ABSTRACTS.

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The original papers referred to in the abstracts marked with an asterisk may be borrowed by Members from the Institute Library.

OILFIELD EXPLORATION AND EXPLOITATION.

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384. Prospects for Deeper Zone Production in California. A. Gregersen and F. S. Parker. *Petrol. Engr*, November 1944, **16** (2), 107.—See Abstract No. 43.

G. D. H.

385.* Wildcat Completions and Discoveries. Anon. *Oil Gas J.*, 25.11.44, **43** (29), 129.—109 wildcats were completed in U.S.A. in the week ended 18th November, 1944.

14 wildcats found oil and two found gas. The completion results are summarized by States and districts. G. D. H.

386.* World Oil Atlas. Anon. *Oil Wkly*, 11.12.44, **116** (2), 1–56.—The atlas shows the location of the producing oilfields, pipe-lines, and refineries in all countries outside of the United States. A map index and field guide are given. G. D. H.

387. Germans Develop Fields in South-Western France. Anon. *Oil Wkly*, 11.12.44, **116** (2), 124.—A small oilfield has been found and three fields partly developed by the Germans in the Gascony region. The fields are presumably on the large Cretaceous anticline of the St. Gaudens area. A small oil-well and several gas-wells were completed there in 1939 and early 1940, but were shut in. The Germans are reported to have built a gasoline absorption plant in the St. Gaudens area early in 1943, and since then 120,000 cu.m./day of dry gas has been piped to Toulouse. G. D. H.

388. China Awakes to its Petroleum Possibilities. Anon. *Oil Wkly*, 11.12.44, **116** (2), 130.—When Japan invaded China, oil exportation was under way in a number of localities, but war practically stopped all work. However, enough drilling has been done to show the presence of commercial oil accumulations in two localities. The Lanchow field of central Kansu province was opened in 1939. It has fourteen producing wells operating at about half their total potential of 5000 brl./day. The crude is roughly refined for local use in a small skimming plant.

In 1941, 700 ml. to the northwest in Sinkiang province, a small field was opened with Russian assistance. Sinkiang province has many large oil-seeps, and is believed to have great oil possibilities. The area is very remote. There are other promising areas with oil-seeps, but they also are difficult of access. In the great Red Basin of Szechuan province oil occurs in Mesozoic beds, and older beds, especially the Permian, have possibilities. G. D. H.

389. Australia Plans Extensive Post-War Search for Oil. Anon. *Oil Wkly*, 11.12.44, **116** (2), 140.—New Guinea seems to offer greater chances of commercial oil discoveries than Australia, for New Guinea, but not Australia, lies in a belt of Tertiary deposited in a great Mesozoic geosyncline. The Tertiary beds of Australia do not appear to have favourable structures, and consequently Woolnough considers the Permo-Carboniferous rocks to offer the best oil possibilities in Australia. Oil has been found in the Tertiary beds, which extend from southeast Victoria to the Esperance area in Western Australia, at Lakes Entrance, Victoria. Non-commercial saturation was found in Miocene glauconitic sands in 1930, at a depth of 1200 ft. Semi-commercial production was found over an area of 8 sq. ml. A shaft is to be sunk in this area to exploit the sand by horizontal borings.

Oil-shale deposits are being exploited in the Glendavis area of New South Wales.

A number of dry holes have been drilled in Papua, and there has been other exploratory work.

In the Roma area of Queensland about 260 wells, 20 comparatively deep, have been drilled. In 1908 one found gas at 3702 ft. Others have found gas and gas-distillate flows, but neither oil nor distillate in commercial amounts was found. Geophysical work has been carried out since 1939.

One well has been drilled near Longreach, Queensland.

16 wells have been drilled in the Hunter River and Sydney–Gosford areas of New South Wales, in the Permian–Triassic basin. Small gas-flows, but no oil, have been encountered.

A stratigraphic test is being drilled in the Tertiary of western Victoria. At 6300 ft. it is still on Middle Miocene beds.

22 wells in Tasmania have failed to find oil. The same is true of 38 tests in South Australia. The Kimberleys and the northwest basin of West Australia show oil residues at outcrops, and 21 holes have been drilled in the Kimberley area and in the Fitzroy River district. Some have had encouraging oil shows. G. D. H.

390. Results of Wartime Explorations in New Zealand Are Disappointing. Anon. *Oil Wkly*, 11.12.44, **116** (2), 142.—Since 1938 at least 11 exploratory wells have been drilled in New Zealand, all near oil-seeps, which are numerous in both of the large islands. The first went to 5700 ft. near Gisborne, on the east coast of North Island, and found good-quality oil, although not in commercial amounts. Southeast of New Plymouth a test reached 10,925 ft. at Midhurst. During 1943, 3 unsuccessful wells were drilled in the New Plymouth area and 2 in the Gisborne area.

In the Moturoa field, southwest of New Plymouth, 3 wells are reported to be yielding an average of 85 brl./day each. Semi-commercial finds have been made in the Gisborne region, also on the North Island, and near Murchison in Nelson Province, South Island, and Greymouth, Westland Province.

Several wells have tapped prolific but short-lived pays. Faulting causes complications in the Gisborne area, and in some areas the deeper geology is obscured by thick gravels and clays, or by volcanic rocks.

Geological and geophysical surveys are now in progress in southern Taranaki and western Wellington provinces, where Tertiary beds are believed to exceed 10,000 ft. in thickness. The east coast of North Island, from East Cape southwestward, is the eroded rim of a Mesozoic and Tertiary basin that extends many miles inland. Many seeps occur along the strike of outcropping Cretaceous beds. This bed continues southwestward across most of the eastern part of South Island. Seepages have been noted in Palæozoic beds farther south. G. D. H.

391. Union of California Contracts with Paraguay for Extensive Exploration. Anon. *Oil Wkly*, 11.12.44, **116** (2), 144.—In partnership with the Paraguayan Government the Union Oil Company of California is to search for oil in the Chaco territory over an area of 54–58 million acres. Geographically the Chaco is an extension of the Argentine Chaco. The oil districts of Bolivia are adjacent to the Paraguayan frontier on the northwest. G. D. H.

392.* Sixty-Two Pool Discoveries Are Reported During October. Anon. *Oil Gas J.*, 9.12.44, **43** (31), 58.—329 wildcat completions in U.S.A. in October provided 62 pool discoveries, of which 21 were gas pools. None of the discoveries seems to be outstanding. Texas had 117 completions, Kansas 39, Illinois 26, Oklahoma 25, Kentucky and California 22 each.

The number of rigs operating is still insufficient to meet the demand in areas of intensive development. There has been some easing of the position regarding repair and replacement parts for rigs.

Sufficient steel has been allocated to meet P.A.W. requests for the first quarter of 1945. G. D. H.

393.* Wildcat Completions and Discoveries. Anon. *Oil Gas J.*, 9.12.44, **43** (31), 127.—84 wildcats were completed in U.S.A. in the week ended 2nd December, 1944. 11 found oil and 3 found distillate. The wildcat completion results are summarized by States and districts. G. D. H.

394.* Wildcat Completions and Discoveries. Anon. *Oil Gas J.*, 16.12.44, **43** (32), 133.—97 wildcats were completed in U.S.A. during the week ended 9th December, 1944, 10 finding oil and 2 finding gas. The completion results are summarized by States and districts. G. D. H.

395.* Drilling Resumed. Anon. *Oil Wkly*, 18.12.44, **116** (3), 54.—Drilling has been resumed at Mary 1, Lion Oil Company's second wildcat on the western shore of the Cape Breton Island, Novia Scotia. The well is 6510 ft. deep. G. D. H.

396. Exploration Is Under Way in Buenos Aires Province. Anon. *Oil Wkly*, 18.12.44, **116** (3), 54.—A gravimeter and torsion balance party are at work in central and southern Buenos Aires Province. Three refraction parties are doing follow-up detail mapping where subsurface structure is indicated. The area is almost completely covered with thick Quaternary deposits. Closed structures have been indicated and several wildcats will be drilled. G. D. H.

397. Three Wildcat Operations Are Under Way in Ecuador. Anon. *Oil Wkly*, 18.12.44, **116** (3), 54.—Arajuno 1, in the eastern Andes foothills, has reached a depth of 2000 ft. In the coastal area, west of Guayaquil, Carizal 1 has been abandoned, while Daular 2 is under way. Camarones 1, on the Esmeraldas coast in extreme northwestern Ecuador, has reached a depth of 3700 ft. G. D. H.

398.* Jumping Pound Strike May Fulfil Canada's Long-Time Dream of "Second Turner Valley." Anon. *Oil Wkly*, 18.12.44, **116** (3), 66.—Shell Oil Company of Canada's No. 4-24-J well at Jumping Pound has penetrated only part of the Madison limestone section. The well has an open flow capacity estimated at 20,000,000 cu. ft./day of wet gas, with several hundred barrels of natural gasoline and light crude oil. The formation pressure is believed to exceed 3000 lb./sq. in. The well is on the crest of a long, broad anticline trending north–south. The depth is 9888 ft., with 270 ft. of Madison penetrated. A porous streak occurs at 9746–9847 ft. This well is comparable to the Madison limestone discovery well at Turner Valley. The base of the Jumping Pound producing horizon is at 5827 ft. below sea-level, while Turner Valley's deepest oil producer has the base of its producing zone at 5602 ft. below sea-level. Shell 4-24-J is on an anticline lying east of the Turner Valley fault-block. Both flanks are believed to be present at Jumping Pound. G. D. H.

399.* Canada Test Abandoned. Anon. *Oil Wkly*, 25.12.44, **116** (4), 63.—Lion Oil Refining Company's Mary 1, near Inverness, Cape Bréton Island, Nova Scotia, has been plugged and abandoned at a depth of 6870 ft. G. D. H.

400.* Guario Field Rig Moved to Guico Field by Socony. Anon. *Oil Wkly*, 25.12.44, **116** (4), 63.—The Guico field, discovered in July 1944, is a northwest extension of the West Guara field. The first well gave 1200 brl./day from two pay-zones. A second dual completion has been made, and other wells are under way. G. D. H.

401.* Marine Deep Tests Near Baku Production Planned. Anon. *Oil Wkly*, 25.12.44, **116** (4), 63.—Preparations are being made to drill wells, some of them 12,000 ft. deep, off-shore south of Baku. The structure, outlined by the seismograph, covers over 200 sq. ml. There are numerous under-water seepages. G. D. H.

402.* Two Producing Areas Near Syzran, Russia, Opened. Anon. *Oil Wkly*, 1.1.45, **116** (5), 51.—Two producing areas have been opened north of Syzran, on the west of the Volga. There are other promising geophysical closures along the Krasnyar–Yablonovog trend running southwest into the Zhigulev Hills. There is subsurface structural connection between the trends of the Syzran and Saratov fields. G. D. H.

403.* South African Government Reported to be Drilling. Anon. *Oil Wkly*, 1.1.45, **116** (5), 51.—The South African Government is reported to be drilling two wildcats near Rietbron. Both wells are said to have encountered oil shows in sandstones, possibly in the Lower Triassic. There is a thick Permian–Triassic shale and sandstone series. G. D. H.

404.* Wildcat Completions and Discoveries. Anon. *Oil Gas J.*, 6.1.45, **43** (35), 104.—During the week ended 30th December, 1944, 78 wildcats were completed in U.S.A. 9 found oil, 1 distillate, and 3 gas. The completion results are summarized by States and districts. G. D. H.

Drilling.

405. Indicating Instruments Play Major Part in Precision Drilling. J. Medford. *Petrol. World*, October 1944, **41** (10), 60–61.—The paper deals particularly with weight indicators and other instruments made by Martin-Decker Corporation of Long Beach, California. A. H. N.

406. Overcoming Heaving Shale, Salt Water. J. L. Ward. *Oil Wkly*, 16.10.44, **115** (7), 58.—A deep well which gave very many mud troubles is studied in some detail. It is believed that the hole could not have been successfully drilled without the use of sodium silicate mud, and that the proper mud conditions could not have been maintained within the necessarily narrow range without use of a continuously recording mud weight indicator. The automatic weighing instrument gave remarkable trouble-free and highly accurate service. This instrument operates as follows: A portion of the mud from the return line is diverted through the chamber of the instrument, in which is measured the difference in pressure required to introduce a flow of gas or air into a column of the mud at two different points in the column. As the weight of the mud changes, the differential pressure thus required varies accordingly and is translated into mud weight in lb./gal. and recorded on a 24-hr. chart so calibrated. The mud chamber is automatically flushed out and refilled and a reading of the weight recorded once every 45 sec. The chart thus obtained provides a continuous record of the mud weight, and thus a permanent record of the drilling operations can be obtained by recording on the chart the pertinent information relating to the indicated conditions. From this chart such conditions as shut-down time due to repairs or making a trip, frequency of filling up the hole while making a trip, lost circulation, and light streaks in the mud, are readily apparent. The latter, in addition to providing the information necessary to maintain mud control is also useful in identifying prospective producing formations and salt water flows. Representative charts illustrating the above are shown. A. H. N.

407.* Rio Grande Floodway Water Successfully Conditioned For Use in Drilling Rigs. E. H. Short, Jr. *Oil Gas J.*, 28.10.44, **43** (25), 63–64.—Six steam-operated drilling rigs are being supplied with water from Pan American Production Co.'s recently completed plant for treating Rio Grande River water. The daily average quantity of water treated is about 400,000 gal. at present, with 630,000 gal. the expected goal. To appreciate the engineering problem involved in such a conditioning project, it is necessary to have a conception of the hardness and origin of floodway water. Seepage from subsurface formations is responsible for some of the hardness, and the Rio Grande River water has a natural hardness. The waste irrigation water which runs off from orchards and various crops makes up most of the volume carried in the floodway. The average hardness of the water is approximately 30 grains/gal., although at times it may run as high as 60 grains. After a heavy rainfall the hardness may drop as low as 10 grains. An analysis of the untreated floodway water shows total solids of 215 grains/gal., as follows: sodium sulphate, 85; sodium chloride, 100; magnesium sulphate, 12; calcium bicarbonate, 8; calcium sulphate, 10. The engineering part is briefly described. Caustic soda, soda ash, and an aluminate are used as precipitants and coagulants.

It was noticed that the precipitates, when stirred, act as precipitant. It is believed that this softening value comes from the slight solubility of the precipitated hydroxides, whose action tends to raise the pH value of the raw water sufficiently to liberate some carbon dioxide. This, in turn, probably throws down the calcium bicarbonates as calcium carbonate. This action is reflected in a comparison of the amounts of chemical theoretically needed to soften the raw water as compared with the amount actually used. The caustic apparently saved by this action amounts to approximately 0·54 lb./1000 gal. of water treated. The saving in soda ash in treating the same quantity of water amounts to 1·23 lb. It has been noted that about 20,000 gal. of sediment in the 5000-brl. tank gives the maximum softening capacity to be obtained from sediments. The water which enters the reservoir pit has a hardness of less than 1 grain/gal. The total soda alkalinity, which is the sum of the excess of caustic and soda ash in treated water, is less than 10 grains/gal. A. H. N.

408.* Modern Drilling. Anon. *Oil Gas J.*, 28.10.44, **43** (25), 74–75.—The mechanical and operational details of Bethlehem Gumbo Buster MC-650 rig are given, together with a schematic diagram of the rig, and two photographs. A. H. N.

409.* Modern Drilling. Anon. *Oil Gas J.*, 11.11.44, **43** (27), 96–97.—The mechanical and operational characteristics of the Portable Rig's Model CT-5 Rig are given, together with a blue print showing schematic diagram and photographs illustrating the rig. A. H. N.

410.* Radiographic Inspection of Oilfield Equipment in Place a Convenient Tool. E. H. Short, Jr. *Oil Gas J.*, 25.11.44, **43** (29), 91.—The use of radium to inspect field equipment in place offers a variety of advantages, not the least of which is the fact that the work can be done without interruption of production or plant operation.

The safety of a well is not affected, and the condition of inside surfaces can be inspected without dismantling. This article describes how such inspection is performed.
A. H. N.

411.* **Modern Drilling.** Anon. *Oil Gas J.*, 25.11.44, **43** (29), 98–99.—This short paper deals with Franks' truck-mounted rotary rig with portable telescoping derrick, and gives the mechanical and operational characteristics, blueprints of schematic arrangement, and photographs. A. H. N.

412. Treatment of Mud with Organic Colloid. W. A. Sawdon. *Petrol. Engr*, December 1944, **16** (3), 67.—The paper deals with the organic colloid "Impermex," sold by Baroid Sales Division. In a properly prepared mud, good wall-building properties will accompany low water loss. A mud with good wall-building properties is one that will form a highly impervious mud cake on the wall of the hole, and as the cake is a deposition of solids remaining after infiltration of water into the formation, the less the water loss the thinner will be the cake. A.P.I. water losses as low as 8 or 9 c.c. have been obtained by the addition to the drilling mud of prepared bentonite with suitable chemicals, but there are conditions where water losses lower than that are necessary. By high concentrations of the organic colloid water, losses of less than 1 c.c. have been obtained. The use of this organic colloid in a drilling mud is not only a means of reducing water loss to a minimum, but is also believed to be the most practical method known at the present time for reducing the high filtration characteristics of a drilling fluid that has been contaminated with salts, such as sodium, magnesium, or calcium chlorides, sulphides, cement, or, as occasionally happens, acid. The characteristics imparted to the mud by the organic colloid have provided (in addition to meeting general drilling problems that require low-water-loss muds for their solution) for drilling through caving formations or those formations that ordinarily become dispersed in the mud stream when the usual muds are employed; for continued use of the same mud after penetrating a flow of salt water or water otherwise contaminated; for drilling through productive zones with minimum infiltration of water into the formation, and for utilizing sea water or other salt water sources as mixing water for the mud. The decrease in water loss from a saturated salt-water mud with increased concentration of the organic colloid is shown graphically. The colloid is of the hydrophilic type, and when it is to be used for treatment of a drilling fluid, provision must first be made to ensure that there is no possibility of decomposition (*e.g.*, by fermentation, bacterial degradation, etc.), and that the base mud is in suitable condition or can be adequately modified to prevent excessive viscosity that may result from the increase of viscosity that generally accompanies the addition of the colloid to the mud. When the base mud has a relatively high concentration of salt it is frequently possible to add the material without any precautions being taken against decomposition. It is possible that a fresh-water mud may be free from inoculation by destructive organisms, which may be absent from the clay and water of which the mud is made and from the formation penetrated, but these circumstances are exceptional, and such sterile conditions cannot be taken for granted. Details are given for making and preserving these specially treated muds. A. H. N.

