

R. A. Jack

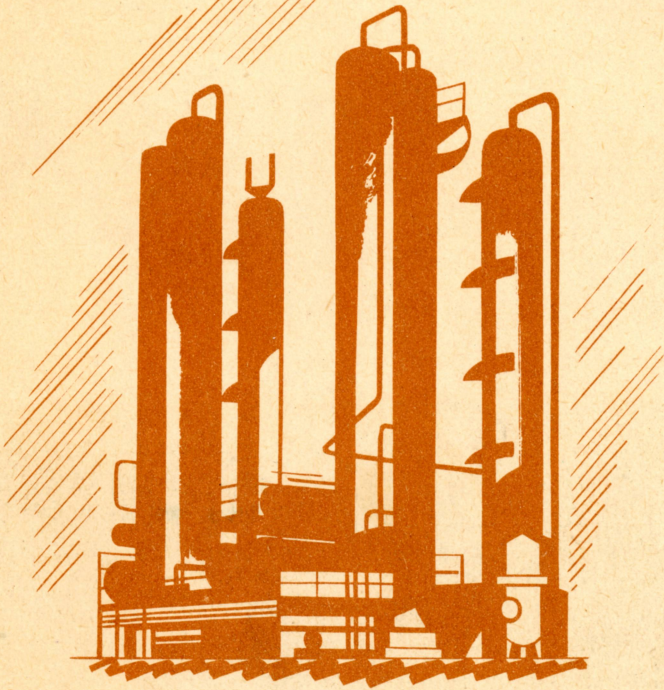
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RESEARCH DEPT.
WOOD RIVER

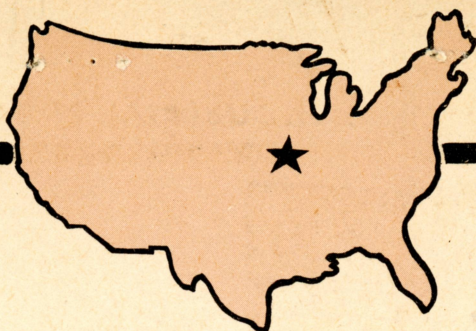


SOUVENIR GUIDE TO

Wood River

REFINERY

SHELL OIL COMPANY, INCORPORATED



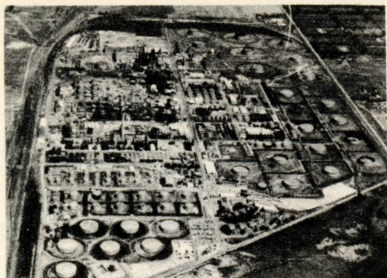
FOREWORD

We are very glad to welcome you to Shell's Wood River Refinery. As part of our welcome, we have prepared this booklet to help you become familiar with the basic design and operation of the plant. The booklet is intended both as an aid during your visit and as a souvenir.

The following pages give a brief account of the refinery, its operation, and the people who work in it. Beginning with a brief history and description of the plant, which is Shell's largest and most modern refinery, the booklet lists its major products and the daily production of each. It also tells, in understandable terms, how the refinery works—what the processes are that transform crude oil into the thousand-odd petroleum products now serving *you*. It describes Shell's research activities at Wood River, gives other interesting facts and figures about the refinery. The booklet is illustrated with pictures of typical equipment and the people who operate it. And a complete keyed map locates units that perform the refinery's main operations.

It is a pleasure to have you with us. We hope you enjoy your visit.

MONUMENT TO INDUSTRIAL PROGRESS



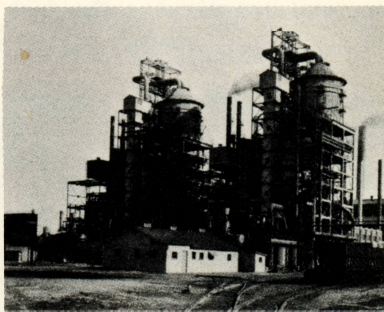
An aerial view of the Wood River Refinery, Shell's largest and most modern. The refinery processes 100,000 barrels — or 4,200,000 gallons — of crude oil daily.

If this is your first visit to the Wood River Refinery, your initial impression was probably of its size. It covers an area of about 1,300 acres. Next, you probably noticed its awesome maze of towers, tanks, furnaces, and other apparatus, all connected with miles of intricate piping.

It is only fair to warn you, however, that spectacular as this equipment is, its operations are hidden. A refinery is rather unique among industrial plants in that few moving parts are visible, and there is never a glimpse of the material being processed — oil.

This refinery is an example of amazing industrial efficiency. Its purpose is to transform crude oil into useful products to serve industry and the American people in innumerable ways. The raw material flowing into this plant is black, smelly crude oil straight from the earth; the products which emerge are gasoline, aviation fuel, diesel fuel, domestic heating oil, lubricating oils, and a thousand and one other necessities of modern civilization.

To bring about this transformation, refining engineers utilize the fact that crude oil is a mixture of various hydrocarbons (chemists' term for compounds of hydrogen and carbon) which boil at different temperatures. Thus they can be separated by distillation and subsequently broken down, recombined, treated, and purified until each meets the exact requirements of the purpose for which it is intended.



These giant twin "cat" crackers tower 15 stories high. Each can process 20,000 barrels of oil daily.

Not a drop of crude oil is wasted: It is all converted into some useful product.

This is modern alchemy beyond the wildest dreams of the ancients.

This is Industrial Progress.

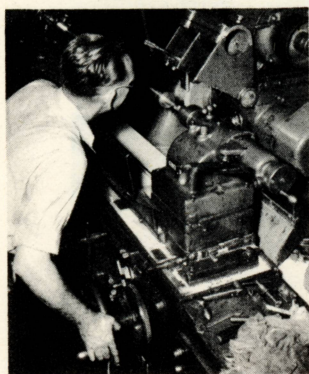
GROWTH HAS BEEN STEADY

Wood River was chosen as an ideal location for a major Shell refinery, because it is strategically situated to serve both the eastern and the middle-western markets with petroleum products. Construction of the plant was started in April 1917, and it was in actual operation by September 1918, processing up to 25,000 barrels of crude oil daily. Since then, its facilities have grown steadily and rapidly. By 1930, daily volume had reached nearly 35,000 barrels per day; by 1938, 42,000 barrels; and at present, over 100,000 barrels — or 4,200,000 gallons — daily!

