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OILFIELD EXPLORATION AND EXPLOITATION.

Geology.

99. Geological Surveys are Planned for Continental Shelf. Anon. World Petrol., Nov. 1945, 16 (12), 65.—After the introduction of new legislation in U.S.A. the Geological Survey has been asked to make recommendations for a survey of the submerged area of the continental shelf, an area exceeding 750,000 sq ml. Seismic surveys can be made, and magnetic surveys are possible by means of aeroplanes. Submarines could carry out gravimetric surveys.

The three most promising areas are the Coast of the Gulf of Mexico, the Pacific Coast, and the Alaskan region.

The shelf is taken as the area with not more than 600 ft of water. Its width varies widely. Off the U.S. coast in the Gulf of Mexico the area involved is 149,000 sq ml.

G. D. H.

100. Pre-Pennsylvanian Stratigraphy of Western Nebraska. G. S. Dillo. Oil Wkly. 22.10.45, 119 (8), 45.—There is, in western Nebraska, a broad anticlinal axis running N.W.-S.E. (Barton Arch or Cambridge Anticline, expressed in Crotaceous and younger rocks). Along this trend a few deep holes have encountered granite, and this granite shows two highs, one in Sheridan County and the other in Lincoln and Dawson Counties. Other highs may be present. The granite outcrop in pre-Pennsylvanian times was 75 ml wide in the Hyannis area of Grant County, narrowing possibly to 20 ml at the Kansas border. The outcrop may have been very broad in Cherry and Sheridan Counties, possibly linking with the schists of Bassett County. The Salina Basin of Kansas may run into Nebraska, but it is not known how far north this will extend as a syncline with pre-Pennsylvanian beds. Mississippian beds occur in the area of Franklin, Webster, and Kearney Counties, but are absont in a well in Valley County. The greatest thickness of Mississippian (310 ft) was recorded in Webster County. Below the Pennsylvanian, Kinderhook beds have not yet been found, but Viola-Galena beds occur. A few wells have logged Simpson, and the Arbuckle and Deadwood have been encountered in the southern part of the State.

The pro-Pennsylvanian Salina Basin extension is not believed to be of great depth, and rises northwards.

On the west and southwestern flank of the granite axis it is believed that all the Kansas formations of pre-Pennsylvanian age will ultimately be found, except the Hunton and Kinderhook.

Over the granite axis only the Kansas City-Lansing and the conglomerate at the base of the Pennsylvanian are thought to have a chance of producing oil. The Cambrian, Arbuckle, Viola-Galena, and the Mississippi lime are all potential oil reservoirs, provided local trapping structures exist.

A tentative map shows the inferred structure of the top of the granite, and the pre-Pennsylvanian outcrops of west-central Nebraska. G. D. H.

101. Shell Oil Activity Spreads in Colombia. Anon. Oil Gas J., 6.10.45, 44 (22), 82.—The Casabo field produces 9000 brl/day from 29 wells. The 21.5° -gravity oil is found at 3700-3900 ft in a relatively low-pressure reservoir. Present development is on 40-acre spacing. A well drilled to 6089 ft showed deeper possibilities of producing 24° -gravity oil in a zone which may be comparable with one of the prolific zones of the De Mares area.

In the Lower Magdalena Valley, about 100 ml from Barranquilla, potential production of 2750 brl/day of $42-46^{\circ}$ -gravity oil has been established by five wells on the El Dificil concession. The first well on test gave 54 brl of oil and 700,000 cu ft of gas/day. All the wells produce from a limestone in the Upper Oligocene, at an average depth of 5800 ft.

In the Llanos region 1 San Martin was abandoned at 3120 ft because of mechanical trouble. A second well has reached 5800 ft. There are unconfirmed rumours of an important oil discovery. 1 Chafurray, also in the Llanos region, was abandoned at 1750 ft. G. D. H.

102. Nova Scotia Wildcat Drilling below 6000 ft. Anon. Oil Gas J., 6.10.45, 44 (22), 82.—A wildcat south of Amherst, Cumberland County, Nova Scotia, has reached a depth of 6000 ft. It is 50 ml southwest across Northumberland Strait from the Hillsborough Bay test. G. D. H.

103. Devonian Deposits found near Krasnokamsk, Russia. - Anon. Oil Wkly, 22.10.45, 119 (8), 66.—An 1100-brl well is reported to have opened up a rich Devonian oil accumulation (Severokamsk) at a depth of 5840 ft near Krasnokamsk. Two wells have been completed in Daghestan at 5000 ft. G. D. H.

Geophysics and Geochemical Prospecting.

104. Newer Phases in Geochemical Technique. A. Bronston. Oil Wkly, 29.10.45, 119 (9), 56.—Soil samples were taken at depths ranging 5-150 ft, making sure that they were quite free from vegetable matter. At least three sets of samples were taken from each hole at different depths. Wax determinations showed fair consistency of values from 10 to 50 ft, but there was a marked decrease in deeper samples. The amounts ranged 30-7000 parts per million. The type of wax was determined. The observations on samples from depths less than 10 ft below the surface could not be used to give usable pictures for solid hydrocarbons. Haloes were obtained in most instances by using at least two samples from each hole.

The most accurate method of determining gaseous hydrocarbons in the soil consists of collecting the gas directly from the hole. Gaseous hydrocarbons in the soil range 10-1000 parts per 1000 million by weight. The hydrocarbon content of the gas is determined by combustion after removal of CO_2 . Gaseous soil hydrocarbons may also be determined colorimetrically.

Liquid hydrocarbons are more consistent in soil samples than are the waxes and gases. They range 1000–10,000 parts per million by weight, and when taken at depths free from vegetable matter increase in quantity with depth. The quantity was determined in a special distillation apparatus. The hydrocarbon type is of value in determining the source. Shallow fields should give greater concentrations than deeper fields. Some holes give low-gravity oils from the first 25 ft, and high-gravity oils deeper. Shallow oil seems to give a comparatively large accumulation of hydrocarbons directly over the reservoir rather than around the edges, although a similar condition has been observed with deep oil where there is no definite geological structure—e.g., West Edmond. On faulted structures with a concentration of hydrocarbons round the edges there is a marked concentration of both liquid and gaseous hydrocarbons along the downthrown side of the fault and a negligible quantity on the upthrown side (Heidelberg).

Where an oil reservoir exists the percentage of hydrogen in the soil at depths of 50–100 ft is practically identical with that of methane. From drilling wells there is a marked decrease in percentage of hydrogen with depth. G. D. H.

Drilling.

105. Drilling Equipment Needs. D. Ragland. Oil Wkly, 12.11.45, 119 (11), 70.—A brief study is presented of the cost of drilling and of time analysis of drilling operations, including coring, cementing, testing, etc. On the basis of this study, several necessary improvements are pointed out. A. H. N.

106. New Ideco Mechanical Rig. C. H. Engelmöhr. Petrol. World, Nov. 1945, 42 (11), 71.—The mechanical rig described is designed for 10,000-ft drilling. The Ideco Powerhoist M-10,000 is powered by three General Motors Twins, which are unique in that they combine the power output of two six-cylinder diesels through a single output shaft. The power units turn at 1600 rpm; the output shaft at 900 rpm. The engines are rated at just short of 300 hp at the above speed for intermittent service. Each engine is equipped with Kittell air cooled silencers. Some loss of horsepower is experienced in the reduction and in the compounding transmission drives. An Ideco 7500-Q chain-driven transmission is built integrally with the hoist unit, which enables the operator to change locations with one less package than most competitivo rigs. This feature notwithstanding, all packages are within read width limitations imposed by many States. Details of the transmission gear and other accessories are given. A. H. N.

107. Rig Mounted on Wheels. H. A. Hess. Oil Wkly, 15.10.45, 119 (7), 36-41.— Various units of the rig, which is capable of drilling to 7500 ft, are mounted on four semi-trailers. One of the trailers carries the diesel-electric power unit, another the mud-pump assembly, another the derrick and draw-works, and the other the fuel tank. The derrick floor, substructure, rotary table, and blowout preventer comprise another unit. However, this unit is not mounted on wheels, but is erected on skids for easy portability. The drill-pipe, of course, is moved on a regular pipe-truck, the remainder of the equipment, tools and miscellaneous items, are carried by trucks or trailers. This arrangement permits quick dismantling, moving, and erection. Disconnection of a few connecting pipes, electric wires, or other items, and the various units are ready to be towed to the next location. Furthermore, the tractor used in towing the units to their next site is not tied up during drilling operations. Another feature of the layout is the use of jacks to take the load off the trailer tyres during drilling operations. Several photographs illustrate details of the rig. A. H. N.

108. Rock Bits. J. B. Isaacs. Petrol. World, Oct. 1945, 42 (10), 53.—Rock bits are found to be the best types to use in California drilling. Different types are discussed, with their special characteristics. A. H. N.

109. Lubrication on the Drilling Rig. J. R. Schones. Petrol. World, Oct. 1945, 42 (10), 62.—Lubrication of rubbing surfaces on the drilling rig is discussed.

A. H. N.

110. Field Installation of Slush-Pump Piston-Rod Lubricators. H. A. Hess. OilWkly, 12.11.45, 119 (11), 68-69.—Photographs illustrate several methods of lubricating the slush-pump piston-rod. Lubrication with oil is advised as the crew appear to pay more attention to such lubricators than to water systems. A. H. N.

111. Carnotite in Squeeze Cementing. A. J. Teplitz and W. E. Hassebroek. Oil Wkly, 29.10.45, 119 (9), 41-45.—The results of several experiments and tests using carnotite as a tracer are described. In spite of the limitations of the method, the use of carnotite as a radioactive tracer is extending the knowledge of physical processes taking place underground during squeeze cementing and other cementing operations. While such information is of interest in itself, its principal value lies in the application to the technique of performing roduction. In conjunction with caliper, electrical, and temperature surveys, radioactive tracing will often indicate the course taken by the cement outside the casing. Although each well presents an individual problem, it is possible that when sufficient data of this type have been obtained, generalizations may be drawn which will enable operators to select most favourable pressure for a particular squeeze job. The possibility is also envisioned that with the knowledge gained, the placement of the original easing cement may be so modified that the necessity for squeezing will be considerably reduced. A. H. N.

112. Valuable New Tables on Cement Slurry Formulas. Anon. Oil Wkly, 15.10.45, 119 (7), 46-48.—Capacity of hole, capacity of pipe, hydrostatic pressures of fluids at various depths, annular space between casing and hole, annular space between tubing and casing, annular space between casings, displacement of pipe and formulas for cement slurry are presented. These tables are taken from a handbook shortly to be published by "Universal Atlas Cement Company." A. H. N.

Production.

113. Application of Oil-Field Water to Geology and Production. L. C. Case. Oil Wkly, 29.10.45, 119 (9), 48.—The principles of oil-field analyses and interpretation are discussed. The applications of water analyses to the study of production in connection with bottom-hole water, to problems of spent acid, to drilling mud or cement waters, and to identification of extraneous waters entering wells are discussed in some detail. Significance of water analysis in calculations connected with water-flooding and saltwater disposal is also discussed in some detail. The interpretation of water analysis in connection with geology forms the latter part of the paper. A. H. N.

114. Volumetric and Phase Behaviour of Oil and Gas from Paloma Field. R. H. Olds, B. H. Sage, and W. N. Lacey. *Petrol. Tech.*, May 1945, 8 (3), *A.I.M.M.E. Tech. Pub.* No. 1861, 1–21.—Samples of liquid and gas were taken from the primary separator of a well in the Paloma field. The volumetric properties of the samples and of six systematically chosen mixtures of the samples were experimentally determined at 100°, 190°, and 250° F., at pressures up to 5000 lb/sq in. From these data the influence of pressure and temperature on the composition and specific volume of the bubblepoint liquid and of the retrograde dew-point gas was established. The formation volumes and gas/oil ratios of the mixtures investigated were calculated on the basis of the plant-product oil, which is defined as the *iso*butane and less volatile portion of each mixture. The results are presented in graphical and tabular form.

The volumetric behaviour of the mixture corresponding to that produced by the well at the time of sampling was determined for 235° F, the reported reservoir temperature, by graphical interpolation of the experimental data with respect to composition and temperature. The results indicate that the well-production mixture probably existed as a gas at its retrograde dew-point under the conditions of temperature and pressure believed to prevail in the producing zone at the time of sampling.

The effect on the phase behaviour occasioned by the omission from the well-production mixture of certain components of intermediate molecular weight was investigated. In the first case, all of the *iso*butane and *n*-butane, and substantially all of the *iso*pentane, were removed from the mixture of trap samples corresponding to the well production. In the socond case, all of the propane, *iso*butane, and *n*-butane, and substantially all of the *iso*pentane were removed. Both modifications led to considerable increases in the retrograde dew-point pressure at 235° F., an increase of 558 lb/sq in above that of the unmodified well-production mixture in the first case, and an increase of 1208 lb/sq in in the second. Accordingly, it was concluded that the materials remaining after the removal of certain components of intermediate molecular weight could not be re-injected into the reservoir in the same proportion in which they were produced without entailing appreciable loss of liquid material through condensation within the formation. G. D. H.

115. Back-Pressure Open-Flow Computations Simplified. W. F. Martin. Petrol. Engr, Nov. 1945, 17 (2), 152.—Charts are reproduced from Petroleum Engineer's Continuous Tables, which were designed to facilitate computing changes in open-flow occurring because of changes in rock pressure. The charts are explained.

A. H. N.

116. Average Gas-Oil Ratio of Nation's Oilfields. K. M. Fagin. Petrol. Engr, Nov. 1945, 17 (2), 51.—A brief discussion of the elements of the different types of drives and its influence on gas/oil ratios is given. The average gas/oil ratios of different States is given graphically, and each State is discussed separately. The estimated average gas/oil ratio of all the oil-wells in the U.S.A. was 1278 cu ft/brl during 1944, compared with 1109 cu ft/brl during 1937. Although this is a ratio increase of only 169 cu ft/brl during the eight-year period, the total gas produced from oil-wells increased from 1,419,830 million cu ft to 2,144,720 million cu ft, representing a total gain of 724,890 million cu ft. Tho large gain in the total volume, therefore, is mainly due to increased oil production rather than to increased gas/oil ratio. This may be interpreted by some as indicating an improvement in the conservation of gas, inasmuch as many of the newer, deeper oilfields have higher gas/oil ratios than the older, shallower oilfields, but the ratios of the oil-wells in some of the individual States increase from year to year.

The ratios in other States decrease, and most State ratio curves fluctuate considerably. The reasons for these variations may be many. Some of the reductions in the gas/oil ratios of some of the States are probably due to actual reductions resulting from a reduction in the gas/oil ratio limits, or the introduction of more pressure maintenance, or better compliance with the rules, but a large part of the apparent reduction in the gas/oil ratio in some of the States is probably due to a reclassification of oil-wells to gas-wells or gas-condensate wells, or more oil production from low-ratio water-drive fields. A. H. N.

117. Elements of Gas-Lift Fractices. L. P. Connor. Petrol. Engr, Nov. 1945, 17 (2), 127.—The general principles of continuous and intermittent gas-lift operations are discussed. Typical test data and worked examples are given. A. H. N.

118. Mobile Unit to Service Paraffined Wells. W. J. Davis. Petrol. Engr, Nov. 1945, 17 (2), 220.—A truck is fitted with equipment necessary for cleaning wells. A 4-hp gasoline engine drives the No. 10 winch by V-belt drive. An outboard bearing carries an extension of the winch shaft, which has a 9-in crank welded to it. This gives an 18-in throw to the spudding attachment used in connection with the winch-drum. An $\frac{1}{2}$ -in soft-laid steel line is used to lower the tools into the hole. The rear of the pick-up has a frame constructed of old sucker rod on which scaffold boards can be placed in order to aid the operator in making connections on wells with tall christmas trees. Photographs illustrate the use of the unit. A. H. N.

119. Opening Clogged Screens with Explosives. D. D. Kinley. Oil Wkly, 5.11.45, 119 (10), 42.--The shot consists of a series of bakelite cups, 4-6 in long and slightly over 1 in in diameter, mounted on 1-in aluminium pipe and spaced equidistant on this pipe. These cups are filled with 100% strength gelatin. The amount of explosive is varied somewhat, depending on the well conditions, such as height of fluid column, nature of fluid, and purpose of shot. This variance is regulated by the length and number of the cups used. The aluminium pipe is filled with blasting caps opposite the charges of gelatin connected by primacord fuse, which is a detonating agent in itself. A spring guide is placed on the aluminium pipe every 6 ft, to centre the charge in the screen. The top of the aluminium pipe is connected to a firing gun which contains a blasting-cap with a primer inserted, devised so that a rod through the centre of the gun will strike the primer, setting off the initial blasting-cap, which in turn detonates the shot below it. Two types of firing guns are used, depending on whether the charge is to be set off by a drop weight or by jar action. In the first case the steel line on which the shot is lowered is passed through a disc at the top of the gun, which is connected to the firing-rod. A weight dropped over the line strikes the disc and moves the rod, setting off the primer cap. In the second case the gun is equipped with a device which enables it to land in a casing collar or in the top of a liner, and the firing-rod is actuated by a set of jars above the gun, operated by manipulating the steel measuring line at the surface after the gun is set in the collar.

