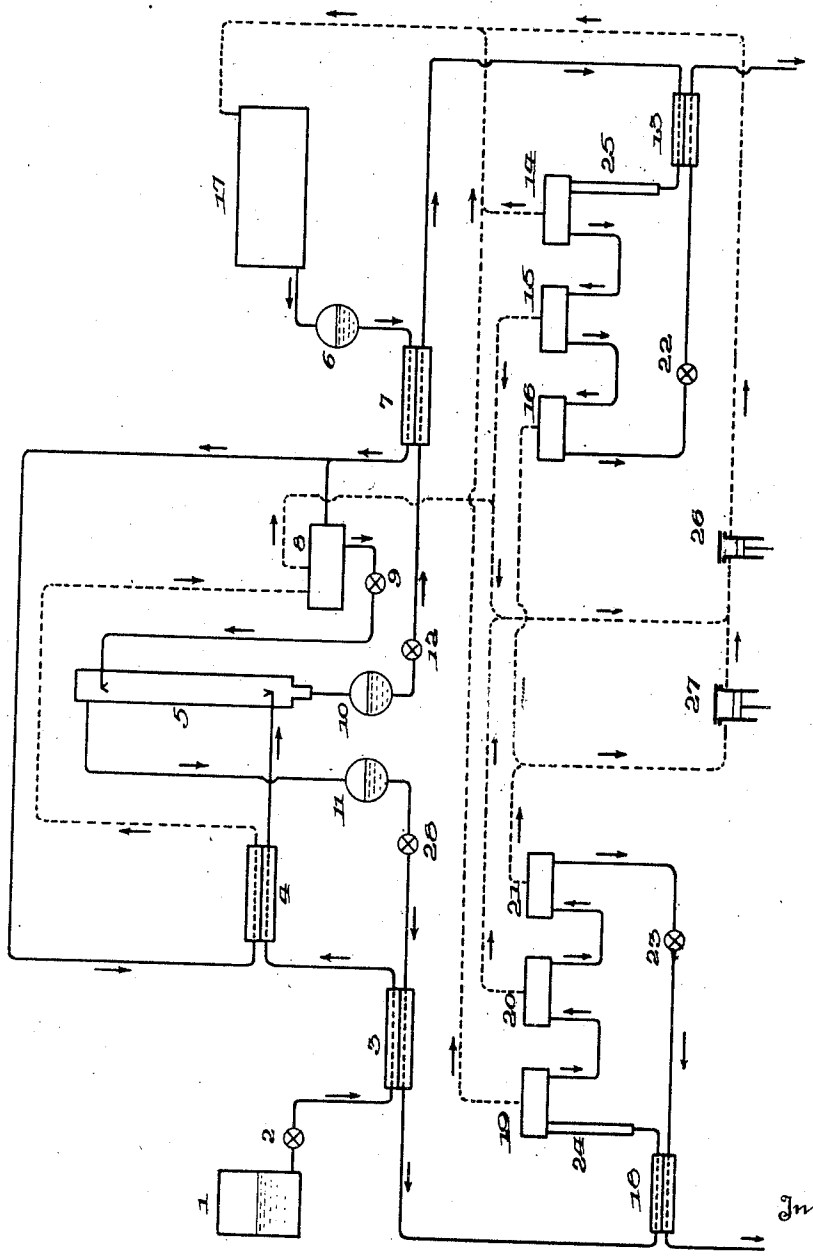
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1,661,565

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PROCESS FOR THE CONVERSION OF HIGH BOILING HYDROCARBONS INTO LOW BOILING HYDROCARBONS

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PROCESS FOR THE CONVERSION OF HIGH-BOILING HYDROCARBONS INTO LOW-BOILING HYDROCARBONS.

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My invention comprises a treatment of petroleum distillates prior to their further fractional distillation by the cracking process, by which treatment objectionable by-products are eliminated or reduced in quantity, and a higher proportion of commercially valuable products secured.

The known cracking processes which consist in the conversion of hydrocarbons of high boiling point into those of low boiling point, increase the yield of light distillates in the fractional distillation of crude oil, at either atmospheric or increased pressure, by causing the oil vapors to remain in contact with the superheated metallic surface of the still. The superheating of the oil vapors causes a splitting of the high boiling hydrocarbons, converting them into lower boiling hydrocarbons. Under very high temperature, the splitting of the molecules of the hydrocarbons is pushed too far, resulting in the formation of fixed gases and a large amount of coke, in addition to the light hydrocarbons.