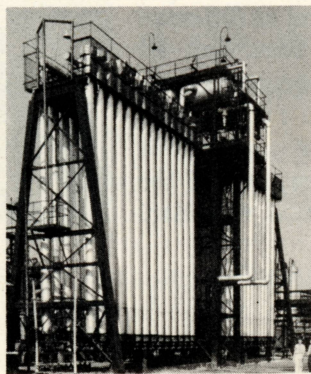
One of the major steps in this expansion was the erection of the lubricating oil plant in 1925 and its modernization in 1934. In 1938, other additions were made to combine the company's East Chicago refinery with Wood River.

Growth after 1938 dwarfed even previous expansion. The alkylation and toluene plants were added, and the gigantic catalytic cracking units were constructed, each capable of processing 20,000 barrels of oil daily.

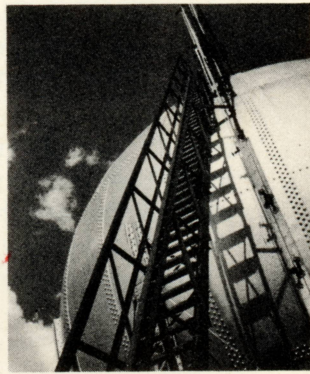
Wood River is noted for having many "firsts" in the field of oil refining. In 1934, it manufactured and delivered to the U. S. Army Air Forces the first 100-octane aviation gasoline ever made in commercial quantities — the fuel which was to play such a vital role in the Allies' mastery of the air in World War II.



Repair shop grinding machine is microscopically accurate.



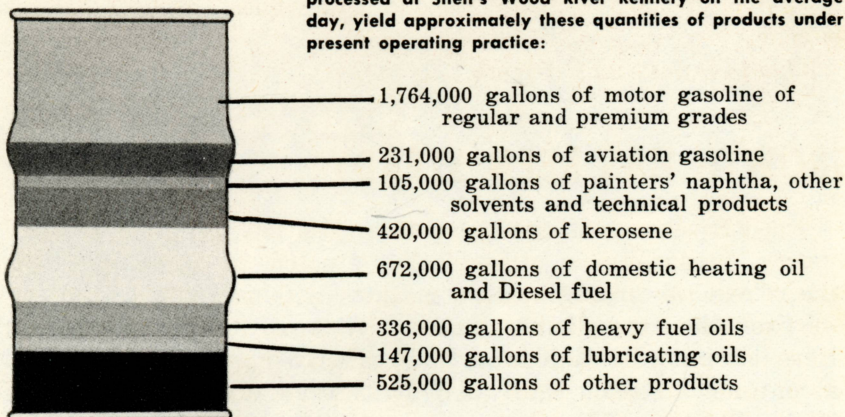
Polymerization unit looks like a gigantic, complex pipe organ.



Refinery uses spherical tanks to store gases under pressure.

PRODUCTS MANUFACTURED

The 100,000 barrels — or 4,200,000 gallons — of crude oil processed at Shell's Wood River Refinery on the average day, yield approximately these quantities of products under present operating practice:



It was the first — and is still the exclusive — supplier of "S-reference fuel," the yardstick for testing all fuels of 100-octane and over.

Wood River was the first to manufacture toluene, basic ingredient of TNT, by a synthetic process. It was the first to produce "2190-T," the turbine oil which solved one of the Navy's toughest lubrication problems. In addition to these products, Wood River turned out Diesel fuels for the Navy, lubricants for every kind of war-plant machinery, rust preventives, gasoline for the ground forces, and innumerable other essential war products. And for these contributions, the refinery was the first in the United States to receive the Army-Navy "E" Award.

The plant is still expanding. A new main office building is soon to be built on a new location, and the main research laboratory is to be moved to a much larger building nearby. New manufacturing units are expected to be added as demand for petroleum products continues to increase in the years to come.

HOW THEY'RE MADE

Much of the crude oil travels as far as 900 miles before reaching the Wood River Refinery, flowing through 10-inch pipelines from Mid-continent and West Texas oil fields. When it arrives at the refinery, it is stored in huge tanks until it is needed.

The actual refining processes by which the crude oil is converted into finished products are far too complex and technical for anyone but a trained petroleum engineer to understand, but a simple explanation of the fundamental steps involved helps make clear



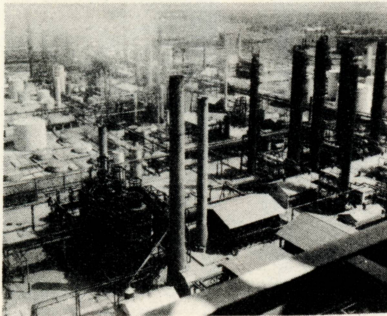
This view shows some of Wood River's 3500 employees streaming toward the main gate at the end of their shift. It gives a good idea of the size of Shell's largest refinery.

the roles of the various refinery units seen in even a casual tour.

From the *storage tanks*, the crude oil is sent to the *topping plant*. Here it is heated until it is partially vaporized, and then is passed in a continuous stream into tall *fractionating towers* — often called “bubble” towers. The vapor, like crude oil, is a mixture of many hydrocarbons, each with a different boiling point. Thus, those with the highest boiling point begin to condense near the lowest (and hottest) part of the tower; those with progressively lower boiling points condense at progressively higher (and cooler) points up the tower. Thus, gasoline stock with the lowest boiling range, is removed from the top of the tower, kerosene distillate further down, then Diesel fuel stock, fuel oils, and so on.

After the primary ingredients in crude oil are separated from each other, they are treated and blended in various ways to make the finished products.

Part of the fuel oil fraction, for instance, goes to the *vacuum flash unit*, where unwanted ingredients are removed and it becomes “charging stock” — i.e., raw material — for the *catalytic cracking plant*. In “cracking,” the stock is subjected to such intense heat and pressure that the original chemical compounds of the oil are broken down and then re-formed into the desired products. Cracking is



The toluene and alkylation plants viewed from atop one of the “twin” cat-crackers.



