

The

FEATURING . . .

"Century of Progress"

JULY—AUGUST

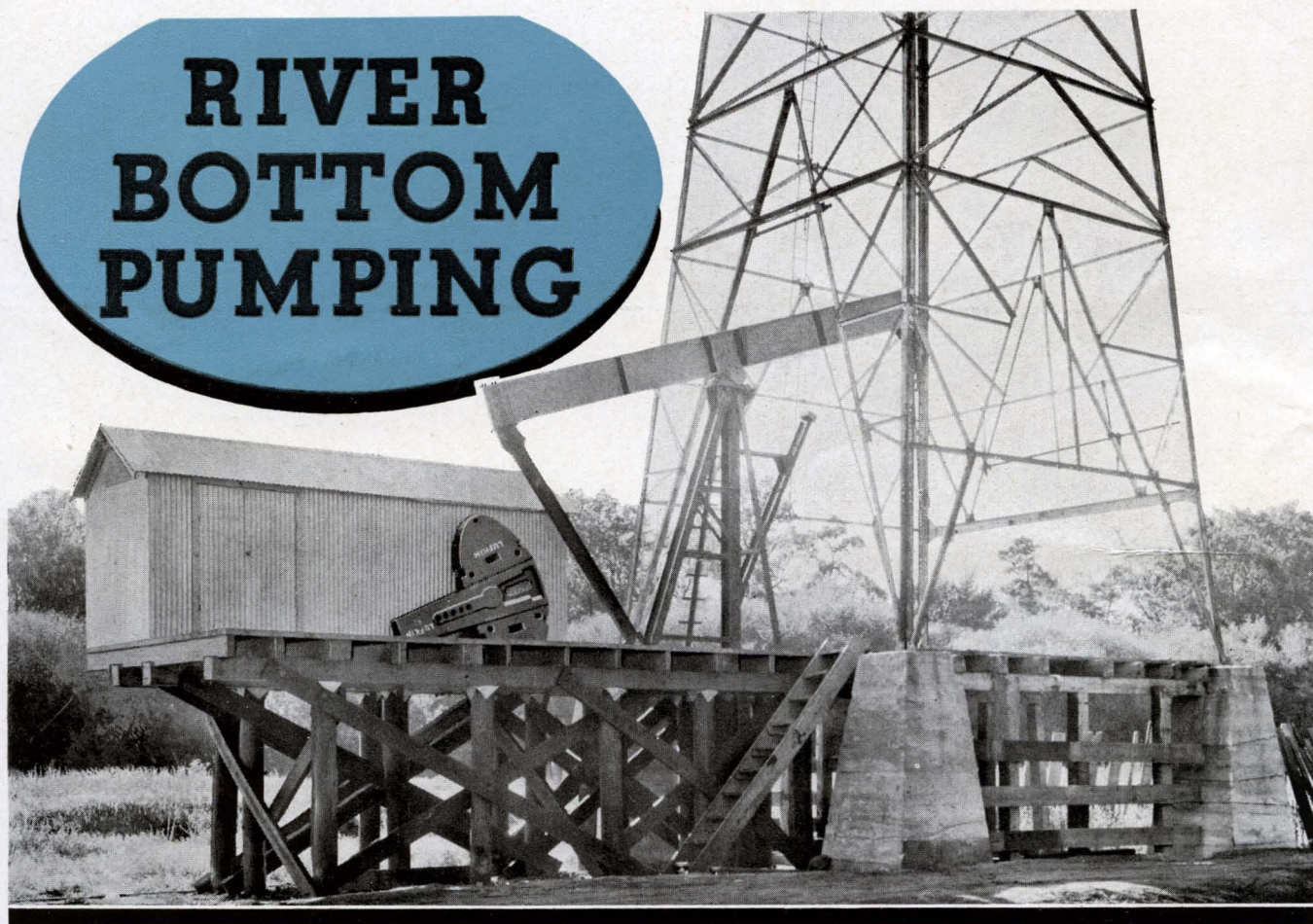
> 1934 <

LUFKIN LINE



Keystone

RIVER BOTTOM PUMPING



Deep Rock Oil Corp. installation in East Texas of Lufkin designed piling job using Lufkin Unit, Etc.

Deep Rock

Keeps Mr. River Away

"You will be glad to know that the units are all installed and that we gave the pile and timber structure on Prichard 110 a. No. 9, the 12 foot high one, the severest test we could, without being able to shake it. We slipped the kidney weights out to the end of the crank, in extreme pumping position, and put the motor in high speed, giving 25 R.P.M. at the crank. There was no movement lengthways or cross-ways and only an almost imperceptible springing up and down of the timber which is of no consequence. We followed very closely the Lufkin design for this structure and should you have other customers for equipment to be installed under similar conditions, we can put on a demonstration that should remove all doubts from their minds."

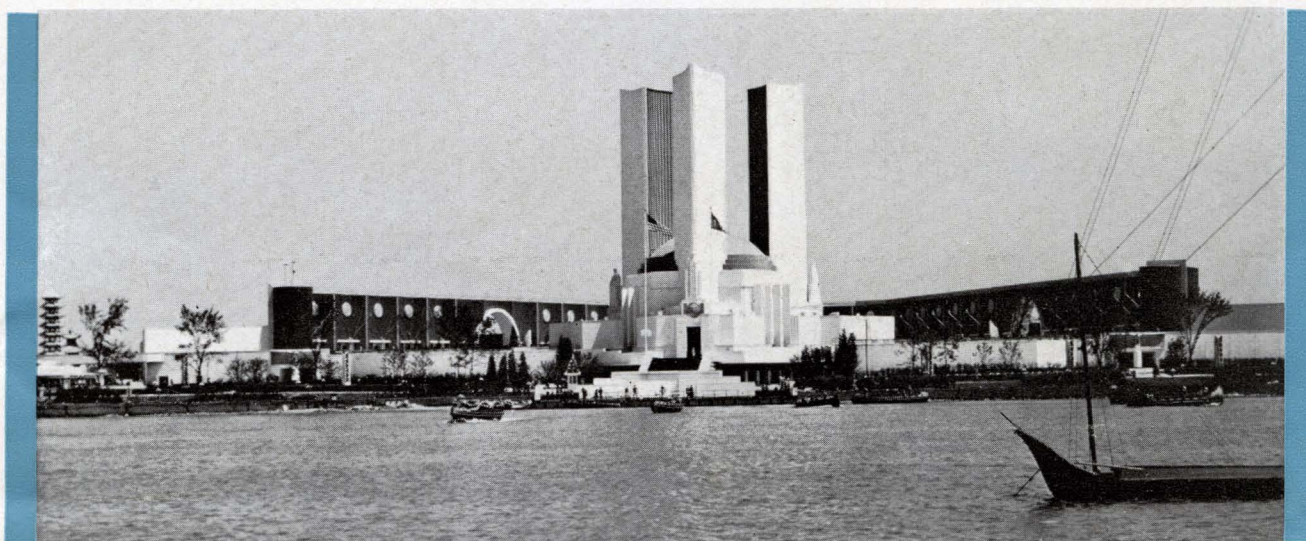
Excerpt from letter of C. O. Moss,
Chief Engineer, October 14, 1933.

To combat flood periods of the Sabine River area in East Texas, surface equipment must be installed sufficiently high that resulting overflows will not damage the machinery or interfere with continuity of production.

The installation above is a typical LUFKIN designed piling job, although quite naturally, Lufkin units are also installed on concrete. The excerpt reproduced (left) indicates a very satisfactory installation.

