★ UNION OIL BULLETIN ★

Vol. 20
No. 3
1939

UNION OIL COMPANY OF CALIFORNIA

TO THE STOCKHOLDERS OF
UNION OIL COMPANY OF CALIFORNIA:

The following is a summary of the results of the Company's operations for the nine months ended September 30, 1939, and the financial position as of that date.

PROFITS (less all expenses and charges, including provision for income taxes) were approximately as follows:

	1939	*Per Share	1938	*Per Share
Profit subject to depletion and depreciation	$12,118,774	$2.60	$13,250,000	$2.84
Provision for depletion and depreciation	7,569,061	1.62	6,850,000	1.47
Net profit for the nine months	$ 4,549,713	$ .98	$ 6,400,000	$1.37

*Calculated on 4,666,270 shares outstanding at September 30th.

The decrease in profits for the nine months of 1939, as compared with 1938, is due principally to reduced sales prices, a lower basis of inventory valuation, and increased depletion and depreciation charges in connection with abandonments of exploratory oil lands and wells. A substantial improvement was reflected in the earnings for the third quarter, however, the net profit for the period being $1,898,569, or 41¢ per share, as compared with $1,450,000 and 31¢ per share for the corresponding period of 1938. Notice of possible additional income taxes for prior years was received in September, 1939, and in respect thereof a charge of $340,000 was made to earned surplus.

CURRENT ASSETS at September 30th amounted to $59,389,196, including cash resources of $25,475,126, an increase of $11,616,075 since the first of the year. This increase reflects the amount received from the sale of the 3% Debentures during August, less the portion thereof that has been deposited with Trustees for the redemption of the Company's 3½% Debentures and Six Per Cent Bonds. Current assets were over 6½ times current liabilities of $9,009,532, which included the dividend declared September 25th.

FUNDED DEBT was increased by about $12,000,000 as a result of the sale on August 16th of $30,000,000 of the Company's 3% Debentures, due August 1, 1959. Of the net proceeds from this issue, $20,066,553 was deposited in irrevocable trusts to cover the redemption on January 1, 1940, at 105½% and accrued interest, of the outstanding $10,000,000 of Fifteen-Year 3½% Debentures and the payment of, and interest to maturity on, the outstanding $8,018,500 of Twenty Year Six Per Cent Bonds, Series A, due May 1, 1942. It is planned to use the remainder of the proceeds for extending and modernizing the Company's facilities, and for additional working capital. The premium of $300,000 on the sale of the 3% Debentures, less expense of $132,997 in connection with the issue, has been added to earned surplus.

PRODUCTION of crude oil and natural gasoline, subject to royalty, amounted to 14,087,697 barrels for the nine months of 1939, a decrease of about 1,812,303 barrels as compared with the like period of 1938 due to the continuation of the curtailment program.

SALES for the nine months amounted to $55,810,884 as compared with approximately $57,950,000 for the corresponding period last year. The quantity sold to date this year was 23,800,395 barrels, an increase of about 100,395 barrels from that sold in the nine months of 1938.

CAPITAL OUTLAY of $6,605,836 consisted mainly of new drilling in developed and prospective fields, additions and improvements to refinery and marketing facilities, and expenditures for the new tankship now under construction.

EARNED SURPLUS at September 30, 1939, was $18,731,093 after the special charge for income taxes for prior years, referred to above, and the cash dividend of 25¢ per share which was declared on September 25th to be distributed November 10th to stockholders of record at the close of business October 10th.

By Order of the Board of Directors,
REESE H. TAYLOR, President,
M. G. KERR, Comptroller.

Los Angeles, California
October 30, 1939

UNION OIL BULLETIN

VOLUME TWENTY | THIRD QUARTER, 1939 | NUMBER THREE

W. L. Stewart, Jr., Union Oil Company's vice-president in charge of manufacturing.

Earle W. Gard, manager of research and development, who guides research work.

Left: Experimental alkylation unit, used in the development of high octane aviation gasoline.

THE QUALITY BUILDERS

IT IS amazing how casually we Americans accept the most outstanding contributions to the comfort and enjoyment of living. Automobiles, motion pictures, radio, electrical appliances of infinite variety, and many other contributions of modern science, following the brief spasm of excitement occasioned by their discovery, have been absorbed into our daily routines, and have quickly become almost as commonplace as bathtubs and kitchen tables. In a few short years every single phase of our national life has been changed remarkably by the developments of science. The change still goes on, and it is doubtful if any other material among the endless elements and compounds that compose the universe has played a more significant part in this process of industrial and social elevation than the ubiquitous substance we call petroleum.

Locked in subterranean vaults by a jealous nature, it has been wrested from its hiding place and adapted to multifarious uses by the

ingenuity of man. In far-off times petroleum lighted the sacrificial fires of fanatic ritualists; the ancient navigators sailed bravely in frail craft caulked with natural asphalt, and Marco Polo tells us that it was used freely in his time to heal the sore humps of camels. These early attempts to find application for petroleum were the beginning of a search that has grown in intensity and broadened in scope down through the ages. Every fresh discovery points new paths of industrial adventure, and despite the success of the past, the promises of petroleum are still beyond our wildest prediction.

The American oil industry dates back only 80 years, and it may be assumed that in the first hectic period of exploitation following Colonel Drake's discovery there was no such thing as organized research. True, among the operators, there were engineers and mechanics, and even untrained men with the inherent inventive genius that contrives and develops despite the lack of education. These made their respective contributions and substantial ones, too, but it was not until oil production had ceased to be an orgy and had become an established industry that men began to consider the economics of the situation. The initial production was totally inadequate to meet the demand, so more operators entered the new game, and drilling activity increased tremendously. As the crude oil supply grew more plentiful, prices began to drop, and it finally became necessary to give some consideration to production costs. Thus began the era of scientific management.

Meantime the refiners were also meeting with problems, the solution of which required the aid of engineers and chemists. Pennsylvania had begun the distillaton of crude petroleum for the manufacture of kerosene, and the paraffine lamp was now the nation's candle, but lamp wicks smoked, and kerosene vapors exploded, and chemists were called in to devise methods of rendering the use of kerosene less hazardous and more effective. Out in California, Lyman Stewart and Wallace Hardison were experimenting with crude oils from their first wells in Ventura County. These men realized early in their careers the value of research. Before Union Oil Company was formed they had employed chemists to find means of improving their kerosene, and utilizing the by-products of petroleum. One of them designed a method for the manufacture of lamp black from petroleum, and its conversion to printers ink. The other discovered the solubility of asphalt in carbon bisulphide, and started the manufacture of asphalt paints. Lyman Stewart, himself, was the instigator of the experiments that first led to the use of fuel oil in railway locomotives in this country.

In the forty-nine years that have elapsed since the organization of Union Oil Company of California, the petroleum industry of the west has grown to gigantic proportions, and its growth has been the simple result of constantly extending and improving its service to the public. There is hardly a phase of our lives in which petroleum or one of its products does not play an essential part. Industry would be paralyzed without fuels, lubricants, solvents, and the wide diversity of products for which it is dependent on the petroleum refiner and compounder, and all of this is the result of a sustained program of applied research in which Union Oil Company has played a leading part since the day of its founding.

To the man on the street, the research laboratory, and particularly the petroleum research laboratory, is a mysterious, somewhat obscure institution whose activities lie far beyond the scope of ordinary understanding. It seems to involve a complexity of apparatus and a confusion of formulae that can only be understood by experts, but while this is true of many research projects, there are many others that can be interpreted in the language of the layman, and the industry has been sadly amiss in not taking advantage of this fact more fully to solicit the understanding and sympathy of the public. For the story of petroleum research is one of intriguing conquest, a story of the battle of science to adapt one of nature's most unattractive products to the unlimited use and convenience of man.

Union Oil Company's research and development department, as already indicated, is by no means new. The principle behind the whole program is as old as the organization itself. Throughout the life of the Company there has been a constant awareness of the need for more efficient methods and better and still better quality. And our predecessors did much more than merely entertain the idea. They were exercised and actuated by it, and the history of the oil industry bears rich testimony to the results of their efforts.

Research and development is an essential service, designed not to advance any specific phase of Company activity, but to aid in the development of every phase. From the exploration of prospective oil producing proper-

Vance N. Jenkins, chemist, and P. S. Clarke, research supervisor at Wilmington Refinery.

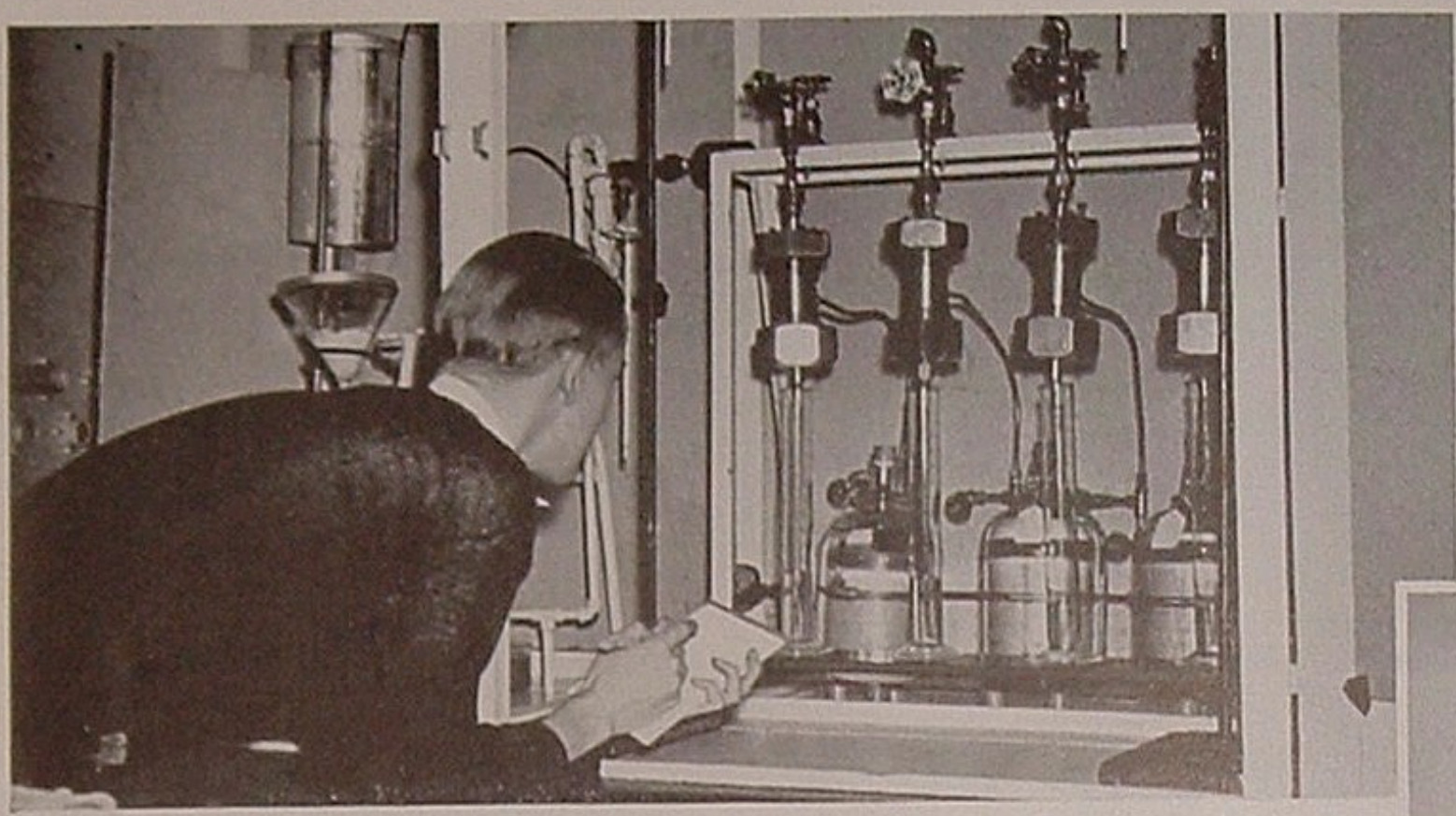
Ross J. Garofalo, patent attorney, and C. E. Swift, Union's newly appointed patent counsel.

B. G. Aldridge, assistant manager of research and development in charge of engineering.

Basil Hopper, assistant manager of research and development in charge of research, Don E. Carr and C. C. Moore, Jr., research supervisors.

A. L. Blount, research supervisor, and K. J. Korpi, chemist.

E. G. Ragatz, assistant manager research and development in charge of economics, and E. A. Wilson, engineer.



Left: This permeability apparatus is used to study flow of liquids through oil sand. It is here operated by D. W. Getzen.

Right: These tests are part of the work of P. H. Jones, one of Union Oil's research supervisors.

ties to the marketing of products, there is not a single aspect of the business in which the technicians of this versatile department don't play some part. Nor is the field of endeavor limited to the confines of the Company. A great diversity of petroleum products are used by industrialists all over the world for a wide variety of purposes. Each new use requires a study of conditions, and a definition of specifications to meet these conditions. Searching for new products and new uses is one of the fundamental responsibilities of the department that has already provided Union Oil Company customers with a choice of products and specialties second to none, and assures our future salesmen that this leadership will be maintained.

The research chemist also is the natural enemy of waste. His lexicon contains no such word as "spoilage." Everything that comes from the well can be adapted to some useful purpose, and he chases down every loose radicle and ties it into some useful product.

Not only is he concerned with the present, but he even projects himself into the future, and endeavors to determine what shall be the need of a distant tomorrow, and what part petroleum shall play in supplying that need.

We can, perhaps, get a more concise understanding of the ramifications of this interesting business if we consider the organization of Union Oil Company's research and development department as it exists at the present time, and discuss in a general way the responsibilities of the various groups of which it is composed.

Under the direct management of Earle W. Gard, who in turn is responsible to W. L. Stewart, Jr., vice president, the department has four main divisions—research, engineering, economics, and patents, all closely allied and co-operatively engaged. As the name implies, the research division is devoted to fundamental research and basic process design; the engineering division is responsible for the design of new equipment and the adaptation or modification of existing equipment; the economics division is concerned with cost studies involving the manufacture of products, plant installations and alterations; and the patents department secures adequate protection for new products, processes, and equipment, checks the validity of claims, searches for interfering claims and copyrights, and in general keeps the Company out of infringement troubles.

The research division maintains quarters adjacent to its two largest refineries at Wilmington and Oleum. The quarters each consist of a series of well-equipped laboratories, divided into groups, under the jurisdiction of research supervisors. As intimated, the work of the division is essentially process development and fundamental research, and this program is distributed among the several supervisors, each of whom has immediate control of some specified phase. Let us just take a sightseeing tour around the laboratories.

