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OILFIELD EXPLORATION AND EXPLOITATION.

Geology.

1088. Cretaceous Producer in Old Venezuelan Field Reported. Anon. *Oil Wkly*, 28.5.45, **117** (13), 62.—A Cretaceous producer is reported to have been completed in the old Netick field, west of Maracaibo. This formation was encountered at 6470 ft. in deepening an old shallow well. 12 km. north of Netick, the Calentura 2 wildcat is to be drilled to the Cretaceous, following Shell's discovery of a major Cretaceous limestone pay in the Mara district in Shell DM 2. G. D. H.

1089. Shell's Chafurray Test in Llanos may be Abandoned. Anon. *Oil Wkly*, 28.5.45, **117** (13), 62.—The Chafurray test in the llanos of southern Meta, Colombia, has recovered a granite core at 1732 ft., and is expected to be abandoned. G. D. H.

1090. New Field in France being Developed. W. Hill. *Oil Wkly*, 28.5.45, **117** (13), 46.—An oil and gas area is being developed in the Saint Marcet field of Haute Garonne, France. The field was opened in July 1939 as a gas area. Oil and gas are obtained from Cretaceous limestone at a depth of 5000–6000 ft. There are 10 producing wells, the daily production now being estimated at 20 brl. of 31-gravity oil and 8,000,000 cu. ft. of gas. The gas gives 0·8 gal. of distillate/1000 cu. ft. A 6-in. gas line runs to Toulouse, and a 5-in. line is being laid to Tarbes.

The Saint Marcet field is an anticline revealed by outcrops. Geology and geophysics have indicated twelve structures in this area. The Gabian pool, Herault province, gives 4–5 brl./day. Its cumulative production since 1924 is 150,000 brl. The Pechelbronn pool has an annual output of about 70,000 tons, from a depth of 2000 ft.

G. D. H.

1091. Exploration Falling Short of P.A.W. 1945 Programme. L. J. Logan. *Oil Wkly*, 28.5.45, **117** (13).—1349 exploratory wells were completed in U.S.A. during the first four months of 1945, 81 more than in the corresponding period of 1944. Thus exploratory drilling is 6·4% above last year's levels, while all drilling shows a 9% increase.

The deterrents to wildcatting are primarily economic rather than physical. 20% of this year's exploratory wells have been successful against 81·1% for the corresponding period of 1944. Relatively good results have been obtained in finding new gas and distillate as well as oil reserves; and for each of these three types of production there have been relatively better results in finding entirely new fields than in finding new pay horizons within known fields or in extending the productive limits of existing fields.

Among 66 tests that opened new fields or pays or extended fields in April, very few if any were of indicated major importance. The Rangely field of Colorado was extended, as was the Elk Basin field of Wyoming. New pay horizons were proved in the Egan, West Tepetate, Ve[illegible]e, and St. Martinville fields of South Louisiana. Kansas yielded new oil and gas reserves in 10 areas. Oklahoma had several fairly promising strikes, including a gas-distillate well in Grady County, at a depth of 10,879–10,882 ft. California had a new pay at Newhall-Potrero, and extensions in two other fields.

Tables summarize the exploratory drilling results in January–April 1945, and analyse the results by States and districts for April and the first four months of 1945. The new oil- and gas-fields, and new pay horizons discovered in U.S.A. in April 1945 are listed with details. G. D. H.

Geophysical and Geochemical Prospecting.

1092. Radio-activity Well-logging. R. E. Fearon. *Oil Wkly*, 4.6.45, **118** (1), 33; 11.6.45, **118** (2), 38.—*Gamma-ray Measurements.*—Radioactivity is essentially a property of the atomic nucleus, which exhibits instability and ejects an electron or a helium nucleus, thereby becoming a different element. The helium nuclei give the so-called alpha rays, and the electrons the beta rays. Thirdly, there are gamma rays, which are of the X-ray type, but more penetrative.

There are numerous radioactive elements in the earth, and differences in the gamma rays are to be expected, so producing a gamma-ray spectrum.

Uranium, thorium, and potassium are the only radioactive elements sufficiently stable to exist in quantities through geological time, and each is effectively a group of elements which are derived successively from the first member. Potassium emits a single kind of gamma radiation, which is of about the same penetrative power as the mixture of radiations from the uranium group. The thorium-gamma radiations have more penetrative components.

Gamma radiations make many gaseous substances electrically conducting, and this property is used in their detection. An ionization chamber is used which contains an inert gas under pressure. The current from this chamber is amplified. In some cases two detectors are used which are sensitive to different parts of the gamma-ray spectrum.

In well-logging, the gamma-ray intensity is plotted against the depth. Because of the fluctuations in the radiation it is necessary to smooth the output of the measuring system, otherwise the curve recorded at the surface would be too erratic. This smoothing process reduces the peaks of the log for some of the thinner radioactive strata if the logging speed (rate of raising the ionisation chamber) is too high. High speed also displaces the peaks, due to lag introduced in the smoothing.

Some radioactive material may be transported in circulating fluid. The effective zone of investigation is in the neighbourhood of the well, and immediately behind any casing which may be present.

Present indications are that there is no direct relationship between the variations in radioactivity and the presence of liquid petroleum. The radiations are, however, useful in studying the rock components of the formation, and so aid in geological correlation.

Neutron Bombardment of Formations.—In this method the rock formations are exposed to a source of primary radiation, and the secondary radiations generated are measured. This method is especially valuable in limestone formations, and in all cases may complement the gamma-ray log.

Neutrons for well logging are obtained by bombarding beryllium with alpha rays from radioactive elements. The fast neutrons strike hydrogen atoms or undergo inelastic collisions with other atoms giving secondary or slow neutrons. The slow neutrons are captured by the nuclei of elements in the rocks, and gamma rays are produced, these being detected as with gamma-ray logging.

In many ways the neutron log is a log of the content of the element hydrogen, whether it be in oil, in brine, in water adsorbed in shale, or chemically combined in some mineral. G. D. H.

Drilling.

1093. Mud Programmes Aid in Economical and Efficient Drilling. R. E. Dansby. *Oil Gas J.*, 9.6.45, **44** (5), 80.—Mud programmes can be divided into two general classifications: first, those for development and workover wells, and, second, those for wildcat wells. In preparing a mud programme for a development well or for a wildcat well it is advisable to include mud characteristics based on a study of the available data for various depths or, preferably, for various geological sections expected, in order that the plan be slightly flexible. It is necessary to allow for a slight fluctuation in the mud characteristics set up for various sections of the hole. As an example, it is usually impossible to keep the density of the mud the same at all times, although this would be necessary for maximum efficiency. It is usually possible to keep mud density within a range of 0·4 lb./gal.—*i.e.*, 0·2 above or 0·2 below the desired density—but in many cases it is possible with very little effort to keep this within $\pm$0·1 lb./gal. range. In making mud programmes, abrupt changes in mud characteristics should never be proposed; for example, if 12-lb./gal. mud is desired at 7000 ft. the mud programme should call for a gradual increase from natural mud of approximately 10–11 lb./gal. between 6000 and 6500 ft., and increased gradually from 11 to 12 lb./gal. between 6500 and 7000 ft. Basing mud density on depth is often misleading, because the well may be running much higher or lower than expected from basic information. Therefore it is necessary in many cases to obtain prompt palaeontological information as the well is drilling in order to correlate the two wells.

In areas where abnormal or subnormal pressures are indicated by some previous drilling experience, much material and time can be saved if the mud programme calls for a mud that will control this abnormal characteristic before the formation is encountered. This is especially true where abnormal-pressure salt-water sands are encountered. Salt water held in the formation does not affect the mud when these formations are penetrated. Mud having a density of 1–1$\frac{1}{2}$ lb./gal. more than is required to balance the formation pressure usually keeps the water in the formation, and the mud is not flocculated. Typical problems are fully worked out. A. H. N.

1094. Drilling-Mud Problems, with Suggested Solutions for Several Types. R. E. Dansby. *Oil Gas J.*, 16.6.45, **44** (6), 135.—In preparing a mud for surface drilling it is important to have a mud with good properties if a good surface-casing cement job is to be obtained. The surface cement job is important for several reasons, but especially because all the flow-out-preventing equipment will have to depend on the

surface pipe if the well tries to blow out. To provide a good surface-drilling mud it is first necessary to obtain an abundant supply of pure water, and second, to use a good bentonite-type clay which will provide the lowest possible density and a good wall-building mud. It is very important to hydrate the clay as much as possible. If steam is available more complete and quicker hydration can be effected by stirring and heating the clay suspension with live steam, but care must be taken not to get the mud too hot if rubber pistons are being used in the mud pumps. Increased temperature apparently disperses clay more completely than can be done in cold water. It should be remembered that in drilling surface formation the mud will not be subjected to the agitation and temperatures that it is in deeper drilling, which assists in dispersing the clay. 9 lb./gal. mud is generally acceptable, but the density should never exceed 9·5 lb./gal., unless surface formations have been charged by previous blow-outs. Since surface formations frequently consist of fresh-water sands, a mud having a density of only 10 lb./gal. is often sufficient to produce lost circulation.

Specific problems of surface sands are discussed, followed by those connected with drilling from the surface pipe to the producing section. The paper ends with a detailed instruction for preparing a low viscosity, low water-loss mud, for drilling the producing section. A. H. N.

1095. Drilling-Mud Problems, with Suggested Solutions for Several Types. R. E. Dansby. *Oil Gas J.*, 23.6.45, **44** (7), 115.—When the problem of gas-cut mud is encountered it is advisable to maintain a low-viscosity and low-gel-strength mud and to raise the mud weight sufficiently to prevent entrance of gas into the hole, agitating the mud and treating it to reduce the gel strength to permit the gas to break out of the mud. . Signs of this condition are usually as follows: (1) Increase of the flow from the well, or in the volume of mud in the pit. (If very large volumes of mud or gas are coming out, it may not be noticed until the mud begins to kick over the blow-out preventer, but this should never happen, because it should have been noted by an increase of the fluid in the pit; (2) On close examination minute gas bubbles which do not break out readily show up in the mud; (3) An odour of gas at the flow line; (4) Uneven flow of mud from well (gas pockets cause mud to flow by heads); (5) Distillate forms emulsion with the mud, and will be shown by ineffectiveness of chemical treatment. Methods of treatment are fully detailed. Contamination with salt, heaving shale, cement, etc., are similarly described, both from the viewpoint of diagnose and treatment. A. H. N.

1096. Mud Pump Manifold Facilitates Drilling. W. A. Sawdon. *Petrol. Engr*, June 1945, **16** (9), 89.—The savings gained through the use of standardised manifolds for mud pumps are discussed; one such manifold unit is described in detail. From the operating standpoint many advantages have been observed by use of the standardised manifold. When a well is being rigged up, the necessary lines to and from the pumps will be laid. Then other lines will be found necessary, and as time goes on conditions may require a complexity of lines that will result in possibly only one man knowing just which lines go where and what valves control certain flows of fluid. In contrast to this, the manifold here shown has been standardised and the same design used on all rigs. Roughnecks, once they learn its operation, can go to any rig and know exactly what to do. The original manifold was stencilled with flow directions, but these were found to be unnecessary after the men became familiar with the manifold.

Photographs illustrate the unit. A. H. N.

1097. Collapse Safety Factors for Tapered Casing Strings. W. O. Clinedinst. *Oil Wkly*, 25.6.45, **116** (3), 50.—Tapered strings are defined as those consisting of two or more weights or grades. Safety factors ranging from $1\frac{1}{8}$ to $1\frac{1}{2}$ based on minimum collapse resistance of casing, or $1\frac{1}{2}$–2 on average, have been used with apparent success for straight strings by casing designers over a period of years. With the advent of the tapered string, consideration has been given to reduction of collapse resistance under biaxial loading encountered at change-over points. Biaxial loading has been allowed for by various means, much as the strain–energy theories of yielding. Consideration should also be given to the fact that a tapered string has more material subjected to the loading permitted by the design safety factor than a straight string.

It seems apparent that the likelihood of failure in a three-section tapered string could be the same as three straight strings having the same safety factors. If this is the case, it would appear that tapered strings should be designed with somewhat higher safety factors than straight strings. Normal law of probability is assumed for the distribution function of casing collapse, and calculations show that the factor of safety for tapered strings should be about 10% higher than for a corresponding straight string. A. H. N.

1098. Casing Design. N. C. Wells. *Petrol. Engr*, June 1945, **16** (9), 140.—The principles of designing casing to withstand collapse, bursting, and tension stresses safely are outlined. A. H. N.

1099. Problems Encountered in Cutting and Fishing Below 13,000 ft. E. H. Short, Jr. *Oil Gas J.*, 30.6.45, **44** (8), 98.—The use of an inside and outside cutter in releasing stuck drill-pipes at a depth of 13,000 ft. is described in some detail. The inside cutting tool is composed of friction blocks that are in constant contact with the inside walls of the fish, slips that expand on a tapered mandrel when released by a rotation, and knives that are forced into the fish through the action of a wedge. This tool is capable of operating at any desired place in the string. With the tool at the depth selected, rotation of the operating pipe causes : (1) the friction-blocks to function by tending to prevent the outer sleeve, which contains the blocks and slips, from turning ; (2) it tends to unscrew the bottom, or nose-piece, which is attached to the stem of the tool. After no more than three or four revolutions of the rotary, the slip and friction block-sleeve is free from the stem, and a downward movement of the operating pipe allows the slips to expand on the tapered mandrel. This action forces the teeth of the slips to bite into the walls of the fish, thereby setting the tool. Cutting operation begins by lowering the operating pipe still further, until the wedge arms force the cutting knives into the walls of the pipe. This is a very delicate operation, and requires gentle application of weight to prevent fracture of the knife-points. After the cutting tool begins to take weight, rotation accomplishes the cut. A. H. N.

1100. Preparing Swamp Locations in Coastal Louisiana. N. Williams. *Oil Gas J.*, 9.6.45, **44** (5), 93.—The short paper discusses some problems raised in swampy locations when drilling is contemplated. Typical of the ingenuity often called for in such instances was that shown by a major company in undertaking a deep wildcat test in one of coastal Louisiana's remote cypress and gum-swamp areas. Densely wooded, and having from up to 4 ft. of water and decayed vegetable refuse overlying a more or less unstable clay bottom with a thick tangle of submerged timber, this swamp presented a number of unusual difficulties and complications in the way of access to and preparations of drilling sites. The way these difficulties were overcome is described.
A. H. N.

1101. Wells Completed in the United States. Anon. *Oil Wkly*, 15.6.45, **118** (2), 93 ; 25.6.45, **118** (3), 73 ; 2.7.45, **118** (4), 61 ; 9.7.45, **118** (5), 63 ; 16.7.45, **118** (6), 77 ; 23.7.45, **118** (7), 69.

