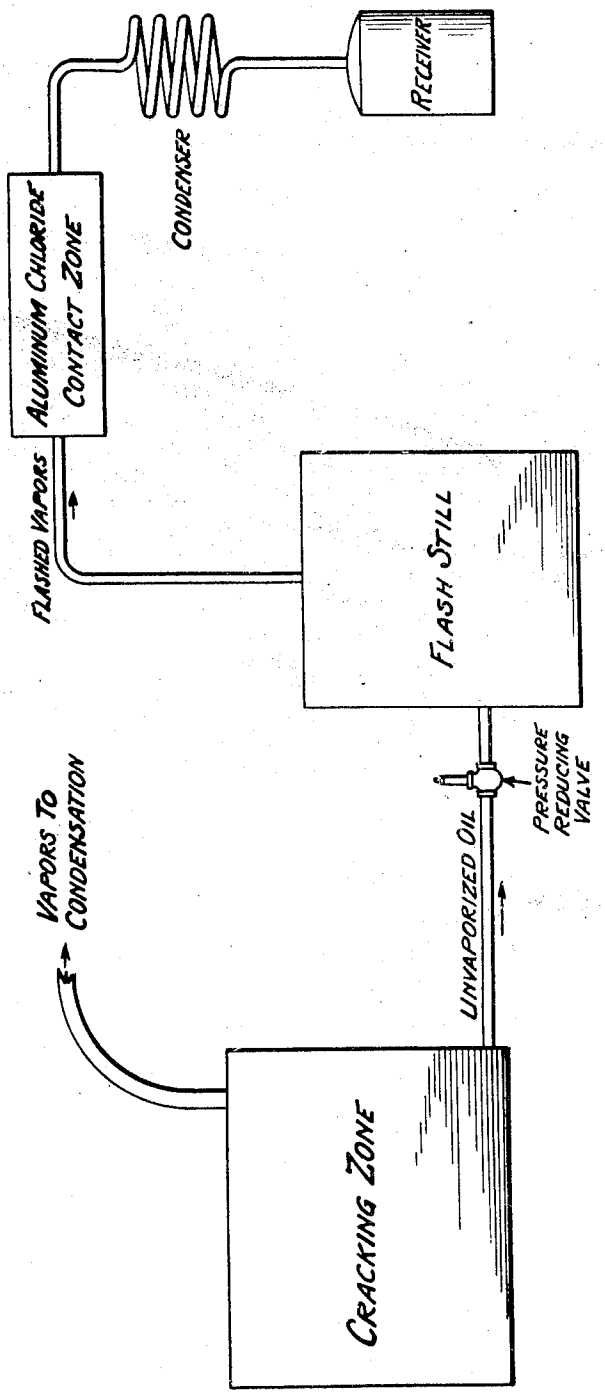
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MANUFACTURE OF LUBRICATING OIL

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Inventor
Gustav Egloff

By Lee J. Garey.
Attorney

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MANUFACTURE OF LUBRICATING OIL

Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill., a corporation of South Dakota

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2 Claims. (Cl. 196—78)

This invention relates to the manufacture of lubricating oils, and refers more particularly to the manufacture of lubricants from cracking operations on petroleum oils.

More specifically, the invention has reference to a process of synthesizing viscous fractions suitable for use as lubricants from a portion or all of the viscous products resulting from hydrocarbon conversion reactions at elevated temperatures and pressures, a novel method and means for accomplishing this object being disclosed hereinafter.

In the conversion reactions attendant upon the pyrolysis of hydrocarbons there is a widening of boiling point range, free hydrogen being liberated on the one hand, and a certain amount of coke or heavy pitch being produced on the other. Intermediate between these two end products a series of hydrocarbon fractions of regularly varying boiling point occurs containing varying amounts of hydrocarbons of the four general series, to-wit: paraffins, olefins, naphthenes and aromatics in varying proportions, with minor amounts of sulphur, nitrogen and oxygen derivatives, depending on the nature of the original stock cracked and the conditions to which it was subjected.

