

ABSTRACTS.

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OILFIELD EXPLORATION AND EXPLOITATION.

Geology.

641. Petroleum Reservoirs that Consist of Convex Traps. Anon. *Oil Gas J.*, 2.3.46, 44 (43), 93.—Simple convex trap reservoirs may be due to structural deformation, or to variation in thickness of the porous zone, or to a combination of the two factors. Differential porosity may be due to thickness variation in deposition, to differential cementation or to lateral variation.

Composite convex trap reservoirs extend across several structural units, while complex convex trap reservoirs have productive intervals composed of separate productive units. G. D. H.

642. Experimental Well on Atlantic Coast. Anon. *Petrol. Eng.*, April 1946, 17 (7), 144.—No. 1 Hatteras in North Carolina has reached a depth of 6500 ft. Water was encountered in the Tuscaloosa. G. D. H.

643. December Wildcat Completions Drop but Year Sets New High. Anon. *Oil Wkly*, 28.1.46, 120 (9), 40.—The U.S. wildcat completions in December averaged 74.8 per week, compared with 93.5 per week in November. 23% of the November completions were successful.

During 1945 there were 473 new oil discoveries. 315 of these were new fields. There were 154 oilfield extensions. 4337 wildcats were completed in 1945. This was a new record, but well below the P.A.W. goal of 5000.

Tables summarize the results of exploratory drilling in December and during the whole of 1945, according to types and to States and districts.

The December discoveries are listed with brief details.

G. D. H.

644. Future Oil Possibilities of New Mexico. R. L. Bates. *Oil Gas J.*, 2.2.46, 44 (39), 52.—New Mexico produces over 100,000 bbl/day mainly from an area in the southeast of the State, with a smaller amount from the northwest. Roughly three-quarters of New Mexico has more or less promising future oil possibilities.

In southeast New Mexico there are about 10,000 ft of sediments, mainly marine, and not metamorphosed. A notable feature is the buried Capitan limestone (Permian) reef, on or near which lie many of the great oil accumulations. Oil occurs in sandstones, bedded limestones and massive reef limestones. The formations are Tertiary, Triassic, Permian, Pennsylvanian and pre-Pennsylvanian. The first two are non-marine and lack oil; the Permian has produced over 400,000,000 bbl of oil, and the older beds are being prospected, promising production having been obtained. There are wedge belts of porosity, as on the margin of the Delaware Basin, from southeast Lea County nearly to Carlsbad.

In the area to the west of the above there are several thousand feet of sediments, except possibly in the mesa country and in parts of the Sacramento Range. A combination of factors seems to rule out much of the Permian as regards oil possibilities. The Lower Permian seems to merit some consideration, and there are signs that the older reefs are farther out in the basin. It is possible that reefs occur in pre-Capitan beds. Pennsylvanian, Mississippian, Devonian, Silurian and Ordovician beds are present. They seem to be marine, but little is known about them. Mississippian reefs are known in the Sacramento Mountains.

Some of the few wildcats have had slight oil shows.

The third area in southwest New Mexico has a cover of alluvium, and lava flows over about four-fifths of its surface. The sediments thin to the west. All the Palaeozoic, except possibly the Cambrian, is represented. There are Cretaceous beds in the east. Most of the beds are marine. There is much evidence of alteration. Signs of oil and gas are restricted to the eastern part of the area. On the whole it appears that the oil possibilities of this area are slight.

The northwestern part of the State is underlain by part of the San Juan basin. A deep test on the Rattlesnake anticline found 7400 ft of beds ranging from Upper Cretaceous to Cambrian. The basin has freshwater Tertiary, marine and non-marine Cretaceous, continental Jurassic, Triassic and Permian, marine Pennsylvanian,

Mississippian and Devonian. There are abundant evidences of oil and gas, production having been obtained at twelve localities, from Upper Cretaceous sandstones and Palaeozoic limestones. The Rattlesnake pool lies within 3 miles of an igneous intrusion; it obtains oil from the Dakota sandstone (76° A.P.I.) and the Hermosa limestone, and helium-bearing gas from the Ouray-Leadville limestone. Productive stratigraphic traps occur in the Upper Cretaceous. There are undoubtedly wedge belts of porosity in the Pennsylvanian and older beds. Forty-five structures have been recognized, and 30 have been drilled, at least to the Dakota. It is believed that oil has been flushed from many structures.

The fifth area is in northeast New Mexico. Pennsylvanian to Recent beds occur. 8000-9000 ft of sediments may be present in some places, the thickness being determined by the form of the pre-Cambrian beds. Marine, lagoonal and continental deposits are known, and there are numerous evidences of oil. There are seeps, and wells have had oil shows. Several unconformities are known, and some are associated with pre-Cambrian highs. A Pennsylvanian limestone appears to have good oil prospects, and the same is true of the granite wash (Upper Pennsylvanian and Lower Permian) and the Dakota sandstone. In areas of this type tests on the crests of highs may fail because the producing beds wedge out on the flanks. G. D. H.

645. South Dakota Test has Oil and Gas Showings. Anon. *Oil Wkly*, 28.1.46, 120 (9), 29.—The Hollingsworth 1 wildcat, near Edgemont, South Dakota, has encountered good oil and gas shows in the third Leo sand. The Morrison sand occurred at 530 ft, the Sundance sand at 790 ft, the Converse sand (Pennsylvanian) at 1710-1840 ft, with a small oil show, the First Leo sand, with some oil, at 2195-2223 ft, the Second Leo sand, with oil and gas, at 2295-2330 ft, and the Third Leo sand was topped at 2396 ft. G. D. H.

646. Discovery of Oil in Nicaragua Denied. Anon. *Oil Gas J.*, 16.2.46, 44 (41), 86.—In 1945 a deep well was drilled in Nicaragua for stratigraphical information, and seismic work is under way, but it is denied that oil has been found. G. D. H.

647. Socony-Vacuum's Barinas Wildcat Down 2900 Ft. Anon. *Oil Gas J.*, 9.2.46, 44 (40), 62.—Floresanto 4 and 5 of the Sinu area of Colombia have been abandoned as dry holes at 1504 and 1330 ft respectively. In Floresanto 6, the aim is to obtain oil from shallow sands. 1 Pedral has reached 8330 ft, and Socony has a wildcat at 8045 ft in the Magdalena Valley.

Guico 20 has been completed as an oil well at 6927 ft, and 1 Tascabana is being completed as a small gas well. A Barinas wildcat is drilling at 9536 ft, while Socony's Barinas test is at 2900 ft. G. D. H.

Geophysics and Geochemical Prospecting.

648. Emanometric Oil and Gas Prospecting. S. J. Pirson. *Petrol. Eng.*, Jan. 1946, 17 (4), 132.—The emanometric prospecting technique endeavours to measure the absolute emanation per unit area of the earth's crust for one or more gases of diagnostic value, in order to detect commercial oil or gas accumulations. Various pieces of evidence point to the existence of micro-seepages, but objections have been raised. It is possible that oil generation is still going on.

Since methane is formed from decaying vegetation it cannot be used as a reliable indicator of the occurrence of subterranean oil and gas accumulations. Ethane is believed to be a satisfactory indicator. Higher hydrocarbons could also be employed, but their rates of diffusion are lower. The observed rates of emanation of ethane are of the same order as those predicted on the assumption that the formations show an overall permeability of 10^{-7} darcy.

In the field the emanations are collected by adsorber tubes, which are then taken to a laboratory for degassing, and fractionation and identification of the diagnostic gases.

It appears that there is a uniform hydrocarbon diffusion field due to present-day generation of oil and gas, possibly directly in life processes, bacterially, by radioactivity or electrolytic synthesis. There is also a possibility of artificial high leakage areas which might be taken for indications of an oil or gas pool. Such artificial highs

may be due to topography and ground-water movement. The measurements must be corrected for these two factors in order to give the anomaly map, which is due to confined pressure sources of oil and gas accumulations. Further corrections are required for soil types, and deep geological effects resulting from structure with a consequent possibility of lateral shift of the anomaly relative to the accumulation.

G. D. H.

649. Present Status of Electrical Prospecting. V. G. Gabriel. *Petrol. Eng.*, Jan. 1946, 17 (4), 66.—Electrical prospecting methods use (a) natural currents, or (b) artificial currents. The latter are subdivided into (1) conductive methods; (2) direct-current measurements; (3) alternating-current measurements; (4) inductive methods; (5) transient methods. Resistivity, transient and radio-frequency methods have been employed in searching for oil.

Resistivity methods have been successfully applied in structural studies of shallow and medium deep horizons, with claims of effective depths of 5000–6000 ft. Some are stated to detect oil directly under favourable conditions. Radio-frequency methods have been applied in structural studies, but are still in the experimental stage.

Tables give examples of the application of the different methods (taken from published descriptions).

G. D. H.

650. Geophysical Prospecting for Oil in India. A. O. Rankine and P. Evans. *Petrol. Times*, 27.4.46, 50 (1272), 432.—A brief summary of the vast work initiated by the Burma Oil Co. to survey India and Burma by the gravitational method, in order to explore for oil under the alluvial deposits which prevented geological exploration, is given, together with the effect of the war in stopping these surveys and a brief glimpse into the future.

A. H. N.

Drilling.

651. Porosity of Drill Cuttings Tested by New Method. M. A. Westbrook and J. F. Redmond. *Oil Gas J.*, 6.4.46, 44 (48), 127.—The well samples containing the cuttings representative of the particular intervals are first washed through a No. 6 gauge screen. The cuttings remaining on the screen are large enough to use for the porosity measurements. From the sized sample, the cuttings to be examined are separated from the shale and other extraneous particles. It is recommended that 10 to 15 c.c. of the selected cuttings be used for measurements, although only 4 to 5 c.c. were used to make the comparative tests described later in the article. These cuttings are extracted and dried by the same methods used for preparing core samples for porosity and other measurements. The clean dry cuttings are weighed, placed in a weighed and volumetrically calibrated graduate, evacuated for approximately 20 min, and then saturated by allowing water to flow into the evacuated system. The system is next opened to the atmosphere and allowed to stand for 5 to 10 min, so that the water will completely penetrate the pores. Longer times may be required for cuttings having very low permeabilities. Water is added until the graduate is filled to the calibration mark. The graduate and contents are reweighed so that the weight of water added may be determined. This weight is converted to volume by knowing the density of the water at the temperature existing at the time the flask was filled to the calibration mark. The resultant volume subtracted from the flask's calibrated volume equals the volume occupied by the dry grains. This volume is later referred to as grain volume. The saturate cuttings are then spread on an alundum disc, which is saturated and in contact with a column of water, being sealed to a funnel, the funnel in hydraulic contact with a reservoir which can be raised or lowered. By lowering the reservoir to a judicious distance, vacuum is created which is just sufficient to drain the excess water without drawing off the water from the pores. The volume of the saturated cuttings is then found by displacement of water from a calibrated cylinder, and thus the bulk volume. Addition of 1 gr of ammonium oleate/l of water prevents air bubbles adhering.

$$\text{Porosity \%} = \left(1 - \frac{\text{grain volume}}{\text{bulk volume}} \right) \times 100.$$

A. H. N.

652. World's Deepest Cable-Tool Test is Completed. J. T. Galey. *Oil Gas J.*, 30.3.46, 44 (47), 266.—The deepest cable-tool hole in the world, so far as can be ascertained, has recently been completed by Manufacturers Light & Heat Co., on the Jesse G. Hockenberry farm, Mercer Township, Butler County, Pennsylvania. This wildcat was abandoned, after it showed considerable salt water, at 10,096 ft. in what is considered to be an Upper Cambrian sand. Stratigraphically, the test is the deepest yet drilled in Western Pennsylvania, Eastern Ohio or West Virginia. The geology and drilling of the well are described. The rig, tools and lines are described and some of the drilling difficulties are given, such as gas pockets which were encountered with various degrees of explosiveness. A. H. N.

653. World's Largest Derrick "Walked" Across West Texas Sand Dunes. E. H. Short, Jr. *Oil Gas J.*, 9.3.46, 44 (44), 60-62.—The derrick and its equipment weigh approximately 125 tons. With the derrick free from all connections, it was jacked up and wooden shoes placed under each corner of the substructure. These shoes, approximately 2½-ft in width and 5 ft in length, were bolted to the upper half of the grillage. Movement of the derrick was then begun (by means of a winch on a 3½-ton truck) on rollers over a plank road. This plank road was carried forward as the derrick was moved. From the time the derrick was jacked up at 7 Sealy Smith to the time it was jacked down at 10 Sealy Smith required only 2 days. It is estimated that the skidding of this derrick saved approximately 14 days over the method of tearing down the derrick and rebuilding it at the new location. A. H. N.

654. Big Rig Features Unitization and Easy Operation. G. M. Wilson. *Oil Wkly*, 18.3.46, 121 (3), 32-36.—The rig described is one of the largest gas-powered units in California and is designed to drill to 15,000 ft. Outstanding features include maximum unitization for easy hauling on highways; convenient stair-step design which makes it adaptable to any height or type of sub-structure; direct air-operated friction clutches for both draw works and rotary drives; and unusually convenient, compactly arranged driller's controls. It is driven by three butane-powered engines compounded into a single transmission, an extra shaft being supplied at the rear of the case for driving one of the two mud pumps. Two unitized engines driving to a common V-belt pump sheave power and other pump. Matching the draw works and pump assemblies in portability and accessibility are the efficient and internally strengthened mud tanks, designed for this rig. They may be quickly and easily broken down for transporting, with hinged walkways folding inward to lay on top the open tanks. Among the operating advantages of this tank system are a simplified type of pump suction cut-off which greatly facilitates the job of closing off and opening up suction lines. The entire rig was designed primarily for internal-combustion engines and consists of the draw works, a selective 3-speed forward and reverse transmission, a three-engine compounding transmission, two slush pumps and the structural steel mounting members. At 900 r.p.m., the three butane-powered engines deliver 1000 hp, although this power rig has a nominal rating of 1250 hp. The present installation is about 80% powered, it being possible to add still another engine to the unit if necessary. It has six hoisting speeds—the three rotary speeds, two reverse speeds to the drum shaft and one for the rotary table. While the draw works in itself has but two hoisting speeds, the additional flexibility is gained through the three-speed transmission. Illustrative of the abundance of power available is the fact that on the previous well drilled, some 9510 ft of ⅝-⅝-inch drill pipe was carried easily with only the four upper speeds of its available six being utilized. The present well is the second job for this unit in California. Details of the rig and its performance are given and illustrated. A. H. N.

655. Byron Jackson New Automatic Drill Pipe and Casing Slips. Anon. *Petrol. Times*, 27.4.46, 50 (1272), 40.—A new design of drill pipe and casing slips, mounted on an arm which is automatically lifted by air, steam or hydraulic power, is described. A. H. N.

Production.

656. The Optimum Rate of Production for Uniform Producing and Variable Depletion Rates. Part 24. P. J. Jones. *Oil Gas J.*, 9.2.46, 44 (40), 88.—Declining rates of production may be accompanied by uniform or variable rates of depletion. A pro-

cedure for estimating the optimum rate of production for a reserve, a fraction of which is recoverable before production starts declining and a fraction at uniform rates of depletion, was considered in Part 23 of this series. In the present article, variable rates of depletion are considered. A procedure for estimating optimum rates of production for increasing rates of depletion is illustrated by an example on a natural-gas reservoir having water encroachment and one on a cycling project. A procedure for estimating optimum rates of production for decreasing rates of depletion is illustrated by examples on oil reservoirs having marginal reserves. A. H. N.

657. Oklahoma's First Triple-Zone Completion. N. Williams. *Oil Gas J.*, 6.4.46, 44 (48), 104-106.—So far, only a relatively few wells, most of them in South Texas, have been completed as triple-zone completions. The complications arising in segregating three horizons in the same well bore have been such until recently as to prevent more general completions of this kind. The triple completion described in this article not only in the first for Oklahoma, but reflects the developments in equipment and technique adaptable for this work. Methods employed ensured the completion of the well with ease and safety. Dimensional details (too many to quote) of the tubings and casings used are given. After setting tubings, packers, etc., each zone was cleaned. With all zones separated, deadweight pressure gauges were taken on each zone for 10 days to make certain all packers were holding. After the ten days, there was 1527 psi pressure on the Glover zone, 1309 psi pressure on the Charlson zone and 1950 psi pressure on the Mona zone, with no apparent leakage. The Charlson (middle zone) was then opened to the atmosphere and the pressure of the other two zones was carefully checked for any drop. Pressure remained constant, proving no leakage existed. The hook up is illustrated diagrammatically. A. H. N.

658. Selective Control Featured in Recent Choke Installations. E. H. Short, Jr. *Oil Gas J.*, 6.4.46, 44 (48), 102.—The usual chokes used in well controls vary in size increments of $\frac{1}{16}$ inch. The variation in production rates resulting from a $\frac{1}{16}$ -inch increase in choke size may be extremely great. For example, consider that a well flows 135 brl through a $\frac{3}{8}$ -inch choke. The well's allowed production may be only 95 brl/day. However, if the next size smaller fractional choke ($\frac{1}{4}$ -inch) is used, the production, based upon decrease in choke area, would amount to only 67 brl/day. Thus, the well would probably be produced for a time on the lower rate and for the rest of the month on the higher rate. The sudden increase in the rate may harm the well. Therefore, a series of chokes were designed to give increments of 10%. A chart gives full detail of the characteristics of these chokes. A. H. N.

659. Automatic Expulsion of Water from Wells Aids Flow. G. B. Nicholson. *Oil Wkly*, 1.4.46, 121 (5), 33.—To postpone arrival of the inevitable artificial life stage with the corresponding increased lifting costs incurred, several operators in fields on the Gulf Coast instal automatic purgers as part of the surface equipment to intermittently expel the head of water which builds up in the tubing of many wells. The mechanical devices, designed to open automatically for releasing accumulated water when it begins to affect the flow characteristics of a well, are growing increasingly popular, replacing manual manipulation of valves or frequent readjustments in choke size, which requires considerable attention.

A universal operating practice includes the use of a surface choke which applies a back pressure to the formation and the tubing, and retards the velocity of fluids moving through the tubing towards the surface. Often, after water appears in the production, the velocity of fluids is so slow that water separates from the oil and has opportunity to drop back into the tubing with the oil and only minor portions of the water being produced. Accumulation of water which forms in this manner is reflected by a drop in tubing pressure apparent to the surface, and continuance of producing under the same conditions often aggravates the grievance, with the result that increasing amounts of water accumulate in the bottom of the tubing, with pressure dropping accordingly. In many wells, the tubing pressure declines to a negligible factor, and often a well ceases to flow entirely. If, when water first begins to settle, the rate of flow is increased until the water is emptied, many wells will continue to flow longer. To eliminate the obvious operational disadvantages of having personnel present to adjust valves on the Christmas trees as a means of expelling the accumulation of water,

a well purger containing a spring-loaded valve is attached to the flow line and, motivated by variations in the tubing pressure, automatically controls movement of fluid from the well as prevention of forming a water column. The valve is placed in the off-tubing wing of the Christmas tree, or in a bypass around the choke. After the tubing pressure drops to a predetermined value, the spring forces the valve to open, allowing a rapid evacuation of fluid from the tubing, during which period the well produces through both the bypass valve and the regular choke. With emptying of water from the tubing, the pressure rises to normal as volume of gas begins to increase, and the pressure serves as the force to close the valve against the spring pressure.

A. H. N.

660. New Type Plug-Back Material Tried in Oil Wells. J. C. Padgett. *Oil Wkly*, 1.4.46, 121 (5), 30-31.—A new type of waterproof plastic cement is being applied on remedial work in producing oil wells, and results have proved gratifying, although full significance of application may not be known until after a number of treatments have "aged" for a year or two. Known as oil-well hydromite, the new compound is composed of a pulverized cementitious filler and a powdered resin. Both materials are activated by the addition of an accelerator and made into a slurry by mixing with water. The setting time of the slurry of plastic cement can be controlled to very close limits. Field tests have proved that an initial setting time within the range of 60 to 100 min is most practical to use in a well and most economical to the well owner in lieu of rig time and other variable costs. The new plastic cement possesses an added feature not usually found in ordinary plastics. It has a linear expansion of approximately 0.3% at the time it takes its initial set. This property has proved very valuable in remedial work where a good tight bond, to either the walls of the casing or the exposed surfaces of a formation, is necessary to ensure adequate protection to the well being worked over. In a manner similar to Portland cement, the material continues to strengthen as it ages for a few hours. Results of an experimental plugging job are given in some detail.

