

PETROLEUM.

By JOHN D. NORTHPROP.

INTRODUCTION.

Among the mineral substances that contribute to the successful conduct of modern warfare petroleum occupies a position of great importance. In its crude or semirefined state petroleum is the most efficient and economical fuel available for the propulsion of battleships, torpedo boats, transports, and merchant vessels and has been adopted for this purpose by the great navies of the world. Behind the first line of defense oil is the principal fuel of many large industrial plants and of many railroads of strategic importance whose lines traverse sections of the country that are devoid of other fuel resources.

Of even greater industrial importance than petroleum itself are the products derived from it. Gasoline is the principal fuel of internal-combustion engines and as such is an essential requirement for the operation of automobiles, motorcycles, autotrucks, airplanes, armored cars, and motor boats. Mineral lubricants are required wherever machinery is operated. Kerosene is utilized as a fuel in the camp kitchen and as a source of light where other illuminants are not available. Engine distillate is a necessary fuel for engines of the Diesel and semi-Diesel type utilized on undersea and surface craft. Paraffin wax is becoming increasingly important as a surgical dressing, and in the realm of therapeutics the places of cymogene, rhigolene, and petrolatum, both solid and liquid, have long been fixed.

Even a casual review of these principal applications of petroleum in modern warfare is sufficient to indicate the vital necessity to a warring nation of an abundant supply.

POSITION OF THE UNITED STATES IN THE PETROLEUM INDUSTRY.

The position of the United States with respect to petroleum resources is most enviable. Its annual output constitutes two-thirds of the world's current supply and in 1916 amounted to 300,767,158 barrels of 42 gallons each. From 1859, when the petroleum industry began in the United States, to the end of 1916 this country produced

approximately 4,000,000,000 barrels of crude oil, or more than 60 per cent of the total quantity produced in the entire world in this period. The accompanying diagram (fig. 6) shows graphically the