413. Control of Mud Weight in Drilling Wildcat Wells. C. C. Pryor. *Petrol. Engr*, December 1944, **16** (3), 119.—The drilling of a semi-wildcat is described. Blow-outs from high-pressure sands were very difficult to control by increasing the weight of the mud, as the highly permeable sands caused loss of circulation. The high gas pressures and the apparently high porosity of the gas sands which made it impossible to obtain the necessary weight and retain circulation, required full attention of the field mud engineer and full use of all materials and equipment at his disposal. Among the important equipment available to the mud engineer was the automatic mud-weighing machine. When the well was blowing mud from the hole and was put on the choke, the flow was still directed through a 2-in. pipe into the mud ditch ahead of the weighing mechanism of the mud machine in order to provide a continuous record of the mud weight. Whenever the mud became gas-cut and decreased in weight it was recorded by the machine as quickly as the mud reached the surface and flowed approximately 30 ft. down the mud ditch to the weighing mechanism. Thus close check on the mud weight was possible by use of the machine owing to the speed, approximately 37 sec., with which it was weighed and recorded. In addition, when the weight of the mud began to drop and there was the possibility of a blow-out, the record warned the crew in time to make preparations that might otherwise not have been made. The change in mud weight recorded by the machine was directly responsible for warning the crew immediately before the gas kick at 8094 ft. One man was stationed at the blow-out preventer, two at the ram controls, and one at the automatic mud-weighing machine recorder. Other members of the crew stood by for the emergency. The basic principle of operation of the mud machine is that it measures the differential pressure required to introduce a flow of air or gas, at predetermined spaced elevations, into a trapped column of mud. Then, as the specific gravity of the mud varies, the differential pressure which is required to introduce the air or gas into the mud column will vary in direct proportion. These pressures are communicated through individual tubes to the recording unit, where they are recorded by a pen on a 24-hr. chart, calibrated directly in lb./gall. Arrangement of the mud column in the weighing unit is such that the mud enters and discharges by gravity. A. H. N.

414. Drilling Practices Under Present Conditions. B. J. Dowd. *Petrol. Engr*, December 1944, **16** (3), 128.—The work of the contractor in drilling wells in the U.S.A. in war-time is described. The concern about blow-outs led to research and the study of mud control. The first objective in mud treatment was to reduce viscosity in order to release occluded gas, remove cuttings, obtain sufficient hydrostatic head to prevent blow-outs, and secure a more pumpable fluid. From continued study it became evident that filtration of water into the surrounding formation might be partly responsible for such troubles as stuck pipe, poor cement jobs, oversize holes, and heaving shale. The solution of such problems required the accumulation and study of much data by technical and research men. Some of the materials available to the industry for the conditioning of drilling mud are: mud weighting materials, gel-forming colloidal drilling clay, salt-water-resisting drilling clay, special clays used as suspending agents when high concentrations of salt or salt water are encountered, fibrous materials for restoring lost circulation, chemicals for increasing and decreasing viscosity, materials for overcoming the effect of cement contamination in mud, materials for overcoming the effect of gypsum and anhydrite contamination in mud, and materials for controlling the water loss of drilling muds.

The proper use of these materials can prevent many blow-outs, stuck drill pipe and ensuing fishing jobs, heaving shale, difficulties encountered when drilling through large bodies of salt, bad cement jobs, and many other problems encountered while drilling. The method of treatment has been reduced to such routine that average muds are now treated by the drilling crew together with their regular duties. To their tools, the centrifuge hydrometer and viscosimeter, have been added the filter press and titration papers, together with an explanation of the basic principles involved. Cementing and completion are very briefly studied. A. H. N.

415. Rotary Drilling Equipment. J. A. Chapman. *Petrol. Engr*, December 1944, **16** (3), 192. *Paper Presented before American Association of Oilwell Drilling Contractors.*—In a brief discussion, the chief requirements of the future equipment to be used in rotary drilling are indicated. They are mainly a reduction in weight and increase in capacity by means of using special alloys. A. H. N.

416.* Directional Drilling as Development Aid in Coastal Louisiana Salt-Dome Field. N. Williams. *Oil Gas J.*, 9.12.44, **43** (31), 66–68.—Some of the various practical applications of directional drilling being made to facilitate development of deep sands around the Potash Dome, coastal Louisiana, are described. Two wells deviated from bank locations to points under the bed of the Mississippi River are included. Hazards of cavity and salt overhang drilling are being avoided. Seven of the present 21 producing wells in the field have employed directional drilling as an originally planned procedure with surface locations made specifically for that purpose. In addition, directional drilling has been employed in a well later abandoned as dry, in which three different holes were drilled to different objectives. Of the 7 producing wells started as planned directional-drilling projects, 2 were deviated to avoid cavities, while the others were necessitated because of inaccessible surface locations. Location of the field is on the east bank of the Mississippi River, about 55 miles below New

Orleans. It is entirely within the Bohemia overflow spillway, a stretch of waste marshland, through which excess water to the river is diverted during flood seasons. The productive area extends out below the bed of the river, where development has been extended and 2 wells completed to date. Access to locations within the field is by means of dredged canals, through which the drilling and servicing of wells are carried on by barges and boats. These conditions create many inaccessible and inconvenient locations, particularly those under the bed of the river. Drilling in the river is not only not permissible, but is also not feasible because of the greath depth and speed of current at this point, and the navigation and other hazards involved. This means that all wells under the river-bed extending around the southwest, west, and northwest sides of the dome must be drilled from the bank. It is also necessary that the surface locations for these wells be a considerable distance from the bank, in order to minimize the possibility of the river bank being washed out and the river breaking through the fields. A. H. N.

417.* Modern Drilling. Anon. *Oil Gas J.*, 9.12.44, **43** (31), 84–85.—Mechanical specifications and operational characteristics of Hopper portable drilling and servicing units are given. Photographs are given of different parts. A. H. N.

418. New Drilling Problems Face Operators in Everglades District of Florida. N. Williams. *Oil Gas J.*, 6.1.45, **43** (35), 44.—Unusual conditions and problems being encountered include both those of terrain, affecting access to and preparation of drilling sites, and subsurface formations, governing actual drilling practices. Remoteness of present drilling in the State from other oil areas and centres of operation has been a major handicap, since supplies and service facilities have had to come from long distances. This has caused operating delays when needs could not be anticipated and has added appreciably to costs. Particularly distinctive of this state and the basis for various problems is the coral limestone bed underlying a large part of the Florida peninsula. This formation, several thousand feet thick in places so far drilled, is honeycombed and cavernous, and capable of taking anything pumped into it. The paramount hazard in this lies in having to drill without returns (*Oil Gas J.*, 6.1.44, p. 56).

The depth at which the coral bed is found varies from the surface in some parts of the peninsula to around 1500–2000 ft. in others. Where it is not at the surface it is generally overlain with loose and porous water-sands and gravels, which also give trouble from loss of returns in drilling the surface hole. Where it lies at the surface it also contributes to certain peculiar conditions which have been faced in providing access to and preparing drilling sites. Methods devised to overcome these troubles are briefly described. A. H. N.

Production.

419.* The Influence of the Compressibility of Edge-waters on the Course of the Exploitation of Petroleum Deposits. I. A. Charnuii. *Bull. Acad. Sci. U.R.S.S. Cl. Sci. Tech.*, 1944, 516–526.—A mathematical discussion in the course of which calculations are given concerning the velocity of progression of the water/oil interface and of the change in oil output with time. V. B.

420. How to Increase Life of Machine Parts. Part 2. E. N. Kemler. *Oil Wkly*, 23.10.44, **115** (8), 38.—Stress concentration in loaded members which have a change in section or in shape are explained. These concentrations lead to fatigue failure in many instances. Photographs of typical failures by fatigue in sucker rod, elevator limb, crank-shaft, etc., are shown. A. H. N.

421. Measuring Plurality of Oil Wells with One Meter Helps to Maintain Records. Anon. *Oil Wkly*, 23.10.44, **115** (8), 42.—Six wells are connected to a central metering unit. Each well is connected to a gas-water and sand separator and scrubber. In the scrubber is a level controlling float. On the electric board is a selector motor with cams, one for each well. When the liquid level in the scrubber has been raised by the incoming oil to a point where the float-switch is tripped, an electrical circuit is closed which stops the aforementioned cam at the proper time, and simultaneously energizes and opens the magnetic valve on the suction line for that particular scrubber, and energizes both the motor circuit starting the pump and the circuit which controls the counter for that particular well. Because the selector has stopped during the period that any of the scrubbers are being pumped out, no other scrubber may come on or "dump" until the first unit has pumped and metered sufficient oil from the oil-chamber to allow its float to fall to the point where it trips the float-switch. This opens the initial circuit, and causes the circuits of all the succeeding stages, including the magnetic selector valve, meter-head micro-switch, and pump-motor, to return to normal, or inactive positions, simultaneously starting the telechron motor and accompanying cam to hunt for other scrubbers which may have been standing ready to come on. When one is automatically found, the complete cycle is repeated. The oil pumped out from each scrubber at the current setting of the float-switches is approximately 6 brl., and is removed in approximately 8 min. Depending on the production rate of the well producing into the particular scrubber, the emptying cycles for each scrubber occur from fifteen to twenty-five times/24 hrs.

The six lines from the six separators manifolded to one line are serviced by a single meter. On the top of this meter dial, which is a $1\frac{1}{2}$-in. piston meter, 50 g.p.m. capacity, the simple actuating mechanism is installed. As soon as each barrel of oil has flowed through the meter, a cam actuates a small micro-switch in the meter dial-head, and this in turn actuates the individual counter of the respective separator on the panel board. The counter records one barrel at a time. The accuracy is claimed to be equal to that obtained by tank gauging. A. H. N.

422. Bradford's Water-Flood Recovery. G. O. Ives. *Oil Wkly*, 23.10.44, **115** (8), 52.—Water-flooding has accounted for the recovery of almost as much oil in the Bradford, Pennsylvania, field as has been produced by natural or primary methods, and in time water-flood operations are expected to be responsible for more oil than primary methods. Production data are given. The reservoir is a well-defined, continuous sand body, lending itself readily to flooding operations, and careful records of production, correlated with core analysis and other factors, have made it possible to calculate recovery/acre from any property or area in the field within practical limits. On the five-spot well pattern, one well develops 1·22 acres, and a comprehensive study shows that recovery/acre for wells drilled in the past several years varies from as low as 2000 brl. to as high as 6500 brl., with a weighted average around 3800 brl. Thus it may be calculated that drilling of 100 wells during any period should develop 122 acres, with resultant ultimate recovery of 463,600 brl. of crude. Any increase or decrease in drilling activity has a direct effect on the production from the field. Development costs are summarized. A. H. N.

423. Choke Control of Gulf Coast Wells—No. 2. J. E. Loeffler. *Oil Gas J.*, 28.10.44, **43** (25), 89.—Removable-type beans were early used on the West Coast, and were called plug-flow nipples. This type of flow-bean was held in a cage-nipple, which was called a flow-bean cage or flow-bushing. The bean was screwed into a tee at the bend of the flow-line. The cross was blanked off opposite the cage-nipples, and opposite the flow-line from the tubing-head fitting, each with a bull-plug. The principal advantage of the positive choke is its simplicity and low cost. The bean is of high-carbon steel, carburized and heat-treated for extreme hardness. To facilitate adjustment and replacement, beans are placed in the outlet of crosses or tees. Modern beans still use the same essential features, but instead of a bull-plug, a quick-change coupling covers the bean replacement post. Beans for positive chokes are of several different styles, and are of heavy construction to withstand high-pressure conditions and sand scouring. They are often made of a solid piece of steel or forging 3–6 in. long. The diameter of the orifice through the bean may range from $\frac{1}{64}$ in, to $\frac{3}{4}$ in. or more. The popular sizes of bores range from $\frac{1}{8}$ in. through $\frac{9}{64}$ in. to $\frac{5}{32}$ in.; by far the majority are those 6 in. in length. The Texas standard proration bore is $\frac{1}{4}$ in. and length of 6 in. Other States may have variations. A pressure gauge on the upstream side of the cage-nipple indicates the back pressure in the well, which should be maintained as steady as possible.

The needle-valve choke is the original design of adjustable type, and is widely used. This model is known as the "screwed type" because the inlet is pipe size with female threads and the outlet is a male pipe thread. Adjustable full-flow chokes are similar in construction to the needle-valve choke, with the exception of the point and seat, which are made to permit a full flow through the pipe. The seat is formed directly on the nipple, in much the same way as the original valve type. This choke is generally considered ideal for fields where it is occasionally necessary to flow the well wide open to get production or to permit the well to clean itself. The advantages of adjustable chokes are discussed.

Combination chokes, convertible from positive to adjustable types, are also discussed. A. H. N.

424. Sucker Rods Replaced with Small Bore Tubing. T. L. Turner. *Oil Wkly*, 30.10.44, **115** (9), 32.—A well which gave a great deal of sand trouble was hooked up with a tubing instead of a sucker rod, and the open cage changed for a closed one. In the conventional type of pumping well the oil is pumped through the annular space between the 2-in. tubing and the sucker rods, then discharged through the pumping tee above the surface into a flow-line connection. In this instance, by using 1-in. tubing instead of sucker rods, the oil was pumped through the tubing and discharged through the steel tee at the top of the tubing into a flexible connection. This connection was a length of 1-in. hose attached to the outlet at the top of the small bore tubing, then connected to the horse-head of the pumping unit. It followed the horse-head down the walking beam to the sampson post, where it left the unit and was attached to a riser coming up from a sand-trap that emptied into the flow-line discharging into the tank battery. To prevent collars on the small bore-tubing from wearing holes in the 2-in. tubing—a difficulty frequently experienced in this type of pumping—the annular space between the 1 in. and 2-in. tubing was filled with clean oil, lending buoyancy as well as lubrication. The use of small-bore tubing together with a small bore-pump permits a high velocity of fluid to be maintained, thus preventing the settling of sand, which occurs when the speed of the oil's ascent is relatively low. Slow ascent of the oil in regular-size tubing allows sand in the oil to drop back on the pump, eventually covering it to such an extent that the pumping unit is unable to lift the load. Then the rods part, or some other difficulty arises. A check on this well revealed that the combination pumped approximately 80% sand with the oil.

A. H. N.

425. How to Increase the Life of Machine Parts. Part 3. E. N. Kemler. *Oil Wkly*, 30.10.44, **115** (9), 34.—The general tendency when failures occur is to blame it on the material. Where replacements must be made on existing equipment, changing of materials will frequently produce little effect if material only be changed. More can usually be done by modifying the design and with care in heat treatment and machining. Where fatigue is a problem, care should be taken to maintain a smooth surface. Small surface scratches may be sufficient to cause the start of a fatigue crack where the stresses are high. Pipe wrenches should never be used in a highly stressed member, and hammering of the part will likewise result in serious damage. Where such scratches already exist or are unavoidably formed it is important that they be removed or smoothed out. A shallow sharp scratch is much more severe than a deep scratch with a rounded bottom. Where there is a change of section the use of generous fillets will reduce the stress concentration. Fillet sizes are discussed.

Corrosion failures, when not severe, can often be greatly reduced by the use of proper alloy steels. For normal temperature service nickel alloys give some protection, while for more severe conditions the use of nickel and chromium produces good results. The stainless steels, where applicable, are the best available for general use, but their cost and availability limit their use to commonly encountered applications. In the general prevention of failure of machine parts, the first and most important factor is careful handling during installation, operation, and repair. A little more time, proper tools, and the effecting of repairs by properly instructed personnel are very important. Training programmes, both in the techniques of repairs and in the identification of the cause of failures, are important. Until the cause has been identified the preventive cannot be applied. The co-operation of management, production men, and engineers is therefore important in the planning and carrying out of good programmes for the improvement of equipment performance.

A. H. N.

426. Thermal Principle Applied to Secondary Oil Recovery. A. Gibbon. *Oil Wkly*, 6.11.44, **115** (10), 170.—Experiments are being performed to supply thermal energy to depleted reservoirs. The principle is to transfer heat by means of superheated air into a depleted formation through a centrally located input well equipped with a heat exchanger. The radiated heat frees locked gases in the surrounding formation, and as they expand they drive underground fluids to nearby producing wells. Thermal action is credited with the ability to liquefy congealed oil in the formation, to set it in motion after the primary energy has been dissipated, and to boost the gravity of the oil at the well mouth. Judging by the results obtained on initial experiments, the technique appears to provide a new method for stripping oil-sands, and the author claims that it will give results in formations after they have previously been subjected to other secondary recovery methods, such as gas repressuring and water-flooding. According to the operator's records, thermal reaction was noted in surrounding wells after the unit had been operating for 10 days. It is reported that after 12 days a well 660 ft. away flowed 36 brl. of oil in 3 hrs. After the unit had been operating for 2 weeks, eight other pumping wells within a radius of 1200 ft. started to head up and flow, and all began to produce considerable gas. In a well 330 ft. away considerable oil showed up around the surface pipe, while another dead well 660 ft. away produced sufficient gas to roar through a $\frac{1}{4}$-in. valve and light a 15-ft. flare.

Gravity of the oil was boosted from 25° to 32°, and approximately 2700 brl. of oil were gained. Tests also indicated that the oil, which was originally produced at a temperature of 60° F., had increased in temperature to 90°. Fuel consumption amounted to a little less than 2 brl. of oil/24 hrs. The superheater was estimated to have heated the air to 1200° F., and to have delivered the air to the heat exchanger at the bottom of the input well at a temperature of 1000° and at the rate of 150 cu. ft./min. The operator reported that all wells on the quarter section were definitely affected by the underground thermal action. A. H. N.

427. Practical Design Given for Repressuring Surface Systems. Anon. *Oil Wkly*, 6.11.44, **115** (10), 176.—Formulæ for calculating capacities and requirements of repressuring systems are given and briefly discussed. A. H. N.

428.* Causative Agents of Corrosion in Distillate Field. P. L. Menaul. *Oil Gas J.*, 11.11.44, **43** (27), 80–81.—Details of the studies undertaken to solve the corrosion problems met in a distillate field in the Katy Areas are given. The organic acid recovered from the Katy water was 0·25 g./litre, or 250 p.p.m. It is very difficult to recover organic acids from such a dilute solution in a quantitative amount, so the recovery was probably not more than 60%, as there was considerable loss due to volatilization and incomplete extraction of the formic–acetic acid fraction. On examination of this material, the neutralizing equivalent was found to be 74; this means that the average molecular weight of these acids is 74, which is the molecular weight of propionic acid. On further examination, the material was found to have the reducing reactions characteristic of formic acid, and to form the sparingly soluble anilide compounds on reaction with aniline. The corrosive property of a dilute solution of these acids extracted from the Katy water was found comparable to the corrosive property of a similar dilute solution of propionic acid, when exposed to filings of mild steel for 12 hrs.

A logical treatment for the correction of the corrosive action would be the introduction into the well-bores of a volatile alkali such as ammonium hydroxide. This would neutralize the organic liquids and form ammonium salts of the various acids. The possible origin of these organic acids that are found in the production from deep wells is considered. The chemical analyses of the produced waters show a low content of dissolved solids. If these waters were produced in the vapour phase from a brine, the salt of the brine would be left in the formation near the well-bore which would soon be made evident by plugging of the well by salt deposition. Since this does not seem to be the case, we can assume that these are waters of low salinity, corresponding to fresh-water lakes or marshes where much vegetable decay could occur. It seems probable that these organic acids were formed by decomposition of organic materials in waters of marshes before subsidence and burial. A. H. N.

429.* Porosity, Number of Voids, and Surface Area. No. 2. P. I. Jones. *Oil Gas J.*, 11.11.44, **43** (27), 87.—Sediments such as sandstones, shales, and limestones are called media. Media are classified as pay and non-pay. Pay contains reservoir fluid of which some is recoverable commercially. Non-pay does not contain commercially recoverable reservoir fluids. Porosity means interconnected voids. The size and distribution of voids in pay seem to control rate of recovery and ultimate recovery. The distribution of voids may be uniform, as in well-sorted sand, or it may be non-uniform, as in limestones having cavernous porosity. Voids may be visualized as openings between particles interconnected by necks. The necks interconnecting voids are irregular in shape and length. They taper down to capillary dimensions near the points of contact between particles. Surface area/unit of porosity is significant. Silt, for example, is not pay because of its comparatively vast surface area. Surface area and the size and number of voids probably account for most of the variations in water saturation in pay. A. H. N.