A. H. N.

661. Curves Summarize Investment and Operating Costs for Water-Injection Plants. L. T. Gibbs. *Oil Gas J.*, 2.3.46, 44 (43), 74.—A graph presents curves which can be used to evaluate the cost in cents/brl from rate of flow in brl/day and the hp of triplex or quintuplex pumps. The basis and use of the curves are explained.

A. H. N.

662. Repressuring Operations in West Texas Pool. E. H. Short, Jr. *Oil Gas J.*, 9.2.46, 44 (40), 85.—The development and characteristics of the pool are given, followed by a brief study of the repressuring operations undertaken by the operators.

A. H. N.

663. Well-Interference Studies Are Important in Spacing, Drainage Problems. K. B. Barnes. *Oil Gas J.*, 13.4.46, 44 (49), 92-94.—For many years the accepted standard spacing was one well to 10 acres. For about the past 10 years a great many pools have been developed on 40-acre spacing—and virtually altogether so during the war period 1942-45. The present majority practice of 40-acre spacing, however, currently is under review in many areas, and for several reasons. One is that war restrictions are now off and those that wish to drill closer may do so. In the other direction, deeper pools are being found, with physical and economic conditions such that some operators desire to space wells further apart than 1 to 40. The question is discussed in this paper from the viewpoint of interference. Reference is made to Muskat's work, which showed that, due to interference, increasing the number of wells in a field does not increase proportionately the rate of production. The ideal conditions of uniform thickness, permeability, circular reservoir with constant influx, complete well penetration and single-phase flow apply. The productive capacity of the first well (6-inch bore) drilled in this ideal field is 1000 brl/day. If a second well is drilled 400 ft away, the combined productivity capacity is not 2000 brl/day, as perhaps might be surmised on first glance, but only 1509 brl/day—due to interference. For three wells so spaced, the total capacity is 1818 brl/day. It is 2061 for a total of four wells, 2132 for five wells, and but 2778 for nine wells. For 16 wells the total productive capacity is not 16,000 brl/day, but only 3333. It is suggested that interference effects can be obtained by shutting in a field or large producing area and, after equilibrium is established or closely

approached, producing one well. The effect on the bottom-hole pressure or fluid levels of the other wells is observed. Or the reverse procedure can be followed, with all wells being produced except the one where the combined interference effects are to be noted. That well, of course, is shut in and pressure or fluid-level tests are made on it.

A. H. N.

664. How to Inject Gas Into Limestone-Dolomite Reservoirs. J. A. Barnett and M. H. Soyster. *Oil Gas J.*, 23.2.46, 44 (42), 161.—The subject is discussed not in general but with reference to the practices employed in the Grayburg unit area in New Mexico. The development, drilling and production methods and the production data of the field are presented. Oil analysis and oil to gas ratios are presented, followed by the principles used in selecting input wells and injection practice.

A. H. N.

665. Application of Laboratory Data on Phase Behaviour to Condensate-Reserves Evaluation. E. W. McAllister. *Oil Gas J.*, 9.2.46, 44 (40), 92.—*Paper presented before California Natural Gasoline Association.*—Typical experimental results on retrograde condensation of natural gas under high pressures are reproduced. The significance of these curves in the calculations of reserves, assuming different modes of production, is discussed, showing when production by cycling is to be preferred to production by pressure depletion.

A. H. N.

666. Completions in Rangely Field are Complicated by Tight Formations. N. Williams. *Oil Gas J.*, 9.2.46, 44 (40), 77.—The field discussed is in northern Colorado. Naturally slow to give up oil, the formation necessitates unusual care in completion of wells to protect the sand face from outside contamination and that means to be taken to induce greater porosity if maximum productivity is to be attained. Technically, the separation of well completion begins with the actual drilling of the formation, since the methods employed in penetrating the section have a direct bearing on how clean the sand is kept. In view of its "tightness," the sand is particularly susceptible to being sealed off with drilling mud or "logged" with water infiltration from the mud. A factor in this is the hardness of the formation which substantially retards drilling and lengthens the time the sand face is exposed to the drilling fluid. The production casing string is set and cemented before drilling the producing formation. Details are given.

A. H. N.

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Oilfield Development.

668. Post-War Oil Supply Areas. J. T. Duce. *Petrol. Times*, 13.4.46, 50 (1271), 382. —Proved reserves and potentialities of the world in general and of the following countries are given:—Alaska, Canada, Mexico, Central America, Colombia, Venezuela, Ecuador, Peru, Bolivia, Chile, Uruguay and the Guianas, Brazil, Argentine, West Indies, Australia and New Zealand, Africa, Egypt, Roumania, Hungary, Germany and Austria, France, Spain and Portugal, Denmark, Poland, Albania, Italy, England and Ireland, Baltic Republics, Sweden, Norway, Finland, Yugoslavia, Bulgaria, Greece and Switzerland, Belgium and Holland, Russia, China, Japan, Phillipines, East Indies, India and Burma, Afghanistan and Persian Gulf Area. Most of these are treated very briefly. A. H. N.

669. Proven Reserves Estimated at 20,826,813,000 bbl by A.P.I. Anon. *Oil Gas J.*, 2.3.46, 44 (43), 43.—At the beginning of 1946 the proven U.S. crude oil reserves were estimated to be 20,826,813,000 bbl, a rise of 373,582,000 bbl during the year. The 1945 production of 1,736,717,000 bbl was a record. New pools accounted for 419,984,000 bbl of the reserves discovered in 1945. 111,250,000 bbl of natural gasoline was produced in 1945, and 4,820,000,000 cu ft of natural gas, making the total barrel equivalent of petroleum products in 1945 2,650,000,000 bbl. G. D. H.

670. Oil Rush on in Northwest Colorado. Anon. *Petrol. Eng.*, Jan. 1946, 17 (4), 224. —Developments are taking place around Rangely, in the Brook plateau region of northwest Colorado. The productive Weber sand, 6000 ft deep, was first penetrated in 1933, but isolation precluded further development until 1945. Reserves are estimated at 418 million bbl, with the field limits not yet defined. A 150-mile 10-inch pipeline has been built to Wansutter, Wyoming, where there are trunk-line connections. G. D. H.

671. **Second Test is Planned in Chile's New Oil Field.** Anon. *Oil Wkly*, 18.2.46, 120 (12), 44.—The discovery well of the oil field in the District of Majellanes flowed 200 bbl/day through a $\frac{1}{2}$ -inch choke, from 7419-7438 ft. A second well is to be drilled $\frac{1}{2}$ mile to the north. G. D. H.

672. **Alberta Production Decline Continues in 1945.** J. L. Irwin. *Petrol. Times*, 30.3.46, 50 (1270), 328.—Statistical study of Alberta oilfields is presented which shows a general decline in total production, in the daily average and the overall value of the crude. Outside Turner Valley, however, the overall change is towards an increase in production. Turner Valley is nevertheless the most important source of petroleum for Canada, as it supplied 92.13% of Alberta's total production, which production forms 94.01% of Canada's total for 1945. A. H. N.

673. **Kuwait Oil Shipments to Start Within 90 Days.** Anon. *Oil Gas J.*, 16.2.46, 44 (41), 86.—Crude oil shipments from the Burgan field are expected to start in May. The productive capacity is 30,000 bbl/day. All the wells were plugged in 1942, and the nine wells are being re-completed. It is hoped to bring in all wells as dual-zone producers, and they are expected to give 2500 bbl/day from each zone. The wells are drilled to the Upper Cretaceous, the maximum depth being 4750 ft. The oil is of 32-36.4° A.P.I. gravity, and has 1.9% of free sulphur. The reserves are conservatively estimated at 5,000,000,000 bbl. G. D. H.

674. **Crude Runs Start from Second Arabian Field.** Anon. *Oil Gas J.*, 16.2.46, 44 (41), 86.—A 40-mile 12-inch pipeline from Abqaiq to Dhahran has begun to deliver oil, and a 40-mile 12-inch line from Dhahran to Ras Tanura, parallel with the existing line, is under construction.

The Dammam field of the Dhahran area was hitherto Saudi Arabia's only producing field, giving 95,000 bbl/day.

Abqaiq is 40 miles southwest of Dhahran. The discovery well was completed in 1941 at 6180 ft, giving oil from the D member of the Arab zone. Five wells have been completed, proving an area about 7 miles long and 3 miles wide, without delimiting the structure in any direction. The structure may be one of the largest in the Middle East. G. D. H.

675. **Zistersdorf Production Receives Sharp Cutback.** Anon. *Oil Wkly*, 18.2.46, 120 (12), 44.—The present production at Zistersdorf is at the rate of 3,226,600 bbl/year, but in 1944 it is reported to have produced 9,758,536 bbl. G. D. H.

676. **War's End Brings Accelerated Activity in Yumen, China's Only Oilfield.** K. C. Lu. *Oil Gas J.*, 29.12.45, 44 (34), 253.—The Yumen field of Kansu Province was opened in 1939. It is on the northern flank of the Chihlienshan Range. The initial well was completed as a pumper at 500 ft. A flowing well was completed in 1941 at 1430 ft. Development was slow because of supply difficulties, but since the war ended expansion of the production and refining capacity has been begun.

Production is from two Cretaceous sands, both medium grained and of high porosity, and about 150 ft thick. Active seeps occur where the Shihyouho River cuts across the structure, and at an outcrop 2 miles to the east. Little is known about the sub-surface structure which seems symmetrical.

Seven wells were drilled between 1939 and 1941, the average depths of these pumps being 550 ft. Since then 18 flowing wells have been drilled by rotary. Several oil sands have been found beneath the lower producing sand.

Drilling and production practices are briefly described. Output is 1500-2200 bbl/day. Several topping batteries and a pipe-still have been built, and a thermal cracking plant is being erected. The crude gives about 21% of straight-run high-octane gasoline. G. D. H.

677. **Chinese Reserves Still a Mystery.** Anon. *Petrol. Eng.*, Nov. 1946, 17 (2), 184.—Oil has been discovered and some reserves proved in Kansu, Shensi, Sinkiang and Szechuan Provinces. There are less substantial oilfields in Chekiang, Kweichow and Sikang. Oil shales occur in Kwangtung, Shensi, Szechuan, Kwangsi, Chahar, Jehol and Liaoning.

In 1934 there was estimated to be 1376 million bbl of oil reserves in Shensi and Szechuan, 2110 million bbl in the four northern provinces and 852 million bbl of shale oil reserves in Shensi. U.S. Geological Survey estimates were 1375 million bbl of crude and 1899 million bbl of shale oil. G. D. H.

REFINERY OPERATIONS.

Refineries and Auxiliary Refinery Plant.

678. Selection and Application of Refinery Instruments. Part I. A. Kreig. *Petrol. Engr.*, Jan. 1946, 17 (4), 120.—The major factors which must be considered in the selection of a pressure instrument for a specific application are:—safety, accuracy, flexibility, simplicity, service facilities and standardization. These also apply to instruments for temperature, liquid level or flow. Pneumatic control action is most commonly used, and is classified in three groups:—(a) On-off or fixed sensitivity; (b) proportional or adjustable sensitivity; (c) proportional re-set or adjustable sensitivity with automatic re-set. The application of instruments and accessories for indicating, recording, regulating or control of pressure are shown in diagrams, described and discussed under the following sections:—self-acting regulator, pilot-operated pressure regulator, sump level control, hydraulic coupling scoop control, tower and receiver pressure control. Pneumatic transmission as practised at the Paulsboro refinery is discussed. W. H. C.

679. Metals and Alloys in the Petroleum Industry. J. H. Wilson. *J. Inst. Petrol.*, April 1946, 32 (268), 230–240.—The metallurgy of ferrous and non-ferrous alloys and their use, especially in the petroleum industry, is briefly studied. "Safety" tools used for non-sparking applications are discussed, with special warnings against using cast "safety" tools and against using them when they pick up silica dust against steel, as they may spark. A. H. N.

680. Corrosion Protection of Steel Pipe by Resin Baking Coating. Anon. *Nat. Petrol. News, Tech. Sect.*, 5.12.45, 57 (49), R992.—A paper on resin baked coatings by induction heating by R. J. Moore, read before the Federation of Paint and Varnish Production Clubs, is reviewed. The phenol-aldehyde resins possess ideal properties for the protective coating of metals and other materials, and during the war their application has been enormously extended. Their many uses are described. The baked resin finishes are plastic coatings which result from the polymerization of the phenol-aldehyde reaction resins on heating (thermosetting), which transforms the alcohol soluble phenol-aldehyde resin product into an alcohol insoluble and infusible material, the so-called C-stage of the process. Because of the polymerization conversion these baked coatings harden to a glass-like surface which withstands shock and high temperatures and pressures without deterioration, and are very resistant to corrosive materials. These thermosetting resins are discussed in comparison with the oxidation films from paints and varnishes and the improvements they afford when used in association with them. Great improvement in the film properties has resulted from the use of induction heating, by which heat is induced in the metal object by passing the coated metal through an electromagnetic field actuated by high or low frequency alternating current. By this means continuous production cycles for transforming the resin coating may be obtained, giving uniform cures in a few minutes, as compared with conventional and infra-red ovens, which take 20–60 min. Another advantage is that, by this method of heating, the film next to the metal is first heated, and the possibility of "case-hardening" does not occur. A diagram of a laboratory continuous induction pipe coating apparatus is shown. The applications of the baked resin coatings in the petroleum industry are discussed.

Coated pipelines buried in various types of corrosive soils remained practically unaffected after 4–6 years.

Low pressure boiler tubes with baked phenolic resin coatings have remained in use for four years without a failure under the same conditions in which uncoated tubes failed in three months, i.e., on the outside water containing mineral salts at 220° F and flame and flue gases through the inside at 675° F.

Admiralty metal tubes in heat exchangers with gasoline or oil outside at 215° F and brackish to salt water at 180–212° F inside, failed in 4 months. Steel tubes coated with baked phenol resin, have been in use two years under the same conditions.

Baked resin coated equipment, in which mixed benzene, steam alcohol and acetic acid is used, is in excellent condition after four months' operation.

Large refinery tests have shown that such coatings withstand the corrosion and pressure conditions in natural gas lines at 720 psi. These tests also involved resistance to lubricating oil and to 30% CaCl₂ solution. Similar protective treatment for boiler and condenser is increasing. W. H. C.

681. New Design of Downspout for Bubble Trays Separates Liquid from Foam and Vapours. Anon. *Nat. Petrol. News, Tech. Sect.*, 5.12.45, 37 (49), R.990.—A radically new design of down-spout for bubble-cap trays in fractionating columns is described in the U.S.P. 2,385,355, granted on 24.9.45 to C. G. Gerhold and the U.O.P. Co.

The new downspout design consists of two conduits of the same length but differing diameters, one concentric to the other, the outer dips beneath the liquid in the lower tray and extends about one quarter of its length above the higher bubble-cap tray and ends in a cap through which the inner pipe extends about one quarter of its length. The cap top is provided with a number of concentrically disposed ports. On the periphery of the outer pipe (downtake) at a point immediately above the bubble-cap tray is also a series of concentrically arranged ports whose area is insufficient to allow the passing of liquid from the tray beyond the level required by the bubble caps. The functions of the design are described in detail and diagrammatic sketches are shown of it and a slightly different arrangement of the cap head ports.

By such means it is claimed that "a portion of the liquid is utilized as an effective head to induce the flow of liquid from the tray into the downspout whenever the height of the liquid level upon the tray rises above a certain predetermined point. When the liquid upon the tray is below this predetermined point only the height of liquid above the tray is effective as head for inducing flow to the downspout. The increased head effected by the arrangement makes possible the use of smaller downspouts, thereby releasing more tray area for bubble caps." Accumulation of sediment on the trays is also eliminated. W. H. C.

682. North American Operating Refineries. Their Capacities and Locations. Anon. *Oil Gas J.*, 30.3.46, 44 (47), 254.—A summary is given of the location and capacities of active plants in the United States and Canada as at 1946.

The type of refinery whether for lubricating oils, asphalt, or gasoline, for example, is stated, together with the crude oil and cracking capacity. The list includes U.S. Government owned synthetic rubber plants, also refineries in Mexico are noted. Data on catalytic and associated units include type, capacity, alkylation and isomerization production. G. A. C.

683. Recent Work on Corrosion and Oxidation. U. R. Evans. *J. chem. Soc.*, 1946, 207.—A review of recent work on the "wet" and "dry" corrosion of metals is given with particular reference to the oxidation of iron and zinc. An electrometric study of oxidative filming reactions at high temperatures has shown that the effect of temperature on the variation of film thickness with time is parabolic or exponential, according to the temperature. By a study of the effect of impurities on the electrical conductivity, it has been found that selective oxidation treatment of aluminium in a Cu-Al alloy will render the copper highly resistant to high temperature oxidation.

The mechanism of corrosion of iron and other metals in oxygen-containing salt solutions is described and shows that, whereas a discontinuous coat of metal which is cathodic to iron is highly corrosive, a metal (*e.g.*, Zn) which is anodic to iron is very protective and, when applied as paint to a rusty surface, will even prevent further corrosion. A discussion of inhibitors shows that anodic inhibitors, although more efficient than cathodic inhibitors, are dangerous if added in insufficient amount owing to intensified corrosion. B. H. K.

684. Measuring Material Characteristics by the Penetron. R. C. Granner. *Petrol. Times*, 27.4.46, 50 (1272), 438.—The Penetron is an instrument utilizing penetrating gamma rays which rapidly and accurately provides inspection data on lines, vessels

and their contents without injury to the material being inspected. It also determines density of liquids and locates liquid levels or the interface between two immiscible liquids, without access to the interior of the containing vessel. The principle of the operation briefly is this:—the radiation detector is placed against the wall of the line or vessel upon which measurement is to be taken. The gamma rays, which are constantly emitted from the radium source, impinge upon the vessel wall and actually penetrate this wall. A portion of these rays is scattered in all directions by the electrons of the atoms which make up the wall. Some of these scattered rays emerge on the same side of the wall from which they originally entered. It is this particular portion of the radiation, termed back-scattered radiation, which is utilized in the Penetron's Conventional Detector, for measuring wall thickness. By measuring the intensity of the back-scattered radiation by means of the detector, it is possible to determine the thickness of the wall, since for a wall of any given composition the intensity of the back-scattered radiation increases as a direct function of the wall thickness. Calibration curves for various metals and materials are supplied with the instrument. Photographs illustrate the instrument and its use. A. H. N.

Distillation.

685. Process Development and Production of Isohexane and Isoheptane as Aviation Fuel Components. S. F. Birch, P. Docksey and J. H. Dove. *J. Inst. Petrol.*, April 1946, **32** (268), 167–205.—Early in 1940 the main components of 100-octane fuel were either hydrocarbon fractions isolated from crude by physical means, such as distillation or solvent extraction, or, alternatively, were hydrocarbon fractions produced by synthetic processes, such as pyrolysis, alkylation and catalytic polymerization followed by hydrogenation. Components such as these were then blended with a suitable base stock and T.E.L. to give the final 100-octane fuel, and it was due to the difficulty experienced in the production of a suitable base stock that a programme of work was instituted which culminated in 1944 in the production of 315,000 gal/day of refined isohexane and isoheptane fractions, representing about 35% of the daily output of 100-octane aviation fuel from the Anglo-Iranian Oil Company Refinery at Abadan. The output of these two components is obtained from eight fractionating units, each 12 ft in diameter, four being fitted with 50 bubble-trays, two with 76- and 100-plate units were built as double columns, so that there are twelve columns in all, varying between 120 and 140 ft in height. The complete super-fractionation installation, including staging, exchangers, pumps, and pipework, represents 6300 short tons of steel, which is equivalent of 0.7 ton steel/brl/day of useful product. A. H. N.

