

# COST OF CRUDE PETROLEUM

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## LETTER FROM THE CHAIRMAN OF THE UNITED STATES TARIFF COMMISSION

TRANSMITTING

PURSUANT TO SECTION 332 (F) OF THE TARIFF ACT  
OF 1930, INFORMATION RELATIVE TO THE APPROXI-  
MATE AVERAGE COSTS OF CRUDE PETROLEUM  
DELIVERED TO ATLANTIC SEABOARD REFINERIES



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## LETTER OF TRANSMITTAL

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UNITED STATES TARIFF COMMISSION,  
*Washington, February 7, 1931.*

The PRESIDENT OF THE SENATE,  
*Washington, D. C.*

SIR: In compliance with the provisions of section 332 (f) of the act of Congress, approved June 17, 1930, I have the honor to transmit herewith the report of the United States Tariff Commission certifying the approximate average cost per barrel to the oil refineries located on the Atlantic seaboard of crude petroleum delivered to them from the oil fields of the United States during the three years preceding 1930, and the present approximate average cost per barrel of crude petroleum from Lake Maracaibo, Venezuela, delivered to the same points.

Respectfully,

HENRY P. FLETCHER, *Chairman.*

## LETTER OF SUBMITTAL

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UNITED STATES TARIFF COMMISSION,  
*Washington, February 7, 1931.*

To the SPEAKER OF THE HOUSE OF REPRESENTATIVES.  
To the PRESIDENT OF THE SENATE.

The United States Tariff Commission herewith submits its report and certifies the results of its investigation to ascertain the approximate average cost per barrel to the oil refineries located on the Atlantic seaboard of crude petroleum delivered to them from the oil fields of the United States during the three years preceding 1930, and the present approximate average cost per barrel of crude petroleum from Lake Maracaibo, Venezuela, delivered to the same points, as directed by section 332 (f) of Title III of the tariff act of 1930.

Respectfully submitted.

HENRY P. FLETCHER,  
*Chairman.*  
THOMAS WALKER PAGE,  
*Vice Chairman.*  
JOHN LEE COULTER,  
ALFRED P. DENNIS,  
EDGAR B. BROSSARD,  
LINCOLN DIXON,  
*Commissioners.*



# COST OF CRUDE PETROLEUM

## SUMMARY OF INFORMATION

The commission is directed by section 332 (f) of the tariff act of 1930 to ascertain the approximate average cost per barrel to the oil refineries located on the Atlantic seaboard of crude petroleum delivered to them from the oil fields of the United States during the three years preceding 1930 and the present approximate average cost per barrel of crude petroleum from Lake Maracaibo, Venezuela, delivered to the same points. The instructions contained in this section are subject to more than one interpretation, and the various possible interpretations are fully discussed in the body of this report.

The average cost of production of crude petroleum at the well, for 1927, 1928, and 1929, in the States of Oklahoma, Texas, Arkansas, Kansas, Louisiana, and New Mexico, from which States is obtained the great bulk of the domestic oil refined along the Atlantic seaboard, was \$1.10. The cost of transporting this oil to the Atlantic seaboard was 88 cents, including pipe-line charges to Gulf ports, a purchasing charge of 10 cents per barrel, and tanker charges from Gulf ports to the Atlantic seaboard. The total cost of the oil delivered at Atlantic seaboard was, therefore, \$1.98 per barrel. This cost is computed on the basis of "company interest oil," i. e., royalty oil has not been included in total production, and includes interest at 6 per cent on the investment of the companies.

The cost of production of oil in the Maracaibo Basin of Venezuela, in 1929 (section 332 (f) calls for "present" cost and 1929 is the latest year for which costs were available) was 56 cents at the point of transfer to ocean tankers. Transportation and other charges necessary to deliver the oil to the Atlantic seaboard were 23 cents, making a total of 79 cents, cost delivered at Atlantic seaboard refineries. This figure also is computed on the basis of company interest oil and includes interest at 6 per cent on the investment of the companies.

The commission has made additional comparisons of the domestic and Venezuelan costs, on bases which might be indicated by other interpretations of section 332 (f). For example, it has compared the 3-year weighted average cost in the United States and in the Maracaibo Basin, Venezuela. On this basis the domestic delivered cost is \$1.98, the same figure as that used above, while the Venezuelan is \$0.89, made up as follows: Cost at the point of transfer to ocean tankers, \$0.65; transportation and other charges, \$0.24.

"Delivered cost to the Atlantic seaboard refineries" might also be interpreted as meaning the delivered prices which the refiners pay, since the price paid for crude oil by those who purchase in the open market is tantamount to the cost to them. The commission, therefore, ascertained not only cost at the well plus transportation and other charges to the Atlantic seaboard, as summarized above, but

also the delivered prices paid for both domestic oil from all fields and oil from the Maracaibo Basin, Venezuela. The 3-year (1927-1929) weighted average price paid for domestic crude from the Mid-Continent-Gulf area by the Atlantic seaboard refiners was \$2.06 and for the Venezuelan crude \$1.10. The price paid in 1929 for domestic crude from the Mid-Continent-Gulf area was \$2.03 and for Venezuelan crude \$1.02.

It is necessary to point out that in comparing the costs of domestic and Venezuelan crudes, articles are being compared which are not similar. The domestic crude, from the Mid-Continent and adjacent areas, the cost of which is here compared with the Venezuelan crude, had an average gravity of approximately 33°, Baumé scale, while the foreign had a gravity of 18° to 19°. The domestic crude refined along the Atlantic seaboard during the period covered yielded, largely by cracking processes, 36 to 44 per cent of gasoline, while the Venezuelan yielded 9 to 12 per cent gasoline and 75 to 83 per cent of fuel oil. (See Tables 14 and 15 showing typical yields of finished products from domestic and Venezuelan crudes.) Gasoline has a much higher unit value than fuel oil.

The difference in quality of domestic as compared with Venezuelan crude is reflected in the wide difference in the price paid by the Atlantic coast refineries. The commission has also ascertained the value of the product derived from the two kinds of crude petroleum by the Atlantic coast refineries during each year. In 1929 the value of the products obtained from the domestic crude used was \$2.97 per barrel, and from the Venezuelan crude, \$1.15 per barrel. There is, however, a decided difference in the costs of refining, the average expenditure per barrel for refining processes being much higher in the case of the domestic than of the Venezuelan crude. The average costs of refining were not, however, ascertained, so that the respective values of the products of the crude over and above refining costs could not be determined.

The commission has ascertained the cost of production and the sales value of crude petroleum in all the other principal producing regions in the United States, as well as in the Mid-Continent-Gulf area. The costs of production of the domestic crude have been tabulated in several different ways in order to afford as much information as possible on various phases of the industry. Costs have been tabulated by large and small companies, by States and groups of States, by fields, by cost groups, and by gravities of the oil produced. Tables showing details for the constituent elements of cost will be found in Part III.

In addition to the costs of production on different bases, considerable general information is herein given, on various phases of oil production in both the United States and Venezuela, and full statistical data are shown on production, imports, exports, stocks, prices, and other aspects of the petroleum situation.

## PART I

### INTERPRETATION OF THE LAW DIRECTING THE INVESTIGATION

Section 332 (f) of the tariff act of 1930 reads as follows:

The Tariff Commission is hereby directed, within eight months from the passage of this act, to ascertain the approximate average cost per barrel to the oil refineries located on the Atlantic seaboard of crude petroleum delivered to them from the oil fields of the United States during the three years preceding 1930, and the present approximate average cost per barrel of crude petroleum from Lake Maracaibo Venezuela, delivered to the same points. Such relative costs shall be immediately certified to the Speaker of the House of Representatives and to the President of the Senate for the information of the Congress.

The Tariff Commission has attempted in this report to cover not only the specific requirements of the law, but also many of the other pertinent factors which throw light upon the tariff problems respecting petroleum. It is believed that information of the kind which is pertinent for the President in an investigation under the provisions of section 336 of the tariff act of 1930 will likewise be useful to the Congress in any consideration of the tariff upon petroleum. The investigations under this section review a number of important phases of each subject, such as the following:

- (1) Article or articles included in investigation.
- (2) Comparability of domestic article with like or similar foreign article.
- (3) Representative period of time to be covered by investigation.
- (4) Principal competing country.
- (5) Evidences of domestic and foreign costs.
- (6) Principal domestic market or markets.
- (7) Transportation and other charges.
- (8) Collateral information.

#### 1. ARTICLE OR ARTICLES INCLUDED IN INVESTIGATION

Section 332 (f) specifically limits the investigation to "crude petroleum." Although the commission has restricted its investigation almost entirely to that product, both because of the wording of the resolution and the time limitation for the completion of the report, some consideration has been given to the uses made of crude petroleum and to the products derived from it. If the Congress should decide to impose a duty on crude petroleum, consideration no doubt will be given to the question of at least compensatory duties on the finished products of petroleum. With this in mind, data are included in the supplemental section of the report with reference to the domestic production, consumption, imports, and exports of petroleum products. Some of these data regarding products may have significance in connection with the question of the duty on crude oil itself.

## 2. COMPARABILITY OF DOMESTIC ARTICLE WITH LIKE OR SIMILAR FOREIGN ARTICLE

There are many different grades or qualities of crude petroleum both in the output of the United States and in that of foreign countries. Some oils are of very different grade from others, contain different kinds and amounts of impurities, and command very different prices. The most important differences are those which affect the relative amounts of the finished products which can be derived from the crude oil by commercially practicable methods. Variations in the "gravity" of petroleum, and the "base," whether asphalt or paraffin, are the most obvious characteristics which determine the amount of the important derived products, such as gasoline, lubricating oils, fuel oils, and paving materials. By reason of differences in these and other respects crude oils from different areas may command widely different prices.

Venezuelan petroleum has an asphalt base, and the bulk of the output has a gravity of about 18° to 19° (Baumé test used throughout this report). The natural gasoline content (that is, the proportion derived without "cracking" processes) is about 8 per cent, and the sulphur content is about 2.5 per cent.

Domestic petroleums are of paraffin, asphalt, and mixed bases, and the average gravity of all domestic crude oil is about 33°, with an average natural gasoline content of about 24 per cent. The sulphur content of most domestic oils is relatively low.

In view of the above facts the commission has given special consideration to the question of the comparability of imported and domestic oils in the cost comparison presented in the body of the report.

Differences in quality do not affect costs of production to the same extent in the oil industry as in the case of many other commodities. ~~The costs of exploration, development, drilling wells, and lifting the oil to the surface may be identical,~~ although the quality of the product, and therefore its value, is widely different. There is, however, a connection in its broad sense between the cost of producing petroleum and its quality. The quality of the crude oil to be obtained largely determines how much the producer can afford to pay in the form of capital investment and current operating expenses to get the oil out of the ground. If the oil in a given area is known to be of low grade producers will go to the expense of drilling wells there only if there is reason to expect a large average output per well which will bring down the average cost per barrel. On the other hand, high-grade oil will justify drilling if the output per well is small and costs per barrel consequently high.

## 3. REPRESENTATIVE PERIOD OF TIME TO BE COVERED BY THE INVESTIGATION

Section 332 (f) directs the commission to ascertain costs of crude petroleum in the United States during the 3-year period preceding 1930 and the "present approximate average cost" from Lake Maracaibo. In all of the commission's investigations cost data are sought for a sufficiently long period to be representative of the average conditions of the industry, and studies are rarely confined to the period of a single year unless it is found that the particular year reflects approx-

imately average conditions. For this reason the commission has obtained cost data for the 3-year period ended with 1929 for both the domestic and Maracaibo Basin oil fields. The cost by years was shown separately, however, so that a comparison may be made upon the Venezuelan costs "at the present time," i. e., during 1929—the last full year for which cost data were available at the time of the enactment of the law.

#### 4. PRINCIPAL COMPETING COUNTRY

Venezuela was the principal source of imports of petroleum into the United States during the 3-year period under consideration. The law, however, specifies that costs shall be obtained "from Lake Maracaibo, Venezuela." The term "Lake Maracaibo" has been interpreted by the commission as meaning the Maracaibo Basin. Oil is produced in that basin in three different areas, namely, from the area under the lake bed itself; from a strip about 3,300 feet wide along the margin of the lake, largely under shallow water; and from other oil-producing lands adjacent to or near the lake in the same basin. These three separate areas in the basin are chiefly under the control of four different producing organizations. It is obvious, therefore, that consideration should be given to the entire basin, which contributes the larger portion of all crude petroleum produced in Venezuela, rather than to attempt to compile data only for the production of the lake bed.

#### 5. EVIDENCE OF DOMESTIC AND FOREIGN COST

(a) *Interpretation of the law.*—The law requires the commission to "ascertain the approximate average cost per barrel to the oil refineries located on the Atlantic seaboard of crude petroleum delivered to them from the oil fields of the United States \* \* \* and \* \* \* from Lake Maracaibo." This wording might be interpreted to mean that the investigation is merely to ascertain what the refineries on the Atlantic seaboard have to pay for oil from the United States and from Lake Maracaibo, respectively. That is, "cost to the refineries" might be taken as meaning the price delivered at the Atlantic seaboard. The commission has not, however, so interpreted the passage quoted. It has assumed that the purpose of the law is to ascertain the cost of production at the wells plus transportation and other charges to the seaboard refineries, for both the Venezuelan and the domestic oils.

This interpretation is supported by the discussion of the subject when the bill was before the Senate. Speaking with reference to section 332 (f), Senator Thomas stated:

This amendment merely authorizes and directs the Tariff Commission to give the Congress some information as to the cost of producing petroleum at home and abroad.

However, the commission has also determined prices, including costs of delivery, paid by the refineries on the Atlantic seaboard for both domestic and Venezuelan crude oil. The wide difference in these prices, which appear in the report, reflects the wide difference in quality, and in the relative quantities of the different finished products which are obtained.

Much of the oil reaching the Atlantic refineries, both of domestic and foreign origin, is not bought and sold in the open market, but is

sent to the refineries by intercompany transfers. Enough is sold, however, to refineries which have no producing subsidiaries, to afford a check on the intercompany transfers, and to indicate that they are made at about the market price.

(b) *Mid-Continent-Gulf crude the basis of comparison.*—The most significant comparison for the purpose of section 332 (f) of the tariff law, as interpreted by the commission, is between Mid-Continent-Gulf oil and Venezuelan oil. The basic tables in this report show the cost of production at wells in the Mid-Continent-Gulf area and the cost of production and delivery charges from that area to the Atlantic coast refineries, in comparison with the cost of production in the Maracaibo Basin of Venezuela and of transportation and delivery to the same refineries.

The Atlantic coast refineries, to be sure, use crude petroleum from all the great producing regions of the United States except the Rocky Mountain region. If it were possible to do so, the commission would have undertaken, in conformity with a strict interpretation of section 332 (f), to ascertain the cost at the wells of the particular crude oil actually refined by the Atlantic coast refineries. It is, however, obviously impossible to segregate, for any given crude-oil-producing region, the cost of producing that part of its output which goes to Atlantic coast refineries from that part which is used otherwise. The only practicable method is to ascertain the average cost of production of all crude oil in a given region.

In the case of the Mid-Continent-Gulf area, the average cost of producing all crude oil is unquestionably substantially the same as the average cost of producing that part of the crude which goes to the Atlantic coast refineries. The same is not true of the other oil regions. The difference arises from the facts (a) that the great bulk of the domestic crude refined at the Atlantic seaboard is from the Mid-Continent-Gulf area and very little from other areas; (b) that the consumption by the Atlantic coast refineries represents a very considerable fraction (about one-sixth) of the total production of the Mid-Continent-Gulf area, while these refineries use only a very small proportion of the total output of the California region; and (c) that the crude received by the Atlantic coast refineries from the Mid-Continent-Gulf area represents oil from most of the scattered fields and pools of that area and is in quality a fair average sample of the total production, which is not the case as regards the oil received by these refineries from California and the eastern region.

The following statement<sup>1</sup> shows for the year 1929, the sources of the domestic crude oil received by the Atlantic coast refineries, from which the dominance of Mid-Continent-Gulf crude is obvious:

Region	Quantity (barrels)	Per cent of total
Mid-Continent-Gulf.....	101,237,000	57.17
California.....	667,000	.38
Illinois and Appalachian.....	5,847,000	3.30
Foreign.....	68,995,000	38.97
Withdrawn from foreign crude stock.....	317,000	.18
Total.....	177,063,000	100.00

<sup>1</sup> Source: U. S. Dept. of Commerce, Bureau of Mines Information Circular 6396, Sources and Distribution of Major Petroleum Products, Atlantic Coast States, 1929.

The following statement <sup>1</sup> compares the receipts of crude from the various regions by the Atlantic coast refineries with the total production of these regions in 1929:

Region	Production	Receipts by Atlantic coast refineries	
		Amount	Per cent of production
	<i>Barrels</i>	<i>Barrels</i>	
Mid-Continent-Gulf.....	641,994,000	101,237,000	15.77
California.....	292,534,000	667,000	.002
Illinois and Appalachian.....	47,136,000	5,847,000	12.40
Rocky Mountain.....	25,652,000	-----	0
Other States.....	7,000	-----	0
Total.....	1,007,323,000	107,751,000	10.70

## 6. PRINCIPAL DOMESTIC MARKET OR MARKETS

The American markets for the crude petroleum produced in the United States are widely scattered, including refining centers in California, along the Gulf coast, along the Atlantic seaboard, and in the interior of the country. The principal American market for the crude petroleum imported from Venezuela, however, is along the Atlantic seaboard. Section 332 (f) prescribes that the commission shall ascertain costs per barrel "to the oil refineries located on the Atlantic seaboard." Consequently, no attempt was made to ascertain costs of petroleum delivered from the producing areas to refineries in other parts of the United States, or the cost of moving the finished products from the refineries to the consuming areas.

The Atlantic seaboard is an important area of refining of both domestic and Venezuelan petroleum. In 1929 the total quantity of crude oil put through stills along the east coast was 172,000,000 barrels out of 988,000,000 barrels for the country as a whole. The approximate quantity of domestic petroleum refined in that area during that year was about 106,000,000 barrels, and of imported about 66,000,000 barrels, most of the imported oil being from Venezuela. Much of the oil produced along the Gulf coast is refined there, but an important part of the finished products goes to the Atlantic coast for marketing, and therefore is affected indirectly by the competition of the crude petroleum of foreign origin refined in the East and of the finished products imported.

## 7. TRANSPORTATION AND OTHER CHARGES

The commission has based its calculation of transportation cost from the Mid-Continent-Gulf area and from Venezuela respectively to the Atlantic seaboard upon the charges of the carriers, not on the actual cost to these carriers for performing the transportation service. In the case of producers of crude oil who do not own pipe lines or tank vessels, the cost of delivery to the eastern refineries, by whomsoever paid, is the rate paid to the transportation agencies. A large majority of the producers, in point of number, in practice use this means of transportation.

<sup>1</sup> Source of production figures, U. S. Bureau of Mines, Annual Petroleum Statement, No. P. 69, Sept. 29, 1930.

On the other hand, a number of the large companies engaged in producing or refining crude oil operate pipe lines and tank vessels, either directly or through closely affiliated concerns. In such cases the cost of oil delivered to the Atlantic seaboard might be considered as the cost of production at the well plus the cost of operation of the transporting agencies. The commission has not deemed it feasible, however, in the limited time at its disposal, to investigate the actual cost of transporting the oil to the Atlantic seaboard as distinct from the regular charges for transportation by pipe lines and steamers. The commission has determined the actual amount-paid in purchasing, pipe-line and tanker charges on a large proportion of the crude oil which moved from the Mid-Continent-Gulf area to the Atlantic seaboard during the period under consideration.

#### 8. COLLATERAL INFORMATION

The commission has added to this report statistical information which was deemed relevant to the consideration of a duty on crude petroleum. These data will be found in Part IV.



## PART II

# COST OF PRODUCTION OF CRUDE PETROLEUM IN THE MID-CONTINENT-GULF AREA AND IN VENEZUELA, INCLUDING DELIVERY TO ATLANTIC SEABOARD REFINERIES

### INTRODUCTION

In order to appreciate the significance of figures showing the cost of production of Mid-Continent-Gulf oil and the delivery thereof to the refineries on the Atlantic seaboard, it is necessary to note the position of the Mid-Continent-Gulf area among the oil producing regions of the United States, and the position of the Atlantic seaboard area in the refining industry and in the consumption of refined petroleum products.

The Mid-Continent-Gulf petroleum region, comprising the States of Kansas, Arkansas, Louisiana, Oklahoma, Texas, and New Mexico, is much the largest source of crude petroleum in the United States. It produced in 1929, 641,994,000 barrels, out of a total for the United States of 1,007,323,000 barrels. It is the only crude oil producing region which is able to send the greater part of its output, either in crude or finished form, to consuming regions of the United States outside of its own borders. The crude oil of the California region, which ranks second to the Mid-Continent-Gulf, is for the most part refined in California itself, and the great bulk of the products thereof are consumed on the Pacific coast, where, on account of the scarcity of coal, the consumption of fuel oil is much larger in proportion to the population than in other parts of the country. California sends a certain proportion of its output, either in crude or finished form, by water to the Atlantic Seaboard, but the quantities sent are much smaller than those originating in the Mid-Continent-Gulf region. There is also considerable exportation of products of California crude oil to the Orient and to South America.

The other two petroleum producing regions are of less importance and their output, whether as crude or as refined products, is mostly consumed within their own borders. The Rocky Mountain region, with oil production in the States of Colorado, Wyoming, and Montana, has as yet a relatively small output, the great bulk of which is consumed in the Rocky Mountain area itself, which, because of its sparse population, finds the production of these wells substantially sufficient for its requirements.

The eastern petroleum production is from widely scattered fields, the most important of which are in the States of West Virginia, Pennsylvania, Ohio, Kentucky, and Illinois. Because of the dense population of this region, the output is far from being sufficient for its requirements, and it draws large quantities, either of crude oil or of refined petroleum products, from the Mid-Continent-Gulf area.

There is no production of crude petroleum along the eastern Atlantic coast. The wells nearest to the coast are in western Pennsylvania and western West Virginia, and, as just stated, these wells have no

surplus to be sent eastward, although on account of the high quality of the oil certain quantities of the refined products derived from it, especially lubricants, are marketed along the seaboard and in other parts of the country. The great population along the Atlantic coast is primarily dependent on petroleum either from the Mid-Continent-Gulf area or from Venezuela.

The consumption of petroleum products is nation-wide. That of gasoline, the most important single product in value and, beginning with 1929, in quantity, is more or less proportional to the number of automobiles, which in turn is roughly proportional to the population. The consumption of fuel oil, until 1929 the largest product in terms of quantity, is more irregularly distributed, being affected greatly by the relative abundance of coal, water power, and, recently, natural gas.

The location of the refineries which transform crude oil into products ready for consumption is not determined exclusively by the geography of the production of crude oil, nor exclusively by the geography of consumption of finished products, but by a combination of these factors. The location of refineries, moreover, is greatly influenced by the fact that transportation by pipe line and transportation by water are both very much cheaper than transportation by rail. The pipe line lends itself especially to the movement of crude oil, although to some extent refined products are also transported in that way for considerable distances.

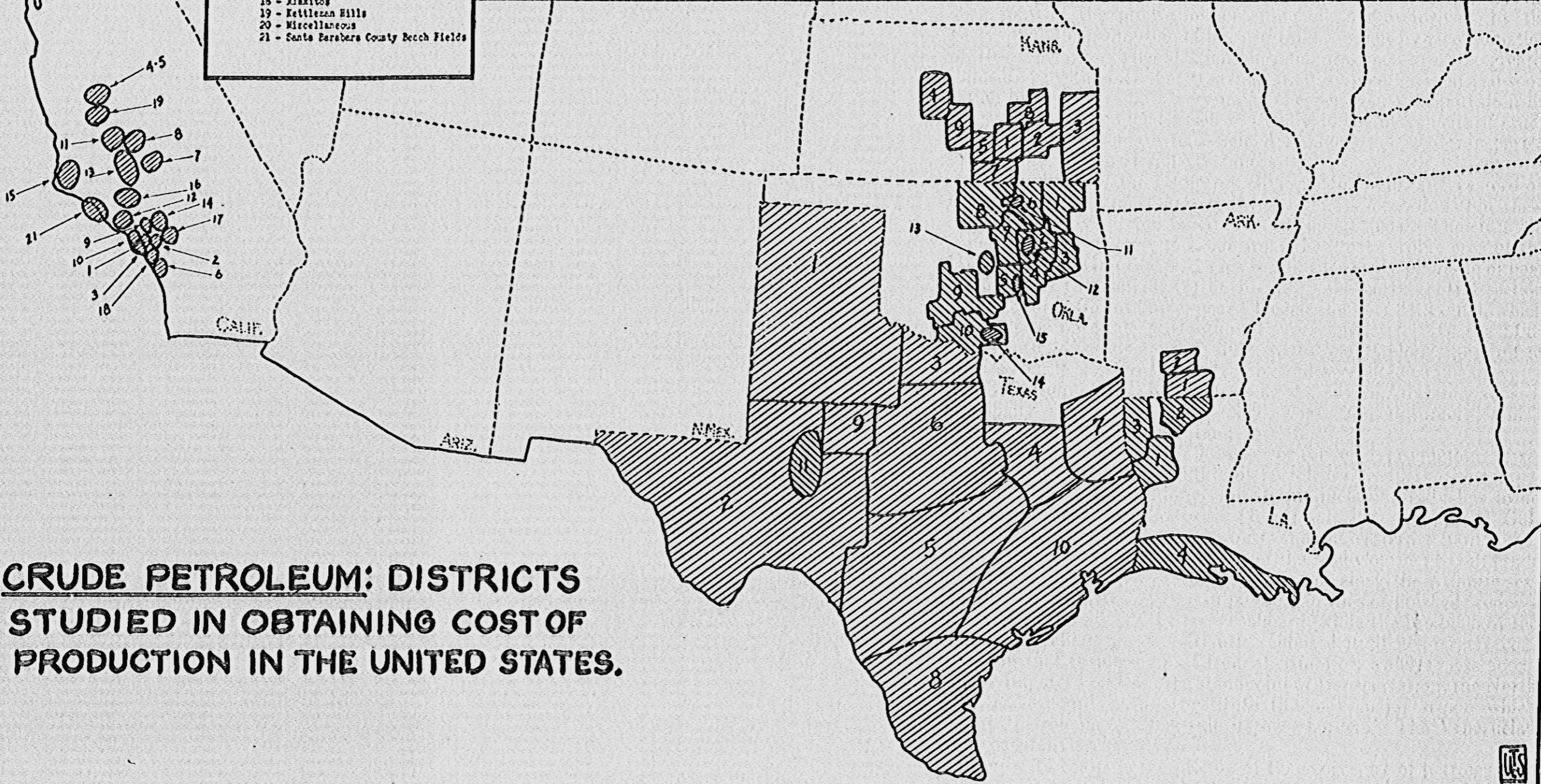
The crude oil of the California, Rocky Mountain, and eastern oil regions is for the most part refined at plants located within these regions respectively, and fairly close to the oil wells. The situation is different with respect to crude from the great surplus area of the Mid-Continent-Gulf States. This is refined: (1) By plants in or near the oil fields themselves; (2) by plants in the north central section of the country (for example, near Chicago and near St. Louis), which has little or no crude production; these refineries receive the Mid-Continent-Gulf crude by pipe line; (3) by plants along the Gulf of Mexico, fairly close to the oil regions and accessible to cheap water transportation; and (4) by plants along the eastern Atlantic seaboard, principally near Philadelphia, New York, and Baltimore, which receive the crude chiefly by tank vessels.

In view of the geographic location of crude-oil production, of refineries, and of the consumption of petroleum products, the competition of Venezuelan crude oil and its products naturally has to do chiefly with the Mid-Continent-Gulf producing region, the Gulf and eastern Atlantic refining regions, and the eastern Atlantic consuming region. At least two-thirds of the Mid-Continent-Gulf crude is refined either along the Gulf of Mexico or along the Atlantic seaboard. The Gulf refineries ship large quantities of finished products by water to the eastern Atlantic seaboard, while the products of the Gulf crude refined on the Atlantic seaboard itself are largely consumed in that region. Apart from the interior, which is less accessible to imported oil from the standpoint of transportation, the North Atlantic seaboard States constitute the only major region which requires petroleum from outside its own borders. The Venezuelan crude naturally seeks this area.

In order to complete the picture of the geography of petroleum, it is necessary to note that the United States is a large exporter of

# LEGEND

CALIFORNIA	OKLAHOMA	TEXAS	LOUISIANA	KANSAS
Dist. No. 1 - Long Beach - Seal Beach 2 - Santa Fe Springs 3 - Torrance - Redonda 4 - Coalinga (Light) 5 - " (Heavy) 6 - Huntington Beach 7 - Kern River 8 - Elk Hills - McKittrick 9 - Rosserana 10 - Dominguez 11 - Belridge - Lost Hills 12 - Ventura 13 - Midway - Sunset 14 - Inglewood - Montebello 15 - W. W. Santa Barbara County 16 - Berdsdale - Washell 17 - Erea - Ollinda - Richfield 18 - Alaritos 19 - Kettleman Hills 20 - Miscellaneous 21 - Santa Barbara County Beach Fields	Dist. No. 1 - Washington - Nowata - Craig - Rogers Counties 2 - Creek - Tulsa Counties 3 - Pagoner - Muskogee - McIntosh Counties 4 - Okmulgee - Okfuskee - Hughes Counties 5 - Seminole - Pottawatomie Counties 6 - Osage County 7 - Pawnee - Payne - Lincoln Counties 8 - Kay - Grant - Noble - Garfield Counties 9 - Garvin - Grady - Caddo - Comanche Counties 10 - Cotton - Stephens - Jefferson - Carter Counties 11 - Burbank Field 12 - Cushing Field 13 - Oklahoma City Field 14 - Eadlton Field 15 - Seminole Field 20 - All other	Dist. No. 1 - Panhandle 2 - East Texas 3 - North Texas 4 - Meade - Wortham 5 - Luling - Bruner 6 - North Central Texas 7 - East Texas 8 - South West Texas 9 - Iatan 10 - Gulf Coast 11 - Big Lake 20 - All others	Dist. No. 1 - Red River - Sabine Parishes 2 - Haynesville - Hoker 3 - Teasle - Mansfield 4 - Gulf Coast  ARKANSAS  Dist. No. 1 - El Dorado 2 - Suckover	Dist. No. 1 - Butler County 2 - Greenwood - Woodson Counties 3 - Eastern Kansas 4 - Russell - Barton Counties 5 - Sedgewick County 7 - Cosley - Sumner Counties 8 - Lyon - Chase Counties 9 - Rice - Reno Counties



**CRUDE PETROLEUM: DISTRICTS  
STUDIED IN OBTAINING COST OF  
PRODUCTION IN THE UNITED STATES.**



petroleum products. Apart from the exports from the Pacific coast to the Orient and to South America, our foreign sales are made chiefly from the Gulf and Atlantic coast refineries.

#### A. COST AT THE WELL IN THE MID-CONTINENT-GULF AREA

##### 1. METHOD OF DETERMINATION OF DOMESTIC COSTS

The requirement of the law, that the investigation should be completed and the report made in eight months, imposed upon the Tariff Commission the necessity of adopting the most expeditious method of cost finding. The size of the petroleum industry and the large number of producers, moreover, precluded any minute or extended examination of the books of the producers in the time allotted. The method adopted was one which was considered most convenient from the point of view of those who were asked to submit their records and at the same time was considered adequate from the standpoint of accuracy.

(a) *Use of questionnaires; comprehensiveness of returns.*—Cost schedules were mailed to 113 producers (including those in other fields as well as in the Mid-Continent-Gulf area), each of whose annual output was listed as 1,000,000 barrels or more. The output of these large producers constitutes about two-thirds of the United States production. Several other producers were subsequently added to this first list, whose output was less than a million barrels each.

Agents of the commission were sent to the oil producing regions to confer with the officials and employees of these larger companies and assist in the work of filling out the schedules. Nearly all of these companies submitted the information requested by the commission. Ninety-six companies, producing 467,114,613 barrels of company-interest oil (that is, that part of the output which becomes the property of the producing concern, excluding that turned over to the land owner as royalty), reported upon the business of 1927; 105 companies, producing 478,573,105 barrels of company-interest oil, reported upon the business of 1928; and 109 companies, producing 558,804,248 barrels of company-interest oil, reported upon the business of 1929. The royalty oil included in the returns amounted to 73,212,275 barrels for 1927; 74,872,556 for 1928; and 89,622,289 for 1929.

In order to secure a sample of the costs of the smaller producers, cost schedules were mailed to an additional list of 500 companies and individuals (including those in all the oil regions) listed as producing less than 1,000,000 barrels a year. Half of these additional schedules were sent to companies listed as having a production between 100,000 and 1,000,000 barrels a year, and half to those listed as having a production of less than 100,000 barrels a year. These producers were selected at random—but with regard to geographical distribution—from a list of 2,500 producers secured from the petroleum division of the Bureau of Mines. Schedules were filled out for the year 1927 and forwarded to the commission by 139 of those producers, with an output of 21,492,448 barrels of company-interest oil; by 155 producers, with an output of 20,967,832 barrels of company-interest oil for 1928; and by 167 producers with an output of 20,096,408 barrels of company-interest oil for 1929. The royalty oil included in these returns

amounted to 3,144,259 barrels for 1927; 3,025,917 barrels for 1928; and 3,088,627 barrels in 1929.

The proportion of the entire United States output represented by the combined production of company-interest oil of the large and small companies reporting to the commission, was, for 1927, 54 per cent; for 1928, 55 per cent; and for 1929, 57 per cent. If the royalty oil were added to the company-interest oil, the proportions to total domestic output would be 63 per cent for 1927; 64 per cent for 1928; and 67 per cent for 1929. For the Mid-Continent-Gulf area, used as the basis of comparison of costs with those of Venezuelan oil, the proportion of output covered by the returns was even larger than for the country as a whole.

The figures submitted by the reporting companies, large and small, were tabulated by the commission, only a negligible number being rejected and then only because of obvious and glaring errors.

(b) *Form of cost questionnaire used.*—A very condensed and simplified cost schedule was used in order to facilitate the work of the companies in furnishing the desired information, and to expedite the investigation. The items called for on this schedule were as follows:

1. Name of company.
2. Name of pool, field, district, or zone.
3. State in which located.
4. Approximate gravity of oil.
5. Base—whether asphalt, paraffin or mixed.
6. Production (barrels)—
  - (a) Gross.
  - (b) Company interest.
  - (c) Other interest.
7. Expenses—
  - (a) Depletion of leasehold cost.
  - (b) Amortization of tangible development cost.
  - (c) Intangible development cost.
  - (d) Current operating costs.
  - (e) General and administrative expense.
8. Income—
  - (a) Sales of oil, barrels, and amount received.
  - (b) Sales of gas, amount received.
  - (c) Miscellaneous revenue.