Based on these facts a great number of processes have been devised for producing gasoline from the high boiling hydrocarbons which processes differ only in the conditions under which temperature and pressure are applied, or in the arrangement of the equipment in which the cracking is carried out.

All of these processes have certain drawbacks in common, which react unfavorably on their commercial value for producing gasoline from high boiling hydrocarbons. The main disadvantages are:

The asphaltum and the substances rich in carbon always present in the cracking stocks, produce during the cracking operation, a large amount of coke which adheres to the walls of the apparatus. Its removal is difficult and necessitates frequent shutting down of the still for cleaning. The residuum oil which has not entered into the reaction and which remains as a by-product generally contains in solution a considerable quantity of colloidal carbon which precipitates when the oil is left standing for a while and which renders it difficult to use this by-product as a fuel.

Nitrogen and sulphur compounds are also usually found in the distillates used as cracking stock. During the cracking process these form sulphuretted hydrogen and other sulphur and nitrogen products which have a strong corrosive action on the equipment and render the handling of the apparatus very difficult.

I have discovered that all the above mentioned drawbacks may be minimized by treating the cracking stock with liquid sulphur dioxide prior to submitting it to the cracking process. It is known that the sulphur dioxide is a good solvent for the nitrogen and sulphur bearing compounds as well as for asphaltum and substances rich in carbon. Separation of these injurious substances by liquid sulphur dioxide removes the causes of the disadvantages enumerated above.

Methods of treatment of petroleum oils with liquid sulfur dioxide for removing substances soluble therein are described in my United States Patents Nos. 911,553 and 1,526,665. A preferred method is illustrated in the accompanying drawing, showing diagrammatically an arrangement of apparatus suitable for carrying out the invention.

Referring to the drawing, the untreated cracking stock is supplied from a convenient source, shown as the tank 1, to a pump 2 by which it is passed through a precooler 3 and the cooler 4 to the lower part of the mixer 5. Both the precooler 3 and the cooler 4 are of the double pipe type. As a low temperature in the mixer 5 is desirable, the cracking oil should be well cooled before entering the mixer 5. In the precooler 3 the oil is precooled by the cold treated oil leaving the mixer 5, and in the cooler 4 it is cooled to the desired low temperature by means of evaporating sulfur dioxide.

The liquid sulfur dioxide required for the treatment of the cracking oil is supplied from a storage tank 6 and passed through a precooler 7 of the double pipe type to the cooler 8. In the precooler 7 the sulfur dioxide is precooled by the cold extract consisting of liquid sulfur dioxide which has dissolved constituents of the oil after leaving the mixer 5; in the cooler 8 it is cooled

by evaporating a part of itself at low pressure. This cold sulfur dioxide is taken by a pump 9 and passed to the top of the mixer 5.

The process of mixing the oil and the sulfur dioxide is a continuous one.

The oil passing through the mixer 5 first dissolves the sulfur dioxide. As soon as the oil is saturated, the sulfur dioxide is extracting the heavy hydrocarbon from the oil. This extract is settling in the lower part of the mixer 5 and drawn off into the extract tank 10. The refined oil is drawn off from the upper part of the mixer 5 into the refined oil tank 11.

The extract is taken from the extract tank 10 by the pump 12 and passed through the precooler 7 and preheater 13 to the evaporators 14, 15 and 16. In the precooler 7 the extract is precooling the sulfur dioxide, heating up itself. In the preheater 13 the extract is heated to a higher temperature by the finished hot extract leaving the last evaporator 16.

In the evaporator 14 the sulfur dioxide contained in the extract is evaporated by heating, by means of heating pipes 25, and passes to the condenser 17, where it is condensed. As the sulfur dioxide contained in the extract cannot be expelled completely only by heating, the remaining extract is passed to the vacuum evaporators 15 and 16 after the greater part of the sulfur dioxide in the first evaporator has been removed; in the vacuum evaporators 15 and 16 the last traces of sulfur dioxide are drawn off by the sulfur dioxide gas pump 26 and vacuum pump 27 and forced into the condenser 17.