686. Toluole Recovery. Anon. *Chem. Tr. J.*, **118** (3077), 593.—A report of a meeting of the Coke-Oven Managers Association at which an azeotropic distillation process for the production of high gravity nitration toluole from low-gravity benzole, was described. With a crude toluole, distillation with methyl alcohol as an entraining agent brings over in succession, non-aromatic hydrocarbons of increasing boiling point up to 125° C, then toluene plus hydrocarbons boiling ca 125° C and finally hydrocarbons of still higher boiling point, each fraction containing methanol. For the production of high-gravity nitration toluole from such a raw material, it is unnecessary to remove the higher boiling impurities by means of the entrainer since, if they are left behind with the toluene, it can readily be separated from them by normal fractionation after an acid wash to remove saturated hydrocarbons and sulphur compounds.

Using the same method, non-aromatic hydrocarbons can be separated from benzene, from xylene and from higher hydrocarbons. T. M. B. M.

Absorption and Adsorption.

687. Practical Refrigeration for Natural Gasoline Plants. R. W. Heath, J. B. Taylor, Jr., and P. W. Hill. *Oil Gas J.*, 23.2.46, **44** (42), 128.—Consideration is limited to the use of propane as a refrigerant and to the application in low-pressure absorption plants with absorber pressures of less than 100 psi.

The advantages of refrigeration lie in the better separation of the fixed gases from the fat-oil tank and wherever colder temperatures are developed. The cost of installing such a unit is small, and the benefits are easily appreciated in existing plants where it

is necessary to increase plant capacity for the purpose of extracting additional light hydrocarbons or to regain a plant efficiency that has been reduced owing to additional load.

In addition to the saving in first costs for a refrigeration system cooling the lean absorption oil there is a definite saving in operating costs, since the fuel requirements of the refrigeration plant are limited to engine fuel and are nominal, while to increase the capacity of the plant by heating and pumping increased quantities of absorber oil would entail a considerably higher fuel bill. The design of suitable refrigeration plant is discussed with a certain amount of operating data. D. L. S.

Solvent Refining and Dewaxing.

688. Propane Deasphalting Process. C. W. Kraemer. *Oil Gas J.*, 30.3.46, 44 (47), 228.—A 14,250 bbl propane deasphalting unit is described. This unit of the Cities Service Refining Corp is sited at Lake Charles, La., and is the first commercial plant to be employed for recovering virgin heavy gas oil catalytic cracking feed stock from crude residuum. The process yields a stock having 2% or less of residual carbon and less than 2 lb salt per 1000 bbl of oil. Propane to oil ratio of about 4 : 1 is used, the mixture is kept in the liquid state in the settlers, a pressure of 505 psi being used, with operating temperatures within 150–175° F. Propane is flashed off from the asphalt-propane phase, the vapours being condensed and returned for recycling, the remaining propane being removed from the asphalt in a vertical stripper.

The deasphalted gas oil propane phase is taken over-head from the asphalt settlers and the propane flashed to the propane condensers successfully in two low and two high temperature steam kettles remaining traces of propane being steam stripped. The propane free deasphalted gas oil is pumped from the stripper to storage. G. A. C.

689. Lubricant Stocks Improved by Propane Deasphalting. J. T. Dickinson and N. R. Adams. *Oil Gas J.*, 30.3.46, 44 (47), 185.—The propane deasphalting process is reviewed from the standpoint of applications and development to date, and future potentialities are explored.

The first commercial propane deasphalting plant was installed in 1934, eight are now in operation, producing a clean deasphalted oil, the asphalt obtained being used as a base material for special asphalt products and road oils.

In the "stage" type unit the reduced crude and liquid propane streams are combined, mixed and heated to a predetermined temperature which causes the asphalt to form a low-ratio phase. The mixture of phases is separated continuously and a deasphalted oil solution withdrawn from the top and an asphalt solution from the bottom of the settling vessel. Some plants have two or more stages of precipitation, and equipment for acid treating and neutralizing. The use of a single solvent with stage deasphalting oil improves the viscosity index but leaves a severe decolorizing problem. The propane tower deasphalting process overcomes this and produces a catalytic cracking charge stock. The plant is of the stage type and operated in a manner similar to the stage deasphalting units used on lubricating oils, and it is likely that more tower units will be installed.

A vertical baffled tower replaces the settling vessels of the stage process; the propane being introduced near the bottom of the tower, and deasphalted oil solution removed from the top and asphalt solution from the bottom, the solution temperatures in the tower being controlled, 67% of the deasphalted oil and 33% of asphalt being produced.

The process allows almost any crude being used as a potential lube crude, and after tower deasphalting any reduced crude can be extracted by a single solvent, and the use of clay for improving colour is seldom necessary. The asphaltic material produced has unusual characteristics which adds to the net return. Propane fractionation yields lower carbon residue products which can be more economically refined.

The process has been developed for the preparation of charging stock from various gas oils for catalytic-cracking units. Propane decarbonizing gives the highest gasoline yields of any process. A study of costs shows that the delayed coking and propane decarbonizing processes are highly competitive and more attractive financially than vacuum distillation as a method of preparing such charging stock, in both the Chicago and Gulf Coast areas, where differing economic conditions prevail. G. A. C.

690. **Secrets of German Lubricating Oil Technology in Wartime. The Highlights of C.I.O.S. and B.I.O.S. Reports to Date.** C. I. Kelly. *Petrol. Times*, 16.3.46, 50 (1269), 272. Part II. **Lubricating Oils. Manufacturing Process:** (a) *Petroleum*.—This section deals with the manufacture of lubricating oils made from petroleum crudes as opposed to synthetic products which will be considered separately.

A. General Processes.

The rapid developments in refining during the 10 years prior to the war made it possible for the petroleum industry to satisfy the demands for more and better lubricating oils. The flexibility of solvent-extraction and dewaxing processes enabled German German refiners to obtain a wide variety of products from their own and Austrian crudes.

B. Solvent Extraction Processes.

I. *Edeleanu Process*. Edeleanu units were in operation at the Shell refineries at Hamburg and Harburg, and the oils produced were utilized in preparing Acrosshell Mittel (85% Edeleanized oil + 15% Voltol); in a low temperature aerogrease, a hydraulic oil and in a blend with synthetic oil for the Luftwaffe. After the failure of the imported Venezuelan oils these plants were supplied with distillates from German and Austrian crudes.

Edeleanu extraction was also used for the production of a high quality diesel fuel and a high quality hard wax from brown coal tar. This was carried out at the Espenhain Works (A. G. Sachsische), which produced annually 64,000 tons diesel oil, 71,000 tons fuel oil, 13,000 tons each of hard and soft paraffin waxes and 12,000 tons electrode coke. The waxes were sold for the manufacture of fatty acids, soaps and lubricating oils.

II. *Duosol Process*. There was a Duosol unit at the Vacuum refinery, Bremen, which operated with a two-stage extraction process, the first giving a half-raffinate which in the second stage was separated into H.V.I. and L.V.I. lubricating oils. Duosol oils were used mainly as components for aero oils.

III. *Furfural Process*. There was a Furfural unit in the Nerag refinery, Misberg, and this process was also intended for use at five "Biber" and the "Dachs" underground refineries.

IV. *The Phenol Process*. As a single solvent extraction process, this was applied at the Lutzkendorf refinery to distillates and deasphalted residuals.

V. *Propane De-asphaltizing*. This was used at the Lutzkendorf and Nerag refineries.

New Solvent Extraction Processes.

A considerable amount of fundamental research was done at the Reichinstitut für Erdölforschung, Hanover.

1. *De-asphaltizing*. It is reported that a unique solvent mixture—90% dioxane and 10% formic acid—was very successful in extracting asphalt from oils when used in equal proportions with oil at 5° C.

2. *Solvent extraction of brown coal tar distillates with HF*. Some work was carried out on the extraction of a diesel oil fraction from brown coal tar with HF. Time of contact had no increasing effect after 60 min, temperature of extraction was usually 18° C (b.p. technical grade HF is 21° C) and solvent/oil ratio 1:2. No corrosion difficulties were found in the laboratory using mild steel equipment.

3. *The Mirasol Process*. This work was carried out at the "Shell" Research Dept., Amsterdam, during the German occupation. Solvent extraction with antimony trichloride at its melting point (about 80° C) with oil/solvent ratio 1:1 was investigated. Losses of antimony trichloride per single operation is stated to be 0.1%.

4. *Process for Separating Naphthenic and Paraffinic Fractions*. Separation of high boiling oils is done by fractional distillation in the presence of azeotrope-forming materials (e.g., bitumen). The use to which this process was put is not entirely clear.

5. *Removal of Oil from Synthesis-wax by Selective Solvent-extraction*. This work was in process at the Ruhrchemie's research laboratories (Sterkrade-Holten) with the object of preparing hard paraffin wax (m.p. 90° C) and a slab paraffin wax (m.p. 50–52° C) from crude wax. The most important solvents were reported to be acetone and petroleum solvents of different boiling ranges.

6. *Extraction of Coal Tars in the Cold*. This has been studied by Metallgesellschaft-

Lurge who were constructing plants for this purpose at Hirschfelde and Altenburg. The work and processes had for their objective: (a) extraction of brown coal tar with amyl and butyl acetates to remove phenols; (b) extraction of 200–350° C fraction with MeOH to give phenols and a diesel fuel-cetane no. of 15.

C. Solvent Dewaxing Processes.

I. *Edeleanu Dewaxing Process*. This process has undergone marked changes in Germany during the war, the solvent formerly liquid SO₂ and benzol being changed in one plant to ethylene chloride and in others to a mixture of methylene and ethylene dichloride.

The plant at the Espenhain works of A. G. Sachsische shows several interesting features, chief among which is a two stage process using ethylene dichloride, claimed to give a hard wax of very low content and a unique design of "band filter" used for the hard paraffin dewaxing stage.

II. *Acetone-Benzol Dewaxing Process*. An improvement tried on a pilot plant scale at the Vacuum's Oslebshausen refinery involves a modification of the Dorr-Oliver filtration process to obtain higher filtration rates.

III. *The "Barisol" Dewaxing Process*. A change of solvent is reported from Oppau where it was intended to use butyl alcohol instead of the usual ethylene dichloride.

New Dewaxing Solvents.

From the Reichinstitut für Erdölforschung, Hanover, comes a report that hydrazine derivatives are particularly good for the separation of wax from an oil. D. L. S.

691. *Secrets of German Lubricating Oil Technology Revealed. The Highlights of C.I.O.S. and B.I.O.S. Reports to Date*. C. I. Kelly. *Petrol. Times*, 30.3.46, 50 (1270), 318. Part II. *Lubricating Oils. Manufacturing Process*: (a) *Petroleum.—The Edeleanu Objective*. This article deals almost exclusively with the C.I.O.S. Report XXXI-85 on the Edeleanu G.m.b.H. Altenburg, a large portion of which is devoted to a translation of a lecture delivered by Professor Terres of the Edeleanu Co. on June 6, 1942, to a committee of the German Brown Coal Industrial Organization.

In 1936 the Edeleanu Co. undertook the complete separation of L.T.C. tars by a continuous process into diesel oil, heating oil, and oil-free hard wax and an oil-poor soft wax. The whole scheme is presented diagrammatically in this review.

The raw tar is distilled into electrode coke, a wax-free distillate and a waxy redistillate. SO₂ extraction of the waxy distillate in three stages takes place and the raffinate is naphtha washed at -10° C and then dewaxed with dichlorethylene. The only new apparatus involved was a closed continuous band-filter for dewaxing.

The products included diesel oil I with cetene number 60–75 and diesel oil II cetene number 35–45, heating oil miscible in all proportions with other heating oils density >1.00 and waxes which refined easily.

The article described the research programme of the company and discusses the theories underlying the process. D. L. S.

Cracking.

692. *Catalytic Refining*. Anon. *Oil Gas J.*, 30.3.46, 44 (47), 135.—A thirty-two page multicolour section contains a graphic presentation of the most important catalytic refining processes, including Cycloversion, Fluid, Houdry, Suspensoid, Thermofor, Hydroforming, H.F. Alkylation, Sulphuric Acid, Isomerization, Desulphurization and Polymerization. Product yields and properties are tabulated for each type of process using different charge stocks. It is shown that the fixed-catalyst bed Houdry process cracks to produce 45–60% gasoline of 76–80 A.S.T.M. octane number, furnace oils and diesel fuels. The fixed-bed Cycloversion process gives approximately the same results. The principle of a fluid catalyst is applied to crack oils at high throughputs. The Thermofor process moves a solid catalyst bed through the reaction zone. The Suspensoid process mixes catalyst and charge. Both natural and synthetic catalysts are used, each with certain advantages. HF or H₂SO₄ alkylation unite olefin and iso-paraffin to make superfuels for aviation and reduce vapour pressures of light hydrocarbons. Isomerization produces isoparaffins and improves octane ratings of naphthas

10 to 30 numbers. Hydroforming aromatises naphthas and increases octane 10 to 30 numbers. Polymerization lowers vapour pressure of too light olefins and makes high anti-knock polymer. Desulphurization reduces corrosion tendencies and improves T.E.L. susceptibility.
G. A. C.

693. A Fluid Catalytic Cracking Unit for the Smaller Refiner. D. Read. *Petrol. Times*, 27.4.46, 50 (1272), 426.—The development of a simplified fluid catalytic cracking unit for the smaller refiner is described. The principal improvements in efficiency and the mechanical simplifications which have been made are listed below:—(1) The reactor and regenerator have been combined into a single vessel which is erected as a self-supporting column in the smaller sized units; (2) When microspherical catalyst is used all secondary catalyst recovery equipment, such as the Cottrell precipitator and a slurry settler or slurry circulating system on the processing side, has been eliminated; (3) The efficiency of both the reactor and regenerator has been improved by the use of additional distribution grids in each section; (4) The redesign of the reactor stripper, the installation of an external stripper, and the additional stripping obtained in the counter-current regenerator results in a marked improvement in stripping efficiency and a reduction of regeneration requirements. The improved method of controlling the new unit results in uniform catalyst flow and smooth operation. This method of control has been tested in the 2600 bbl/day commercial unit.

The flexibility of the fluid catalytic cracking process has been demonstrated by commercial units, which have processed stocks ranging from naphthas to topped crude at reactor temperatures of 600–1000° F. Various recycling operations and combinations of catalytic and thermal cracking operations have been investigated in both pilot plant and commercial units. The reduced investment and operating costs now permit this process to compare favourably with thermal cracking investment and operating costs.
A. H. N.

694. Comparison of Bead and Clay Catalysts. L. P. Evans. *Oil Gas J.*, 30.3.46, 44 (47), 167.—The relative merits of bead and clay catalysts used in T.C.C. plant operation are discussed.

The cost of clay catalyst is \$100 per ton on a dry basis as against \$240 per ton for the dehydrated beads.

The make-up rate for beads is 1 to 1½ tons per day, for clay it is 3 to 4 tons per day. Catalyst losses are greatly effected by attrition resistance and crushing strength properties; laboratory tests indicate that the bead type is superior.

Initially, bead catalyst costs more but make-up requirements are less. Clay catalysts deteriorate at 1450° F, whereas the bead type can be safely heated in air to 1700° F, and initially bead catalysts have higher initial activity and better ageing characteristics. Commercial T.C.C. experience shows that bead units with lower make-up requirements maintain equilibrium activity at about four points higher than clay. Both laboratory and plant data show that beads yield a more favourable product distribution than clay, for example, the substitution of beads for clay in a 10,000-brl per day plant, gave 260 brl per day more of total liquid products.

Beads result in improved gasoline quality in T.C.C. operations with higher yields. On a 10,000-brl unit, beads show consistently higher process earnings than clay, approximately \$1000 per day, thus the incremental cost of the initial batch of bead catalyst can be written off, in less than three months.

With abnormal stocks, high in sulphur and nitrogen compounds, which exert a severe poisoning action on clay catalysts with 40% increase in coke production, the bead type is not affected, a normal yield pattern over the entire range of 30 cycles being maintained.

Changes in bead catalyst manufacture which raised the sodium content, improved the ageing properties and thus will increase the over-all catalyst performance.

A number of tables and figures fully illustrate the comparisons of product yields and properties of the two catalyst types.
G. A. C.

695. Cat-Cracking Feed Stock Improved by Delayed Coking. R. B. Tuttle. *Oil Gas J.*, 6.6.46, 44 (48), 109.—A recent report on the delayed coking process is discussed.

A 30% reduced crude yielded more than twice as much cracked gasoline, one-sixth more gas oil and no tar when processed by the delayed coking method. Coke removal

is accomplished by hydraulic jets operated from above the coko bed, a product free from contamination and ready sized being obtained.

The modern delayed coking process differs from conventional thermal cracking in that quickly heated topped crude enters an insulated coking drum at high temperature and is coked by its contained heat, the pressure being from 5 to 50 psi dependent on feed stock and desired yield. High flexibility allows for controlled variation in products to suit market conditions, for example, gas oil boiling range may be varied by altering coking temperature and pressure.

The alternate charging, coking and cleaning of the service drums in the coking section gives a constant throughput process, the cleaned drums being preheated before cutting into service again.

G. A. C.

696. Addition of One Coil Increases Cracker's Efficiency by Two-Thirds. B. B. Tuttle. *Oil Gas J.*, 1.12.45, **44** (30), 83.—See abstract No. 66 "First 3-Coil Thermal Cracking Unit in U.S. Goes on Stream at Sunray Refinery." (*Nat. Petrol. News, Techn. Sect.*, 5.9.45, **37** (36), R.676).

W. H. C.

Hydrogenation.

697. German Wartime Aviation Fuels Largely Made by Hydrogenation of Coal. Anon. *Oil Gas J.*, 16.2.46, **44** (41), 92.—This article is based on Technical Report 145-45 produced by the U.S. Naval Mission in Europe, July 1945.

The Germans made two grades of aviation fuel, B.4, or Blue grade, and C.3, or green grade, each containing 4.35 cc per gallon of T.E.L.

The B.4 grade was a fraction made from the liquid product of the hydrogenation of coal tar and contained 10-15% vol aromatics, 45% vol naphthenes and the remainder paraffins, with octane No. 89. The C.3 grade O.N. about 95, contained 10-15% synthetic isoparaffins and 85% of an "aromatized base stock" said to be made by treating coal tar hydrogenated gasolines by hydroforming operations.

At least 85% of all German aviation fuels were made up of base stock derived directly from coal and coal tar by destructive hydrogenation. Three operations were involved:—(a) bulk destructive distillation of coal to make tar; (b) purification of this tar; (c) hydrogenation of (b) to make gasoline, and other products which were recycled back to the reactor. The catalyst used was generally Al_2O_3 mixed with 10% MoO_3 .

Two hydroforming units were operated in Germany processing Roumanian and Austrian crude oil fractions. There was no commercial catalytic cracking process in operation.

Isoparaffins were made by hydrogenation of polymerized olefins or by alkylation of isobutane with butylenes. The first process was carried out at Leuna, Ludwigshaven-Offau and Heydebrek using isobutylene made from isobutyl alcohol itself synthesized by a variant of the Fischer Tropsch process.

The alkylation process did not materialize until 1943 and the plants as designed in Germany varied somewhat from American practice.

Four *n*-butane isomerization plants were operating using a vapour phase process with $AlCl_3$ as catalyst, this differing little from standard American processing.

D. L. S.

Polymerization.

698. Secrets of German Lubricating Oil Technology Revealed. Highlights of C.I.O.S. and B.I.O.S. Reports to Date. C. I. Kelly. *Petrol. Times*, 13.4.46, **50** (1271), 369. Part II. Lubricating Oils. *Manufacturing Processes* (b) *Synthetic $AlCl_3$ Processes*.—Lubricating oils for the three German services were made during the war by synthetic methods using $AlCl_3$ in four main types of process.

1. Polymerization of ethylene made from ethane and acetylene.
2. Polymerization of liquid olefines boiling within the gasoline range.
3. Polymerization of paraffinic and aromatic hydrocarbons.
4. Mixed polymerization of olefin-polymer and petroleum lubricating oils (this did not reach large-scale practice).