Supplemental information was obtained with reference to the investment of the companies and interest at 6 per cent was computed on the value of the assets.

## 2. CALCULATIONS ON THE BASIS OF COMPANY-INTEREST OIL

It is customary, though not universal, for the ownership of oil lands to remain in other hands than those of the operating concerns which produce the oil. In such cases a payment is made to the owner of the lands, usually in the form of a proportion of the oil produced. The most customary royalty in the United States is one-eighth of the output. In Venezuela the royalty is about 9 per cent of the output.

The commission, for the general purposes of this report, has calculated average unit costs both in the United States and in Venezuela, by dividing the total costs of the producing concerns by the quantity of company-interest oil, that is, excluding royalty oil. That is, generally speaking, the divisor in ascertaining the average cost per barrel is in the United States, seven-eighths of the oil produced, and in Venezuela, 91 per cent of the oil produced. This method of cal-

culating average costs is that customary in the trade and appropriate for most economic purposes.

The amount of royalty is, on the average, slightly more than one-eighth. It ranges, however, from a small fraction to as much as 47 per cent. When the percentage going to the royalty owner is as high as the latter figure it indicates that the producer is developing the property on a share basis, as in such cases nothing is reported for leasehold costs.

Another possible method of calculating average cost is to divide the costs reported by the producing companies by the total quantity of oil produced, including royalty oil. This procedure necessarily gives an average such that the producing companies could not sell at that cost without incurring a loss.

Still another method is to calculate the value of royalty oil at current market prices, add this to the costs of the producing companies, and divide the sum by the total quantity of oil produced, including royalty oil. Under this method the unit cost will vary according to the market price of the royalty oil. If the price of royalty oil is greater than the cost of production, the average thus computed will be higher than the average based on company-interest oil alone; if the market price is below the cost of production, the reverse will be the case.

For general purposes this method of calculating costs is therefore less significant than that based on company oil alone. If, however, it is desired to determine what part of the costs of producing oil consists of payment to landowners (whether in the form of a share of the oil produced or in the form of purchase price paid for leaseholds) this method is the necessary one. It has therefore been used for this particular purpose in the present report. (See Part III.)

### 3. CREDIT FOR BY-PRODUCTS

In addition to the production of crude oil, large companies often operate gas properties, engage extensively in buying and selling crude oil, and carry on other operations quite extraneous to a strictly crude-oil producing enterprise. The smaller producers, on the other hand, have less diversified operations, and many of them engage only in crude-oil production. The questionnaires submitted to the companies by the Tariff Commission called for careful separation of the expenditures and receipts between the crude-oil producing business and other collateral enterprises. Natural gas, however, is frequently a by-product of the oil industry rather than a separate enterprise.

In all cases where oil flows freely to the surface, gas is produced coincidentally with the crude petroleum. Some companies utilize this gas in various ways while others permit it to flow as waste into the air. Natural gas is utilized extensively in some States for producing carbon black. It seems to be the usual practice in these States to sell the gas to a separate company or subsidiary, which undertakes the carbon black production independent of the crude-oil producing company. In other places gas is sold extensively for heating and lighting purposes. This practice is especially common where the oil field is near some rather large metropolitan or industrial district, but gas pipe lines are being constantly extended to longer distances. Receipts from gas and miscellaneous sources have been placed as by-product credits against the cost of production of the crude oil.

#### 4. OVERHEAD EXPENSE

Methods of allocating overhead applicable to crude-oil production differ radically between companies. Some concerns, at least for income-tax purposes, compute these expenses on a flat per barrel basis, irrespective of the field, district, or lease from which the oil was produced. This is equivalent to saying that overhead cost is the same for all crude oil produced by the company notwithstanding the fact that operating conditions differ radically between fields or even districts. Another basis that is used to allocate overhead to districts or leases is according to the amount of other operating expenses that can be directly assigned to the different districts or leases operated. On this basis a proportionately larger share of overhead is allocated to properties having larger operating costs. Although the proportions may not be correct, nevertheless this basis probably more nearly conforms to actual conditions than a flat per barrel proration. It seems obvious that more overhead (per barrel of crude oil) should be charged to an old property with wells which are being pumped than to a new property with free-flowing or gusher production.

A third basis for the allocation of overhead is to prorate it according to the number of producing wells within each district or lease where the company is operating. As this would have the effect of allocating as large an amount to a well producing a few hundred as to one producing thousands of barrels per year, the costs as submitted for companies making their allocation in this manner were revised on a per-barrel basis.

Under the caption of general and administrative expense, companies were requested to report all expenses of an administrative nature, as well as others not having a direct bearing on production in any one district, such as dry-hole and test-well expenditures, abandonment of such properties as were found nonproductive or which were abandoned prior to having been amortized through depreciation or depletion, rentals paid on nonproductive leases, amortization of nonproductive leasehold costs, engineering, geological and land department expenses.

#### 5. LEASEHOLD VERSUS DEVELOPMENT EXPENSE

In addition to the payment of a share of the oil produced as royalty, producing concerns often pay to the owners of land large sums for the privilege of obtaining a lease of their property for oil purposes. These payments or allowances for depletion are designated as leasehold expenses. The policy of a company with respect to expansion of production has an important effect upon the relation of this item of cost to the item of development expenses. Some companies elect to acquire undeveloped or unproved properties, while other companies pursue a more conservative policy of acquiring only proven properties. In the former case leasehold costs and rentals are likely to be small, but development expense, including geological work and dry-hole costs, is likely to be large. Where the more conservative policy is followed, on the other hand, leasehold cost is likely to be large and development expense small.

Some companies amortize leasehold cost over the period the lease has to run or until oil has been discovered, at which time the balance

remaining is depleted on the ratio of unamortized value to possible recoverable oil. Should the lease prove worthless prior to expiration, the companies either write off the unamortized value and cease payment of rentals, or capitalize leasehold costs and rentals and write them off at the expiration of the lease. Because of the interrelationship between leasehold cost and development expense it is necessary that these items be considered together in making comparisons between companies.

Development expenses are classified for income tax purposes as tangible expenses which include buildings, equipment, casings, etc., and intangible expenses comprising only the labor cost. The taxpayer is required to capitalize the tangible expenses and "write them off" or depreciate them on an annual basis irrespective of the quantity of oil produced.<sup>1</sup> With respect to the intangible (labor) development expense, on the other hand, the taxpayer is allowed two alternatives: He may capitalize this expense and pro rate or deplete it over the total oil produced; or he may charge it off as a current operating expense in the year in which it is incurred. The only requirement is that the taxpayer must follow consistently whichever practice he first decides upon. Without interfering in any way with this option concerning intangible development expense, the Bureau of Internal Revenue has required the taxpayer to show the total amount of this expense that has been incurred since 1925. With but few exceptions, however, the taxpayers have elected to charge intangible development expense against current operations, that is, they have chosen the second alternative. Probably income tax practice has been followed by most of the companies in reporting these expenses to the commission.

## 6. DRY-HOLE EXPENSES

In the course of developing an oil property it is inevitable that some dry holes will be drilled. Dry holes will result from efforts to locate oil pools before the property has become productive; and after the property has become productive other dry holes will be drilled as a result of the practice of drilling offset wells. A difficult question arises as to when a dry-hole expense is bona fide development cost and when it represents wildcatting or general exploration cost. It is certainly true that in the course of developing a particular property the expense of drilling certain dry holes, whether on the property or not, is a legitimate item of exploration cost. Dry-hole expense incurred only on productive properties as indicated above, does not tell the whole story since in the course of development many dry holes that represent legitimate costs (of exploration and development) are drilled on properties that never become productive; this drilling must be undertaken to some extent in order to locate the good properties.

## 7. INTEREST ON INVESTMENT

With the exception of eight companies, investment in leasehold, tangible development, capitalized intangible development, and equipment, was submitted together with reserves for depletion and depre-

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<sup>1</sup> It should be noted that probably the larger part of these items, such as casings, derricks, etc., become worthless when the oil deposit is depleted. In other words, the useful life of the tangible equipment, depends upon production of oil rather than the lapse of time, and hence should be depleted rather than depreciated.



ciation. Net investment (gross after deducting reserves) was used in calculating interest at six per cent. For those companies which did not submit figures on investment, the average net investment, on the per barrel basis, of the companies which did report this item, was used.

### 8. CLASSIFICATION OF EXPENSES

Basing their reasoning on the foregoing considerations, the commission issued instructions to the companies to classify their expenses in the following way:

(a) Depletion of leasehold cost should be based on aggregate cost of producing leases, within reporting district, and total estimated recoverable oil.

(b) Amortization of tangible development costs should be the amount of depreciation charged on all tangible property, such as derricks, casings, tubing and rods, pumping equipment, line pipe and fittings, tanks, temporary buildings, etc.

(c) *Intangible development costs.*—All expenditures incurred in the development of producing properties should be included under this heading. This should cover all labor, teaming, supplies, fuel and water, drilling, rig expense, rental of equipment, erecting temporary camp sites, etc., incurred in the development of producing properties.

(d) *Current operating costs.*—Expenses such as labor, teaming, supplies, fuel and water, pumping, repairs, torpedoes, cleaning out, insurance, taxes (income tax not to be included), general lease expense, and any other incurred in the actual production of oil should be included under this caption.

(e) *General overhead and administrative expense.*—This should include prorated amount, charged to each producing district, of such items as officers' and office salaries, office supplies and expense, telephone and telegraph, automobile and truck expense, contributions, legal and auditing, depreciation on other company assets not directly chargeable to specific districts, engineering and geological expense, abandoned or canceled leases, dry hole and test well contribution, exploration costs, etc.

### 9. COST OF PRODUCTION PER BARREL

The results of the commission's investigation of costs of production of crude petroleum are shown in detail in Part III of this report. Here it is sufficient to give the summarized results as regards the cost of producing oil in the Mid-Continent-Gulf region, which furnishes the basis for comparison with the cost of Venezuelan oil.

The returns were tabulated separately for large companies, producing one million or more barrels each (that is, on the basis of their total production in the United States, and not merely their production in the Mid-Continent-Gulf region), and for smaller companies. The combined average for both large and small companies is substantially the same as that for the large companies alone, because the great bulk of the production covered by the returns was that of the large companies. For the three years 1927-1929 combined, the cost data covered 1,318,983,000 barrels of oil (including both company-interest and royalty oil), produced by large companies, and 30,510,000 barrels produced by small companies, a total of 1,349,493,000 barrels, in comparison with a grand total output of the Mid-Continent-Gulf

region during those years as reported by the Bureau of Mines, petroleum division, of 1,842,935,000 barrels. The returns for each separate year covered substantially the same proportion of the output of that year.

The averages given in the accompanying table are obtained by dividing the total costs incurred by the producing companies by the quantity of company-interest oil produced. Thus calculated, the average cost of production for the three years taken together was \$1.10 per barrel for the large companies, and \$1.06 for the small companies; the combined average for all reporting companies being \$1.10. For 1927 the average cost for all companies was \$1.20; for 1928, \$1.07; and for 1929, \$1.04.

TABLE 1.—Average cost per barrel (company-interest oil) at wells in the Mid-Continent-Gulf area, large and small companies combined, 1927-1929

[Cost per barrel]

	1927	1928	1929	Weighted average 1927-1929	Per cent
Production: (thousand barrels).....	379,664	383,158	417,090	1,179,912	-----
Expenses:					
Depletion of leasehold.....	\$0.13	\$0.11	\$0.11	\$0.12	10.91
Amortization tangible development.....	.18	.16	.15	.16	14.65
Intangible development.....	.28	.22	.24	.24	21.82
Current operating.....	.28	.27	.27	.28	25.45
General and administrative.....	.30	.29	.27	.29	26.36
Total expenses.....	1.17	1.05	1.04	1.09	99.09
Deduct gas sales and miscellaneous revenue.....	.06	.07	.08	.07	6.36
Net cost, excluding interest.....	1.11	.98	.96	1.02	92.73
Interest at 6 per cent on investment.....	.09	.09	.08	.08	7.27
Net cost including interest.....	1.20	1.07	1.04	1.10	100.00
Average sales value at well.....	1.31	1.16	1.28	1.25	-----

The table distinguishes between the direct expense of production and interest on investment. For the three years together, the average direct expense for large and small companies combined amounted to \$1.09 per barrel. From this is deducted the credit for by-products obtained as incidental to the business, consisting chiefly of sales of gas, and amounting on the average to \$0.07 per barrel of crude oil (company-interest) produced. With this deduction the net direct expense averaged \$1.02 per barrel. Adding interest on investment, calculated at 6 per cent and amounting on the average to \$0.08 per barrel, the total net cost of production becomes, as already stated, \$1.10 per barrel.

All five of the items of direct cost distinguished in the returns bulk large, both for the bigger companies and the smaller concerns. For the small companies the largest single item is that of operating cost, consisting chiefly of cost of pumping wells, but for the large companies the largest single item is general and administrative expense, which slightly exceeds that for operating cost. An important fraction of the general and administrative expense is made up of the cost of dry holes.

The average sales value at the well exceeded the net cost including interest in each of the three years. In 1927 the average sales value

was \$1.31 per barrel as against a net cost of \$1.20 per barrel; in 1928 the sales value was \$1.16 and the cost \$1.07; in 1929 the sales value was \$1.28 and the cost \$1.04, while for the three years combined the sales value was \$1.25 per barrel as against a net cost of \$1.10 per barrel.

## B. COST OF PRODUCTION OF CRUDE PETROLEUM IN VENEZUELA

### 1. INTRODUCTION—POSITION OF THE VENEZUELAN PETROLEUM INDUSTRY

(a) *Development and potential production in Venezuela.*—Although exploration and development work started a number of years earlier, large scale production of petroleum in Venezuela did not begin until 1925. Areas known to contain petroleum are enormous and it has been said that only additional drilling and transportation facilities are necessary for oil production on a scale similar to that in the United States. It is probable that many other vast fields in Venezuela still remain to be proved.

TABLE 2.—*Venezuelan production of crude petroleum, 1917–1930 (6 months)*

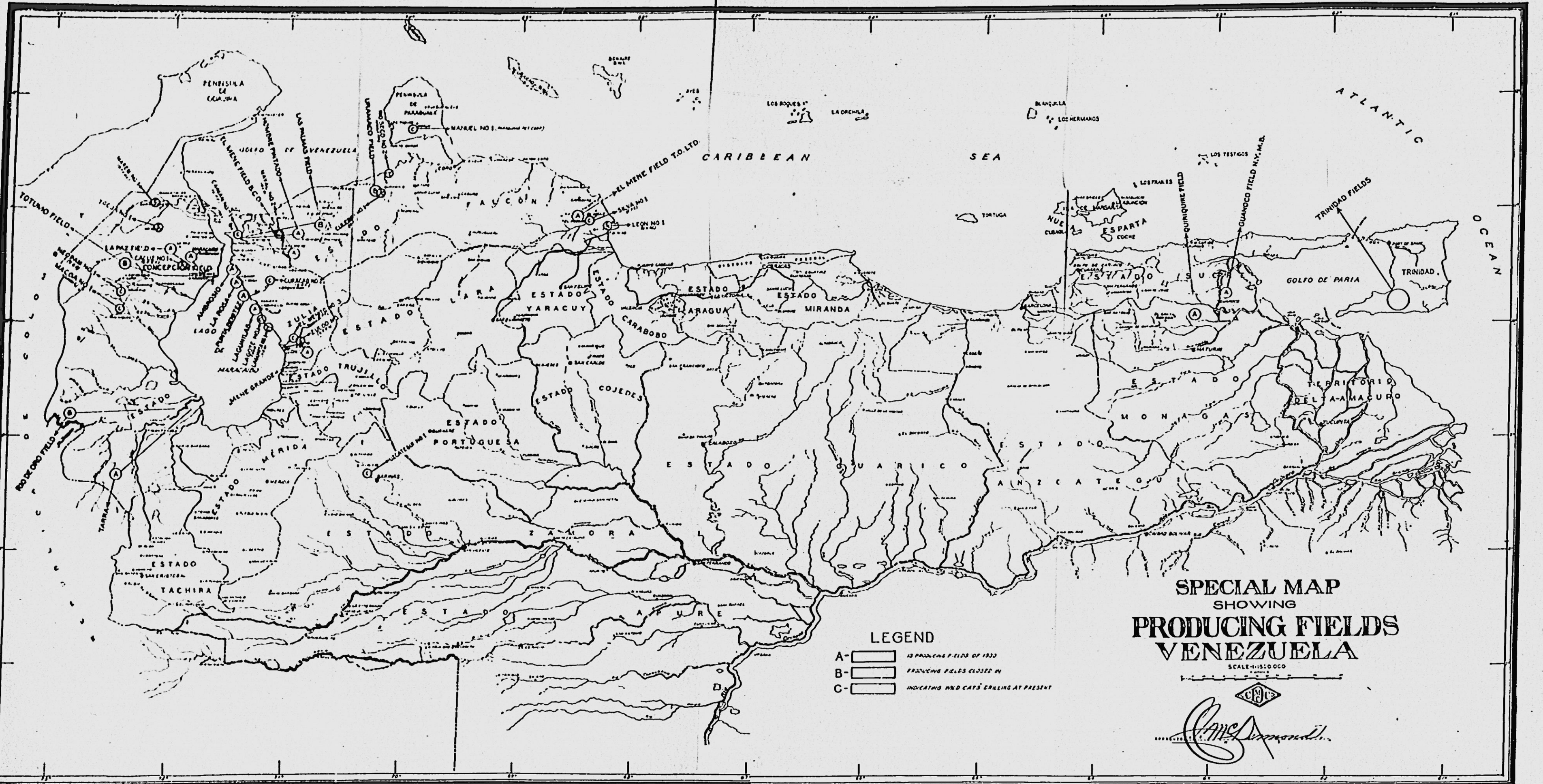
Year	Quantity	Year	Quantity
	<i>Barrels of 4½ gallons</i>		<i>Barrels of 4½ gallons</i>
1917.....	120,000	1924.....	9,042,000
1918.....	333,000	1925.....	19,637,000
1919.....	425,000	1926.....	36,911,000
1920.....	457,000	1927.....	63,134,000
1921.....	1,433,000	1928.....	105,749,000
1922.....	2,201,000	1929.....	137,388,270
1923.....	4,201,000	1930 (6 months).....	66,340,787

Source: Mineral Resources, Part II, Bureau of Mines, except 1929 and 1930, which are from O'Shaughnessy's South American Oil Reports.

The bulk of the petroleum produced in Venezuela at present comes from Lake Maracaibo. Smaller quantities are produced in the surrounding basin and in other sections of Venezuela. The main producing region of the lake is comprised in the so-called Bolivar coastal fields situated on the eastern shore. In this section the Lagunillas and La Rosa-Ambrosio fields account for the major part of the production, in 1927 the output amounting to about 78 per cent of total Venezuelan production and in 1929 to about 94 per cent. The map opposite this page shows the principal petroleum-producing fields in Venezuela.

Because ocean tankers can not enter Lake Maracaibo, the oil from this area is shipped in shallow-draft tankers to deep-water terminals where it is transferred to ocean tankers for export to the United States and Europe, or goes direct to refineries, located in the Dutch West Indies.

(b) *Principal producing companies.*—Four companies control the output in the Bolivar coastal fields. The Standard Oil Co. of Indiana, through its subsidiary the Lago Petroleum Corporation, controls the concessions under the lake bed, except the "marine zone," a strip 3,300 feet wide extending under the water around the entire shore of the lake, which is controlled by the Venezuela Gulf Oil Corporation, subsidiary of the Gulf Oil Corporation of Pennsylvania, and the



**SPECIAL MAP**  
 SHOWING  
**PRODUCING FIELDS**  
**VENEZUELA**

- LEGEND**
- A- [Symbol] IS PRODUCING FIELDS OF 1933
  - B- [Symbol] PRODUCING FIELDS CLOSED IN
  - C- [Symbol] INDICATING WILD CATS DRILLING AT PRESENT

SCALE-1:150,000

*Claremont*



Creole Petroleum Corporation, subsidiary of the Standard Oil Co. of New Jersey. The Royal Dutch Shell Co., through its subsidiaries, controls the concessions on the shore. Production of petroleum in Venezuela is about equally divided between the American companies and the subsidiaries of the Shell Co.

The following tables show production by companies and by fields in Venezuela for the years 1927 to 1930 (6 months):

TABLE 3.—Crude petroleum: Production in Venezuela by companies, 1927-1930 (6 months)<sup>1</sup>

[Barrels of 42 gallons]

	1927	1928	1929	1930 (6 months)
<b>American companies:</b>				
Lago <sup>2</sup> .....	16,301,856	30,938,465	36,737,656	18,232,409
Creole Petroleum Corporation.....		12,237,822	7,646,273	2,781,671
Gulf.....	13,891,279	3,730,771	29,967,728	11,274,877
Gulf Venezuela Petroleum.....		7,945,735	( <sup>3</sup> )	( <sup>3</sup> )
General Asphalt.....	317,192	437,000	426,000	252,100
Falcon Oil Corporation.....		657,269		
<b>Total American.....</b>	<b>30,510,327</b>	<b>55,947,062</b>	<b>74,677,657</b>	<b>32,541,057</b>
<b>Shell companies:</b>				
Venezuela Oil Concessions.....	20,832,854	36,150,906	45,294,900	20,536,740
Caribbean Petroleum.....	10,160,658	14,146,981	15,374,040	9,887,143
British Controlled Oil Fields (Ltd.).....	2,482,063	1,853,559	2,041,673	1,006,347
Colon Oil Company.....				2,370,500
<b>Total Shell.....</b>	<b>33,475,575</b>	<b>52,151,446</b>	<b>62,710,613</b>	<b>33,799,730</b>
<b>Grand total.....</b>	<b>63,985,902</b>	<b>108,098,508</b>	<b>137,388,270</b>	<b>66,340,787</b>

<sup>1</sup> Source: O'Shaughnessy's South American Oil Reports.

<sup>2</sup> Includes Lagomax Co.

<sup>3</sup> Included with Gulf.

TABLE 4.—Crude petroleum: Production, by fields, in Venezuela, 1927-1930 (6 months)<sup>1</sup>

[Barrels of 42 gallons]

	1927	1928	1929	1930 (6 months)
Lagunillas.....	29,772,217	63,111,959	82,512,128	35,945,161
La Rosa-Ambrosio.....	20,085,454	28,390,758	36,310,022	16,193,226
Mene Grande.....	9,874,531	14,146,981	15,374,040	8,494,843
El Mene.....	2,525,023	1,863,559	2,041,673	1,006,347
Benitez.....	<sup>2</sup> 801,102	158,251	616,727	454,751
Guanoco.....	614,300	437,000	426,000	252,100
Concepcion.....	<sup>2</sup> 523,928	( <sup>3</sup> )	59,722	1,055,852
La Paz.....	227,371	( <sup>3</sup> )	35,402	176,707
Tia Juana.....			12,556	
Tarra.....				2,370,500
All other.....				1,392,800
<b>Grand total.....</b>	<b>64,436,926</b>	<b>108,098,508</b>	<b>137,388,270</b>	<b>67,340,787</b>

<sup>1</sup> Source: O'Shaughnessy's South American Oil Reports.

<sup>2</sup> Shut in part of year.

<sup>3</sup> Shut in.

(c) *Developments outside the Lake Maracaibo field.*—In addition to the four major producing companies in Venezuela, more than 30 others are engaged in exploration for oil, hold concessions, or are actually drilling wells, some of which are now producing. Much of the development work, however, has been reduced or stopped during the

past year, following the general curtailment policy with respect to production of crude oil.

The State of Zulia, which nearly surrounds Lake Maracaibo, and hence accounts for the major part of the Venezuelan production of oil, is also the scene of much new development work outside the Maracaibo Basin, more especially in the areas west, southwest, and southeast of the lake, in one or more of which the four large companies and about 20 other companies, many of them American, hold concessions. Many concessions have been granted in the State of Falcon, bordering Zulia on the northeast, and in the State of Monagas, about 500 miles east of Lake Maracaibo.

The Creole Petroleum Corporation has been carrying on development work for seven years in the State of Monagas, eastern Venezuela. It is reported that future production may be obtained on a large scale over an area of about 2,100 square miles. The company has undertaken the building of wharves, pipe lines, storage tanks, camps, highways, and a railroad. A total of 39 wells was reported to have been drilled to September 1, 1930, of which 18 were under production. The first tanker of crude oil was shipped from this field in September. The oil is reported to be of lower gravity than that from the Maracaibo Basin.

The Standard Oil Co. of New Jersey is also exploring or drilling in the States of Falcon, Sucre, and Zamora, and in the territory of Delta Amacura; the Standard Oil Co. of Indiana and the Gulf Oil Corporation, in the State of Monagas, and the Shell interests, in the States of Falcon and Monagas.

Other well-known American companies or their subsidiaries are exploring or holding and developing concessions in Zulia, Falcon, or Monagas. Among these the following American companies may be mentioned: Standard Oil Co. of California; California Petroleum Corporation; Union Oil Co. of California; Atlantic Refining Co.; Texas Co.; Pure Oil Co.; Beacon-Sun Oil Co. (also holding concessions in the State of Trujillo); American Maracaibo Co.; New England Oil Co.; Richmond Petroleum Co.

(d) *Capital invested.*—It is reported<sup>1</sup> that the capital invested in petroleum by the Shell companies and the principal American companies in Venezuela is \$105,378,000 and \$184,122,000, respectively, or a total of \$289,500,000. It is also reported<sup>1</sup> that the Creole Petroleum Corporation has invested in various works of exploration and drilling in Venezuela the sum of \$63,000,000.

(e) *Curtailment of production.*—Under a gentleman's agreement, a restriction of crude oil production in Venezuela has been in effect for some time. The estimated potential production of all producing and shut-in wells in October, 1930, was about 593,300 barrels daily and actual production was at the rate of 383,500 barrels daily—about two-thirds of potential production. Of the estimated curtailment about 133,200 barrels was in the Lagunillas and La Rosa-Ambrosio fields.

In response to a resolution of Oklahoma oil producers in December, 1929, the Royal Dutch Shell proposed in February, 1930, curtailment of Venezuelan production for the year, proportionate with the year's curtailment compared with 1929 in the United States. In Septem-

<sup>1</sup> World Petroleum, December, 1930, p. 548.

ber, 1930, the Standard Oil Co. of Indiana proposed that Venezuelan production be curtailed 9 per cent as of October, 1930. No action has been taken on either of these proposals.

(f) *Refineries in Caribbean region.*—A recent development in connection with Venezuelan petroleum is the erection of three refineries in the Dutch West Indies by two of the largest petroleum producers in Venezuela. The oil is shipped in lake tankers from Lake Maracaibo to these refineries, and the gasoline is exported to the United States and elsewhere, thus accounting for the large increase in our imports of gasoline in recent years. These two companies do not export Venezuelan crude to the United States. The two largest refineries are equipped with modern cracking units, so that the gasoline yields are substantially higher than in topping operations, with the result that gasoline is probably the principal product in value, although not in quantity.

Two of these refineries are operated by the Dutch Shell interests on the Island of Curacao, Dutch West Indies. (See map.) They have daily capacities of 175,000 and 17,500 barrels. The smaller refinery has no cracking equipment. Late in 1928, the Lago Petroleum Co. commenced operation of a refinery of 110,000 barrels daily capacity on the neighboring Island of Aruba. (See map.) The total daily capacity of the three refineries is 302,500 barrels of crude oil.

In 1929 there were exported from the Dutch West Indies 9,713,579 barrels of gasoline, 158,519 barrels of kerosene, 1,042,195 barrels of lubricating oils, 6,166,014 barrels of gas oil, 54,430,544 barrels of fuel oil, and 800,016 barrels of Diesel oil. Due to greater production by the Lago refinery, imports of gasoline into the United States from the Dutch West Indies increased from 7,494,107 barrels in 1929, to 15,472,685 barrels in 1930, and represented, respectively, 84.8 and 91.4 per cent of the total imports of gasoline.

In addition, the Shell interests have one refinery of 20,000 barrels daily capacity, the West India Oil Co., one of 2,000 barrels daily capacity, and the Lago Petroleum Corporation one of 5,000 barrels daily capacity in Venezuela. These are all located in the Maracaibo region. There is one refinery in Colombia, and 17 in Mexico, a large percentage of the capacity of which has been inactive recently.

## 2. COST DATA FOR CRUDE PETROLEUM IN VENEZUELA

The methods used in ascertaining and classifying costs were similar to those used in the case of domestic crude, as already described. Questionnaires were sent to the four principal producers of petroleum in the Maracaibo Basin at the same time that domestic producers were asked to submit their costs. The four companies, namely, the Creole Petroleum Corporation and subsidiaries, the Lago Petroleum Corporation, the Venezuela Gulf Oil Co., and the Royal Dutch Shell group, submitted cost figures for the years 1927, 1928, and 1929. The quantity of petroleum upon which the four companies reported costs represented 87.1 per cent of the total Venezuelan production in 1927, 89.7 per cent in 1928, 89.5 per cent in 1929.

The net cost of the Venezuelan oil, at point of transfer to ocean tankers, including interest on the investment of the companies, was found to be \$0.87 per barrel in 1927, \$0.63 in 1928, and \$0.56 in 1929.



The 3-year weighted average was \$0.65 per barrel, computed on a total 3-year production of 272,738,214 barrels of oil. The sale or transfer value of oil reported by these companies was \$0.94 in 1927, \$0.65 in 1928, and \$0.60 in 1929—\$0.685 for the 3-year weighted average. However, actual sales reported show a value of \$1.14 for 1927, \$0.77 for 1928, and \$0.79 for 1929; or a weighted average for the three years of \$0.847.

TABLE 5.—*Crude petroleum: Unit cost per barrel of Venezuelan oil delivered at loading point for 1927-29, and sales value of production for same period*

Item	1927	1928	1929	3-year cost
<b>Expenses:</b>				
Depletion.....	\$0.0273	\$0.0225	\$0.0159	\$0.0210
Amortization.....	.0815	.0626	.0694	.0694
Intangible development.....	.1806	.0925	.0935	.1107
Operating.....	.1274	.1127	.0850	.1032
General and administrative.....	.2456	.1799	.1684	.1880
Total expense.....	.6024	.4702	.4332	.4923
Less miscellaneous revenue.....	.0066	.0001	.0128	.0092
Net cost.....	.6558	.4641	.4204	.4831
Transportation to loading point.....	.0937	.0840	.0769	.0828
Net cost at loading point.....	.7495	.5481	.4973	.5659
Interest on investment.....	.1229	.0790	.0642	.0811
Net cost and interest.....	.8724	.6271	.5615	.6470
Sale or transfer value of production.....	.9353	.6451	.6044	.6853
Quantity of production covered (barrels).....	54,997,400	94,812,086	122,928,728	272,738,214

The average gravity of the petroleum for which costs were obtained was 19.5° in 1927, and 19.3° in 1928 and 1929. Only a portion of this oil, however, was exported to the United States, the average gravity of which was 18.3°, as reported by the producing companies in each of the three years, 1927, 1928, and 1929. This compares with an average gravity of Venezuelan crude, reported by Atlantic coast refineries as received by them, of 18.9° in 1927, 18.7° in 1928, and 17.9° in 1929.

There are various taxes in Venezuela covering exploration, exploitation, and production; stamp taxes for titles, maps, and ships' manifests; and a navigation license fee and buoy tax on vessels navigating Lake Maracaibo and the channel to the sea. The taxes now in force are generally based on the petroleum law of 1928. Prior to that time special concessions were granted to various companies at specifically determined rates which are still in force.

These various taxes were all included in the Venezuelan costs of production, except the production or royalty tax, which has been treated in the same manner as royalty in the United States. That is to say, Venezuelan costs are based on company-interest oil, and cash paid as royalty in lieu of oil has not been considered as an item of costs.

The Venezuelan Government owns all the subsoil rights in the country, by virtue of which it levies a production or royalty tax on petroleum. Under the petroleum law of 1928, this tax is 10 per cent,<sup>1</sup> to be paid in cash or in kind. If paid in cash, a minimum of 2

<sup>1</sup> Under concessions granted prior to 1928, rate of about 9 per cent is still in force.

bolivars per metric ton (5.8 cents per barrel of 42 gallons) is specified. On concessions covered by waters of the sea, lakes, or navigable rivers, the tax is reduced by one-fourth. In such concessions the exploration and exploitation taxes are reduced by one-half. In the case of some of the present producers in the Maracaibo Basin, there are underlying royalties which involve some of the original concessions.

The buoy tax is based on the registered tonnage of the tankers employed in exporting oil to foreign countries. It amounts to 2 bolivars per registered metric ton to all countries, except the Netherland West Indies, to which it is 1 bolivar under the terms of a 25-year concession.

After receipt of the questionnaires, representatives of the commission visited each company to obtain additional information necessary to establish costs comparable with those of the domestic producers. Unlike domestic producers, whose costs stop at boundary line of lease where sales are made, Venezuelan producers include the cost of transporting crude petroleum by lake tankers from Lake Maracaibo to the point of transfer to ocean-going tankers. Costs have therefore been calculated for both domestic and Venezuelan production at "point of sale" and include for Venezuela interest on investment in lake tankers.

Producers of petroleum in Venezuela are obliged to spend large sums in the construction of living quarters, hospitals, roads, and other conveniences to afford proper living conditions for employees, whereas in the United States this is seldom done. These expenditures explain the large interest charge apparent in Venezuelan costs of production.

The average depth of wells in the Bolivar coastal fields (Laguinillas, La Rosa, Ambrosio, Punta Benitez, Tia Juana) is about 3,500 feet, of the wells in Mene Grande field, about 2,500 feet, and in the El Mene field, about 1,150 feet. The average depth of wells in Venezuela is considerably less than the average depth in the United States. The average daily production of wells in these principal fields is about 3,000 barrels per well, which would be reduced under the present curtailment program. In the United States the estimated average daily initial production of all wells was 341 barrels per well in 1927, and 668 barrels per well in 1928. The average daily production of wells in certain flush fields in Texas, California, and Oklahoma, varies from 1,000 to 14,000 barrels and over. These facts as to depth and size of wells have an important bearing on relative costs per unit.

### C. COST OF TRANSPORTING AND DELIVERING MID-CONTINENT GULF CRUDE TO ATLANTIC SEABOARD

#### 1. INTRODUCTION—THE METHOD OF MARKETING CRUDE PETROLEUM

Crude petroleum, as it is first brought to the surface, contains varying percentages of water and sand or other sediment. It is run into settling tanks, in order to separate the oil from the impurities. When a crude-oil purchasing company buys the oil from the producer, a deduction is usually made to allow for water and sediment which remain in the oil. The amount which may be deducted is fixed by law in Oklahoma and Kansas at 3 per cent and in Texas at

2 per cent.<sup>3</sup> Allowances are sometimes based on actual tests, when the conditions vary from the average or normal. The purchasing company usually takes the entire production, including the royalty interests, and sends checks to the various parties who own interests in the oil.