Lubricating oils are an important class of products. Here they are being barreled.

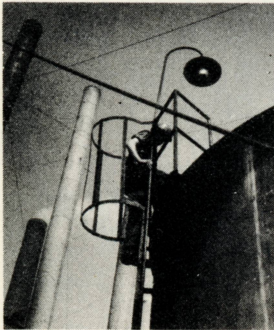


Wood River at night — a refinery's operations continue around the clock.

used to increase the yield of gasoline and fuel oil from a given quantity of crude, and to improve the quality of products turned out.

Other refining processes, such as *stabilizing* and *absorption*, are for the purpose of removing unwanted fractions, "wild" gases, etc., from stocks, while processes such as *alkylation* and *polymerization* are utilized to convert some light gases, formerly burned as waste fuel, to valuable aviation and motor gasolines. Finally, modern chemical refining or "treating" processes are employed to meet exacting specifications on finished products.

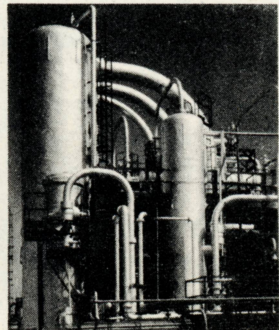
The *lubricating oil plant* receives special stocks produced by the topping plant and subjects them to a number of separate processes. These stocks are de-asphalted and de-waxed; resinous and tarry



A gauger checks fuel supply in large boiler house tank.



Instrument man makes sure control devices are accurate.



The Duo-Sol plant extracts harmful materials.

materials are removed by a special solvent; then they are filtered through clay, and blended with other stocks to meet the exact specifications for the purpose for which they are intended.

After each product from the refinery has been subjected to rigid testing of specifications for high quality, it is shipped to distributing points by pipe line, barge, rail and tank truck.

The refinery wastes nothing. Some gas, a by-product of gasoline manufacture, is bottled as Shellane in steel cylinders and used for cooking and domestic heating needs, and the remaining gas is used as fuel for the boilers and stills. Steam produced by the cracking units is used for heat and power. Cooling water is recirculated and used again and again.

Oil refining never stands still. It's intensely competitive, and discoveries of new techniques and new processes are being made constantly.

The result to the consumer is a steady rise in the quality of products at lower prices.

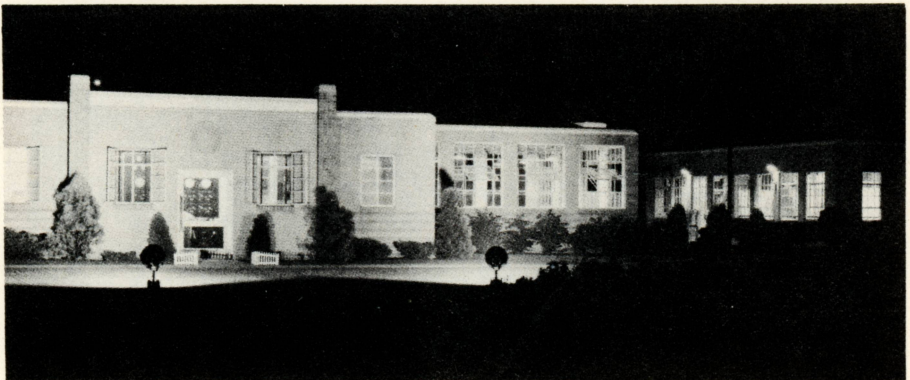
RESEARCH

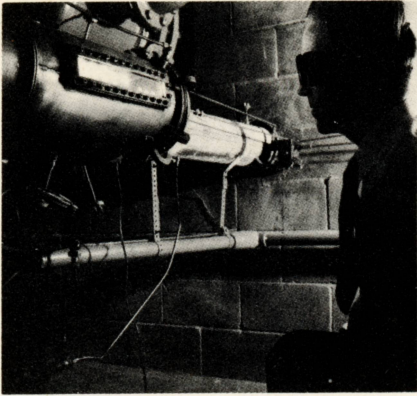
In the past 25 years, the oil industry has increased the number of its products from five to almost 1100 — and Shell scientists say it is possible to make crude oil yield literally thousands more.

Today, oil fuels ships and flies planes. It powers cars, feeds tractors, rolls trains. It keeps houses warm in winter and keeps industry's wheels turning. It lubricates every type of machine man uses, from vacuum cleaners to battleships.

Today, we wear oil in rayons. We use oil in medicines, as insulation and roofing in our houses. Oil products go into plastics, paints, alcohols, insecticides, and fertilizers. Oil products pave streets, help make synthetic rubber tires and soap.

The products pipe line pump house handles 2,436,000 gallons of finished products daily.





A researcher studies jet flame in action through window built into jet engine tube.

RESEARCH

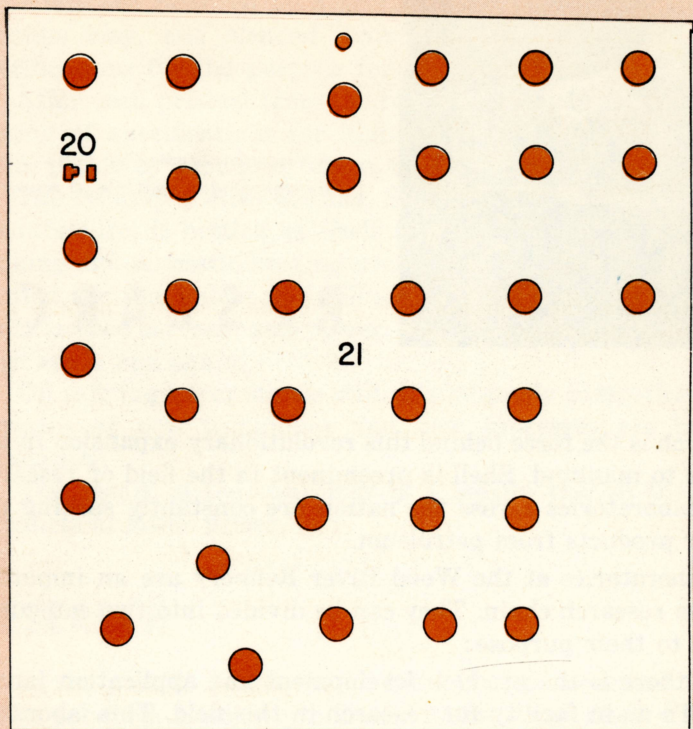
Research is the force behind this revolutionary expansion in oil's usefulness to mankind. Shell is preeminent in the field of research; its great laboratories across the nation are constantly seeking new and better products from petroleum.

