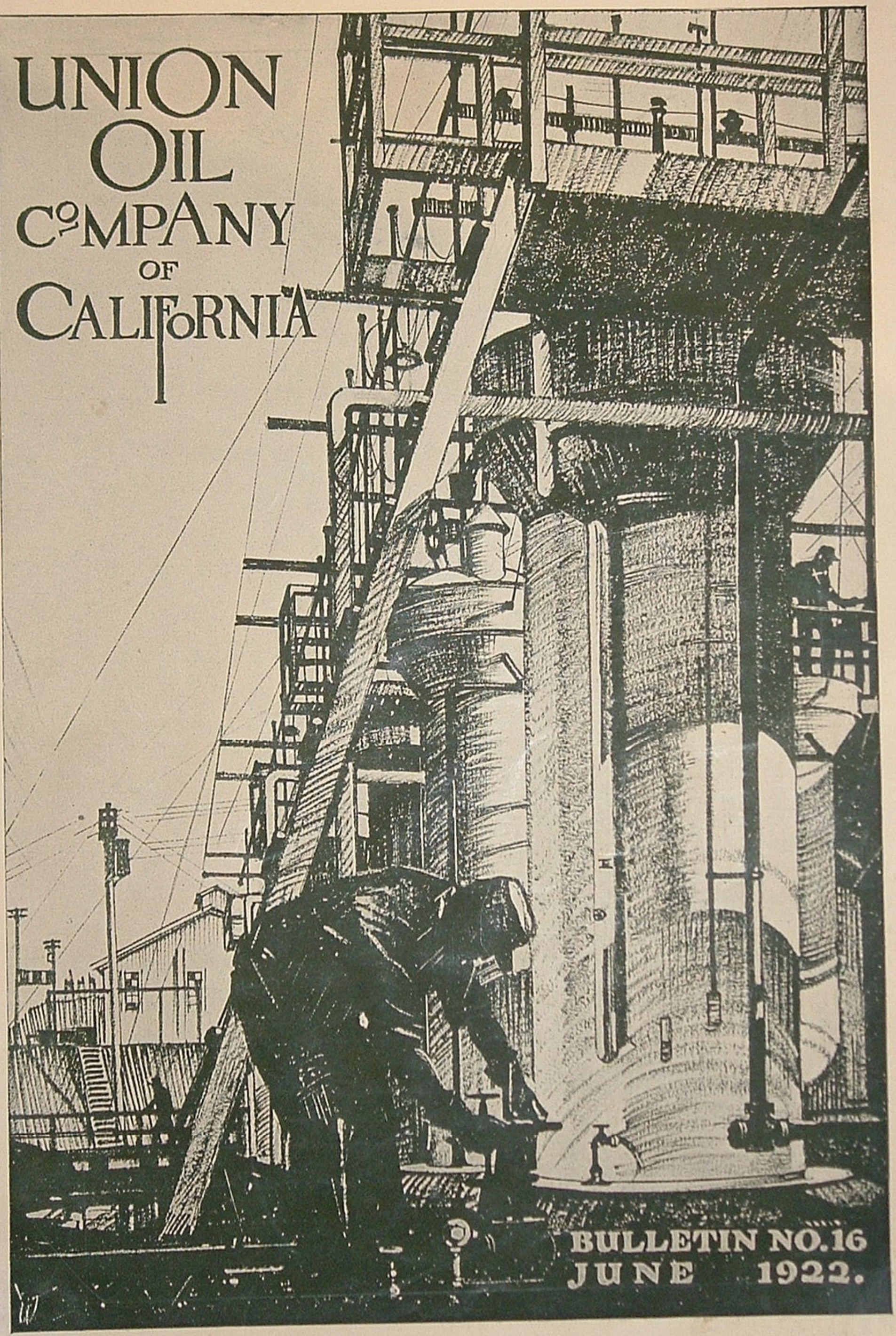
UNION OIL COMPANY OF CALIFORNIA



BULLETIN NO. 16
JUNE 1922.

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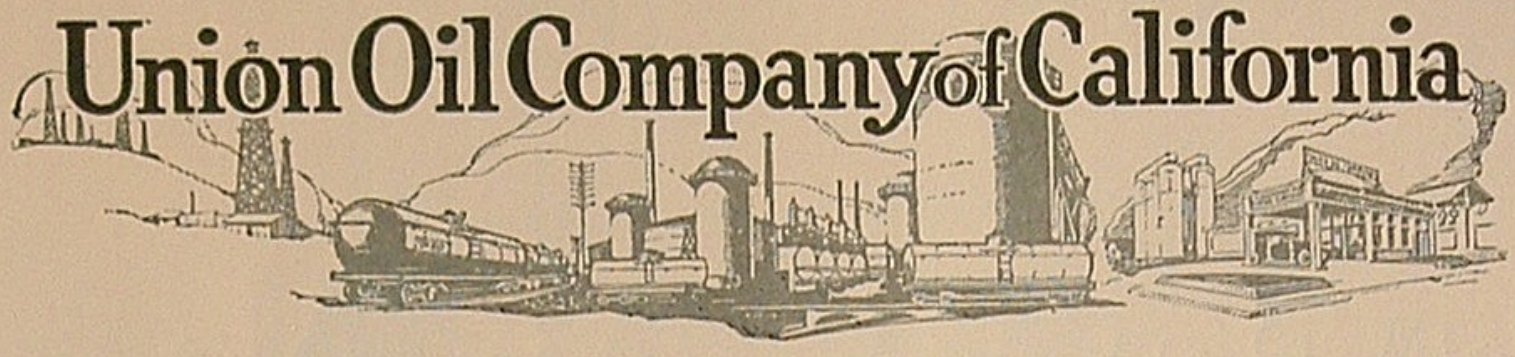

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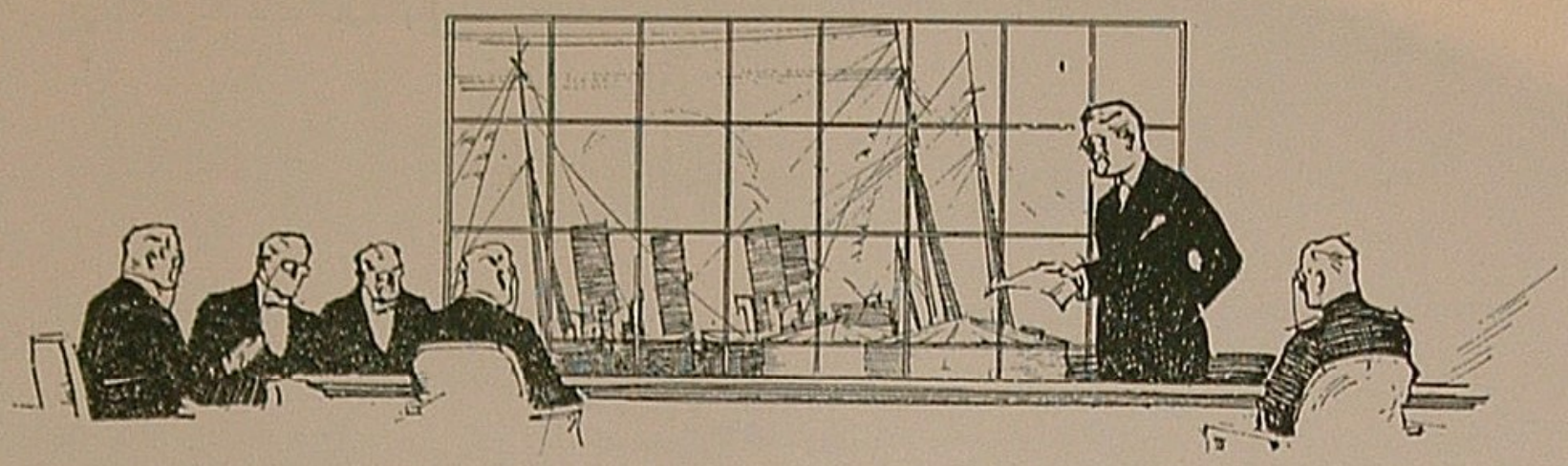
VOLUME 2 JUNE, 1922 BULLETIN NO. 16

Thos A. O'Donnell

Mr. Thomas A. O'Donnell



MR. THOMAS A. O'DONNELL, President of the American Petroleum Institute, and member of the Board of Directors of the Union Oil Company of California, first came to this company in 1890, at that time serving in the capacity of pumper and tool dresser on the leases along the Little Sespe in the Ventura field.

The life of this kindly gentleman, who is so highly regarded in the oil world, has been a practically continuous pursuit of the liquid gold. He was born in Pennsylvania, State of the first oil properties, in 1870, and his earliest recollections are of selling newspapers to the oil men in Bradford during the old-time excitement in that region. At the age of ten he went to Colorado, leaving in 1890 for California.

The Union Oil Company of California had just been organized when the young Easterner was given a job by Ben Scott, then foreman of the Tar Creek lease. During the ensuing four years he worked over all the properties of the company in the Ventura field. The names of the leases along the Little Sespe—Four Forks, Los Angeles, Hawkswing, Hogshead, Hogsback, Old Kentuck, Canyon, Keystone, Maple Creek and Tar Creek—are now almost forgotten and strangely unfamiliar to the oil men of today, but they arouse memories in the minds of the few who were following the rising lines of California derricks over thirty years ago.

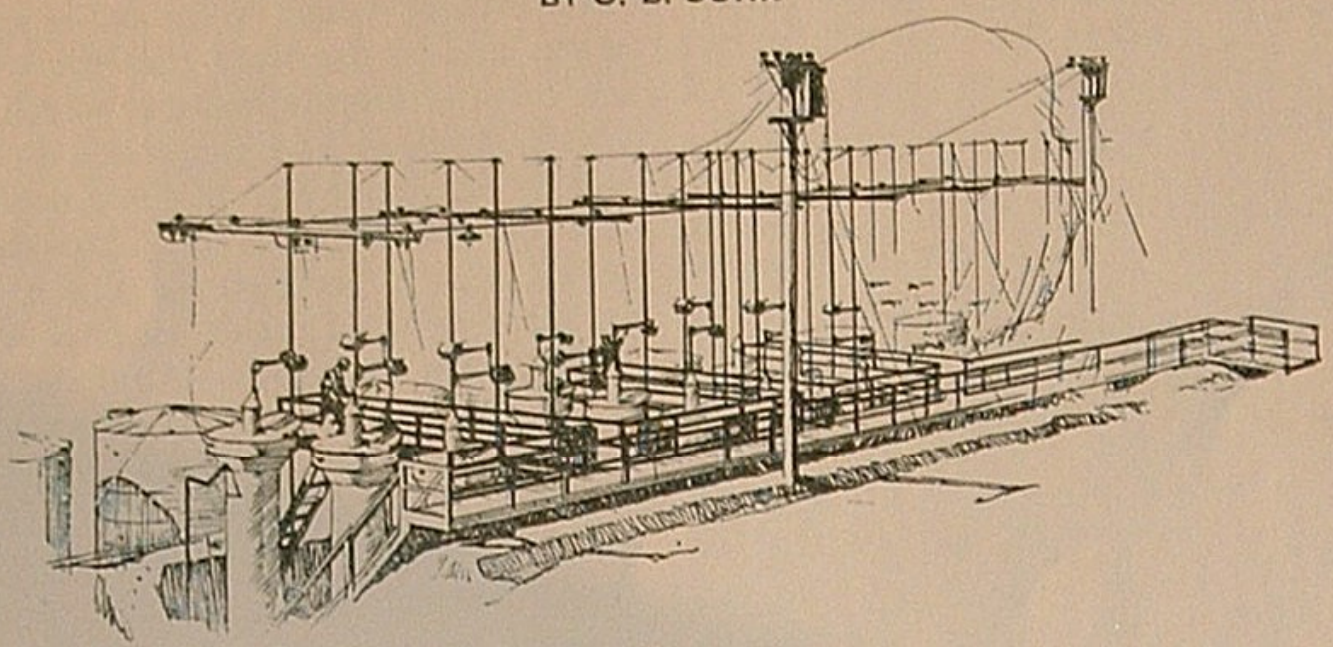
In the fall of 1893, Mr. O'Donnell came to Los Angeles, working on the early development of Mr. Doheny's properties in the Los Angeles field, around the old Second Street Park. This association with the now famous Mexican oil operator was broken the next year for the forming of a long-existing partnership with Mr. M. H. Whittier as contractors and producers in and around the Los Angeles fields. Subsequently, however, Mr. O'Donnell resumed his connection with Mr. Doheny, serving as Director in several of his companies. In recent years he has been President and latterly Chairman of the Board of Directors of the California Petroleum Company and its subsidiaries. He is also a Director of the Farmers and Merchants National Bank.