	Field			Wildcat.		
Week ended	Oil	Gas	Total	Oil	Gas	Total
16th June, 1945	252	31	404	11	2	86
23rd June, 1945	291	29	424	4	3	81
30th June, 1945	273	53	420	10	2	92
7th July, 1945	268	48	417	4	3	77
14th July, 1945	259	45	397	20	0	90
21st July, 1945	329	39	450	18	3	83

G. D. H.

Production.

1102. Convection Currents in a Porous Medium. C. W. Horton and F. T. Rogers, Jr. *J. Appl. Phys.*, June 1945, **16** (6), 367–370.—The problem is considered of the convection of a fluid through a permeable medium as the result of a vertical temperature-gradient, the medium being in the shape of a flat layer bounded above and below by

perfectly conducting media. It appears that the minimum temperature-gradient for which convection can occur is approximately $4\pi^2 h^2 \mu / kg\rho_0 D^2$, where h^2 is the thermal diffusivity, g is the acceleration of gravity, μ is the viscosity, k is the permeability, α is the coefficient of cubical expansion, ρ_0 is the density at zero temperature, and D is the thickness of the layer; this exceeds the limiting gradient found by Rayleigh for a simple fluid by a factor of $16D^2/27\pi^2 k\rho_0$. A numerical computation of this gradient, based on the data now available, indicates that convection currents should not occur in such a geological formation as the Woodbine sand of East Texas (west of the Mexia Fault zone); in view of the fact, however, that the distribution of N_2Cl in this formation seems to require the existence of convection currents, and in view of the approximations involved in applying the present theory, it seems safe tentatively to conclude that convection currents do exist in this formation, and that the expression given above predicts excessive minimum gradients when applied to such a formation.

A. H. N.

1103. Measurement of Capillary Pressures in Small Core Samples. G. L. Hassler and E. Brunner. *Petrol. Tech.*, March 1945, **8** (2); A.I.M.M.E. Tech. Pub. No. 1817, 1–10.—In studying capillary pressure and the wetting of oilfield rocks the capillary diaphragm method has been used, but its utility is severely limited by the low displacement pressures of reasonably permeable diaphragms. Therefore a centrifuge method has been developed for making this type of study.

The initially saturated core is centrifuged at increasing rates, and the average saturation is measured at each rate with the aid of a stroboscopic device. The theory and calculation procedure are given whereby accelerations and saturation values can be converted into a true curve of capillary pressure *versus* saturation. The relationship between saturation and capillary pressure under decreasing saturation can be quickly determined for small-core samples. The sample is centrifuged alone, in this respect differing from previously described techniques, and thus the whole range of saturations required by the properties of the sample and the radially varying centrifugal force occurs within the sample. Nevertheless the calculation procedure adopted secures correct results from simply obtained values of the average saturation. The technique can be applied with two immiscible liquids, as well as with a gas and a liquid.

G. D. H.

1104. Average Permeabilities of Heterogeneous Oil-Sands. W. T. Cardwell and R. L. Parsons. *Petrol. Tech.*, March 1945, **8** (2); A.I.M.M.E. Tech. Pub. No. 1852, 1–9.—Oil reservoirs have complicated shapes, and non-uniform permeabilities and porosities. In practical applications of the theory of fluid-flow in porous media for predicting reservoir behaviour, it may be useful to apply a single equivalent permeability. This equivalent permeability would give the same flux under the same pressure drop in a segment of the same dimensions as the actual reservoir.

The equivalent permeability of a heterogeneous oil-sand lies between a harmonic volume average and an arithmetic volume average of the actual permeabilities, the volume elements in these averages being weighted according to the inverse squares (or higher powers) of their distances from the well. For practical purposes when the permeability variations away from a well are unknown, it is reasonable to assume that the equivalent permeability of a heterogeneous oil-sand lies between the harmonic depth average and the arithmetic depth average of the core-sample permeabilities. Qualitative reasoning, based on known reservoir characteristics, indicates that the equivalent permeability lies near to the upper, arithmetic, limit than to the lower harmonic, limit.

G. D. H.

1105. Multistage Acidization Increases Recovery and Productivity From Multizone Wells. K. B. Barnes. *Oil Gas J.*, 9.6.45, **44** (5), 99.—Acidizing can pay off handsomely in increasing well productivity and, very often, in obtaining more recovery. This is particularly true in multizone formations. As to the character of limestones and dolomites, the porous make-up is here briefly reviewed, whether foramenular, intermediate, or intergranular. On the practical side, two jobs on Clear Fork wells at Fullerton are described in detail: the first where three zones were acidized, in five stages, with a total of 24,000 gal.; the second, also a multizone producer, with four stages totalling 16,000 gal., by Electric Pilot control.

A. H. N.

1106. Automatic Scrapers Used in West Edmond Oil Wells. K. M. Fagin. *Petrol. Engr*, June 1945, **16** (9), 105–106.—The scraper is designed to fit loosely in the tubing and to weigh enough to drop freely through the fluid when the well is closed in. The largest diameter of the scraper should be an average of the inside and drift diameters of the tubing in which it is to be used. The three washer-shaped fins are slipped on a rod and welded in place. Three angle braces are welded to the top and bottom fins, and four angle braces are welded to the centre fin for reinforcement. A fishing-neck is provided on the upper end of the device to permit removal from the well in case it becomes stuck or the well pressure becomes insufficient to flow it back to the Christmas tree. The fishing-neck on $\frac{5}{8}$-in. rod used for 2-in. tubing scrapers should be upset to $\frac{3}{4}$-in. to insure an adequate grip. Precautions to be taken with the scraper and its method of operation are discussed in some detail. A. H. N.

1107. Salt-Water Disposal in East Texas. Part 9. Anon. *Petrol. Engr*, June 1945, **16** (9), 125.—The chemistry of the closed and open systems of treating salt water before disposal is outlined. The purposes and functions of aeration are given in some detail. A. H. N.

1108. Explosive Mixtures in Air-Drive Operation. R. F. Nielsen and S. T. Yuster. *Petrol. Engr*, June 1945, **16** (9), 96.—The possibility that the gases produced along with the oil in air-drive operations may be within the explosive range is discussed. The method of calculating the explosive range from the chemical analysis is illustrated with three different samples of casinghead gas, one of which was very near the explosive limit. A simple field apparatus, made from easily available materials, for determining the explosive limits is described, and the measured limits are shown to agree reasonably well with the calculated values. A. H. N.

1109. Experimental Water-flood in a California Oilfield. E. C. Babson, J. E. Sherborne, and P. H. Jones. *Petrol. Tech.*, March 1945, **8** (2); A.I.M.M.E. Tech. Pub. No. 1816, 1–9.—Studies of the Chapman zone of the Richfield field, Orange County, California, show that the oil recovery to date is about 19% of the oil in place, and continuation of the present methods of production might be expected to give an ultimate yield of 21–22%. The principal recovery mechanism has apparently been expansion of dissolved gas. Average porosity of the reservoir is about 31%, its air permeability is approximately 1100 md., while the interstitial water content is believed to be 37%.

In order to determine whether water-flooding offers promise of becoming an economical method of recovering some of the large proportion of residual oil believed to be present, an experimental water-flooding operation was instituted. An area was chosen where the wells were approaching an unprofitable rate of production, where natural water encroachment was absent, and where the sand was thin, so as to reduce damage if the experiment failed. A single injection well was drilled between old producing wells, and a water-treating plant using alum flocculation and chlorination was designed and built. This plant is described in some detail.

Water has been injected into the input well for six months at rates in excess of 100 brl./day. Production from one of the neighbouring wells has increased materially, the oil having risen from 7 to 30 brl., and the water from 1 to 40 brl./day. This well has produced nearly 3000 brl. of oil above that which it would normally have produced.

Definite conclusions regarding the economic success of water-flooding in the Chapman zone are not yet justified, but the experiment shows that water can be injected continuously into the zone, and that this water will displace appreciable amounts of oil from the sand. G. D. H.

1110. Turner Valley Field Gets First Gas-Repressuring Programme. J. A. McCutchin. *Oil Gas J.*, 9.6.45, **44** (5), 89.—The British Amercian repressuring and gas-conservation programmes are briefly discussed. A. H. N.

1111. Calculation of Static Pressure Gradients in Gas Wells. M. J. Rzasa and D. L. Katz. *Petrol. Tech.*, March 1945, **8** (2); A.I.M.M.E. Tech. Pub. No. 1814, 1–14.—For many years reservoir pressures have been computed from the well-head pressures of gas-wells. Three methods of computing the static pressure gradients in natural

gas wells are presented in detail to show the assumptions made. A series of charts are developed from which the pressure gradients may be read when the well-head pressure, the well-fluid gravity, depth, and average well temperature are known. There is also a chart for estimating the well-fluid gravity from the condensate content and the separator gas gravity. Examples of the application of the different formulae and charts are given.

During flow the well-bore and surrounding earth gradually increase in temperature over the normal earth temperature gradient. Hence a well which has been flowing prior to measurement of the well-head pressure will have a higher average well temperature than at thermal equilibrium. Therefore further refinements in the computation of pressure gradients in gas-wells that have been flowing just before the measurement of the well-head pressure will involve some allowance for this factor. After a lapse of a day after flow there may still be inaccuracies if no allowance is made for this factor. G. D. H.

Oilfield Development.

1112. Petroleum Engineering Education and the Quantitative Approach. H. H. Power. *Petrol. Tech.*, March 1945, **8** (2), A.I.M.M.E. Tech. Pub. No. 1815, 1–8.—The student in petroleum engineering must have a sound preparation in basic fundamentals. He must be able to analyze his problems quantitatively and recognize separately the various elements involved. He must know what qualities go to make up engineering judgment—that is, skill in reaching the best possible conclusion under the limitations of allotted time and required accuracy. He must appreciate the importance of cost and of practical economics. He must be able to organize his thoughts and to express them clearly in speech and in writing. He must be willing and able to adjust his personality to his environment. Finally, he must have a decided interest in continued professional development, and a sound philosophy of social values. G. D. H.

1113. The Nation's [U.S.A.] Reserves of Natural Gas. E. de Golyer. *Oil Gas J.*, 23.6.45, **44** (7), 76.—In the near future it is likely that 10,000 cu. ft. of gas may be regarded as a potential barrel of gasoline. Hence gas conservation is of immediate importance.

U.S.A. has a proved gas reserve exceeding 140 million million cubic feet, 91% of which is free gas-cap gas. These reserves are at 16·4 lb./sq. in. and 60° F. The reserves are distributed as follows: District 1, 5,000,000 million cu. ft.; District 2, 17,000,000 million cu. ft.; District 3, nearly 104,000,000 million cu. ft.; District 4, 2,000,000 million cu. ft.; District 5, 13,000,000 million cu. ft.

In 1944 the total production of natural gas, including that flared or wasted, was about 4,000,000,000,000 cu. ft.

It is only reasonable to expect that with increasing depth the ratio of gas to oil discovered will increase. Additional gas can be found if there is need for it. Rather than obstruct or aid in the obstruction of the expansion of gas markets, supply, and the finding and developing of additional supplies of natural gas, all federal agencies and all the State regulatory bodies should aid the natural gas producers to get all available natural gas into pipe-lines, so as to increase the natural wealth of the individual States and the nation as a whole. Adequate price is the greatest conserving agent.

Many States permit oil production with gas–oil ratios up to 2000 cu. ft./brl., although cases of fields with more than 1000 cu. ft./brl. dissolved are rare, and the general average is 500–600 cu. ft./brl. There is the erroneous notion that it is not wasteful to burn solution gas, since it has been effective in bringing oil to the surface.

Markets and suitable prices will reduce waste. In California less than 1% of the total gas produced in 1944 was wasted, because the gas sells at 6–12 cents./1000 cu. ft. G. D. H.

1114. Fullerton Pool is Guide-post in Developing Clear Fork and Devonian Reserves. K. B. Barnes. *Oil Gas J.*, 2.6.45, **44** (4), 69.—Clear Fork production was opened at Fullerton in February 1945, and Devonian production in August 1944. To the north Clear Fork production occurs at Lubbock, Lubbock County, Smyer, Hockley County, Russell, Eubock and Wasson, Gaines County, to the south in Ector, Winkler, Ward,

Crane and Pecos Counties. In Andrews County there are the Union (Wichita-Albany) and the Embar (Clear Fork) fields. Devonian production has been found in the TXL pool of Ector County, and between TXL and Fullerton.

Fullerton has about 200 Clear Fork wells. Its reserves are estimated at 250–300 million barrels. The Clear Fork pays occur at 6800–7300 ft. Wells take 40–50 days to drill. Special muds are needed for the Salado salt formation. All but 4 of the wells flow.

Geological, production, and reservoir data are being collected, and are being studied with regard to the possibility of pressure maintenance. Strategically selected wells have been cored.

A 12,500 M. cu. ft./day natural gasoline plant has been built.

Pressure maintenance may increase the recovery to 60 million brl.

Structurally Fullerton is a broad north–south high. The highest and edge wells differ in elevation by 400 ft. in the Clear Fork. The main structure has numerous local highs. Over much of Fullerton there are 3 Clear Fork pay-zones. In the central area the Upper zone totals 70 ft. in thickness; the second zone 10–50 ft. lower is 200 ft. thick at its maximum; the third zone averages 150 ft. in thickness. Most of the top and bottom pay-zones are dolomite. The better pay-sections have permeabilities of 1–10 md., but much of the permeability is under 1 md. The porosity is 8–10%. The middle pay-zone has a porosity of 15% and a higher permeability (generally under 50 md.).

The proved area in the Upper Clear Fork oil-zone may be 30,000 acres. The original bottom-hole pressure was 3000 lb./sq. in. Clear Fork production at the beginning of 1945 totalled 3,233,258 brl. The Devonian had produced 27,785 brl. at the same date.

The wells receive acid treatment which substantially increases the productivity index. G. D. H.

1115. Argentina's Oil Production Registers Slight Drop. Anon. *Oil Gas J.*, 9.6.45, **44** (5), 76.—In 1944 Argentina produced 3,852,088 cu. m. of oil, 96,324 cu. m. less than in 1943. The State fields produced 2,576,369 cu. m. in 1944. It was necessary to import crude and refined oils, and rationing had to be instituted. G. D. H.

1116. First-quarter Oil Output in Bolivia 75,680 Brl. Anon. *Oil Gas J.*, 9.6.45, **44** (5), 76.—Bolivia produced 75,680 brl. of crude in the first quarter of 1945, and 40,985 brl. of oil was processed at Camiri and Sanandita. G. D. H.

1117. Venezuela Production up 36·2 Per Cent. Anon. *Oil Gas J.*, 9.6.45, **44** (5), 76.—In the first quarter of 1945 Venezuela produced an average of 771,252 brl./day, 36·2% more than in the corresponding period of 1944. 50·5% of the oil was provided by Creole.

The country's potential is estimated to be 900,000 brl./day and may be 1,000,000 brl./day at the beginning of 1946. G. D. H.

1118. Cuba's Newest Field Contains 14 Producers. Anon. *Oil Gas J.*, 9.6.45, **44** (5), 76.—The Jarahueca field of Santa Clara Province, Cuba, is currently producing 400–500 brl./day from serpentine at depths ranging down to 1800 ft. The Motembo field is being rapidly depleted. G. D. H.