The crude petroleum is collected from the point of production by gathering lines, which are usually small pipes laid on top of the ground. Sometimes the force of gravity alone is employed, but more often a pumping station is necessary. The crude may be stored for a time in a "tank farm" before being pumped through the trunk pipe line. The customary gathering charge in the Mid-Continent region is from 12½ cents to 20 cents per barrel. These gathering lines carry the oil to a trunk pipe line for transportation to refineries or to Gulf points from which it is carried in tank steamers to Atlantic seaboard refineries.

Considerable crude oil formerly was pumped through transcontinental pipe lines from the Mid-Continent field to the Atlantic seaboard, but only one or two large companies are now known to transport oil in this way. Most of the oil which moves from the Mid-Continent field to the Atlantic seaboard now goes via pipe line to Gulf ports and thence via tankers.

## 2. THE PURCHASING CHARGE OR MARKETING COMMISSION

The intermediary between the producer and the refiner is the purchasing company.

Some of the crude oil purchasing companies buy for their own use or that of parent refining companies, others in whole or in part for resale. The Texas Co., the Gulf Oil Corporation, the Midwest Refining Co., the Standard Oil Co. of California, the Union Oil Co. of California, and the Associated Oil Co. have purchasing departments which buy for their own refineries. The purchases of the Standard Oil Co. of Louisiana, the Humble Oil & Refining Co., and the Magnolia Petroleum Co. are for their own refineries and those of their parent companies, the Standard Oil Co. of New Jersey, and the Standard Oil Co. of New York. The Stanolind Co. purchases partly for the parent company, the Standard of Indiana, and partly for resale. The South Penn Oil Co., the Prairie Oil & Gas Co., and others purchase mostly for resale.

Sales of crude petroleum by pipe-line or oil-purchasing companies to refineries are usually made at a delivered price.

The delivered price of the Prairie Oil & Gas Co. is the average price paid for mid-continent crude petroleum during the calendar month in which delivery is made, plus the marketing commission of 10 cents per barrel, plus the gathering charge, plus the trunk line transportation charge.<sup>4</sup>

The purchasing charge, or marketing commission, was not separately reported by the companies which buy for their own use, being included in the reported price paid for oil, and it was necessary for the commission to make an investigation to establish the amount of this purchasing charge as an individual item. This amount has been added to the other charges in the calculation of delivered costs, but

<sup>3</sup> These deductions have been made by the companies in reporting to the Tariff Commission the amount of their production and it is on these figures, for production, that the commission has computed the cost.

<sup>4</sup> Federal Trade Commission Report on Prices, Profits, and Competition in the Oil Industry, 1928.

care has been exercised so that there would not be duplication because of the inclusion of such a charge with pipe-line charges by any company.

The customary purchasing charge in the Mid-Continent-Gulf area is 10 cents per barrel. Officials of purchasing companies state that as the result of many years of experience, 10 cents per barrel has been fixed as the average charge for the following services:

(a) The work of the legal department in checking and verifying all leases and oil contracts to determine the actual ownership of the oil—whether it is vested in the drilling company, the owners of leases, or the land owner—and to determine the actual interests of various royalty owners. Trouble may be caused by later appearances of minor heirs, trustees of imbeciles, Indians, brokers, or various royalty owners. If the purchasing company pays money for oil to the wrong person, it may later be required by the courts to pay again to the rightful owner.

(b) The second service is that of arranging with gathering lines and trunk lines for transportation of the crude from the settling tanks at the wells to refining organizations. The purchasing company takes care of the settlement of transportation accounts and all matters of loss in transit, leakage, and evaporation.

(c) The purchasing company finds the buyer—the refining company to which the crude oil is sold.

(d) The purchasing company has large amounts of money invested in storage tanks and in oil in transit and storage. In order to supply refineries with regular amounts on contract from day to day, it is necessary for the purchasing company to have pipe lines full of flowing oil and to have oil at storage at different points. Refineries operate seasonally and this fact adds to the necessity for keeping a large amount of crude oil in storage. The purchasing company not only incurs the expense of storage but runs the risk of loss by evaporation of oil; of reduction in the gravity of oil by evaporation of the first fractions; and of losses by a fall in the price.

### 3. THE POSTED PRICE OF PURCHASING COMPANIES

The crude purchasing companies announce the prices they will pay by posting them on a bulletin board. Such posted prices are considered offers to buy. This system was not followed in the early days of the industry. In the Pennsylvania region crude petroleum was bought and sold on an exchange at Oil City, Pa. Oil sold on long-term contracts is sometimes sold at a fixed price for the entire time, and sometimes at a price varying according to the posted price.

### 4. PIPE-LINE CHARGES

As already stated, the bulk of the domestic crude petroleum delivered to the Atlantic coast in recent years from the Mid-Continent-Gulf area has moved by pipe line to Gulf ports, whence it was shipped by tankers to the eastern seaboard. In 1927, the proportion reported as moving by this route was 85.5 per cent of the total Atlantic coast receipts from this area; it was 95.5 per cent in 1928, and 96.5 per cent in 1929. The amount of crude shipped to the Atlantic seaboard all

the way by pipe line from the area west of the Appalachians and east of the Rockies has correspondingly declined. The commission has therefore undertaken to ascertain pipe-line charges only for the movement to Gulf ports.

Most of the pipe line companies are owned or controlled (sometimes jointly) by the large oil companies. As common carriers they are obliged to transport all oil tendered to them. When engaged in interstate business their rates are subject to regulation by the Interstate Commerce Commission; when in intrastate business, usually to regulation by State public utility commissions or bodies with similar regulatory powers. In most instances, pipe-line rates of different companies between similar points of origin and destination are substantially the same, although the elements constituting some total rates may vary in different cases. One company may quote the same rate from all points in Kansas and northern Oklahoma to the Gulf, while another will have separate rates from each pick-up point in that area, but the average for the several rates will be about the same as the flat rate of the other company. Again, gathering or feeder-line charges for one area may differ as between two companies, but such differences may be compensated for in the trunk-line rates. In general, the tariffs are based on mileage and the difference in elevation between points.

To attempt to obtain actual costs of transporting oil by pipe line would require far more time than is available under the law for this investigation, and greater resources than are now at the disposal of the commission.

Since pipe line companies are common carriers and entitled to make a profit, are subject to regulation and do not grant rebates to related companies, the rates which they charge, and which are paid ultimately by the refineries, appear to be a proper basis for calculation of transportation costs for the purposes of this investigation. Since the bulk of the oil delivered to the Atlantic seaboard from the Mid-Continent-Gulf region during the period 1927-1929 moved by pipe line to the Gulf coast, the commission has employed in its calculations the weighted average charges applying to such movements.

It was not possible to use the pipe-line charges shown in returns from the Atlantic seaboard refineries regarding the cost of the oil purchased by them. For some districts the pipe-line and also the purchasing charges were included in the cost of the oil delivered at Gulf ports and not segregated from the price paid for oil at the wells. In other cases, pipe-line charges reported by the refineries include purchasing charges, or were included in tanker charges.

The pipe-line charges as used in the commission's cost comparison, were determined from the Interstate Commerce Commission tariffs and weighted by the amounts of oil reported in the refinery schedules as received from the various districts of the Mid-Continent-Gulf region. The pipe-line tariffs include the gathering charges. In most instances the Interstate Commerce Commission tariffs showed the transportation and gathering charges from the area in which the oil was produced to the Gulf coast. In a very few instances where the oil was produced in an area for which no rates are shown in the tariffs, a charge was estimated on the basis of that from the nearest known point. In the few instances where the State but not the district in which the oil was produced was shown in the reports of the producing companies, an average rate was used based on the fact that one large pipe-line

company applied a flat rate for an entire State. In some cases the rates to different Gulf coast ports from a given producing field were different. In nearly all these cases the port of shipment of the oil was known, and the rate to that point was used. When the port of shipment was not known, an average of the rates to the different ports was used.

Computed on the above basis, the weighted average pipe-line charges, from the wells to Gulf ports, on the oil which moved from the Mid-Continent-Gulf area to the Atlantic seaboard in the three years under consideration were: In 1927, 52 cents; in 1928, 51 cents; and in 1929, 49 cents.

Table 6 shows, according to the reports of the leading Atlantic seaboard refineries, the quantities of crude, by districts of origin in the Mid-Continent-Gulf area, which moved by pipe line to Gulf ports and thence by tanker to those refineries, together with the calculated weighted average pipe-line and tanker charges thereon, for the years 1927, 1928, and 1929.

TABLE 6.—*Pipe-line and tanker charges on petroleum moving to Gulf ports and Atlantic seaboard, 1927-1929*

District	Number of barrels reported	Pipe-line charges		Tanker charges	
		Total	Per barrel	Total	Per barrel
1927					
Kansas.....	125, 282	\$86, 131	\$0. 6875		
Oklahoma.....	8, 119, 946	4, 807, 092	.5920		
North and Central Texas.....	23, 132, 460	13, 109, 590	.5667		
Oklahoma and Texas, mixed.....	4, 858, 858	2, 672, 372	.5500		
Total Mid-Continent.....	36, 236, 540	20, 675, 185	.5706	\$12, 621, 189	\$0. 3483
South Texas—Gulf coast.....	11, 347, 922	2, 197, 271	.1936	3, 432, 746	.3025
West Texas.....	11, 674, 719	6, 421, 096	.5500	4, 011, 433	.3436
Texas Panhandle.....	9, 933, 236	6, 953, 265	.7000	3, 171, 682	.3193
Louisiana and Arkansas.....	8, 659, 364	4, 199, 864	.4850	3, 242, 066	.3744
Total.....	77, 851, 787	40, 446, 681	.5195	26, 469, 608	.3400
1928					
Kansas.....					
Oklahoma.....	11, 416, 691	\$6, 845, 206	\$0. 5996		
North and Central Texas.....	16, 248, 675	9, 431, 781	.5805		
Oklahoma and Texas, mixed.....	10, 109, 411	5, 560, 176	.5500		
Total Mid-Continent.....	37, 774, 777	21, 837, 163	.5781	\$8, 465, 328	\$0. 2241
South Texas-Gulf Coast.....	11, 760, 838	2, 251, 531	.1914	2, 186, 340	.1859
West Texas.....	29, 735, 554	16, 382, 056	.5500	6, 091, 146	.2045
Texas Panhandle.....	4, 312, 486	3, 018, 740	.7000	879, 316	.2039
Louisiana and Arkansas.....	4, 661, 656	1, 961, 724	.4208	972, 888	.2087
Total.....	88, 295, 311	45, 451, 214	.5148	18, 630, 311	.2110
1929					
Oklahoma-Kansas.....	11, 674, 286	\$6, 753, 770	\$0. 5785		
North and Central Texas.....	14, 783, 413	8, 696, 935	.5891		
Oklahoma and Texas, mixed.....	10, 323, 074	5, 677, 690	.5500		
Total Mid-Continent.....	36, 780, 773	21, 128, 395	.5747	\$10, 848, 104	\$0. 2954
South Texas.....	18, 434, 630	3, 907, 715	.2120	4, 962, 602	.2692
West Texas.....	34, 915, 601	19, 203, 580	.5500	10, 177, 898	.2916
Texas Panhandle.....	1, 954, 505	1, 368, 154	.7000	569, 543	.2914
Louisiana and Arkansas.....	3, 148, 166	1, 213, 084	.3853	940, 672	.2988
Total.....	95, 213, 675	46, 820, 928	.4917	27, 231, 111	.2866

## 5. TANKER CHARGES

Table 6 shows, according to the reports of the leading Atlantic seaboard refineries, the quantities of crude which move to those refineries from the Mid-Continent-Gulf field, and on which tanker charges; also shown, were properly reported.

The tanker charges reported by refineries are from the books of the marine departments or subsidiary transportation companies, and include profits, if any, of these organizations.

The commission obtained data from a few refineries showing actual costs to operate these tankers per barrel of crude. In 1927 these costs varied from 17.6 to 26 cents per barrel, with a weighted average of 21.8 cents; in 1928, from 12¼ to 23 cents per barrel, with a weighted average of 17¼ cents; in 1929, from 13.2 to 24 cents per barrel, with a weighted average of 18.8 cents. Some of the reported costs were of necessity in the form of estimates. Limitations of time precluded the commission from ascertaining detailed costs of transporting petroleum in tank steamers.

In contrast with rates charged by pipe-line companies, there are no regulations governing rates charged by operators of tank steamers. Most of the large refineries in the East own and operate, directly or through subsidiaries, a sufficient number of tank steamers to take care of nearly all of their requirements and these vessels are not common carriers; however, a large number of tankers are available for charter and the rates which their owners charge are subject to the supply and demand for such bottoms. The rate which the refinery subsidiaries operating their own tankers charge to the parent company is in most cases governed by the so-called "going charter rate." In times when there is a surplus of tankers the "going charter rate" may be less than the cost of operation. It is more economical to operate tankers at a slight loss than to undergo the expense of laying them up.

TABLE 7.—*Crude petroleum: Transportation and other charges from Mid-Continent-Gulf area to Atlantic coast refineries, 1927-1929*

[Weighted average per barrel]

Year	Pipe line	Purchasing	Tanker	Total
1927 .....	\$0.5195	\$0.10	\$0.3400	\$0.9595
1928 .....	.5148	.10	.2110	.8258
1929 .....	.4917	.10	.2860	.8777
3-year weighted average.....	.5078	.10	.2767	.8845

#### D. COST OF TRANSPORTING VENEZUELAN CRUDE TO ATLANTIC SEABOARD

As already stated, the costs of local pipe-line transportation of Lake Maracaibo oil, as well as the costs of transportation by small lake tankers to the point of transshipment to ocean going tankers, are not segregated from the costs of production of Venezuelan crude oil. The various oil producing companies operate the local pipe lines and the lake tankers themselves. There is no long distance pipe line transportation of the Lake Maracaibo crude, and even the gathering lines are very short. The transport costs up to the point of transshipment to ocean tankers are a relatively small item.

The charges on Venezuelan oil for transportation by ocean tankers to the Atlantic coast refineries are as shown by the books of those refineries, that is, the amounts paid by them for the transportation. They therefore include whatever profit there is to the transporting organizations. The transportation is performed in part by subsidiaries of the Venezuelan producing companies, in part by subsidiaries of the Atlantic coast refining concerns, and in part by independently operated tankers.

A few of the Atlantic coast refineries reported the payment of small amounts for "other charges" not specified as to kind, on Venezuelan oil. These have been added to the reported tanker charges. The average ocean tanker charge on Venezuelan oil as thus computed was \$0.31 per barrel in 1927; \$0.24 in 1928, \$0.23 in 1929, and an average of \$0.24 for the three years.

#### E. COMPARATIVE COSTS OF PRODUCTION AND DELIVERY

Table 8 summarizes the costs of production and delivery of Mid-Continent-Gulf and Venezuelan (Lake Maracaibo) oil, respectively. As already pointed out, the quality of Mid-Continent-Gulf oil is much higher than that of the Venezuelan oil. This difference is more fully discussed in section G.

The table shows that on the average for the three years, 1927 to 1929, the cost of production of crude oil in the Mid-Continent-Gulf area was \$1.10 per barrel. The average cost of transportation by pipe line and ocean tankers from the wells to Atlantic seaboard refineries, together with the costs of purchasing oil, during this period was \$0.88 per barrel, making the total cost delivered to the Atlantic seaboard refineries \$1.98. The average cost of production of Venezuelan oil in 1929, which may be taken as representing "present" costs, for the purposes of section 332(f), including local pipe line and lake tanker transportation, was \$0.56 per barrel and the cost of ocean tanker transportation to the Atlantic seaboard refineries was \$0.23, making a total delivered cost of \$0.79 cents. On the average for the three years, 1927 to 1929, the Venezuelan crude cost, delivered at the Atlantic seaboard refineries, was \$0.89 per barrel. All these figures for Venezuelan oil relate to the Lake Maracaibo product only.

TABLE 8.—*Crude petroleum: Cost of production and of delivery to refineries on Atlantic seaboard of Mid-Continent-Gulf and of Venezuelan oil, 1927-1929*

[The Venezuelan costs relate only to Lake Maracaibo oil]

	Costs of production and delivery		
	Cost of production at well	Transportation and other charges <sup>1</sup>	Cost delivered at Atlantic seaboard refineries
Mid-Continent-Gulf oil:			
1927.....	\$1.2009	\$0.9595	\$2.2604
1928.....	1.0652	.8258	1.8910
1929.....	1.0352	.8777	1.9129
3-year weighted average.....	1.0983	.8845	1.9828
Venezuelan oil:			
1927.....	.8724	.3111	1.1835
1928.....	.6272	.2356	.8628
1929.....	.5616	.2288	.7904
3-year weighted average.....	.6470	.2428	.8898

<sup>1</sup> Purchasing charge of 10 cents per barrel on domestic crude is included.



### F. PRICES OF CRUDE PETROLEUM DELIVERED TO REFINERIES LOCATED ON THE ATLANTIC SEABOARD

As previously stated, the possible ambiguity in the interpretation of section 332 (f), of the tariff act of 1930, resulted in the commission's obtaining, in addition to the costs of production of crude petroleum at the well and of delivery thereof to the refineries on the Atlantic seaboard, the amounts paid per barrel by those refineries for the oil delivered to them, which may for convenience be called prices delivered. The commission obtained the delivered prices from all oil refineries on the Atlantic seaboard having a capacity of 5,000 barrels or more per day. No returns were requested from individual asphalt plants which, with one or two exceptions, are of less than 5,000 barrels daily capacity, operate largely on Mexican petroleum and are not important factors in the gasoline and fuel oil markets. The returns covered from 93 to 97 per cent of the total actual runs of domestic crudes to refineries located on the Atlantic seaboard, and nearly 100 per cent in the case of Venezuelan crude.

#### 1. PRICES PAID FOR DOMESTIC CRUDE

Table 9 shows the prices paid for domestic crude petroleum, delivered to the refineries on the Atlantic seaboard, by districts in which produced.

It should be noted that the weighted average price per barrel of all domestic crude petroleum delivered to Atlantic seaboard refineries is, for all three years and for the first six months of 1930, higher than the price of crude from the Mid-Continent-Gulf area only.

TABLE 9.—Prices paid for domestic crude petroleum delivered to Atlantic seaboard refineries by districts in which produced, 1927-1930 (6 months)

District	1927			1928		
	Average gravity	Number of barrels delivered net	Total delivered prices	Average gravity	Number of barrels delivered net	Total delivered prices
Texas, Oklahoma, Kansas.....	37.1	49,307,015	\$122,324,510	36.9	41,603,688	\$94,178,135
Average unit costs.....			2.4809			2.2642
Gulf coast, Texas-South Texas.....	27.0	11,347,922	20,060,389	26.5	11,760,838	19,114,590
Average unit costs.....			1.7677			1.6253
West Texas.....	33.3	11,074,719	23,356,997	30.4	29,785,554	45,140,070
Average unit costs.....			2.0006			1.5155
Texas Panhandle.....	36.6	9,983,531	20,976,510	37.3	4,554,205	8,871,217
Average unit costs.....			2.1011			1.9479
Louisiana-Arkansas.....	26.2	8,659,394	18,730,234	27.2	4,661,656	8,224,662
Average unit costs.....			2.1630			1.7643
California.....	26.6	8,765,554	16,342,500	26.0	2,044,414	3,963,515
Average unit costs.....			1.8644			1.9387
Pennsylvania.....	42.6	3,833,392	14,352,246	42.6	3,838,750	14,235,690
Average unit costs.....			3.7440			3.7084
Grand total.....	33.9	103,571,527	236,143,386	33.3	98,249,105	193,727,879
Total average unit costs.....			2.2800			1.9720

TABLE 9.—*Prices paid for domestic crude petroleum delivered to Atlantic seaboard refineries by districts in which produced, 1927-1930 (6 months)*—Continued

District	1929			Jan. 1 to June 30, 1930		
	Average gravity	Number of barrels delivered net	Total delivered prices	Average gravity	Number of barrels delivered net	Total delivered prices
Texas, Oklahoma, Kansas.....	37.1	40,498,354	\$96,483,906	37.0	19,025,014	\$43,645,775
Average unit costs.....			2.3824			2.2941
Gulf Coast Texas & South Texas.....	26.9	18,434,640	32,440,938	27.0	14,225,579	23,661,528
Average unit costs.....			1.7598			1.6633
West Texas.....	30.1	34,915,601	61,369,414	30.1	17,850,006	30,961,341
Average unit costs.....			1.7577			1.7345
Texas Panhandle.....	37.9	2,118,939	4,038,353	39.0	546,475	1,308,174
Average unit costs.....			2.3306			2.3938
Louisiana-Arkansas.....	26.7	3,148,166	5,813,032	25.8	1,392,295	2,546,960
Average unit costs.....			1.8468			1.8293
California.....	28.2	469,409	870,111			
Average unit costs.....			1.8536			
Pennsylvania.....	42.5	4,972,096	21,669,159	43.1	2,032,960	10,537,853
Average unit costs.....			4.3582			3.5929
Grand total.....	32.9	104,557,205	223,585,813	32.3	55,970,329	112,661,631
Total average unit costs.....			2.1384			2.0129

The districts shown as sources of the domestic crudes are those generally used to represent the principal types of oil produced in the United States. The deliveries of domestic crudes to the Atlantic seaboard were, for the most part, by pipe line to the Gulf coast, and thence by tanker to the refineries.

The following summary statement compares the prices paid by the refineries in each of the three years 1927 to 1929 for Mid-Continent-Gulf oil delivered to their plants, with the figures of cost of production at wells in the Mid-Continent-Gulf area plus transportation and other charges for delivery to the Atlantic seaboard refineries.

TABLE 10.—*Costs and prices of Mid-Continent-Gulf oil, including delivery to Atlantic seaboard refineries, 1927-1929*

Year	Cost at wells plus transportation and delivery	Prices paid by Atlantic seaboard refineries, delivered
1927.....	\$2.2604	\$2.2584
1928.....	1.8910	1.9004
1929.....	1.9129	2.0284
3-year weighted average.....	1.9828	2.0606

## 2. PRICES PAID FOR VENEZUELAN CRUDE

Table 11 shows the prices paid by Atlantic seaboard refineries for crude petroleum from the Maracaibo Basin, together with the payments for transportation and other expenses of delivery to the refineries. In this case the price paid for the oil itself is at the point of transfer to ocean tankers, and thus includes cost of local pipe-line transportation and of transportation by lake tankers.

TABLE 11.—*Prices paid for Venezuelan crude petroleum (Maracaibo Basin) delivered to Atlantic seaboard refineries, 1927-1930 (6 months)*

	Average gravity	Number of barrels delivered net	Price paid for oil	Ocean tanker expenses	Total delivered price
Total for 1927.....	18.9	12,427,243	\$14,656,019	\$3,866,472	\$18,522,491
Average unit costs.....			1.1793	0.3111	1.4904
Total for 1928.....	18.7	39,257,517	31,702,491	9,187,446	40,889,937
Average unit costs.....			0.8076	0.2356	1.0416
Total for 1929.....	17.9	36,231,154	28,710,796	8,290,906	37,001,702
Average unit costs.....			0.7925	0.2288	1.0213
Total for 1930 (6 months).....	17.9	14,611,762	10,964,895	3,460,671	14,425,566
Average unit costs.....			0.7504	0.2369	0.9873

The following table compares the costs of production of Venezuelan crude plus transportation to Atlantic seaboard refineries, with the prices paid by those refineries for the oil delivered to them:

TABLE 12.—*Costs and prices of Venezuelan (Lake Maracaibo) oil*

Year	Cost at wells plus transportation and delivery	Prices paid by Atlantic seaboard refineries delivered
1927.....	\$1.1835	\$1.4904
1928.....	.8628	1.0416
1929.....	.7904	1.0213
3-year weighted average.....	.8898	1.0967

### 3. COMPARISON OF PRICES PAID FOR DOMESTIC AND VENEZUELAN CRUDE

The following table compares the prices paid by the Atlantic seaboard refineries for Mid-Continent-Gulf crude delivered to them, with the prices paid for Venezuelan crude delivered to them:

TABLE 13.—*Prices, including transportation and delivery, paid by Atlantic seaboard refineries for Mid-Continent-Gulf and for Venezuelan (Lake Maracaibo) crude petroleum*

Year	Mid-Continent-Gulf crude	Venezuelan crude
1927.....	\$2.2584	\$1.4904
1928.....	1.9004	1.0416
1929.....	2.0284	1.0213
3-year weighted average.....	2.0600	1.0967

## G. FACTORS AFFECTING COMPARATIVE COSTS AND PRICES OF DOMESTIC AND VENEZUELAN OILS

### 1. COMPARATIVE QUALITY OF OIL

As stated in Part I of this report, domestic and Venezuelan crude oils are not of the same quality. How far the difference in the cost of production is due to this difference in quality there is no way of stating. The costs of drilling an oil well are independent of the

quality of the oil which may be found, although producers will naturally be inclined to drill deeper and more expensive wells where they anticipate a high quality of output than where they anticipate a low grade product. The costs of pumping and handling the oil are almost entirely independent of gravity and other characteristics which determine quality.

Whatever may be the relation between the cost of production and the quality of crude oil, there is an unquestioned relation between price and quality. Refiners will naturally pay a higher price for a crude which contains large proportions of the more valuable products than for one which contains only small proportions of such products. The difference in the net price paid by Atlantic coast refiners for Mid-Continent-Gulf as compared with Venezuelan crude, delivered to their plants, as shown in the preceding section, is a reflection of the difference in quality.

The nature of this difference in quality is further shown by statistics of the products obtained from the domestic and the Venezuelan crude, respectively.

There is a close connection between the yields of the several products and the gravity of the crude. Venezuelan petroleum has an asphalt base and although the gravity ranges from 16° to 33° Baumé, the bulk of the output is of about 18° to 19°. The natural gasoline content is about 8 per cent and the sulphur content about 2.5 per cent. The refineries which receive imports of Venezuelan crude oil "top" or "skim" the crude to obtain this natural gasoline content. Small quantities of other distillates are also obtained, consisting chiefly of gas oil, some of which is cracked to produce more gasoline. The total amount of gasoline obtained by the Atlantic seaboard refineries from Venezuelan crude averaged 11.7 per cent of the quantity of the crude used in 1927, but the proportion fell to 9¼ per cent in 1929. The bulk of the product in quantity is in the form of the residue after this partial distillation process. On the average, from 80 to 83 per cent of the Venezuelan crude comes out of the refineries as fuel oil.

Domestic petroleums are of paraffin, asphalt, and mixed bases. The paraffin base oils, such as Pennsylvania crude, are in demand for lubricating oils, and consequently command premiums. Lubricants are also made from asphalt base oils, which are more abundant and hence not quoted at premiums.

The average gravity of all domestic crude oils is about 33° and the average natural gasoline content about 24 per cent. Domestic crudes from various fields vary greatly in gravity, extremes being as low as 6.8° with no gasoline content, and as high as 48° with 65 per cent gasoline content. The oil from the Mid-Continent-Gulf area, the basis used for the cost comparisons in this report, averages about 33° gravity, about one-fourth of 1 per cent sulphur, and is generally of paraffin-asphalt base. The average gravity of all domestic oils delivered to refineries on the Atlantic coast during the period 1927-1929 ranged from 33.9 to 32.3°. Some fields in California and the Smack-over field in Arkansas produce oil very nearly comparable in gravity to Venezuelan oil, but only small quantities of these crudes have reached the Atlantic seaboard in recent years.

In 1914 the yield of gasoline from all domestic crudes averaged about 18 per cent. In 1929 the yield had increased to about 39 per cent and for refineries on the Atlantic coast, which use chiefly Mid-

Continent-Gulf crude, to 44 per cent. It has been stated <sup>1</sup> that the yield could be increased to 60 per cent or more if the new refining methods were applied to all the crude oil refined.

In general, therefore, the characteristics of domestic and Venezuelan petroleums are so different that the former is run chiefly for gasoline, and the latter chiefly for fuel oil. In 1929 nearly 5 barrels of Venezuelan crude would have been required by the refineries on the Atlantic seaboard to produce an amount of gasoline equal to that which they produced from one barrel of domestic crude.

Tables 14 and 15 show typical yields of finished products derived from domestic and Venezuelan crudes by Atlantic seaboard refineries during the years 1927 to 1929. The average price commanded at the refineries by each of these major products is multiplied into the quantity derived, and the approximate total value of the products realized from a barrel of crude is thus computed. It will be seen that in 1929 the value of products derived from a barrel of domestic crude—the greater bulk of the domestic crude used being from the Mid-Continent-Gulf area—was \$2.97, while the corresponding value of the products derived from Venezuelan crude was \$1.15. The difference is primarily due to the relative proportions of gasoline and fuel oil and the wide excess in the price of gasoline over that of fuel oil. The average price of gasoline in 1927 was about two and one-fourth times that of fuel oil, but in 1929 it was worth four times as much as fuel oil. Furthermore, a small but valuable yield of lubricating oils is obtained from the domestic crudes, whereas the Atlantic coast refineries do not undertake to obtain lubricating oils from the Venezuelan crude.

TABLE 14.—*Typical yields of finished products, 1927-1929*

	Domestic crude, Atlantic coast refineries								
	Thousand barrels			Per cent			Value refined products per barrel crude		
	1927	1928	1929	1927	1928	1929	1927	1928	1929
Crude run to stills *	117,332	113,249	117,933						
Refined products:									
Gasoline.....	42,532	44,591	52,172	36.25	39.37	44.24	\$1.280	\$1.606	\$1.694
Kerosene.....	10,413	8,563	8,091	8.87	7.56	6.86	.244	.250	.227
Gas oil and fuel oils.....	42,637	35,548	34,890	36.34	31.39	29.58	.709	.474	.382
Lubricants.....	10,144	10,817	10,874	8.65	9.55	9.22	.430	.494	.554
Wax.....	824	841	950	.70	.74	.81	.055	.081	.089
Coke.....	695	626	817	.59	.55	.69	.005	.006	.007
Asphalt.....	3,790	6,036	518	3.23	5.33	.44	.059	.118	.008
All other.....	1,134	1,316	1,463	.97	1.16	1.24	.020	.026	.032
Unknown.....			2,093			1.77			
Loss.....	3,163	4,911	6,065	4.40	4.35	5.15			
Total.....	117,332	113,249	117,933	100.00	100.00	100.00	2.802	3.055	2.973
Cost of crude delivered to Atlantic coast refineries per books of refineries.....							2.280	1.972	2.138

\* From U. S. Bureau of Mines Reports.

<sup>1</sup> Oil Conservation and Fuel Oil Supply, National Industrial Conference Board (Inc.), 1930.

TABLE 15.—*Typical yields of finished products, 1927-1929*

	Venezuelan crude, Atlantic coast refineries								
	Thousand barrels			Per cent			Value refined product per barrel crude		
	1927	1928	1929	1927	1928	1929	1927	1928	1929
Crude run to stills <sup>1</sup> .....	9,979	37,217	30,471						
Refined products:									
Gasoline.....	1,167	3,896	2,820	11.69	10.47	9.26	\$0.400	\$0.367	\$0.305
Gas oil.....	161	454	378	1.61	1.22	1.24	.032	.012	.008
Fuel oil.....	7,576	30,086	24,712	75.93	83.26	81.10	1.218	.802	.689
Miscellaneous product.....	955	1,363	2,210	9.57	3.66	7.25	.238	.077	.151
Loss.....	120	518	351	1.20	1.39	1.15			
Total.....	9,979	37,217	30,471	100.00	100.00	100.00	1.888	1.258	1.153
Cost of crude delivered to Atlantic coast refineries, per books of refineries.....							1.490	1.041	1.021

<sup>1</sup> Amounts of Venezuelan crude shown by refineries giving data on yields of refined products from Venezuelan crude.

These figures of the realization from domestic and Venezuelan crudes can not be taken as a direct measure of the difference in the value of the two kinds of crude, for the reason that they do not take into account the difference in refining costs. Because of the greater variety of products obtained from the domestic crudes, necessitating not only more elaborate distillation processes but other processes of purifying and perfecting the products, the cost of refining the domestic oils, calculated per barrel of crude, is considerably greater than the cost of refining the Venezuelan oils. The Tariff Commission did not attempt to ascertain the costs of refining domestic and Venezuelan crudes, partly because of the limitation of time, and partly because some refineries mix domestic and Venezuelan or various imported oils to such an extent that it would be impossible to obtain representative costs.

## 2. DIFFERENCE IN AGE OF WELLS

Another element affecting the relative costs of production of petroleum in the United States and in Venezuela is the difference in age of the wells in the two areas. Initial or flush production of an oil pool is at substantially lower cost per barrel than the output of later years when pumping is employed to lift the oil. Sometimes a well may produce in the first year 50 per cent of its ultimate output during its entire life. The greater part of the domestic production of petroleum during the period 1927-1929 was from relatively old wells on the pump, notwithstanding the recent bringing in of gushers (wells flowing from natural pressure) in Oklahoma and elsewhere.

The average producing age of the oil fields of the United States is substantially greater than that of the fields of the Maracaibo Basin. Production on a large scale in Venezuela commenced about 1925-26, and reached its peak in 1929, the decrease in 1930 being chiefly due to curtailment on the part of the operators. Heretofore the production has been chiefly from gushers. Many of the wells in the Maracaibo Basin have, however, recently been, or are about to be,

equipped with pumps. It is evident that production in the Bolivar coastal fields of Lake Maracaibo has largely passed the flush stage, and that therefore operating costs in this region may be expected to increase. Flush production in other parts of Venezuela, however, such as the eastern section, where a subsidiary of the Standard Oil Co. of New Jersey is operating, has yet to be reached.

### 3. EFFECT OF CURTAILMENT OF PRODUCTION

The curtailment of production, which has recently been put into effect in Oklahoma, California, and elsewhere also affects costs. Shutting in of a gusher, or of a flowing well, increases the per barrel cost of production because of the lessened output, and in some recently brought-in wells, has resulted in the inflow of salt water. Ceasing to pump a nonflowing well reduces the ultimate output, or, according to recently observed indications, may result in complete loss of production. During the three years 1927-1929, for which cost data were obtained, curtailment was not a large factor in the American petroleum industry, but during 1930 it has become of major importance, especially in Oklahoma and California. In Venezuela curtailment has also been in force during 1930, but not in any important degree prior to that year.

### 4. RELATIVE STABILITY OF INVESTMENT IN THE UNITED STATES AND VENEZUELA

The relative stability of investments in petroleum in Venezuela and in the United States may have a bearing on the interpretation of the costs of production in the two countries. Capital costs for both countries have been computed in this report on the same basis. The large expenditures of American and other producers in Venezuela for facilities incidental to production, such as towns, hospitals, service facilities, etc., have been placed in the capital account in the same manner as ordinary capital expenses of producers in the United States. This method, however, is different from that employed by some of the producers in Venezuela, who charge such items to operating expense in the year incurred. Their reason for doing this is given as the risk involved in investments in Latin-American countries. They consider it sound business practice to charge to expense as many items as possible, rather than to capitalize them over a period of years, which may be of uncertain stability.