Processes 1 and 2 were similar in their main principles and were in operation at 7 plants, while 2 additional plants had not been operated by the end of the war.

Details of operating conditions at all these plants are summarized in a comprehensive table.

The most complete report (C.I.O.S. XXXII-107) deals with the Leuna plant where ethylene was made by cracking a mixture of ethane and oxygen.

The crude ethylene was purified to remove unwanted reaction products and finally subjected to low-temperature fractionation to give a material of 95% purity. Then followed polymerization in the presence of $AlCl_3$, separation of lubricating oil from the polymerization products, and fractionation to the required specification. There were variations in the processing conditions at the different plants, some of which used ethylene prepared by alternative methods or liquid olefines made by cracking wax. In the main, bright stocks were produced by these processes and these were used mainly in the blending of aviation oils.

Process 3 was carried out at only one place in Germany, Rheinpreussen-Homberg, by the following manufacturing steps:—(a) Chlorination of Fischer Tropsch "Kogasin" of boiling range 250–350° C; (b) condensation of the chlorinated product and naphthalene in presence of $AlCl_3$; (c) neutralization and decolorisation; (d) distillation.

The oils produced ranged from spindle to cylinder oils and had a good reputation.

Process 4 had for its key principle the reaction in presence of $AlCl_3$ between a synthetic polymer and a petroleum lubricating oil distillate, which had been deasphalted and dewaxed but not solvent refined. It was primarily developed by the I.G. Farbenind., but there is no information of the operation of the process on a large scale in any of the available reports.

D. L. S.

699. Polyethene Compared with Other Similar Macromolecular Hydrocarbons.

R. Houwink. *Brit. Plastics*, May 1946, 18 (204), 192.—The properties of polyethene are compared with those of some other high polymers of a similar type on the basis of their molecular structure. Special attention is given to mechanical behaviour, dissolving and swelling capacity, chemical resistance and electrical properties, of which last dielectric constant and dielectric losses are particularly stressed. The conception that the molecules are branched is supported. The technical merits of the material are discussed.

T. M. B. M.

Alkylation.

700. Numerous Improvements in HF Alkylation will Cut Costs and Reduce Losses.

W. B. Shanley and H. J. Nebeck. *Oil Gas J.*, 1.12.45, 44 (30), 94.—Developments that have taken place during the first two years of commercial HF alkylation will allow easier operating, longer on-stream times, less maintenance, fewer chemicals and utilities and permit a wider range of feed stocks to be processed. The improvements and modifications are described, and operating procedures are shown by flow diagrams of:—(1) the original plant; (2) the original plant modified; and (3) the latest design, alkylation units.

The two most important improvements are modification of the HF regenerating system and the re-location of the primary bauxite defluorinating towers. It has been found that metallic aluminium decomposes the combined fluorine (SiF_4) produced in the system. The liberation of HF by this reaction will be of much value for its recovery from the combined fluorine contained in the deisobutanizer bottoms stream. Combined fluorine production and neutralization of bauxite has on average accounted for a consumption of 0.3 lb HF/brl of alkylate produced. Re-location of the primary defluorinating towers will reduce this consumption to 0.1 lb HF/brl or less. A similar reduction may be effected by the aluminium defluorinators. As acid consumption is reduced by this means so too will be the consumption of bauxite or its equivalent. Another economy is effected by the modifications, and is described, in respect of the water produced at the time the SiF_4 is formed, and which passes with the recycle to the contactors, to be expelled therefrom with its equivalent of HF. This mechanism formerly accounted for about $\frac{1}{3}$ lb HF/brl of alkylate, but, by the modifications, this loss will now be eliminated.

Developments in constructional materials have brought about considerable reduction of the corrosion formerly found in pumps and equipment, this also saves acid. Through the improvements described, on-stream periods of 92% plus will accrue, and acid

consumption, exclusive of mechanical losses, will be around $\frac{1}{4}$ lb HF/bbl of alkylate produced.

The developments have shown that by HF process, the less expensive olefin—propylene—produces a good grade of alkylate. Amylene can be processed either alone or with other olefins, requiring only an increased rate in the regeneration of acid and no increase in chemical consumption.

W. H. C.

701. Alkylation of Alkanes. G. Egloff and G. Hulla. *Chem. Rev.*, 1945, **37** (323), 399.—Available literature on the subject, excluding patents, is reviewed. Reaction conditions, reactant mixture composition, catalyst and product composition data are discussed for catalytic alkylation procedures using aluminium chloride, double compounds of aluminium chloride and alkali metal chlorides, aluminium bromide, both alone and with aluminium chloride, zirconium chloride, boron fluoride, hydrogen fluoride and sulphuric acid. The use of alkenyl halides and alkyl fluorides in place of alkenes with appropriate catalysts is discussed.

Thermal alkylation reactions between C_2-C_4 alkenes and C_3-C_4 alkanes are described, with thermodynamic equilibrium data for two reaction mixtures. Differences in reactivity of individual alkanes and alkenes under conditions for catalytic and thermal alkylation are summarized. Alkylation of alkanes by methyl radicals is considered as a transition between the catalysed and thermal processes. Available data on the products of alkane alkylation reactions are analysed qualitatively and the influence of reactant mixture composition and catalyst type shown in tabular form for the alkylation of straight-chain alkanes, isobutane with C_1-C_3 alkylating agents and isobutane with C_4 alkylating agents, with products up to $C_{10}-C_{12}$ listed individually. The most frequent products are noted and gaps in experimental data indicated.

Mechanisms of catalytic alkylation proposed by seven groups of investigators are discussed. These include:—direct addition of an alkene to the tertiary carbon of an isoalkane, suggested by Ipatieff and Grosse; a proton transfer mechanism in sulphuric acid-alkane complexes, followed by subsequent reactions, due to Birch and co-workers; the addition of alkane fragments, formed by C-C bond scission in sulphuric acid, to alkenes proposed by McAllister *et al*; a similar mechanism due to Caesar and Francis involving intermolecular methyl group transfers, with comparative thermodynamic calculations of product composition; Schmerling's theory of alkane alkylation catalysed by aluminium and hydrogen chlorides as a chain reaction involving transient conversion of alkane into alkyl chloride, addition of alkyl chloride to alkene to give a higher alkyl chloride and exchange of chlorine for hydrogen with initial alkane to give the final product; a discussion by Bartlett and co-workers of Schmerling's theory in terms of carbonium-ion intermediates; Ciapetta's application of carbonium-ion theory and statement of essential factors for satisfactory catalytic alkane-alkene alkylation. Radical and hydrogen replacement mechanisms proposed for thermal alkylations are considered.

G. H. B.

Chemical and Physical Refining.

702. Desulphurization of Petroleum Hydrocarbons. R. M. Reed. *Oil and Gas J.*, 30.3.46, **44** (47), 219.—A summary of sulphur compounds occurring in petroleum hydrocarbons and the commercial methods available for desulphurizing is given. Compounds present include alkyl and dialkyl sulphides, carbon disulphide, carbonyl and hydrogen sulphides, mercaptans, thiophane, thiophene and thiophenol, elemental sulphur and a number of substituted and complex sulphur compounds. Hydrogen sulphide may be removed by fractionation and by chemical processes.

The Seaboard process was the first to employ a liquid absorbent that could be regenerated; the gas is contacted with a dilute solution of sodium carbonate and removed from the solution by air blowing. The Thylox process employs sodium thioarsenate solution as absorbent, air-blowing regenerates the solution with production of elemental sulphur. The Girbotol process uses solutions of amines; re-separation of the gas is accomplished by heating the amine solution. The Shell phosphate process employs a solution of tripotassium phosphate, and the Phenolate process absorbs hydrogen sulphide from gases by absorption in sodium phenolate. The Houdry intermittent process utilises nickel oxide at about 800° F.

Three types of processes are available for mercaptan removal:—(1) those which chemically convert mercaptans to disulphide; (2) those which remove mercaptans and

not other sulphur compounds; and (3) those which remove some or all of the different types of sulphur compounds.

Those of the first which include doctor treatment, copper-chloride and lead sulphide processes, oxidize the mercaptans to disulphides. Processes of the second type are regenerative and actually remove the mercaptans, are similar to those described for hydrogen sulphide removal, and include the Shell Solutizer, Mercapso and Tannin Solutizer methods. The removal of the mercaptans results in the use of less lead tetracetyl to bring the treated gasoline to the required octane value, than by processes described under Type 1. With either type the prior removal of hydrogen sulphide is necessary. With Type 3, which includes sulphuric acid treating, catalytic desulphurization processes and catalytic hydrogenation processes; previous removal of hydrogen sulphide is not essential, although desirable. The Gray catalytic process uses clay as catalyst, and the Perco employs bauxite. Catalytic hydrogenation processes for desulphurization operate in the same way as catalytic desulphurization except that hydrogen is added to aid in the conversion of organic sulphur compounds to hydrogen sulphide, the excess hydrogen being removed by fractionation or oil absorption. These processes are utilized where the sulphur content is either high or not easily removed. Carbon disulphide and carbonyl sulphide may be removed by alcoholic caustic solution or by the catalytic processes previously mentioned, and elemental sulphur by fractionation or doctor treatment.

G. A. C.

Metering and Control.

703. On Dimensional Analysis and the Presentation of Data in Fluid-Flow Problems. E. R. Van Driest. *J. Appl. Mech.*, March 1946, **13** (1), A34-A40.—The method and application of dimensional analysis are discussed, making use of the fundamental concept of function. The π -theorem is re-stated and proved in general form. Pipe friction, drag of spheres, and flow through Venturi meters are examples used to illustrate the rearrangement of dimensionless products of a relationship to obtain the most convenient form for presentation of data.

A. H. N.

PRODUCTS.

Chemistry and Physics.

704. Physical Properties and Chemical Constitution. Part IX. Aliphatic Hydrocarbons. A. I. Vogel. *J. chem. Soc.*, 1946, **133**.—Further data is given for parachors and refractive indices using C, D, F and G lines of normal and some branched chain hydrocarbons from which the corresponding physical constants for CH_2 , H and C are deduced. (*J.C.S.*, 1943, 18.) Detailed preparations of the hydrocarbons (*n*-pentane to *n*-hexadecane) in a high degree of purity are described.

B. H. K.

705. The Antoine Equation for Vapor-Pressure Data. G. W. Thompson. *Chem. Rev.*, 1946, **38**, 1-39.—A large number of equations, either empirical or with a semi-theoretical basis, that have been used to relate vapour pressure and temperature data for pure liquids and their mixtures, over both restricted and extended temperature ranges, are critically reviewed. The equations of Cox, Blot, Gamson and Watson are considered to be most satisfactory for use over the entire liquid range, up to the critical temperature. For practical purposes two Antoine equations of the form $\log P = A - B/(t + c)$ are recommended, the first up to a reduced temperature of 0.75, and the second from this point to the critical point. Simple methods are described for computing the empirical constants from experimental data, including rules for estimating the value of *C*. For organic compounds which are liquid at room temperature, an average value of $C = 230$ is used to construct a nomograph for 55 substances, including hydrocarbons, alkyl and alkylene halides, alcohols, esters, ethyl aviation and motor fluids, lead-, aluminium-, bismuth- and mercury-alkyls, and related organometallic compounds. Individual Antoine equations of high or moderate precision are tabulated for 23 substances, including several hydrocarbons and a separate table lists the three constants of the Antoine equations for all the *n*-paraffins from C_1 to C_{19} . The use of Antoine equations for the calculation of heats of vaporization is described

in detail, and its application to the representation of other temperature-dependent properties of liquids indicated briefly. 59 literature references are quoted.

G. H. B.

706. The Theory of Plasticity—An Outline of Work Done in Russia. W. W. Skolovsky. *J. Appl. Mech.*, March 1946, **13** (1), A1-A10.—Whilst the paper deals particularly with plasticity in soils and solids, its concepts may be found applicable to the rheology of petroleum products in a number of uses or conditions. The theory of plasticity, as an important part of the mechanics of continuous materials, has occupied the attention of many Russian workers in recent years. In the first paper in this field, published in 1935 by S. Sobolev, the propagation in time of a plastic zone was investigated around a circular hole in an infinite plate. The plastic zone was assumed to have a polar symmetric shape. Based on the works of L. Prandtl, Th. von Karman, R. von Mises, H. Hencky, A. Nadai and others, more recently a group of young Russian engineers have investigated further the theory of plasticity and added many new developments to it. While the investigations abroad and in Europe, outside of Russia, were being aimed at establishing the validity of the theory of plasticity, most of the papers appearing in the literature in Russia were devoted to the solutions of concrete problems. This review does not attempt to discuss broadly the work done in the theory of plasticity. The author confines himself to certain parts of the theory which have been developed in Russia. Naturally those closest to his own scientific interests have been selected for treatment. These are examples of soil formations subjected to various types of stresses and with the distribution of stress in plates with holes of various shapes.

A. H. N.

707. An Experimental Comparison of the Chemical Effects of Deuterons and of Alpha Particles on Methane and *n*-Butane. R. E. Honig and C. W. Sheppard. *J. Phys. Chem.*, March 1946, **50** (2), 119-143.—An experimental comparison of the chemical effects of deuterons and alpha particles on methane and *n*-butane has been carried out. The principal gaseous products from both types of bombardment were paraffin hydrocarbons and hydrogen. A comparison of the complex liquid product obtained from butane was made only for those properties which could be determined on small quantities. The larger quantities of liquid obtained from the deuteron bombardments were distilled and the resulting cuts studied. A wide range in molecular weights is indicated. Evidence is obtained for the presence of olefin and ring structures. The mean energy dissipated/molecule decomposed, termed the dissociation expenditure, is computed in all cases. Its use eliminates difficulties encountered in calculations of ionization. While it is obviously impossible to prove the complete identity of the chemical effects of deuterons and alpha particles, it has been shown in this experimental comparison that these effects are very similar. Thus it appears that the deuteron beam is a most valuable adjunct to naturally radioactive sources, especially where large amounts of conversion products are required.

A. H. N.

708. A Theoretical Analysis of the Relative Chemical Effects of Alpha Particles and Deuterons. C. W. Sheppard and R. E. Honig. *J. Phys. Chem.*, March 1946, **50** (2), 144-152.—The relative chemical effects of alpha particles and deuterons are compared from a theoretical point of view. A review is made of the existing information concerning the manner in which the energy of the incident particles is distributed in the reacting system. Evidence is presented which indicates that the energy absorption is predominantly an electronic process, and that the energy is distributed among the various states of excitation and ionization of the reacting system in a manner which is independent of the charge and mass of the bombarding particle and only slightly dependent on its velocity. An explanation is advanced for the frequently observed fact that chemical reactions occur in properties to the ionization produced in the system.

A. H. N.

709. Purification and Properties of 29 Paraffin Alkylcyclopentane, 10 Alkylcyclohexane and 8 Alkylbenzene Hydrocarbons. A. F. Forziati, A. R. Glasgow, Jr., C. B. Willingham and F. D. Rossini. *Bur. Stand. J. Res. Wash.*, February 1946, **36** (2), 129.—The results are given of the purification and measurements of refractive index (n_D at 20° and 25° C), boiling point and pressure coefficient of the boiling point (at 1 atm) and,

except for four of the compounds, the freezing point, together with the calculated amount of impurity, of samples of 51 hydrocarbons. The paraffins examined are:— 2 pentanes, 5 hexanes, 3 heptanes, 17 octanes, *n*-nonane, and *n*-decane; the alkylcyclopentanes: cyclopentane and its methyl, *n*-propyl and isopropyl derivatives; the alkylcyclohexanes; cyclohexane and its methyl and ethyl derivatives, together with *cis*- and *trans*-1:2-, 1:3-, and 1:4-dimethylcyclohexane as well as the *n*-propyl derivative. The alkylbenzenes include benzene toluene, ethylbenzene, the three xylenes and *n*- and isopropylbenzene.

T. M. B. M.

710. The Course of Autoxidation Reactions in Polyisoprenes and Allied Compounds. Part XI. Double Bond Movement During the Autoxidation of a Mono-olefin. E. H. Farmer and D. A. Sutton. *J. chem. Soc.*, 1946, 10.—An attempt has been made to confirm the mechanism of hydroperoxide formation in the autoxidation of polyisoprene and similar $\Delta^{1:4}$ -dienes by following the hydroperoxidation of 1:2-dimethyl- Δ^1 -cyclohexene. (See Farmer, *et al*, *J.C.S.*, 541, (1943).) The hydroperoxides, formed by photo-oxidation of the cyclohexene, were reduced with a platinum-palladium catalyst to give isomeric secondary and tertiary alcohols which were isolated and identified.

Further action of aqueous alkali on 1:2-dimethylcyclohexene-3-hydroperoxide gave the same dihydroresorcinol as did 1-methylcyclohexene-3-hydroperoxide (*i.e.*, 2-methylcyclohexane-1:7-dione). It is suggested that this compound, which was isolated and identified, is probably formed by oxidation by active oxygen formed in the decomposition of the O-OH groups by the mechanism referred to above.

B. H. K.

711. Synthesis of: (1) Glycerol and Propylene Glycol from Propylene, and (2) Ethylene Glycol from Ethylene. D. M. Newitt and P. S. Mene. *J. chem. Soc.*, 1946, 97.—The formation of polyhydric alcohols by oxidation of corresponding olefins at high temperatures and pressures is described. A pressure of about 70 atm and a temperature of about 230°C appears to give fairly good yields of propylene glycol and glycerol from propylene. A possible mechanism involving the intermediate formation of an oxide is postulated.

B. H. K.

Analysis and Testing.

712. The Evaluation of Unsaturation in Mixtures of Hydrocarbons (Motor Spirits) by the Use of Pyridine Sulphate Bromide. G. E. Wilson and H. B. Nisbet. *Analyst*, 1946, 71, 183.—The application of pyridine sulphate bromide reagent, originally developed by Rosenmund and Kuhnhehn for the determination of the iodine value of fatty oils, and later adopted as the standard reagent for measuring the unsaturation of the unsaponifiable fraction of fatty oils, is claimed to give a rapid and reliable measure of unsaturation in hydrocarbons of the motor spirit type.

It is stated that the inherent disadvantages of variable substitution reactions in the McIlhiney method and of varying excess of reagent in the Francis method are overcome by the use of this method

Table I shows the results obtained by each of the three methods on thirteen samples of hydrocarbon materials.

Table II summarizes the application of the method to synthetic hydrocarbon mixtures containing known amounts of olefines and shows the widely varying excess of reagent used in the determinations.

The results quoted show good repeatability and agreement with the theoretical olefine content.

A brief outline of the method is supplemented by a bibliography of nine references.

B. W. S.

713. Determination of Aromatics, Naphthenes and Paraffins by Refractometric Methods. R. M. Gooding, N. G. Adams and H. T. Rall. *Industr. Engng Chem. Anal.*, 1946, 18 (1), 2-13.—Group analyses of ten American crude-oil naphthas are given, calculated from specific dispersions and refractivity intercepts obtained on narrow-boiling distillate fractions. The experimental methods used, based on the work of previous authors, are described in detail.

A. W.

714. Analysis of Ternary Mixtures of Methylcyclohexane-Toluene-Aniline. C. S. Carlson, A. E. Schubert and M. R. Fenske. *Industr. Engng. Chem. Anal.*, 1946,

18 (2), 109-111.—A method of analysing the ternary mixture methyl cyclohexane-toluene-aniline has been developed, based on refractive index determinations before and after acid extraction for the removal of aniline. With the aid of an experimentally established curve the ternary analysis can be found. A. W.

715. Apparatus for the Flash-Distillation of Butadiene. A. P. Hobbs and H. R. Rector. *Industr. Engng. Chem. Anal.*, 1946, 18 (2), 140-141.—An apparatus for the flash distillation of butadiene is described. Its efficiency has been determined with the aid of the Darrell weathering-test apparatus. Substantially complete removal of butadiene dimer is accomplished without appreciable loss of C₃ hydrocarbons. A. W.

