The tremendous drain caused by the demand for motor fuels can be realized also by consideration of the increase in the number of motor vehicles used in this country. Five years ago that number was estimated at approximately 500,000, whereas now more than 2,000,000 motor vehicles are said to be in actual operation. If the present rate of increase continues, it will be only two or three years before this number will be doubled.

The figures cited do not include the large number of internal-combustion engines in industrial operation that use gasoline or naphtha as fuel. If it be assumed that the average power of these motor-propelled vehicles is 25 horsepower, their aggregate capacity is 50,000,000 horsepower. The significance of this figure can be conceived from the fact that the total primary power developed in the manufacturing industries amounts to less than 20,000,000 horsepower, according to the United States Bureau of the Census.[c] On the Continent, benzene obtained from the destructive distillation of coal is largely used as a motor fuel, but the percentage recovered per ton of coal is at present so small that it does not alter appreciably the world's dependence on petroleum as the chief source of supply.

TEMPORARY NATURE OF RELIEF AFFORDED BY NEW OIL FIELDS.

From time to time the bringing in of a prolific oil field relieves the strain by the great outflow of refinable oil that follows, but the relief is only temporary, as the life of a gusher field is generally short. In 1914 the Cushing pool in Oklahoma was considered a menace to the oil producers, owing to its tremendous production and the consequent decrease in price of crude oil at the well that it brought about, but by November, 1915, the prices of crude oils had attained nearly their former high levels, and producers and refiners were looking for new sources of supply. The rising market price for gasolines is the concrete evidence of present conditions. Thus, the discovery of new fields, which is daily becoming more difficult, can hardly furnish a solution of the problem of how to meet the ever-increasing demand for one of the products of crude petroleum.

Still another factor demands consideration. Even if crude oil could be obtained in sufficient quantity to meet the needs of the gasoline market an excess supply of less desirable products would be bound to result.

EFFORTS TO INCREASE YIELDS OF MOTOR FUELS.

The fact that such a large proportion of the world's supply of crude petroleum seemed to be unsuited to the production of motor fuels has led a number of investigators to undertake to work out

[c] Thirteenth Census of the United States, vol. 8, Manufactures, 1909; U. S. Bureau of the Census, 1913, p. 330.

commercially practicable processes whereby yields of these products from a given quantity of refinable oil can be largely increased, or a nonrefinable oil be made to yield the desired products. It is obvious that if such processes can be successfully developed, a better effect will result than if the production of crude oil is proportionately increased. The supply of crude oil will be conserved, and the market will not be burdened with products of limited commercial use or unprofitable to produce. These processes, of which a number have been brought forward during recent years, involve the "cracking" or decomposition of heavy oils—either low-grade natural crudes or the heavier fractions of refinable crudes—that have at present a low commercial value.

ORIGIN AND DEVELOPMENT OF CRACKING PROCESS.

The cracking process, so-called, may be said to date from its accidental discovery at Newark, N. J., in the year 1861. Essentially it consists in heating oils to such a temperature that their heavy molecules decompose into lighter molecules with the production of mixtures of lower boiling point.

FIRST APPLICATION OF CRACKING PROCESS.

As originally employed, the process was directed toward the conversion of that fraction of crude petroleum intermediate between the burning (kerosene) oils and the lubricating oils into liquid hydrocarbon products of lower density and boiling point, which would be suitable for use as illuminants. An open still was used, so that partial condensation of the vapors could occur in the upper part of the still, permitting more heat to be supplied to the boiling liquid, with consequent increase in its temperature and the desired decomposition into products of lower boiling point.

CHEMICAL NATURE OF CRACKING PROCESS.

The cracking process is simply one instance of the well-known tendency of organic substances to decompose on the application of heat. The heavier the hydrocarbon molecule, the more easily it is dissociated. In actual fact, cracking to a greater or less degree is the rule rather than the exception in the majority of distillation processes involving more than moderately low temperatures. In 1868 it was pointed out that, during the distillation of hydrocarbons on a commercial scale, cracking always takes place to some degree.[a]

A natural hydrocarbon oil, or crude petroleum, is a mixture of substances of varying boiling points. Each of the hydrocarbons of high boiling point contained in such mixtures is, during the process of

[a] Hirsch, Joseph, On the distillation of hydrocarbons: Chem. News, vol. 18, July 31, 1868, pp. 51–52.