A request to the Lufkin office of the Lufkin Foundry & Machine Company will bring complete details.

LUFKIN PUMPING UNITS



Looking across North Lagoon toward the Federal Building and the Court of States. This group, in resplendent new dress for the 1934 fair in Chicago presents a charming picture

Century of Progress OFFERS BETTER FAIR FOR 1934

» » » American Petroleum Exhibit Again Feature of Chicago's Fair

With new features and free attractions adding to the color and gaiety and educational value, the Century of Progress Exposition again opened by popular request on Saturday, May 26. This encore was demanded by the enthusiastic visitors of last year—from President Roosevelt and countless others. Yet it is by no means the same World's Fair. In every way it has been added to, replanned and reconstructed, profiting by the experience of last year. The exhibit of the American Petroleum Industries, covering 6000 square feet in the Hall of Science, has been retained. This feature, one of the most outstanding in the Science building, has likewise undergone complete overhauling and refurnishing. So popular and so instructive was it acclaimed last year, that no basic changes have been made. The same committee who so ably spent months of research in preparing the exhibit for its initial showing, are responsible for its 1934 appearance.

In keeping with the dramatic presentation of scientific discoveries which typified many exhibits last year, the petroleum exhibit was of

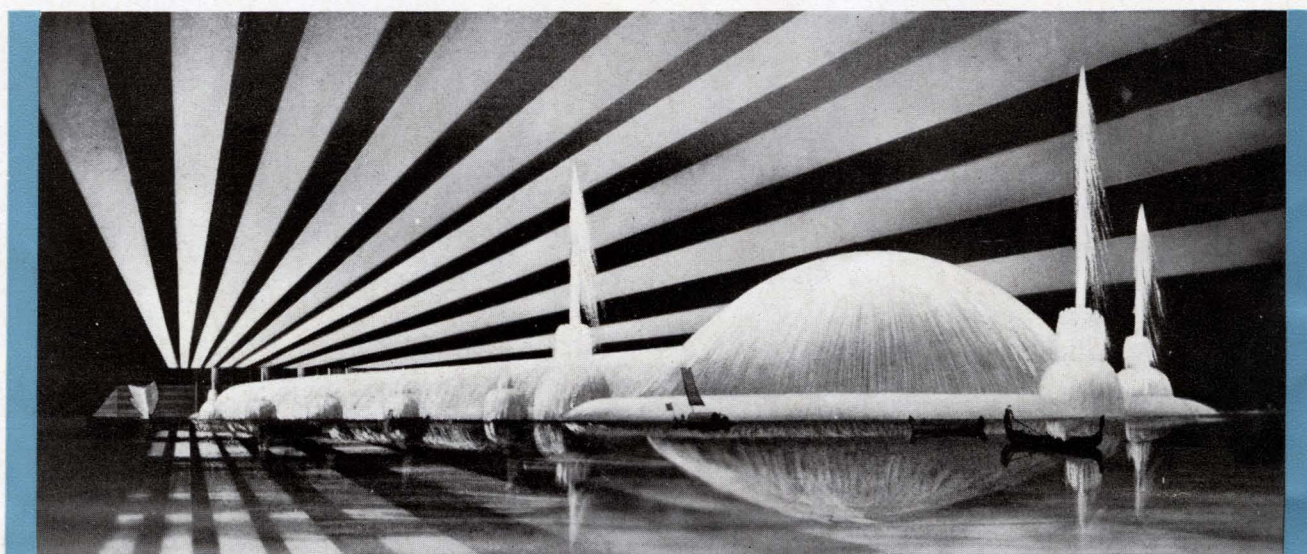


Model Refinery—One of the most interesting exhibits of the oil industry is located in the main room of the Hall of Science. Major refining operations, from the fractional distillation of crude oil to the final treatment of the five basic products and including the cracking process, are demonstrated in a glass-enclosed model refinery, extending 30 feet in length.

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World's Largest Fountain, Outstanding Feature of New World's Fair. This huge bank of water, two city blocks long, and having a flow great enough to service a city of 1,000,000 will be located in the North Lagoon. It will have spectacular lighting effects in five colors, and a giant "aurora borealis" of 40 great search-lights will play a melody of colors in the sky above it.

unusual interest and the occasion for curious study by the great crowds which came to the Hall of Science. By official count, this building was among the most popular attractions at the Fair, and the Petroleum Industry Exhibit with conspicuous and centrally located displays, was viewed by a large percentage of these visitors. As the same conditions and the same results will pertain this year, an outline of the specific value of the exhibit should be of interest.

Its primary function was to inform the public, to show motorists and operators of plants and factories with what care, what ingenuity, and

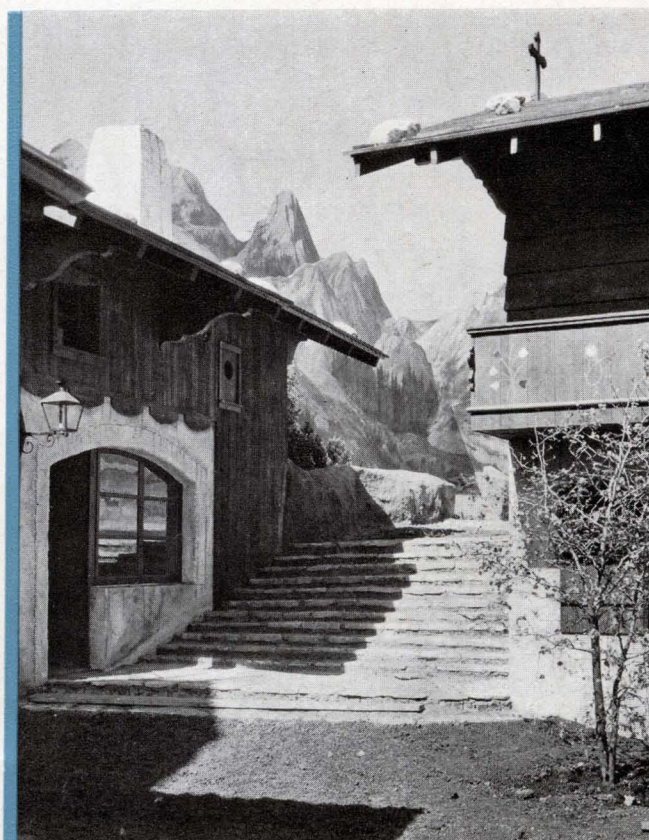
with how many modern scientific means crude oil is brought from the ground and, through all the phases of the industry, finally served to the consumer. Not only did the various

dioramas, models, transparent photographs, graphs, captions and synchronized voice lectures show the work entailed, as well as the many mechanical elements incorporating

An Alpine scene in the Swiss Village at the World's Fair. Against a 200 foot reproduction of the Swiss Alps, covered with synthetic snow, nestle the typical Swiss Chalets, and below are reproductions of houses in the older portion of Berne, capitol of Switzerland. Yes, there are yodelers, and St. Bernards.



The Black Forest Village: Showing a bit of the forest in Black Forest Village. Closely clustered snow-clad houses and roofs fade into painted snowy mountains with painted villages snuggling against them. The village teems with all the life and charm of an actual settlement in the Black Forest.