716. The Amperometric-Titration of Mercaptans with Silver Nitrate. I. M. Kolthoff and W. E. Harris. *Industr. Engng. Chem. Anal.*, 1946, 18 (3), 161-162.—A simple amperometric titration method for the routine determination of primary, secondary and tertiary mercaptans with silver nitrate in the presence of ammonia is described using the rotating platinum wire electrode. Amounts of mercaptan sulphur as small as 0.2 mg can be analysed with an accuracy of 1 or 2%, the time required for each titration being about 2 minutes. Large amounts of bromide, as well as cyanide and other ions which yield insoluble silver salts in ammoniacal medium, interfere with the determination. A. W.

717. Colorimetric Determination of p, p'-DDT in Technical DDT. S. W. Chaitrin. *Industr. Engng. Chem. Anal.*, 1946, 18 (4), 272-273.—A colorimetric procedure is described for the determination of p, p'-DDT; it is based on the colour produced when this compound is heated in a mixture of glacial acetic and concentrated sulphuric acids. The method is applicable to the estimation of p, p'-DDT in mixtures with the o, p'-isomer and in technical DDT when a small correction is made. A. W.

718. Laboratory Determined Pour Points of Lubricating Oils as Related to Ability to Flow under Field Storage Conditions. J. J. Giammaria. *A.S.T.M. Bull.*, Jan. 1946, 138, 44.—This paper reviews the work of A.S.T.M. sub-committee No. XVI on Cloud and Pour Test with particular reference to "pour point reversion."

In the 1945 Report of Committee D-2 a method was proposed for determining "Maximum Pour Points of Lubricating Oils Containing Pour Point Depressants." This method has now been compared with A.S.T.M. D.97, "S.O.N.J. Type V Test" and with results obtained with limited field testing.

It is concluded that the new proposed test is more reliable than any yet published, and shows 63% agreement with field tests as against 10% for D.97 and 37% for the Type V test. It requires only the ordinary pour test equipment and can be performed in 6-8 hours, whereas the Type V test requires about a week to run and utilizes elaborate equipment. On the other hand the Type V test shows a somewhat better relationship between stable pour point determinations and the frequency of solidification in the field.

The proposed A.S.T.M. test is quite consistent in giving warning in the case of very unstable oils, but such warning is not consistently justified for all oils. D. L. S.

719. Acid Flocculation Test. W. A. Proell and J. A. Bolt. *Oil Gas J.*, 30.3.46, 44 (47), 234.—A method for determination of gum content of heavy distillate fuel oils is described. Previous attempts to devise a method were based on evaporation at relatively high temperatures in the presence of an inert gas. The method described is based on the theory that the gum which deposits in fuel systems is present in the oil as a colloidal dispersion and can be flocculated by hydrochloric acid. No chemical change is caused in the oil itself. The oil is contacted with the acid, the floc filtered out, washed free of oil and weighed. The diatomaceous earth used in the test must be freed from traces of iron since iron compounds are gum-forming catalysts. Oil soluble materials, irrespective of molecular weight, are not measured as gum.

A wide range of fuels were examined and duplicate analysis on high-gum stocks give results within 2% of the total gum content. The test is regarded as suitable to distinguish between gums and heavy, low volatility hydrocarbons present in the oil. G. A. C.

Gas.

720. Liquefied Petroleum Gas Industry and Its Peacetime Problems. F. L. Fisher and J. W. Vaider. *Pet. Engr*, Jan. 1946, 17 (4), 116.—A survey of the present position of the liquefied petroleum industry is presented and a forecast of trends for 1946 is given. From the published P.A.W. figures for 1945, the peak demands amounted to 25 million gal/month, for synthetic rubber production; 200 million for aviation gasoline components, and 16 million gal/month for chemical manufacture, about half being propane, excluding the amounts pipe transported for this purpose which is considered to be more than double this figure. The offtake for synthetic rubber may be expected to continue at a high rate for some time, the release of butanes-butylenes anticipated by a lessening demand for aviation needs will be used: (1) to boost volatilities of motor fuels to pre-war levels; (2) via, polymerization, alkylation and polyforming operations for improvement of octane values of motor fuels, consumption for chemical manufacture will rise to satisfy an ever growing market.

Other uses for liquefied petroleum gases are:—butanes-butylenes for gas enrichment and to accommodate peak loads, domestic heating and cooking will call for larger volumes, and their use in internal combustion engines will probably increase. A study is in progress of their use as fuels for air-conditioning apparatus, particularly as applied to railway equipment. Some aspects of their use in agriculture are outlined.

W. H. C.

721. Liquefied Petroleum Gas in 1945. G. G. Oberfell and R. W. Thomas. *Petrol. Engr*, Jan. 1946, 17 (4), 59.—See Abstract No. 618 (*Oil Gas J.*, 12.1.46, 44 (36), 64).

W. H. C.

Lubricants.

722. Silicones as Lubricants. T. A. Kauppl and W. W. Pederson. *Nat. Petrol. News, Tech. Sect.*, 5.12.45, 37 (49), R.944.—The many uses for silicone fluids are given and the physical properties of five types are tabulated and discussed. Their viscosity temperature slopes are plotted in comparison with two petroleum products. S.U. viscosities range from 29 to 3960 seconds at 100° F.

It is claimed that silicone fluids possess superior heat stability, oxidation resistance, non-volatility and viscosity index qualities to petroleum oils. The tests reported show that variations in chemical composition greatly affects their lubricating properties. Some, however, approach petroleum oils in their ability to reduce wear, but even the best is not an E.P. lubricant. A new wear test machine is described and two series of tests with silicone fluids and various metal and alloy test pieces, in comparison with petroleum oils are reported. The best silicone fluid, DC.710, showed less loss than an S.A.E. 10 oil, up to 2000 gr loads, but twice as much wear under 300 gr loads. Under 1500 gr load this gave considerably less wear than S.A.E. oil at all running times up to 16 hours. The tentative conclusion drawn from the tests is that the DC. 710 fluid is better than the petroleum oil for steel to brass at moderate loads, but less effective than petroleum oil at loads approaching extreme pressure range. With soft steel test piece, for the same time and 1500 gr and 4000 gr loads, the silicone fluids DC. 200 and DC. 510, are quite poor. DC. 550, slightly better and DC. 710, seemed to be equivalent to petroleum oil of about the same viscosity. Various metals and alloys, tested with DC. 200, DC. 550 and DC. 710, in comparison with S.A.E. 20 for 2 hours under 1500 gr load showed aluminium to be worn most and spring steel the least. DC. 710 is an improvement over DC. 200 and excepting aluminium is about the equivalent of the S.A.E. 20 oil.

Three silicone greases and test results are described—one thickened with carbon black is serviceable at -4° F and at 200-300° F has between 5 and 10 times the service life of high temperature petroleum greases, it is suitable for use in ball bearings operating under 150 psi at speed of 1750 rpm and under these conditions was still serviceable after 2500 hours at 257° F; at 347° F it had a service life of 900 hours. Another type thickened with a metallic soap gave good performance at 300° F at a speed of 10,000 r.p.m. The third type is similar to the last and does thicken at -90° F has given good performance in bearings operated at 200° F. These greases lose less than 5% at 175° C in a four hour test, compared with 34-58% loss that high temperature petroleum greases sustain under the same conditions.

W. H. C.

723. Use of Phosphorus Sulphide Organic Reaction Products as "Lube" Oil Additives. Part 3. G. G. Pritzker. *Nat. Petrol. News. Tech. Sect.*, 5.12.45, 37 (49), R.1001.—The more severe conditions of temperature and pressure met with in modern engines and bearings has led to the development of additives containing both phosphorus and sulphur in order to obtain superior materials for the purpose, these elements being known to impart extreme pressure, film strength and anti-corrosive properties, some also acting as detergents. In this paper U.S. patents since 1938, are surveyed in two sections. Group I covers 80 specifications relating to the reaction of inorganic phosphorus sulphide with various organic materials. Group II relates to 34 specifications of organic compounds containing phosphorus and sulphur as the essential constituents. The patents disclose a diversity of materials and organic compounds, containing sulphur and phosphorus, or reacted with various phosphorus-sulphur, phosphorus-oxygen or phosphorus-sulphur-bromine compounds. Some recent and interesting specifications are:—

In Group I. Probably the basic patent of the group is that of Chittich's (2,142,998—1939) in which a mineral, animal or vegetable oil is treated with a phosphorus compound such as a halide, oxyhalide, or compounds of the oxygen family including oxides, sulphides, tellurides or selenides; metallic phosphides such as sodium or tin phosphites, at a temperature high enough to cause the phosphorus to react with the oil. The sludge formed is removed and 10% of the reacted product is added to lubricating oil; Cook (2,323,943—1945) by reacting an acylated phenol with P₂S₅, produces di-(acyl-phenyl) thiophosphates of an alkaline earth or of Ni, Al, Pb, Hg, Cd, Zn, Mg, etc., which have heat stability, extreme pressure and good pour point characteristics. He states that the -C=O- group in the product provides sludge dissolving, detergent and oiliness properties. In patent (2,368,000—1945) Cook specifies compounds such as Ba di(ethyl hexyl), or Ba di-tetradecyl, dithiophosphates for use as anti-foaming crank-case lubricants. These are made by reacting P₂S₅ at 90–100° C with branched chain alcohols or mixtures of alcohols and ketones.

In Group II. For steam cylinder lubricating Downing (2,215,956—1940) employs a tricresyl or (triphenyl, trinaphthyl, trinitro-phenyl) monothiophosphate and phosphite; Lincoln (2,339,710—1944) obtains high film strength and oiliness agents for lubricating oils by reacting an amine with PSCl₃; Morgan (2,301,918—1942) gives a formula for a flushing oil consisting of 88.9% fuel oil, 10% xylol, 0.5% each of sulphurized cresyl phosphate and phosphite. W. H. C.

724. Mechanical Testing of Extreme Pressure Lubricants (with Special Reference to Hypoid Oils). H. L. West. *J. Inst. Petrol.*, April 1946, 32 (268), 206–229.—In an attempt to provide a source of information in a readily available and comparable basis, this paper was prepared for the Lubricants Panel of Sub-Committee No. 5 of the Standardization Committee of the Institute of Petroleum. The historical development of E.P. lubricants is given, followed by a study of the Almen, Timken, Four-Ball, Falex and S.A.E. machines. The correlation of the test results of the various machines is reviewed. An appendix gives several standard methods of testing E.P. lubricants. A. H. N.

725. Lithium Soap Greases. Anon. *Chem. Trade J.*, 26.4.46, 118 (3075), 546.—This reviews E.P. 575,544 of 1946 granted to Shell Development Co. for an improved lithium soap grease which covers a grease containing an oxidation inhibitor made with a low pour point and low viscosity mineral oil with V.G.C. greater than 0.84.

The patent claims that such greases must contain free fatty acid to prevent excessive gelling, and recommends 0.5% free acidity calculated as stearic acid.

The use of a naphthenic oil base rather than a paraffinic oil improves low temperature properties.

In manufacturing a slurry of the soap in oil is heated to about 375° F and phenyl alpha naphthylamine added. Heating is continued to 385–400° F when the grease is run into open pans and quickly cooled.

By this means a grease containing 7% soap can be produced with A.S.T.M. penetration of 275, with operating range down to -67° F, and with low bleeding tendencies. D. L. S.

726. Lubrication Vade Mecum Addendum. (5). E. W. Steinitz. *Petroleum*, May 1946, 9 (5), 107.—Part 5 of the Addendum to the *Lubrication Vade Mecum* includes

notes on the problems concerned in the lubrication of air-liquefying plant, barrel cleaning and washing machines, colour enamel and sand-grinding mills, tableting and pelleting machines and glass-blowing apparatus. Cable ways, capstans, diesel, electric and steam locomotives are also dealt with.

G. A. C.

Special Hydrocarbon Products.

727. Crystallography of Waxes and Related Substances (2). L. Ivanovszky and J. H. Wrodden. *Petroleum*, May 1946, 9 (5), 110.—The crystallography of thin wax films produced without the use of solvents is discussed. Polarized light was used in the microscopical examination of the films produced under four sets of experimental conditions. Methods used included pressureless cooling, slow cooling under slight pressure, shock cooling under slight pressure and shock cooling under pressure.

Microscopic examination showed that the development of the needle-shaped wax crystals is influenced by rate of cooling and pressure, the formation being almost completely suppressed by shock cooling under pressure.

G. A. C.

Miscellaneous Products.

728. New Synthetic Rubbers Based on Methylpentadiene. F. M. McMillan, E. J. Bishop, K. E. Marple and T. W. Evans. *India Rubber World*, Feb. 1946 (Reprint).—The properties of methylpentadiene and polymers and their applications are discussed. Products in which methylpentadiene is the major component and in which the other component is another diolefin have the most value for general application in the synthetic rubber industry. Methylpentadiene is a reactive double saturated hydrocarbon of the same type as butadiene. It can be polymerized at 100° C in an emulsion system employing standard GR-S equipment. The unvulcanized polymer exhibits a rubber-like tackiness, which is not lost during storage, and the plasticity can be controlled by varying the polymerization conditions. The unvulcanized polymer is subject to viscous flow under prolonged stress, and although resistant to oxidation, slow oxidation will occur, thus an anti-oxidant should be added.

Milling and processing characteristics are superior to any of the available synthetics, pigments and plasticisers are easily incorporated. Vulcanization of methylpentadiene polymers is affected with the conventional curing agent used for GR-S and natural rubber. The polymers have the same durometer hardness and tear strength as GR-S but the tensile strength is lower. The product makes a satisfactory tyre rubber and could find use in wire insulation, and as a blending agent to correct some of the differences of other rubbers.

G. A. C.

729. Production of Synthetic Rubber Reached Nearly 700,000 Tons in 1945. W. W. Burns. *Oil Gas J.*, 30.3.46, 44 (47), 125.—Synthetic rubber consumption in United States rose from 6000 tons in 1941 to 693,392 tons in 1945. Since the Japanese surrender, 3368 tons of natural rubber have been imported from the East Indies, and some 95,800 tons are in store there. Unsettled political conditions in the East Indies will keep exports below estimated 650,000 tons annually, and it would be two or more years before American industry could return to the unlimited use of natural rubber. General purpose synthetic rubber can be sold about 4 cents cheaper than the natural product.

G. A. C.

ENGINES AND AUTOMOTIVE EQUIPMENT.

730. The Gas Turbine Discussion. Dr. S. G. Hooker, Dr. H. R. Ricardo, R. M. Clarkson and W. G. Carter. *J. Roy. Aero. Soc.*, May 1946, 50 (425), 298.—The main contributors to the discussion covered four fields:—(1) application of the G.T. to aircraft and propulsion; (2) turbine compounding of the piston aero engine; (3) application of G.T. to commercial aviation; and (4) application to military aircraft. The main conclusions were:

- (1) Dr. Hooker. (a) The G.T. is lighter than the corresponding reciprocating engine;
- (b) A higher proportion of its maximum power is available at cruising conditions than is possible with the piston engine;
- (c) It operates most efficiently at high altitudes

and at high speeds; (d) Its maintenance costs are low and safer and cheaper fuels can be used.

(2) Dr. Ricardo outlined a compound engine, comprising a blower, a small piston engine in place of the usual combustion chamber and a turbine. The piston engine delivers and the blower consumes, about the same power while the turbine will deliver 50% more than either. The piston engine operates to advantage at the high temperatures (greater than 1500° C) of the cycle whilst the turbine delivers power at the low temperatures, for which it is better suited. Preliminary experiments with a simple valveless 2-stroke cylinder working with inlet pressure 4.4 atm at 2,800 r.p.m., have shown that between 50 and 60 lb of diesel oil per hour per litre of cylinder capacity can be burned. The maximum cylinder pressure did not exceed 1400 lb/sq. in. and thermal troubles were avoided.

The thermal efficiency of such compound plants should be about 42% when cruising at 15,000 ft at 50% of the take-off power, corresponding to a diesel oil consumption of 0.32 lb/s.h.p. hour.

(3) Mr. Clarksons discussed the economics of operating commercial aircraft with G.T. and piston engines. For a medium twin feeder line aeroplane the turbine plant to carry the same pay load as the piston version is 22% smaller, 18% cheaper, 22% lighter, 16% faster, requires 21% less installed power, is 32% cheaper to run and can perform 16% more work in a year. For long-range Empire air liners direct operating costs of turbine plants are substantially lower than piston types provided the cruising speeds and altitudes are favourable.

(4) Mr. Carter outlined the peculiar requirements of military aircraft at high Mach number. Increased thrust is required for better climbing performance but the thrust must be provided with a minimum frontal area, e.g., centrifugal engines provide 400 lb-thrust per square foot of frontal area but with axial types the figure may be increased to 750 lbs.

I. G. B.

731. Evolution of Energy in Jet and Rocket Propulsion. P. Bielkowiez. *Aircraft Engrg*, 18 (205), 90.—The author discusses the following factors:—(1) calorific value of fuels and their relation to unit mixture with the oxygenizing factor; (2) fundamental data on the specific heats of combustion products; (3) dissociation of the products; (4) methods of obtaining the highest temperature in the combustion chamber and eventually the highest velocity of ejection. Fuels are compared on the basis of the heat energy per unit weight of exhaust gases. Thus for 100% efficient heat conversion the thrust for hydrogen is 530 lb/lb, while methane, heptane, aviation petrol, octane, eicosane show thrusts around 455 lb/lb. Owing to the difficulties of handling liquid oxygen the properties of other oxygenizing factors are given—HNO₃, H₂O₂, C(NO₂)₂, N₂O₄, O₂, O₃. Properties of solid powdered fuels are listed but the difficulties of obtaining a perfect mixture with oxygen, air or other liquid are stressed. I. G. B.

732. Design and Performance of Jet Propulsion Gas Turbine. D. M. Streid. *Petrol. Engrg*, Jan. 1946, 17 (4), 190.—The development of a gas-turbine for jet propulsion by the General Electric Co. is outlined. Design was originally to obtain a 3000-lb static thrust. Later on, in 1945, it was decided to produce a 4000-lb thrust at sea level conditions. This was known as the Type 1-40, jet propulsion gas turbine. Its design and drawings then took three months and the first was completed in January 1944 and delivered for testing. Performance test data are given and, because the tilt of the turbine buckets were not considered satisfactory from a safety viewpoint, the speed had been limited to 8700 r.p.m. a new turbine wheel was installed and the tests repeated, the following data, corrected to 14.7 psi and 59° F at compressor inlet:—

Speed	11,550 r.p.m.
Thrust	4200 lb.
Fuel	5070 lb/hr.
Exhaust temperature	1300° F.
Jet diameter	18.2 inches.

As the exhaust temperature was far higher than desired, the jet was enlarged to 19 inches, in order to reduce the temperature below 1200° F. Further improvements in the 1-40 gas turbine were developed and three were constructed and were used for tests, the fourth was sent to Lockheed at Burbank, California, and after tests was

installed in the XP.80 A. airplane (the "Shooting Star") and after flying tests at 10,000 ft in June 1944, was found very satisfactory. The further mechanical improvements to this engine are described, no major redesign was found necessary. A cutaway section of the gas turbine and a diagram of its lubricating system are shown. A detailed description of its components and construction is given. Performance is shown in four graphs and is discussed. This information is now disclosed for the first time.

W. H. C.

733. Water Injection for Aircraft Engines. M. R. Rowe and G. T. Ladd. *Flight*, 23.5.46, 49 (1952), 517.—In a review of this U.S. article, *Flight* summarizes the results as:—(1) Water provides the greatest degree of cooling at high power output; (2) Water-methanol mixtures are superior to water-ethanol mixtures; (3) Water-methanol mixtures provide the greatest increase in detonation-limited horsepower output; (4) Water-methanol mixtures provide the greatest saving in engine critical altitude; (5) Pure alcohol additions should not be used for aircraft engines—they will cause a decrease in detonation—limited output when using 100-octane fuel; (6) Water injection will permit the use of 91 and 87-octane fuels in place of 100-octane for equivalent power output up to take-off horsepower; (7) Water injection can be used most efficiently at lean fuel-air mixtures.

