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BENEFICIATING LIGHT HYDROCARBON DISTILLATES

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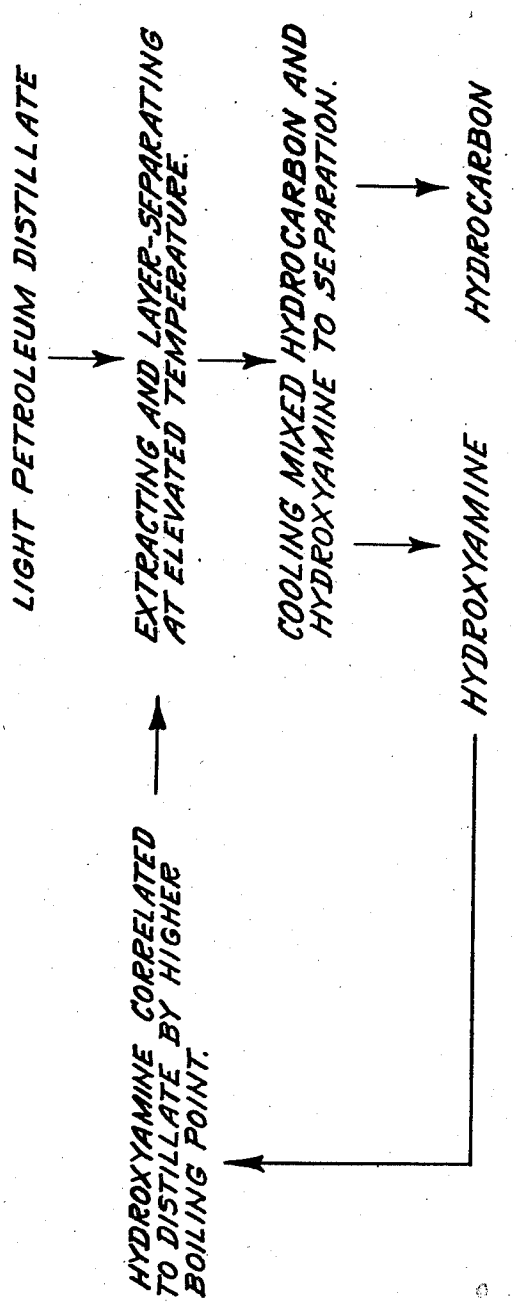

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BENEFICIATING LIGHT HYDROCARBON DISTILLATES

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8 Claims. (Cl. 196—13)

In the patent to Robert E. Burk, Patent No. 2,234,538, dated March 11, 1941, there is set forth the improving of naphthas by extraction with amine compounds. We have now found that the treatment of light hydrocarbon distillates to improve their anti-knock properties for fuel usages, or to improve their solvent properties for solvent usages can be effected with particular manufacturing advantages by procedure as detailed more particularly hereinafter.

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 and the annexed drawing 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.

In said annexed drawing:

The sole figure is a diagrammatic illustration on the order of a flow sheet, showing the process.

According to the use intended for the distillate, it may vary considerably in boiling range, and the boiling range may involve wide or narrow cuts. Where working with distillates containing appreciable proportions of hydrocarbons of five or less carbon atoms, it is sometimes desirable to separate these, by distillation, and proceed to extract the remainder. And, after the extraction treatment, the five carbon, and under, compounds may be re-mixed with the extracted product. For normal gasoline usage, a distillate with end point of 437° F., or in some instances lower, is employed, and for special fuel purposes the end point may be selected as appropriate. The distillate is treated with a solvent from the group consisting of high boiling hydroxyamines, their derivatives and their salts, the solvent being applied at elevated working temperature, and being separable on cooling, and having excellent selectivity between high and low anti-knock constituents and high and low solvent constituents. Illustrative of these solvent compounds are phenylethanolamine, phenyldiethanolamine, triethanolamine, diethylaminoethanol, dioctylaminoethanol, ethylphenylethanolamine, monoethanolamine, diethanolamine, monoisopropanolamine, triisopropanolamine, diisopropanolamine, N-morpholinethanol, hydroxyethylethanoldiamine, triethanolamine abietate, triethanolamine naphthenate, butyl diethanolamine, N-dibutylaminoethanol, p-tertiary-amyl phenyldiethanolamine, p-tertiary-amyl phenylmonoethanolamine, diethylamino-2,3 propanediol, etc. In some cases mixtures are advantageous. Where desired, diluents may be used with the amine compounds, and with advantage particularly with some of lesser solubility.

