

SHELL NEWS

JUNE 1956



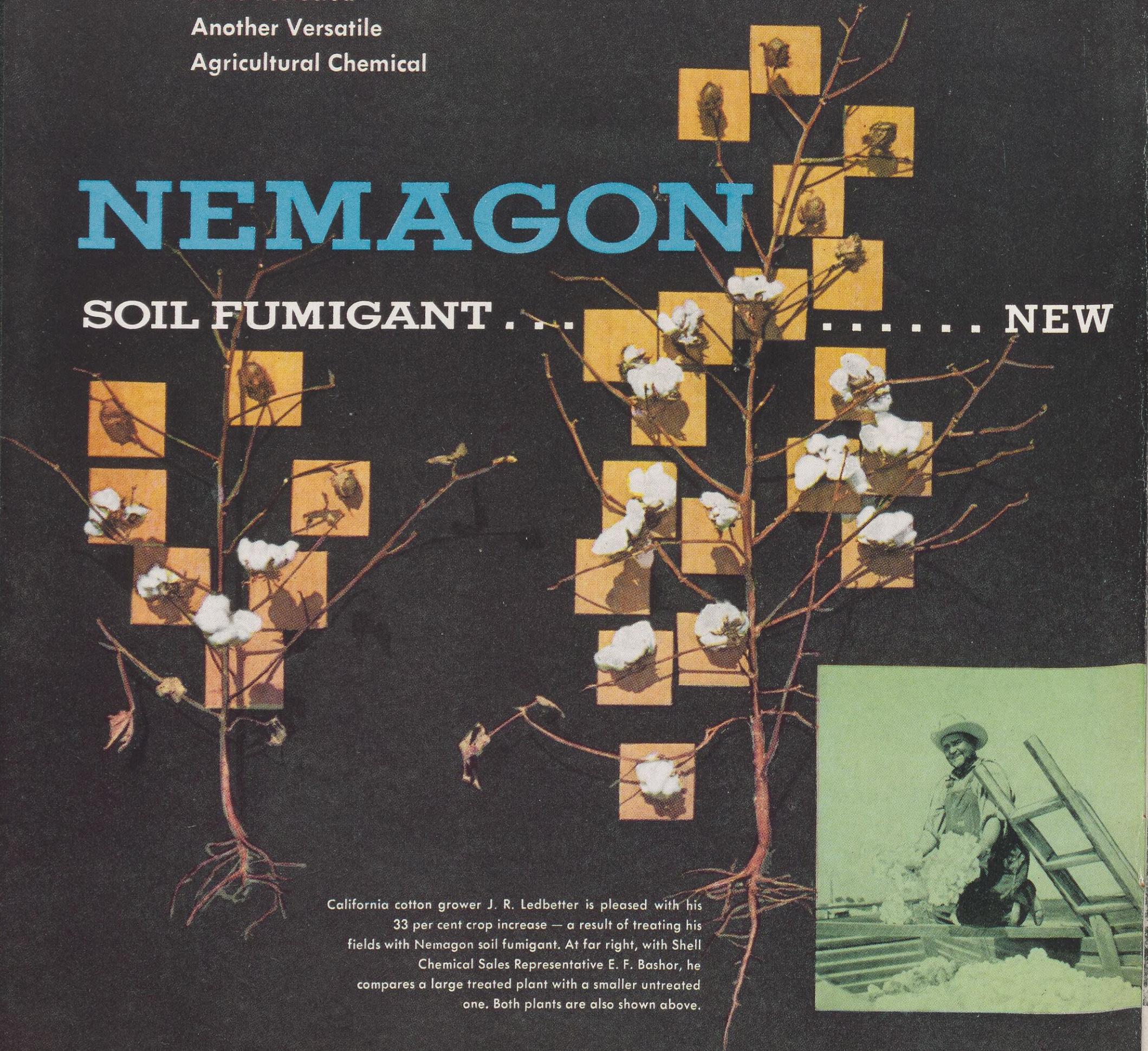
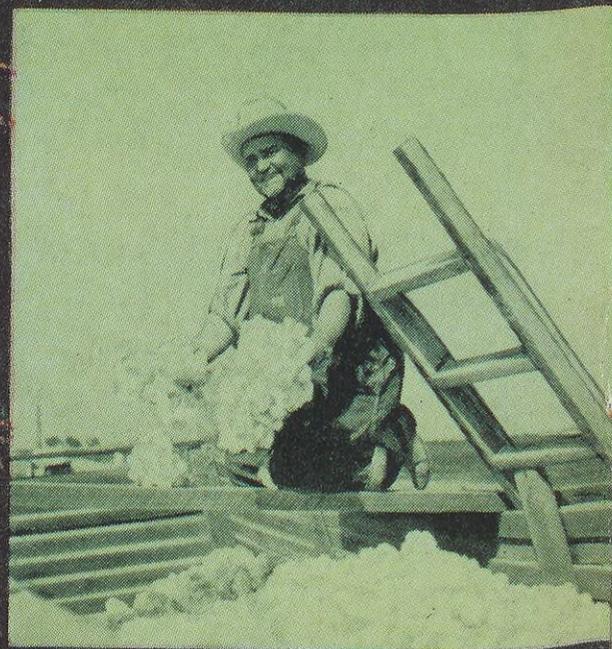
WELL TEST AT ELK CITY

After Years of
Research and Testing,
Shell Scientists
Have Perfected
Another Versatile
Agricultural Chemical

NEMAGON

SOIL FUMIGANT NEW

California cotton grower J. R. Ledbetter is pleased with his 33 per cent crop increase — a result of treating his fields with Nemagon soil fumigant. At far right, with Shell Chemical Sales Representative E. F. Bashor, he compares a large treated plant with a smaller untreated one. Both plants are also shown above.



SHELL NEWS

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Dedicated to the principle that the interests of employees and employer are mutual and inseparable

Employee Communications Department
New York, N. Y.

contents

Nemagon Soil Fumigant	1
Summer Scholars	4
The Industrial Atom	6
Close Watch on the Line	10
Asphalt to Alaska	14
Albany and Atlanta Marketing Divisions Organization Charts	16
Persians with a Pedigree	18
Spirited Specialties	20
Shell People in the News	22
They Have Retired	23
Fountain Head	24
Coast to Coast	26
Service Birthdays	29

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FEELING PRODUCTION'S PULSE

The man adjusting a valve on this month's front cover, W. J. Freudiger, is a Subsurface Analyst. His job is to check the pressure at the bottom of wells in the Elk City (Oklahoma) Field to make sure the special techniques used there result in the optimum ultimate recovery of liquid hydrocarbons. Shell and other operators in the field have unitized their leases in order to gain maximum production and at the same time conserve natural resources.

An effective new weapon has been developed by Shell Development Company in the continuing war against greedy nematodes, tiny worm-like parasites that feed mostly on the underground parts of plants. It is called NEMAGON* Soil Fumigant and is now available to farmers from coast to coast.

Soil scientists estimate that nematodes gobble up about 10 per cent of the U. S. farmers' gross income each year. In 1954, this amounted to more than three billion dollars in crop damage. With two of Shell Chemical Corporation's potent products—D-D® and Nemagon soil fumigants—plus increased efforts for nematode control among farmers everywhere, the long and costly reign of the nematode as the king of crop killers now appears to be definitely threatened.

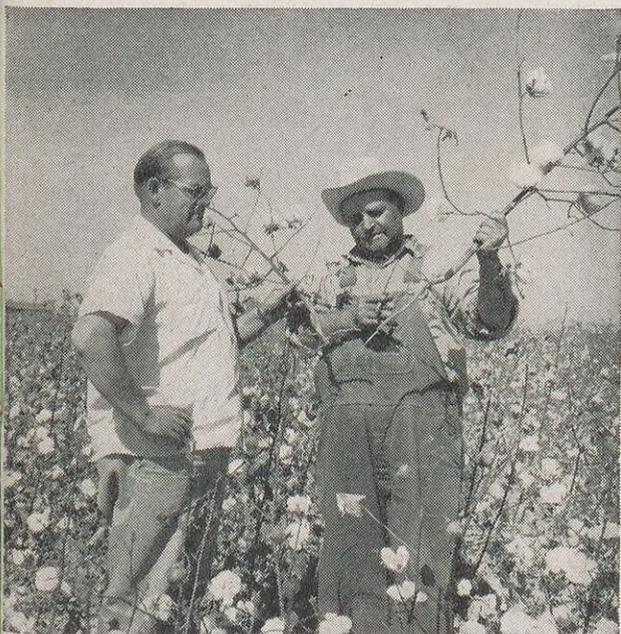
NEMESIS FOR CROP KILLERS

Nematodes were first identified in the 18th century, but for more than a hundred years bacteria, fungi, inadequate fertilizer or soil conditioning were falsely blamed for damage caused by them. It wasn't until the beginning of the present century that scientists turned their attention to the nematode problem.

Several different chemicals were tried in the nematode war, but without much success. However, agricultural scientists did discover two effective methods of combating nematodes under certain conditions. One was crop rotation, but this had a major drawback in that the alternate crop was often less profitable. The other method was to let nematode infested fields lie fallow for one summer. Farmers also objected to this method because, in addition to the monetary loss, it worked well only when rainfall was light and summer temperatures were high.

The first significant gains in the war against nematodes were made in 1946 when Shell Chemical, after years of research and testing, started marketing D-D soil fumigant. The chemical was an immediate success as a nematode killer. Applied to the soil before planting, it was used for many crops and has been especially successful in pineapple and tobacco fields.

The success of D-D did not stop nematode research at Shell Development's Agricultural Research Division laboratories. As a result, the more versatile



* Trademark Shell Chemical Corporation



The peach tree was among the plants "tolerant" to Nemagon soil fumigant in tests at Shell Development Company's Agricultural Laboratory at Modesto, California. Here Nematologist C. W. McBeth, left, examines a thriving peach seedling which is growing in a small plot of Nemagon-treated soil and Plant Pathologist W. A. Kreutzer studies a small and sickly seedling which was planted at the same time in soil infested with nematodes.

Nemagon soil fumigant went on the market early this year.

The chemical compound, 1,2-dibromo-3-chloropropane, which is the main ingredient of the new product, was mentioned as far back as 1861, when a chemist named Reboul published a note on its physical properties in a German chemical journal. Over three-quarters of a century went by before Shell Development's Modesto Agricultural Laboratory, in the process of testing a number of chemicals for their ability to control nematodes, noted that this one was much better than the rest. Further tests confirmed its effective performance. Even such tough customers as the sugar-beet nematode, which dries up in a ball and forms a tough protective cyst when conditions are unfavorable,

could not resist it.

After the new soil fumigant had passed numerous laboratory tests, both Shell Development and Shell Chemical started extensive field trials in 1953. These were conducted throughout the United States in conjunction with the U. S. Department of Agriculture, state agricultural experiment stations and private growers of cotton, tobacco, peaches, citrus fruits, vegetables, strawberries, flowers and shrubs. Selected individual homeowners tested the fumigant on their lawns during the experiments.

During a three-year test period, the new chemical was used on 91 crops in 43 states and Hawaii. A few crops, such as tobacco, onions, garlic and potatoes, show sensitivity to the new nematocide and are not on the list

of the chemical's recommended uses. In most cases, however, the crops thrived at dosages which gave excellent control of nematodes.

In 1955, Shell Chemical's Denver Plant started manufacturing Nemagon soil fumigant in quantity and the Agricultural Chemicals Sales Division launched an experimental sales program. Meanwhile, further field tests on still more crops helped to point out new and promising applications of the chemical.

A unique characteristic of this new nematocide is that it can be applied to many living plants, whereas D-D and other brands of soil fumigants must be applied to the soil before planting. In the past, citrus growers found the cost of uprooting, fumigating and replanting their groves to be exorbitant, though some of them tried it as a last resort. Now they can use Nemagon around their trees and get the same results at much less cost.

The Nemagon product is also used as a pre-planting fumigant and can be injected into the soil with the same power equipment used to apply other soil fumigants. But more simply and at less cost, it can also be applied in granular form. On most lawns and



ornamental plants it can be used in liquid form as a drench. Its versatility has been further increased by a recent method of application—impregnating fertilizer granules with it. Thus, the farmer can fertilize his fields and kill nematodes at the same time.

In cotton fields infested with root-knot nematodes, tests proved the new fumigant to be more than a match for the tiny pests. For example, in a California experiment where Nemagon was used in pre-planting treatment, 92.3 per cent of the nematodes were destroyed. A yield of 1.79 bales of lint per acre amounted to an increase of nearly half a bale an acre over an adjacent untreated plot. The cost of treatment was about \$16.50, but the estimated net profit as a direct result of the treatment was \$62.22 per acre.

The success of the field tests and the experimental sales program made it possible for Shell Chemical to start nation-wide marketing of the new soil fumigant in January of this year. Even though the chemical is now



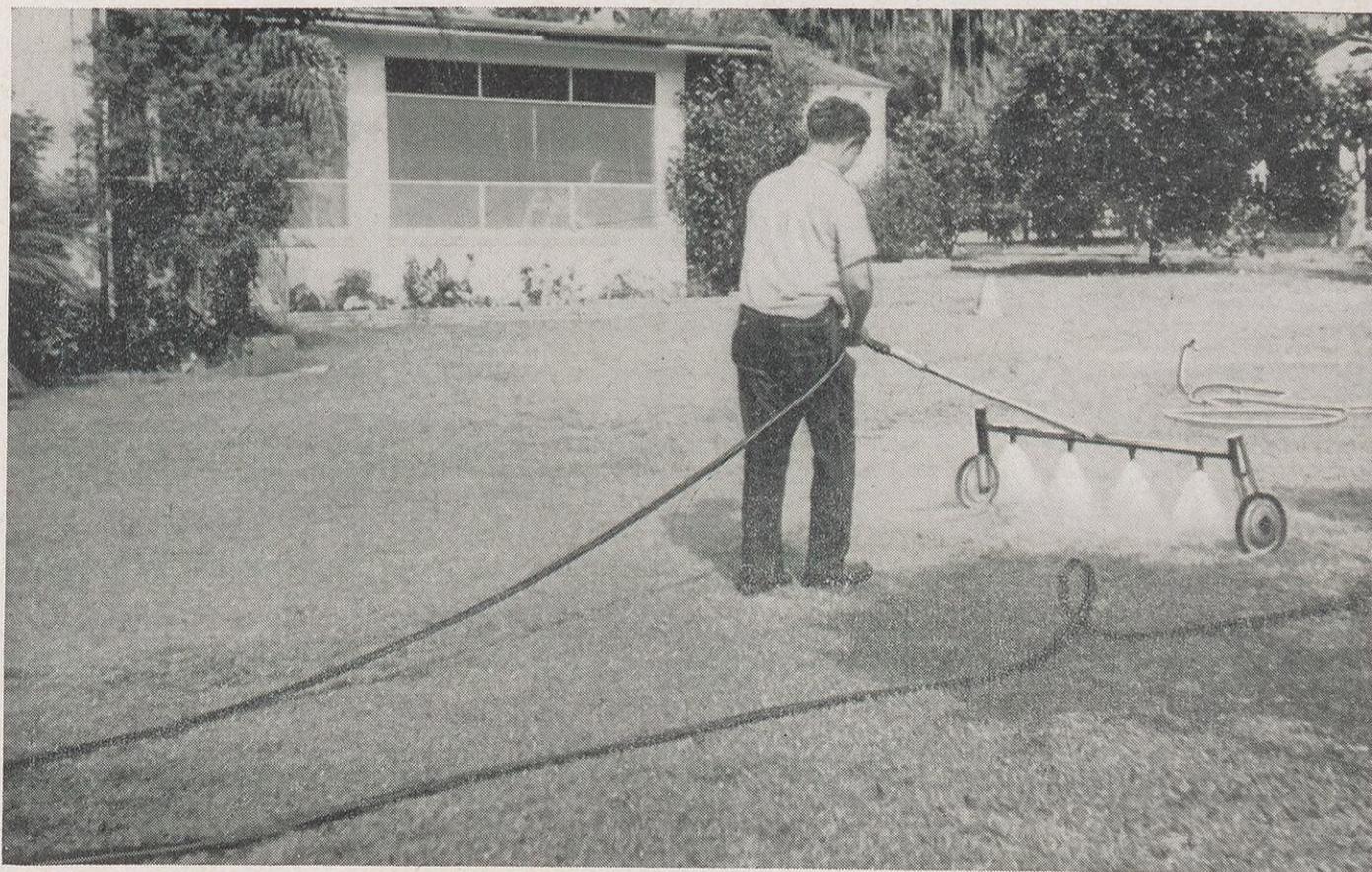
Tests conducted with the cooperation of a Florida nursery proved Nemagon soil fumigant's effectiveness in promoting the growth of ornamental plants in nematode-infested soil. Here a nurseryman holds treated, left, and untreated ornamentals, commonly called snake plants.

being used by farmers throughout the United States, tests are still being conducted—the results of which are being passed on to consumers through formulators and distributors.

An important weapon in the

farmers' battle against nematodes, Nemagon soil fumigant has not ended the war. Shell's agricultural researchers are still working in laboratories in the search for even better chemicals for destroying nematodes.

At left, the ravages of the nematode are shown in samples of treated (the larger specimen) and untreated Centipede lawn grass. Nematodes attacked the roots of the smaller, stunting the grass and giving it a burned look. The larger, Nemagon-treated grass has long, healthy roots and is green and sturdy. At right, a growing lawn in Winter Park, Florida, is being sprayed with Nemagon soil fumigant—an advantageous feature of the new product since several well-known nematocides can only be used before lawns or crops are planted.



Summer Scholars

*Sixty High School Science and Mathematics Teachers Will Gain
New Inspiration and Knowledge Under Shell Merit Fellowships*

MISS ALLENE ARCHER is a high school mathematics teacher at Richmond, Virginia, who adds a third dimension to her teaching.

Miss Archer, a teacher for more than 30 years, found while she was instructing handicapped children that visual aids worked wonders in helping students learn. The same aids worked equally well, she found, among her mathematics students at Richmond's Thomas Jefferson High School—so well, says one student, that “they make math interesting, and it becomes easier to understand.”

Using plastic, paper, wood and string to put meaning into mathematics has led easily into using the same materials for visual aids in classes to help fellow teachers gain new instruction ideas. So now Miss Archer is an acknowledged expert in visual aids. She also is a good example of the high caliber of the 60 high school science and mathematics teachers who have been awarded Shell Merit Fellowships for study this summer.

Miss Archer is one of the 30 who teach in states east of the Mississippi River who will go to Cornell University. The other 30, who teach in states west of the Mississippi, will study at Stanford University. The Shell Companies Foundation, Incorporated, is underwriting the special fellowships, but the 60 recipients were selected by the two universities from more than 2,000 applicants. The 60 teachers will attend summer seminar courses, hear lectures by outstanding scientists, and visit industrial plants and research laboratories.

Each of the Fellowship winners will receive from Shell a travel allowance, all fees, tuition and living expenses, and in addition will get \$500 in cash to make up for loss of potential summer earnings.

The objective of the Merit Fellowships is to give fresh inspiration to outstanding science and mathematics teachers, who in turn may lead more students to careers in science or in teaching science. The art of inspiring students is no accidental accomplishment, being a blending of enthusiasm and knowledge—a blending now needed more than ever because of the decreasing number of students majoring



Miss Allene Archer, a mathematics teacher at Thomas Jefferson High School in Richmond, Virginia, is considered an expert in making and using visual teaching aids such as those shown here. She will be among 30 high school teachers studying this summer at Cornell University on Shell Merit Fellowships.



F. D. Reinoldson, one of the 30 Shell Merit Fellowship winners who will study this summer at Stanford University, explains a molecular model to student Loretta Wasson. Reinoldson teaches at San Lorenzo (California) High School.

in science courses at a time when industry needs more and more engineers and scientists.

Aimed as they are at encouraging American teachers everywhere, the Shell Fellowships this summer will number among their recipients teachers from Hawaii, Canada, the Canal Zone and Puerto Rico, as well as 41 states.

And a variety of teaching methods are represented. For example, F. D. Reinoldson of the San Lorenzo (California) High School concentrates on giving his students a firm foundation in fundamentals, while Jacob Skilken of Cincinnati believes in a freer hand in individual student projects. Skilken teaches at Walnut High School, which admits only outstanding students. There he encourages pupils to develop their scientific knowledge and curiosity by undertaking special experiments on their own. He, too, undertakes experiments in education, incorporating new teaching techniques into his class work. In one class he is giving only college level material.

Reinoldson and Skilken, as well as the rest of the 60 summer scholars, will be encouraged to devote a part

of their Shell Merit Fellowship study to any phase of their work which they feel needs special research or attention.

Those who will attend Cornell University, and the communities where they teach, are:

- DELAWARE: Martin Roberts, Smyra.
- FLORIDA: Lloyd D. Remington, Pinellas Park.
- ILLINOIS: Leroy Sachs, East St. Louis; Miss D. Ruth Greenwald, Highland Park; Miss Alice Boon, Sullivan.
- INDIANA: Mrs. Jennie Howe, Indianapolis; Elmer L. Watkins, Muncie.
- KENTUCKY: William J. Elliott, Fort Thomas.
- MARYLAND: Lewin A. Wheat, Chestertown.
- MASSACHUSETTS: John B. Sbraga, Holyoke.
- MICHIGAN: Lester D. Anderson, Grand Rapids.
- MISSISSIPPI: Miss Mary Catherine Alexander, Laurel.
- NEW HAMPSHIRE: Brother Amedy Francis Martin, Manchester.
- NEW JERSEY: Norman Krapf, Vineland.
- NEW YORK: Louis Alper, New York City; Alfred B. Heermans, Iliion; Louis Auerbach, New York City; Paul M. Shaver, Sodus.
- NORTH CAROLINA: Henry A. Shannon, Garner.
- OHIO: Jacob Skilken, Cincinnati.
- PENNSYLVANIA: Benjamin Karp, Philadelphia; Robert C. Matzen, Pittsburgh.
- PUERTO RICO: Mrs. Lucia R. Tirado, Lares.

RHODE ISLAND: George McCahey, Providence.

SOUTH CAROLINA: Mrs. May Denton, Columbia; David J. Haigler, Saint Matthews.

VERMONT: Leslie MacDonald, West Woodstock.