430.* Choke Control of Gulf Coast Wells—No. 3. J. E. Loeffler. *Oil Gas J.*, 11.11.44, **43** (27), 91.—Pressure-control methods and equipment used within the well include special types of removable production chokes. These are called bottom-hole chokes, and may be placed at any desired depth in the flow column, but are usually put in the lower end. The diameter of the flow tubing employed and the choke depth exert important influences on pressure conditions within the well. Efficient pressure utilization is obtained when the gas pressure is completely spent as the fluids are discharged at the surface; this may be achieved if the choke or bean is placed in the lower end of the tubing through which the oil flows to the surface, instead of in its upper end as the christmas tree. Several advantages are claimed for this method of producing through chokes. Less gas is required to move the volume of oil, due to the fact that the mixture of gas and oil passing through the choke under compression is released above with such an increased velocity that it creates a higher pressure differential than if the choke were not used. In this way wells may be induced to flow when insignificant gas pressure is present to flow through the open tubing. Inasmuch as the higher velocities in the lower end of the flowing column in the tubing may also correct tendency of a well to surge, and may help to prevent accumulation of sand, it may be possible to maintain continuously lower rates of production, which is sometimes of assistance in meeting proration requirements. Low-energy wells producing low-pressure gas or oil with a low gas–oil ratio may continue, by this means, to flow their production beyond the time when they would otherwise have to be pumped. Both fixed and adjustable types are described, and briefly discussed. A. H. N.

431.* Properties of Water Found in Reservoirs. Part 3. P. I. Jones. *Oil Gas J.*, 18.11.44, **43** (28), 205.—Water figures in production from the time of discovery down to abandonment are given. Some properties of the water found in reservoirs vary primarily with the quantity and type of the salts dissolved in water. As water is compressible and expands when heated, the space occupied by water in reservoirs varies with pressure and temperature. At high pressures the solubility of gas in water should probably be considered. The viscosity of water is less than 0·3 centipoise at temperatures greater than 200° F. The correct interpretation of electric logs with regard to water contacts and water saturation in pay depends, among other things, on the resistivity of water. Resistivity of water varies with temperature and with the quantity and type of the salts dissolved in water. A. H. N.

432.* Choke Control of Gulf Coast Wells—No. 4. J. E. Loeffler. *Oil Gas J.*, 18.11.44, **43** (28), 214.—The flow through the bean is: (1) Directly proportional to the primary or upstream pressure (known also as tubing pressure or back pressure). (2) Directly proportional to the orifice or bean area. (3) Diversely proportional to the square root of the absolute inlet temperature. (4) Inversely proportional to the specific gravity of the gas at standard conditions. (5) Unaffected by the secondary or downstream pressure as long as it is below the critical throat pressure of the bean. The critical throat pressure in the case of the curves illustrated, and also for the usual flow-bean, is generally taken at 50% of the secondary pressure. Curves are given for calculations.

Rapid expansion of gas, due to sudden release of pressure at the casing-head, control valves, and more especially the production choke, often results in considerable cooling of the fluids and the accumulation of frost on the connections. The chilling effect on the oil may result in the separation of paraffin, which is deposited within the well-head equipment. The paraffin may combine with sand to form an abrasive much like valve-grinding compound, and this combination often causes excessive wear in the flow-beans of chokes. Also, the chilling effect on the metals in the various connections on the tree lowers their impact value, thereby reducing their factor of safety. To offset this tendency, some operators locate the pressure-control equipment at a point where benefit may be received from the natural formation temperature. This, of course, may be readily accomplished by using one or more bottom-hole chokes or bottom-hole chokes and regulators, either alone or in a combination with a surface choke. In still other instances the oil and gas are passed through a heating device placed in the flow-line between the choke and gas separator. The bottom-hole choke released energy in moving the oil to the surface, and the temperature reduction is dissipated throughout the well tubing.

An additional safety measure against freezing of the connections in the case of an emergency shut in has been to equip the cellars with steam radiators and build a house over the christmas tree. This method of indirect heating was used in order to prevent the unequal expansion and contraction which would result from having steam coils in contact with the fittings. Heaters of similar type have been used in the Tomball field. A. H. N.

433. Unloading Retrograde Condensate from Dually Completed Wells. E. H. Short, Jr. *Oil Gas J.*, 18.11.44, **43** (28), 225.—All 22 wells in the La Gloria pool were dually completed, and were also equipped with the piping arrangement and valves necessary to provide a simple, effective means of automatically unloading the accumulation of retrograde condensation. Retrograde condensation takes place not only in the well, but also in the formation, when an appreciable drop in pressure occurs. Maintenance of reservoir pressure through cycling operations eliminates retrograde condensation in the formation itself; there is no way to prevent this type of condensation from occurring in the well-bore. Therefore, if operations are to be carried on at the maximum efficiency, a means of unloading the distillate from the well must be provided at the time of completion. The mechanism is described. A. H. N.

434.* North Burbank may be Largest Individual Secondary-Recovery Reserve. K. B. Barnes. *Oil Gas J.*, 25.11.44, **43** (29), 62–66.—The geology and development of the field up to date are described. The field is worked by a co-operative system of unit production. Increase in oil production as a result of the gas-drive amounts to 15 million brl., with future reserves by continued operation estimated to be approximately 35 million brl. The latter figure is in part based on oil removed and slope or increase in produced gas–oil ratio, which in essence is a relative permeability–saturation relationship. In addition, up to the present time the gasoline plants in the field have extracted approximately 1,100,000,000 gal. or 26,000,000 brl. of gasoline. The fraction of this recovery which may be definitely attributed to the gas-return programme cannot be precisely stated, for such figure requires analysis of the consolidated past operational data and curves for each of the gasoline plants over their past history. Furthermore, there are several different bases for such computations and various complexities of economic viewpoints. Actually, some of the smaller plants would by now have passed their economic end-point had it not been for the injection programme. Over the "normal" trend of expectancy to date the increase in actual gasoline yield by repressuring has been possibly of the order of 40%. Although gas yields have been reduced from about 6 g.p.m. before repressuring to 3 or so now, the increase in raw incoming gas has more than compensated the difference. Under continued operation the pool has a future gasoline reserve of the order of 250 million gallons.

Apparently, there will be need for water drive after the gas drive, as over 600 million brl. of oil will be left in the sand after gas-drive depletion. A. H. N.

435.* Interstitial Water, Gravity, and Capillary Pressure. Part 4. P. I. Jones. *Oil Gas J.*, 25.11.44, **43** (29), 83.—Reservoirs contain interstitial water, but some reservoirs contain more water than others. The cause of the variation is probably a combination of several factors, such as surface area, size of voids, number of voids/acre foot, and molecular attractions. In production, molecular attractions are implied in such phrases as surface phenomena, capillarity, and capillary pressure. Gravity would probably displace more of the water found in reservoirs if there were no opposing forces. Physicists have found that the opposing forces are capillary pressure. They have also shown that capillary pressure is proportional to the curvature of the interfaces between (1) water and reservoir liquid, (2) water and reservoir gas, and (3) reservoir liquid and reservoir gas. These items are discussed and diagrams are given illustrating the chief points. A. H. N.

436. Dual Completion Well Programme Aids Rapid Development of New Hope Field. C. C. Pryor. *Petrol. Engr*, December 1944, **16** (3), 92.—The field discussed has 25 out of 26 wells drilled, dually completed. The geology of the field is briefly discussed and the practices used in drilling and mud control are described. The completion rig employed in the New Hope field consists of the portable derrick, draw-works and engine, rotary table and drill-stem, and the mud-pump and engine. Four hours are required for erection of the cantilever three-section tubular type derrick and for rigging-up. The height of the derrick is 90 ft., permitting the operator to stack pipe in the derrick in doubles. The dead load capacity of the derrick is 150,000 lb., using $\frac{7}{8}$-in. wire line to rig the six-line blocks. The record round trip in the field, made with 8200 ft. of 2-in. tubing, was 5 hrs., 25 min. The working load of the derrick is 85,000 lb. The derrick and draw-works are of a type used for completion and servicing of wells to a depth of 12,000 ft. Drilling-mud circulation is supplied by a 6-in. by 16-in. pump driven by a 180-h.p. gas, gasoline, or butane engine.

The draw-works employed on the completion rig is a fast, light-weight, compact unit equipped with skids that permit easy loading for transportation by truck. Power for the draw-works is supplied by a 132-h.p. gas, gasoline, or butane engine operating at 1600 r.p.m. The drum barrel of the draw-works is of laminated steel construction of two $\frac{1}{2}$-in. plates, cold rolled and electrically welded. It is of the free-rolling, full release type, and revolves on a stationary shaft on self-alighting bearings. The diameter of the drum is 16 in. and length 50 in.; it has a capacity of 7840 ft. of $\frac{7}{8}$-in. drilling line. The drum-clutch is a fan-shaped, eight-jaw type, designed to prevent disengaging under load and for equal jaw contact. Brakes are full-wrap, self-energizing, with a single adjustment. Either brake will operate independently of the other to hold a load as an important safety feature for a completion or portable rig. The draw-works transmission is of the heavy-duty type that has high torque capacity. A. H. N.

437. Salt-Water Disposal in East Texas. Anon. *Petrol. Engr*, December 1944, **16** (3), 166.—The three types of reservoir drives are discussed. Recoveries under water drive can be expected to be 80% or more of the oil in place; recoveries from gas-cap drive reservoirs are usually about 60%, and can, if fully utilized and under favourable conditions, approximate the efficiency of a water-drive reservoir. Recoveries under dissolved gas drive are between 20% and 40% of the oil in place. Dissolved gas-drive is the expansion of gas as it comes out of solution with the oil when no free gas-cap or water source is present. This type of drive may be approached in fields having a gas-cap and a source of water, if production rates are excessively high or gas is produced from the gas-cap. In gas-cap drive the downward expansion of the gas-cap maintains pressure on the oil column and prevents or retards the release of dissolved gas from the oil. In fields where a gas-cap does not exist it is often beneficial to create one by injecting gas at the highest structural position. Gas injection is also used to expand an original gas-cap with a lesser pressure reduction.

A detailed study of East Texas field is given, from which it is shown that the control is a water drive. An efficient water drive depends on several factors. First there must be a porous and permeable formation with the water in contact with the oil. The permeability of the reservoir rock and the area of contact between oil and water must be sufficiently great to permit water influx at a rate to allow economic production without undue loss in reservoir pressure. The production rate must be regulated to the speed of water influx, or portions of the reservoir will be controlled by dissolved gas or gas-cap drive. Because of the low compressibility of water its expansion as a means of oil displacement was overlooked and water drive was thought possible only when the oil-bearing zone outcropped near the field. Owing to the large volume of water in contact with the oil in many fields, only a slight expansion is necessary to displace the oil. It should be remembered that under water expansion the efficient rate of a water drive will decrease as the pressure is reduced farther away from the oil–water contact.

Natural and induced water drives in the East Texas fields are studied.

A. H. N.

438.* Oil Recovery by Air and Gas Pressure. Anon. *World Petrol.*, December 1944, **15** (13), 42–45.—The U.S. Bureau of Mines has recommended secondary recovery methods in the Appalachian reservoirs of Pennsylvanian crudes. Gas-injection methods are compared with water-flooding systems of production and laboratory findings are discussed. These laboratory findings are an argument in favour of gas-injection operations in those areas of the Appalachian region where the water saturation of sands is high. As water saturations in some Venango sands of Pennsylvania range from 40% to 60% and oil saturations from 25% to 35%, these sands cannot be economically water-flooded, but they can be successfully exploited by gas-injection methods. It is therefore very important that operators recognize the possibility that gas-injection operations may be successful in sands of relatively low oil saturation, precisely because of comparatively high water saturation. In fact, air-injection operations in general have been profitable on several properties where attempts to water-flood Venango sands have been unsuccessful. Natural gas, when available in sufficient volumes and at low cost, is preferable to air as an injection medium in gas-injection projects. Because the necessary quantities of gas are not available at low cost in the Appalachian region and the demand for natural gas for fuel purposes seasonally exceeds the combined productive capacities of wells, most operators of small gas-injection projects must use air instead of natural gas in secondary oil-recovery operations.

Although air is a cheap and convenient injection medium in secondary-recovery operations, its use is attended with several disadvantages, which, however, can be overcome by taking certain precautions. An air–gas mixture produced with the oil gradually decreases in fuel value, sometimes to such an extent that it can no longer be used as fuel for engines. If this mixture produced with the oil is cycled, as it usually is, explosive mixtures result that are hazardous to life and equipment unless properly handled. Because air or air–gas mixtures contain oxygen, some corrosion of steel equipment will occur, mainly in the producing wells when small amounts of water are produced with the oil. Air used as the injection medium also tends to oxidize crude oils, but laboratory experiments and field observations indicate that the degree of oxidation of a paraffin-base crude such as Pennsylvania Grade oil is not serious. It is emphasized that only field tests can determine whether air or gas should be used.

The selection of wells, methods of injection, and operating results are discussed. Figures and discussion of results on systems already in use are in favour of secondary recovery methods.

A. H. N.

439.* Operating Results Explain Expansion of Multi-Pay Completions in Texas. K. B. Barnes. *Oil Gas J.*, 9.12.44, **43** (31), 69.—In some Texas areas greater well depths, coupled with thin individual pays, have increased multi-zone completion practice, particularly of the dual type. Typical arrangements are presented, and use of cross-over packers, side-door chokes, and other devices are described. There have been a few triple-zone completions. Otherwise all have been dual-production completions in the four classifications : (1) Dual oil ; (2) dual gas ; (3) upper oil, lower gas ; (4) upper gas, lower oil ; and some combinations of injection to one pay with production from another. A substantial part of the dual jobs has been in connection with cycling operations. Basically the purpose of a dual or multi-pay completion is to make one well-bore do the work of two or perhaps three, and the appropriateness of decisions to use or not to use the method rests principally in an economic balance of a number of factors. This balance will be between the actual savings that may be obtained from the multiple completion and the sum of whatever practical difficulties there will be in (1) effecting and maintaining a positive seal between the formations ; (2) keeping free of obstructions the exposures to the formations and up the flow passages to the surface ; and, finally, (3) producing each of the formations to ultimate exhaustion.

The relative " unbalance " becomes more favourable to the multiple-zone work as depths and cost of the single well increases. Further, the benefit increases as the yield/acre from the zones becomes less, and in some cases formations can be produced simultaneously which could not profitably be drilled separately or even produced one after the other. These factors can be briefly illustrated by the following simple arithmetical examples, with the revenue from crude taken as $1/brl., after deducting royalty and severance or gross production tax. A $25,000 well which on 40-acre spacing will recover 6000 brl./acre requires only 10·4% of the total revenue to repay its cost; at 4000 brl./acre, 15·6%; at 2000 brls./acre it becomes 31%. The proportions are doubled for a $50,000 well, and 21%, 31%, and 62·5%, respectively, of the total yield are necessary to pay out the well. For a $100,000 well the ratio of well cost to gross revenue again doubles, and is 42%, 62·5%, and 125% for the same scale of recoveries.

Drawings illustrate dual- and triple-completions. A. H. N.

440.* Core Data as a Production Tool. P. J. Jones. *Oil Gas J.*, 9.12.44, **43** (31), 89.—Core description should include (1) the composition, texture, size, shape, and degree of sorting of particles, (2) the composition and texture of bonding materials, (3) a description of the mass features of ores as to lithology, stratigraphy, structure, texture, degree of cementation, and colour, and (4) the depth of oil shows, cuts, odours, and bleeding cores. Data on dips from several cored wells may be significant. Observations on primary and secondary porosity may be pertinent. Fractures, joints, cracks, solution channels, stylolites, and cavities should be recorded. In other words, the person describing cores should be familiar with the principles of stratigraphy and with the characteristics of media from the viewpoint of producing oil, gas, and water.

Sampling and shipping cores are discussed, together with forms used for logging description and other data. Average values of porosity of a well can be obtained from core porosities by means of a summation and average formulæ given. Similarly interstitial water for a well may be found. A. H. N.

441.* A Method for Determining Water Input Profile. R. J. Pfister and R. L. McCormick. *Oil Gas J.*, 16.12.44, **43** (32), 78.—Brine and fresh water are used in the input well instead of water and oil to define a boundary because it is thought that the introduction of oil in a water well may have deleterious effects. The brine is introduced at the bottom of the well through ¾-in. tubing and the water is injected in the annulus between the regular well tubing and the ¾-in. tubing. A probe or contactor electrode has been devised by which the sharpened brine boundary can be accurately located. For this, an electric current is carried down an insulated cable to an electrode, which forms a contact to ground through the well fluid at the sand depth. The contact is formed through brass lugs placed on the insulated plastic section placed opposite the production formations. Thus, the well fluid outside the pipe in the immediate vicinity of the electrode determines the amount of current flowing to ground. By measuring the brine and water rates into the well while the boundary is held stationary, the amounts of fluid entering the sands above and below the boundary are known. Raising the position of the boundary 1 ft. and repeating the measurement gives by difference the amount of fluid entering this 1 ft. section of sand. This analysis requires as additional special equipment two high-pressure manometers for measurement of instantaneous brine and fresh-water flow rates, and one high-pressure manometer for measuring the deviation from the equilibrium injection pressure. Two methods for operation of the equipment are available for determining the water input profile: (1) the constant boundary method described above, in which the flow rates are separately and simultaneously determined for both fresh water and brine to hold the boundary at any selected 1-ft. level; (2) the moving-boundary method, in which the time in seconds for the boundary to travel 1-ft. intervals is photographically recorded while it is continuously moving from top to bottom, or vice versa. The constant-boundary method is essentially simple, but requires careful balancing of two equilibrium rates, which is both tedious and time-consuming. The moving-boundary requires the setting of only one rate at a time, either water or brine, and calculation of the foot-by-foot input from the total flow rate and the linear movement of the boundary. A derivation of the formula for the cumulative brine rate, Q^B, entering the sand below the boundary is given at the end of the article. Successive differences in Q^B give directly the foot-by-foot intake, or the water-input profile. Also shown is the formula by which the cross-sectional area of the bore-hole or its radius may be found. Most of the data are collected by the second method, because of its rapidity. A. H. N.

442.* Mechanics of Producing Oil, Condensate, and Natural Gas. Part 7. Resistivity of Pay and Non-Pay. P. J. Jones. *Oil Gas J.*, 16.12.44, **43** (32), 88.—In this part of the series the elements of resistivity logging are described. Application of electric log data to production depends on (1) the resistivity of pay and non-pay, and (2) the characteristics of electric logs. This article is limited to the resistivity of pay and non-pay. The next article will consider the characteristics of electric logs, and the following one the application of electric-log data. The distinction between pay and non-pay may be due to composition and texture of media, or it may be due entirely to water saturation. As a result, the resistivity of a non-pay may be either greater or less than that of pay. The resistivity of pay itself varies because of the wide variation in composition, texture, and interstitial water. However, the resistivity of a given pay may be expressed in terms of its water saturation. Conversely, if the resistivity is known, the water saturation may be estimated. Typical curves are given, and their significance explained. A. H. N.

443.* Triple Injection Well Successfully Completed in Brooks County, Texas. E. H. Short, Jr. *Oil Gas J.*, 23.12.44, **43** (33), 66–67.—Most of the triple completions failed, but a procedure adopted in a triple completion of La Gloria Unit No. 2 appears to give satisfactory results. Sufficient time has elapsed since the completion of this unit to indicate a successful job. While this well is probably the first to be completed as a triple-injection well, the most important thing about the job is that the method employed demonstrated a safe and comparatively easy method of killing the sands and washing in.