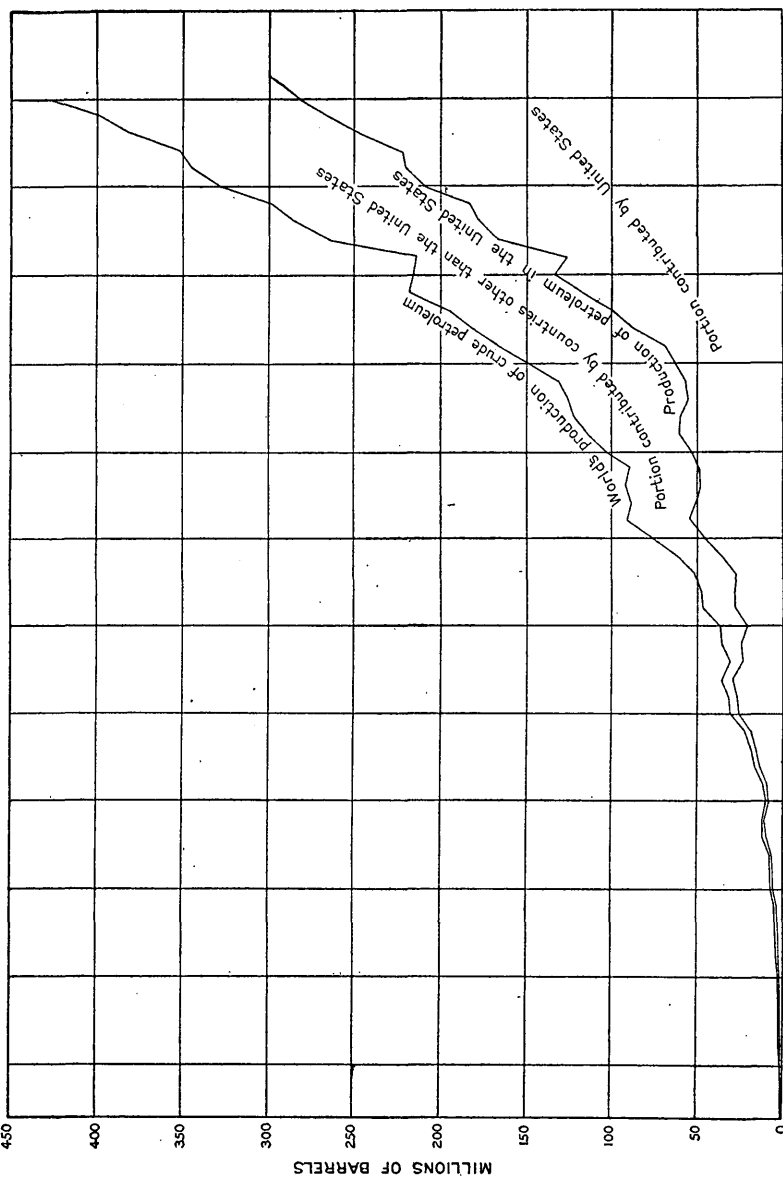


FIGURE 6.—Graph showing the total quantity of petroleum marketed annually in the United States from 1859 and the total quantity produced annually in all other countries of the world from 1857 to 1916.

annual output of crude petroleum in the United States since 1859 and the relative importance of the United States as a contributor to the world's supply of this mineral.

SOURCES OF DOMESTIC SUPPLY.

Crude petroleum is produced in commercial quantities in 18 States and in the Territory of Alaska and is reported to have been discovered recently in the Department of Mindanao, P. I. The relative importance of these sources as contributors to the petroleum supply of this country is shown in the following table, which includes statistics for 1916 and cumulative totals of the quantity produced since the beginning of the petroleum industry in each State:

Crude petroleum marketed in the United States in 1915 and since 1859.

[In barrels of 42 gallons each.]

State.	1916	1859-1916
Alaska, Michigan, Missouri, and New Mexico.....	7,705	94,682
California.....	90,951,936	918,817,030
Colorado.....	197,235	11,064,853
Illinois.....	17,714,235	209,082,546
Indiana.....	769,036	104,468,594
Kansas.....	8,738,077	40,108,638
Kentucky and Tennessee.....	1,203,246	10,736,490
Louisiana.....	15,248,138	123,335,110
New York.....	874,087	(a)
Ohio.....	7,744,511	448,331,841
Oklahoma.....	107,071,715	666,820,434
Pennsylvania.....	7,592,394	a 771,373,177
Texas.....	27,644,605	256,386,687
West Virginia.....	8,731,184	278,228,797
Wyoming and Montana.....	6,279,054	18,489,523
	300,767,158	3,917,328,402

a New York included in Pennsylvania.

The areas in which crude petroleum is produced in the United States are assigned to ten major fields. This division, though mainly geographic, incidentally expresses to a considerable degree differences in the characteristics of the oil produced.

1. The Appalachian field includes all areas of oil production in southwestern New York, western Pennsylvania, eastern Ohio, West Virginia, Kentucky, and Tennessee. The crude oils produced in this field range in gravity from 25° to 50° Baumé, are in the main of paraffin base, are free from asphalt and objectionable sulphur, and yield by ordinary refining methods relatively high percentages of gasoline and illuminating oils. Near Franklin, Pa., Volcano, W. Va., and Mecca, Ohio, small quantities of high-grade petroleum suitable in the crude state for lubrication are produced. The Appalachian field has been under development for more than 50 years, and though its annual production is still in excess of 20,000,000 barrels, its output of petroleum is declining steadily at an average rate of 5 per cent a year. Its productive areas are practically all developed with the exception of the south end, where considerable undeveloped territory of promise has in the last year been proved to exist in Kentucky and Tennessee.

2. The Lima-Indiana field embraces the areas of petroleum production in western Ohio and in Indiana. The product of this field ranges in gravity from 30° to 35° Baumé and is of paraffin base, though containing a small proportion of asphalt. Objectionable sulphur compounds that require special refinery treatment for their removal are also present. This field has been under development since 1885. Its annual production has declined steadily since 1904 and in 1916 was less than 4,000,000 barrels. Well-directed effort over a period of many years has failed to disclose any evidence that the productive area of this field can be materially increased, though its present limits are acknowledged to include considerable territory that is not completely drilled. In such territory operations have been retarded by a scarcity of cheap fuel. In western Indiana the discovery and development of small isolated pools of oil is expected to extend the date of ultimate exhaustion of the Lima-Indiana field many years into the future.

