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# CRACKING GASOLINE --- 1938

by DON McPHERSON

**T**IMES change with the years and so do methods of doing things. At the top of the list, along with "truckin" and "suzy-Q-in," is the manufacture of gasoline to be used in the millions of autos owned by the American public today. Among the very latest processes comes the high pressure high temperature liquid phase method that is now being built by "The Lummus Company" of New York and London. This company has built, tested, and placed in operation gasoline refineries the world over.

To explain this process it is best to start from the very beginning with the crude oil as it comes direct from the well. The crude oil enters a storage tank from which it is picked up by a booster pump and sent to a centrifugal pump, changing the velocity head to a static head of 100 lbs. per square inch. This pump sends the oil through a heat exchanger, a device that utilizes heat that would ordinarily be wasted, and it is heated to a temperature of 160 degrees Fahrenheit.

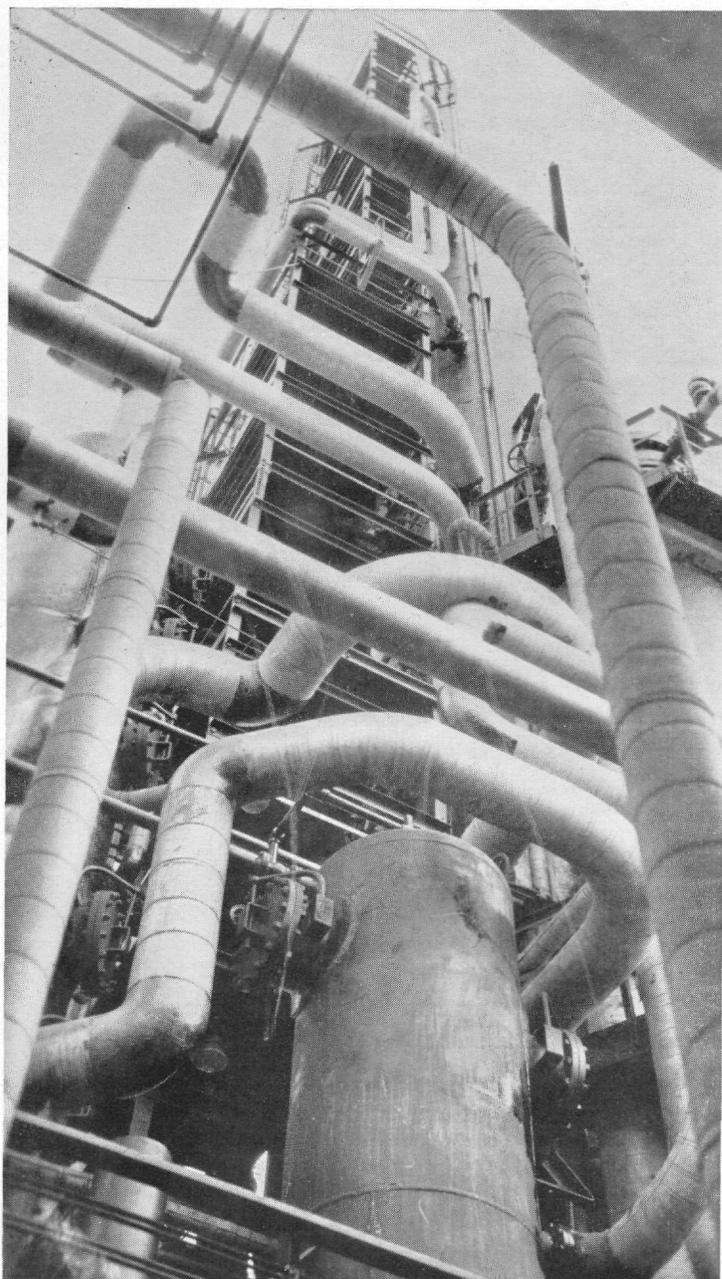
As the oil leaves the exchanger, a stream of water is injected into the pipe. The oil now goes into a set of desalting or rectifying tanks. Here the salt, found in all crude oils, is removed by an electric current of 220 volts. From the desalters the course takes the oil through a surge tank where all water and sediment are removed. Then the oil is again picked up by a pump and sent through another heat exchanger where the temperature is raised to 300 degrees Fahrenheit, at 200 lbs. pressure.

The oil is now directed through a low temperature, low pressure tube still, where it is heated to 630 degrees Fahrenheit, under 30 lbs. pressure. On leaving the tube still the pipe leads to a primary fractionating tower, called D-1.

