

CHAPTER 1

Petroleum

The word petroleum means *rock oil**. Commercial petroleum is known as *crude oil*. It is a liquid bituminous substance composed essentially of carbon and hydrogen. The petroleum is pumped from oil wells.

Distillation is the operation by which a *volatile liquid may be separated from a substance which it holds in solution or by which liquids of different boiling points may be separated*.

Ques. Upon what does distillation depend?

Ans. It depends upon the transformation of liquids into vapor by the action of heat and on the condensation of the vapor by cooling.

Ques. What happens as the temperature to which the crude oil or petroleum is subjected is increased?

Ans. The heavier fractions such as kerosene, gas oil and lubricating oils which are composed of hydro carbon molecules containing successively more carbon atoms are passed off in the same way, leaving a final residue such as fuel oil, asphalt or coke, the molecules of which contain a relatively high percentage of carbon atoms.

*NOTE.—A translation of the Latin: *Petro* meaning *rock* and *oleum*, oil, hence rock oil.

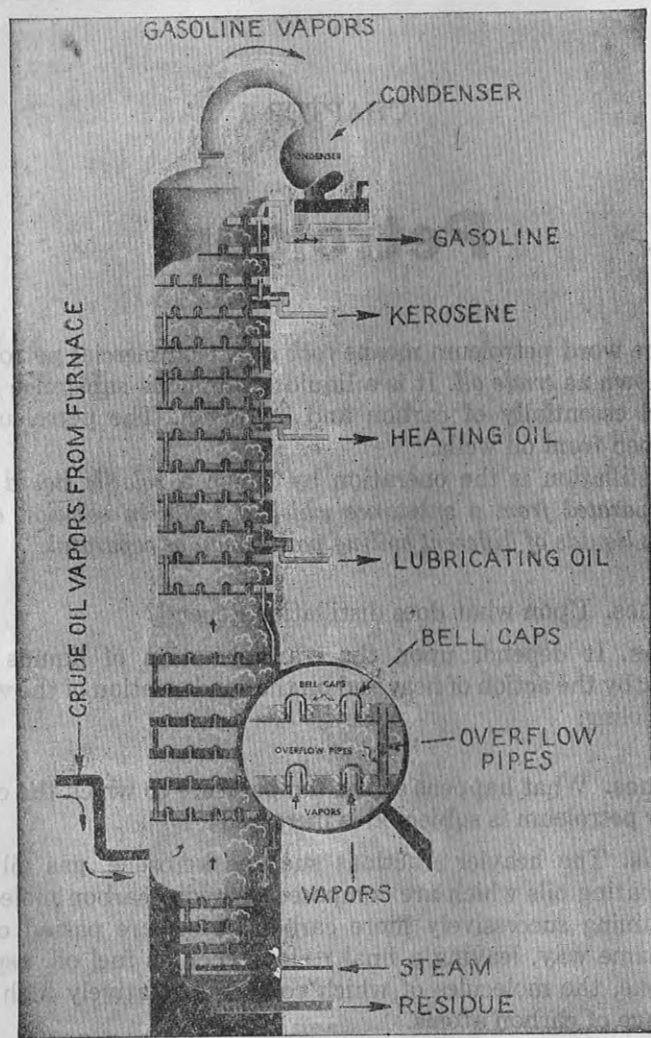


FIG. 1—Pictorial diagram showing the process and essential apparatus for the distillation of petroleum.

Origin.—The theory of the origin of oil is somewhat disputed, but it is generally accepted that petroleum or crude oil is the product of distillation of marine organism; that is, vegetables and animals that died millions of years ago, sank to the bottom of the seas and were covered with sand and rock where they decomposed and were distilled.

The great upheavals in the crust of the earth raised the bottom of the seas and the extreme pressure from these changes forced the oil out of the sand and rock and made large underground lakes of oil.

Supply.—The outstanding experience of the past history of oil production is that the potential supply has always been grossly underestimated. Since the first oil well in the United States was drilled, during each succeeding ten years there has been a volume of production equal to, or greater than, the total production throughout the whole previous history of the industry.

For example, during the nine year period from 1916 to 1925, there was more oil produced in the United States than during the whole previous period from 1859 to 1916. This production has gone on in spite of the fact that the most careful estimates and surveys from time to time have predicted a more limited supply.

Distillation in Practice.—Distillation of crude oil into its various fractions is the key of all petroleum refining. In the process, after being heated to about 800° Fahr. in the pipe still, (fig. 1) the crude oil, now partially vaporized, enters the fractionating tower where it flashes completely into vapor.

As the vapors rise in the tower, which contains horizontal trays spaced all the way down within it, they gradually grow cooler. The vapors have different boiling ranges and they condense and collect on the trays as fractions with different characteristics. Some liquid from each tray drops to the tray below through the overflow pipes.

The liquid also has components of different boiling ranges which becomes segregated on their way down the towers just as vapors do on the way up. The lightest vapors are liquified in the condenser on top of the towers and part of the liquid is reintroduced into the top tray.

The trays can be considered as a series of tea kettles, the escaping vapors from each heat the liquid in the tray above by partially condensing as they bubble through from the bell caps, and the heat generated in turn releases still higher vapors from the liquid in that tray. Each component can be thus drawn off from the trays as desired. The one with the highest boiling point collects at the bottom of the column and is drawn off as a residue for use as heavy fuel oil.

Higher up, *lubricating oil* is drawn off at about 600-700 Fahr. *heating oil* condenses at about 500° Fahr., *kerosene* at about 300°, *Gasoline* collects at the top at about 100°. The components are then ready for further processing.