It is usual in the operation of cracking heavy oils to produce motor fuel to regulate conditions to prevent or minimize the formation of highly unsaturated hydrocarbons of the olefin series since these compounds have objectionable features from the standpoint of instability, their tendency to polymerize resulting in the development of gummy or resinous material on storage which is objectionable in itself and which is accompanied by an intensification of color which is objectionable from a sales standpoint in commercial gasoline. Treatment of cracked distillates has, therefore, been generally directed toward the selective removal of the more highly unsaturated olefins which are thus necessarily produced in cracking processes. When such compounds are treated out by sulphuric acid and other chemical and polymerizing agents, their loss is complete and the yield of the cracking operation is reduced often to an undesirable point. The present invention provides a process for treating out any desired amount of the unsaturated constituents of cracked products and the recovery of the same in commercially valuable form.

In one specific embodiment, the invention comprises treating the vapors flashed from cracking residue with aluminum chloride.

In one particular type of commercial cracking operation, conditions of temperature, pressure and time are regulated so that the conversion reactions are stopped short of the formation of any substantial amount of solid carbonaceous residue. The liquid residuals may be removed from the process and utilized as fuel or a base for asphalt manufacture, or they may be further treated at slightly higher temperatures or pressures lower than the pressure in the heating and reaction zones to drive off a further quantity of light hydrocarbon vapors. It is commonly characteristic of the vapors thus "flashed" from cracked residua that they are of a highly unsaturated character, probably owing to the low hydrogen-carbon ratio in the cracked residua. The vapors thus produced provide readily polymerizable material and it is with their conversion by polymerization with aluminum chloride that the present invention is concerned.

One of the most desirable properties of hydrocarbon oil lubricants is a low temperature coefficient of viscosity which is usually measured by the change in its Saybolt viscosity when heated from 100 to 210° F. compared with an adopted standard based upon the corresponding change in a high class lubricant of proven value. The experimental and analytical data at hand show conclusively that the lower temperature coefficients of viscosity are possessed by oils of the highest straight chain or paraffin content, and that the highest coefficients are characteristic of naphthenic oils. The property of retaining viscosity or "body" at elevated temperatures is, therefore, predictable on a basis of the chemical constitution of hydrocarbon oil mixtures.

In the manufacture of synthetic lubricants by the liquid-phase polymerization of individual olefin hydrocarbons, it has been shown that the best lubricants are, in general, produced from mono-olefins of relatively high molecular weight, at least up to olefins having 16 carbon atoms. It has also been shown that the polymerization of olefins containing ternary and quaternary carbon atoms yields lubricants with a higher viscosity temperature coefficient than those produced from straight chain olefins of equivalent molecular weight. Thus the results obtainable by the use of aluminum chloride to produce polymerized lubricants from cracked flashed vapors will produce lubricants of varying value, depending upon the type of operation and charging stock used in the cracking process, and it

will be evident that the better grades of lubricants will be made by this process in plants employing highly paraffinic charging stocks such as are characteristic of Pennsylvania oil producing areas.

The properties of aluminum chloride permit its use as a polymerizing reagent in a very simple manner since it is readily volatile without decomposition at temperatures in the neighborhood of 360° F. under atmospheric or slightly superatmospheric pressures. The anhydrous material can, therefore, be generated under slight pressure by heating a bulk supply and the vapors injected into the vapor line or dephlegmator of the flashing or evaporating elements of a cracking system to initiate the desired polymerizing reactions. The reactions may be substantially completed in the vapor-phase and the reaction by-products consisting of sludge-like or cokey aluminum chloride complexes may be either settled or filtered prior to condensation of the vapors, or in case the formation of sludge by-products is of a low order, the total vapors may be condensed and the liquid products subjected to elevated temperatures with agitation to insure the further action of the aluminum chloride in promoting the formation of viscous compounds.