VIRGINIA: Franklin Kizer, Norfolk; Miss Allene Archer, Richmond.

WISCONSIN: Thomas Ritzinger, Rice Lake.

Those who will attend Stanford University are:

ARIZONA: Kenneth R. Beals, Phoenix.

CALIFORNIA: Robert R. Coombs, Bakersfield; Mark R. Jacobs, Marysville; Fred D. Reinoldson, Oakland.

CANADA: Stanley Norris, Cayley, Alberta.

CANAL ZONE: Lester D. Hummel, Balboa.

COLORADO: Lawrence D. Lynch, Denver.

HAWAII: Katashi Nose, Lihue, Kauai.

IDAHO: Virgil W. Vail, Nampa.

IOWA: Robert G. Phipps, Clinton.

KANSAS: Jacob B. Speery, Chapman.

LOUISIANA: John A. Manning, Natchitoches.

MINNESOTA: Bertine A. Whiting, Two Harbors.

MISSOURI: Harold C. Hein, Springfield.

MONTANA: Bruce D. Johnson, Helena.

NEBRASKA: Ervin H. Hoffard, York.

NEVADA: Miss E'Lois I. Campbell, Reno.

NEW MEXICO: Robert L. Starkey, Carlsbad.

NORTH DAKOTA: Raymond C. Yeasley, Bismarck.

OKLAHOMA: The Rev. Alfred J. LaFleur, Tulsa.

OREGON: Michael A. Fiasca, Beaverton.

SOUTH DAKOTA: Lyle V. Sladek, Mitchell.

TEXAS: Allan R. Peach, Houston; Aurlocus C. Herald, Houston.

UTAH: Miss Eva A. Crangle, Salt Lake City; Harry H. Kemp, Logan.

WASHINGTON: Glen L. Crum, Puyallup; Morris W. Hutchinson, Everett; Harold E. Babcock, Wenatchee.

WYOMING: R. E. Lahti, Casper.

Jacob Skilken, right, encourages special self-initiated experiments by his students at Walnut High School in Cincinnati, Ohio. He will be in the Cornell University Group.



THE INDUSTRIAL

Atomic Power and Radioactive Materials Prove Valuable Allies



Laboratory Assistant A. F. Roscoe removes an irradiated rock sample from a lead-lined box at Shell Development Company's E & P Research Laboratory as Engineer C. W. Chapman stands by with a radiation detector.

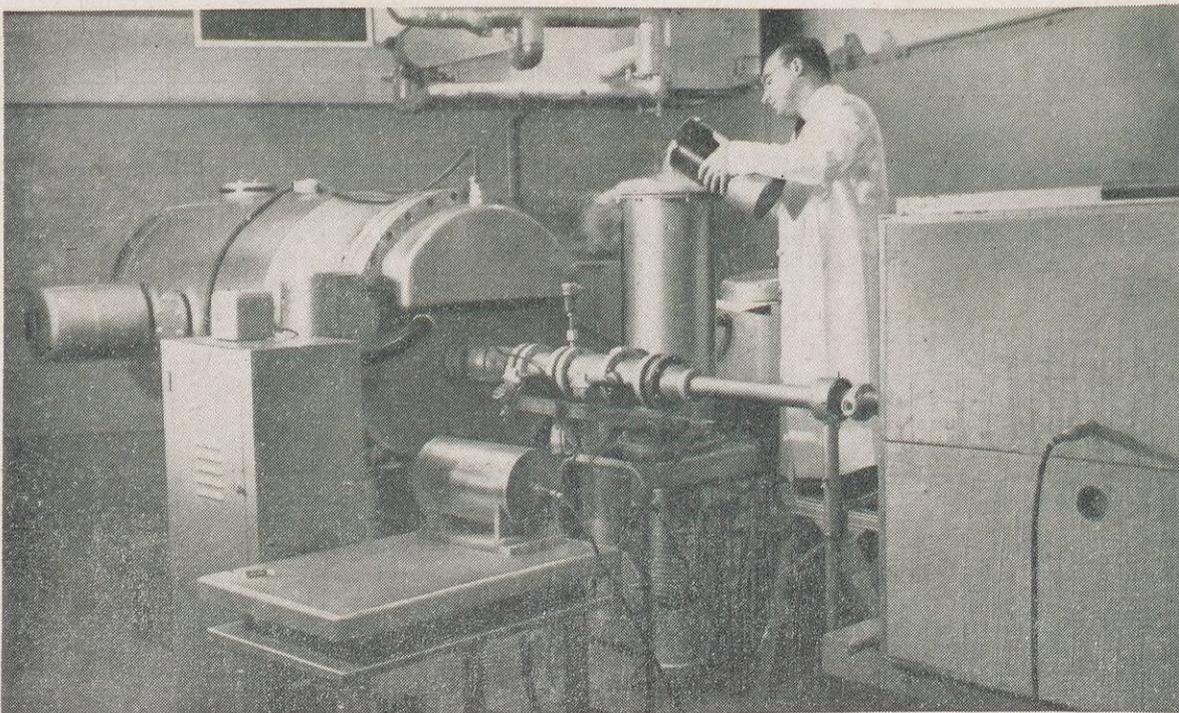
THE first decade of the Atomic Era hasn't answered all the questions of how atomic power will alter the future, but for the oil industry, at least, the last 10 years have brought assurance that the atom is a valuable ally in the industry's growth.

During the years since atomic power made its destructive debut, experience in harnessing it for constructive use has convinced experts that nuclear energy will supplement, not supplant, petroleum and other energy providers. And not only will the atom

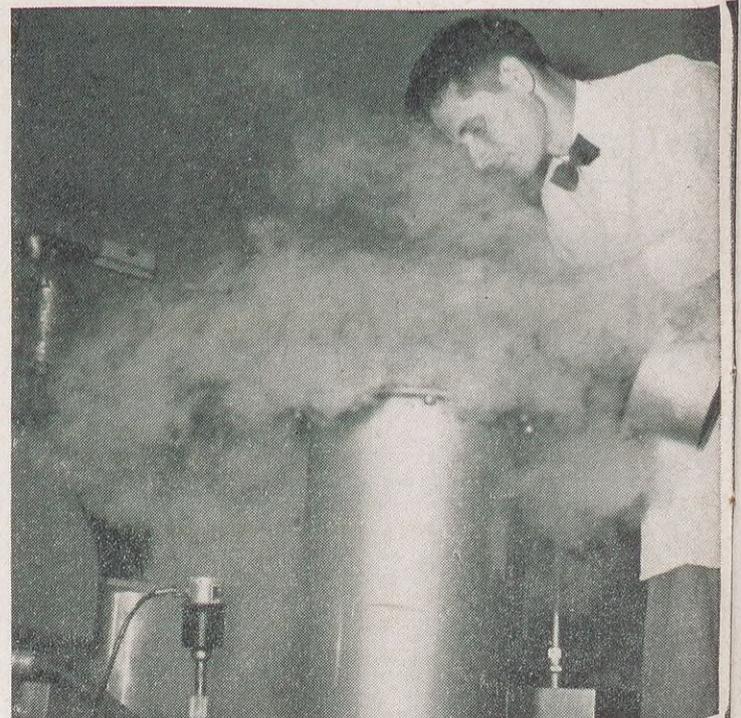
team with oil in providing energy, but atomic knowledge will make possible improved petroleum products—as it already is doing.

Educated guesses of what changes nuclear fission will bring in the future still vary widely. It would be as impossible today to make accurate predictions of the atomic future, for example, as it would have been to predict television after Benjamin Franklin flew his kite. It seems agreed, however, that the industrial and social changes to come probably will arrive slowly, because the technical problems involved in harnessing the atom's power, plus the huge investments tied up in present power sources, appear to put major atomic power installations many years away.

However, the first steps toward the atomic future have proved its poten-



This two-million volt Van de Graaff accelerator at the Houston Laboratory is used to "age" rocks by bombarding them with atomic particles shot from the accelerator, left, through the tube to the target box, right. Here Chemist D. R. Lewis sets up an "aging" experiment.



Chapman pours liquid nitrogen into the accelerator before "aging" begins. The nitrogen removes moisture from the tube.

ATOM

to the Oil and Other Industries

tial. The first civilian nuclear power plant is under construction at Shippingport, Pennsylvania, and others are in advanced planning stages. Two U. S. Navy submarines, the *Nautilus* and the *Seawolf*, move beneath the sea with atom-powered propellers. And the Atomic Energy Commission has approved industrial studies of a proposed atom-powered reciprocating engine, a power reactor of relatively small size and reactors for rural electrical systems' specialized needs.

As atomic sources increase, they will help close the gap between the world's energy needs and its present supply. The rising demand for energy is a major reason why the oil industry and the atom will be partners, not competitors, in the foreseeable future. As atomic energy is made available throughout the world, particularly in underdeveloped areas, standards of living will rise and new markets for petroleum should appear.

The atom as an industrial research and processing tool is still a youngster. Current major efforts are aimed at learning how to use it. The research under way in oil companies and in other industries ranges from the purely theoretical to the immediately practical. One of the most promising research projects is the rearrangement of the molecules in materials by bombarding them with atomic particles. This "atomic age alchemy" may create new and different products by rearranging nature's basic building blocks. Already plastics are made harder, foods kept fresh longer and medicines kept free of germs—by bombarding them with atomic particles.

A major research tool is the Van de Graaff particle accelerator. One of these powerful instruments already is in use at the Shell Development Com-

pany's Exploration and Production Research Laboratory at Houston. Another and even more powerful one soon will be in operation at the Company's Emeryville Research Center.

These accelerators operate like atomic machine guns. Their ammunition is nuclear particles each thousands of times smaller than an atom. These particles are accelerated by high-voltage electricity to almost the speed of light and are fired at the target material. Scientists have complete control of the direction and amount of atomic particles shot by the accelerator.

At the Houston Laboratory the two-million volt machine is used to "age" rocks by showering them with positive ions. The aging process, which takes nature millions of years, is accomplished in a matter of days in the laboratory. Researchers use information gained to learn more about the changes that took place when the rocks were formed—information that may help in the search for oil.

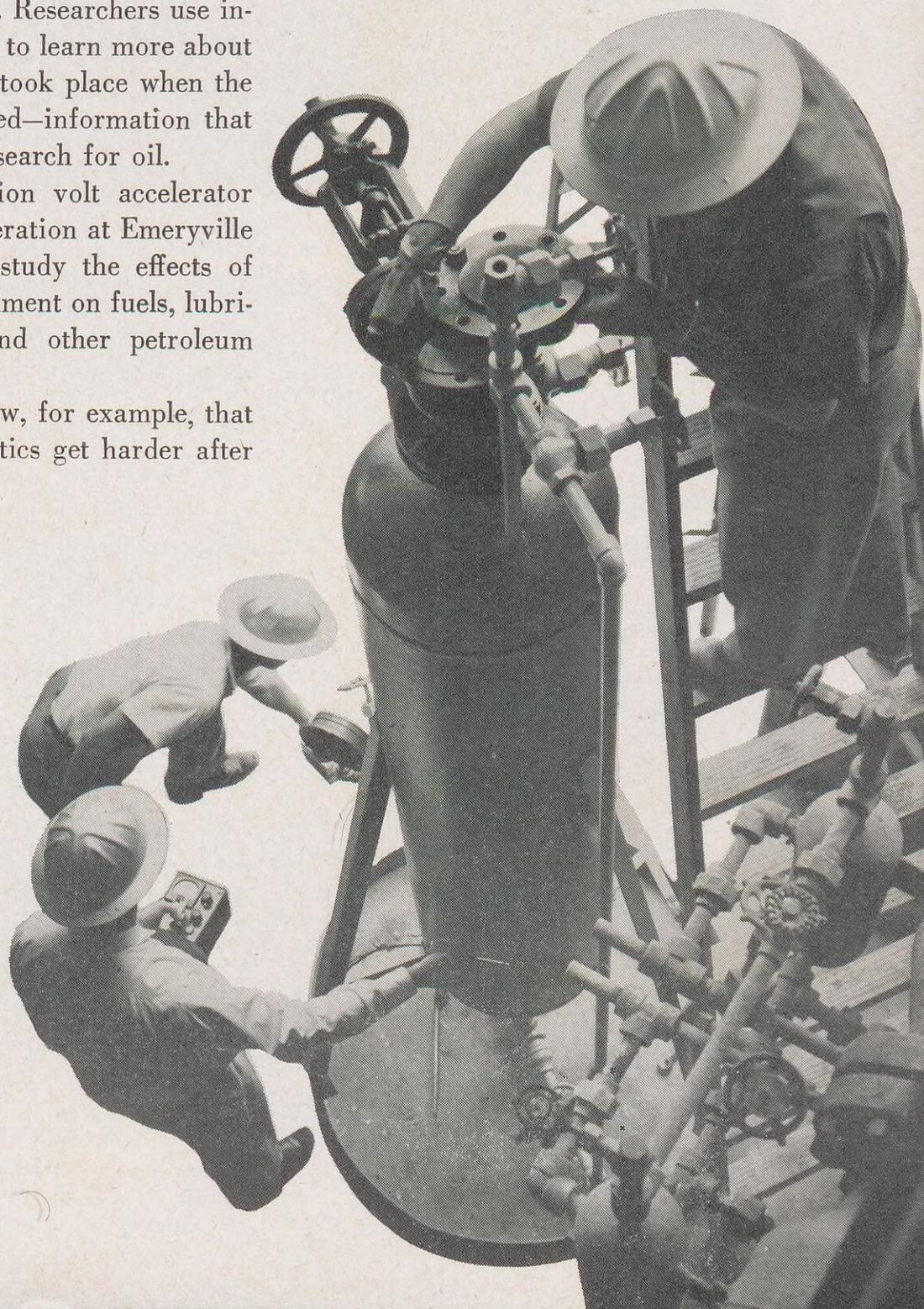
The three-million volt accelerator scheduled for operation at Emeryville will be used to study the effects of electron bombardment on fuels, lubricants, plastics and other petroleum products.

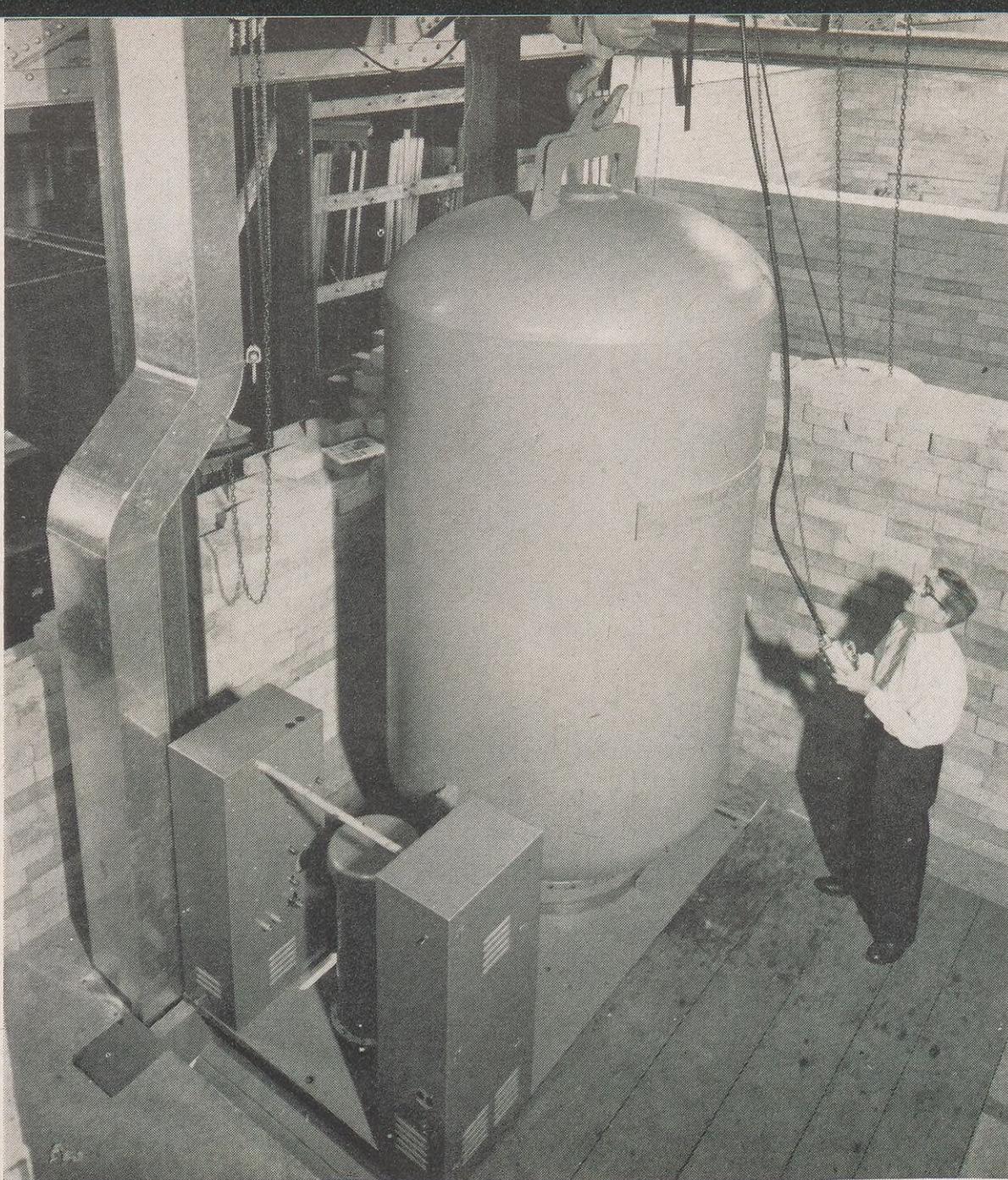
It is known now, for example, that polyethylene plastics get harder after

exposure to irradiation. Scientists say molecules of plastic are tied together loosely and need stronger atomic bonds to resist heat and pressure. A stream of electrons fired into this plastic knocks aside some atoms and allows others to cling tightly together. This changes wax-like plastic into a clear, hard substance. One of the best-known results is a plastic, unbreakable baby bottle which can be boiled without losing its shape.

The same technique also may produce better vulcanizing for tires and tubes. Scientists at an electrical equipment company have found that firing electrons into silicone gum converts

A pressurized vessel containing radioactive catalyst is connected to a processing unit at the Houston Refinery. The "hot" tracers are used to study phases of catalytic processes.



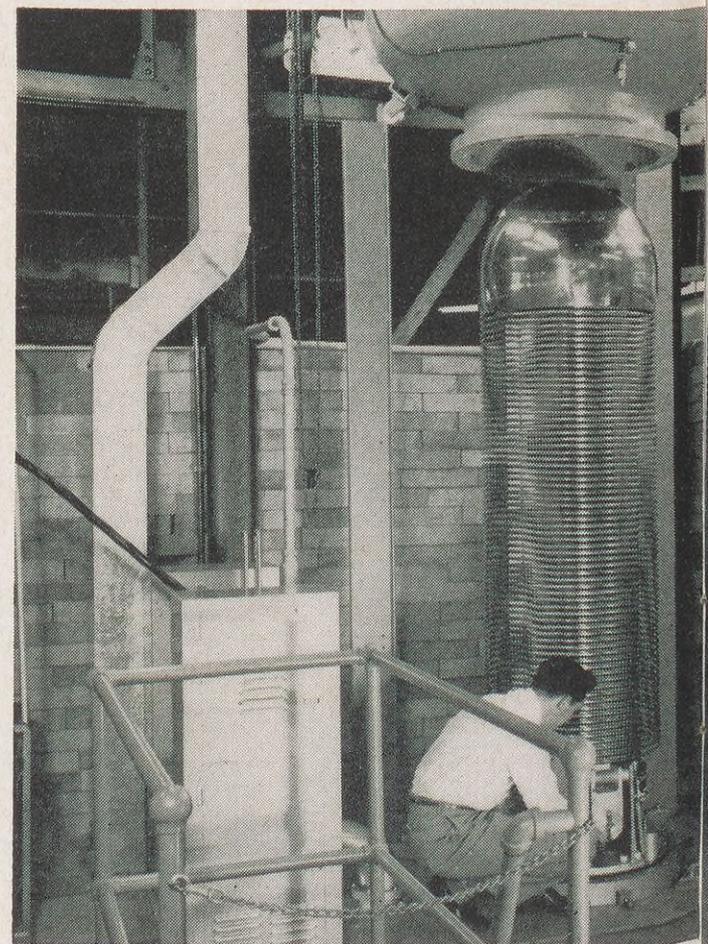


A thick metal bell surrounds a Van de Graaff accelerator shown at the manufacturer's plant. It is similar to one which is now being installed at Shell Development's Emeryville Research Center. It will be used to study the effects of electron bombardment on oil products.

it almost immediately into silicone rubber by rearranging the molecules. The laboratory tests produce better rubber faster, because silicone rubber vulcanized by conventional processes loses some desirable properties. The method is not ready for commercial application yet, but scientists predict it will become an important vulcanizing process in coming years.

Theoretically, the use of similar radiation treatment in the refining of crude oil could produce more high octane fuel from each barrel of oil. Catalytic cracking at refineries now breaks down big hydrocarbon molecules and rearranges them to form high-test gasoline. Battering the same king-sized molecules with atomic particles may do this job better and faster—though a practical way to refine large amounts of petroleum in this way is certainly years in the future.

Oversized hydrocarbon molecules are only one of the rapidly increasing number of targets for scientists who are redesigning nature with atomic energy. The field of experiment is expanding so fast that it may embrace



The heart of an accelerator, like the one being installed at Emeryville, is shown here with the metal bell hoisted above it. Electric charges

practically all major manufacturing processes in future years.

The research in the food industry, for example, ranges from altering seeds by radiation before planting to altering food molecules to allow long storage without spoilage. Many scientists believe different varieties of the same plant family were caused by the effect of solar radiation on seeds. Laboratory-controlled radiation can turn out countless thousands of altered seeds—some of which may start new and better plant varieties.

After food is harvested and processed, radiation may preserve it in storage. Again the molecules are rearranged by atomic particle bombardment—in some cases lengthening storage life without bad effects. But in other cases bombardment has not been satisfactory. The U. S. Army Quartermaster Corps reports such foods as beans, bacon and codfish respond well to the molecular battering; but others such as bananas, cheese and lettuce no longer taste or smell the same.