In one corner of the building we find a supervisor and his staff engaged in the solution of problems concerned with the manufacture and uses of asphalt, lubricating oils, waxes,

and other related matters. Here we note a miniature still for the manufacture of air-blown asphalt. There are also some weird looking contraptions we recognize as wax filters. And on the benches are all the paraphernalia that are required for the testing of asphalts, waxes, lubricating oils and their derivatives. Standing out in the middle of the floor in full operation is a small roofing paper mill, by means of which the physical characteristics of the impregnated asphalt can be determined and correlated with the results of the various tests. In this manner Union Oil Company is able to develop information of real value to the commercial manufacturers of roofing paper, and similarly other uses of asphalt are studied in order to improve prevailing practice and point the way to future accomplishment. So it is with the waxes and lubricating oils. There is no such thing as a finished job in the research department. The adaptation of these commodities is limited only by the application and ingenuity of the technicians. The results of lubricating oil research are already well known to employees and patrons of Union Oil Company. Propane solvent refining, developed in our own research laboratory, gave us Triton, the oil that brought a new conception of lubrication values to industry, and changed the whole tenor of refining procedure. The adoption of phenol solvent treatment, also the recommendation of the research department, enabled the Company to increase the yield of Triton to meet the growing demand. Paraffine wax is already finding many new uses in the home and in the factory, and in asphalt is locked up an infinity of possibilities that are slowly being exposed by the insatiable curiosity and the technical wizardry of this group.

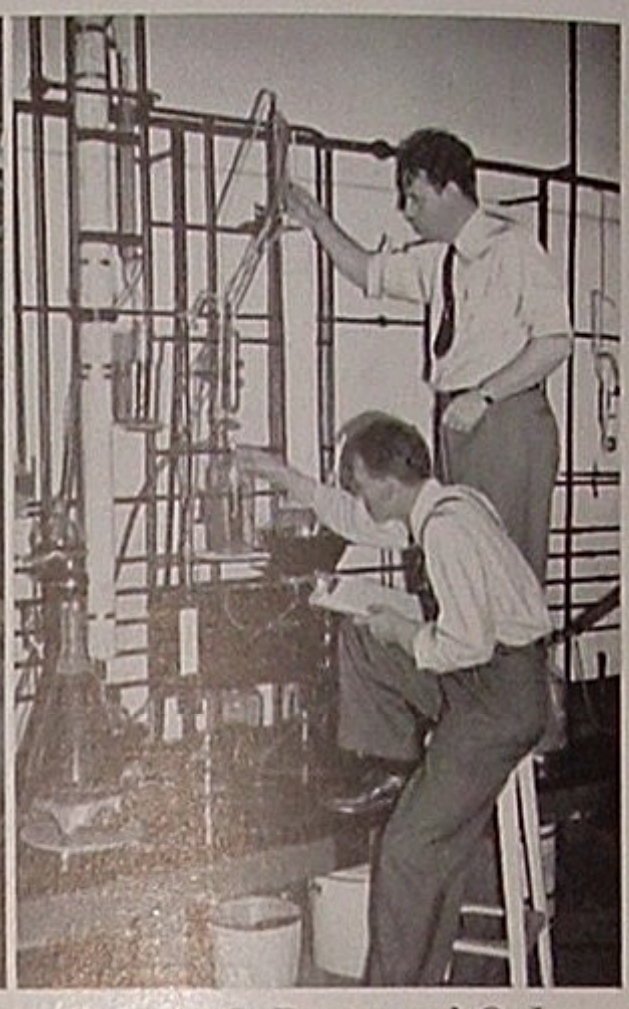
In another small laboratory is a supervisor and his aides who devote their time to the development of specialties. Endless, but orderly, rows of labeled bottles, beakers and sample cans, glass retorts, condensers, and all the alluring requisites of the chemist's art, testify to the effort that is put forth to add to an already imposing array of Union Oil Company products. Out of this laboratory have come window cleaners, auto polish, auto wax, fly sprays, shoe polish, and there is no end in sight. Customer problems and competitive products are also a prime concern of these chemists, and their facilities are at the disposal of any manufacturer whose processes involve the use of Union Oil Company products. What the future holds in the way of new specialties it would be hazardous to predict, but edible fats, perfumes, cosmetics, medical

Above: C. Jones and M. T. Flaxman use the Faville-LeValley tester to determine the film strength of various lubricating oils.

Right: This equipment is used to study various methods of removing sulfur from gasoline fractions. Shown in picture are G. E. Melton and Dr. W. E. Bradley, research supervisor.

Stanley Reiner tabulates results of a gas analysis.

R. A. Dunham studies roofing asphalt on this device.



Drs. A. C. Byrns and O. L. Polly study oil fractions.

compounds, ointments, and other products of which we little dream at the moment, may someday be materialized from the experiments of this small but intense organization.

A third supervisor is adapting the laws of chemistry and physics to the needs of the field department, and helping that department to drill more productive wells faster and cheaper. Down into the ground 10,000 feet, even 15,000, mud is pumped during well-drilling, to lubricate the drill, carry off the drillings, prevent cave-ins, and perform other essential functions. In this supervisor's work-shop are ponderous gadgets that duplicate the tremendous underground pressures, and other subterranean influences, so that he may predict flow tendencies under a wide range of conditions. The results of these studies become the tools of the petroleum engineers and drilling superintendents, and this association of research and applied engineering explains the enviable reputation which Union Oil Company's field operators enjoy in the industry. With the tendency towards deeper drilling, science becomes an aid in the development of pertinent information. Water studies are also an important phase of this work. Oil emulsions and oil flow are influenced by the character of the water encountered and introduced during operations, and it is necessary to determine the nature of these influences, their causes and effects. From all of which come invaluable contributions to the economics of one of the most vital operations of the Company. To assure efficient operation of steam driven equipment, steam heaters, and interchangers, this supervisor conducts a continuous study of boiler waters from all available sources. He is also the expert on the disposal of waste waters, particularly where they might be injurious to fish and game, or might tend to pollute natural potable waters.

In an annex to the main building we next find supervisor number four busy in the midst of a complex assembly of dynamometers, knock-rating machines, and other abstruse aids to the business of fuel and motor testing. This is the tryout department in which 76 proved its efficiency before it was submitted to convincing road tests, and finally distributed to a grateful public. Here is the type of research work that has made the present high compression motor possible, and will, undoubtedly, point the way to future automotive development and still better engine performance. Every characteristic of the most temperamental engine can be determined. Power output under any set of conditions, engine performance with any type of fuel, and the effects of all variable factors become clear in this workshop. Engines are built up, run under stipulated conditions, and then torn down to determine what has happened to pistons, rings, etc. Readers of the Bulletin are familiar with the exhaustive tests that preceded the introduction of Triton motor oil. This is where the actual

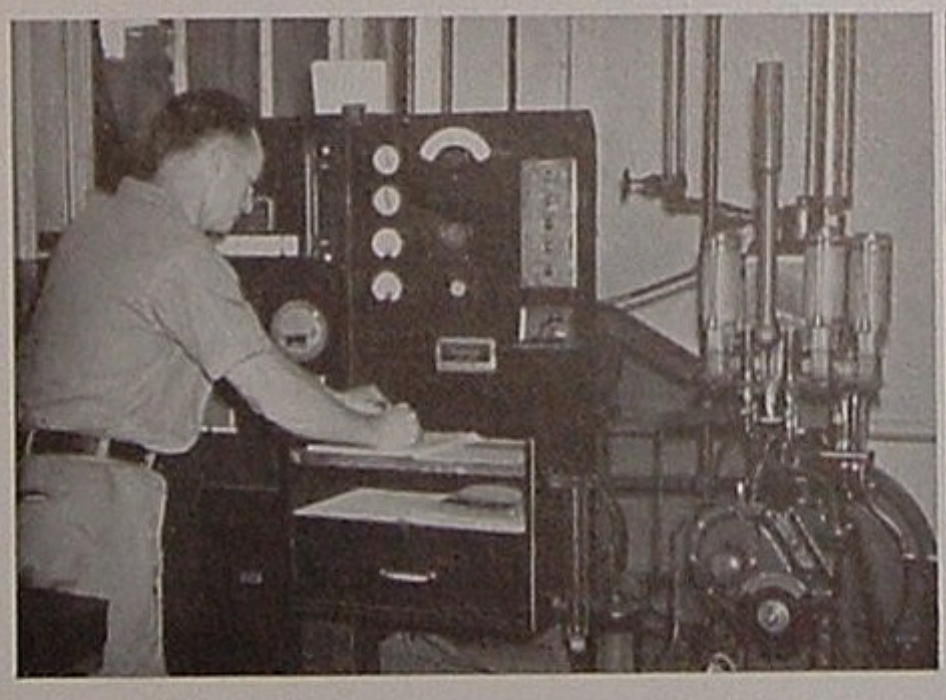
test work, laboratory and road, was controlled, and this will, unquestionably, be the testing ground of all future motor fuels and engine lubricants, regardless of what development may be. Aviation and diesel fuels have also commanded the attention of this group of experts, and the importance of their work is evident in the fact that the final judgment of fuel efficiency and performance, lies in the laboratory and road tests for which they are responsible.

In another wing of the main building we discover two more supervisors with their respective laboratories and staffs whose particular job seems to be peering into the future. The synthesis of gasolines and other organic compounds is their main interest. Actually, they are trying to visualize the needs of new generations, and are conducting researches leading to the transmutation of old products into new. They tear molecules apart and reassemble them; remove hitherto unremovable constituents from existing compounds; and break down hitherto unbreakable substances. Employed in their investigations are vacuum stills in which mixtures of gases are reduced to liquids, and distilled into their component fractions at temperatures far below zero. Strange assemblies of twisty tubes and chromium plated containers are used in the study of catalytic polymerization, alkylation, and other recent departures in refinery practice that turn former waste products into highly valuable industrial commodities, and conjure new products from old. The laboratory studies lead to the building of actual processing units on a reduced scale and the research laboratory yard, with its array of aluminum painted fractionating columns, pipes, condensers, stills, etc., has all the appearance of a small but complete refinery.

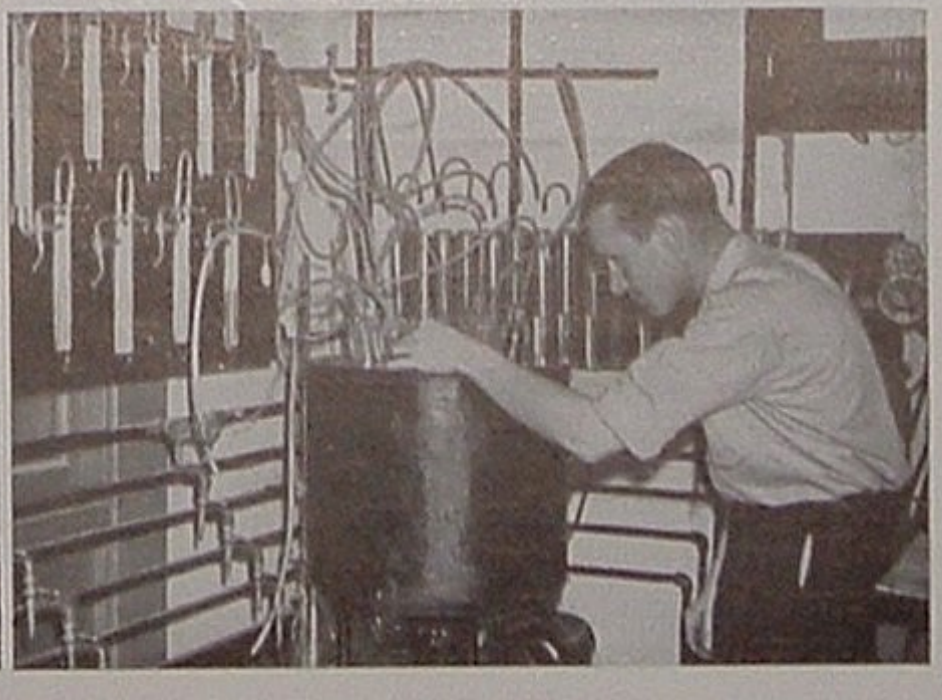
Oleum refinery is largely devoted to the manufacture of Triton motor oil, compounded greases, other types of lubricants, and asphaltic compounds. The research department at that point, therefore, is naturally devoted to the development of processes and products relating to these activities. Solvent refining of lubricating oils, studies of various compounds and the effects of their incorporation in compounded lubricants, modification and improvement of asphaltic products and processes, investigations of accepted testing methods, and the definition of new methods, are just a few of the problems that keep the research laboratory and its supervisors and staff in the Bay area thoroughly occupied. It should also be pointed out that many of the researches being carried on in the Wilmington laboratory are shared by the Oleum unit, so that there is no definite distinction between their work. It is a wholly co-operative effort with the one objective of serving Union Oil Company, its several departments, and its host of customers, in the most effective and most efficient manner.