The laboratories at the Wood River Refinery are an important link in this research chain. They can be divided into two categories, according to their purpose:

First, there is the product development and application laboratory, Shell's main facility for research in this field. This laboratory employs regularly about 135 highly skilled personnel. They use test engines and mechanical testing equipment of almost every conceivable kind to improve and develop new uses for all varieties of fuels and lubricants. In a complete chemical section of the research laboratory, other aspects of product development are constantly under investigation.

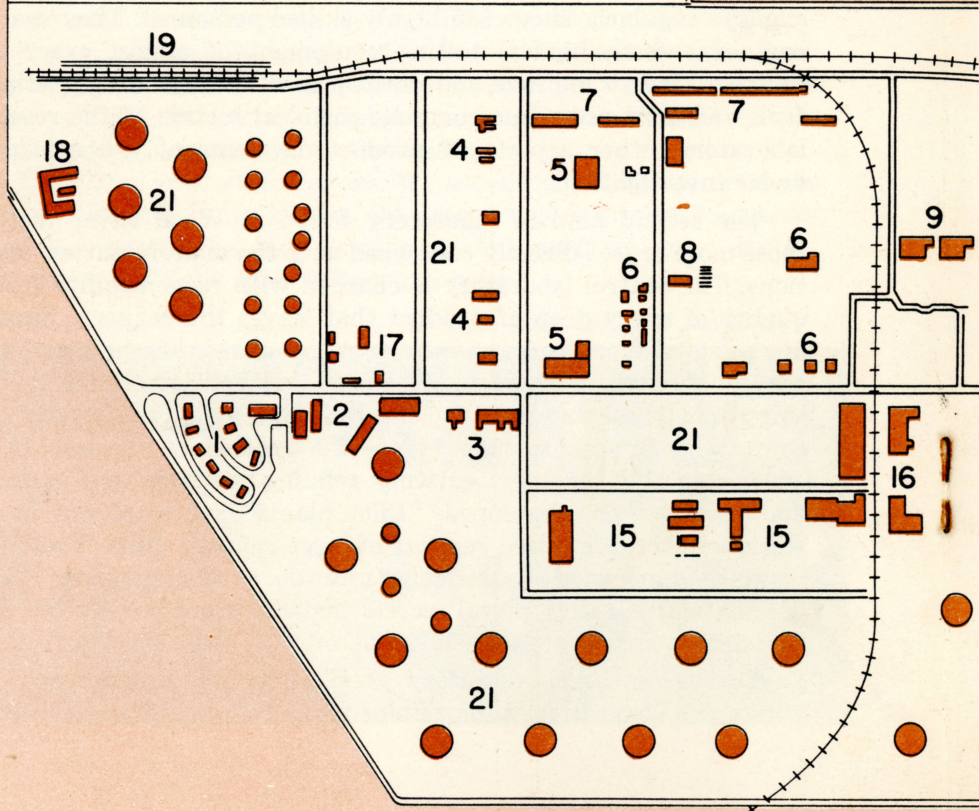
The second kind of laboratory found at Wood River includes those more or less directly concerned with the manufacturing operations. The control laboratory is charged with responsibility for the quality of every drop of product that leaves the refinery. Samples are removed from tanks at various stages of manufacture and from the tanks in which products are stored just before being loaded for shipment. These samples are checked for purity, uniformity, and conformity to specifications before the product is released. In the experimental laboratory, existing refining methods are improved and new methods developed. "Pilot plants" are employed in this work — laboratory-sized replicas of large refinery units. These pilot plants operate exactly as the larger units do, producing quarts instead of tankfuls; but they reveal secrets that could not be detected from the steel-and-concrete monsters out on the plant grounds.

To the research laboratory goes credit for a number of the "firsts" in Wood River's impressive record.



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clarity. Many

1. Main office
2. Main gate
garages
3. Control an

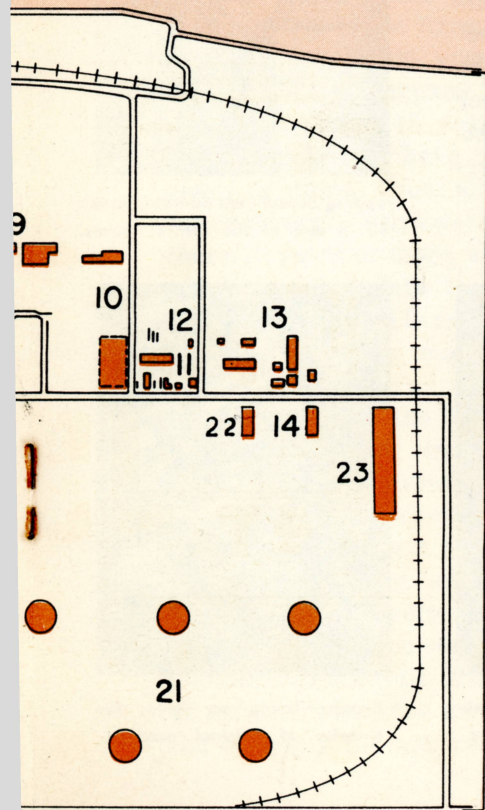


MAP OF
Wood River
 REFINERY

This drawing of the ground plan of the plant has been greatly simplified for the sake of clarity. (Many details have been omitted altogether.)