3. The Illinois field includes the principal area of oil production in the southeastern part of Illinois, as well as a number of scattered pools of small individual extent in the central and western parts of the State. The oil in this field ranges in gravity from 28° to 40° Baumé and contains varying proportions of both asphalt and paraffin. Sulphur is generally present but rarely in such form as to necessitate special treatment for its removal. Illinois has been an important contributor to the petroleum supply of the United States since 1906, its output in 1908 reaching a maximum of nearly 34,000,000 barrels. Since 1908 its production has declined at a moderate rate, and in 1916 it amounted to only 17,714,235 barrels. Aside from minor pools that may be discovered from time to time in the western part of the State, the productive oil territory in this field is believed to be now under development. A steady though gradual decline in production of petroleum is predicted for the Illinois field.

4. The Mid-Continent field includes all areas in which petroleum is produced in Kansas and Oklahoma. The field has been a large contributor to the petroleum supply of the United States since 1904, and in the last two years it has furnished more than 35 per cent of the petroleum produced in the entire country. The oils of this field vary in composition within wide limits, ranging from asphaltic varieties that are lean in gasoline and illuminants to high-grade paraffin oils that yield a large percentage of the lighter products of distillation. The range in gravity is between 27° and 42° Baumé. Sulphur is present in varying quantities in the lower-grade oils, in certain of which—the Healdton grade, for example—it exists in a form that necessitates special treatment for its elimination. Although this field is believed to have attained its maximum annual production, amounting to 115,809,792 barrels, in 1916, it is destined to remain

the principal contributor to the petroleum supply of the country for many years, as its productive districts are only partly drilled, and its boundaries embrace large areas of untested and apparently not unfavorable territory.

5. The north Texas field includes a number of detached areas of oil production in the northern and east-central parts of Texas. The oils produced are in general similar to those of the Mid-Continent field, with the exception of that obtained in the Powell pool, Navarro County, which has a gravity of about 23° Baumé and is of little commercial value except as a fuel. Aside from the Navarro County district, including the Corsicana and Powell pools, which have produced petroleum since the early nineties, the north Texas field has been an important source of oil only since the development of the Wichita district, including the Electra and Burkburnett pools, in 1912. Since that year its yield has been in excess of 9,000,000 barrels annually. Considerable undrilled territory of promise is included in this field, the development of which should serve to maintain production at the present rate for two or three years at least.

6. The north Louisiana field includes the areas of petroleum production in Caddo, De Soto, Bossier, Red River, and Sabine parishes. The oils of this field range in gravity from 22° to 42° Baumé and are of paraffin base, though containing ordinarily small percentages of asphalt. Sulphur is present in the oils of lower gravity. The north Louisiana field became important as a source of petroleum in 1910 and attained its record production of 15,082,034 barrels in 1915. Individual wells and pools in this field are not long lived, and although the productive area of the field has not been completely drilled and its boundaries have not been fully determined, there is little basis for believing that new territory will be developed in the future with sufficient rapidity to more than offset the decline in production of the old wells or to increase the output of the entire area beyond 12,000,000 barrels a year.

7. The Gulf field includes a large number of detached oil pools associated with saline domes in southeastern Texas and southern Louisiana. Oils from the Gulf field, though variable in composition, are characterized by relatively high percentages of asphalt and low percentages of the lighter distillation products. In general they range in gravity between 15° and 28° Baumé and contain considerable sulphur, much of which is in the form of sulphureted hydrogen and is easily removed by steam before the oil is utilized.