The use of the shot for cleaning is described.

A. H. N.

120. Use of Electrolytic Models. H. G. Botset. Oil Wkly, 26.11.45, 119 (13), 33. The operation of the electrolytic model is based on the fact that if two electrical terminals, one positive and one negative, are placed in a conducting liquid (ionized salt solution), the current flowing between the electrodes will be carried by the ions of the salt. These ions represent the fluid particle in the oil or gas reservoir, and the water in which they are dissolved represents the porous sodium or reservoir rock. By making the dissolving medium gelatinous by the addition of agar-agar, the mechanical diffusion of the conducting ions is reduced to a very small magnitude, and essentially the only motion of the ions in the medium is that resulting from the electrical gradient. By the use of the proper salts, coloured ions are produced so that their motion in the electrical field may be visually observed and photographed. In the electrolytic model two salt solutions are used, one for the output wells and the porous medium, and the other for the input wells. It is desirable to be able to see the ions representing the input fluid; therefore, these are coloured, while the others are colourless. The two salts generally used in the electrolytic model are zinc-ammonium chloride and copper-ammonium chloride. The copper-ammonium

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ions are deep blue in colour, while the chloride and the zinc-ammonium ions are colourless. The detailed construction of a typical model is discussed and typical results are reproduced. A. H. N.

121. Water Permeability of Reservoir Sands. N. Johnston and C. M. Beeson. Petrol. Tech., May 1945, 8 (3), A.I.M.M.E. Tech. Pub. No. 1871, 1-12.—For many years the permeability of reservoir sands has been measured by passing air through a cleaned and dried core sample. Such a measurement differs from the true reservoir permeability in one important respect : in the reservoir the rock particles are surrounded by interstitial water, not air, and their physical shape and state of hydration are greatly dependent thereon. Permeability as defined must be measured with a single phase fluid. No means exist for removing the oil and gas from a core sample by simply flowing water through it; the sample must be cleaned and then re-saturated with water before testing. After such a cleaning process a considerably different permeability value is obtained with salt or fresh water from that for air. On rewetting after drying, particles may swell and break down, and even migrate. The ratio of air permeability to salt-water permeability ranged from 3300 or more down to one, while the ratio of the fresh-water permeability to the salt-water permeability ranged from zero to one.

When the salinity of the water flowing was varied, some cores showed a rapid permeability decline even at high salinities; other samples maintained a high water permeability down to low salinities. The data indicate that the amount, distribution, and properties of the clay or other affected solids in the sand must vary over a considerable range in many reservoirs.

It is suggested that the salt-water permeability is probably closer to the true reservoir permeability than is the measurement with air. Possibly the application of such measurements will improve the empirical relationship between specific productivity index and permeability, but so far the average air/salt-water permeability ratio for over 1200 cores does not show a large enough value to account for the entire deviation from the theoretical relationship. G. D. H.

122. Behaviour of Water-Input Wells. Part 2. P. A. Dickoy and K. H. Andresen. Oil Wkly, 26.11.45, 119 (13), 46.-It is important to be able to tell, as the intake rate declines in the early stages of injection, whether the decline is due to plugging of the sand, and therefore remedial, or to the fill-up of the reservoir, and therefore irremedial. What is required, therefore, is a method of determining the intake capacity of the well itself without regard to the conductivity of the whole system surrounding it. Such tests could be made periodically on certain selected wells scattered over a flood, and a close check on the efficiency of the input wells could be maintained. It is believed that an entirely practical method of determining the efficiency of an input well is determination of its localized injectivity index. Injectivity index is the reverse of productivity index, a concept that has proved of value in the study of the efficiency of producing wells. Injectivity index is defined as "the number of brl/day of gross liquid injected into a well/lb/sq in pressuro differential between mean injection pressure and mean formation depth." In order to be most useful, in studying the behaviour of individual input wells this concept should be restricted to define the conductivity of the individual well, and not the general conductivity of the whole system-i.c., it should not be affected by the whole area of sand surrounding the well and the productivity indices of the adjacent producing wells. It should be the determination of the conductivity of a cylinder of sand surrounding the well, in which cylinder most of the pressure drop takes place, and whole inside wall is the sand face-which is apt to become clogged by impurities in the injected water. This restricted index will be called the "localized injectivity index."

These concepts are discussed together with mathematical derivation of the injectivity index A. H. N.

123. Factors Affecting Lateral Vibration of Walking Beams with Beam Counterbalance. K. N. Mills. *Oil Wkly*, 22.10.45, **119** (8), 36–39.—One of the most discussed theoretical disadvantages of beam counterbalance on a pumping unit is the possibility of a walking beam or samson post failure due to lateral vibration of the walking beam. The results of this investigation indicate that dangerous lateral vibrations cannot be

induced in the beam of a properly designed beam counterbalance pumping unit. They also indicate that the samson post is the least rigid member in the system, and, therefore, the rigidity of the samson post should be high. When numerical values are substituted in the equation for the moment of inertia of the beam weights, it will be found that the largest contributing factor to their inertia is distance from their centre of gravity to the centre line of the samson post. As increasing the value of the moment of inertia of the system lowers its natural frequency, it is desirable to locate these weights as near the samson post as is economically practical.

A. H. N.

124. Miniature Oilfield Foretells Production. Anon. Petrol. Engr, Nov. 1945, 17 (2), 216.—The model recently discussed by H. G. Botset is described. See Abstract No. 120. A. H. N.

125. Two Veteran Oil-Wells. E. Adams. Petrol. Engr, Nov. 1945, 17 (2), 100.—A search for the oldest producing oil-well has uncovered some interesting side-lights of the beginnings of the oil industry and found, still in comparative obscurity, two oil-wells whose history almost spans that of the U.S.A. oil industry. Right to the title of "Oldest Producer in the World" is claimed for each of the two veteran wells. This record is not easily checked in the U.S.A., and is even more difficult to verify for the world. Several months of inquiry have uncovered no other well with as strong basis for its claim. The closing of the old wells, however, must come before the record for "longest period of production" can be determined for either well. One of the producers was drilled not far from the Drake Well on Oil Creek, Pa, Aug. 1861. It was then known as the Colby well, and has since been renamed the McClintock No. 1. The other octagenarian is less than 200 miles away in southeastern Ohio. It is the Old Buell No. 1, at the edge of Macksburg near Duck Creek. The well takes its name from the first owner, Barnum Buell, who with George Dunlevy completed it in 1862 or 1863. The obscurity of the date is not surprising considering the length of time required for drilling in those days. The Drake was started in 1858 and completed in Aug. 1859. The history of the two wells is given.

A. H. N.

126. Patents on Drilling and Production.—H. Allen, assr to Cameron Iron Works. U.S.P. 2,380,388, 31.7.45. Appl. 21.10.40. Well-head and casing suspension structure.

G. L. Hassler, assr to Shell Development Co. U.S.P. 2,380,520, 31.7.45. Appl. 24.4.42. Borehole indicating apparatus.

H. J. Quintrell, assr to Lane-Wells Co. U.S.P. 2,380,612. Appl. 25.2.42. Tubing anchor and packer assembly.

W. G. Eris, assr to The Texas Co. U.S.P. 2,380,639, 31.7.45. Appl. 16.9.43. Production of oil.

L. D. Mowrey. U.S.P. 2,380,669, 31.7.45. Appl. 11.3.43. Well anchor.

E. B. Williams. U.S.P. 2,381,415, 7.8.45. Appl. 19.11.43. Drill bit.

J. C. Stokes, assr to Reed Roller Bit Co. U.S.P. 2,381,844, 7.8.45. Appl. 11.5.42. Core-taking apparatus.

J. C. Stokes, assr to Reed Roller Bit Co. U.S.P. 2,381,845, 7.8.45. Appl. 11.5.42. Pressure core-drilling apparatus.

C. M. Bryant, assr to Dow Chemical Co. U.S.P. 2,381,875, 14.8.45. Appl. 19.9.41. Apparatus for treating wells.

D. G. C. Hare, assr, by mesne assignments to The Texas Co. U.S.P. 2,381,904, 14.8.45. Appl. 16.10.41. Method and apparatus for logging wells.

M. Schlumberger. U.S.P. 2,381,929, 14.8.45. Appl. 1.8.41. Well-conditioning apparatus.

J. T. Phipps, assr to M. O. Johnston Oil Field Service Corpn. U.S.P. 2,382,094, 14.8.45. Appl. 7.1.42. Hook-wall well-packer.

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A. Wolf and G. Herzog, assr to The Texas Co. U.S.P. 2,382,279, 14.8.45. Appl. 27.11.43. Device for recovering a radiation source.

J. W. Johnson. U.S.P. 2,382,422, 14.8.45. Appl. 3.2.43. Sucker-rod connection.

G. F. Turechik, assr to Lane-Wells Co. U.S.P. 2,382,455, 14.8.45. Appl. 20.1.42. Bridging plug.

F. E. Frey, assr to Phillips Petroleum Co. U.S.P. 2,382,471, 14.8.45. Appl. 3.3.41. Method of recovering hydrocarbons.

A. J. Penick. U.S.P. 2,382,578, 14.8.45. Appl. 8.6.43. Producing equipment for wells.

E. N. Washburn, assr to Phillips Petroleum Co. U.S.P. 2,382,685, 14.8.45. Appl. 14.7.41. Rotary jet gun.

E. Koppl and F. W. Harris, assr to Pateo Inc. U.S.P. 2,382,725, 14.8.45. Appl. 9.12.42. Rotary underfeamer.

D. E. Batchelder, assr to Lane-Wells Co. U.S.P. 2,382,770, 14.8.45. Appl. 3.3.42. Setting tool for bridging plugs.

J. A. Zublin. U.S.P. 2,382,933, 14.8.45. Appl. 16.12.41. Method of drilling holes.

A. L. Prout, assr of one half to B. Pugsley, and one half to M. A. Campbell. U.S.P. 2,383,214, 21.8.45. Appl. 18.5.43. Well casing expander.

E. D. Garrett, assr to The Browster Co. Inc. U.S.P. 2,383,248, 21.8.45. Appl. 25.10.41. Combination tubing head and tubing support.

C. S. Crickmer. U.S.P. 2,383,453, 28.8.45. Appl. 29.6.42. Anchoring device.

H. G. Abadie, assr of one half to F. G. Bradbury. U.S.P. 2,383,455, 28.8.45. Appl. 28.11.42. Method and apparatus for locating leaks in wells.

J. G. Bouslog. U.S.P. 2,383,844, 28.8.45. Appl. 2.11.42. Oilwell bailer line measuring device.

W. S. Crake, assr to Shell Development Co. U.S.P. 2,383,934, 4.9.45. Appl. 1.8.44. Oil-well pump.

L. Hartsell, U.S.P. 2,384,090, 4.9.45. Appl. 20.10.44. Well tool.

D. Johnston. U.S.P. 2,384,173, 4.9.45. Appl. 27.10.43. Deep well pump.

H. C. Otis and J. C. Luccous, said Luccous assr to said Otis. U.S.P. 2,384,192, 4.9.45. Appl. 26.8.40. Well packer and apparatus for producing wells.

J. P. Walker, assr of 40% to G. O. Marchant and 6% to C. G. Wells. U.S.P. 2,384,222, 4.9.45. Appl. 28.4.41. Method of and means for desalting petroleum well fluids.

A. H. Nailson. U.S.P. 2,384,331, 4.9.45. Appl. 8.2.45. Insert for sucker-rod elevators.

S. Krasnow and L. F. Curtiss, assr to Geophysical Development Corpn. U.S.P. 2,384,840, 18.9.45. Appl. 16.4.37. Radioactive well logging method and apparatus.

M. Muskat, assr to Gulf Research & Development Co. U.S.P. 2,385,298, 18.9.45. Appl. 16.10.41. Recovery of oil from oilfields.

R. O. Walton, assr to Merla Tool Corpn. U.S.P. 2,385,316, 18.9.45. Appl. 9.6.44. Well-flow device.

R. G. Piety, assr to Phillips Petroleum Co. U.S.P. 2,385,378, 25.9.45. Appl. 11.6.42. Well surveying. G. F. W.

Oilfield Development.

127. Construction Programme Under Way in Iraq will Triple Present Crude Output. C. O. Willson. Oil Gas J., 10.11.45, 44 (27), 60.—A 16-in 620-ml pipeline from Kirkuk to Haifa is planned. This will run parallel with the existing 12-in pipeline. A similar line may be built to Tripoli, and both should have a capacity initially of 100,000 brl/day. Kirkuk has produced 280,000,000 brl since 1934, and can maintain an output of 300,000 brl/day for many years. It has been classed as the world's largest single reservoir.

Interest in Iraq existed before 1914, and the Iraq Petroleum Co. commenced exploration in 1925. In 1927 the 1 Baba Gurgur gusher was completed at 1521 ft, near the crest of the Kirkuk structure, and near oil and gas seeps. The two 12-in pipelines began to carry crude in 1934. In 1936 a three-unit crude stabilization plant was built in the field to combine gasoline recovery with removal of H_2S and fixed gases. The Haifa refinery had an original capacity of 30,000 brl/day, but was enlarged to 90,000 brl/day.

Before the war 55 wells had been drilled in the field, which is 65 ml long and averages 2 ml wide. These included observation wells. All but 6 were plugged and permanently abandoned as a war measure. When normal production became possible again 5 wells met the pipeline capacity.

The uppermost beds at Kirkuk are sands, gravels, and conglomerates. Below the Upper Fars consists of sand, siltstone, and shale, and the Lower Fars of siltstone, anhydrite beds with minor limestones, and an anhydrite-limestone series. These rest on the main producing limestone. The producing porous limestone is extensively fissured, giving long-distance communication between wells. It is of Oligocene and Upper Eocene age. The surface structure does not conform with that of the reservoir. Wells are drilled on a contour pattern. It has been found that a well can produce as much as 20,000 brl/day without disturbing reservoir conditions. The bottom-hole pressure is always kept above the bubble-point, maintaining liquid-phase conditions in the reservoir, and giving substantially the same gas/oil ratio in all wells.

Because of plugging, redrilling has been necessary. Ten wells are now capable of producing, and the present programme calls for a total of 20, which will give an output of 400,000 brl/day.

The wells are fitted with controls and have calibration charts which facilitate adjustments of output. They are drilled by the rotary method. No lining or tubing is used.

A large reserve of low-gravity high-sulphur content oil has been established at Qaiyarah, but the oil is not at present refinable, and no plans have been made for its development. A small Cretaceous structure has been discovered at Ain Zalah. The field is not fully defined. Its crude is similar to that of Kirkuk. A major reserve has been discovered on the Qatar Peninsula, less than 100 ml from Bahrein and Dammam. Two producing wells have been drilled to depths of 5000-6000 ft. G. D. H.

128. Five Fields with 51 Wells in Iran Produce Total of 365,000 Brl of Crude Daily. C. O. Willson. *Oil Gas J.*, 6.10.45, 44 (22), 74.—The discovery well at Masjid-i-Sulaiman was completed in 1908. Initial development was on close spacing. A well, F-7, was completed in 1911 for 1000 brl/day, but in 1914 its production rose to 7000 brl/day. When mudded off in 1926 it had given over 50,000,000 brl, making it the world's largest well until two wells at Haft Kel exceeded this figure.

Production is from the Asmari limestone in southwest Iran. The upper 500 ft of this formation at Masjid-i-Sulaiman consists of thick-bedded foraminiferal limestones; the lower part includes marls and anhydrite. The limestone is mostly of low porosity, but folding has created fissures, and only where fissures occur is there commercial production under present practices. Some early fissures are filled with calcite and anhydrite. The overlying Lower Fars differs considerably in structure from the Asmari, which outcrops and gives seeps not far from Masjid-i-Sulaiman.

Production of oil causes the gas-oil level to fall and the oil-water level to rise less quickly. Development practice gives water-free crude with a minimum gas/oil ratio, the gas being wholly solution gas. Efforts are made to maintain horizontal gas-oil and water-oil surfaces as far as permeability and other conditions allow. Reservoir fluid levels and pressures are carefully observed by periodical measurements in indicator wells.