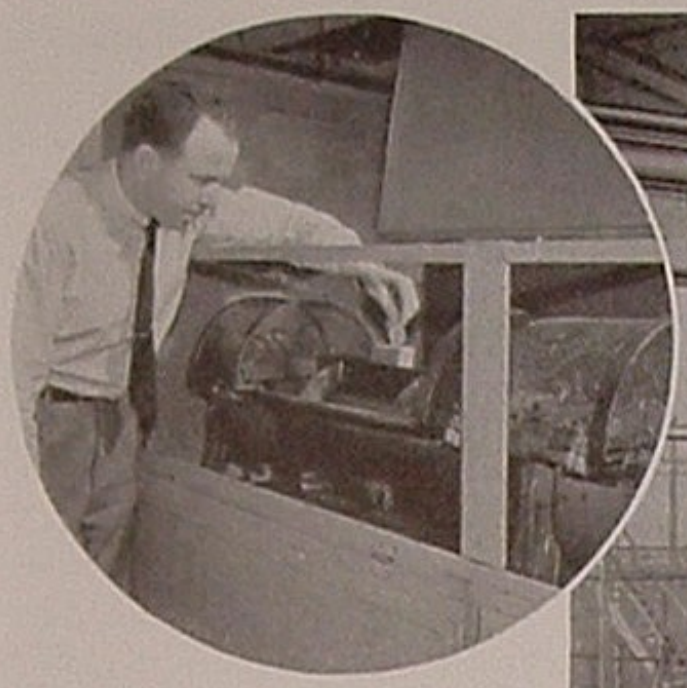
One of the most essential adjuncts of a research department is a reference library, and under the capable direction of Miss Elizabeth Burroughs, there has been built up at Wilmington one of the finest chemical and engineering libraries in the west. Name any subject in which a chemist might be interested, and if Miss Burroughs can't give you promptly a list of references as long as your arm, there just aren't that many references. She has the unique faculty of being able to read and retain every significant scrap of information, and her accurate association of pertinent arti-

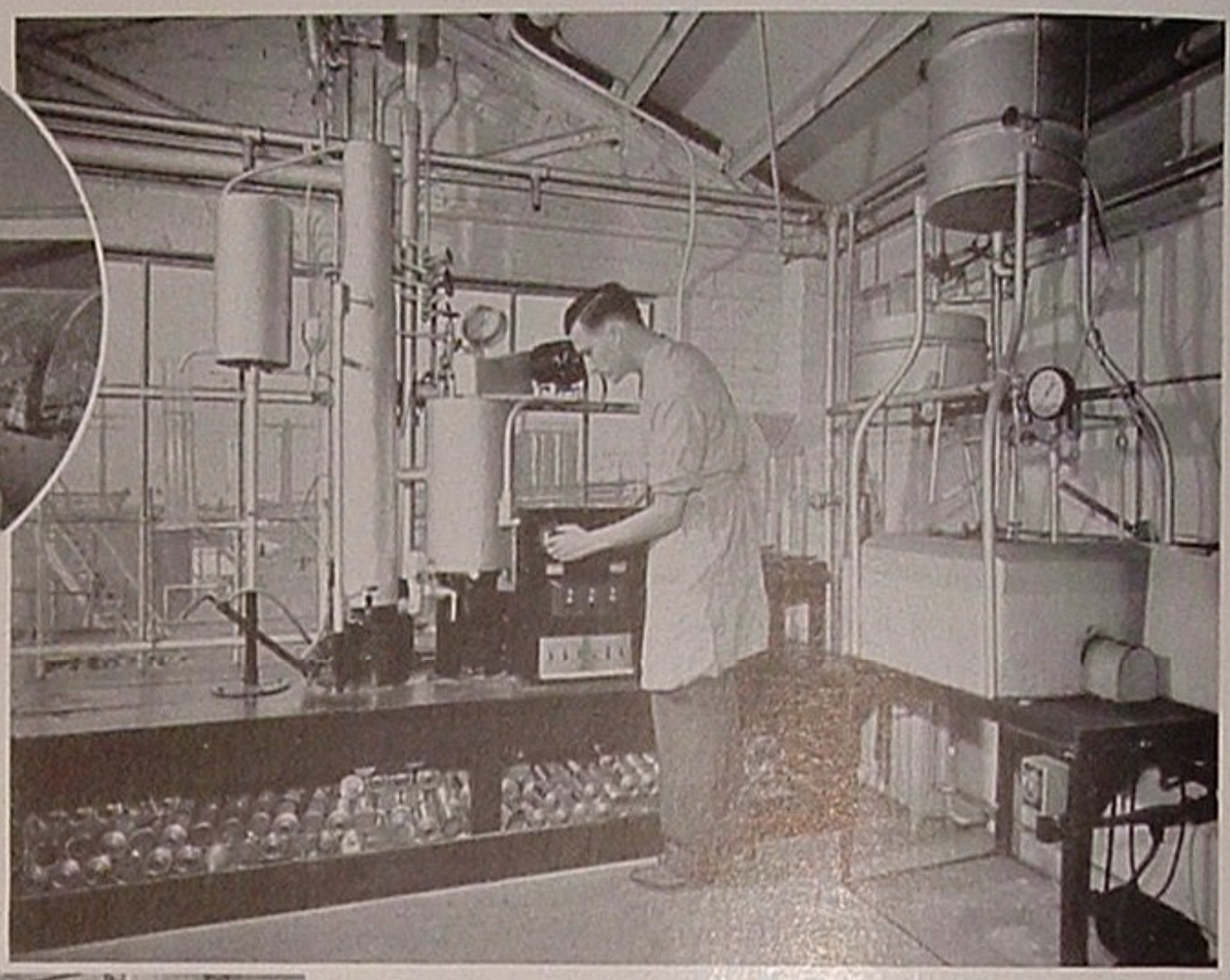
R. E. Hall uses the fuel research testing engine to determine octane rating of a gasoline.



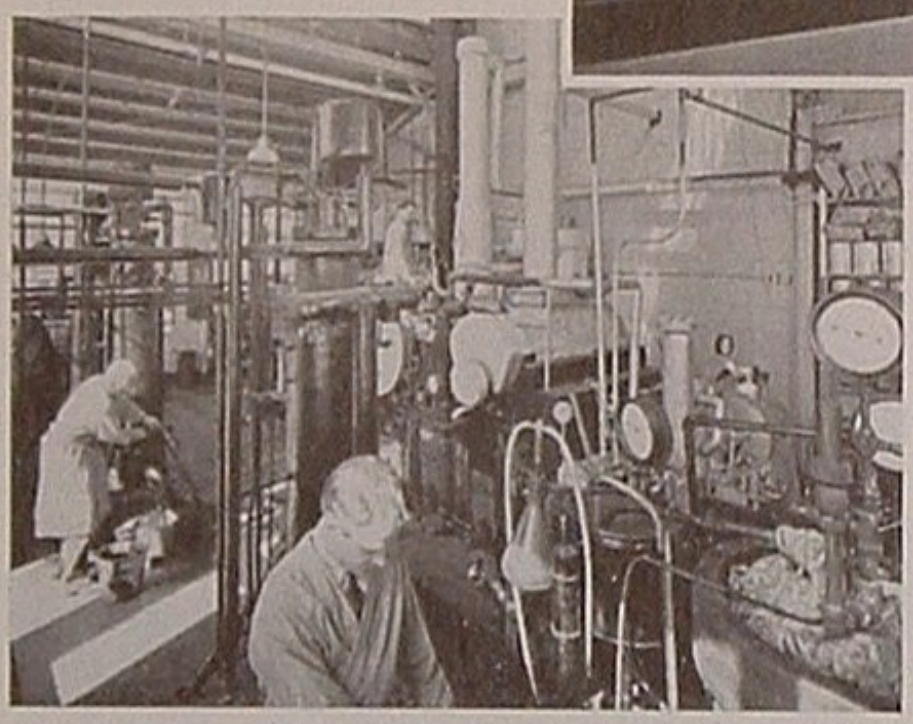
Dr. H. W. Ritchey studies the oxidation of lubricating oils with the aid of this apparatus.







Above: L. W. McLennan, chemist, uses this strange apparatus to test greases.



Above: Dorsey B. Smith operates this experimental gasoline treating and distillation apparatus at Oleum Refinery. It is really a miniature refinery. *Left:* Complicated distillation equipment used to study manufacturing problems.

cles with publications and issue dates is an asset which her chemical and engineering patrons vastly appreciate.

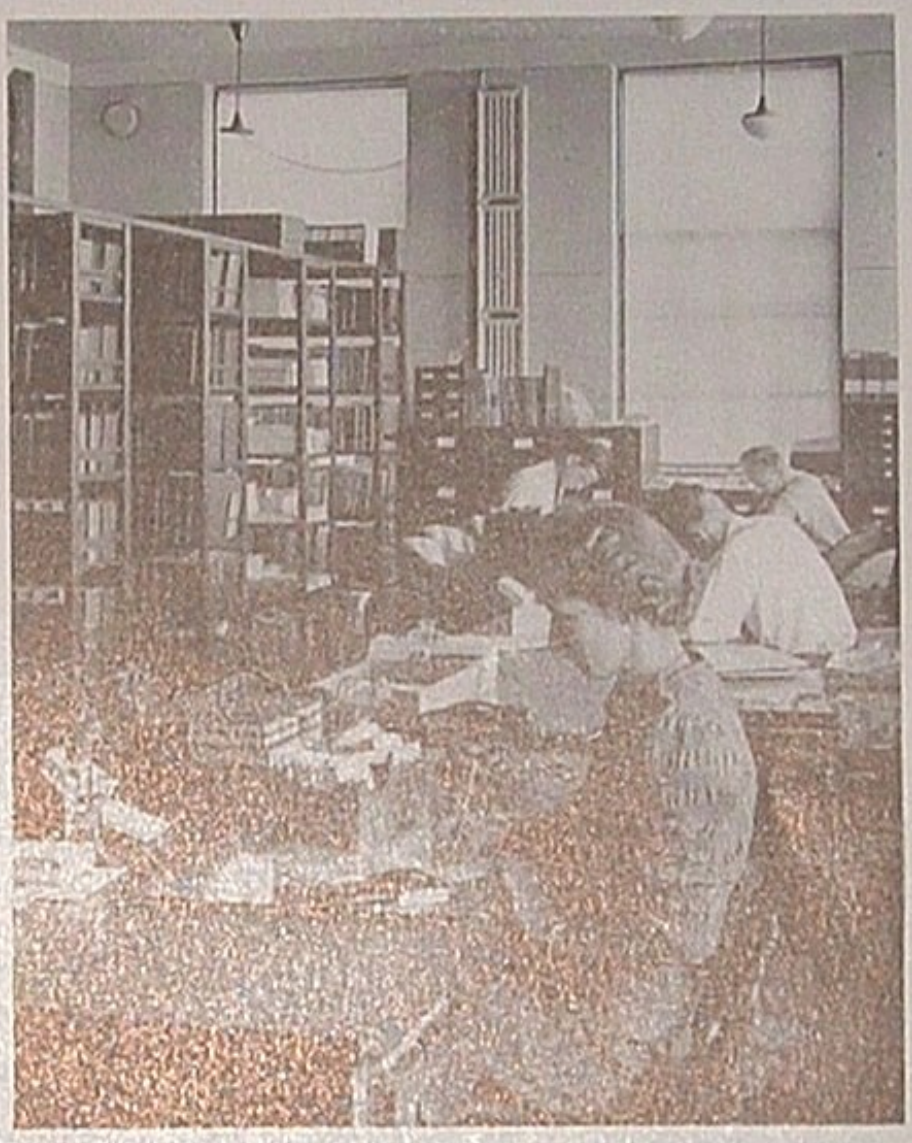
And, of course, there is the office staff devoted largely to reportorial and stenographic work, but incidentally taking care of the ordering of equipment, the filing of reports, and all the office detail that is involved in the handling of a substantial group of men engaged in a queer diversity of occupations. There are also the store facilities, where equipment is available to the laboratory workers, and where, also, thousands of samples of every conceivable commodity are stored until they are no longer required.

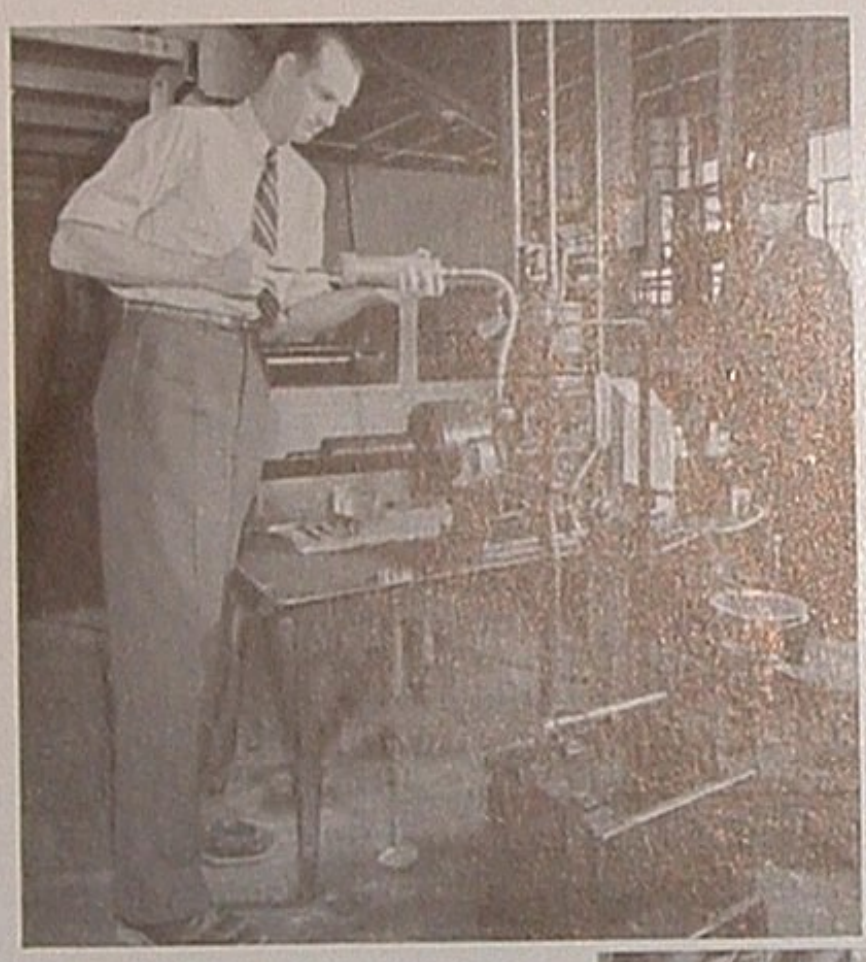
The engineering division of the research and development department comprises a small group of well-qualified engineers whose function is the design of new equipment for the operating departments. In late years the larger proportion of this work has been devoted to the design and specification of refinery units of various involved types. Utilizing fractions of high volatility, and commodities of a corrosive nature, the construction of refinery units such as the propane solvent refining, phenol treating, heavy oil cracking, and vacuum distillation units has required the highest degree of engineering skill, in order to avoid corrosion, give adequate control of unusual pressures and temperatures, eliminate operation hazards, and, in general, build economical and efficient units. New alloy metals have been developed to meet special conditions, equipment of types never before used has been designed and installed, and the completed plants have by their performance, fully justified the methods of the design engineers. Other departments have likewise profited by the experience and qualifications of these engineers. Whether an absorption plant is projected for the gas department, a pump station for the pipeline department, a storage plant for the sales department, or an engineering problem for the field department, their expert advice and willing aid is always available.