The low-gravity oils from this field are used chiefly as fuel and for the manufacture of asphalt and asphalt products. The lighter grades are refined and yield lubricating oils of superior quality. The production of individual pools in this field has been remarkably large, but once the maximum yield is attained the output declines abruptly

to a relatively low rate, which is, however, maintained for many years. Owing to the number of individual pools involved and to the peculiar mode of occurrence of the oil, the production in the Gulf field is extremely erratic. Between 1901 and 1905 the output increased from 3,500,000 to 36,500,000 barrels. In 1906 it was 20,500,000 barrels; subsequent to that year it declined to as low as 8,500,000 barrels in 1912 and 1913 but increased with the discovery of deep sands in the Humble pool, Harris County, to about 20,500,000 barrels in 1915 and 1916. The future of the Gulf field is conjectural. The developed pools represent but a fraction of the vast area of the Gulf Coastal Plain, much of which has not been adequately tested by the drill. Recent discoveries of petroleum in commercial quantities at Damon Mound, Brazoria County, Tex., at Big Hill, Matagorda County, Tex., and near Houma, New Iberia Parish, La., indicate that the petroleum output of the Gulf field will probably be maintained at the present rate for at least two years more, and that the probabilities of the discovery of additional pools of oil in this area are high. Whether the new pools will be of sufficient capacity or will be discovered rapidly enough to sustain or increase the present rate of production of the field as a whole is purely a matter of speculation.

8. The Rocky Mountain field includes all areas of petroleum production in Colorado, Wyoming, and Montana, as well as areas of prospective oil production in Utah and New Mexico. Crude oils from this field are in the main of paraffin base and yield relatively high percentages of gasoline, illuminating oils, lubricants, and fuel distillates. The greater part of the oil produced ranges in gravity from 32° to 48° Baumé and contains little or no objectionable sulphur. Heavy asphaltic oils, ranging in gravity from 18° to 24° Baumé, suitable chiefly for fuel or for the manufacture of asphalt, are obtained in certain parts of this field. As a contributor to the petroleum supply of the United States the Rocky Mountain field is in its infancy, its production prior to 1912 averaging considerably less than 1,000,000 barrels a year. Since 1912 its production has increased rapidly, amounting to about 6,500,000 barrels in 1916 as a consequence of active operations in Wyoming and southern Montana.

In addition to large areas of prospectively favorable but as yet untested oil territory, the Rocky Mountain field includes a vast acreage of easily accessible oil shale that averages in petroleum content between 15 and 60 gallons to the ton. It is estimated that in northwestern Colorado alone there are 39 townships (1,400 square miles) underlain by an average thickness of 53 feet of shale in beds 3 feet or more in thickness, which, according to field tests, will yield on distillation an average of 25 gallons of crude oil to the ton of

rock. Crude oil from these shale beds will yield by ordinary refining methods approximately 9.5 per cent of gasoline, and by modern cracking processes a much larger proportion. An equivalent or larger area of equally rich oil shale exists in northeastern Utah and southwestern Wyoming.

The net result of field investigations conducted by the United States Geological Survey is that these shale areas constitute a latent reserve of crude petroleum, the possible yield of which is much in excess of the past and future supply of petroleum obtained and obtainable from wells in the United States. The development of this vast reserve of crude petroleum must be undertaken in the near future if the growing demand for petroleum products in the United States and elsewhere is to be supplied. The construction of a pipe line from western Colorado to connect with the trunk lines in Kansas for the purpose of conveying shale oil to the refineries of the Mid-Continent and Atlantic seaboard may easily mark the dawn of the next great epoch in the petroleum industry of this country.

The development of the petroleum industry in the Rocky Mountain field has been retarded by a lack of refining and transportation facilities. This lack is now being rapidly supplied, and production is steadily increasing. The area of prospective oil territory in Wyoming particularly is large, and proved districts are numerous and by no means completely drilled.

9. The California field embraces all areas of oil production in that State. The oils of this field are in the main of asphalt base and range in gravity from 12° to 35° Baumé. Relatively small quantities of paraffin-base oils are found in certain localities. About 25 per cent of the petroleum produced in California is used for fuel or for the manufacture of asphalt and asphalt products. The remainder is subjected to some form of refinery treatment, its chief products being fuel oils, lamp oils, lubricants, road oils, and paving materials. The lighter-gravity oils yield a fair percentage of gasoline and naphtha. As indicated in the table on page 3, California has yielded more oil than any other State. Its maximum annual production is believed to have been reached in 1914, when the output was about 100,000,000 barrels. Its productive areas are considered to have been essentially outlined and their periods of flush yield to have been passed. Considerable undrilled acreage remains, however, within the areas outlined, the development of which, if not interrupted, would doubtless serve to maintain a relatively high rate of production for the next two or three years, after which an appreciable decrease appears certain.