office building and staff houses
 gate, cafeteria, wash house, and
 restrooms
 control and experimental laboratories

4. Topping units, where crude oil is first separated into its various components
5. Mechanical shops
6. Thermal cracking units and vacuum flashing ("cat" cracker feed)
7. Cooling water towers
8. Gas plant
 9. Catalytic cracking plants
 10. Toluene plants
 11. Iso-octane plant
 12. Polymerization plant
 13. Alkylation plants
 14. Butane isomerization plant
 15. Lubricating oil plants
 16. Compounding and barreling house
 17. Light oil treating
 18. Product development and application research laboratory
 19. Railroad tank car loading racks
 20. Products pipe line pumping station
 21. Tanks and storage areas
 22. Catalytic desulfurization unit
 23. Car shops



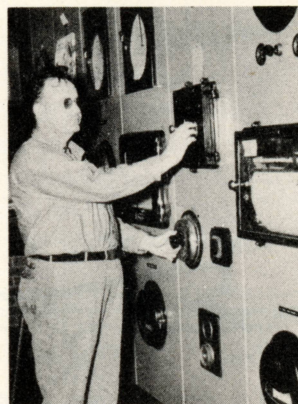


PERSONNEL

The Wood River Refinery has about 3,500 employees. Of this number, about 760 staff employees are necessary for engineering, research, development, and laboratory work; for bookkeeping and general office work; and for supervision. The remaining 2,740 or so are engaged in actually running the operating units and other equipment, on a three-shift, around-the-clock basis, keeping the stills, steam boilers, tanks, pumps, and other equipment in proper and safe condition; testing the products before shipment; and performing other plant duties.



Hard at work on after-coolers of plant's coker and reformer section.



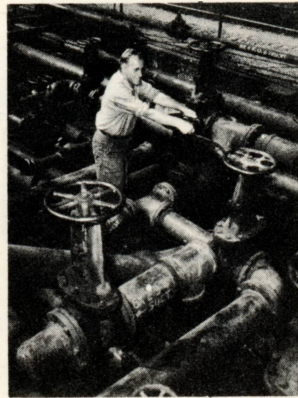
Topping department operator on the job in one of the control rooms.



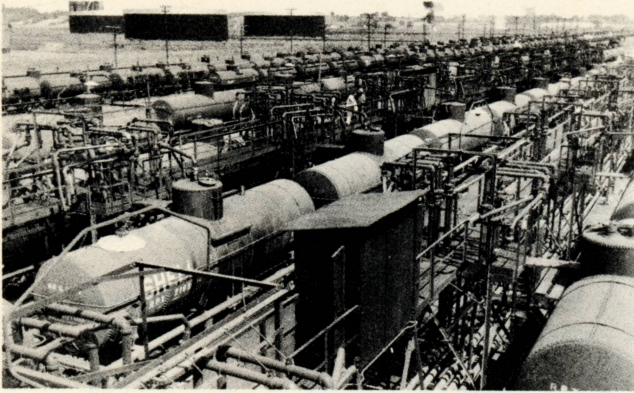
Repairman in the car shop flashes a smile at the camera.



Dubbs coke handler at work on steam and water manifold.



Pumper lining up valves for transfer of finished products.

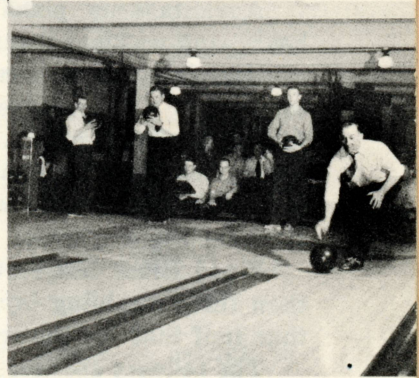


Many tank cars are loaded simultaneously at these racks.

The average wages of refinery workers are among the highest paid in manufacturing industry. The refinery's total payroll is approximately \$1,000,000 a month. The buying power it represents is a major factor in the economic life of Wood River, Alton, Roxana, Edwardsville, and other surrounding communities.

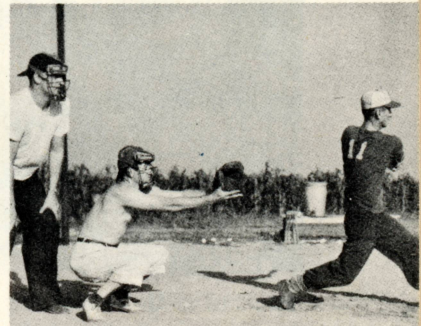
The management is particularly proud of the Wood River plant's old-timers. Over 1,600 employees have been with the company 10 years or longer; 940 over 15 years; 440 over 20 years; and 40 have been here 25 years or more. Thus, almost half of the refinery's employees have been there 10 years or more, and a number of oldsters antedate the refinery itself! Such a record is proof of friendly relations between management and employees.

Employees of the Wood River Refinery participate in an unusually complete and progressive program of benefits. In the Provident Fund, for example, Shell has a plan that makes saving both easy and exceedingly profitable. For every dollar an employee deposits, the company deposits another to his credit. After five years of service, when the employee leaves the company for any reason, he gets



Above: Down the alley in an all-day company bowling tournament at Alton. More than 300 Shell employees participated.

Below: Action during a softball game in the refinery's inter-department league.



back double his investment, plus compound interest.

A company-paid Pension Plan provides regular monthly payments for eligible retiring employees. After 20 years of service, men who reach 60 and women who reach 55 qualify for a pension without any cost to themselves.

All employees' with one to 15 years' service receive two weeks' vacation each year with pay; those with over 15 years' service, three weeks.

Advantageous plans for low-rate group life insurance and health-and-accident insurance are available to all employees.

Complete and modern facilities are provided for the health and comfort of all employees. A large cafeteria furnishes wholesome food at moderate prices. In the up-to-date emergency hospital, with a company doctor in charge, registered nurses are on duty 24 hours a day. Modern wash-house and bath facilities are maintained for all operating employees.

Wood River has an outstanding safety record. Its rate of less than three disabling injuries per million man-hours worked is less than half that for the refining industry as a whole.

