system is to be maintained. This use of both high temperature and high pressure is a source of danger when large quantities of liquids are treated in a single operation, as the retainers are apt to give way and the great volume of highly heated liquid becomes a serious menace. A carbon deposit accumulates in the stills and large retorts employed in pressure-cracking processes, which on account of its high insulating power causes the vessels to burn out during prolonged runs. Recently this difficulty has been largely obviated by the use of stills with seamless bottoms.[a]

Processes of this nature are also subject to the limitation common to all two-phase (liquid-vapor) systems, namely, that the temperature and the pressure can not be varied independently of each other. This fixed interdependence of temperature and pressure is one of the greatest handicaps of all two-phase processes, for the higher temperatures and pressures favorable for cracking the lighter and intermediate fractions of a crude petroleum can not be attained because of the difficulty in finding retainers that will withstand the necessary strain. For example, such interdependence makes impracticable the use of kerosene (burning oils) as an initial material in the production of gasoline.

CRACKING AT ATMOSPHERIC PRESSURE.

A considerable number of processes have been brought forward for effecting at atmospheric pressure the cracking of heavier hydrocarbons into gasoline hydrocarbons.

Laing[b] proposed to accomplish this result by passing the vapors coming from the still through a superheater placed in the flue connected with the oil still, a suitable arrangement being provided for regulation of the heat.

The process patented by Seigle[c] provides for the passage of the initial hydrocarbon material through a series of vaporizing chambers, and thence through a series of heating or cracking chambers where the vapors are superheated and cracked. Heat is supplied by immersing both series of chambers in a bath of molten lead.

Cowper-Coles[d] in 1906 patented a process for obtaining low-boiling hydrocarbon oils from liquid hydrocarbon distillates obtained from shale, peat, coal, etc. The initial material is heated in a still and the vapors then pass through a series of small pipes heated to a temperature of about 925° C., from which they are conducted to a condenser. The size of pipes is not indicated.

[a] See Humphries, R. E., U. S. Patents 1122002, 1122003, Dec. 22, 1914.
[b] Laing, John, English Patents 11079, May 16, 1891; 4120, Mar. 17, 1890.
[c] Seigle, Adolphe, U. S., Patents 567751, 567752, Sept. 15, 1896; French Patents 249583, Aug. 13, 1895, 252068, Nov. 29, 1895; English Patents 18518, Oct. 3, 1895, 23235, Dec. 4, 1895.
[d] Cowper-Coles, S. O., English Patent 27945, Dec. 7, 1906.

Noad[a] passes a mixture of oil and water, in the proportion of two parts of oil to one of water, into one end of a U-shaped chamber filled with scrap iron, and maintained at a dull red heat (about 482° C.), the vapors then being led to a condenser.

A process of somewhat similar nature to that of Noad's, aside from the different construction of the converter, is that controlled by the New Oil Refining Process (Ltd.), an English corporation.[b]

An emulsion of oil and water is fed into a vertical tube, which may be constructed of fire clay or metal. This retort, which is inclosed in a furnace, is filled with scrap iron or other refractory material, and is heated to 538° to 650° C. The oil enters the top of the retort by gravity feed, and the water is injected into the bottom of the tube in a similar manner. The vapors pass upward out of the retort into a first condenser where, it is claimed, the unconverted vapors are condensed; thence they return to the retort for further treatment, and the lighter converted vapors pass into a second condenser. The oil that remains liquid at the temperature in the interior of the retort is drawn off at the bottom.

In the process patented by Adams[c] oil is fed into a converter into which an electric heater is introduced. The liquid oil is maintained under a partial vacuum and is forced upward through an insulating shell into the interior of the converter so as to localize the heating of the oils. The heater, which is maintained at a "cherry red" or or "white heat," is kept submerged to avoid explosion of the oil vapors. The vapors are then passed to a condenser.

Moeller and Woltereck[d] pass vapors of heavy oil, mixed with steam, superheated to 700° to 800° C. at atmospheric pressure, through tubes filled with broken coke and heated to a dull red heat (600° to 800° C.).

Another process involving the use of steam is that patented by Valpy and Lucas.[e] Superheated steam is introduced into a still containing liquid oil, and the mixture of steam and oil vapors resulting is passed through cracking tubes inclosed in a furnace chamber. The tubes are filled with a catalytic material (thin nickel tubes electrically heated may be used) and are heated to a temperature varying between "dull and bright red." The decomposed steam and oil vapors are then passed to a condenser. Provision is made for the mixed vapors to traverse a pair of coils, one of which is placed in the still and the other in the oil-supply tank, as a means of adding heat to the oil and cooling the vapors before they enter the condensers.

[a] Noad, James, U. S., Patent 971468, Sept. 27, 1910.
[b] The New Oil Refining Process (Ltd.), and Neilson, R. G., English Patents 13675, 1908; 28460, Dec. 18, 1911; 20074, 20075, Aug. 28, 1913.
[c] Adams, J. H., U. S. Patent 976975, Nov. 29, 1910.
[d] Moeller, Julius, and Woltereck, H. C., English Patent 16611, July 19, 1913.
[e] Valpy, O. H., and Lucas, O. D., English Patent 20470, Sept. 10, 1913.