In D-1 the liquids that are too heavy to vaporize fall to the bottom to form topped crude. This amounts to about 40% of all the original petroleum. The lighter vapors are passed up through the column to be cooled by the descending reflux. The virgin gas oil or cracking stock, to be used later in the process, comes off at a temperature of about 450 degrees Fahrenheit, while the next stream contains kerosene, to be sent to storage. The last to be condensed in this column is the naphtha, while the straight run gasoline passes off as a vapor. The naphtha and straight run gasoline are also to be used in the process later.

The residue of D-1 is sent through another surge tank from which the oil is flashed under

10 lbs. pressure into a flash tower, which we shall call D-5. Here the larger part of the oil is caught in a weir, a large doughnut cutter shaped affair turned upside down. This part of the oil is sent to a tank which constitutes viscosity breaker charge. A smaller part goes out the top of D-5 to another tank containing flash distillate, to a light gas oil accumulator to be used later. A smaller portion falls to the bottom of the tower and forms fuel oil, a heavy viscous liquid, used mostly as industrial fuel.



The vis-breaker charge is picked up by a pump operating at 600 lbs. pressure and is forced through the vis-breaker where the light tar is changed to form gas oil or cracking stock. As the oil leaves the furnace it goes into the evaporator tower, operating at 200 lbs. pressure, called D-2. Here a portion of the oil is collected at the bottom and sent back to D-5 to again go through the cycle just described. The larger part, however, goes out the top of the tower, D-2, in the form of gas oil. Here at a temperature of 765 degrees Fahrenheit and pressure of 200 lbs., it goes into the high pressure bubble tower, D-3. In this tower part of the oil is sent out the top at a temperature of 425 degrees Fahrenheit in the form of unstabilized gasoline. However, the larger portion is sent, in the form of heavy gas oil, to the heavy gas oil heater where it is broken down to form light gas oil. A smaller portion is sent, in the form of light gas oil, to an accumulator to be used later.

On leaving the heavy gas oil heater the oil is again sent through D-2 tower and into D-3 where the portions are distributed much as before, with the percentages being different. This time most of the product is light gas oil, while some becomes what is called heavy cycle stock.

The light gas oil on leaving D-3 is mixed with the light gas oils from D-1 and D-2 in the accumulator where it is picked up by a diesel driven charging pump, and the pressure is raised to 1200 lbs. Under this tremendous pressure it is mixed with the naphtha from the first step of the process and sent through the light gas oil heater, breaking down the molecules to form gasoline, more cycle stock, and fuel oil. The mixture is then sent to the D-2 tower where it becomes a part of the cycle. This time, however, a large part of the mixture goes into unstabilized gasoline, while part of the original crude becomes heavy cycle stock, and eventually all becomes gasoline or fuel oil.

The unstabilized gasoline is now mixed with the straight run stock from the first of the process in the accumulator where all the gases that vaporize at 200 lbs. pressure and 100 degrees Fahrenheit are collected and used as a fuel gas in the unit. From the accumulator, the gasoline is sent through the stabilization tower, D-6. Here the gases, such as butane, propane, ethane, and methane, are driven off by heating to approximately 400 degrees Fahrenheit, and are collected for use as a fuel. The mixture of cracked and straight run gasoline is then taken out of the bottom of the tower in the finished state.

This finished product has an octane rating ranging from 67 to 69. To this is added tetraethyl of lead, dye, and inhibitor, to form the marketable gasoline.

The percentage of gasoline in the crude varies, some being much better for gasoline refining than others. The main states for producing crude are Texas,

California, Oklahoma, Pennsylvania, West Virginia, and Ohio.

Coke has been the oil refiner's bugaboo in former processes. One of the main features of this process is that it does not form any appreciable coke. Originally the method used was to fill a large steel shell still with petroleum where the oil was allowed to soak through the entire process. This was not only inefficient, but it was costly due to the numerous shut-downs necessary to clean the coke out of the shell.

Someone later thought of a method employing a series of tubes in which to heat the oil and from these it was sent to a reaction chamber where the soaking took place. This chamber now had to be cleaned but not as often as the old shell cracker. This method is still in wide use today.

A present and later method employs the tube still as a soaking chamber. This, too, has its faults as it needs to be cleaned as soon as enough coke forms, to prevent the passage of the oil. This is done more rapidly than in the other methods and hence it is still in wide use at the present. The time between shut-downs in the Lummus unit, for instance, is often about forty days while in this more modern method it usually takes only five to eight days.