Except at Masjid-i-Sulaiman all the active fields employ multi-stage stabilization of the crude. At Gach Saran the equipment is controlled from a central point, and the crude then flows 166 ml to the refinery through a 12-in pipe. Wherever possible the stabilizing plant is situated so as to allow gravity flow. The stabilizing equipment is briefly described. At present Gach Saran is producing 40,000 brl/day from three active wells. This structure is only partly defined, and may be the largest yet discovered in Iran.

In 1939 the re-injection of part of the crude-oil fraction was begun at Masjid-i-Sulaiman to secure an operating balance between supply and demand. The fraction is obtained from a local topping plant, and provision has been made for the return of surplus products from the Abadan refineries. After injection the heavier oils settle to just above the water level. This process saves overground storage.

At Agha Jari special precautions are needed in drilling to combat heaving formations and high pressures. On drilling into the reservoir mud losses indicate the presence of producing fissures. Then drilling is stopped and swabbing or bailing undertaken to initiate oil flow.

The extent of the present producing formations has been determined in only three of the existing fields. Masjid-i-Sulaiman is said to have reserves exceeding 70,000,000 brl in an area 18 by $3\frac{1}{2}$ ml. A similar area is involved at Agha Jari, while Haft Kel is 20 by 3 ml. G. D. H.

129. Pemex has Active Drilling Programme. Anon. Oil Wkly, 12.11.45, 119 (11), 62.— The Tampico embayment is the most important of Mexico's proven oil provinces, having produced 85% of the total oil, and possessing a similar percentage of the known reserves. The Isthmus-Tabasco area is next in importance. No oil production has been found in northern Mexico, but the similarity of conditions to those of South Mexico make such discovery likely. Northern Mexico has three gas fields.

Seventeen geological parties are working in Northeast Mexico, the Tampico-Tuxpan embayment, the Isthmus-Tabasco area, and Lower California. Geophysical work is under way in a number of areas, and includes seismic and gravity investigations.

G. D. H.

130. Completion Rate Rises. Anon. Oil Whly, 22.10.45, 119 (8), 51.—During Sept. U.S. well completions averaged 543/week, compared with 502/week in Aug. and 558/week in July. The figure for Sept. 1941, was 716/week.

19,079 wells have been completed in the first nine months of 1945, 9% more than in the corresponding period of 1944. There are indications that the 1945 total will be about 25,500 wells.

A table summarizes the completion results for Sept., by States and districts, and gives totals for Aug. 1945, and Sept. 1944. The cumulative completions for the first nine months of 1945 are analysed, and rig and footage figures are given. G. D. H.

131. An Engineering Study of the Lafitte Oil-Field. H. Vance. Petrol. Tech., May 1945, 8 (3), A.I.M.M.E. Tech. Pub. No. 1869, 1-15.—The Lafitte field, South Louisiana's largest oil reserve, is in Jefferson Parish, some 25 ml due south of New Orleans. The discovery well was completed in May 1935, for 960 brl/day of 34.9° A.P.I. oil from 9558 to 9572 ft. 3-8 wells have been drilled per year, giving 60 producers and 3 dry holes at the beginning of 1944. Wells are drilled by steam-driven rotaries mounted on submergible barges, floated into position along a canal dug to the location. After completion the barge is refloated and taken to a new location.

The structure is an elongated dome broken into three segments by two north-south faults. The west segment is highest and contains most oil and gas. There are five main producing sands, two having no gas cap. These sands lie 8045–10,070 ft deep, and average 28–52 ft in thickness. Up to the beginning of 1944 35,662,264 brl of oil and 39,285,054 million cu ft of gas had been produced. Porosities and permeabilities are probably high. The pressure in each sand is maintained by natural water encroachment, although in the early history of the deepest sand the operation was under gas drive.

A salt intrusion is probably responsible for the uplift, but no salt has been found yet. Contour maps are given for each sand, and also reservoir performance diagrams.

G. D. H.

TRANSPORT AND STORAGE.

132. Zinc Anodes for Freventing Corrosion of Distribution Mains. C. L. Morgan. *Petrol. Engr.*, Sept. 1945, 16 (13), 196.—Experiences with the use of zinc anodes to prevent corrosion to certain steel gas distribution mains in Houston, U.S.A., are given.

Frequent leaks due to soil porrosion on steel welded 6- and 10-in poorly coated gas mains cost \$2500 to find and repair in 1941.

The mains were divided into 100-ft electrically insulated sections for the provision of cathodic protection to each. After exploratory experiments, a 99-9% pure zine plate $\frac{1}{2}$ by 3 by 36 in and weighing 14 lb was selected as the anode, costing, after preparation for installation, \$2.15 each. The section of main was completely insulated from all metallic structures, such as the house piping, and steel pipe from cast-iron pipe.

Tests using a 6-volt storage battery as a source of current were made to determine the current required to protect the section for a 15-year period. Approximately 15 plates operating at 15 milliamperes per plate were required to maintain 1000 ft of wellinsulated $6\frac{1}{2}$ in O.D. steel treated pipe at 0.85 volt with reference to CuSO₄ electrode after the pipe had polarized; and generally more zinc than was required was installed.

Five zinc plates were installed in a vertical stack in fairly low resistance soil, with the top plate deep enough so as not to be affected by seasonal drying out of the soil; at depths not exceeding 20 ft, and the backfill mixtures carefully selected.

Complete records of data on all conditions and factors influencing the performance of zinc were obtained, and frequent observations made. It is estimated that the average cost of protecting a mile of 6-in pipe was \$2000. Protection to all mains in the business section of Houston was completed early in 1944, and only only leak has been found up to July 1945. There was an average of 19 corrosion leaks in 1941, 1942, and 1943.

Performance of the zinc has been satisfactory, the zinc potential has not lowered materially, and efficiency has been found to be 90%. A table shows weight loss and current efficiency data of test plates removed. Further work has shown that bare lines are most difficult to protect; well-coated ones require very little current. Other metals and alloys are being tested as current sources. G. A. C.

133. Graphic Solutions of Design Problems. 5. Resistance of Fittings. P. Buthod and B. W. Whiteley. Oil Gas J., 17.10.45, 44 (28), 286.—This article deals with the calculation of pressure differences in pipes. The various factors which affect the difference in pressure between inlet and outlet sections of the pipe are listed as: (i) difference in elevation; (ii) gain or loss of kinetic energy of the fluid; (iii) mechanical work added or taken from the fluid; (iv) frictional losses in the fluid system, consisting of friction loss in the straight pipe, enlargement and contraction losses, and resistance of fittings, meters, orifice plates, etc.

Of these, (iv) is usually of the major importance, and a method is given of calculating the resistance to flow afforded by various fittings in terms of an equivalent of straight pipe. Within the viscous flow region, the resistance is primarily a function of the Reynolds number, but in the turbulent region of flow the resistance of fittings is independent of the Reynolds number, and the experimental values for equivalent lengths may be used with reasonable accuracy for such viscous fluids as oils.

The equivalent lengths of various types of fittings are shown plotted against pipe diameter, and in order to calculate pressure loss in a line, the equivalent length of all fittings in the system is added to the length of straight pipe.

Methods of calculation and examples are given.

T. M. B. M.

REFINERY OPERATIONS.

Refineries and Auxiliary Refinery Plant.

134. Distinguishing Features of Refinery Centrifugal Pumps. J. Taylor. Petrol. Times, 24.11.45, 49 (1261), 989.—The differences between centrifugal refinery pumps and those used for other purposes are discussed in the light of the more severe duties they are called upon to perform. The auxiliaries installed with refinery pumps aro described and the reasons for their provision and future trends of design are discussed.

The duties for centrifugal refining pumps as compared with most other pump applications involve variable combinations of high pressures and temperatures, lighter specific gravities, and low values of net positive suction head over vapour pressures of liquid handled. "Suction" pressures of 450 psi or higher, with discharge as high as 2100 psi, and temperatures up to 800° F. are common. Most refinery pumps have vertically split casings with circular joints to allow for high temperatures and pressures,

and light liquids; and are centre line-mounted to eliminate misalignment between pump and driver resulting from expansion when handling hot liquids. Pressure influences choice between cast and forged steel for construction materials, and temperature between cast iron and cast steel. Forged steel is used for combination of pressures above 1200 psi and temperatures above 600° F. Cast iron is used for other extremes below 200 psi and 200° F. Practical limits for cast-iron casings would be 300 psi and 300° F. The inside of forged-steel cylindrical case-barrels is lined with a welded layer of stainless steel to prevent corrosion; and rubbing parts are suitably hardened. There are several minor differences, such as wearing rings on both sides of impellor in a single-stage "process-type" pump. Auxiliary piping is liberally used for distributing cooling water, supplying gland oil and lubricant, and for bleeding off liquid to reduce the pressure. Facking boxes require a piping to arrange for difficult conditions.

As flow in modern refineries must be continuous, stand-by pumps must be installed. Fire is a great hazard, hence motors and electrical equipment are made explosion-proof, and insulating jackets and lagging provided on hot pumps and lines to protect personnel as well as conserve heat.

Vertical pumps offer a saving, and speeds higher than 4000 rpm are likely in the future. G. A. C.

135.* Determination of Pressure Fluctuations on the Simultaneous Operation of Centrifugal and Ram Pumps Connected in Series. I. A. Charnui. Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1945, 491-496.—In order to increase the speed of operation of a ram pump, a scheme has been worked out whereby a centrifugal pump feeds into the suction line of the former. A mathematical analysis is presented of the pressure fluctuations in the suction side of the ram pump for two cases : (a) direct connection of the pumps by means of a line; and (b) connection by means of an intermediate air chamber.

V. B.

136. Pressure Vessel Design Calculations. S. M. Jorgenson. *Refiner*, Oct. 1945, 24 (10), 381-385.—Formulæ and graphs are presented for stress and strain calculations in high-pressure plants. Vacuum vessels designs are also studied quantitatively. A. H. N.

137. Analysis Determines Control Variables for Distillation Systems. C. W. Perry. Chem. Met. Eng., 1945, 52, 108.—The purpose of the paper is to clarify Gilliland and Reed's rigorous analysis of the degrees of freedom for multicomponent, multistage, interphase contact systems. The treatment is based on Gibbs' Phase Rule, as well as on the fundamental laws of matter and energy, and special attention is paid to the application of the method to practical problems encountered in automatic control. Systems considered are: (1) single-stage non-condensing still; (2) single-stage condensing still; (3) rectifying columns with boiler and total condenser. The practical examples of stabilizer control and alcohol-still operation are discussed in some detail. L. B.

138. Slide Rule Conversion for Manometer Readings. M. E. Klecka. Chem. Met. Eng., 1945, 52, 127.—In the measurement of flow of water, a mercury differential manometer set across an orifice plate in the line is frequently used, and the differential pressure read in inches mercury. This may be rapidly expressed in terms of feet water, by setting 21 on the C scale of a slide rule opposite 22 on the D scale. Then inches mercury set on the C scale will give the corrected pressure drop in feet water on the D scale. L. B.

139. Determining Pump Discharge by Height of Stream from Vertical Open-End Pipe. F. C. Bennett. Chem. Met. Eng., 1945, 52, 126.—The characteristic discharge curvo of a pump may be determined by allowing it to discharge through a pipe which is straight for 40 diameters and then rises vertically. The end of the pipe must not be submerged. A fountain is produced, and 0, the quantity of water discharged, in gals per minute, is related to D, the pipe diameter in inches and S, the height of fountain in feet, by the equation $0 = 19 \cdot 6 CD^2 \sqrt{S}$. If the pump discharges through a section of pipe, C = 0.98. If a sharp-edged orifice is used at the exit, C = 0.63.

140. Use of Cast Iron in Chemical and Process Industries. F. L. La Que. Nat. Petrol. News Tech. Sect., 3.10.45, 37 (40), R. 806 .- The metallographic structure of groy cast iron is briefly discussed in relation to corrosion resistance, and extensive data are recorded of the corrosion rate of cast iron and austenitic cast iron (Ni-resist) in contact with materials used in the petroleum and chemical processing industries. Factors dictating the choice of cast iron for use when corrosive materials are employed are discussed, and reference made to the increased resistance to corrosion by the addition of nickel or nickel and copper, and large amounts of silicon. Ni-resist contains about 20% nickel or nickel and copper in the ratio of 2:5 Ni to 1 of Cu. An English alloy, "Nicrosilal," contains approximately 18% Ni, 6% silicon, and 2% chromium; both are austenitic alloys suitable for use up to 1500° F, where small permanent dimensional changes may be tolerated; and in the petroleum industry are used for tube supports, crude-oil distillates, acid and acid sludge, valves and fittings, pumps and pump liners, condenser sections, meters, etc. For services where the casting may be subject to abrupt and considerable changes in temperature, which lead to high thermal stresses, up to 30% nickel gives much lower coefficient of thermal expansion; the minimum thermal expansion is attained with about 35% Ni. Particularly corrosive materialse.g., cold and hot H_2SO_4 , with or without oxidizing compounds present, HNO_3 , H_3PO_4 organic acids and acid salts, require an alloy with about 14.5% silicon. Tabulations are given showing type of alloys useful for pumps and valves used with corrosive gases and liquids in refinerics. W. H. C.

141. Metallizing Refinery Flash Towers. L. V. Hils. Refiner, Oct. 1945, 24 (10), 386-387.—Metallizing with aluminium resulted in longer periods between shutdowns and more economical working. A. H. N.

142. 90,000-Barrel Haifa Refinery Largest in Mediterranean Area. C. O. Willson, Oil Gas J., 17.10.45, 44 (28), 160.—A description is given of the 90,000-brl plant of Consolidated Refinerics, Ltd. (jointly owned by Anglo-Iranian and Anglo-Saxon). located at Haifa. The Iraq Petroleum Co. produces 85,000 brl/day of crude from the Kirkuk field, half of which is sent to Tripoli, Lebanon, and the other half to Haifa, constructional work on this site being commenced in 1938 for the processing of this crude.

The first 29,000-brl unit consisted of crude oil topping, wax cracking, and viscosity breaking of the residual product, and a second unit of the same design and capacity was completed in 1941. Reforming units for reforming the heavy gasoline cut from the crude oil topping were built, but have never been operated. The course of the war necessitated changes in original design before completion of the second combination unit, however, as it was considered that the plant should be operated to maximum yield of liquid products, and operating changes were therefore made in the combination units to distil and fractionate additional crude. The viscosity breaking unit was altered to produce an asphalt cut, and a plant was installed to process solid and cutback bitumens from the asphalt fraction.

The installation of a third 28,800-brl crude oil distillation unit was completed in Aug. 1944, which had the effect of increasing the crude oil capacity to 85,000-90,000 brl daily.

The distillation of the stabilized Iraq crude is 45° C I.B.P. with 30% distilling to 187° C, 50% to 287° C, and 70% to 400° C, and the main products at Haifa at the present time are 80 O.N. motor gasoline, special naphtha, kerosine, gas oil, diesel fuels, fuel oil, bitumen, and butane gas.

The refinery operates its own sulphuric-acid manufacturing plant, producing 30 tons per day of 98% acid, using the contact process with vanadium pentoxide catalyst. A flow diagram of refinery operations is included and a full description of these is given. T. M. B. M.

Distillation.

143. Equilibrium Flash Vaporization Correlation of ASTM and High Pressure Curves. J. Griswold and M. E. Klecka. *Refiner*, Oct. 1945, 24 (10), 388-393.—Relations between ASTM and equilibrium flash vaporization curves are reviewed, and a dependable correlation is presented for slope of the flash curve at superatmospheric pressures.

A. H. N.

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144. Refiners Notebook. Side Reflux. W. L. Nelson. Oil Gas J., 18.8.45, 44 (15), 155.—Side reflux is defined and its advantages and disadvantages discussed. The method of calculation of side-reflux heat is given together with examples.

T. M. B. M.

Cracking.

145. Small-Scale Catalytic Cracking. H. D. Nell and V. O. Bowles. Refiner, Oct. 1945, 24 (10), 373-380.—Small-scale Thermofor Catalytic Cracking plants are discussed and operational data discussed. The studies presented in this paper lead to a number of interesting and practical conclusions: (1) TCC is now available for the small refiner. Studies have been prepared which show that the process is feasible for the refiner processing 3000 or more brl/day of crude oil; (2) the competitive market for motor fuel points towards higher gasoline octane numbers in the future. Catalytic cracking will, in many cases, be the only means of economically reaching those competitive levels; (3) the earnings from catalytic cracking at a given octane level are, in nearly every case, sufficiently greater than for thermal cracking to justify its installation; (4) reduction in yield of residual fuel makes for greater flexibility in meeting many local market conditions; (5) substantial investment savings can be achieved in many cases by using existing thermal equipment. A. H. N.

Polymerization.