These selective solvents it will be noticed have the peculiarity of being higher boiling than the gasoline or hydrocarbon. And, such a higher boiling selective solvent results in the possibility of easy separation, without practical loss of solvent, and the gasoline or light hydrocarbon does not have to be stripped from a large amount of solvent, for example in amounts of 1–10 volumes of solvent per volume of stock to be extracted, the solvent being generally used in larger volume than the hydrocarbon. The extraction is effected at elevated temperature. The temperature may be 60–500° F. for instance, depending upon the solvent and the distillate treated. The mixture is then at substantially extracting temperature allowed to separate into layers. Of these, the raffinate layer and the solvent layer, the former contains very little solvent but the solvent layer contains a large amount of unsaturated hydrocarbons of gasoline range, also aromatic hydrocarbons if originally present, and such layer may be cooled and a further separation thereof effected into a particularly gasoline-rich or hydrocarbon-rich layer, and a solvent layer. The settling temperature depends on the solvent used and may be 60–390° F. for instance. On separating these layers the gasoline or hydrocarbon may be easily distilled from such hydrocarbon rich layer, and the solvent layer may be reheated and returned to the extracting zone. The solvent from the distillation zone may be added, and the contained heat may contribute part or all of the necessary heat for maintaining the main body of solvent at the proper extracting temperature.

Where a distillate is treated which contains aromatics, toluene, etc., the aromatics can be segregated in pure state in this way, if desired. Thus, by so treating a distillate which has been through an aromatizing catalytic zone for instance, the distillate product may be extracted with a high boiling selective solvent and be separated at substantially extracting temperature into hydrocarbon and solvent layers, and as the solvent contains the aromatics then such layer may be cooled to further separate it into solvent and aromatic-rich layers, and the aromatic be distilled off from the latter. Where for example the product of aromatization of a narrow cut in

the heptane range is thus operated upon, a pure grade of toluene can be obtained.

As an example: A naphtha showing a Kattwinkel test of 40, representing the percentage of aromatics and unsaturates, is thoroughly mixed with four volumes of phenylethanolamine and subjected to extraction at a temperature of about 100° F. The extract amounts to about 45 per cent and shows a Kattwinkel test of 53.

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.

We therefore particularly point out and distinctly claim as our invention:

1. In a process of the character described, substantially eliminating from a light hydrocarbon distillate hydrocarbons of five carbon atoms and under, mixing with the distillate phenylethanolamine, at elevated temperature, allowing layer formation to occur, separating the respective raffinate and solvent layers, cooling and separating mixed solvent and hydrocarbon into hydrocarbon-rich and solvent layers, distilling off gasoline hydrocarbons from the former, and returning the solvent for reuse.

2. In a process of the character described, substantially eliminating from a light hydrocarbon distillate hydrocarbons of five carbon atoms and under, mixing with the distillate phenyldiethanolamine, at elevated temperature, allowing layer formation to occur, separating the respective raffinate and solvent layers, cooling and separating mixed solvent and hydrocarbon into hydrocarbon-rich and solvent layers, distilling off gasoline hydrocarbons from the former, and returning the solvent for reuse.

3. In a process of the character described, substantially eliminating from a light hydrocarbon distillate hydrocarbons of five carbon atoms and under, mixing with the distillate a selective solvent correlated to the distillate by having a higher boiling point from the group consisting of phenylethanolamines, at elevated temperature, allowing layer formation to occur, separating the respective raffinate and solvent layers, cooling and separating mixed solvent and hydrocarbon into hydrocarbon-rich and solvent layers, distilling off gasoline hydrocarbons from the former, and returning the solvent for reuse.

4. In a process of the character described, mixing with a hydrocarbon distillate phenylethanolamine, at elevated temperature, allowing layer formation to occur, and separating the respective raffinate and solvent layers, cooling and separating mixed aromatics and solvent into aromatic-rich and solvent layers, and distilling off aromatic from the aromatic-rich layer.

5. In a process of the character described, mixing with a hydrocarbon distillate phenyldiethanolamine, at elevated temperature, allowing layer formation to occur, and separating the respective raffinate and solvent layers, cooling and separating mixed aromatics and solvent into aromatic-rich and solvent layers, and distilling off aromatic from the aromatic-rich layer.

6. In a process of the character described, mixing with a hydrocarbon distillate a selective solvent correlated to the distillate by having a higher boiling point from the group consisting of phenylethanolamines, at elevated temperature, allowing layer formation to occur, and separating the respective raffinate and solvent layers, cooling and separating mixed aromatics and solvent into aromatic-rich and solvent layers, and distilling off aromatic from the aromatic-rich layer.

7. In a process of the character described, mixing with a hydrocarbon distillate phenylethanolamine, at elevated temperature, allowing layer formation to occur, separating the raffinate and solvent layers, and cooling and further separating mixed solvent and hydrocarbon into hydrocarbon-rich and solvent layers.

8. In a process of the character described, mixing with a hydrocarbon distillate phenyldiethanolamine, at elevated temperature, allowing layer formation to occur, separating the raffinate and solvent layers, and cooling and further separating mixed solvent and hydrocarbon into hydrocarbon-rich and solvent layers.

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