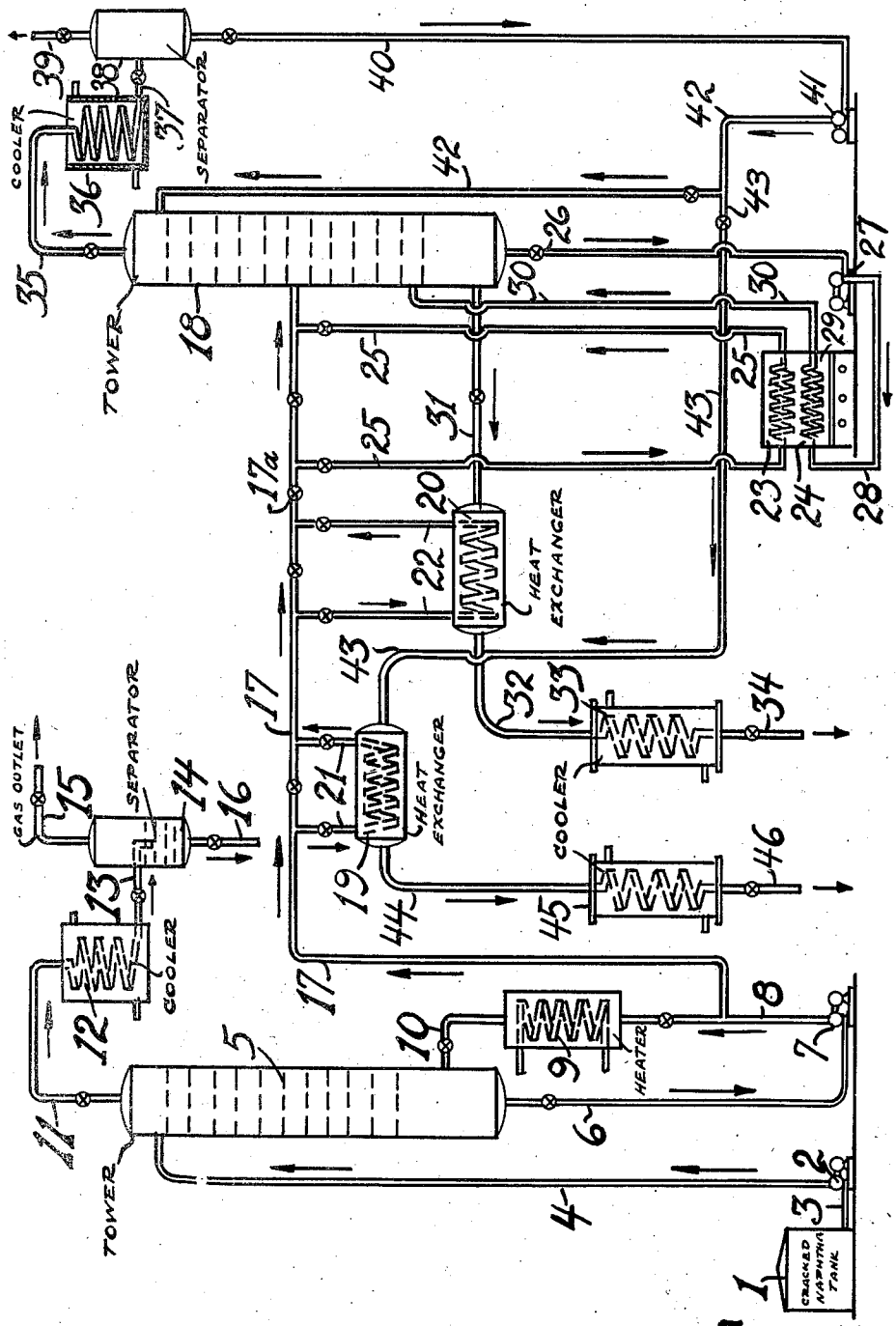
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TREATMENT OF HYDROCARBON OILS

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TREATMENT OF HYDROCARBON OILS

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This invention relates to certain improvements in the treatment of hydrocarbon oils and is more particularly concerned with the desulfiding, stabilization and fractionation of hydrocarbon distillates such as naphthas, heavy naphthas, gas oils and the like.