Another by-product of atomic

energy—the radioactive tracer—is being used by the oil industry in an ever-increasing variety of ways. For example, radioactive well logging is helping to find new oil reserves.

Radioactive particles, however, have little or no effect on products or processes when the particles are used as “hot” tracers in every-day industrial applications or in laboratory probing. U. S. industries are saving \$100 million a year in production costs by using these tracers, according to Atomic Energy Commissioner Joseph Campbell. He predicts the savings will keep increasing during the next 10 years.

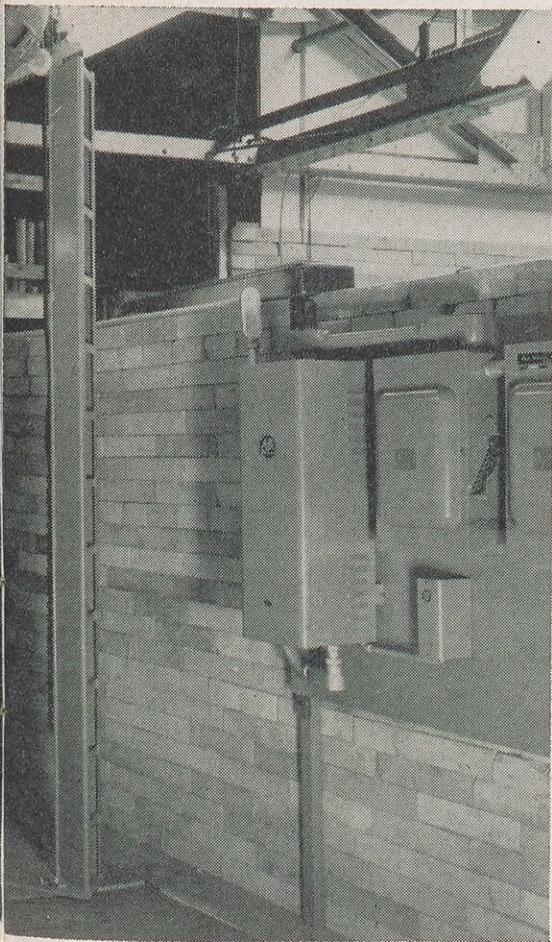
An example of this saving is Shell's use of radioactive cobalt to check welding of pipe line joints. Radiation from a capsule of cobalt 60 gives an X-ray picture of a weld and pinpoints any flaws. When the Butte Pipe Line was laid in Montana and Wyoming, the weld of every tenth pipe joint was checked by this form of radioactive X-raying. All welds of pipe to be laid under water were X-rayed by cobalt.

While moving petroleum through

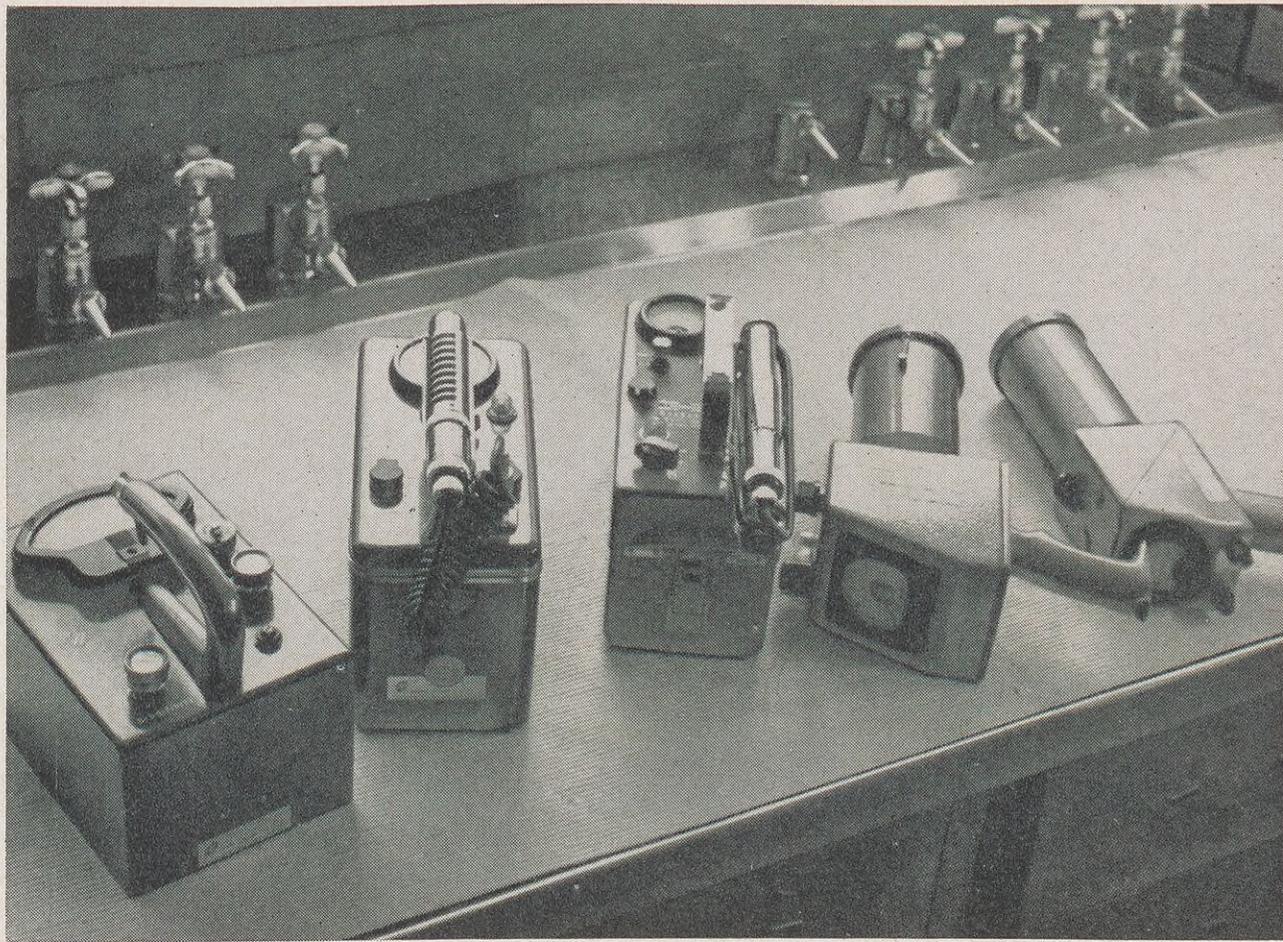
pipe lines, another oil company uses a radioactive antimony isotope to signal the end of one type of product and the start of the next. The antimony is put in an oil solution and injected into the line between product shipments. A Geiger counter at the next station alerts operators of approaching changes so they may turn the proper valves at the proper times without ever seeing what's in the line.

Radiation has become a valuable laboratory tool. At Shell Development's Emeryville Research Center, for example, tests of lubricants' ability to reduce gear wear by using irradiated gears are made in a fraction of the time—and give more accurate results—than was possible using former testing methods. Now the radioactive gears are run in the test lubricant, and minute metal particles worn off are detected immediately.

Such peacetime uses of the atom are triggering a chain reaction of their own as each new development or discovery opens new possibilities. As atomic uses expand, so do the horizons for industrial progress.



accelerate atomic particles within the coils to near the speed of light and fire them from the bottom of the machine.

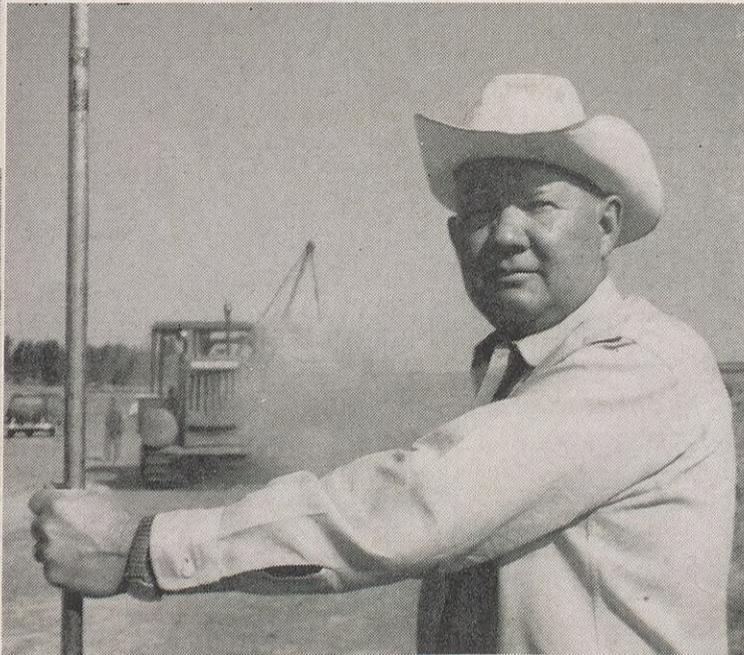


Important tools in the atomic age are instruments used to measure amounts of radioactivity and to insure safety in laboratories working with “hot” research materials. Here, left to right, are a Sampson counter, two Geiger counters and a pair of pistol-shaped radiation detectors known as “cutie pies.”

Close Watch on the Line

Each Inch of Pipe of a New Crude Oil Carrier

Gets a Careful Scrutiny Before and As It Goes Into the Ground



1. With the pipe line right-of-way cleared and the ditching machine slicing a groove across the state, Right-of-Way and Ditch Inspector H. H. McDonald holds a "range pole" to guide the ditching machine operator.

A SMALL, unprotected scratch on the surface of a pipe can, in time, cause a shutdown of a major pipe line. An infinitesimal flaw in the weld joining two lengths of pipe is an invitation to a weld fracture and expensive delays.

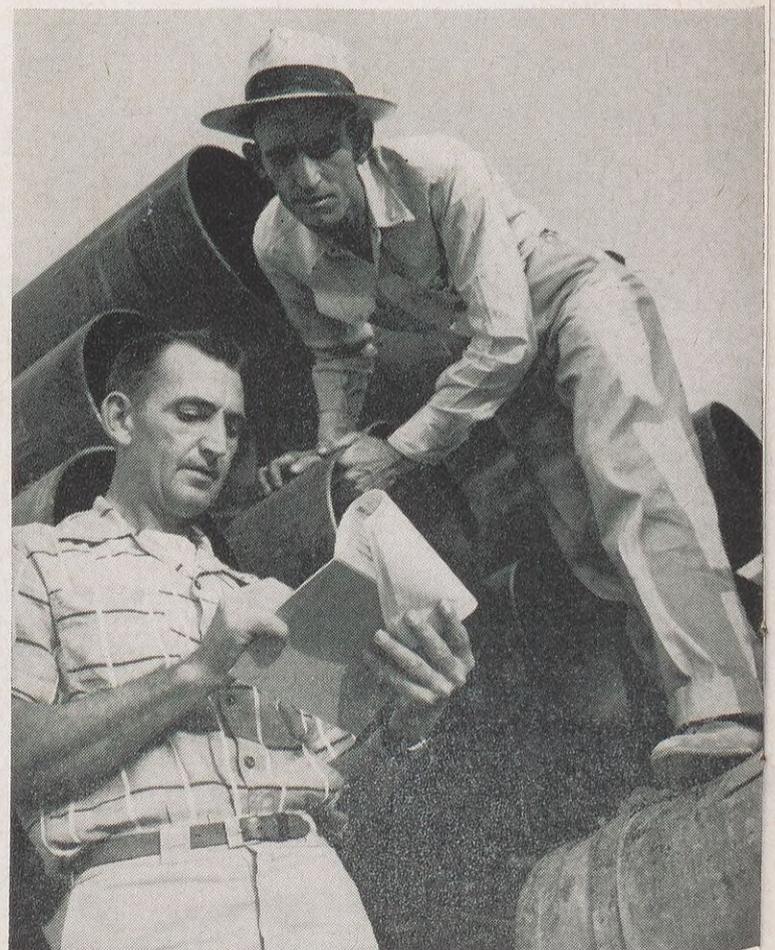
To forestall such trouble and to keep crude oil and products flowing in the lines it operates, Shell Pipe Line Corporation assigns a hawk-eyed crew of inspectors to watch each step in the

construction of new lines and to examine each length of pipe as it goes into the ground. They work side-by-side with the contractors' construction crews laying the lines.

The pictures on this and the following three pages show Shell Pipe Line inspectors in Wyoming as they carefully examined a new crude oil pipe line. The men shown inspected one of four sections of the new 450-mile Butte Pipe Line.



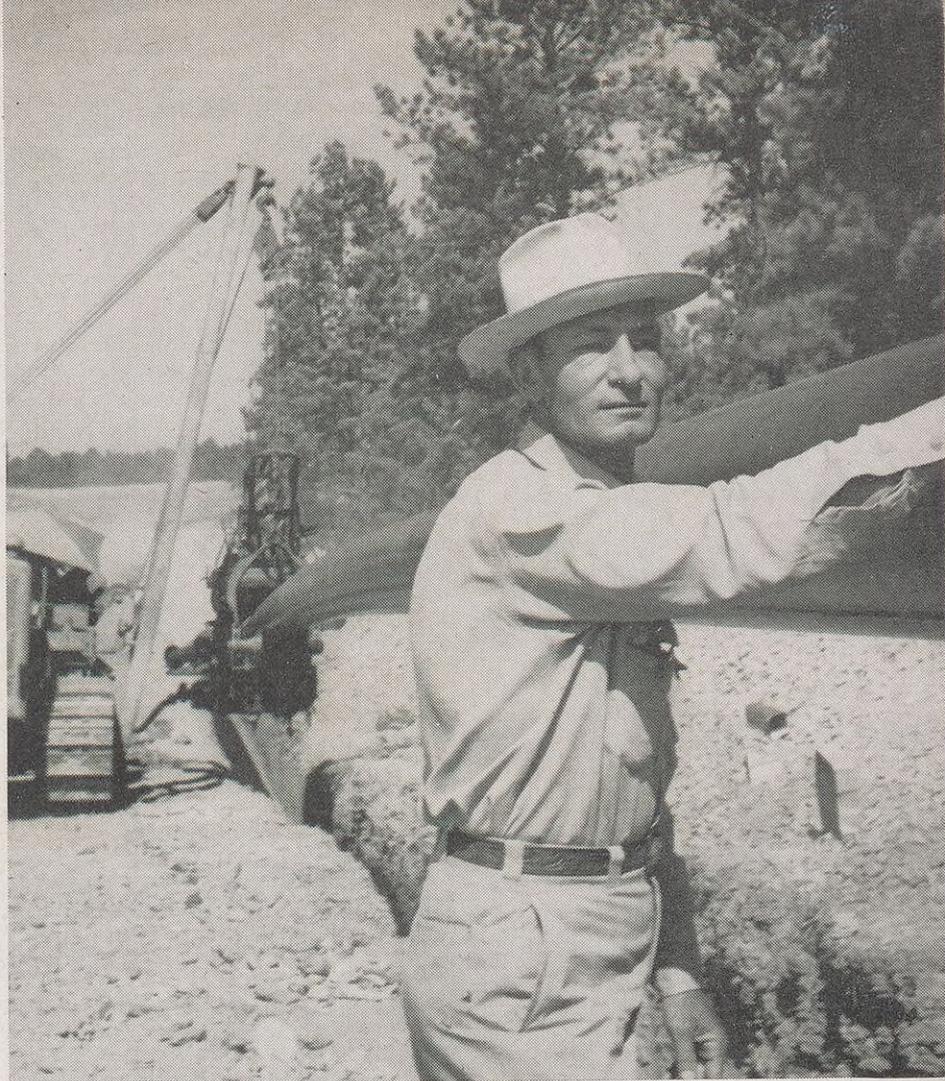
2. McDonald, right, with Chief Inspector Fred Harmon next to him, peers into the freshly dug ditch as the ditching machine moves on. C. P. Hamilton, contractor's superintendent, also checks it. The man in the ditch indicates its width and depth.



3. Not an inspector in title, but nevertheless a careful checker of pipe destined for the line, Storekeeper D. B. Boyd, lower left, checks out a load of pipe with a contractor's truck driver.



4. With the ditch dug, a "stringing" crew drops lengths of pipe along its route. Welding crews then join the pipe together. Here Welding Inspector J. L. Tuttle, using a hand mirror, examines the weld at the bottom of a joint. At least 10 per cent of the welds are given an X-ray examination for flaws, and all field welding of pipe which will eventually lie under water is X-rayed.



5. The first step in protecting the pipe is to apply a steaming hot priming coat of asphaltic "primer." Utility Inspector L. M. Glover examines the priming coat before a special wrapping finishes the protective coating. His job requires wide experience so he can pinch-hit in several inspecting jobs.



6. Following the priming coat, a doping and wrapping machine coats the pipe with hot asphaltic enamel and simultaneously wraps it with a protective "bandage" of tough felt-like material that resists moisture and other corrosive materials. Dope Inspector H. B. Williams makes sure this coating is not damaged and here, right, is shown watching workmen lower the coated and wrapped pipe into the ditch. Special care is taken to avoid getting dust between the layers of primer and enamel. If not satisfied, the inspector can order recoating and wrapping.



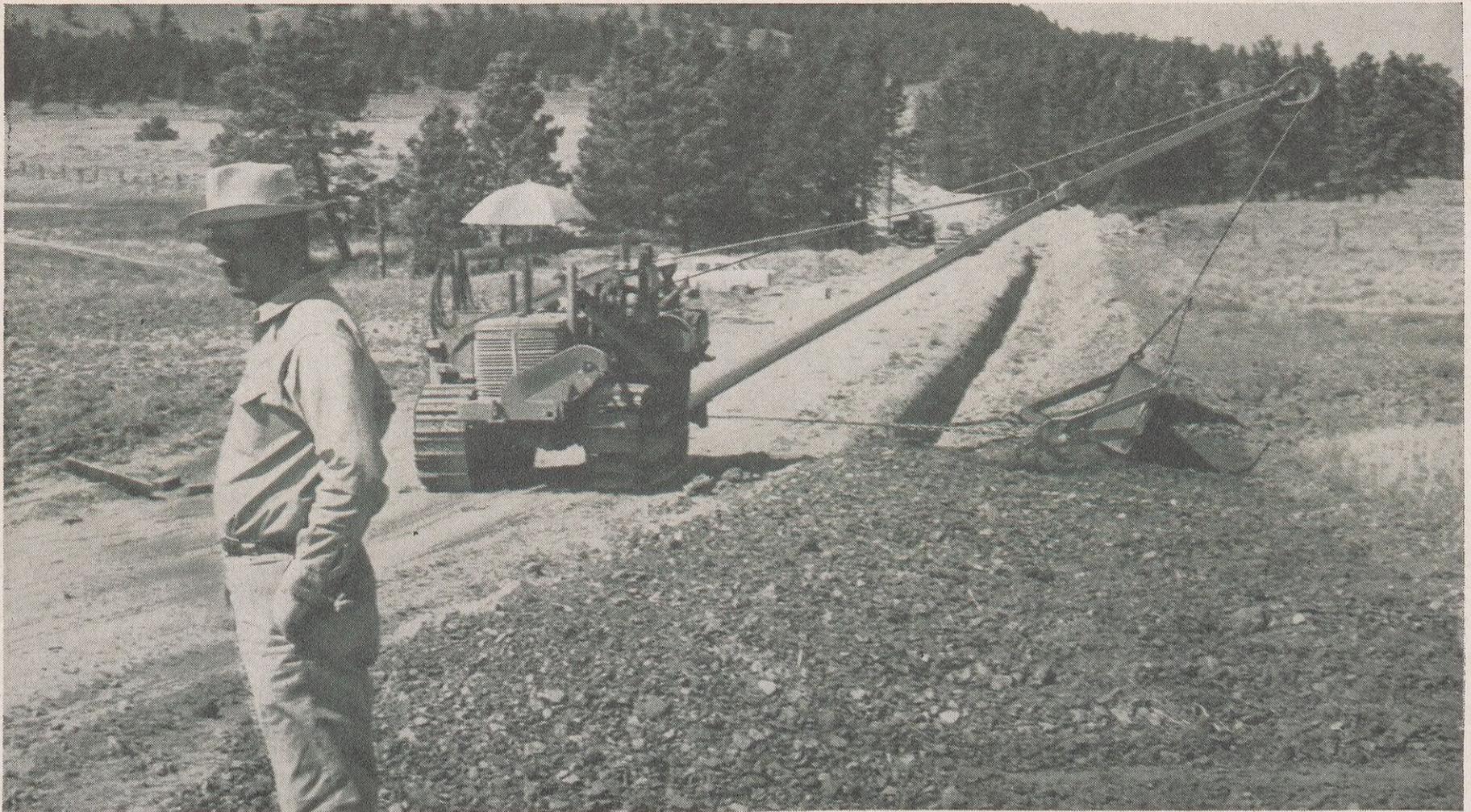
7. Meanwhile, prefabricated sections of pipe are bent to fit the contours of stream beds. They are laid already coated and wrapped. Here Tie-In Inspector C. W. Gold walks a tie-in section through a muddy stream bed.



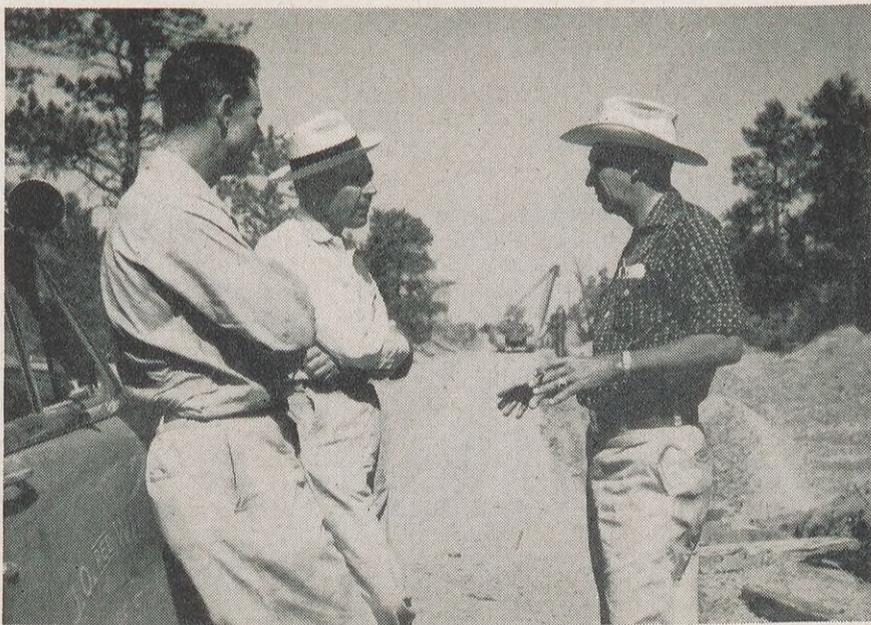
8. All pipe to go under rivers is first hydrostatically tested at 1,300 pounds of pressure per square inch before the pipe is laid. Chief Inspector Harmon, standing right, watches installation of a hydraulic pump which will test pipe in the background.