The method is described, and diagrams illustrate the well hook-ups. A. H. N.

444.* Mechanics of Producing Oil, Condensate, and Natural Gas. Part 8. Characteristics of Electric Logs. P. I. Jones. *Oil Gas J.*, 23.12.44, **43** (33), 75.—The significance of electrical logs of wells giving resistivity and self-potential (S.P.) curves is discussed. An electric log has an S.P. curve, and it may have three resistivity curves. One of the objectives of electrical logging is to record the resistivity of the pay in reservoirs, but the resistivity recorded on these logs may be influenced by several factors. First, there are the diameter of a well-bore and the resistivity of the mud in the well-bore. Second, mud filtrate may invade some beds and change the resistivity of the invaded region. Lastly, the thickness and resistivity of pay and non-pay must also be taken into consideration. The S.P. recorded at a given depth is probably the sum of a number of possible sources of potential. The principal sources of potential, however, are said to be filtration and resistivity potentials. The S.P. curve is also influenced by the resistivity of mud and by invasion of mud filtrate. Control of mud resistivity and filtration characteristics is apparently just as important to obtain reliable S.P. curves as it is to obtain reliable resistivity curves. A number of curves are given and analysed. A. H. N.

445.* Water-Input Profile Measurements. R. L. McCormick and R. J. Pfister. *Oil Gas J.*, 23.12.44, **43** (33), 92.—During development of a method for the measurement of water-input profiles of a well (see Abstract No. 441) data were obtained and analysed to indicate possible applications of the method; these are presented in this article. A comparison is made between the profile measured by the method and that predicted from core analysis. On one well the beneficial effects of corrective shooting are shown. Three different types of selective plugging experiments and an acidizing experiment were performed and the results compared. A. H. N.

446.* Internal Corrosion of Tubing in Gas-Condensate Wells Measured by Recording Caliphers. E. H. Short, Jr. *Oil Gas J.*, 6.1.45, **43** (35), 46–47.—This article describes an instrument which can be run inside the tubing strings under closed-in pressure to determine the magnitude of corrosion pits. The tool has been successfully used to survey 12 Cotton Valley Operators Committee wells, and while the caliper is still in the development stage, it has possibilities for rendering a valuable service. A photograph shows the instrument and details. The metering head consists of three $\frac{7}{8}$-in. steel balls 120° apart, which are forced out against the wall of the tubing by a spring-loaded cone. The ratio of the steel-balls travel to the cone travel is 1 to 1. The use of a large-angle cone avoids the locking effects of the steel balls. As the steel balls move in and out, the cone moves along the axis of the tool operating a push rod, which in turn actuates a crosshead. Attached to the crosshead is a rod which drives a stylus. This stylus records the changes in tubing diameter on a strip chart. There is also a fixed stylus which provides a reference line on the chart. The strip chart is driven from a friction wheel on the lower end of the tool mounted on a spring-loaded arm, which forces it against the wall of the tubing. A continuous record is obtained on coming up; the chart is not moved on lowering. A. H. N.

447.* Mechanics of Producing Oil, Condensate, and Natural Gas. Part 10. Characteristics of Reservoirs. P. I. Jones. *Oil Gas J.*, 6.1.45, **43** (35), 49.—The chief characteristics of reservoir formations are studied and illustrated, the outstanding one being non-uniformity. Productive areas vary from a few acres up to several thousand acres and their shape may be circular, elliptical, or cigar-like. If limited by faults, the shape may be semicircular or triangular, or if limited by pinch-outs, elongated and sinuous. The average pay thickness within productive areas ranges from a few feet up to several hundred feet. The dip may be less than 1°, or it may be 90° or even overturned. The pay thickness with a given reservoir ranges from zero up to a maximum. The maximum thickness may be near the centre of a productive area or it may be somewhere along a perimeter. The porosity of pay varies from as low as 5% up to about 35%. The permeability of pay ranges from a fraction of a millidarcy up to several million millidarcies. The interstitial water content of reservoirs may be anywhere from 5% or porosity up to 65%. A barrel of reservoir space may contain nearly a barrel of oil or it may contain only gas. A comparison of the characteristics of a given stratigraphic interval within a reservoir commonly shows a variation from one well location to another. A study of the logs from a given well shows a still greater variation in the vertical direction. In short, the outstanding characteristic of reservoirs in non-uniformity. Non-uniformity makes one reservoir different from all others, the upper part of the reservoir different from its lower part, and one end different from the other. These vertical and areal variations are controlling factors in locating and completing wells. They also influence producing and operating methods, rate of recovery, ultimate recovery, and the cost/unit of ultimate recovery. These items are briefly studied. A. H. N.

448. Bottom-Hole Pressure Data in Conservation and Proration Work. Anon. *Oil Gas J.*, 6.1.45, **43** (35), 69.—The measurement of bottom-hole pressure and its interpretation are studied at some length. Bottom-hole-pressure gauges may be obtained with any desired pressure range up to 7000 p.s.i. Instruments capable of recording high pressures are less sensitive than lower-range instruments, the accuracy of a given type of gauge being inversely proportional to the pressure range. For this reason the pressure range of the instrument selected for use in a field or area should not greatly exceed the maximum pressure to be measured. Gauges of the continuously recording type are recommended. The clocks used to drive the chart-holder mechanism are available in various ranges of from 1 to 72 hrs. The higher-speed clocks are preferable for measuring static pressure; the longer-range clocks are necessary on producing bottom-hole-pressure tests. All exposed parts of bottom-hole-pressure gauges should be of materials resistant to corrosive gases, oils, and waters, and to acid. Instruments should be of sturdy construction, capable of withstanding considerable shock; this requirement is of great importance in the case of gauges which are to be used on production tests in pumping wells.

Procedure for measuring static and producing bottom-hole pressures are detailed. Potential determination by means of bottom-hole pressures are also discussed.

A. H. N.

Development.

449. English Oil Field. Anon. *Petrol. Engr*, November 1944, **16** (2), 254.—In 1939 the English oil output was 238 tons/month, but now it is 100,000 tons/year, from 230 wells. The oil is rich in high-grade lubricating fractions and paraffin waxes.

There has been an increase in efficiency of the drilling methods. Portable outfits are in use. Wells have been completed in 7 days, and the time for moving from site to site has been reduced to less than 12 hr.

The main field is about 2 ml. long and ½ ml. wide, the producing formation being 2000–2500 ft. deep. The producing life may be 10–15 years, at decreasing rates.

G. D. H.

450. Production in the Argentine Maintained During War by Intense Activity of Y.P.F. Anon. *Oil Wkly*, 11.12.44, **116** (2), 124.—While Y.P.F. production has increased from 12,500,000 brl. in 1940 to 16,550,000 brl. in 1943, the yield of privately operated properties has hovered round the 8,000,000-brl. mark. During 1943 the Comodoro Rivadavia production rose by 723,000 brl., and that of the Plaza Huincul area by 647,000 brl. The Mendoza area had a decline of 182,000 brl., and there was a small decline in the Salta fields.

In June 1944, Y.P.F. completed a 1000-brl. wildcat on the north side of the Rio Deseado, 45 ml. southwest of Comodoro Rivadavia. The 10-ft. producing zone was 5261 ft. deep. Other wells had been abandoned in basalt sills at higher levels. Nine pays have been logged, but only the deepest has been tested. During 1943 development drilling was less than in the three preceding years, and the bulk of the 97 completions were in the Comodoro Rivadavia field; 44 wells were successfully deepened. The decline in drilling is attributable to deterioration of equipment and the difficulties of obtaining new supplies from U.S.A. A certain amount of equipment is being manufactured in Argentina.

The Comodoro Rivadavia field has been considerably extended to the east, under the Gulf of St. George. Deeper pays have been opened in some areas. The Plaza Huincul field is being extended to the west and south, and a new deep pay is being developed in the Tupungato field of Mendoza Province.

Geological and geophysical investigations reached their all-time peak in Argentina in 1943 and 1944. Greatest attention is being paid to the eastern front of the Andes, and surveys are also proceeding almost to the Atlantic coast through the southern part of the province of La Pampa and northern Rio Negro. Gravimetric, magnetic, and seismic surveys are being made. G. D. H.

451.* Summary of Completions. Anon. *Oil Gas J.*, 25.11.44, **43** (29), 128.—During October 1944, 2217 wells were completed in U.S.A. 1194 found oil and 215 found gas.

The completion results are summarized by States and districts, and the footage and number of wells in different depth ranges are given. G. D. H.

452. Mexico Headed for Minor Place in Early Post-War World Petroleum Affairs. C. Vinson. *Oil Wkly*, 11.12.44, **116** (2), 128.—The yield of existing fields in Mexico has been maintained and new producers drilled in the rich Poza Rica area have kept up production, but the potential has declined because of the absence of new discoveries. Only 5 wildcats have been drilled by Pemex between the 1938 expropriation and September 1944. The failures were 4 ml. west of the old Dos Bocas well, searching for a structure en echelon with the Golden Lane; about 30 ml. southwest of Panuco; south of the Golden Lane area. Wildcats are now being drilled just south of the Texas border, 15 ml. west of the old Golden Lane structure, and just north of the Tuxpan river, and just south of the Poza Rica field.

The Mexican potential is now estimated to be 145,000 brl./day, and to be declining by 10% per year. Domestic consumption is about 90,000 brl./day. In 1943, the production averaged 95,600 brl./day, 56,180 brl. being from Poza Rica, and 13,000 brl. from the Isthmus area. In the middle of 1944 the production was 100,900 brl./day.

Pemex will pay in salaries and social benefits 51% of the value of production, as compared with the average in other industries of transformation of 17·7%. Mounting operating costs are being passed on to the public.

Tables show the drilling activity and the production and producing well data.

G. D. H.

453. East Indies Post-War Prospect. Anon. *Oil Wkly*, 11.12.44, **116** (2), 134.—Before the war Sumatra produced 39,220,000 brl. of oil per year, Borneo 13,394,000 brl., Java 6,216,000 brl., Geram 740,000 brl., and Burma 8,140,000 brl. Undoubtedly the Japanese have been obtaining oil from the East Indies. In 1936, Japan produced 8% (2,960,000 brl.) of its consumption.

The Borneo fields are in the Samarinda area. Oil is produced in Sumatra in the Palembang, Djambi, and Achin areas.

It is estimated that destruction at Tarakan, Balikpapan, and Palembang cut off 88% of the oil available in the Indies. Restoration of the producing wells is a slow matter. G. D. H.

454. England Breaks Into Oil-Producing Ranks with 50,000 barrels Monthly. Anon. *Oil Wkly*, 11.12.44, **116** (2), 144.—Great Britain now has 238 wells producing an average of about 50,000 brl./month. The oil is of paraffin base. G. D. H.

455. Wells Completed in United States in Week Ended December 9, 1944. Anon. *Oil Wkly*, 11.12.44, **116** (2), 171.—422 field wells (280 giving oil and 43 giving gas) and 82 wildcats (8 giving oil and one giving gas) were completed in U.S.A. during the week ended 9th December, 1944. The completion results are summarized by States and districts. G. D. H.

456.* Rate of Completing Wells Lower During November but Many Rigs in Operation. Anon. *Oil Wkly*, 18.12.44, **116** (3), 14.—In the five weeks ended 2nd December, 1944, U.S.A. well completions averaged 484 per week, compared with 528 per week in October, 539 in September, and 440 per week in November, 1943. For the first eleven months of 1944 weekly average completions were 458, 26·6% higher than in the corresponding period of 1943.

It appears that the 1944 totals will closely approach the goal of 24,000 new wells set by P.A.W.

Excepting Arkansas, North Louisiana, and Nebraska, practically all States and districts have had more drilling in 1944 than in 1943. Above average increases have occurred in Texas (42%), California (37%), South Louisiana (40%), Mississippi (120%), Kentucky (86%), Montana (45%), New Mexico (54%), West Virginia (40%), and Wyoming (38%).

The U.S.A. completions for November and the first eleven months of 1944 are summarized by States and districts, with some 1943 figures for comparison.

G. D. H.

457.* Six-Well Peruvian Field Averages 100 Barrels Daily. Anon. *Oil Wkly*, 18.12.44, **116** (3), 54.—The 6 wells of the Blue Goose field of eastern Peru are averaging 100 brl./day each. The field's potential is estimated at 2700 brl./day. Both crude and products are being sent down the Amazon. G. D. H.

458.* Wells Completed in United States in Week Ended December 16, 1944. Anon. *Oil Wkly*, 18.12.44, **116** (3), 55.—373 field wells and 81 wildcats were completed in U.S.A. during the week ended 16th December, 1944. 249 of the former and 9 of the latter found oil, and 37 of the former and 3 of the latter found gas. The results of the completions are summarized by States and districts. G. D. H.

459.* Production in Russia's Emba District Declines. Anon. *Oil Wkly*, 25.12.44, **116** (4), 63.—In 4 of the 8 known producing fields of the Emba district there are now only pumping wells. The daily yield of all the fields of this region is believed to be less than 30,000 brl./day, most of which comes from Dossor, Koschagyl, Komsomolski, and Makat. The pumping fields are Iskine, Kulsary, Bek Beke, and Baychonas.

G. D. H.

460.* 24 Wells Now Producing in Casabe Field, Colombia. Anon. *Oil Wkly*, 25.12.44, **116** (4), 63.—Two new wells, each with a capacity of 1000 brl./day, at Casabe, bring the total number of producers to 24. This field is 15 km. west of the La Cira field on the west of the Magdalena. G. H. D.

461.* Yield from Brazil's Bahia Wells is 150 Barrels Daily. Anon. *Oil Wkly*, 25.12.44, **116** (4), 63.—The 6 producing wells in the 3 producing areas of the Bahia Trough area are giving only 150 brl./day. G. D. H.

462.* Wells Completed in United States in Week Ended 23rd December, 1944. Anon. *Oil Wkly*, 25.12.44, **116** (4), 64.—377 field wells (238 giving oil and 49 giving gas) and 70 wildcats (11 giving oil and 1 giving gas) were completed in U.S.A. during the week ended 23rd December, 1944. The completion results are summarized by States and districts. G. D. H.

463.* Venezuela Well Completed. Anon. *Oil Wkly*, 1.1.45, **116** (5), 51.—The eighth well of the Mercedes field was about to be completed in mid-December. There are seven shut-in producers, with about 550 acres proved. G. D. H.

464.* Wells Completed in United States in Week Ended December 30, 1944. Anon. *Oil Wkly*, 1.1.45, **116** (5), 55.—385 field wells (253 giving oil and 33 giving gas) and 64 wildcats (8 giving oil and 5 giving gas) were completed in U.S.A. during the week ended 30th December, 1944. The completion results are summarized by States and districts. G. D. H.

Transport and Storage.

465.* The Application of Polyvinyl-Acetal Coatings for the Gasoline-Proofing of Concrete. S. N. Ushakov, E. M. Lavrent'eva, L. I. Medvedeva, and E. I. Gretzova. *J. Appl. Chem.* (*U.S.S.R.*), 1944, **17**, 125–136.—Experiments were made with films of polyvinyl-acetate, polyvinyl-ethylal, and polyvinyl-butyral. The films had a thickness of 0·1–0·2 mm., and the effect of the addition of plasticizers and fillers on mechanical properties, swelling in water and gasoline, and permeability to water and gasoline and their vapours, was studied. An azeotropic mixture of butyl acetate, toluol, and EtOH (50 : 35 : 15) was used as solvent; the concentration of solution varied from 7·5% to 15%, depending on the solute viscosity. The results show these coatings to be satisfactory for preventing the passage of gasoline and of water through concrete. Excellent adhesion is obtained between the protective coating and the concrete.
V. B.

466. Economic Factors of the Corrosion Problem. H. C. Gear. *Petrol. Engr*, July 1944, **15** (11), 128.—A study is made of the economic factors relating to the depreciation of pipe-line systems due to corrosion; in particular the depreciation caused by the diminution in service life due to the selective and concentrated attack of corrosion causing " mortalities " of units of pipe and the need for repairs and replacements. The renewal of property units of a group installation in a like environment will follow some definite pattern, with the rate of renewal reaching the maximum at the average life of the group. The annual renewal curves calculated by Kurtz, Winfrey, Marston, and Agg are developed by treating each renewal as an original group installation which will have the same mortality frequency characteristics as the original group installation. Sound results are not developed when this system is applied to a group installation of units such as joints of steel pipes. It is common experience that when a large number of units of steel pipes are laid underground there will be a diversity in the rate at which the renewal of these units will be required during successive service years. The rate of failure is a function of service age, corrosion intensity of the soil, and protective resistance to corrosion offered by coatings, and is not materially affected by any diversity in the quality of the pipe itself. Thus the renewal will be subject to the same external condition that brought about the failure of the original units, and its mortality characteristics will conform to that of the units replaced rather than to that of the group taken as a whole. This will have a profound bearing on the development of mortality frequency distribution curves. The relative economic worth of any particular method of pipe protection must be established by a comparison of its overall cost with that of other methods of protection and the overall cost of no protection at all.

An analysis of the past mortality experience of a group of similar units that have been subjected to the same external conditions will indicate future mortality characteristics of those units. When replacement and renewal data are meagre, they must be supplemented by other data. The total annual repairs developed by case-history and the extrapolation of these data provide a basis on which to estimate the future behaviour of a potential liability. The ultimate in any problem is to arrive at the cost of the continuous service. The terms such as service life, service age, average life, and mortality frequency distribution curve are defined, and basic mathematical formulas are developed in appendices. G. A. C.

467. Pipe Protection on the Big Gas Line. S. Thayer. *Petrol. Engr*, November 1944, **16** (2), 188–196.—The construction of the Tennessee Gas and Transmission Co. line was designed with the object of securing freedom from corrosion, and is based on the accumulated experience of other companies. From these data and from soil examinations it was decided to coat and wrap 1045 miles of the line between Corpus Christi and central Kentucky. Coal-tar enamels were used for coating, the type depending on air temperature at the time of laying, and the coated pipe was wrapped with 15-lb. asbestos pipe-line felt. Coating procedure and method of application, with special arrangements made for river crossings, are described and illustrated. Particular attention was paid to inspection of coating, holiday detectors were employed, and care taken to ensure repair of any faults detected. The job was so organized that coating did not delay construction, and actually as much as 2 miles of pipe was coated in a single day. Portions of the line in rocky country have not been coated, as no serious corrosion is anticipated. It is intended later to apply cathodic protection to the whole line, and preliminary trials indicate that a very substantial reduction in current requirements has been achieved as a result of the method of coating and wrapping applied, and also of the emphasis placed on inspection and repair of detected faults found during construction of this line. R. A. E.

468. The Oil Pipe-Line. Anon. *Industr. Chem.*, 1945, **21**, 66–70.—Over 2400 million gals. of petroleum products have been carried by pipe-lines linking British west coast ports to consuming centres. The network cost over £7 million and required 80,000 tons of steel. There are no welded joints. The designed working pressure is 600 p.s.i., pumping being mainly by electrical centrifugal pumps. F. S. A.