Naphthas obtained for example in pressure cracking operations frequently contain relatively large quantities of hydrogen sulfide. In addition, they usually contain small amounts of light hydrocarbons such as propane, butane and pentane which are too volatile for the purposes for which the naphtha is to be used. These undesirable constituents must be removed before the naphtha is fit for commercial use. The naphtha fraction must also frequently be fractionated in order to obtain oils of the proper boiling ranges for particular purposes. These and other objects are accomplished by stabilization and fractionation or rerunning. Heretofore stabilization has been carried out in a tower operating on the depropanizer principle in which the naphtha to be treated is introduced into a tower the top of which is maintained at a relatively low temperature and the bottom at a relatively much higher temperature. The undesired lighter fractions and hydrogen sulfide are removed from the top of the tower and the desulfided and stabilized naphtha removed from the bottom of the tower. These bottoms are still at a relatively high temperature and they are ordinarily cooled by means of water in a shell and tube type cooler. The removal of heat in this manner is not only a waste of heat but involves additional investment and operating expense which makes the entire operation unduly costly. Subsequently the cooled stabilized naphtha may have to be rerun and this operation involves reheating of the naphthas to a suitable rerunning temperature.

It is a particular object of the present invention to provide a new and less costly method of desulfiding, stabilizing and rerunning hydrocarbon distillates in which the heat content of the stabilized naphtha is utilized instead of being lost.

The nature of the invention and the manner in which it is carried out will be fully understood from the following description when read with reference to the accompanying drawing which is a semi-diagrammatic view in sectional elevation of one type of apparatus suitable for the purpose.

In the description it will be assumed that the hydrocarbon distillate to be treated is a cracked naphtha but it should be understood that the invention is not limited to such a distillate but is equally applicable to other types of hydrocarbon distillates which must be stabilized and rerun.

Referring to the drawing, numeral 1 designates a supply tank of cracked naphtha to be treated. Pump 2 withdraws naphtha from tank 1 through line 3 and forces it at atmospheric temperature through line 4 into the top portion of a conventional type plate tower 5 operating on the depropanizer principle. The bottom of the tower is maintained at a temperature of say 250 to 300° F. by continuously withdrawing liquid through line 6 by means of pump 7 and forcing it through line 8 into and through an indirect heating means 9 and then returning it into the tower through line 10 at a point somewhat above the bottom thereof. The heating means 9 may be supplied with any convenient heating medium such for example as steam. The tower 5 is maintained under pressure, preferably of about 60 to 100 pounds per square inch. With the heat supplied to the bottom of the tower sufficient to maintain a temperature between 250 and 300° F. the top of the tower will be maintained at a temperature between 100 and 130° F.

Gases and vapors are removed from the top of tower 5 through line 11, are passed through a cooling means 12 and then discharged through line 13 into a separator 14 from which uncondensed gases are removed through line 15 and condensate through line 16. It will be found that substantially all of the hydrogen sulfide content of the original naphtha will be removed through line 15. The condensate may be passed to the main refinery stabilizing system or otherwise disposed of.

A portion of the bottoms leaving tower 5 through line 6 will be required to be circulated through the reboiler circuit to maintain the bottom of the tower at the desired temperature. The remaining portion of the hot bottoms from tower 5 will be withdrawn from line 8 through line 17 and introduced into a second tower 18 in which further stabilization and fractionation of the desulfided naphtha takes place. Tower 18 may also be a conventional type plate tower essentially similar to tower 5. Prior to the introduction of the hot bottoms from tower 5 into tower 18, all or a portion thereof are passed through heat exchanger 20 wherein they are heated by indirect heat exchange with the heavier fractions which later will be withdrawn from tower 18. Additional heating of the bottoms from tower 5 prior to their introduction

into tower 18 may be effected by passing all or a portion thereof through a heating coil. In the drawing the hot bottoms from tower 5 are bypassed around heat exchanger 19 and passed into 20 through the circuit designated by numeral 22 and are passed through a heating coil 23 mounted in a furnace setting 24 through a circuit designated by numeral 25.

Tower 18 is maintained under a somewhat lower pressure than tower 5, say between 30 and 50 pounds per square inch, so that a pressure release valve 17a is provided in line 17 to effect the necessary reduction in pressure. The bottom of tower 18 is maintained at a temperature between say 400 and 450° F. by continuously circulating a portion of the bottoms withdrawn therefrom through a heating coil. Thus a portion of the bottoms is withdrawn from tower 18 through line 26 by means of pump 27, forced through line 28 into and through a heating coil 29 which may be mounted in the same furnace setting 24 as heating coil 23 and then reintroduced into tower 18 through line 30 at a point near the bottom thereof. With the bottom of tower 18 maintained at a temperature of 400 to 450° F. in this manner, the top of tower 18 will be maintained at a temperature between say 250 and 300° F.

A portion of the bottoms in tower 18 is withdrawn therefrom through line 31, passed through heat exchanger 20 to give up part of its heat content to the bottoms from tower 5, then passed through line 32 into a cooling means 33 and finally removed from the system through line 34. These bottoms will consist of the heavier fractions of the original naphtha feed.