I. G. B.

734. Jameson Aero Engine. Anon. *Flight*, 23.5.46, 49 (1952), 511.—The article gives details of the development of a 100-hp engine with an extremely low specific consumption, developed by Jameson Aero Engines, Ltd. Performance figures obtained on official development tests were:—

At between 96 and 100 hours:—

Fuel—87 O.N.

B.H.P. full throttle, 104–108 at 3000 r.p.m.

B.M.E.P.—138.3 lb/sq in.

Maximum economical cruising 90 b.h.p.

B.M.E.P.—120 lb/sq in.

Consumption—385 lb/b.h.p. hr.

The high thermal efficiency is attributed to the induction theory based on the fact that turbulence is a disadvantage and that progressive stratification in mixture strength is desirable. This is obtained by arranging the induction system so that the ingoing charge consists of alternating rich and weak mixtures, a cylinder head with minimum turbulence and a device which ensures that the rich portion of the inducted charge enters the combustion chamber last.

A reduction in bearing loads occurs as a result of cutting off peak pressures, resulting in a marked effect on engine life, and after 235 hours running all the principal components were in good shape. The power/weight ratio is low for an engine of its power category and it is believed that further reductions could be made.

I. G. B.

735. Propelling Machinery for Moderate and High-Powered Motor Ships. Anon. *Motor Ship*, May 1946, 27 (316), 44.—In a short review, this editorial comment holds the diesel engine as the most efficient prime mover of any that is now constructed. Comparing the price of diesel oil with boiler oil used in steamers, the diesel still shows an operating economy over the steamer. The lowest service figure recorded in modern American geared turbine ships is 0.64 lb/s.h.p. hr. This represents a 50% greater fuel consumption than that of a corresponding motor ship.

The gas turbine offers possibilities of fuel consumptions down to 0.42 lb/s.h.p. hr. these being obtained on large experimental units. Even without fuel-saving equipment, offers have been made to produce engines with guaranteed oil consumption of 0.55 lb/s.h.p. hr. The future trend appears to lie in the use of diesels up to about 7000 s.h.p., with the usual employment of gas turbines above that output. Steam turbines would be used under special applications where they show to advantage.

I. G. B.

735a. 3300 B.H.P. Gas Turbine for Liberty Ship. Anon. *Motor Ship*, May 1946, 27 (316), 62.—Resulting from the operating experience with the Elliott Lysolm gas turbine, the U.S. Maritime Commission has ordered a 3300 (max. rating) b.h.p. gas

turbine to power a Liberty ship collier. Estimated details of the engine performance are as follows:—

Fuel consumption	0.437 lb/s.h.p. hr.
Thermal efficiency	{ 29.7% at full load. 27.0% at 50% load. 16.0% at 10% load.
Machinery weight	339 tons.
Lubricating oil for turbines and compressor	200 S.S.U. at 100° F.
Lubricating oil for reduction gears	400 S.S.U. at 100° F.

Combustion chamber design follows the Elliott "elbow" type. It permits heat releases of 2.5×10^6 B.Th.U./cu ft/hr with air supplied at 95 lb/sq in and 650° F and the pressure drop is 16 inch water column. Operating characteristics require air-fuel ratios from 600 : 1 in the low-pressure chamber to 120 : 1 in the high-pressure chamber. The desirability of clean combustion is stressed but no details are given of experience with these chambers. Fuel is vaporized and ignited in the ignition cone. Combustion is completed in proceeding along the double vortex produced by the elbow design. The system succeeds in keeping the chamber lining at a temperature not more than 300° F above the outlet gas temperature. The burners are constant-pressure mechanical atomizing units supplying oil under a pressure of 400 lb/sq in. I. G. B.

MISCELLANEOUS.

736. **Exposing a Fallacy.** C. J. Deegan. *Oil Gas J.*, 2.3.46, 44 (43), 44.—Economic forces compel the oil industry of U.S.A. to operate with a raw material inventory representing 12-14 years' supply. Between 1918 and 1945 over 86% of all the oil ever produced in U.S.A. has been produced and marketed. During this period the highest inventory was 17.7 years' supply, in 1923; over the whole period the average was 13.6 years' supply; at the end of 1945 the figure was 12.3. The oil industry does not show undue alarm over the present position.

Studies of the reserve and price situation show that the adoption of conservation principles did not fix prices, or nullify the natural economic laws of supply, demand and price: it simply checked wild fluctuations. It seems that the proved oil reserves will fluctuate around 13.5 years' supply. Proven reserves are a function of drilling, which in turn is influenced by the price of oil.

It has been found that by restricting production rates the ultimate recovery of oil from a well is increased. The declines are slower than for uncontrolled production; but a continuous drilling programme is necessary to maintain a given rate of production. Thus additional market demands call for more drilling, and, under the new methods as under the old, the natural interplay of supply, demand and price still tends to keep the raw material inventory of proved reserves at about the same average level of 13-14 years' supply. G. D. H.

737. **Two Rigs Assigned to North Spain Exploration.** Anon. *Oil Gas J.*, 2.3.46, 44 (43), 52.—At Saint Marcet, about 100 miles north of the Spanish frontier, some ten wells produced gas and a considerable amount of oil. On a concession near Montpellier, about 200 miles north of the Pyrenees, approximately fifteen producing wells have been completed.

Exploration is to be undertaken in the Pyrenees area of northern Spain. G. D. H.

738. **United Kingdom Petroleum Import Trade.** Anon. *Petrol. Times*, 16.3.46, 50 (1269), 267-268. **U.K. January Oil Imports Show Trend Away from Dollar Purchases.** Anon. *Ibid.*, 268-269.—Statistics of trade are presented. A. H. N.

739. **United Kingdom Petroleum Imports and Exports.** Anon. *Petrol. Times*, 13.4.46, 50 (1271), 376.—Statistical data for the imports and exports of petroleum into and from the United Kingdom are given for February and for January and February combined, both for 1946 and 1945. A. H. N.

BOOKS RECEIVED.

Bibliography on the Petroleum Industry. E. De Golyer and Harold Vance. College Station, Texas: Agricultural and Mechanical College of Texas, 1944. Pp. 730 + xxxii.

Published as No. 11, Vol. 15, of the Bulletin of the Agricultural and Mechanical College of Texas, this bibliography of some 20,000 references to petroleum has been made possible by combining Dr. De Golyer's personal bibliography of some 12,000 items with that of the College's Petroleum Engineering Department and a complete bibliography on air-gas lift furnished by S. F. Shaw. The references are indexed under 900 subjects, using Prof. L. C. Uren's decimal system, and are arranged under each subject in chronological order. While the bibliography is not claimed to be complete in its entirety, it should prove of value to one who desires to review progress on any subject over a period of time.

British Standard 1306 : Part I : 1946. Non-Ferrous Pipes and Piping Installations for and in Connection with Land Boilers. London: British Standards Institution, 1946. Pp. 14. 2s. post free.

This specification applies to the general and detail construction of the pipework connecting a land steam boiler to engine, turbine or industrial plant and all auxiliary pipework in connection therewith, together with the individual pipes and pipe fittings forming parts of such installations.

TECHNICAL MISSIONS TO GERMANY.

The following B.I.O.S. (British Intelligence Objectives Sub-Committee), C.I.O.S. (Combined Intelligence Objectives Sub-Committee) and F.I.A.T. (Field Information Agency, Technical) reports on technical investigations of German industry have been received. Those marked * may be borrowed in accordance with the Library Rules.

B.I.O.S. REPORTS.

13. German Montan-Wax Industry. 17 pp.
69. Continental Gummiwerke A.G., Hanover. 16 pp.
70. Harburger Gummiwaren-Fabrik Phoenix at Hamburg/Harburg I. 11 pp.
75. The Production of Acetaldehyde, Acetic Acid, Acetic Anhydride and Acetone from Acetylene at the Bunawerke, Schkopau. 24 pp.
- 82.* Inspection of Hydrogenation and Fischer-Tropsch Plants in Western Germany during September 1945. 28 pp.
- 118.* Munich Technical High School. (Fuels and Lubricants.) 71 pp.
- 119.* Deutsche Versuchsanstalt für Luftfahrt (V.D.L.) Institut für Betriebsstoff Forschung. 39 pp.
- 120.* Wirtschaftliche Forschungs G.m.b.H. Hitzaker Depot. 29 pp.
- 121.* Wirtschaftliche Forschungs G.m.b.H. (WIFO) Heiligenstadt Installation. 9 pp.
- 122.* Wirtschaftliche Forschungs G.m.b.H. Interrogation of Herr Helmut Ploto of the Construction Department. 20 pp.
125. Ernet Bouttler Werke, Dinglingen, near Lahr. 5 pp.
128. Wood Distillation Plant at Brilon-Wald. 7 pp.
131. The Production of Alcohols and Ketones from Olefines at the Treibstoff Werk, Rheinpreussen, Moers, near Duisberg. 12 pp.
- 134.* I.G. Farbenindustrie Chemische Werke, Hüls, near Marl, Rechlinghausen. 12 pp.
- 137.* Cyclopolyolefines (Paper by Dr. J. W. Reppe, I. G. Farben. Research Chemist). 27 pp.
- 145.* Technical High School, Munich. 5 pp.
152. Developments in Protective Clothing in Germany. 27 pp.
176. Scholler Wood Sugar Plant at Holzminden. 15 pp.

185. The Cellulose Plastics Industry in Germany. 56 pp.
- 197.* Reichsinstitut für Erdölforschung Technische Hochschule, Hanover. 7 pp.
- 199.* "Ten Years of Oxygen-Gasification at Leuna," by Oberingenieur Sabel. 32 pp.
- 200.* Organization of Deutsche Versuchsanstalt für Luftfahrt (D.V.L.). 4 pp.
203. The Non-Destructive Testing of Materials and X-Ray Protection Methods. 6 pp.
216. (1) Technical High School, Darmstadt; (2) C. F. Boehringer und Söhne, Mannheim-Waldhof; (3) Dr. Freudenberg, Heidelberg University; (4) Dr. Wolman, wood preservation specialist, Bad Kissingen; (5) Imbert Gas Producer Plant, Cologne. 10 pp.
240. Synthetic Tanning Agents and Leather Auxiliary Products of the I.G. Farbenindustrie. 33 pp.
244. I.G. Hoechst and Ludwigshafen. Manufacture of Sulphuric Acid, I.G. Converter Design and Vanadium Catalyst. 13 pp.
247. German Chemical Plant, with Particular Reference to Centrifuges. 17 pp.
273. Symposium of Interrogations and Reports on German Methods of Statistical Reporting. 206 pp.
280. Interrogation of Prof. Alexander von Philippovich. 22 pp.
294. Hydrogen Peroxide Works of Otto Schickert & Co. at Bad Lauterberg and Rhumspringe. 20 pp.
- 324.* Band Oil Refinery at Porta, near Minden. 7 pp.
- 325.* Kaiser Wilhelm-Institut für Strömungsforschung Abteilung, Reibungsforschung, Berlin. Interrogation of Dr. Ing. G. Vogelpohl. 14 pp.
- 326.* Interrogation of A. Bollhorn, E. Grages and Dr. Gross of Deutsche Erdöl A.G. Berlin. 29 pp.
- 330.* Wirtschaftliche Forschungen G.m.b.H. (WIFO) Eickeloh Installation. Investigation of Installation and Interrogation of Personnel. 11 pp.
- 331.* Amalia Benzole Refinery, Harpener Bergwerksverein, Bochum. 4 pp.
- 332.* Chemische Fabrik Weyl A.G., Sandhoferstr 96-106, Mannheim-Waldhof. 8 pp.
- 333.* Winkler Generators for Manufacture of Water Gas, etc. 37 pp.
- 334.* Developments of Geophysical Prospecting in Germany during the War. 5 pp.
- 335.* Metallgesellschaft A.G. and the Lurgi Group of Chemical Engineering Companies. 209 pp.
345. A German Thermometer for Use in the Range 400-1200° C. 9 pp.
349. German General Rubber Goods Industry. 262 pp.
350. The Synthesis of Intermediates for Polyamides on an Acetylene Basis. (Translation of a Report by Dr. W. Reppe, Ludwigshafen.) 16 pp.
351. Preparation of Adipic Acid from Tetrahydrofuran and Carbon Monoxide. 3 pp.
352. Cyclopolylefines. Miscellaneous Report compiled from interviews with Dr. Reppe, Dr. Schlichting and Dr. Kröper (I.G. Farben., Ludwigshafen). 4 pp.
354. Polyvinyl Pyrrolidones. Translation of a report by Dr. Fikentscher and Dr. Herrlo, Ludwigshafen. 29 pp.
357. Propargyl Alcohol Dehydration and Oxidation to Hexadienediol. 7 pp.
358. Acrylic Esters. Synthesis from Acetylene and Nickel Carbonyl. 11 pp.
360. Notes on Manufacture of Ethylene Oxide by I.G. Farben. 8 pp.
361. Non-Metallic Materials for Aircraft. Visits to Research Establishments in Germany. 50 pp.
370. Manufacture of Acetaldehyde. 11 pp.
- 373.* I.G. Farbenindustrie A.G. Ludwigshafen (Fuels and Lubricants). 141 pp.
398. The German Activated Bleaching Earth Industry, with Some Observations on German Bentonite and Neuberg Chalk. 15 pp.
- 447.* Interrogation of Dr. Otto Roelen of Ruhrchemie A.G. 63 pp.
- 430.* Gesellschaft für Teerverwertung m.b.H., Duisberg-Meiderich and Castrop-Rauxel. 55 pp.

C.I.O.S. REPORTS.

- II— 11. Societe Belge L'Azole, Liege. 6 pp.
- V— 30. Chemical Industries in Belgium and France During German Occupation. 55 pp.
- VI— 22.* The Fischer-Tropsch Process. 28 pp.

- XV— 2. French Shale Oil Industry. 59 pp.
 XVII— 2. Engelbert Factories—Liego and Aachen Kabelundgummiwerke—Eupen. 67 pp.
 XVIII— 5.* Synthetic Lubricating Oil Production in Franco. 9 pp.
 XIX— 4. Hydrogen Peroxide Production Through 2-Ethyl Anthraquinone. 7 pp.
 XXII— 1. Chemische Werke Hüls A.G. 7 pp.
 XXII— 7. I.G. Farbenindustrie Synthetic Rubber Plant, Ludwigshafen. 52 pp.
 XXII— 15.* I.G. Farbenindustrie Plant, Frose, Germany. 4 pp.
 XXII— 18. Production of Hydrazine Hydrate, I.G. Farben. A.G., Leverkusen, Germany. 8 pp.
 XXII— 19. I.G. Farbenindustrie A.G., Leuna. 8 pp.
 XXII— 20. I.G. Farbenindustrie A.G. Bunawerk, Schkopau, Germany. 14 pp.
 XXII— 21. Synthetic Rubber Plant, Chemische Werke, Hüls. 125 pp.
 XXII— 22. Synthetic Rubber Plant, Buna Werke-Schkopau A.G. 65 pp.
 XXIII— 4. The Leverkusen Works of I.G. Farben. 50 pp.
 XXIII— 15.* I.G. Farbenindustrie A.G. Frankfurt/Main. 30 pp.
 XXIII— 16.* Oil Targets in Ruhr and Hanover Areas. 23 pp.
 XXIII— 18. Production of Concentrated Hydrogen Peroxide Solutions, Bad Lauterberg (Harz). 31 pp.
 XXIV— 6. Gas Turbine Development, B.M.W., Junkers, Daimler Benz. 30 pp.
 XXIV— 9. Synthetic Lubricating Oil Plant, Rheinpreussen, Homburg. 17 pp.
 XXIV— 18. I.G. Farbenindustrie A.G.—Griesheim Elektron Frankfurt am Main. 8 pp.
 XXIV— 19. Anorgana G.m.b.H. Werk, Gendorf. 38 pp.
 XXIV— 30. German Refrigeration Industry. 64 pp.
 XXV— 1.* Kaiser Wilhelm Institut für Kohlenforschung, Mulheim. 17 pp.
 XXV— 4.* Wirtschaftliche Forschungs G.m.b.H. Aussenstelle München 1 (WIFO 1) Stockdorf, near Munich. 5 pp.
 XXV— 6.* Steinkohlen-Bergwerk Rheinpreussen Moers-Meerbeck. 150 pp.
 XXV— 7.* Plant of Klocknerwerke A.G., Castrop-Rauxel. 12 pp.
 XXV— 20. Dr. Alexander Wacker Gesellschaft für Elektrochemische Industrie, Burghausen, Germany. 30 pp.
 XXV— 24.* Die Staatliche Materialprüfungsanstalt an der Technischen Hochschule. 18 pp.
 XXV— 25.* Krupp Treibstoffe Werke G.m.b.H., Wanne-Eickel. 11 pp.
 XXV— 26.* I.G. Farbenindustrie, Mainkur-Hoechst. 33 pp.
 XXV— 27.* Wartime Research on Synthetic Fuels, Kaiser Wilhelm Institut für Kohlenforschung. 8 pp.
 XXV— 45. German Aircraft Maintenance. 21 pp.
 XXVI— 2. Synthetic Emulsifying Agents, Wetting Agents, Detergents and Soap Substitutes. I.G. Farben. A.G., Hoescht/Main. 39 pp.
 XXVI— 5.* Wirtschaftliche Forschungs G.m.b.H., Strassfurt and Bad Berka. 7 pp.
 XXVI— 11. I.G. Farbenindustrie A.G., Höchst am Main. 84 pp.
 XXVI— 48.* Dr. F. Raschig G.m.b.H. Chemische Fabrik, Ludwigshafen am Rhein. 6 pp.
 XXVI— 51.* Plant of Chemische Werke Hüls, Hüls, Germany. 8 pp.
 XXVI— 54. I. G. Farbenindustrie A.G. für Stickstoff-Duenger Knapsack. 7 pp.
 XXVI— 64. Manufacture of Hydrocyanic Acid, I.G. Farbenindustrie, Oppau. 4 pp.
 XXVI— 68.* Wirtschaftliche Forschungs G.m.b.H. Eferbachtel Fuel Blending Station. 8 pp.
 XXVI— 73. Insecticides, Insect Repellants, Rodenticides and Fungicides. I.G. Farben., Elberfeld and Leverkusen. 48 pp.
 XXVI— 78.* French Shale Oil Industry. 10 pp.
 XXVI— 79.* I.G. Farbenindustrie, Mainkur-Hoeschst. 33 pp.
 XXVI— 80.* Steinkohlen-Bergwerke Rheinpreussen Moers-Meerbeck. 152 pp.
 XXVI— 87.* Dachs I Lubricating Oil Plant, Porta, Germany. 8 pp.
 XXVI— 83. Bayerische Motor Werke (BMW). 10 pp.

