to temperature recorder controller **11** to reset the same to maintain a tower top temperature responsive to the detected vapor pressure.

While the vapor pressure detecting arrangement, which has been shown is that which is now preferred, it will be obvious to those skilled in the art in possession of this disclosure that other means can be employed to detect the vapor pressure of the oil phase leaving column **2** and to reset the reflux to the top of the tower, and, therefore, the tower top temperature is responsive to said vapor pressure, according to the invention.

The system is operated so that only traces of lean oil will appear in the overhead gasoline vapors taken off in pipe **18**. The amount of lean oil in the vapors in pipe **18** can be determined by a suitable means or method. A simple manner of detection involved is an Engler type distillation which results in a residue of lean oil which can be readily measured. Since only traces of lean oil are to be found in the overhead vapors leaving by way of pipe **18**, it is preferred to operate the invention so that there will be only traces of lean oil visible in the flask, thus, avoiding actual measurement of lean oil in the flask.

Furthermore, as noted, the vapor pressure in chamber **20** is maintained constant, thus, when the vapor pressure of the hydrocarbons in chamber **20** increases beyond a tolerable amount, controller **26** will reset controller **11** to decrease cooling water entering dephlegmator **2** at **9**, thus, to take overhead more gasoline vapors, in effect lowering the vapor pressure of the oil finding its way to chamber **20** and vice versa. If at any time during operation it is found that gasoline vapors condensed from pipe **18** contain an undesirable amount of lean oil, controller **13** is readjusted to maintain an oil vapor pressure in vessel or chamber **20** and vice versa if insufficient gasoline is being recovered overhead through pipe **18**.

Usually the pressure in chamber **20** will be above atmospheric, in which event, oil removed by way of valve **22** and pipe **23** to tank **28** and flows through pressure drop tank **28** being maintained at atmospheric pressure. Oil from tank **28** is removed by way of pipe **29** and controlled by valve **30**. This oil can be returned for further use to absorb gasoline. If, for any reason, it is desired to operate chamber **20** below atmospheric pressure, tank **28** will be operated at a pressure lower than that of the pressure to be maintained in chamber **20**.

Under ordinary conditions the vapor pressure maintained in chamber **20** can vary from as low as 10 to as high as 50 pounds per square inch absolute. The actual vapor pressure which will be maintained in chamber **20** will, of course, depend upon factors extant in the operation but is to an extent subject to control of the operator since conditions can be changed by maintaining somewhat different temperatures and pressures at various places in the operation.

Although the invention has been described with respect to the recovery of natural gasoline from absorber oil vapors with which it is admixed, it will be obvious to one skilled in the art in possession of this disclosure that the modus operandi, which is a physical one, is applicable to other vapor recovery or fractionation systems.

Specific example

The following operational data are given in connection with the operation of a low pressure dephlegmator operated in conjunction with a combination of high and low pressure streams.

2. Dephlegmator	Top 165–185° F.—45 p.s.i.g.
18. Gasoline vapors overhead	288 mols water per day; 3240 mols hydrocarbons per day; combined specific gravity 2.05 at 60° F.; 160°—45 p.s.i.g.
7. Vapors to dephlegmator	7,748 mols hydrocarbons per day; 29,744 mols water per day; 380° F.—50 p.s.i.g.
16. Condensed Hydrocarbons	4,498 mols per day—279° F.
4. Reflux water out of dephlegmator	260° F.—385 g.p.m.
9. Reflux water into dephlegmator	130° F.
14. Oil to chamber 20	1/2 gallon/minute.

As noted above, the drawing is merely diagrammatic and is not intended to fully show all component parts of equipment which one skilled in the art will routinely design for the operation. Indeed, the showing of an element or piece of equipment does not mean that all such or similar pieces of equipment which may or can be designed by one skilled in the art in possession of this disclosure have been shown. Likewise, the omission of an element which one skilled in the art might include in an actual unit does not mean that such a piece of equipment is intended to be omitted simply because it does not appear in the drawing. Suffice to say, the drawing is for illustrative purposes as is the description thereof.

Reasonable variation and modification are possible within the scope of the foregoing disclosure, drawing, and the appended claims to the invention, the essence of which is that a vapor recovery or fractionation tower overhead temperature is controlled responsive to the vapor pressure of at least a portion of the kettle product substantially as set forth and described herein.

