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DEPHLEGMATOR OPERATION AND APPARATUS

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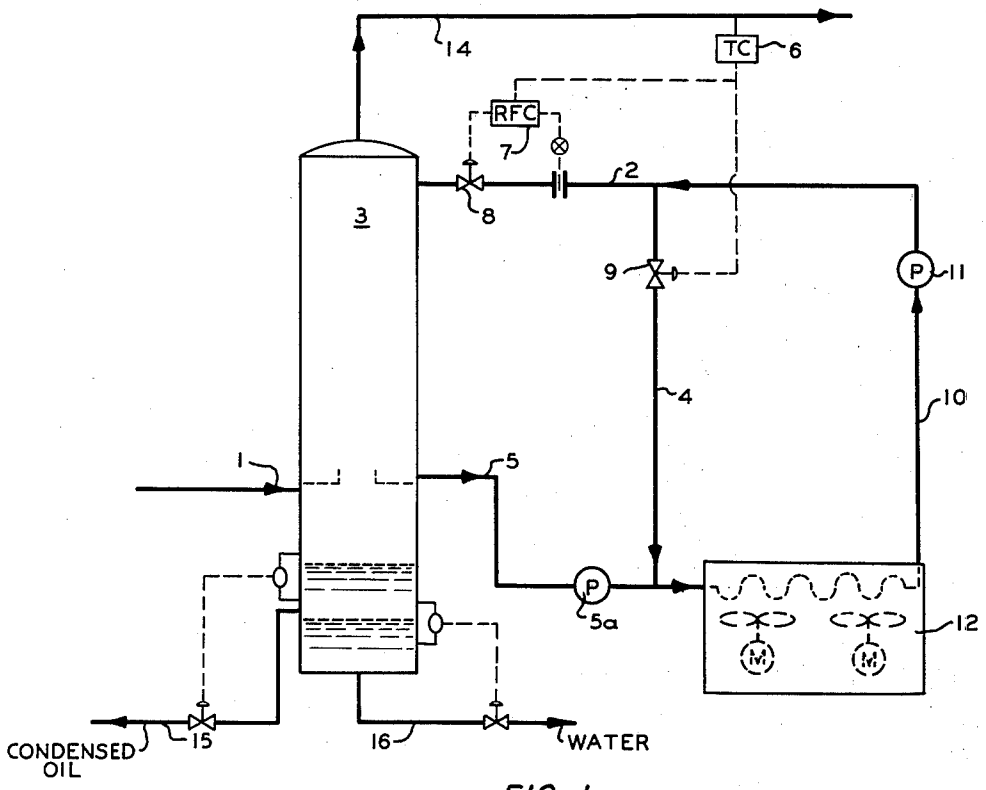


FIG. 1

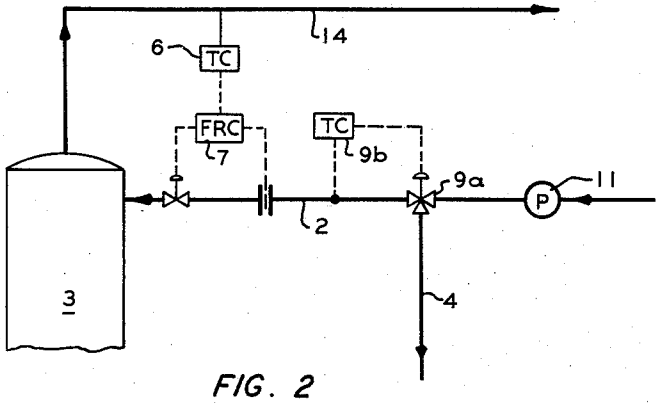


FIG. 2

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DEPHLEGMATOR OPERATION AND APPARATUS

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This invention relates to dephlegmator operation and to a dephlegmator apparatus. In one of its aspects, the invention relates to a method of operating a dephlegmator, for example, a dephlegmator used to dephlegmate vapors containing gasoline and oil used to strip gasoline from gases or vapors containing the same, in which operation, water is cyclically passed from the dephlegmator through a cooler and back to the dephlegmator and in which operation there is returned to the suction of a provided circulating pump, a portion of cooled water, the portion being determined by the dephlegmator tower top temperature. In another of its aspects, the invention relates to an apparatus comprising in combination a dephlegmator tower, means for circulating liquid from said tower through a cooler and back to said tower, means for circulating at least a portion of liquid from said cooler directly back to said cooler in cyclic manner, means responsive to the dephlegmator tower overhead temperature, and means responsive to said means responsive to tower top temperature to control said means for circulating said portion back to said cooler.