- XXVII— 6. Manufacture of Styrene and Polystyrene, I.G. Farbenindustrie, Schkopau. 13 pp.
- XXVII— 14. I.G. Farbenindustrie, Hoescht/Main. 50 pp.
- XXVII— 15. Manufacture of Acetaldehyde, I. G. Farbenindustrie, Schkopau. 5 pp.
- XXVII— 18.* The Oxo Plant, Ruhrchemie Oberhausen-Holden. 4 pp.
- XXVII— 54.* Chemische Werke Essener Steinkohle A.G., Bergkamen, Germany. 5 pp.
- XXVII— 55.* Gesellschaft für Linde's Eismaschinen, Holbrigelskreuth. 19 pp.
- XXVII— 60.* The Wesseling Synthetic Fuel Plant. 155 pp.
- XXVII— 68.* Fischer-Tropsch Unit, Leipzig Gas Works. 6 pp.
- XXVII— 69.* The Fischer-Tropsch Plant of Ruhrchemie A.G., Sterkrade-Holten. 97 pp.
- XXVII— 70.* Gutchhoffnungshütte A.G. Sterkrade. 6 pp.
- XXVII— 82.* Fischer-Tropsch and Allied Processes. 24 pp.
- XXVII— 84. I.G. Farbenindustrie A.G., Ludwigshafen and Oppau. Wehrmacht Items. 69 pp.
- XXVII— 85. Miscellaneous Chemicals. I.G. Farbenindustrie A.G., Ludwigshafen and Oppau. 95 pp.
- XXVII— 93. Wirtschaftliche Forschungs G.m.b.H. Fuel Blending Station, Heiligenstadt. 8 pp.
- XXVIII— 13. Synthetic Rubber Plant, Buna Werke-Schkopau A.G. 42 pp.
- XXVIII— 23.* A.G. Sachsische Werke—Esenhain. 10 pp.
- XXVIII— 28. Leuna Works near Merserberg. 11 pp.
- XXVIII— 35. Production of Fatty Acids from By-Products of the Fischer-Tropsch Process. 2 pp.
- XXVIII— 36.* H. Koppers G.m.b.H., Essen. 4 pp.
- XXVIII— 40.* The High Pressure Hydrogenation Plant Especially for Brown Coals, Wesseling. 150 pp.
- XXVIII— 57.* Deutsche Erdöl A.G. Erdölwerke "Nova" Dachs II Plant, Ebensee, Austria. 5 pp.
- XXVIII— 62. Glossary of Some German Names for Chemical Products. 25 pp.
- XXIX— 40. Lubricants Manufactured and Used by Zeiss in Jena. 5 pp.
- XXIX— 51.* Thysserische Gas und Wasserwerke G.m.b.H., Duisberg-Hamborn, and Krupp Treibstoffwerke, Wanne-Eickel. 16 pp.
- XXIX— 54.* Ignition by Means of an Injection of "Ignition Oil." 9 pp.
- XXX— 5.* Synthetic Lubricating Oils. 3 pp.
- XXX— 10. I.G. Farbenindustrie, Hoeschst. 10 pp.
- XXX— 12. Schaumkohle and Dr. Heinrich Schmitt-Werke K.G. 6 pp.
- XXX— 13.* A.G. Sachsische Werke, Bohlen. 15 pp.
- XXX— 16. German Marine Paints. 48 pp.
- XXX— 18.* Oil Recovery from Wurttemberg Shale. 34 pp.
- XXX— 34. Technical Assistance on Synthetic Oils Rendered the Japanese by the I.G. Farbenindustrie A.G. 13 pp.
- XXX— 67. Synthetic Coatings for Gasoline Tanks. 5 pp.
- XXX— 70.* The Preparation of Tetrahydrofuran Polymers as a Synthetic Lubricant for Metals. 8 pp.
- XXX— 85. A Survey of the German Can Industry During the Second World War. 481 pp.
- XXX—102.* Scholven Hydrogenation Plant. 29 pp.
- XXX—104.* Botrop-Welheim Hydrogenation Plant. 29 pp.
- XXX—105.* Gelsenberg Hydrogenation Plant. 39 pp.
- XXXI— 23.* Metallgesellschaft-Lurgi, Frankfurt am Main. 54 pp.
- XXXI— 24. Fuel Research and Technology at Rheinisch-Westpalische Kohlen-Syndikat, Essen. 9 pp.
- XXXI— 25.* Fuel Research and Technology, Bergbau-Verein, Essen-Heisingen. 14 pp.
- XXXI— 27. Coal Extraction Plant of Ruhröl G.m.b.H. 10 pp.
- XXXI— 29.* Fuel Research Activities of the A.G. der Kohlenwertstoff-Verbande, Bochum. 9 pp.
- XXXI— 30. Krupp-Lurgi Low-Temperature Carbonization Plant, Wanne-Eickel. 8 pp.

- XXXI— 41. The Design of German Aircraft Hydraulic Systems, Fuel Systems and Fuel System Components and Accessories. 439 pp.
- XXXI— 58.* Compilation of German Fuels and Lubricants Specifications. 29 pp.
- XXXI— 78. Internal Combustion Engines. ("Ring" Process of Ignition.) 16 pp.
- XXXI— 79. The Manufacture of Synthetic Butter (from Paraffin Wax). 4 pp.
- XXXI— 85.* Edelcanu G.m.b.H., Altenburg. 73 pp.
- XXXII— 3.* Deutsche Erdöl Mineralölwerke, Rositz. 6 pp.
- XXXII— 14.* Deutsche Erdöl A.G., Regis. 12 pp.
- XXXII— 15.* Kukuck I Plant, Niedersachswerfen. 5 pp.
- XXXII— 16.* Stuttgart Technische Hochschule Forschungs Institut für Kraftfahrwesen und Fahrzeug Motoren. 10 pp.
- XXXII— 61. History of General Automotive Development at Stuttgart Research Institute. 29 pp.
- XXXII— 68.* The Manufacture and Application of Lubricants in Germany. 51 pp.
- XXXII— 89.* Luftfahrtforschungsanstalt Braunschweig. 29 pp.
- XXXII— 90.* Wintershall A.G., Lutzkendorf. 37 pp.
- XXXII— 91.* Lurgi Gesellschaft für Wärmetechnik, Frankfurt am Main. 16 pp.
- XXXII— 92.* Brabag I Plant, Bohlen. 42 pp.
- XXXII— 93.* Gesellschaft für Teerverwertung G.m.b.H. Duisberg-Meiderich. 5 pp.
- XXXII— 94.* German Petroleum Industry, Hamburg District. 150 pp.
- XXXII— 96.* Ruhrchemie A.G., Sterkrade-Holten. 90 pp.
- XXXII— 107.* I.G. Farbenindustrie A.G. Works, Leuna. 140 pp.
- XXXIII— 5. The Methanisation of Coal Gas. Information obtained from Dr. Martin of Ruhrchemie A.G. and Dr. Traenckner of Ruhrgas A.G. 6 pp.
- XXXIII— 24.* Report on Investigations by Fuels and Lubricants Team at the Brabag Works at Troglitz-Zeitz. 25 pp.
- XXXIII— 30.* Stickstoffwerk-Hibernia, Wanne-Eickel, Ruhr. Recovery of Hydrocarbons from Coke-Oven Gas. 6 pp.

F.I.A.T. REPORTS.

- 37.* Perlon U; Polyurethanes at I.G. Farbenindustrie, Bobingen; Austria. 5 pp.
145. Acetic Anhydride Production from Acetic Acid, I.G. Farben., Dormagen. 3 pp.
- 293.* I.G. Farbenindustrie, Leverkusen, Germany. 11 pp.
- 368.* Interrogation of Dr. Gunter Spengler, Munich, formerly of Institute for Coal Research, German Technical High School, Prague. 26 pp.
- 401.* Wifo Berlin Evacuated Personnel at Munich. 12 pp.
422. Manufacture and Regeneration of Catalysts at I.G. Farbenindustrie, Ludwigshafen Oppau. 9 pp.
- 423.* Synthetic Lubricating Oil Manufacture, Rhenania-Ossag Mineralölwerke A.G., Hamburg Refinery. 6 pp.
- 426.* Interrogation of Dr. Pier and staff, I.G. Farbenindustrie A.G., Ludwigshafen/Oppau. 29 pp.
476. Deep Well Turbine Submersible Pump Motors. 11 pp.
478. Coal Tar Creosote for Wood Preservation during the War Period. 12 pp.
480. German Wood Preservatives other than Coal Tar Creosote for the War Period. 40 pp.
488. Polymerization of Ethylene. 25 pp.



INSTITUTE NOTES.

JULY, 1946.

A YEAR OF COUNCIL.

General Functions of Council.

The Council is the governing body elected by members of the Institute to carry on the work of the Institute. It consists of the President, Past-Presidents, Vice-Presidents and twenty-one ordinary members, of whom seven retire each year but are eligible for re-election.

This year, voting took place to fill seven places which became vacant, and four hundred voting papers were returned, resulting in the election of seven, of whom two were new, Members of Council, *i.e.*, Mr. C. Chilvers and Mr. F. L. Garton.

Much of the detailed work of Council is carried on by Committees, of which eleven are standing committees, *i.e.*, Awards, Benevolent, Branches, By-Laws, Education, Election, Engineering, Finance, House, Publications and Standardization. These, with their sub-committees, cover fields of work which go on from year to year.

Special or topical issues are dealt with by *Ad Hoc* Committees or Sub-Committees appointed as needed, such as that dealing with publicity as described later under Publications Committee.

Non-Council members are co-opted to Council Committees as needed where their contributions are of value.

The Past Year.

During the past year several issues beyond routine have been very much alive, and have been considered in detail :

1. *Membership Grades of the Institute.*

In 1936 a special committee sat and made recommendations which resulted in changes, in particular in the change of name from Institution of Petroleum Technologists to Institute of Petroleum, and in the grades of membership. The grade of Fellow was introduced to include members of the Institute of high technical qualifications, and the Member grade mainly for non-technical grades.

Last year an *Ad Hoc* Committee was appointed to consider in more detail definitions of membership which would assist the Election Committee in grading applicants for membership. As a result of its deliberations, the following recommendation was made and accepted by Council :

It is desirable to inaugurate an examination sponsored by the Institute for the purpose of issuing a diploma, and, possibly at a later date, to institute a further grade of technical membership to cater for applicants not meeting the exacting requirements for Fellowship.

This year an Education Committee was formed to consider how best this should be done, and discussions held with the City and Guilds Institute of London; it is hoped that in the near future a revised City and Guilds' examination will be available, which will serve the needs of the Institute.

2. *House Committee.*

The House Committee has been considering the question of better facilities for members, which is a matter of great importance but difficult to solve in view of the limited accommodation at Manson House.

The increase in the work of the Institute has made necessary an increase in Staff. A Publications Secretary, Mr. George Sell, has been appointed to take care of publications of the Institute, and a Technical Secretary, Mr. Peter Kerr, to look after the technical activities of the Institute, and in particular the Standardization and Engineering Committees.

3. *Publications Committee.*

A new Sub-Committee is now considering improvements in the scope and layout of the Journal, with the object of improving the non-technical and news section of the Journal. An *Ad Hoc* Committee has been formed with the object of giving members of the Institute and others a better knowledge of the work of the Institute.

The Library Sub-Committee has taken steps to re-house the Library at Manson House from the Adelphi where the books have been kept during wartime, so that the whole of the Library will be available to members of the Institute.

4. *Engineering Committee.*

During the past year, the Engineering Committee has sponsored a Code of Electrical Practice, which is now being prepared for publication.

5. *Branches Committee.*

The Branches Committee has been very active during the year, and has issued a draft constitution for the guidance of Branches, particularly new Branches, and has generally improved and strengthened the ties between the Council and the Branches.

The Northern, Stanlow, and South Wales Branches have each had

a programme of meetings during the year; the Northern Branch held its first post-war social function on March 1, 1946, with a well-attended dinner and dance.

The Scottish Branch recommenced its meetings on April 5, when Professor F. H. Garner gave his presidential address, illustrated by films, to about 120 members and friends at Edinburgh.

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.

Applications for Membership.

- BERRY, William Henry, Erection Superintendent, United British Oilfields of Trinidad. (*J. E. Smith ; S. T. Waite.*)
- VAN BERTSBERGH, Jan Willem Bausch, Geologist, Apex (Trinidad) Oilfields, Ltd. (*A. H. Richard ; H. W. Reid.*)
- BRETT, Dennis Arthur, Director, Caleb Brett & Son Ltd. (*E. A. Hunting ; J. V. Delves.*)
- BROOK, Conrad Guy, Sales Manager, National Benzole Co. Ltd. (*Thos. F. Laurie ; W. H. Hoffert.*)
- BRYSON, Charles Randolph, Technical Officer (Chemist), Imperial Chemical Industries Ltd. (*E. G. Brown ; E. R. H. Davies.*)
- EDWARDS, Kenneth Ward, Junior Exploitation Engineer, United British Oilfields of Trinidad Ltd. (*J. E. Smith ; G. F. Hazzard.*)
- GRIFFITHS, Frederick Albert Donovan, Maintenance Superintendent, United British Oilfields of Trinidad Ltd. (*S. T. Waite ; J. E. Smith.*)
- HICKSON, Charles Robert Tuthill, Geologist, United British Oilfields of Trinidad Ltd. (*S. T. Waite ; J. E. Smith.*)
- JONES, Charles Frederick, Assistant Installation Manager, Shell Company of Ceylon Ltd. (*A. E. Hewitt ; A. W. H. Phelps.*)
- MCCARL, Robert Alick, Assistant Chemist, Anglo-American Oil Co. Ltd. (*C. Chilvers ; F. Tipler.*)
- McMURRAN, John, Technical Assistant, Trinidad Leaseholds Ltd. (*A. R. Richards ; G. F. Hazzard.*)
- MACNAUGHTON-JONES, Henry Wells, Acting Deputy Manager, Refinery, Trinidad Leaseholds Ltd. (*B. G. Banks ; E. G. Stibbs.*)
- NASH, George Charles, Equipment Engineer, United British Oilfields of Trinidad, Ltd. (*J. E. Smith ; S. T. Waite.*)

- PARSONS, Philip, Student Apprentice (Engineering), National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley.*)
- PENNELL, Montague Mattinson, Physicist, Anglo-Iranian Oil Co. Ltd. (*A. E. Dunstan ; D. A. Howes.*)
- STRADLING, Thomas Eric, Student Apprentice (Engineering), National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley.*)
- WOOLF, Abraham Vernon, Engineer, Lebites Oilfields Ltd. (*J. C. Wood-Mallock ; A. Cluer.*)
- YOUSSEF, Ibrahim, Chief Chemist, Government Refinery, Suez. (*M. Allam ; W. Farag.*)

Applications for Transfer.

- BAGGS, James Milton, Plant Chemist, The Flintkote Co., Morristown, N.J. (*Student to Associate Member.*)
- DOVE, John Henry, Chemist, Anglo-Iranian Oil Co. Ltd. (*A. E. Dunstan ; D. A. Howes.*) (*Student to Member.*)

PERSONAL NOTES.

ALEXANDER LOWE MCCOLL, Chairman of the Lubricating Oil Committee of the Petroleum Board, was accorded the honour of Knight Bachelor on the occasion of H.M. the King's Birthday.

SYDNEY GEORGE WRAIGHT, lately manager of Anglo-Egyptian Oilfields, Ltd., refinery at Suez was awarded the O.B.E. in the Birthday Honours List.

MOSTAFA ALLAM, director of the Egyptian Government refinery at Suez, was awarded the Order of the Nile (4th Class) on the occasion of King Farouk's birthday.

MAJOR D. G. PIDGEON, R.A.S.C., has been awarded the M.B.E. (Military) for gallant and distinguished service in Italy.

A. C. HARTLEY has been elected a vice-president of the Institution of Mechanical Engineers.

H. S. EVANS, G. JONES, W. MCCARTHY, J. D. MCHAY, W. R. THOMAS and S. J. WILLIAMS were successful in gaining the National Certificate in Chemistry as the result of recent examinations.

FIELD AND REFINERY DEVELOPMENTS.

Members or others engaged in oilfields and refineries are specially invited to forward notes on any matters of general interest to petroleum technologists. Particulars of any unusual phenomena or occurrences met with by geologists, surveyors, engineers or field operators would be welcomed by the Council with a view to incorporation in the Journal. Photographs or sketches illustrating any descriptions or showing interesting or exceptional occurrences

would likewise prove acceptable either for publication or permanent record in the Library of the Institute.

DONATIONS BY BATAAFSCHE IN HOLLAND.

Recently N.V. De Bataafsche Petroleum Maatschappij, The Hague, Holland, made donations, totalling more than four million guilders (about £400,000) to the Universities of Leyden and Delft and to the Scholarship Fund, to be distributed as follows :

One million guilders for building and fitting up a Physical Laboratory for the University of Leyden, in order to renew the famous Kamerlingh Onnes Laboratory (managing directors Prof. Dr. W. J. de Haas, Prof. Dr. H. A. Kramers and Prof. Dr. C. J. Gorter).

It is the intention that this laboratory should be provided with the most modern equipment for obtaining low temperatures and that it should be in a position to maintain the traditions of the Kamerlingh Onnes Laboratory, *i.e.*, the fundamental research into the properties of materials at different temperatures, and that students will find there an opportunity of studying in particular the theory of heat.

One million guilders for building and fitting up a Laboratory for Physical Technology (managing director Prof. Dr. W. J. D. van Dijk) at the Technical University of Delft, in which students will be in a position to acquaint themselves, theoretically as well as practically, with the "unit operations" in the oil and chemical industry.

One million guilders for the extension and fitting up of the Laboratory for Chemical Technology (managing director Prof. Dr. H. I. Waterman) at the Technical University of Delft, in which students can acquaint themselves in a practical way with the technical realization of the most important "unit processes" in the chemical industry.

Furthermore, Bataafsche has instituted for the next five years a number of scholarships for students of all Netherlands Universities. Each year during the next five years twenty graduate-students in chemistry, physics and geology, will receive a scholarship for a maximum of four years, amounting to f. 2,000 annually, with special allowances for travelling abroad. A total amount of more than one million guilders has been allocated for this scheme.

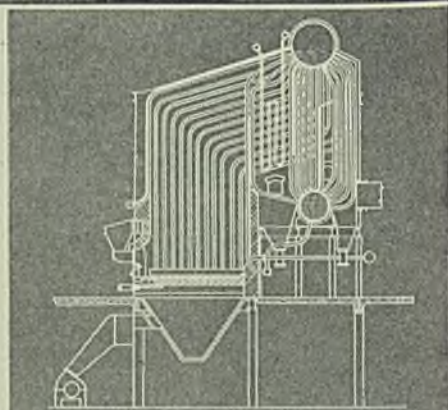
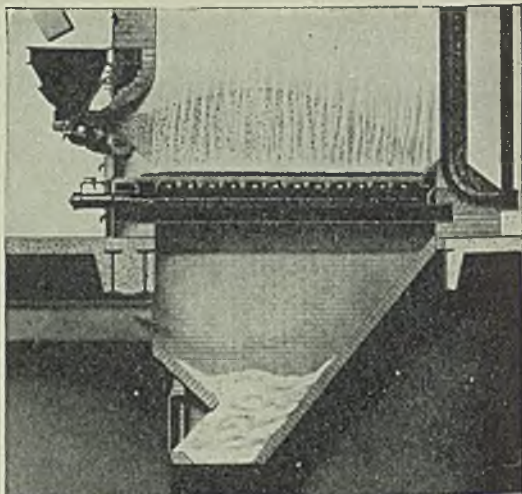
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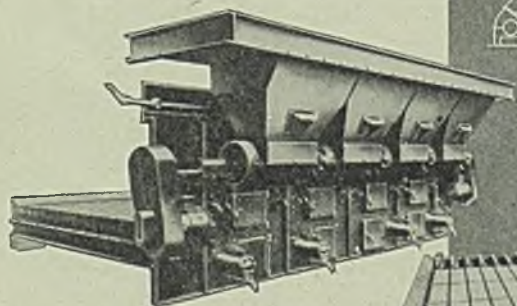