During the war Mr. O'Donnell rendered signal service as Director of the Oil Division of the Fuel Administration for the United States Government, and, following this honor, he was in 1919 elected first President of the American Petroleum Institute, a choice which has been repeated in the two succeeding years.

The lure of the active life begun in those early days on the Little Sespe rigs now finds expression in numerous sports and the outdoors generally. He is an enthusiastic golfer, fisherman and good shot, maintaining memberships in the California, Los Angeles Athletic, Jonathan, Los Angeles, San Gabriel and Annandale Country Clubs.

The Dehydration of Petroleum

BY O. B. SUHR



You have often heard it said, "You cannot mix oil and water." It is the purpose of this article to show that much of our petroleum oil as it comes from the wells is mixed with water; so thoroughly mixed that its separation is a difficult and expensive matter. It is also proposed to mention briefly something of the methods used in separating the two and to touch on the results accomplished, with particular reference to the new dehydrating plant at Orcutt, the only function of which is to separate water from oil.

Practically all oil wells penetrate one or more water bearing strata before reaching the oil sand. One of the troublesome problems of the oil driller is to prevent this overlying water from forcing its way into the oil sand. Before the method of cementing the bottom sections of the casing solidly to the walls of the well with cement was introduced — the casing string was landed in an impervious stratum if possible, a few feet being drilled of a smaller diameter than the casing so that the casing shoe could be forced snugly into this smaller hole and so keep out the water. This rarely resulted in a perfect water shut-off and as time went on the intruding water enlarged its channel around the end of the casing shoe and the amount of water in the oil increased.

After the use of cement successful shut-offs were the rule, but even now there are a number of failures, due to various causes, so that of the hundreds of producing wells in each large field a number will have imperfect water shut-offs and the intrusion of this upper water into the oil sands acts in a very detrimental manner as it tends to drive away the oil from the vicinity of the bottom of the well.

Another source of water trouble is the gradual encroachment of the water in the oil formation itself. As the gas pressure in the field decreases and the oil is withdrawn from the formation, water gradually encroaches, replacing the oil so that many wells along the lower dip of the formation gradually produce more and more water. In some of the older fields the percentage of oil is not so large as in those fields of more recent discovery, this being due to the two causes mentioned, the first an avoidable one now, and the second an unavoidable one due to the infirmities of approaching old age.

In the case of flowing wells the water and oil become mixed at the flow nipple, the gas pressure acting as the mechanical force or mixing agent churning the oil and water into an intimate mixture or emulsion.

In the case of pumping wells the oil and water may become emulsified by the action of the pump as the mixture comes through the valves and is churned in the working barrel and tubing by the motion of the sucker rods.

In some instances emulsion may be produced in the formation itself as in so-called

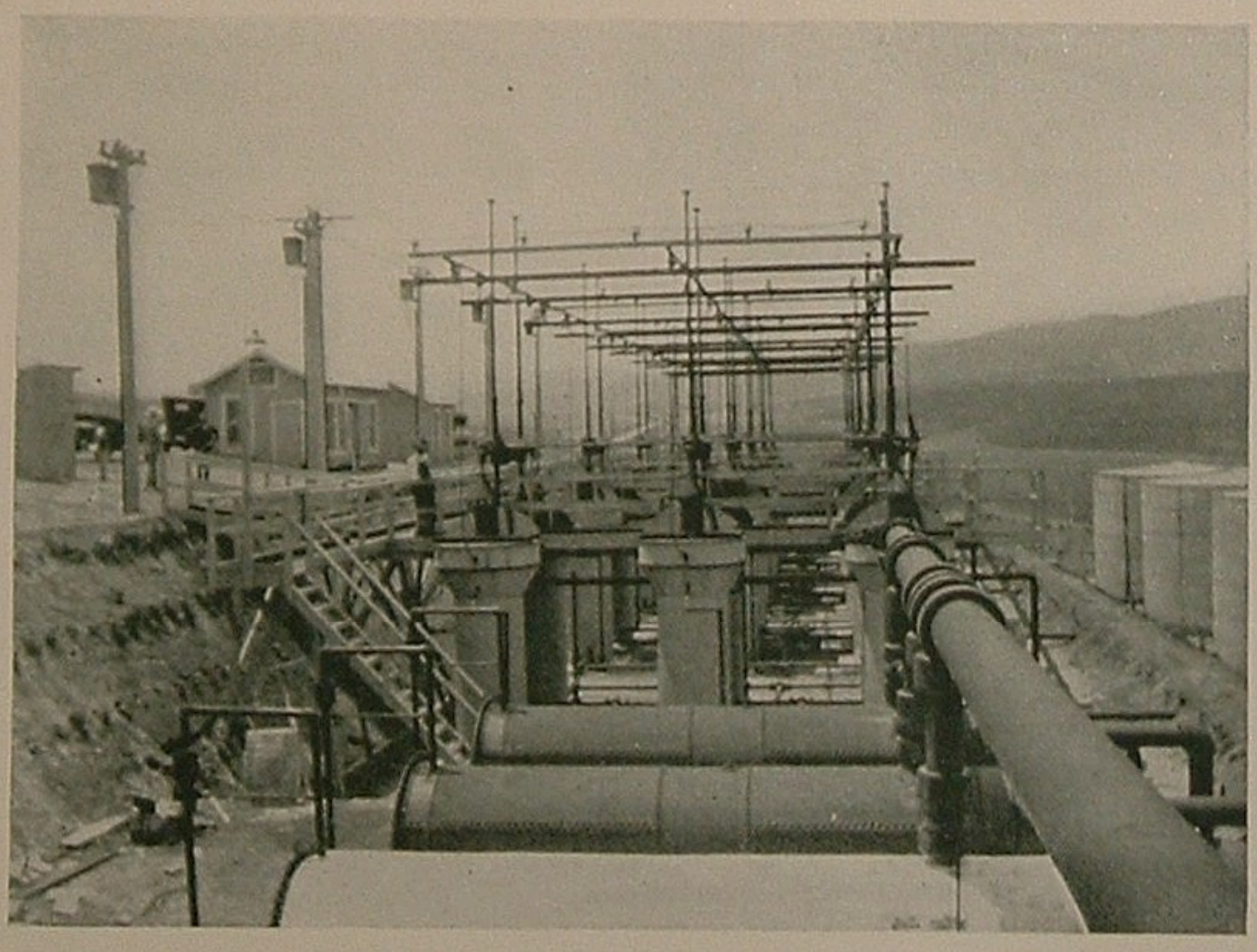
"crevice wells," where the oil is not found in a true sand, but in flinty shale, and is supposed to migrate from another source through cracks and crevices in the formation. In this passage through the cracks water is also forced through with the oil by gas pressure and is emulsified in the process.

From no point of view is it desirable to retain more than a nominal percentage of water in crude petroleum. The heating value as fuel is lowered. The cost of the initial topping and refining processes is greatly increased and the operations complicated. Transportation costs are directly increased in proportion to the amount of water. Many trunk oil lines are carrying from the fields to the sea coast a considerable quantity of this useless and detrimental water. It is therefore apparent why the oil should be freed of this burden.

The first separation of water from oil is made in the field tanks into which the oil is pumped from the wells. In these tanks the oil and water are allowed to settle. The free water, being on an average about 10 per cent heavier than the oil, readily settles to the bottom of the tank and is drawn off through a bottom drain, together with the bulk of the sand and sediment which often accompanies the oil.

In addition to the free water there is the water contained in the emulsified oil which will not settle out and which requires extraordinary means to set it free. The studies which were made of this oil water emulsion proved that the water is in the form of minute globules which are completely trapped and suspended in the body of the oil. Each one of these minute drops is insulated from its neighbors by a film of oil which prevents its union with adjacent drops. In this manner the drops will remain in suspension indefinitely until by the proper application of heat or other outside force the oil films are weakened. When this occurs neighboring drops can unite, and with a continuation of the process of amalgamation, a drop of such size is formed as to force its way by gravity to the bottom.

Naturally the demand for a drying process and its money making possibilities called out much experimental effort. Processes in which heat was used were the more numerous, and were quite extensively adopted in practice. Heat was applied by steam coils, or in some cases directly in a furnace. In some instances hot compressed air was blown through the oil to evaporate the water. Where high temperatures were used there was a serious loss of the light hydrocarbons of the oil, unless these were collected in condensers. Lower temperatures were generally less efficient. On the



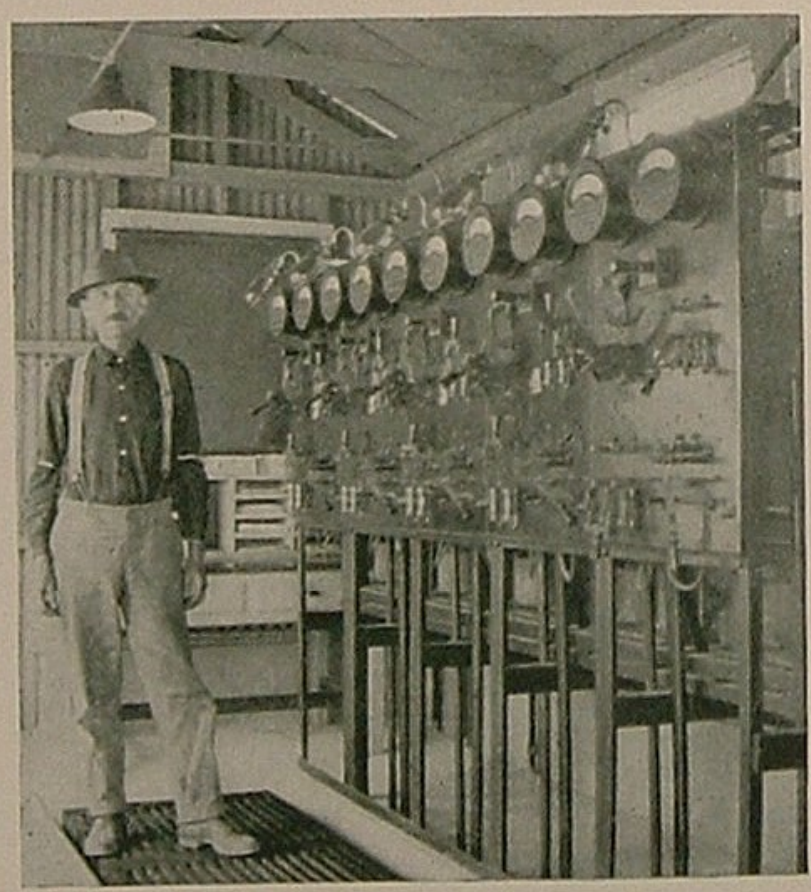
GENERAL VIEW OF ORCUTT DEHYDRATING PLANT LOOKING SOUTH

whole, heating methods are expensive and mostly inefficient. They were generally abandoned when the electrical process became known, except where incidental to refining operations.