THE FORD EXHIBIT



at Century of Progress

One of the largest and most interesting of the new exhibits is the Ford Building. This 900-foot long building, covering eleven acres, including five acres in a park, fronts 1100 feet on Lake Michigan and is divided in the middle by a tower which rises into a dome ten stories high and from which is projected a torch of light, 200 feet broad at the base, that under proper atmospheric conditions rises to a height of one mile. This powerful beam is produced by twenty-four 36-inch projectors with an aggregate intensity of 600,000,000 candlepower. A total of 289 master loud-speakers and 223 auxiliary speakers are employed in the sound system by which the story of "Ford" is continuously told. No speaker is greater than 3-watt volume so that none speak louder than a conversational tone. The whole system is centrally and automatically controlled so that no two speakers clash. The system is so intricately interwoven and so carefully adjusted that four separate programs may be broadcast in the building simultaneously without one interfering in the slightest with the other. In one wing of the building, Ford has placed his Drama of Transportation, showing every vehicle of the wheel, through early Roman Chariots down to the automobile from the first clumsy machine to the latest model. For the visitor, Ford has provided places for rest and picnic and as an especial attraction has secured the Detroit Symphony Orchestra for a period of three months for daily concerts in Ford Park.

every branch of modern science, but also gave a clear indication of the thoroughness with which the oil men do their jobs, and brought some inkling of the enormous task and great expense of operating one of the nation's largest and most necessary industries. Although thousands of people have seen the petroleum exhibit many new visitors will now have an opportunity to learn the fundamentals others were taught last year.

A full range of oil operations covers every phase of the industry

in the models, drawings and dioramas: 1. Geological—aerial, exploration and mapping; 2. Geophysical surveying; 3. Deep drilling. Sub-surface geology; 4. Production; 5. Transportation and Storage; 6. Refining.

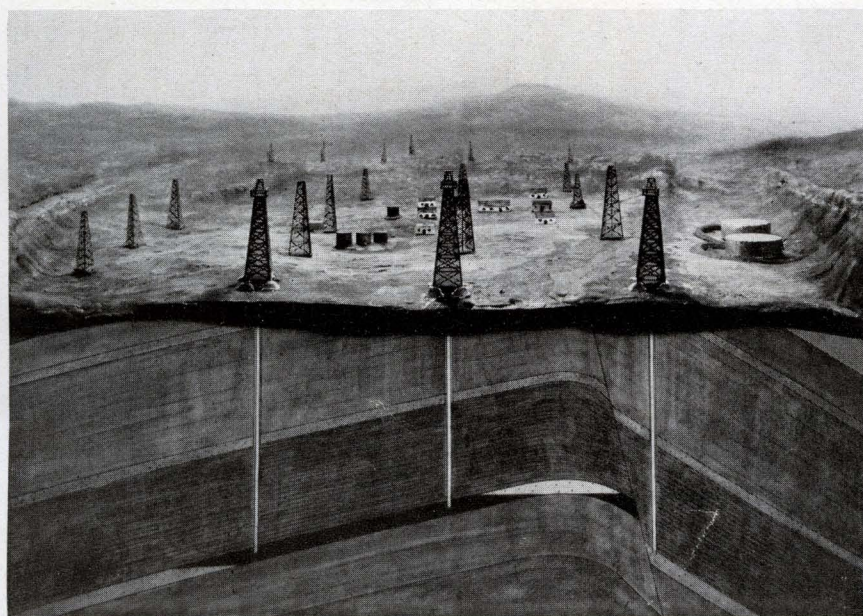
Exciting New Aspect of 1934 Fair

A Century of Progress Exposition for 1934 is even better than last year's. As the list of new attractions is broadcast throughout the

country, more people will want to come to Chicago. It is virtually a new Fair.

The color scheme of the buildings is entirely new. The lighting is new. Many large buildings, most spectacular and largest of all the Ford buildings, have been erected. The lagoons will be more than ever the center of attraction, and the bridges, taken over by large exhibitors, are a vast improvement. In the north lagoon, the world's largest fountain pours forth its thunderous volume of water along a length equalling two city blocks.

A most popular feature of the new Fair is sure to be the Foreign Villages. Encouraged by the great success of the Belgian Village in 1933, fifteen villages, authentic to the smallest detail, range along the space last year given over to the Midway. The amusement section has been moved to more spacious grounds on Northerly Island, near the children's Enchanted Island. There will be



Photograph of miniature model of the oil field diorama which is one of the features of the Petroleum Industry's presentation at the "World's Fair" in Chicago. It will be animated showing wells being drilled in and will show why a "dry hole" may occur near prolific producers. Synchronized voice equipment will explain, among other things, the migratory nature of oil.

The Lufkin Line

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Lufkin No. 150 Herringbone power driven by National Transit Six-Cylinder Vertical engine.

Lufkin at the Tulsa Oil Show

Lufkin exhibited a No. 48 Herringbone Single Reduction Unit, a No. 11 Lufkin Double Reduction Unit and a Heavy Duty Herringbone Power. Lufkin Units attracted great notice at the show.

Bringing the Story in Pictures to Listeners' Doors



"McCall's on Parade," a traveling theatre in which the publications new movie, "Living Pages," will be shown to women in residential neighborhoods throughout the Country.



SAILED—On the Santa Lena, January 1934, International Petroleum's Mr. Hopkins—Mr. Bimel and Mr. Myers.

POINTED PARAGRAPHS

The wheel that squeaks gets the most grease.—Eugene A. Holland.

An editor cannot be valiant in print and a valet at heart.—Tom Wallace. We want evolution. When you hear talk of revolution there is one letter too many.—Franklin D. Roosevelt.

Tradition is the accumulated com-

mon sense of centuries, a sort of ballast to keep us on an even keel.—Sir Arnold T. Wilson.

We give renewed assurance that the passions of war are moldering in the tombs of time, and that the purposes of peace are flowing in the hearts of a united people.—Franklin D. Roosevelt.

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TWENTY-ONE state and regional scenic booklets . . . count them . . . and hotel and cottage camp guides for every section of the country have been printed by Conoco and are now being sent out to tourists by the Travel Bureau.

Selling Transportation BY AUTOMOBILE . . .

A Major Service Department
of Continental Oil Company

From a comparatively small beginning in 1930 to a major service department, serving almost 200,000 groups of tourists in 1933, is the record growth of the Conoco Travel Bureau founded by the Continental Oil Company in response to the demands of motor vacationists and everyday travelers who wish to be certain they are taking direct, trouble-free routes to their destinations and yet see the most interesting sights found in the country they journey through.

"With improved business conditions, we are looking forward to serving at least 300,000 motor travelers in 1934," says Joe H. Thompson, director of the Conoco Travel Bureau, "for as the nation's busi-

ness goes, so goes the tourist business."

"We know that the nation's business is swinging upward steadily," said Thompson. "It's hardly neces-

sary to say that people have more money to spend and are spending it. A very definite increase in both our travel service and gasoline consumption has been felt since the first of the year."

The Conoco Travel Bureau is conceded to be America's foremost free travel service. Upon writing the bureau at Denver, or by applying at any one of Conoco's nearly 20,000 retail stations, the motorist will receive free of charge highway maps of all states through which he intends to travel, individually marked to show the best highways and the most scenic route; hotel and cottage camp guides showing nightly rates; booklets describing scenic attractions along his route, and any other helpful information he may request regarding fishing, hunting, golf or other sports. In the Bureau's central office in Denver, more than 150 carefully trained employees consult daily road reports from every state in the Union; note even the shortest detours, and incorporate this information into the routes they mark on all maps sent out. This year Conoco expects to serve 300,000 tourists.