1119. Ecuador's Crude Output for Quarter 27,393,324 gal. Anon. *Oil Gas J.*, 16.6.45, **44** (6), 98.—In the first quarter of 1945 Ecuador produced 27,393,324 gal. of crude. The figure for the first quarter of 1944 was 26,834,472 gal., and for the last quarter 30,261,084 gal. 618,235,000 cu. ft. of natural gas was processed yielding 403,177 gal. of natural gasoline in the first quarter of 1945. G. D. H.

1120. Valuable East Indian Oilfields Wrested from Japanese Army. Anon. *Oil Gas J.*, 7.7.45, **44** (9), 64.—It is reported that the Japanese had not been able to raise the Borneo oil production to more than 245,000 brl./month, about one-third of the pre-war output, in spite of drilling 200 new wells.

In 1940 Tarakan gave 4,374,000 brl. of crude from 500 wells. The Balikpapan and Samarinda areas yielded 9,476,000 brl. of crude in 1940, from 400 wells, 1500–3300 ft. deep.

There are possibilities of new fields in the Barito estuaries of Dutch Borneo, in the marshy region round Bandjermasin. The Miri fields gave 1,314,000 brl. of oil in 1940, and the Seria field yielded 5,732,559 brl. from wells 1800–6000 ft. deep. There are prospects of new fields at Muka in Sarawak at Labi in central Brunei, and at Lahad Datu and Tawau in British North Borneo, just north of Tarakan. G. D. H.

Transport and Storage.

1121. Experimental Investigation of Turbulence Diffusion—A Factor in Transportation of Sediment in Open-Channel Flow. E. R. Van Driest. *J. Appl. Mech.*, June 1945, **12** (2), A91–A100.—An experiment was conducted for the purpose of measuring certain diffusion properties of water flowing in an open channel. By measuring the displacements of immiscible globules, mean-square deviation data were obtained at various depths for three rates of flow in a smooth channel, and for one rate in an artificially roughened channel, all flows having the same total depth. Theory was reviewed to provide the reader with the necessary background for analysis of the data. It was seen that it was possible to fit either one of two types of curve to the data presented in this paper, one corresponding to a power-correlation law and the other to an exponential-correlation law. Since the two curves differed widely in their characteristics, it was concluded that the experimental data, in spite of the fact that about 400 observations were taken for each mean-square deviation point, were not of sufficient precision to warrant the computation of second derivatives and, consequently, the determination of the shape of the correlation curve. Of the two curves suggested, the one corresponding to the exponential-correlation law is of more interest because of its close conformity to the expected nature of the correlation curve—*i.e.*, at a time interval of zero the value of the correlation coefficient is unity, and at a time interval large compared to T_0 the value of the definite integral of the correlation function approaches a finite quantity. A. H. N.

1122. Operation "Pluto." Anon. *Pet. Times*, 1945, **49**, 433.—By the successful accomplishment of operation " Pluto " (Pipe-Lines Under The Ocean) the 1000-mile pipe-line system in Britain was extended by the laying of some 20 pipe-lines under the English Channel from the Isle of Wight and Dungeness to Cherbourg and Boulogne, respectively. Two types of pipe were laid : (1) the Hais cable, which in construction resembled the submarine electric power cable, but with the core and insulation absent. This had a capacity of 30,000–40,000 gal. per day. First tests were carried out on cables laid across the Bristol Channel, and from the results obtained the diameter of the cable was increased to 3 in. ; (2) The Hamel pipe-line, made up of 20-ft. lengths of 2 in. (later 3 in.) diameter steel pipe, welded together to the required length. The resultant pipe was wound on drums of 30 ft. or more diameter, from which it was unwound relatively straight. First successful pipe-laying trials took place in the Thames Estuary and in the Solent. The construction of the Hais cable and the Hais cable coupling, the manufacture of the Hamel steel pipe, as well as the methods of laying each across the Channel, are described in detail. Reference is made to the personnel and the firms concerned in the project. L. B.

1123. Johnson Coupling. Anon. *Pet. Times*, 1945, **49**, 346.—The construction of the Johnson coupling, some 200,000 of which were used as the pipe-joints in the 1000-mile pipelines for Britain's underground petrol grid, is described with illustrations. Other applications of the coupling are referred to. L. B.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1124. Stresses in a Cylindrical Shell Due to Nozzle or Pipe Connections. G. J. Schoessow and L. F. Kooistra. *J. Appl. Mech.*, June 1945, **12** (2), A107–A112.—Results are reported of a strain-guage test conducted on a 54-in. diam. cylindrical shell to which

was attached two 12-in. diam. pipes. The pipes were subjected to direct axial-tension loading, direct axial-compression loading, and transverse bending moments. This construction simulates the conditions existing in boiler drums, pressure piping, hydraulic penstocks, etc., where pipe connections are subject to forces and moments that develop strains in the shell to which the pipes are attached. Moderate loading applied to the pipes resulted in 20,000-p.s.i. bending stresses in the shell. These stresses are of a magnitude that demands the respect and attention of the designers. By publication of these data the authors hope to stimulate interest in further experimental and analytical investigations of the problem, which will eventually establish a basis for predicting the magnitude of stresses in cylindrical shells. Such data are not now available. A. H. N

1125. Method for Field Lining Vessel Heads with Stainless-Steel Strip. K. E. Luger. *Oil Gas J.*, 12.5.45, **44** (1), 92.—The head and parts of the vessel are lined with a series of short length, narrow-width strips, or parallel-edge strips in herringbone pattern. It is claimed that this method is simple, does not require elaborate detailing in the drafting room, takes less time since small pieces allow fit-up flexibility, avoids waste from scrap, and the same stock is used for lining side walls and heads.

A scale print of the tower showing approximate dimensions of the head is prepared, and from simple formulae the size of wedges is determined. In welding procedure the pieces must not overlap, and a figure is given for sequence for welding the strips in the herringbone pattern. G. A. C.

1126. Heat Transfer Equipment. Principles and Constructional Details of Typical Tubular Units are Reviewed to Aid a Better Understanding of Maintenance and Repair of Exchangers. P. W. Blaylock. *Nat. Petrol. News, Tech. Sect.*, 3.1.45, **37** (1), R.16.—Briefly describes and illustrates various types of heat-transfer equipment used in industry, particularly of shell-and-tube construction with types of floating heads or flexible expansion joints. Their design and construction are discussed, and the accepted codes, specifications, and tolerances are given. Tube lengths, diameters, thicknesses, spacing arrangements, tube-sheet materials, and the tools for, and methods of, expanding the tubes, baffling, gaskets, and bolts and pressure tests are discussed. W. H. C.

1127. Refining Mixtures of Kansas–West Texas Crude Oil Proves Practicable. A. L. Foster and R. B. Tuttle. *Oil Gas J.*, 20.1.45, **43** (37), 58.—A preliminary report is presented of the experience of one refinery which has been processing a corrosive crude mixture for about six months. The mixture is composed of approximately 90% of a Kansas crude and 10% of the Slaughter sour crude of West Texas. The Slaughter crude oil contains 325 lb./1000 brl. of salt, 2·7 lb./1000 brl. free acidity and potential acidity 22·7 lb./1000 brl.; it has a sulphur content of 1·92%. The amount of Slaughter crude used in the mixture is controlled by the following factors: when kerosine is being made conforming to a maximum sulphur content of 0·10%, not more than 10% can be mixed. If kerosine is not being made, it is possible to use up to 15% of the Slaughter crude and obtain a gasoline conforming to specification. With such mixtures maximum corrosion occurs between 650° and 800° F. The mixture of the two crudes is desalted by mixing with 3% of alkaline water and passing it through a heat exchanger to enter the bottom of a tower at 250° F., the mixture flowing out at the top to a settling receiver. This procedure removes 90% of the salt and a large proportion of the H_2S. The desalted mixture is then preheated by passage through an exchanger receiving heat from the vapours from the main cracking units. As corrosion is first encountered here, the exchanger tubes are made of 11–13% Cr, and the shell is lined with the same alloy, strip welded. The stream then flows to a tower for debutanizing, and thence through a vapour heat-exchanger, where it is heated to 600° F. against cracked vapours, before entering the straight-run tower. This vapour heat-exchanger is situated in the upper section of the vapour separator of the large cracking plant, and is equipped with 5% Cr tubes, 7% Cr headers, and 11–13% Cr baffles. The shell side is lined with 11–13 Cr strip. A small amount of lime slurry is injected into the exchanger inlet stream. Corrosion in the straight-run tower is found only at the hot crude inlet, so this section is lined with 11–13% Cr. Admiralty metal tubes are used in the condensers, and water is injected with the vapours

prior to their entering the condensers, to help wash out any H_2S. The gasoline stream is washed with reclaimed caustic alkali before storage. The refinery has facilities for cracking the products of the mixed crudes; they consist of a naphtha reforming unit, a gas-oil cracking unit, and a heavy-oil cracking unit. The three furnaces have tube coils of 4–6% Cr alloy. The duties of each of the two coils in the three furnaces and their hook-up with the three vapour separators are outlined. The naphtha reforming unit employs a fractionator working at 300 p.s.i., the lower half of which is lined with 11–13 Cr strip, and which contains 12 alloy trays. Transfer lines are similarly lined. Corrosion is most serious at the point in the coils where transition between liquid and vapour takes place, the temperature there being 800–850° F. The vapour separator for the gas-oil and heavier oil cracking units are lined at the top similarly to the crude preheater, and the vapours from this separator pass to the crude oil fractionator, the lower half being fitted as described for the naphtha-reformer fractionator. The temperatures of the crude-oil fractionator range from 650° to 400° F. There was no corrosion of the carbon-steel equipment of the vacuum tower in which the heavy bottoms from the cracking units vapour separator are processed at around 700° F. Corrosion-resisting alloys and the method of lining and fitting equipment with them are widely discussed. Sketches show how the liner is welded to steel surfaces and how corrosion-resistant gasket surfaces are provided on flanges. W. H. C.

1128. Four Refiners Join to Convert Common Cracking Plant to War. P. Truesdell and W. E. Lemmen. *Refiner*, June 1945, **24** (6), 237–244.—The conversion of a refinery in Oil City, Pennsylvania, into a 100-octane gasoline plant is described. A. H. N.

1129. Arabian Refinery Unique War-Time Project. Anon. *Oil Gas J.*, 28.7.45, **44** (12), 114.—The Arabian American Oil Co. have built a refinery at Ras Tanura in Saudi Arabia. The plant is of 50,000 brl. daily capacity; principal source of crude the Damman oilfield. Heavy equipment is supported on piles driven into a sandstone stratum. There are two 25,000-brl. crude stills, and straight-run gasoline will be reformed in two thermal reformers. Plant for motor gasoline, diesel, and fuel oils is to be erected. Approximately 4,000,000-brl. of all welded steel storage and working tanks have been installed, and 5 pipe-lines transfer products to the 6-mile-distant terminal. G. A. C.

Distillation.

1130. Tower Temperatures. W. L. Nelson. *Oil Gas J.*, 30.6.45, **44** (8), 129.—Curves are given for flash-vaporization of gasoline, motor naphtha, kerosine, and diesel fuel; and of approximate top and side-draw temperatures in a topping tower computed to cover all usual ranges of pressure, product, steam, and reflux. From these the top and side-draw temperatures can be calculated, two examples being given. G. A. C.

1131. Tower Capacity. W. L. Nelson. *Oil Gas J.*, 14.7.45, **44** (10), 139.—A chart gives the density of vapour in lb./cu. ft. at reflux plate conditions of temperature and pressure, and the distance between plates in inches. From these, rapid estimates of tower diameter or capacity of an existing tower may be made. A short-cut method of estimating these is also given. G. A. C.

Absorption and Adsorption.

1132. Dehydration of Furnace Oil with Activated Alumina. Anon. *Nat. Petrol. News Technical Section*, 3.1.45, **37** (1), R.63.—Activated alumina is exceptionally useful as a dehydrating material, as it is easily regenerated and has high absorptive qualities. The drying system described is composed of two vertical tanks 6 × 2½ ft. connected in parallel, one for use, while the other is under the process of regeneration. Each holds 550 lb. of 4–8-mesh activated alumina, which is sufficient to dry 100,000 gal. of furnace oil, on the basis that this amount is saturated with moisture at 75° F. The rate of flow is normally 750 gal./min. The alumina will absorb 7·4% moisture, by weight, before moisture begins to pass on with the flow. Regenerating methods

are discussed—*e.g.*, the use of hot flue gases or inert gases, methane, or nitrogen—but the method favoured is by heating the charge under a relatively high vacuum, using the available 90 p.s.i. steam for this purpose, through a 200-ft. 1-in. coil situated in the vertical tanks described. The coil is surrounded by the alumina, the heating area being equivalent to 1 sq. ft. per 8 lb. of alumina. Nearly bone-dry furnace oil is obtained. Moisture control is made by the liberation of acetic acid, by the reaction of water in the sample from acetyl chloride in the presence of pyridine, and its titration with standard alkali. W. H. C.

Solvent Refining and Dewaxing.

1133. New Solvent Lubricating Oil Plant Designed for Varying Blends of Crudes. Anon. *Nat. Petrol. News Technical Section*, 3.1.45, **37** (1), R.7.—The destruction by fire two years ago, of the vacuum fractionating unit at the Champlin Refining Co.'s lubricating oil plant, Enid, Okla, lead the management to reconstruct the whole plant on up-to-date lines with doubled capacity. So modernized, the operations consist briefly of the vacuum distillation of topped crudes into gas oil, wax distillate, and bottoms, Duosol solvent extraction of the reduced crudes, and dewaxing. The wax distillate is chilled to −5° F. and dewaxed by filter pressing, the dewaxed filtrate being fractionated to viscosity requirements and given acid and alkali treatments, then percolation through Fuller's earth completes the neutral oils. The reduced crude is charged at the rate of 2850 brl./day to the Duosol plant with Selecto and propane in the ratios of 420% and 350%, respectively, to the charge. The operating conditions of this unit are described. The recovery system had to be specially designed for the broad type of crude (*e.g.*, Mid-Continent) being processed and the product (*e.g.*, bright stock or neutral, finished S.A.E. grades, etc.) produced. The size of equipment installed in this instance might prove inadequate under the requirements for a markedly different type of crude, or in finishing a given product to widely differing specifications.

The raffinate, after passing through the propane tower, is stripped of the Selecto solvent by means of steam, and is then ready for dewaxing. The dewaxing plant and operation are described. The procedure is largely conventional; an unusual feature is the use of heptane instead of naphtha as diluent. Chilling is obtained by heat exchange with the dewaxed oil from the centrifuges, in 13 towers 35 × 10 ft., followed by chilling to −45° F. in passing through 8 ammonia chilled towers, after which the wax is separated by means of 23 Sharples centrifuges and is deheptanized in a batch still. The dewaxed bright stock after traversing the heat exchanger mentioned is freed from heptane in a 63 × 5 ft. fractionator at 450° F. The bright stock receives a "polish" by passing through Fuller's earth. Process data and analyses are given and the grades are discussed. W. H. C.