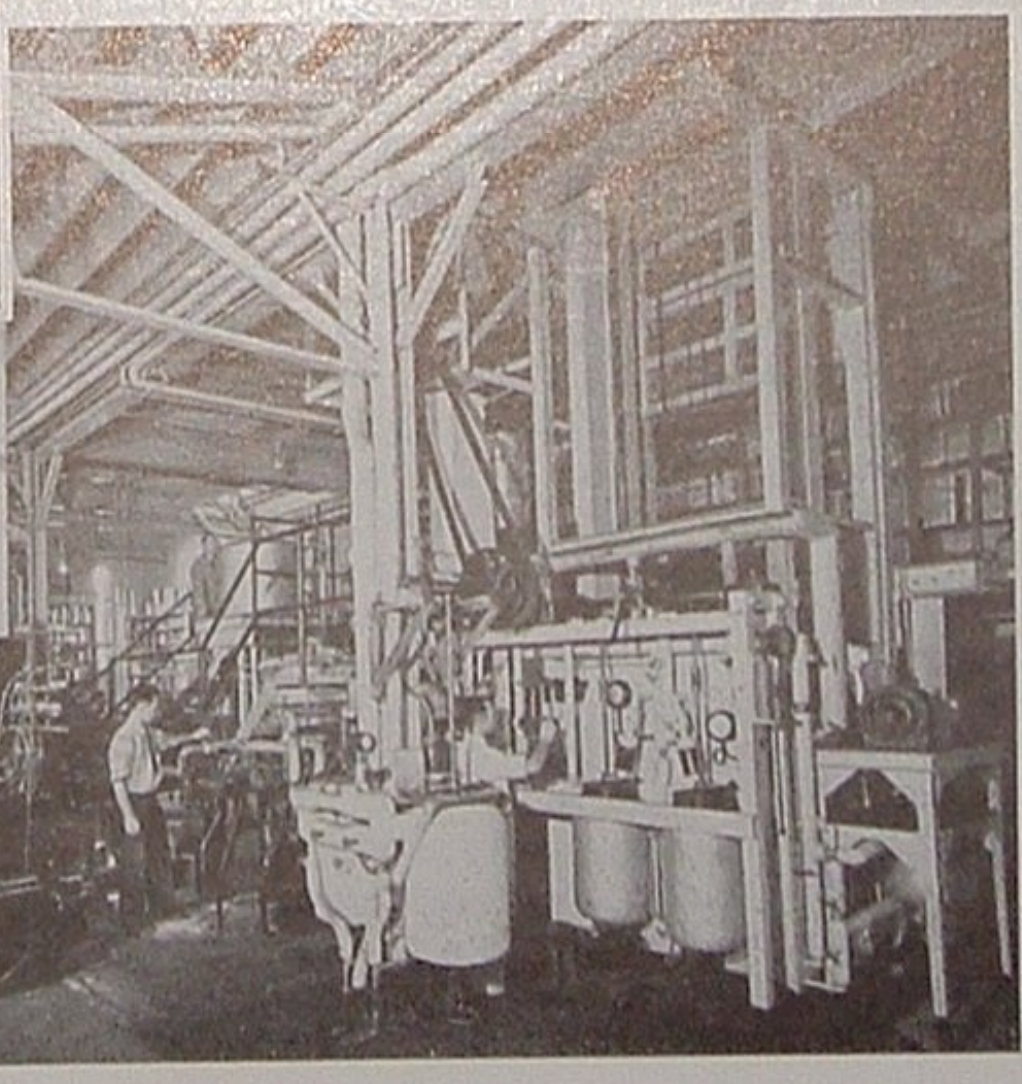
The economics division may be regarded as the seat of scientific accounting. Not the least important considerations in any new venture

are probable sales volume, the initial cost, and the operating cost after completion. The responsibility of the economics division is to translate the ideas of the research chemists and engineers into terms of dollars and cents. A process may work out just exactly as the chemist predicts, the design of the plant may be absolutely fool-proof in the opinion of the engineers, but if the ultimate processing unit is not operable at a reasonable margin of profit, or with some other compensating benefit, the economics engineer will have none of it. His stock in trade are mathematics, prices, and the law of supply and demand, and his endeavors are a very important item in the establishment of Union Oil Company as a sound, efficiently performing institution.

The patents division of the research and development department is not properly treated at the end of the chapter, because its work frequently comes first. This article, however, is too wide in scope to permit of a detailed treatment of any division, and is merely a general introduction which we hope will be followed later with more intimate stories of specific phases of the work of the department. The function of the patents division is, as already stated, to secure adequate protection for all Company-developed patents and copy-







Above: W. L. Spencer tests the film strength of greases. T. F. Ott, general research supervisor, watches the experiment.

Right: The main room of the Oleum research laboratory presents an impressive array of intricate equipment.

Above right: Miss Alma Miller assists Miss Elizabeth Burroughs (not shown) in the comprehensive research library at Wilmington, Calif.

rights, and to guard against the infringement of patents and copyrights belonging to others. It is a tremendously complicated business that necessitates constant study of industrial trends, and familiarity with the obscure workings of the various governmental patent offices and procedures. Its significance, however, can readily be realized, and its necessity in any form of inventive or development enterprise can be easily appreciated.

Summing up the work of the entire research and development department, there can be no doubt that the constant application of chemical and engineering research has been one of the prime factors in maintaining Union Oil Company as an aggressive, forward-looking organization. Past accomplishment, and the present position of leadership is due to the constant search for newer, more efficient methods, and better and still better quality products. There can be no doubt of the future of Union Oil Company so long as the research department functions in its present efficient, co-operative, and productive manner.

SWIFT SUCCEEDS SUBKOW AS PATENT COUNSEL

C. E. Swift

Philip Subkow

Announcement was made by Earle W. Gard, manager of research and development, of the appointment, effective October 1, 1939, of C. E. Swift as patent counsel, succeeding Philip Subkow resigned.

Mr. Subkow joined the company as a patent engineer in 1927 and was later made patent counsel, following his admission to the California State Bar in 1929. Well equipped for this type of work, he studied chemical engineering at Lehigh University and later taught at Johns Hopkins. In 1923 he joined the patent examining staff of the U. S. Patent Office, and after about two years as an examiner, became associated with an international patent law firm. During his twelve years with Union, Mr. Subkow has been instrumental in organizing the Patent Department, which handles all patent, trade mark and copyright matters.

Mr. Subkow leaves the Company to enter private practice in Los Angeles. It is his desire to specialize in patent, trade mark, copyright and unfair competition causes. He will be retained by the Company as counsel on certain developments now under way.

C. E. Swift is a native of Rapid City, South Dakota, but came to California in 1894. He received his academic training at The University of Southern California, from which he graduated with a degree in chemistry. After extensive experience in industrial research work, he joined the research laboratory staff of Union Oil Company in 1926, where additional valuable contact with diverse petroleum problems was acquired. Meantime he had already begun the study of law, with the specific purpose of entering the patents department. He was admitted to the California State Bar in 1929, and in June of the following year was transferred to patents work. Mr. Swift played a significant part in the early development of propane solvent refining, and later, following transfer to the Patent Department, aided in the smooth and efficient handling of the patent aspects.

From Powell Memorial Point on the Grand Canyon's south rim, the photographer catches a rainbow.

GRAND CANYON—NATURE'S SPECTACULAR HANDIWORK

LONG ago, many decades before man penned the first word of history, Mother Nature sat back in her chair, laid her brushes down, and beamed at one of the most colorful and awe-inspiring panoramas she had ever created. It was a vast canyon, richly colored and with a narrow band of water boiling in its depths. It was the Grand Canyon, a mighty masterpiece that every year attracts thousands of tourists to witness its scenic grandeur. And, as Mother Nature keeps constantly on the job enlarging and retouching her creation, so does the number of tourists constantly grow. At this time of year, with hot weather gone, Grand Canyon becomes a mecca for western travelers, a place where people may look and wonder.

But here's a surprising thing, many persons visit Grand Canyon without seeing it all, chiefly because they don't know what to look for. They stand and gaze at that tiny thread, the Colorado river, as it flounders along through the depths of the gorge, much as an astonished school boy gazes at a fly in the inkwell. Then they turn away, sometimes with a feeling of disappointment, thinking that's all there is to see. One has not seen it, however, without having first learned what it is made of and how it came to be there, and it sometimes takes days to discover these interesting things.

However impressed with his own importance the visitor may be, Grand Canyon can reduce him to the least common denominator in about fifteen seconds. Practically all he needs to know in order to begin realizing how comparatively unimportant he is in the earthly scheme of things is that the canyon was created something like 15,000,000 years ago, and that its maximum depth of 6000 feet was attained through the process of erosion at the rate of one inch a year.

One realizes, quite naturally, upon entering an area embracing 645,808 supervised acres containing 105 miles of colorful canyon that one is indeed out in the wide open spaces, but the actual magnitude of the situation is not

Left: Looking west from Mohave Point, one sees the muddy Colorado river twisting deviously through the canyon bed.

Below: As thick as strong coffee, the rushing Colorado river tumbles over boulders at the foot of Bright Angel.

immediately realized even though one be a seasoned traveler.

It does, however, begin to permeate the system when you stand there holding in your hand a letter addressed to a postoffice only ten miles distant, and someone volunteers the information that it will take your letter four days to reach its destination, and that in covering the short span of space that letter will actually travel 939 miles.

That's the way things hit you in the Grand Canyon country. From El Tovar on the south rim of the canyon to North Rim Lodge is a distance of exactly ten miles, but if one posts a letter at El Tovar Hotel for North Rim Lodge, it traverses parts of three states and is ninety-six hours reaching its destination. It goes from El Tovar to Williams, Ariz., from there to Barstow, Calif., and from there to Cedar City, Utah, by rail, and from Cedar City to North Rim Lodge by auto stage.

Probably a carrier-pigeon would not deliver the letter more quickly, because small birds do not, as a rule, fly across Grand Canyon. This statement is controversial, because tagged birds have been known to fly it, but the generally accepted theory is that large birds, such as eagles and hawks, which fly at considerable altitude, do cross the awful chasm. Small birds are said to follow the contour of the land and cross upon reaching a point where the gorge is comparatively narrow.

Several important mountain ranges might be picked up and dropped into Grand Canyon almost without their presence there being detected, for it is 6000 feet deep and from 10 to 15 miles across. The late Will Rogers, on the occasion of his first visit there, is said to have remarked that he never saw a better place to throw old safety razor blades.

At the bottom of all this is the muddy Colorado river which, according to Victor Patrosso of El Tovar Hotel, is too thick to drink and too thin to plow. This stream, by itself, constitutes one of the wonders of the Western Hemisphere.

It was created by the junction of the Grand and Green rivers, both fed by the snows of the Rockies. The Colorado is more than 2000 miles long. Its delta is in the upper portion of the Gulf of California. Enroute from source to outlet the stream drains one-fourteenth of the entire area of the United States. In winding its way from the snow-clad Rockies to its outlet, the river passes first through a high mountainous region, and finally across a desert. It is in the plateau region, where the surface has been lifted 5000 to 9000 feet above sea level, that the Grand Canyon is situated.

The canyon of gorgeous grandeur occupies

Right: Yaki Point overlooks fantastic formations which are typical of the canyon. The Indians add atmosphere.

Below: Phantom Ranch, near the south rim, nestles in a clump of pine trees and is the center of a lovely area.

a desert setting, as is indicated by the fact that only two living streams empty into it in a distance of 500 miles, yet it serves as a medium through which large streams in the northwestern part of the United States escape into Mexico.

The Colorado river, which flows through the canyon, ranges in depth from 15 to 60 feet, having a width varying from 50 to 300 feet. The impression held by most people is that it is a slow, sluggish yellow stream, meandering along toward the Gulf of California, but actually it is filled with dangerous rapids, and its current whirls the water along at a speed sometimes as great as 20 miles an hour.

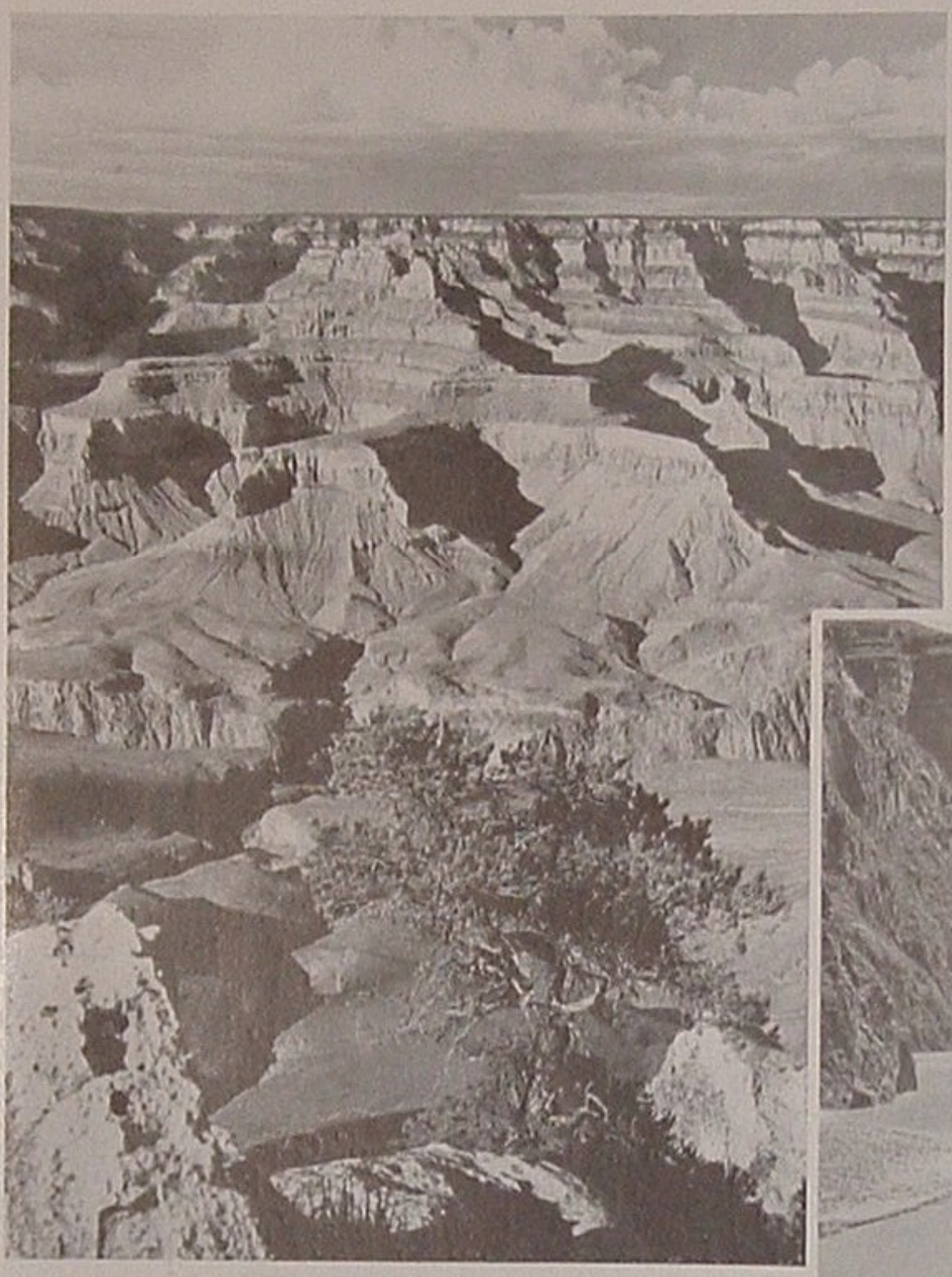
There are perhaps as many as 15 hazardous rapids along its course. In one stretch of the canyon the entire body of water drops 210 vertical feet in 10 miles. At certain points along this drop, the river throws up waves 10 feet high.