The Lufkin Line

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Humble Tourist Service

While not as extensive in scope as the Conoco service, the Humble Oil & Refining Company is the only Texas Oil Company providing a free travel service to the traveling public, according to G. A. Mabry, director of this department. "This service was started by Humble," says

Mr. Mabry, "in May 1933, when one of our Open Door series of advertisements appeared in daily newspapers throughout Humble terri-

tory. The response was prompt and numerous — hundreds of coupons were received almost over night from motorists desiring travel information to all parts of America and Canada.

Requests for information addressed to the Humble Tour Service, according to Mr. Mabry, are answered promptly and in complete detail. Travelers are furnished with new



Conoco Tourist Service » Views of Department Maintained by Continental Oil Company



Nine interesting views of Conoco Travel Bureau offices and activities in Denver. Stenographers, mail clerks, carefully trained map makers, literature clerks and general information clerks all help make a Travel Bureau trip service the last word in vacation assistance.

The Home of the LUFKIN LINE » In this modernly-equipped and fire-proof p



Lufkin Foundry & Machine Comp
"QUALITY MACHINERY SINCE

fire-proof plant the complete line of Lufkin Oil Field Equipment is manufactured



Machine Company, Lufkin, Texas
MACHINERY SINCE 1900"

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Conveniently located on the ground floor of the Humble Building, it is easily accessible to the street.

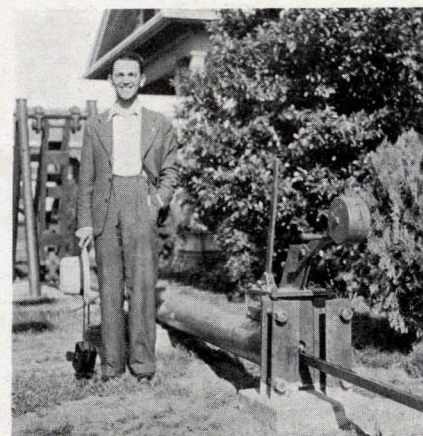


1934 Humble road maps; logs of the distances between major points are furnished, with up-to-the-minute road information and literature regarding interesting places to visit enroute.

Selling Automobile Transportation

In the last analysis the job of the oil companies is to sell transporta-

tion by automobile. The stimulation of travel by automobile is one of this industry's major problems. If they can increase the number of travelers by car—if they can secure the business of those already traveling by car, they are much nearer to a better and more profitable business. Touring Service is potentially a most effective contact with traveling public—Conoco and Humble are doing an effective job.



Industria Roumana De Petrol's Nic. N. Stefanescu, Chief Engineer, visits Lufkin's East Texas headquarters.



Lufkin's field home in East Texas, (Henderson—Arp Highway) showing equipment on display.



—Keystone View Company

GET A HORSE! *This and similar nasty remarks greeted the first public appearance of this dashing, stream-lined, super deluxe automobile. It created quite a stir, too. The fashionably dressed young ladies are feeling very reckless and perhaps just a little bit scared. They're wondering if they shouldn't have taken Mother's advice and stayed at home—but you know this generation? P.S.—Note the balloon tires.*

sources of motive power, principally gas. In 1870 Julius Hock of Vienna produced a practical but very low-powered petroleum engine, and two years later, George B. Brayton, an Englishman living in Boston, Massachusetts, applied for a patent on a two-cylinder gasoline engine.

With the turn of the twentieth Century, America awoke to find the "Horseless Carriage" an actuality, and within a few years the taunting cry "Get a Horse!" had passed into the limbo of forgotten slang.

As internal combustion engines improved, better fuel and lubricants were provided. Today, we're told, the oil industry produces more than fifteen billion gallons of motor fuel a year for this country's twenty-four million automobiles, as well as nearly four hundred million gallons of motor oil and other lubricants.

All hail, the "Horseless Carriage."

Get a Horse!

Oil Industry Owes Much To The "Horseless Carriage"

It has been truly said that the horseless carriage of the old days made the Petroleum Industry what it is today. The *Texaco Star* points out that, nursed through infancy by the kerosene lamp, the oil business did not reach manhood until a few dreamers here and abroad—began to experiment with self-propelled vehicles and finally succeeded in making them run.

Man has been toying with the idea

of mechanical propulsion ever since Hero of Alexandria built the first steam engine of record one hundred and thirty years before the birth of Christ.

Early in the nineteenth Century the steam locomotive started to emerge as something more than an idle dream and inventors began to experiment with other



Sun Oil Company Wilbur No. 15, Barbers Hill: *This Lufkin Unit and other Lufkin equipment is all set to go when the well stops flowing.*

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COVETED

Edward Longstreth Medal



WILLIAM E. SYKES

TO WILLIAM E. SYKES

Inventor of Machine with which LUFKIN
Generates Herringbone Gears

Upon the unanimous recommendation of its Committee on Science and the Arts, the Franklin Institute, Philadelphia, has awarded William E. Sykes, the Edward Longstreth medal "in consideration of the design and development of the Sykes Gear Generators."

The Franklin Institute of the State of Pennsylvania has a very high

reputation nationally and it is said it has an even higher reputation in foreign countries.

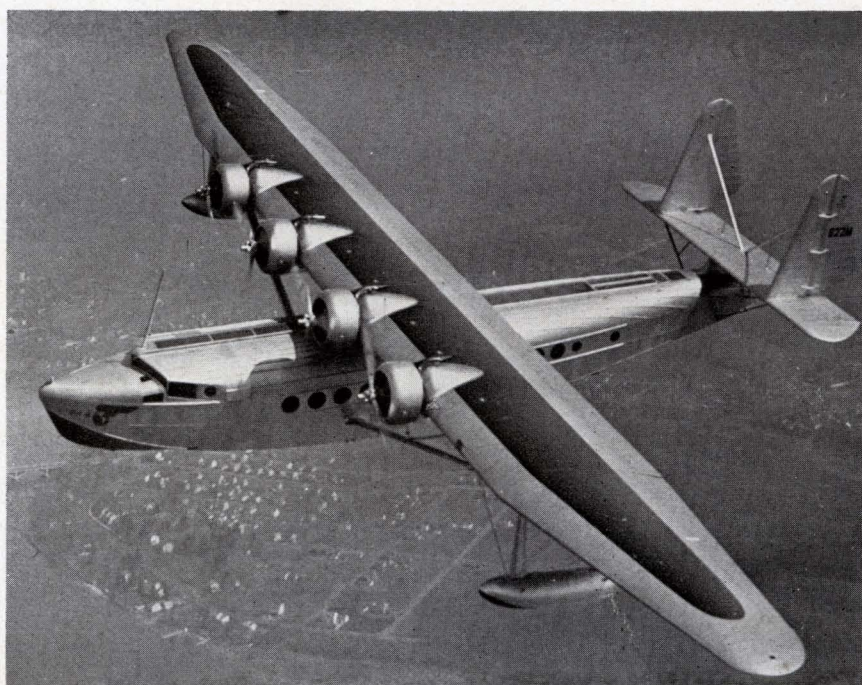
Mr. Sykes was born in England in 1883. In 1911, while chief engineer and factory manager of the Power Plant Company, Ltd., West Drayton, Middlesex, England, he developed the first gear generator that bears his name and for which he

has just been honored. Coming to the United States in 1922, he joined the Farrel-Birmingham Company, and since, at its Buffalo plant, has supervised the building of gear generators, one of which machines is used in the Lufkin plant for gear generating, said to be the only machine of its kind in the Southwest.

Besides the original patent, Mr. Sykes has a great number of additional patents. He has received, in the United States, fourteen patents and at the present has ten pending. In foreign countries all over the world he has also been granted patents.