9. Tie-In Inspector Gold, right, watches workmen lower a prefabricated section of pipe which goes around a curve. He checks to see that the pipe fits properly to that already in the ditch. A poor fitting could cause a serious and expensive underground leak.



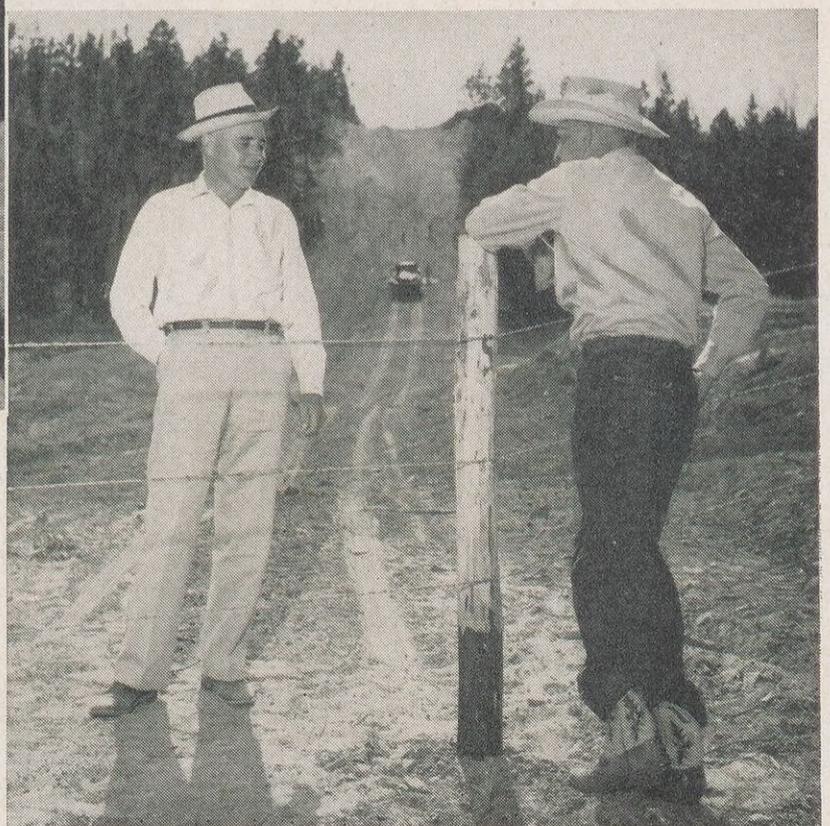


10. With the pipe line in the ditch, a backfilling machine begins dragging earth back into the ditch under the eye of Backfill Inspector C. E. Hart. He sees that the backfill material is free of sharp rocks and other objects that might damage the protective coating on the pipe. When the ditch is dug through rock, topsoil and small gravel must be hauled to cover the pipe, preventing punctures. The backfill inspector also sees that as nearly as possible a farmer's land is left in as good or better condition than it was before the ditch was dug.



11. Right-of-Way Man R. E. Shaw, right, discusses a problem with Harmon and a contractor's representative. On the line from start to finish, Shaw acts as liaison with land owners. He remains after line is completed to settle possible claims.

12. The pipe line secure beneath the ground, Harmon chats with a rancher about a new fence that has been built as a clean-up truck puts finishing touches on the right-of-way in the distance. Fences torn out to make way for the pipe line construction are duplicated when replaced. They are often better fences than the old.



Asphalt to Alaska

Battling Heavy Seas, A Tugboat and Special Barge

Open A New Outlet for Bulk Supplies of Shell Asphalt

DURING the warm summer months, the tugboat *Wando* bucks the high seas on pioneering voyages between Shell's Willbridge Terminal at Portland, Oregon, and Anchorage, Alaska. On each trip she tows a barge filled with 20,000 barrels of bulk asphalt.

The versatility of asphalt, as well as its relatively low cost, have made it an important paving and construction material in booming Alaska. It is used mainly on streets, highways and airport landing strips—all vital links in transportation and communication during the territory's long, bitter winters.

Prior to the barge shipments, asphalt was transported to Alaska in 55-gallon drums. Since it solidified at normal temperatures, it had to be heated in the drums before being used—a slow, expensive and wasteful process.

In 1953, however, two Anchorage contractors organized the Alaska Asphalt Company to tackle the problem of getting asphalt to Alaska in bulk, so it could be pumped in storage tanks and transferred to trucks or tank cars for easier delivery in workable condition to construction sites. For aid in planning the project, they called on J. C. Dalton, then Asphalt Manager of the Portland Marketing Division. (Now in a similar position in the San Francisco Division.)

Dalton called in A. C. Saul, Manager of the Transportation and Supplies Organization for the West Coast.

Saul arranged for transportation of the asphalt in a compartmented barge lined with coils through which hot oil could be pumped at the destination. The heat from the coils melts the asphalt. As the barge was prepared, the Alaskan partners started construction of terminal and supply facilities at Anchorage.

In July 1954, the *Wando* moved

slowly down the Columbia River from the Willbridge Terminal on her way to the Pacific and the first long haul of asphalt in bulk to Alaska. Heavy seas and fog caused the barge to disappear from view for days at a time during the 2,000-mile voyage; only the steady pull on the cable told the tug crew that the cargo of asphalt was still with them.

The Wando tows her asphalt-laden barge away from Shell's Willbridge Terminal on the first leg of a trip to Alaska. The barge has a draft of 17 feet, but the cargo of asphalt—the heaviest of petroleum products—leaves as little as a foot of freeboard above water.





Bulk shipments of asphalt to the booming Territory of Alaska—pioneered by the Alaska Asphalt Company, with the aid of Shell marketing specialists—make possible easier and less expensive deliveries of the product in workable condition to paving projects such as this.

After more than a week of pitching and rolling, the small vessel and her tow reached the town of Portlock at the mouth of Cook Inlet—doorway to Anchorage. There she waited seven more days for the dock facilities to be completed. Then, as she was pulling in, stout four-inch hawsers connecting the *Wando* with the new docks broke against the pull of the fast-ebbing tide. The tug and barge went aground only 30 feet from their destination.

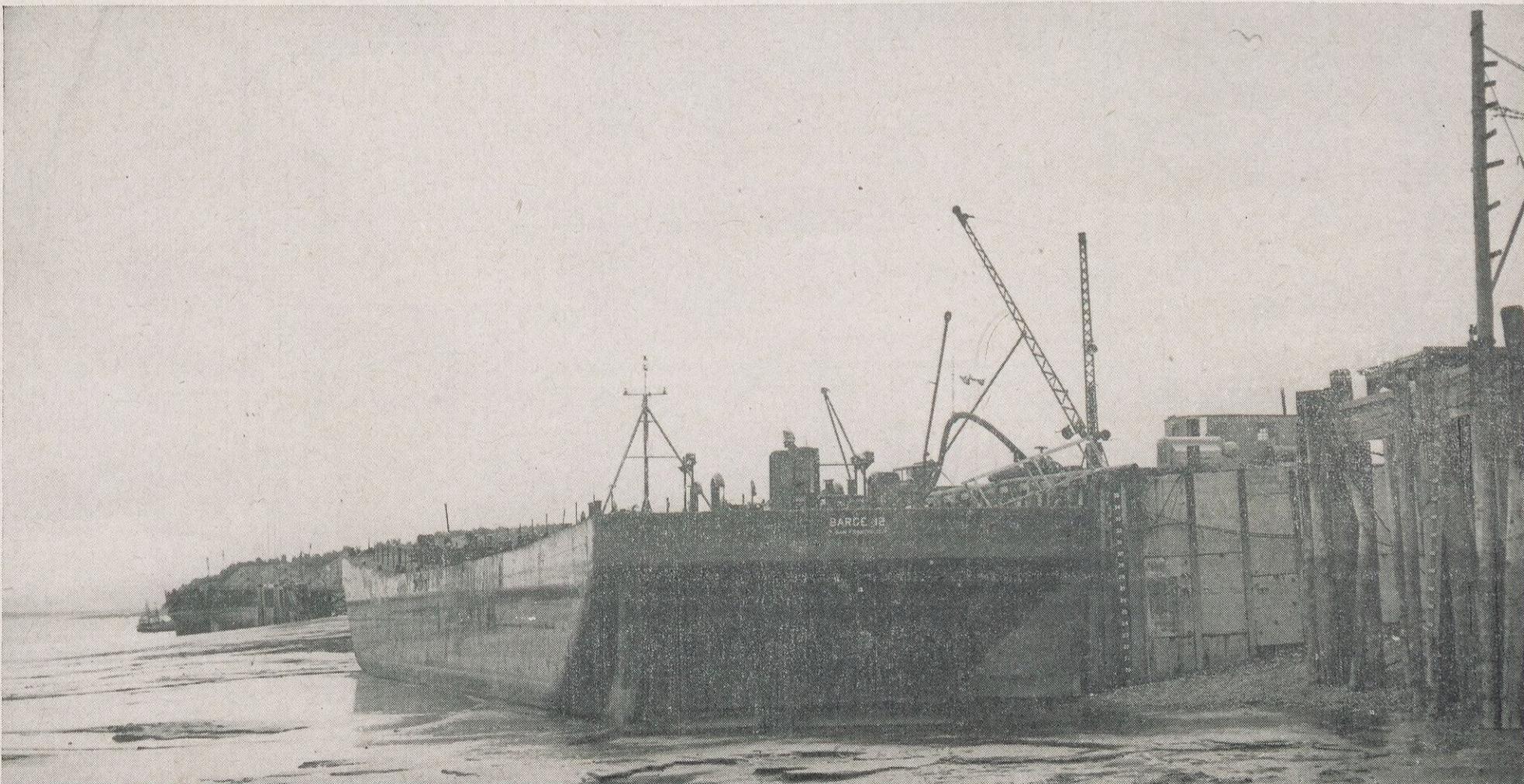
Finally, 18 days after leaving Will-bridge, the barge was docked and hot oil started coursing through its coils, taking the sea-chill off the asphalt. A day and a half later, the cargo was pouring into shoreside storage tanks.

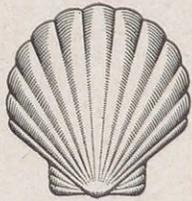
Since that first eventful voyage, the *Wando* has made seven round trips to Alaska, towing more than 21,000 tons of Shell asphalt. This year the tug will continue her summer voyages, fighting the heavy seas of the Northern Pacific to deliver her cargo.

The need for asphalt in Alaska is exemplified by this street scene in Anchorage, where paving lags behind the construction of homes and office buildings. The city's big boom has boosted the population of greater Anchorage from 5,000 to 55,000 in 17 years.



The fast-flowing ebbtide at Anchorage leaves the sea-going asphalt barge high and dry at the dock. This same quick tide broke four-inch hawsers and sent the tug and barge aground only 30 feet from the dock on their first trip to Alaska with a cargo of bulk asphalt.





The thirteenth and fourteenth in a series of organization charts

Shell Oil Company

June—1956

Albany Marketing Division Organization Chart

Division Manager

C. A. Foster, Jr.

Operations Manager

H. Wearne

Sales Manager

G. W. Hart

Treasury Manager

E. F. Daly

Marketing Service Manager

H. K. Haeffner

Personnel Manager

D. B. Kessell

Real Estate Manager

N. J. Ganslen

Division Engineer

W. C. Handy

Superintendent Distribution

R. F. Kinsley

Asphalt Manager

M. L. Richards

Aviation-Commercial Manager

R. F. Peck

Fuel Oil—LPG Manager

J. G. Sestak

Industrial Products Manager

J. P. Thomas

Chief Accountant

D. R. Albright

Credit Manager

D. J. Creagan

Div. Rep. Pub. Rel., Advtg. & Sales Prom.

G. G. Cease

Div. Rep. Purchasing-Stores

P. C. Blair

Retail Manager

G. H. Natole

District Manager Burlington

W. M. Vandeventer

District Manager Rensselaer

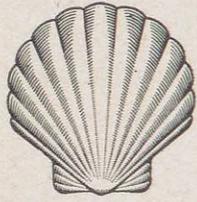
W. J. Lamb

District Manager Syracuse

E. F. Loveland

District Manager Utica

A. G. Nelson

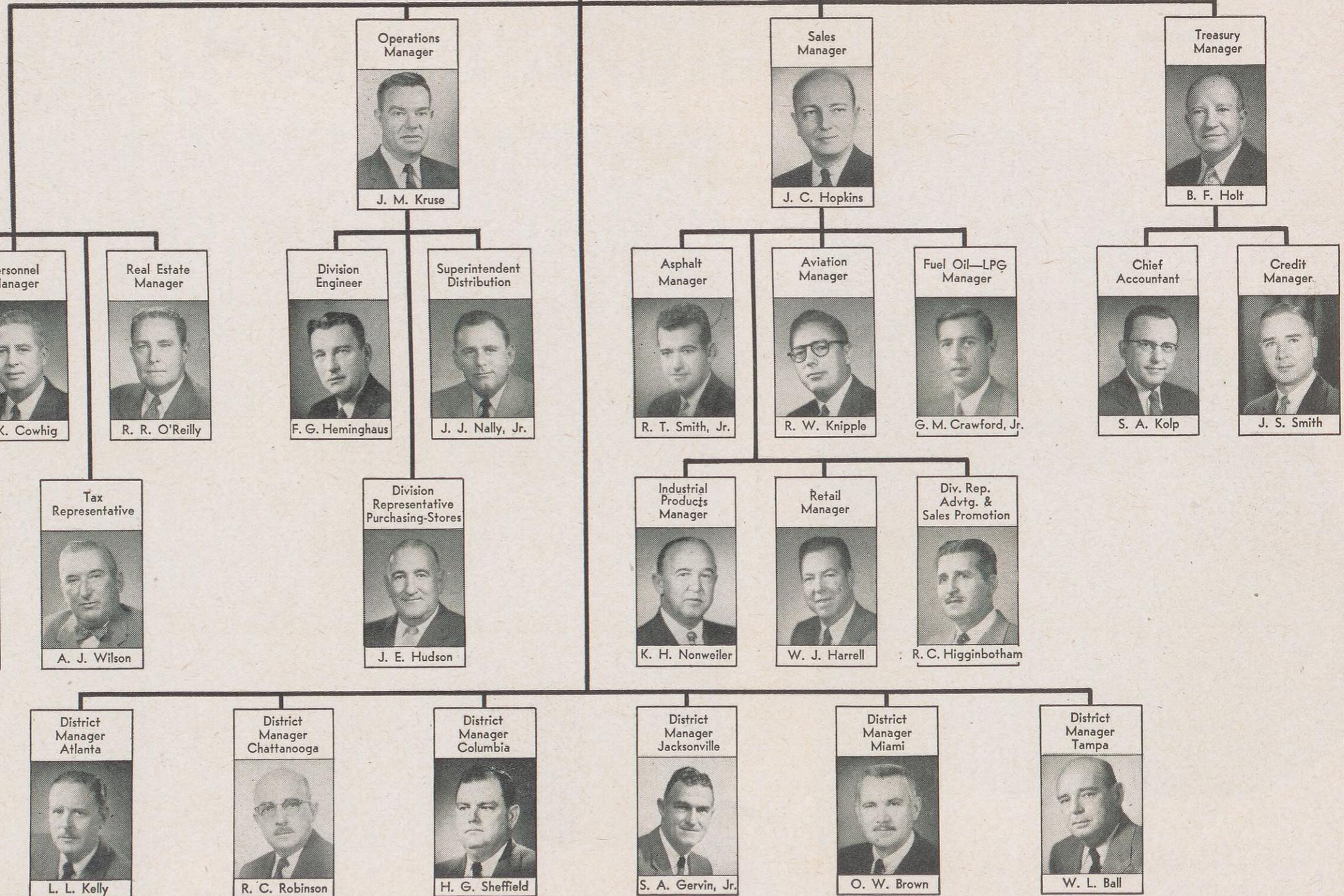


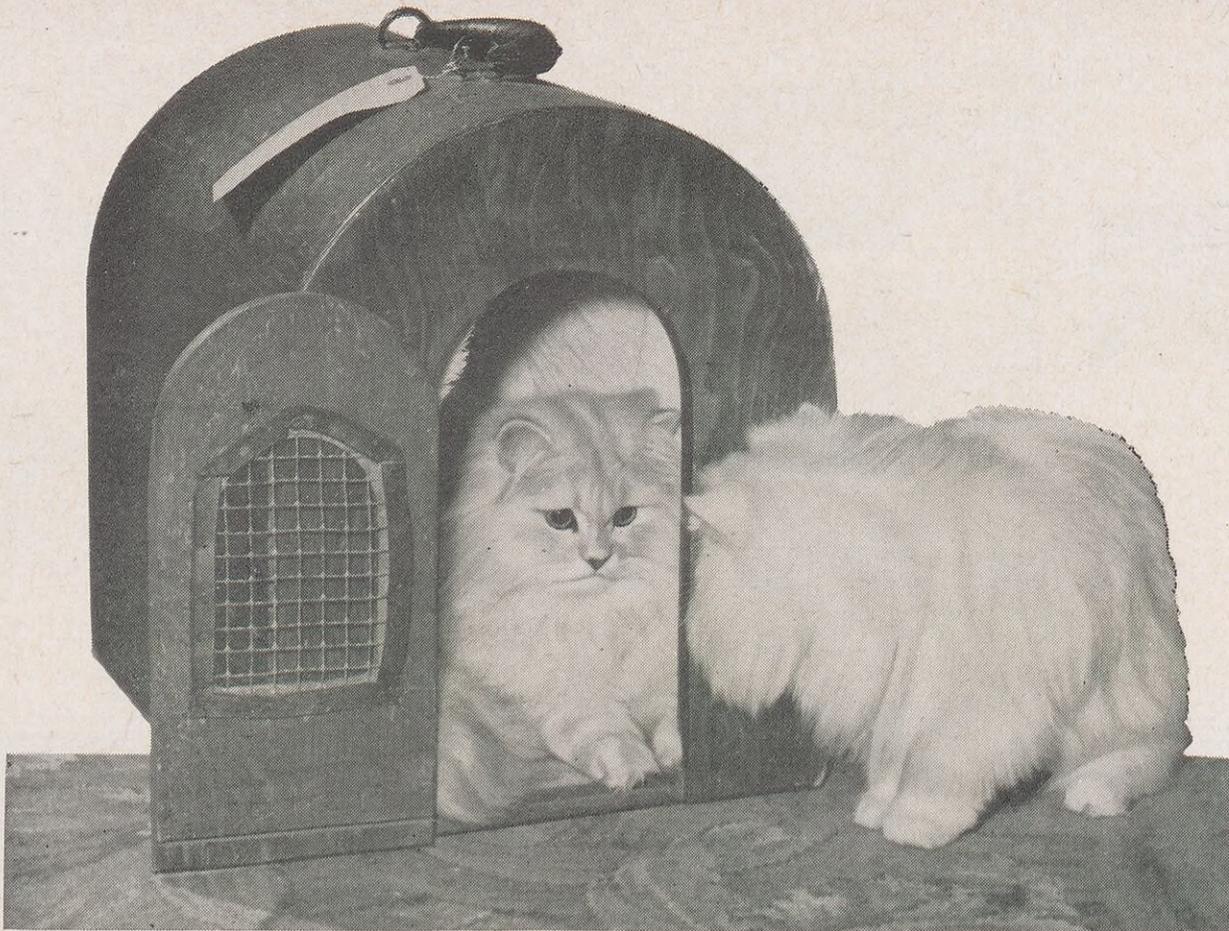
Atlanta Marketing Division Organization Chart

Division Manager



R. D. Kizer





Persians

A Shell Employee's H

provements, and they entered their first show in December 1946.

When the owner of the Beverly-Serrano Cattery died in 1948, she bequeathed the cattery to the Petersons, who have become outstanding specialists in raising the "Silvers." That breed of cat is silver-white with a wide head and body, short legs and tail and large, blue-green eyes. At one time England was reputed to be the best source of "Silvers," but now cat connoisseurs concede that the Long Beach breeds are at least equal to the English breeds—with the Peterson pets among the prime examples.

The Peterson cattery, located behind their home at Buena Park, near Long Beach, is virtually a laboratory for scientific litters. It has room for 25 cats, and was designed by the Petersons. Each cat has a separate pen with a veranda which is electrically heated to keep the temperature at 60 degrees through cool California nights.

A SICK and homeless alley cat led Mrs. Vivian Peterson, an employee in the Long Beach, California, office of Shell's Pacific Coast Exploration and Production Area, into a Persian "silver" market of international scope.