The refinery sponsors a number of employees' athletic and social activities, in which plant personnel take an active interest. Over 40 bowling teams, softball, tennis, golf, and basketball teams are organized either on a departmental or plant basis. The refinery property contains softball diamonds and a tennis court. A Choral Club is quite active, and employees' social activities include dances, picnics, and outings.



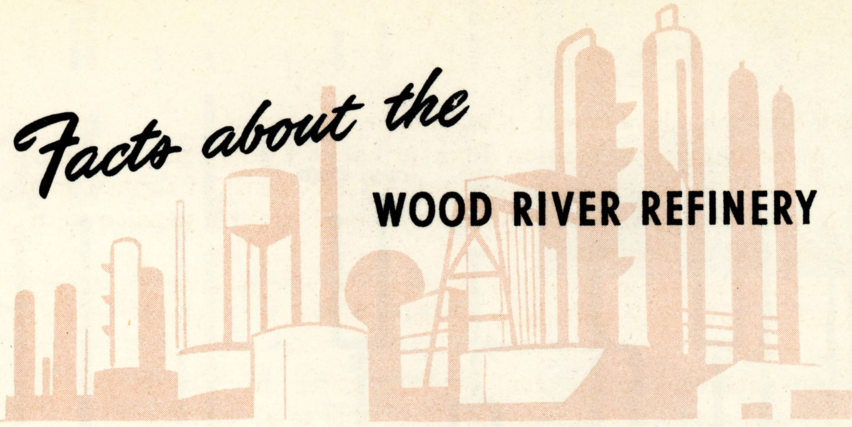
Left: Mrs. James Doolittle unveils Wood River memorial to 100-octane aviation fuel.



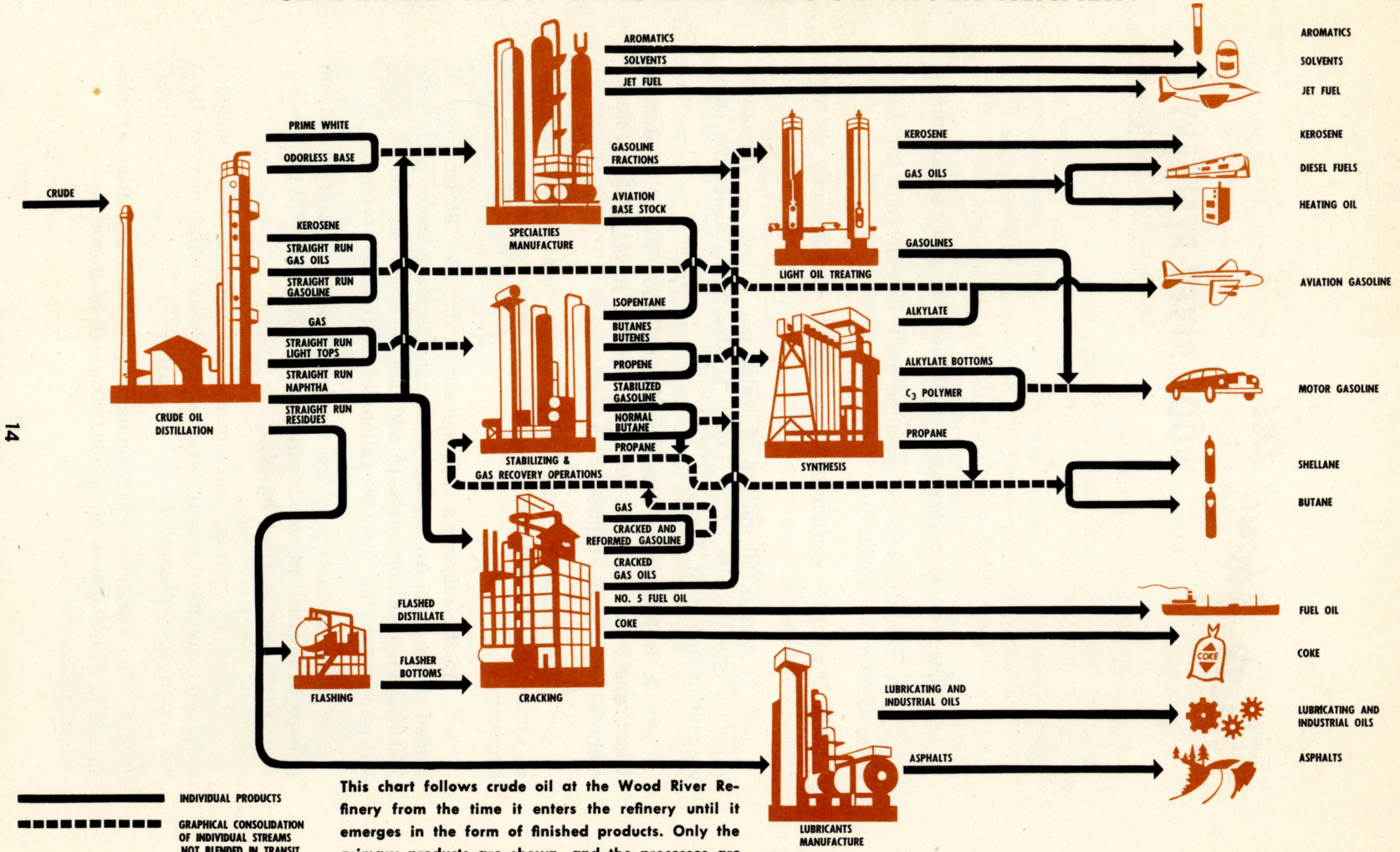
Right: Noon-hour on the horseshoe courts.