469.* Pipe-Line Underground Storage Grid Covers Britain. Anon. *Petrol. Times*, 20.1.45, **49** (1239), 43.—A description is given of the 1000-mile length of pipe-line built in Britain during the period 1941–1944 for the transport of motor gasoline, aviation gasoline, kerosine, and vaporizing oil. 80,000 tons of steel were used, and the diameter of the pipes was 4–12 ins., more than half being in 8-in. diameter. The cost was about £7 million. The capacity permits of a current average daily rate of 5 million Imp. gals., and up to the end of 1944 over 2400 million Imp. gals. had been transported. Five pipe-lines have been constructed, one from the south-west ports to the London area, a second from the north-west coast ports to the south, and a third being the south coast Spur from the south-west London line. The fourth and fifth lines are the 100-octane grid (Western Ports circuit) and the south and east coast extensions which handles other products as well as 100-octane fuel.

The pumps used on the system are mainly of the centrifugal type, directly driven by electric motors; and the total horse-power of the pumping stations is over 20,000. G. A. C.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

470. Cities Service Lake Charles Refinery and Butadiene Plant now on Stream. J. H. Kunkel. *Petrol. Engr*, July 1944, **15** (11), 68.—The basic refinery, completed in 21 months, occupies 550 acres of a 2500-acre tract near Lake Charles, Louisiana.

The refinery is at present running at 50,000 brl. per day, and is designed for a throughput of 80,000 brl., but it is expected that this will be exceeded by 30%. The end products are 100-octane and secondary aviation gasolines, butane-butylene charge for the butadiene plant, motor gasolines, kerosines, furnace oil, fuel oil, and asphalt.

The basic refinery consists of two topping units, three fluid catalytic cracking units, two sulphuric acid alkylation units, a desalting and deasphalting unit, a straight-run gasoline fractionating and thermal reforming unit, a gasoline recovery and fractionating unit, a treating plant, an acid plant, and an ethylizing plant.

Two high-pressure boilers each generate 325,000 lb. per hour of superheated steam at a pressure of 825 lb. per sq. in., and a temperature of 850° F., six low-pressure boilers with four generating 120,000 lb. per hour each of steam at a pressure of 250 lb. per sq. in., and two generating 200,000 lb. per hour each at the same pressure. Two bleed-type turbo-generators generate 31,250 kva. (25,000 kw.) each, of which less than half is used in the refinery, with the balance going to the butadiene plant and a nearby copolymerization plant. Storage facilities include 18 cone-roof crude storage tanks, 11 with a capacity of 80,000 brl. each, and 7 with a capacity of 55,000 brl. each. There are 66 spheroids and tanks of various capacities and 15 finished products storage tanks each of 100,000-brl. capacity.

The topping units process Woodlawn, Jennings, and East Texas crudes. The straight-run fractionating unit takes in the 360° F. end-point gasoline overhead from the topping unit in addition to natural gasoline.

The principal components of this unit are: a reboiler furnace, prefractionator, depropanizer, debutanizer, and de*iso*pentanizer towers. The desalting unit is for producing the maximum charge for the catalytic cracking units; and the deasphalting unit is to remove salt, deleterious to the catalyst, from the crude. The three fluid catalytic cracking units employ a synthetic powder catalyst, to produce C_4s for butadiene and alkylate. These plants also produce furnace and heavy gas oils.

Heavy naphtha from the straight-run fractionating unit is the charge for the thermal reforming unit. A very flexible gas recovery and fractionation unit provides 100 plus octane and secondary aviation gasolines, but is so designed that in the post-war era two of the units will make motor gasoline.

Clay treating, acid, caustic and methanol treating, caustic washing, inhibiting, and sweetening units comprise the treating plant; and spent sulphuric acid from the alkylation units and treating plants is regenerated to produce 98% white sulphuric acid on the acid plant.

The butadiene plant occupies 85 acres adjoining the refinery, and is designed for the manufacture of 55,000 tons of butadiene per year. Its product is supplied to a neighbouring copolymerization unit, operated by the Firestone Tyre and Rubber Co.

G. A. C.

471. The Maintenance and Repair of Refinery Turbines. G. G. Coombs. *Nat. Petrol. News, Technical Section* 2, 6.9.44, **36** (36), R. 590.—A procedure is described for the maintenance and repair of refinery turbines by mechanics experienced in other precision mechanical work, rather than by the manufacturers' specialists. A major repair job to a 335 h.p. 6-stage condensing turbine having an operating speed of 4320 r.p.m., and driving a centrifugal water-pump through a reduction gear, is described in detail. Full instructions are given on how to dismantle the turbine, the precautions to be taken to ensure the best results in setting the blades; and on balancing the wheel. The effect of heat (when this must be employed to remove the wheel) on the blades is stressed. The cleaning of corroded turbine rotors by sand blasting, and the location of vibration by means of a vibrometer and its correction, are described.

G. A. C.

472. Processing of West Texas Sour Crudes. L. R. Gray. *Petrol. Engr.*, October 1944, **16** (1), 160–178.—See Abstract No. 61. R. A. E.

Solvent Extraction and Dewaxing.

473. Modern Lubricating Oil Plant at Marcus Hook. P. D. Barton. *Petrol. Engr*, October 1944, **16** (1), 206–218.—A new plant for producing oils of high-viscosity index has recently been put into operation at the Marcus Hook Refinery of the Sun Oil Co. The unit is designed to process up to 14,600 brl. a day of charging stock, which consists of tower bottoms from 4 crude units, the proportions of which are capable of adjustment.

The unit consists of five sections :—

(1) A vacuum distillation unit in which the residue is topped to remove unwanted light fractions, leaving a residue of the desired properties.

(2) A Duo-Sol extraction unit in which the residue from (1) is treated with propane and "selecto."

(3) An M.E.K.—benzole dewaxing unit with the necessary auxiliary units for solvent removal from oil and wax.

(4) A dewaxed oil rerun unit, in which the dewaxed oil is heated with Filtrol clay, and bottoms from the vacuum flash tower, containing the clay, passed to a rotary drum pre-coat filter at a temperature of 300–400° F. for removal of the clay. The distillates require no further treatment.

(5) A blending and packaging unit.

At present the plant operates on Mid-Continent and Gulf Coast oils for production of aviation and heavy-duty lubricating oils. The various sections of the plant and features designed to provide maximum flexibility of operation are described and illustrated. R. A. E.

Cracking.

474. Deeper Cracking Triples Butylene Yield from Naphtha Reformer. Anon. *Nat. Petrol. News, Technical Section* 2, 6.9.44, **36** (36), R–576.—Yields of butylene using 60° A.P.I. wide-cut naphtha as feed-stock have been found to be 194% greater at severe reforming temperatures than at mild reforming on a naphtha reforming unit operated by Standard Oil Co. (Ohio). There is also a 46·6% increase in CFR–R octane number. Data are given on the dimensions of towers, drums, and exchangers used, and on the history of the development of severe operating conditions which is given for seven runs.

With the flow-chart for the naphtha reforming unit is a diagram of furnace and tube arrangement after modification of the convection and radiant sections. Test conditions and yields from the process on three runs are tabulated, and results correlated on charts from which yields from charge stocks similar to those used in the process may be predicted.

The effect of the high temperatures on the equipment has been that although several failures of carbon steel header boxes in the radiant section have occurred, and the rate of tube renewal has increased 13%, there is a general decrease in the corrosion rate on the tubes and fractionating equipment over a period of three years, during the last half of which time the severe temperature operating conditions have prevailed. Feed stocks during that period averaged 0·25% sulphur content in 1941, 0·38% in 1942, 0·42% in 1943, and 0·36% in the first half of 1944. Future tube replacements will be made with 2% chrome steel tubing containing a slight amount of silicon. Part of the decrease in corrosion in tubes and vessels may be due to use of alloy equipment and linings.

Heavy coking in the release line and separators was finally eliminated by using Tar quench stock, resulting in a drop in temperature of the separator top to 450–480° F., and by moving the quench point so that the quench stock was introduced just ahead of the separator inlet. Runs without shut-downs due to coking have now approached 2000 hrs. G. A. C.

Polymerization.

475. Polymerization of *iso*Butene over Hydrosilicate Catalysts. Part III. B. A. Kazanskii and M. I. Rozengart. *Nat. Petrol. News, Technical Section* 2, 6.9.44, **36** (36), R. 643.—Phosphoric acid catalysts and Gayer synthetic aluminium silicate are similar with respect to the character of their polymerizing and isomerizing effects on *iso*butene, producing products of similar composition. Their activities also resemble each other, although the Gayer product fatigues more rapidly. Since natural aluminium silicates of the floridin or Japanese acid-clay type and synthetic aluminium silicate prepared by Gayer and containing no free alumina easily polymerize olefinic hydrocarbons, it is concluded that a hydroaluminosilicate distributed on the surface of the silica gel is the active agent. Also all these substances are acidic, thus accounting for their efficiency.

Zinc and thallium catalysts prepared by the Gayer method were unable to polymerize *iso*butene. A catalyst prepared in the same way and containing thorium decreased rapidly in activity when polymerizing *iso*butene, and the catalyst could not be revived.

G. A. C.

Special Processes.

476.* Synthetic Lubricants from Cracked Distillates. M. G. Mamedli. *Petroleum*, January 1945, **8** (1), 6.—See Abstract No. 546, 1944. R. A. E.

477. Manufacturing Processes for High-Octane Aviation Gasoline. E. V. Murphree. *Petrol. Engr*, November 1944, **16** (2), 118E–119.—Developments in respect of quantity and quality of aviation-fuel production since 1935 are outlined. Present-day practice is to blend base stocks, blending agents, and T.E.L., so that availability depends on the quality standard and the allowable T.E.L. content of the finished fuel.

The first blending agent, made available commercially in 1935, was Hydro-dimer—*i.e.*, hydrogenated di-*iso*butylene obtained by polymerization of *iso*butylene by the cold-acid process. In early 1938 the manufacture of Hydro-codimer was commenced. This product is produced by the hydrogenation of the co-dimer of *iso*butylene and butene-2, obtained by hot-acid polymerization. The increase in blending agent obtainable by this process, as compared with Hydro-dimer, was still insufficient, and eventually the alkylation process was developed. The potential increase which this process made available in the production of high-octane blending agents from refinery gases has resulted in its becoming the most important process of this type, and research is still proceeding with a view to improving the quality of the alkylate produced. The extension of the process has, however, resulted in an overall shortage of *iso*butane obtainable by normal methods, and consequently the isomerization process has been developed. This enables *n*-butane, available in ample quantities, to be converted into *iso*butane.

The increase in blending agent so obtained necessitated increase in the production of suitable high-quality base stocks. This problem has been largely solved by the development of catalytic cracking. The fluid catalytic process is briefly described. Forty such units, having a capacity of about 400,000 brl. a day, are either in operation or under construction. As a result of the operation of these plants, more unsaturates, suitable for alkylation to blending agents, have been made available. Other processes for production of suitable base stocks to which reference is made are : superfractionation of virgin naphtha to remove low-octane components, hydroforming and also hydrogenation, now particularly applied to catalytically cracked gasoline fractions.

A full-scale aviation test stand has been installed by the Jersey company, and will be used in the development of improved fuels and for development of more accurate testing technique. R. A. E.

Metering and Control.

478. Continuous Automatic Ethyl Blending Facilities. T. H. Kimhel. *Petrol. Engr*, November 1944, **16** (2), 61–67.—The Sun Oil Co. has installed a 60-ton continuous automic loss-in-weight ethyl fluid blender in its Toledo refinery. The storage area is situated more than a mile from the refinery, and lacked the necessary facilities for installation of the conventional batch-type blender. To permit refinery supervision and avoid excessive pumping, the continuous unit operated in conjunction with an existing 8-in. line between refinery and storage areas, and was therefore chosen as the most suitable solution of the problem. A small eductor pump takes suction on the gasoline stream pumped from refinery tanks at a point just below a venturi tube installed in the main line, and passes a portion of the gasoline through an eductor, where it picks up the exact amount of ethyl fluid required for the blend in process from the weight tank and returns it to the main stream, whence it flows to blending tanks or main storage. The construction and operation of the various units of the automatic blending plant are described and illustrated. Tests carried out during a 12-hr. trial run indicated an average T.E.L. addition of 1·22 mls./gal., compared with an objective of 1·2 mls./gal. R. A. E.

Products.

Chemistry and Physics.

479.* Catalytic Action of Activated Alumino-silicates. A. F. Nikolaeva and A. V. Frost. *Bull. Acad. Sci, U.R.S.S. Cl. Sci. Tech.*, 1944, 536.—Among the products obtained by clay treatment of hexylene, 2- and 3-methylpentane were identified. V. B.

480.* Dehydrogenation of Ethyl Alcohol over Mixed Catalysts. S. L. Lel'chuk, A. A. Balandin, D. N. Vaskevich, and I. I. Groer. *J. Appl. Chem.* (*U.S.S.R.*), 1944, **17**, 60–64.—Rectified ethanol passed over a copper/alumina catalyst promoted with CdO or TiO_2 at temperatures in the range 225–350° C. yielded products consisting principally of acetic acid (up to 19%) and ethyl acetate (up to 38%). V. B.

481.* Investigations on Diphenylmethane and its Derivatives. I. An Examination of the Catalytic Factors in the Production of Diphenylmethane. N. K. Moshchinskaya and R. L. Globus. *J. Appl. Chem.* (*U.S.S.R.*), 1944, **17**, 76–82.—The preparation of diphenylmethane according to the reaction $2C_6H_6 + CH_2O = C_6H_5CH_2C_6H_5 + H_2O$ requires the presence of sulphuric acid of a strength $\nless$69–70%. The reaction is strongly catalysed by the addition of CH_3OH; impurities in the sulphuric acid, especially iron, also have a beneficial catalytic action. Yields of diphenylmethane in excess of 60% are obtainable. V. B.

482.* Investigations on Diphenylmethane and its Derivatives. II. The Variation of Diphenylmethane Yield with the Ratio of Benzene and Formaldehyde. N. K. Moshchinskaya and R. L. Globus. *J. Appl. Chem.* (*U.S.S.R.*), 1944, **17**, 137–143.—A considerably greater excess of benzene is required when the process is continuous than when it is a batch one. The kinetics of the reaction are discussed, and data are given on the formation of more highly condensed products. In the production of diphenylmethane economy may be effected in the use of sulphuric acid by the continuous removal, by distillation, of the water formed. V. B.

483.* Fluorine in Coal. Part III. The Manner of Occurrence of Fluorine in Coals. H. E. Crossley. *J. Soc. chem. Ind.*, 1944, **63**, 289–292.—The fluorine contents of coals from all the British coalfields have been determined and shown to be proportional to the phosphorus contents. The results obtained indicate that the fluorine is present as a form of fluorapatite. C. F. M.

484.* Fluorine in Coal. Part IV. The Industrial Significance of Fluorine in Coal in Steam-raising, Gas Making, and Brewing. H. E. Crossley. *J. Soc. chem. Ind.*, 1944, **63** 342–347.—A study of the effects of thermal decomposition on coals and twelve fluoride-phosphate minerals further supported the view that fluorine occurs in coals as a form of fluorapatite. It also showed that when coal is burnt in boiler furnaces practically all the fluorine is evolved, probably as either hydrogen fluoride or silicon tetrafluoride. C. F. M.

485.* Some Observations on the Photochemistry of Fluorescent Substances. Part I. The Quenching of Fluorescence by Nitric Oxide and the Photochemical Formation of Nitroxides. H. Weil-Malherbe and J. Weiss. *J. chem. Soc.*, 1944, 541–544.—The quenching of the fluorescence of polycyclic hydrocarbons in solution by nitric oxide is described and discussed. In character and extent it is analogous to the effect of oxygen. C. F. M.

486.* Some Observations on the Photochemistry of Fluorescent Substances. Part II. Concentration Quenching (Self-quenching) of Fluorescence. J. Weiss and H. W. Weil-Malherbe. *J. chem. Soc.*, 1944, 544–547.—The concentration quenching of several polycyclic hydrocarbons and of ethyl chlorophyllide has been investigated in various solvents in an atmosphere of pure nitrogen and in the absence of foreign quenching substances. The primary photochemical process of self-quenching is represented by an interaction between excited and normal molecules, and the hyperbolic quenching equation was found to be valid in all the cases investigated.

C. F. M.

487.* The Infra-red Spectrum of Phenylacetylene. H. W. Thompson and P. Torkington. *J. chem. Soc.*, 1944, 595–597.—The infra-red absorption spectrum of phenylacetylene has been measured between 3 and 20μ. The results have been correlated with data from the Raman spectrum, and a consideration of several related molecules suggests a series of magnitudes for some of the vibrations of the phenyl nuclear skeleton.

C. F. M.

488.* The Vibrational Spectra of Acrylonitrile and Perbunan. H. W. Thompson and P. Torkington. *J. chem. Soc.*, 1944, 597–600.—The spectrum of acrylonitrile has been measured over a wide range in the infra-red. A consideration of the results together with Raman data suggests a probable assignment of magnitudes to the normal vibrational modes. The spectrum of a sample of perbunan has also been measured, and some suggestions have been made about the structure of this molecule. C. F. M.

489.* The Structure of Poly*iso*prenes. Part III. Ultra-Violet Absorption Spectra. L. Bateman and H. P. Koch. *J. chem. Soc.*, 1944, 600–606.—The quartz ultra-violet absorption spectra of highly purified poly*iso*prenes have been found to correspond closely to those of simple ethylenes having the same degree of alkyl substitution at the double bond. C. F. M.

490. Heats of Combustion of Eight Normal Paraffin Hydrocarbons in the Liquid State. E. J. Prosen and F. D. Rossini. *Bur. Stand. J. Res., Wash.*, October 1944, **33** (4), 255.—The heats of combustion of the normal C_5, C_6, C_7, C_8, C_9, C_{10}, C_{12}, and C_{16} paraffin hydrocarbons have been measured in an electrically calibrated bomb calorimeter (full details of apparatus and method are given). The following values in kg.-cal./mole were obtained for the heat of combustion at 25° C. and constant pressure of the liquid hydrocarbons in gaseous oxygen to form gaseous carbon dioxide and water, all reactants and products in their thermodynamic standard reference states :—

n-pentane,	838·71 ± 0·18 ;	*n*-hexane,	994·99 ± 0·20 ;
n-heptane,	1151·33 ± 0·21 ;	*n*-octane,	1307·54 ± 0·25 ;
n-nonane,	1463·89 ± 0·27 ;	*n*-decane,	1620·13 ± 0·26 ;
n-dodecane,	1932·73 ± 0·39 ;	*n*-hexadecane,	2557·58 ± 0·68.

C. L. G.

491. The Synthesis of Complex Phenols. W. Simpson. *Paint Tech.*, December 1944, **9** (108), 267.—Methods for the synthesis of phenol are briefly discussed and details given of the methods available for the synthesis of complex phenols which possess the necessary oil solubility for use in paints. For the synthesis of phenol the main methods in commercial use are : (1) Fusion of sodium benzene sulphonate with caustic soda, followed by acidification with sulphur dioxide. (2) Heating chlorbenzene at high-temperature pressures with complex caustic soda, followed by acidification, or with sodium carbonate, which gives phenol direct. (3) Catalytic hydrolysis of chlorbenzene with water vapour, which produces hydrochloric acid available for re-use in the production of chlorbenzene.

The complex phenols may be obtained by similar syntheses to the above, or by the introduction of alkyl and aralkyl groups into the phenolic nucleus by action of an alcohol, alkyl, or aralkyl halide or an unsaturated hydrocarbon on phenol in the presence of a catalyst. A further method is the isomerization of alkyl or aralkyl phenol ether. The method involving the addition of unsaturated hydrocarbons to phenol is the one most widely used—*e.g.*, production of *para-tert.*-butylphenol and *para-tert.*-octylphenol from *iso*butylene polymers and phenol. C. L. G.