It is known in the industry to dephlegmate vapors obtained from an operation in which gasoline vapors are stripped from a so-called rich oil. In the dephlegmation of the vapors which consist essentially of gasoline components absorbed in oil and water, the water being used as a species of reflux or tower top temperature controller, the water is cycled from an intermediate point of the usual dephlegmator through a cooling zone and thence to a point in the upper portion of the dephlegmator tower.

In the operation of the usual dephlegmator, employing an air fin cooler, the cooler the reflux water flowing through the air fin cooler, the less water is passed into the dephlegmator. This decrease in water passed into the dephlegmator may be so low that the flow through the cooler will be decreased until the water will freeze in the coils of the cooler. Further, it has been noted that when the overhead vapor temperature of the dephlegmator is controlled with a temperature-controller-recorder which regulates the flow of water through the cooler and into the dephlegmator, the overhead vapor temperature can vary as much as ±5° F.

It has now been found that if the flow of water from the dephlegmator through the air fin cooler is so controlled that there will be a substantially constant flow of water through the air fin cooler, regardless of the requirement of the dephlegmator for cooled water, certain advantages accrue. Thus, the substantially constant flow rate through the dephlegmator avoids freezing of the water in the coils of the cooler and, quite surprisingly, there is a considerable reduction in the fluctuation of the overhead vapor temperature.

It is an object of this invention to provide a dephlegmator operation. It is a further object of this invention to provide a dephlegmator apparatus. It is a still further object of this invention to provide a novel control for a dephlegmator operation. It is a further object of this invention to dephlegmate gasoline vapors, to recover absorbent oil therefrom, in an improved manner. It is a still further object of this invention to provide means and method for the control of flow of water through an air fin cooler in a manner such that freezing of the cooler coils is avoided. A further object still provides means and method for a dephlegmator operation whereby the

overhead vapor temperature of the dephlegmator can be more closely controlled.

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

According to the present invention, water from a dephlegmation zone is passed through an air fin cooler and then back to the dephlegmation zone for use in conventional manner, the rate of flow of water back to the dephlegmation zone is controlled responsive to the dephlegmation zone overhead vapor temperature, flow of water through the cooler being achieved by controlling a bypass from the discharge of the cooler to the feed to the cooler responsive to said overhead vapor temperature.

In the drawing, FIGURE 1 is a diagrammatic view of the flow plan of a particular application of the basic concept of the invention. FIGURE 2 shows a different form of apparatus for embodying the invention.

Referring now to the drawing which diagrammatically shows a form or embodiment of the invention, gasoline vapors containing some unavoidably entrained absorbent oil are fed to dephlegmator zone **3** by pipe **1**. Gasoline vapors travel upwardly through the zone which is "refluxed" by cooled water which enters by pipe **2**. Water is collected on a tray within zone **3** and is passed by pipe **5**, pump **5A**, through air fin cooler **12**, and by pipe **10** and pump **11** to pipe **2** back to dephlegmator **3**. A cross-over pipe **4** with an automatically controlled valve **9** is provided, as shown. The temperature of overhead gasoline vapors passing by pipe **14** is sensed by temperature controller recorder **6** which is operatively connected to valve **9** in pipe **4**. The dephlegmated oil is removed from a bottom portion of the dephlegmator by pipe **15**, and water is withdrawn from the bottom thereof by pipe **16**.

In operation, depending upon the dephlegmator tower top vapor temperature, valve **9** in pipe **4** will be more or less open. Together, the flow through pipe **2** and pipe **4** will total the flow through the air fin cooler. If desired, make-up water can enter the system at any desired point, for example, just ahead of pump **5A**.