I claim:

1. A method for recovering a maximum amount of

gasoline, and removing absorber oil, from a mixture of gasoline vapors and entrained absorber oil unavoidably entrained when said vapors are stripped in a stripping zone from a gasoline component-rich absorber oil obtained in the recovery of natural gasoline, which comprises feeding said mixture of gasoline vapors and entrained absorber oil to a dephlegmation zone heated only by said mixture of vapors and entrained absorber oil, condensing in said dephlegmation zone some gasoline component and absorber oil, refluxing said dephlegmation zone with water, removing from said dephlegmation zone at the top portion thereof gasoline vapors from which entrained absorber oil has been removed, collecting in said dephlegmation zone, at a point substantially removed from the top portion thereof at which gasoline vapors are removed, water which has been introduced into said dephlegmation zone, passing at least a portion of said water to the top portion of said dephlegmation zone as reflux therefor, controlling the temperature of the gasoline vapors removed from the top portion of said dephlegmation zone by, in a controlling zone, controlling the reflux introduced into the top portion of said dephlegmation zone responsive to said temperature, thus while keeping the temperature of the gasoline vapors exiting from the top portion of said dephlegmation zone at a constant level permitting the temperature of liquid collecting in the bottom portion of said dephlegmation zone to vary, removing at least a portion of said liquid collecting in the bottom portion of said dephlegmation zone, passing the removed liquid to a vapor pressure sensing zone, in said vapor pressure sensing zone adjusting the removed liquid passed thereto to a constant predetermined temperature, sensing the vapor pressure of the liquid in said vapor pressure sensing zone at said constant predetermined temperature, relaying a signal corresponding to said sensed vapor pressure to said controlling zone and resetting the controlling zone to control the temperature of the gasoline vapors removed from the top of said dephlegmation zone so as to maintain the vapor pressure of said removed liquid, when sensed at said constant predetermined temperature, at a constant predetermined value, thereby removing from the mixture of gasoline vapors and absorber oil, a maximum amount of gasoline so that absorber oil returned to the recovery of natural gasoline will have a maximum capacity for recovering additional components of gasoline and ultimately a maximum amount of gasoline is recovered from both the gasoline recovery system and the dephlegmation zone.

2. A method for recovering a maximum amount of vapors and removing absorber medium from a mixture of vapors and enrtained absorber medium, unavoidably entrained when said vapors are stripped in a stripping zone from a vapor-rich absorber medium which comprises feeding said mixture of vapors and entrained absorber medium to a dephlegmation zone heated only by said mixture of vapors and entrained absorber medium, forming a liquid in said dephlegmation zone by dephlegmation of said mixture of vapors and entrained absorber medium therein, refluxing said dephlegmation zone with a portion of the liquid therein, removing from said dephlegmation zone at the top portion thereof vapors from which entrained absorber medium has been removed, collecting in said dephlegmation zone, at a point substantially removed from the top portion thereof at which vapors are removed, liquid which has been introduced into said dephlegmation zone and which has been obtained as stated herein, passing at least a portion of said liquid to the top portion of said dephlegmation zone as reflux therefor, controlling the temperature of the vapors removed from the top portion of said dephlegmation zone by, in a controlled zone, controlling the reflux introduced into the top portion of said dephlegmation zone responsive to said temperature, thus while keeping the temperature of the vapors exiting from the top portion of said dephlegmation zone at a constant level permitting the temperature of the liq-

uid collecting in the bottom portion of said dephlegmation zone to vary, removing at least a portion of the liquid collecting in the bottom portion of said dephlegmation zone, passing the removed liquid to a vapor pressure sensing zone, in said vapor pressure sensing zone adjusting the removed liquid passed thereto to a constant predetermined temperature, sensing the vapor pressure of the liquid in said vapor pressure sensing zone at said constant predetermined temperature, relaying a signal corresponding to said sensed vapor pressure to said controlling zone and resetting the controlling zone to control the temperature of the vapors removed from the top of said dephlegmation zone so as to maintain the vapor pressure of said removed liquid, when sensed at said constant predetermined temperature, at a constant predetermined value, thereby removing from the mixture of vapors and absorber medium a maximum amount of vapors so that the absorber medium removed from the dephlegmation zone will have a maximum capacity for recovering additional absorbable vapors so that ultimately a maximum amount of vapor is recovered from both a vapor recovery system using said absorber medium and the dephlegmation zone.

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