146. Polymerization and Isomerization are Effective in Motor-Fuel Manufacture. Part 3. A. L. Foster. Oil Gas J., 29.11.45, 42 (21), 103 .- An epitome is presented of the catalysts specified in patents, mainly U.S.A., recorded during 1942-44, of which 25 relate to polymerization and 56 are for promoting isomerization of hydrocarbons. For polymerization, the most effective catalyst is phosphoric acid, supported on magnesium sulphate, or other inert medium, for promoting polymerization of light olefinic hydrocarbons to liquids of high anti-knock qualities simultaneously with a reduction of the vapour pressure to desirable limits and giving high yields from the feed stock. Of the 25 patents mentioned, 10 relate to the use of supported phosphoric acid in some form-e.g., with copper metal, Ca and Cu phosphates, or with HCl as promoter; pyro-phosphates of many metals with and without a promoter. Other catalysts noted include : aluminium chloride and a metal, or with a metal chloride. An interesting application is the use of spent AlCl₃ catalyst to reduce catalyst poison in the feed-stock before contacting with the AlCl_a in the reactor. Another favours the use of supported H_3PO_4 and the addition of water at three points in reactor, to a total of 3% H_2O at exit. One patent specifies the use of a solution of 67% H2SO4 and 2% AgSO4 supported on a porous plate through which olefins enter and are emulsified and catalysed.

Isomerization can be accomplished on paraffins, olefins, cyclo- and aromatic hydrocarbons in two ways : (1) conversion of normal paraffins-e.g., low-octane naphthasto more branched chain structures of improved octane ratings and high volatility; (2) treatment of intermediate or raw stocks to prepare feed stocks for other operations such as alkylation-c.g., treating butanes or pentanes, or combinations to form isoparaffins containing tertiary carbon atoms for use as one of the intermediates in alkylation to produce high quality aviation components. That Friedel-Craft type catalysts are pre-eminently satisfactory in promoting the necessary rearrangement of the structure of hydrocarbons, is shown by the fact that 70% of the catalysts patented relate to an aluminium halide, mainly the anhydrous chloride. Many varieties of support are used. HCl is a favourite promoter. In three specifications, water is introduced in small quantities—1-1.5 times the weight of hydrocarbon reacted. Some interesting patents are : liquid-phase isomerization of low-octane naphthas by an AlCl₃-hydrocarbon complex ; Al₂O₃ plus AlCl₃ vapour, with periodic removal of a part of the catalyst bed for resaturation by AlCl₃ vapour and return to the reactor; one patent relates to a method for the recovery of the aluminium halide from the isomerization sludge. Another condenses AlCl₃ vapour with the feed vapours and adds olefins to the condensate as a second part of the process to obtain an alkylation reaction. One patentee proposes the use of molecular hydrogen and anhydrous HCl heated to a temperature above the cracking reaction, and introduced to the reactor operating at 700° F. on AlCl₃ and feed. Other catalysts employed for olefin isomerization are :

bauxite and H_3SO_4 or H_3PO_4 ; brucite activated by SO_3 and IIF or BF₃, with or without HF in molal excess of the SO_3 . W. H C.

Chemical and Physical Refining.

147. Unisol Process Improves Octane Number and T.E.L. Susceptibility. C. D. Lowry and F. C. Moriarty. Oil and Gas J., 3.11.45, 44 (26), 105 .- The Unisol process of the Atlantic Refining Co. extracts mercaptans from gasoline by contact with caustic soda containing methanol. Operating costs approximate to 1-1; cents/brl for chemicals and utilities. Advantages of the process include practically complete removal of all mercaptans from any gasoline; the octane number is not lowered nor inhibitor susceptibility adversely affected, and the methanol is separated from the caustic during each regeneration, thus the latter can be readily replaced. The process consists essentially of five steps, the first being the preliminary caustic washing to remove hydrogen sulphide, aliphatic acids, and phenols, followed by extraction of mercaptans and removal of methanol from the gasoline. The caustic methanol solution containing mercaptans is then regenerated by steam stripping, the methanol mercaptan and water vapours from the regeneration column are condensed to produce a two-phase system, from which the upper mercaptan phase is removed by skimming. The lower aqueous methanol phase is fractionated to recover the methanol. A table shows commercial results obtained from a wide variety of gasolines. G. A. C.

148. Poisoning of Nickel Hydrogenation Catalysts by Water Vapour. W. B. Burford, III, and J. C. W. Frazer. J. Amer. chem. Soc., 1945, 67, 331-332.—Water vapour is shown to be a poison for nickel hydrogenation catalysts, the effect being noticeable even with 3×10^{-4} mm pressure of water vapour. The poisoning is reversible, the catalyst being reactivated by heating in hydrogen. E. H. W.

Metering and Control.

149. Chart Reading by the Integrator Method.W. J. Kennedy. Refiner, Oct. 1945,24 (10), 420-422.—The use of integrating methods for calculating flow rates by orificesis illustrated by examples.A. H. N.

150. Calculations of Orifice Meter Charts by the Square-Root Planimeter Method. J. T. Cortelyou. *Refiner*, Oct. 1945, 24 (10), 418–420.—The paper forms a part of the Southern California Meter Association Meter Course. A. H. N.

151. Sight Reading of Orifice Meter Charts. H. A. Faull. Refiner, Oct. 1945, 24 (10), 415-417.—The paper forms a part of the Southern California Meter Association Meter Course. The quantitative evaluation of the orifice formula by means of charts is presented. A. H. N.

PRODUCTS.

Chemistry and Physics.

152. Ethylation of Benzene. Course of the Reaction. E. M. Marks, J. M. Almand, and E. E. Reid. J. org. Chem., 1944, 9, 13-20.—Ethylated benzenes are obtained by reacting ethylene, or, less economically, ethyl chloride with benzene in the presence of aluminium chloride. The proportions of the products do not, as commonly supposed, depend only on the amounts of reactants. An attempt was made to study the reaction mechanism by using varying conditions, the products being separated by fractionation.

The amounts of the various homologues correspond roughly to the number of moles of ethylene used. A remarkable feature is that a large amount of hexa-ethylbenzene is formed in the early stages of the reaction, for of the first mole of ethylene used, 18%forms hexa-, and only 27% forms mono-ethylbenzene; for the second and third moles of ethylene introduced there is a slight decrease in hexa-ethylbenzene concentration, which afterwards rises to a maximum at about 6 moles of ethylene.

Variations in the ratio $C_8H_8/AlCl_3$ cause some change in the proportions of the

homologues produced, a small ratio resulting in a high percentage of 1:3:5-isomer, and less di- and penta-ethylbenzenes; the percentage of triethylbenzene is uniformly high.

Temperature variations cause marked changes in the proportions of the products, and small amounts of water have an accelerating effect on ethylene absorption in the early stages of the reaction. The rate of introduction and speed of stirring are also factors influencing the proportions of the products.

The results support the view that after complete alkylation of part of the benzene, a disproportionation occurs, producing largely 1:3:5-triethylbenzene, such redistribution being greatly affected by reaction conditions. C. N. T.

153. Catalytic Hydrogenation of the Benzene Nucleus. I. The Hydrogenation of Phenyl-Substituted Aliphatic Acids. H. A. Smith, D. M. Alderman, and F. W. Nadig. J. Amer. chem. Soc., 1945, 67, 272-276.—This work represents an attempt to determine the effect of structure on the rate of hydrogenation of the benzene nucleus.

The kinetics of the catalytic hydrogenation of phenyl-substituted aliphatic acids have been studied. The factors affecting the relative rates of catalytic hydrogenation are discussed. E. H. W.

154. Catalytic Hydrogenation of the Benzene Nucleus. H. Hydrogenation of Benzene and Mono-alkylbenzenes. H. A. Smith and E. F. H. Pennekamp. J. Amer. chem. Soc., 1945, 67, 276-278.—Continuing the work reported in the previous abstract, the kinetics of the catalytic hydrogenation of a series of mono-alkylbenzenes were studied. Factors affecting the relative rates of catalytic hydrogenation are discussed and tho results of the present work are compared with previous publications. E. H. W.

155. Catalytic Hydrogenation of the Benzene Nucleus. III. Hydrogenation of Polymethylbenzenes. H. A. Smith and E. F. H. Pennekamp. J. Amer. chem. Soc., 1945, 67, 279-281.—Studies of the kinetics of the catalytic hydrogenation of the polymethylbenzenes and p-cymene are reported.

It is shown that increased methyl substitution generally decreases the rate of hydrogenation of the benzene nucleus, but the position of substitution is also important. The results are compared with those of other workers. Factors influencing the relative rates of catalytic hydrogenation are discussed. E. H. W.

156. Foam Drainage. G. D. Miles, L. Shedlovsky, and J. Ross. J. Phys. Chem., 1945, 49, 93-107.—The rate of flow of liquid through aqueous foams of uniform liquid concentration is studied under varying conditions. The foam is produced by blowing air through the solution and the liquid introduced at the top and collected at the bottom by a syphon. Solutions used include those of sodium lauryl sulphate, sodium lauryl sulphate + lauryl alcohol and two commercial preparations of sodium salts of sulphated glycerides.

Results are: (1) Establishment of a linear relation between the amount of liquid held by the foam and electrical conductivity. The latter is used as a measure of the equilibrium state of the foam; (2) If y = rate of flow of liquid through the foam in cc/min, and x = cc of liquid in the foam, then $y = ax^n$, where a and n are constants; (3) if V = cc of liquid drained from the foam in t seconds, $kt = V + a \log V + b$, where k, a, and b are constants; (4) the rate of flow of 0.1% sodium lauryl sulphate containing 1% sodium sulphate shows a cumulative decrease as temperature is lowered, due to increased viscosity of the solution. A corresponding decrease is obtained when glycerol is added. The addition of lauryl alcohol shows an anomaly which is attributed to increased surface viscosity at the interface; (5) decrease in bubble size decreases rate of flow of liquid through the foam.

It is concluded that the relative drainage of liquid from foams cannot be regarded as a reliable measure of foam stability, owing to the many factors involved.

H. C. E.

157. Relationships Between Velocity of Sound and Other Physical Properties of Liquids. R. T. Lagemann and W. S. Dunbar. J. Phys. Chem., Sept. 1945, 49 (5), 428-436.

If v = velocity of sound, d = density of liquid, M = molecular weight, and v is a constant independent of temperature, then the new physical constant

$$v = \frac{M}{d} v^{1/3}$$

involving the velocity of sound in liquids, is found to be a linear function of the parachor, mole refraction, Souders' viscosity constant, molecular magnetic rotation, critical volume, and van der Waals' b for members of four homologous series. The constants of the equations are evaluated. This implies that all the afore-mentioned properties are linear among themselves for homologous series. To a good approximation the linearity may be applied to all compounds. The critical temperatures and boiling points of homologous series of unassociated compounds are linear with the log of v. Lists of atomic increments and the accompanying constitutive values are compiled for several of the properties, including molecular sound velocity. Lists of bond increments are reported and their relationships noted. A. H. N.

158. Flow Orientation in Isotropic Fluids. A. Bondi. J. Appl. Phys., Sept. 1945, 16 (9), 539-544.—A theory of flow orientation was developed which is based on a relation giving the change in entropy accompanying molecular orientation under the influence of a stress field, and on the applicability of the Eyring theory of viscous flow. The proposed theory predicts the ratio of the viscosity at attainment of complete orientation to the viscosity of "normal"—*i.e.*, random flow to be equal to the ratio of the average length v_3^1 to the actual length of the (fully stretched) molecule. The thermodynamics of a flow-oriented system are outlined, predicting the temperature changes, accompanying adiabatic orientation and disorientation. It is also suggested that the relaxation times in viscous media are large enough to prevent observation of flow orientation in capillary viscosimeters in many cases. A. H. N.

159. Effect of Surface-Active Agents Upon Dispersions of Silica in Xylene. V. R. Damerell, K. Gayer, and H. Laudenslager. J. Phys. Chem., Sept. 1945, 49 (5), 436-442.—Dispersions of silica in xyleno have been made in the presence of a number of surface-active materials. The particle-size distributions of these dispersions have been determined by sedimentation analysis. The most successful surface-active agents were found to be the various metal sulphosuccinates, metal naphthenates, and lecithin. These agents are thought to aid dispersion by forcing aggregates apart in the process of adsorption, since in all cases where adsorption was determined the successful surface-active agents were found to be strongly adsorbed on the silica. The silica had a surface of 118 sq m/g. It was positively charged in the xylene suspension, and was coagulated by the addition of water, alcohol, acetone, and ether. Heating also produced coagulation. A. H. N.

160. Significance of Contact Angle in Relation to the Solid Surface. D. C. Pease. J. Phys. Chem., 1945, 49, 107-110.—The significance of advancing, receding, and equilibrium contact angles (θ_a, θ_r) , and θ_r respectively) are discussed in relation to work of adhesion to the solid surface. θ_a and θ_r occur when the surface is carefully dipped into or removed from the liquid. Assuming the system to be unidimensional, hydrophobic groups on the solid surface are responsible for θ_a and θ_r ; and hydrophilic groups for θ_r . θ_a is dependent on the least possible mean work of adhesion; and θ_r to the line of greatest possible mean work of adhesion. θ_r is a function of the line of the least possible work of adhesion that the three-phase junction can take up. H. C. E.

161. Minima in Surface-Tension and Interfacial-Tension Curves. G. D. Miles. J. Phys. Chem., 1945, 49, 71-76.—Following the results previously described (J. Phys. Chem., 1944, 48, 57), information on the relative surface concentrations of two-component mixtures of surface-active materials as a function of bulk concentration is presented.

Surface- and interfacial tensions are measured by a du Nouy Tensimeter, and selective adsorption of the surface-active material is obtained by bubbling air through the solutions to produce a large volume of foam. Curves of interfacial tension against concentration of sodium lauryl (dodecyl) sulphate against benzene shows no minimum; with sodium heptadecane sulphate as impurity a minimum is obtained. It is shown

that the minima of these and similar curves occur when the relative surface concentration of one of the components is a maximum. In opposition to the viewpoint that such minima can be explained as a critical concentration for micelle formation, a plot of specific (electrical) conductance and concentration for pure sodium lauryl sulphate (no minimum in interfacial tension) and for sodium lauryl sulphate with lauryl alcohol (minimum in interfacial tension) both showed discontinuities at the same point.

H. C. E.

162. Minima in Surface Tension/Concentration Curves of Solutions of Sodium Alcohol Sulphates. G. D. Miles and L. Shedlovsky. J. Phys. Chem., 1944, 48, 57-62.—The surface tensions of aqueous solutions of sodium dodecyl sulphate and sodium tridecane-2-sulphate are measured at concentrations up to 1/100 molar, using a du Noūy Tensimeter. Curves are presented showing the effect of: (1) dodecanol on the surface tension of sodium dodecyl sulphate solutions; (2) sodium pentadecane-2-sulphate and sodium heptadecane-2-sulphate on the surface tension of sodium tridecane-2-sulphate solutions; (3) sodium hexadecyl 2-sulphate on the surface tension of sodium dodecyl sulphate solutions.

The effect of impurity is always to introduce a minimum into the curves at about 5-6 M/1000 concentration. Case 1 is produced by two surface-active materials, of which one is only slightly soluble in water, and cases 2 and 3 occur with two anionic surface-active electrolytes. The latter effect is greatest when the impurity is either a homologue of higher molecular weight or another more surface-active analogue of the principal substance. Discussion centres around selective adsorption on the surfaces, and attention is directed to the possibility of the Gibbs adsorption theorem giving "anomalous" results when the materials are not carefully purified. H. C. E.

163. Molecular Condition of Phenols in Benzene Solution. J. A. Davison. J. Amer. chem. Soc., 1945, 67, 228-233.—A description is given of an apparatus for measuring the freezing points of dilute solutions (0.002-0.1 molal).

The cryoscopic constant of benzene was calculated from the freezing points of solutions of triphenylmethane in benzene.

Freezing points of solutions of phenol in benzene are given, and the results are interpreted as due to the formation of solid solutions of phenol in benzene.

Cyroscopic data are also presented for solutions of nitrobenzene in benzene. Freezing points of solutions of o-cresol, p-cresol, m-nitrophenol, p-nitrophenol, and 2:4dinitrophenol in benzene are given. The equilibrium constants for the formation of dimers were calculated. E. H. W.

164. Hindered Phenols. G. H. Stillson, P. W. Sawyer, and C. K. Hunt. J. Amer. chem. Soc., 1945, 67, 303-307.—A series of 2:4:6-trisubstituted phenols, with t-butyl or other large hydrocarbon groups in the two positions ortho to the hydroxyl group, have been synthesized. These compounds have been characterized as the hindered phenols. They are insoluble in aqueous or alcoholic alkali and do not respond to any of the conventional tests and reactions of phenols. Evidence is given to support the structures assigned to them, and methods for the synthesis of these compounds and their derivatives are described. E. H. W.