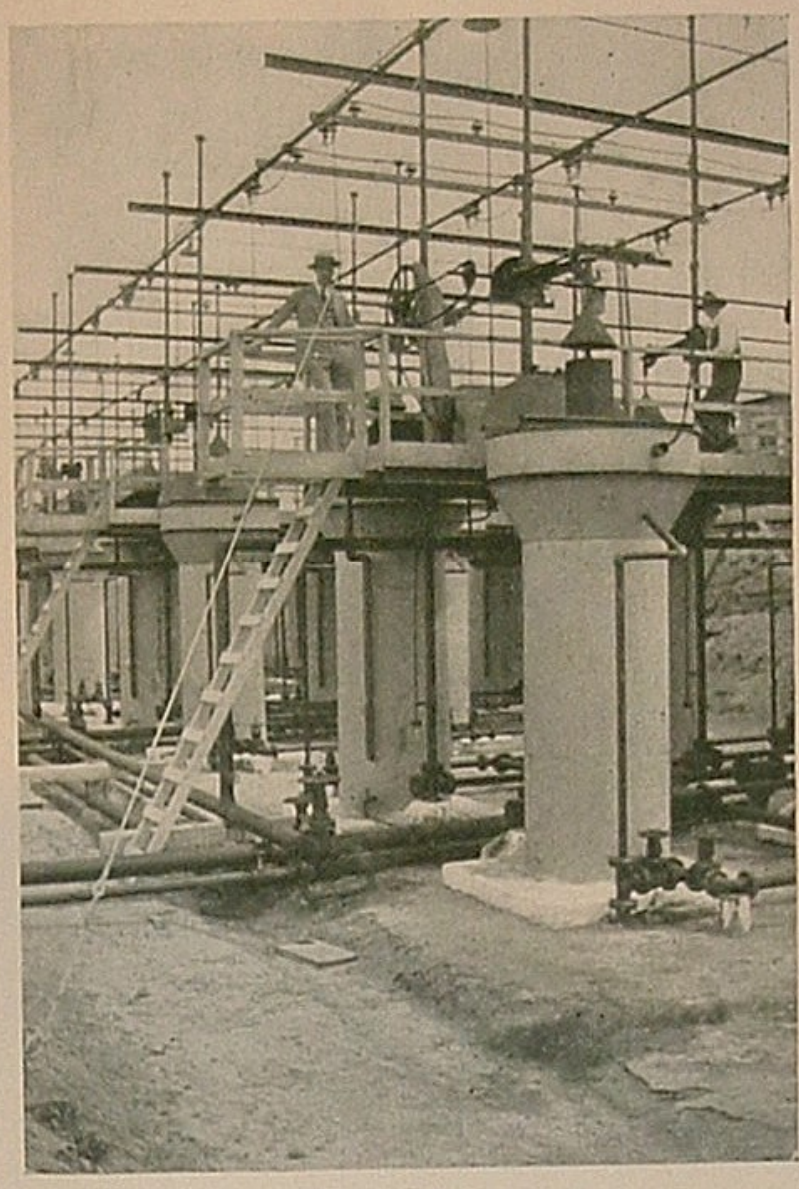
Certain chemical methods of drying were efficient as to the results attained but were entirely too costly. Centrifugal machines are effective in a degree on the lighter oils, but are less efficient with the heavy oils, and the machines are of small capacity. They are extensively used in the oil fields for testing the water content of oil emulsions—though this can be done more accurately by the distillation method. Filtration methods, while they offer some promise of success, have not been developed on a commercial scale.

The first Cottrell plant was built in the Coalinga fields in the year 1909. Since that time many such plants have been built. Electricity is the agent used to effect the separation. The water burdened oil is made to flow slowly through a succession of zones, each of which is the field of intense electrical action.

This action takes the form of a continuous electrical discharge which forces its way through and across the stream of emulsion in hundreds of zigzag but roughly parallel paths. Each particle of water in the oil comes many times in contact with these paths of electrical influence. An extremely interesting thing now occurs. The globules of water adjacent to each of the



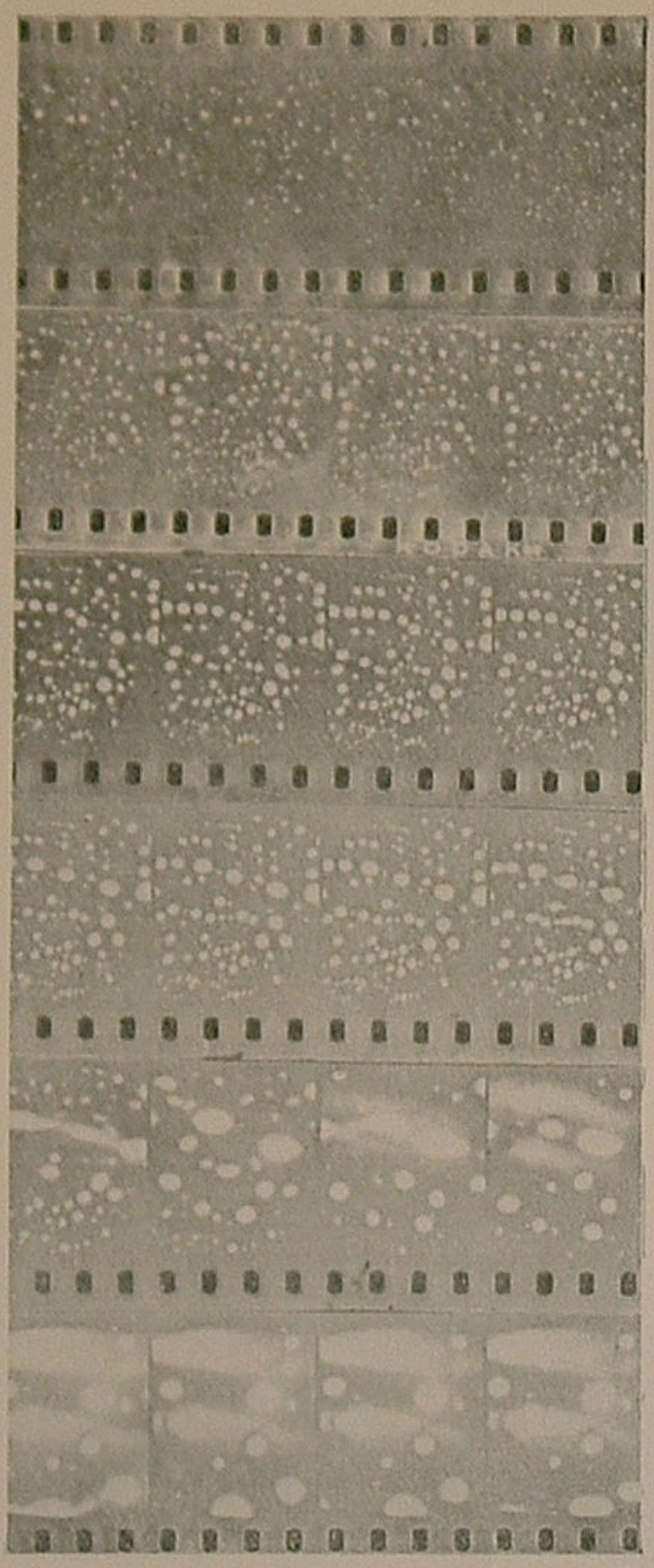
SWITCH BOARD WITH MR. J. R. MARTIN, ENGINEER IN CHARGE OF PLANT.



DETAIL OF TREATERS.

paths of electrical influence crowd together and arrange themselves in lines, resembling miniature chains of beads. You have no doubt seen the manner in which iron filings arrange themselves in curved lines between the poles of a magnet. The action of the water droplets has a very similar appearance. Thus the adjacent globules are enabled to coalesce and form a drop of larger size. This process, repeated many times, results in drops of continuously increasing size until ultimately they are large enough to readily settle from the oil. The treated mixture then undergoes a process of settling by which the water is drawn off from the bottom in the usual way.

The accompanying illustration, here used by the courtesy of the Petroleum Rectifying Company, shows in a group of moving picture films, an interesting photographic history of the water drops as they pass through the successive stages of the process. The tiny dots shown on the first film are the highly magnified globules of different sizes, scattered heterogeneously throughout the oil. The next section of the film shows the effect of the electric current, in the collection of the globules into bead-like chains in which the droplets are larger and of



KINEMA FILM SHOWING THE AGGLOMERATION OF WATER GLOBULES.

more uniform size. The succeeding films show further growth in size until in the last film the drops have completed their evolution and are ready to settle out.

The mechanical devices by which the above described process is accomplished in practice are simple. The oil receives its electrical treatment in tall tanks or "treaters" which have funnel-shaped tops, as shown in the photographs. Electric current is conducted into the center of the treaters from the top and distributed to a series of circular metallic plates or electrodes, each of which is horizontally fastened at its center to a vertical shaft. The whole is entirely insulated from the tank, and the entire arrangement is such that there is an annular space between the circumference of each plate and the tank shell. The electrical discharge is made to pass from the circumference of the plates across the annular space to the shell of the treater. The voltage required to overcome the resistance of the oil is 10,000, more or less, depending upon the water content of the oil. The whole electrode is made to rotate on its central vertical shaft in order to secure a uniform distribution of the electrical discharge and to prevent localized short circuits through the oil. The oil enters the treater near the top, passes slowly downward and at each circular plate receives an electrical treatment as it passes through the annular space between the electrically charged plate and tank shell. The treated oil is drawn off continuously from the bottom of the treater and passes to an adjacent "trap" tank, in which the settling process takes place and from which the water is drawn off from the bottom and the dehydrated oil from the top.

In the year 1920 the Engineering Department of the Union Oil Company of California, in conjunction with the engineers of the Petroleum Rectifying Company, designed and built such a plant for the dehydration, by the Cottrell process, of the oils of the Santa Maria field. The plant was built immediately adjacent to the Orcutt Pump Station, whence the oil collected from the Santa Maria field and from adjacent leases, is pumped to the coast.

The percentage of water in the oil from the Santa Maria fields in 1920 was around 25 per cent, and as it cost proportionately to send it through the pipe line from Orcutt to Avila it was deemed expedient to treat the crude oil at Orcutt and thus save the expense of transporting water through the pipe line. At one time it was thought that the presence of a certain amount of water in the oil acted as a lubricant in the pipe line. Some pipe lines, in fact, were built using pipe which had rifled grooves and a stream of water was fed along with the entering oil, the idea being that the water would travel in the grooves and serve as a lubricant to the oil, thus facilitating its passage.

When the Orcutt dehydrating plant was built and put into commission this idea was

found to be erroneous. Previous to its construction and use there was at Orcutt a large pump station and heating plant, a heating plant at Thelma, a pump station and heating plant at Summit of the same size as that at Orcutt, and thence the oil was sent to Avila. The dehydrating of the crude oil at Orcutt obviated the necessity for the Thelma and Summit stations, the oil being pumped straight through from Orcutt to Avila. So much for the lubricating qualities of water in pipe lines. Not only were two stations eliminated but the line pressure was considerably lowered. Under the old system Orcutt carried 650 pounds and the same pressure was necessary at Summit. Oil can now be sent from Orcutt through the same 8-inch pipe line at the rate of a barrel of oil hourly to the pound of pressure, so that 500 pounds pressure will send 12,000 barrels per day to Avila.