It will be understood by one skilled in the art in possession of this disclosure having studied the same, that the practice of the present invention will provide a flow of water through the cooler at a substantially constant rate. In effect, then, the method of the invention involves bypassing some of the effluent water from the cooler back into the suction of the pump, forcing water through the cooler. Thus, the rate of bypassing water flow is controlled with a temperature controller recorder which is connected to the overhead vapor line and to a motored valve on the bypass line.

Operating according to this invention, it has been found that the fluctuation of the overhead vapor temperature in the wintertime has been reduced from as much as ±5° F. to about ±2° F. and even much lower. This reduction in the fluctuation of the temperature is a result of the more uniform flow of water through the air fin cooler.

Although the invention has been described in connection with an air fin cooler, it is evident that the flow pattern and control can be employed with advantageous results in connection with other cooling zones or coolers. The invention being physical in character, one skilled in the art can readily adapt the same to other operations and to various forms of apparatus in which various vapors are being dephlegmated.

As an example of the operation of the invention, vapors from a stripping still, not shown, are passed through line **1** at the rate of 2600 moles of hydrocarbons per day and 7000 pounds of steam per hour. Water is passed through line **2** into dephlegmator **3** at the rate of about 250 gallons per minute. This rate can vary from 120–270

g.p.m. Water is by-passed through line 4 at the rate of about 20–150 g.p.m. Under abnormal conditions, this rate can vary from 0–270 g.p.m. The temperature of the air out of the air fin cooler can vary from 100–140° F. The temperature of the water entering the dephlegmator, through line 2, can vary from 100–150° F. However, the temperature of the water from one hour to the next will vary only 5–10° F. The temperature of the water passing through line 5 from dephlegmator 3 is about 270° F. The temperature of the overhead vapors is 160±2° F. Before the use of this invention, in the particular operation described, the overhead vapor temperature was 160±5° F. The temperature of the air out of the air fin cooler varies from 100–140° F. There are two fans in the air fin cooler of the said operation described. Each fan may be operated at either high or low speeds. To provide a rough control of the temperature of the water passing out of air fin cooler, the speeds of the fans are varied from high to low and in some instances, a fan may not be operated.

In the operation of the invention, the temperature of the overhead vapors is measured by pneumatic temperature controller 6. This is a conventional temperature controller whose output signal is in proportion to the temperature measured. The rate of flow of water through line 2 is controlled by a conventional rate of flow controller 7 which has a reset. The motor valve 8 is a conventional normally closed valve. The signal sent from temperature controller 6 resets the rate of flow of controller 7 to increase the rate of flow through line 2 when the overhead vapor temperature is above a predetermined value. The pneumatic signal sent from temperature-controller 6 also passes to normally opened valve 9. When the overhead vapor temperature rises above a predetermined value, the pneumatic signal sent from temperature-controller 6 to normally open valve 9, is increased to decrease the flow of water through by-pass line 4.

In FIGURE 2, the method of control is different from that of FIGURE 1. In FIGURE 2, the temperature-controller only controls controller-flow-recorder 7. A three-way valve 9A is used to control the rate of flow of water that is by-passed through line 4. This three-way valve 9A is controlled by a temperature controller 9B to maintain the temperature of the water flowing through line 2 at a predetermined temperature.

Reasonable variation and modification are possible within the scope of the foregoing disclosure, the drawing and the appended claims to the invention, the essence of which is that in the operation of a dephlegmator to which water is passed as a "reflux" and from which water is taken and circulated through a cooling apparatus, such as an air fin cooler, a substantially constant flow of water through the cooler is maintained by regulating a return from the discharge of the air fin cooler to the air fin cooler responsive to the dephlegmator overhead vapor temperature and that suitable apparatus for so doing has also been provided.

I claim:

1. A method of dephlegmating vapors in a dephlegmation zone which comprises feeding vapors into said zone, collecting in and removing from within said zone a liquid moving downwardly in said zone in direct contact with vapors therein, cycling said liquid into and through a cooling zone and then directly into the upper portion of said dephlegmation zone for intimate direct contact with said vapors in said zone responsive to the temperature of the vapors leaving said zone in an amount sufficient to maintain the temperature of said vapors at a predetermined valve, by-passing at least a portion of the liquid effluent from said cooling zone directly back to the inlet of and through said cooling zone, and controlling the amount of by-passed liquid responsive to the temperature of vapors at the top of said dephlegmation zone.