165. Reduction of Multiple Carbon Bonds. V. Reduction of Aromatic Hydrocarbons and Dialkylacetylenes by Calcium Ammonia. K. N. Campbell and J. P. McDermott. J. Amer. chem. Soc., 1945, 67, 282-283.—The reduction by calcium ammonia of benzene, toluene, and three dialkylacetylenes is reported. Benzene gave cyclohexene, toluene gave a mixture of two mono-olefins, and the dialkyl acetylenes were reduced to the corresponding trans olefins. E. H. W.

166. Mechanism of Vinyl Polymerization. I. Role of Oxygen. C. E. Barnes. J. Amer. chem. Soc., 1945, 67, 217-220.—An explanation is given for the inhibiting action of oxygen on the photopolymerization of vinyl compounds and some additional data are given. Oxygen is shown to exert a similar inhibiting action on thermal polymerization as well, and both these processes are shown to involve peroxide formation in preference to polymerization. E. H. W. 167. Spectroscopic Analysis. Application of the Ultra-Violet Absorption Method to the Analysis of Mixtures Containing Aromatic Hydrocarbons. R. R. Gordon and H. Powell. J. Inst. Petrol., Nov. 1945, 31 (263), 428-449.—The principles, apparatus, and technique involved in the quantitative analysis of 2., 3., and 4-component mixtures of aromatic hydrocarbons by the ultra-violet absorption method are discussed in detail. A method has been evolved which is not dependent on comparison between the unknown mixture and synthetic blends. The mixtures dealt with are: (a) benzenetoluene; (b) the C_8 aromatics ethylbenzene, ortho., meta., and para-xylene; (c) orthoxylene and isopropylbenzene. The accuracy attainable is calculated, and is illustrated by the analysis of a number of synthetic mixtures. The dependence of the error on the composition of the mixture is graphically illustrated, and the maximum possible error in this method of analysis is discussed. A. H. N.

168. Isothermal and Adiabatic Compressibilities of Oil. A. Cameron. J. Inst. Petrol., Nov. 1945, 31 (263), 421-427, 494.—The work published on both the isothermal and adiabatic compressibilities of oils is considered, and average curves are given for both compressibilities over a range of temperatures. The ratio of isothermal to adiabatic compressibility equals gamma the ratio of the specific heats, which is shown to be 1·135 for mineral oils. A. H. N.

169. Alkylation of isoParaffins by Olefines in Presence of Hydrogen Fluoride. C. B. Linn and A. V. Grosse. Ind. Eng. Chem., Oct. 1945, 37 (10), 924-929 .- The advantages of hydrogen fluoride as a catalyst for alkylation are discussed. Alkylation reactions with isoparaffins and olefines have been carried out in the laboratory using apparatus of simple design, by both batch and continuous processes. The experiments involved the paraffins, isobutane, and isopentane, and the olefines propene, isobutene, 1-butene, and 2-butene, as well as the production of an alkylate from a butane-butene mixture. The effects of temperature, contact time, ratio of isoparaffin to olefin, and catalyst concentration in water are described. Normally the fluorine content of the alkylate is low, but can be reduced by certain materials such as calcium fluoride and aluminium fluorides at elevated temperature. The effect on octane number of small concentrations of fluorino (present as tertiary butyl fluoride) on a leaded and unleaded blend of 50% iso-octane and 50% straight-run gasoline is given. The major effect occurs for the leaded fuel, up to about 0.1% fluorine there being a loss of 1 octane number per 0.05% fluorine added. A. W.

170.* On the Problem of Flameless Combustion. G. N. Khudyakov and V. S. Pushkin. Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech., 1945, 545-553.—A study is made of the flameless combustion of natural gas (methane 50%, hydrogen 15%, other hydrocarbons 25%) on the surface of particles of refractory material (chamotte and corundum). A slight excess (1-2%) of air was used. Curves are given relating the thermal potential to the particle size and particle area. Combustion was carried out in water-cooled iron tubes of varying diameter, a minimum value of the latter of 32 mm. was required in order to maintain the process. Examination of the temperature in various zones of the packed tube shows that the maximum temperature is rapidly attained close to the inlet point of the gas mixture; this combustion zone is situated at a height of 45-50 mm from the bottom of the tube. At a height of 70 mm combustion is complete. V. B.

171. Vapour-Liquid Equilibria for Natural Gas-Crude Oil Mixtures. C. H. Roland. Ind. Eng. Chem., Oct. 1945, 37 (10), 930-936.—A consistent set of equilibrium constants and related phase data are presented for a mixture of natural gas and a crude oil for pressures from 1000 to 10,000 psi and at temperatures of $120-200^{\circ}$ F. Data were also obtained for several oil and gas mixtures, and are compared to the data for the fixed-composition mixture. The effect of composition upon the equilibria is noted, and through two experiments in which the composition was varied by removal from the system of a liquid phase at a higher pressure, the effect of a particular composition change is determined. The composition change appears to affect the equilibrium constants. Coloured hydrocarbon fractions were observed in the vapour phase at high pressures. A. W.

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172. Rentwood Products as Inhibitors of Oxidation in Petroleum Hydrocarbons. H. F. Lewis, M. A. Buchanan, D. Fronmuller, and E. F. Kurth. *End. Eng. Chem.*, Oct. 1945, 37 (10), 988-900.—Redwood tannin preparations are shown to be effective inhibitors of the oxidation of mineral oil—for instance, 0-001% of a purified tannin shows an induction period of 11 hr as compared with 7 hr for the same amount of benzyl-p-aminophenol. The active inhibiting principles are present in the ethyl acetate-soluble part of the tannin fraction, and appear to be absent in the ethyl acetate-insoluble part. The ether-soluble tar and the phenol fraction obtained by a vacuum destructive distillation of redwood phlobaphene are both effective inhibitors for mineral oil. Redwoods, on destructive distillation, yield tars differing in composition from the hardwood tars; they are effective inhibitors and there appears to be no advantage in separating the phenolic fractions from them. A. W.

173. Catalytic Cracking of Pure Olefinic Hydrocarbons. B. S. Greensfelder and H. H. Vogo. Ind. Eng. Chem., Oct. 1945, 37 (10), 983–988.—Cracking over a silica-zirconia-alumina catalyst at $350-500^{\circ}$ C of seven aliphatic olefines, two diolefines, two cyclic olefines, and two aromatic olefines was studied. The principal conversions of aliphatic mono-olefines were isomerization, cracking, saturation, and formation of higher-boiling materials and coke. Diolefines and aromatic olefines were extensively saturated and transformed to higher-boiling materials and coke. Catalytic and thermal cracking of olefines at $400-500^{\circ}$ C are compared. The catalysed reactions, which are of the order of 1000-10,000 times as fast, yield larger fragments, involve much more isomerization, and lead to greater saturation of the products. A. W.

174. Solubilities of Some Normal Saturated Aliphatic Hydrocarbons. A. W. Ralston, C. W. Hoerr, and L. T. Crews. J. org. Chem., 1944, 9, 319-328.—The solubilities of octane, dodecane, hexadecane, heptadecane, and dotriacontane have been determined in benzene, cyclohexane, tetrachloromethane, trichloromethane, ethyl ether, ethyl acctate, butyl acctate, acetone, 2-butanone, isopropanol, and n-butanol, eutectics being formed with the first four of these.

In less polar solvents the solubility curves are qualitatively similar to those of polar aliphatic compounds of similar chain-lengths; with solvents more polar than acetone, the solubilities decrease abruptly, the hydrocarbons being practically immiscible with strongly polar solvents such as methanol, ethanol, nitroethane, and acetonitrile. Polar aliphatic compounds are, however, generally miscible with these.

There is a pronounced correlation between hydrocarbon solubility and solvent polarity, and the possibility of molecular association is reviewed. Any deviations from a linear solubility/temperature relationship appear to be due entirely to intermolecular forces between paraffin chains, and to disparity between the polarities of solvents and hydrocarbons. The limited solubilities of the higher aliphatic compounds in highly polar solvents may be due to the difficulty such solvents have in overcoming the mutual attraction of the alkyl chains. C. N. T.

175. Nomographs for Enthalpies of Pure Hydrocarbons and Their Mixtures. E. G. Scheibel and F. J. Jenny. Ind. Eng. Chem., Oct. 1945, 37 (10), 990-995.—Three nomographs present the vapour and liquid enthalpies of individual hydrocarbons and hydrocarbon mixtures. The first gives the enthalpies of normal paraffins from C_4 to C_8 , and from a single setting on the nomograph, the enthalpy can be found for all the liquid components at a given temperature, and for all the components in the vapour at a given temperature and pressure. The second nomograph shows the liquid and vapour enthalpies of light hydrocarbon mixtures based on the average molecular weight of the mixture. The third nomograph gives the liquid and vapour enthalpies of an oil with a characterization factor of 11-8. The last two nomographs are sufficiently accurate for general process calculations.

A. W.

176. Thermal Expansion and Second-Order Transition Effects in High Polymers. Part II. Theory. R. F. Beyer and R. S. Spencer. J. Appl. Phys., Oct. 1945, 16 (10), 594-607.—The nature of the thermal expansion anomaly in high polymers, known as the second-order transition, is examined in some detail. It is suggested that below the transition temperature, Tm, polymer chains can expand sidewards but not parallel to their length. At Tm lengthwise expansion becomes prominent, thus accounting for the sudden increase in thermal expansion. Experimental results are presented showing the anisotropic expansion of oriented polymers below Tm. The transition effect is then treated as a problem in viscous flow, which gives rise to various semi-empirical plots connecting Tm with applied forces, plasticizer content, and time effects. The brittle point, T_b , involves highly elastic deformation, and is shown to be a fundamentally different test, although Tm and T_b are sometimes numerically equal. Various factors influencing the brittle point are briefly A. H. N.

177. Molecular Weight Studies on High Polymers with the Electron Microscope. R. F. Boyer and R. D. Heidcarcich. J. Appl. Phys., Oct. 1945, 16 (10), 621-639. Some preliminary results are reported on measurements of molecular-weight distributions for polychlorostyrene. The following technique of isolating single polymer molecules is used : a precipitating agent, such as propanol, is added to a very dilute (1 ppm) solution of the polymer in benzene, presumably causing the molecules to coil up. Drops of this mixture are evaported on a silica screen and examined in the microscope. Circular particles ranging in diameter from 15A to 500A, and believed to represent single polymer molecules, have been obtained on various polymers. The relationship between measures particle diameter and molecular weight is reviewed in some detail. The data appear to favour the concept of a random coil to the extent that particle diameter varies as the square root of the molecular weight. The molecular-weight distribution curves obtained are of the expected shape and extent, although the average molecular weights computed from the distribution curves are 4-5 times greater than values measured by an independent method. Finally, the rôle of electrical charges in stabilizing isolated polymer molecules is discussed.

A. H. N.

178. Diethylstilbestrol and Related Compounds. M. Rubin, A. Kozlowski, and M. R. Salmon. J. Amer. chem. Soc., 1945, 67, 192-193.—The synthesis is described of diethylstilbestrol and diethylstilbestrol monoethylether. E. H. W.

179. Trans-2-Butene. The Heat Capacity, Heats of Fusion and Vapourization and Vapour Pressure. The Entropy and Barrier to Internal Rotation. L. Guttman and K. S. Pitzer. J. Amer. chem. Soc., 1945, 67, 324-327.—It is shown that the potential barrier to methyl group rotation is around 2000 cal. per mole for both trans-2-butene and propylene. Heat capacities for solid and liquid trans-2-butene are reported from 15° to 270° K. and vapour pressures from 200° to 274° K. The melting point, heat of fusion, heat of vapourization, and the entropy of ideal gas at the boiling point are also reported. E. H. W.

180. Structure of Spiropentane. J. Donohue, G. L. Humphrey, and Y. Schomaker. J. Amer. chem. Soc., 1945, 67, 332-335.—From the results of an electron diffraction investigation, the C_5H_8 hydrocarbon prepared by Murray and Stevenson is confirmed to have the spiropentane structure assigned to it by these workers on the basis of the Raman spectrum. The dimensions for the molecule are given. E. H. W.

181. Racemization, Alkylsulphuric Acid Formation, and Exchange in the Reaction between Acid- d_2 and Optically Active 2-Butanol. R. L. Burwell, Jr. J. Amer. chem. Soc., 1945, 67, 220-223.—Following previous work on the racemization of s-butyl alcohol by sulphuric acid, evidence is now presented showing that a hydrogen exchange reaction accompanics the racemization when sulphuric acid- d_2 is used. The interrelations of these and other reactions taking place at the same time are considered. E. H. W.

182. Vapour Pressures of cis- and trans-Decahydronaphthalene. W. F. Seyer and C. W. Mann. J. Amer. chem. Soc., 1945, 67, 328-329.—The vapour pressures of cisand trans-decahydronaphthalene are reported over a range of temperature of -30° to 223° C. The critical temperatures, latent heats, and Trouton constant are calculated from the data. E. H. W.

183. New Syntheses of Picene. M. S. Newman. J. org. Chem., 1944, 9, 518-528.— Syntheses of picene, by two closely related methods, and also of 5-methylpicene, 13-methylpicene, and 13-picenol, together with the necessary intermediates, are described in detail.

Many earlier syntheses involved aluminium chloride catalysed intramolecular cyclizations, resulting in poor yields; in the case of methylated products also, the positions of these substituents were rather doubtful, owing to the known lability of alkyl groups in Friedel-Crafts condensations. Methods closely related to previously developed chrysene syntheses (M. S. Newman, J. Amer. Chem. Soc., 1938, **60**, 2947-51; 1940, **62**, 870-4, 2295-300) are used, and are generally applicable for mono- or polysubstituted picenes, and lead undeniably to the expected products. C. N. T.

184. Dichlorodiphenyltrichloroethane. I. Solubility in Various Solvents. F. A. Gunther, J. Amer. chem. Soc., 1945, 67, 189–190.—The weight per cent solubility of dichlorodiphenyltrichloroothane (D.D.T.) has been determined for the following purified solvents: acetone, benzene, carbon tetrachloride, chloroform, ether, 95% ethanol and petroleum ether ($30-60^\circ$), for the temperature range $0-48^\circ$ C. Approximate data was also obtained for the solubility of D.D.T. in dioxane and pyridine. It is concluded that from the solvents examined benzene is the most efficient for the removal or "stripping" of D.D.T. at room temperature. E. H. W.

185. Corrosion of Lead by Oxidising Agents and Lauric Acid in Hydrocarbon Solvents. C. F. Prutton, D. Turnbull, and D. R. Frey. Ind. Eng. Chem., Oct. 1945, 37 (10), 917-924.—Rates of corrosion of pure lead by representative organic peroxides in hydrocarbon media containing organic acids are compared. Organic oxidizing agents other than peroxides or oxygen may be effective in causing corrosion of lead in these media; oxy-nitrogen compounds, quinones, and diacetyl are agents of this type. For hydroperoxides and oxygen it is likely that lead hydroxide or lead oxide is intermediate in the corrosion process. For other types of peroxides and non-peroxidic oxidizing agents the ovidence indicates that there is no metal oxide or hydroxide intermediate in the process. Reactivity of oxidizing agents towards lead are compared at a constant acid concentration. To evaluate the effective corrosivity of an oil, it is necessary to consider the thermal stability of the oxidizing agent as well as its chomical reactivity. Evidence is cited to show that oxy-nitrogen compounds, as well as peroxides and oxygen, may be among the oxidizing agents present in oils.

A. W.

186. Preparation of Alkyl-lead Salts. G. Calingaert, F. J. Dykstra, and H. Shapiro. J. Amer. chem. Soc., 1945, 67, 190-192.—Improved methods for the preparation of some alkyl-lead salts have been developed, and the following new salts were prepared: diethyl-lead dihydroxide, diethyl-lead carbonate, triethyl-lead bicarbonate, and trimethyl-lead acetate. E. H. W.

Analysis and Testing.

187. Determination of Metals in Lubricating Oils. L. Lykken, K. R. Fitzsimmons, S. A. Tibbetts, and G. Wyld. Refiner, Oct. 1945, 24 (10), 405-414.—Paper Presented before the Petroleum Division of the American Chemical Society. Detailed procedures are given for the determination of lead, copper, cadmium, barium, tin, silica, zine, iron, aluminium, calcium, magnesium, and alkali metals in new or used lubricating oils without interference from other elements, such as sulphur, phosphorus, and chlorine. In the general procedure for all elements except lead the oil is ashed by ignition in air; the ash is treated with acid and copper. Cadmium, tin, silica, and barium are obtained in the residue after adding hydrogen sulphide and sulphate ion. Iron, aluminium, and zine are separated from the remaining ions as hydroxyquinolates. For the principal metals the general method is accurate to $\pm 5\%$ of the amount present. In the singlified, direct method the oil is oxidized with nitric and sulphuric acids, and the lead is determined as lead sulphate after removing interfering elements; iron and copper are determined colorimetrically either on the ash or on the residue obtained after oxidation with nitric and sulphuric acids. The direct method is accurate to $\pm 0.01\%$ lead and $\pm 0.001\%$ iron and copper, regardless of the other elements present. Data are given on the application of the method to synthetic oil samples and inorganic solutions. A. H. N.