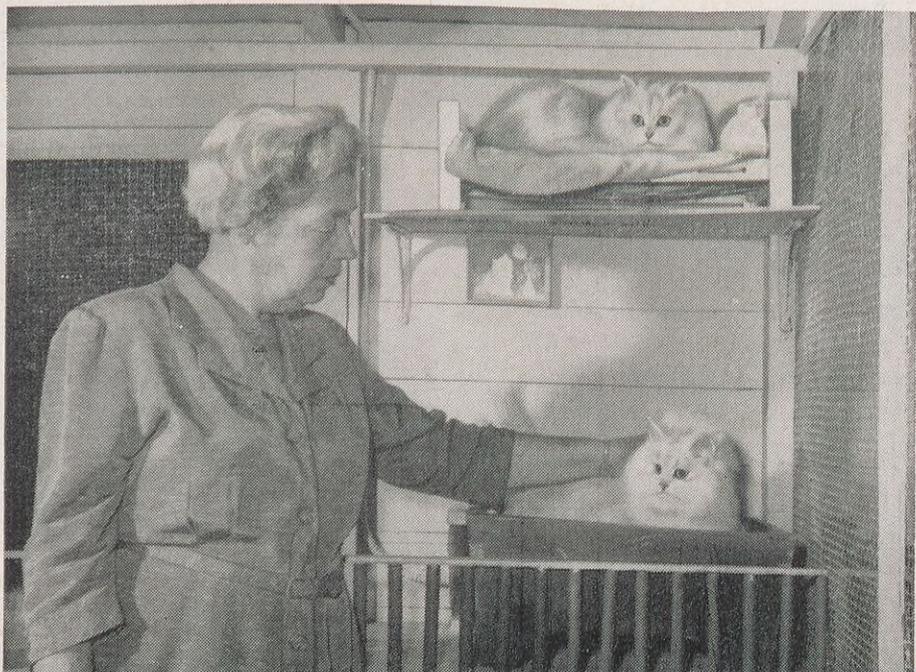
When the alley cat found a home with the Petersons about 10 years ago, Mrs. Peterson was not fond of felines. But while taking care of it during its illness, she gradually lost her fear of cats and developed a strong liking for them—so strong that when a friend later gave her a purebred Silver Persian, she and her husband, E. W. Peterson, began raising cats as a hobby.

Today the Petersons own a 25-pen cat kennel, a trophy case full of awards won at cat shows, and have customers for their kittens as far away as Europe.

But their success in breeding purebreds did not start with the first litter, or even the first dozen litters. Lacking the knack that comes only with experience, they were at first unable to breed animals with the eye and coat color and length of hair that mark a first-class silver Persian. Trial and error—teamed with advice from professionals and eventually a working arrangement with the owner of the Beverly-Serrano Cattery—brought im-

Shell's Mrs. Vivian Peterson, right, and a neighbor, Diane Montgomery, prepare one of Mrs. Peterson's purebred Persians for a cat show appearance.

Mrs. Peterson, employed in the Long Beach, California, office of the Pacific Coast Exploration and Production Area, has pens for 25 cats in her Beverly-Serrano Cattery. The pens are electrically heated.



s With a Pedigree

's Hobby of Raising Purebred Persians Has Brought Her International
Recognition Among Cat Fanciers

Stairs connect the two levels in each cat cubicle, which kittens learn to climb by following their mothers. Railings prevent the kittens from falling the three feet to the floor below the pens.

Each litter is registered with the Cat Fanciers' Association, and the registrations are published each year for cat breeders' information. Last year the Petersons raised more than 50 kittens. With a pedigree, a purebred kitten sells for from \$75 to \$125. Without pedigree documents, the price per kitten ranges from \$35 to \$50. The demand for the kittens is greater than the supply.

For trips to distant customers, kittens are shipped by air in specially constructed carriers. Food is tied to the handle of the cage and fed to the cats, in the event of a layover, by airline cargo service personnel.

Though a kitten is not officially a cat until it is eight months old, the Petersons enter four-month-old kittens in shows to begin their training.

E. W. Peterson, an active partner with his wife in breeding the Persians, joins her here in feeding their pets scraps of cheese.



During the winter, when cat fur is thickest, cats are entered in shows in different parts of the country almost every week-end.

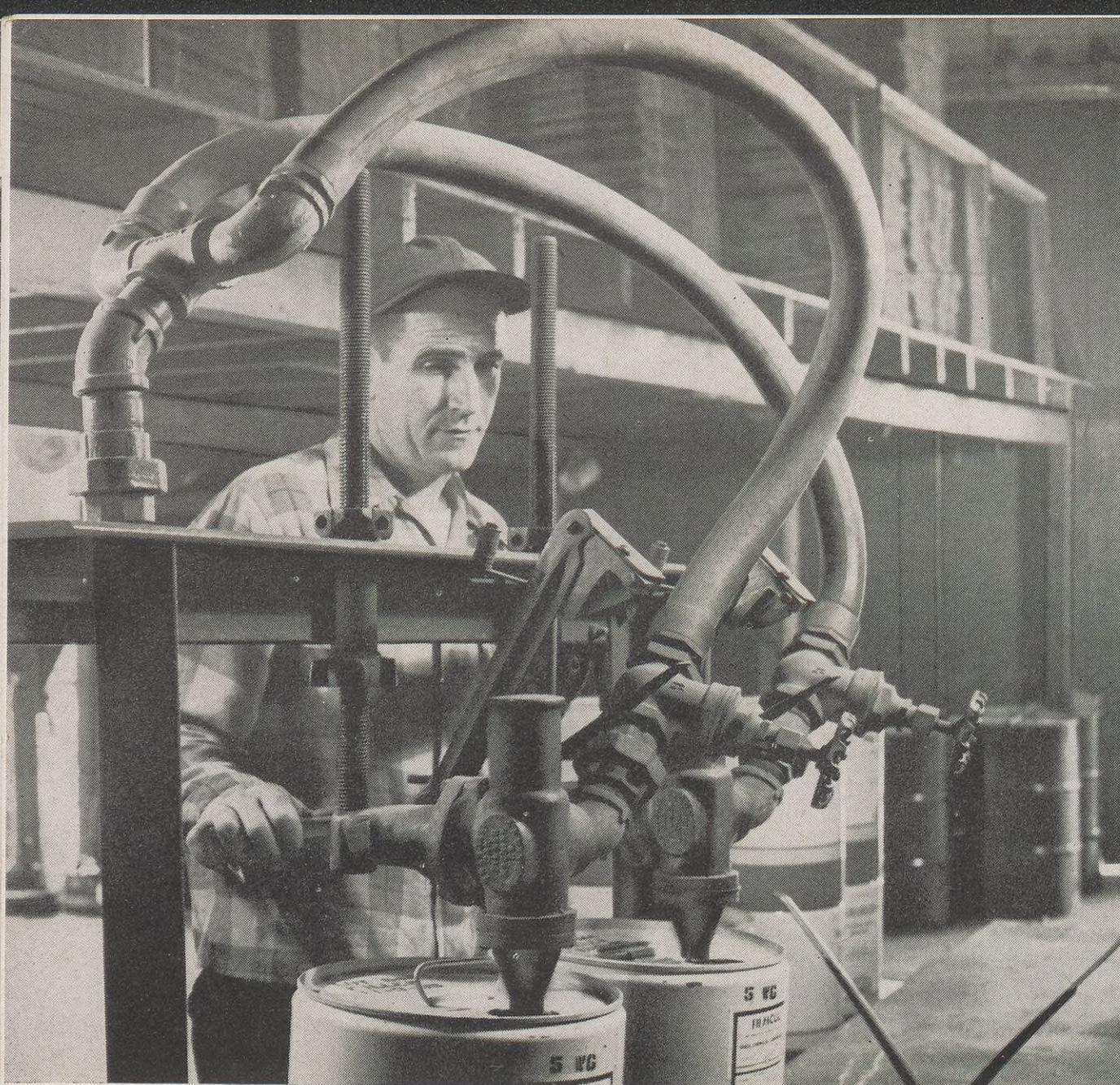
Besides being active as an exhibitor, Mrs. Peterson also is president of the West Shore Cat Club of Long Beach, a club which she founded in 1950. In

1953, it sponsored the largest cat show ever held in the United States.

But Mrs. Peterson plans to taper off on her entries in cat show competition and spend more time judging shows. And for good reason — the Petersons now have so many trophies they are faced with a storage problem.



Mrs. Peterson stands with one of her prize-winning silver Persians before her filled trophy case. In the 11 years she and her husband have operated the Beverly-Serrano Cattery their cats have gained international reputation. Demand for their kittens exceeds the supply.



Filler-Weigher Vernon M. Young fills five gallon cans with a solvent prepared at the Culver City Alcohol Denaturing Plant.

Spirited Specialties

Shell Chemical Concocts "Tailor Made" Alcohol Compounds for Industrial Use In Products Ranging From Shampoo to Shellac

IN a plant once used for distilling gin and bottling Canadian whiskey, Shell Chemical Corporation now makes pure ethyl alcohol unfit to drink and blends it into dozens of "recipes" to suit the needs of manufacturers throughout the nation.

Located at Culver City, California, the plant is the newest of Shell Chemical's alcohol denaturing plants. It was purchased in 1954 from the Lac Chemical Company (formerly Pacific Distillers) and is operated as part of Shell Chemical's Dominguez Plant.

Like other Shell denaturing plants—located at Houston, Texas; Argo,

Illinois; and Sewaren, New Jersey—the job of the Culver City Plant is to "denature" ethyl alcohol (make it unfit to drink) and sell it to various manufacturers who blend it with substances to make such diversified products as dyes, perfume and lacquer thinner.

The alcohol used at Culver City comes from Shell Chemical's Houston Plant, as does the alcohol used at the other denaturing plants. A chartered tanker transports it via the Panama Canal to California, where it is pumped into bonded storage tanks near Los Angeles harbor. From there

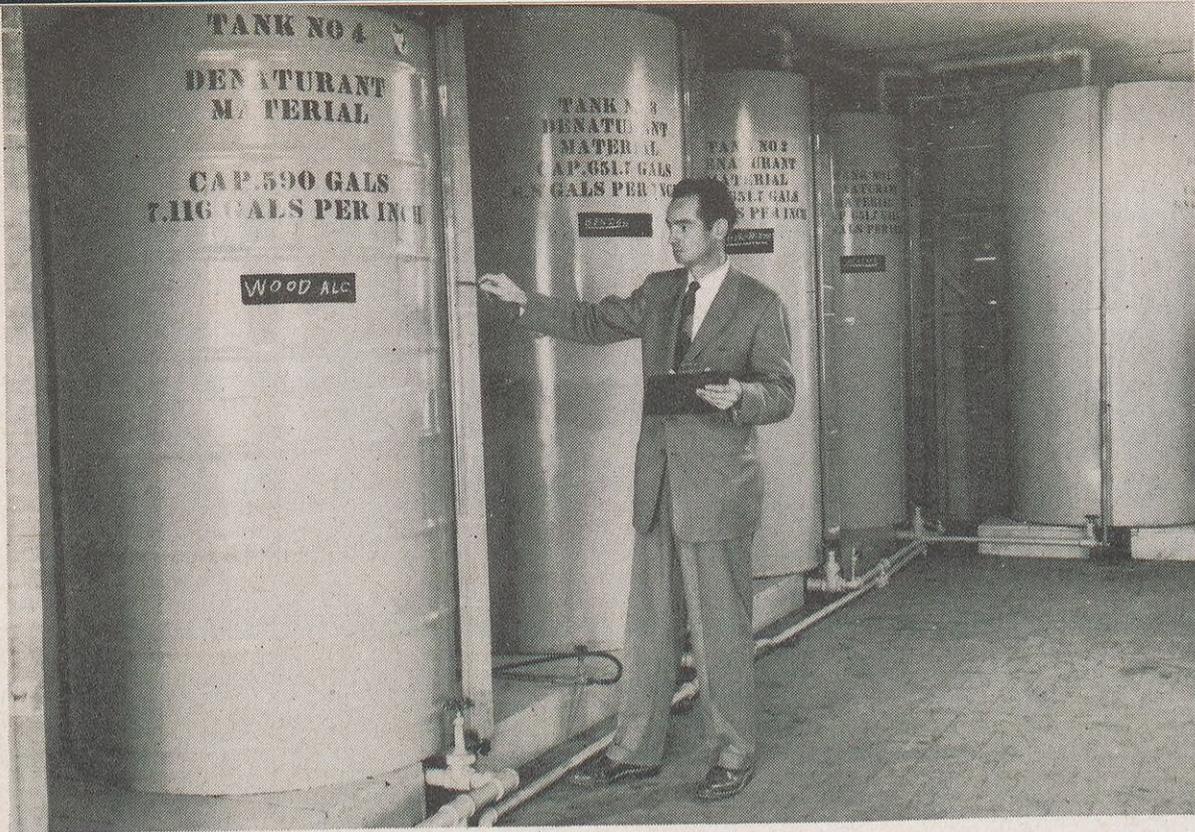
it is moved by bonded tank truck to Culver City, where ten 10,000-gallon tanks are used for storage.

U. S. Treasury agents, or "T-Men," keep a close tab on all movements of ethyl alcohol because, in its pure state, it is drinkable and thus subject to federal tax. Storage tanks on the California-bound tanker are sealed by a Treasury agent in Houston and another agent breaks the seal at the destination. At Culver City, federal gaugers are on hand for the transfer of the alcohol to storage tanks, which are sealed with government locks. And only the "T-Men" have the keys. During the denaturing processes, the federal agents are also present.

Denaturants added to the alcohol—such as methanol and acetone (both petroleum derivatives), ammonia, wood alcohol, benzol and ethyl acetate—are tested by a government laboratory for purity. Other denaturants used in smaller amounts are certified pure by the manufacturer and include green soap, oil of peppermint, oil of wintergreen, camphor, iodine, oil of sassafras, oil of lavender, kerosene, pine tar and oil of cloves. These items and many more are on the shelves of the blending room at the Culver City Plant, where the recipes or formulas are prepared for customers.

The recipes of 190 proof ethyl alcohol and denaturants are mixed in either 5,000 or 10,000-gallon tanks—depending upon the amount of the customer's order. The Culver City Plant has four 5,000-gallon and five 10,000-gallon blending tanks.

A typical recipe calls for 10 pounds of "various essential oils and other aromatic substances" with each 100 gallons of alcohol. Such blends as this are used by manufacturers in producing hair and scalp preparations, bay



Foreman Virgil E. Kane checks the level of a denaturant storage tank at the Culver City Plant. The wood alcohol, benzol, ethyl acetate and acetone in these tanks are agents used in denaturing pure ethyl alcohol.

Filler-Weigher Allen W. Strohl pours out boric acid, one of the hundreds of "small agents" kept on the shelves of the plant's blending room for use in preparing alcohol "recipes" which manufacturers blend into such products as mouth washes and soaps.



U. S. Treasury Agent L. D. Burt, right, cuts the seal on a storage tank aboard a tanker which transports ethyl alcohol to California from Shell Chemical's Houston Plant. Looking on are Captain Mitchell Justin, left, skipper of the tanker, and Chemist Roger D. Mays.

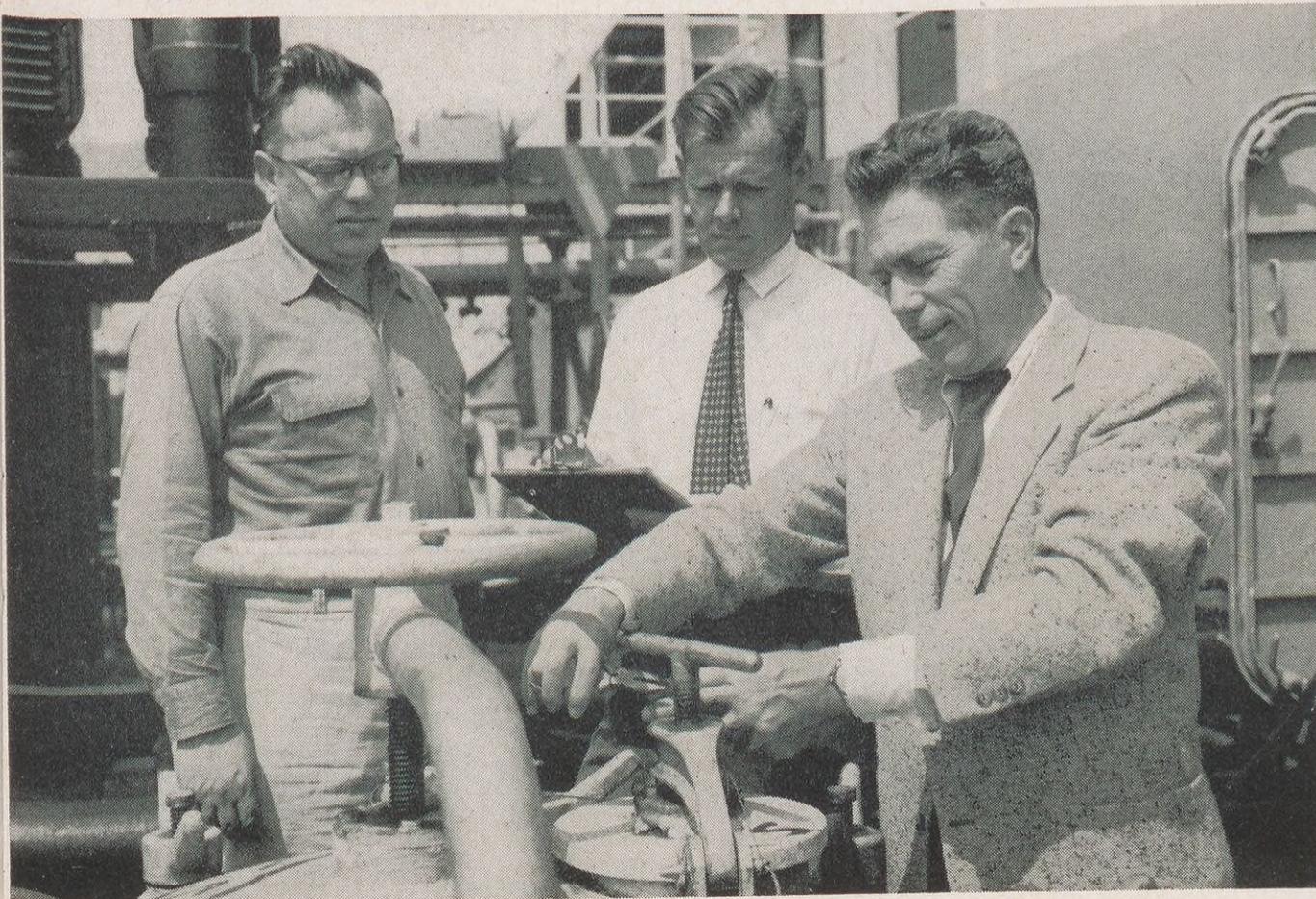
rum, face and hand lotions, deodorants, toilet waters, shampoos and soaps.

Other types of denatured alcohol compounds prepared at the Culver City Plant are industrial solvents — chemical workhorses in everyday industrial use. Each is used in various ways by many different industries. For example, NEOSOL* proprietary solvent is used as a shellac thinner, a stain remover, a cleaner for printing presses, a fuel for spirit lamps, a radiator cleaner, in coatings for leather and an important agent in the manu-

* Trademark Shell Chemical Corporation

facture of printing inks. It is also used by commercial laundries in wet clothes to prevent mildew.

Not all shipments of alcohol from the Culver City Plant are unfit to drink. A small amount of pure ethyl alcohol is shipped to hospitals and laboratories. On these shipments, of course, federal tax is paid and alcohol tax stamps are affixed to each barrel by the "T-Men." Under special conditions, pure ethyl alcohol is sent to hospitals and laboratories on a tax-free basis for use in scientific and medical research.



Shell People in the News

F. S. Clulow To Retire; To Be Succeeded By M. P. L. Love

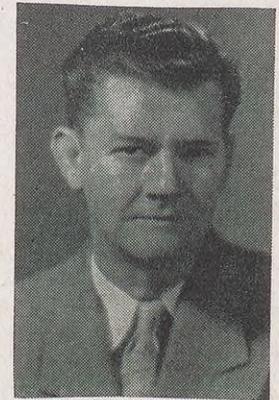
F. S. "STAN" CLULOW, Vice President, Manufacturing, Shell Oil Company, is retiring on June 30 after nearly 36 years of service. He will be succeeded by M. P. L. Love, Jr.



F. S. CLULOW

Mr. Clulow became Department Manager at the Martinez Refinery in 1930 after 10 years of service with the Shell Group outside the United States. Four years later he became Manager of the former East Chicago Refinery and in 1938 returned to the West Coast to become Vice President of the Manufacturing Department with headquarters in San Francisco. Upon the consolidation of the Pacific Coast and East of Rockies Manufacturing organizations on January 1, 1949, he came to New York to assume the same position for all Shell refineries in this country.

M. P. L. LOVE, JR., is a graduate of Mississippi College and did graduate work in Organic Chemistry at the University of Virginia. He joined Shell in 1935 as a Junior Chemist at the Wood River Refinery. Two years later he became a Senior Research Chemist. In 1939 he was named Assistant Chief Research Chemist and the following year moved to New York as Senior Technologist. He became Chief Research Chemist at Houston Research Laboratory in 1942 and the following year was named Director of Research there. He returned to Wood River in November, 1943, as Research Director and five years later became Manager of Manufacturing's Research Department in New York. He was named Manager of the Houston Refinery in 1951 and remained there until August, 1954. Since that time he has been on a special assignment with Shell Petroleum Company in London.