## PART III

### OTHER COST DATA

The data set forth in Part II cover the costs of crude petroleum in the Mid-Continent-Gulf area, the Venezuelan costs, the transportation and other charges incident to delivery of these oils to the Atlantic seaboard, the delivered prices paid by refineries and the comparability of the domestic and Venezuelan crudes. Part III of the report deals with average costs of crude petroleum for the United States as a whole, but does not, for reasons set forth at length at the beginning of Part II, deal with the cost of delivering such oil to the Atlantic seaboard.

#### 1. FORM IN WHICH THE TABULATIONS OF COSTS HAS BEEN PRESENTED

The costs obtained have been tabulated in several different ways in order to bring out as many pertinent facts as possible, as well as to provide a further check on their reasonableness and accuracy.

They have been arranged, keeping large and small companies separated, as well as the years:

1. By companies.
2. By States and groups of States.
3. By districts or fields.
4. By cost groups.
5. By gravity of the oil produced.

All the tables above referred to are based on company-interest oil, and do not consider the value of royalty oil as an element in cost. At the end of this part is presented a table on the other basis, that is, counting the value of royalty oil as one of the elements of cost, but dividing the various items of cost by the total output including royalty oil.

#### 2. WEIGHTED AVERAGE COSTS FOR LARGE AND SMALL COMPANIES, IN THE COUNTRY AS A WHOLE

The first tabulation made of costs shows the weighted average for large and small companies, respectively, for each of the three years, 1927, 1928, and 1929, and a weighted average for all companies. This calculation was made without regard to States or fields where the oil was produced, and without reference to the gravity, base, or other quality of the oil produced. The results give an average cost for the production of crude petroleum for the country as a whole. The figures are weighted so heavily by the large quantity of oil produced in the Mid-Continent-Gulf fields that the average is not widely different from that shown above in the report for the aforesaid fields. The figures for weighted average costs are as follows:



GROUP I.—*Companies having an annual output of 1,000,000 barrels or more*

Year	Weighted average cost per barrel	Weighted average price received per barrel
1927.....	\$1.15	\$1.28
1928.....	1.05	1.16
1929.....	1.00	1.28
Average, 3 years.....	1.07	1.24

GROUP II.—*Companies having an annual output of less than 1,000,000 barrels*

Year	Weighted average cost per barrel	Weighted average price received per barrel
1927.....	\$1.16	\$1.21
1928.....	1.21	1.21
1929.....	1.41	1.40
Average, 3 years.....	1.26	1.27

GROUPS I AND II.—*Combined average costs and prices for all companies*

Year	Weighted average cost per barrel	Weighted average price received per barrel
1927.....	\$1.16	\$1.28
1928.....	1.06	1.16
1929.....	1.02	1.28
Average, 3 years.....	1.08	1.24

The averages of costs shown for the small companies are not, it will be noted, markedly different from those for large companies, and when the two groups are combined, the far greater quantity produced by the large companies causes the weighted average to be very close to that shown for Group I, or the large companies. The reports made by large companies to the commission represent a much larger proportion of the total production of all large companies in the country than the reports made by small companies represent of the production of such companies. If the reports from small companies can be considered representative for all companies of that class, a complete average cost for the entire output of the United States would be slightly higher than shown in the above table.

The figures, given in Part II for the cost of crude petroleum delivered at Atlantic seaboard refineries, are based on the cost of production in the Mid-Continent-Gulf area (which includes Kansas, Oklahoma, New Mexico, Texas, Arkansas, and Louisiana fields) plus transportation, purchasing, and other charges incident to delivery. It was thought to be of interest and value, however, to present the above figures, which would show an average cost of production for the country as a whole.

The figures for price received per barrel agree very closely with the figures given by the petroleum division of the United States Bureau of Mines for average value, at the well, of all crude petroleum produced in the United States. The figure given by the Bureau of Mines for average value in 1927 was \$1.30 per barrel, while the amount ascertained by the Tariff Commission is \$1.28; the Bureau of Mines figure for 1928 is \$1.17 per barrel as against \$1.16 as found by the commission; while in 1929 the Bureau of Mines found the value to be \$1.27 and the Tariff Commission, \$1.28. Figures for the whole country and the Mid-Continent-Gulf area show the predominant influence exerted by that area on the general situation.

*Itemized cost for the United States as a whole.*—Table 16 shows the separate items of cost, per barrel, for oil produced by both large and small companies in the United States as a whole, as reported to the commission. The distribution of costs among the items for the country as a whole is closely similar to that shown for the Mid-Continent-Gulf area only.

TABLE 16.—Average cost per barrel at wells in the United States, large and small companies combined, by items

[Based on company interest oil]

	1927	1928	1929	Weighted average, 1927-1929	Per cent
Production (thousand barrels).....	488,607	499,541	578,901	1,567,049	
Expenses:					
Depletion of leaseholds.....	\$0.13	\$0.11	\$0.10	\$0.11	10.19
Amortization of tangible development.....	.18	.16	.16	.16	14.82
Intangible development.....	.27	.23	.26	.26	24.07
Current operating cost.....	.32	.31	.29	.31	28.70
General and administrative.....	.27	.27	.24	.26	24.07
Total.....	1.17	1.08	1.05	1.10	101.85
Deduct receipts from gas sales and miscellaneous revenue.....	.11	.11	.12	.11	10.19
Net cost excluding interest.....	1.06	.97	.93	.99	91.66
Interest on investment (6 per cent).....	.10	.09	.09	.09	8.34
Net cost including interest.....	1.16	1.06	1.02	1.08	100.00
Average selling price.....	1.28	1.16	1.28	1.24	

### 3. QUANTITY OF OIL PRODUCED AT DIFFERENT AVERAGE COSTS

There are wide differences in the cost of producing oil on the part of different concerns. There are often also wide differences for a single concern as between the costs in different fields in which it operates. The data obtained by the commission showed for each producing company its costs in each of the pools, fields, or other areas, distinguished in its accounts. The data for each area were punched on a separate card, together with the average unit cost per barrel. These cards were subsequently sorted according to unit costs and the quantity produced within different cost limits were thus ascertained.

The results are shown in the two following tables. Table 17 shows the percentage of the total quantity of oil produced within each specified limit of cost, while Table 18, obtained by cumulating the figures in the preceding table, shows how much oil was produced at or below each specified limit of costs.

It will be seen that the great bulk of the oil was produced, in the case of both the large companies and the small companies, at a cost not less than 40 cents nor more than \$1.60 per barrel. In the case of the large companies, much more than half of the oil was produced at between 40 cents and \$1.20 per barrel, and from seven-eighths to nine-tenths of the total (varying in different years) was produced at a cost of less than \$1.60 per barrel. The figures of Table 17 are illustrated by the accompanying diagrams.

TABLE 17.—Percentage of oil reported which was produced within cost limits specified

	Group I. Large companies			Group II. Small companies		
	1927	1928	1929	1927	1928	1929
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
0 to 39 cents per barrel.....	11.09	10.68	13.17	13.45	8.89	3.96
40 to 79 cents per barrel.....	20.97	27.45	28.52	23.32	26.52	22.29
80 cents to \$1.19 per barrel.....	30.24	35.96	32.65	21.88	20.10	23.46
\$1.20 to \$1.59 per barrel.....	22.51	11.79	14.92	21.67	23.49	23.74
\$1.60 to \$1.99 per barrel.....	6.61	6.48	5.38	7.70	8.83	9.18
\$2 to \$2.39 per barrel.....	3.91	3.03	1.87	7.04	6.87	8.01
\$2.40 to \$2.79 per barrel.....	1.80	1.02	1.01	1.22	1.56	1.41
\$2.80 to \$3.20 per barrel.....	.49	1.38	.50	1.03	1.04	1.34
Over \$3.20 per barrel.....	2.38	2.21	1.98	2.69	1.80	6.61

TABLE 18.—Percentage of oil reported which was produced at or below the cost specified

	Group I. Large companies			Group II. Small companies		
	1927	1928	1929	1927	1928	1929
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Less than 40 cents per barrel.....	11.09	10.68	13.17	13.45	8.89	3.66
Less than 80 cents per barrel.....	32.06	38.13	41.69	36.77	35.41	26.25
Less than \$1.20 per barrel.....	62.30	74.09	74.34	58.05	55.51	49.71
Less than \$1.60 per barrel.....	84.81	85.88	89.26	80.32	79.00	73.45
Less than \$2 per barrel.....	91.42	92.36	94.64	88.02	87.83	82.63
Less than \$2.40 per barrel.....	95.33	95.39	96.51	95.06	94.70	90.64
Less than \$2.80 per barrel.....	97.13	96.41	97.52	96.28	96.26	92.05
Less than \$3.20 per barrel.....	97.62	97.70	98.02	97.31	98.20	93.39
More than \$3.20 per barrel.....	2.38	2.21	1.98	2.69	1.80	6.61

#### 4. ARRAY OF COMPANIES ACCORDING TO AN ASCENDING SCALE OF COSTS

In addition to the above-mentioned classification according to costs, the returns of each company, considered as a whole and independent of its operations in different fields, were classified according to an ascending scale of average unit costs.

After the figures were arranged in this way, diagrams, in the form of cumulative cost figures, were drawn. (See figs. 4 to 9.) It is to be noted that the costs rise in a gradually ascending scale until nearly the entire quantity of oil has been covered, in each year, but that the latter end of the curve ascends very steeply. The costs represented by this right-hand end of the diagram, in each case, and covering in no instance more than 2 per cent of the entire quantity of oil produced, are the costs of a few producers who met with extremely bad fortune. In most of the cases they were producers who had spent considerable

FIGURE I

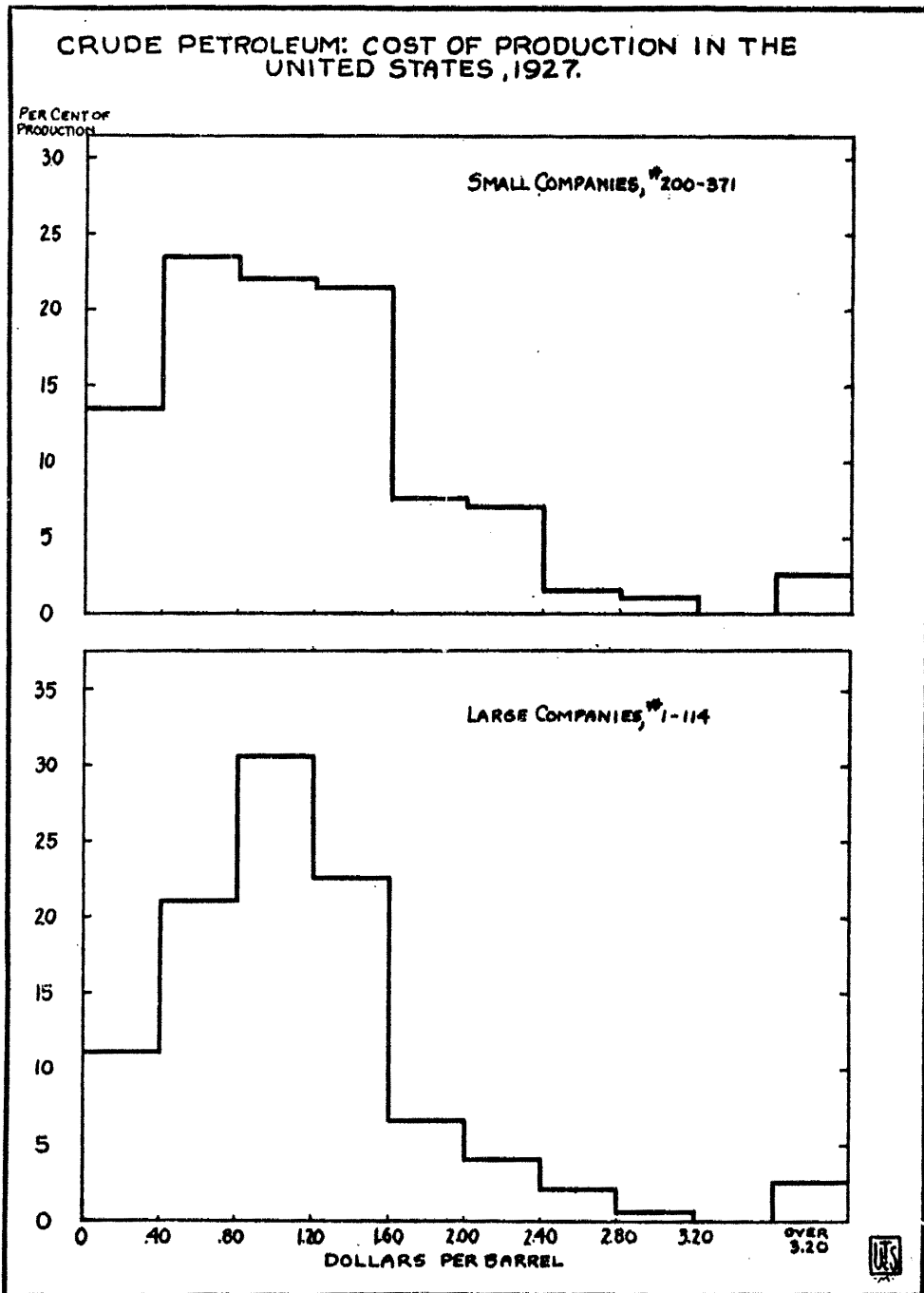


FIGURE II

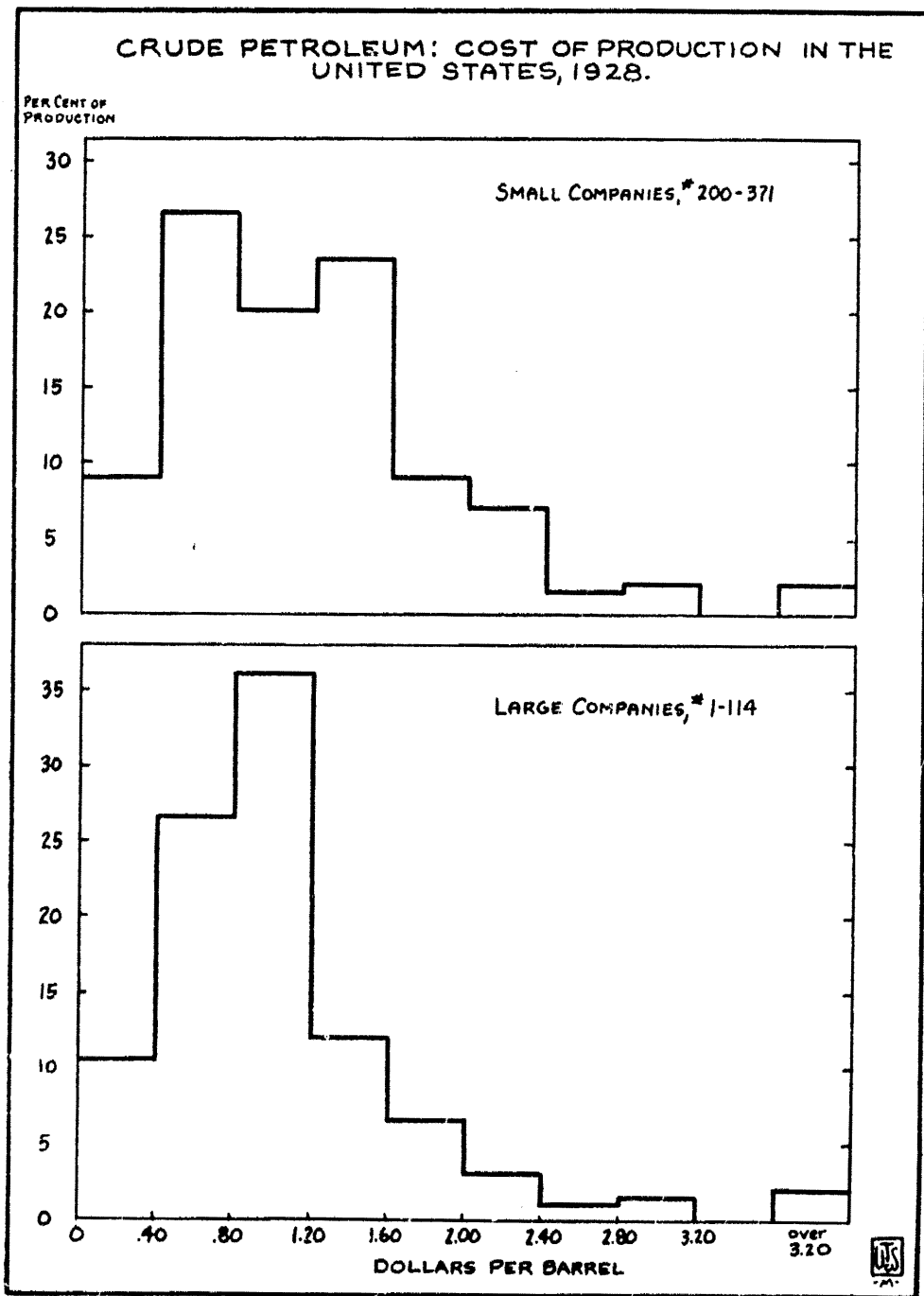
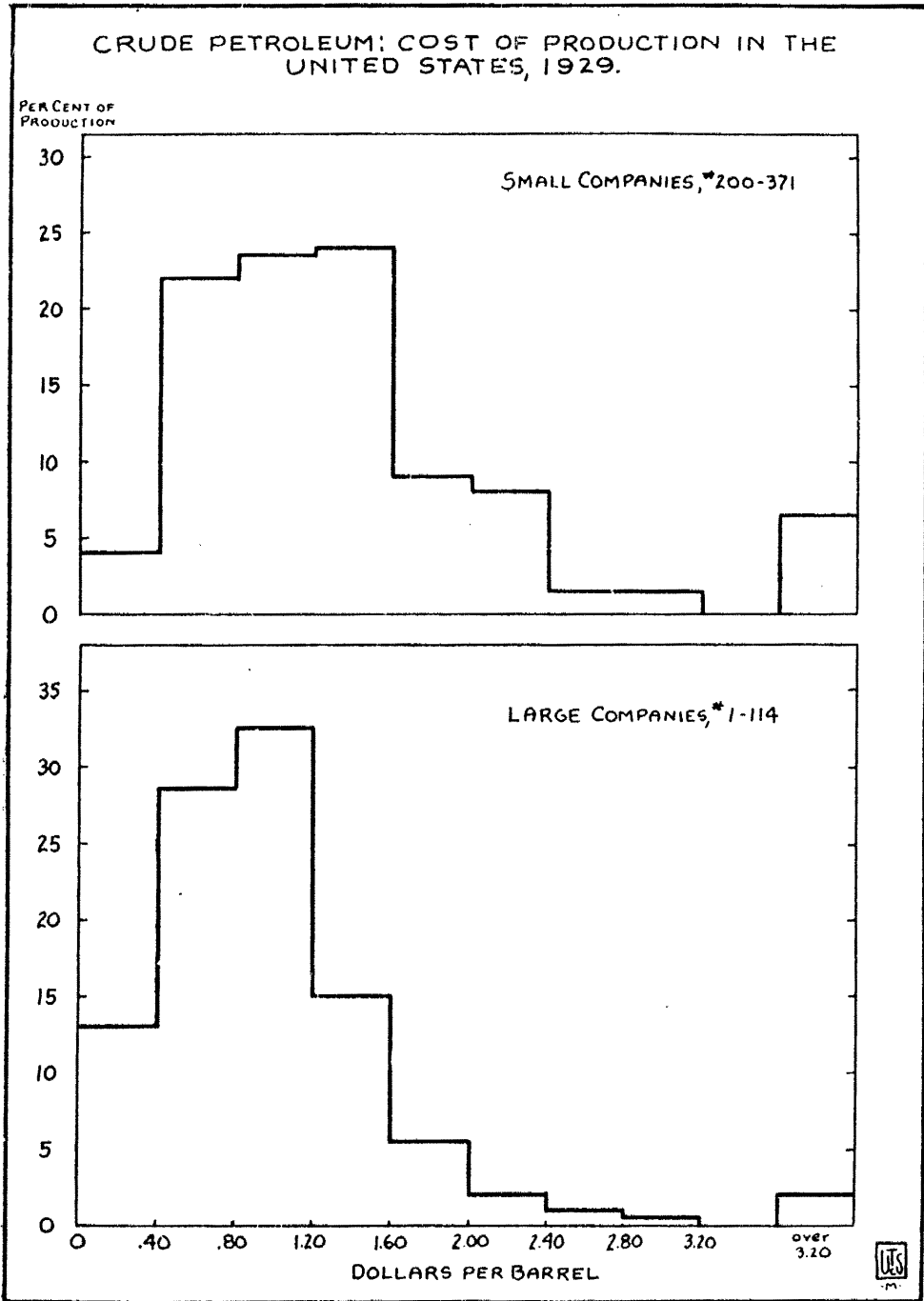


FIGURE III



money in development but were only producing a very small quantity of oil. Costs ranging as high as \$50 or \$75 a barrel might have been considered wholly abnormal and thrown out of the tabulation entirely. This was not done, however, and they were included in making up the average cost figures, because those with extremely low costs were included.

#### 5. COSTS BY STATES AND GROUPS OF STATES

For the purpose of the next tabulation, the States were arranged in the following groups:

Group (a).—California.

Group (b).—Oklahoma, Texas, Arkansas, Louisiana, Kansas, and New Mexico.

Group (c).—Wyoming, Colorado, and Montana.

Group (d).—Illinois, Indiana, Ohio, Kentucky, Tennessee, West Virginia, Pennsylvania, New York, and Michigan.

It was considered that this was a natural grouping, since the conditions in California are distinctly different from those in the Mid-Continent-Gulf fields, which were put in group (b), while the Rocky Mountain section, included in group (c), and the States east of the Mississippi, put in group (d), also have entirely different conditions of production. In this tabulation the large companies of Group I were kept separate from the small companies of Group II.

*Costs of the large companies, Group I, by States.*—Analyzing the costs of the large companies, it is found that California had the lowest weighted average cost for the three years 1927–1929, inclusive. The weighted average cost for the three years for California companies was 75.8 cents per barrel. The weighted average cost for the three years for companies in the Mid-Continent-Gulf group of States was \$1.099 per barrel. The average for the Rocky Mountain field, covering the States of Wyoming, Colorado, and Montana, was \$1.057 per barrel and the average for the Eastern States was \$2.655 per barrel.

The lowest State average cost for the large companies in 1927 was 68.6 cents per barrel for California. Excluding Tennessee and Michigan, where the quantity of oil covered by returns was insignificant, the highest cost for any State in that year was \$4 in Pennsylvania. The lowest State average cost in 1927 for any State in the Mid-Continent-Gulf area was 91.8 cents per barrel for Arkansas, and the highest \$1.88 for New Mexico.

The lowest State average for any State in 1928 was 80.6 cents for California and the highest (again not counting Tennessee and Michigan) was for Pennsylvania, \$3.53. In the Mid-Continent-Gulf group in this year, 94 cents per barrel was shown for Texas while the cost in Arkansas rose to 98.5 cents per barrel.

The lowest State average cost for any State in 1929 was again shown for California, being 77 cents per barrel, while the highest cost was \$3.84 per barrel for Pennsylvania. Texas showed the lowest cost of any State in the Mid-Continent-Gulf group in 1929, the cost being but 82.6 cents per barrel as against \$1.16 per barrel in Oklahoma and \$1.13½ per barrel in Arkansas.

*Costs of small companies—Group II—by States.*—Turning to the small companies, those in Group II, we find that the lowest weighted