In addition to his connection with the Farrel-Birmingham Company he has, in England, his own very successful company, the W. E. Sykes, Ltd., of which he is Chairman of the Board.

All of the Lufkin Herringbone Gears are generated on machines manufactured by the Farrel-Birmingham Company under the Sykes patent.



GIANT FLYING BOAT UNDERGOES TEST FLIGHT

The S-42, giant flying boat built by Sikorsky for Pan-American Airways, winging her way over Bridgeport, Conn., during a test flight March 30. The plane, built on specifications by Col. Charles A. Lindbergh, technical advisor to the line, was planned as America's largest passenger craft. Powered by four engines, it is capable of flying 2,500 miles non-stop with a mail load and crew. The great ship is 76 feet long and its wing span is 114 feet 2 inches. Its gross weight is 38,000 pounds. For the line's South American service, however, it will be fitted with 32 passenger seats.

—Keystone View Company

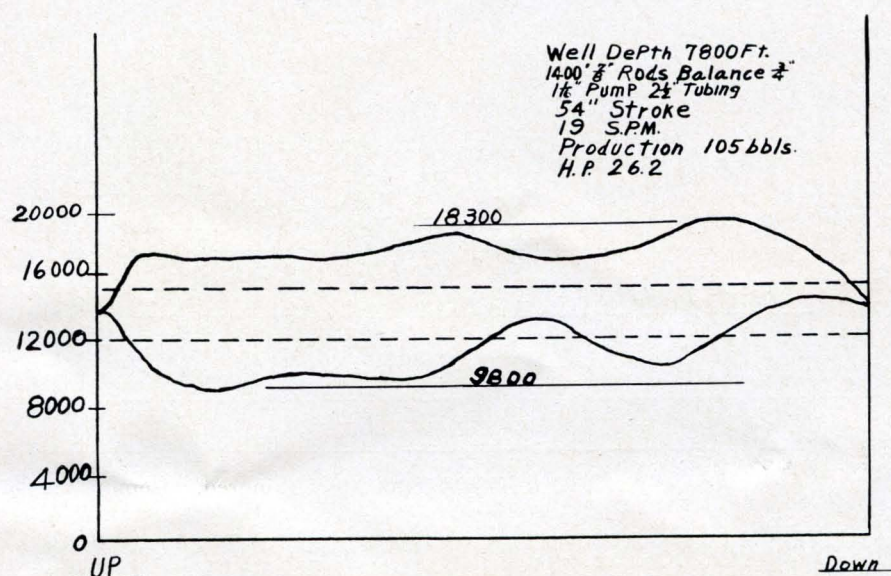


FIGURE 2

DEEP WELL PUMPING

(Continued from page 6)

of loads there is an actual downward movement of the oil in the tubing caused by the oil load stretching and increasing the length of the tubing. Since the oil in the tubing does come to a rest during each downward stroke it follows, it must be started upward again by the plunger on each succeeding upward stroke; the plunger must therefore not only lift the weight of the oil but also accelerate the weight upwardly, and in addition overcome the frictional resistance offered by the tubing wall to the passage of the oil. Therefore, it is apparent there are loads other than the weight of the oil that the plunger must overcome to raise the oil to the surface. In addition to these loads of oil weight, acceleration, and tubing friction, there are frictional losses due to plunger packing and rubbing of sucker rods along the tubing walls, all which must be borne by the plunger, sucker rods and lifting mechanism.

In the past, sucker rods were all made of a given diameter from the top of the hole to the bottom, but recently many operators have been using rods made of different diameters, the larger sections being installed at the surface end of the rod string; the object being to overcome the stretch in rods due to the weight of the load itself. After these rods

are hung in the well, there is a change in their length due to the weight, and there is a correspondingly additional change in length due to the weight of the oil and the acceleration of the oil. This is best explained by visualizing these rods as sensitively suspended like a spring and extremely responsive to any load changes, which may be placed on them; in fact, without a plunger attached to them, if the crank is started suddenly upward, there would be an interval of time intervening between the starting movement of the upper and lower ends of the rods, and at the upper end of

the rods—the reversal. The rods at the top would be going downwardly while the rods at the bottom would momentarily be stationary. At the end of the downward stroke after reversal, the upper rods would have started upward while the lower ones would be still descending. All these movements can be seen in action by hanging a weight on the end of a small rubber band held in the hand. To this varied and erratic movement of the rods can be attributed most of the trouble encountered in pumping deep wells and the difficulty in obtaining practical volume results, which theoretical computations should warrant. From the above it is apparent that the rods selected should be designed to give the most movement when acted on by their own weight, secondly, a reasonable long stroke should be used, thirdly, the smallest diameter of plunger consistent with the production desired and, lastly, the plunger speed should be held at a rate equal to the maximum travel with which the oil will follow the plunger through the standing-valve passage-way.

Summing up the above, we know that the greater the bore, the greater the area of plunger exposed to the fluid column pressure, and therefore the greater the fluid load, which in turn means, the greater the stretch, or in terms of net plunger movement means, the less plunger travel. In deep well pumping it is essential that the plunger travel be as nearly as possible the same as that of the polish rod, and to this end a crank speed variation of 16 to 24 strokes

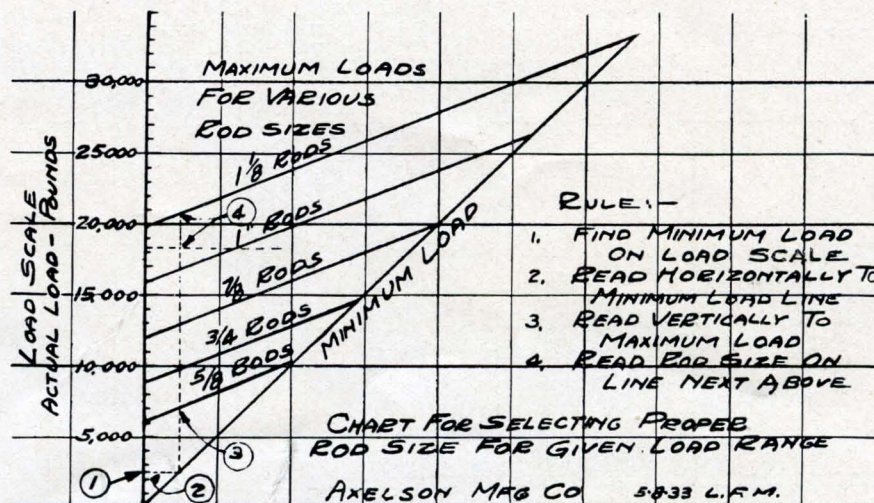


TABLE 3

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per minute is generally accepted for the most desirable speed where the polish rod stroke varies from 52 inches to 73 inches.

In determining the proper speed, stroke length, etc., it is essential that each well be studied as an individual problem, and only by experimenting with different stroke lengths and speeds can the maximum production be obtained from a given pump diameter. Let us for a moment consider the types of pumps, without going into detail we might sum up the experiences of a few California operators who pumped successfully wells from below 7000 feet. Where the crude oil to be handled is fairly heavy gravity, containing reasonable lubricating qualities, and doesn't contain excessive sand or other undesirable elements, the insert liner pump is most commonly used. When the gravity of the oil is very light, and the lubricating qualities poor, and with sand and other abrasives present, a standard liner pump with slightly greater clearance between plunger and liner is generally used. With two-inch tubing the bores are usually 1 1/16 inches and 1 1/4 inches, and with 2 1/4-inch tubing the bores are generally 1 1/2 inches and 1 3/4 inches.