Cracking.

1134. Houdry Catalytic Cracking Process. Anon. *Petrol. Times*, 1945, **49**, 515.—An account is given of the events which led up to the establishment of the Houdry process on a commercial basis in the U.S.A., and of the part it played in the production of aviation gasoline for the war effort. A short general description is given of a Houdry unit, and reference is made to various adaptations of the process, viz., one-step operation, two-step operation, catalytic-thermal-catalytic operation, catalytic reforming, and adiabatic catalytic cracking. L. B.

1135. Catalytic Cracking in the Manufacture of 100 O.N. Gasoline. Anon. *Petrol. Times*, 1945, **49**, 346.—By July 1945 production of aviation fuels in the U.S.A. exceeded 500,000 brl. per day, representing an increase in average yield of 100 O.N. fuel from 0·21 to 4·2 gal./brl. of crude. It is estimated that 22·8% of the increased output was achieved by the use of cumenes as blending agents; 14% by mechanical improvements; 13·8% by conversion of catalytic cracking units to aviation fuel production; 9·1% by the use of codimers as blending agents; 3·5% by the addition of 0·6 c.c. TEL, whilst 35·5% represented increased production from new facilities. The steps in the manufacture of 100 O.N. gasoline are illustrated, and the dollar values of the principal materials involved in the construction programme for 100 N.O. fuel are tabulated. L. B.

1136. Thermofor Catalytic Cracking Process. E. R. Smoley and V. O. Bowles. *Petrol. Times*, 1945, **49**, 523.—The Thermofor kiln, successfully used by the Socony Vacuum Oil Co. for the regeneration of spent percolation clays, was adapted to catalytic cracking for the production of aviation base stocks. The T.C.C.P. Plant may be divided into three sections: (1) the vaporizing heater, flash tower and oil-vapour superheater; (2) the catalytic reactor, catalyst regenerator, and catalyst circulating equipment, consisting of a special bucket elevator designed to operate at 1000° F. The catalyst is of the synthetic bead type, is rugged, resists attrition, and is catalytically stable; (3) the fractionating equipment.

The feed (reduced crude or gas oil) is vaporized and the vapours superheated to 850–950° F., whereupon they enter the rector. The catalytically cracked product which leaves the reactor as a highly superheated vapour is quenched to 600° F. in the vapour line or in the base of the fractionator. Heavy catalytic gas oil is removed as a residue from the latter, whilst the vapours are separated into recycle if desired, or into No. 2 furnace oil distillate, heavy naphtha, and distillate gasoline. The wet gas is reprocessed on stabilizers. A detailed description is given of the T.C.C. Unit reactor and catalyst regenerator. Operating conditions, yields, and quality of products, with special reference to the processing of gas oils from East Venezuela, East Texas, and West Texas, are discussed. The excellent quality of T.C.C.P. furnace oils is stressed. L. B.

1137. T.C.C. Catalytic Cracking Process for Motor-Gasoline Production. R. H. Newton, G. S. Dunham, and T. P. Simpson. *Oil Gas J.*, 2.6.45, **44** (4), 84.—A review is given of the chemical engineering features of the T.C.C. process employing the moving-catalyst principle. Catalyst particle size was chosen at 0·1–0·2 in. diameter, and elevators of 200 ft. lift for transporting catalysts at 900–1000° F. were satisfactorily produced. Laboratory experiments with coloured pellets in transparent full-size models were conducted to study distribution of flow of catalyst particles. To prevent rapid deterioration of the catalyst, alternate burning and cooling zones were designed. Isolation of the oil system from the air was accomplished by pressure seals of inert gas in the reactor. Studies of the heat transfer from gas to pellet catalyst were made, and the data show the absorption of 830 lb./hour of water by the catalyst amounting to ½% of its weight.

The cracking-plant heaters, coolers, distillation, and gas units are conventional in design. Catalyst purging is accomplished by arranging for rapid and uniform distribution of steam to each of 400 holes connected with the upper flow plate of the catalyst flow-control system. Steam is removed from the catalyst, leaving reactor in a depressuring pot. The kiln design is based on commercial experience with percolation clay regenerators, with elimination of angle packing and replacement of salt cooling system with direct steam generating coils. The distribution and flow of catalyst in the kiln are similar to those in reactor. The kiln has a suspended tile lining. Two vertical ducts supply air separately to the kiln, flow being controlled by ducts. An elutriator in the upper part of the kiln removes catalyst fines.

The links, upper sprocket, and head shafts of the elevators are designed to operate at high temperatures. Oil containing 30% fine graphite is used for lubrication of sprocket teeth and chain; and the head shaft is hollow and water-cooled. G. A. C.

1138. T.C.C. Announces Liquid Processing Using Pelleted Clay or Beaded Catalyst. T. P. Simpson. *Oil Gas J.*, 12.5.45, **44** (1), 88.—Freshly regenerated catalyst from the Thermofor kiln is supplied to a solid deep bed of catalyst in the reaction zone, where adequate time is allowed for the reaction. Facilities for steam-purging spent catalyst are provided, the regenerated catalyst from the kiln is delivered to the hopper which continuously feeds the reaction system, thus completing the catalyst cycle.

The concurrent solid bed downflow type of reactor is used for the liquid charge, which is first preheated to near the reaction temperature in a conventional-type furnace before entering the upper part of the reactor and being distributed on to the down-flowing mass of extremely porous catalyst particles. Operation temperatures are 800–950° F., with pressures of 5–15 lb. guage. Use and amount of steam are optional. Catalyst residence time varies from a few minutes to 2 hours, and space velocity ranges from 0·2 to 3. Adequate soaking time in the reaction zone converts the liquid charge stock into gasoline, cycle stock, gas, and coke.

The reactor charge may be liquid alone or part liquid and vapour, thus allowing a high degree of flexibility. Typical heavy charge stocks and representative yields of motor gasoline, light fuel oil, and heavy cycle stock for liquid charge T.C.C. operations are given. Properties of catalytic products from the process are normal in all respects. Coke deposition from heavy stocks is two to three times greater than from medium boiling range gas oils from similar crude sources. The selection of type of stock, whether deasphalted or not, is a matter of economics based on investment and operating costs of the catalytic unit. G. A. C.

1139. Engineering Aspects of Utah 100-Octane Plant. Part 2. J. H. Kunkel. *Petrol. Engr*, Feb. 1945, **16** (5), 74.—Alkylation and butane isomerization processes and plant are described, and the components, capacities, and functions of the various units, their operating conditions, and distribution of their products are recorded, and flow diagrams are given.

Alkylation takes place in four horizontal reactors, each divided into three sections with partition walls forming weirs. The reaction section is about two-thirds of the whole, and has the feed line along the bottom, which is studded with high-velocity glass jets fixed at an angle of 35–45°. The next section is for acid settling and removal, the last section holds the hydrocarbon effluent. Three of the reactors are for alkylation of the butenes, and are fed with B.B.'s and the C_3 hydrocarbons previously mentioned. The fourth reactor is for pentene alkylation and is fed from the C_5 to 150° F. E.P. fractions and some hexenes. The respective feed-streams meeting recycle emulsion of acid and hydrocarbon (50–50%) and recycle *iso*butane from the alkylation depropaniser, pass through the high-velocity jets for contacting, and remain in the reacting section for about 30 min., before passing over the weir for acid settlement and over the last weir to the effluent section, from which it is pumped via caustic soda-washers and settlers to the alkylation de*iso*butanizer. The components of the alkylation fractionating system, their functions, etc., are described. The products are alkylates for blending, and butane which is sent with $AlCl_3$ to the reactors of the vapour-phase butane isomerization unit, which is fully described. The overhead is recycled and the bottoms-*iso*butane-augments the alkylates mentioned.

The Standard Oil Co. of Indiana's naphtha isomerization, or Neohexane plant and its operation are fully described. It is considered to be largely responsible for the very high amounts of 100-octane aviation gasoline produced at Utah. This unit feeds light naphtha containing some hexanes and pentanes at the rate of 1750 brl./day, which on reaction with HCl and $AlCl_3$ in the presence of hydrogen to inhibit cracking, produces 1061 brl./day of isomate-neohexane, and *iso*pentane as an overhead from the isomate fractionator. A stream is also obtained from the bottom of the heptane tower which is rich in naphthenes and suitable for aviation blending.

The catalyst cycle $AlCl_3$-hexane slurry is described.

The hydrogen plant uses natural gas as a feed-stock which with steam is converted at 1200° F. to hydrogen, carbon monoxide, and carbon dioxide in a down flow reforming furnace containing 16 radiant sections of 25–20 Cr–Ni tubes filled with Stanco catalyst. Girbotol purifying is used, and after silica drying 88–95% hydrogen is obtained. The new boiler plant and its construction, which embodies a novel feature, is fully described. W. H. C.

Alkylation.

1140. Alkylation—Backbone of Aviation Gasoline. W. Mendius. *Refiner*, June 1945, **24** (6), 201–204.—The production of alkylation products from exothermic reaction of unsaturated hydrocarbons, such as propylene, butylene, amylene, or condensation products from polymerization of butylenes with *iso*butane, using either hydrofluoric or sulphuric acid as catalysts, is given in some detail. A. H. N.

Chemical and Physical Refining.

1141. Skelly Blends Gasoline Before Sweetening. Anon. *Refiner*, June 1945, **24** (6), 220–221.—In this process the desired blends for balanced motor fuel are determined prior to the sweetening process. A few details are presented. A. H. N.

Metering and Control.

1142. Electronics—Its Application to Petroleum Technology. F. R. Staley. *Oil Gas J.*, 26.5.45, **44** (3), 123.—The characteristic of beam power tubes (valves) is that the anode current rises very rapidly with anode voltage at low anode voltage and then flattens sharply, and except at very low currents there is no secondary emission. The effects of change in a system can be rapidly determined by changing one or more circuit elements, the circuit measurements replacing tedious mathematical computation.

Grid-controlled gas rectifier tubes, thyratrons, have limitations similar to those of a gas rectifier, in that there is a certain peak current that should not be exceeded even instantaneously. Cold-cathode diode tubes contain neon at low pressure, and find use as voltage regulators, stroboscopic light-sources, and in surge-protection devices. The cold-cathode gas triode is useful for controlling relays or in keeping power consumption low during standby periods.

Phototubes are made sensitive to ultra-violet or infra-red light by combination of factors effecting characteristics. They can be used with alternating currents. Among circuit components capacitors and inductances have important places. The capacitor stores energy in the form of stress in the dielectric; and an inductance stores it in its magnetic field. Transformers may be regarded as an inductance in circuit analysis. The use of direct-current motors for electronic control is now possible with the electronic tube, and when employed with tubes only, the constant speed alternating-current motor is usually used, the tubes acting merely as switches. G. A. C.

Safety Precautions.

1143. Penetron Quickly Determines Steel Thickness. Anon. *Oil Gas J.*, 30.6.45, **44** (8), 106.—Penetron equipment weighing only 40 lb. is a device for measuring the thickness of solids such as walls of surge drums, reaction chambers, and pressure vessels, and for determining the levels and densities of liquids contained in vessels and pipes. The Penetron device makes use of electronic and radiactivity principles, whereby matter is bombarded with penetrating radiations and the intensity of the returned rays measured. As the thickness of the subject matter increases, the back-scattering of the gamma rays becomes greater, and their recordings are interrupted by calibrated curves for known material. A microammeter measures the current produced in a detector by the radiations, and the instrument is calibrated on specimens of tubing and flat plates, to convert readings into wall thicknesses in inches. Such curves have to be established only once. Measurements can be made in vessels containing liquids provided a correction is made for the influence of the fluid on the reading. Routine calibrations to check the apparatus can be easily made with the set of concentric half-round steel shells and the calibration curve provided with the equipment. The limitations of accuracy are approximately 0·75 in. thickness for steel and approximately 1 in. for aluminium, and the accuracy is within plus or minus 3%.

The Penetron cannot be used for detection of pin holes or pin-hole-type corrosion, because it measures the average thickness over an area of about 1 sq. in., nor does it differentiate between component layers of laminates. In measuring liquid levels the reading of the instrument will remain constant until it reaches a point opposite the level of the liquid in the container, at which position the microammeter will indicate an increase in the amount of back scattered radiations due to the presence of the liquid.

The method may be adapted to control liquid levels, and guage gas and liquids in storage; and in operations such as control of blending operations and routing the flow of oil in pipe-lines. The Penetron consists of two main parts, the head and the control box. The head contains a radiation source, detector and shield; and a preamplifier. It is connected to the control box which contains the measuring circuit and power supply. The instrument operates on 110 v. 60 cycle AC. G. A. C.

PRODUCTS.

Chemistry and Physics.

1144. Studies in Adsorption in Relation to Constitution. Part V. B. P. Gyani and P. B. Ganguly. *J. Phys. Chem.*, May 1945, **49** (3), 226–238.—The adsorption of the lower members of the series of alcohols, esters, and ketones on active silica gel has been measured by a static method, the gel being completely freed from residual gases. Silica gel is a powerful adsorbent for all the vapours studied. The maximum capacity is as good as that of the charcoals used by Coolidge or Polanyi and Goldmann. At high relative pressures the amounts of adsorptions are always in the inverse order of the molecular weights in the same series of compounds. These orders are not maintained at lower relative pressures, and may further change according to the mode of plotting adopted. Esters and ketones give smooth isotherms; those for the alcohols reveal multiple branches. The peculiarities in the curves for alcohols have been explained on the basis of formation of surface compounds. The capillary condensation theory has been examined afresh with the help of the parachors of the compounds studied, and is not found to apply satisfactorily as far as the present data are concerned. A. H. N.

1145. Polymerization of Styrene under Various Experimental Conditions. J. Abere, G. Goldfinger, H. Naidus, and H. Mark. *J. Phys. Chem.*, May 1945, **49** (3), 211–225.—Polymerization of styrene has been carried out in various solvents (particularly toluene, methanol, and carbon tetrachloride) with various amounts of benzoyl peroxide as catalyst at 60° and 100° C. in various concentrations of the monomer. It is found that the polymerization in methanol shows certain irregularities, which are presumably due to the formation of a gelatinous phase during polymerization. The initial overall rate of the polymerization increases with monomer concentration somewhat faster than simple proportionality would require. A method is indicated to show how intrinsic viscosities of the polystyrene samples obtained can be used to estimate the number average polymerization degree. The initial number average polymerization degree can be expressed in terms of three rate constants: rate of propagation, termination, and chain transfer. The influence of the solvent on the last of these is discussed. A. H. N.

