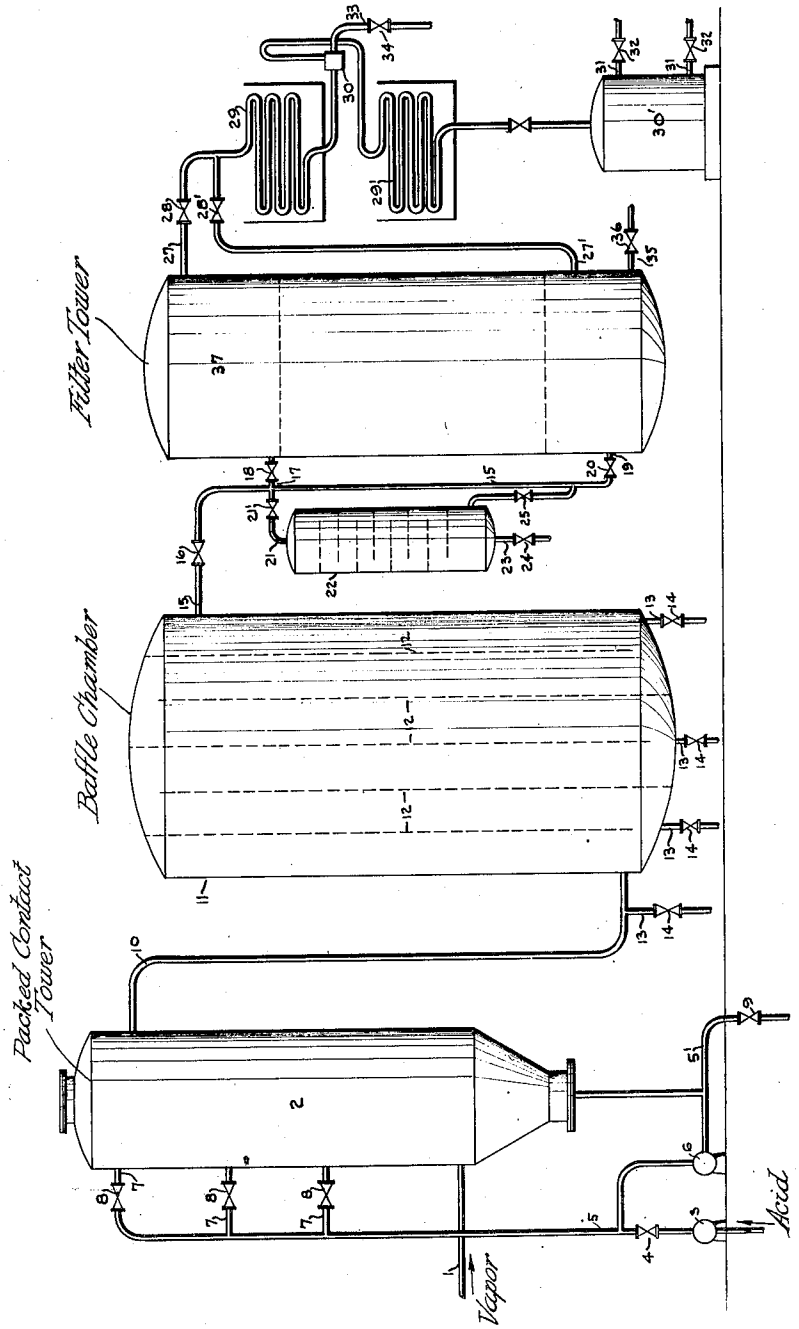
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METHOD OF TREATING HYDROCARBON OILS

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METHOD OF TREATING HYDROCARBON OILS

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1 Claim. (Cl. 196—36)

This invention relates to the refining of hydrocarbon oils and more particularly relates to the refining of cracked distillates which are the products of the thermal conversion of high boiling hydrocarbons into lower boiling hydrocarbons suitable for motor fuel. Cracked distillates from the modern cracking process contain a high percentage of unsaturated hydrocarbons and aromatic hydrocarbons which are reacted upon or are soluble to a large extent, especially the unsaturated hydrocarbons, when treated with sulphuric acid, which is the usual refining agent for such distillates.

Refining with sulphuric acid, which is usually accompanied by other refining steps such as water washing after the removal of the sludge and treatment with an alkaline substance, is relatively expensive not only because of the losses involved both by reaction solution and polymerization, but also because in practically all cases the distillate so treated must be redistilled to produce a stable and marketable product. When cracked distillates are treated with sulphuric acid, the derivatives or reaction products of the acid and the unsaturated hydrocarbons remain in part in the distillate and cause it to deposit gums, tars and other substances which generally render the gasoline unsalable and usually unfit for use if not redistilled. When redistilled in the presence of steam these derivatives usually remain in the residue in the still and thus permit the production of a salable product when the proper conditions of refining and redistillation have been observed.