FIGURE IV

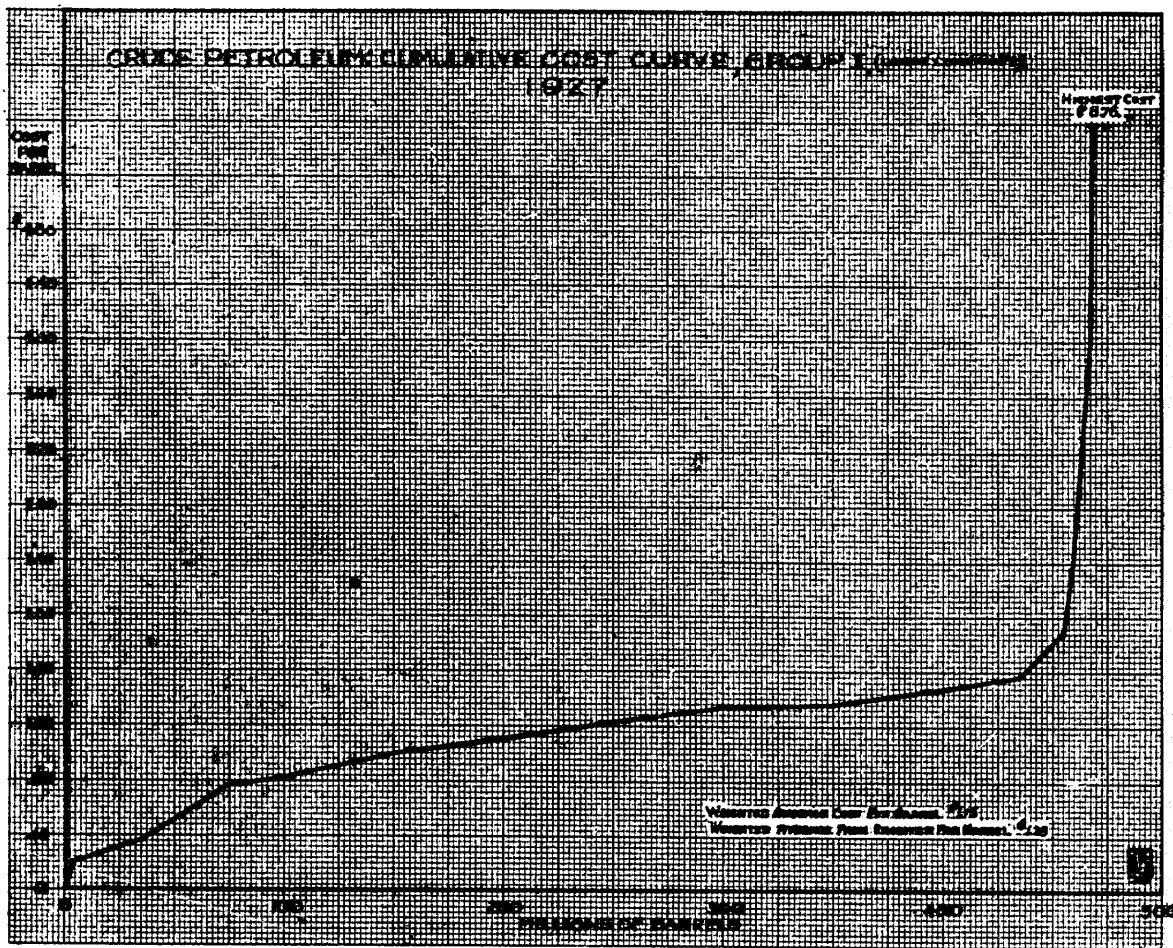




FIGURE V

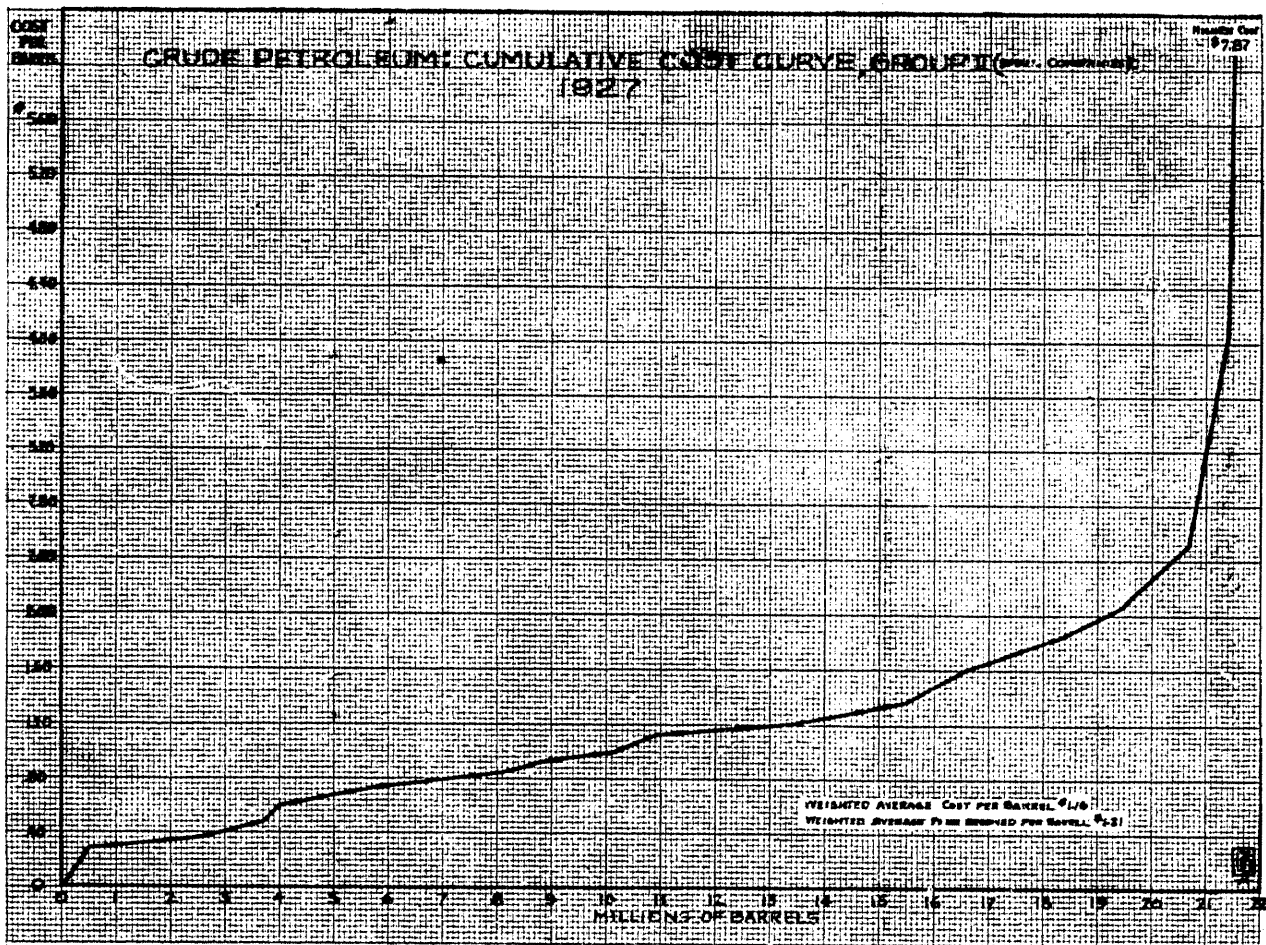


FIGURE VI

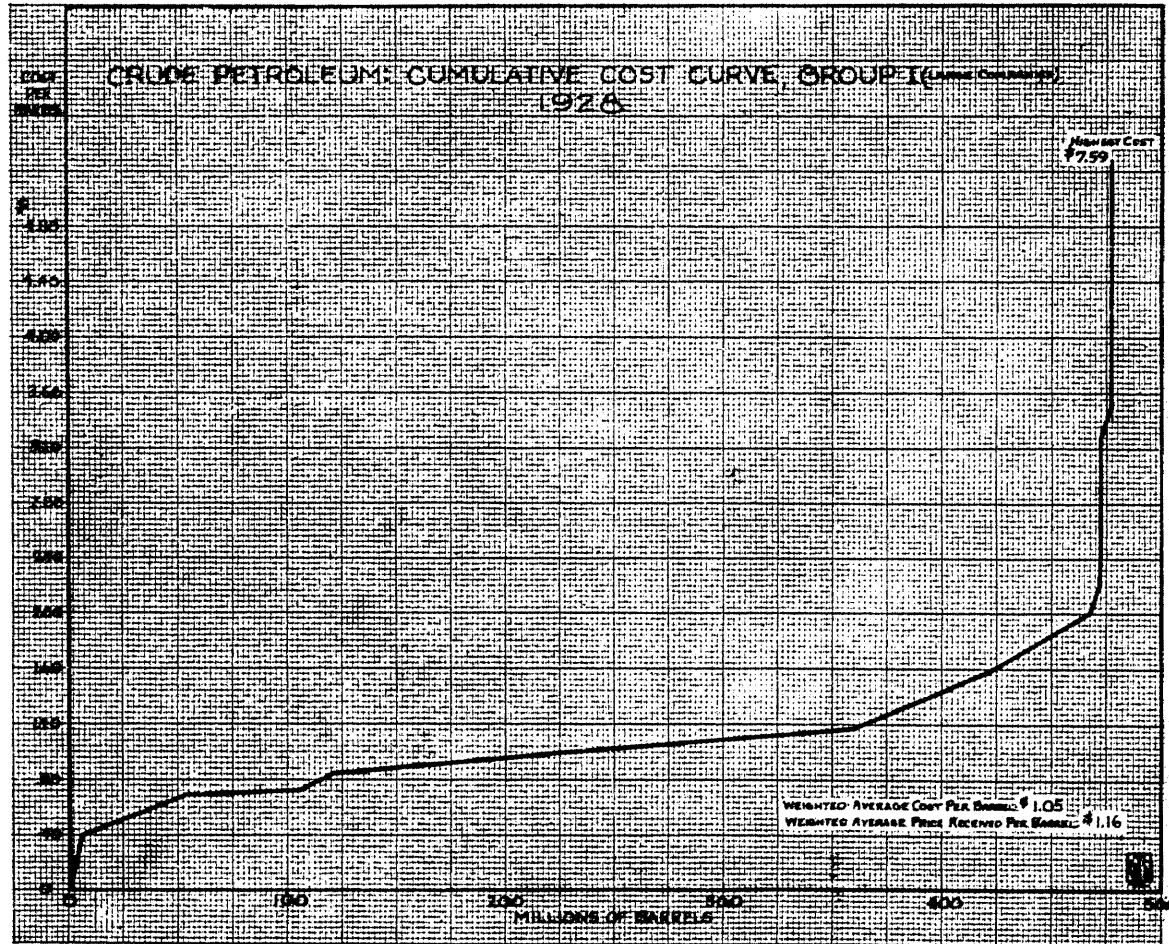


FIGURE VII

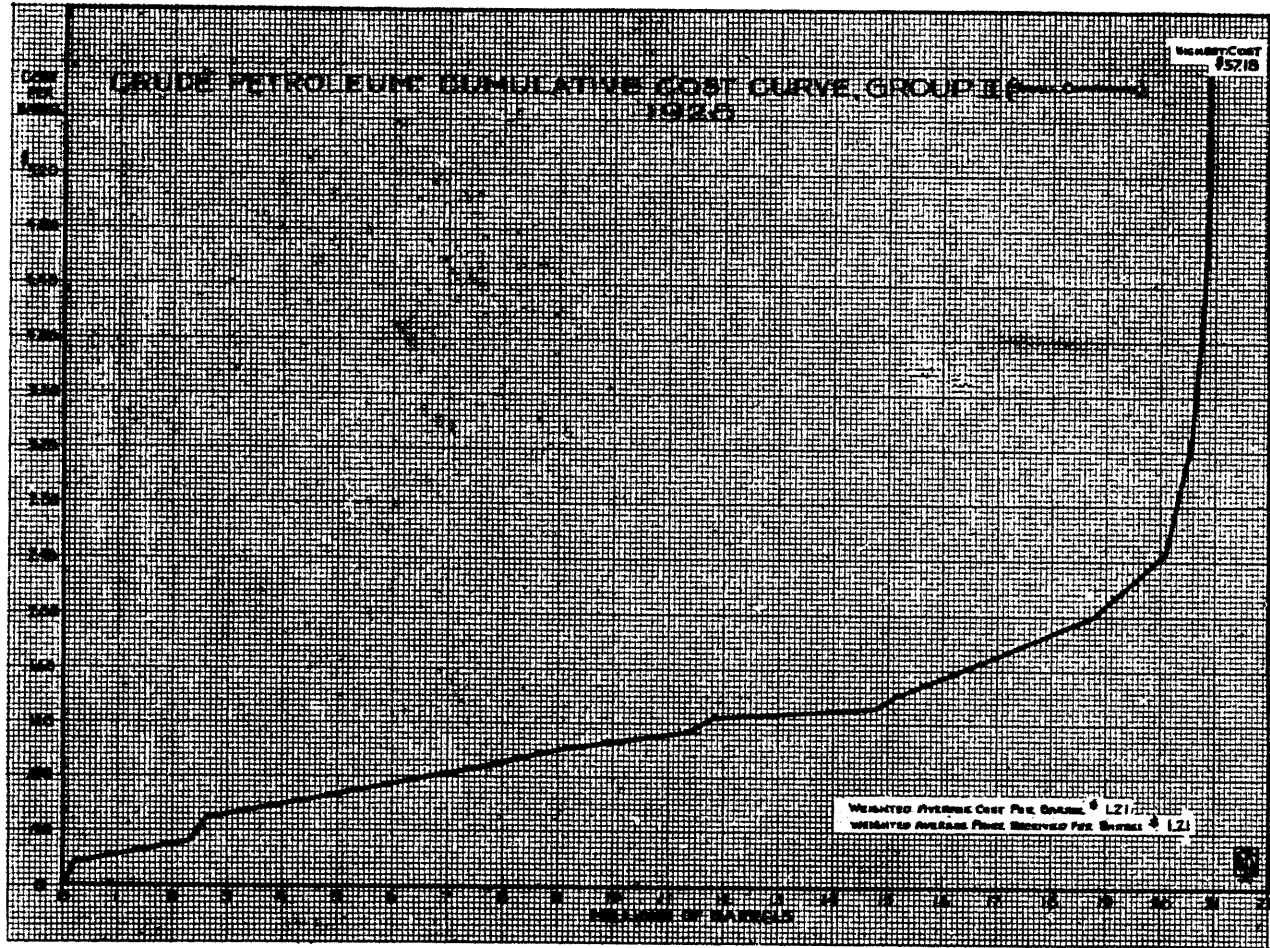


FIGURE VIII

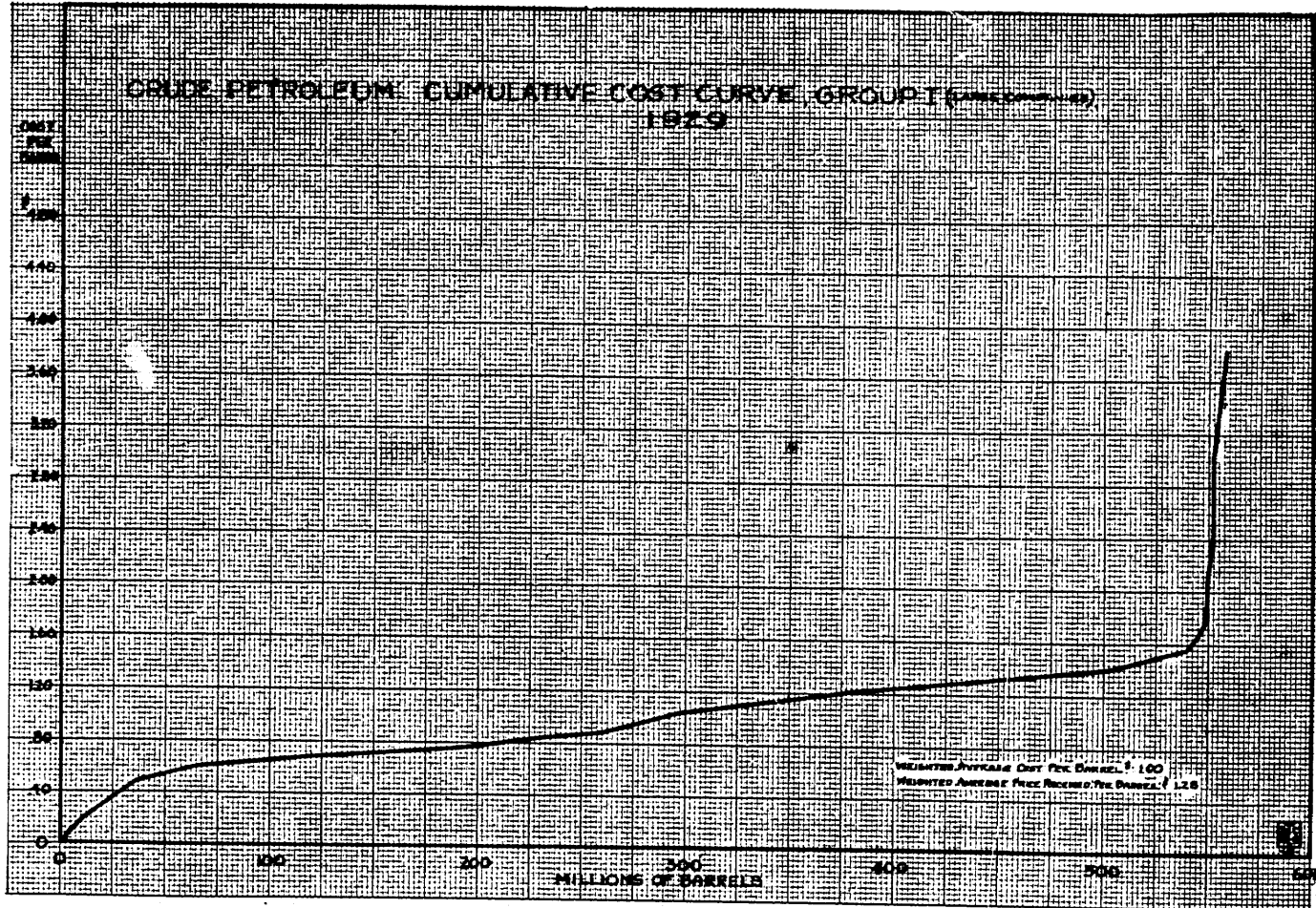
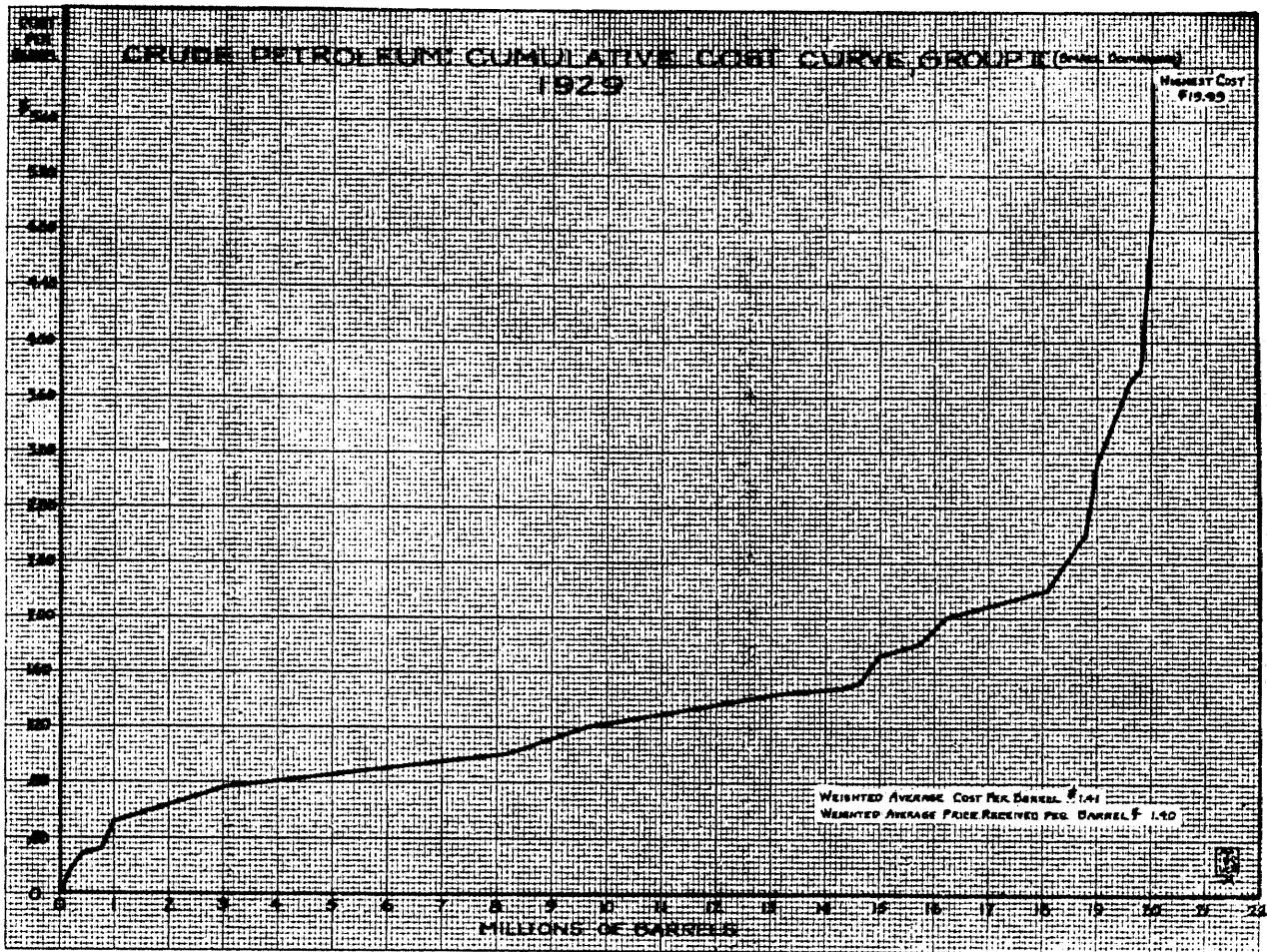


FIGURE IX



average cost for any of the four great regions for the three years, was for California, \$1.05 per barrel; for the Mid-Continent-Gulf field it was \$1.06 per barrel; for the Rocky Mountain field, \$1.30 per barrel; and for the eastern field, \$2.27 per barrel.

The lowest cost of small companies for any State in 1927 was for Arkansas, which had an average cost of 54.8 cents per barrel. The highest cost for any State in that year was \$3.72 per barrel for West Virginia. The lowest cost for any State in 1928 was 76.7 cents per barrel for Arkansas and the highest for 1928 was \$4.36 per barrel for West Virginia. The lowest cost for any State in 1929 was 76.4 cents per barrel for Arkansas; and the highest cost was \$4.77 per barrel for West Virginia. Texas and Oklahoma had weighted average costs for the three years of \$1 and \$1.22 per barrel, respectively.

TABLE 19.—Unit costs and sales value by States and averages for the three years, 1927-1929

[Company-interest oil only]

State	Large companies			Small companies		
	Average annual production of reporting companies	Average cost per barrel, including interest	Average sales value per barrel	Average annual production of reporting companies	Average cost per barrel, including interest	Average sales value per barrel
California.....	100,349,872	\$0.7583	\$1.0683	7,045,335	\$1.0539	\$0.9096
Oklahoma.....	173,882,515	1.1645	1.4161	2,285,642	1.2236	1.3529
Texas.....	157,997,265	.9636	1.0832	5,332,781	.9962	1.0565
Arkansas.....	16,459,068	.9989	.9291	506,835	.6398	1.0440
Louisiana.....	15,234,411	1.4307	1.1990	112,409	1.1709	1.0350
Kansas.....	20,543,921	1.3937	1.4208	633,440	1.3366	1.4278
New Mexico.....	315,789	2.9469	1.3000			
Total.....	384,432,969	1.0991	1.2497	8,871,107	1.0609	1.2024
Wyoming.....	2,941,711	.9853	1.2299	1,029,844	1.2353	1.2899
Colorado.....	992,992	.9589	1.0936			
Montana.....	718,067	1.4909	1.7049	216,610	1.8286	1.7045
Total.....	4,652,770	1.0577	1.1667	1,846,454	1.3049	1.3386
Illinois.....	3,452,876	1.1952	1.6079	412,597	1.5015	1.6171
Indiana.....	137,504	2.0065	1.6156	14,354	1.9045	1.5485
Ohio.....	1,151,475	2.2167	1.8764	222,844	1.9940	1.9157
Kentucky.....	607,773	2.1815	1.6179	1,499,382	1.8602	1.7039
Tennessee.....	1,045	30.8338	1.5407			
West Virginia.....	604,447	2.0377	3.4659	91,873	4.3098	3.1981
Pennsylvania.....	5,776,618	3.7906	3.2468	555,473	3.1477	3.4540
New York.....				292,810	3.4089	3.5991
Michigan.....	329,973	1.7899	1.5707			
Total.....	12,061,711	2.6557	2.5111	3,089,333	2.2666	2.2457
Total, all States.....	501,497,322	1.0680	1.2432	20,852,229	1.2598	1.2701

<sup>1</sup> Reported for only 2 years, 1927 and 1928.

Although in the United States as a whole for each of the three years the average unit cost of production was higher for the small companies than for the large companies, there are numerous exceptions to this rule in individual States. In the entire group of Eastern States taken together the average costs of the small companies were lower in each year than those of the large companies, and the same was true in a number of individual States in other regions of the country. It is impossible to determine the relative efficiency of pro-

duction of large and small concerns from general averages for large areas. Costs often differ widely in different fields of the same State and the relation between the general average cost for large companies and for small companies in a State as a whole may be greatly affected by the geographic distribution of the wells of the respective groups of companies.

*Relation of costs to sales value.*—In comparing the average unit cost of production with the average unit sales value of petroleum in the several States, it should be borne in mind that the cost figures include interest on the investment of the companies at 6 per cent. For convenience one may speak of a loss where the average sales value is less than the average cost, including interest, but many companies which show a loss when thus computed are making at least some return on their investment. It is true, however, that in many cases the average realization is not sufficient to cover the operating expenses of production. Similarly, the word "profit" may for brevity be used to denote an excess of average-sales value above average cost of production including interest.

When the unit cost of production is compared with the unit sales value it is shown that the sales afforded a profit in the States of largest production in most of the individual years and that the weighted average unit sales value for the three years was greater than the weighted average unit cost of production. The States which showed the greatest departure from this rule were Louisiana, New Mexico, and Arkansas, among the States west of the Mississippi River. The group of Eastern States showed a loss on the whole for both large and small companies when weighted average sales value is compared with weighted average cost of production. However the quantity of production covered by the figures obtained by the commission for the Eastern States was not as large as for the Mid-Continent-Gulf area or for California and perhaps it can not be regarded as so completely representative of the costs in this area as are the costs for the Mid-Continent-Gulf field.

West Virginia was the only Eastern State in which the large company group showed a profit for all three years while in that State the small company group showed a loss in all three years. On the other hand, the small companies in Illinois and Pennsylvania showed a profit in all three years while the small companies in New York showed a profit in two years out of the three and a profit for the 3-year period as a whole.

In the case of the small companies the average unit sales value was less than the cost of production in California in each of the three years and the same was true of Group C (Rocky Mountain States) in 1928, and of Group D (Eastern States) in both 1927 and 1928. Otherwise the averages for the several groups show a profit for the smaller producers. In the individual States the relationship of costs and sales for the small companies varies considerably.

*Items of costs by States.*—The individual items of cost and the credits for sales of gas and miscellaneous revenue are shown by States in Tables 24 and 25.

The relative amounts expended under the different heads vary decidedly from State to State. These variations are affected by the physical conditions of production, such as the depth of the well and the average output per well, and also by the length of time during

which the oil fields have been worked. In the States which were actively developing their new oil resources during the period covered by the investigation, like California, Oklahoma, Texas, and New Mexico, the intangible development cost was a large item of expense. In the case of the large companies as a group this was the largest expense item in California and Oklahoma for the 3-year period as a whole. In the Eastern States, on the other hand, where there is less new development, current operating cost, depletion, and amortization bulked much larger than intangible development, although in Pennsylvania, in the case of both large and small companies, intangible development cost, while considerably less than operating cost, was larger than depletion or amortization.

General and administrative expense was a larger proportion of the total expense in the case of the large companies than the small companies, being for the country as a whole, roughly, one-fourth in the former and one-seventh in the latter case. Considering the large company group alone, the share of total expense reported for general and administrative expense was somewhat more than one-fourth in Texas, Louisiana, Kansas, and New Mexico, and a little less than one-fourth in California, Oklahoma, and Arkansas. In the small company group the proportion for general and administrative expense ran much less than one-fourth in all of the foregoing States except Kansas, in which it was more than one-fourth.

Interest at 6 per cent was computed on the investment of the companies and added to the other net costs to give a total cost. Interest on investment represented 8.3 per cent of the total cost thus computed in the case of the large companies, and 14.7 per cent in the case of small companies. The item of interest ran somewhat larger, relatively, for the Eastern than for the Western States in both the large and small company groups. For the large companies the share represented by interest in total cost of production was, on the average for the three years 1927-1929, 10.5 per cent in California, 6.9 per cent in Oklahoma, and 7.3 per cent in Texas.

## 6. COSTS BY PRODUCING DISTRICTS OR FIELDS

In the questionnaire sent to the oil producers, it was requested that the data pertaining to the costs of production be prepared by districts or pools. When these data were assembled it was found that some companies had reported their information lumped for an entire State, while others had presented theirs for each separate lease. There were varying conditions between these two extremes.

The oil producers were also asked to file with the questionnaire maps showing the location of the districts in which they were producing oil. In many instances these maps were not included. As many of the smaller pools are often known by several names and as many companies included a number of adjoining pools under the name of one pool of a group, it was found to be quite difficult to identify some of the pools without accompanying maps.

So many data were presented, covering so many different fields and pools, that it was found necessary to group the figures for the most part into a few large districts, some of which include a considerable number of pools, showing separately, however, figures for a few of the major individual pools of the country. Texas, for example,



was divided into such districts as west Texas, north Texas, etc., with separate data for such major fields as Mexia, Luling, and Big Lake. No division into pools or districts was made for the States of small production.

In some cases it was found difficult to separate one district absolutely from another. As an example, several companies reported costs for the Iatan district in Texas. This district includes several counties lying between what are commonly known as west Texas and north central Texas fields. Other companies have included production of the western counties of the Iatan districts in their costs for the west Texas field and for the eastern counties of the district in their costs for north central Texas. The classification of the returns by districts was finally made to conform with the returns of the majority of the companies which filed reports.

TABLE No. 20.—Crude-oil production: Unit cost and unit sales price, by districts

GROUP I

District	1927			1928			1929			Three-year average	
	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Unit cost, including interest on investment	Unit sales price
California:	<i>Barrels</i>			<i>Barrels</i>			<i>Barrels</i>				
Long Beach, Seal Beach, Signal Hill.....	18,962,688	\$0.60	\$1.05	33,266,829	\$0.62	\$1.00	35,030,127	\$0.55	\$1.13	\$0.59	\$1.08
Santa Fe Springs.....	5,081,385	.71	1.18	6,223,159	1.59	1.22	36,205,457	1.03	1.37	1.07	1.33
Redonda-Torrance.....	3,732,717	.89	1.11	2,825,232	.90	1.08	2,388,467	1.06	.87	.94	1.04
Coalinga (light).....	1,231,736	1.06	.83	482,082	2.05	.76	119,508	5.91	.60	1.64	.80
Coalinga (heavy).....	1,009,920	1.06	.76	997,334	1.15	.77	1,088,914	1.15	.54	1.12	.68
Huntington Beach.....	5,026,280	.70	1.02	3,476,154	.82	.90	2,721,460	.92	.89	.79	.95
Kern River, Kern River Front, Mount Poso, Round Mountain.....	2,286,905	1.87	.79	2,021,495	1.78	.68	4,338,078	1.02	.51	1.42	.62
Elk Hills, McKittrick.....	1,310,503	.40	.81	1,234,808	.37	.80	1,087,598	.42	.66	.40	.76
Lawndale, Potrero, Rosecrans.....	1,105,752	1.06	1.57	857,593	1.68	1.52	1,100,388	1.53	1.70	1.40	1.60
Dominquez.....	3,481,436	.59	1.18	2,438,057	.87	1.12	1,983,329	.84	1.25	.74	1.18
Belridge, Lost Hills.....	1,197,385	1.09	.93	1,128,535	.96	.86	1,240,581		.83	.60	.87
Ventura (Avenue).....	13,649,364	.25	1.10	14,065,679	.50	.99	17,183,423	.60	1.15	.46	1.08
Buena Vista, Maricopa, Midway Sunset, Wheeler Ridge.....	10,769,904	.75	.71	8,857,218	.88	.89	8,313,770	.79	.79	.80	.79
Culver City, Inglewood, Montebello, Whittier.....	2,169,047	.63	.96	1,691,413	.76	.72	1,356,601	.95	.86	.75	.90
Arro Grande, Casmalia, Cat Canyon, Lompoc, Santa Maria.....	210,443	1.36	.95	195,788	1.33	.91	169,896	1.73	.91	1.46	.92
Barnsdale, Conejo, Newhall, Ojai, Peru, Santa Paula.....	14,908	.98	.87	25,540	2.72	.85	70,957	1.48	.86	1.70	.86
Brea-Olinda, Coyote Hills, East Coyote, West Coyote, Olinda, Richfield.....	6,418,932	.71	1.03	5,237,967	.74	.96	4,698,572	.85	.99	.76	1.00
Alamitos.....	256,143	2.83	.95	178,683	.72	1.01	1,144,396	.59	1.19	.97	1.13
Kettleman Hills.....				2,663	.26	1.00	639,204	1.50	1.50	1.50	1.50
Baldwin Hills, La Helva, Merced Hills.....	3,170,538	1.18	.93	2,472,406	1.18	.91	2,885,856	1.15	.88	1.17	.91
Elwood, Rincon, Summerland.....				572,174	1.20	1.44	7,896,239	.34	1.44	.40	1.44
Total.....	81,085,986	.69	1.00	88,300,809	.81	1.01	131,662,821	.77	1.15	.76	1.07

COST OF CRUDE PETROLEUM

TABLE No. 20.—Crude-oil production: Unit cost and unit sales price, by districts—Continued

## GROUP I—Continued

District	1927			1928			1929			Three-year average	
	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Unit cost, including interest on investment	Unit sales price
<b>Texas:</b>	<i>Barrels</i>			<i>Barrels</i>			<i>Barrels</i>				
Panhandle.....	17,920,123	\$1.52	\$1.00	11,635,267	\$1.30	\$1.00	16,999,774	\$1.00	\$1.30	\$1.28	\$1.11
West Texas.....	24,646,670	.90	.75	67,928,681	.60	.63	73,312,562	.48	.83	.59	.74
North Texas.....	11,613,693	1.77	1.43	10,986,866	1.50	1.37	14,813,151	1.25	1.41	1.48	1.41
Mexia.....	8,498,240	1.87	1.45	5,724,368	2.23	1.38	4,966,783	2.18	1.43	2.06	1.42
Luling.....	5,627,182	1.14	1.10	4,887,200	1.35	1.04	13,654,963	.93	1.07	1.66	1.07
North central.....	10,734,960	1.66	1.53	11,851,836	1.29	1.37	14,134,885	1.23	1.74	1.37	1.56
East Texas.....	29,729	.64	1.45	30,048	14.27	1.43	28,113	7.93	1.47	9.58	1.45
South West Texas.....	1,014,517	1.57	1.07	1,213,504	1.35	1.01	1,350,281	1.40	.87	1.43	.88
Iatan.....	510,240	1.34	1.08	1,060,534	.91	.71	1,022,638	.91	.76	.99	.90
Gulf coast.....	36,532,891	.86	1.41	32,486,052	.93	1.18	37,681,123	1.03	1.25	.94	1.28
Big Lake.....	5,751,665	.64	1.26	4,612,982	.84	1.16	3,911,725	.68	1.28	.72	1.24
Corsicana heavy.....	107,987	2.44	1.09	88,450	1.46	1.01	80,435	1.06	.82	1.72	.99
Mixed districts and others in Texas.....	4,234,180	.96	.95	5,686,838	.77	.75	6,620,175	.68	1.16	.78	.97
<b>Total.....</b>	<b>127,222,062</b>	<b>1.20</b>	<b>1.20</b>	<b>158,193,125</b>	<b>.94</b>	<b>.94</b>	<b>188,576,608</b>	<b>.83</b>	<b>1.12</b>	<b>.96</b>	<b>1.08</b>
<b>Oklahoma:</b>											
Bartlesville and Nowata, Rogers, Craig, Dewey, Washington Counties.....	1,126,292	2.82	1.30	1,163,458	2.35	1.19	1,339,591	2.31	1.26	2.48	1.25
Tulsa, Creek Counties.....	4,607,376	1.59	1.37	3,887,704	1.63	1.28	4,116,021	1.52	1.30	1.58	1.32
Wagoner, Muskogee, McIntosh Counties.....	87,089	2.55	1.37	81,357	3.76	1.32	257,379	1.64	1.43	2.00	1.40
Okmulgee, Okfuskee, Hughes Counties.....	2,443,299	1.62	1.45	1,936,805	1.80	1.45	1,821,696	1.96	1.53	1.77	1.47
Seminole, Pottawatomie Counties.....	5,150,183	1.24	1.58	5,594,250	1.27	1.59	4,740,482	1.48	1.49	1.32	1.43
Osage County.....	7,052,016	1.64	1.43	6,368,412	1.72	1.37	4,648,835	1.80	1.40	1.71	1.40
Pawnee, Payne, Lincoln Counties.....	3,450,762	1.72	1.47	2,520,862	1.71	1.43	2,238,700	1.82	1.50	1.74	1.47
Kay, Noble, Garfield, Grant Counties.....	14,247,343	1.14	1.58	8,731,266	1.24	1.57	6,708,519	1.23	1.49	1.19	1.56
Caddo, Grady, Comanche, Garvin Counties.....	255,612	1.70	1.31	205,110	2.10	1.18	347,390	1.47	1.12	1.70	1.20
Stephens, Cotton, Carter, Jefferson Counties.....	5,771,004	1.41	1.30	5,442,718	1.40	1.18	11,600,101	1.23	1.33	1.32	1.28
Burbank Field.....	5,195,551	1.51	1.47	3,154,364	1.64	1.36	2,169,859	1.38	1.41	1.52	1.41
Cushing Field.....	5,343,123	1.23	1.48	4,448,530	1.24	1.48	3,963,137	1.36	1.54	1.27	1.50
Oklahoma City Field.....				74,071	.71	1.41	3,879,039	.91	1.52	.90	1.52
Heraldton Field.....	4,530,975	1.09	1.20	4,882,073	1.09	1.23	4,213,848	.99	1.09	1.05	1.11
Seminole Field.....	54,499,153	1.01	1.41	81,405,249	.94	1.43	85,635,218	1.04	1.49	1.00	1.44
Oklahoma State: Mid-Kansas Gas Co., Arkansas National Gas Co., Carter Oil Co.....	38,060,815	1.53	1.44	29,591,135	1.07	1.30	26,042,119	1.19	1.43	1.39	1.40

Mixed districts in entire State.....	1,989,345	1.22	1.43	998,049	1.53	1.31	661,788	1.72	1.42	1.39	1.40
Counties: Beckham, Coal, Greer, Kiowa, Le Flore, Logan, Latimer, Marshall, Murray, Pittsburg, Sequoyah, Tillman.....	1,090,089	2.24	1.35	4,457,241	1.29	1.27	6,881,141	.84	1.37	1.18	1.34
Total.....	185,500,029	1.20	1.42	164,942,654	1.12	1.38	171,204,863	1.16	1.45	1.16	1.42
<b>Kansas:</b>											
Eldorado-Augusta.....	7,705,644	1.63	1.39	7,376,871	1.61	1.32	9,926,925	1.45	1.46	1.56	1.40
Greenwood and Woodson Counties.....	3,975,872	1.43	1.47	3,827,837	1.60	1.43	3,902,736	1.59	1.53	1.54	1.48
East Kansas.....	727,562	1.90	1.39	788,973	1.68	1.30	1,132,869	1.39	1.36	1.61	1.35
Russell County.....	426,520	1.40	1.50	277,930	1.93	1.40	266,861	1.98	1.42	1.71	1.45
Wichita.....	92,330	1.56	1.47	612,024	.98	1.44	3,791,663	1.08	1.65	1.04	1.62
Sumner County.....	6,871,003	1.22	1.37	6,146,755	1.09	1.35	1,297,787	1.30	1.48	1.17	1.37
Lyon County.....	37,556	1.34	1.51	20,285	1.70	1.45	12,767	1.39	1.52	1.29	1.49
Rice County and Hutchinson District.....	105,592	2.67	1.32	70,687	2.22	1.19	2,236,690	.49	1.41	.64	1.40
Total.....	19,942,079	1.46	1.40	19,121,372	1.43	1.35	22,568,311	1.30	1.49	1.39	1.42
<b>Arkansas:</b>											
Eldorado.....	8,281,913	.93	1.07	7,127,189	1.03	.89	5,805,872	1.54	.94	1.08	.97
Smackover.....	11,658,430	.91	1.02	8,963,288	.95	.79	7,520,511	.96	.84	.94	.90
Total.....	19,940,343	.92	1.04	16,110,477	.99	.83	13,326,383	1.14	.88	1.00	.93
<b>Louisiana:</b>											
Bull Bayou.....	499,568	2.14	1.46	664,799	1.56	1.39	668,254	1.85	1.42	1.80	1.42
Haynesville.....	11,280,837	1.30	1.18	9,011,244	1.37	1.09	7,188,880	1.59	1.14	1.40	1.14
Caddo.....	2,616,598	1.59	1.45	2,135,185	1.63	1.39	2,037,655	1.59	1.48	1.60	1.44
Gulf Coast.....	2,198,727	1.48	1.12	3,779,954	1.17	1.13	3,601,472	1.38	1.22	1.35	1.16
Total.....	16,595,790	1.40	1.22	15,591,182	1.36	1.15	13,516,261	1.55	1.23	1.43	1.20
<b>Wyoming:</b>											
Salt Creek.....	193,375	1.89	1.40	197,228	1.94	1.29	316,734	2.60	1.43	2.22	1.23
Big Muddy.....	151,043	.74	1.35	129,101	.64	1.29	368,777	1.77	1.41	1.31	1.37
Grass Creek.....	574,651	.72	1.44	514,849	.58	1.39	483,000	.70	1.54	.67	1.45
Rock River.....	530,762	.78	1.35	504,870	.71	1.29	528,706	.66	1.33	.72	1.32
All other districts in Wyoming.....	1,152,925	1.21	1.14	1,525,473	.82	1.04	1,653,580	.86	1.05	.95	1.07
Total.....	2,602,756	1.03	1.28	2,871,521	.83	1.17	3,350,857	1.08	1.24	.99	1.23
<b>Colorado:</b>											
Montana.....	1,152,183	.94	1.24	1,141,554	.95	1.01	685,239	1.00	.99	.96	1.09
New Mexico.....	770,521	1.18	1.54	583,054	1.52	1.74	800,626	1.77	1.83	1.49	1.70
Illinois.....	267,740	1.88	1.39	203,408	2.00	1.30	476,221	3.95	1.25	2.95	1.30
Indiana.....	3,652,504	1.14	1.65	3,407,034	1.22	1.52	3,299,099	1.23	1.64	1.20	1.61
Ohio.....	137,038	2.30	1.65	142,613	1.88	1.53	132,862	1.84	1.67	2.01	1.62
Kentucky.....	1,265,401	2.24	1.80	1,083,179	2.24	1.83	1,105,844	2.17	2.01	2.22	1.88
Tennessee.....	577,232	2.33	1.54	543,781	2.44	1.55	702,305	1.86	1.74	2.18	1.62
West Virginia.....	2,452	26.64	1.56	683	45.90	1.47				30.83	1.54
Pennsylvania.....	651,543	2.41	3.25	610,300	1.92	3.41	551,499	1.73	3.79	2.04	3.47
Michigan.....	5,739,090	4.00	2.92	5,664,579	3.53	3.13	5,926,184	3.84	3.67	3.79	3.25
	9,864	8.36	1.93	61,789	5.82	1.56	918,265	1.45	1.57	1.79	1.57