Grand Canyon was discovered by Cardenas in 1540, but was not explored for 329 years because of its inaccessibility. In 1869 the first real exploration of the canyon was undertaken by Maj. J. W. Powell. He with five others made a boat journey from the junction of the Green and Grand rivers to the lower end of Grand Canyon. In 1890 Robert Stanton and others went through by boat to investigate the feasibility of building a railroad along its base.

During the 20 years of Grand Canyon's existence as a National Park it has been visited by over 3,000,000 persons. In that time some 637,000 automobiles have journeyed there and back. Although we think these days in terms of auto transportation, it is astonishing to note how many persons have journeyed to Grand Canyon by train. They number 945,000, compared with more than 2,000,000 who have gone by auto. Persons who have flown number about 2000.

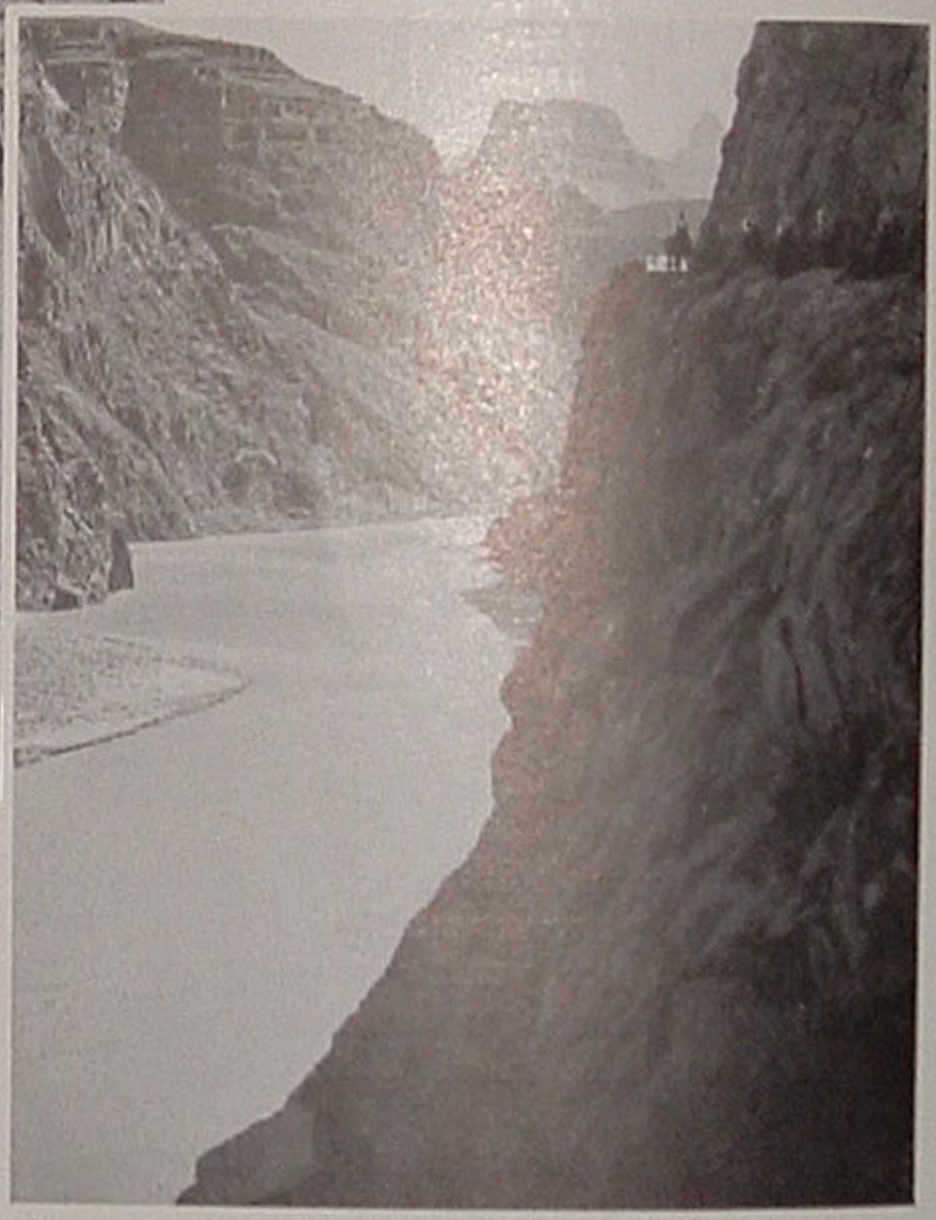
One reason why auto transportation ranks high as a means of making the trip is that luxurious auto stages not only run there from many distant cities, but are operated from the park hotels on pleasurable tours to the many points of interest. Once regarded as almost inaccessible, the canyon is now rated as one of the easiest places to reach in the entire southwest. Luxurious Pullmans are operated direct to El Tovar Hotel on the south rim, from Williams, Ariz., and auto busses operate between Cedar City, Utah, and the north rim.

Vacationers may drive to the canyon in their own cars over wonderful highways, and find excellent accomodations at moderate-priced hotels, or they may find satisfactory conditions in the campgrounds operated by



Left: The canyon as it appears from Yavapai Point on the south rim. Here the processes of erosion are clearly defined, even to the casual observer.

Below: The River Trail below Bright Angel Point threads its way down the precipitous canyon wall to meet the muddy and treacherous Colorado.



the National Park Service. This is adjacent to auto courts and stores. These camps are equipped with cooking fireplaces, tables, benches, water and sanitary facilities.

Whether the visitor is interested in birds, animals, reptiles, geology or archeology he will find a wealth of interesting material there. A number of trail trips up and down the steep sides of the chasm may be taken on the backs of gentle, surefooted saddle animals. These trails lead to points where the geological history of the universe may be studied to better advantage than anywhere else in the world. Three of the five great geological ages are to be found in this great gorge within a distance of one vertical mile.

Within that mile four distinct climatic and plant zones have been produced by the extreme variations in altitude from the canyon's base to the north rim. At the bottom of the canyon conditions corresponding to the deserts of Mexico prevail, while on the high points of the north rim climatic conditions similar to those of northern Canada are found. Snow to a depth of 18 feet falls there in winter. At the south rim of the canyon, which is 1000 feet lower, and at 7000 feet elevation above the sea, there is a transition or intermediate zone.

The canyon's influence archeologically is reflected in more than 500 ruins of ancient Indian pueblo dwellings along the rim, while tucked away back under the sheer walls are cliffdwellings which are believed to date back from 800 to 2000 years.

Today Indian life in that region is represented by four tribes, these being the agricultural Navahos on the Painted Desert, the pueblo-dwelling Hopis who reside fifty miles

or so to the east, the Piutes on the plains to the north, and the Havasupais who reside to the west, in Havasu canyon. This tribe, numbering slightly less than 200, has a village near the bottom of the canyon. They are noted for fine basketry and also for a peculiar breed of horses, remarkably small, but possessing unusual strength.

At the time it was conceived, perhaps no great amount of thought was given to the probable effect of Hoover Dam upon Grand Canyon. Unlike the harnessing of Niagara Falls and the commercialization of many another great natural asset, the mechanization of the Colorado river did not and never will dim the beauty of the Grand Canyon, because the dam is 260 miles downstream from the suspension bridge of Kaibab Forest at the north rim, and the artificial lake which is backing up for 200 miles never will come within 60 miles of the canyon area which is being exploited for the benefit of sight-seers.

The range of plant and animal life found within the boundaries of the park embraces 25 kinds of reptiles, 180 species of birds, 60 types of mammals and five amphibians. Among the larger mammals are Rocky Mountain mule deer, antelope, mountain sheep, coyotes and cougar.

One of the unexplainable things about the small mammals is the difference between the squirrels of the south and north rims, separated by a distance of 10 to 15 miles. At the south rim is the Albert squirrel, with reddish brown body and a fluffy gray tail. At the north rim is the Kaibab squirrel, with a dark body and a plumy white tail. This species is found nowhere else in the world, and these two types of Grand Canyon squirrels are said to be the only two species in the United States which have tufted ears.

One of the geological oddities of Grand Canyon is the gigantic red limestone cliff, about midway up the canyon side in the vicinity of Bright Angel trail. In places it reaches for a vertical distance of 558 feet. Originally this formation was a grayish or bluish lime deposit, but through the ages that have gone its face has been painted a brilliant red by the constant drip of iron oxides from upper formations. The limestone is exceedingly pure, an indication that it once was deposited there by a quiet sea.

The skeletons of innumerable prehistoric animals and plants are freely intermingled in the stone. Beautiful seashells are found there in profusion.

During Devonian times fishes were the ruling form of life. In the lavender rocks, representing the Devonian period in the canyon, bony armor-plates and heavy scales are frequently found in a splendid state of preservation. In the Permian age, when soft-coal beds were being deposited east of the Missouri river, northern Arizona was being buried by red sediment deposited there by rivers from the granitic highlands. In the canyon these now appear as alternating layers of shale and red sandstone. Some of these deposits are 950 feet thick.

In that age, ferns and similar plants formed most of the vegetation. There was little animal life other than a group of primitive quadrupeds, whose footprints were discovered some years ago in the canyon walls. Some were three and five-toed. The Hermit shales are literally filled with fossils of fern. The flora of the Hermit shales includes 35 species, chiefly unknown elsewhere. Ferns and cone-bearing plants, many of them greatly dwarfed, constituted the majority of this ancient plant life.

Just south from Tuba City and not far from the canyon are the petrified dinosaur tracks of the Jurassic age. The canyon walls not only reveal dinosaur tracks, but those of toads and frogs. Many of the mammals of those days lived on land, but some inhabited the swamps or streams of fresh water.

One of the really astonishing things about the canyon is the Colorado river, rolling along at 20 miles an hour. Although one cannot see them, huge boulders are constantly borne along in the bed of this stream. They grind away eternally, wearing down the stream bed by a continuous grinding process, at the rate of perhaps an inch a year.

The volume of silt and sand carried by the stream, is measured every hour in the day at a gauging station in the canyon. Every day in the year 1,000,000 tons of sediment in suspension pass a given point on their way to the river's delta at the upper end of the Gulf of California, and at times this sedimentary matter has gauged 15,000,000 tons in 24 hours.

Thus do chunks of Wyoming, Montana, Colorado, Utah and Arizona, as large as three or four modern skyscrapers, find their way into Mexico each day through Nature's age-old and inexorable process of soil erosion.

At the Fish Hatchery in Shasta City millions of trout are bred and set free in the Sacramento River.

DUNSMUIR—DOOR TO THE SHASTA EMPIRE

DUNSMUIR, located in the heart of the "Shasta Empire," northern California's year-round playground, nestles in the Sacramento River canyon, midst perpetually green hills. This little town was first established in the early '80's when the Southern Pacific was pushing northward into Oregon and took its name from Lord Dunsmuir, a British Columbia coal baron. According to legend, his lordship while passing through in one of the first trains was favorably impressed with the location of the new settlement and promised to erect a fountain at the depot if the town were named for him. Such a proposition was agreeable to the "powers that were" and the fountain was duly installed in new-born Dunsmuir. It is still in use.

Railroading has been Dunsmuir's bread and butter for years, but lumbering has come into its own in this area and is today a secondary factor in the town's economic machinery. An additional factor which loyal Dunsmuir citizens hope will play an increasingly important part in the economic picture is U.S. Highway 99 which passes through the city, carrying a stream of tourists headed for Shasta National Forest only a few miles north. Because of its strategic position near the base of Mt. Shasta, Dunsmuir can justly claim to be the center of a year-round vacationland.

Within the limits of a day's drive are lakes, streams, cool forests, ski-slides, excellent trout fishing grounds, and restful mineral springs. Famous Shasta Springs, a long established resort and the home of Shasta Water, is only a few miles from town. Other nearby spas include Ney Springs, McGuinness Springs, and Shasta Retreat. By trail from Shasta Springs one can hike or ride a cable car to the bottom of the canyon and see Mossbrae Falls, so named because of the abundant growth of moss and ferns through which the water flows to tumble into the Sacramento River. Dunsmuir gets its palatable water from the springs at the head of these falls.

Burney Falls, an easy day's trip to the east, is a favorite spot for nature lovers and fishermen. Here the creek tumbles over a lava cliff profusely overgrown with fern, and falls into a deep, shaded pool. Fine brook trout abound in this beautiful spot.

Situated between spectacular Mt. Shasta and jagged Castle Crags, Dunsmuir is near the head-waters of the Sacramento River and so

Above: Mt. Shasta rising out of the clouds, presents a majestic, snow-capped mass, dominating the scenery in the Dunsmuir-Shasta area.

Below: The famous Shasta Lily, which covers the valleys and mountain slopes of the area, is a delicately formed but sturdy flower and resists extremes of temperature without assistance from man.

Left: Castle Crags State Park takes its name from these imposing pinnacles. Camping in this area is delightful.

Below: Burney Falls excites both artist and sportsman, for this lovely spot is worth painting, and full of lively trout.

Below: This creel full of trout was the result of one morning's fishing by Union Oil's Dunsmuir agent, R. M. Kimble.

makes an ideal base of operations for hunters as well as tourists bent on visiting the Shasta National Forest area and the Castle Crags State Park. The scenery is of course enthralling and there are a number of interesting sidelights the visitor should not miss. At Shasta City, eight miles north of Dunsmuir, is the largest trout hatchery in the world, where thousands of speckled beauties are reared and introduced into the Sacramento River.

Farther north, at Weed, the Long Bell Lumber Company operates one of the largest pine mills in the world. Dunsmuir might also be considered the "gateway" to the Central Valley water project, where some day a huge lake will back up behind the mighty Shasta Dam now building. Other tours the visitor should not miss while in the Shasta area include Castle Lake, a glacier made body of water which provides excellent trout fishing, Mt. Bradley Lookout, which provides a dramatic panorama, and Black Butte, a recommended moonlight hike.

During the winter season, Dunsmuir and environs play host to the winter-sports crowd. The town lies at the base of Snowman Hill where the annual State Championship Jumps are held. Nearby also are 15 to 50 mile-an-hour ski trails, a 14-mile long Kehrlein Schuss, and a 2,200-foot up-ski recently installed. These choice ski grounds, incidentally, are for the most part accessible by automobile, as are other attractions in this fascinating country.

ANACORTES—HOME OF THE FISHING FLEET

PEOPLE who live in Anacortes, Washington, think of their colorful town as the "Gloucester of Puget Sound"—a not at all inept word picture of this industrious fishing port and gateway to British Columbia waters.