2. A method of dephlegmating vapors according to claim 1 wherein the cooling zone is cooled by atmospheric air.

3. A method of dephlegmating gasoline vapors containing some unavoidably entrained absorbent oil which comprises the steps in combination as follows: passing said vapors to a dephlegmation zone, passing the vapors upwardly through said zone, removing overhead gasoline vapors, refluxing said zone with cooled water which is passed into said zone into direct contact with vapor therein, collecting reflux water in said zone, removing said water from said zone, passing said water to a cooling zone, passing cooled water from said cooling zone to the dephlegmation zone as reflux therefor, passing the water passing through said cooling zone therethrough at a substantially constant rate of flow, adjusting and controlling the rate of flow of said cooling water reflux to said dephlegmation zone responsive to the temperature of gasoline vapors taken overhead from said zone, passing at least a portion of the cooled water from the cooling zone directly back to the inlet of and through the same cooling zone, and regulating the amount of water passed directly back to said cooling zone responsive to the temperature of the vapors taken overhead from said dephlegmation zone.

4. Dephlegmator apparatus comprising in combination as follows: a dephlegmator, a cooler, a pump, piping connecting said dephlegmator to said pump, piping connecting said pump to said cooler, and piping connecting said cooler to said dephlegmator, said dephlegmator, piping, pump and cooler being arranged so that liquid from the dephlegmator can be cyclically pumped through the cooler and back to the dephlegmator, the liquid being withdrawn from a lower portion of the dephlegmator and being returned to the dephlegmator at an upper portion thereof, piping connecting a point in the pipe between the discharge of the cooler and the dephlegmator and the inlet of said cooler, a control valve in said last-mentioned piping, temperature-controller-recorder means at the top of said dephlegmator, said last-mentioned means being operatively connected to said valve, a flow controller on said piping connecting the discharge of said cooler and said dephlegmator, said flow controller being positioned on said piping between said point and said dephlegmator, said flow controller being responsive to control rate of flow responsive to said temperature-controller-recorder means.

5. A method according to claim 3 wherein the amount of water passed directly back to said cooling zone responsive to the temperature of the vapors taken overhead is adjusted simultaneously with said controlling the rate of flow of said cooling water reflux.

6. A method of dephlegmating gasoline vapors containing some unavoidably entrained absorbent oil which comprises the steps in combination as follows: passing said vapors to a dephlegmation zone, passing the vapors upwardly through said zone, removing overhead gasoline vapors, refluxing said zone with cooled water which is passed into said zone into direct contact with vapor therein, collecting reflux water in said zone, removing said water from said zone, passing said water to a cooling zone, passing cooled water from said cooling zone to the dephlegmation zone as reflux therefrom, passing the water passing through said cooling zone therethrough at a substantially constant rate of flow, adjusting and controlling the rate of flow of said cooling water reflux to said dephlegmation zone responsive to the temperature of gasoline vapors taken overhead from said zone, passing at least a portion of the cooled water from the cooling zone directly back to the inlet of and through the same cooling zone, and regulating the amount of water passed directly back to said cooling zone responsive to the temperature of said reflux.

7. In the dephlegmation of a vapor in a dephlegmation zone by contacting the same with a cooling liquid introduced into direct contact with said vapors in said zone

wherein the cooling liquid used in said zone is collected and passed to a cooling zone, and from said cooling zone, again to said dephlegmation zone, thus establishing a circuit of cooling liquid flowing from said cooling zone to said dephlegmation zone and back to said cooling zone, the improvement which comprises passing the cooling liquid through said cooling zone at a substantially constant rate of flow, controlling the rate of flow of cooling liquid passing from said cooling zone into said dephlegmation zone responsive to the temperature of vapors leaving said dephlegmation zone, by-passing directly back to the

inlet of said cooling zone a portion of the cooling liquid passing from said cooling zone to said dephlegmation zone and back to said cooling zone, and controlling the rate of by-passing of said portion of the cooling liquid responsive to said temperature.

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