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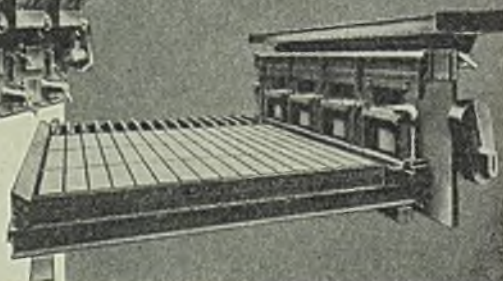
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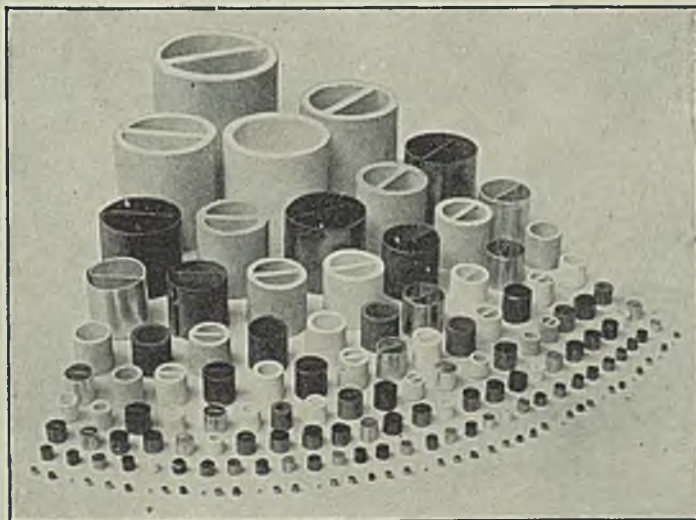
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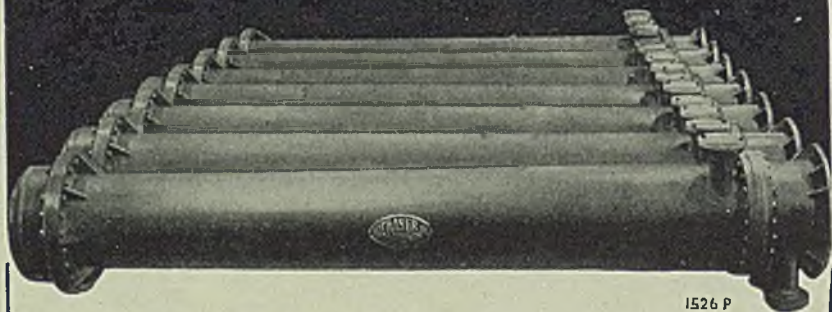
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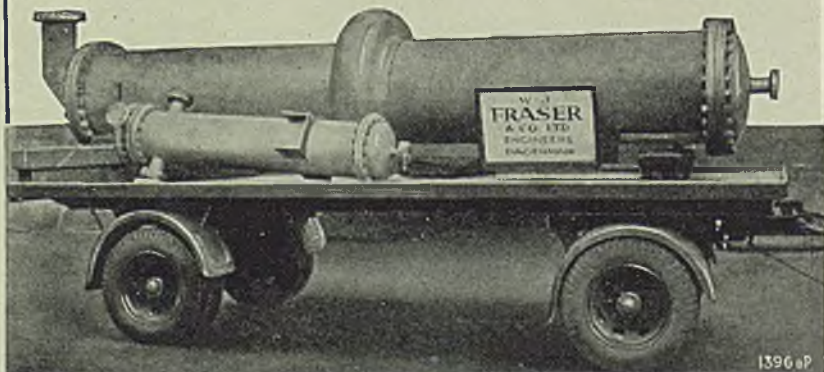
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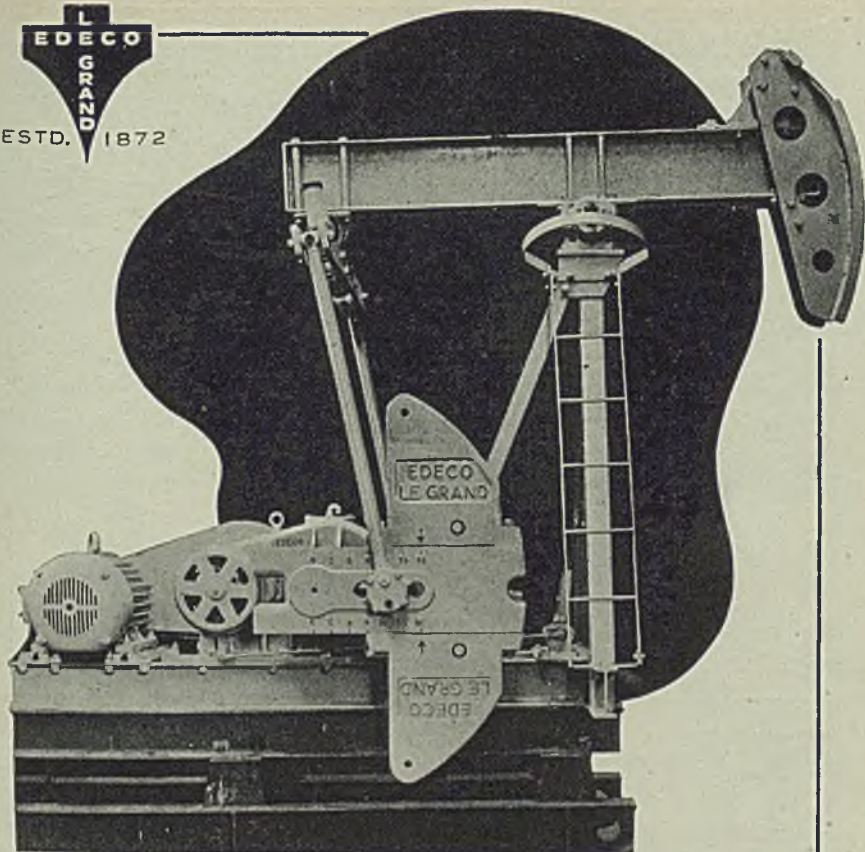
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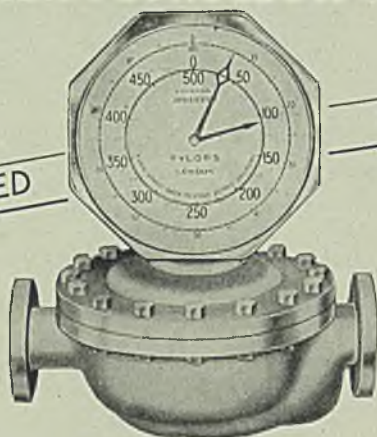
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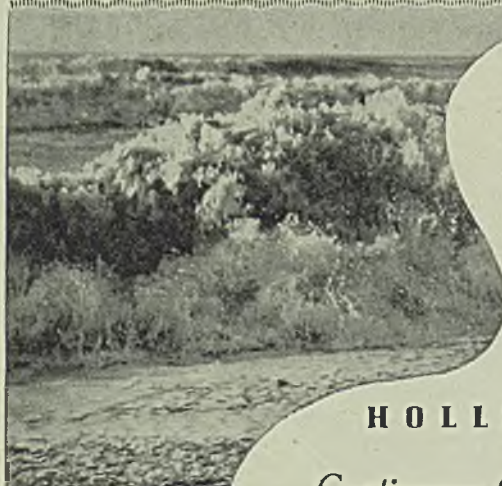
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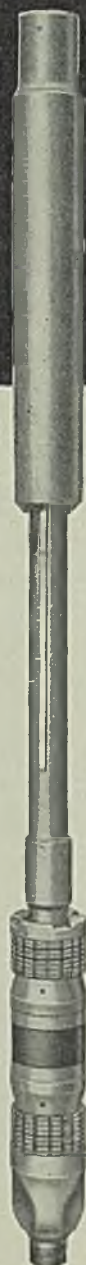
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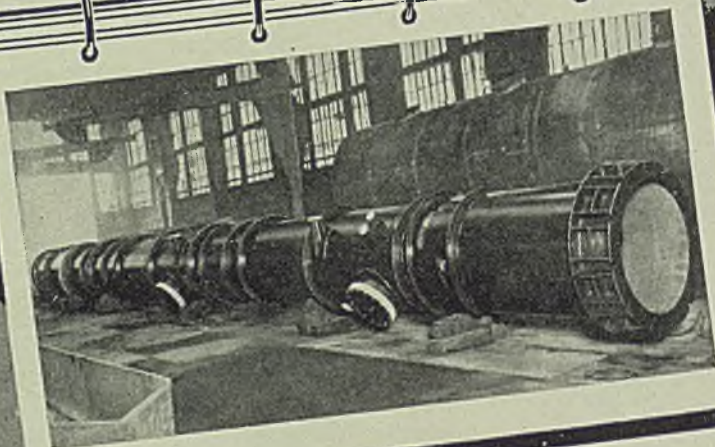
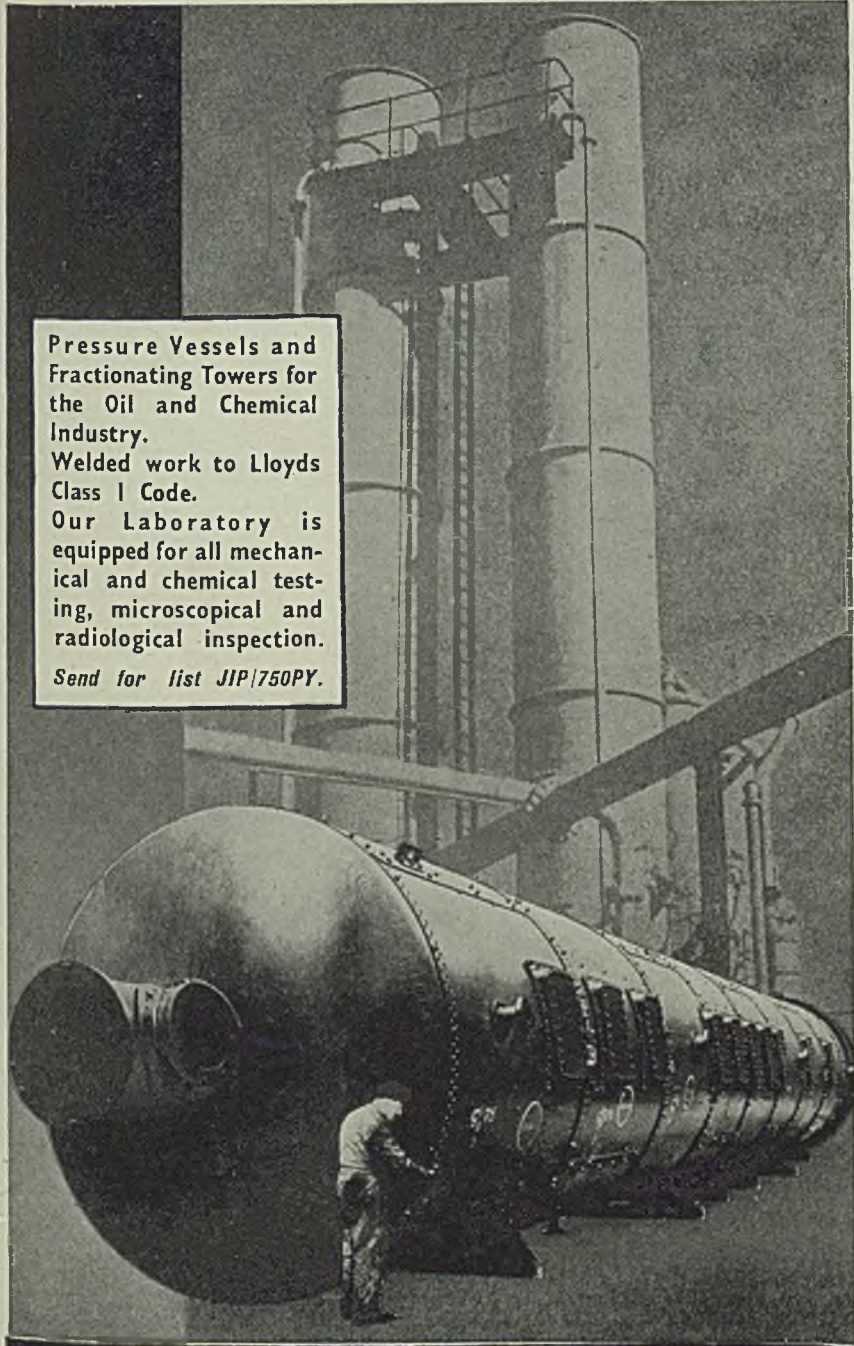


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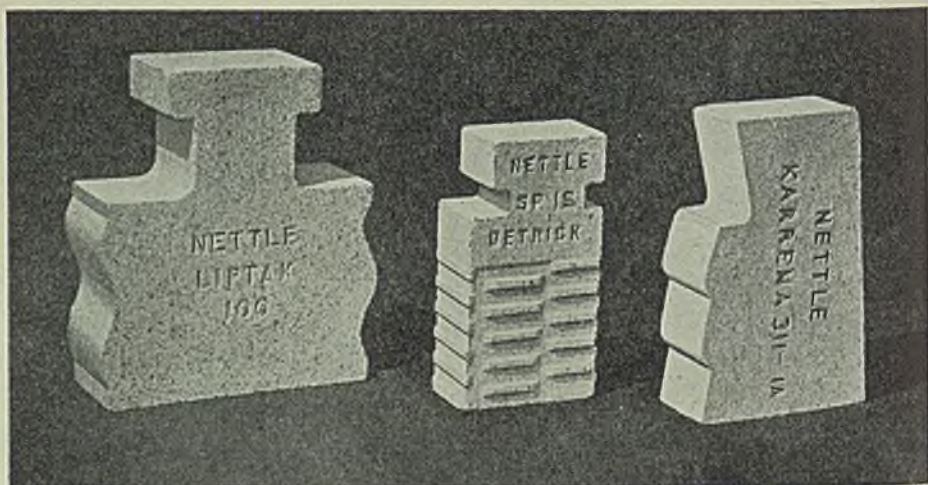
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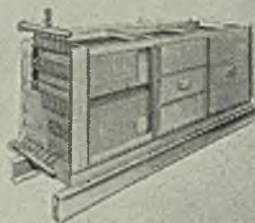
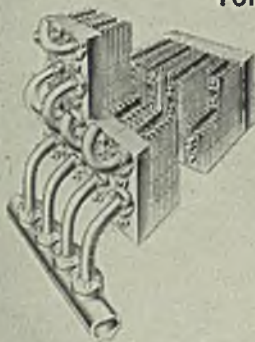


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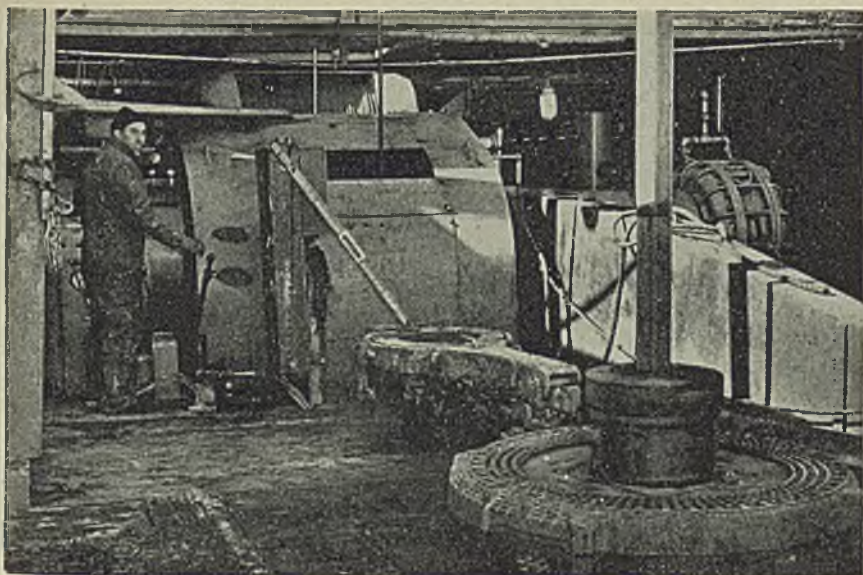
The tables have been calculated using, whenever possible, legally recognised equivalents, but where such equivalents have no legal status, the latest and most accurately determined metrological data were used in the computation of the table concerned.

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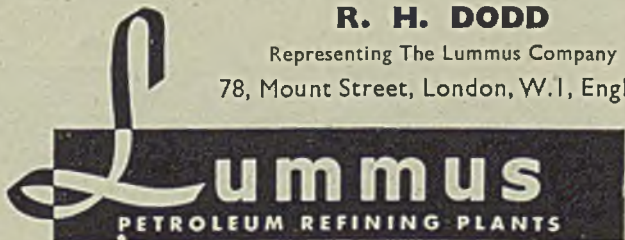
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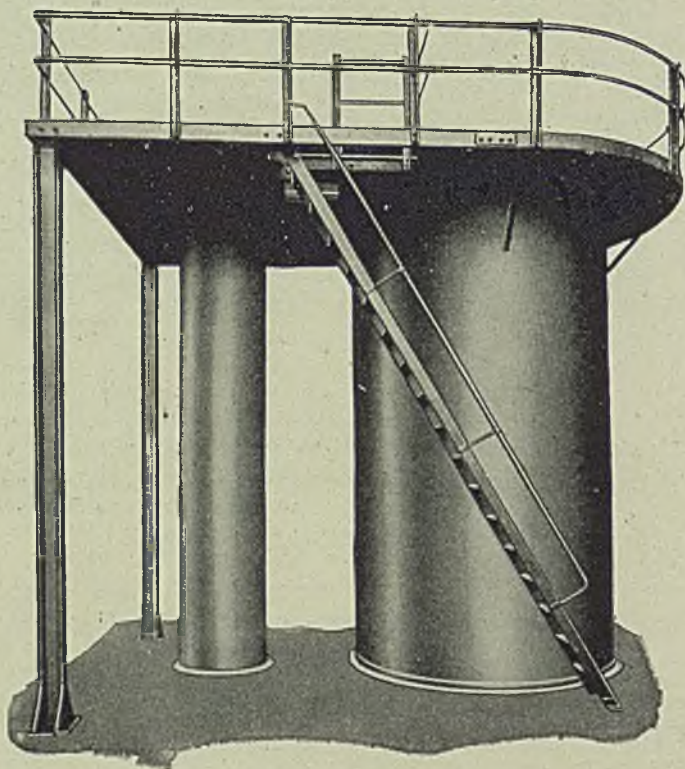
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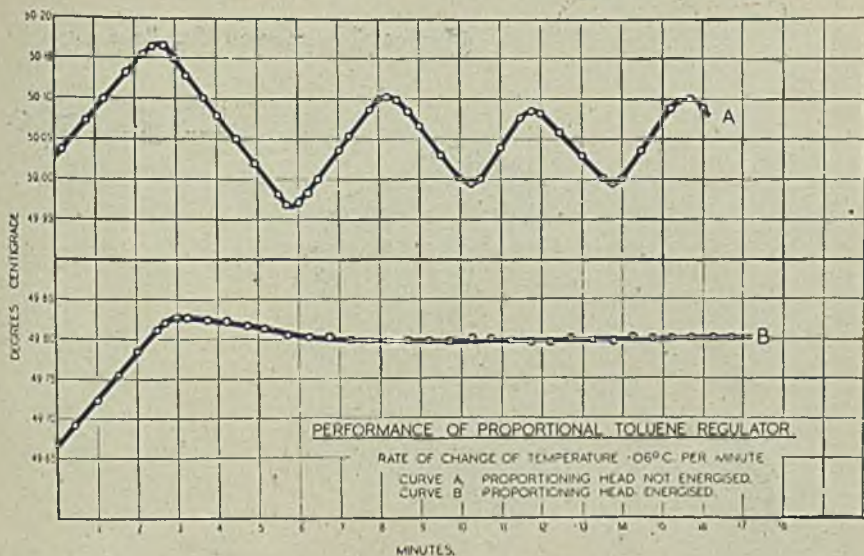
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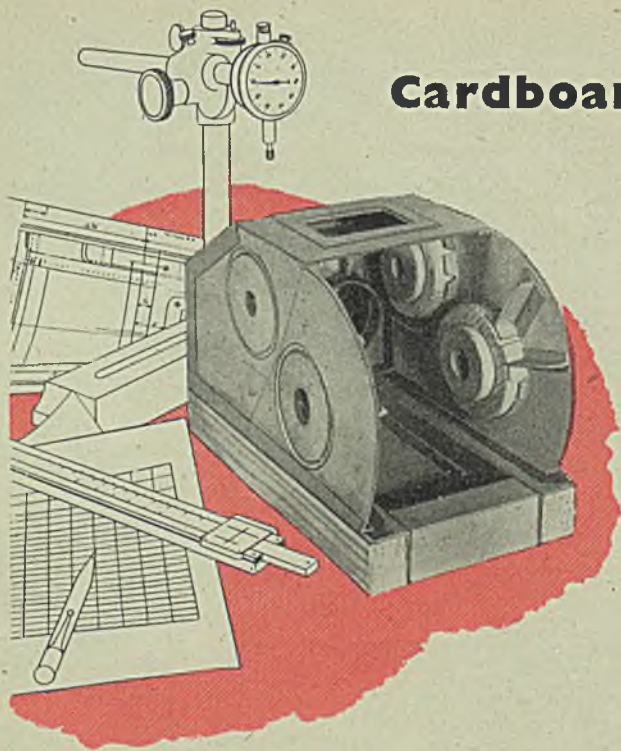


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