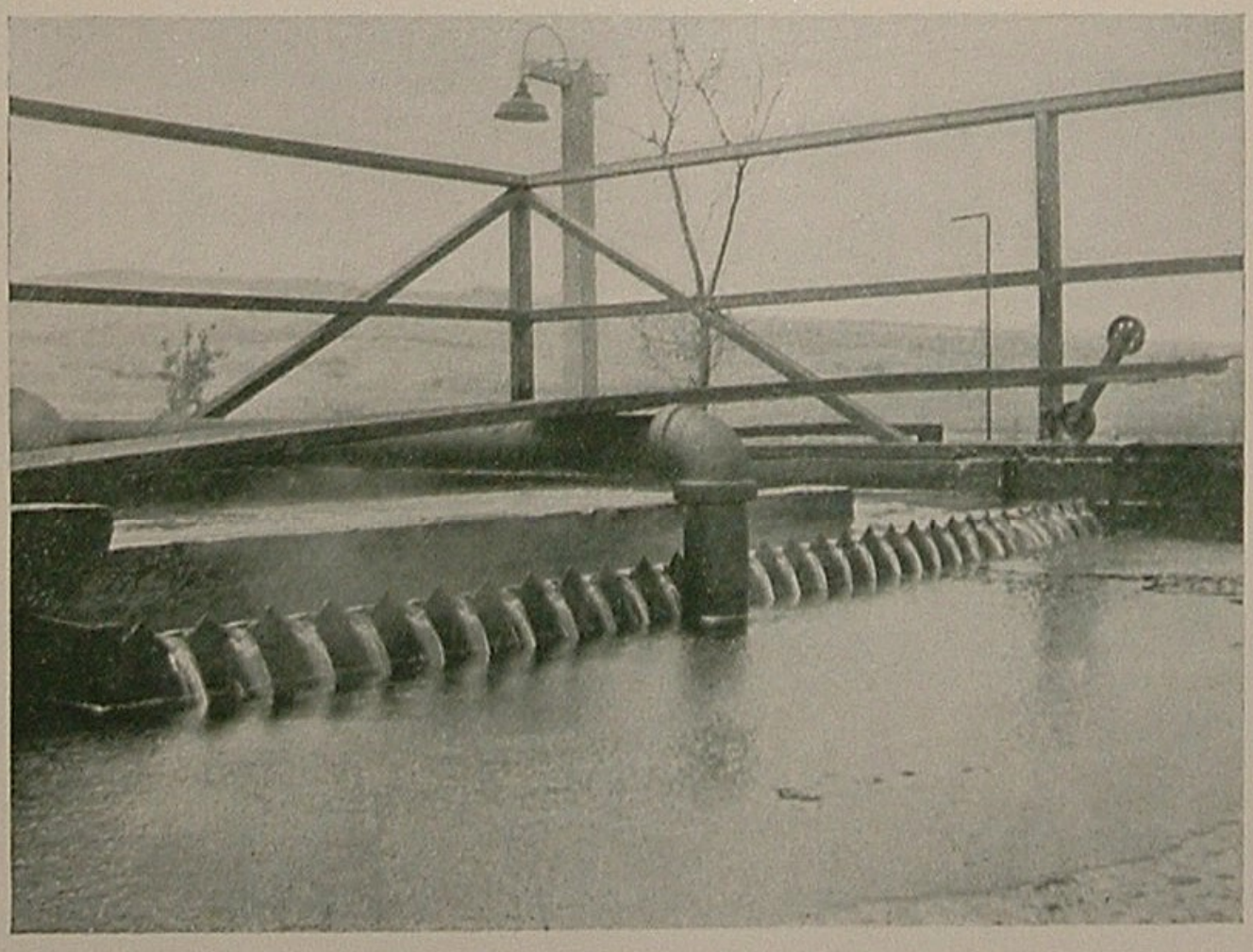
The Orcutt plant receives the oil from over 200 wells, some of which produce dry oil, but most produce a wet oil containing from 4 per cent to 80 per cent of emulsified water. The dry oils are not treated and pass directly to the station tanks. The average oil requiring treatment contains about 35 per cent water, and the plant is capable of treating 15,000 barrels of such oil per day, reducing the amount of water to less than 4 per cent.

The wet oil is received in collecting tanks and when ready for treatment it is first heated and then passed to the treaters. As shown on the accompanying photos there are thirty treaters, which are arranged in groups of six; each group is capable of being operated as an independent unit.

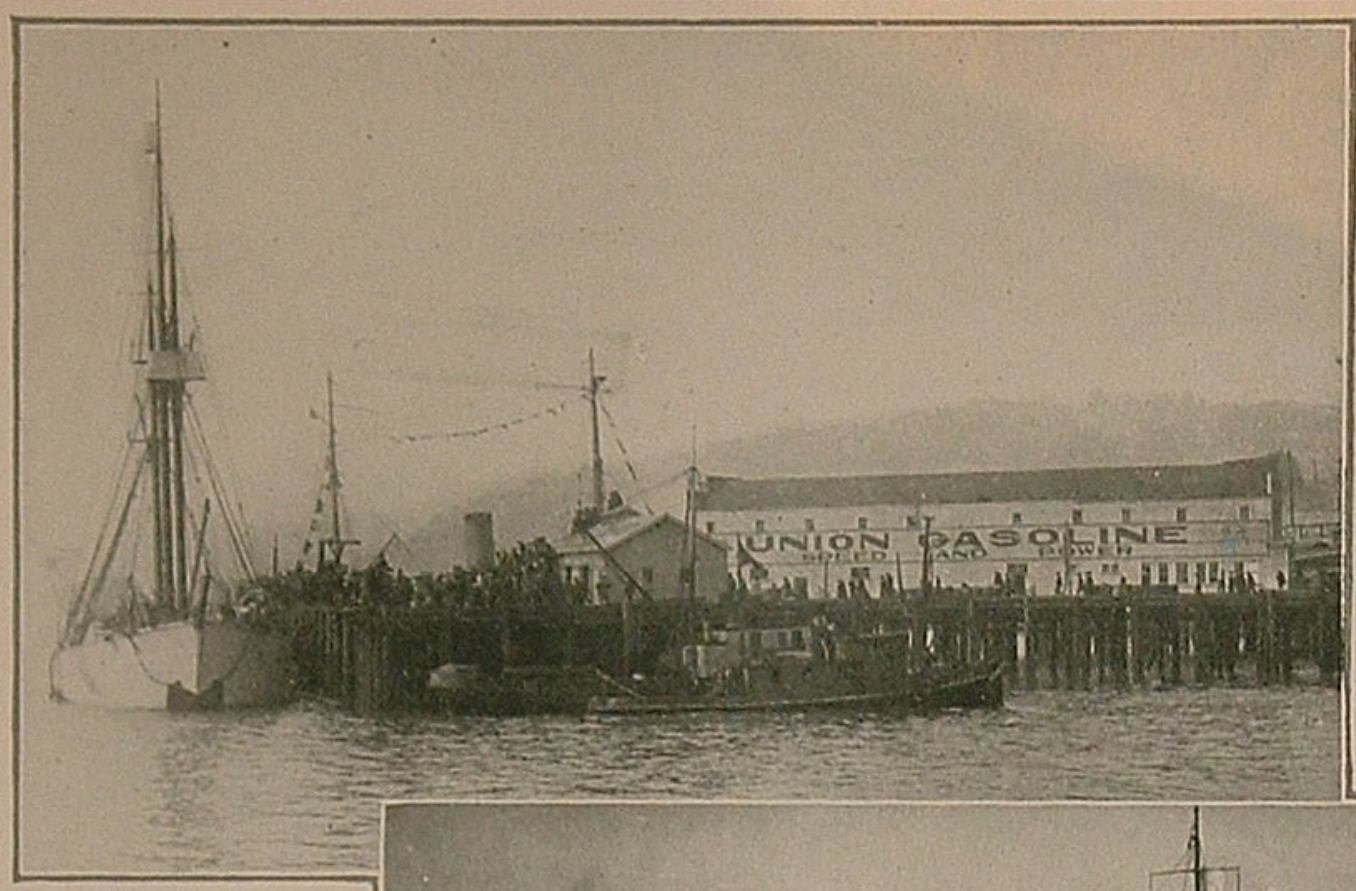
Each unit has a 1½-horsepower electric motor with which to drive the treater shafts. The revolving plates and the upper end of the treater shaft is furnished with a cone cover to keep out the rain.

To each group of treaters there is one settling "trap" tank, whence the dry oil is collected in a balance tank ahead of the pump station. The oil, which is still warm, is then pumped to the station tanks and finally is sent on its journey to the coast. The separated water, the cause of all this expensive treatment, is further relieved of the last traces of oil in a special concrete settling basin, and then discharged into an adjacent natural drainage channel.

In the treaters the high temperature of the oil and short circuits due to occasional slugs of water cause flashes which may ignite the vapors in the treater top, and so care must be taken to prevent fires. A pipe runs around the top of the treater with holes perforated for the escape of steam into the treater. Across the treater top there is a line to the treater lid with an inset fusible link which melts at a temperature of 140 degrees Fahrenheit, thus dropping the treater lid. The lid in falling hits a trip valve, which turns on the steam into the now closed treater and the spray of steam puts out the fire.

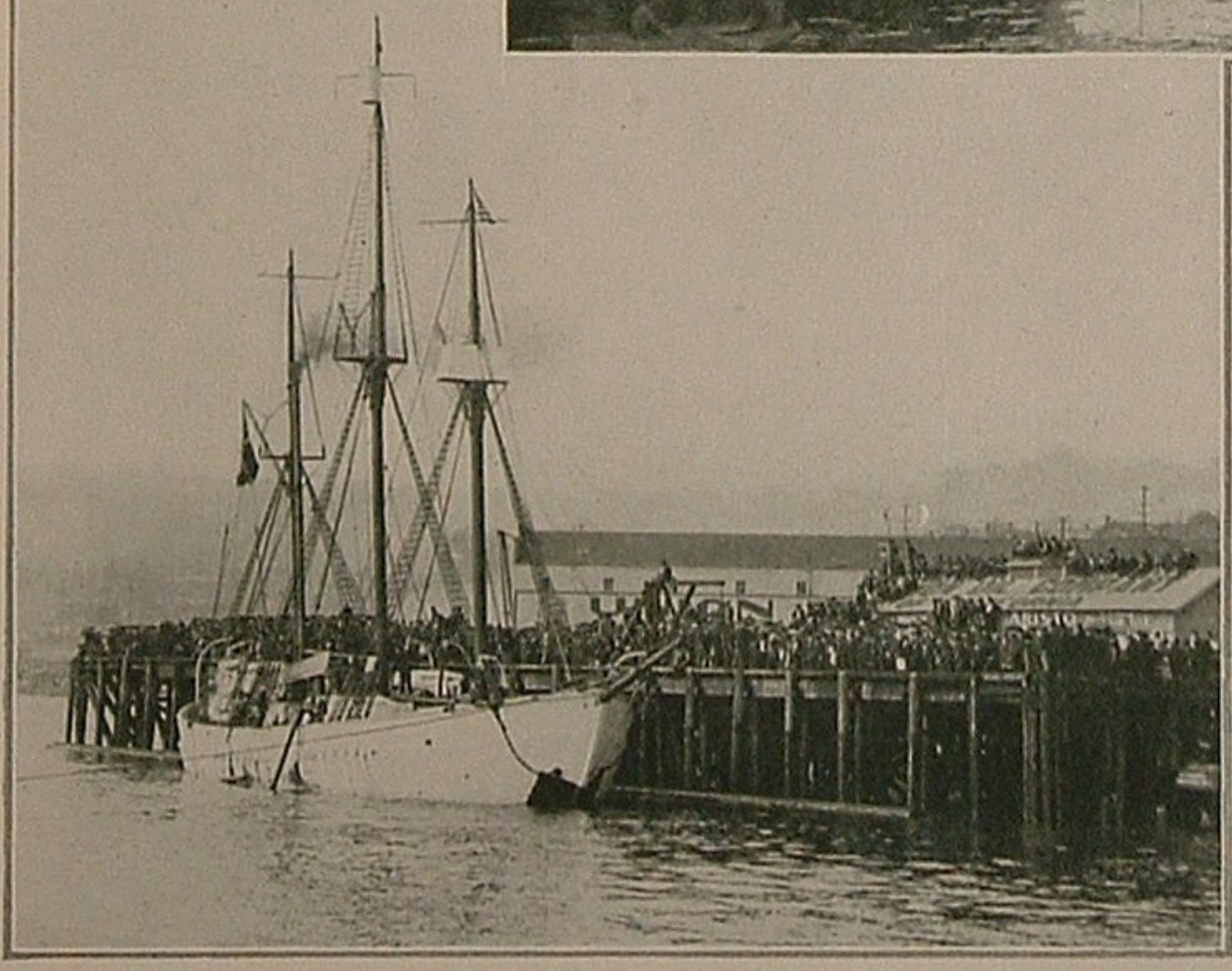


THE SEPARATOR BOX OR SKIMMING POND.