Tucked into the northwest corner of Washington, Anacortes is the closest mainland point to the 172 enchanting islands which make up the San Juan group. These tiny islands, clustered in the expanse of Puget Sound, are served by the Black Ball Ferry Line, whose capacious, ultra-streamlined boats connect Anacortes with Sidney, Victoria, and Vancouver, British Columbia. Because Anacortes serves as an ideal base of operations for travelers who plan to explore these interesting islands and because its waters harbor Puget Sound's adventuresome and picturesque fishing fleet, it has rightfully earned its reputation as a vacation center.

Within a brief twenty minutes after leaving any one of the town's many wharves by ferry or chartered launch, the visitor becomes lost in the San Juan group. As the boat passes Cypress Island, skirts the beach of St. Clair, and slips by Upright Head, an endlessly varying pattern of timbered slopes, wide sandy beaches, and narrow twisting water channels will unfold before his eyes. This sort of scenery is distinctly in a class by itself and is unexcelled subject material for amateur movie and still photographers. The islands are as pleasant upon close inspection as from afar. Except for a few tiny hamlets they are rugged and unspoiled by the scythe of man's prog-

Featured in Anacortes' annual Mariners' Pageant are Indian canoe races.

ress. Buried in their fastnesses, the historian will find the footprints of Spanish explorers, of Captains Cook and Vancouver, and can hear dim echos of the "Pig War" which came very near to plunging the United States and Great Britain into conflict. There is a wealth of historical background in the San Juan group for those interested in piecing it together.

Anacortes, itself, is really located on Fidalgo Island although it is generally thought of as a part of the mainland because it is reached by bridge rather than boat. In itself, Fidalgo boasts many attractions, including the Deception Pass State Park and the adjoining Rosario Beach in the southwest section of the island. Here, amid rugged grandeur, is the magnificent Deception Pass Bridge, which links Fidalgo with Whidby Island. This ribbon of steel and concrete stretches high above the angry waters that swirl through the channel. Winding roads and paths, stemming for the main highway in this vicinity, lead to many sandy beaches where C.C.C. boys have constructed beach kitchens and other facilities for picnicking and bathing.

Other attractions in or near Anacortes include Cap Sante Park, Similk Beach, Causland Memorial Park, Burrows Bay, and five fresh water lakes where the urge to go boating or swimming can be indulged.

But it is the fishermen, blustery, bearded men who make Anacortes their home port during the summer season, that attract most visitors to the town. Each week-end, when fishing closes within the Sound, the sturdy prows of the purse seiners point toward Anacortes. By dozens these boats return from the various fishing banks. When they tie up along the water front, their masts form a veritable forest. During their week-end layover the seafarers buy supplies, diesel oil for their engines, mend nets and make fine subject material for visiting artists and photographers.

During these summer months the town's five major salmon canneries are going full blast. Tuna, clam, oyster, crab, shrimp and kelp soap plants are also a part of the sea food industry which thrives in this locality. Aside from marine industries, Anacortes boasts several large sawmills, a pulp mill, four shingle mills, a plywood mill, and a paper mill.

At the height of every summer, local citizens take time off to play. The annual Mariners' Pageant is a gala four-day event, done up in sea-going style and flavored with Indian tribal ceremonies, street dancing, parades, carnival bands, and gay costumes. Out in the protected waters of Fidalgo Bay, the native Indians from many nearby tribes stage canoe races, and the Northwest Outboard Association presents the cream of Washington's outboard racing stars in a series of breath-taking speed events. This yearly Marine Pageant is Anacortes' big event. At its conclusion local residents settle back to the less hectic routines which sustain this port of call in normal times.

Above: Speed rather than comfort is the keynote of the roaring outboard hydroplanes which rocket through the calm waters off Anacortes during the Mariners' Pageant.

Right: Each week-end the Puget Sound fishing fleet returns to Anacortes, presenting a colorful sight along the industrious waterfront.

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DID you ever notice how people crowd closer and closer into the large cities, until at the center it seems as though they are just crawling over and under each other like larvae in an old apple? An industrial organization, when it grows big enough, can, if not properly managed, present a very similar picture. Every large company has a headquarters, a central point at which all business transactions are consummated, and towards which the attention of its members is continuously directed. The range of the human eye and the human ear being limited, those in the immediate vicinity of the core have the best chance of learning what is going on in the inside, but as the outer fringe is approached, the view becomes more and more obscured, until at the extreme territorial limits we are apt to find members of the organization who snatch eagerly at the few morsels of news that happen to be relayed to them by the fellows in front, and remain news hungry. They never become quite resigned to this situation, and despite the improbability of realizing their aims, they live in a constant ecstasy of curiosity about the goings on in the inner shrine. The net result of such conditions is that everything converges towards the center, and everyone becomes so intent on this inward looking and inward moving that they fail to realize the limitless field that lies unexplored and unexploited directly behind them. And yet in this field is the great concourse of humanity known as "the public."

Industry in recent years has become more acutely conscious of this tendency, and has been trying earnestly by various means to overcome its effects. Decentralization of authority, for instance, has had a most beneficial reaction in those concerns which operate over widely scattered areas. It is obvious that the necessity of appealing to a distant headquarters for decisions on territorial problems, at once not only slows down local operations, but has at the same time the more pernicious effect of qualifying the local operators as irresponsible persons. Customers like to deal directly with men who have sufficient authority to carry their business through to a mutually satisfactory conclusion, and salesmen are more likely to tackle their jobs enthusiastically when vested with that authority.

Union Oil Company has for many years recognized these facts, and has sought through the establishment of sound basic policies to provide its employees with a foundation structure, elastic enough to permit of the complete negotiation of business in any territory, regardless of its distance from headquarters. This helps to build the confidence of the customer in the man with whom he deals, and consequently in the Company, for, to the public, the local representative *is* the Company.

Ever since the foundation of Union Oil Company, its management and its members have been cognizant of the value of public goodwill, and have zealously built and jealously guarded a sympathetic understanding relationship. This has been done by the simple expedient of conducting all business affairs in a rational, honest manner, and treating employees and customers fairly.

Union Oil Company is an organization of western people, who have proved that western petroleum can be adapted in a multitude of ways to the comfort and convenience of western living. It has given employment to generations of westerners and maintenance to their families, has helped beyond measure to open up the west and elevate its living standards to a level not surpassed in any part of this rich country. This has been made possible through the development of public patronage, which in turn is the reward of public confidence. The future effort will be to look outward, thus to sense the public need, and thus to foster and expand that ideal relationship, which brings the maximum benefit to organization and customer alike.

Left: Before taking off for the fire zone this Willard Flying Service plane receives a new propeller and a thorough mechanical check-up.

Below: Supplies are sacked, weighed, and tagged at the flying field by this crew of workers.

Above: The sacks are then tied to burlap chutes and packed in the plane by another crew. Each package is numbered by tag.

Right: Taking off on an errand of mercy. The big Willard monoplane leaves for the fire zone loaded with food which will be dropped to the front line fire-fighters.

FIGHTING FIRE FROM THE AIR

FIRE, the crackling monster that consumes great areas of virgin timber at a gulp, has met a new opponent. No longer will the flaming monster be able to eat out the heart of green forests and laugh at the futile efforts of men unable to fight him with supplies and equipment. Today, Forest Service men have solved the problem of transporting equipment to remote areas . . . they have taken to the air! The airplane, unhampered by such things as brush, formidable cliffs and other obstacles that pack trains cannot overcome, has now been put to a new use.

First-hand information about this innovation in fire fighting methods was recently released by the Forest Service unit at Mount Baker National Forest in Washington. Developments in this particular area have been closely watched because the past year brought the driest and most hazardous fire season on record. Dry lightning storms made things extremely uncomfortable. During one storm, over two hundred lightning strikes occurred within the forest's boundaries and, as a result, two hundred or more fires began their work of devastation. Such a baptism of fire called out all the men and equipment the Mount Baker Forest Service controlled. All available C.C.C. Camps were immediately summoned and hundreds of hired fire fighters went into action. This picture will give the reader a good idea of the problems that arise within a few moments' time . . . problems that must be hastily solved if preservation of forests and game is to be realized.

Some of these fires occurred in back country

through which trails had not been built and which therefore could not be approached by pack train. When such fires in isolated regions broke out previous to the use of planes, the only means of getting food and equipment to the fighters was by back pack. As can readily be seen, this means of servicing the fire line was grueling work for the packers. The general topography of the Mt. Baker Forest is fine for mountain goats but does not lend itself to easy back-packing and, consequently, the average weight per pack is usually limited to about 30 pounds. In addition to the grievances caused by this slow and hazardous means of transportation, the services of the men detailed to packing are lost to the actual fire control unit.

Now, to get a real view of proceedings, let's take a look into the activities of the Forest Service immediately after a fire report has been received. First the fire is plotted on an area map, and if found to be in a section where trails have not been constructed, the fire crews are dispatched by truck to the nearest road point. At the same time, the plane (or planes, depending on the size of the fire) is ordered at the airport. The packaging crew and droppers also proceed to the airport taking with them the equipment needed to carry on the work. Subsistence supplies are ordered from the local merchants, equipment is sent from the Ranger's Station, and within a very short time the service unit at the airport is ready to function. Meanwhile the fire fighters are off to do battle with the flaming monster.

But, of course, there are myriad details that encumber such activities. Only a certain kind of plane is suitable for this type of work. Planes must be the high wing, single motor, five or six passenger type, capable of carrying a heavy pay load. This means that the load weight must be sufficient to compensate for the rate per hour that plane owners charge. The seats and right door of the plane are removed and the cabin reinforced with veneer, giving a storage space of about 48 cubic feet.

The parachutes used for dropping equipment and supplies are made of tight-weave burlap, 7′x7′. To each corner of the chute is fastened a 17-foot length of sash cord. These are tied together just above the package leaving only enough cord to securely fasten the load. For the average package, about 50 pounds, one chute is used; for a package weighing over 65 pounds, two chutes are used; and for packages weighing over 100 pounds, three chutes are necessary.

Each package is weighed and numbered, a record being kept of the plane number, the pilot's and dropper's names, the number of packages in the load, the total weight, the time of departure and return and a description of packages by their number. To each package is also attached a tag giving the number of packages in the load and the number of the package. In dense country, the ground crew is thus able to know when they have retrieved all the packages dropped. An additional help in dense country is afforded by long orange colored streamers pinned to the chute. These streamers hang in trees and clearly indicate to the ground crew just where each package is.

Thus has the Forest Service added another important link in the chain of fire prevention and fire suppression methods. Perhaps some day large forest fires that leave their black scars on the natural beauty of the nation will become a thing of the past. That day will be proclaimed as another "Thanksgiving" by vacationists and nature lovers everywhere.

Six More States Adopt Deferred Registration

Permanent deferred motor-vehicle registration laws this year were adopted by six states —Delaware, Oklahoma, New Mexico, Pennsylvania, Rhode Island, and Wisconsin. Approximately half of the states now have laws permanently fixing the registration of motor vehicles at a date after the first of the year, usually April 1.

In the years following 1929 a number of state tax officials observed that gasoline tax revenue slumped sharply during the first three months of the year and investigation showed as many as one-quarter of the motorists failed to re-register their cars promptly because the Christmas shopping and year-end bills had put a crimp in motorists' pocketbooks.

In every state where the plan has been adopted the motorists are enthusiastic over the breathing spell they obtain, the tax officials are happy over increased revenue that comes with no increase in tax rates, and merchants endorse the plan because millions of dollars, which otherwise would be diverted from trade, find their way into retail purchases during the year-end buying season when the urge to shop is at its yearly peak.

SCIENCE AND SERVICE STATION PAINT

By **Lloyd Greenville**
The Paraffine Companies, Inc.

TO THOSE unfamiliar with the exacting requirements of industry, the research work that precedes the development and introduction of new products, and the multitudinous tests that are utilized to control uniformity and quality of already established products, present a never-ending and intensely interesting story.

Such a common commodity as service station paint would seem on casual consideration to hold little in the way of romance for the lay reader, yet it represents the culmination of an industrial adventure as alluring as the old tale of Treasure Island.

The first crude efforts of primitive man to protect his properties from the elements with coatings of mud was actually the beginning of the paint industry. Trial in actual use was the test of the day. If the product failed, he tried another, and so on until he found one that was satisfactory. In later years to the protective specification was added "decoration," and the search began for coloring matters—pigments—that might protect and beautify at the same time. Down through countless centuries this process of trial and error was carried on, and it is surprising how much our so-called uncivilized ancestors found by their crude methods.

Then dawned the era of civilization when men began to probe the mysteries of chemistry and physics, and to utilize the jealously guarded secrets of nature to his own advantage. The properties of countless new substances were revealed, and the conditions to which they were subjected under all manner of circumstances began to be understood. Specialization became the order of the day. Specific products were made for specific purposes. Paints were developed for house tops and ship bottoms. There was one type for the inside walls of the home, and another for the outside walls. Iron paints, wood paints, varnishes and lacquers, and a thousand-and-one commodities for a thousand-and-one uses gradually came into being. Pigments of immense variety were discovered, their characteristics determined, and their uses defined. Vehicles (liquids that carry the pigments) were derived from countless new sources, analyzed and tested, and incorporated. Thinners, driers and spreaders occupied the attention of an army of research chemists, and to put it mildly, the business of manufacturing paints had become, and still is, a highly complex, but nevertheless precise process.

Each paint is definitely designed to meet the scope of conditions under which it has to be applied and maintained, and that in itself

All paints and liquid ingredients are tested for viscosity in the Stormer "Viscosimeter."

The covering quality of paints is measured by the "Cryptometer" seen above in operation.

opens up a bewildering series of considerations. In the case of a service station paint, for instance, it is apparent at once that it must present a clean, attractive effect, and yet at the same time must be able to withstand the whole gamut of atmospheric changes from the driest weather to the wettest, from the coldest to the hottest, in the areas in which it is to be applied. In addition, service stations are constructed of a diversity of materials, and it becomes a decidedly complex problem to compound a paint that will satisfactorily cover, protect, and beautify over an extended period of time.

Let us study some of the actual conditions that are encountered. In the first place, the service station may, depending on its original ownership, be built with an exterior surface of steel, concrete, brick, stucco, or less often, wood. The station may be on an ocean boulevard, where it is subject to the extremely corrosive influence of salt spray and the abrasive action of sand. It may be in a deep mountain canyon beyond the sun's rays and submerged in shade all the year round. The greatest possibility, however, is that it will be on the corner of Sycamore and H Streets in the thriving city of Smithsburg, where it will be subjected to the normal influence of summer sunshine and winter rains. The majority of locations are of this type in the west, and it is neither practical nor economical to develop an additional series of service station paints to meet the more strenuous conditions to which the others are subject, particularly if there is a possibility that one product might be compounded to take care of the whole range of conditions. That is actually what has been accomplished by Pabco chemists and engineers.