TABLE 21.—Crude oil production: Unit cost and unit sales price, by districts

## GROUP II

District	1927			1928			1929			Three-year average	
	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Unit cost, including interest on investment	Unit sales price
California:	<i>Barrels</i>			<i>Barrels</i>			<i>Barrels</i>				
Long Beach, Seal Beach, Signal Hill.....	1,193,520	\$0.87	\$1.02	1,606,847	\$1.10	\$1.01	1,437,246	\$1.03	\$1.14	\$1.01	\$1.06
Santa Fe Springs.....	335,664	.86	.98	260,888	2.07	1.36	760,539	2.22	1.26	1.86	1.21
Redondo Torrance.....	323,906	1.28	.93	215,331	1.26	.84	247,636	1.40	.40	1.31	.74
Coalinga (heavy).....	188,005	.83	.91	170,191	.83	.74	163,735	.77	.60	.81	.77
Huntington Beach.....	753,745	1.15	1.11	506,277	.93	.87	386,491	1.64	.98	1.20	1.01
Kern River, Kern River Front, Mount Poso, and Round Mountain.....	750,795	.90	.77	887,585	.83	.73	598,889	1.01	.54	.90	.69
Elk Hills, McKittrick.....				102,633	1.38	.65	112,282	.99	.54	1.17	.84
Lawndale, Potrero, Rosencrans.....	100	179.44	1.92				31,421	1.08	.60	1.33	.60
Buena Vista, Maricopa, Midway Sunset, Wheeler Ridge.....	1,086,492	1.37	.80	1,332,762	1.07	.77	1,558,750	.91	.65	1.09	.73
Culver City, Inglewood, Montebello, Whittier.....	24,910	.89	.85	23,411	.91	.85	22,226	.83	.71	.88	.81
Arro-Grande, Casmalia, Cat Canyon, Lompoc, Santa Maria.....	472,079	.97	.81	408,812	1.17	.77	158,159	1.96	.63	1.20	.76
Barnsdale, Conejo, Newhall Ojai, Pira, Santa Paula, Sespic Semi.....				30,525	.32	.51	11,588	1.02	1.01	.52	.65
Brea-Olinda, Coyote Hills, East Coyote, Olinda, Richfield, West Coyote.....	1,073,742	1.03	1.01	1,243,644	1.13	1.16	1,300,800	.78	1.05	.97	1.01
Baldwin Hills, La Hubra, Merced Hills, Northern Western Orcutt.....	143,987		.91	653,029	.60	.83	557,362	.38	.95	.39	.89
Total.....	6,346,945	1.02	.93	7,441,935	1.05	.88	7,347,124	1.09	.92	1.05	.91
Texas:											
Pandhandle.....	773,653	.68	.91	927,054	.76	1.06	918,726	1.09	1.31	.85	1.10
West Texas.....	2,136,351	.32	.35	2,734,345	.40	.58	1,104,242	1.06	.95	.49	.56
North Texas.....	1,715,942	1.18	1.42	1,168,466	1.64	1.43	1,414,814	1.58	1.46	1.44	1.44
Mexia.....	181,585	.87	1.40	250,255	1.08	1.28	176,065	1.42	1.37	1.12	1.34
North central.....	404,735	1.79	1.40	390,307	1.76	1.40	342,708	1.77	1.47	1.78	1.42
East Texas.....	34,536	1.52	1.61	24,181	1.57	1.58	25,257	1.59	1.69	1.55	1.62
Gulf coast.....	472,354	1.03	1.16	437,041	1.60	1.29	365,728	1.54	1.21	1.37	1.22
Total.....	5,719,156	.81	.93	5,931,648	.91	.90	4,347,540	1.35	1.43	1.00	1.06

TABLE 21.—Crude oil production: Unit cost and unit sales price, by districts—Continued

GROUP II—Continued

District	1927			1928			1929			Three-year average	
	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Production	Unit cost, including interest on investment	Unit sales price	Unit cost, including interest on investment	Unit sales price
Oklahoma:											
Bartlesville and Nowata, Dewey, Craig, Rogers, Washington Counties.....	<i>Barrels</i> 500,840	\$1.36	\$1.32	<i>Barrels</i> 544,774	\$1.25	\$1.22	<i>Barrels</i> 530,698	\$1.15	\$1.25	\$1.26	\$1.27
Creek, Tulsa Counties.....	260,606	1.93	1.36	219,548	1.41	1.27	275,112	1.26	1.26	1.54	1.30
McIntosh, Muskogee, Wagoner Counties.....	11,623	2.02	1.55	10,559	1.96	1.43	10,335	1.76	1.52	1.92	1.50
Hughes, Okfuskee, Okmulgee Counties.....	18,451		1.36	12,878		1.34	25,072		1.59		1.46
Seminole, Pottawatomie Counties.....				5,413	2.86	1.39	141,277	1.44	1.53	1.49	1.53
Osage County.....	195,000	1.58	1.31	205,716	1.27	1.21	220,241	1.32	1.26	1.39	1.26
Lincoln, Pawnee, and Payne Counties.....	167,471	1.95	1.47	133,719	2.13	1.39	118,312	2.18	1.43	2.06	1.43
Kay, Noble, Garfield, and Grant Counties.....	43,079	1.17	1.53	27,114		1.42	15,071	.09	1.52	.36	1.49
Caddo, Comanche, Grady, Garvin Counties.....	32,132	2.58	1.14	40,448	1.60	.74	33,181	.57	.75	1.57	.87
Stephens, Cotton, Carter, and Jefferson Counties.....	33,061	1.72	1.29	81,193	1.61	1.20	159,278	1.68	1.28	1.67	1.26
Cushing Field.....	106,374	.39	1.87	127,208	1.17	1.56	237,253	1.02	1.52	.02	1.61
Healdton Field.....	66,913	1.33	1.26	62,554	1.07	1.10	58,182	1.12	1.13	1.18	1.17
Seminole Field.....	1,105,702	.88	1.41	382,824	.75	1.41	318,164	1.15	1.43	.90	1.41
Mixed districts.....	8,464	4.12	1.41	8,926	2.08	1.38	8,424	1.54	1.43	2.57	1.41
Counties—											
Beckman, Coal, Greer, Kiowa, Le Flore, Logan, Latimer, Marshall, Murray, Pittsburg, Sequoyah, Tillman.....	60,290	1.30	1.50	133,858	1.35	1.52	49,588	1.72	1.48	1.42	1.51
<b>Total.....</b>	<b>2,660,006</b>	<b>1.22</b>	<b>1.40</b>	<b>1,996,732</b>	<b>1.22</b>	<b>1.31</b>	<b>2,200,188</b>	<b>1.24</b>	<b>1.34</b>	<b>1.22</b>	<b>1.35</b>
Kansas:											
Eldorado-Augusta.....	46,159	.96	1.40	27,319	1.15	1.30	24,237	1.12	1.36	1.05	1.36
Greenwood and Woodson Counties.....	256,644	.85	1.53	166,968	1.07	1.45	114,346	1.59	1.51	1.08	1.50
East Kansas.....	114,975	2.12	1.25	146,649	1.69	1.20	164,223	1.45	1.23	1.71	1.22
Sumner County.....	365,602	1.34	1.48	229,532	1.42	1.47	243,665	1.29	1.54	1.35	1.49
<b>Total.....</b>	<b>783,380</b>	<b>1.27</b>	<b>1.46</b>	<b>570,468</b>	<b>1.37</b>	<b>1.38</b>	<b>546,471</b>	<b>1.39</b>	<b>1.43</b>	<b>1.34</b>	<b>1.43</b>

COST OF CRUDE PETROLEUM

Arkansas:											
Eldorado.....	488,301	.81	1.15	332,240	.85	.94	246,717	.76	1.07	.81	1.07
Smackover.....	393,526	.22	1.01	59,719	.30	.85				.23	1.00
Total.....	881,827	.55	1.09	391,959	.77	.92	246,717	.76	1.07	.64	1.04
Louisiana:											
Bull Bayou.....	97,105	1.15	1.12							1.15	1.12
Haynesville.....	50,778	.71	1.18	95,055	1.22	.90	66,277	1.01	.89	1.03	.96
Caddo.....	4,080	4.24	1.26	10,011	3.43	1.25	13,922	.91	1.32	2.29	1.28
Total.....	151,963	1.09	1.14	105,066	1.43	.93	80,199	1.00	.96	1.17	1.04
Wyoming:											
Salt Creek.....	1,501,710	1.23	1.38	1,317,526	1.16	1.29	1,167,977	1.12	1.31	1.18	1.33
Grass Creek.....	135,125	1.91	1.56	132,234	2.03	1.36	119,095	.82	1.50	1.62	1.47
All others.....	70,788	.98	.80	99,038	1.75	.76	346,038	1.42	.91	1.42	.86
Total.....	1,707,623	1.28	1.37	1,548,798	1.27	1.26	1,633,110	1.16	1.23	1.24	1.29
Montana.....	75,964	1.67	1.24	81,642	1.76	1.50	492,223	1.86	1.81	1.83	1.70
Illinois.....	422,560	1.64	1.68	417,878	1.43	1.52	397,354	1.43	1.08	1.50	1.62
Indiana.....	16,864	2.18	1.70	15,305	1.81	1.37	10,393	1.60	1.58	1.90	1.55
Ohio.....	262,100	1.81	1.84	222,450	2.01	1.76	183,983	2.25	2.21	2.00	1.92
Kentucky.....	1,751,395	1.87	1.66	1,294,772	1.90	1.64	1,451,980	1.82	1.82	1.86	1.70
West Virginia.....	89,120	3.72	2.87	83,482	4.36	3.06	103,017	4.77	3.60	4.31	3.20
Pennsylvania.....	509,900	2.93	3.08	532,587	2.82	3.33	623,933	3.60	3.87	3.15	3.46
New York.....	113,645	3.61	3.04	332,609	3.08	3.39	432,176	3.61	3.91	3.41	3.60

7. TABULATION OF COSTS BY GRAVITY IN SPECIAL DISTRICTS

The costs in selected districts were tabulated by gravity in an effort to discover whether there is any regular relationship between gravity and costs, between gravity and sales price, and also between costs and prices for the different gravities of oil. No regular relationship was discoverable between any of the above factors. Theoretically the higher gravity oil, being of better quality, would cost more to produce because presumably the companies would be willing to expend larger sums in development in fields where the higher gravity oil is likely to be produced. In practice, however, this does not hold true, if for no other reason than because it is almost impossible to predict the gravity of oil which will be produced, even when there is some basis of experience in the locality where development is being undertaken.

The relationship which might be expected between gravity and sales price is often upset by the transportation factor. Low-gravity oil near good pipe-line facilities might bring more than high-gravity oil which was disadvantageously located. Moreover, low-gravity oils sometimes have good lubricating properties, in which case they might bring more than a higher gravity oil of different quality. The prices of the purchasing companies customarily show a higher price offered for higher gravity oils, the spread generally shown being 2 to 4 cents per degree. This relationship holds good, however, only when other factors are equal, and the figures compiled by the commission seem to indicate that these other factors frequently upset the relationship based solely on gravity. The tabulation for three leading producing districts given below illustrates the foregoing points.

TABLE 22.—Crude oil production costs and sales prices by gravity in selected districts, per barrel

Degree of gravity and year	Texas, Gulf coast		Arkansas, Smackover		Louisiana, Haynesville	
	Net cost †	Sales price	Net cost †	Sales price	Net cost †	Sales price
19 or under:						
1927.....	\$1.91	\$1.31	\$0.94	\$1.02	\$0.67	\$0.58
1928.....	1.69	1.29	1.07	.77	1.63	.94
1929.....	1.48	1.34	1.28	1.05	1.21	.95
	1.71	1.31	1.07	.95	.99	.74
20 to 24:						
1927.....	1.09	1.24	.86	1.00	1.59	1.03
1928.....	1.18	1.19	.88	.77	1.60	.81
1929.....	1.23	1.19	.84	.83	2.41	.78
	1.16	1.21	.86	.88	1.72	.91
25 to 29:						
1927.....	.73	1.46	1.53	1.11	1.12	1.03
1928.....	.81	1.17	1.48	.97	1.66	.79
1929.....	.96	1.26	1.31	1.02	2.14	.85
	.84	1.30	1.46	1.05	1.59	.91
30 to 34:						
1927.....	2.13	1.33	1.68	1.32	1.21	1.21
1928.....	2.60	1.23	1.44	1.20	1.29	1.11
1929.....	1.70	1.20	1.15	1.23	1.54	1.13
	2.08	1.26	1.45	1.26	1.32	1.15
35 to 39:						
1927.....	2.64	1.52	1.11	1.40	1.61	1.40
1928.....	2.40	1.29	1.03	1.28	1.44	1.33
1929.....	1.15	1.19	1.26	1.31	1.44	1.38
	1.29	1.21	1.11	1.35	1.50	1.37
40 to 44:						
1927.....	171.09	1.46	-----	-----	4.18	1.60
1928.....	21.98	1.33	-----	-----	.57	1.35
1929.....	24.62	1.33	-----	-----	.87	1.40
	32.40	1.33	-----	-----	1.89	1.45

† Including interest.



## 8. COSTS INCLUDING ROYALTY OIL

All the preceding tables of costs in Part III, as well as the cost computations in Part II, of this report have been based on company-interest oil only. As already stated, there is a certain significance in considering the relative importance of the different items of expense when the value of royalty oil is considered as one item of cost, and when the divisor used in calculating the averages includes the total quantity of oil produced, both that going to the producing company and that going as royalty to the landowner. Such a presentation is made in Table 23.

It will be seen that the value of royalty oil, which represented for the United States as a whole between 13 and 14 per cent of the total quantity of oil produced, was equal, on the basis of the market prices at the time of production, to 17 cents per barrel of crude oil produced, this item representing 15½ per cent of the total net cost of production as thus computed. On the average for the three years the cost of production of oil including royalty oil as an element of cost was \$1.10 per barrel in the United States as a whole, as compared with \$1.08 per barrel when the calculation is based on company-interest oil only. The difference is due to the fact that the average market price of royalty oil is somewhat greater than the average cost of producing it.

TABLE 23.—Average cost per barrel at wells in the United States, large and small companies combined

[Based on company and royalty oil]

	1927	1928	1929	Weighted average, 1927-29	Per cent
Production (thousands barrels).....	564,964	577,439	671,612	1,814,016	.....
Expenses:					
Depletion of leasehold.....	\$0.11	\$0.09	\$0.09	\$0.10	9.09
Amortization of tangible development.....	.15	.14	.13	.14	12.73
Intangible development.....	.23	.20	.23	.22	20.00
Current operating cost.....	.28	.27	.25	.27	24.55
General and administrative.....	.24	.23	.21	.22	20.00
Total.....	1.01	.93	.91	.95	86.37
Value of royalty oil at market price.....	.17	.16	.18	.17	15.45
Total including royalty.....	1.18	1.09	1.09	1.12	101.82
Deduct receipts from gas sales and miscellaneous revenue.....	.09	.10	.10	.10	9.09
Net Cost.....	1.09	.99	.99	1.02	92.73
Interest on investment (6 per cent).....	.08	.08	.07	.08	7.27
Net cost, including royalty value and interest.....	1.17	1.07	1.06	1.10	100.00
Average selling price.....	1.28	1.16	1.28	1.24	.....

TABLE 24.—Petroleum: Unit cost of production and sales value by States, 1927-1929

GROUP I

Year	State	Production company interest	Expenses					Less gas sales and miscellaneous revenue	Net cost	Interest on investment	Net cost including interest	Unit sales value	
			Depletion	Amortization of tangible development	Intangible development	Operating cost	General and administrative						Total
1927	California, Group A	81,085,986	\$0.07	\$0.15	\$0.23	\$0.27	\$0.14	\$0.86	\$0.25	\$0.61	\$0.08	\$0.69	\$1.00
1928	do	88,300,809	.07	.15	.30	.27	.16	.95	.23	.72	.09	.81	1.01
1929	do	131,662,821	.08	.16	.33	.21	.14	.91	.22	.69	.08	.77	1.15
Total, 3 years		301,049,616	.07	.15	.30	.24	.15	.91	.23	.68	.08	.76	1.07
1927	Oklahoma	185,500,029	.14	.20	.34	.24	.27	1.19	.07	1.12	.08	1.20	1.42
1928	do	164,942,654	.14	.19	.26	.27	.27	1.13	.10	1.03	.09	1.12	1.38
1929	do	171,204,363	.13	.18	.30	.28	.29	1.18	.10	1.08	.08	1.16	1.45
Total, 3 years		521,647,546	.14	.19	.30	.26	.28	1.17	.09	1.08	.08	1.16	1.42
1927	Texas	127,222,062	.12	.15	.26	.29	.34	1.16	.05	1.11	.09	1.20	1.20
1928	do	158,193,126	.08	.11	.20	.23	.29	.91	.04	.87	.07	.94	.94
1929	do	188,576,606	.08	.11	.18	.22	.23	.82	.06	.76	.07	.83	1.12
Total, 3 years		473,991,796	.09	.12	.21	.24	.28	.94	.05	.89	.07	.96	1.08
1927	Arkansas	19,940,343	.10	.16	.03	.35	.24	.88	.04	.84	.08	.92	1.04
1928	do	16,110,477	.09	.19	.06	.39	.21	.94	.04	.90	.09	.99	.83
1929	do	13,326,383	.09	.19	.07	.46	.28	1.09	.05	1.04	.10	1.14	.88
Total, 3 years		49,377,203	.09	.18	.05	.40	.24	.96	.05	.91	.09	1.00	.93
1927	Louisiana	16,595,790	.10	.21	.20	.52	.37	1.40	.08	1.32	.08	1.40	1.22
1928	do	15,591,182	.11	.21	.19	.52	.38	1.41	.13	1.28	.08	1.36	1.15
1929	do	13,516,261	.12	.20	.29	.54	.42	1.57	.11	1.46	.09	1.55	1.23
Total, 3 years		45,703,233	.11	.20	.22	.53	.39	1.45	.10	1.35	.08	1.43	1.20
1927	Kansas	19,942,079	.13	.23	.21	.34	.44	1.35	.03	1.32	.14	1.46	1.40
1928	do	19,121,372	.11	.25	.21	.34	.44	1.35	.02	1.33	.10	1.43	1.35
1929	do	22,668,311	.09	.24	.31	.29	.30	1.23	.02	1.21	.09	1.30	1.49
Total, 3 years		61,631,762	.11	.24	.25	.32	.39	1.31	.03	1.28	.11	1.39	1.42

TABLE 24.—Petroleum: Unit cost of production and sales value by States, 1927–1929—Continued

## GROUP I—Continued

Year	State	Production company interest	Expenses						Less gas sales and miscellaneous revenue	Net cost	Interest on investment	Net cost including interest	Unit sales value
			Depletion	Amortization of tangible development	Intangible development	Operating cost	General and administrative	Total					
		<i>Barrels</i>											
1927	New Mexico.....	267,740	\$0.05	\$0.12	\$0.96	\$0.19	\$0.49	\$1.81	\$0.02	\$1.79	\$0.09	\$1.88	\$1.30
1928	do.....	203,408	.05	.15	.76	.21	.76	1.93	.02	1.91	.09	2.00	1.30
1929	do.....	476,221	.41	.17	1.58	.16	1.71	3.85	.08	3.77	.18	3.95	1.25
	Total, 3 years.....	947,369	.23	.15	1.13	.19	1.16	2.86	.05	2.81	.14	2.95	1.30
1927	Total, Group B.....	369,468,043	.13	.18	.28	.28	.31	1.18	.06	1.12	.09	1.21	1.31
1928	do.....	374,162,219	.11	.16	.22	.27	.29	1.05	.07	.98	.09	1.07	1.16
1929	do.....	409,668,647	.10	.15	.24	.27	.27	1.03	.08	.95	.08	1.03	1.27
	Total, 3 years.....	1,153,298,909	.11	.17	.25	.27	.29	1.09	.07	1.02	.08	1.10	1.25
1927	Wyoming.....	2,602,756	.04	.17	.20	.42	.18	1.01	.07	.94	.09	1.03	1.28
1928	do.....	2,871,521	.04	.18	.11	.33	.15	.81	.09	.72	.11	.83	1.17
1929	do.....	3,350,857	.27	.15	.08	.30	.23	1.03	.08	.95	.13	1.08	1.24
	Total, 3 years.....	8,825,134	.12	.17	.12	.35	.19	.95	.08	.87	.12	.99	1.23
1927	Colorado.....	1,152,183	.04	.17	.35	.27	.10	.93	.06	.87	.07	.94	1.24
1928	do.....	1,141,554	.04	.21	.43	.25	.10	1.03	.20	.83	.12	.95	1.01
1929	do.....	685,239	.06	.32	.14	.31	.10	.93	.14	.79	.21	1.00	.99
	Total, 3 years.....	2,978,976	.05	.22	.33	.27	.10	.97	.13	.84	.12	.96	1.09
1927	Montana.....	770,521	.21	.14	.37	.27	.12	1.11	.03	1.06	.10	1.18	1.54
1928	do.....	583,054	.18	.21	.28	.51	.22	1.40	.03	1.37	.15	1.52	1.74
1929	do.....	800,626	.22	.20	.48	.46	.33	1.69	.09	1.60	.17	1.77	1.83
	Total, 3 years.....	2,154,201	.21	.18	.39	.40	.22	1.40	.05	1.35	.14	1.49	1.70
1927	Total, Group C.....	4,525,460	.07	.17	.27	.35	.15	1.01	.06	.95	.09	1.04	.98
1928	do.....	4,596,129	.06	.19	.21	.33	.15	.94	.11	.83	.11	.94	1.20
1929	do.....	4,836,722	.23	.18	.16	.33	.23	1.13	.09	1.04	.15	1.19	1.30
	Total, 3 years.....	13,958,311	.12	.18	.21	.34	.18	1.03	.09	.94	.12	1.06	1.17

1927	Illinois	3,652,504	.14	.14	.05	.64	.10	1.07	.04	1.03	.11	1.14	1.65
1928	do	3,407,024	.13	.14	.01	.73	.14	1.15	.04	1.11	.11	1.22	1.52
1929	do	3,299,099	.14	.15	.02	.71	.15	1.17	.04	1.13	.10	1.25	1.64
	Total, 3 years	10,358,627	.14	.14	.03	.69	.13	1.13	.04	1.09	.11	1.20	1.61
1927	Indiana	137,038	.13	.26	.48	.93	.27	2.10	.04	2.06	.24	2.30	1.65
1928	do	142,613	.12	.36	.06	.89	.26	1.69	.04	1.68	.23	1.88	1.53
1929	do	132,862	.12	.36	.02	.90	.26	1.66	.04	1.62	.22	1.84	1.67
	Total, 3 years	412,513	.12	.33	.19	.92	.26	1.82	.04	1.78	.23	2.01	1.62
1927	Ohio	1,265,401	.20	.42	.41	1.06	.44	2.53	.49	2.04	.20	2.24	1.80
1928	do	1,083,179	.22	.34	.19	1.11	.46	2.32	.29	2.03	.21	2.24	1.83
1929	do	1,105,844	.22	.32	.25	1.04	.36	2.19	.21	1.98	.19	2.17	2.01
	Total, 3 years	3,454,424	.21	.37	.29	1.07	.42	2.36	.34	2.02	.20	2.22	1.88
1927	Kentucky	577,232	.52	.28	.36	.62	.45	2.23	.03	2.20	.13	2.33	1.54
1928	do	543,781	.52	.29	.45	.59	.46	2.31	.02	2.29	.15	2.44	1.55
1929	do	702,305	.28	.26	.21	.46	.55	1.76	.02	1.74	.12	1.86	1.74
	Total, 3 years	1,823,318	.42	.28	.33	.54	.50	2.07	.02	2.05	.13	2.18	1.62
1927	Tennessee	2,452			12.46	2.21	11.78	26.45		26.45	.19	26.64	1.56
1928	do	683	10.70	13.37	.53	3.03	17.58	45.21		45.21	.69	45.90	1.47
1929	do												
	Total, 3 years	3,135	2.33	2.91	9.86	2.39	13.04	30.53		30.53	.30	30.83	1.54
1927	West Virginia	651,543	.79	.38	.51	.42	.89	2.99	.88	2.11	.30	2.41	3.25
1928	do	610,300	.60	.38	.40	.49	.77	2.64	.99	1.65	.27	1.92	3.41
1929	do	551,499	.57	.47	.46	.54	.68	2.72	1.25	1.47	.26	1.73	3.79
	Total, 3 years	1,813,342	.66	.41	.46	.48	.78	2.79	1.03	1.76	.28	2.04	3.64
1927	Pennsylvania	5,739,090	.16	.33	.45	2.90	.46	4.30	.75	3.55	.45	4.00	2.92
1928	do	5,664,579	.15	.31	.32	2.56	.58	3.92	.83	3.09	.44	3.53	3.15
1929	do	5,926,184	.13	.30	.43	2.72	.56	4.14	.71	3.43	.41	3.84	5.67
	Total, 3 years	17,329,853	.15	.31	.40	2.73	.53	4.12	.76	3.36	.43	3.79	3.25
1927	Michigan	9,864	.01	.69	4.75	.38	2.40	8.23		8.23	.13	8.36	1.93
1928	do	61,789		.16	2.39	.58	2.59	5.72		5.72	.10	5.82	1.56
1929	do	918,265	.02	.19	.63	.11	.48	1.43	.03	1.40	.05	1.45	1.57
	Total, 3 years	989,918	.02	.19	.78	.14	.64	1.77	.03	1.74	.05	1.79	1.57
1927	Total, Group D	12,035,124	.21	.28	.33	1.75	.38	2.95	.47	2.48	.29	2.77	2.35
1928	do	11,513,948	.19	.26	.24	1.65	.45	2.79	.50	2.29	.29	2.58	2.45
1929	do	12,636,058	.16	.26	.31	1.62	.43	2.78	.42	2.36	.26	2.62	2.72
	Total, 3 years	36,185,130	.19	.27	.29	1.67	.42	2.84	.46	2.38	.28	2.66	2.51
1927	Total, all States	467,114,613	.12	.18	.27	.32	.28	1.17	.11	1.06	.09	1.15	1.28
1928	do	478,573,105	.10	.16	.23	.31	.27	1.07	.11	.96	.09	1.05	1.16
1929	do	558,804,248	.10	.16	.26	.28	.24	1.04	.12	.92	.08	1.00	1.28
	Total, 3 years	1,504,491,966	.11	.16	.26	.30	.26	1.09	.11	.98	.09	1.07	1.24

TABLE 25.—Petroleum: Unit cost of production and sales value by States, 1927-1929

GROUP II

	Production company interest	Expenses						Less gas sales and miscellaneous revenue	Net cost	Interest on investment	Net cost, including interest	Unit sales value
		Depletion	Amortization of tangible development	Intangible development	Operating cost	General and administrative	Total					
<b>California, Group A</b>												
1927.....	6,346,945	\$0.19	\$0.20	\$0.15	\$0.46	\$0.12	\$1.12	\$0.28	\$0.84	\$0.18	\$1.02	\$0.93
1928.....	7,441,935	.19	.20	.19	.34	.11	1.03	.14	.89	.16	1.05	.88
1929.....	7,347,124	.18	.21	.30	.33	.11	1.13	.20	.93	.16	1.09	.92
Total, 3 years.....	21,136,004	.19	.20	.22	.37	.11	1.09	.21	.88	.17	1.05	.91
<b>Oklahoma:</b>												
1927.....	2,660,006	.15	.26	.18	.41	.24	1.24	.17	1.07	.15	1.22	1.40
1928.....	1,996,732	.19	.21	.05	.52	.26	1.23	.16	1.07	.15	1.22	1.51
1929.....	2,200,188	.17	.21	.16	.49	.24	1.27	.16	1.11	.13	1.24	1.34
Total, 3 years.....	6,856,926	.17	.23	.14	.47	.24	1.25	.17	1.08	.14	1.22	1.35
<b>Texas:</b>												
1927.....	5,719,156	.17	.12	.11	.27	.10	.77	.03	.74	.07	.81	.93
1928.....	5,931,649	.15	.12	.12	.32	.15	.86	.05	.81	.10	.91	.90
1929.....	4,347,540	.32	.14	.16	.46	.23	1.31	.13	1.18	.17	1.35	1.43
Total, 3 years.....	15,998,345	.20	.13	.13	.34	.15	.95	.06	.89	.11	1.00	1.06
<b>Arkansas:</b>												
1927.....	881,827	.08	.07	-----	.28	.09	.52	-----	.52	.03	.55	1.09
1928.....	391,959	.13	.13	-----	.38	.07	.71	-----	.71	.06	.77	.92
1929.....	246,717	.12	.12	-----	.36	.10	.70	-----	.70	.06	.76	1.07
Total, 3 years.....	1,520,503	.10	.10	-----	.32	.08	.60	-----	.60	.04	.64	1.04
<b>Louisiana:</b>												
1927.....	151,963	.16	.20	-----	.51	.12	.99	-----	.99	.10	1.09	1.14
1928.....	105,066	.13	.22	.19	.66	.08	1.28	-----	1.28	.15	1.43	.93
1929.....	80,199	.09	.20	.06	.39	.08	.82	-----	.82	.18	1.00	.96
Total, 3 years.....	337,228	.13	.21	.07	.53	.10	1.04	-----	1.04	.13	1.17	1.04

<b>Kansas:</b>												
1927.....	783,380	.19	.27	.14	.30	.36	1.26	.08	1.18	.09	1.27	1.46
1928.....	570,468	.15	.23	.18	.35	.45	1.36	.08	1.28	.09	1.37	1.38
1929.....	546,471	.15	.24	.22	.36	.40	1.37	.06	1.31	.08	1.39	1.43
Total, 3 years.....	1,900,319	.17	.25	.17	.33	.40	1.32	.07	1.25	.09	1.34	1.43
<b>Total, Group B:</b>												
1927.....	10,196,332	.16	.17	.12	.31	.15	.91	.07	.84	.09	.93	1.11
1928.....	8,995,874	.16	.15	.10	.37	.19	.97	.07	.90	.11	1.01	1.16
1929.....	7,421,115	.25	.17	.16	.46	.24	1.28	.13	1.15	.15	1.30	1.39
Total, 3 years.....	26,613,321	.18	.16	.13	.37	.19	1.03	.08	.95	.11	1.06	1.20
<b>Wyoming:</b>												
1927.....	1,707,623	.40	.30	.07	.36	.12	1.25	.11	1.14	.14	1.28	1.37
1928.....	1,548,798	.38	.33	.05	.32	.10	1.18	.07	1.11	.16	1.27	1.26
1929.....	1,633,110	.37	.09	.15	.32	.13	1.06	.08	.98	.18	1.15	1.23
Total, 3 years.....	4,889,531	.39	.24	.09	.33	.11	1.16	.08	1.08	.16	1.24	1.29
<b>Montana:</b>												
1927.....	75,964	.27	.05	.84	.10	.23	1.49	.01	1.48	.19	1.67	1.24
1928.....	81,642	.30	.20	.57	.39	.25	1.71	.04	1.67	.09	1.76	1.50
1929.....	492,223	.12	.31	.64	.52	.19	1.78	.12	1.66	.20	1.86	1.81
Total, 3 years.....	649,829	.16	.27	.65	.46	.20	1.74	.10	1.64	.19	1.83	1.70
<b>Total, Group C:</b>												
1927.....	1,783,587	.40	.29	.10	.35	.12	1.26	.10	1.16	.13	1.29	1.37
1928.....	1,630,440	.38	.33	.08	.32	.10	1.21	.07	1.14	.16	1.30	1.27
1929.....	2,125,333	.31	.14	.26	.37	.15	1.23	.09	1.14	.18	1.32	1.36
Total, 3 years.....	5,539,360	.36	.24	.16	.35	.12	1.23	.09	1.14	.16	1.30	1.34
<b>Illinois:</b>												
1927.....	422,560	.26	.13	.18	.71	.20	1.48	.05	1.43	.21	1.64	1.68
1928.....	417,878	.25	.13	.10	.68	.11	1.27	.05	1.22	.21	1.43	1.52
1929.....	397,354	.16	.13	.10	.72	.15	1.26	.04	1.22	.21	1.43	1.66
Total, 3 years.....	1,237,792	.22	.13	.13	.70	.16	1.34	.05	1.29	.21	1.50	1.62
<b>Indiana:</b>												
1927.....	16,864	.20	.89	.12	.79	.07	2.07	.02	2.07	.11	2.18	1.70
1928.....	15,805	.21	.52	.25	.79	.02	1.70	.02	1.68	.13	1.81	1.37
1929.....	10,393	.20	.67		.60	.02	1.49	.04	1.45	.15	1.60	1.58
Total, 3 years.....	43,062	.20	.70	.14	.71	.04	1.79	.01	1.78	.12	1.90	1.55

TABLE 25.—Petroleum: Unit cost of production and sales value by States, 1927–1929—Continued

GROUP II—Continued

	Production company interest	Expenses					Less gas sales and miscellaneous revenue	Net cost	Interest on investment	Net cost, including interest	Unit sales value	
		Depletion	Amortization of tangible development	Intangible development	Operating cost	General and administrative						Total
Ohio:	<i>Barrels</i>											
1927.....	262,100	\$0.19	\$0.48	\$0.11	\$0.48	\$0.17	\$1.43	\$0.01	\$1.42	\$0.39	\$1.81	\$1.84
1928.....	222,450	.21	.51	.15	.59	.17	1.63	.06	1.57	.44	2.01	1.76
1929.....	183,983	.24	.56	.14	.73	.20	1.87	.11	1.76	.49	2.25	2.21
Total, 3 years.....	668,533	.21	.51	.13	.59	.18	1.62	.06	1.56	.44	2.00	1.92
Kentucky:												
1927.....	1,751,395	.70	.15	.09	.37	.32	1.63	.06	1.57	.30	1.87	1.66
1928.....	1,294,772	.77	.13	.13	.32	.28	1.63	.08	1.55	.35	1.90	1.64
1929.....	1,451,980	.42	.17	.24	.43	.31	1.57	.08	1.49	.33	1.82	1.82
Total, 3 years.....	4,498,147	.63	.15	.15	.38	.30	1.61	.07	1.54	.32	1.86	1.70
West Virginia:												
1927.....	89,126	.44	.55	.48	1.38	.29	3.14	.59	2.55	1.17	3.72	2.87
1928.....	83,482	.57	.65	.27	1.66	.59	3.74	.67	3.07	1.29	4.36	3.06
1929.....	103,017	.66	.53	.84	1.47	.63	4.13	.46	3.67	1.10	4.77	3.60
Total, 3 years.....	275,619	.56	.57	.56	1.50	.51	3.70	.57	3.13	1.18	4.31	3.20
Pennsylvania:												
1927.....	509,900	.36	.27	.43	1.15	.34	2.55	.22	2.33	.60	2.93	3.08
1928.....	532,587	.26	.27	.42	1.09	.29	2.33	.15	2.18	.64	2.82	3.33
1929.....	623,933	.31	.25	1.20	.93	.29	2.98	.14	2.84	.76	3.60	3.87
Total, 3 years.....	1,666,420	.31	.26	.71	1.05	.31	2.64	.17	2.47	.68	3.15	3.45
New York:												
1927.....	113,645	.51	.32	1.23	.74	.07	2.87	.02	2.85	.76	3.61	3.04
1928.....	332,609	.45	.40	.73	.75	.11	2.44	.02	2.42	.66	3.08	3.39
1929.....	432,176	.55	.49	.87	.77	.11	2.79	.02	2.77	.84	3.61	3.91
Total, 3 years.....	878,430	.51	.43	.87	.76	.10	2.67	.02	2.65	.76	3.41	3.60

Total, Group D:													
1927-----	3,165,584	.53	.22	.21	.59	.28	1.83	.09	1.74	.38	2.12	1.99	
1928-----	2,899,583	.51	.23	.25	.63	.24	1.86	.10	1.76	.46	2.22	2.18	
1929-----	3,202,836	.38	.26	.51	.66	.26	2.07	.09	1.98	.50	2.48	2.56	
Total, 3 years-----	9,268,003	.47	.23	.33	.63	.26	1.92	.09	1.83	.44	2.27	2.25	
Total, all States:													
1927-----	21,492,448	.24	.20	.14	.40	.16	1.14	.14	1.00	.16	1.16	1.21	
1928-----	20,967,832	.24	.19	.16	.39	.16	1.14	.11	1.03	.18	1.21	1.21	
1929-----	20,096,408	.25	.19	.28	.43	.19	1.34	.14	1.20	.21	1.41	1.40	
Weighted average, 3 years----	62,556,688	.23	.19	.18	.39	.16	1.15	.12	1.03	.17	1.26	1.27	



## PART IV

### GENERAL STATISTICS OF PETROLEUM

In addition to the cost investigation conducted by the Tariff Commission, it has assembled for the convenience of the Congress a number of statistical tables relating to the production, refining, transportation, exports, imports, and prices of petroleum. These tables are derived from numerous sources, as indicated in the accompanying footnote.<sup>1</sup>

Attention may briefly be called to a few points of a general character brought out by these tables.