Analysis and Testing.

492.* Rapid Estimation of Sulphur in Gasoline. A. N. Bashkirov and A. G. Nikolaev. *Bull. Acad. Sci. U.S.S.R.* (*Div. Tech. Sci.*), 1943, **9/10**, 68–69.—This method may be used for gasoline with a F.B.P. up to 200° C. 2 gm. samples are used on which an accuracy of 0·01% is claimed, the time taken being 20 min. The apparatus, a sketch of which is given, consists of a flask, combustion chamber, and absorption vessel, the whole being fitted together with ground-glass joints. A suction pump is used to draw products of combustion through the absorption vessel, and a small pressure pump to regulate the flame. The method consists in weighing gasoline into the flask, where it is evaporated by bubbling a stream of air through by means of the suction pump, warming if necessary. The resulting vapours are burnt in a jet in the combustion chamber, the combustion products are absorbed, and the sulphur dioxide produced is determined by titration. A table comparing results obtained by this method with those obtained by the normal lamp method shows that very good agreement is obtained.

D. A.

493.* Tribometer with an Elastic Axis for the Measurement of Kinetic Friction under Boundary Lubrication Conditions. M. M. Kusakov and K. S. Kruim. *Bull. Acad. Sci. U.R.S.S. Cl. Sci. Tech.*, 1944, 275–287.—A description, with drawing, is given of a new design of instrument having an elastic steel tape as the vertical axis. The inherent friction of such instruments is thus claimed to be eliminated. The results can be directly recorded photographically. Thin films of lubricants were applied by dipping the test surface in an oil solution; it was observed that the thickness of the retained oil film (measured optically) was dependent on the surface tension at the oil solution/air boundary. Experiments were carried out on the addition of the following substances to turbine oil: calcium abietate (1·5%), aluminium naphthenate (2·3%), lead naphthenate (1·5%), aluminium stearate (1·6%) and lead oleate (2·5%); the effectiveness decreases in the above order. In all cases the oil film had a thickness of 20 mμ and the load was 2 kg./cm.^{2} The rate of rotation was 243 r.p.m., corresponding to a linear velocity of 1 cm./sec. It is concluded that the apparatus described is satisfactory for the relative measurement of the wear-resistance of thin lubricating-oil films, enabling evaluation to be made of the oiliness of the oil concerned. V. B.

494.* The Application of the Abbé Refractometer and the Waldmann Coefficient to Dispersion Measurements on Hydrocarbons. G. D. Gal'pern. *Bull. Acad. Sci. U.R.S.S., Cl. Sci. Tech.*, 1944, 351–357.—The values of n^{20}_C, n^{20}_D, and n^{20}_F are recorded for 63 pure hydrocarbons. From these there are calculated the corresponding values of Waldmann's coefficient Q ($= \frac{n_D - n_C}{n_F - n_C}$, *Helv. Chim. Acta*, 1938, **21**, 1053). The mean value of Q from these, and a further 106 determinations on petroleum fractions, is 0·2863, which agrees closely with Waldmann's figure of 0·286 and shows the applicability of his coefficient to hydrocarbon analyses. Taking the limiting theoretical value of Q as 0·2905, ($= K$) the difference, ($K - Q$), is least for paraffins and most for aromatic hydrocarbons. It is suggested that in the examination of highly paraffinic hydrocarbon mixtures, a value of $Q = 0{\cdot}288$, and for highly aromatic mixtures $Q = 0{\cdot}283$, should be taken. V. B.

495.* The Quantitative Removal of T.E.L. from Ethylized Motor Fuels. N. G. Titov. *Bull. Acad. Sci. U.R.S.S. Cl. Sci. Tech.*, 1944, 537.—T.E.L. may be removed from both straight-run and cracked fuel without affecting any of its other properties, by the use of glacial acetic acid. A (1 : 3 or 1 : 4) mixture of the spirit and acid is heated for 3 hrs. in a sealed container at 80° C. and the spirit is then water-washed. All the T.E.L. passes into the aqueous phase as lead acetate. V. B.

496.* The Micro-Colorimetric Determination of Vanadium in Minerals and Ores by means of Benzidine. I. P. Alimarin. *J. Appl. Chem. (U.S.S.R.)*, 1944, **17**, 83–93.—The method permits of the determination, within 2 hrs., of 0·02–0·5% of V_2O_5 in 5–30 mg. of sample. The test is carried out in phosphoric acid solution, and depends on the colour produced by the oxidation of benzidine. The experimental technique and the elimination (by reduction) of interfering elements (Cr, Mn) is described. V. B.

497.* A Laboratory Thermostatic Regulator for Gas Heating. A. L. Deadman. *Chem. and Ind.*, 1945, 4–5.—A description is given of a simple device for use in conjunction with the conventional toluene-mercury bulb to regulate gas heating. The gas does not come into contact with the mercury. C. F. M.

498.* The Vertical Mounting of Viscometers. Anon. *Chem. and Ind.*, 1945, 39.—Details are given of Townson and Mercer's method of mounting any type of U-tube viscometer in a flat Tufnol disc so that the capilliary tube is perpendicular to the underside of the disc to an accuracy of 10′ f. of arc. C. F. M.

499.* The Scaling of Boilers. Part V. Identification of some of the Combinations of Silica and of Magnesia in Boiler Scales. T. C. Alcock, L. M. Clark, and E. F. Thurston. *J. Soc. chem. Ind.*, 1944, **63**, 292–298.—The following minerals have been identified for the first time as constituents of scales formed either in boilers or in pipe lines : crestmoreite, $2CaO{\cdot}2SiO_2{\cdot}3H_2O$; sulphatic cancrinite,

$$4Na_2O{\cdot}CaO{\cdot}4Al_2O_3{\cdot}9SiO_2{\cdot}2(CO_2,SO_3){\cdot}3H_2O ;$$

periclase, MgO ; barytes, $BaSO_4$; the new compound, magnesium hydroxyphosphate, $Mg_3(PO_4)_2{\cdot}Mg(OH)_2$, is sometimes a constituent of boiler scales, and its synthesis is described. In addition, a detailed description is given of the identification and conditions for deposition of chrysotile, $3MgO{\cdot}2SiO_2{\cdot}2H_2O$, sepiolite, $2MgO{\cdot}3SiO_2{\cdot}4H_2O$, sodalite, $3(Na_2O{\cdot}Al_2O_3{\cdot}2SiO_2){\cdot}2NaCl$, analcite, $Na_2O{\cdot}Al_2O_3{\cdot}4SiO_2{\cdot}2H_2O$, and brucite, $Mg(OH)_2$. The X-ray powder patterns of some of these minerals are recorded, together with those of some magnesium phosphates. C. F. M.

500*. Note on the Determination of Tar Acids in Coal Distillation Products by Means of the Spekker Photo-electric Absorptiometer. T. S. Harrison. *J. Soc. chem. Ind.*, 1944, **63**, 312–313.—The phosphomolybditungstic acid reagent of Folin and Denis has been found suitable for the approximate determination of "tar acids" in effluents, of mixed and varied contents, and the accurate analysis of solutions containing single phenol homologues or mixtures of constant composition. C. F. M.

501. Further Advances in the Determination of Phenol in Coal Distillation Products by Means of the Spekker Photo-Electric Absorptiometer. T. S. Harrison. *J. Soc. chem. Ind.*, 1944, **63**, 347–350.—The introduction of the more selective mercury-vapour light source for the absorptiometric determination of phenol greatly reduces the interference from cresols and, coupled with a slight modification of procedure, enables the application of a "rapid" process to the assay of tar acids and creosotes. C. F. M.

502.* Soap-Film Calibrators. W. J. Gooderham. *J. Soc. chem. Ind.*, 1944, **63**, 351–352.—Descriptions are given of two forms of apparatus for checking gas meters at flow rates up to some 5 litres per min. A soap film is carried by the gas up a calibrated tube thus giving visual measurement of the rate of flow. C. F. M.

503. A Rapid Test for *iso*Butane Fractions in Natural-Gasoline-Plant Residue Gases. G. M. Liljenstein and W. M. Schaufelberger. *Oil Gas J.*, 16.12.44, **43** (32), 96.—The *iso*butane (+) test described is a development of the butane-absorption-weathering test for pentanes (+), described by R. N. Donaldson before the Californian Natural Gas Association in February 1935. The pentane (+) test is carried out by passing a known volume of gas into a measured volume of liquid butane solvent at $-44°$ F., and the contacted solvent is weathered to a prescribed end-point temperature. The *iso*butane (+) test is carried out in exactly the same way, but at $-110°$ F., and with a liquid propane solvent. It has the advantage that both butanes and pentanes (+) can be determined in absorber residue gases, and the butanes may be separated into the normal and *iso*compounds when the intake composition and absorption factor are known. The procedure of the test, the absorption-weathering tube, and plates are described, and the set-up of the apparatus illustrated. The specifications for the two solvents and for the thermometers are given. Standardization curves for the pentane-weathering and butane-weathering tests, and butanes conversion factors for different pentanes (+) fractions, are shown. The accuracy and time required for a test are discussed and shown in comparison with a fractional analysis. W. H. C.

Crude Oil.

504. Oxidation of Heavy Hydrocarbon Oils, Pitches, and Asphaltenes of Perm Crude Oil, and the Origins of Pitch and Asphaltene. V. I. Zabavin. *Bull. Acad. Sci. U.S.S.R.* (*Div. Tech. Sci.*), 1943, **9/10**, 57–67.—Perm crude oil is subjected to steam distillation, after which a tarry residue remains, from which are obtained asphaltenes (extracted with petroleum ether), pitch (extracted by silica gel and then benzole), and heavy hydrocarbon oil. These three fractions are oxidized as follows.

The asphaltenes are oxidized by air at 180–185° C. for 216 hrs., giving products soluble in alkali, and very similar in their composition and properties to gum acids.

Pitch is oxidized by oxygen at 180–185° C. for 492 hrs., giving a product insoluble in alkali and containing unchanged pitch, asphaltenes, and insoluble asphaltenes. The asphaltenes produced have a different elementary composition from asphaltenes of the same petroleum. The insoluble asphaltenes can be methylated, giving appreciable methoxyl numbers. Examination and comparison of the elementary compositions of asphaltenes and pitches from different petroleum oils and bitumens with those of the products of oxidation of Perm petroleum pitch show that the products of oxidation are not quite identical in composition and properties with the natural asphaltenes of the same petroleum oil or bitumen.

Oxidation of heavy hydrocarbon oils with oxygen for 269 hrs. gives solid products from which it is possible to separate unchanged heavy hydrocarbon oils, asphaltenes, in soluble asphaltenes, and a liquid condensate (a light mobile oil). The asphaltenes and insoluble asphaltenes have elementary compositions very close to, but not identical with, the composition of the natural asphaltenes of Perm petroleum oil. Unlike the latter, they can be methylated. Their formation during the process of oxidation of heavy hydrocarbon oils is accompanied by a destructive splitting process with the formation of light oils. This suggests that destructive processes have taken place during the natural formation of the heavy components of petroleum oil.

D. A.

505.* The Obtaining of Lubricating Oils from " Second Baku " Crudes. S. S. Nametkin, R. Teneva, S. S. Nifontova, and P. I. Sanin. *Bull. Acad. Sci. U.R.S.S. Cl. Sci. Tech.*, 1944, 536–537.—A new method has been developed whereby Ishimbaev crude is pretreated prior to distillation, so that corrosion of the distilling equipment and coke formation are diminished. No indications as to the method are given. Ishimbaev crude yields residual motor oils with Conradson values higher than existing standards.

V. B.

506. Cracking of Latin American Crude Oils. 6. Reforming Mexican Gasolines and Naphthas. G. Egloff. *Oil Gas J.*, 9.12.44, **43** (31), 76.—The Poza Rica crude oils are both paraffinic and naphthenic in character, and vary in A.P.I. gravity from 28 to 34. The properties of a typical Poza Rica crude oil are shown, and also those of two straight-run gasolines and a naphtha from the same crude. These products had A.S.T.M. octane values of 51, 37, and 29 respectively. Once-through thermal reforming of these was made in a pilot plant, one run on the lightest gasoline, and two runs each on the heavier gasoline, at different temperatures and the same pressures and charging rates; and on the naphtha at the same pressures, but different charging rates and temperatures. The gases produced in the naphtha reforming at the highest temperature and lower relative charging rates contained 16·9% of propylene and higher olefins, which by the H_3PO_4 process would produce 6·3% polymer gasoline, having an A.S.T.M. octane value of 82. If used for alkylation with *iso*butane, the olefinic gases would give 6·1% of butylene alkylate, calculated on the naphtha charge, having an A.S.T.M. octane number of 93. The reformed gasolines (1 and 2) were treated with 1 lb. H_2SO_4/brl. neutralized with caustic soda and re-run at a maximum temperature of 350° F., (2) in addition was given a plumbite treatment. The gasoline from the reformed naphtha was plumbite sweetened only. The products had the following properties :—

	Gasoline.		Naphtha.
Product from operation.	1.	2.	3.
Sulphur, %	0·04	0·05	0·03
Gum, mg./100 ml., copper dish :			
Without inhibitor	3	2	29
With 0·025% inhibitor	3	1	6
Induction period, minutes :			
Without inhibitor	80	85	90
With 0·025% inhibitor	900	990	215
Octane number :			
Research	—	74	
A.S.T.M.	74	—	69

The Naranjos district produces mixed base crude oils, which have A.P.I. gravities ranging from 14 to 23, they contain from 4% to 10% of gasoline, their sulphur content varies from 3·5% to 4%, and they have a paraffin-wax content of about 4%. Two once-through reforming operations on Naranjos gasolines were made : (1) at 760 p.s.i., 961° F., and charging rate of 2·05, (2) at 770 p.s.i., 973° F., and charging rate of 1·48. The gasoline yields were (1) 78·4% with an A.S.T.M. octane number of 68, and (2) 56·4% with 75 A.S.T.M. octane value. The propylene and higher oelfins were 12·7% and 15·8%, which would give 3·7% and 8·1% of polymer gasoline or, alternatively, 4·2% and 11·1% alkylate, for runs 1 and 2, respectively. The unrefined product from the higher-temperature and lower-charging-rate operation (2), had a Reid vapour pressure of 11·5 p.s.i., a sulphur content of 0·13%, with gum content of 22 mg./100 ml., without inhibitor ; and 9 mg./100 ml. with 0·025% inhibitor and induction periods, without inhibitor of 105 mins., with 0·025% inhibitor, 315 mins.

Once-through reforming operations were made on products from Tonacinc, Minanavy and Tonala crude oils which are paraffinic rather than naphthenic in character.

(1) A Tonacine light gasoline at 990° F., 750 p.s.i., and charging rate of 1·71, the yields were : 67·9% gasoline, 11·8% propylene, and higher olefins, which would produce 5·2% polymer gasoline or, alternatively, 8·25% alkylate.

(2) A Minanavy medium gasoline, at 990° F., 750 p.s.i., and charging rate of 1·99 ; the yield of gasoline was 64·2%.

(3) A Tonala naphtha, at 975° F., 500 p.s.i., and charging rate of 1·98 ; the yield of gasoline was 78·7%.

The three products were acid refined, neutralized, and re-run at a temperature not exceeding 350° F. All had A.S.T.M. octane values of 72, none required a gum inhibitor, and with 0·025% inhibitor had high induction periods. W. H. C.

Engine Fuels.

507. Diesel Fuels from the Synthine Process. Anon. *Nat. Petrol. News, Technical Section* 2, 6.9.44, **36** (36), R. 585.—The Synthine (Fischer–Tropsch) process is a source of diesel fuels which surpass any made from crude petroleum. The Navy Department is making tests of a new high-cetane rating diesel fuel which, from its description, is that produced by the Synthine process from natural gas. Fischer–Tropsch oils are highly paraffinic, and those boiling in the range of 200–300° C. have a cetane number of 100, and when diluted with tar oils or heavy petroleum oils give a satisfactory diesel fuel.

A diesel-fuel fraction of about 85 cetane number can be prepared by cracking Fischer–Tropsch wax. Straight Synthine diesel fuels have a drawback in their high solidification point, about 2° C.

The cost of Synthine diesel fuels is higher than that for petroleum-derived diesel fuels, but extensive research has been conducted for some years by several companies, and lower costs should result. It is reported that the Texas Oil Co. is to construct an $880,827 pilot plant for the Synthine process at its Los Angeles refinery. The low cost of diesel fuels and higher thermal efficiencies in operation have created a wide scope of application for the diesel engine. The Synthine process offers a new way of obtaining high ignition-quality fuels without upsetting the balance of refinery gasoline operation. G. A. C.

508.* Ethyl Ether for Cold Starting. Anon. *Petroleum*, January 1945, **8** (1), 11.—Application of ethyl ether to the intake air of diesel engines to assist starting in cold weather is common practice. Results of tests carried out by G. H. Cloud and L. M. Ferenczi of Standard Oil Development Co. are briefly described. Beyond a value of 55, increase in cetane value of the fuel gives little improvement in starting, and for subzero conditions setting point imposes an upper limit to cetane value. Tests with other dopes and doped fuels showed lack of correlation between starting performance and cetane value. Other tests showed that volatility was not a deciding factor. The superior performance of ethyl ether appears to be due to its relatively low ignition temperature and wide range of inflammability. A blend of ether (40–50%) and fuel permitted starting at a lower temperature than the use of either constituent alone, and the ether addition lowered the pour point of the fuel. With this blend, heating the intake air had a deleterious effect. The results indicate that introduction of ethyl ether into the air-stream of diesel engines will allow starting down to at least −40° F. without additional starting aids, providing the crankcase lubricant and cranking facilities give sufficient speed. R. A. E.

Lubricants.

509.* The Mechanical Properties of Lubricating Oils at Low Temperatures, in Connection with the Winter Operation of Machinery. M. P. Volarovich and V. L. Val'dman. *Bull. Acad. Sci. U.R.S.S. Cl. Sci. Tech.*, 1944, 428.—The viscosity of lubricating oils was examined down to $-50°$ C. U.S.A. aviation lubricants do not show any advantage over U.S.S.R. oils, but in the case of automobile oils the U.S.A. products are somewhat better. U.S.S.R. additives of the "paratone" type give satisfactory results. The determination of viscosity at 0° C., in specially designed apparatus, is proposed as a standard U.S.S.R. test for engine lubricants. V. B.

510.* Field Tests are Necessary to Evaluate Lubricating Oils. V. A. Kalichevsky and F. C. Savage. *Oil Gas J.*, 11.11.44, **43** (27), 77.—Friction, fluid, and boundary lubrication are discussed, and the properties of lubricants requisite for these conditions are described. The authors believe that boundary lubrication is present in all bearings operations. The development of additives has had a great influence on refining technique. Whenever additives are employed, refining is carried out with the purpose of securing maximum additive response rather than optimum performance in the absence of additives.

The uses of additives, such as pour-point depressants, viscosity-index improvers, anti-welding agents (oiliness carriers), oxidation inhibitors, detergents, anti-foaming and anti-rusting agents, are described and discussed. Pour-point depresants are high-molecular-weight substances which can modify the crystalline character of wax, viscosity-index improvers are also high-molecular-weight compounds, and in consequence often possess pour-point depressant qualities. They are added to the oil in quantities considerably greater than those normally used for depressing the pour point. Curves are reproduced showing the improvement in viscosity index afforded by increasing percentates of viscosity-index improver. The maximum viscosity-index limit of blends varies with the type of oil and the type of viscosity-index improver employed, thus affording an easy method for evaluating quality of viscosity-index improvers.