188. Determination of Small Amounts of Sulphur in Naphthalene. J. A. Hinckley, Jnr, M. C. Wilson, H. McKnight, and B. B. Corson. Ind. Eng. Chem. (Anal.), Oct. 1945, 17 (10), 642-646).—A method, described for the determination of sulphur in naphthalene, is applicable to the sulphur range of 0.002-2%. The method involves combustion in a current of purified air and the turbidimetric determination of sulphur as barium sulphate. It is applicable not only to naphthalene, but to other high-boiling organic materials. Figures are given for the absolute error which approaches 40%in the range 0.002% sulphur content. A. W.

189. Low-Temperature Viscometer. Y. A. Pinkevich. Petrolcum, Nov. 1945, 8 (11), 214.—Based on the Ubbelohde-Holde method, an apparatus has been devised for the determination of viscosities of oils at temperatures down to -50° C. The viscometer is of the U-tube pattern, the oil under test being filled into the apparatus to the appropriate marks, and then a determined amount of dyed alcohol poured on top of the oil. The apparatus is placed in a thermostat and connected to a source of pressure; the time of flow of the alcohol into a bulb and out again on release of the pressure is noted.

The absolute viscosity η is calculated from the usual expression $\eta = cPt$, where P is the pressure in mm of mercury, t is the mean time of flow in seconds, and c is the constant for the viscometer. Experimented work has shown that neither alcohol nor gasoline mix with the oil under the test conditions. It is claimed that the accuracy of the method attains 0.5%. The method may also be applied to the determination of the absolute viscosity of opaque petroelum products at higher temperatures using a higher alcohol. G. A. C.

190. Petroleum-Oil-Spray Deposits on Citrus Leaves. J. B. Redd. Ind. Eng. Chem. (Anal.), Oct. 1945, 17, (10), 621-623.—A method is presented for the determination of the amount of oil deposited by oil sprays on eitrus leaves and the amount retained after a period of several weeks. Errors due to the extraction of variable amounts of plant waxes are largely overcome by sulphonation of the petroleum ether extract. The petroleum ether containing the unreacted oil is separated and this oil weighed after evaporating the ether. A. W.

Engine Fuels.

191. Determination of Cetane Value from Average Boiling Point and Specific Gravity. G. Vorberg. Refiner, Oct. 1945, 24 (10), 394-396. (Translated by E. J. Barth from Ocl u. Kohle, 1943, 39, 847-850.)-A simplified procedure has been developed to determine cetane numbers of diesel fuel oils based on the simple procedure of determining the density and boiling point of the fuel, and by the use of tables which have been empirically developed from engine-test data. The fundamentals of the method were originally worked out by Heinze and Marder; this work led Marder to develop and devise the gravity method known by his name. The procedure outlined in this report will give the cetane number which is comparable to values obtained by the engine method. The specific-gravity method of Marder furnishes cetane numbers which were checked and based on the throttle method of engine-test procedure. The procedure is applicable to all sundry fuel oils of diverse origins except for those which contain antiknock additives; the latter type are not commonly found in the market today. The advantage of the procedure is its simplicity, its good agreement with the results of the motor-test method for determining cetane numbers by the ignition method. A. H. N.

192. Slow-Motion Pictures Throw New Light on the Cause of Knock in Fuel Combustion Camera Developed by N.A.C.A. Engineer Photographs Burning of Fuel in Engine Cylinders at the Rate of 40,000 Frames a Second. Aids Knock Study. Anon. Nat. Petrol. News Tech. Sect., 3.10.45, 37 (40), R773.—An important contribution to the study of combustion in i.e. engines has been made, and was the subject of a paper presented at the Cleveland S.A.E. by C. D. Miller on 17th May on "Slow Motion Study of Injection and Combustion in a Diesel Engine." Since 1936 he has developed a camera which will record 40,000 pictures per second, and which since 1938 has been used almost exclusively in the study of spark-ignition engine knock in the war-time projects of the National Advisory Committee for Aeronautics. The apparatus and procedure are briefly described. Normally cinematograph films are recorded and screened at the rate of 16-24 pictures per second; the high-speed recordings are projected at a rate 2500 times slower than the actual duration of the combustion reaction-i.e., 16 pictures per second, which is 1 in per second as the apparent average speed of the spray tip scaled to the actual combustion-chamber dimensions, in comparison with the actual speed of the injection spray tip, found in some of the studies to be 210 ft/sec. Injection and combustion of fuel in a diesel engine are shown in a series of 198 photographs taken in 0-005 sec, which shows the beginning of injection in the second picture and the commencement of combustion in the 104th and the combustion peak at the 198th exposure. In the original negative the beginning of combustion is first apparent in the 99th picture. Still higher speed will be needed to complete the knowledge. The multiple and single orifice nozzles used are shown by dimensional diagrams. The author's summary is as follows :--

"The high-speed photographs demonstrate the better fuel distribution by the multiple-orifice nozzle as compared with the single-orifice nozzle on the basis of actual comparative combustion. They illustrate how diesel knock associated with short inflammation time develops with increasing injection advance angle. They show the increasing ignition lag and consequent increased vaporization with increasing injection-advance angle, and also the increased smoke formation with large injectionadvance angles. The rare occurrence of a phenomenon probably identical with spark-ignition engine knock has been demonstrated in the diesel engine. Finally it has been demonstrated how mixtures too lean for combustion may be formed by early injection with very small fuel quantities, whereas the same mixtures will burn with later injection because of the concentration of the fuel in droplets."

W. H. C.

193. Chemical Composition and Road Antiknock Performance of Postwar Motor Fuels. Jane F. Jordan. Nat. Petrol. News Tech. Sect., 3.10.45, 37 (40), R777 .- The extensive advances in the production of gasoline blending components during the war has given refiners wide choice of materials for improving peace-time motor fuels. This paper reviews the opportunities for such, and also the C.F.R. research and A.S.T.M. motor methods, the latter being designed to correlate with the C.R.F. Uniontown road method. For blending motor fuels to fit engine requirements the Borderline antiknock test method is eminently suitable, as it indicates the actual road antiknock performance of a gasoline by means of a curve which shows the ability of a fuel to tolerate spark advances throughout the entire engine-speed range. The borderline method, procedure, and the equipment necessary for a test car are briefly described, and anti-knock tests have been made on various saturated and unsaturated gasolines, without and with T.E.L. additions, and with various blending components, etc., without and with various additions of T.E.L. The results are shown on twelve charts, the borderline curves representing spark advance (vertical axis) and the "engine-die-out speed" (horizontal axis) with the distributor spark advance curve superimposed. The results of the tests are fully discussed in relation to fundamental variations in fuel types; sonsitivity as a criterion of fuel quality; the effect of type of light blending components; effect of olefins in the higher boiling range. In general, improvements can be made in average fuels by altering their composition so that they approach the type of fuel whose borderline pattern parallels the distributor spark advance curve of the average motor engine : (1) by substituting a small amount of high-boiling paraffinic, naphthenic, or aromatic material for the high-boiling olefinic hydrocarbons normally contained in highly cracked fuel; (2) by adding light olefinic or aromatic material to a straight-run fuel; (3) by blending refinery stocks with due consideration to the effect of such blending on the road lead susceptibility of the fuel throughout the speed range, so that the maximum advantage is obtained from the lead additions; (4) by using light olefinic material rather than light parafinic material to adjust volatility.

An attempt has been made to show the greater meaning of the actual road anti-

knock performance of motor fuels over their indicated laboratory values. Greater awareness of the implications of the newer refining methods for improving anti-knock characteristics will permit the selection of new equipment which will complement existing plant facilities. W. H. C.

Lubricants.

194. Sulphonic Derivatives as Lubricating Additives. G. G. Pretzker. Nat. Petrol. News Tech. Sect., 3.10.45, 37 (40), R.793.—One hundred U.S. patents from 1927 to 1943 are surveyed, including 16 for 1944 and 7 for the year 1945. Sulphonates from acid refining of petroleum distillates, obtained either from the treated oils or the acid sludge, are widely used as additives for lubricating oils. In this survey the dopes are divided into three groups: (1) as the sole additive; (2) in combination with other additives forming a reaction product or co-acting with other additives to produce a more potent oil additive; (3) acting in a subordinal manner to the chief additive as emulsifiers, non-jelling or detergent agents.

The survey outlines various patents giving the source and type of the dope, and, where specified, its manufacture and the formula of the doped lubricant.

Recent 1944-45 patents include: Group I. Waugh (U.S.P. 2,342,027) specifies salts of esters of sulphocarboxylic acids—e.g., calcium salts of dioctyl esters of sulphosuccinic acid for corrosion inhibition. Highee (U.S.P. 2,361,476) describes the method of producing calcium sulphonates from petroleum sulphonic acids for use as engine dopes. Morgan (U.S.P. 2,355,994) obtained an improved oil emulsion additive by chlorinating Duvall crude oil with a catalyst containing an organic halide, and treating the intermediate product with chlorosulphonic acid and neutralizing with an alkali.

Group II. Reudrich (U.S.P. 2,367,435) found that marked improvement of sulphonates could be obtained by oxidizing the sulphonated product with KMnO₄, which removed corrosive materials. Mixon (U.S.P. 2,367,469) obtained dopes which prevented corrosion, ring-sticking, wear, sludge, and varnish in gasoline and diesel engines, by reacting polymers with chlorsulphonic-acid and neutralizing and reacting the product with sulphur and/or phosphorous-containing products such as S_2Cl_4 , SCl_2 , P_2S_5 , P_4S_7 , PCl_3 , PCl_5 , and P_2O_5 .

Group III. Svenson (U.S.P. 2,349,058) found a complex soap of Pb and metal of the alkali and alkaline-earth group with a mahogany sulphonate or naphthanate of Na, K, Ba, Al, Fe, or Pb to solubilize the former, gave an improved E.P. additive; Van Ess (U.S.P. 2,352,669) states that thioallophanates and allophanates act as carbon softeners in lubricants susceptible to such formation, and salts of Mg, Ca, Sr, Ba, Zn, Cd, Al, Sn, Pb, Bi, Cr, Mn, Co, Ni, and organic amines of petroleum sulphonates, when added to the former, act as detergents; Lincoln (U.S.P. 2,353,170) shows that benzene and naphthalene sulphonic acids impart E.P. properties and reduce wear in lubricating oils; to solubilize E.P. agents of the dithiophosphate type—c.g., barium dilauryl dithiophosphates in lubricating oils, Cook (U.S.P. 2,369,132) uses petroleum sulphonate, esters of sulphophthalic acid, lauryl sulphonated esters of sulphonyl sulphonate, esters of sulphophthalic acid, lauryl sulphonated esters of sulphonyl acids; Van Ess (U.S.P. 2,372,411) discloses that petroleum sulphonates improve lubricants of the first petroleum sulphonate improve sulphonate improve the sulphonate acids improved to the sulphonate improved to the sulphonate improve the sulphonate sulphonate improved the sulphonate improved the sulphonate improved to the sulphonate containing as the chief improving agent zinc dissopropyl salicylate.

W. H. C.

195. Carbide's New Non-Petroleum Motor Oil on Sale in Two States Experimentally. V. B. Guthrie. Nat. Petrol. News, 37 (42), 10.—Carbide and Carbon Chemicals Corpn have announced the commercial production of new type lubricating oils from nonpetroleum sources, which are wax free and can be produced to any viscosity. Pour points range from -70° F to -80° F, and flash-points are above 300° F. They have a density about that of water, give carbon residue values of less than 0.01%, and have viscosity indices of 140–160. They are characterized by low changes of viscosity with temperature. The particular advantages claimed are practical elimination of sludge and varnish formation in the engine and case of starting in cold weather. Wear is in line with that experienced with ordinary mineral oils. The products (now marketed as Prestone) have been extensively used for military purposes, and have been exhaustively tested in internal-combustion engines. Details of the process by which the oil is made have not been disclosed, but the raw material is known to be natural or refinery gas. C. L. G.

196. Oxalic Acid in Oils. Anon. Chem. Tr. J., 28.12.45, 117 (3058), 746.—An article by S. S. Bhatnagar and K. G. Krishnamurthi in the Oct. issue of the Journal of Scientific and Industrial Research of New Delhi describes recent research work on the incorporation of up to 0.05% of oxalic acid or ethyl oxalate in blends of mineral and vegetable oils used as lubricants (Ref. Indian Pat. 29,408 of 1943). It is pointed out that additives for restricting or inhibiting oxidation changes in vegetable oils consist of: (1) hydroxy compounds (phenolic derivatives, naphthols, etc.); (2) nitrogen compounds (naphthylamines and aniline derivatives); or (3) certain halogen, sulphur, and phosphorous compounds. Most of these have two effects on the lubricating oil, decreasing oxidation rate or lengthening the induction period and counteracting the effect of metals which serve as oxidation accelerators. Few, however, have any specific effect on the metal in inhibiting corrosion from free acids or oxidation products from the oil. It has now been found that dibasic dicarboxylic acids have this specific effect, possibly as a result of formation of a protective film of, e.g., oxalate on the metal. In combination with effective anti-oxidants such as a naphthol corrosion of bearings and oxidation of the oil are minimized to a remarkable degree.

C. L. G.

197. Lubricant Developed for Jet-Propulsion Engines. Anon. Oil Gas J., 18.8.45, 44 (15), 106.—Shell Oil Co's Wood River Laboratory have developed a lubricating system for jet-propulsion engines which employs a mist-like spray consisting of 95%chilled compressed air and 5% oil. This is directed on the ball bearings at either end of the engine on which the single longitudinal axle revolves. The air cools the metal, and the oil protects it from foreign matter and rust. The spray is finally exhausted into the jet.

The lubrication problems of jet-propulsion engines are compared with those of the conventional internal-combustion aircraft engine, and the properties of the ideal jet-engine lubricant are discussed. T. M. B. M.

198. Identification of Type and Classification of Lubricating Greases By Visual and Photographic Means. A. E. Hickel. *Refiner*, Oct. 1945, 24 (10), 397-399.—A new empirical test is described for identifying the type of soap in grease by means of the pattern the grease leaves on breaking between two discs. The pattern may be either visually examined or photographed. A. H. N.

Asphalt, Bitumen and Tar.

199. Flow Test for Asphaltic Bitumens. Anon. J. Inst. Petrol., Nov. 1945, 31 (263), 450-451.—The sample is put in a special hollow L-shaped mould, and the extent to which it flows under standard conditions is measured. A. H. N.

200. Use of Mechanical Tests in the Design of Bituminous Road-Surfacing Mixtures. Part I. Dense Tar Surfacings. A. R. Lee and P. J. Rigden. J. Soc. chem. Ind., 1945, 64, 153-161.—The term "dense tar surfacing" is used to denote a material containing stone, sand, filler, and a tar binder, the mixture having to be spread hot and consolidated with a roller. The paper describes how the results of investigations of mechanical properties of laboratory-made specimens of surfacing material may be used for deciding the proportions of the four constituents to give a satisfactory mixture for use on the road. Resistance to deformation is important and a simple tensile strength method of test has been standardized. It is shown that for given constituents, formula or a series of graphs may be used to determine the optimum mixture. Specifications of the materials are given and procedure for mixing and laying. The resistance to skidding of these surfacings is generally good.

F. J. W.

201. Manufacture and Laying of Dense Tar Surfacings. H. G. Barnes and G. H. Fuidge. J. Soc. chem. Ind., 1945, 64, 271-274.—This paper is complementary to the one above, and is a review of the practical results achieved with experimental dense tar surfacings having compositions decided largely by the method of Lee and Rigden. These were laid on Surrey roads carrying considerable Army transport and tanks, and although present experience is over a comparatively short period of time, the general conclusion is that dense tar surfacings can form a satisfactory road surface capable of carrying very heavy traffic. The surfacings designed by the theoretical method were found in practice to have maximum wearing qualities. F. J. W.

202. Bitumen and the Bitumen Industry. 5 (1) Industrial Applications of Asphaltic Bitumen. J. S. Jackson. *Petroleum*, Nov. 1945, 8 (11), 216.—A selective survey is given of the many industrial applications of bitumen as distinct from use in road construction. In the specialized process for the manufacture of roofing felt, bitumen bitumen, then through heated press rollers to remove excess bitumen, and after cooling a coating of a blown grade of bitumen is applied to both surfaces, and then dusted with a mineral powder to prevent sticking. After cooling the felt is recled for storage. The properties of the coating material are important, climatic conditions in country of use influencing choice of impregnant, for example the saturating and coating media should be compatible to avoid separation.