10. The Alaska field is at present unimportant as a contributor to the petroleum supply of the country. As now developed it consists of a few producing wells near Katalla that yield a high-grade

paraffin-base oil ranging in gravity between 39° and 45.9° Baumé. Further drilling is necessary to determine the presence or absence of a valuable pool of oil in this district. Seepages of petroleum are known elsewhere in Alaska, as near Yakataga and adjacent to Iniskin Bay and Cold Bay, but their value as indicators of notable accumulations of petroleum is as yet undemonstrated.

INFLUENCE OF THE EUROPEAN WAR.

Coming at the climax of a period of gross overproduction of crude petroleum in the United States, the unexpected outbreak of the European war in 1914 resulted in a demoralization of export facilities that reacted adversely on the entire petroleum industry of the country. The increased hazards of ocean traffic forced freight rates to unprecedented heights. A great number of bulk and case carriers of petroleum and its products were either tied up in foreign ports or promptly withdrawn from commercial service, and charters for foreign conveyance were difficult if not impossible to obtain. As a consequence refinery stocks of all petroleum products increased so rapidly that operations at many plants were temporarily suspended. This condition brought about an accumulation of stocks of crude petroleum held by pipe-line companies and by oil producers that reacted unfavorably on an already depressed market for crude oil and resulted in a decided curtailment of drilling activity in all fields.

Owing to the prompt action of the Entente powers in securing mastery of the seas, to the urgent need by the belligerent nations for gasoline, lubricants, and engine distillates, and to a remarkable increase in the demand for motor fuels and lubricants in the United States, the demoralization occasioned by this combination of depressing influences was of short duration. Before the end of 1914 the export situation had improved materially. The shortage in bottoms was rendered less acute by the transfer to American registry of many oil carriers formerly operated under foreign flags, by the conversion of a few bulk carriers to case carriers, and by the employment of sailing vessels of all types for the conveyance of case oils.

Emerging from this period of readjustment the American petroleum industry found the large foreign markets for illuminating oil of which it had been deprived by reason of the blockade declared against the ports of the Central powers replaced by larger and more attractive markets for other and similar products in the Entente and neutral countries. The destruction of the Galician oil fields early in the war, together with the isolation of the Rumanian fields and the cessation of foreign exports from the Russian fields as a result of the closing of the Dardanelles, presented an opportunity for increased export trade in western Europe and elsewhere that American refiners and exporters were not slow to recognize. The steps taken to supply

these markets as well as the rapidly expanding home market for petroleum products resulted in a prompt stabilization of conditions throughout the industry. Shipyards were overtaxed with orders, pipe-line capacities were increased, new refineries were installed throughout the Mid-Continent region, and the vast field accumulations of crude petroleum in this area were withdrawn from the open market, passing into the control of a few far-sighted companies that had the courage of their convictions and the capital with which to back them. The withdrawal of this storage oil from the open market resulted in an increased demand for oil produced in other fields and was accompanied by advancing prices for all grades of crude oil. Before the end of 1915 activity in drilling had attained normal proportions in practically all fields and was spreading out from proved areas in quest of new territory.

During the six-month period ending with January, 1915, the foreign trade of the United States in petroleum and its liquid products decreased steadily, the net loss being 10 per cent in gross quantity compared with the six-month period ending with January, 1914, and about 14 per cent compared with the six-month period ending with July, 1914. Subsequent to January, 1915, foreign shipments of petroleum and its liquid products increased notably in quantity, the gross exports in 1915 exceeding those in 1914 by more than 88,000,000 gallons, or nearly 4 per cent. In 1916 the gain over 1915 was nearly 11 per cent.

The following table, compiled from the records of the Bureau of Foreign and Domestic Commerce, shows the trend of the foreign trade of the United States in crude petroleum and its principal liquid products during the last four years:

Mineral oils exported from the United States, 1913-1916, in gallons.