Anti-welding agents (E.P.) afford satisfactory oiliness or protection from seizure should the metals become inadvertently contacted. Oxidation inhibitors protect the oil itself from oxidation by air, and immunize the metal by destroying its catalytic action by formation of protective surface coatings. The functions of detergents, anti-foaming, and anti-resting agents are described. Lubricating oils are evaluated on the basis of physical and chemical tests, engine performance, and field service. Some of the test methods are well standardized and widely accepted, while others are of local importance. The relative value of tests varies with the service for which the oil is intended. Comparisons of laboratory and field tests are given, and show that actual field or road testing is the only method by which lubricants can be evaluated with any degree of accuracy. W. H. C.

511.* Boundary Lubrication. No. 3. Liquids and Additives. J. E. Southcombe. *Petroleum*, December 1944, **7** (12), 216.—The behaviour of various liquids and additives under boundary lubrication conditions, and the effect of temperature is discussed. According to the work of Bowden and his collaborators, with clean and dry surfaces of various materials the coefficient of friction μT appeared to be independent of load and speed from 60 to 600 cm./sec. When lubricants were applied, fluid films formed with viscous oils, even down to low speeds, but with thin oils the coefficient was constant for all speeds, indicating the boundary state. Kinetic friction was found to be a function of the length of the carbon chain in each homologous series, paraffin, alcohol, and fatty acids, falling with increasing weight to a minimum, then remaining constant. From studies on the nature of sliding it was considered that the high spots, which, being relatively minute in area, carry an intense load, rise during sliding to temperatures which are limited by the melting point of the more fusible metal of the rubbing pair.

Three types of sliding are described with dry surfaces and when lubricated with mineral oil. Kinetic friction can be regarded as a series of static frictions, and not only are the surface atoms involved, but atoms or molecules deep below the surface of the metal are disturbed, and the "bulk" properties of the metal are important.

They also measured the electrical conductance with moving surfaces, and described three types of "bridges" which should occur corresponding to the types of sliding described. In the presence of mineral oils the conductance was of the same order of magnitude as for dry surfaces, but there was less conductance during the slip because an oil wedge was formed. When lubricating with a polar acid, the conductance was still high, but did not fluctuate.

The deceleration tests, made by Beeck, Givens, and Smith, show the reduction of friction effected by oleic acid. They explain the sudden fall in friction at a certain critical velocity to be due to the formation of an oil "wedge" (fluid) induced by the surface activity of the polar acid. By electron diffraction it was shown that all substances which produce this "wedge" were all highly oriented. A non-polar compound, such as tetratriacontane, showed some orientation in the cold, but the molecules quickly evaporated on warming, while the highly polar stearic acid showed orientation up to 200° C. Up to 100° C. three types of lubricants could be recognized :—

(1) Static friction constant with rising temperature—pure non-polar compounds or highly refined mineral oils.
(2) Static friction rising with temperature.
(3) Static friction falling with temperature.

The last two types occurred with lubricants containing active substances capable of being selectively absorbed. It was also found that the μ**T** curve was reversible in some cases and irreversible in others.

Temperature *versus* boundary lubrication is discussed. Southcombe's work in this sphere shows the influence of heating films of oil in air on the coefficient of friction (1) pure mineral oil gave irregular readings (stickslip) in the cold, steadying as the temperature increased, and reappearing again at the top end of the temperature scale. (2) Commercial lubricating oils invariably showed an inflection in the μ**T** curve at certain temperatures; the heating curve was never reversible after rising to 200° C. in air, and the cooling curve was almost flat. On repeated heated and cooling, *in situ*, the curves ultimately became nearly reversible, and the same effect was produced by previously subjecting the oil to heat and air in the Air Ministry Oxidation apparatus. Exline, Kramer, and Bowman showed that with paraffinoid oils the load-carrying capacity increased during oxidation to almost double the original value, while a naphthenic oil behaved similarly, at first, then decreased rapidly after further oxidation. It is noted that the change-over from boundary to fluid lubrication in engineering practice is related to the smoothness or state of finish of the rubbing surfaces, increasing smoothness favouring formation of fluid films under certain conditions.

W. H. C.

512.* Selecting the Best Lubricant. E. V. Paterson. *Petroleum*, December 1944, **7** (12), 220.—A chart is given from which the best lubricant for a particular purpose can be selected according to a series of arbitrary numerical ratings allotted to the oils in respect of their more important characteristics for a range of specific applications. The characteristics concerned are: specific gravity, viscosity index, resistance to oxidation, flash point, cold or pour test, specific heat, carbon content or residue, acidity, demulsibility, and volatility. A variable number of maximum "points" is given to each characteristic for a range of 19 grades of oil corresponding to 14 different applications. According to the particular requirements of each engine or machine, some tests will be of greater importance. Some of the tests are discussed under the following sections: (1) viscosity index in every case; (2) specific gravity in all cases except for transformer oil.

Specific heat has been included, though not often specified, as it is important where cooling duties are required, especially for crankcase and gear-box work. The paraffin-base oils have specific heats of from 0·47 to 0·5, asphaltic type oils seldom exceed 0·45.

Oxidation Tests. The Air Ministry test is discussed, but the carbon test will generally be used. Apart from the quality of the lubricating oil itself, impurities in air, steam, and water, type of fuel/air ratio, overloading, etc., influence the rate of oxidation in an oil and affect the rate and quantity of carbon in internal-combustion engines.

To Read the Chart. In each test the oil having the best figures shall be awarded the maximum marks, and the one showing the poorest results shall be marked zero Should one of the results be completely hopeless, the test would be discarded without appeal to other tests.

In order to give conclusive significance, the selected oil should have a good superiority of points. It is doubtful if there would be anything to choose between two oils having, according to the chart, a total of points that did not vary by more than 10. If this should be so, it would be better to select the one having the lower viscosity at the higher temperature, providing of course that it is within the limits of the specification. The chart is not intended for those who wish price to be their deciding factor.

W. H. C.

Special Hydrocarbon Products.

513. Petroleum Naphtha in Industry. A. W. Trusty. *Petrol. Engr*, July 1944, **15** (11), 118.—A review is given of the industrial applications, properties, and methods of test of petroleum naphthas, with tabulated data on a range of aliphatic and naphthenic grades.

In paints, the evaporation rate of the thinner largely governs the type of film formed on the painted surface, and paint naphtha must have suitable volatility and solvent powers and be stable and free from harmful or corrosive impurities. Petroleum naphthas are also used as diluents in nitro-cellulose lacquers.

In the manufacture of tyres and rubber goods such as adhesives, hot-water bottles, and overshoes, petroleum naphtha should be a satisfactory solvent or dispersing agent for the rubber, whilst having no chemical action on it: it should be stable towards oxygen and moisture, and possess minimum inflammability and toxicity, and should also have a suitable volatility and be free from objectionable odour.

Petroleum naphtha permits almost instant drying of ink in rotogravure printing, thus speeding up the process. In dry-cleaning processes the desirable qualities of a cleaning naphtha are similar to those required in the rubber industry, and include non-toxicity. It should not discolour or injure fabrics or dyes.

Naphtha is used in perfume manufacture, the flower petals being extracted with cold solvent, while in the expression of oil from oil-bearing seeds hot naphtha solvents find considerable employment. From bones and other animal refuse the oil and grease are removed by naphtha.

Petroleum naphthas find other uses in the leather and furniture industries, in the manufacture of asbestos binders in brake linings, and in waterproofing compounds and insulating materials.

Laboratory assessment consists in the determination of flashpoint, distillation characteristics, colour, doctor and corrosion tests, kauri-butane number (of particular value in the paint and varnish industries), and the dilution ratio.

Certain close-cut solvents, such as *n*-hexane, heptane, and *cyclo*pentane, are now fractionated from natural gasoline; and the hydrocarbon class of coal-tar solvents includes benzene, toluene, xylenes, tetralin, amylnaphthalenes, and mixtures.

A table shows the general applications of each of the standard grades to which reference is made.

G. A. C.

514. Preparation and Application of Soluble Oils. A. Treffler. *Chem. Ind.*, December 1944, **55** (7), 922.—The preparation of soluble oils is discussed and formulations given based on relatively cheap and available emulsifiers, and a procedure given for preparing an emulsifying agent to replace sulphonated mineral oil. Unsaturated fatty acids with a C chain of 18 or 20 have low interfacial tension against mineral oil, but tall oil acids have too long a C chain for the one solubilizing group, so that the incorporation of oleic or linoleic acid is desirable. Neutralization of the acids causes cloudiness or separation, requiring the addition of large amounts of coupling agents in the case of degreasing compounds or soluble oils used with very hard water and in great dilutions, but for dry-cleaning soaps and in soluble oils used at higher concentrations the amount of coupling agent required can be reduced by leaving one-third of the fatty acids unneutralized. Alternatively, if neutralization is carried out with, *e.g*, triethanolamine, a coupling agent is unnecessary.

Mahogany soaps coupled with fatty acid soaps and free fatty acids form a valuable emulsifier for cutting oils, the former being of value in sludge dispersion and for protecting metal parts from oxidation. A substitute for mahogany soaps may be prepared by sulphonating lard oil, low titre tallow, or tall oil fatty acid with sufficient sulphuric acid to sulphonate only the unsaturated groups. Addition of a coupling agent, fatty acid potash, and oil yields a satisfactory clear product, after any necessary correction with oleic acid, potash, or coupling agent. Naphthenic acids or Alox (oxidation product of mineral oil containing various saturated fatty acids, higher alcohols, ketones, and aldehydes) are useful emulsifiers, the latter being of particular value with crude high-viscosity mineral oils. It has been found that the easily oxidized mineral oils—*e.g.*, from Oklahoma or Texas—are more readily coupled than straight paraffin-base oils. For bacteria control, cresylic acid, mono- and polychlor-phenols, etc., may be added to the soluble oil.

For the manufacture of hand soaps (formulæs given), the use of pine oil as the base avoids the necessity for free fatty acids, while the substitution of part of the resin or tall oil by oleic acid increases the stability to hard water. A coupling agent may be necessary if more than 2–3% of perfumes are incorporated. C. L. G.

515. Dry Cleaning Soaps. A. Treffler. *Soap*, December 1944, **20** (12), 36.—The formulation of dry-cleaning soaps of the soluble-oil type for removing moisture and soil during dry cleaning with solvents is discussed and suitable compositions are given. A method for the evaluation of dry-cleaning soaps by the peptization of lamp-black is also described. The soap generally consists of naphtha, fatty acid, alkali, alcohol, soap and water, and coupling agents, a high amount of alcohol being used to hold up water absorbed during use. Oleic and vegetable-oil fatty acids are preferred to stearic, as they require less alcohol and low titre fatty acids for coupling, and are not so easily precipitated by moisture on to the fibre. With Celanese fabrics a mixture of 30 parts of a solvent with 100 parts of naphtha soap may be applied with safety, and for paint-spot removal mixtures of alcohol, benzol must be diluted with naphtha.

The peptizing value of dry-cleaning soaps for oil and water-insoluble particles can be determined by adding lamp-black to a solution of the soap in naphtha, shaking, and noting the extent to which the lamp-black settles after varying periods of time. From experiments described it was inferred that oleic acid soaps were preferable to linseed oil, fatty acid, or stearic acid soaps. C. L. G.

516.* Quenching Fluids. Anon. *Petroleum*, January 1945, **8** (1), 16–17.—The principal metallurigcal changes which take place during the quenching of steels are described and illustrated. The media commonly used are water, dilute soda solutions, brines, oils, and air. The merits and limitations of each are discussed. Curves show the relative cooling rates of steel specimens immersed in water and in oils, and effects of bath temperature on cooling rates. Tests applied to determine the suitability of mineral and other oils for quenching purposes are described, and suitable conditions for carrying out quenching and interrupted quenching outlined. The chief use of oil is for producing martensitic hardness with minimum distortion in high-alloy steels. Any tendency for tool steel to crack with oil quenching may be avoided by finishing off the cooling in air. R. A. E.

517.* Insecticidal Sprays and Flying Insects. W. A. L. David. *Nature*, 17.2.45, **155**, 204.—It has already been shown that when subjected to insecticidal sprays of droplet size less than 10 microns in diameter, stationary insects are very much less affected than flying insects. This has now been confirmed by microscopic examination of the wings of flying insects after spraying, it being also shown that by far the greatest amount of spray is collected on the wings. If the wings of sprayed insects are removed, the 24-hr. kill is reduced by about 50%. Cleaning by the insects of heads, antennæ, and wings from drops of spray may result in a contact effect through the legs or a stomach poison effect by ingestion. C. L. G.

Derived Petroleum Chemicals.

518. Teepol X. A New Synthetic Wetting Agent and Detergent. A. V. Billinghame. *Textile Manufacturer*, October 1944, **70** (838), 451.—The properties and applications of a new synthetic wetting agent and detergent produced from petroleum in the U.K. are described. Data are given on the effect of varying concentrations of the product on surface tension and interfacial tension between water and xylene, and wetting properties by the Draves test. The value of the product when used in hard water is illustrated by photographs showing the lime-soap dispersion properties of the product. The applications of Teepol in dyeing, chlorination of wool, and other textile processes, are briefly discussed. C. L. G.

519.* Rise Recorded in Chemical Raw Materials from Oil. Anon. *Oil Gas J.*, 16.12.44, **43** (32), 110.—See Abstract No. 520. C. L. G.

520.* Petroleum Chemicals. Anon. *Ind. Eng. Chem.*, January 1945, **37** (1), 18.—According to a report issued by the U.S. Tariff Commission, the production of chemical raw materials from petroleum in 1943 amounted to 1,564,914,655 lb., of which sales accounted for 1,067,058,199 lb., valued at $34,435,706 (*i.e.*, 3·2 cents per lb.). Production is made up as follows :—

Cresylic acid, 13,915,900 lb.; naphthenic acid, 17,341,192 lb.; 1 : 3-butadiene, 103,091,279 lb. (value 21·4 cents per lb.); ethylene, 166,224,385 lb.; C_3 hydrocarbons, 394,620,200 lb.; C_4 hydrocarbons, 668,496,079 lb. : and all other products, 201,225,630 lb.

It has been stated that 175 organic chemicals are produced from petroleum. The amount of ethyl alcohol produced from petroleum is equivalent to half the country's pre-war requirements. In addition to the above figures, 90% of the production of 164,000,000 gals. of toluene is estimated to have been produced from petroleum. Other hydrocarbons obtained from petroleum include ethyl benzene, *iso*butane, cumene, *iso*heptenes, *iso*-octane, butadiene, and *iso*prene. C. L. G.

Coal, Shale and Peat.

521.* The Obtaining of Liquid Fuel from Shale by the Method of Thermal Solution. M. K. D'yakova, *Bull. Acad. Sci. U.R.S.S. Cl. Sci. Tech.*, 1944, 258–274.—By the thermal solution process a conversion of as much as 95% of the organic matter of shale into liquid fuel is possible. The mechanism of the process, which consists in heating the shale with a solvent to a temperature of about 400° C. at a pressure of the order of 30 atm., is not yet clear. It is evident that cracking of the organic matter of the shale occurs, and such cracking may well be catalysed by the mineral portion of the shale, since this contains alumino-silicates. In the laboratory experiments described, seven samples of shale, typifying U.S.S.R. deposits and including both high- and low-sulphur shales, were investigated. The factors influencing the reaction were in turn examined and lead to the following conclusions : the size to which the shale is ground is not, within wide limits (0·3–5 mm.), significant. A considerable choice of solvent is permissible, such as anthracene oil, petroleum fuel oil, various shale oils, diesel fuel, hydrogenated shale tars, etc. Its physical properties should, however, be such that the liquid state is maintained under the reaction conditions; it should have good thermal stability and be free from tar and asphaltic matter which would hinder the removal, by filtration at the end of the reaction, of undissolved material. Excellent solvent properties are shown by anthracene oil and by a shale-tar distillate of 220–370° C. boiling range. The use of the latter is preferable, since it makes the process self-contained. A 1 : 1 solvent : shale ratio is the best, and also makes the mixture of a pumpable consistency. Optimum conditions for the reaction are : temperature in the range 385–420° C., with a duration of 5–20 mins., and a pressure of 30–40 atm.; the milder conditions are applicable to high-sulphur shales. On the seven samples examined an utilization of organic matter of 72–96% was obtained.

A description is given of a continuous pilot plant which was set up (capacity 30 kg. shale/hr.). On this plant extensive trials were carried out with one of the low-sulphur shales, containing 48% of organic matter. The solvent used was a shale oil cut of boiling range 220–370° C. (d^{20}_{20} 0·933, viscosity at 25° C., 3·4° E. volatile to 300° C., 48%). A mixture of equal weights of solvent and shale was processed at 425–430° C. for 20 mins. at a pressure of 32–34 atm. Yields obtained were as follows : gasoline 39·3%, diesel fuel 2·9%, casinghead gasoline (recovered by absorption from the gas) 0·6%, pitch 30·2%, gas 8·8%, water (pyrogenic) 6·3%, and insoluble matter 8·4%. These figures, calculated on the organic content of the shale, show a utilization of this of 91·7%. The solvent cut is regenerated and re-used. Separation of the insoluble portion is effected by filtration from the extract on a filter press, after removal of fractions boiling below 220° C., the residue being then de-oiled by washing with shale naphtha.

Inspection data are given on all the products, as well as details of the refining treatment of the gasoline. The finished re-run product had boiling range 69–185° C. (17% at 100° C.), octane No. 64, with 3 ml. T.E.L. 76. The yield of this on the original raw shale was 15·5%. A schematic material balance is also given. V. B.

522.* Thermal Solution—A New Method for Obtaining Artificial Liquid Fuel. M. K. D'yakova. *Bull. Acad. Sci. U.R.S.S. Cl. Sci. Tech.*, 1944, 498–505.—" Thermal solution " is the solvent extraction of solid fuels at temperatures such that cracking occurs. The yield of liquid products obtained is 3–5 times as great as that from retorting processes. Various solvents may be used, such as fuel oil, anthracene oil, gas oil, tetralin, etc. The proportion of soluble organic matter decreases with increasing carbonization (age) of the solid fuel, ranging from 80% in the case of peats down to 6% for anthracite coals. In the case of shale, on which most work has been done, the utilization of organic matter present is as high as 85–90%, compared with 35–45% for the conventional distillation process. A typical thermal solution process, applied to shale, is as follows. The shale (organic content 50–60%) is dried to a moisture content of 1–3% and ground to 0·2–0·3 mm. The material is then mixed (1 : 1) with solvent (shale distillate of boiling range 220–370° C.), heated to 415° C., and transferred to a reaction chamber, where it is maintained for 20 mins. at 425–430° C. under a pressure of 20–30 atm. The reaction product is freed from gas and products boiling below 225° C., and is then filtered to remove undissolved material. Typical yields (wt.) are gasoline (to 225° C.) 20%, casinghead gasoline 0·3%, diesel fuel 1·5%, gas 4·5%, tar 15%. Hydrogenation of the latter will yield a further 12% of gasoline (figures are on original shale, containing approximately 50% of organic matter).

The process is particularly applicable to peat. Using petroleum fuel oil as solvent (1 : 2) a conversion of 45% of the organic content of peat into gasoline/kerosine fractions is possible. V. B.

