pressure by introducing into the still a hydrocarbon of low boiling point, such as benzene, the combined vapors of the benzene and initial material passing to a superimposed cracking vessel, placed in the same furnace construction but with separate means of heating. The liquids that form in this cracking vessel run back into the still. The cracked vapors are passed through a series of fractional condensers arranged in towers, the vapors entering at the bottom and ascending through the series.

CRACKING PROCESS FOR THE PRODUCTION OF GASOLINE.

A large number of processes have been patented for the production of increased quantities of gasoline or motor spirits from the heavier hydrocarbon mixtures by destructive distillation.

Of all these processes only one so far as known is in extensive use in the industry, this being the well-known Burton process, which is owned and controlled by the Standard Oil Co. of Indiana, and has been rather generally employed by the various Standard Oil companies at different periods. The fact that the Standard Oil marketing companies have put in large and expensive installations involving the use of this process is the best possible indication of the need of efficient cracking processes in the industry. With their usual foresight these companies have perceived that the supplies of crude petroleum would not satisfy the continually increasing demand for motor spirits. The fact that to a large degree the employment of the Burton process has improved the situation so far as these companies are concerned is a tribute to the sagacity of the companies, as well as to the intrinsic merits of the process itself. There can be no question that the use of this process in the past few years by the Standard Oil companies has contributed greatly to relieve threatened shortages in the supply of gasoline. The process itself has been a real conservation factor so far as American petroleum resources are concerned, and too much credit can not be given to the inventor as well as to the companies whose faith and energy have made its successful development possible.

CLASSES OF GASOLINE-CRACKING PROCESSES.

Broadly speaking, gasoline-cracking processes may be divided into three types—those that involve cracking at atmospheric pressure; those that involve cracking under pressure in stills and large vessels; and those that involve cracking under pressure in small vessels or tubes.

The disadvantage of processes involving cracking at atmospheric pressure is the large volume of olefins formed. It is also difficult to obtain cracking in any effective degree, as the higher temperatures

can not be attained without causing vaporization, and without pressure the vapors can not be held in the heated zone. Fuel consumption is considerable as the operation has to be conducted slowly to give satisfactory results. The degree of conversion is necessarily less at atmospheric pressure than under higher pressures as, on account of the greater stability of the lighter molecules, only the heavier molecules are subject to alteration.

In the processes involving the use of pressure as an aid to cracking, some of the investigators lay emphasis on having the condensation occur under pressure, and others favor condensation after release of pressure. Burton [a] claims that by having the pressure-controlling valve placed beyond the condenser, so as to have the condensation take place under a pressure of approximately 75 pounds, the volume of unsaturated hydrocarbons is largely reduced. On the other hand, Brooks, Bacon, and others [b] describe experiments conducted first with the valve between the still and the condenser, and then with the still and the condenser in free communication so as to allow condensation under pressure, the conditions remaining otherwise the same. They report that no difference was observable in the volume of olefins formed.

One disadvantage of processes in which the vapors are permitted to escape only through a pressure-release valve, such as those patented by A Riebeck's Mining Works Inc., in Halle,[c] and others,[d] is the irregularity of the distillation. This irregularity is obviated by having condensation take place under pressure, and theoretical considerations favor such condensation.

LIMITATIONS OF CONVENTIONAL CRACKING PROCESSES.

Hall [e] and others [f] have pointed out the great danger inherent in cracking operations in which a large volume of liquid is heated under pressure in a still or other large container. As discussed more fully later, a two-phase system—that is, one in which both liquid and vapor are present—necessitates the employment of a given pressure for a given temperature, and vice versa, unless one of the phases be caused to disappear. Therefore, in order to reach the high temperatures that are desirable in order to bring about a maximum of cracking, it is necessary to use correspondingly high pressures if the two-phase

[a] Burton, W. M., U. S. Patent 1049667, Jan. 7, 1913.

[b] Brooks, B. T., Bacon, R. F., and others, The preparation of gasoline and kerosene from heavier hydrocarbons: Jour. Ind. and Eng. Chem., vol. 7, March, 1915, p. 180.

[c] A. Riebeck's Mining Works, Inc., in Halle, German Patent 37728, Klasse 23, Feb. 28, 1886.

[d] Bacon, R. F., and Clark, C. W., U. S. Patent 1101482, June 23, 1914; Young, James, English Patent 3345, Dec. 27, 1865.

[e] Hall, W. A., Address delivered to Institution of Petroleum Technologists, London, Feb. 18, 1915; abstracted in Petroleum World, vol. 12, March 1915, p. 137.

[f] See Clark, E. M., U. S. Patent 1119496, Dec. 1, 1914; Humphries, R. E., U. S. Patent 1122022, Dec. 22, 1914.