Into the service station paints is built resistance to corrosive and abrasive elements, such as chemical fumes of wide variety, salt spray, dust and sand, in addition to the properties that are essential to enduring protection under normal exposure. Like the family doctor who treats everything from colds to scarlet fever, the service station paints offer protection against all the diversified influences that may develop in the yearly cycle.

To build this quality into paints requires a thorough understanding of their constitution and function, and so for half a century Pabco chemists and physicists have been tearing the molecules apart, and wresting from the raw products of their art, not only information as to their basic qualities, but, still more important, information as to the reasons for these

Regardless of outside temperatures, this apparatus determines the drying time.

This is a spraying booth in the Pabco laboratory. Here paint is prepared for testing.

qualities. Chemical analysis resolves complex substances into their elementary constituents which are then studied to determine their reactions to the destructive influences. Experimental compounding in the laboratory points the way to commercial manufacture, and endless tests of the finished products reveal covering power, protective power, spreading capacity and resistance.

There are many qualities by which these service station paints are judged. They may be brushed or sprayed on the surface. In either case they must be sufficiently fluent to spread evenly, but not fluent enough to sag or run. They must possess the requisite binding power so that they will adhere to the surface, and, of course, must produce a satisfactory finish as to color, hide, and surface texture. "Hide" is the trade expression for the capacity to obscure the under surface, and presents a rather difficult problem when the paint scheme embraces a change of color.

This question of color is one that causes the manufacturer of paints many anxious moments. The color in many materials is perishable, and apart from the difficulty of finding pigments of the exact colors prescribed by the purchaser is the greater task of finding the exact colors that will retain their shades for periods of more than two years.

Service stations are repainted at intervals of one to two years to keep them fresh and trim in appearance, for despite the fact that the covering may be adequate even after that time for protection, the average customer is a particular individual who is attracted by cleanliness and orderliness, and without customers there would be no need for service stations in the first place. The object of the paint job, thus, is two-fold—to protect the structure, and to lure the customer.

The exactitude of the paint problem is borne out in the fact that even the repaint job is a technical process for which the surface must be receptive through the proper type of wear, or must be carefully prepared in advance. A new coat applied to a glossy undercoat will not be bonded, and in time may peel, and since the shaded parts of the station show less wear than those exposed to the sun, it becomes obvious that the expert painter has to do more than merely slap on paint with a brush or spray.

Conditions during the period of application of the paint are also important, and definitely affect the finish. The experienced painter

knows that the temperature of the surface must be right for the best job, and that it should be clean and dry. He knows also the technique of applying paint during dry or humid weather, thus avoiding dust accumulation on slow-drying surfaces, or brush "lapping" during fast periods. His work is so regulated as to provide the requisite drying intervals between the drying of primers (on new work), the main coat, and finally the lettering.

All of these complex details, although seemingly incontrollable in many cases, are definite factors in the original manufacture of the paints, and the ultimate product is one that offers the greatest facility of manipulation under the combination of conditions mentioned.

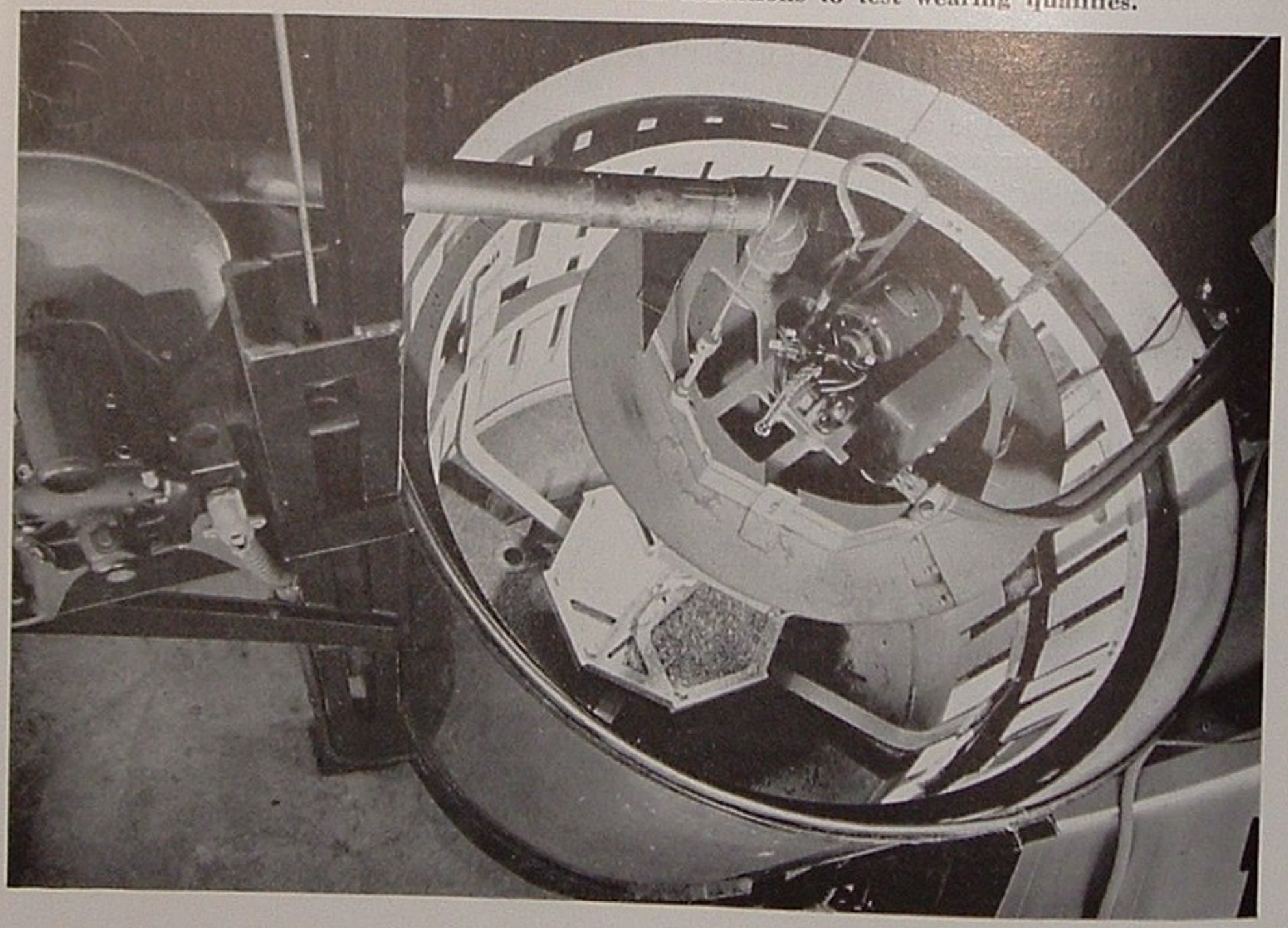
In the building of new service stations, or when new equipment is installed, the nature of the primer coat is the first matter to decide. Steel may be black or galvanized (the latter to prevent corrosion). Black steel must be sand-blasted to remove mill scale, and the primer applied immediately following, in order that no rusting may take place. *All surfaces must be strictly clean and dry before painting*, no matter of what material they may be.

Equipment in the stations is painted in accordance with the standard color scheme. Items such as compressors, containers, etc., must be coated with enamels that are immune to the solvent action of petroleum compounds.

Between paintings, the station buildings may also be kept spotlessly clean by frequent washing, but caution must be exercised to use only the mildest types of soaps and washing powder, and the surfaces should be thoroughly rinsed with cold water to remove the last traces of soap. Many paint failures can be traced to the incomplete removal of this soap in the final washing.

Service station paints are developed in conformity with the exacting specifications of the station owners, and the greatest task of the manufacturer is to insure a steady output of paint of uniform character—uniform as to color, composition, fluidity, working quality and durability. This necessitates the establishment of stringent specifications to control raw

Artificial weather, electrically produced in this "Weatherometer," subjects paint samples to extreme and variable conditions to test wearing qualities.

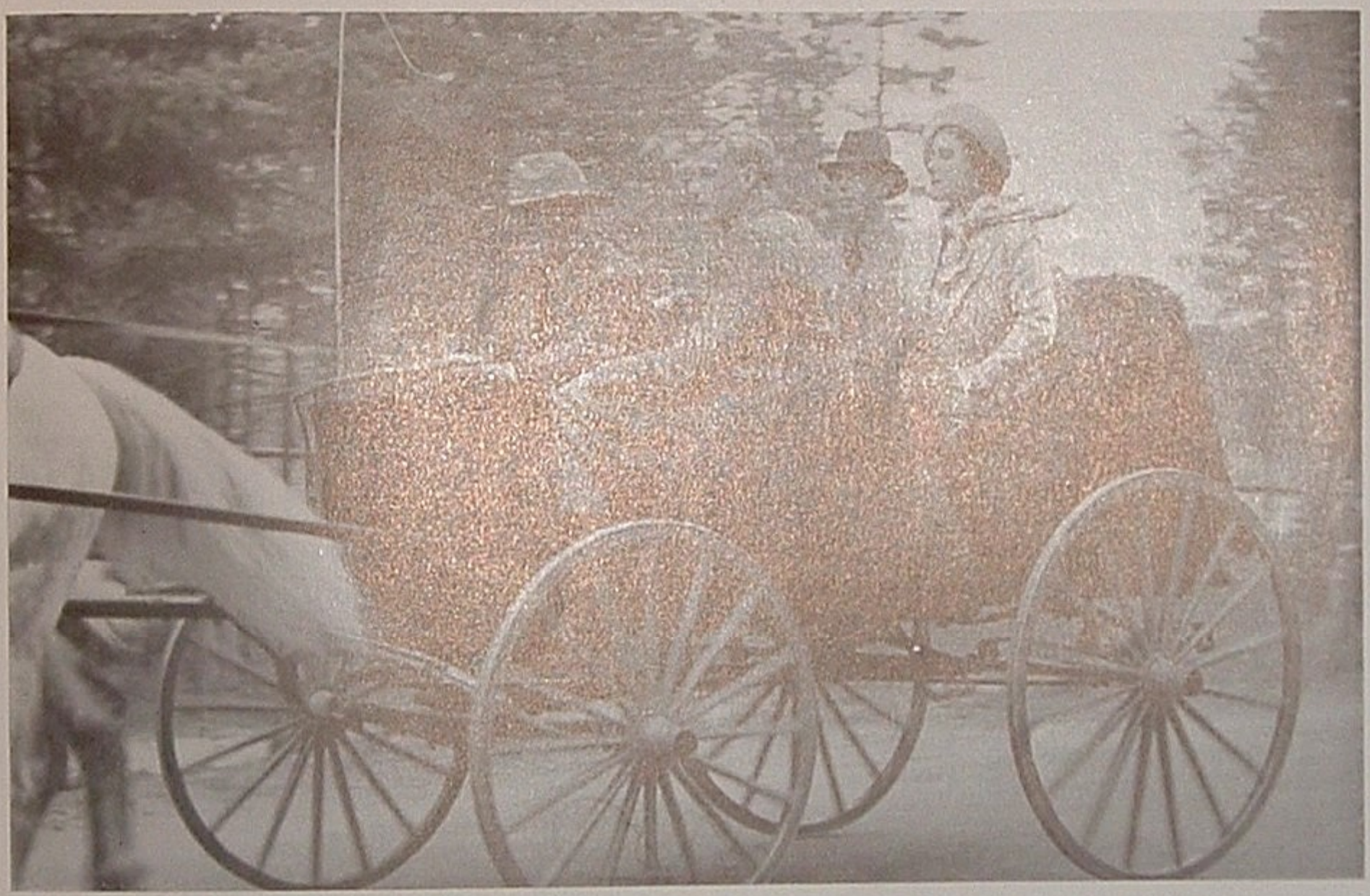


and heat treated oils, pigments, driers, thinners and all the ingredients that go into such products. These raw materials are as rigidly uniform as the paints themselves.

Ingenious devices have been fabricated by the chemists to simulate the conditions of actual use. Weather fluctuations are imitated and accelerated, so that in a few weeks the paints under test may be subjected to a year of sunshine, rain and snow. Every essential quality from the liquidity of linseed oil to the lasting quality of the finished material is measured by some accurate and precise instrument. Some are very simple, some very complicated, but all effective, and all designed to assure the customer not only the highest degree of protection, but the highest degree of protection for the longest possible interval of time.

Behind the seemingly endless endeavors of the industry to keep abreast of the national need, are societies and associations engaged in constant studies of products, processes, and tests. The American Society for Testing Materials, the National Bureau of Standards, the Institute of Paint and Varnish Research, the Varnish and Lacquer Association are all assiduously helping Pabco to make better paints for better service stations.

Introducing "Jim" Brewster—Host to Royalty



During their visit to Canada last summer, the King and Queen took a trip to Banff in this venerable carriage. In the driver's seat is Mr. Jim Brewster.

When royalty visits the Canadian Northwest, they invariably see the country under the capable guidance of Mr. J. I. "Jim" Brewster, who is one of the best-known figures in the territory. The Brewster Transportation Company started in a small way when Brewster, at the age of sixteen, became a packer for hunters and prospectors. From such beginnings he and his brother became operators of an extensive service and today own a large fleet of cars and busses, as well as horses and pack-trains. While in the Banff area last summer, Their Majesties, the King and Queen of England, availed themselves of the Brewster Transportation Company's excellent service to see the lovely scenery that "Jim" knows so well. Because the King was interested in the country's game, he also visited Brewster's own trophy room during one personally conducted tour. The Brewster organization, incidentally, have used Union Products in their automotive equipment for the past fifteen years, with excellent results.

"ON THE AIR"

The cast of Union Oil's first air show, "The Merry Widow," are here shown rehearsing their parts. Above, from left to right, are musical director Thomas Pelusa, soprano Emily Hardy, and CBS announcer Mel Rouick. At left is tenor Mario Chamlee and, at right, baritone James Newill, who has appeared on other Union Oil radio shows.

A mixed chorus supports the soloists, rings the show on and off the air each Thursday night.

These actors speak the lines. Left to right, Ted Osborne, Rosemary DeCamp, Gail Gordon, Fred Shields.