Kind.	1913	1914	1915	1916
Crude petroleum.....	194,469,634	124,735,553	158,263,069	172,027,903
Gasoline and naphtha.....	188,043,379	209,692,655	281,009,081	355,870,283
Illuminating oils.....	1,119,441,243	1,010,449,253	836,968,065	834,688,404
Lubricating oils.....	207,639,092	191,647,570	239,678,725	260,805,939
Fuels, including gas oils and residuum.	426,872,373	703,508,021	812,216,209	964,089,837
	2,136,465,721	2,240,033,652	2,328,725,749	2,607,482,366

The outstanding features of this tabulation are the enormous gain in foreign shipments of gasoline, liquid fuels, and lubricants and the diminished but now recovering demand abroad for illuminating oils and for crude petroleum.

With regard to the importation of crude petroleum and its products by the United States, the influence of the war has been relatively slight. The bulk of the petroleum imported by the United States consists of crude oil from Mexican ports, imported for use as

fuel and in the manufacture of asphalt. The normal increase in domestic demand for liquid fuels would readily account for the increase in the quantity of crude oil imported during the last four years, as shown in the following table, compiled from the records of the Bureau of Foreign and Domestic Commerce:

Crude petroleum imported for consumption in the United States, 1913-1916.

[In barrels of 42 gallons each.]

1913.....	17, 809, 058
1914.....	17, 247, 483
1915.....	18, 140, 110
1916.....	20, 570, 075

Among the minor products of petroleum imported in considerable quantities for consumption in the United States prior to the war is paraffin oil, principally liquid petrolatum, a carefully refined medicinal oil having about the consistency of light lubricating oil, imported from Russia and utilized as a vehicle for protective sprays in nose and throat treatment but more especially for internal administration as a laxative. The development of the market for oil of this type, on the basis of the Russian product, was largely a matter of convenience rather than necessity, inasmuch as oils of essentially the same characteristics can be refined from certain grades of petroleum available from domestic sources. At the outbreak of the European war direct importations of this material abruptly ceased, though they were resumed to some extent a few months later. Before such resumption, however, American refiners had seized the opportunity presented and had supplied the domestic market with American-made substitutes, with the success indicated in the following table, which shows the steady decrease since 1913 in importations of paraffin oil:

Paraffin oil imported for consumption in the United States, 1913-1916.

[In barrels of 42 gallons each.]

1913.....	3, 676
1914.....	2, 481
1915.....	1, 707
1916.....	901

The less direct influence of the European war on the petroleum industry of the United States has been manifest in a variety of ways.

The impulse given to practically all industries by increased foreign demand for iron, steel, and agricultural products in particular resulted in general prosperity that reacted in a remarkable expansion in the automobile industry and in the utilization of power machinery on farms throughout the country. As a consequence, the domestic

market for gasoline and lubricating oils increased so greatly that petroleum refiners were forced to exert every effort to meet the current demand. This condition brought about the erection of a great number of new refineries, the enlargement of many already established, and a general effort to devise new methods and processes for increasing the percentage of gasoline recovered from crude petroleum.

Thanks to the ability of the oil fields of the United States to respond to increased demands for crude petroleum, to the success of certain of the modern processes for increasing the relative proportion of gasoline that can be manufactured from petroleum (notably the Burton process), and to the development of efficient methods for the extraction of gasoline from natural gas, the domestic and foreign demand for motor fuels has thus far been approximately met.

The curtailment of imports of certain chemicals utilized in petroleum refining has resulted in an appreciable increase in the cost of refinery treatment of crude petroleum since July, 1914. The demand for iron and steel in wartime industries has resulted in a scarcity of structural steel, casing, pipe, and drilling supplies that has not only increased the cost of drilling and of petroleum transportation but has necessitated the repression of field operations and the delay or indefinite postponement of pipe-line and refinery betterments.

INFLUENCE OF THE WORLD WAR.

The entrance of the United States into the European conflict as a belligerent on the side of the Entente powers has given this struggle the status of a world war. The opportunity of supplying our allies with petroleum and its products has now become a duty that the petroleum industry of this country must exert itself to the utmost to fulfill. To the task set before it this industry brings an equipment of oil-transporting and oil-refining facilities adequate to meet normal requirements and capable, if adequately supplied with iron and steel, of rapid expansion to any magnitude that may be justified by the quantity of crude petroleum available. The principal question is whether or not the sources of crude petroleum in the country can meet the demands that must be made on them both at home and abroad. Their capabilities in this regard have already been touched on in the foregoing discussion of individual fields.