Bitumen is also used in the manufacture of floorcloth, and in bitumenized paper products for the packing trade. Double kraft paper consists of two sheets of brown paper cemented together with a thin layer of suitable bitumen, and is water-proof and of considerable mechanical strength. Dispersions of bitumen in clay emulsion, as thixotropic pastes containing up to 60% bitumen are used for the manufacture of bituminous paper and boards.

As an impregnant for the jute or hessian wrappings of electric cables, and in joint box, trough and sealing compositions bitumen finds use. Blown grades are employed for manufacture of compositions for lining and coating steel pipes, the compositions being chosen as a result of laboratory flow and shatter tests. It has been shown that internal linings do not decrease the carrying capacity of the pipe.

G. A. C.

Special Hydrocarbon Products.

203. Solvents for D.D.T. H. A. Jones, H. J. Fluno, and G. T. McCollough. Soap, Nov. 1945, 21 (11), 110.—The U.S. Bureau of Entomology and Plant Quarantine have determined the solubility of relatively pure D.D.T. at 27-30° C. in a wide range of organic solvents, aliphatic, and aromatic petroleum fractions, coal-tar fractions, pine distillation products, etc. Two methods were used for determing solubility: (1) adding increments of solvent to a given weight of D.D.T. at intervals of time with agitation until complete solution is obtained; and (2) plotting a curve of refractive index of a saturated solution. Physical properties of some useful solvents for D.D.T. are tabulated, and advice given on the selection of the appropriate solvent for different purposes. C. L. G.

204. Insecticide Toxicity Studies. Experimental Results on Comparative Toxicity of Benzene Hexachloride, D.D.T. and Pyrethrum. W. A. Gersdorff and E. R. McGouran. Soap, Nov. 1945, 21 (11), 117.—Tests on the toxicity to houseflies of kerosine solutions of the gamma isomer of benzene hexachloride, the para para isomer of D.D.T. and pyrethrins, have been carried out using the turn-table method. A range of concentrations was tested and the concentrations giving 50% mortality (24 hr kill) were determined graphically. These concentrations were : Benzene hexachloride 0-0888 mg/ml, D.D.T. 0.788 mg/ml and pyrethrins 1-61 mg/ml. The ratios of toxicity of the two former products to pyrethrins at 50% mortality level were thus 18-1 and 2.04 respectively. At these concentrations the knockdown (25 min) given by benzene hexachloride and D.D.T. were very considerably smaller than those given by pyrethrins. C. L. G.

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Derived Chemical Products.

205. Oxidation of Paraffins. Part III. E. Stossel. Oil Gas J., 1.9.45, 44 (17), 69.— Following two previous articles (see abs. Nos. 1387/8) on the preparation of fats and soaps in Germany by oxidation of Fischer-Tropsch slack wax, the industrial application and methods for purification of the crude oxidation products and separation of different classes of these from the mother mass are discussed.

The mass production of fatty acids for the soap industry placed large quantities of by-products on the market, as only the $C_{10}-C_{18}$ fatty acid fraction (60-70% of the total fatty acid yield even when exidation is very carefully controlled) can be used for soap-making.

The acids below C_7 are used in the leather industry in crude form, or may be worked up by methylethyl ketone-benzene extraction, or by distillation to purer products. Acids in the range C_7 - C_9 have proved to be important in the form of their esters as plasticizers for synthetic resins, and their amides find use in the paint industry. Their metallic scaps have found application in the paper industry (aluminium salts) and in grease-making. Not much is known about the utilization of the residue containing acids with more than 18 carbon atoms, except as a raw material for shellac substitutes and as rubber filler. It may be used also after saponification in the production of lubrication greases.

Only about 25-30% of the total crude reaction product consists of fatty acids, the unsaponifiable matter consisting of: (a) unattacked hydrocarbons; and (b) neutral oxidation products, e.g., alcohols, aldehydes, and ketones of the same range as the fatty acids. Separation of (b) from (a) may be effected by selective solvent extraction, distillation, or esterification. Aldehydes can be separated from (b) by formation of their sodium bisulphite compound, and alcohols by esterification (e.g., with phosphorie acid).

The yield of alcohols from the oxidation process can be greatly increased by carrying this out in presence of weak inorganic or organic acids of low molecular weight, such as boric or acetic acids. The resulting esters are separated from the crude reaction product by solvent treatment and purified from fatty acids by: (a) precipitation from the solvent with low boiling petroleum; or (b) saponification and extraction of the soap solution. The crude oxidation product containing the boric acid esters can be used for the preparation of creams, polishing waxes, and wax pencils. Oxidation can also be carried out in presence of boric acid using air laden with acetic acid vapour.

Alcohols and aldehydes were found of value in the perfume industry, as stabilizers, foam-preventing agents, wetting agent manufacture, detergents. The reaction products of alcohols with phosphorus oxychloride are used in the production of extremepressure lubricants. Higher fatty alcohols are in demand because of the detergent properties of their sulphonates and phosphates, and also for the synthesis of waxes.

In the author's opinion it is doubtful whether the Fischer-Tropsch process can compete under normal world market conditions with natural petroleum products, since slack wax became available in Germany only owing to the high production of synthetic gasoline and oils for war purposes. Many of the other available raw materials need refining or solvent treatment before they can be oxidized satisfactorily.

A list of references covering the three articles is included. T. M. B. M.

206. Ethyelne—A Raw Material for the Chemical Industry. R. M. Bridgwater. Petroleum, Nov. 1945, 8 (11), 209.—Ethyleno has a special place in syntheses owing to its simple structure and readiness to react. There are three potential sources, from ethyl alcohol, from coal by carbonization and from refinery gases. Fermentation of molasses provides industrial alcohol, 175,000 tons being produced in 1938, from which 106,000 tons of ethylene could be made. The two carbonization industries of Great Britain yield gas containing from 1 to 2% of ethylene, but the low concentration presents isolation difficulties.

Adsorption, solution, thermal diffusion, and liquefaction are possible methods of separation. Existing standard liquefaction processes are not designed for separation of ethylene, but the Linde-Brown method for the separation of hydrogen from cokeoven gas by liquefaction of all the other constituents yields a first fraction containing 30.6% of ethylene. The liquid mixture could be fractionated to obtain pure ethylene. Refrigeration processes using a Claude-type expansion cylinder or a Kapitza expansion turbine require investigation.

World production of ethyleno in 1942 was 2,000,000 tons from the cracking and reforming processes in the petroleum industry, the ethyleno being separted from the refinery gases by fractionation under pressure. Other methods, such as direct hydration, or treatment with chlorine water, are being investigated, but fiscal arrangements largely influence the possibilities of producing ethylene from petroleum in this country. The main uses and products of ethylene are tabulated. G. A. C.

207. New Synthesis of Acrylic Acid. Anon. Mod. Plastics, Nov. 1945, 23 (3), 102.— A report was presented by Dr. Reppe of the I.G. Farbenind. A.G. at the Plastics Committee Meeting in Frankfurt-am-Main on Dec. 11, 1940, on a new synthesis of acrylic acid from acetylene, carbon monoxide, and water, using nickel carboxyl as the CO carrier. It is assumed that the first reaction is the formation of unstable cyclopropenone, which then combines with compounds containing labile hydrogenations, giving with water acrylic acid, and with alcohols acrylic esters. When nickel carbonyl is used as the CO carrier the presence of halogens or acids is necessary to bind the metal of the carboxyl as a salt. The reaction proceeds violently, but gives practically quantitative yields. The nickel carbonyl can be simply regenerated from the nickel salt by addition of ammonia and treatment of the resulting hexaminonickel-2 chloride with carbon monoxide, yielding the carbonyl and an aqueous solution containing ammonium chloride and ammonium carbonate, the anmonia of which is regenerated with milk of lime.

The cost of production of acrylic acid and derivatives by this process is relatively low, and a semi-commercial plant at Ludwigshafen produced 30/50 t.p.m. of acrylic ester.

A similar reaction takes place with olefins, the unstable alkyl cyclopropanone splitting in either possible direction to give straight-chain and a-methyl-substituted carboxylic acids (with water) or esters (with alcohols). Yields here are also quantitative, and the possibilities of producing higher fatty acids and esters from olefins are being studied.

A further process—the so-called OXO synthesis of the Ruhrchemie—similarly depends on the splitting of the intermediate *cyclopropane* ring, thus producing from olefins, carbon monoxide, and hydrogen, straight-chain and a-methyl aldehydes, which can be converted into alcohols by hydrogenation.

The new carbonyl reaction is expected to play an important part in organic synthesis. Interesting possibilities are the production of hydrindone (containing 4 mols. of acetylene and one of carbon monoxide) and the reaction of aldehydes and ketones with acetylene in the presence of metallic carbonyls yielding acids. C. L. G.

208. Hydrogenated Solvents. A. E. Williams. Paint Manufacture. Nov. 1945, 15 (11), 325.—The value of cyclohexanol and of tetrahydronaphthalene to the paint and varnish industry is discussed and small-scale units for their manufacture are described. Hexalin (cyclohexanol) is of particular value as a solvent for synthetic resins, particularly as up to 5% of a diluent can be absorbed. In nitrocellulose lacquers it is used to reduce the viscosity and to prevent blushing, but it is not a direct solvent for the nitrocellulose. It is also a useful homogenizing agent in varnishes and lacquers. Tetralin is not a good solvent for phenol formaldehyde resins in the cold, but dissolves most other synthetic and natural resins, etc. Its high flash point (80° C.) reduces evaporation losses and increases safety, but leads to slow drying in varnishes, etc.

Typical plants are described for the production of hydrogen for the manufacture of these solvents, by the steam-iron and electrolytic methods, and typical batch or continuous hydrogenation units described, with brief indications of optimum processing conditions, precautions necessary, etc. C. L. G.

209. Coal Chemicals in the North-East. Proposals of Northern Industrial Group. Anon. Chem. Tr. J., 14.12.45, 117, 686.—The Coal Processing Industries Panel of the Northern Industrial Group have issued two reports proposing developments in the coal-products industry, which are now under the consideration of the Ministry of Fuel and Power. It is proposed to establish a chemical industry in the North

based on coal and coal-tar products normally exported from this area, with particular respect to the production of raw materials for the plastics industry by further refining of tar distillates. With assistance from the Government, an organization would be set up to develop the extraction of ethylene from coke-oven gas, and to develop the use of the Fischer-Tropsch process, if this is to be used for the production of oil from coal. It is proposed that a plant for phthalic anhydride should be set up in this area, and that the present multiplicity of small-scale tar distilleries should be replaced by largo central plants. The chemical possibilities of anthracene and other highboiling derivatives should be explored. Production by coal power of carbide for organic chemicals would require heavy subsidies. It is pointed out that 1000 million cu ft of coke-oven gas would yield 5000 tons of methane, 700 tons of ethylene, 2300 tons of carbon monoxide and approximately 1200 tons of hydrogen, and the separation of these should be carried out at convenient centres. In this connection reference is made to the Hypersorption process used in the U.S., in which olefines are removed from refinery gas by counter-current contact with activated charcoal, at a processing cost of 4.24 cents per U.S. gal of C3 and C4 olefines recovered in a plant costing \$20,000 and handling 4 million cu ft of refinery gas per diem. C. L. G.

Coal, Shale and Peat.

210. New I.C.I. Works for Tees-side. Heavy Organic Chemicals to be Made. Anon. Chem. Tr. J., 14.12.45, 117, 674.—Imperial Chemical Industries, Ltd., have recently acquired a 3500-acre site near Middlesbrough, and propose to develop this for the large-scale production of heavy organic chemicals from coal and oil, a capital expenditure of £10,000,000 being involved. In addition, it is proposed to construct a sulphuric-acid plant, an electrolytic chlorine-caustic soda plant, and a vacuum salt plant. The site is adjacent to a supply of salt, while cooling water will be available from the Tees estuary. Deep-water docks within a mile of the site are proposed.

C. L. G.

211. Shale Oil Production and Recovery. Anon. World Petrol, Sept. 1945, 16 (10), 80.—The U.S. Burcau of Mines is exploring the deposits of oil shale in the Rocky Mountain region, the greater part being in western Colorado, southwestern Wyoming, and eastern Utah, with an assay value of from 15 to 60 gal of crude oil per ton, amounting to 92 billion brl of recoverable oil. This is sufficient for 50 years—about four times as long as present proved petroleum reserves. A plant to process 200 tons of oil shale per day is to be constructed at Rifle, Colorado, at a cost of \$1,500,000; together with a research laboratory at Laramie, to cost about \$500,000.

The laboratory will develop a commercial process for recovery and refining of the oil from shale, and of by-products.

The Bureau's work is part of a 5-year programme for which \$30,000,000 was authorized.

A new continuous retorting process, employing counter-current flow, has been developed by the Socony-Vacuum Oil Co., and placed at the Bureau's disposal. The crushed shale is passed down a tower, counter-current to a stream of heating gases which raises the temperature to 1000° F. Vapours are taken off at top of tower and condensed. Mining and crushing will cost \$2.20 per ton, and experimental yields were from 17 to 40 gal/ton, the crude shale oil being very waxy, highly unsaturated, with high sulphur and nitrogen content. G. A. C.

Miscellaneous Products.

212. Polyvinylpyrrolidone. Anon. Mod. Plastics, Nov. 1945, 23 (3), 157.—At a meeting of the Plastics Committee in Ludwigshafen on November 10, 1943, Dr. Fikentscher and Dr. Herrle of the I.G. Farbenind. A.G. reported on the development of polyvinylpyrrolidone, a soluble plastic used in a 2.5% solution as a blood plasma substitute (Periston) for transfusion. Vinylpyrrolidone is prepared by the Reppe synthesis from acetylene and formaldehyde via butinediol, butanediol, and pyrrolidone. It is readily polymerized with hydrogen peroxide on heating to 110° C, the toxic monomer being removed from the polymer by ether extraction. The conditions

of polymerization and the properties of the product have been studied in detail. The aqueous solution is neutral, stable without refrigeration, and is compatible with all blood groups. Solutions of the polymer are also used as bonding agents, thickeners, and sizing agents (Kollidon). They may be cross linked with diisocyanates to produce water-insoluble polymers. C. L. G.

213. Acetylene Industry in Wartime Germany. R. L. Hasche. Chem. Met. Eng., 1945, 52, 116.—Owing to the lack of petroleum reserves and carbohydrate material, the Germans built up a very large acetylene industry during the war. The gas was prepared from calcium carbide as well as by the electric arc, and was used in the manufacture of butadiene, ethylene, vinyl compounds, monomeric acrylonitrile, as well as other intermediates in the plastic industry. Comprehensive tables show the extent of the acetylene industry in relation to the production of ethylene, solvents, synthetic rubber and fibres, and plastics generally. L. B.

214. Efficacy of D.D.T. in Soap. G. A. Campbell, F. C. Hymas, and T. F. West. Nature, 22.12.45, 156 (3973), 749.—It has been found that fleas and lice on dogs are killed by washing with household soap into which D.D.T. has been milled, and that reinfestation, even when eggs are present, does not occur for up to three months. The amount of D.D.T. deposited on the hair was estimated at 0.05-0.07%, as compared with the concentration on fabrics (0.01%) active against lice. There must therefore be a smilar absorption on the surface of the hair which withstands washing off with the soap. C. L. G.

215. Optical Glass Substitute. Anon. Brit. Plastics, Dec. 1945, 17 (199), 528.—The Polaroid Corpn of Cambridge, Mass., have developed a process for the manufacture of high-precision optical plastic elements, based on moulding in precisely surfaced glass moulds. After baking, the elements require no further treatment, reproducing the glass surface accurately. Two types of polymers have been standardized for this purpose : polycyclohexylmethacrylate, which corresponds optically to erown glass, and polystyrene, which corresponds to flint glass. Lenses made from these materials are more easily scratched than glass, but are lighter, and easy to produce in large quantities. They are stable under extremes of temperature, and are tough and substantially free from colour, haze, and strain. C. L. G.

MISCELLANEOUS.

216. Uses in Petroleum Industry for Uranium Atom. R. E. Fearon. Refiner, Oct. 1945, 24 (10), 401-404.—After discussing the general physics of nuclear fission, the author discusses the use of radioactivity as a chemical tracer in refining and production, in identification of geological samples, in testing pipelines, and in its use to generated chemical reactions. A. H. N.

217. Petroleum vs. Plutonium. C. Goodman. Oil Gas J., 17.10.45, 44 (28), 227.— This article considers the possible effects of atomic energy on the petroleum industry.