Where the fluid levels are generally low, the relative hydrostatic pressure in the pump is high, usually a 1 1/16-inch pump is recommended.

With regard to the selection of rods, combination strings are generally used; the upper portion of ap-

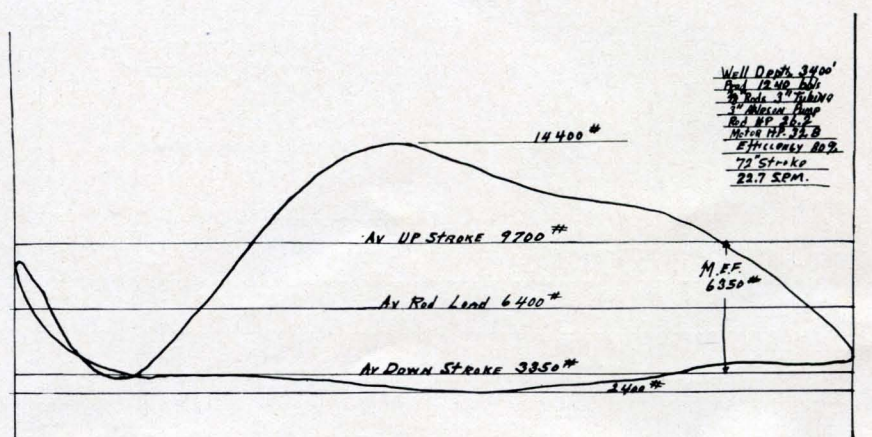


FIGURE 3

proximately 1500 to 3000 feet are usually 7/8 inch and the balance 3/4 inch, depending, of course, upon hydrostatic load or the live load to be handled.

Table No. 1 is one rod manufacturer's recommendation for a combination rod string.

TABLE 1

Percentage of 7/8-inch rods in 3/4-inch and 7/8-inch combination strings in relation to pump bore.

Bore	Percent
1 1/16 inches	25
1 1/4	27
1 1/2	30
1 3/4	34
2	38
2 1/4	42
2 1/2	47
2 3/4	52*
3 3/4	80*

*In the case of three-inch and four-inch pumps—100% 7/8 string is always recommended.

Well depth 3400-ft
Rod Size 3/4"
Upset Tubing 2-1/2"
2-1/2" Insert Liner Pump
42" Stroke 23 S.P.M.
245 Bbls Fluid

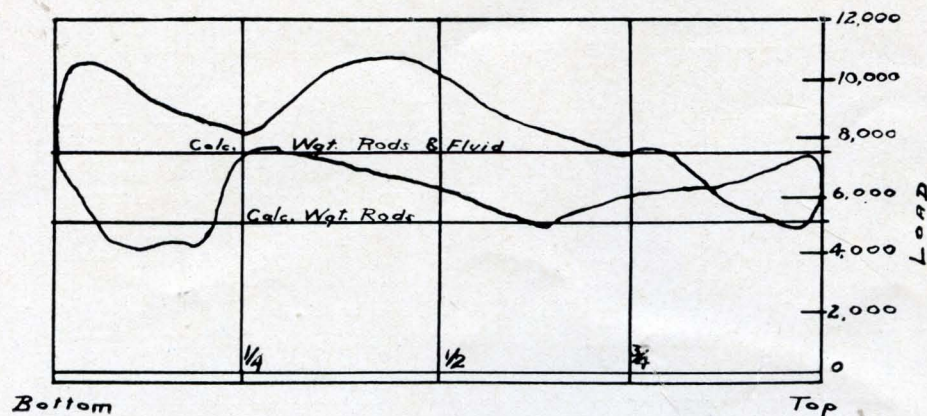


FIGURE 4

It is usually found that those wells in which a high maximum load is experienced, a low minimum may be expected. The dynamometer card in Figure 1 is a good illustration, the maximum load being 16,700 pounds, and a minimum load a minus 300 pounds, making a total load range of 17,000 pounds. In this case the total load range exceeds the maximum peak load, which is very undesirable for any combination string of rods and not recommended by any rod manufacturer. The dead load, or rod load, of 6467 pounds, is approximately three fourths of the accelerated fluid load of 10,233 pounds. Contrast this with Figure 2, a 7800-foot well, an ideal curve in which the minimum load of 9800 pounds and a maximum of 18,200 pounds represents a load range of 8400 pounds, or less than 50 percent of Figure 1, a 3300-foot well. The dead load in the deep well is 13,360 pounds and is taken care of by the counterbalance crank, the effect of which on well loads we shall discuss later, and the live load of 4840 pounds represents approximately 25 percent of the total load.

Table 2 is one manufacturer's chart for rod size selections based on load ranges.

Figure 3, a 3400-foot well, represents a better operating condition than that of Figure 1. Although the pump depth is approximately the same, the stroke is longer and the speed slightly less, the production of 1240 pounds almost double that of the first well under consideration. It is not the writer's intention to dis-

cuss in detail the characteristics of each curve, Figure 3 is merely presented to show better operating conditions for similar type wells.

Figure 4 illustrates another serious condition in shallow wells in which the plunger of the pump is hitting fluid very badly near the bottom of the downward stroke. Even though this condition could be remedied with a smaller pump or by slowing down the well, it is pointed out that similar conditions exist in many comparatively shallow wells, which is a more severe test for rod fatigue than is generally found in properly conditioned exceptionally deep wells.

TABLE 2

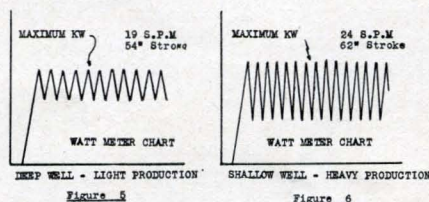
Pump Bore	1-1/16"	2 3/4"
Pump Depth	6,780'	3,315'
Gravity of Oil	42	27
Percentage of Water	27	58
Surface Stroke	54"	34"
Fluid Load	1,140	4,870
Rod Load	10,800	5,280
Total Load	11,940	10,150

Table 3 represents a practical comparison for study. It is pointed out that although the total loads in both cases are very nearly equal, the active or "live load" in the first example is 9.55 percent of the total load; yet in the second case it represents 43.56 percent. From the fatigue characteristics of steel, it is perfectly obvious that whereas the range of loading in the deep well is easily within safe working limits, yet in the shallower well, when we ordinarily would assume the load to be less, we find the fatigue condition to be very dangerous and, in fact, that is typical of wells in which rod trouble is a serious problem.

Considerable technical data has been compiled by a few major oil company engineers of rod stretch characteristics, rod fatigue, and plunger travel compared to polish rod travel, but no authentic information is available for a standard as each well presents an individual problem. The crookedness of the hole, gas and sand conditions, plunger fitness, etc., make any formula or table somewhat empirical and only by actual test on each individual well can these characteristics be determined.

It is difficult to interpret the technical data of the two accepted test instruments used for this purpose

without indulging in technical terms and phrases, so presented here is a rough or simplified comparison of the effects of load range on an electric motor of a shallow well with that of a comparatively deep one. For example, conditions as in Table 3 can be exemplified by a watt-hour meter diagram roughly sketched in Figures 5 and 6.



A simple analysis indicates the wide load range even in a perfectly counterbalanced well in Figure 6, as compared to less load range and smoother operation in the deep well. This is the basis of the opening remark that extremely deep wells are generally easier to pump than some common conditions in comparatively shallow wells.