M. P. L. LOVE, JR.

Shell Oil Company Marketing Personnel Changes

In a shift of three positions in the Shell Oil Company Marketing Organization, the following personnel changes became effective June 1:

W. L. SHAW



J. M. MCGINNIS



W. A. BURNETT

	FROM	TO
W. L. SHAW	Operations Manager, Boston Division	Operations Manager, Los Angeles Division
J. M. MCGINNIS	Manager, Fleet Division, Marketing Distribution, Head Office	Operations Manager, Boston Division
W. A. BURNETT	Distribution Superintendent, New York Division	Manager, Fleet Division, Marketing Distribution, Head Office

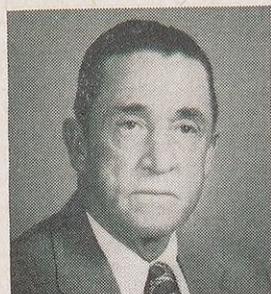
They Have Retired



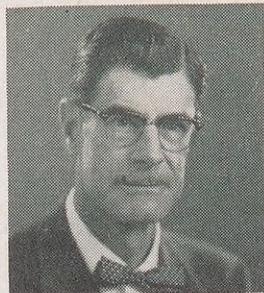
W. W. COLE
New Orleans Area
Production



R. B. DOERN
Martinez Refinery
Lubricating Oils



P. O. FARISS
Pacific Coast Area
Production



S. R. GASKILL
Sacramento Division
Marketing Service



E. J. GUIDRY
Norco Refinery
Engineering



H. A. HEGSTRUM
San Francisco Division
Sales



G. L. KNEELAND
Pacific Coast Area
Treasury



S. S. KNIGHT
San Francisco Division
Sales



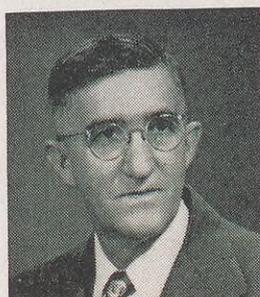
G. J. LOWRY
Pacific Coast Area
Production



M. MCGHEE
Houston Refinery
Engineering



J. MILLS
Wood River Refinery
Engineering



O. O. OLANO
New Orleans Area
Production



G. G. PULTZ
Wilmington Refinery
Engineering



W. A. ROSEBERRY
Pipe Line Department
Wood River, Illinois



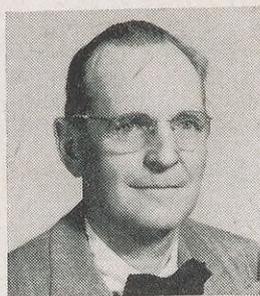
P. G. SCHMIDT
Shell Chemical Corp.
Shell Point Plant



E. P. SEVERNS
San Francisco Division
Treasury



C. L. SHULTZ
Houston Refinery
Engineering



J. L. SLAUGHTER
Wood River Refinery
Engineering



F. L. SMITH
Shell Pipe Line Corp.
West Texas Area



W. B. STUEBINGER
San Francisco Division
Treasury



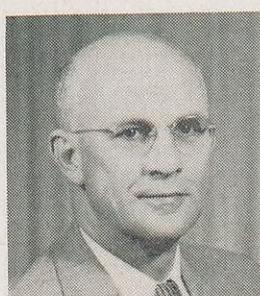
T. J. SUDBECK
Houston Refinery
Distilling



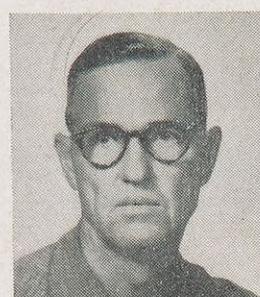
F. E. TAMME
Minneapolis Division
Operations



T. E. THOMPSON
Pacific Coast Area
Production



R. W. TODHUNTER
Seattle Division
Operations



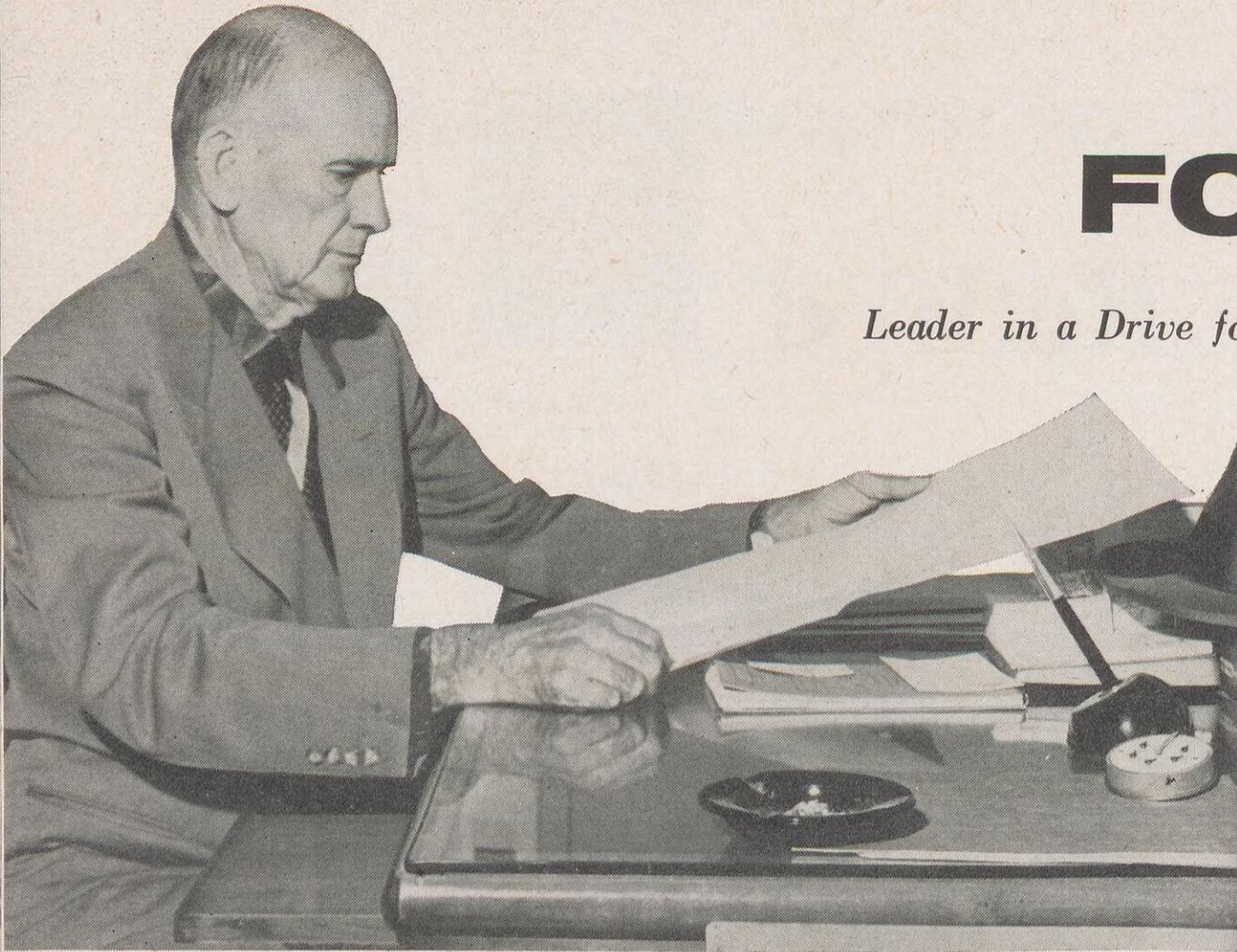
D. O. WAYMIRE
Shell Pipe Line Corp.
West Texas Area



W. E. YATES
Shell Pipe Line Corp.
Texas Gulf Area

FOUNTAIN

*Leader in a Drive for a Community Water System, This
Now Heads the Water Treating*



Norco Refinery Pipe Fitter J. N. "Nick" Fabares retired to a second career as superintendent of a St. Charles Parish, Louisiana, water treating plant and secretary-treasurer of the district water board. Here, in his office at the water plant, Mister Nick, as he is called, studies blue prints of water connections to be made in a new housing development.

several oil fields have been discovered within the parish boundaries. Despite these natural resources, St. Charles Parish was hampered in its growth because of an inadequate water supply for domestic consumption.

The Mississippi River was the source of water used by the refineries in the towns of Norco and neighboring Destrehan. The refineries, with their own water treating plants, supplied a limited amount of water to citizens of these towns. But the rest of the parishioners relied on cisterns or wells for their water. The cisterns often were inadequate because their water supply was limited.

With this situation before him, Nick started his campaign for a more plentiful water supply as early as 1939. As a member of the St. Charles Parish Planning Board and the Young Men's Business Club, he talked water to farmers and townspeople alike.

"Of course, I wasn't the only one talking water," Nick said. "A lot of others were helping out."

But Nick is generally credited with giving the most convincing speech of the campaign. At a meeting held by parishioners to discuss the construction of a parish sanitation project, he convinced those present that an adequate water system was necessary for the sanitation project to be successful. It was the turning point in the water drive.

Shortly after the meeting, Nick and a group of water system advocates drew up a petition for an election to provide a bond issue for a parish water system. When the required number of signatures had been pro-

FOR ten years, Joseph N. "Nick" Fabares spent much of his spare time working with his neighbors for the creation of an adequate water system for St. Charles Parish, Louisiana. He didn't realize it, but he was laying the groundwork for his retirement.

Fabares, who was a pipe fitter at the Norco Refinery, retired in 1949 after 21 years' service with Shell. And the following year, when voters approved a bond issue for the water system, it was natural for "Mister Nick" to be named a member of the water board. Later he was appointed superintendent of District No. 1 Water Treating Plant near the community of New Sarpy.

Located 20 miles northwest of New Orleans, St. Charles Parish contains 295 square miles of fertile land which grows bountiful crops, mainly of sugar cane, cotton and vegetables. The Mississippi River, which flows through the parish, has attracted oil refineries and other industries. Also,



Located on the east side of the Mississippi River, the new District No. 1 Water Treating Plant in St. Charles Parish purifies 500,000 gallons of muddy river water daily.

HEAD

Retired Norco Refinery Pipe Fitter Plant He Helped Create

cured, the petition was presented to the Police Jury, the parish governing body. An election was called and the parish approved the bond issue by an overwhelming majority. Ten years of "talking water" had paid off.

In 1951, work was started on two water treating plants. Naturally the source of the water for the plants was the Mississippi River. The parish was divided into two districts — District No. 1 for the east side of the river and District No. 2 on the west side—and a board of citizens to govern each district was formed.

Nick was appointed a member of the District No. 1 water board, along with others who led the fight for the water system. Included in the group were Assistant Chief Engineer Jules Carville and Inspector S. R. Robichaux, both of Shell's Norco Refinery; Shipping Supervisor E. J. Crochet of Shell Chemical Corporation's Norco Plant; A. J. Crovetto, James E. Tuft and Alvin Cambre of the nearby Pan-American Refinery. Later B. J. Braud, a Foreman at the Norco Refinery, was named to replace Carville when the latter transferred to the Wood River Refinery and George Keller, a New Sarpy businessman, replaced Nick when he was appointed superintendent of the new District No. 1 water plant. Still plant superintendent, Nick is now back on the board as secretary-treasurer. Carville has returned to Norco and is a consulting engineer for the board.

The District No. 1 plant, which Nick oversees, started operating in March 1952 and produces about 500,000 gallons of pure water per day.

But it was designed for the expected growth of St. Charles Parish and has a potential capacity of 1,500,000 gallons per day. The water system itself will be a major reason for needing the additional capacity, for it already is attracting new residents and business to the parish.

"The parish is growing now," Nick said. "New plants are moving into the area and 1,500 new homes are scheduled to be built here this year."

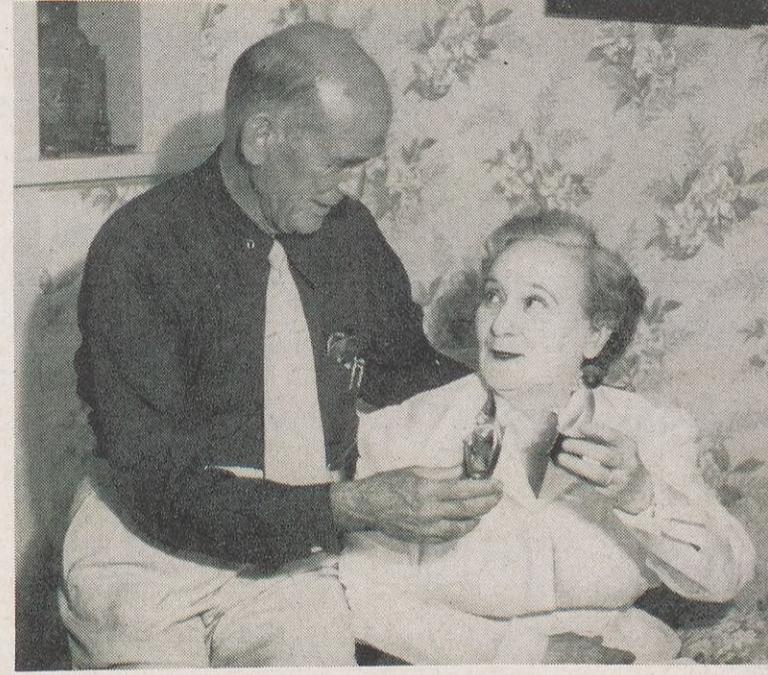
Among the new plants is Shell's Norco Chemical Plant which gets all of its domestic water from the District No. 1 plant. (Processing water is obtained from the chemical plant's own water treating unit.) The Norco Refinery also buys water from the plant to supplement its own domestic water system.

"Shell is one of our best customers," says Nick Fabares, proudly.

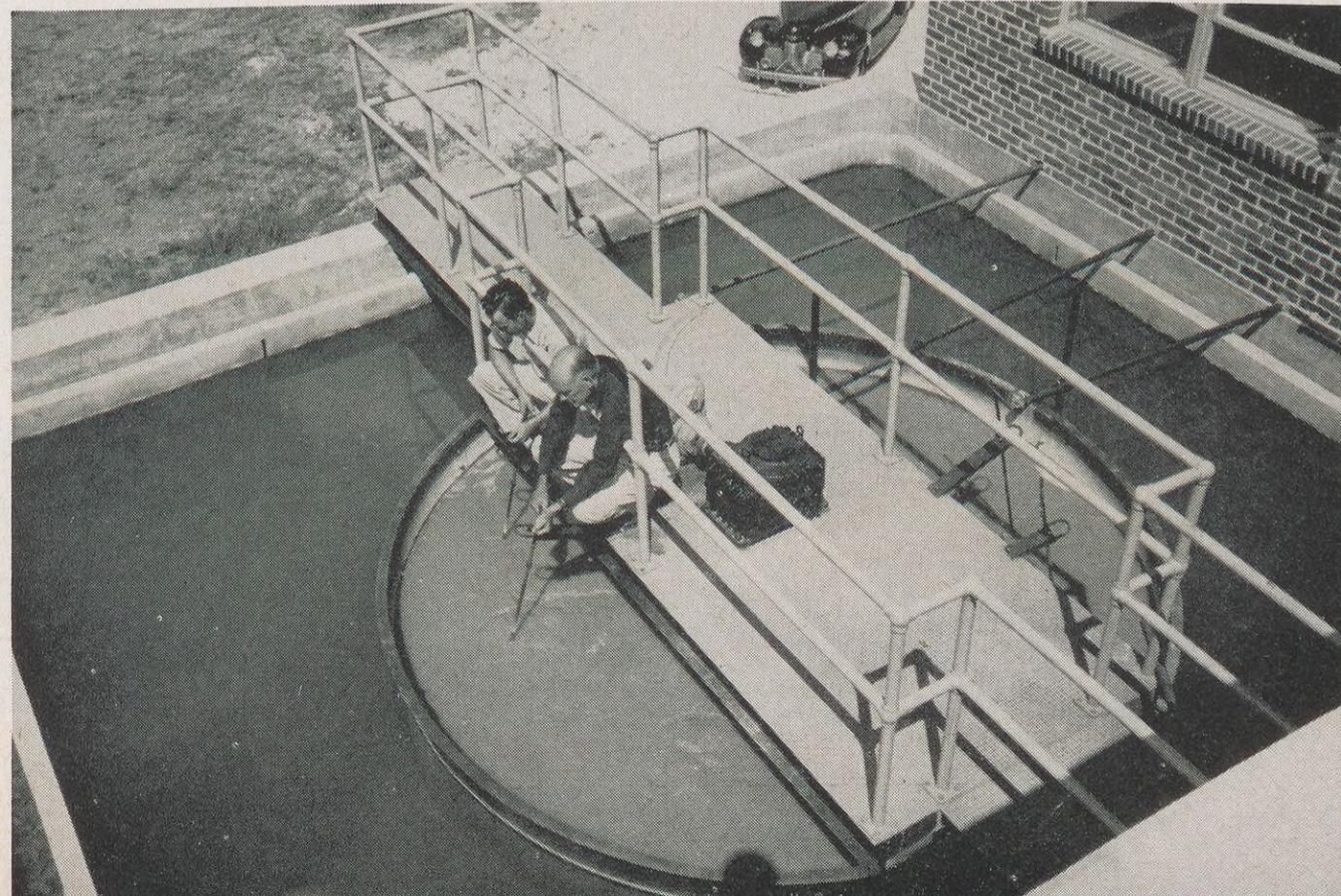
At the district plant, Fabares and an operator check the muddy water in the settling tank where the water treating process starts. Here the water is agitated and chemicals are automatically added to it, causing the mud to settle to the bottom within a few minutes.

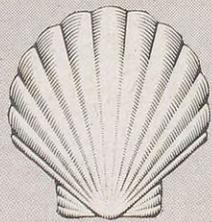


Fabares and a district employee study a map of a housing project built since the new water supply became available.



In their New Sarpy home, Mrs. Fabares, a practical nurse, shows her husband two ceramic figures made by one of her patients.

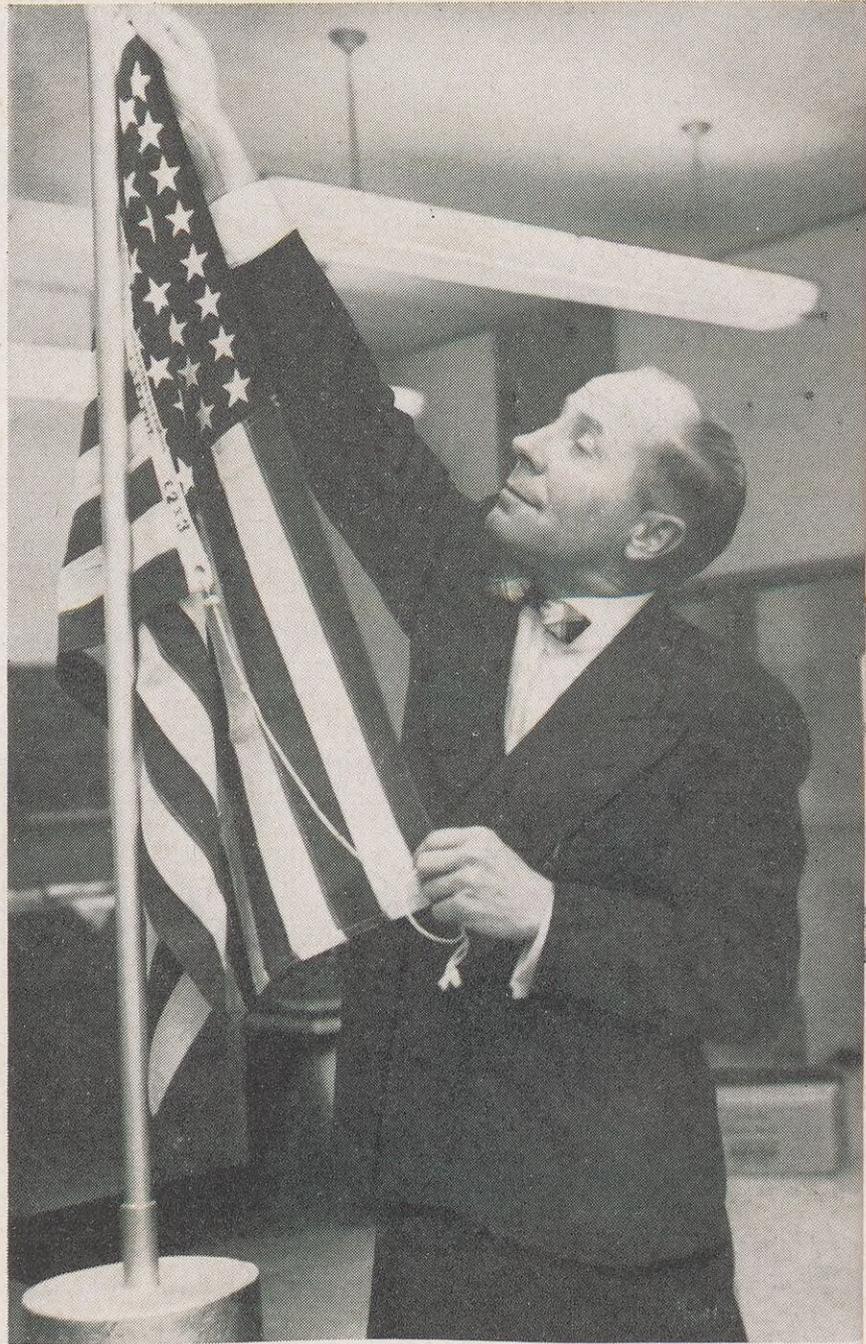




SHELL COAST TO COAST

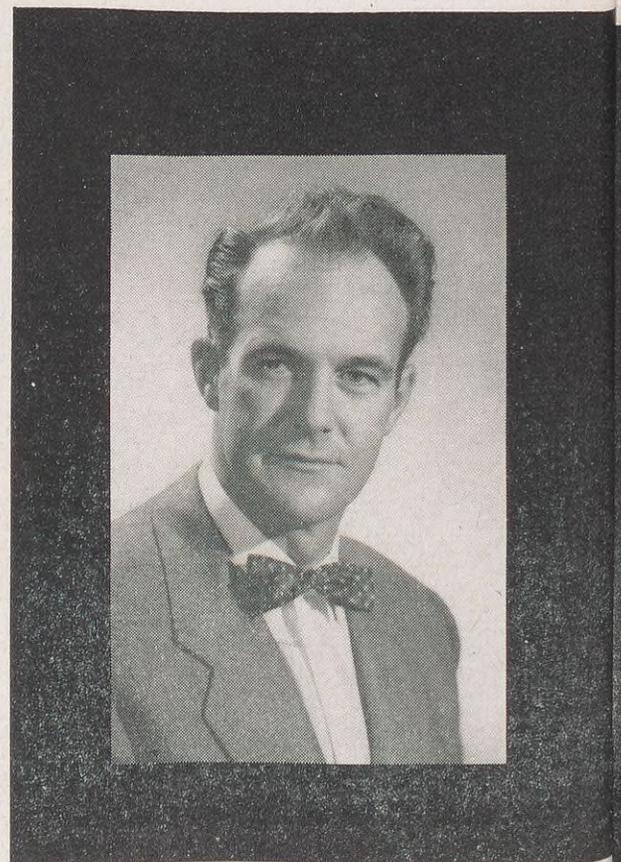
Standard Bearer

Because the 6-year-old son of W. L. McBride, Operator in Shell Chemical Corporation's Ventura Plant, asked why American flags were hung on broom sticks, McBride presented the Ventura County Board of Supervisors with a plan to put better standards at the county's polling places. He designed a uniform metal flag standard and base, right, for use at the county's 265 polling places. A welding company made a free demonstration standard. The Board of Supervisors adopted the idea and new standards are being made. Now, McBride plans to carry his suggestion to the California legislature for adoption of a state-wide law.