On October 5 Union Oil Company returned to the air with a new series of half-hour broadcasts featuring condensed versions of light operas, operettas, and the more popular operas. Pictures above show the first production, Franz Lehar's "Merry Widow" in rehearsal. Other programs billed for the near future include "Carmen," "New Moon," "H. M. S. Pinafore," "The Desert Song," and many others. These shows make possible the presentation of the world's finest music in a form that is proving highly popular. They may be heard each Thursday at 9:30 p.m. over the Columbia Broadcasting Company's Pacific Coast Network, are also rebroadcast by shortwave to Hawaii, and may be heard at 8:00 p.m. Friday nights in Phoenix and Tucson, Arizona, through electrical transcriptions.

Pests flee when the Bif gun appears.

Renewing the car finish is easy with Union Auto Polish.

Glass Cleaner makes windows sparkle.

SPECIALTIES COVER WIDE FIELD

THIS business of petroleum marketing is pretty far-reaching in scope, and the ramifications of a manufacturing department the size of Union Oil's are complex to say the least. Aside from the gasolines, lubricants and other better known commodities which are sold to the public through Company and dealer outlets, we produce and market many greases, asphalts, and base materials that aid in making the wheels go round in every phase of the West's industrial system. Newspaper, billboard, and radio advertising over a long period of time have indelibly coupled Union Oil Company with 76 Gasoline and Triton Motor Oil. The consuming public, however, is not perhaps so conscious of the Company association in the case of Bif insect spray, Stop Spot cleaner, and a dozen-and-one other specialties with which the Company makes life pleasanter for housewives and motorists.

As a matter of fact, for years Union Oil Company has utilized the by-products of petroleum refining to create a long and popular line of household necessities. To paraphrase that old story about the pig's squeal, little is left of a barrel of crude but the smell after Union's manufacturing technicians and research men finish with it. That the manufacture of specialty products is efficiently conducted can readily be seen, if one studies the cost sheets. Union's special household and automotive products are made at the lowest cost consistent with high quality as indicated by the ready consumer acceptance of the specialty line.

Not only are these products acceptable in themselves, but they are useful messengers of good will for the Company because their uniform high quality is a convincing argument in favor of other, equally high quality, Union Oil products. The housewife who eases her daily burden by using Union Glass Cleaner, and wafts countless winged pests to insect heaven with her potent Bif gun is pretty apt to assume that 76 and Triton are equally effective . . . an absolutely correct assumption of course.

The specialties cover a wide field. From his favorite 76 station the motorist buys radiator cleaners and conditioners such as Stop Rust, Stop Leak and Anti-Freeze, also gets valve lubricants, specially treated dust cloths, metal polish, tire paint, the highly effective new Union Auto Polish and Auto Wax, and a number of other products. In his home, the shelves may hold a can of Bif, a bottle of Union Glass Cleaner, some Union Garden Spray, a convenient Stop Spot can with the applicator top, which simplifies spot removing, and a can of Union Cleaning Solvent for the larger jobs. It may also carry Union's self-polishing floor wax, handy Stop Wear sticks to banish jammed doors, and a supply of Sure-

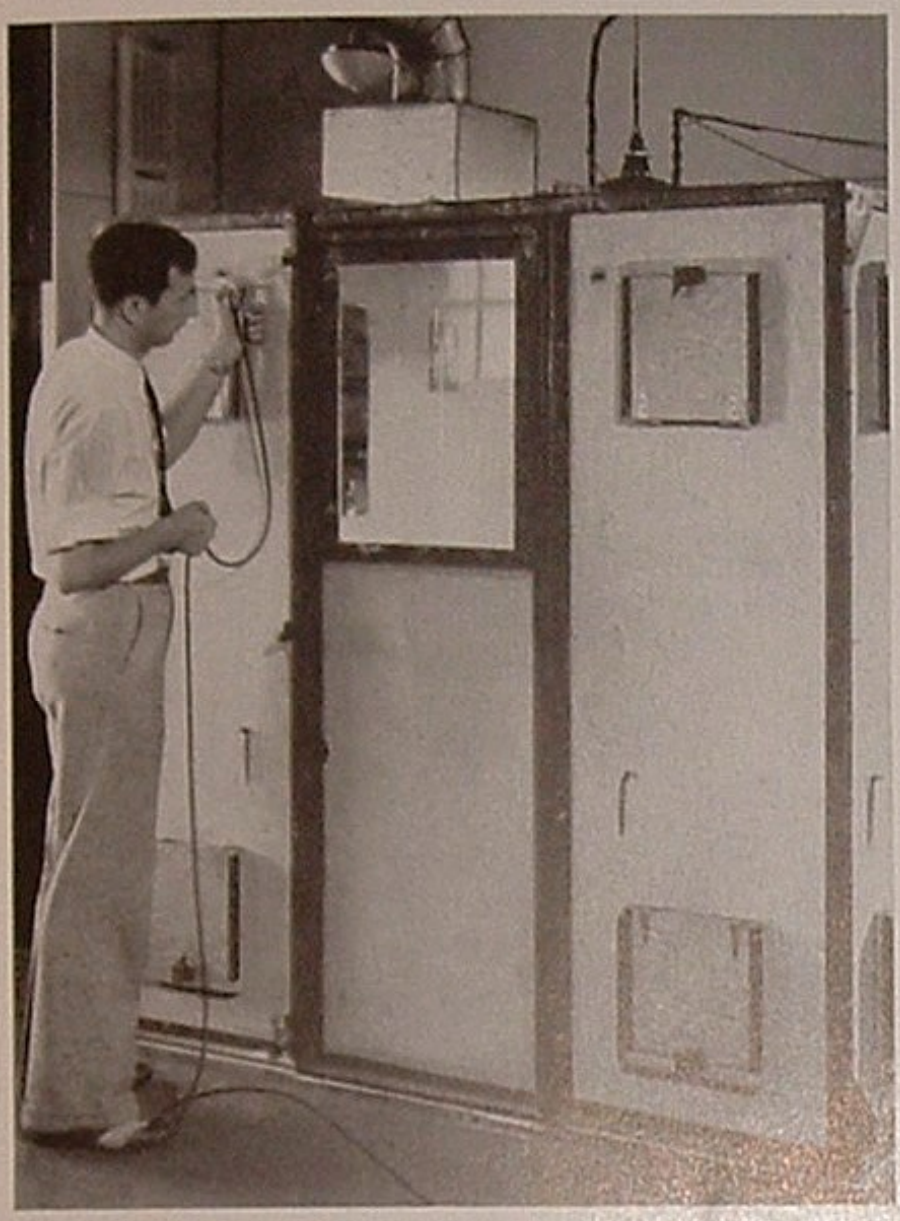
To keep terminal and sky-liner windows clear and bright, United Airlines buy Union Glass Cleaner in large quantities. Their policy is plus service in every detail.

Fire lighter fluid. Of course we're not inferring that every home is a small scale warehouse for Union's products, but all of these items have gained excellent consumer acceptance and are making chores less tiresome in western homes every day.

Certain of these products are also packaged in commercial sizes and sold to industrial concerns. Union Glass Cleaner is one outstanding example. United Airlines, the Los Angeles Passenger Terminal and many another large consumer purchases this item in quantity lots to keep windows, glassware, and showcases clear and sparkling. Such products as Bif, Glass Cleaner, Garden Spray, Stop Wear sticks, and Wax can also be obtained from grocery and hardware stores.

There's many an interesting story behind the development of these products. Bif, for instance, owes its effective lethal qualities to careful study and experiment in the research laboratory. Before it was marketed, many combinations were tried. In order to produce a pest killer that would be harmless to human beings and household pets, yet highly toxic to flies, moths, ants and other insects, the re-

Union's new Auto Wax, made from highest quality ingredients, gives a long-lasting finish.



Above: **In this death chamber Peet-Grady tests are conducted to determine the toxicity of Bif and other insect sprays. One hundred healthy flies are placed inside and sprayed. Bif invariably knocks them all down within ten minutes.**

search department constructed a fly farm where it bred and raised millions of flies for testing purposes. The standard biological assay, known as the Peet-Grady test, was employed to determine the spray's potency. In this test approximately 100 lusty, five-day old flies are admitted to the lethal chamber. Twelve millilitres of the spray being tested are then injected by means of an atomizer. After ten minutes the chamber is ventilated and the number of flies still clinging to the walls is counted. In this test Bif showed a 100 per cent knock down in ten minutes. Other factors also entered into the development of a desirable insect spray. It could not be injurious to delicate fabrics or wallpapers and its odor had to be pleasant. All of these things complicated the problem, but the ultimate solution speaks for itself.

Other specialties have involved equally interesting experiments. The recently introduced Union Auto Polish owes its ease of application and lasting qualities to a compound of ingredients called "propalite," which was developed after many other less effective combinations were tried. Union Glass Cleaner, too, has been the subject of constant study and recent changes in formula have still further improved this popular item.

And so, although the public hears most about the constant research that has created such products as 76 and Triton, the little things are not overlooked. The same care and effort have also resulted in a group of household and automotive necessities that in a quiet way make the daily routine easier for the average home manager and motorist.

To keep glass doors and windows clean, Union Glass Cleaner is used in the new Los Angeles Union Passenger Terminal. Telesforo Florez, above, demonstrates how easy it makes this task.

COLLEGE PRESIDENT REMINISCES

Photographed during an informal session were Dr. Tully C. Knoles, president of College of the Pacific, Amos Alonzo Stagg, grand old man of football and coach of College of Pacific's hard-hitting squad, and Hugh A. Matier, Union Oil public relations representative who served as guest lecturer on petroleum geology at the college last month.

College of the Pacific, at Stockton, California, has gained considerable fame during the past few years because its football coach, Amos Alonzo Stagg, who left the University of Chicago after exceeding retirement age, has been turning out very formidable teams. Last month his squad astounded fans by upsetting the mighty California Bears, 6 to 0. Stagg is just 76 years old and students proudly display Union Oil's 76-College of Pacific stickers, which are particularly apropos in this case. President of the college, Dr. Tully C. Knoles, is an eminent educator and ranks right with Stagg in student popularity. Dr. Knoles, incidentally, was an intimate friend of Mr. Lyman Stewart, Union Oil's founder, during his youth and likes to tell how he helped Union Oil along the high-road to success. According to his story, he was driving by horse and buggy from Ontario, California, to San Diego one fine day in the year 1838, and, while passing through what is now known as Brea Canyon, found time to stop and explore a little. It was a hot summer day and as he walked across the fields, his feet sank into a patch of soft, oozing tar. Without delay he informed Mr. Stewart of this condition, an act which probably led to the later discovery by Union Oil Company of extensive commercial production in the area. Dr. Knoles admits with chagrin that he didn't so much as buy a lot in Brea Canyon and thereby passed up a golden opportunity to cash-in on the California petroleum industry 50 years ago.

Concrete Roads Safer When "Buttered" With Asphalt

"In order to increase the useful life of the older concrete pavements which often carry heavy traffic with resultant heavy surface wear," reports the Michigan State Highway Department, "the maintenance division during the past five years has adopted a program of bituminous treatments not only to protect the pavement but to provide a safe surface.

"This is called the non-skid surface treatment and it has proved so satisfactory that several municipalities are now using it in the restoration of their worn street pavements."

REFINED AND CRUDE

By Richard Sneddon

Next year we will be faced with another presidential election, and it is well that we begin now to give thought to this highly important matter. It is no minor problem, the choice of a man who is big enough to lead this great country through four years of social and industrial striving, and at the same time is able to make a presentable appearance when photographed in a five-gallon hat with a string of trout in his hand.

And don't forget, it won't take the grass long to grow on the streets if we will only quit riding up and down looking for a place to park.

Saying which, we pause to repudiate the report that an American firm is sending large shipments of shatter-proof glass to Scotland for the manufacture of engagement rings.

The whole thing is a gross fabrication, and a gross fabrication is actually 144 times larger than an ordinary fabrication.

Incidentally, when your golf ball drops into a mud puddle, that is also a dirty lie.

And golf, of course, brings us very neatly back to the Scotch, whom we left very abruptly three paragraphs back. Our old friend, Angus McBagpipes, tells us that the alumni of Glasgow University usually wind up their meetings by giving two hearty cheers for their alma mater.

He also informs us that Scotland Yard is two feet eleven inches.

Which reminds us that the roughest distance between two given points is a detour.

Diverging at this stage, Junior's roommate at college is feeling rather disconsolate these days. He sent home for money to buy a study lamp, and his dad sent him the lamp.

Junior, by the way, is certainly coming along fine with his violin lessons. We can now tell when he is playing and when he is just tuning the instrument.

And in this connection, a friend of ours took his girl out to hear Fritz Kreisler at the Hollywood Bowl a while ago. The young lady talked incessantly, until he shrieked in exasperation, "Darn that Kreisler, I can't hear a word you're saying for his old violin."

Then there were the two roustabouts who were engaged in a terrific argument, when one of them suddenly yelled in a burst of indignation, "What do you think I am?" Says the other one, as calm as you please, "I don't know, but whatever it is, I'll bet there's only one of it."

One of our local toastmasters' clubs is starting a speaking class for ladies. We might suggest as their next project a swimming class for ducks.

In which connection we should again repeat that the most enjoyable period in a sales meeting is that brief interval just after the speaker has been introduced and just before everybody begins to cough.

And the game of football is becoming more dignified every year. We read in one of the local dailies about a quarterback who limped off the field suffering from a severe "Charles horse."

It is reported, by the way, that after the U. C. L. A.-Texas Christian game, a certain Union Oil Company employee was observed in Desmond's buying a hat. "That one sure looks good on you," said the salesman. "Yeah," was the reply, "It looks swell, but haven't you something softer, I've got to eat it."

Then there was the story of the two old ladies who arrived at the football match just as the kickoff whistle blew. After about ten minutes of play one eleven made a touchdown and the same team kicked off again, whereupon one old lady tapped the other on the shoulder and said, "Let's go. This is where we came in."

Which recalls a stirring pep talk delivered by a football coach just before the game started. "Now lissen, boys," he shouted, as he crashed his fist on the table. "The team that will win this game is the team that can show initiative, individuality, and leadership. Now go on in there and do just exactly as I told you."

Proving once more that there's a catch in everything but a forward pass.

The district accountant sent a report back to the gauger carrying the pencilled admonition, "Please write more legibly." Next day the gauger called him up to enquire, "What was that you scrawled on my report yesterday?"

And when the roustabout who was leaving by request expostulated to the foreman, "Don't forget I gave you the best three years of my life," the foreman exclaimed in amazement, "Gee whiz, were these your best three years?"

Wherewith we turn to the intriguing story of the oil magnate who had been raising a sand barrage for some thirty minutes in a weak effort to eject an obstinate golf ball from a treacherous trap. Presently one of his partners came over and advised him quietly, "Better come out, Bill, or people will think you're working here."

All of which ends our tale as the cat said when he backed into the lawn mower. Remember, if you would really like the winter to pass swiftly, just have your note fall due in the spring.

And for that tired feeling—sit down.

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