The lighter fractions are removed from tower 18 through line 35, passed through a cooling means 36 and then discharged through line 37 into a separator 38 from which uncondensed gases, if any, are withdrawn through line 39. Condensate is removed from separator 38 through line 40 by means of pump 41 and a small portion thereof is returned to the top of tower 18 through line 42 to act as reflux. The remainder of the condensate from separator 38 is forced through line 43 into a cooling means 45 and finally is removed from the system through line 46. This condensate consists essentially of the lighter, stabilized fractions of the original naphtha feed.

In the operation of the process it will be understood that the particular temperatures and pressures used will depend very largely upon the nature of the feed stock and the number and boiling range of the various fractions into which the feed is to be segregated.

The process of the invention is not restricted to a naphtha nor to the particular temperatures and pressures given above merely for illustrative purposes but is applicable in general to the treatment of any hydrocarbon distillate in which it is desired to remove a small amount of objectionable light ends and subsequently to separate the oil by fractional distillation into various fractions of predetermined physical characteristics.

We claim:

1. An improved method for desulfiding, stabilizing and fractionating a naphtha containing objectionable light ends which comprises introducing said naphtha into the top portion of a plate tower maintained under a superatmospheric pressure, maintaining the bottom portion of the tower at a temperature between 250 and 300° F., removing vapors and gases from the top of the tower, withdrawing hot liquid from the bottom of the tower and introducing it without cooling into the middle portion of a second plate tower maintained under a lower superatmospheric pressure than the first tower, maintaining the bottom portion of the second tower at a temperature between 400 and 450° F., removing vapors from the top of the second tower and liquid from the bottom thereof, condensing a portion of the vapors so removed to form a condensate, passing the bottoms from the second tower in indirect heat exchange relationship to the liquid removed from the bottom of the first tower and finally cooling said condensate and the liquid from the second tower to form a lighter naphtha fraction and a heavier naphtha fraction.

2. An improved method for desulfiding, stabilizing and fractionating a naphtha containing objectionable light ends which comprises introducing said naphtha into the top portion of a plate tower maintained under a superatmospheric pressure, maintaining the bottom portion of the tower at a temperature between 250 and 300° F., removing vapors and gases from the top of the tower, withdrawing hot liquid from the bottom of the tower, and introducing it without cooling and with the addition of further heat thereto into the middle portion of a second plate tower maintained under a lower superatmospheric pressure than the first tower, maintaining the bottom portion of the second tower at a temperature between 400 and 450° F., removing vapors from the top of the second tower and liquid from the bottom thereof, condensing a portion of the vapors so removed to form a condensate, passing the bottoms from the second tower in indirect heat exchange relationship to the liquid removed from the bottom of the first tower and finally cooling said condensate and the liquid from the second tower to form a lighter naphtha fraction and a heavier naphtha fraction.

3. Improved method of separating a relatively small amount of normally gaseous materials from a relatively large amount of normally liquid hydrocarbon oil boiling in the range between naphthas and gas oils containing same, which consists in introducing said oil as a liquid phase feed at a pressure not substantially above 100 lbs./sq. in. as the sole feed into the top of a fractionating tower, heating said oil in the bottom of said tower to a temperature sufficient to vaporize the most volatile hydrocarbon constituents and to boil out hydrogen sulfide, removing the vaporized constituents from the top of the tower, withdrawing the hot bottoms from said tower and passing them into a second fractionating tower at a pressure substantially lower than the pressure in said first tower but not substantially above 50 lbs./sq. in., and subjecting said bottoms to fractionation in said second tower, whereby the heat in said bottoms from the first tower substantially assists the fractionation in the second tower.

4. Method according to claim 3 in which propane and lighter hydrocarbons are vaporized and removed from the first tower.

5. Improved method of separating a relatively small amount of normally gaseous materials from a relatively large amount of normally liquid naphtha containing same, which consists in introduring said naphtha as a liquid phase feed at a pressure of about 60–100 lbs./sq. in, as the sole feed into the top of a plate fractionating tower, heating said naphtha in the bottom of said tower to a temperature of about 250° to 300° F., thereby maintaining the top of the tower at a temperature of 100° to 130° F., and thereby vaporizing

the most volatile hydrocarbon constituents and boiling out hydrogen sulfide from said naphtha, removing said gaseous constituents from the top of the tower, withdrawing the hot bottoms from said tower and passing them into a second fractionating plate tower at a pressure of about 30–50 lbs./ sq. in. and subjecting said first tower bottoms to fractionation in said second tower while maintaining the bottom of said second tower at a temperature of 400° to 450° F. and the top of said tower at a temperature of about 250° to 300° F., whereby the heat in the naphtha bottoms from the first tower substantially assists the fractionation in the second tower.

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