Above—Union Oil Dock just prior to departure of the "MAUD."

Aft view of schooner showing Norwegian flag flying.



Swinging out from the dock.

The Lost Continent.

WHEN the white, three-masted schooner bearing on her stern the name "Maud," and which is shown in the picture on the opposite page, docks at Nome, Alaska, about the 25th of this month, the last sight of what is called civilization will be taken by a valiant Norwegian explorer and his Norseman crew, following which brief farewell they will depart for five years of exploration work in the North Polar regions.

The same spirit which in times past prompted Columbus, Magellan and the Cabots to undertake perilous journeys in pursuit of knowledge is manifested in this latest of the continued attempts of Captain Raold Amundsen to secure information from which to prepare future maps describing more accurately the vast stretches of territory around the top of the earth now but vaguely outlined.

Captain Amundsen, one of the most famous of Arctic explorers, has already to his credit the placing of the Norwegian flag at the South Pole, which he accomplished five weeks prior to the arrival of the ill-fated British expedition under Captain Robert Scott. In fact, Amundsen's life has been devoted entirely to the solving of the existing mysteries regarding the North and South pole regions. His latest decision to spend five years exploring the white spaces that are said to include a million square miles of unknown land—to locate the earth's "lost continent"—comes very shortly after an expedition begun four years ago, but which had to be abandoned owing to the ice currents encountered.

Of added interest to the employees of the Union Oil Company of California is the fact that it was from the Union Oil Company's dock at Seattle, where she had been for some days conditioning and fueling herself for the adventure, that these modern disciples of Eric the Red departed on June 4th on the eventful voyage. Eighty tons of fuel oil were taken for the schooner's engines, as well as 2000 gallons of kerosene, 13,000 gallons of diesol and over 500 gallons of Aristo Heavy lubricating oil. A large supply of empty drums and barrels was also taken on board for emergencies and the establishment of depots and winter quarters. A United States Army Band played the American and Norwegian National Anthems, while the flags of the two nations flew from the ship's masts. Five thousand people jammed the company's dock, cheering the dauntless ship's company as the "Maud" slowly made her way out of the harbor.

Captain Amundsen has in his equipment an aeroplane to be piloted by a former Canadian army aviator. It is expected that even if the flat-bottomed schooner herself does not drift over the Pole, lateral flights will be made to the topmost point of the earth and the desired observations thus made possible.

After leaving Nome late this month the "Maud" will head into Bering Sea, then westward, touching the North Siberian coast to drop three natives who have been with the party since the ship left the Arctic last winter after her unsuccessful 1918 expedition. Wrangel Island will be passed and the "Maud" will then veer north and the important stage of the voyage will be reached, the object being to push as far as possible into the ice of the Pacific-Polar-Atlantic current before freezing in.

The further progress of the expedition depends largely upon chance. From calculations founded on scanty information securable regarding the current, it is figured that the floe will carry the explorers in a fairly direct course across the Pole, drifting through a passage between Greenland and Spitzbergen into the Atlantic and thence back to the home port of the explorers in Norway.

So far only Peary has reached the North Pole, and the mysteries of its surroundings remain practically unsolved. When the value of these discoveries to the world of the future is considered, it seems fortunate that, standing out from the hundreds of millions who would regard the smallest part of an expedition of this kind as a living death, are a few who will give their lives if necessary in such pursuits. The balance of the home-loving millions can only encourage and admire the few—just as the five thousand enthusiastically cheered Captain Amundsen as his craft left the Union Oil dock at Seattle on this latest great Arctic expedition.

The Tale of a Wildcat

BY F. M. SMITH

There will be readers of this article who are familiar with the thrill of a huntsman as he stalks big game in the hills. Exactly such a thrill comes to that economic huntsman who directs the wildcatting operations in the field for a large producing company. This huntsman-like "kick" is especially marked when the scent is hot; that is, when conditions are such that the tapping of a high pressure zone may be momentarily expected.

Mr. George Kammerer, Superintendent of the Valley Division of the Union Oil Company of California, has drilled more wildcats than any other man in Kern County. The K. C. Wallace well was recently drilled by him in the west end of Elk Hills and is a typical wildcat. Features of interest, geological and otherwise, were many and the well has furnished all of the customary thrills.

Interest was keen and thrills were present in spite of the fact that no spectacular blowouts occurred, and after drilling to a depth of 4615 feet the wild one was pronounced a dry hole. It is the object of this article to record events of interest and to impart to co-workers a few ideas on the mechanics and geology of this particular wildcat.

In the continuous quest for new oil territory decision to drill the Wallace well was formulated when a local stock selling company uncovered a pocket of high pressure gas, presumably petroleum, at a depth of about 2365 feet. This was in a well a short distance north of the lease which we later acquired. There were also other determining factors involved in the decision, chief among which was the presence of an apparent anticline, which is mapped in the accompanying diagram. For the non-technical reader it is stated here that by an anticline is meant a fold in the earth's strata which extends over the oil fields. In bygone ages the fold has acted as a trap, catching and impounding the oil. Evidence of such folds is now much sought after by the geologist or "rock hound."

The well was spudded in with the expectation of encountering gas under high pressure at a depth of about 2300 feet with productive oil below the gas. Such are the conditions which exist elsewhere in the Elk Hills, notably on the Hay and Carmen leases. These leases include the nearest producing wells within the Elk Hills proper, and still farther east on what probably is the same structure are found the big gushers in the vicinity of the Tupman camp. From the available evidence at hand it appeared a safe bet for the wildcatter within the limits of the hazards of the game to predict similar conditions at the Wallace location.

The ponderous rotary ground its way downward and expectancy increased. With the big fishtail bit at about 2000 feet watchers eagerly examined the cuttings, and each change of formation was carefully noted. It was about this stage of the hunt that chloroform and ether tests were first resorted to in an effort to bring forth showings that were not otherwise apparent. These tests were conducted at ten-foot intervals to the bottom of the hole, but the much desired brown discoloration of the chloroform, which is commonly taken as an indication of the presence of oil, never appeared. And the tests were carefully made.

For the benefit of those unfamiliar with

the practice of drilling, it is stated here that oil bearing formations are frequently penetrated with a hole full of rotary mud, and no evidence of the fact that the drill has nosed out its game appears at the surface. Unless the rock pressure, in pounds per square inch, where the pay streak is penetrated, is greater than the pressure due to the weight of rotary mud above, oil and gas will not enter the hole. If the pressure due to the weight of rotary mud is sufficiently in excess of the rock pressure, movement into the formation will take place until the sands are mudded off. Hence the most careful watching may avail nothing, but it should be and is practiced as a possible means of obtaining valuable information.

Drilling was continued to a depth of 2775 feet, when the dictates of caution bade a good rotary man to put some pipe in the hole. No showings worth while had been noted, but the formation below 2000 feet was treacherous and cavey, hence out came the drill pipe and the casing was started.

In drilling a rotary hole it is highly desirable to run in the casing at the earliest possible time following the suspension of drilling. Otherwise the blue shale walls of the hole may begin to "slack" and caving ensues. This entails great difficulty in getting to bottom with the casing. Such a situation developed at Wallace. The usual cleaning out and washing down methods were futile. Great shale boulders, spherical and oblong in shape, rolled into the hole.

When further progress seemed impossible the resourcefulness of the superintendent asserted itself. With the 12½-inch casing "froze" at 1810 feet an "outside circulator" was installed and the 10-inch casing started. With high pressure pumps mud fluid was forced into the hole between the 12½-inch and the 10-inch casings and returned to the surface on the inside of the 10-inch pipe. As the circulating fluid returned to the surface laden with shale cavings, the heavy pipe slowly disappeared into the hole.

Blue shale boulders as large as a man's head riding up from an underground depth of approximately half a mile were not only an inspiring sight but were also of great importance from a technical viewpoint. Samples were readily afforded which would be a delight to any geologist, and especially the "mud smeller" who had been forced to contend with the vagaries of a rotary drill.

One sample which was typical was strapped and weighed. It was a blue shale boulder, shaped like an egg, with dimensions 7½ inches by 9⅝ inches by 15 inches, and it weighed twenty-five pounds. Among the samples was a piece of coal, and it was a real hand sample like mother would select for the kitchen stove. Lignite had been previously reported from a deep well on Buttonwillow swell, but, owing to the minute specimen obtained, there had always been a lingering doubt. The Wallace sample, recovered by "Tiny" Coveney, was a true lignitic coal measuring 7½ by 4½ by 2½ inches and weighing 2½ pounds. It came from between limits of 1810 feet and 2560 feet in depth.

After an effort extending over two months high pressure broke a hole in the 12½-inch casing and mud fluid, forced into the hole around the 10-inch casing, bubbled to the surface outside of the derrick floor. The impression received was similar to that in regions of solfataric action such as Yellowstone Park or Steamboat Springs, Nevada. The practical result was the 10-inch casing "froze" at 2560 feet. It was decided to prospect ahead and cement the 8¼-inch casing above the first showing encountered.

At 2950 feet a showing of gas was noted. The showing was so slight that experienced men did not attach much significance to it. However, it was a bonanza for those with an axe to grind; that is, the stock sellers on nearby leases who receive donations from the public. Excitement ran high in Westside towns as the drillers prepared to give the well the absolute test. Upper water was shut off by cementing the 8¼-inch casing at 2929 feet, the cement was drilled out and the hole was bailed dry. Neither water, oil nor gas entered the bottom of the hole and many fond hopes were blasted.

With ever dwindling bit the rotary drove downward. At 3165 feet it was noted that a hot flowing salt water had access to the well. And thereby hangs an excuse as to why we did not get oil at this location. The geological significance of this artesian flow of hot salt water is mention later in the article. Its source is sus-

pected as having been in formations shortly below the 8¼-inch shoe at 2929 feet. The finger of suspicion was directed to this source by large, white crystals of quartz sand which were found to be present in formation samples as high as 3000 feet. The crystals were identical in every respect with those from a sand in a well drilled about three miles and a half to the south and east. This also was an artesian water well.