1146. Equilibrium Spreading Coefficient of Amphiphatic Organic Liquids on Water. E. Heymann and A. Yoffe. *J. Phys. Chem.*, May 1945, **49** (3), 239–245.—It is shown that the equilibrium spreading coefficient, which according to Antonoff should be always zero, is in fact a small negative quantity as revealed by several independent workers' experiments. Theoretical justification for the reality of this residual negative quantity is given in the paper. A. H. N.

1147. Physical Properties of Light Hydrocarbons. M. L. Smith and G. H. Hanson. *Oil Gas J.*, 14.7.45, **44** (10), 119.—A table of physical properties of light hydrocarbons, incorporating the most recent values, is given. Ideal and actual values for properties involving gaseous volumes are shown, the former being those which would be obtained if the hydrocarbon vapours were ideal gases, and the actual values include the deviation from ideal gases. G. A. C.

1148. Heat of Evaporation. W. L. Nelson. *Oil Gas J.*, 26.5.45, **44** (3), 163.—Two diagrams show the latent heats of vaporization for paraffin, intermediate, and naphthene base and cracked stocks, at their boiling points. The values for pressures other than atmospheric are shown. Two examples are worked out from the figures. G. A. C.

Analysis and Testing.

1149. Precision and Accuracy of Viscometry Using B.S.I. Tubes. Viscosity Panel of Standardization Sub-Committee No. 6.—Lubricants. *J. Inst. Petrol.*, Aug. 1945, **31** (260), 239–247.—The results of measuring the viscosity of oils by certain tubes in different laboratories and of determining the absolute viscosity by different methods

in various countries are discussed. A dynamic quality control test is proposed. A discrepancy is noted between British and American viscometric results.

A. H. N.

1150. New Viscometer for Determining the Viscosity of Petroleum Products at Low Temperatures. Yu. A. Pinkevich. *Symp. Visc. Liquids and Colloids, Acad. Sci. U.S.S.R.*, 1944, **2**, 141–144.—The viscosity of oils at low (down to −50° C.) temperatures is a factor of which increasing knowledge is necessary. Pour-point determinations are, owing to their empirical nature, unsatisfactory. A U-tube type of viscometer is described, based on the Ubbelohde–Holde type, which, in turn, is the basis of the standard U.S.S.R. method for kinematic viscosity. To avoid having to make observations through the cooling liquid, there is placed over the oil (25 ml.) a small amount (5 ml.) of dyed alcohol (methyl or ethyl). The rate of movement of the alcohol between marks on the upper portion of the viscometer tube is observed, and indicates the rate of flow (*i.e.*, viscosity) of the oil in the capillary. It is proved that mixing does not occur between the oil and the alcohol. The viscometer is designed to operate under pressure. Accuracy of measurement is 0·5%. The method may be adopted for measuring the viscosity of dark oils at normal temperatures, using in this case higher alcohols (butyl, amyl) as indicating liquids.

Dimensional details and diagrammatic lay-out of the apparatus are given. V. B.

1151. Viscosity and Pumpability of Oils at Low Temperatures. V. K. Limar and V. G. Sidorov. *Symp. Visc. Liquids and Colloids, Acad. Sci. U.S.S.R.*, 1944, **2**, 145–154.—The necessity for low-temperature (−40° C.) winter operation of I.C. engines requires knowledge of the flow properties of lubricating oils under these conditions. Determinations of viscosity in capillary-tube instruments, particularly under pressure, is a valuable guide and more reliable than the pour point, but does not fully characterize the low-temperature flow. A description is given of a laboratory type (7-litre storage capacity) pumping installation developed by the Research Dept., of the Red Army Air Force. The pumpability of an oil is expressed as weight delivered per revolution of the oil pump. Measurements were carried out at a pressure of 6 kg./cm². Five groups of lubricating oils were examined : (1) lubes from Dossori crude having equal pour points but varying viscosities at 100° C.; (2) lubes from Surakhani paraffinic crude having varying pour points but approximately equal viscosities at 100° C.; (3) low-viscosity automobile lubes with equal pour points and varying viscosities at 100° C.; (4) synthetic lubes of equal pour points and varying viscosities at 100° C.; and (5) various grades of castor oil. Viscosity and pour points for all oils are tabulated, and for each group the pumpability is plotted against the temperature. Samples of used (50 hrs.) oils were also tested : despite an increase in viscosity, the pumpability was unaffected. A 3-months full-scale trial, in winter (−2° C. to −35° C.) conditions, of the startability of aero-engines showed excellent agreement between laboratory determined limiting pumpability temperature and limiting temperature for normal startability. For oils of the same origin and pour points the pumpability temperature decreases with decrease of viscosity at high (50° C. and 100° C.) temperatures. Anomalous viscosity effects are insignificant for mineral oils, but marked in the case of castor.

V. B.

1152. A Machine for Performance Tests of Anti-friction Bearing Greases. P. G. Exline and S. A. Flesher. *Nat. Petrol. News, Technical Section*, 3.1.45, **37** (1), R.25.—A grease evaluation machine is described for testing the performance of anti-friction bearing greases in ball bearings under simulated service conditions. Speed, load, and temperature can be chosen and closely controlled. Temperatures are automatically recorded, and give an indication of grease failure by a sudden rise. The greases are also examined periodically to follow developments, and also to declare grease failure if the race paths are found dry without temperature rise. Typical examples of notes taken during tests are given to illustrate their use in evaluating the greases. The degree of test reliability is indicated in tables showing results in duplicate tests.

W. H. C.

1153. Testing of Greases for Ball-Bearings. S. R. Pethrick. *J. Inst. Petrol.*, Aug. 1945, **31** (260), 246–254.—Conventional methods for testing greases are of little assist-

ance in the selection of greases for particular applications. Tests on lime-base greases should include : (1) flow measurements at various rates of shear and at various temperatures ; (2) an oxidation test with an examination of the oxidation product ; and (3) a syneresis test involving capillary action. Soda-base and lithia base greases vary widely in texture, cohesion, and adhesion, and some method of measuring these properties is desirable. The combined cohesion and adhesion properties can be examined by measurements of the torque exerted on the housing of a rotating bearing, when the latter is partly filled with grease. A suitable apparatus for torque measurements is described. A churning test followed by torque measurements gives useful information on the stability of a grease. A. H. N.

1154. High Temperature, High-Pressure Rheometer for Plastics. H. K. Nason, *J. Appl. Phys.*, June 1945, **16** (6), 338–343.—A modified Bingham-type rheometer, designed for operation at temperatures up to 500° F. and at pressures up to 2000 p.s.i., is described. Interchangeable orifice plates permit wide variation of shear conditions. With this instrument flow properties may be studied under conditions approximating those encountered in the actual processing of thermoplastics—*e.g.*, by molding or extrusion. Typical results are presented for cellulose acetate, polystrene, and polyvinyl resin plastics, and correlation with practical experience is pointed out. The instrument is slow, and this limits its usefulness for other than research investigations. A. H. N.

1155. A.S.T.M. and T.B.P. Curves. W. L. Nelson. *Oil Gas J.*, 2.6.45, **44** (4), 107.—A correlation curve is given from which the true-boiling-point distillation temperatures of hydrocarbons can be obtained from the A.S.T.M. distillation temperatures. A second figure shows the A.S.T.M. curves of aviation gasoline, motor naphtha, kerosine, and diesel fuel oil superimposed on the true-boiling point curve of the crude oil from which they were derived. G. A. C.

1156. Life Testing of Lubricating Oil. H. C. Mougey. *Nat. Petrol. News, Technical Section*, 3.1.45, **37** (1), R.49.—Routine tests of lubricating oils have some value for such purposes as the checking of deliveries with specification and the control of manufacture ; and some afford a certain amount of correlation with performance in service, but they do not give any information as to the performance of an oil under the practical conditions of its use. The importance of oxidation tests and the influence of catalysts with the different metals and in different amounts, and effects of inhibitors carried over from a previous oil through inefficient cleaning, are discussed. Correlation between laboratory tests and bench engine tests and with service tests for performance evaluation are discussed. The U.S. Army and Navy have specifications of lubricating oils for a variety of engines which include conventional laboratory tests for classifying the oils and bench-engine tests to help in predicting the performance under actual service conditions. These specifications include tests of the oils on the following engines, which are briefly described as to operating conditions, extent, character, and purpose of the test : L1, L2, L3 Caterpillar tests ; L4 Chevrolet test ; L5 General Motors Diesel test. By a combination of such tests, predictions of the performance of an oil can be made. The tests cover information relative to ring sticking, wear, and detergency, in a diesel oil : detergency and bearing corrosion, resistance to oxidation and formation of varnish or sludge in gasolines, etc. W. H. C.

1157. Determination of Mercaptan Sulphur in Calorimetric Bomb. E. Dittrich. *Refiner*, June 1945, **24** (6), 221–222.—After a discussion of experimental data, it is concluded that low-weight aliphatic mercaptans can only be accurately determined in the calorimetric bomb by employing initial oxygen pressures of at least 35 atm. ; the mercaptans must be highly diluted. Using concentrated mercaptans, the method of Grote and Krekeler (combustion in quartz tubes) is also still excellent. A. H. N.

1158. X-Ray Diffraction. Part 3. F. G. Firth. *Refiner*, June 1945, **24** (6), 223–226. —As X-ray diffraction reveals structure, it may be used for any of the following purposes in suitable cases : (1) Simple chemical identification ; (2) Phase identification, qualitative and quantitative, with two or more identities present ; (3) Deter-

mination of lattice parameters; (4) Quantitative determination of solid or mutual solubility; (5) Average particle size evaluation; (6) Particle size distribution studies; (7) Orientation in solid materials and correlation with mechanical and other data; (8) Molecular-weight determination (especially in the case of high-molecular-weight materials such as proteins); (9) Stress analysis in metals; (10) Grain-size determination; (11) Structure determination; (12) Order-disorder phenomena studies; (13) Atomic distribution in amorphous substances such as glasses. The use of X-ray diffraction in hydrocarbon studies is very briefly indicated.

A. H. N.

Gas.

1159. Increasing Propane Recovery in Existing Natural Gasoline Absorption Plants. F. W. Bell. *Refiner*, June 1945, **24** (6), 227–229. *Paper Presented before California Natural Gasoline Association.*—A summary is given of the problem of increasing propane recovery in existing gasoline absorption plants. Four things are discussed that can be done without making expensive or radical changes, and with a minimum of shutdown time. These are: Use of a lighter absorption oil; use of refrigeration on the lean oil and rich gas deethanizer overhead; use of stabilizer bottoms recycle to the still final condenser; use of the deethanizer control method as described.

A. H. N.

Engine Fuels.

1160. Postwar Internal Combustion Engines and their Fuels. T. B. Rendel. *Nat. Petrol. News, Technical Section*, 3.1.45, **37** (1), R.66.—Internal-combustion engines and their fuels are discussed under the sections: (1) *Spark ignited engines*, (*a*) aviation gasolines, (*b*) motor gasolines, (*c*) tractor fuels; (2) *Compression ignition engines*, (*a*) high-speed types, (*b*) internal-combustion turbines, (*c*) medium and low-speed types. The fuels are also considered from the viewpoint of post-war engine developments and economic refinery operations in the production of fuels from the crude materials available. Co-operative research problems are discussed, most important is information with respect to: (1) the development of methods of measuring detonation to render them more exact and reproducible; (2) the means of interpreting laboratory ratings of octane numbers in terms of actual engine performance. Pre-ignition is another subject on which wider information may help in obtaining higher efficiencies.

W. H. C.

Lubricants.

1161. Current Lubrication Problems. P. H. Moore. *Petrol. Times*, 4.8.45, **49** (1253), 605.—"Oiliness," that property of a lubricant which reduces friction, is imparted by compounds containing active polar molecules, and which adhere to the metal surface.

The effect of temperature on an oil is important, and chemical composition influences the viscosity index. It has been found that viscosity increases considerably as the pressure is raised, and frequently the oil of the best temperature/viscosity characteristics has the lower viscosity increase under pressure.

Subtractive refining has led to the use of additives in making the highest-quality lubricants; small quantities, for instance, of *iso*butane polymers increase the viscosity and viscosity index.

Two classes of additives have been developed to assist in lubrication under pressures in the order of 400,000 lb. per sq. inch. One class contains sulphur or chlorine, or both; the sulphur or chlorine forming a metal sulphide or chloride which serves as an anti-welding agent. The molecule should be labile. The second class have been previously mentioned as agents which impart oiliness.

Lubricants must remain fluid at any temperature for which they are required, and pour-point depressors such as wax phenols which prevent the formation of large wax crystals are added.

Lacquering of pistons, ring-sticking, and sludge formation, particularly in high-speed diesel engines, are combated by addition of detergents, the function of which it is to disperse small particles. Calcium phenyl stearate and barium and other soaps of the naphthenic acids are successful detergents; many compounds are satisfactory by laboratory tests, but fail in service.

A lubricating oil is subject to oxidation in use, and compounds such as tri-butyl phosphite are added to absorb the oxygen, or the inhibitor renders impotent metals exciting the oxidation reaction.

A refined lubricating oil develops corrosive properties in use, and sulphur or phosphorus compounds are added to prevent this and cylinder corrosion.

Multi-functional additives impart two or more different properties, but their use is open to question.

The use of additives will increase, the increase in cost of the oil being more than offset by better performance. G. A. C.

1162. Problem of Engine Deposits. A. Lahiri, Z. Karpinski, and E. W. J. Mardles. *J. Inst. Petrol.*, Aug. 1945, **31** (260), 27–302.—A description of rheological methods found useful in investigating the problem of engine deposits is given. Measurements have been made of the specific viscosity of: (*a*) dispersions of aero-engine deposits and oxidised oil products to determine molecular weights and asymmetry of the constituent particles; and (*b*) of carbon dispersions in oils and non-aqueous media to measure the degree of flocculation. The flow behaviour of mineral oils oxidizing at high temperatures has been studied, using a coni-cylindrical rotor fitted with small vanes immersed in the oil and operated by weights acting over a pulley. It has been found that rigidity developed slowly at first with time, then the oxidizing oil suddenly gelated when the concentration and degree of polymerization of the oxidized products reached a critical value. This behaviour was confirmed by measurements made with a tackmeter. The tendency of an oil to deposit soot and other combustion detritus in suspension has been measured from: (*a*) torsional rigidity and yield values; and (*b*) sedimentation rates and volumes. In general, a high degree of flocculation of carbon black, etc., results in high specific viscosity, high sedimentation rates and volumes, and high rigidities and yield values of the suspensions. A. H. N.

1163. Lubrication of Metal Surfaces by Fatty Acids. F. P. Bowden, J. N. Gregory, and D. Tabor. *Nature*, 28.7.45, **156** (3952), 97.—Hardy was the first to investigate systematically boundary lubrication, and showed that the friction was a function of separate contributions by the solid surfaces, the chemical series to which the lubricant belonged, and the number of carbon atoms in the chain. Later workers on static friction did not fully confirm Hardy's assumption that friction between unlubricated surfaces is due to the surface fields of force. Measurements of kinetic friction also show that there is no linear relation between friction and chain-length, but a rapid decrease in the coefficient of friction to a constant value of about 0·1 as the chain-length increases.