Facts about the

WOOD RIVER REFINERY

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- ✓ The refinery covers an area of more than two square miles.
 - ✓ It produces enough gasoline daily to run your car 1,000 times around the world.
 - ✓ It requires electric power enough to supply a city the size of Indianapolis.
 - ✓ It uses 6,700 gallons of water per minute — enough to supply a city the size of St. Louis. It also burns about the same amount of fuel as St. Louis.
 - ✓ A freight train extending from Wood River to Boston, Mass., and back to Detroit would be required to carry the products manufactured at the refinery in a single year.
 - ✓ The refinery's "tank farms" have a total storage capacity of approximately 300,000,000 gallons of crude oil and petroleum products.
 - ✓ At the refinery's railroad tank car racks, 95 cars can be loaded at one time. An average of 90 tank cars are loaded daily with 750,000 gallons of products. In addition, 60 trucks are loaded daily, with approximately 500,000 gallons of petroleum products.
 - ✓ The products pipe line transports approximately 2,200,000 gallons of finished products daily, and another 400,000 gallons per day are shipped by river barge.
 - ✓ Besides refining equipment, the complete plant includes machine, instrument repair, welding, carpenter, paint, electric, tank car repair, and other shops.
 - ✓ The warehouse keeps on hand spare parts and other articles valued at \$1,800,000 — plus \$400,000 worth of chemicals.

SIMPLIFIED FLOW DIAGRAM — WOOD RIVER REFINERY



This chart follows crude oil at the Wood River Refinery from the time it enters the refinery until it emerges in the form of finished products. Only the primary products are shown, and the processes are greatly simplified.

OTHER SHELL REFINERIES

Houston, Texas

Slightly smaller than Wood River, Shell's Houston refinery has a capacity over 90,000 barrels per day. It plans considerable expansion in the immediate future, including the construction of a new lubricating oil plant. Operated in conjunction with it is one of Shell Chemical Corporation's major plants for manufacturing chemical products from petroleum.

Norco, Louisiana

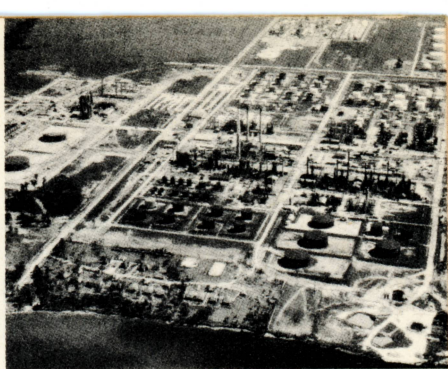
This refinery is about one-third the size of the Wood River plant and manufactures a smaller variety of products. The center of a rather isolated community, Norco is known particularly for its "family" atmosphere and the number and variety of its employee activities.

Wilmington-Dominguez, California

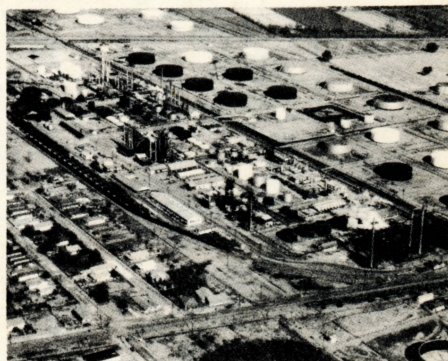
Really one refinery, although it spreads out over two distinct areas not far apart. Its refining facilities approximate those at Houston. It was originally established to handle crude from Shell's Ventura and Signal Hill oil fields.

Martinez, California

About half the size of the Wood River refinery, Martinez manufactures a diversity of products, including lubricating oil, grease and asphalt. It is slightly older than Wood River, having begun operations in 1916.



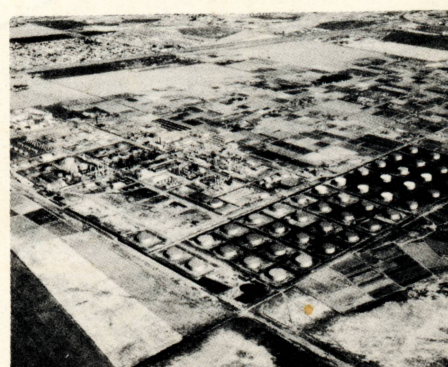
Houston, Texas



Norco, Louisiana



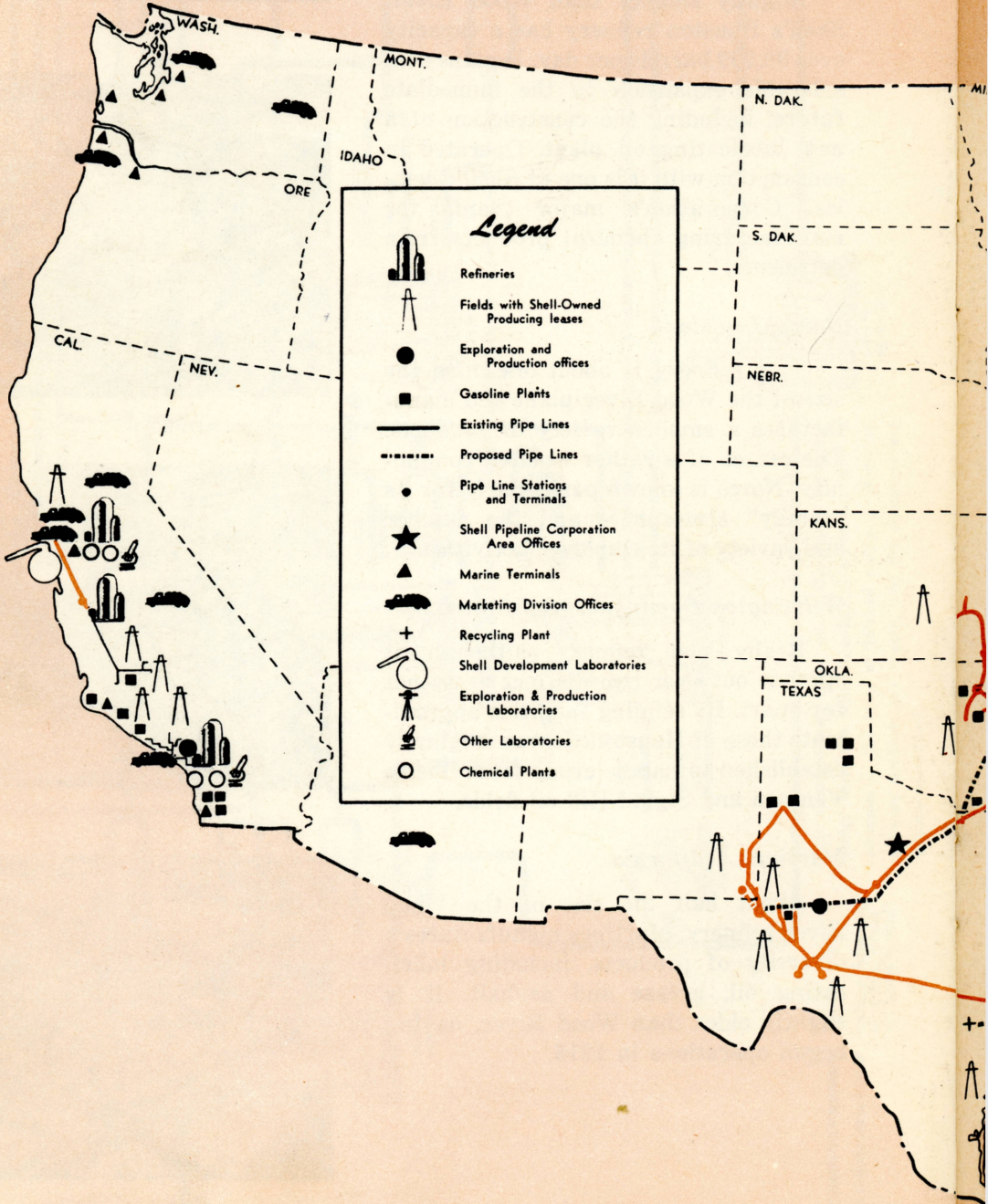
Wilmington-Dominguez, Calif.