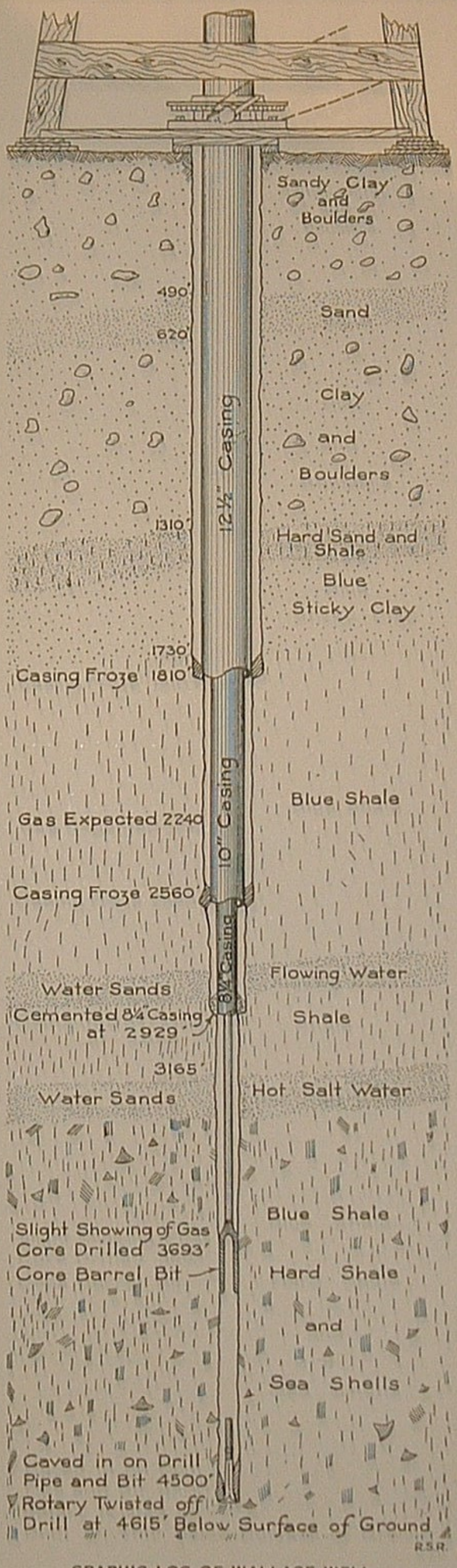
At 3695 feet a slight showing of oil on the ditch was suspected. The suspicion may have been born largely of despair. At any rate Superintendent Kammerer had a new core barrel and was anxious to try it out. Coring as a means of accurately identifying formations was coming rapidly into vogue. So the core barrel was run and a core obtained from Mother Earth at a depth of over two-thirds of a mile as deftly as cook could accomplish it in the kitchen with a good ripe apple.

The core showed shale with some sand and carried the ear-marks of having been subjected to an extremely high temperature. However, the formation was not favorable for the presence of oil and drilling was resumed. Expectancy had dropped and hopes were fast ebbing.

From the time the core was taken until the total depth of 4615 feet was reached there was nothing more which would stimulate interest. The horizon in which pay was expected had been drilled through. Oil bearing formations were still possible but no longer probable. Drilling would be continued until a caving hole made the cost of further progress excessive.

At a depth of 4615 feet the walls of the hole closed in on the drill stem. With a flowing water which had never been completely mudded off it was remarkable that caving had not occurred ere this depth was reached. The fact that the hole had remained open so long was regarded as further evidence that the artesian water was coming from formations close to the 8¼-inch shoe. Had there been a considerable length of open hole above the flow the overlying formations would have been undermined to such an extent that caving would have occurred much sooner.

After pulling for thirty-six hours the drill pipe and bit complete tore loose from the hole. To re-enter the hole without additional casing would be dangerous, in-



GRAPHIC LOG OF WALLACE WELL.

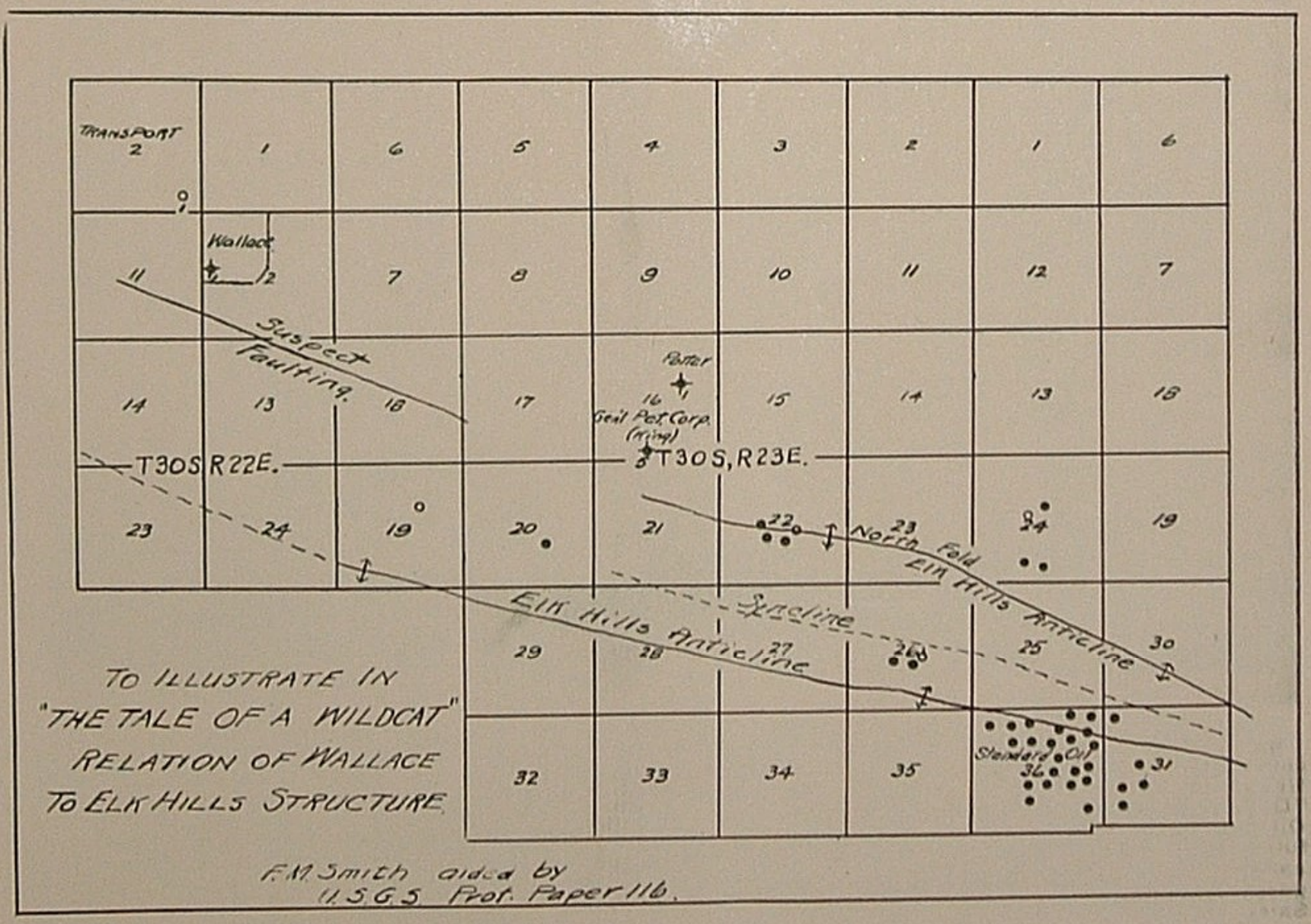
curring high risk of losing considerable drill pipe and accomplishing nothing. Therefore it was decided to quit and Superintendent Kammerer, by an ingeniously devised expanding plug placed in the 8¼-inch casing, personally supervised the shut-off of flowing water and abandonment followed. It now remains but to furnish an alibi as to why we did not obtain oil at Wallace.

The reader will note the traces of what are mapped as anticlinal folds on the accompanying plan. On the north side of the fold three key wells are drilled. Two of them are Potter Oil Company's well No. 1 and the General Petroleum Corporation's "King" 5 on Section 16. The third key is Wallace on Section 12, three miles to the north and west. Both at Wallace and at King No. 5 in the same stratigraphic horizon an artesian water was found. The waters were identical and the presence of a high head of water was also suspected at Potter location.

Within the area of the key wells on the north side of the structure efforts to obtain production have been fruitless. The outstanding feature has been the failure to find the oil bearing formations which were never missed on the opposite side of the trace as it is mapped. This description does not apply to the extreme easterly portion of the field. Tupman is not considered as being within the area of the key wells considered.

The explanation which suggests itself is obvious. The northerly fold of the Elk Hills anticline in the west end of the field is in reality a fault. A sequence of formation exists north of the fault which is different from that where oil has been found.

Beyond the fact that the topography just south of Wallace location is slightly suggestive of faulting, the writer has never verified the existence of such a break by detail work in the field. The explanation as above which appears to be probable is offered for what it is worth. The alternative explanation for conditions at Wallace would be that it is located too low on the anticline. If such were the case formations which contain oil at higher locations could be expected to hold water at Wallace. Regardless of the alibi, Wallace remains a dry hole.



TO ILLUSTRATE IN "THE TALE OF A WILDCAT" RELATION OF WALLACE TO ELK HILLS STRUCTURE

F.M. Smith aided by U.S.G.S. Prof. Paper 116.

Sacramento has just enacted, in a week of c arnival festivity, the stirring days of the discovery of gold at Sutter's Creek, the completion of the Central Pacific railroad over the Sierra Nevadas, the Indian battles and the old mining town activities. In the reproduction of these "Days of '49"—as the celebration was called—members of the Sacramento organization of Union Oil Company of California took an enthusiastic part. Pictured above is the company staff in the full regalia of side arms and flowing beards which the city demanded in its replica of California's early life. Below, from left to right, are shown L .W. Rackerby, Equipment Clerk; Miss Margaret Fraser, Billing Clerk; Miss A. M. Plate, Sales Stenographer, and S. D. Herkner, District Sales Manager.

Workmen's Compensation Insurance

BY C. L. CRAIG

Systematic compensation for injuries arising out of work is now a world practice. Legislation varies greatly in the number and character of occupation included, the rate of payment and the mode of assuring and administering it, but its fundamental principle is universal. The basis of compensation is no longer fault actually proved or imputed, but the coincident fact of injury while at work. The form of our legislation has been strongly influenced by that of the British compensation acts of 1897 and 1906.

While fundamentally affected by foreign examples, our state enactments are sharply modified by local traditions, phraseology, and various political and social influences, as well as by constitutional limitations, which, in adapting the pattern to its environment, have produced many dissimilarities in detail and verbiage and in the consequent judicial and administrative construction. The resultant obligation of the employer to assure limited compensation for work injuries and the reciprocal duty and right of the employee to accept it, vary greatly, therefore, in different States. There is not only a decided lack of uniformity in statutory language, but a decided legislative intent to produce varying degrees of liability, and some decided differences of judicial opinion as a consequence.

The first compensation act passed in the United States was in New York in 1910 and no laws enacted on any subject have ever made such progress in this country. It is only about eleven years since the first permanent Constitutional law on this subject was passed and now we have 43 States in which such laws are in force. That they are still in the experimental stage seems to be apparent by the changes that are being continually made in them by the different States and hardly a legislature meets that does not amend the compensation act. Space will not allow in this article to elaborate on, or make comparison, between the acts of the different States.

California, in due keeping with the Western spirit of progressiveness, in the following year passed the Employers' Liability Act of 1911, popularly known as "The Roseberry Act," an elective compensation act. On October 10, 1911, the State Constitution was amended by adding Section 21 to Article XX, authorizing further legislation to provide for a compensation law in a compulsory form. On May 26, 1913, the Workmen's Compensation, Insurance and Safety Act, Chapter 176, Laws of 1913, a compulsory compensation act with certain exceptions, popularly known as the "Boynton Act," was passed, and superseded the compensation provisions Chapter 399. This was amended in 1915 in various particulars. On January 1, 1918, the Workmen's Compensation, Insurance and Safety Act of 1917, Chapter 586, Laws of 1917, a compulsory act, a reinactment of the Boynton Act with improvements and

additions, went into effect, repealing practically all the provisions of the Boynton Act, which with the amendment of 1919, Chapter 471, Laws of 1919, constitutes the law in operation at the present time.

For the information of the employees of the Union Oil Company of California, the following are the principal points of the Workmen's Compensation, Insurance and Safety Act as applied to the State of California, this being the principal State of operation of our Company.

It will be noted by the title of the Act that it provides for compensation, insurance and safety, but the safety feature will not be touched on in this article, as it is a big enough feature to warrant special consideration.