New Citizens

V. M. Shouliakovsky, an Operator at Shell Chemical Corporation's Martinez Plant, and his wife, right, who fled from the Communists in the Far East, recently became U. S. citizens together. Both were born in Manchuria after their parents fled from Russia. They left Shanghai in 1948 to go to the Philippine Islands and came to the U. S. in 1950.





Forest Farmer

native to the California mountain country. In nine years he has raised more than 1,000 trees and shrubs, ranging from redwoods to grapevines, on six acres at his home near Vallejo.

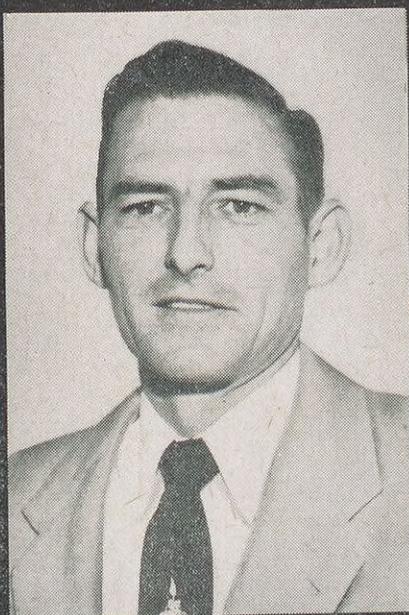
Koski and his brother, Carlton, collect most of the specimens during the summer. With forest rangers' approval, Koski takes each small specimen home, then transfers the seedling to a flower pot for two years to develop roots before planting it in his back yard forest. Each seedling needs water every two weeks during its first

seven years, and Koski pumps at least 6,000 gallons of water a week through 2,000 feet of garden hose for this purpose.

More than 90 per cent of Koski's specimens survive the change in altitude, weather and natural hazards. Several years ago his forest's prime evil was rabbits, which chewed up seedlings. A "wholesale jackrabbit hunt" ended that uprising. Koski's only major problem now is space. He's running out of land to plant trees!

ROY E. KOSKI, Chemist at Shell Chemical Corporation's Martinez Plant, is raising a miniature forest in his backyard.

His goal is to grow at least one specimen of every tree and shrub

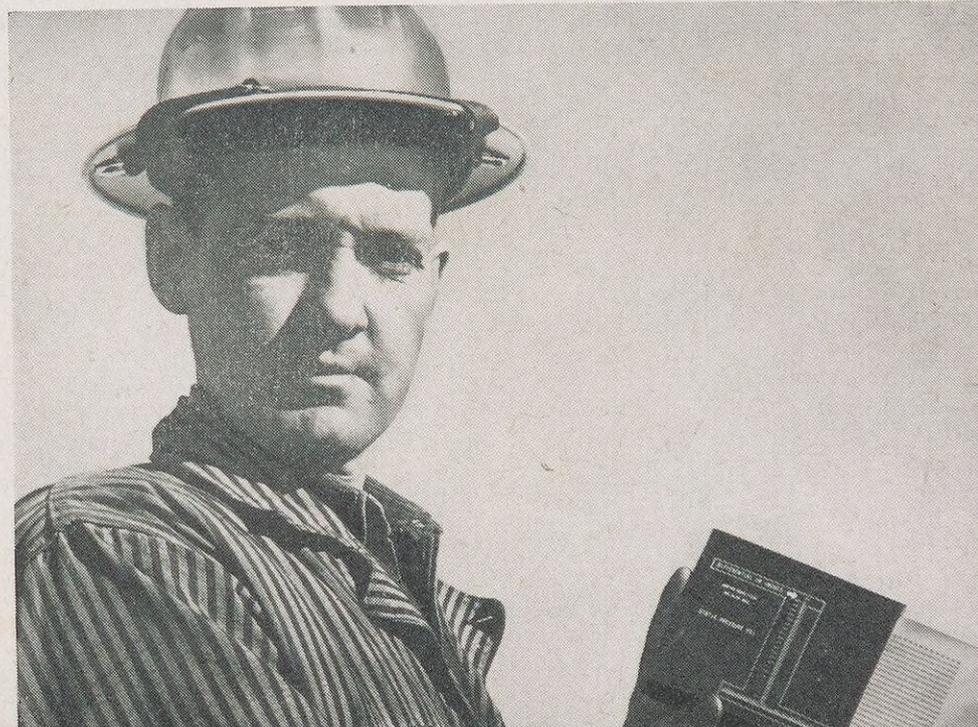


Safety Officers

N. W. Jacobsen, left, Safety and Industrial Hygiene Supervisor at Shell Development Company's Emeryville Research Center, has been elected Vice President of the Northern California Industrial Safety Society. O. L. Russell, right, Safety Representative of the Hobbs Division of Shell Oil Company's Midland Exploration and Production Area, is chairman of the Lea County, New Mexico, Traffic Safety Commission.

Flowing Figures

R. T. Gerlitz, a Pumper in Shell Oil Company's Calgary Exploration and Production Area, has designed a pocket-size gas flow calculator to give quick estimates of gas flow rates through orifice meters. It allows adjustment of flow from wells without involved calculations. Fellow workers joined Gerlitz in producing the calculator.



Sharp Shooters

ONE of the best sharpshooting teams in the nation came into being 16 years ago when Gladys Rising dropped her crocheting to join her husband Merrill at the firing line. Since their first cooperative trigger

squeeze, Merrill—an Operator at the Wilmington Refinery—and his wife have won more than 800 medals and trophies and more team championships than they can remember.

Rising has been a smallbore rifle marksman most of his life, but until 1940 his wife never had fired a weapon. While Rising shot, she crocheted at the sidelines—until she decided to join him. Under Rising's coaching, she has set the Women's Individual National Record at 50 meters and the Women's Individual Record at 50 yards.

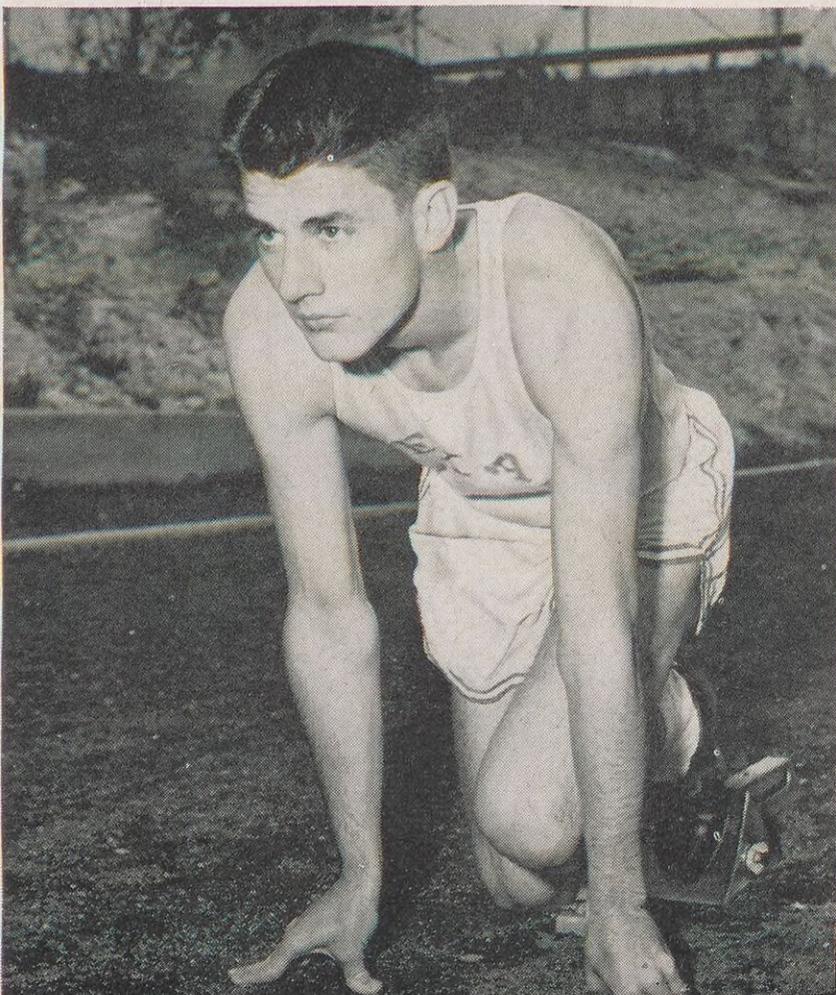
Rising, who was a Navy Ordnance Specialist during World War II, is most proud of his Canadian Shooting Star emblem, won by firing a perfect score in competition of 20 shots each at 50 and 100 yards. His specially equipped Winchester 52 includes a ground lens in the rear sight to allow him to shoot without his glasses.

The Risings have logged more than 80,000 miles in the past six years participating and officiating in rifle matches. They travel in a furnished trailer named, aptly enough, "Home on the Range."



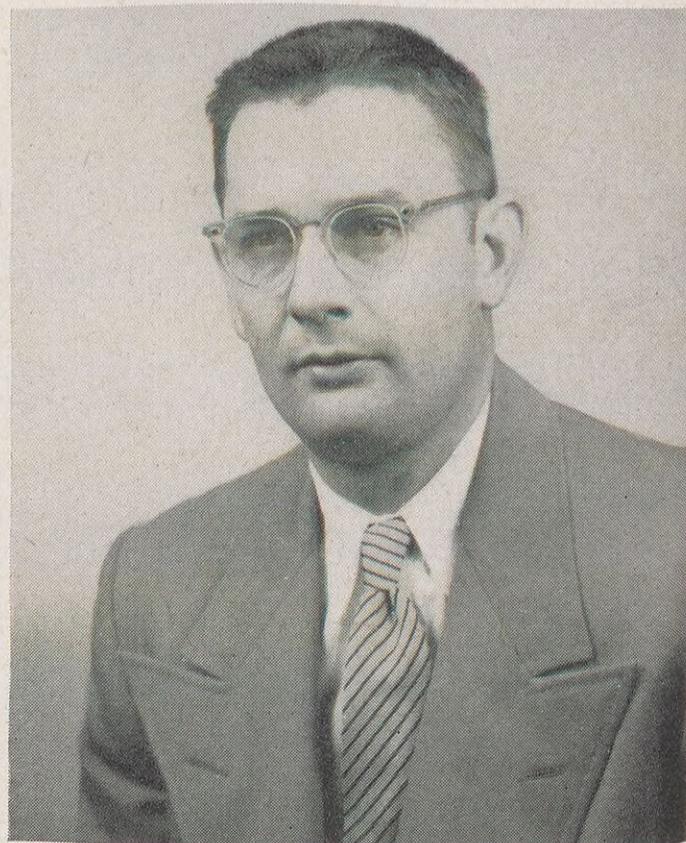
Dash Flash

Bobby Whilden, son of R. H. Whilden, Manager of the Legal Department of Shell Oil Company's Houston Exploration and Production Area, was named outstanding athlete in the recent Kansas Relays. A University of Texas junior, he was on the quarter-mile relay team and he won the 100-yard dash.



Water Rescue ▶

G. L. Rouleau, Terminal Attendant at Shell Oil Company's Argo, Illinois, Pipe Line Terminal, recently rescued two teen-agers from drowning when their automobile crashed into a creek near Frankfort, Illinois. Rouleau saw the car careen over a 20-foot embankment, stopped his car and pulled the injured pair from the water.



Service Birthdays

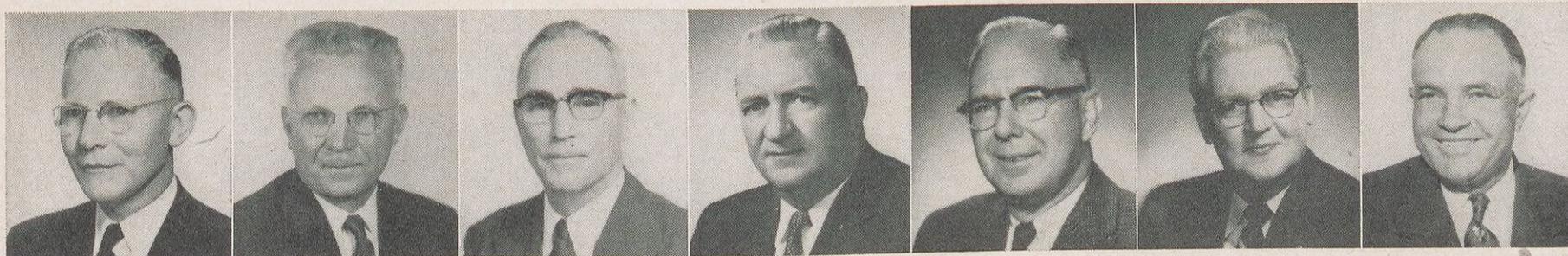
Forty Years



C. R. BROWN
Tulsa Area
Production

A. W. STRAIN
Martinez Refinery
Lubricating Oils

Thirty-Five Years



L. J. CLISHAM
Pacific Coast Area
Trans. & Supplies

A. H. HAUSSMAN
Martinez Refy.
Compounding

H. A. KIDDY
Tulsa Area
Production

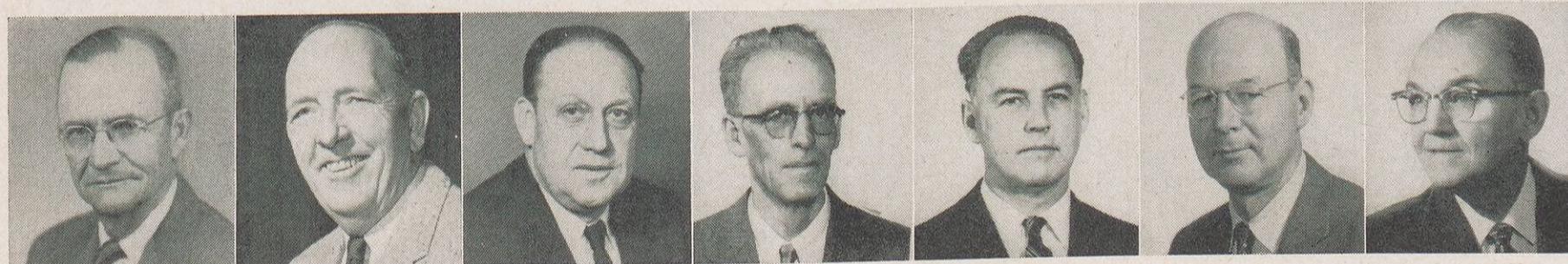
E. P. MOONEY
Denver Area
Production

J. R. RODGER
Pipe Line Dept.
East Chicago, Ind.

L. E. TINGEY
Pacific Coast Area
Treasury

G. J. TROXLER
Norco Refinery
Engineering

Thirty Years



W. W. BOWLING
Tulsa Area
Production

R. L. BUSSEY
Portland Div.
Operations

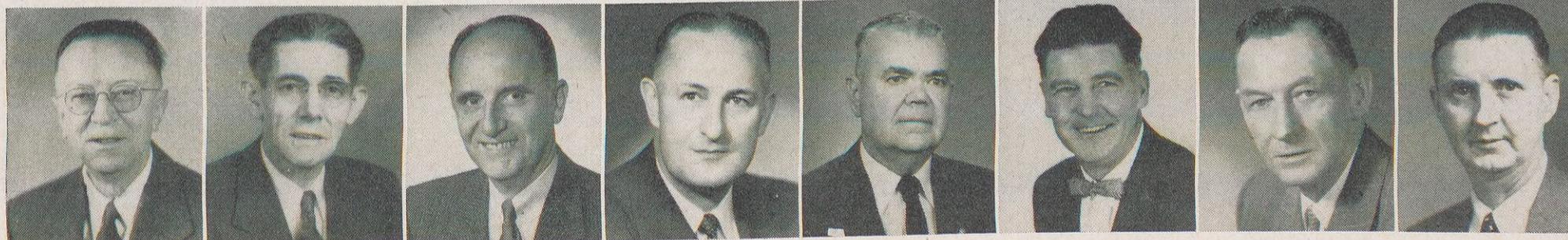
E. K. CALVIN
Wood River Refy.
Dispatching

H. F. CAMPBELL
Wilmington Refy.
Engineering

A. M. COLLINS
Wilmington Refy.
Dispatching

F. W. CURTIS
Wilmington Refy.
Engineering

E. A. DAVIS
Seattle Div.
Sales



H. C. FOWLER
Martinez Refy.
Cracking

F. J. FRIZZELL
Wood River Refy.
Engineering

C. E. HERING
San Francisco Office
Financial

J. T. HORNBERG
Seattle Division
Marketing Service

A. G. HULL
St. Louis Div.
Operations

C. D. JOHNSON
San Francisco Div.
Operations

M. JOHNSON
Seattle Division
Operations

V. L. MAJOR
Wood River Refy.
Distilling



D. F. McELDERRY
Cleveland Div.
Sales

H. H. McQUEEN
Pipe Line Dept.
Los Angeles, Calif.

C. H. MEYER
Wilmington Refy.
Engineering

E. C. NEAL
Pacific Coast Area
Pers. & Indus. Rel.

W. I. NELSON
Pacific Coast Area
Gas

J. J. POST
Martinez Refy.
Lubricating Oils

M. A. SHERWOOD
Midland Area
Production

R. W. STARR
Martinez Refy.
Cracking

Thirty Years (cont'd)



A. L. SUDHOFF
Houston Area
Treasury

K. R. TURNER
Wood River Refy.
Engineering

B. VAN DER SCHILDEN
Calgary Area
Exploration

J. B. VEDER
Martinez Refy.
Cracking

G. M. WALKER
Los Angeles Div.
Sales

C. H. WATKINS
Tulsa Area
Production

S. J. WEBER
Norco Refy.
Engineering

C. L. WOOD
Wood River Refy.
Thermal Cracking

Twenty-Five Years



C. S. BABIN
Norco Refy.
Purchasing-Stores

W. W. BEARD
New Orleans Area
Production

D. S. BICKMORE
Pacific Coast Area
Production

W. M. CLEMENT
Shell Pipe Line Corp.
Texas Gulf Area

R. W. COVERT
St. Louis Div.
Marketing Service

C. CURTIS
San Francisco Office
Marketing

H. H. DAWSON
Shell Pipe Line Corp.
Mid-Continent Area

W. FETTE
Shell Fettle Corp.
Ventura Plant



J. E. GALLEY
Midland Area
Exploration

R. GUTWEIN
Sewaren Plant
Terminal

L. E. HENTON
Pacific Coast Area
Production

O. A. HIGH
Shell Pipe Line Corp.
Mid-Continent Area

L. E. HUTSON
Shell Pipe Line Corp.
Texas Gulf Area

C. M. JENNINGS
Los Angeles Div.
Treasury

M. KELLY
Detroit Division
Operations

R. L. KITTLE
Shell Chemical Corp.
Head Office



L. C. LAURENT
Anacortes Refy.
Engineering

C. LESLIE
Pacific Coast Area
Production

C. B. LOCKE
Houston Refy.
Lubricating Oils

E. LONDON
Chicago Division
Treasury

S. MACALUSO
Shell Chemical Corp.
Shell Point Plant

F. I. MARION
New Orleans Div.
Sales

R. H. MILLER
Calgary Area
Production

E. M. MOONEY
Sewaren Plant
Terminal



C. SABO
Sewaren Plant
Engineering & Maint.

S. L. STEVENS
Shell Pipe Line Corp.
Head Office

Z. L. SUMLIN
Shell Pipe Line Corp.
Texas Gulf Area

R. R. SURA
Pacific Coast Area
Production

D. F. TERNAHAN
San Francisco Div.
Sales

E. C. THOMAS
Shell Chemical Corp.
Shell Point Plant

J. G. THOMPSON
Shell Chemical Corp.
Shell Point Plant

R. C. WARREN
New Orleans Area
Transport

SHELL OIL COMPANY

Head Office

20 Years
 R. N. Burnley.....Manufacturing
 D. N. Harris.....Manufacturing
 S. Pile, Jr.....Purchasing-Stores

15 Years
 C. R. White.....Manufacturing

10 Years
 Eleanor A. Berge.....Financial
 M. May Decker.....Gen. Exec. Office
 R. L. Koons.....Financial
 G. A. Walker.....Manufacturing

San Francisco Office

20 Years
 I. W. Johnson.....Trans. & Supplies

10 Years
 J. M. Ferguson.....Purchasing
 Mary Loskutoff.....Marketing
 P. J. Zelalich.....Purchasing

Exploration and Production

HOUSTON OFFICE

20 Years
 B. P. Goodman.....Trans. & Supplies

TECH. SERVICES DIVS. (HOUSTON)
 20 Years
 R. B. Hale.....Exploration

CALGARY AREA

15 Years
 L. A. Lewis.....Exploration

DENVER AREA

20 Years
 E. W. Richmond.....Production

15 Years
 M. L. Irwin.....Exploration
 V. L. Metz.....Production
 R. L. Patterson.....Production

10 Years
 R. W. Carlin.....Exploration

HOUSTON AREA

20 Years
 L. P. Carr.....Land
 C. C. Williams.....Gas
 A. Willis.....Production

15 Years
 B. D. Beasley.....Production
 L. A. Hopson.....Treasury
 L. Misher.....Treasury
 M. L. Reed.....Production
 W. K. Smith.....Production
 R. E. Taylor.....Production

10 Years
 M. A. Eversole.....Production
 M. W. Fleener.....Pers. & Indus. Rel.
 J. W. Hughes.....Land
 S. R. Johnson.....Treasury
 R. C. Knapp.....Exploration

MIDLAND AREA

20 Years
 L. Fischer.....Exploration
 W. B. Gaines.....Treasury
 M. T. Smith.....Crude Oil
 L. F. Uhrig.....Exploration

15 Years
 R. G. Patterson.....Exploration

10 Years
 F. E. Samuelson.....Treasury

NEW ORLEANS AREA

20 Years
 G. H. Loch.....Exploration
 F. J. Williams.....Exploration

15 Years

J. H. Dufrene.....Production
 R. R. Eckart.....Production
 R. L. Ferris.....Production
 W. J. Hebert.....Production
 R. H. Kennedy.....Land

10 Years

J. I. Bourgeois.....Production
 S. S. Day.....Exploration
 G. G. Dixon.....Exploration
 W. P. Legendre.....Production
 M. J. Olivier.....Production
 R. Porter.....Gas