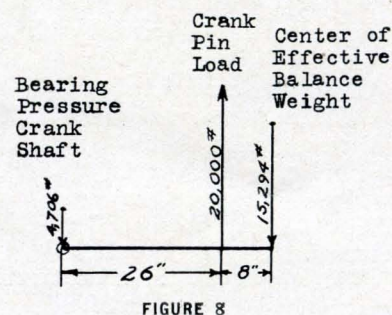
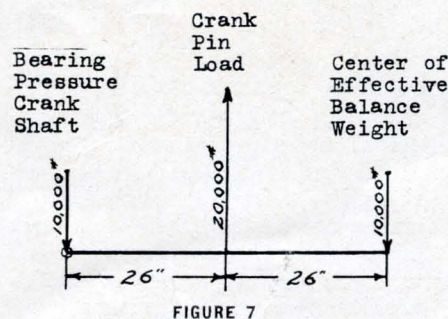
This brings us to the point of properly counterbalancing the long string of rods in deep wells and the proper selection of surface equipment to insure the most economical means of actuating the rods. In counterbalancing a well it is accepted practice to have the effective static weight of the crank counterbalance equal to the weight of the rods plus one half the weight of the fluid. It is here pointed out that the beam type or reciprocating type of balance is not discussed for it is considered an obsolete method of balancing; however, in some cases a combination of beam and crank is used in a satisfactory manner on deep wells where the beam balance does not exceed 30 percent of effective balance of the crank type. For our study we shall consider the crank-type counterbalance only.

There are several types of crank balances being used successfully on deep wells; some with long crank arms and a small amount of auxiliary weight attached to the end, others where the weights are concentrated nearer the crank pin, requiring more weight. Cheaper cranks are generally made with the longest possible radius of gyration of the effective mass so as to reduce the weight to a minimum for cheapness' sake. In these cranks, however, high bearing pressures are experienced on the crank shaft bearings, and larger and heavier bearings are required for this additional pressure. The force diagram in Figures 7 and 8 clearly represent the bearing pressure of two types of cranks. The best motion is obtained when the radius of gyration of the mass equals the radius of the crank pin.

It is not, however, always possible to obtain these desired results in balancing deep wells as it is impractical to apply the desired weight at the radius of the crank pin.

The problem of balancing deep wells is actually an easy one. The dead load is usually a large percentage of the total load and is taken care of by the counterbalance crank, and when the live load is relatively small it is very easy to determine approximately half this load to get the desired balance.

The crank is actuated by means of a prime mover through a reduction gear unit or a standard band-wheel belt drive. The standard rig, an old accepted method of operating a walking beam, is cumbersome, inefficient, and not reliable for continuity of service and has been replaced by efficient and dependable reduction gear units. Complete records maintained by one major company operating in California show an average belt maintenance cost



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alone of 29.3 cents per day per well for 1932, and 30.1 cents per day per well for 1933—these figures derived from an average of 245 wells in the Los Angeles Basin and 186 wells in the Midway District. This cost coupled with high lubrication expense of lubricating open bearings, clutch maintenance, general rig repairs, and labor for keeping rig tight, made the maintenance cost of the standard rig incomparably greater than that of a well designed reduction gear pumping unit. This is even more actually true in deep production where the present A. P. I. specifications of the standard rig are not suitable for such service.

There are several makes and types of reduction gear units in successful operation, some of which have operated continuously without any maintenance cost other than lubrication for the past eleven years. The general types are chain drives, single helical, worm, and double helical or herringbone gear—both single and double reduction, the single reduction herringbone gear unit has met with the greatest success. Higher efficiency and lower maintenance cost is due to few moving and replaceable parts. The general gear ratio of ten to one is ideal for single cylinder gas engine drives as the belt ratio is approximately one to one, whereas, in double geared units it is necessary to speed up pinion speed to secure the desired crank speed which is contrary to good engineering practice. They are likewise ideally suited for multi-cylinder gas engine drives and medium speed electric motors, but are not suitable when relatively slow crank speeds are essential. The herringbone gear needs no defense; it is the most efficient and practical means of speed reducing power transmission for oil well pumping.

It is not our intention to discuss the different types of units available, or defend any type of unit, bearing, gears, or general make-up. It is, however, essential that in deep well pumping a unit should be selected that is designed especially for oil well service, that will withstand the pulsating and shock loads of oil well pumping, and not merely an industrial gear and gear box with a crank on the slow speed shaft, and called a pumping unit. Industrial gear units with factors of safety of

two to one for oil well use likewise have no place in the oil fields. A factor of safety between four and six to one overall industrial ratings have proved far more economical in oil well operation and should be maintained for practical results.

Reduction gear units should be rated on a time and wear basis. With the horsepower based on a life of twenty years of continuous service at rated capacity, obviously a longer life can be expected at under-rated capacity loads. Some pumping unit manufacturers have made considerable headway in this respect, basing their horsepower ratings on a tooth pressure load, the allowable tooth pressure derived from noting the wear based on several years' continuous operation. The ratings should be based upon an average load with sufficient factor of safety to take care of the peak load, which is generally figured 1.75 times the average load. Maximum wear occurs on the few gear teeth that take the peak loads or accelerating loads of the rods and fluid, and since the peak occurs for such a short duration, the few gear teeth on the gear wheel taking this load are subject to the maximum wear, for the gear wheel is made of a softer material than the pinion. It is not practical to rotate the gear wheel in relation to the crank as soon as wear occurs on the teeth that take the peak loads, for this wear would cause back-lash in the gears, and the shock or pound of such back-lash would be transmitted to the rods. A horsepower rating based upon tooth pressure, per inch of face per inch of diameter for a given life, would insure the user the expectant life of the gears, and obviously if he desires only a few years service he could make his selection accordingly. At high ratings for short life of gears, the unit would have to be protected with shaft and bearing sizes suitable for high torque and bearing loads during this period.

One important feature, which is not fully appreciated by many producers, is the proper lubrication of geared units, a feature one would think would be given greatest consideration and proper study, for all marketing oil companies maintain large lubrication engineering staffs to meet any type of lubrication problem. Yet it is common prac-

tice for the producing departments to order their cheapest oils to meet the manufacturers' general specifications. This no doubt is a result of past experiences with the lubrication of Standard handwheel rigs that were equipped with the plain type of loosely fitted open bearings, which were in reality not a lubrication problem. The best possible lubricating oil for precision gears is unquestionably the most economical oil, for the added few cents per gallon is negligible compared to the added life and performance of the gears. Of a given manufacturer's S. A. E. rating it is recommended that the best dewaxed oil of the lowest carbon residue that will withstand the highest pressure, be used.

The types of prime movers will not be discussed, for their selection depends upon too many factors for a general study. The location of the well, the type of service which is required, the cost of electric power, the amount of gas available, and other items are a few factors that determine their selection. It is well, however, to state that the drive from the prime mover to the reduction gear unit should unquestionably be a vee belt drive, as the vee belts are shock absorbers of the impact loads from the unit to the prime mover. This type of drive, if properly designed with suitable belts for the load, is highly efficient and adds an extended life to both the geared unit and prime mover from its shock absorbing qualities.

From the above the producer can appreciate the necessity of proper selection of pumping equipment. His profits lie in the continuity of his production, and returns from his production against charges of interest on initial investment, operating expense, maintenance cost and replacement cost.

It is fundamentally true that the larger the investment in initial cost of equipment, the lower will be the other three phases of costs. In case of extremely deep wells, this fact is more sharply emphasized than in the average case. That these costs increase rapidly with the depth is well known. It is, therefore, the exercising of excellent judgment to operate the best type of equipment that can be purchased—if the hole is to pay out in profitable amounts as a deep pumper.