If the friction is measured in an apparatus which prevents the " stick-slip " motion, the effect of the chain-length of the lubricant may be demonstrated. With short-chain fatty acids the motion proceeds in " stick-slip " and wear occurs; but smooth sliding occurs, friction falls, and wear is appreciably reduced when the chain reaches a certain length. This transition with steel surfaces occurs at a molecular weight of about 100.

Experiments carried out on films of stearic acid deposited on the metal from a surface of tap water, which may consist of the calcium soap rather than the fatty acid, showed that a certain amount of wear of the metal surfaces takes place even with the thickest molecular films.

In the lubrication of metals by fatty acids, the first adsorbed layer is responsible for the lubrication observed.

The effect of temperature on the lubricating properties of boundary lubricants is important. With mineral oils at temperatures above 200° C. oxidation occurs, the products are adsorbed at the metal surface and improve the lubrication, but at high temperature, after prolonged heating, the lubricating properties deteriorate.

At lower temperature, on warming the steel surface to 70° C., the motion changes from continuous sliding to " stick-slip "; on increase of temperature the friction rises and an increase in wear occurs; and those changes are reversible on cooling. These results show that the first monolayer is responsible for the lubricating properties of the lubricant and for the phenomenon associated with the measurements of the transition temperature.

Investigations by Hughes and Whittingham show that the lubricating properties

of the fatty acids depend markedly upon the nature of the metal, (*a*) upon which chemical attack is absent or is barely detectable, and (*b*) upon which chemical attack is marked.

Fatty acids are only effective as lubricants when the metallic soap is formed as a result of chemical reaction between the metal and the fatty acid.

The physical properties and texture of the lubricating film is important, experiments with sodium stearate on steel surfaces illustrating this. In boundary lubrication the friction is greatly influenced by the properties of the metals concerned. Plastic flow of the metals occurs when lubricated metal surfaces are in contact, and the lubricant film has to reduce the amount of metallic contact between the surfaces by interposing a layer that is not easily penetrated and possessing a relatively low shear strength. Fatty acids are only slightly more effective when applied to unreactive surfaces than saturated hydrocarbons; but they are much more effective at heavy loads and high temperatures in the form of metallic soaps, because the softening points of the soaps are very much higher than those of the pure acids. When the soap film has a close coherent texture, is evenly deposited over the surface, and is well adsorbed, the best results are obtained. Any solvents present may cause disruption of the film.

The frictional behaviour of soap films resembles the lubricating properties of thin films of soft metals deposited on hard substrates. G. A. C.

1164. Frictional Properties of Some White Metal Bearing Alloys. The Rôle of the Matrix and the Hard Particles. D. Tabor. *J. Appl. Phys.*, June 1945, **16** (6), 325–337.—A previous paper has described an investigation of the frictional properties of alloys of the copper–lead type which consist of a hard matrix (copper) in which are dispersed particles of a soft material (lead). It was shown that these alloys function by the extrusion and smearing of the soft phase over the hard matrix, so providing metallic-film lubrication. This paper describes experiments on a typical lead-base bearing alloy which consists of a soft matrix in which are dispersed numerous hard crystallites. Measurements of the friction were made at room temperature and at elevated temperatures for clean and for lubricated surfaces. Comparison with a special alloy consisting of the matrix material alone showed that the hard particles played no appreciable part in the basic frictional and wear properties of the bearing alloy. It is suggested that the frictional behaviour of the bearing alloy is determined essentially by the properties of the matrix material itself, although in practical running operations there may be other properties which determine the suitability of the alloy for use in bearings. Similar experiments are described on a typical tin-base bearing alloy and a corresponding tin-base " matrix " alloy. A. H. N.

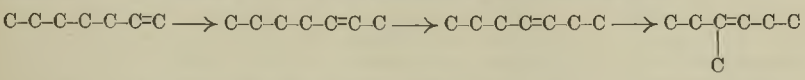
1165. A Rational Basis for the Viscosity Index System. Part 1. E. W. Hardiman and A. H. Nissan. *J. Inst. Petrol.*, Aug. 1945, **31** (260), 255–270.—Anomalies are noted in the present scale for oils having viscosity indices exceeding 130. Equations and graphs are then used to derive a modified scale which eliminates these anomalies. A. H. N.

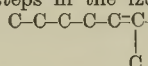
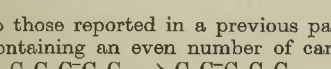
1166. Lubricating Greases. A. S. C. Lawrence. *J. Inst. Petrol.*, Aug. 1945, **31** (260), 303–314.—A general description of the physical chemistry of greases is given. Peptization and structure are discussed. A. H. N.

Special Hydrocarbon Products.

1167. Isomerization of Normal Heptene. A. D. Petrov and V. I. Shchukin. *Oil Gas J.*, 20.1.45, **43** (37), 77. (Translated by J. G. Toplin from *Zurnal Obshchei Khimii*, 1941, **11**, 1092–1095.)—Isomerization of normal heptene and normal octene to produce branched-chain hydrocarbons has been made with a view to establish the difference between the behaviour of olefins of odd and of even numbers of carbon atoms. The experiments were conducted using phosphoric acid as catalyst, and under conditions which would, as far as possible, reduce or eliminate the formation of by-products by polymerization. The products of the isomerization were fractionated and then examined and analysed, before and after: (*a*) oxidation; (*b*) chlorination by the Schaarschmidt–Moldavskii method; and (*c*) hydrogenation. The isomerization

product from the *n*-heptene was hydrogenated and its Rahman spectrum investigated, which established the presence of 3-methylhexane and the absence of 2-methylhexane. The authors conclude that with *n*-heptene the transformation to the branched-chain hydrocarbon is accomplished by the following bond rearrangement :



producing methyldiethylethylene. The steps in the izomerization of *n*-octene are shown to produce dimethylbutylethylene,  . These steps are similar to those reported in a previous paper on the isomerization of another hydrocarbon containing an even number of carbon atoms—viz., *n*-hexene:  . Isomerization of the two hydrocarbons containing an even number of carbon atoms lead to the formation of 2-methyl-2-alkenes, whereas the isomerization of that containing an odd number of carbon atoms lead to the formation of 3-methyl-3-hexene. W. H. C.

1168. Concentrated Insecticides. A. W. Lindquist, H. O. Schroeder, and E. F. Knipling. *Soap*, 1945, **21** (7), 109.—Tests on house flies and mosquitoes exposed in cages to kerosine-based sprays containing pyrethrum, D.D.T., or mixtures have shown that small quantities of highly concentrated sprays are equally as effective as larger quantities of more dilute sprays containing the same amount of toxicant. The necessary distribution of the more concentrated solution can be obtained with a domestic type sprayer if a 0·017-in. capillary tube is substituted for the relatively large siphon tube. Using a pocket-size sprayer of this type, the same toxicity was obtained with 1 ml. of a spray containing 10% of D.D.T. as with 3·3 gm. of aerosol from a bomb containing 3% of D.D.T., whereas with an ordinary domestic sprayer a lower knock-down (but a similar 24 kill) was obtained. Exposure of the insects after the spray had been allowed to settle gave a lower kill in the case of the domestic sprayer, indicating the greater rapidity of settlement of the drops. C. L. G.

1169. Mode of Entry of Contact Insecticides. W. H. Potts and F. L. Vanderplank. *Nature*, 28.7.45, **156**, 112.—It has been generally assumed that when using contact insecticides it is necessary to bring the poison into maximal contact with the body of the insect. Work on tsetse-fly control has shown, however, that contact of the feet, particularly if the pulvilli are well developed, for 2 to 5 sec. with pyrethrum or D.D.T. on cattle hide is fatal. The rapid paralysis induced by pyrethrum excludes the possibility of the removal of the poison to the spiracles in an attempt to get rid of it. The nature of the adhesives (gum, wax resin, etc.) used with the toxic material, also precludes the possibility of direct entry through the spiracles. C. L. G.

1170. Effect of Pretreatment on the Toxicity of Insecticidal Films on Building Surfaces. P. S. Hewlett and E. A. Parkin. *Nature*, 1945, **155**, 755.—The toxicity to flour beetles of films of solutions of pyrethrum extract in white oil has been shown to vary according to the type of surface sprayed. Thus on rough deal and brick high kills are given, whereas on lime-washed brick, concrete, and cement little or no kills are given. Decreasing the degree of penetration of the solution into the surface by pre-treatment with size, gelatin, starch, etc., greatly increased the toxicity. C. L. G.

1171. Insecticidal Action of D.D.T. J. R. Busvine. *Nature*, 11.8.45, **156**, 169.—Two theories that have been put forward to account for the toxicity of D.D.T. : (1) that of Dr. Lauger, in which the linked *p*-chlorbenzene rings are considered the toxic constituent while the $-CCl_3$ group imparts lipoid solubility; and (2) that of Dr. Martin, which is the reverse, on the basis that the CCl_3 group may split off HCl at the vital centres. Investigations of the toxicity to lice and bed-bugs of a number of compounds analogous to D.D.T. have shown that the relatively highly toxic dimethoxy compounds have only a slow rate of hydrolysis, while there appears to be no connection

in general between toxicity and solubility (in olive oil and white oil). It is considered possible that the shape and size of the molecule are important. C. L. G.

1172. Tar Product Sprays. Anon. *Chem. T. J.*, 17.8.45, **117**, 184.—Experimental tar derivative sprays TAC2 and TAC4 have been developed for killing potato haulms. These are four times as expensive as sulphuric acid, application costing £2 per acre, and are about 10% less efficient, but are nearly as rapid in action, and much more convenient to handle. As a result of trials carried out last year by the Agricultural Research Council and the D.S.I.R., an improved product (TAC 36C) has been developed which has little or no effect on the skin, mixes more readily with water, and gives a better haulm kill. C. L. G.

1173. Toluole Purification. An Azeotropic Distillation Process. Anon. *Chem. Tr. J.*, 1945, **117**, 110.—E.P. 569,405 of 1942 and 569,416 of 1943, granted to Woodhall-Duckham, Ltd., H. M. Spiers, and W. J. Chadder describes the continuous separation of non-aromatic hydrocarbons from toluole by azeotropic distillation with an aqueous aliphatic alcohol ($\geq$3 carbon atoms). The fractionating column contains a stripping and a rectifying section and produces (*a*) water, (*b*) toluene, and (*c*) a non-aromatic hydrocarbon-alcohol distillate. The addition of (*a*) to (*c*) causes separation of the non-aromatic hydrocarbons, which may be further treated to remove alcohol, the aqueous alcohol being returned to the column. An example is given of the recovery of toluene of sp. gr. 0·8699 from a low-grade nitration toluole containing 86·5% toluene, using methyl alcohol containing 20% of water.

The later patent describes a modification in which water, substantially free from alcohol, is removed with hydrocarbons, separated, and the latter returned to the column. C. L. G.

1174. Physical and Chemical Properties of Butadiene. Anon. *Refiner*, June 1945, **24** (6), 230–231.—Physical and chemical properties of butadiene are tabulated and graphed. A. H. N.

Derived Chemical Products.

1175. Use of Chemicals by the Petroleum Industry. R. Reuter. *Nat. Petrol. News, Technical Section*, 3.1.45, **37** (1), R.76.—A very large expansion has taken place in the volume and diversity of chemicals used in the petroleum industry owing to the war. This article reviews the subject under three sections: catalysts; inhibitors and additives; and processing chemicals, and discusses the quantities, shortages, substitutes and new materials and types being used.

Synthetic catalysts, used in the fluid and Houdry processes and the bead catalyst, are chemically very similar—*i.e.*, they are classed as silica gels. Their physical forms are, however, different, the fluid catalyst being a fine powder, the Houdry catalyst, pellets and the bead type, spheres. The Thermofor catalyst is a treated natural clay in the form of pellets, but the synthetic-bead-type catalyst is sometimes used. It is thought that after the war, with lower octane demands, treated natural clays may compete with synthetic catalysts.

Aluminium chloride and hydrogen chloride are discussed in relation to butane isomerization.

The use and advantages of sulphuric and hydrofluoric acids for alkylation work are compared and discussed, and the former as to refining, and the disposal or regeneration of waste from the angle of spent alkylation acid. Phosphoric acid or its salts are used for cumene manufacture or for copolymerizing light olefinic gases to unsaturated liquids—octenes—which are hydrogenated to octanes.

Nickel and tungsten form the principal ingredients in hydrogenating catalysts; for dehydrogenation, the oxides of chromium and molybdenum with some iron compounds are the main components of the catalysts used, *e.g.*, for butane—butylenes; butylenes—butadiene; naphthenic hydrocarbons—toluene (hydro-forming).

Inhibitors and Additives. Tetraethyl lead and gum inhibitors for gasolines are discussed. Additives for oiliness, detergency, dispersancy, anti-oxidant are discussed. A new inhibitor for anti-foaming is an organic silicon compound recently manufactured. Research on additives is briefly reviewed. Water corrosion inhibitors are of economic

importance. Water treating has become more and more a complex science. Chemicals now used for the purpose include silicates, phosphates and chromates. Complex organic compounds of chromium with certain sugars have been found effective in very low concentration. In some cases after a large initial dose a concentration as low as 5–10 parts per million has been sufficient to maintain the protection. Sodium nitrite is used to inhibit corrosion due to water in pipes, etc.

Process chemicals, caustic soda, clays-bauxite and prepared alumina, etc., are reviewed. A wide variety of solvents for solvent refining processes and chemicals for fire fighting are briefly reviewed and discussed. W. H. C.

1176. Texas Refinery Unit Producing Allyl Chloride for Pharmaceuticals and New Type Plastics. Anon. *Nat. Petrol. News*, 11.7.45, **37** (28), 38.—A new unit has been opened at the Shell Oil Co., Deer Park Refinery, Texas, for the production of allyl chloride and allyl alcohol. The main uses for the allyl products include the manufacture of drugs and pharmaceuticals (*e.g.*, *cyclo*propane and barbiturates), synthetic mustard oil, and plastics (polyallyl compounds and allyl starch, etc.).

C. L. G.

Coal, Shale and Peat.

1177. Shale-Oil Emulsions and Sludges. G. E. Mapstone. *Refiner*, June 1945, **24** (6), 209–219.—The discussion is divided into two sections. The first deals with the formation and stability of the emulsion. In summary: (1) The lower the specific gravity of the oil the less the tendency to emulsion formation and the lower the stability of any emulsion formed; (2) When the oil and water are mixed together mechanically, emulsification is promoted; (3) Increase in temperature increases the rate of resolution of the emulsions and this effect can be attributed mainly to the decrease in the viscosity of the oil; (4) The presence of carbonaceous solid particles (called BS) in the oil strongly stabilizes the emulsions; (5) The ash content of this BS neutralizes its activity when comprising 75 to 80% of the solid weight; (6) The rate of separation of water from the emulsions depends rather on the drop size of the dispersed water than on the amount present (Stokes' law); (7) The tendency for emulsion formation and emulsion stability increase and decrease with the pH of the aqueous phase; (8) Reduction of the oil-water interfacial tension increases the rate of resolution of the emulsions; (9) On prolonged storage "wet" crude oil deposits a heavy sludge containing a critical proportion of water and a very high proportion of solids.