#### 1. GROWTH OF THE PETROLEUM INDUSTRY

The most striking fact in regard to the crude petroleum situation during the past 20 years has been the immense increase in production and consumption throughout the world, and especially in the United States. The output of crude petroleum in the United States has increased from less than 200,000,000 barrels in 1909 to more than 1,000,000,000 barrels in 1929, without taking into account the production of more than 50,000,000 barrels of natural gasoline derived from natural gas in the latter year, a product of which there was no output 20 years before. Meantime the production of other countries has increased with nearly the same rapidity. The United States, however, has maintained its dominant position in production as well as in consumption. Possessing about 16 per cent of the world's estimated reserves of crude petroleum, it now produces about 68 per cent of the annual output of crude oil. The increase in production in the United States and in other countries has been largely due to the discovery of new fields and new pools in old fields. The crude-oil-producing area in the United States has gradually extended from east to west. In recent years about 75 per cent of the domestic output has come from three States, California, Oklahoma, and Texas.

The search for new sources of oil has been stimulated by the great demand for gasoline resulting from the development of the automobile industry. Conversely, the large supplies of petroleum produced, and the consequent moderate or low prices prevailing, have tended to stimulate the use of motor vehicles. The production of gasoline in

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<sup>1</sup> Sources of material in tables in Part IV:

(a) Commerce Yearbooks, 1928 and 1930. Petroleum and Refined Products. Natural Gas and Natural-Gas Gasoline.

(b) Statistical Abstract of the United States, 1929 and 1930.

(c) Petroleum in 1927 and Petroleum in 1928. Bureau of Mines, Department of Commerce. Petroleum, Petroleum Products, and Natural Gasoline, 1929 (Final Summary). Annual Petroleum Statement No. P. 69. Mimeographed.

(d) Census of Manufactures, 1927, and preliminary advance sheets for 1929.

(e) Monthly Petroleum Statements for the year 1930. Bureau of Mines, Department of Commerce. Mimeographed.

(f) Petroleum Refinery Statistics, 1928. Bureau of Mines Bulletin 318.

(g) Foreign Commerce and Navigation of the United States. Various years.

the United States increased from less than 13,000,000 barrels in 1909 to nearly 435,000,000 barrels in 1929. The increase in the use of automobiles has also caused a great growth in the demand for lubricants. Although the proportion of the crude oil turned into gasoline has constantly risen, the production of gasoline entails the incidental production of a great quantity of fuel oil, the output of which at present is substantially the same as that of gasoline itself. The availability of these large supplies of fuel oil has given rise to new demands for that product. By reason of its great convenience, it is being used in constantly increasing quantities as fuel for locomotives, steamships, factories, and households.

## 2. THE PETROLEUM REFINING INDUSTRY

The petroleum refining industry in the United States has kept pace with the crude-production industry. Relatively little crude oil is exported, the great bulk of the domestic production as well as the considerable quantity of imported crude being refined in the United States itself. The value of products of the refining industry in the United States was about eleven times greater in 1929 than in 1909, and notwithstanding the great increase in the efficiency of operation, the number of wage earners in the industry multiplied about five and one-half times.

As shown in Part III of this report, Venezuelan oil is largely handled by a "topping" process, by which only the lightest fraction of the crude is separated, leaving the remaining large residue for use as fuel. The refining of the domestic product is ordinarily carried on by complete distillation, breaking up the crude oil into several fractions of different gravities. The "first run" products are, in the order in which they come from the stills, and in the order of their gravity, (1) gasoline, naphtha, and benzene; (2) kerosene; (3) gas and fuel oil; and (4) lubricating oil. In some cases the lubricating oil is not separated. Much of the gas and fuel oil coming from the "first run" of the crude is subjected to the further process of "cracking"—distilling under superatmospheric pressures and at high temperatures—by means of which the yield of gasoline per barrel of crude is substantially increased. There are 25 or 30 different processes of "cracking," in use at different refineries. Recently a new process of hydrogenating petroleum has been devised which gives still much larger yields, not only of gasoline but also of other refined products. This hydrogenation process is not yet in general commercial use.

In addition to the distillation and cracking processes, the products of petroleum are subjected to various after treatments of purification and improvement of quality.

The growth in the demand for gasoline has been accompanied by a marked change in refining methods, with a view to increasing the proportion of gasoline extracted. In the early days of the industry, kerosene was the principal product sought. Even as late as 1909 the amount of kerosene produced was about three times as great as the amount of gasoline. In 1929, on the other hand, gasoline production was more than seven times that of kerosene.

### 3. GROWTH OF EXPORT TRADE IN REFINED PRODUCTS

Throughout the history of the petroleum industry the United States has been the world's largest exporter of refined petroleum products. In the earlier days of the industry the ratio of exports to production was even larger than at present. The great expansion of oil production has, however, been accompanied by a great growth in the export trade. The total value of the exports of refined oils (liquid products only) increased from less than \$100,000,000 in 1911 to over \$493,000,000 in 1929. Including nonliquid products the value of exports in the latter year was \$523,000,000, besides the exportation of crude petroleum to a value of \$38,000,000 and besides fuel oil loaded on United States or foreign vessels engaged in foreign trade to a value of nearly \$55,000,000.

The products of the American refining industry are shipped to all countries of the world. Europe takes much more gasoline and lubricating oil than any other continent, but has only a small lead over Asia and Australasia in purchases of American illuminating oil, while South America takes more of our gas oil and fuel oil than any other continent.

### 4. INCREASE IN IMPORTS OF CRUDE PETROLEUM FROM VENEZUELA

Prior to the World War the United States imported very little crude petroleum. During the war production in Mexico developed rapidly, and imports into the United States, which at that time were chiefly from Mexico, rose to a maximum of 127,000,000 barrels in 1922. During more recent years crude production in Mexico has declined and the imports from that country have fallen greatly. Meantime, however, production has begun in Venezuela and grown rapidly. In 1928 Venezuela displaced Mexico as the chief source of imports of crude. The total importation of Venezuelan crude rose from less than 1,000,000 barrels in 1923 to nearly 5,000,000 barrels in 1925, over 22,000,000 barrels in 1927, and nearly 51,000,000 barrels in 1929. The total imports from all countries in 1929 were 79,000,000 barrels, as compared with a maximum of 127,000,000 barrels in 1922 and the postwar minimum of 58,000,000 barrels in 1927. During postwar years there has also been a considerable importation of refined petroleum products, especially of gasoline and of "topped" oils—that is, the remainder of the crude after the extraction of gasoline and similar light products. The imports declined in 1927 and 1928, by reason of a falling off in purchases from Mexico, but increased greatly in 1929 by reason of purchases of the products of Venezuelan crude, mostly coming from refineries in the Netherland West Indies, which receive crude oil from the near-by Maracaibo Basin.

### 5. PRICES OF MID-CONTINENT CRUDE.

The price of average grade (about 33°) Mid-Continent crude has fluctuated between \$1 and \$2 per barrel most of the time since 1920. The price fell from \$3.50 per barrel in 1920, to \$1 per barrel in the summer of 1921, recovering to \$2 per barrel in the last two months of that year. Since 1920 it has been above \$2 per barrel only during the summer months of 1926, when it rose to a few cents more than

that price. Higher gravities command higher prices, the differential varying from 2 cents to 5 cents per degree, the typical differential being about 3 cents.

Pennsylvania crude sells on a different price level than Mid-Continent crude. It has fluctuated between \$2.50 and \$4 since 1929, with the typical price at approximately \$3 per barrel.

TABLE 26.—*Production of crude oil in the world, the United States, and Venezuela and of natural gasoline<sup>1</sup> in the United States*

[All quantities in thousands of barrels of 42 gallons]

Period (annual average) or year	Production of crude oil				United States percentage of world total	United States pro- duction of—	
	World total	United States	Vene- zuela	Other countries		Natural gasoline	Crude oil and natural gasoline
1901-1905.....	195,433	102,083	-----	93,350	52	( <sup>2</sup> )	-----
1906-1910.....	277,796	172,769	-----	105,027	62	( <sup>2</sup> )	-----
1911-1915.....	384,345	247,739	-----	136,606	64	722	248,461
1916-1920.....	541,733	362,661	-----	179,072	67	6,382	369,043
1921-1925.....	944,777	647,961	7,313	280,593	69	18,254	666,215
1926-1929.....	1,292,148	895,200	85,816	311,132	69	41,976	937,176
1920.....	688,884	442,929	457	245,498	64	9,161	452,090
1921.....	766,002	472,183	1,433	292,386	62	10,713	482,896
1922.....	858,898	557,531	2,201	299,166	65	12,044	569,575
1923.....	1,015,736	732,407	4,201	279,128	72	19,434	751,841
1924.....	1,014,318	713,940	9,042	291,336	70	22,235	736,175
1925.....	1,068,933	763,743	19,687	285,503	71	26,845	790,588
1926.....	1,096,823	770,874	36,911	289,038	70	32,455	803,329
1927.....	1,262,582	901,129	63,134	298,319	71	39,075	940,204
1928.....	1,324,734	901,474	105,749	317,511	68	43,191	944,665
1929.....	1,484,451	1,007,323	137,472	339,656	68	53,183	1,060,506

<sup>1</sup> Natural gasoline is that derived from treatment of natural gas.

<sup>2</sup> Not available.

TABLE 27.—*Production of crude petroleum by countries*

[All quantities in thousands of barrels of 42 gallons]

Country	Production				Percentage of world total			
	1926	1927	1928	1929	1926	1927	1928	1929
World total.....	1,096,823	1,262,582	1,324,734	1,484,451	100.0	100.0	100.0	100.0
United States.....	770,874	901,129	901,474	1,007,323	70.3	71.4	68.0	67.9
Venezuela.....	36,911	63,134	105,749	137,472	3.4	5.0	8.0	9.3
Mexico.....	90,421	64,121	50,151	44,688	8.2	5.1	3.8	3.0
Peru.....	10,762	10,127	12,006	13,422	1.0	.8	.9	.9
Colombia.....	6,444	15,014	19,897	20,385	.6	1.2	1.5	1.4
Argentina.....	7,851	8,630	9,070	9,391	.7	.7	.7	.6
Trinidad.....	4,971	5,380	7,684	8,716	.5	.4	.6	.6
Russia.....	64,311	77,018	84,704	99,507	5.9	6.1	6.4	6.7
Rumania.....	23,314	26,368	30,773	34,689	2.1	2.1	2.3	2.3
Poland.....	5,844	5,342	5,493	4,988	.5	.4	.4	.3
Persia.....	35,842	39,688	43,461	42,145	3.3	3.2	3.3	2.8
Netherland East Indies.....	21,243	27,459	32,118	38,072	1.9	2.2	2.4	2.6
British India.....	8,011	8,032	8,741	8,366	.7	.6	.7	.6
Sarawak.....	4,942	4,943	5,223	5,279	.4	.4	.4	.4
All other countries.....	5,082	6,197	8,190	10,098	.5	.4	.6	.6
United States production of natural gasoline <sup>1</sup> .....	32,455	39,075	43,191	53,183	-----	-----	-----	-----

<sup>1</sup> Year ended Sept. 30.

<sup>2</sup> Not included above.

## COST OF CRUDE PETROLEUM

TABLE 28.—United States production of crude petroleum by fields

[In thousands of barrels of 42 gallons]

Period (annual average) or year	Total	Appalachian	Lima-Indiana <sup>1</sup>	Illinois <sup>1</sup>	Mid-continent	Gulf coast	Rocky Mountain	California
1901-1910.....	137,426	28,943	17,253	12,659	25,088	17,436	402	35,641
1911-1915.....	247,739	24,594	5,052	24,955	87,656	12,357	2,605	90,512
1916-1920.....	362,661	27,161	3,468	13,918	184,616	24,273	11,830	97,384
1921-1925.....	647,961	28,504	2,297	9,585	343,545	33,688	35,258	195,074
1926-1929.....	895,200	30,977	1,770	7,700	526,759	50,260	31,266	245,054
1926.....	770,874	28,572	2,030	8,418	423,867	45,275	<sup>2</sup> 37,945	224,673
1927.....	901,129	30,454	1,835	7,720	546,987	52,069	<sup>2</sup> 30,429	231,196
1928.....	901,474	31,059	1,670	7,425	553,125	46,591	<sup>2</sup> 29,199	231,811
1929.....	1,007,323	33,824	1,547	7,237	583,058	57,106	<sup>2</sup> 27,489	292,534

<sup>1</sup> Southwestern Indiana reported with Illinois beginning in 1921; with Lima-Indiana region previously.<sup>2</sup> Includes Alaska.

TABLE 29.—United States production of crude petroleum, by States

[In thousands of barrels of 42 gallons]

State	1901-1910 average	1911-1920 average	1921-1925 average	1926	1927	1928	1929
<b>Eastern fields:</b>							
Pennsylvania.....	10,538	7,832	7,607	8,961	9,526	9,956	11,820
West Virginia.....	11,605	9,399	6,576	5,946	6,023	5,661	5,574
Kentucky <sup>1</sup> .....	696	2,910	8,044	6,274	7,719	7,359	7,775
Ohio.....	15,677	8,084	7,045	7,272	7,593	7,015	6,743
Indiana.....	6,527	1,016	1,011	808	852	1,052	981
Illinois.....	12,659	19,436	8,815	7,760	6,994	6,462	6,319
New York.....	1,153	892	1,274	1,956	2,242	2,603	3,377
Michigan.....				94	439	594	4,528
<b>Mid-Continent-Gulf fields:</b>							
Kansas <sup>2</sup> .....	4,603	17,396	32,733	41,498	41,069	38,596	42,813
Oklahoma <sup>2</sup> .....	19,076	85,366	155,068	179,195	277,775	249,857	255,004
Arkansas.....			36,644	58,332	40,005	32,096	24,917
Louisiana.....	4,310	16,057	25,759	23,201	22,818	21,847	20,554
Texas.....	14,534	35,632	127,009	166,916	217,389	257,320	296,876
New Mexico.....	( <sup>3</sup> )	( <sup>3</sup> )	<sup>4</sup> 554	1,666	1,226	943	1,830
<b>Rocky Mountain field:</b>							
Colorado.....	381	176	392	2,768	2,831	2,774	2,358
Montana.....		64	2,729	7,727	5,058	4,015	3,980
Wyoming.....	21	6,978	31,901	25,776	21,307	21,461	19,314
California.....	35,641	93,948	195,074	224,673	231,196	231,811	292,534

<sup>1</sup> Kentucky includes Tennessee report until 1907.<sup>2</sup> Kansas includes Oklahoma report in 1905 and 1906.<sup>3</sup> Not separately shown until 1924.<sup>4</sup> Average of 1924 and 1925.

## EXPLANATION OF TABLE 29A SHOWING THE RELATION OF DEMAND TO SUPPLY IN THE UNITED STATES

Table 29a, prepared by the Bureau of Mines for the Federal Oil Conservation Board, shows domestic supply and demand for petroleum and petroleum products for the years 1918-1929. In its make-up, petroleum products, such as gasoline, are included in imports, increase or decrease of stocks on hand, and exports, but not in domestic production, thus avoiding duplication.

Among the significant points brought out by this table are:

1. Excess of domestic production over domestic demand each year since 1920. This has resulted in an accumulation of stocks of crude petroleum of 682,000,000 barrels, or eight months supply, at the end of 1929.

2. Relatively stable volume of imports of crude oil since 1922. The largest quantity imported in any year since 1922 was in 1923,

when over 79,494,534 barrels came from Mexico out of a total of 82,015,024 barrels imported. The smallest quantity imported in any year since 1922 was in 1927, when imports from Mexico had declined and imports from Venezuela had not reached their present volume. A marked increase of gasoline imports, coming mainly from the Netherland West Indies, was recorded in 1929.

3. A larger rate of increase in production of natural gasoline than in crude oil.

4. A larger rate of increase of exports of crude oil than of refined products. This would indicate increase of refining capacities in foreign countries.

5. A larger volume of imports than of exports of crude oil, which is more than offset, however, by exports of refined products.

TABLE 29a.—Balance sheet for petroleum production and consumption, 1918–1929<sup>1</sup>

(Thousands of barrels of 42 gallons)

Year	New supply											
	Domestic production						Imports				Total new supply	
	Crude petroleum		Natural gasoline	Benzol	Total		Crude	Refined	Total	Daily average	Quantity	Daily average
	Total	Daily average			Quantity	Daily average						
	(1)	(2)	(3)	(4)	(5) (1+3+4)	(6)	(7)	(8)	(9) (7+8)	(10)	(11) (5+9)	(12)
1918.....	355,928	975	6,727	1,273	363,928	997	37,736	1,207	38,943	107	402,871	1,104
1919.....	378,367	1,037	8,370	1,497	388,234	1,064	52,822	1,340	54,162	148	442,396	1,212
1920.....	442,929	1,210	9,161	1,771	453,861	1,240	106,175	2,619	108,794	297	562,655	1,537
1921.....	472,183	1,294	10,713	1,348	484,244	1,327	125,364	3,412	128,776	353	613,020	1,680
1922.....	557,531	1,527	12,044	1,688	571,263	1,565	127,308	8,639	135,947	372	707,210	1,938
1923.....	732,407	2,007	19,434	2,327	754,168	2,066	82,015	17,593	99,608	273	833,776	2,339
1924.....	713,940	1,951	22,235	2,203	738,378	2,017	77,775	16,806	94,581	258	832,959	2,276
1925.....	763,743	2,092	26,307	1,857	791,907	2,170	61,824	16,376	78,200	214	870,107	2,384
1926.....	770,874	2,112	32,305	2,112	805,291	2,206	60,382	20,936	81,320	223	886,611	2,429
1927.....	901,129	2,469	38,657	2,562	942,348	2,582	58,382	13,353	71,736	197	1,014,084	2,778
1928.....	901,474	2,463	42,326	2,909	946,609	2,586	79,767	11,790	91,557	250	1,038,166	2,837
1929 <sup>2</sup> .....	1,005,598	2,755	52,271	3,055	1,060,924	2,907	78,915	29,794	198,709	298	1,169,633	3,204

Year	Increase (+) or decrease (-) in stocks of all oils			Demand									Excess domestic production over domestic demand
	Crude	Refined	Total	Total demand		Exports			Domestic demand <sup>3</sup>				
				Quantity	Daily average	Crude	Refined	Total	Bunker oil	Other	Total	Daily average	
	(13)	(14)	(15) (13+14)	(16) (11±15)	(17)	(18)	(19)	(20) (18+19)	(21)	(22) (23-21)	(23) (16-20)	(24)	
1918.....	-26,754	+1,921	-24,833	427,704	1,172	5,884	61,176	67,060	6,603	354,041	360,644	988	3,284
1919.....	+5,020	+1,897	+6,917	435,379	1,193	6,348	56,505	62,853	14,031	358,695	372,726	1,021	15,508
1920.....	+17,933	+9,369	+27,302	535,353	1,463	9,295	68,696	77,991	26,335	431,027	457,362	1,250	3,501
1921.....	+67,876	+16,330	+84,206	528,814	1,449	9,627	60,763	70,390	27,076	431,348	458,424	1,256	25,820
1922.....	+89,437	+12,643	+102,130	605,080	1,658	10,805	62,144	72,949	31,692	500,439	532,131	1,458	39,132
1923.....	+80,907	+18,778	+99,685	754,091	2,066	17,534	82,857	100,391	37,582	616,118	653,700	1,791	100,468
1924.....	+28,831	+518	+29,349	803,610	2,196	18,239	98,728	116,967	43,328	643,315	686,643	1,876	51,735
1925.....	+12,037	+18,083	+30,120	839,987	2,301	13,337	100,216	113,553	42,827	683,607	726,434	1,990	65,473
1926.....	-27,562	+2,798	-24,764	911,375	2,497	15,407	116,087	131,494	26,662	753,219	779,881	2,137	25,410
1927.....	+70,320	-217	+70,103	943,981	2,586	15,844	125,191	141,035	50,051	752,895	802,946	2,200	139,402
1928.....	+17,282	+5,500	+22,782	1,015,384	2,774	18,966	135,483	154,449	51,226	809,709	860,935	2,352	85,674
1929 <sup>3</sup> .....	+49,197	+18,409	+67,606	1,102,027	3,019	26,374	135,883	162,257	52,308	887,462	939,770	2,575	121,154

<sup>1</sup> Prepared by Bureau of Mines for Federal Oil Conservation Board.

<sup>2</sup> Deficiency.

<sup>3</sup> Preliminary.



## COST OF CRUDE PETROLEUM

TABLE 30.—Summary of value data regarding petroleum and its products

[All values in thousands of dollars]

	Annual average			Year			
	1901-10	1911-20	1921-25	1926	1927	1928	1929
Crude oil production at wells.....	\$101,548	\$460,746	\$999,186	\$1,447,760	\$1,172,830	\$1,054,880	\$1,280,417
Natural gasoline production (value at point of consumption).....		25,328	82,205	136,412	118,688	138,944	158,231
Natural gas production (value at point of consumption).....	<sup>1</sup> 57,940	121,541	229,002	300,168	317,930	364,000	413,000
Imports of crude oil.....	( <sup>2</sup> )	17,050	68,000	79,308	78,609	90,473	70,943
Exports of crude oil <sup>3</sup> .....	6,350	10,100	22,500	28,500	25,900	26,800	37,800
Bunker oil loaded on vessels in foreign trade.....	( <sup>2</sup> )	<sup>4</sup> 24,200	55,900	71,000	73,000	59,400	54,700
Total materials consumed by refineries.....					1,752,997		2,055,734
Value added to material by refineries <sup>5</sup> .....					389,652		555,947
Total value of products of refineries (includes some duplication).....					2,142,649		<sup>6</sup> 2,611,681
Imports of refined liquid products.....	( <sup>2</sup> )	3,050	22,200	44,596	33,638	40,943	61,045
Imports of all refined products.....			22,797	45,248	34,825	42,369	63,636
Exports of refined liquid products.....	79,450	224,750	363,600	497,212	429,663	465,214	493,332
Exports of all refined products.....			382,665	526,038	459,959	499,066	523,391

<sup>1</sup> Average 1906-1910.<sup>2</sup> Not available.<sup>3</sup> Not including reexports of imported commodities nor shipments to noncontiguous territories of the United States.<sup>4</sup> Average 1916-1920.<sup>5</sup> Value of products less cost of materials, supplies, fuel, and power.<sup>6</sup> Preliminary.

TABLE 31.—Summary of average values per barrel

[Per barrel of 42 gallons]

	Annual average			Year			
	1901-1910	1911-1920	1921-1925	1926	1927	1928	1929
Crude oil production at wells.....	\$0.74	\$1.51	\$1.54	\$1.88	\$1.30	\$1.17	\$1.27
Natural gasoline production (value at point of consumption).....		7.13	4.53	4.20	3.04	3.22	2.98
Imports of crude oil.....	( <sup>1</sup> )	.55	.72	1.31	1.35	1.13	1.01
Exports of crude oil <sup>2</sup> .....	1.89	2.12	1.69	1.85	1.64	1.41	1.43
Bunker oil loaded on vessels in foreign trade.....	( <sup>1</sup> )	<sup>3</sup> 2.07	1.53	1.52	1.46	1.16	1.05
Imports of refined liquid products.....	( <sup>1</sup> )	3.61	1.77	2.13	2.53	3.50	2.06
Exports of refined liquid products.....	3.01	4.35	4.76	4.59	3.72	3.69	3.90

<sup>1</sup> Not available.<sup>2</sup> Not including reexports of imported commodities nor shipments to noncontiguous territories of the United States.<sup>3</sup> Average 1916-1920.

TABLE 32.—Summary of import statistics

Year	Crude oil			Liquid refined products			Non-liquid products, <sup>1</sup> value
	Total	Venezuelan product <sup>2</sup>	All other	Total	From Venezuela crude <sup>3</sup>	All other	
Quantity in thousands of barrels of 42 gallons							
1910 <sup>4</sup>	4 326	None.	326				
1915 <sup>4</sup>	15,564	50	15,514	202	None.	202	
1920	106,175	None.	106,175	2,619	( <sup>5</sup> )	2,619	
1921	125,364	69	125,295	3,410	24	3,386	
1922	127,308	986	126,322	8,639	33	8,606	
1923	82,015	964	81,051	17,593	59	17,534	
1924	77,775	1,366	76,409	16,759	243	16,516	
1925	61,824	4,947	56,877	16,325	1,008	15,317	
1926	60,382	12,689	47,693	20,902	4,036	16,866	
1927	58,383	22,014	36,369	13,281	4,479	8,802	
1928	79,767	47,474	32,293	11,700	6,224	5,476	
1929	78,933	50,867	28,066	29,632	26,916	2,716	
Value in thousands of dollars							
1910 <sup>4</sup>	4 609	None.	609				352
1915 <sup>4</sup>	8,918	39	8,879	873	None.	873	296
1920	55,799	None.	55,799	10,104	3	10,101	821
1921	66,547	52	66,495	10,842	323	10,519	325
1922	70,383	987	69,396	17,802	491	17,311	299
1923	53,882	996	52,886	24,272	771	23,501	559
1924	73,842	1,644	72,198	26,370	1,074	25,296	645
1925	75,407	6,581	68,826	31,283	3,842	27,441	1,003
1926	79,308	17,073	62,235	44,597	16,013	28,584	652
1927	78,609	29,764	48,855	33,638	17,352	16,286	1,187
1928	90,473	49,101	41,372	40,943	31,618	9,325	1,426
1929	79,943	44,987	34,956	61,045	56,578	4,467	2,591
Average value per barrel							
1926	\$1.31	\$1.35	\$1.30	\$2.13	\$3.97	\$1.69	
1927	1.35	1.35	1.34	2.53	3.87	1.85	
1928	1.13	1.03	1.28	3.50	5.08	1.70	
1929	1.01	.88	1.25	2.06	2.10	1.64	

<sup>1</sup> Combined imports from Venezuela, Netherland West Indies, and Trinidad and Tobago, nearly all originating in Venezuela.

<sup>2</sup> Paraffin and paraffin wax.

<sup>3</sup> Fiscal years.

<sup>4</sup> Listed as "Mineral oil." No segregation of crude and refined.

<sup>5</sup> Less than 500 barrels.

TABLE 33.—Imports from the several countries

	Quantity (thousands of barrels)			Value (thousands of dollars)		
	1927	1928	1929	1927	1928	1929
Crude oil, total.....	58,383	79,767	78,933	\$78,609	\$90,473	\$79,943
Venezuela.....	11,424	21,987	34,431	14,946	21,275	32,609
Netherland West Indies.....	10,136	24,989	16,222	14,229	27,370	12,185
Trinidad and Tobago.....	454	497	213	579	457	212
Mexico.....	26,019	17,584	12,663	30,442	19,400	11,388
Colombia.....	7,962	11,838	12,620	13,559	17,210	18,490
Ecuador.....		765	1,279		1,191	1,747
Peru.....	1,886	1,224	1,454	4,157	2,707	3,233
All other countries.....	502	883	51	697	863	99
<b>Total refined liquid products<sup>1</sup>.....</b>	<b>13,189</b>	<b>11,681</b>	<b>29,626</b>	<b>33,300</b>	<b>40,909</b>	<b>61,001</b>
Topped oils including fuel oil, total.....	8,124	7,268	20,545	10,176	8,485	16,513
Venezuela.....		90	( <sup>2</sup> )		100	
Netherland West Indies.....	1,554	2,847	18,317	2,818	3,636	14,140
Trinidad and Tobago.....		5	8		5	7
Mexico.....	6,234	3,812	1,654	6,878	3,952	1,591
All other countries.....	336	514	566	480	742	775
Gasoline, naphtha, and other light products, total.....	5,002	4,198	8,834	22,773	31,516	43,335
Venezuela.....	7	149	64	56	1,114	512
Netherland West Indies.....	2,502	2,462	7,494	12,316	22,766	37,370
Trinidad and Tobago.....	399	661	1,012	2,072	3,845	4,853
Mexico.....	1,823	760	229	6,989	2,915	869
All other countries.....	271	166	35	1,340	876	231
Kerosene, total.....	55	202	208	248	716	662
Mexico.....	42	194	192	160	657	466
All other countries.....	13	8	16	88	59	96
Lubricating oils, total.....	8	13	39	103	192	591
Paraffin and paraffin wax, total.....	\$ 20,462	\$ 24,741	\$ 40,860	1,187	1,426	2,591
British India.....	\$ 3,796	\$ 7,972	\$ 16,655	241	489	1,061
Netherland East Indies.....	\$ 14,725	\$ 12,632	\$ 21,595	821	677	1,379
All other countries.....	\$ 1,941	\$ 4,237	\$ 2,610	125	260	151

<sup>1</sup> Total of items shown. Does not include "tops and other unfinished distillates."

<sup>2</sup> Less than 500 barrels.

<sup>3</sup> Thousands of pounds.

TABLE 34.—Exports of petroleum and its products, not including shipments to non-contiguous territories and possessions of the United States, other than the Philippine Islands

	Unit	Quantity			Value (thousands of dollars)		
		1927	1928	1929	1927	1928	1929
Crude Petroleum.....	1,000 barrels.....	15,843	18,966	26,401	25,945	26,786	37,800
Refined liquid products, total.....	do.....	115,399	126,159	126,377	429,663	465,214	493,382
Gasoline, etc.....	do.....	43,334	51,752	60,007	209,839	232,293	266,904
Illuminating oil.....	do.....	19,352	21,847	19,820	79,303	93,466	83,798
Gas oil and fuel oil.....	do.....	42,963	41,573	35,715	49,802	45,812	37,200
Lubricating oil.....	do.....	9,619	10,931	10,775	89,333	93,130	104,927
Refined nonliquid products and residuum, total.....	do.....				30,295	33,851	30,009
Lubricating greases.....	1,000 pounds.....	100,483	108,112	116,692	5,299	5,588	6,111
Paraffin wax.....	do.....	310,423	392,652	319,276	15,034	16,864	14,074
Petroleum asphalt.....	1,000 long tons.....	314	440	428	8,325	9,789	8,543
Petroleum coko.....	do.....	93	129	116	1,053	1,384	1,134
Residuum.....	1,000 barrels.....	217	63	35	584	226	147
Fuel oil loaded on vessels in foreign trade. <sup>1</sup>	do.....	50,051	51,226	52,278	73,000	59,400	54,700

<sup>1</sup> Not included above; not treated as exports.

TABLE 35.—Exports of crude oil and principal refined products to the principal countries

[Quantities in thousands of barrels of 42 gallons]

Country	Crude oil		Gasoline		Illuminating oil		Gas oil and fuel oil		Lubricating oil	
	1928	1929	1928	1929	1928	1929	1928	1929	1928	1929
Grand total.....	18,966	26,401	51,752	60,007	21,847	19,820	41,573	35,715	10,931	10,775
Europe:										
United Kingdom.....	35	92	15,636	17,518	2,945	2,794	4,403	3,593	1,963	1,815
France.....	( <sup>1</sup> )	4	7,726	8,738	1,670	1,255	578	249	1,555	1,642
Germany.....	181	33	1,318	1,768	839	737	1,793	1,351	1,434	1,303
Italy.....			1,465	1,319	160	171	403	311	543	377
Belgium.....		( <sup>1</sup> )	1,274	1,350	296	222	434	490	1,012	835
Netherlands.....	53	( <sup>1</sup> )	1,885	1,850	1,599	1,383	894	888	288	244
Spain.....	186	148	967	1,370	102	88	153	210	91	101
Scandinavian countries.....	<sup>2</sup> 59	<sup>2</sup> 47	2,819	3,079	1,250	1,326	851	975	324	354
Asia and Australasia:										
British India.....			15		475	523	7	( <sup>1</sup> )	505	437
Japan.....	2,066	2,476	738	913	2,372	1,304	5,114	5,172	289	322
China, Hong Kong, and Kwantung.....			245	503	4,769	4,026	1,131	934	309	317
Australia.....		( <sup>1</sup> )	2,572	3,404	993	908	24	20	390	482
New Zealand.....	6	61	1,220	1,251	177	154	948	775	79	98
Philippine Islands.....			377	463	360	462	592	887	75	68
America:										
Argentina.....	( <sup>1</sup> )	101	1,783	2,291	190	201	2,114	506	237	296
Brazil.....		28	1,254	1,435	650	602	887	503	309	279
Chile.....		50	234	265	9	29	6,329	6,064	60	71
Uruguay.....			406	461	181	194	590	106	37	35
Mexico.....	175	211	295	558	36	37	1,219	1,741	90	76
Panama.....	128		180	324	19	254	5,189	3,332	16	12
Cuba.....	528	701	809	614	10	7	2,026	2,569	81	95
Canada.....	15,431	22,412	4,410	5,225	150	120	2,387	2,126	503	568
Africa:										
British South Africa.....			932	850	326	428	( <sup>1</sup> )	1	88	126
Algeria and Tunisia.....			565	461	207	217			21	21

<sup>1</sup> Less than 500 barrels.

<sup>2</sup> Sweden only.

TABLE 36.—Census statistics of petroleum refining industry, 1899-1929

Year	Establishments	Wage earners (average for the year)	Horse-power	Wages (1,000 dollars)	Cost of materials, fuel, and power (1,000 dollars)	Value of products (1,000 dollars)	Value added by manufactures (1,000 dollars)	Crude oil consumed (1,000 barrels)
1899.....	67	12,109	36,127	6,717	102,859	123,929	21,070	52,011
1909.....	147	13,929	89,983	9,830	199,273	236,998	37,724	120,775
1914.....	176	25,366	128,190	19,397	325,265	396,361	71,097	101,963
1919.....	320	58,889	238,906	89,750	1,247,908	1,632,533	384,624	365,272
1921.....	366	63,189	( <sup>1</sup> )	102,294	1,382,170	1,727,440	345,270	( <sup>2</sup> )
1923.....	382	66,717	349,154	103,834	1,425,053	1,793,700	368,647	601,748
1925.....	359	65,324	393,753	104,645	1,889,678	2,376,857	486,979	739,489
1927.....	354	71,234	552,651	113,717	1,752,997	2,142,649	389,651	831,332
1929.....	375	76,840	( <sup>3</sup> )	125,949	2,055,734	2,611,681	555,947	982,423

<sup>1</sup> Not called for in schedule for 1921.