The Workmen's Compensation Act is administered by a Board consisting of three members appointed by the Governor from the State at large and known as the Industrial Accident Commission. The term of office is four years. The present Commissioners are Will J. French, A. J. Pillsbury and A. H. Naftzger. California has been very fortunate in the personnel of its Commission. Will J. French, formerly president of National Association of Industrial Accident Commission, and A. J. Pillsbury, recognized National authority on Workmen's Compensation, having been Commissioners since its formation. Both of these men being of high caliber and vitally interested in the work, it is needless to say their efforts have been of immeasurable value in perfecting the Act which is considered one of the best, if not the best, in the whole of the United States.

Workmen's Compensation Insurance, as a rule, is carried by Insurance Companies or what are known as Insurance Carriers, but the Act provides for the issuance of certificates of consent to self-insure to employers of labor approved of by the Commission. They are required to deposit with the State Treasurer, security or bond to guarantee the payment of compensation. At present there are about 237 such certificates issued covering approximately 210,-427 employees, and for whose protection security to the amount of $4,307,000.00 was deposited with the State Treasurer. Our Company is what is termed a self-insurer and owing to the large number of its employees, the cost of operation is considerably cheaper than by carrying same in a recognized Insurance Company and therefore has the advantage over the Insurance Company whose policy is settling their claims as economically as possible, by being able to deal directly with the injured party in the relation of employer and employee and thus by not always adhering strictly to technicalities, settle claims amicably and more generously, giving the employee the benefit of the doubt, if any, thus increasing loyalty to the Company. The Act covers every person in the service of an employer, including aliens and minors, but excludes any person whose employment is both casual and not in the course of the trade, business, profession or occupation of his employer, also excludes any employee engaged in household, domestic service, farm, dairying, agriculture, viticulture or horticulture labor. and stock or poultry raising. However, any employer having in his employment any employee under the excluded list can by the joint election of himself and employee elect to come under the provisions of the Act. Employers, self-insured or insured through Insurance Carriers, are presumed to include excluded employment unless notice is given by the employee to the contrary.

All employees of the Union Oil Company of California and its subsidiaries come under the provisions of this act with the exception of the officers and seamen of the Marine Department, over which the act has no jurisdiction, therefore, in case of injury to any of the Company's employees with the foregoing exceptions, arising out of and in course of their employment, they are entitled to be provided with such medical, surgical and hospital treatment, including nursing, medicines, medical and surgical supplies, crutches and apparatus, including artificial members as may reasonably be required to cure and relieve from the effects of the injury (the term injury as used in the act includes occupational disease of which there are 25 but only two or three are applicable to this State) in addition to which, if the injury causes a temporary disability, a disability payment shall be payable on the eighth day after the injured employee leaves work as a result of the injury. If the period of disability does not last longer than seven days after the date of injury, no disability payment is recoverable, in other words, there is a waiting period of seven days for which

the injured employee receives no compensation. The temporary disability payment therefore commences on the eighth day and consists of 65% of 95% of the average weekly earnings with a maximum of $20.83 per week, payable in advance for the first week, if possible to estimate disability and thereafter on employer's regular payday not less frequently than twice a month. In case of a permanent disability, as soon as the injury is fully healed and all function possible is restored, application is made to the Industrial Accident Commission, when a rating is issued by the Permanent Disability Rating Department awarding the injured party an amount commensurate with the injury, payable in weekly installments on employer's regular payday. The rating does not provide for the payment of compensation for the balance of life, but for a certain specified number of weeks on the basis of an average period of time which experience has indicated will be sufficient for the employee to accommodate himself to his usual duties or acquire a new occupation. This is computed, by the Commission referring to a schedule of permanent disabilities which has been adopted by them for the purpose. Each employee's ability to earn is rated at 100% and injuries resulting in a permanent loss of 70% or more entitles the injured person to full compensation for four and one-half years and a pension for the balance of life consisting of 1% per week for each 1% of disability above 60%.

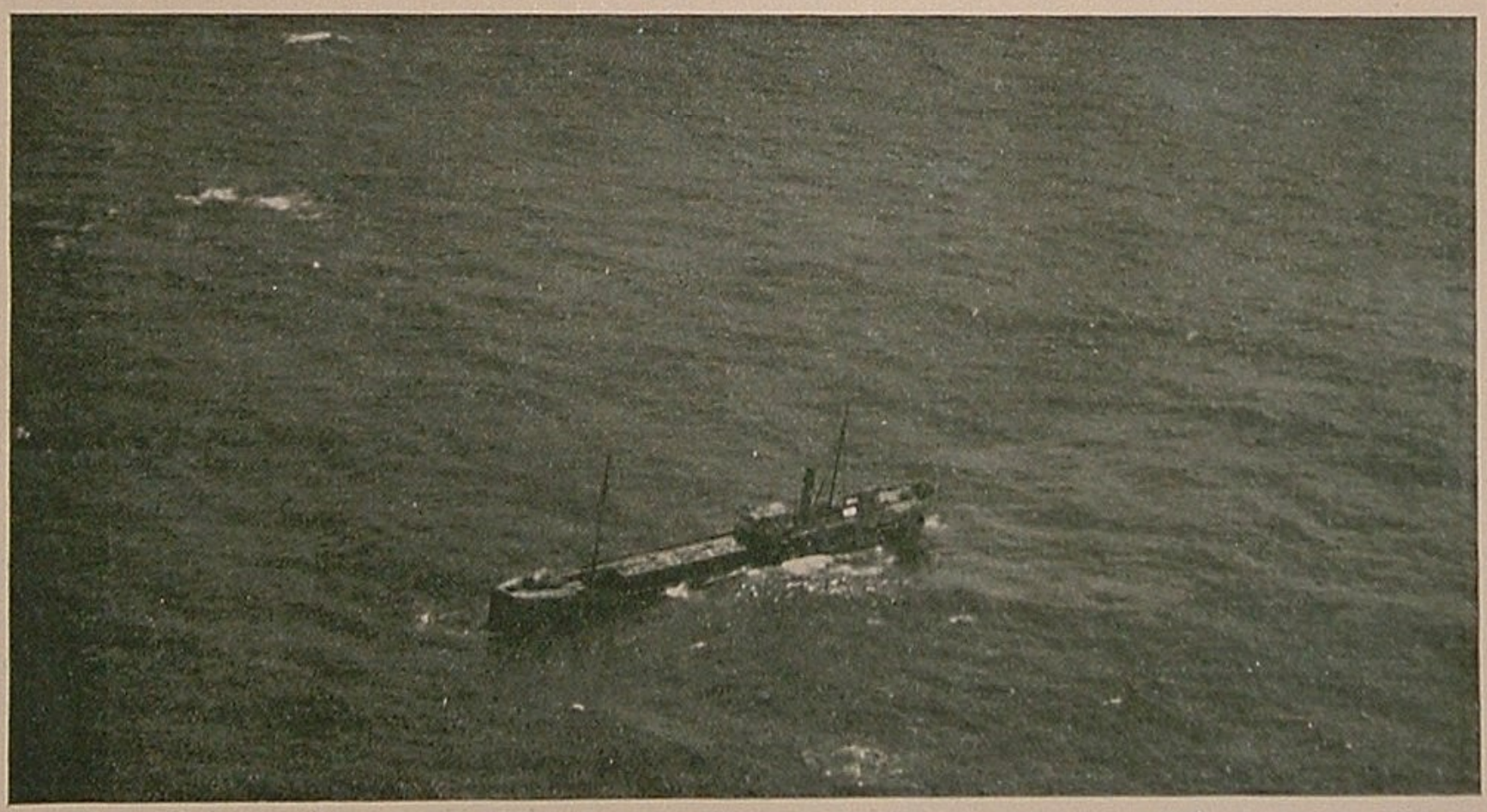
In case of fatal injury, if there are dependents, wholly dependent on the deceased employee for support, such dependent is allowed the reasonable expense of burial not exceeding $100.00 and a death benefit which, together with the cost of burial shall equal three times his average annual earnings, such average annual earnings to be taken at not less than $333.33 nor more than $1,666.66, or a total sum of $1,000.00 and $5,000.00 respectively, which award shall be payable in weekly payments, payable on the employers' regular pay day, not less frequently than twice in each calendar month, unless otherwise ordered by the Commission. The Commission may also in its discretion, at the time of making the award or any time thereafter, commute the compensation, payable in a lump sum. The commutations, as a rule, are only allowed for the purposes of buying homes, businesses or to pay off mortgages, the commutation being made on a basis of 6% per annum.

Should an employee be injured or killed by reason of any action of any other than employer, action can be brought against the third party either by the employer or employee or both, and the fact of the employee or dependents claiming compensation will not affect the right of action for damages against the third party but the compensation payments made by employer will be allowed as first lien against any judgment recovered by employee or if the employer alone brings action against third party and recovers more than the amount paid by him as compensation, the excess amount shall be paid to employee or other person entitled thereto.

While the Act is primarily for the employees' protection, it also offers benefits to the employer in that he is relieved from suit for damages in case he is insured or has a self-insurance permit. In May, 1919, what is termed as the Rehabilitation Act, was passed by the State of California to provide for the rehabilitation and re-education of the employees disabled during the course of their work. This Act was modeled on a similar Statute of New York, which has been held constitutional in the Courts of that State. Similar Acts are now being adopted by many States. However, same was short lived as the Supreme Court of California, on January 27, 1922, held it to be unconstitutional. The report of the Industrial Accident Commission of California for their fiscal year ending June 30, 1921, summarized very briefly, shows that there were 592 Industrial Deaths as compared to 586 in the previous year. Permanent injuries numbered 1929 as against 1714 the previous year. Temporary injuries totaled 131,587 as against 105,952 the previous year, based on the population of California, the death rate shows a decrease of 2.60 as compared with the previous year.

Our own Company's report for year ending December 31, 1921, discloses that the injuries were as follows: Four fatalities costing $19,663.30; 13 permanent injuries costing $14.339.28; 1426 temporary injuries costing $47,207.44, or a total cost per employee for year of $13.91 per capita as against $15.91 per capita in 1920, or a reduction of 12.5%.

Wreck of S. S. "Whittier"



Union Oil Company of California Tanker S. S. "WHITTIER," caught from the side and above in two remarkable pictures showing her plight as she lay stranded on Saunder's Reef, 10 miles south of Point Arena, California.

En route to Eureka with a cargo of oil fuel from San Pedro on May 1st, the "WHITTIER" crashed on the rocks at 1:50 a. m., and within fifteen minutes the engine room was flooded and all lights out. The tanker is still in the position shown in the photographs—high on the reef, the waves continually breaking against her sides. The "WHITTIER" is regarded as a total loss, as she will sink if washed from the rocks, and salvage at the present time is impossible.

The aerial picture was taken the day after the unfortunate incident, from a plane of the United States Air Service, flying over the doomed vessel at a height of 1000 feet.