The refined oil is taken from the raffinate tank 11 by the pump 28 and passed through the precooler 3 and the preheater 18 to the evaporators 19, 20 and 21. In the precooler 3 the raffinate is precooling the untreated cracking stock, heating up itself, and in the preheater 18 the raffinate is heated to a higher temperature by the finished raffinate coming from the last evaporator 21.

In the evaporator 19 the sulfur dioxide dissolved in the refined oil is removed mainly by means of heating pipes 24, the last traces of sulfur dioxide are drawn off by gas pump 26 and vacuum pump 27 from the vacuum evaporators 20 and 21.

The finished hot extract is discharged from the last evaporator 16 by the pump 22 and passed through the preheater 13 to the storage tank. In the preheater 13 the finished extract is heating up the extract going to the first evaporator 14 at the same time cooling down itself.

The finished hot raffinate is taken from the last evaporator 21 by the pump 23 and passed through the preheater 18 to the storage tank. In the preheater 18 the finished raffinate is heating up the raffinate going to the first evaporator 19 and at the same time cooling itself down.

The vacuum pump 27 draws off the last traces of sulfur dioxide from the last evaporators 16 and 21 under high vacuum and pushes the vapors to the gas pump 26.

The gas pump 26 draws off that part of sulfur dioxide which cannot be driven out only by heating, from the evaporators 15 and 20. At the same time it draws off vapors of sulfur dioxide from the cooler 8. It compresses all the vapors and pushes them to the condenser 17 in which they are liquefied.

The liquid sulfur dioxide is collected in the tank 6 and used again.

For cooling the cracking stock, part of the liquid sulfur dioxide is branched off before entering the cooler 8 and passed through the cooler 4. In the cooler 4 the liquid sulfur dioxide comes in contact with the cracking stock having a higher temperature than the sulfur dioxide and a part of the sulfur dioxide vaporizes at a rather low temperature as the pressure is kept low at the sulfur dioxide side. Thus the cracking stock passing the cooler is cooled to the desired temperature.

The vapors of sulfur dioxide are drawn off through the cooler 8 to the gas pump 26.

As one illustration of the advantages of my invention I give the following: By the treatment with liquid sulphur dioxide of a Texas Luling gas oil having a specific gravity of 0.889 and a sulphur content of 0.8%, a gas oil with a specific gravity of 0.865 and sulphur content of 0.24% is obtained. If both gas oils are cracked separately under equal conditions of pressure (about 85 lbs.) and temperatures (about 770° F.) the following products result:

	Non-treated gas oil	Treated gas oil
	Per cent	*Per cent*
Cracked distillate	82	90.5
Gasoline	45	53.7
Coke	4.6	1.5
Sulphur in the cracked distillate	0.34	0.09
Sulphur in gasoline	0.1	0.06

In non-treated gas oil which remains as a by-product there will form after a while a sediment of about 6% of carbon and asphaltic matter, while in the treated gas oil there will appear only traces of sediment.

If the cracking of gas oil into gasoline is affected by pressure and catalytic action, as for instance by means of any of the known catalysts for aiding in the conversion of hydrocarbons, the advantages of using a gas oil preliminarily treated with liquid sulphur dioxide are more striking.

The invention is not restricted to any particular oil or cracking process but pertains generally to the use of liquid sulphur dioxide

for treating the materials to be cracked prior to subjecting them to cracking.

What I claim is:

1. An improved process for the cracking of high boiling hydrocarbons into low boiling hydrocarbons which consists in submitting to a pressure cracking process the portion of the distillates which remains undissolved after being treated with liquid sulphur dioxide.

2. An improved process for the cracking of high boiling hydrocarbons into low boiling hydrocarbons by removing from the cracking stock the nitrogen and sulphur compounds as well as the asphaltum by means of liquid sulphur dioxide and by afterwards submitting the cracking stock to a pressure cracking process.

3. An improved process for cracking hydrocarbons having a high boiling point into hydrocarbons having a lower boiling point by treating them with liquid sulphur dioxide, separating the liquid sulphur dioxide and hydrocarbons dissolved therein, and subjecting the undissolved hydrocarbons to pressure cracking in the presence of a catalyst.

In testimony whereof, I have signed my name to this specification.

LAZAR EDELEANU.