The second part deals with treatment and resolution of emulsions and sludges. Physical, mechanical, and chemical methods are detailed. The appendix to the paper gives analytical methods for studying emulsions. A. H. N.

Miscellaneous Products.

1178. Whither Polystyrene? A. J. Warner. *Plastics*, 1945, **9**, 319.—Increased production of styrene for GR–S programme in U.S.A. will soon displace cellulose acetate as cheapest and most abundant thermoplastic. Eventual price of styrene will be 9 cents per lb. and polysytrene 12–14 cents. per lb. Figures are shown for 1944 production of urea and phenolic plastics, polysytrene, acrylics, polyethylene, vinyl resins, cellulose ester plastics, and ethyl cellulose. S. J. L.

1179. Availability of Petroleum for Synthetic Rubber Manufacture. B. K. Brown. *Chem. Eng. News*, 1945, **23**, 713.—Butadiene for U.S. War-time Buna-S production has been largely manufactured by cracking naphtha. Productive capacity can be increased nearly fivefold by using butane or butylene instead. Annual requirements of petroleum would then be 7,200,000 brl. to give adequate quantities of synthetic rubber. This being less that 1% of normal annual drainage from reserves, it is of no consequence when discussing overall adequacy of petroleum reserves. Additional quantities of GR-S could be produced from either alcohol or butylene diverted from 100-octane manufacture. S. J. L.

1180. Raw Materials for Plastics and Synthetic Rubbers.—I. D. D. Howat. *Chem. Age*, 1945, **52**, 497.—Increased production and reduced cost of synthetic rubber in

U.S.A. will enable it to compete later with natural rubber. Raw materials used are alcohols, natural gases, and petroleum refinery gases. For plastics mainly formaldehyde, benzene, and phenol are required. Lack of crude-oil in U.K. and limited acreage for home-grown cereals necessitates full utilization of coal. Liquid by-products of carbonization are benzene, phenol, cresols, cresylic acids, toluene, naphthalene, coumarone, indene, and indirectly styrene, butadiene, and adipic acid. Water-gas from coke produces formaldehyde, methanol, and formamide, and hence phenolics, urea and melamine resins, acrylics and vinyl polymers. Calcium carbide provides acetylene for the eight synthetic rubbers and ethylene could be produced from British coke-oven gases. S. J. L.

1181. Raw Materials for Plastics and Synthetic Rubbers.—II. D. D. Howat. *Chem. Age*, 1945, **52**, 515.—Efficient recovery of benzol from town gas, formerly uneconomic, can increase availability of benzene by 50%. Recent reduction in cost of benzol for chemicals by 9*d*. per gallon has produced stimulus to plastics manufacture. Only one-third of available naphthalene in coal-tar is being extracted: reduced exports of such scarce raw materials is suggested. Increase in low-temperature carbonization of coal can supply necessary requirements, and computed figures are given for yields of phenol, cresylic acid, ethylene, propylene, and butylene. Carbide production must be doubled to meet requirements. Utilization of 13·5% of total power production from proposed hydro-electric development in Scotland and the Severn could produce annually 250,000 tons of 80% carbide. Cost of this power, however, must be less than ½*d*. per unit to make manufacture feasible. A large British carbide plant is described. S. J. L.

1182. Raw Materials for Plastics and Synthetic Rubbers.—III. D. D. Howat. *Chem. Age*, 1945, **52**, 537.—Britain has several untapped sources of supply. Instead of burning coke-oven gas, efficient treatment of only 20% will yield 43,000 tons of ethylene, 200,000 tons of methane, and 58,000 tons of hydrogen. Treatment involves several-stage liquefaction process. Hydrogen produced thus is more economic of coal reserves than by "steam-iron," electrolytic, or water-gas processes. Establishment of oil-refining industry in Britain, capable of treating ten million tons of crude oil annually, would make available one million tons of unsaturated gaseous hydrocarbons, and hence one million tons of plastics and synthetic rubbers. Of twelve million tons of oil at present annually imported, only two million tons are refined in Britain. Heavy capital outlay on new home-refining industry would be compensated by saving £20,000,000 in foreign currency, by an annual revenue of more than £100,000,000 and by sale of plastics. S. J. L.

1183. Tar Products Output. *Statistical Digest* 1944, *Cmd.* 6639 (*H.M.S.O.*).—Particulars are given of output of principal tar distillation products in Great Britain during past three years. Total tar distilled has only increased from 1,860,000 tons in 1938 to 2,083,000 tons in 1943. Output of creosote oil, creosote-pitch mixture, road-tar, naphthalene, pyridine bases, and cresylic acids has remained fairly steady, only phenol and anthracene showing slight increases. S. J. L.

1184. Polyvinyl Plastics. Anon. *Chem. Tr. J.*, 1945, **117**, 152.—A review (from Canadian Chemistry and Process Industries, June 1945) of the development of the Shawinigan plant for the manufacture of polyvinyl acetate and allied plastics. Vinyl acetate is prepared by passing acetylene through acetic acid containing a suspended mercury catalyst, and fractionating the resulting mixture of vinyl acetate, acetaldehyde, and acetic acid. The vinyl acetate is mixed with benzol and peroxide catalysts and heated for 4/5 hr., the benzol being subsequently removed by steam distillation. The solid residue "Gelva" is extruded into rods, which are stored under water, being cut into chips and crushed before shipment. Gelva is used as a base for lacquers or adhesives, but cannot be used as a moulding plastic without hydrolysis to the alcohol followed by acetal formation with an aldehyde—Formar with formaldehyde, Alvar with acetaldehyde, and Butvar with butyraldehyde. The reactions are carried out simultaneously in a solution of butyl alcohol and butyl acetate, the final product being extruded to rods, shredded, and crushed. C. L. G.

1185. The Part a British Oil Company Played in Water-Proofing D. Day Invasion. Anon. *Petrol. Times*, 1945, **49**, 293.—The development of a water-proofing compound consisting of a type of grease (not specified) containing up to 25% of asbestos fibre of specified size is described. The compound displays high electrical resistance to H.T. voltage, does not change shape, and retains satisfactory water-proofing and electrical properties under the influence of extremes of temperature. It is also easy of application. Some technical notes on the testing and inspection of the product are given.
L. B.

1186. Navajo Plant Yields Large Amounts of War-Needed Helium. A. L. Foster. *Oil Gas J.*, 28.8.45, **44** (12), 130.—A large source of natural gas containing 7·6% helium was discovered whilst drilling in New Mexico at about 7000 ft. A 4-inch line pipes the gas 8 miles to the plant site at a well-head pressure of about 3000 lb./sq. in. The plant includes a stripping unit to remove recoverable hydrocarbons from the raw gas, carbon dioxide removal processes, helium-concentration, and purification equipment; and gas holders on the lines to provide operating surge capacity.

A 30-mile 4-in. line pipes combustible gas for the plant from the gas line of the Southern Union Gas Co. 90 miles of 2-in. pipe transport the pure helium to the railroad at Gallup.

The hydrocarbon recovery unit is of conventional design, and the extremely low temperatures employed (−300° F.) in the helium purification system require the gas to be stripped of water vapour and carbon dioxide, and this unit includes heat exchangers, compressors, expansion engines, and other auxiliaries.

The separation of helium from the stripped gas is achieved by a secret Bureau of Mines process, but it is disclosed that equipment in this part of the process is of bronze, brass and copper.

Helium of 98·5% concentration enters the pipeline to Gallup at a pressure of 2500 lb./sq. in.
G. A. C.

1187. Commercial Values and Physical Tests of Paraffin and Micro-Crystalline Waxes. A. E. Hickel. *Refiner*, June 1945, **24** (6), 207–208.—Wax is classified into slack wax, semi-refined wax, and fully refined wax. The physical properties of the different types of wax are summarized, and methods of measuring ductility, adhesion and wire cone melting-point described.
A. H. N.

1188. Relationship Between Rheological Properties and Working Properties of Printing Inks. R. Buchdahl and J. E. Thimm. *J. Appl. Phys.*, June 1945, **16** (6), 344–350.—It is shown that the working properties of a printing ink—*i.e.*, its performance during the printing operation—can be interpreted in terms of the rheological properties as measured in a rotational viscosimeter. The instrument used in this investigation is a viscosimeter of the Stormer type. Data are presented to show that it is necessary to distinguish between time-dependent and time-independent flow phenomena. Various theories suggested to explain the time-independent flow phenomena are discussed briefly. The flow of a printing ink over the main mechanical elements of a typographic printing press is analyzed and correlated with simple flow phenomena which can be measured in a rotational viscosimeter.
A. H. N.

Miscellaneous.

1189. Management from the Superintendent's Viewpoint. Part 2. O. B. Wendeln. *Refiner*, June 1945, **24** (6), 232–236.—Methods are suggested for reducing costs by analysis of all factors entering the costing of the finished product.
A. H. N.

1190. Siting and Lay-Out of Industrial Works. H. W. Cremer and R. L. Fitt. *Chem. Age*, 1945, **53**, 74.—Location of site is nowadays dependent rather upon markets than proximity of raw materials. Other factors are availability of specialized labour, with adequate transport and housing, and access to site by road, rail or water. Disposal of waste and its legal pitfalls are discussed. Electrical power and coal supplies are not as important as coal-gas in influencing siting. Preliminary agreement with local authorities, supply undertakings and railway companies is stressed. Process routing

is facilitated by flow-sheets for material, energy and time relating to respective processes. Division into identical self-contained units is advocated, allowing of a "progressive completion" construction programme. This enables production to commence in stages and facilitates training of operatives. Other items dealt with are laboratories, lighting, and storage. S. J. L.

1191. U.S. Bombers did a Job at Ploesti. J. L. Walden. *World Petroleum*, 1945, **16** (4), 37–41.—Official information released by the Bureau of Public Relations of the U.S. War Department reveals that as a result of the U.S.A.A.F. raids on Ploesti in August 1943 and April/July 1944, 90% of refining capacity of the Ploesti refinery area was destroyed. The first raid by 117 B.24's on August 1, 1943, was carried out at a loss of 54 planes, for a delivery of 142 tons of bombs. Although throughput was reduced from 458,000 m. tons in July to 269,000 m. tons in August, repair work was so speedily effected that a throughput of 431,000 tons was obtained in September. Raiding was resumed in April 1944, and by August 19, when the Soviet armies captured the area, 5,479 sorties in 26 raids with a delivery of 13,700 tons of bombs had stopped all operations at 10 of the 15 refineries, and reduced the output of the area to 10% of the July 1943 total. J. C. W.-M.

BIBLIOTEKA POLITECHNICZNA SL

INSTITUTE NOTES.

OCTOBER, 1945.

ELECTION TO COUNCIL.

The attention of Members is drawn to the following extracts from the By-Laws governing election to the Council of the Institute :—

(*a*) The Council of the Institute shall be chosen from the Fellows and Members only.

(*b*) Every Fellow, Member, and Associate Member of the Institute may send in writing to the Council the name of a Fellow or Member whom he desires to recommend for election to the Council. This nomination must be signed by at least nine other Fellows, Members, or Associate Members and delivered to the Secretary **not later than 30th day of November** in any year. No Fellow, Member, or Associate Member may sign more than one Nomination Paper in any one year.

FORTHCOMING MEETINGS.

Wednesday, 14th November, 1945. **"Investigation of Piston Ring Sticking on High Duty Aero Engines,"** by Dr. A. Lahiri and F./Lt. Mickolojenski.

Wednesday, 12th December, 1945. **"Oil Well Shooting,"** by J. F. Waters.

The above meetings will be held at 26, Portland Place, London, W.1.

NORTHERN BRANCH.

16th October, **"Engine Testing of Lubricants,"** by Dr. Norman Kendall.

20th November. **"The Evaluation of Crude Oils, with special reference to the Characteristics of the Lubricating Oil Fractions,"** by G. H. Harries, B.Sc., F.R.I.C.

PERSONAL NOTES.

News has been received that Professor H. I. Waterman has returned from German imprisonment to The University, Delft, Holland.

JOURNAL WANTED.

The following Journal of The Institution of Petroleum Technologists is required :—No. 19, Vol. 5.

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.

ANTHONY, John Stanley, Petroleum Cargo Surveyor, B. & R. Redwood. (*W. F. Jelffs ; A. T. White.*)

BEAUCHAMP, Kenneth George (Major R.A.S.C.), Attached to National Oil Refineries, Ltd. (*R. B. Southall ; E. Thornton.*)

BLAKELEY, Thomas Hedley, Research Chemist, Esso European Laboratories. (*W. E. J. Broom ; C. S. Windebank.*)

BRAINE, Alfred Ernest, Chief Draughtsman, Agwi Petroleum Corpn., Ltd. (*H. D. Demoulins ; E. Evans-Jones.*)

EVE, David, Analytical Chemist, Texas Oil Co. (*N. L. Anfilogoff ; R. C. Paterson.*)

HOLMES, Patrick Ivone (Lt.-Col., R.A.S.C.), Attached to National Oil Refineries, Ltd. (*R. B. Southall ; E. Thornton.*)

HOOPER, Minard Gilbert, Asst. Installation Supt., National Oil Refineries, Ltd. (*R. B. Southall ; E. Thornton.*)

HOWARD, John (Major, R.A.S.C.), Attached to National Oil Refineries, Ltd. (*R. B. Southall ; E. Thornton.*)

JEFFERS, John Harold (Lt.-Col., R.A.S.C.), Attached to National Oil Refineries, Ltd. (*R. B. Southall ; E. Thornton.*)

LEUTY, Henry (Major, R.A.S.C.), Attached to National Oil Refineries, Ltd. (*R. B. Southall ; E. Thornton.*)

PEARSON, Stanley Cecil, Petroleum Cargo Surveyor, B. & H. Redwood. (*W. F. Jelffs ; A. T. White.*)

ROUX, Louwrens Willem le, Analytical Chemist, South African Railways and Harbours. (*W. G. Scharges ; E. W. Pomeroy.*)

WILLIAMS, Edward George Victor, Petroleum Cargo Surveyor, B. &. R. Redwood. (*W. F. Jelffs ; A. T. White.*)

Transfers.

CHARLESWORTH, Percy Allan, Research Chemist, Moore & Barrett. (*H. E. Charlton ; J. Barrett.*) (*Associate Member to Member.*)

CHRISTIAN, John Bell, Deputy Manager (Refinery Division), Trinidad Leaseholds, Ltd. (*F. Morton ; A. G. V. Berry.*) (*Member to Fellow.*)

HARRIS, William Herbert, Oil Refinery Engineer, Shell Refining & Marketing Co., Ltd. (*E. LeQ. Herbert ; R. W. J. Smith.*) (*Associate Member to Member.*)

RICHARDS, Alan Roy, Chemist, Trinidad Leaseholds, Ltd. (*F. Morton ; A. G. V. Berry.*) (*Member to Fellow.*)

WRAIGHT, Sidney George, Refinery Manager, Anglo-Egyptian Oilfields, Ltd. (*P. M. Griffiths ; E. LeQ. Herbert.*) (*Associate Member to Fellow.*)

STAFF VACANCIES.