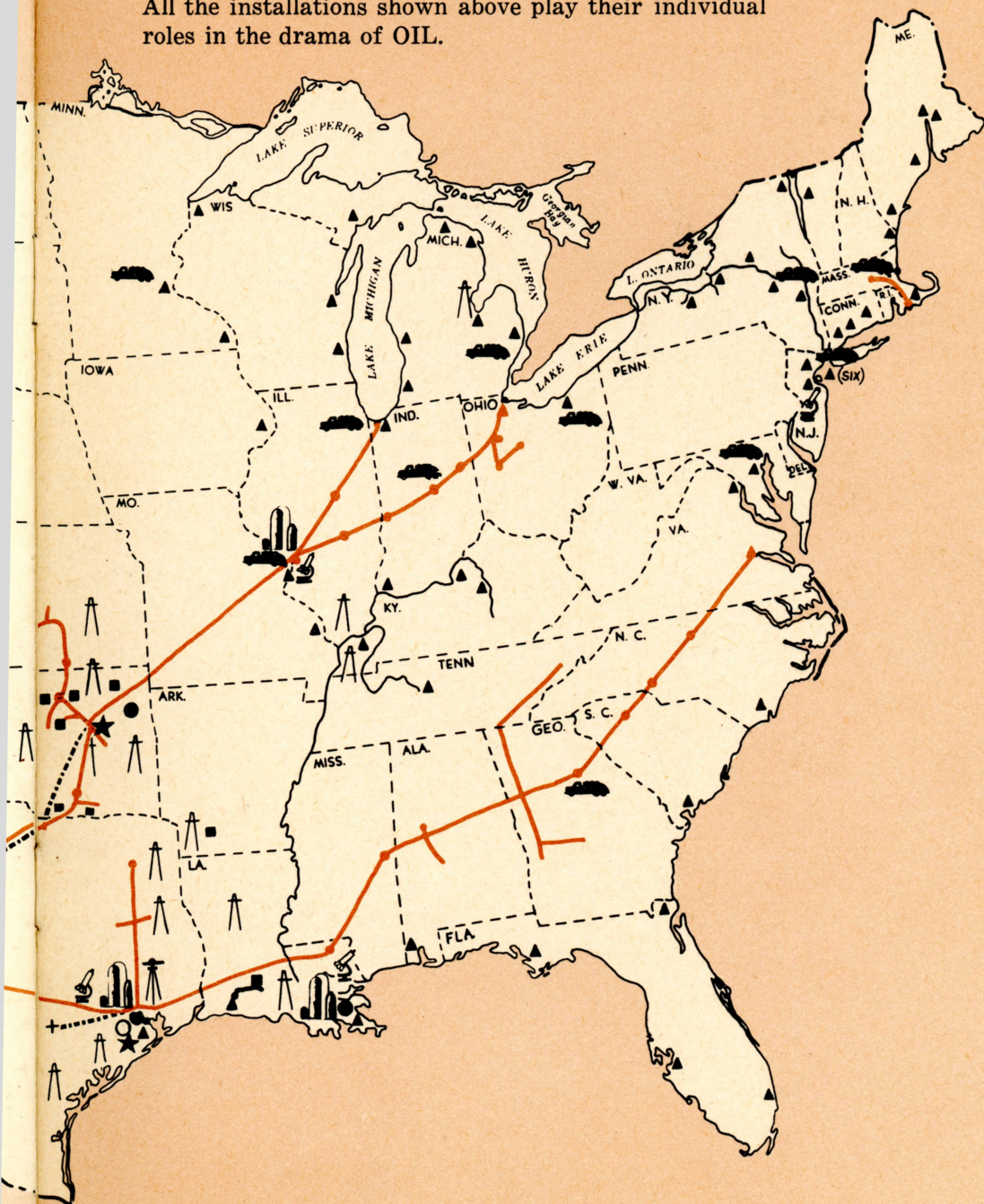
Martinez, California

NATIONWIDE

Refining is only one phase of Shell's vast and complex operations — as can be seen from this map. First of all, oil is found by the Exploration Department. Then wells are drilled, and crude oil is produced from them. Through pipe lines, barges, or tankers, the crude oil is carried



to the refineries, where it is transformed into useful products. Another network of transportation goes into action to bring these products to consumers of every kind, who are serviced by the Marketing Department. All the installations shown above play their individual roles in the drama of OIL.



We hope you enjoyed your visit