After the reactions are substantially completed the sludge may be withdrawn and the supernatant polymerized oil neutralized with alkalies, washed with water and redistilled with steam or under vacuum, if necessary, to produce lubricants of commercial grades with regard to viscosity range and other desirable properties. When flashed vapors containing relatively high percentages of saturated or non-polymerizable compounds have been subjected to treatment, it may be found necessary to subject the washed product to preliminary reducing distillation to remove components of low viscosity.

By treating the aluminum chloride sludge with water or steam, it may be made to undergo hydrolysis with the liberation of additional amounts of oil. This oil may be utilized as fuel, blended with the raw oil charging stock to the cracking plant or fractionally distilled, in some cases, to produce increased yields of lubricating oil fractions, usually, however, of somewhat inferior grade to those produced as the principal product of the operation.

An example of one set of results obtainable by the use of the process will serve to establish its value as a commercial improvement in the manufacture of lubricating oils.

A cracking plant may be operated upon a 26° A. P. I. gravity charging stock consisting of 50% of topped Mid-Continent crude and 50% heavy gas oil distillate from the same general type of crude oils. The plant layout in which the cracking is conducted may be of the type having a low pressure flashing chamber to recover additional quantities of gasoline from the reaction chamber residuum upon reduction of pressure. Under ordinary operating conditions, the following approximate yields of products may be produced:

	Percent
425 end point gasoline	49
6 gravity residuum	35
Cracked gas oil	10
Loss, gas and coke	6

Of the total gasoline yield indicated, 5% may come from the flashing of the cracked residuum, this gasoline being of a highly unsaturated nature, for the reasons enumerated previously, and containing in fact 60 to 80% of unsaturated hydrocarbons. By injecting 4% of aluminum chloride into these flashed vapors at a temperature of approximately 400° F., they may be caused to yield 60% of heavy viscous polymers, based on the vapors undergoing treatment, utilizable as a base for lubricating oil manufacture. The treated vapors after condensation may be reduced to produce as 5% of the raw oil charged to the process a lubricating stock having a viscosity Saybolt of 800 seconds at 100° F. and 85 seconds at 210° F., this corresponding to a "viscosity index" of 110, indicating that the stock is approximately 10% better than the standard paraffinic lubricant having a low coefficient of viscosity change with temperature.

The overhead distillate obtained in the reduction of the polymerized distillate will be of a saturated character and serve either for direct admixture with the gasoline from the plant or as recycled stock for further conversion.

The foregoing example will serve to indicate the economic value of the process when applied to flashed vapors from a particular type of charging oil. However, since it may be applied when other oils are subjected to the same type of cracking operation and is also applicable to the treatment of cracked vapors produced when the products are totally discharged from the reaction chamber, neither the foregoing example nor the details of the preceding disclosure are to be strictly construed as imposing limitations the scope of the invention.

The accompanying drawing is a flow sheet diagrammatically illustrating a preferred embodiment of the process and is self-explanatory.

I claim:

1. In the cracking of heavy hydrocarbon oil wherein the cracked oil is separated into vapors and unvaporized oil under pressure and the separated unvaporized oil flash distilled, the method which comprises separating the flashed vapors from the flashed residue and contacting the same with aluminum chloride under conditions conducive to the formation of lubricating oil fractions, condensing the thus treated flashed vapors and separating the lubricating oil fractions from the resultant condensate.

2. In the cracking of heavy hydrocarbon oil wherein the cracked oil is separated into vapors and unvaporized oil under pressure and the separated unvaporized oil flash distilled, the method which comprises separating the flashed vapors from the flashed residue and contacting the same with aluminum chloride vapors under conditions conducive to the formation of lubricating oil fractions, condensing the thus treated flashed vapors and separating the lubricating oil fractions from the resultant condensate.

GUSTAV EGLOFF.