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METHOD FOR SEPARATING CRACKED HYDROCARBON MATERIAL

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By his Attorney
This invention relates to an improved method for resolving cracked hydrocarbon material into a series of products.

In one method for cracking petroleum oil to form gasoline, a stream of petroleum oil is flowed through a zone in which it is heated under pressure to a cracking temperature and thereafter held in a digesting zone in which further cracking takes place.

Cracked material is withdrawn in a continuous stream from the digesting zone. My invention particularly comprehends a method for more efficiently separating the material withdrawn into marketable products.

The drawing is a diagrammatic longitudinal cross section of apparatus in which the preferred embodiment of my method may be carried out.

In operating the same, the cracked material from the digesting zone flows, without substantial loss of heat, through pipe 1 to tar separator 2, in which separation takes place. Tar separated is continuously withdrawn through pipe 3 and cooler 4 to an accumulator. Vapors pass off from the separator through dome 5 and pipe 6. In dome 5 the vapors pass in indirect heat interchanging relationship to oil circulating in coil 20, which will be hereinafter more fully described. The vapors then pass through pipe 6 to coil 7 in the lower portion of fractionating column 8 and are partly condensed simultaneously with the re-boiling of the bottoms in column 8 by heat from the vapors.

The mixture of liquid and vapor in coil 7 flows through pipe 9 into chamber 10. The vapors are further condensed by contact with coil 12 and the condensate so produced, together with liquid originally present, flows through pipe 13 to accumulator 14. The uncondensed vapors flow through pipe 15 to the intermediate portion of tower 16, in which fractionation takes place. The bottoms from the tower 16 pass through pipe 17 to pump 18, by which they are continuously discharged through pipe 19 to the coil 20. In this coil the bottoms partially condense in dome 5, are heated thereby, and thereafter flow through pipe 21 to separator 22, in which vapors produced by the heat exchange separate from the residual liquid. The vapor flows through pipe 22 and re-enters column 16 at the base for further fractionation, while the liquid is continuously withdrawn, and may be returned to the feed accumulator 14 through pipe 23, or diverted through pipe 24 to cooler 25 and thence to storage. Vapors passing overhead from column 16 move in heat exchanger 26 in indirect heat interchanging relationship to the feed stock passing to feed accumulator 14 through pipe 26a, thereby simultaneously preheating the feed and maintaining proper rectifying conditions in column 16. Reflux returns to the column 16 through pipe 29.

The streams of liquid discharging into accumulator 14 comprise the total feed stock for the cracking unit and may be withdrawn for that purpose continuously or periodically, as desired. Light ends in the feed stock may be separated therefrom if desired by the application of heat to the accumulator 14 from any suitable source, the vapors so produced passing through pipe 14b to chamber 10, or alternatively, directly to column 16 through pipe 14c. Vapors from exchanger 26 pass through pipe 27 to the intermediate section of the final tower 8, in which fractionation takes place. The bottoms in this tower are re-boiled by indirect heat exchange with the material flowing in coil 7. Reflux to tower 8 is provided by partial condenser 29, the condensate returning to the column through pipe 30.

This condenser is supplied with cooling water from any source, the amount thereof being adjusted so that the vapors passing off through pipe 31 to coil 32 in which they are condensed, have an end point of about 360°F, and consist of light naphtha. The bottoms from column 8 may be withdrawn through pipe 33 and cooler 34 or alternatively may be diverted to accumulator 14 through pipe 33a.

By control of the amount of bottoms from the intermediate column passing into heat interchanging relationship by means of coil 20 with the vapors in dome 5, all products of lower boiling point than the gas oil fraction are vaporized and separated.
therefrom, the product withdrawn through cooler 25 consisting essentially of gas oil.

The vapors passing overhead from column 16 contain substantially all the fractions within the gasoline range together with hydrocarbons intermediate gasoline and gas oil such as those present in kerosene. The control supplied by partial condenser 29 further converts these vapors into a light naphtha overhead, which is finally condensed and discharged from cooler 32 and a bottom of heavy naphtha and kerosene which is finally cooled and delivered from cooler 34 or returned for further cracking via line 33a. The tar withdrawn from separator 2 contains sufficient condensate as a result of the circulation of liquid in pipe 20 to impart the necessary fluidity for convenient handling.

It will be understood that the apparatus shown is an illustration and not a limitation and that my method may be carried out in various forms of apparatus. Various alternative procedures may be adopted within the scope of the appended claims, in which it is my intention to claim broadly all novelty inherent in my invention.

I claim:

1. An improved process for separating mixtures of hydrocarbons into a series of valuable condensates, comprising separating vapors from tarry materials, passing the vapors in indirect heat exchange with condensate from a later stage of the operation, passing remaining vapors in indirect heat exchange with a second condensate formed in a later stage of the operation, whereby a portion of the vapors is condensed and the said second condensate is reboiled, passing remaining vapors into a rectifying zone in which they are in part condensed to form the condensate which is in indirect heat exchange with the vapors first separated from the tarry material, and recovering a final vapor product from the system.

2. Method according to claim 1, in which the vapors from the rectification stage are passed into the stage in which the second condensate is collected and reboiled.

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