In cracking of high boiling hydrocarbons to produce low boiling hydrocarbons it is entirely feasible to fractionate the product of the process to produce a gasoline having the desired boiling range, but such practice is limited because of the difficulties mentioned above in refining the product to a suitable motor fuel.

My invention has for its object the treatment of hydrocarbon vapors, particularly cracked hydrocarbon vapors, the source of which may be a cracking still or a re-run still, in order to effect the economies which are obvious from the above discussion.

In operating the process the hydrocarbon vapors are passed through a column or tower containing packing material such as broken rock, tile, or special ceramic shapes, which permits close contact of the ascending vapors with an acid refining agent in situ or passing counter-current to the ascending vapors. The acid treated vapors are then passed preferably through a baffled member giving a long and tortuous path of travel which permits the dropping out of mechanically suspended sludge particles or products of reaction. The vapors are then passed through a body of filtering medium, the purpose of which is to further remove any entrained or suspended acid or acidic substances and, in this connection, I prefer to use materials showing alkaline properties, such as lime, caustic soda and mixtures of lime and caustic soda technically known as soda lime alone and/or in admixture with finely divided inert materials, such as quartz sand or gravel, and I may also utilize adsorbent materials such as the various adsorbent clays and earths, carbonaceous materials such as bone black and metallic oxides, iron oxide, bauxite, or aluminum oxide, and others, alone or in combination with the other materials mentioned.

Preferably I employ acids which have a relatively low volatility at the operating temperature; for example, concentrated sulphuric acid, including fuming sulphuric, the various phosphoric acids, including orthophosphoric, pyrophosphoric, metaphosphoric, and the oxides of these acids, sulphur trioxide, phosphorus trioxide, phosphorus pentoxide, glacial acetic acid, and others, or mixtures of these acids.

As an example of the manner in which the process is carried out and referring to the drawing, the oil vapors, for example, cracked hydrocarbon vapors, pass through vapor line 1 into packed column or tower 2. Preferably this column is insulated and equipped with conical bottom so as to permit collection of the sludge at the bottom of the tower. The acid, for example sulphuric, phosphoric, alone or in admixture, is fed in by means of pump 3 controlled by valve 4, through line 5, to the top of the tower 2, or to various levels, through lines 7, controlled by valves 8. Line 5' and valve 9 permits withdrawal of sludge, as desired and pump 6 permits recirculation of the acid from the bottom of the tower 2 back into line 5 and thence again to the tower 2 as above described. The vapors leave tower 2 and pass through vapor line 10 into baffled element 11 equipped with baffle plates 12, the purpose of which is to permit the removal of sludge-like or polymer-like materials entrained by the vapors. Lines 13 equipped with valves 14 permit the withdrawal of sludge collecting in the transfer line 10 and the baffled element 11. The vapors leaving the latter pass through line 15, controlled by valve 16, into the filter tower 37 either through line 17, controlled by valve 18, or line 19, controlled by valve 20, which will permit the vapors to pass respectively down

or up through the filter body. The latter may consist of an inert material, such as quartz sand, in admixture with an alkaline neutralizing material, such as lime or caustic or both, in admixture with an adsorbent material, such as fuller's earth, bone black, or the like, or a layer of these materials may be used.

It is preferable to have present in the filter body a finely divided solid for mechanical removal of entrained material and an alkaline material for neutralization of acidic substances, which may be the acid itself or derivatives of the acid. Vapors leaving line 15 may be bypassed through line 21 and valve 21' into baffled trap 22 to further remove undesirable acidic or tar-like materials from the vapors through line 23 and valve 24. The vapors are led from the trap back into line 15 by means of valved connection 25. A drain from the filter tower 37 is provided by line 35 controlled by valve 36. The vapors leaving the filter tower containing the filtering and neutralizing material pass through vapor line 27 when the filtration is upward and through vapor line 27' when the filtration is downward, controlled respectively by valves 28 and 28', into condenser and cooler 29. A higher boiling condensed product may be removed through trap 30 by means of line 33 controlled by valve 34, and the lower boiling vapors continued through the lower section of cooler and condenser 29, indicated as 29', and is finally collected in receiver 30' equipped with draw-off lines 31 and valves 32.

As an example of my process, the cracked vapors from the fractionating element of a cracking unit which would have an endpoint when condensed of 430° F. and a color of 12 Saybolt was refined using a mixture containing phosphoric and sulphuric acid, and a product was produced after leaving the filter column containing a layer of sand and a layer of a mixture of used fuller's earth and lime which had a color of +25 Saybolt and an endpoint of approximately 432° F. The color stability of the product was good.

The above example is purely illustrative and, in view of the many modifications to which my process is subject, should not be construed as a limitation upon the broad scope and spirit of the invention.

I claim as my invention:

A process for refining cracked hydrocarbon vapors of motor fuel boiling range which comprises passing the vapors upwardly through a descending subdivided flow of acid refining agent, then passing the vapors in a tortuous path to separate entrained reaction products, and finally filtering the vapors through a filtering medium containing alkaline material.

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