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AL. E. CUDLIPP, Editor

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FATHEADS AND JACKASSES

Most letters we get are conventional. But once in a while we get one from a man who writes as he talks, as, for example, the one from the choleric individual who complained about one of the many varieties of error we manage to perpetrate in our ingenious way. It began, "What fathead in your organization . . . ?"

Here's a natural that came in just yesterday:

"Permit me to apologize for neglect in paying our bill. Check is enclosed. Your previous statement was passed on to a jackass in our organization with instructions to check and pay."

Doctor—When did you first notice something peculiar in your lodger's manner?

Landlady—Yesterday, when he paid his rent.—Soendagnisse Strix.

Meek voice over the telephone: "Doctor, this is Mr. Henpeck. My wife has just dislocated her jaw. If you're out this way next week or the week after, you might drop in and see her."

She—What are all those men doing in a circle with their heads together? Is it a football team?

He—No, my dear, just a bunch of Scotchmen lighting a cigarette.

"Are you going to settle your account?"

"Not just yet."

"If you don't I'll tell all your creditors that you paid me."—Pathfinder.

In a saxophone playing marathon, Oscar Omerth of Paris claims the world's record, 16 hours and 5 min-

utes, without stopping. Then his lips became temporarily paralyzed, as might be expected from an outraged Mother Nature.

"Pardon me," said the stranger, "are you a resident here?"

"Yes," was the answer, "I've been here goin' on fifty years. What kin I do fer you?"

"I am looking for a criminal lawyer," said the stranger. "Have you any here?"

"Well," said the other, "we're pritty durn sure we have, but we can't prove it."

At Atlantic City—Mo says he ran into a vaudeville team who explained that they weren't working on account of sinus trouble.

"Yeah," said the male half of the act, "nobody will sign us."—Pittsburgh Post.

Boss—There's two dollars missing from my desk drawer and no one but you and I have a key to it.

Office boy—Well, let's each put a dollar back and forget it.—Arizona Kitty-Kat.

There Is No Dearth of IDEAS!

» » for instance

Full 100 horsepower is built into a new motor of less than a foot diameter. It's designed to drive direct-mounted cutting tools whose diameter and speed must be held to a minimum. . . .

Absence of after-odor distinguishes a new garlic sauce. Even your best friend can't tell you've used it, it's said. . . .

The machine's even invaded noodle-making. With a new noodler, housewives make 'em in a jiffy, forming them from batter and dropping them into hot water or soup by a twist of the wrist. . . .

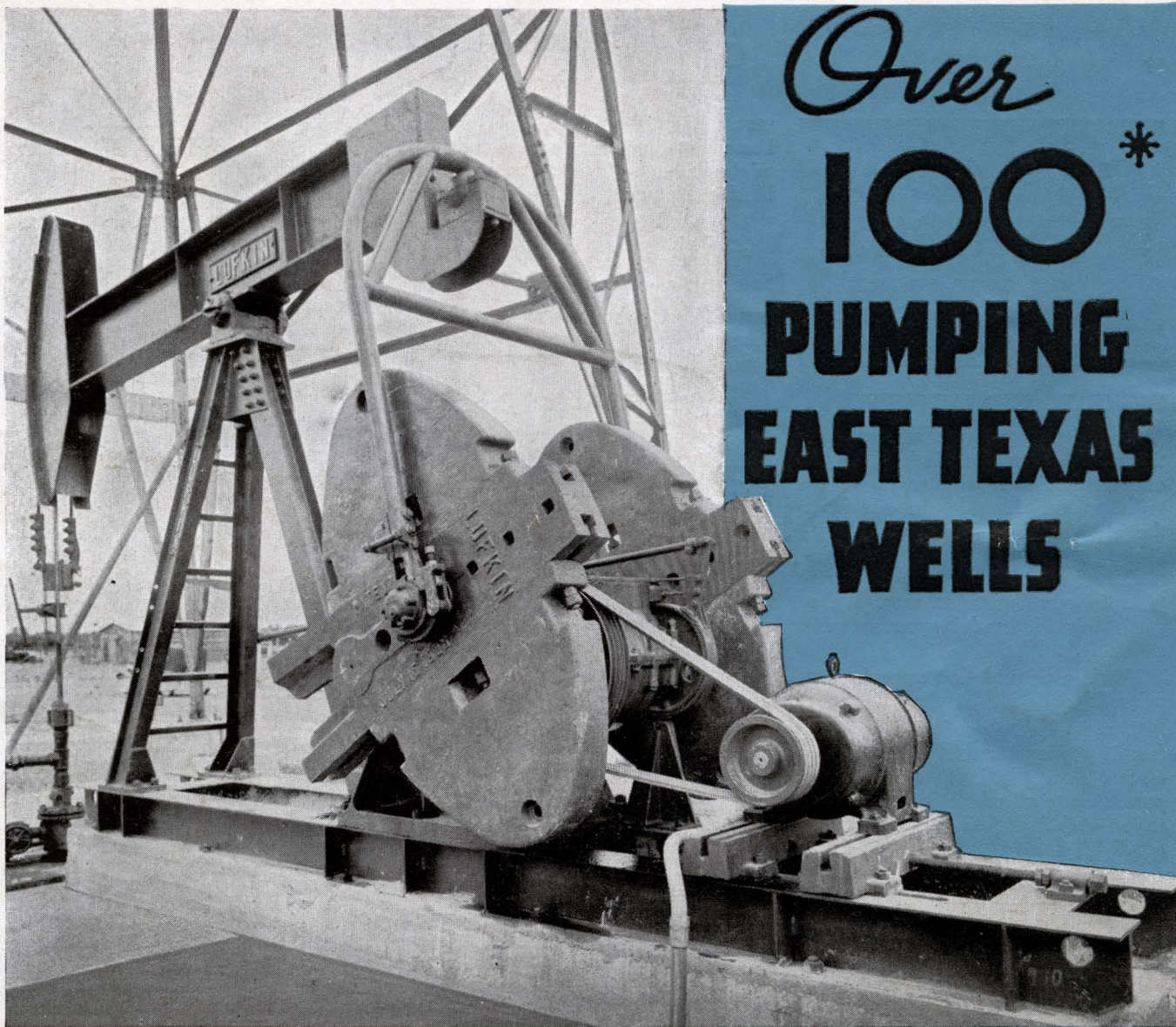
An image is formed in thin air by a new advertising device consisting of a series of lenses in a narrow metal box. The illusion's said to be so perfect that people try to grasp the image. . . .

Even lollipops can't escape change. A heightened safety factor is claimed for a new one in which a flexible loop handle, made of a special type of paper, replaces the usual wooden stick. . . .

THE FAR-REACHING EFFECTS OF PRODUCT DESIGN



—The New Yorker
"Her mother was frightened by an Airflow Chrysler."



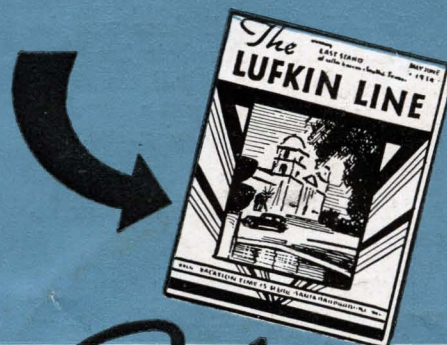
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*Lufkin Twin Crank Units only to June 1, 1934

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