The Institute invites applications for the following posts :

(1) **A Technical Secretary** whose principal duties will be connected with the activities of the technical committees of the Institute, such as Standardization, Engineering, etc.

Candidates for this post should hold a Science Degree and have had experience in the petroleum industry. An aptitude for technical committee secretarial work is essential.

(2) **A Publications Secretary** who will be responsible for the preparation and production of the Institute's *Journal*, *Standard Methods*, and similar publications.

Candidates for this post should have had some experience of technical journalism or other publication work and some experience in the petroleum industry.

Applications stating qualifications, experience, present position, and salary required, should be addressed to the Secretary.

GEOLOGICAL INVESTIGATION AND MINERAL DEVELOPMENTS IN THE COLONIES.

The Imperial Institute announces the inauguration of a series of lectures on the above subject. Each lecture will be devoted to a particular territory and will be given by a recognized authority, such as the Director or a Senior Officer of the Geological Survey or Mines Department of the country concerned.

The first of the series will be given on **Wednesday, 31st October, at 3 p.m.,** by F. Dixey, Esq., O.B.E., D.Sc., F.G.S., Director of the Geological Survey of Nigeria, on

" Nigeria, Its Geology and Mineral Resources."

The chair will be taken by A. Creech Jones, Esq., M.P., Parliamentary Under-Secretary of State for the Colonies.

The lecture, which will be illustrated, will be held in the Cinema Hall of the Imperial Institute, South Kensington, S.W.7 (East Entrance), and will be followed by a discussion.

A second lecture in the series, by N. R. Junner, Esq., O.B.E., M.C., D.Sc., D.I.C., M.Inst.M.M., Director of the Gold Coast Geological Survey, is being arranged for a date early in December, and others will follow.

No tickets of admission are required.

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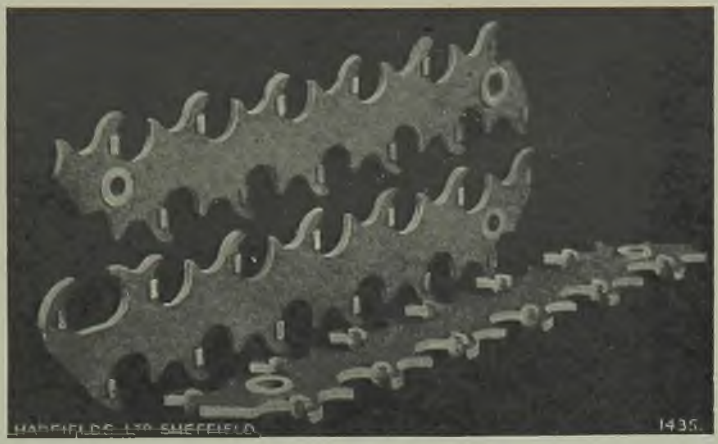

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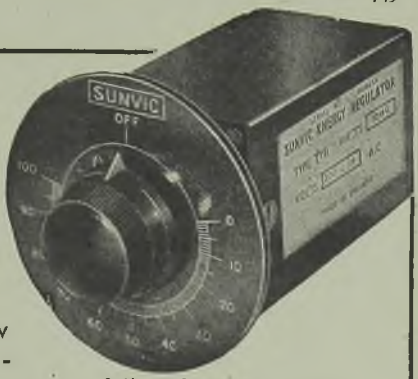

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TABLES
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MEASUREMENT OF OIL

"Measurement of Oil in Bulk—Part I—Standard Weights and Measures" was published by the Institute in 1932. "Tables for Measurement of Oil" can be regarded as Part II of the work on this subject.

The book has been prepared to meet the demands of the petroleum industry for authoritative tables for use in computing oil quantities in territories which employ the British (Imperial) system of weights and measures. It will, however, also be found of considerable value to those using American (U.S.A.) units.

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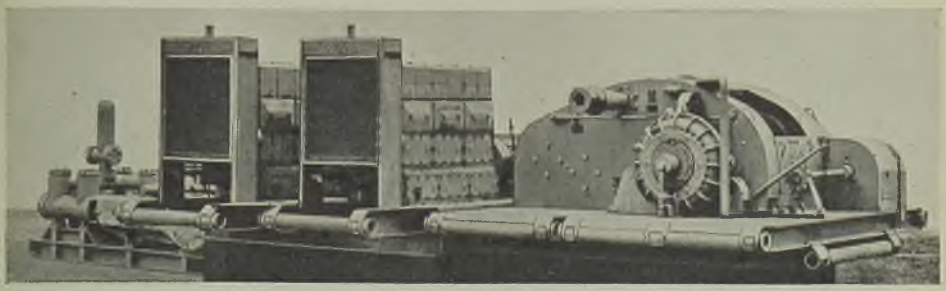

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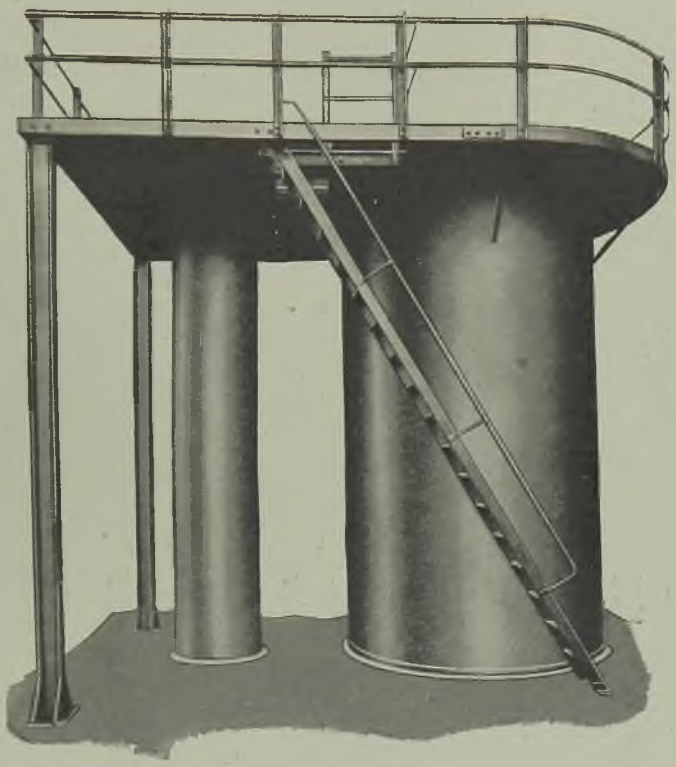

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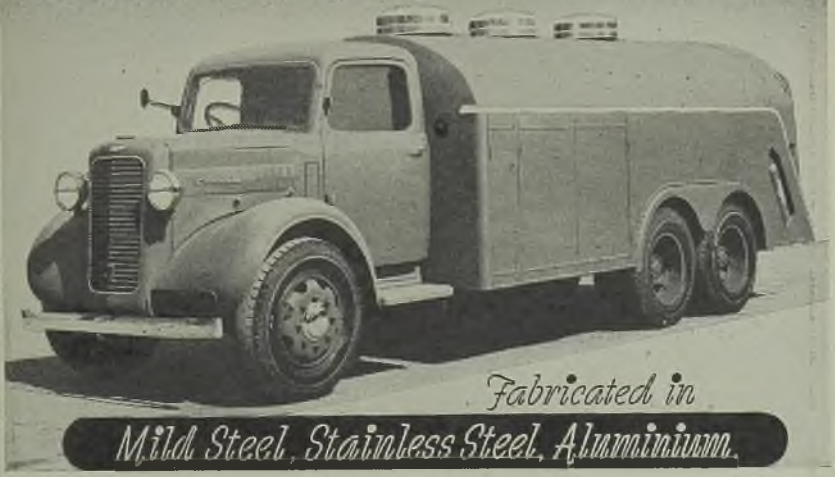

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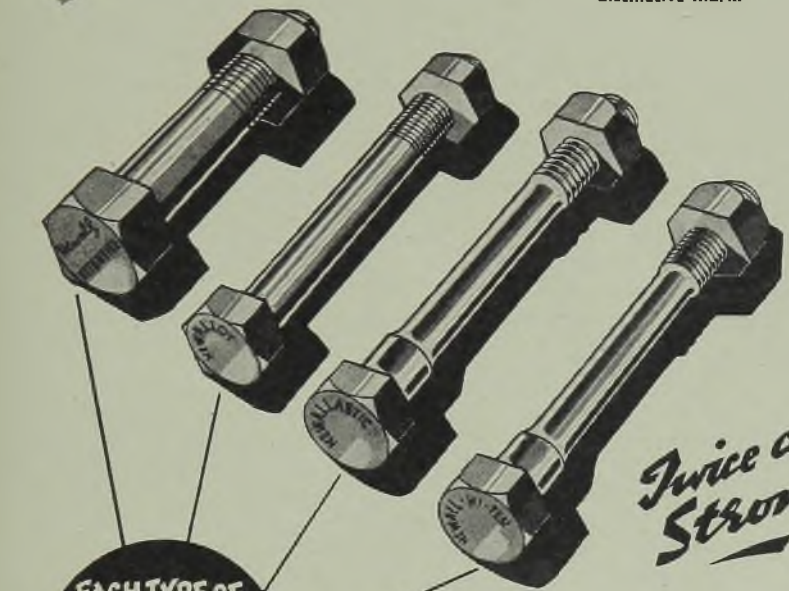

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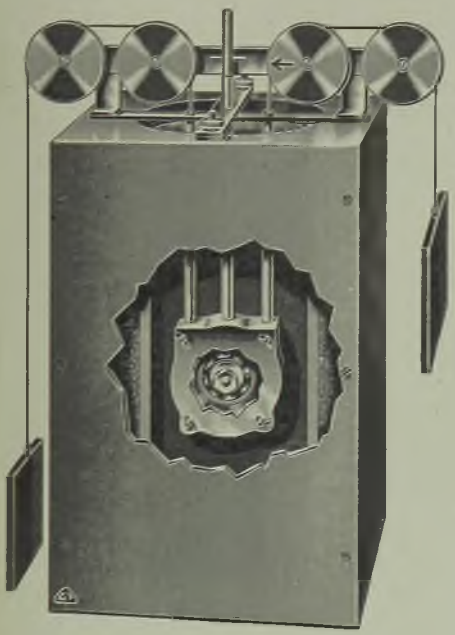

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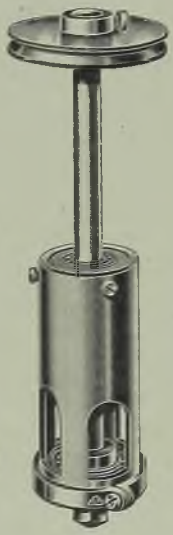

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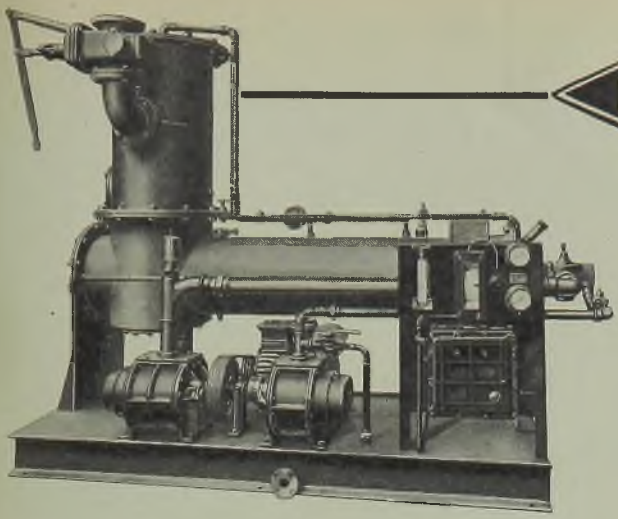

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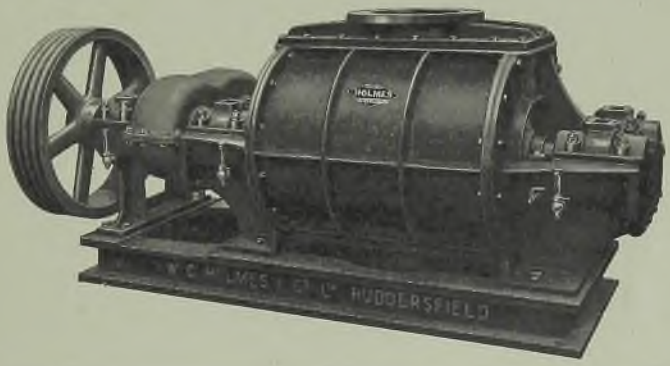

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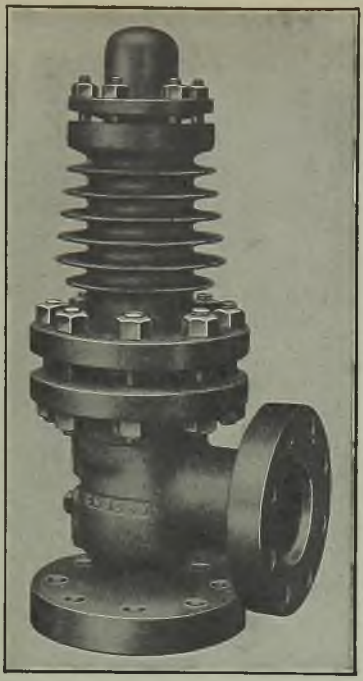

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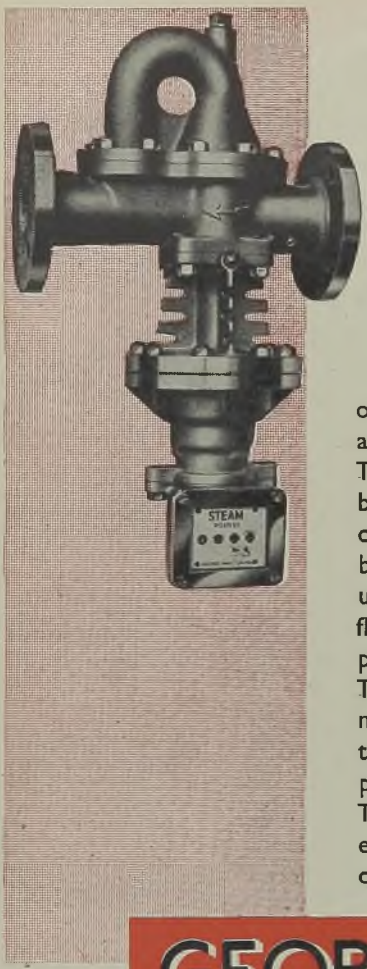

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