On the whole the outlook is not such as to encourage optimism in view of the fact that the present rates of oil production and of oil consumption in the United States are approximately equivalent and that the total reserves of crude petroleum held by pipe-line companies and large refineries were depleted to the extent of nearly 15,000,000 barrels in the last half of 1916. The total surface reserve of crude petroleum in the United States on January 1, 1917, is estimated at 175,000,000 barrels, a quantity none too large to stabilize

conditions in an industry that requires 25,000,000 barrels of oil a month for current needs.

If normal demands for petroleum products can barely be met by current production of crude oil, supplemented as to gasoline supply by the contributions of the casing head gasoline industry, the abnormal demands occasioned by the entrance of the United States into the world war render imperative an immediate increase in production. From a review of the fields in which, it appears reasonable to believe, well-directed effort would result in prompt and substantial gains in production, Kentucky, Oklahoma, the Gulf field, Wyoming, and the shale area of western Colorado and eastern Utah stand forth as most promising. To effect the increase that seems possible in these areas, however, and in fact to maintain production at the present rate (July, 1917), it is necessary that the existing famine in pipe, casing, and drilling supplies be remedied at once. Proved areas, no matter how productive of oil, can not be developed without casing, nor can oil be marketed efficiently without pipe lines. This fact can not be too strongly emphasized. The potential yield of the Irvine pool, Estill County, Ky., has been estimated as high as 4,500,000 barrels a year. Petroleum is now being marketed from this pool at the rate of only 1,500,000 barrels a year because of a lack of pipe-line facilities.

Oklahoma is plentifully supplied with refining facilities and with ample pipe-line outlets to the Atlantic and Gulf seaboards and includes within its borders the Osage Indian Reservation, the unleased portion of which constitutes one of the prospectively richest sources of petroleum in the United States. Development in Oklahoma and Kansas is seriously retarded by the acute famine in well casing and other drilling supplies. The same condition prevails in Texas and Louisiana, where considerable territory, both proved and prospective, remains undrilled. In Wyoming field development and oil production are now in excess of transportation and refinery facilities, but this discrepancy is being remedied as rapidly as practicable by the construction of new pipe lines and by the enlargement of existing refineries. Betterments now in progress will result before the end of 1917 in placing the Wyoming and Colorado branches of the petroleum industry in a position to supply a larger proportion of the domestic requirements of petroleum products of the Middle West and Rocky Mountain regions than in the past and thus release for eastern consumption or export more of the output from Mid-Continent and Appalachian sources.

Though representing a vast resource of petroleum, the oil shales of Colorado and Utah can not be considered an emergency source of oil. Methods of mining, crushing, and retorting the shale are yet to be developed. Pipe lines must be constructed to existing refineries or

new plants erected near the sources of supply. Unknown difficulties must be overcome before the shale-oil industry can either supplement or supersede the crude-petroleum industry.

In consideration of the steadily increasing demand for petroleum and its products both at home and abroad and of the primary dependence not only of this country but of its allies on the sources of petroleum in the United States for aid in the successful conduct of the war, it is obvious that a serious shortage in the supply of motor fuel is imminent. This famine can be deferred by the exercise of strict economy in the utilization of the supply now available by every operator of a motor vehicle in the country and by the curtailment of the use of gasoline-driven vehicles for pleasure and for such business purposes as can not be efficiently accomplished by the substitution of electrically propelled vehicles. It may be still further deferred by the substitution in a multitude of small plants of one kind or another throughout the country of water, steam, or electric power for that now derived from gasoline.

No commercially practicable substitute for gasoline as a motor fuel has yet been discovered or devised, nor can it be expected that one will be made available in time to assist the United States and its allies in winning the war.

In the light of this fact, the conservation of existing gasoline supplies and the discovery and development of new sources of petroleum stand forth as opportunities for patriotic service that are presented to a surprisingly large proportion of the population of this country and that can not be ignored under penalty of an irreparable loss in the fighting efficiency of this Nation and of the nations with which it is leagued in the greatest conflict the world has ever known.