A description is given of the fundamental principles underlying the release of energy by nuclear fission, and the meaning of some of the specialized terms used is explained with reference to the periodic table. The four most successful methods of separating the isotopes of uranium (thermal diffusion, gascous diffusion, centrifugal and electro magnetic) are explained, and the mechanism of the preparation of plutonium from uranium by the graphite pile is given.

In order to utilize the heat generated by the graphite pile for industrial purposes, it would be necessary to operate it at temperatures comparable with those of modern steam plants, and the problems inherent in this transition are shown to be very large. It is stated, however, that if developments are allowed to flourish unhampered by military restrictions and Government controls, these problems may be solved in a reasonably short time, and atomic energy may be available within the next decade. Whether atomic power will then be able to compete with petroleum, coal, and water power on an economic basis involves too many unknowns, and allows only speculation, but the answer will probably not be clear-cut.

60 A

Natural uranium and graphite piles are far too bulky to be used in units for mobile power, but the size of the pile might be diminished by using uranium enriched with U235 or to which plutonium has been added. The use of heavy water as a moderator instead of graphite would also allow substantial reduction in size. With decrease in size of power units, competition might begin with petroleum in replacing fuel oil in large sea-going vessels. Refuelling in such cases would be very infrequent, and the fire hazard would be completely absent. The shielding of the radioactive emanation would be a very major problem, and would add considerably to the size and weight of such units. In order to compete seriously with diesel oil and gasoline, atomic engines would havo to be adaptable to trains, planes, commercial vehicles, and motor-cars.

It is pointed out that most of the considerations outlined above have been limited to the production of atomic energy by the nuclear fission of heavy elements. The consolidation of light elements into those of medium weight, however, releases comparable amounts of energy, although such nuclear synthesis have never been attained on a large scale. If future research achieves the production of atomic energy by such a means, many of the above limitations may be removed, and it is probable that the light elements used would be more plentiful than the relatively scarce fissionable uranium and thorium.

It is concluded that petroleum and coal will probably continuo for at least another generation as primary sources of energy, and will generate most of the electricity during the next 50 years. Atomic energy may enter as a competitor, but its most extensive applications will probably be in new fields of human endeavour, such as production of extremely high temperatures and high speeds, production of radioactive substances for industrial and medical purposes, and the treatment of materials by radiation.

The author points out finally that when petroleum reserves are exhausted there will probably be ample atomic energy available, but that before this occurs petroleum will have ceased to be used mainly for fuel, and will have become the main raw material for organic chemicals. T. M. B. M.

218. Postwar Inventories of Crude Oil and Petroleum Products in the United States. A. J. McIntosh. Petrol. Tech., May 1945, 8 (3), A.I.M.M.E. Tech. Pub. No. 1870, 1-13.—Petroleum consumption will undoubtedly decline temporarily after V-J day, and therefore the oil industry is urged to use this period as a favourable time for rebuilding its war-depleted inventories, thereby helping to cushion the effect of this decline on producers and refiners. Higher inventories should be re-established, since recent experiences have indicated that, by and large, the present inventories of crude are too low, even with the tremendous current production available. Analyses of inventories in earlier years indicates that inventory levels could be built up to about 490,000,000 brl by the end of 1947, an increase of about 40,000,000 brl over the stock estimated for the war's end. The dates are taken on the assumption that 1947 will be the first complete post-war year. If at the end of the war the military have some 20,000,000 brl on hand, this inventory will either be re-sold to the industry or certain demands that have been assumed to be met by industry will be supplied out of these military stocks, which would leave about 20,000,000 brl (net) to be built up from current production. For stock rebuilding the industry could use 10,000,000 brl of crude, plus 10,000,000 brl of products. Spread over a year this would mean 55,000 brl/day.

Tables give the average inventories held in a year and the total quantity of goods handled during the year, and indicate how far the inventories should increase in the immediate post-war period. The tables deal with crude, total refined products, gasoline, kcrosine, distillate and residual fuel oils, and other products, for the East Coast, Gulf Coast and Inland Districts, California, and the whole of U.S.A.

G. D. H.

BOOKS RECEIVED.

An Outline of the History of the Academy of Sciences. Technical Sciences. (In Russian.) Moscow-Leningrad: Academy of Sciences of the U.S.S.R., 1945. Pp. 68.

This pamphlet, issued on the occasion of the celebration of the 220th anniversary of the foundation of the Academy of Sciences of the U.S.S.R., gives a brief account of the technological work sponsored by the Academy since its commencement. Most of the space is devoted to work carried out after the Revolution, divided into 13 sections, dealing with various branches of applied science. In the section dealing with combustible minerals a couple of pages are devoted to a listing of some of the work on petroleum technology carried out by Russian scientists working in this field.

Twenty-Five Years of Soviet Technology. (In Russian.) Moscow-Leningrad: Academy of Sciences of the U.S.S.R., 1945. Pp. 208.

This volume consists of a collection of lectures made by various members of the Academy on the occasion of the celebration of the 25th anniversary of the Revolution, in 1942. The book is divided into five main sections, dealing with the following branches of technology : Mechanics, Machine Construction and Automatic Equipment; Energetics (Electricity, Gas and Steam); Metallurgy; Mining and Petroleum Industrics; Transport.

The section dealing with the petroleum industry (23 pp.) is an account of the development of the industry in the period under review, with particular reference to oilfield development and crude-oil production; refining and transport of petroleum are but briefly mentioned.

A.S.T.M. Standards on Petroleum Products and Lubricants. Philadelphia, Pa., 1945. Pp. 530 + x. \$2.75. Obtainable also from The Institute of Petroleum, 14s. 6d. post free.

This latest compilation of A.S.T.M. Standards on Petroleum Products and Lubricants brings together in convenient form over 80 specifications, tests, and definitions that have been standardized through the work of Committee D.2 on Petroleum Products and Lubricants.

In addition to the current report of the committee, there are several appendices covering the following: results of tests on method for estimating maximum pour points of lubricating oils containing pour point depressants, and two proposed methods covering a test for maximum pour point and total olefinic and aromatic hydrocarbons in gasoline.

The specifications cover cut-back asphalts—rapid and medium curing type, emulsified asphalts (five types), petroleum spirits, Stoddard solvent, thermometers, fuel oils, gasoline, etc.

The large number of test methods provide authoritative procedures for determining properties of a wide range of petroleum products, for example, acid heat of gasoline, aniline point, ash content, autogenous ignition temperatures, aromatics, olefins, benzene and *iso*pentane insolubles, crankcase oils, knock characteristics of fuels, specific gravity, colour, distillation, melting point, viscosity-temperature charts (Saybolt and kinematic), etc.

INSTITUTE NOTES.

FEBRUARY, 1946.

CADMAN MEMORIAL LECTURE.

The Institute has been appointed Trustee of a Fund comprised of contributions received from those associated with the Anglo-Iranian Oil Company, Ltd.

The object of the Fund will be to commemorate the work of the late Lord Cadman relating to Petroleum, and the Institute will arrange for a lecture to be delivered so far as is practicable every year, but in no case less than once in every three years.

The First Cadman Memorial Lecture will be delivered by Sir William Fraser, C.B.E., at the Royal Institution, Albemarle Street, London, W.1, on Wednesday, 27th March, 1946, at 5.30 p.m.

Admission will be by ticket only, obtainable from the Secretary of the Institute of Petroleum.

FORTHCOMING MEETINGS.

Wednesday, 13th March, 1946. "The Development of Fluid Catalytic Cracking," by Dr. J. F. Walter.

The meeting will be held at 26 Portland Place, London, W.1., at 5.30 p.m.

STANLOW BRANCH.

Wednesday, 20th March, 1946. "Engine Testing of Lubricating Oils," by C. D. Brewer.

Wednesday, 17th April, 1946. "Design, Erection and Operation of Pilot Plants," by C. Buck, T. Hayes, and R. C. Williams.

The above meetings will be held at the Grosvenor Hotel, Lower Mersey Street, Ellesmere Port, at 7.30 p.m.

ELECTION OF OFFICERS.

The following have been elected Vice-Presidents of the Institute for the Session 1946–1947 :---

G. H. COXON. E. A. EVANS. A. C. HARTLEY, C.B.E. V. C. Illing, M.A., F.R.S. J. S. Jackson, B.Sc., F.R.I.C. J. A. Oriel, M.C., M.A.

ELECTION FOR COUNCIL.

In accordance with the Articles of the Institute, the following members of Council retire at the next Annual General Meeting, but are eligible for re-election :---

E. B. EVANS, Ph.D., M.Sc. C. A. P. SOUTHWELL, M.C., B.Sc. H. C. TETT, B.Sc., D.I.C. A. BEEBY THOMPSON, O.B.E. A WADE, D.Sc. C. W. WOOD, F.R.I.C.

New nominations have also been received in favour of :---

V. BISKE, B.Sc., F.R.I.C. C. CHILVERS, B.Sc., F.R.I.C. H. DE WILDE, M.Sc., M.I.Mech.E. F. L. GARTON, M.A., B.Sc. E. EVANS-JONES, B.Sc., M.I.Mech.E., A.M.I.Mech.E.

E. LEQ. HERBERT, B.Sc., F.R.I.C.

J. E. SOUTHCOMBE, M.Sc.

As there are only seven vacancies on Council, it will be necessary to hold a Ballot in accordance with the By-Laws. Ballot papers will be circulated in the near future.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

The following have applied for admission or transfer to the Institute. In accordance with the By-Laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Membership.

ABLEWHITE, Kenneth, Asst. Exploitation Geologist, Trinidad Leaseholds, Ltd. (H. H. Suter; K. W. Barr).

ANDREW, William, Field Superintendent, Trinidad Leaseholds, Ltd. (F. H. L. Tindall; H. H. Suter).

INSTITUTE NOTES

- BOTTOM, James, Engineer, "Shell" Refining & Marketing Co., Ltd. (J. A. Oriel; E. LeQ. Herbert).
- Le CLAIR, Camille Clare Sprankling, Technical Director, Tecalemit Ltd. (S. J. M. Auld; A. C. Hartley).
- COSTELLOE, Hubert Creagh, Production Engineer, Apex (Trinidad) Oilfields, Ltd. (J. D. Fullerton; A. H. Richard).
- CURLET, Alexander Shearer, Chemist, Trinidad Leaseholds, Ltd. (R. O. Young; H. C. H. Darley).
- FARAG, Wahib, Chemist, Anglo-Egyptian Oilfields Ltd. (H. E. F. Pracy; J. L. Black).
- GRIMSHAW, Albert, Asst. Chemist, Anglo-American Oil Co., Ltd. (F. Tipler; G. M. Davies).
- HALEY, Arthur Harrison, Research Chemist, Trinidad Leaseholds, Ltd. (H. C. H. Darley; H. H. Suter).
- HAQ, A. H. M. Qamrul, Chemist, Attock Oil Co., Ltd.
- JASZUNSKI, Szymon, Process Operating Foreman, Consolidated Oilfields, Ltd. (R. C. H. Cox; S. G. Tidy).
- JENKINS, Norman Marsden, Storage & Export Operator, Anglo-Iranian Oil Co., Ltd., Abadan.
- MORRIS, William Stephen, Electrical Engineer, "Shell" Refining & Marketing Co., Ltd. (J. A. Oriel; E. LeQ. Herbert).
- MORRISON, Joseph Allison, Chief Materials Engineer, "Shell" Refining & Marketing Co., Ltd. (J. A. Oriel; E. LeQ. Herbert).
- NIVEN, Frederick William Archer, Draughtsman, "Shell" Refining & Marketing Co., Ltd. (W. H. Park; Peter Kerr).
- STEET, William Robert, Chemist, W. B. Dick & Co., Ltd. (P. W. L. Gossling; L. F. Moore).
- SUGAR, Henry, Chemist, R.A.O.C., Bombay. (J. L. McKee; G. Peace).
- SULIMIRSKI, Stefan, Engineer, Industrial Department, Polish Army. (W. J. Klimkiewicz; W. J. Piotrowski).
- TOGNI, Philip Ivor, Student, Royal School of Mines. (V. C. Illing).
- WARDEN, Thomas Wilkie Muir, Technical Assistant, Central Mining & Investment Corpn. (V. C. Illing; H. C. W. Johnston).
- WATERS, John Farrell, Technical Assistant, Anglo-Iranian Oil Co., Ltd. (D. Comins; C. A. P. Southwell).
- WETHERELL, Kenneth, Trainee Exploitation Engineer, United British Oilfields of Trinidad, Ltd. (G. F. Hazzard; J. E. Smith).
- WILDE, Marcel Frederick, Chemist & Director, Oiline Refining Co. Ltd. (P. H. Snow; Wm. Blackwell).
- WILKIE, Sydney Kerr, Asst. Petroleum Technologist, Apex (Trinidad) Oilfields Ltd. (A. H. Richard ; H. W. Reid).

Transfers.

- BALDWIN, Alan Henry, Army Officer, R.E.M.E. (T. G. Hunter; A. H. Nissan). (Student to Associate Member).
- De BRUIJN, Jan Antonie, Chief Chemist, Dutch Chinol Ltd. (H. I. Waterman). (Student to Associate Member).
- CAHILL, Patrick, Analytical Chemist, W. J. Bush & Co., Ltd. (E. P. Driscoll; A. R. Stark). (Student to Associate Member).
- EVERIST, Geoffrey Edward, Chemist, Shell-Mex and B.P. Ltd. (A. E. Hope; H. E. Priston). (Associate Member to Member).
- FREWING, Joseph John, Chemist, "Shell" Central Laboratories. (R. I. Lewis; J. S. Jackson). (Student to Member).
- HICKS, Alexander Edward, Assistant Chemist, Anglo-Iranian Oil Co., Ltd. (D. A. Howes; W. A. Partridge). (Student to Associate Member).
- Wood, George Frederick, Research Worker, Birmingham University. (F. H. Garner; A. H. Nissan). (Student to Associate Member).

HONOURS.

Included in the New Year Honours are the following :---

KNIGHTS BACHELOR.

H. B. HEATH EVES (Fellow). Lt.-Col. R.

Lt.-Col. R. A. THOMAS, C.B.E. (Hon. Member).

C.B.E.

Air Commodore R. A. CHISHOLM, D.S.O., D.F.C. (Associate Member).

0.B.E.

L. W. BERRY (Associate Member). C. S. CLEVERLEY (Associate Member). J. E. JENKIN (Fellow).

M.B.E.

J. R. G. BARTER (Fellow).

INSTITUTE APPOINTMENTS.

Mr. Peter Kerr, M.A., B.Sc., F.Inst.Pet., has been appointed Technical Secretary, and Mr. George Sell, F.Inst.Pet., Publications Secretary. Both will commence their new duties on the 1st March, 1946.

LIST OF MEMBERS.

A list of members is now being prepared for early publication and members desiring to make changes are requested to notify the Secretary immediately.

INCORRECT ADDRESSES.

The Secretary would welcome any information regarding the present addresses of any of the members listed below :---

William Allan. Darrel G. F. Bailey. D. E. Bookless. N. M. Brodie. E. C. Brown. J. Chapman Brown. K. Burton. E. B. Chapelle. P. B. Clayton. C. S. Cleverly. F. A. J. Cole. R. F. Connock. S. Crossley. J. C. Daniel. A. K. Davis. R. F. Douglas. R. Dunn. C. H. Edmonds. M. M. Faingar. R. R. Ferner.

David Filitz. A. Frame. A. W. Furniss. P. A. Garrett. V. C. S. Georgescu. H. Gibson. A. J. Goodman. H. A. S. Gothard. Wm. Hawkins: Richard S. H. Hebbard. G. E. Heisch. H. K. Hekmat. W. Helmore. G. O. Higgins. F. J. Hudson. L. J. Huggins. A. G. Hutchison. . R. A. Ijdens. L. J. Jeffreys. W. P. Jones.

INSTITUTE NOTES

W. J. Kemnitzer. J. Khalili. F. G. Lauchner. A. P. Lieser. F. W. Longbottom. I. Lusty. J. F. F. McQueen. Edward T. Marshall. T. F. Mason. R. P. Matthews. Mrs. B. E. Mielnikowa. T. A. Miller. S. Moazami. B. Mostofi. V. Nercessian. W. W. Neville. Stewart Nicol. G. A. O'Neill. Simon Papp. E. Poppy.

C. W. M. Read. L. G. M. Roberts. A. W. Robinson. T. W. S. Robinson. D. A. Shackell. D. L. Ramsay Smith. H. G. Spearpoint. J. Tavana. H. E. Tester. Percy F. Thurlow. P. Tonge. Bernard J. Vavasour. H. C. G. Vincent. J. T. Ward. F. C. Waters. J. G. Whitney. Ing. A. S. Wolfner. Norman E. Wood. P. W. Wright.

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