California Oil Statistics for the Month of April, 1922

DISTRICT	Gross Barrels	April	March	1921	1920	1919	1918
		DAILY AVERAGES					
Kern River	620,855	20,695	19,907	18,357	20,377	20,907	22,083
McKittrick	204,342	6,811	6,601	5,672	7,106	7,773	8,385
Midway-Sunset	2,565,321	85,511	83,740	78,902	83,788	88,908	95,429
Elk Hills	1,122,132	37,404	35,607	49,549	19,853	77	.....
Lost Hills-Belridge	254,406	8,480	8,603	8,934	11,362	12,770	14,967
Coalinga	1,030,076	34,336	35,648	34,307	42,888	44,956	44,823
Santa Maria	409,894	13,663	13,195	14,973	15,869	16,665	19,747
Ventura-Newhall	224,872	7,496	7,033	5,762	5,601	4,858	3,827
Los Angeles-Salt Lake	114,008	3,800	3,302	3,601	3,608	3,625	3,691
Whittier	59,070	1,969	2,064	2,015	2,300	2,744	2,866
Fullerton	457,136	15,238	15,065	16,334	14,309	12,017	11,943
Coyote	599,811	19,994	19,835	20,326	23,859	27,952	34,563
Santa Fe Springs	202,950	6,765	4,298	571	.....	.....	.....
Montebello	629,101	20,970	21,059	24,838	30,395	33,153	18,735
Richfield	780,981	26,033	26,346	22,485	7,009	2,646	8
Huntington-Newport	645,024	21,501	22,067	6,901	104	.....	.....
Long Beach	261,602	8,720	6,148	207	.....	.....	.....
Summerland	4,500	150	145	148	148	148	148
Total	10,186,081	339,536	330,663	313,882	288,576	279,199	281,215
March	10,250,547	330,663	.....	.....	.....	.....	.....
April	.....	.....	.....	339,536	339,536	339,536	339,536
Increase	64,466*	8,873	.....	25,654	50,960	60,337	58,321

SHIPMENTS AND STOCKS

Stocks April 1st, 1922	34,761,736
April Production	10,186,081
Total	44,947,817
April Shipments	8,144,625
Stocks May 1st, 1922	36,803,192
Stocks Increased April	2,041,456
Stocks January 1st, 1922	31,556,277
Total 1922 Surplus	5,246,915
1922 Daily Surplus	43,724

DAILY AVERAGE

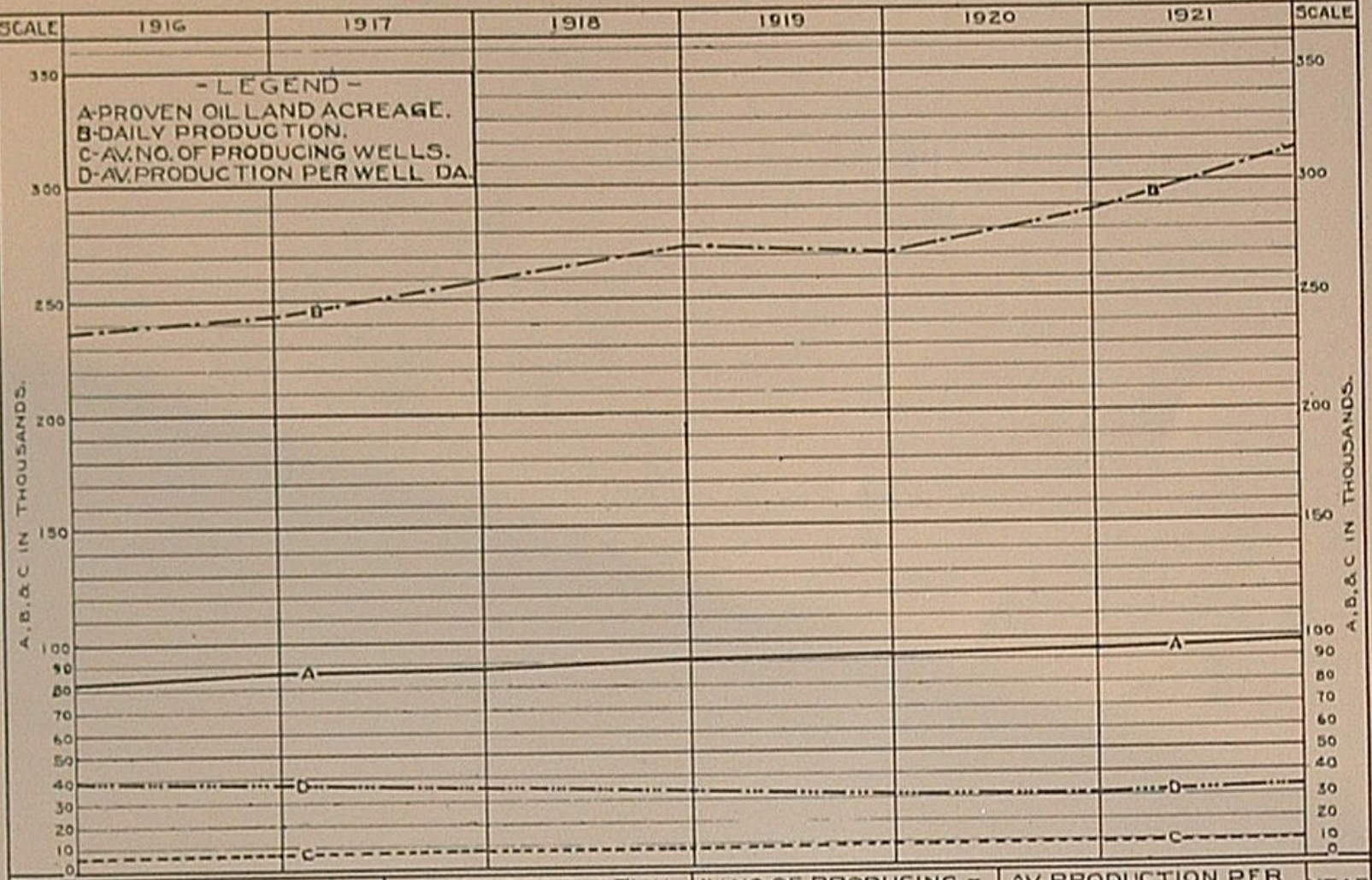
DAILY	April	March	1921	1920	1919	1918
Production	339,536	330,663	313,882	288,576	279,199	281,215
Shipments	271,487	284,945	281,177	310,941	282,873	290,836
Surplus	68,049	45,718	32,705	22,365*	3,674*	9,621*

SUMMARY OF FIELD OPERATIONS FOR APRIL

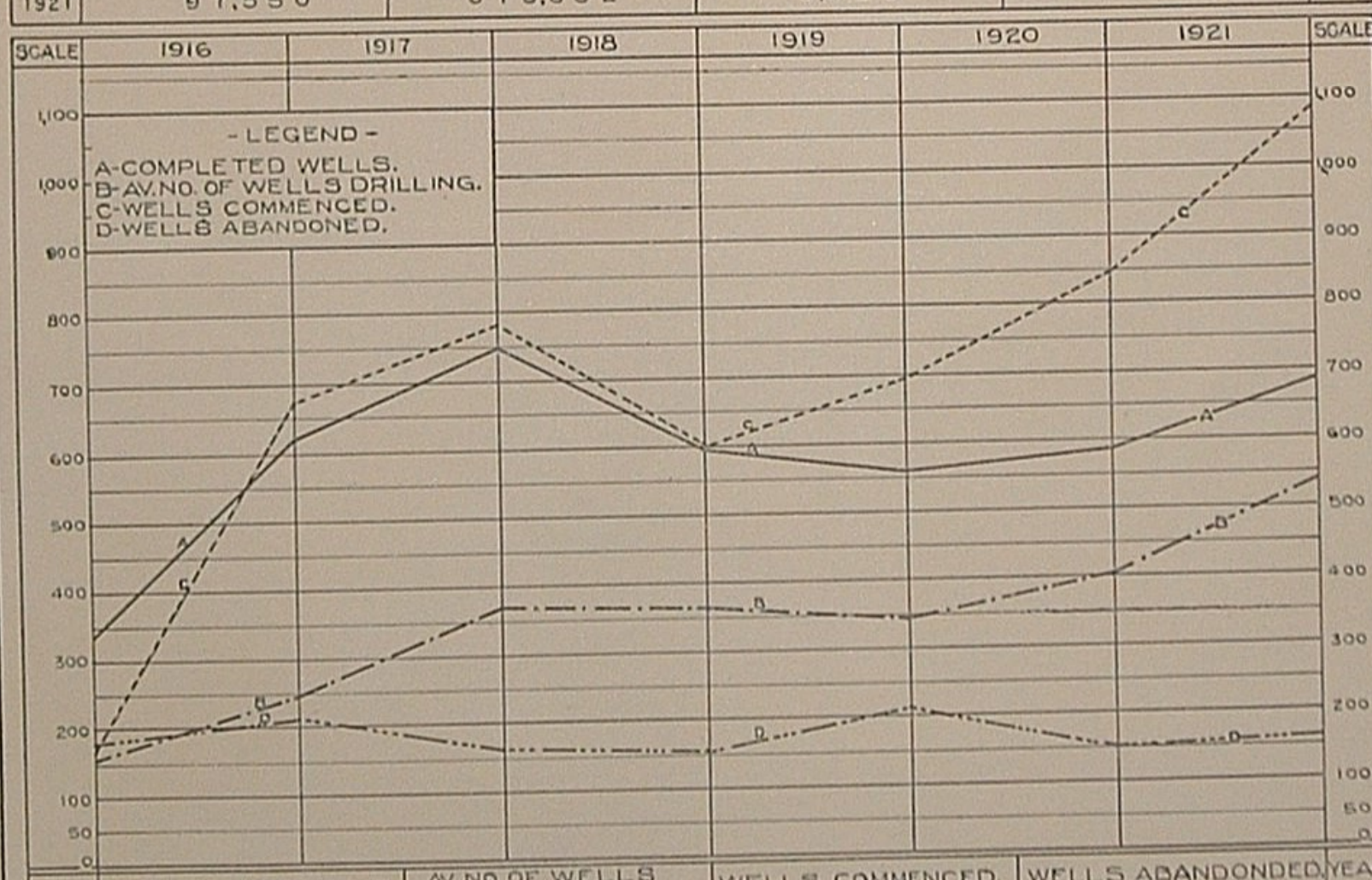
DISTRICT	New Rigs Up	Active Drilling	WELLS Completed	WELLS Active Producing	WELLS Abandoned
Kern River	1	4	2	2,208	1
McKittrick	2	11	1	299	2
Midway-Sunset	16	74	12	2,475	3
Elk Hills	4	36	3	149	..
Lost Hills-Belridge	..	11	..	489	..
Coalinga	3	30	1	1,267	3
Santa Maria	2	9	..	438	1
Ventura-Newhall	1	43	..	562	..
Los Angeles-Salt Lake	1	2	1	674	..
Whittier-Fullerton	5	84	2	1,129	2
Santa Fe Springs	8	55	1	4	..
Huntington-Newport	16	106	8	90	..
Long Beach	23	68	7	25	1
Summerland	..	..	..	142	..
Miscellaneous Drilling	4	64	..	....	5
April	86	599	38	9,951	18
March	99	567	62	9,871	18
Increase	13*	32	24*	80	..
Average Year 1921	90	536	57	9,425	14
Average Year 1920	77	403	49	9,299	13
Average Year 1919	58	340	47	8,774	18
Average Year 1918	50	362	50	8,210	13

*Decrease—Shortage

STATE FIELD DEVELOPMENT.



YEAR	PROVEN OIL LAND ACREAGE.	DAILY PRODUCTION BARRELS.	AV. NO. OF PRODUCING - WELLS.	AV. PRODUCTION PER WELL DAILY - BARRELS.	YEAR
1915	82,250	236,970	6,016	39	1915
1916	86,550	243,294	6,542	37	1916
1917	88,745	259,208	7,399	35	1917
1918	90,844	273,132	8,210	33	1918
1919	92,087	271,965	8,774	31	1919
1920	94,567	288,576	9,299	31	1920
1921	97,550	313,882	9,425	33	1921



YEAR	COMPLETED WELLS	AV. NO. OF WELLS DRILLING.	WELLS COMMENCED.	WELLS ABANDONDED.	YEAR
1915	333	153	168	175	1915
1916	619	247	672	214	1916
1917	749	368	780	162	1917
1918	597	363	600	155	1918
1919	558	340	696	211	1919
1920	587	403	847	150	1920
1921	684	536	1,082	162	1921


UNION OIL COMPANY
UNION GASOLINE