PACIFIC COAST AREA

20 Years

A. M. Gentry.....Production
 W. W. Lupton.....Production
 H. C. Waggoner.....Production

15 Years

A. L. Herald.....Gas
 E. S. Hersey.....Production
 E. M. Marron.....Pers. & Indus. Rel.

10 Years

R. F. Bilohlavek.....Production
 D. H. Butts, Jr.....Treasury
 R. G. Johnson.....Exploration
 W. A. Kendrick.....Production
 J. B. Latimer.....Exploration
 R. E. Murphy.....Production
 J. O. Pullen.....Exploration
 G. W. Rea.....Purchasing-Stores
 Z. L. Wood.....Production

TULSA AREA

20 Years

D. K. Boggs.....Production
 E. G. Hamilton.....Production
 G. T. N. Roberts.....Production
 E. M. Schlender.....Gas
 E. C. Sparks.....Production

15 Years

R. E. Clark.....Production
 C. L. Creager.....Production
 O. B. Freels.....Production
 J. J. Gibbens.....Production
 L. L. Himelic.....Gas
 L. E. Jackson.....Exploration
 C. E. Matthews.....Transport
 J. A. Mayhew.....Legal
 C. R. Meryman.....Production
 L. G. Montague.....Land
 G. H. Thompson, Jr.....Exploration

10 Years

L. H. Sands.....Treasury

Manufacturing

ANACORTES REFINERY

15 Years

P. Cherry.....Zone B

10 Years

H. H. Wingert.....Treasury

HOUSTON REFINERY

15 Years

R. Baker.....Lubricating Oils
 L. J. Bonnette.....Engineering
 E. E. Kerbow.....Gas
 A. B. McGinty.....Dispatching
 J. W. Norton.....Engineering
 L. H. Reeves.....Control Laboratory
 A. V. Rowland.....Engineering
 A. F. Sartor, Jr.....Research Laboratory
 H. E. Walker.....Research Laboratory
 W. O. Wicker.....Engineering

10 Years

M. H. Alston.....Engineering
 W. T. Bratton.....Engineering

W. C. Lawhon.....Research Laboratory
 E. Rhodes.....Engineering
 O. H. Richardson.....Engineering
 S. Salone.....Engineering

MARTINEZ REFINERY

20 Years

T. J. Billecci.....Dispatching
 L. P. Cook.....Control Laboratory
 J. E. Nicolson.....Lubricating Oils
 J. J. Ronchetto.....Engineering

15 Years

F. E. Biasca.....Cracking
 M. J. Dromey.....Compounding
 N. L. Forsyth.....Engineering
 G. G. Freed.....Cracking
 T. W. Long.....Engineering
 R. T. MacNeely.....Engineering
 H. E. Schmitz.....Research Laboratory
 L. L. Wahmuth.....Fire & Safety

10 Years

F. P. Aiello.....Engineering
 R. W. Barker.....Cracking
 O. H. Bishop.....Engineering
 T. J. Hart.....Engineering
 E. Knight.....Compounding
 G. W. Kresha.....Control Laboratory
 H. E. Kubitschek.....Research Laboratory
 D. E. Olson.....Control Laboratory
 F. S. Redfield.....Engineering
 N. G. Rose.....Engineering
 L. E. Silva.....Research Laboratory

NORCO REFINERY

20 Years

R. G. Braud.....Gas

15 Years

J. C. Becnel.....Engineering
 S. R. Dufrene.....Control Laboratory
 R. Duhe.....Engineering
 A. A. Hymel.....Catalytic Cracking
 U. C. Hymel.....Utilities
 C. V. Lovetro.....Engineering
 G. A. Morris.....Engineering
 J. Perilloux.....Dispatching
 R. J. Richoux.....Pers. & Indus. Rel.

10 Years

J. A. Cleveland.....Distilling

WILMINGTON REFINERY

20 Years

R. E. Gaskill.....Engineering
 A. P. Schwarz.....Engineering

15 Years

M. McFadden.....Engineering
 D. D. Watt.....Dispatching
 W. J. Woods.....Effluent Cont. & Util.

10 Years

C. E. Boston.....Engineering
 H. V. Crawford.....Control Laboratory
 E. L. Howard.....Control Laboratory
 K. R. Lewis.....Control Laboratory
 R. J. Miller.....Engineering
 E. M. Scales.....Engineering
 A. G. Smith.....Effluent Cont. & Util.
 E. B. Watkins.....Engineering

WOOD RIVER REFINERY

20 Years

F. G. Adams.....Aromatics
 J. Gilreath.....Compounding
 A. C. Hogge, Jr.....Administration
 D. C. Isted.....Lubricating Oils
 N. E. Kruse.....Compounding
 C. E. Oetken.....Control Laboratory
 R. H. Pruett.....Engineering
 E. F. Rhoades.....Engineering
 L. L. Sarchett.....Treasury

15 Years

M. W. Armistead.....Technological
M. H. Belflower.....Engineering
E. B. Brown.....Engineering
J. D. Brown.....Compounding
W. H. Burchell.....Engineering
J. C. Carlton.....Thermal Cracking
W. S. Catalano.....Engineering
J. D. Clevenger.....Compounding
J. E. Compton.....Engineering
R. W. Cooke.....Engineering
G. G. Eardley.....Engineering
D. E. Eccles.....Engineering
D. F. Fink.....Research Laboratory
G. K. Friemann.....Compounding
H. F. Gillespie.....Dispatching
G. J. Grizio.....Engineering
R. W. Henry.....Technological
A. A. Ingersoll.....Engineering
E. H. Kraut.....Engineering
J. J. Merkel.....Utilities
A. H. Mersinger.....Engineering
G. R. Meyers.....Catalytic Cracking
L. G. Neese.....Thermal Cracking
E. L. Pitman.....Control Laboratory
N. E. Prante.....Dispatching
P. B. Rands.....Engineering
T. Renner.....Engineering
A. P. Rinderer.....Engineering
H. J. Rose.....Engineering
M. W. Rommerskirchen.....Engineering
M. F. Sandretto.....Engineering
L. F. Scheibal.....Engineering
G. A. Shahan.....Stores
H. T. Sherer.....Compounding
I. A. Stechman.....Engineering
L. H. Steffens.....Engineering
W. A. Sturgill.....Engineering
R. A. Viehweg.....Thermal Cracking
J. L. Webb.....Research Laboratory
E. W. Winkle.....Control Laboratory

10 Years

H. K. Barnett.....Effluent Control
S. S. Brown.....Engineering
J. W. Davis, Jr.....Technological
J. T. Fisher.....Technological
H. J. Foederer.....Treasury
C. W. Mosser.....Lubricating Oils
R. G. Tuell.....Research Laboratory
H. L. Wagenblast.....Compounding

Marketing

MARKETING DIVISIONS

20 Years

L. E. Augsbury.....Albany, Operations
K. D. Sheehy.....Albany, Operations
J. T. Pettit.....Atlanta, Sales
J. L. Bartolomeo.....Baltimore, Operations
E. W. Beck.....Baltimore, Operations
J. C. Decker.....Baltimore, Operations
R. G. Hall.....Boston, Operations
F. Grauwels.....Chicago, Operations
C. W. Irwin.....Detroit, Sales
A. W. Hammond.....Minneapolis, Operations
R. F. Stover.....Minneapolis, Operations
J. N. Heroy.....New York, Marketing Service
M. B. Lishon.....New York, Administration
K. T. Bunker.....Portland, Operations
A. D. Wilkinson.....Portland, Operations
L. J. Gibson.....Sacramento, Operations
E. Billings.....St. Louis, Operations
J. J. Witte.....St. Louis, Sales
R. S. Peters.....San Francisco, Operations
L. Weaver.....Seattle, Operations

15 Years

C. G. Gilbert.....Albany, Treasury
C. A. Martin.....Boston, Operations
J. L. Baer.....Chicago, Sales

J. W. Koerble.....Chicago, Operations
R. L. McCornock.....Chicago, Mktg. Service
V. C. Gilcher.....Cleveland, Operations
K. R. Dunham.....Indianapolis, Operations
D. H. Marshall.....Los Angeles, Operations
M. D. Van Horn.....Los Angeles, Operations
F. J. Lechner.....Minneapolis, Treasury
R. N. Engelke.....Portland, Mktg. Service
E. L. Burkhardt.....St. Louis, Operations
Winifred M. Bowe.....San Francisco, Treasury
G. K. Castle.....San Francisco, Sales
H. J. Hallmeyer.....San Francisco, Operations
E. L. McIver.....San Francisco, Sales
J. W. Cummings.....Seattle, Operations

10 Years

J. Hagues.....Atlanta, Operations
J. H. Riden.....Atlanta, Operations
M. J. Stewart.....Atlanta, Treasury
J. B. White.....Atlanta, Treasury
F. C. Joran, Jr.....Baltimore, Operations
J. W. Seibert.....Baltimore, Operations
M. Marjorie Murphy.....Boston, Treasury
D. E. Dornburg.....Chicago, Mktg. Service
M. I. Rockett.....Chicago, Treasury
L. L. Schaefer.....Chicago, Operations
Dolly I. Toth.....Cleveland, Treasury
R. R. Friske.....Detroit, Operations
P. E. Kostrzewski.....Detroit, Operations
A. S. Petersen.....Detroit, Treasury
L. C. Rock.....Detroit, Operations
A. C. Sawyer, Jr.....Detroit, Sales
J. D. Keller.....Indianapolis, Treasury
H. W. Osborne.....Indianapolis, Operations
Bernadine G. Lawlor.....Los Angeles, Treasury
H. W. Judson.....New Orleans, Operations
C. W. Boehringer.....New York, Sales
A. Centola.....New York, Treasury
H. E. Walbridge.....New York, Sales
L. G. Campbell.....Portland, Operations
A. A. Etzel.....Portland, Operations
W. K. Drury.....Sacramento, Administration
Felice Thorpe.....San Francisco, Treasury
A. E. Olson.....Seattle, Operations

SEWAREN PLANT

15 Years

W. A. Cummings.....Compound
W. J. Hanley.....Engrg. & Maint.
A. Horoshko.....Asphalt
J. Kovacs.....Compound
D. H. Tappen.....Engrg. & Maint.

10 Years

T. A. Crain.....Compound

Pipe Line Department

20 Years

H. M. Coggins.....Zionsville, Ind.
W. A. Kuhn.....Muncie, Ind.
J. Russell.....Toledo, Ohio
P. D. Spudick.....Harristown, Ill.

15 Years

F. Franks.....East Chicago, Ind.
R. R. Meyer.....Jackson, Mich.
L. Prewett.....Bakersfield, Calif.
C. G. Tuttle.....Effingham, Ill.

10 Years

A. G. Griggs.....Tracy, Calif.
L. E. Keyes.....Waltham, Mass.

SHELL CHEMICAL CORP.

20 Years

M. T. Hartwell.....Dominguez
R. F. Buller.....Head Office
E. L. Hutchins.....Head Office
E. W. Brown.....Houston
J. F. Taylor.....Houston
R. E. Thurmond.....Houston
V. S. Tucker.....Houston
J. L. Davies.....Shell Point

15 Years

P. Konstan.....Head Office
H. R. Wynne.....Head Office
L. Alexander.....Houston
R. Edwards.....Houston
J. T. Harlan.....Houston
A. H. Parker.....Houston
C. W. Pearce.....Houston
R. D. Phillips.....Houston
J. Smith.....Houston
J. A. Wasek.....Houston
R. Williams.....Houston
H. J. Billeci.....Martinez
D. J. Haydel.....Norco
G. J. Matherne.....Norco
A. N. Smith.....Norco
C. M. Costa.....Shell Point
P. E. Jennings.....Shell Point
R. R. Holloway.....Torrance
F. C. Pearce.....Torrance

10 Years

G. W. Ewald.....Head Office
V. Promptoff.....Head Office
F. L. Fredrickson.....Houston
M. O. Leach.....Houston
R. A. Campbell.....Martinez
R. T. McGowan.....San Francisco
A. M. Besselievre.....Shell Point
A. Biagi.....Shell Point
J. J. De Lost, Jr.....Shell Point
J. W. Aten.....Torrance
L. D. Wareham.....Torrance

SHELL DEVELOPMENT CO.

20 Years

H. D. V. Finch.....Emeryville
D. H. Hannum.....Emeryville
J. R. Niles.....Houston

15 Years

R. H. Kercher.....Emeryville
F. M. Nelsen, Jr.....Emeryville
J. L. Van Winkle.....Emeryville
D. E. Winkler.....Emeryville
J. Zachar.....Emeryville

10 Years

A. A. Bondi.....Emeryville
R. C. Bowers.....Emeryville
J. A. Buell.....Emeryville
June R. Hughes.....Emeryville
S. L. Scordelis.....Emeryville
J. E. Weigel.....Emeryville

SHELL PIPE LINE CORP.

20 Years

G. G. Billings.....West Texas Area
C. C. Boyles.....Mid-Continent Area
J. D. Cochran.....West Texas Area
C. A. Craig.....Mid-Continent Area
E. E. Handley.....Mid-Continent Area
J. N. Johnson.....Mid-Continent Area
W. L. LaFon.....West Texas Area
R. J. Mayes.....West Texas Area
R. T. McDonald.....West Texas Area

15 Years

E. M. Blevins.....Mid-Continent Area
J. H. Darling.....Mid-Continent Area
R. H. Jones.....Mid-Continent Area
A. B. King.....Mid-Continent Area
D. W. Montgomery.....Mid-Continent Area
R. M. Moore.....West Texas Area
G. D. Smith.....Mid-Continent Area
H. C. Stevens.....Head Office
T. A. Thompson.....Mid-Continent Area
Gladys M. Wilson.....Head Office

10 Years

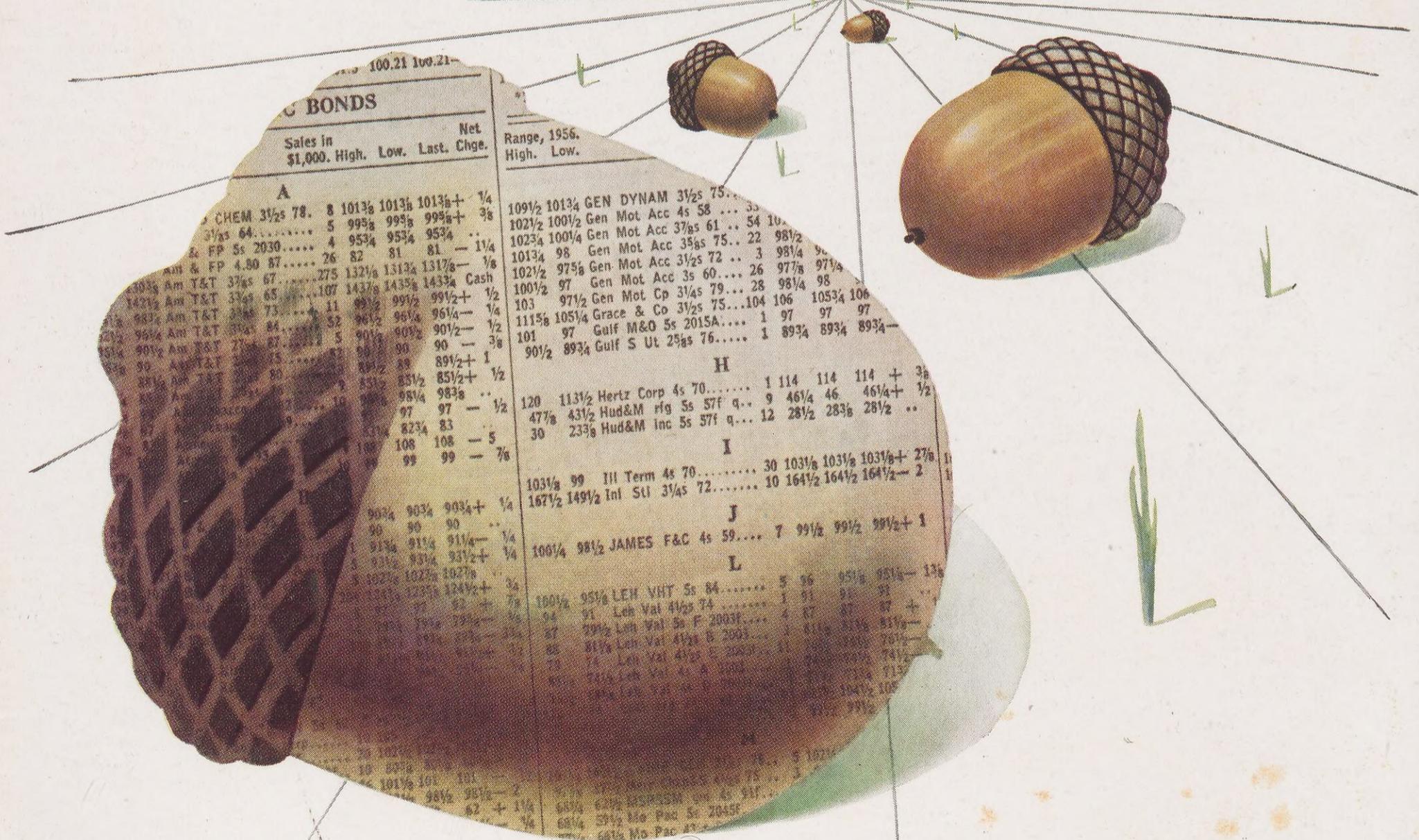
D. L. Herrington.....West Texas Area
J. L. Pixley.....Texas Gulf Area
A. G. Smith.....West Texas Area
E. D. Smith.....Mid-Continent Area
P. E. Smith.....West Texas Area
E. W. Travis.....Mid-Continent Area

matters of
fact

The money in your Provident Fund account grows steadily each month because Shell matches your contributions dollar for dollar. In addition you share in the earnings of the Fund. In 1955 alone Shell contributed more than \$16 $\frac{1}{3}$ million to the Provident Fund for the benefit of members. Nearly \$6 $\frac{1}{2}$ million more was added through investment earnings.

The more than 99 per cent of eligible Shell employees who are Provident Fund members can look forward to retirement secure in the knowledge that they will have a substantial retirement "nest egg".

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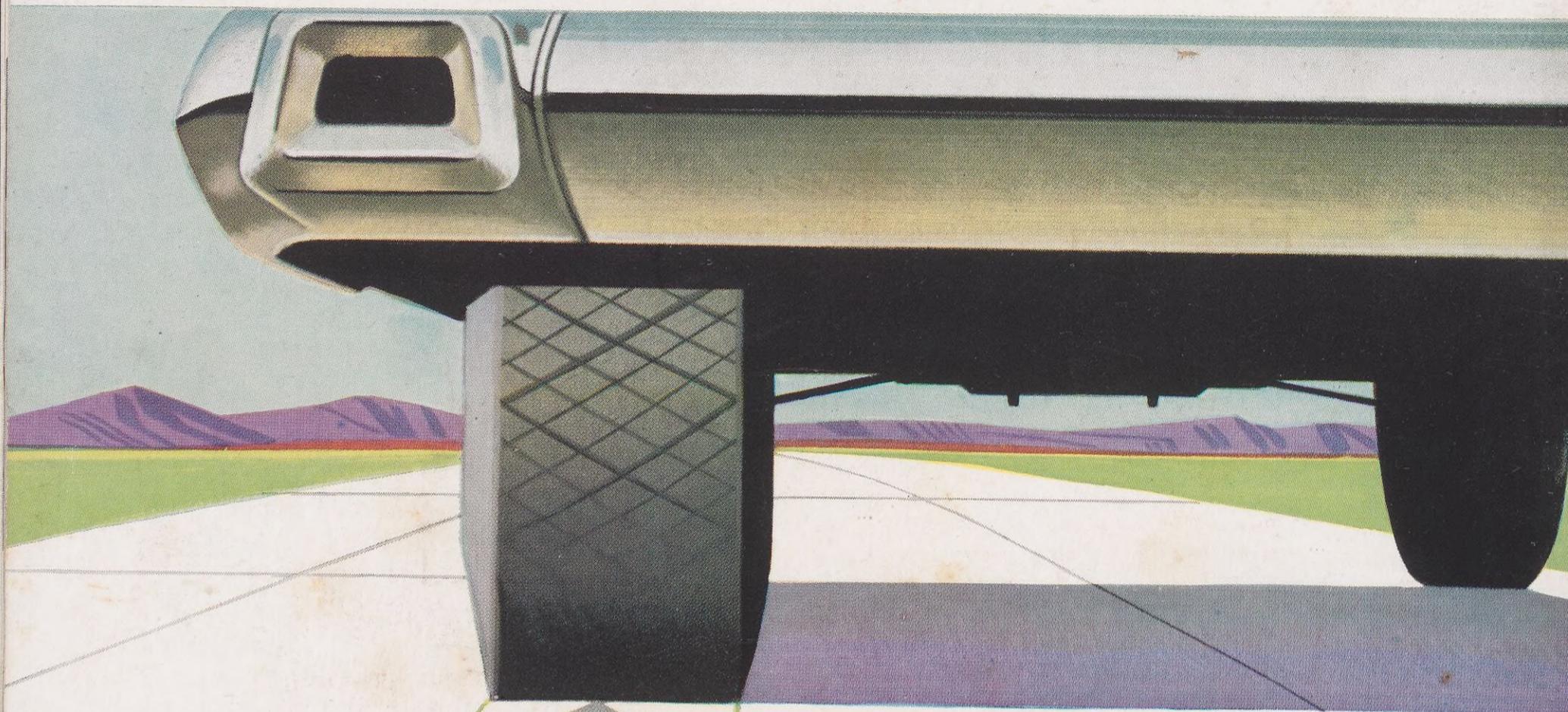
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SYNTHETIC RUBBER



If all the synthetic rubber produced by Shell Chemical Corporation's Torrance Plant went into the manufacture of automobile tires, there would be enough to make more than 54,000 tires daily. Actually, about 75 per cent of the plant's present output eventually does find its way into vehicles — not only as tires, but in such things as chassis and window mountings and shock absorbers. The remaining 25 per cent is used in the manufacture of such items as wiring insulations, office supplies, toys, fire and garden hose, foam rubber cushioning, machine rollers, boots, and many others.

Shell's synthetic rubber in several types and grades is supplied to more than 80 manufacturers, large and small. Expanding research to improve its quality and increase its applications should add to this number.

RB