<sup>2</sup> No exact data: Estimated at 485,500,000 barrels of crude oil and partially run distillates.

<sup>3</sup> Not available.

TABLE 37.—*Products of the petroleum refinery industry*

[All quantities, except as stated in footnotes, in thousands of gallons, values in thousands of dollars]

	Quantity			Value		
	1925	1927	1929	1925	1927	1929
All products of industry.....				\$2,364,069	\$2,133,923	\$2,597,370
Light products, total.....	11,278,891	13,391,340	18,199,059	1,265,234	1,102,164	1,592,981
Gasoline <sup>1</sup> .....	10,726,262	13,180,880	17,982,832	1,218,236	1,090,955	1,579,083
Naphtha.....	294,947					
Benzine.....	41,714	50,556	61,072	4,993	4,625	5,276
Tops.....	215,948	159,904	155,155	12,117	6,574	8,622
Illuminating oils.....	2,365,302	2,217,591	2,332,437	161,880	147,925	164,009
Fuel oils, total.....	14,604,038	15,415,860	16,134,961	488,958	456,959	379,683
Distillates.....	1,204,037	976,670	1,005,280	51,743	44,287	38,391
Gas oils.....	1,812,645	2,576,591	2,845,053	79,602	99,328	94,672
Residual fuel oils.....	11,586,466	11,862,599	12,284,628	357,613	313,344	246,620
Partially refined oils, sold for rerunning.....	1,497,879	1,583,727	1,423,414	65,305	62,210	48,435
Lubricating oils.....	1,361,072	1,381,902	1,546,000	252,105	244,629	301,922
Liquid asphaltic road oils.....	274,317	204,799	320,670	12,512	9,308	10,998
Residuum, or tar.....	125,115	118,467	96,340	5,582	5,118	2,854
Greases <sup>1</sup> .....	45,820	63,039	57,672	13,921	12,961	16,774
Paraffin wax.....	89,762	94,257	84,225	30,590	23,433	22,221
Asphalt <sup>1</sup> .....	2,276	2,642	3,090	30,461	37,884	34,273
All other products <sup>1</sup> .....				37,471	31,342	23,220

<sup>1</sup> Includes naphtha representing about 4 per cent of the value in 1927 and 1929.<sup>2</sup> Revised.<sup>3</sup> In addition, lubricating greases are produced to a large extent by establishments classified for census purposes in the "Lubricating oils and greases, not made in petroleum refineries" industry. The total production of greases in that industry was valued at \$16,829,012 in 1929 and \$9,781,858 in 1927.<sup>4</sup> Quantity in tons (2,000 pounds).<sup>5</sup> Includes "Acid oil," "coke petroleum," and "all other refinery products."TABLE 38.—*Petroleum refining: Consumption of crude oil and natural gasoline, and output of major products, by region of location of refineries<sup>1</sup>*

[In thousands of barrels of 42 gallons (except for wax). Data differ slightly from corresponding census statistics]

Region	Crude oil run to stills		Natural gasoline run to stills or blended		Output of refineries, 1929				
	1928	1929	1928	1929	Gasoline	Kerosene	Gas oil and fuel oil	Lubricants	Wax
Total.....	913,295	987,708	35,233	45,463	434,241	57,164	447,894	34,359	630,074
East coast.....	170,506	172,434	2,204	2,473	57,851	8,091	91,011	10,874	260,166
Appalachian.....	33,643	33,802	732	642	16,061	3,671	7,165	5,243	96,117
Indiana, Illinois, Kentucky, etc.....	98,905	110,349	2,226	2,636	65,102	5,334	36,296	3,901	59,482
Oklahoma, Kansas, and Missouri.....	111,342	115,449	4,632	4,248	62,432	10,062	38,439	2,678	40,618
Texas.....	186,076	211,693	6,963	9,749	93,589	13,336	92,448	7,727	67,165
Louisiana and Arkansas.....	76,640	75,428	5,082	6,731	31,093	5,601	32,114	968	65,256
Rocky Mountain.....	26,061	25,443	1,384	1,492	16,431	1,530	6,960	690	41,270
California.....	211,222	243,110	12,000	17,492	91,682	9,659	143,471	2,388	-----

<sup>1</sup> Bureau of Mines statistics.

TABLE 39.—Production, imports, exports, stocks, and domestic demand of gasoline, kerosene, gas oil, fuel oil, and lubricating oils

[Thousands of barrels of 42 gallons]

Period	Production	Imports <sup>1</sup>	Exports <sup>2</sup>	Stocks, end of period	Domestic demand <sup>3</sup>	Production	Imports <sup>1</sup>	Exports <sup>2</sup>	Stocks, end of period <sup>4</sup>	Domestic demand <sup>5</sup>
	Gasoline					Gas oil and fuel oil				
1921.....	122,704	900	13,134	13,954	107,525	230,991	-----	22,676	31,697	195,656
1922.....	147,672	1,479	14,166	21,043	127,906	254,910	2,947	18,479	31,065	240,010
1923.....	179,903	4,555	20,741	28,014	156,746	287,481	12,286	33,372	36,072	261,388
1924.....	213,326	3,453	28,967	30,823	185,003	320,476	12,927	37,249	39,774	292,452
1925.....	259,601	3,813	31,497	38,875	223,865	364,991	12,245	36,088	24,681	( <sup>6</sup> )
1926.....	299,734	5,540	43,313	39,023	261,813	365,195	14,432	38,351	24,898	( <sup>6</sup> )
1927.....	330,435	5,002	44,337	33,316	296,807	393,066	8,124	47,391	34,022	( <sup>6</sup> )
1928.....	376,945	4,198	52,904	33,066	328,489	427,237	7,268	44,427	34,926	( <sup>6</sup> )
1929.....	439,123	8,834	62,018	43,132	375,699	433,785	20,544	39,151	34,425	( <sup>6</sup> )
1930 (January to November, inclusive).....	407,182	15,963	60,496	38,705	367,076	343,458	23,784	33,340	40,427	( <sup>6</sup> )
	Kerosene					Lubricants				
	Production	Imports <sup>1</sup>	Exports <sup>2</sup>	Stocks, end of period	Domestic demand <sup>3</sup>	Production	Imports <sup>1</sup>	Exports <sup>2</sup>	Stocks, end of period <sup>4</sup>	Domestic demand <sup>5</sup>
1921.....	46,313	-----	18,016	8,119	29,537	20,896	-----	6,936	5,735	12,047
1922.....	54,913	3	21,489	6,692	34,854	23,304	43	7,941	5,613	15,628
1923.....	55,927	7	20,347	7,231	35,048	26,128	29	8,372	6,138	17,260
1924.....	60,026	10	21,961	8,594	36,712	27,498	11	11,988	6,420	18,124
1925.....	59,689	19	21,212	7,121	39,969	31,055	37	9,678	7,253	20,681
1926.....	61,768	74	22,248	8,575	38,140	32,293	33	9,435	7,576	22,668
1927.....	56,113	55	19,537	7,715	37,491	31,721	8	9,776	7,860	21,669
1928.....	59,353	202	22,034	9,001	36,235	34,658	13	11,023	8,340	23,168
1929.....	55,992	208	20,023	9,039	36,603	34,359	39	10,860	8,269	23,609
1930 (January to November, inclusive).....	45,633	163	15,678	7,379	31,778	31,692	24	9,519	10,536	20,130

<sup>1</sup> Data except for gasoline not available prior to October, 1922.  
<sup>2</sup> Including shipments to Alaska, Hawaii, and Porto Rico.  
<sup>3</sup> Indicated deliveries by refineries for United States consumption.  
<sup>4</sup> Beginning 1925 data for gas oil and fuel oil represent east of California only.  
<sup>5</sup> Not available because of absence of complete stock figures; see note 4.

TABLE 40.—Percentage yield of major refined products

Product	All regions										
	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	
Gasoline.....	26.8	27.7	29.5	30.9	33.1	35.1	38.5	39.9	41.3	44.0	
Kerosene.....	12.7	10.4	11.0	9.6	9.3	8.1	7.9	6.8	6.5	5.8	
Gas oil and fuel oil.....	48.6	51.9	50.9	49.5	49.3	49.3	46.9	47.4	46.8	45.3	
Lubricants.....	5.7	4.7	4.7	4.5	4.3	4.2	4.1	3.8	3.8	3.6	

Product	Refinery districts											
	East coast			Appalachian			Indiana, Illinois, etc.			Oklahoma, Kansas, etc.		
	1921	1928	1929	1921	1928	1929	1921	1928	1929	1921	1928	1929
Gasoline.....	25.1	31.5	33.5	32.6	47.2	47.5	45.3	56.3	59.0	36.0	54.7	54.1
Kerosene.....	11.1	5.0	4.7	19.1	11.1	10.9	10.4	6.4	1.8	11.4	9.2	8.7
Gas oil and fuel oil.....	54.1	55.1	52.8	23.4	21.6	21.2	27.7	33.1	32.9	45.0	33.4	33.3
Lubricants.....	6.5	6.3	6.3	18.3	15.2	15.5	5.9	4.0	3.5	2.4	2.4	2.3

## COST OF CRUDE PETROLEUM

TABLE 40.—Percentage yield of major refined products—Continued

Product	Refinery districts											
	Texas			Louisiana and Arkansas			Rocky Mountain			California		
	1921	1928	1929	1921	1928	1929	1921	1928	1929	1921	1928	1929
Gasoline.....	25.3	45.5	44.2	25.0	35.3	41.2	52.2	63.3	64.6	14.3	31.6	37.7
Kerosene.....	12.3	7.8	6.3	11.8	7.7	7.3	10.7	7.0	6.0	4.5	4.0	4.0
Gas oil and fuel oil.....	55.7	42.6	43.7	48.5	44.9	42.6	44.3	27.2	27.3	70.3	64.2	59.0
Lubricants.....	5.2	4.5	3.7	1.2	1.0	1.3	2.0	2.4	2.3	2.2	1.1	1.0

Source: Bureau of Mines, Department of Commerce.

NOTE.—The figures, obtained by dividing output by the quantity of crude oil run to stills, do not strictly represent the proportions of the several products actually obtained from crude oil, especially because gasoline obtained by rerunning natural gasoline, a rapidly increasing quantity, is included. For the same reason the percentage in some cases adds to more than 100. Deducting natural gasoline from the total gasoline production the yields of gasoline in 1928 and 1929 were 37.4 and 39.4 per cent, respectively.

TABLE 41.—Monthly statistics of crude petroleum and of exports and imports of refined liquid products

[In thousands of barrels of 42 gallons]

	Production of crude oil					Stock of crude oil	Crude oil run to stills	Imports		Exports	
	Total	Eastern field <sup>1</sup>	Gulf and Mid-Continent <sup>2</sup>	Rocky mountain <sup>3</sup>	California <sup>4</sup>			Crude oil	Refined products	Crude oil	Refined products
1927											
January.....	71,758	3,143	45,773	2,650	20,192	405,296	69,529	4,593	1,189	1,204	9,538
February.....	68,122	3,120	44,562	2,450	17,990	410,837	62,961	4,181	1,507	1,165	9,368
March.....	75,514	3,636	49,328	2,706	19,844	415,814	68,672	4,582	1,027	1,199	8,879
April.....	73,132	3,324	47,562	2,725	19,501	423,856	66,493	4,063	1,201	1,171	9,247
May.....	76,845	3,473	51,134	2,724	19,514	431,590	69,700	4,557	1,329	1,300	11,410
June.....	75,303	3,479	50,073	2,553	19,188	440,433	67,567	4,019	1,448	1,411	10,990
July.....	78,780	3,377	53,251	2,766	19,386	448,919	71,405	4,823	1,053	1,069	9,326
August.....	78,788	3,565	53,372	2,504	19,247	456,501	70,957	6,261	774	1,382	11,383
September.....	75,909	3,417	51,062	2,299	19,131	462,931	68,532	5,122	868	1,297	9,309
October.....	77,534	3,406	52,308	2,308	19,517	466,939	71,761	4,633	1,042	1,539	11,107
November.....	74,493	3,319	50,308	2,265	18,561	472,896	69,988	5,399	1,189	1,280	10,138
December.....	74,951	3,189	50,303	2,454	19,005	473,379	71,271	6,210	766	1,717	8,790
Total.....	901,129	40,448	599,066	30,429	231,196	473,379	828,848	58,363	13,353	18,944	119,495
1928											
January.....	72,793	3,137	48,277	2,410	18,969	481,712	69,161	6,390	1,165	1,226	11,571
February.....	68,565	3,166	45,147	2,186	18,096	486,199	66,648	6,086	1,055	1,243	9,465
March.....	74,528	3,527	49,349	2,570	19,062	490,818	72,621	6,343	1,134	1,530	10,722
April.....	72,393	3,239	48,533	2,339	18,262	492,419	78,084	5,661	1,080	1,368	11,460
May.....	75,277	3,627	49,794	2,548	19,306	493,473	77,414	6,706	1,162	1,493	12,062
June.....	72,676	3,403	47,643	2,435	19,195	491,988	75,988	6,553	712	1,879	11,907
July.....	75,584	3,514	49,862	2,471	19,737	490,298	80,602	7,878	782	1,669	12,303
August.....	77,807	3,572	52,155	2,581	19,499	488,934	81,561	6,141	1,007	1,893	10,238
September.....	76,484	3,226	51,931	2,422	18,905	486,930	79,894	7,139	598	1,502	10,862
October.....	79,751	3,636	54,148	2,686	19,381	488,349	79,663	6,703	771	2,015	9,860
November.....	76,123	3,351	50,564	2,352	19,556	488,193	77,149	6,908	728	1,691	11,039
December.....	79,493	3,360	52,313	2,399	21,521	490,798	79,530	6,307	996	1,529	9,210
Total.....	901,474	40,748	599,716	29,199	231,811	490,788	913,295	79,767	11,790	18,962	131,099

COST OF CRUDE PETROLEUM

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<sup>1</sup> Eastern field includes Appalachian, Lima-Indiana, Michigan, and Illinois and southwestern Indiana fields.

<sup>2</sup> 1927 and 1928 include Salt Dome pools.

<sup>3</sup> Includes Alaska.

<sup>4</sup> 1927 and 1928 annual and semiannual figures from Division of Mines and Minery Department of Natural Resources, California. Monthly figures prorated on basis of monthly reports by American Petroleum Institute.



TABLE 41.—Monthly statistics of crude petroleum and of exports and imports of refined liquid products—Continued

[In thousands of barrels of 42 gallons]

	Production of crude oil					Stock of crude oil	Crude oil run to stills	Imports		Exports	
	Total	Eastern field	Gulf and Mid-Continent	Rocky mountain	California			Crude oil	Refined products	Crude oil	Refined products
1929 <sup>a</sup>											
January.....	82,054	3,446	52,998	2,157	23,453	497,525	78,825	8,075	884	1,972	11,760
February.....	75,456	3,113	48,025	1,947	22,371	505,920	72,031	7,016	908	1,678	9,507
March.....	82,463	3,601	52,260	2,209	24,393	512,989	80,708	6,790	1,489	1,600	10,873
April.....	80,412	3,533	51,375	2,137	23,367	516,161	80,459	7,828	2,634	1,726	10,364
May.....	84,499	3,901	54,214	2,262	24,122	518,980	84,420	7,552	2,732	1,932	11,080
June.....	83,407	3,891	52,552	2,272	24,692	523,104	84,400	6,591	2,426	2,615	12,483
July.....	91,309	4,517	57,552	2,426	26,814	529,983	85,919	6,122	3,176	3,117	12,441
August.....	92,165	4,340	58,072	2,503	27,250	538,982	86,733	5,800	3,430	2,236	12,771
September.....	87,453	4,079	54,804	2,446	26,124	543,557	84,099	6,953	2,725	1,988	8,570
October.....	88,430	4,499	54,569	2,458	26,904	545,186	88,390	5,766	3,643	2,869	13,984
November.....	78,758	4,095	51,015	2,314	21,334	539,837	81,061	4,554	3,327	2,579	10,565
December.....	80,917	4,121	52,728	2,358	21,716 <sup>b</sup>	540,851	80,663	5,886	2,403	2,089	12,321
Total.....	1,007,323	47,136	640,164	27,489	292,534	540,851	987,706	78,933	29,777	26,401	136,719
1930											
January.....	79,453	4,113	51,492	1,865	21,963	528,398	80,163	5,450	3,806	1,808	11,96
February.....	74,427	3,963	47,740	1,838	20,886	533,286	72,414	4,321	3,224	1,731	10,075
March.....	77,384	4,222	51,475	1,987	19,700	532,131	80,252	4,827	3,713	1,944	12,496
April.....	77,175	4,259	52,114	2,033	18,769	529,677	80,434	5,781	3,214	1,900	12,442
May.....	80,176	4,414	54,697	2,021	19,044	527,391	83,674	4,984	3,603	2,203	9,410
June.....	76,513	3,947	52,675	1,870	18,021	524,143	80,747	5,767	4,027	2,508	14,257
July.....	76,743	3,831	52,202	1,908	18,802	523,885	78,644	5,877	4,040	1,973	10,945
August.....	74,853	3,417	50,655	2,011	18,770	526,012	78,289	5,059	4,329	2,407	12,564
September.....	70,977	3,396	47,630	1,967	17,984	521,204	75,950	5,808	3,614	1,961	8,753
October.....	72,696	3,627	48,855	1,970	18,244	518,843	74,016	5,061	3,799	2,167	11,803
November.....	68,174	3,222	44,958	1,885	18,109	518,170	70,310	4,467	2,807	1,765	7,776
December <sup>a</sup> .....											
Total (Jan. 1–Nov. 30).....	828,571	42,411	554,493	21,355	210,312	518,170	854,893	57,402	40,176	22,367	122,469

<sup>a</sup> Exports include shipments to Alaska, Hawaii, and Porto Rico—and include benzol. Run to stills does not include unfinished rerun.<sup>b</sup> Not available.

TABLE 42.—*Production, imports, exports, stocks, and domestic demand of gasoline, illuminating oil, gas oil and fuel oil, and lubricating oil, by quarters, 1927-1930*

[In thousands of barrels of 42 gallons]

Period	Gasoline					Gas oil and fuel oil				
	Production	Imports	Exports <sup>1</sup>	Stocks, end of period	Domestic demand <sup>2</sup>	Production	Imports	Exports	Stocks, end of period <sup>3</sup>	Domestic demand <sup>4</sup>
<b>1927</b>										
January-March.....	80,870	1,429	10,320	52,410	53,592	95,498	2,258	11,201	22,561	( <sup>5</sup> )
April-June.....	79,980	1,457	12,330	43,768	77,749	97,046	2,482	12,147	26,590	( <sup>5</sup> )
July-September.....	83,844	1,053	10,955	20,738	87,972	100,130	1,581	11,944	31,631	( <sup>5</sup> )
October-December..	85,973	1,064	10,837	32,323	73,615	99,668	1,822	12,047	31,982	( <sup>5</sup> )
<b>1928</b>										
January-March.....	84,113	1,193	11,070	41,078	66,474	99,347	2,067	11,564	29,104	( <sup>5</sup> )
April-June.....	90,845	1,052	14,731	33,862	83,382	105,255	2,428	12,061	36,085	( <sup>5</sup> )
July-September.....	100,744	939	14,567	26,378	95,600	111,148	1,396	10,907	39,900	( <sup>5</sup> )
October-December..	101,481	1,112	12,529	33,066	83,376	110,005	1,377	9,930	34,926	( <sup>5</sup> )
<b>1929</b>										
January-March.....	101,109	1,232	13,266	48,224	73,923	108,625	1,947	9,094	30,195	( <sup>5</sup> )
April-June.....	107,628	2,283	15,710	42,017	100,408	113,441	5,421	9,367	37,332	( <sup>5</sup> )
July-September.....	114,978	2,593	16,740	33,181	109,667	115,350	6,640	9,141	40,646	( <sup>5</sup> )
October-December..	115,410	2,726	16,282	43,132	91,703	111,369	6,536	11,549	34,425	( <sup>5</sup> )
<b>1930</b>										
January-March.....	108,330	3,401	16,355	55,239	83,269	98,509	7,163	9,743	32,998	( <sup>5</sup> )
April-June.....	114,987	4,757	17,810	50,225	106,948	97,299	5,934	10,081	38,302	( <sup>5</sup> )
July-September.....	112,849	5,106	16,818	38,254	113,608	90,808	6,810	8,525	41,480	( <sup>5</sup> )
October, November.	71,016	2,699	10,013	38,705	63,261	58,852	3,877	4,991	40,427	( <sup>5</sup> )
<b>Kerosene</b>										
<b>1927</b>										
January-March.....	14,368	4	4,366	8,753	9,828	7,669	2	2,379	8,085	4,833
April-June.....	13,579	4	5,110	8,567	8,659	7,811	3	2,384	7,628	5,897
July-September.....	13,590	4	4,735	8,120	9,306	8,206	1	2,608	7,447	5,790
October-December..	14,577	43	5,269	7,669	9,802	8,035	1	2,439	7,860	5,184
<b>1928</b>										
January-March.....	14,522	63	5,753	7,700	8,787	8,260	-----	2,612	8,383	5,125
April-June.....	15,125	45	5,624	8,432	8,874	9,127	5	3,217	7,832	6,466
July-September.....	15,443	21	5,602	8,593	9,701	8,552	3	2,684	7,742	5,961
October-December..	15,066	75	5,087	9,001	9,646	8,720	5	2,542	8,340	5,585
<b>1929</b>										
January-March.....	13,650	63	5,408	7,856	9,451	8,391	7	3,032	8,853	4,853
April-June.....	14,264	42	4,910	8,348	8,903	8,832	13	2,619	7,869	7,210
July-September.....	13,292	39	4,452	8,569	8,658	8,931	12	2,631	7,589	6,592
October-December..	14,786	64	5,253	9,039	9,591	8,205	7	2,578	8,269	4,954
<b>1930</b>										
January-March.....	13,639	15	4,918	8,455	9,320	8,727	7	2,507	9,561	4,935
April-June.....	12,778	105	4,242	8,352	8,744	9,298	6	2,841	9,742	6,282
July-September.....	11,750	42	4,099	7,771	8,274	8,712	7	2,433	10,257	5,771
October-November.	7,466	1	2,419	7,379	5,440	4,955	4	1,538	10,536	3,142

<sup>1</sup> Including shipments to Alaska, Hawaii, and Porto Rico.<sup>2</sup> Indicated deliveries by refineries for United States consumption.<sup>3</sup> East of California only, for gas and fuel oil.<sup>4</sup> Not available owing to absence of complete stock figures; see note 3.

TABLE 43.—*Petroleum: Prices of crude and refined products*<sup>1</sup>

Year	Dollars per barrel		Cents per gallon		
	Crude petroleum	Fuel oil	Gasoline	Kerosene	Lubricating oil
1917	1.77	1.57	20.6	8.5	19.5
1918	2.22	2.01	21.7	10.2	30.9
1919	2.25	1.59	22.2	12.7	32.2
1920	3.44	2.79	26.5	17.1	49.0
1921	1.86	1.30	22.3	12.9	27.6
1922	1.78	1.24	21.7	12.4	20.4
1923	1.71	1.20	17.5	12.8	19.4
1924	1.84	1.35	15.9	12.7	23.0
1925	1.96	1.46	16.6	12.3	26.1
1926	2.03	1.47	17.5	14.7	26.1
1927	1.55	1.14	15.0	12.9	25.3
1928	1.54	.91	14.7	12.9	24.3
1929	1.67	.89	13.9	13.4	25.3

<sup>1</sup> Statistical Abstract of the United States, 1930, p. 783. Prices of crude and fuel oil in dollars per barrel of 42 gallons; others in cents per gallon. Compiled by Joseph C. Fogue. The weighted average prices are computed from 5 principal grades of crude oil at wells, from 5 markets each for kerosene and gasoline from tank wagon, from 5 refining locations for fuel oil, and for 5 grades of lubricating oil.

TABLE 44.—*Petroleum—Average price per barrel paid for crude petroleum at the wells, 1924-1928, by States*

[Source: Petroleum in 1928, by G. R. Hopkins and A. B. Coons, Bureau of Mines. Based on actual purchases, including premiums]

State	1924	1925	1926	1927	1928	1929
Alaska	(1)	\$4.25	(1)	(1)	(1)	(1)
Arkansas	\$0.94	.89	\$1.11	\$1.06	\$0.86	\$0.88
California <sup>2</sup>	1.20	1.42	1.84	1.13	.99	1.10
Colorado	1.10	1.48	1.84	1.20	.99	1.01
Illinois	1.76	1.94	2.22	1.67	1.54	1.65
Indiana:						
Southwestern	1.80	1.92	2.22	1.65	1.53	1.66
Northeastern	1.93	2.06	2.07	1.51	1.24	1.43
Total Indiana	1.84	1.95	2.19	1.63	1.50	1.64
Kansas	1.54	1.94	2.26	1.42	1.26	1.46
Kentucky	1.97	2.32	2.43	1.67	1.61	1.70
Louisiana:						
Gulf coast	1.63	1.57	1.39	1.21	1.16	1.23
Northern	1.41	1.61	1.70	1.33	1.20	1.26
Total Louisiana	1.44	1.60	1.65	1.30	1.18	1.25
Michigan		2.50	2.69	1.90	1.55	1.36
Montana	1.33	1.57	1.32	1.40	1.59	1.82
New Mexico	1.30	1.71	1.96	1.37	1.36	1.19
New York	3.64	3.70	3.68	3.17	3.26	3.90
Ohio:						
Central and eastern	2.74	2.67	2.74	2.02	2.20	2.51
Northwestern	2.00	2.17	2.34	1.80	1.59	1.73
Total Ohio	2.52	2.53	2.64	1.97	2.06	2.34
Oklahoma	1.57	1.97	2.31	1.43	1.39	1.43
Pennsylvania	3.61	3.02	3.56	3.06	3.27	3.79
Tennessee	1.80	2.21	2.37	1.50	1.52	1.58
Texas:						
Gulf coast	1.56	1.62	1.50	1.30	1.19	1.21
Rest of State	1.51	1.86	1.96	1.10	.87	1.06
Total Texas	1.52	1.81	1.85	1.14	.92	1.09
Utah	(1)	1.00	(1)	(1)	(1)	(1)
West Virginia	3.52	3.48	3.46	2.89	3.03	3.60
Wyoming	1.23	1.76	1.98	1.40	1.28	1.28
Other	3.38		1.25	4.71	5.00	4.29
United States	1.43	1.68	1.88	1.30	1.17	1.27

<sup>1</sup> Included under "Other."

<sup>2</sup> Division of Mines and Mining, Department of Natural Resources, California.

<sup>3</sup> Alaska and Utah.

TABLE 45.—Value of crude petroleum at wells, 1928 and 1929<sup>1</sup>

	1928		1929	
	Total	Average per barrel	Total	Average per barrel
Alaska.....	( <sup>2</sup> )	-----	( <sup>2</sup> )	-----
Arkansas.....	\$27,450,000.00	\$0.86	\$21,890,000.00	\$0.88
California <sup>3</sup> .....	230,000,000.00	.99	321,867,000.00	1.10
Colorado.....	2,750,000.00	.99	2,380,000.00	1.01
Illinois.....	9,980,000.00	1.54	10,430,000.00	1.65
Indiana:				
Southwestern.....	1,470,000.00	1.53	1,520,000.00	1.66
Northeastern.....	110,000.00	1.24	90,000.00	1.43
Total Indiana.....	1,580,000.00	1.50	1,610,000.00	1.64
Kansas.....	52,500,000.00	1.36	62,510,000.00	1.46
Kentucky.....	11,850,000.00	1.61	13,220,000.00	1.70
Louisiana:				
Gulf coast.....	8,150,000.00	1.16	9,150,000.00	1.23
Rest of State.....	17,700,000.00	1.20	16,550,000.00	1.26
Total Louisiana.....	25,850,000.00	1.18	25,700,000.00	1.25
Michigan.....	920,000.00	1.55	6,140,000.00	1.36
Montana.....	6,400,000.00	1.59	7,260,000.00	1.82
New Mexico.....	1,280,000.00	1.36	2,170,000.00	1.19
New York.....	8,750,000.00	3.36	13,170,000.00	3.90
Ohio:				
Central and eastern.....	11,950,000.00	2.20	13,200,000.00	2.51
Northwestern.....	2,520,000.00	1.59	2,570,000.00	1.73
Total Ohio.....	14,470,000.00	2.06	15,770,000.00	2.34
Oklahoma.....	347,600,000.00	1.39	364,650,000.00	1.43
Pennsylvania.....	32,550,000.00	3.27	44,800,000.00	3.79
Tennessee.....	70,000.00	1.52	30,000.00	1.58
Texas:				
Gulf coast.....	47,120,000.00	1.19	59,930,000.00	1.21
West Texas.....	80,520,000.00	.65	110,780,000.00	.83
Rest of State.....	108,660,000.00	1.15	151,810,000.00	1.33
Total Texas.....	236,300,000.00	.92	322,520,000.00	1.09
Utah.....	( <sup>4</sup> )	-----	( <sup>4</sup> )	-----
West Virginia.....	17,150,000.00	3.03	20,070,000.00	3.60
Wyoming.....	27,400,000.00	1.28	24,700,000.00	1.23
Other.....	30,000.00	5.00	30,000.00	4.29
United States.....	1,054,880,000.00	1.17	1,280,417,000.00	1.27

<sup>1</sup> Source: Annual Petroleum Statement No. P. 69, Bur. Mines.

<sup>2</sup> Included in "Other."

<sup>3</sup> Division of Mines, Dept. of Natural Resources, California.

<sup>4</sup> Alaska and Utah.

TABLE 46.—General summary table—Petroleum

[Quantities in barrels of 42 gallons]

	1927	1928	1929
World production.....	1,262,582,000	1,324,734,000	1,484,451,000
United States production.....	901,129,000	901,474,000	1,007,323,000
Venezuela production.....	63,134,000	105,749,000	137,472,000
All other countries.....	298,319,000	317,511,000	339,656,000
Per cent of world total.....	100.0	100.0	100.0
United States.....	71.4	68.0	67.9
Venezuela.....	5.0	8.0	9.3
Natural gasoline produced in the United States.....	39,075,000	43,191,000	53,183,000
Crude oil and natural gasoline combined.....	940,204,000	944,665,000	1,060,506,000
Imports:			
Crude oil.....	58,383,000	79,767,000	78,933,000
Refined liquid products.....	13,281,000	11,700,000	29,632,000
Total.....	71,664,000	91,467,000	108,565,000

## COST OF CRUDE PETROLEUM

TABLE 46.—General summary table—Petroleum—Continued

[Quantities in barrels of 42 gallons]

	1927	1928	1929
<b>Exports:</b>			
Crude oil.....	15,843,000	18,966,000	26,401,000
Refined liquid products.....	115,399,000	126,159,000	126,377,000
<b>Total.....</b>	<b>131,242,000</b>	<b>145,125,000</b>	<b>152,778,000</b>
<b>Ratio of imports to domestic production of crude oil and natural gasoline.....</b>	<b>7.6</b>	<b>9.7</b>	<b>10.2</b>
<b>Ratio of exports to domestic production of crude oil and natural gasoline.....</b>	<b>14.0</b>	<b>15.4</b>	<b>14.4</b>
<b>Production plus imports minus exports (crude oil and natural gasoline).....</b>	<b>982,743,000</b>	<b>1,005,466,000</b>	<b>1,113,038,000</b>
<b>Increase or decrease of stocks of crude and refined oils at end of year.....</b>	<b>+70,103,000</b>	<b>+22,782,000</b>	<b>+68,156,000</b>
<b>Consumption by refineries:</b>			
Crude oil.....	828,835,000	913,295,000	987,708,000
Domestic.....	778,729,000	835,711,000	912,191,000
Imported.....	50,106,000	77,584,000	75,517,000
Unfinished oils re-run (net).....	12,879,000	15,970,000	15,969,000
Natural gasoline treated by refineries.....	32,162,000	35,223,000	46,457,000
<b>Total above.....</b>	<b>873,876,000</b>	<b>964,488,000</b>	<b>1,050,134,000</b>
<b>Value:</b>			
Crude oil produced at wells.....	\$1,172,830,000	\$1,054,880,000	\$1,280,417,000
Natural gasoline production at point of consumption.....	118,688,000	138,944,000	168,231,000
Natural gas production at point of consumption.....	317,930,000	364,000,000	413,000,000
Cost of materials, fuel, and power used by refineries.....	1,752,997,000	-----	2,055,734,000
Value added to material by refining.....	369,652,000	-----	555,947,000
Total value of refinery products.....	2,142,649,000	-----	2,611,681,000
<b>Imports—</b>			
Crude oil.....	78,609,000	90,473,000	79,943,000
From Venezuela, Netherland West Indies, and Trinidad and Tobago <sup>1</sup> .....	29,754,000	49,101,000	44,987,000
Refined liquid products.....	33,638,000	40,943,000	61,045,000
From Venezuela, Netherland West Indies, and Trinidad and Tobago <sup>1</sup> .....	17,352,000	31,618,000	56,578,000
Other refined products (paraffin and paraffin wax).....	1,187,000	1,426,000	2,591,000
<b>Total.....</b>	<b>113,434,000</b>	<b>132,642,000</b>	<b>143,579,000</b>
From Venezuela, Netherland West Indies, Trinidad and Tobago <sup>1</sup> .....	47,106,000	80,719,000	101,585,000
<b>Exports:</b>			
Crude oil.....	25,900,000	26,800,000	37,800,000
Refined liquid products.....	429,663,000	465,214,000	493,382,000
To Venezuela, Netherland West Indies, Trinidad and Tobago.....	804,000	2,109,000	7,392,000
Other refined products.....	30,296,000	33,852,000	30,009,000
<b>Total.....</b>	<b>485,859,000</b>	<b>525,866,000</b>	<b>561,191,000</b>
Total to Venezuela, Netherland West Indies, Trinidad and Tobago.....	804,000	2,109,000	7,392,000
<b>PRICES AND AVERAGE UNIT VALUES</b>			
Average value all crude oil at well (per barrel).....	\$1.30	\$1.17	\$1.27
Average value domestic crude oil at refinery (per barrel).....	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Average value crude oil exported (as such at port (per barrel).....	1.64	1.41	1.43
Average value crude oil imported in foreign country (per barrel).....	1.35	1.13	1.01
<b>Pogue price indexes:</b>			
Average crude at wells (per barrel).....	1.55	1.54	1.67
Average kerosene (per gallon).....	.129	.129	.134
Average gasoline (per gallon).....	.150	.147	.139
Average fuel oil (per barrel).....	1.14	.91	.89
Average lubricating oil (per gallon).....	.253	.243	.253
Average posted prices paid by pipe-line companies for Oklahoma, Kansas, crude of 33°-33.9° gravity.....	1.31	1.20	1.23

<sup>1</sup> Nearly all originating in Venezuela.<sup>1</sup> See Table, Part II.