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SOLVENT-EXTRACTING GASOLINES

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It has been known for some time to selectively extract gasoline like other petroleum products. I have now found, however, that remarkably effective results may be had by pressure selective extraction of such light distillates by solvents operated in the neighborhood of the distillation temperature of the gasoline, particular care being taken to maintain the hydrocarbons in liquid state.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

The stock to be treated may be a gasoline or aromatized naphtha or other desired naphtha, the boiling range varying of course, in accordance with the intended use, whether for motor fuel or solvent usages, etc., and may involve wide or narrow cuts. Where the naphtha includes an appreciable proportion of light hydrocarbons, such as those of 5 carbon atoms or less, it may be advantageous to separate off by fractionation such light end, and, after the extraction treatment of the remainder, blend the light material back with the heavier.

The extraction treatment is carried out at an elevated temperature, approximating for instance (slightly below or above), that required for distilling the gasoline, and thus temperatures on the order of 300–400° F. or somewhat higher are applicable in general. The solvent for such operation is of a character having little selective solubility for aromatic and unsaturated hydrocarbons at ordinary temperatures, but effective solubility at the high temperatures indicated. Such solvents also must be capable of being maintained in liquid state and while lower boiling solvents can be used, with adequate pressure maintenance, it is advantageous to employ solvents of higher boiling point than the gasoline or naphtha treated, and such solvents may be in general high-boiling polysubstituted compounds where the substituents are OH, NH_2, CN, etc., illustrative of which are phenylene diamine, phenyl ethanol amine, diethanol amine, hydroxy ethyl ethylene diamine, etc. Particularly advantageous are mixtures of such polysubstituted compounds, as for example phenylene diamine and triethanol amine, a result being that the solvency can be adjusted by varying composition and also be right for the subsequent distillation.

The hydrocarbons which are to be treated are mixed with the treating agent or solvent generally in larger volumes than the hydrocarbon, for instance, 1 to 10 volumes of solvent per volume of stock, and a particular advantage of the present process is that the allowable solvent ratio can be increased very greatly over the old processes, without appreciable increase of the operating cost, and settling rates are very rapid at the high temperatures employed. The hydrocarbon distillate and solvent are thoroughly mixed and at an elevated temperature of 250–500° F., depending upon the solvent and the distillate treated; the layers are allowed to form and separate, this occurring readily at such high temperatures. The pressure is super-atmospheric up to 200 pounds per square inch, or more as desired in any instance. Advantageously, the extraction may be carried out by multi-stage equipment, or in an extraction tower. Counterflow of solvent and hydrocarbon phases is desirable, although not essential. The solvent and contained hydrocarbon are finally segregated by distilling off the hydrocarbons from the solvent, and it is to be particularly noticed that this may be very easily accomplished, by reason of the high heat content, it being merely necessary to reduce the pressure and flash off the hydrocarbons. These may be put to such appropriate use as desired, and the solvent may be returned to the extraction zone.

As an example: m-Phenylene diamine is mixed with catalytically aromatized straight run naphtha containing 43% aromatic and unsaturated hydrocarbons, the solvent ratio being 2:1 and operation being at the temperature of 325° F. and pressure 60 pounds per square inch. A 15 per cent yield of extract is obtained which contains 86 per cent aromatics and unsaturates.

As another example: A stock having a Kattwinkel test 38 and embodying a petroleum naphtha containing benzene, toluene and xylene, is extracted with diethanol amine in solvent ratio 2:1, at 350° F. and 100 pounds pressure per square inch. A 16 per cent yield of 69 Kattwinkel extract is obtained.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A process of the character described, which comprises fractionating from a naphtha hydrocarbon of five carbon atoms and under, extracting the remaining portion at around 400° F. under pressure maintaining liquid state with a selective solvent having a higher boiling point than the naphtha, allowing layers of raffinate naphtha and solvent extract to form and separate, distilling off extracted hydrocarbons from the solvent, and combining the previously segregated hydrocarbons of five carbon atoms and under with such extracted hydrocarbons of the naphtha.

2. A process of the character described, which comprises fractionating from a naphtha hydrocarbons of five carbon atoms and under, extracting the remaining portion at a temperature which is at least not much below its distillation temperature under pressure maintaining liquid state with a selective solvent having a higher boiling point than the naphtha, allowing layers of raffinate naphtha and solvent extract to form and separate, distilling off extracted hydrocarbons from the solvent, and combining the previously segregated hydrocarbons of five carbon atoms and under with such extracted hydrocarbons of the naphtha.

3. A process of the character described, which comprises fractionating from a naphtha hydrocarbons of five carbon atoms and under, extracting the remaining portion at a temperature which is at least not much below its distillation temperature under pressure maintaining liquid state with a high-boiling polysubstituted selective solvent having as substituents at least one member of the class consisting of the groups OH, NH_2 and CN, allowing layers of raffinate naphtha and solvent extract to form and separate, and distilling off extracted hydrocarbons from the solvent.

4. A process of the character described, which comprises extracting a naphtha at a temperature which is at least not much below its distillation temperature under pressure maintaining liquid state with a mixture of high-boiling polysubstituted selective solvents having as substituents at least one member of the class consisting of the groups OH, NH_2 and CN, allowing layers to form and separate, and distilling off extracted hydrocarbons from the solvent.

5. A process of the character described, which comprises extracting a naphtha at a temperature which is at least not much below its distillation temperature under pressure maintaining liquid state with m-phenylene diamine as a solvent, allowing layers to form and separate, and distilling off extracted hydrocarbons from the solvent.

6. A process of the character described, which comprises extracting a naphtha at a temperature which is at least not much below its distillation temperature with diethanol amine as a solvent while keeping the naphtha in liquid phase, allowing layers to form and separate, and distilling off extracted hydrocarbons from the solvent.

7. A process of the character described, which comprises extracting a naphtha at a temperature which is at least not much below its distillation temperature under pressure maintaining liquid state with a mixture of phenylene diamine and triethanol amine as a solvent, allowing layers to form and separate, and distilling off extracted hydrocarbons from the solvent.

8. A process of the character described, which comprises extracting a naphtha at a temperature which is at least not much below its distillation temperature under pressure maintaining liquid state with a polyhydroxy compound of higher boiling point as a solvent, and allowing layers to form and separate.

9. A process of the character described, which comprises extracting a naphtha at a temperature which is at least not much below its distillation temperature with a high boiling polysubstituted selective solvent having as substituents at least one member of the class consisting of OH, NH_2, and CN, while maintaining pressure and liquid state, and allowing layers to form and separate, and distilling the extracted hydrocarbons from the solvent.

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