523.* British Research on Petroleum Substitutes. Part III. Direct Replacement : Colloidal Fuel. R. M. Bridgwater. *Petroleum*, January 1945, **8** (1), 2.—Reference is made to the research work on the preparation of colloidal fuels, which has been carried out : effects of particle size and concentration on rate of settling, the use of stabilizers in reducing the tendency of the coal particles to separate, and on the selection of suitable oils for the purpose. It is pointed out that these so-called " colloidal fuels " are really suspensions of coal in oil, since the particle size of the pulverized coal used ranges from 1 to 64μ, which represents the economic limit.

The main potential advantages of the colloidal fuel are high thermal value per unit volume, ease of handling, and elimination of risk of spontaneous ignition if the specific gravity is over 1·00 and the product is stored under water. The results of practical trials are discussed. The number made is limited, but indicate that such fuels can be burned satisfactorily with the same equipment as for oil fuel. However, a larger combustion space is needed, or additional air must be supplied at the appropriate point, slagging of ash must be avoided, and provision made for ash removal. The fuel is thus more suitable for merchant than for naval vessels. In view of the limited stability of fuels prepared to date, development depends on the interest displayed by potential users. A revival of interest in colloidal fuels has occurred in the U.S. as a result of oil shortage on the western seaboard. R. A. E.

Miscellaneous Products.

524. Analytical Aspects of Plastics. H. Barron. *Brit. Plastics.* Part II, October 1944, **16** (185), 460 ; Part III, February 1945, **17** (189), 56.—Methods are given for the estimation of a wide variety of synthetic resin and other base materials in plastics including plasticizers, lubricating materials, etc., *e.g.*, phenol, cresol, formaldehyde, aniline, furfural, urea, thiourea, cellulose acetate, acetobutyrate, and nitrate, camphor, polystyrene, acrylic, and methacrylic esters, polyvinylchloride, dibutyl phthalate, tricresyl phosphate, calcium stearate, and white lead. C. L. G.

525. A New Market for New Chemicals. Wet Strength Paper. K. W. Britt. *Chem. Ind.*, November 1944, **55** (5), 734.—A large potential market is considered to exist for synthetic resins in the treatment of packaging paper to improve the wet strength. While some papers are difficult to wet, in particular waxed or asphalted paper, all lose 90%, and over of their dry strength when thoroughly wet. This can be reduced to below 50% by incorporation of 2% of a synthetic resin or 1% of dimethylol urea. Three main methods of application are used : (1) impregnation of the paper sheet, (2) incorporation into the stock of a special resin such as melamine-formaldehyde which can be absorbed on to the fibre without alum, and (3) impregnation of the paper or incorporation into the stock of a partly polymerized urea–formaldehyde composition with a catalyst followed by curing by heat or storage. The treatment may affect the absorbency, softness, bearing strength, and folding strength, depending on the type and quantity of product used, while the resins may be affected by hydrolysis. Some improvement in the above directions is likely to take place. It is estimated that in the U.S. the potential market for wet strength paper is about 12 million tons, but the treatment in question represents a rather substantial added cost which may be difficult to justify for all applications. C. L. G.

526.* Palm Oil in the Steel Industry. Anon. *Petroleum*, December 1944, **7** (12), 224.—A summary is given of an article by R. P. Dunmire in *Iron and Steel Engineer*, 1943, **20** (1), 55.—The production of palm oil is described, and the properties and composition of the Belgian and Sumatra products are given and discussed. In the cold rolling mill, the palm-oil supply and return tanks are placed in the basement below the mills and the oil supplied to them at about 165° F. to ensure fluidity. The sheet from the hot-strip mill and pickling operations runs through a palm-oil bath, partly to inhibit corrosion and partly to form an initial film of oil on the work when it enters the cold mills where more palm oil is fed on to the sheet. Excess oil and cooling water drop into gutters and return to tanks in the basement, where the oil rises to the surface as a sludge containing 30–60% of water. In the hot-dipping process of tin plating, iron or steel sheet is passed through a bath of flux, and then through molten tin, the surface of which is covered with palm oil, which is therefore subject to a temperature of about 470° F. with consequent rapid deterioration.

The causes of deterioration of the oil are discussed, and the properties of used oils are shown in comparison with the original oil. The used oil is treated by a new process, which is described. W. H. C.

527.* Control of Red Spider Mites. A. C. Simpson. *Nature*, 24.2.45, **155**, 241.—Following reports from the U.S. of the value of 2 : 4-dinitro-6-*cyclo*hexylphenol for the control of mites on citrus, cotton, and hops, tests have been carried out in this country on hops and greenhouse tomatoes. Hops were treated with (*a*) dusts (two proprietary and one kaolin base) and (*b*) aqueous suspensions containing 1% of the di*cyclo*hexylamine salt of 2 : 4-dinitro-6-*cyclo*hexylphenol, the salt being less phytocidal than the original product. $\frac{1}{3}$ lb. dust was applied to each plant, kills of 94–95% being obtained compared with 27% for flowers of sulphur. Similar high kills were obtained with the aqueous suspensions, compared with 65% for lime–sulphur. It was also found that the product was compatible with cuprous oxide, copper oxy-chloride, and nicotine, and was highly ovicidal. On tomatoes, good results were obtained with the di*cyclo*hexylamine salt, the original product causing severe damage, as did dinitro-*ortho*-cresol. It was found that a wetting agent was necessary to obtain satisfactory cover of the foliage. Preliminary experiments with red spider on damsons have given similar promising results. C. L. G.

Miscellaneous.

528. Technical and Economic Status of Liquid Fuel Production from Non-Petroleum Sources. R. E. Wilson. *Nat. Petrol. News, Technical Section* 2, 6.9.44, **36** (36), R. 596.—Known domestic reserves of oil shale and coal both far exceed known domestic reserves of petroleum and natural gas.

The increasing use by industry of hydrogenation, catalytic, and conversion processes will lead to a great accumulation of new information on methods and equipment applicable to coal-conversion operations. Gasoline from coal or the richer oil shales could be produced at only 5 cents per gallon above present costs from crude petroleum.

The conversion of petroleum residues into higher-grade fuels by cracking has increased their value as a crude substitute to within less than 2 cents per gallon of that of the crude in a given area. Eventually these residues will pass out of use if crude prices rise and they come into direct price competition with coal.

Natural gas is a most promising source of liquid fuel; but as reserves on heat-content bases are not quite as large as those of crude petroleum, the processes using gas will only help to " stretch " crude reserves an extra decade or so, rather than take their place.

Other processes may come into use under local conditions of unusual supply or demand, or large transportation differentials before they are commercially feasible on a nation-wide scale. For instance, furnace oil made either from crude or natural gas in Texas, shipped by tanker, would be the economic household fuel in New England. The fermentation of agricultural wastes or other products to make alcohol has an economic future rather for industrial alcohol than as a motor fuel.

As sources of raw materials for liquid fuel manufacture, oil-shales, tar-sands, and coal should supply needs for a thousand years, and exploration in these fields is necessary.

Close examination and guidance of any Government research programme are necessary. In the absence of profit motive, problems of national interest could be studied which a private concern could not justifiably undertake. Such Government research should be directed to the agricultural and forestry fields, and in making surveys of available raw materials. For instance, better information is required in the field of oil-shale regarding size, location, and average oil content of the more promising deposits; and as for coal utilization, research and pilot-plant tests need to be carried out on the various processes as applied to different types of coal. German technological development in recent years should be studied, as should be the size, quality, and mining of tar-sands in the U.S. and Western Canada. Gasification, distillation, or extraction, in the ground, of solid bituminous materials should be investigated. On the other hand, Government research can be subject to political pressure, and another disadvantage of work organized by the State is the reluctance of industry to co-operate in a highly competitive field. The industries could, if the Government desired, set up an advisory committee of technologists to co-operate in a research programme, the designing of pilot plants, and guiding the work along practical lines. G. A. C.

529.* Motor Vehicle Taxation. C. Ridley. *Petroleum*, 1945, **8**, 18.—A discussion, written before the new tax rates were announced, of the S.M.M.T. proposals. It is recommended that private cars be taxed on capacity, public vehicles on seating, and goods vehicles on gross weight. Diagrams are given showing the advantage of the " square " engine as against the present British long-stroke type. The former type permits of larger water spaces round the valves, an advantage with the higher pressures attending the use of high-octane fuels. V. B.

530. European Petroleum Refining. H. Moore. *Industr. Chem.*, 1945, **21**, 53–55.—Post-war European requirements for refinery capacity will be about 30 million tons annually. The cost is estimated to be £3–4 per ton. Replacements will be at the rate of 10% per annum, thus ensuring a constant level of orders for the engineering industry. The possibilities for British manufacturers are discussed. F. S. A.

531. Progress of the Liquefied Petroleum Gas Industry in 1944. G. G. Oberfell and R. W. Thomas. *Oil Gas J.*, 1945, **43** (35), 38–40, 105.—A statistical summary of the production and utilization of liquefied petroleum gases in the U.S.A. for the year under review. A table is included giving marketed production, total and by industries, since 1922, which shows that 1944 consumption at 785 million U.S. gallons was 16·5% above the previous year and 236% above 1939. Owing to the synthetic rubber and aviation gasoline programmes, the use of C_3 hydrocarbons has progressed much faster than that of the butanes which are currently required as feed for dehydrogenation and isomerization plants. It is suggested that this situation will be reversed following the end of the Pacific war. J. C. W.-M.

BOOKS RECEIVED.

British Standard No. 1111 : 1943.—Summary of British and American Standard Specifications for Iron and Steel. Pp. 132. British Standards Institution, 28, Victoria Street, London, S.W.1. Price 12*s.* 6*d* net.

This summary presents concisely in tabular form the details of the various specifications for Iron and Steel that have been issued by the British Standards Institution, and by American organizations (Society of Automotive Engineers, American Iron and Steel Institute, American Society for Testing Materials, War Production Board of America).

British Standard Code 1041 : 1943.—Temperature Measurement. Pp. 76. British Standards Institution, 28, Victoria Street, London, S.W.1. Price 12*s.* net.

The temperature measurement code set out is issued for the convenience of engineers responsible for the control and testing of heat-using plant. A number of different types of temperature-measuring devices are described, together with the measurement of temperature in liquids, gases, and in the interior and on the surface of solids.

British Standard Code B.S. 1042 : 1943.—Flow Measurement. Pp. 64. British Standards Institution, 28, Victoria Street, London, S.W.1. Price 12*s.* 6*d.* net.

The purpose of this British Standard Code is to set out fully the conditions governing the design, installation, and use of standard pressure-difference devices for measuring fluid flow in pipes and ducts, in order to obtain consistent and generally acceptable results within a specified tolerance, from commercial instruments. The " secondary devices," or flowmeters, are not dealt with.

Hardness Reducers in Drilling (Poniziteli Tverdosti v Burenii). By P. A. Rebinder, L. A. Shreiner, and K. F. Zhigach. Pp. 199. Moscow–Leningrad. 1944. [In Russian.]

This booklet is published under the auspices of the Colloid-Electrochemical Institute of the Academy of Sciences of the U.S.S.R. It is sub-titled " A Physical-Chemical Method of Facilitating the Mechanical Disintegration of Hard Mining Structures on Drilling." The publication deals with both the theory and the practical application of the subject; among the more widely used hardness-lowerers are the chlorides of sodium, magnesium, aluminium, sodium hydroxide and carbonate, lime and various soaps. The speed of drilling, as compared to that when water alone is used, is raised by 20–60%. A portion of a chapter is devoted to the use of such agents in the drilling of oil-wells. The work concludes with a table showing the practical effect of such additions in 136 cases. A bibliography of 58 references (mainly Russian) is included.

The Viscosity of Lubricating Oils at Low Temperatures (Vyazkost' Smazochnuikh Masel pri Nizkikh Temperaturakh). Pt. I. By M. P. Volarovich. Moscow–Leningrad, 1944. 112 pp. [In Russian.]

This pamphlet is published by the Institute of Machine Operation of the Academy of Sciences of the U.S.S.R. The present publication consists, in the main, of a review of published work on the subject. It is intended to present the author's own investigations in this field in Part II. The contents list indicates the ground covered.

Chap. IV. Temperature-viscosity relationships of lubricating oils at low temperatures (extrapolation of viscosity values to low temperatures, experimental data on the viscosity of lubricating oils at low temperatures, synthetic lubricating oils, viscosity index, and the viscosity index of lubricating oils at low temperatures, the structure and viscosity of lubricating oils at low temperatures).

V. The effect of additives on the viscous properties of lubricating oils at low temperatures.

The booklet concludes with a bibliography of 153 references, the greater part of them to Russian publications.

Methane, Its Production and Utilization. B. J. P. Lawrie. Pp. 66. London: Chapman & Hall, Ltd. 1940. Price 6*s*.

Describes the occurrence, production, and uses of methane gas, particularly as a fuel for internal-combustion engines.

Thorpe's Dictionary of Applied Chemistry. By J. F. Thorpe and M. A. Whiteley (Editors). 4th edition, revised and enlarged. Vol. VI. Glau-Inv. and Index to Vols. I–VI. Pp. xii + 611. London: Longmans, Green & Co. 1943. Price £4.

This is the latest volume in the revised edition of this standard work, and contains many comprehensive articles in addition to a wide variety of topics treated in a succinct dictionary form.

Technical Data on Fuel. By H. M. Spiers (Editor). 4th edition, revised and enlarged. Pp. xvi + 358. London: British National Committee, World Power Conference. 1943. Price 12*s*. 6*d*.

The data, presented with explanatory notes, cover a wide range of subjects connected with fuel technology, and is arranged in the form of tables and charts to permit of ready application. Recognized experts in various branches of industry have collaborated in the preparation of the volume.

Structural Design of Oil Tankers. By J. L. Adam. Pp. 32. North-East Coast Institution of Engineers and Shipbuilders, Newcastle-upon-Tyne. 1943. Reprinted from the Institution Transactions. Price 3*s*. 6*d*.

Various structural arrangements adopted in modern tankers are examined critically so that their relative merits and demerits may be assessed.

Lewis's Medical, Scientific, and Technical Lending Library. New Edition. Pp. 922. London: H. K. Lewis & Co., Ltd. Price 12*s*. 6*d*. to subscribers, 25*s*. to non-subscribers.

A complete catalogue to the end of 1943 on medical and scientific books available on loan from Lewis's Lending Library.

In two parts—Part I: Authors and Titles, arranged alphabetically; Part II: A classified index of subjects with names of authors.

The Examination of Water and Water Supplies. 5th Edition, 1944. By E. V. Suckling. Pp. 849. (London: S. & A. Churchill, Ltd.) Price 60*s*.

Deals with the qualities required in water for domestic and industrial purposes, inspection of water-works, and analysis of samples; also purification and treatment of water.

A.S.T.M. Standards on Petroleum Products and Lubricants. October 1944. Pp. 514. American Society for Testing Materials, 260 S. Broad Street, Philadelphia 2, Penna. Price $2 75c. (14*s*. 6*d*.).

This latest compilation of all A.S.T.M. specifications, methods of test, and definitions pertaining to petroleum products includes some 80 standards, together with certain supplementary material.

In addition to the current report of the Society's Committee D-2 responsible for most of the standards, there are certain proposed methods, for example, one on the saponification number of petroleum by electrometric titration; proposed conversion tables for petroleum oils of metric tons to long tons and short tons. There is also a discussion on oil measurement; proposed methods of analysing petroleum sulphonates; and a test for potential gum in aviation gasoline.

The large numbers of test methods provide authoritative procedures for determining the properties of a wide range of petroleum products, for example, acid heat of gasoline, aniline point, burning quality of various products, carbon residue, colour, distillation, specific gravity, knock characteristics of fuels, melting point, etc.

Specifications are included covering fuel oils and gasolines, Stoddard solvent, various types of asphalt, etc.

This book, which includes the emergency method of test for colour of Army motor fuel, and certain emergency provisions, can be obtained from A.S.T.M. Headquarters, and from the Institute of Petroleum, 26, Portland Place, London, W.1.

INSTITUTE NOTES.

April, 1945.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

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

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

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

Membership.

Bassett, Conrad John, Engineer, Esso European Laboratories. (*W. E. J. Broom ; K. T. Arter.*)

Carder, Reginald Aubrey, Managing Director, Anglo-American Oil Co., Ltd. (*F. H. Garner ; H. C. Tett.*)

Corfield, William Gordon, Director, Assam Oil Co., Ltd. (*T. Dewhurst ; P. Evans.*)

Cowen, Lawrence Gordon, Research Chemist. (*A. E. Dunstan ; W. H. Cadman.*)

Evans, Joseph Henry, Chief Chemist, British Timken, Ltd. (*E. A. Evans ; W. D. Doughty.*)

Forbes, Edgar St. Clair, Executive, Lubricating Oil Pool, Petroleum Board. (*R. B. Hobson ; E. G. Grant.*)

Grimsey, Alfred Herbert Roberts, Technical Officer, H.M. Forces. (*E. A. Satchell ; G. W. Dunkley.*)

Hesketh, Raymond, Chemist, "Shell" Refining & Marketing Co., Ltd. (*W. R. P. Hodgson ; J. Parrish.*)

Hill, William Albert, Technical Representative, C. C. Wakefield & Co., Ltd. (*E. A. Evans ; J. C. Cragg.*)

Langton, Aubrey Turner, Laboratory Engine Tester, Anglo-American Oil Co., Ltd. (*W. E. J. Broom ; C. H. Sprake.*)

Maddison, Robert Edwin Witton, Chief Chemist, Messrs. Claud Campbell & Co., Ltd. (*W. J. Wilson ; S. T. Minchin.*)

Miller, William, Physicist, Anglo-Iranian Oil Co., Ltd. (*C. J. Wright ; W. Rutherford.*)

Raper, Bernard Arthur, Supervisor, Attock Oil Co., Ltd. (*A. E. Chrisman ; J. G. A. Jeffrey.*)

Simpkins, Clarence Reginald Peers, Refinery Foreman, Bahrein Petroleum Co., Ltd. (*N. L. Anfilogoff ; A. H. Goodhind.*)

Sussums, Alfred Ashby James, Laboratory Engine Tester, Anglo-American Oil Co., Ltd. (*W. E. J. Broom ; C. H. Sprake.*)

Wachal, Antoni Leszek, Petroleum Engineer. (*W. de J. Piotrowsky ; A. E. Dunstan.*)

Watt, David Blair, Physicist, Anglo-Iranian Oil Co., Ltd. (*C. J. Wright ; W. Rutherford.*)

Weller, Owen George, Chemical Engineer, Assam Oil Co., Ltd. (*R. J. Hayman ; A. G. Eadie.*)

Wyszynski, Zbigniew Stanislaw, Trainee, Anglo-American Oil & Prospecting Co. (*T. G. Hunter ; G. D. Hobson.*)

Transfers.

Higgs, Percival George, Chemist, "Shell" Refining & Marketing Co., Ltd. (*J. S. Jackson ; W. R. P. Hodgson.*)

Lawrence, Albert Edward Thomas, Research Chemist, British Bitumen Emulsions, Ltd. (*I. Cameron ; R. M. Kerry.*)

Pearce, Austin William, Research Worker, Birmingham University. (*F. H. Garner ; A. H. Nissan.*)

Rappoport, Frederick Gerald, Civil Engineer, British Controlled Oilfields, Ltd. (*R. R. Tweed ; V. C. Illing.*)

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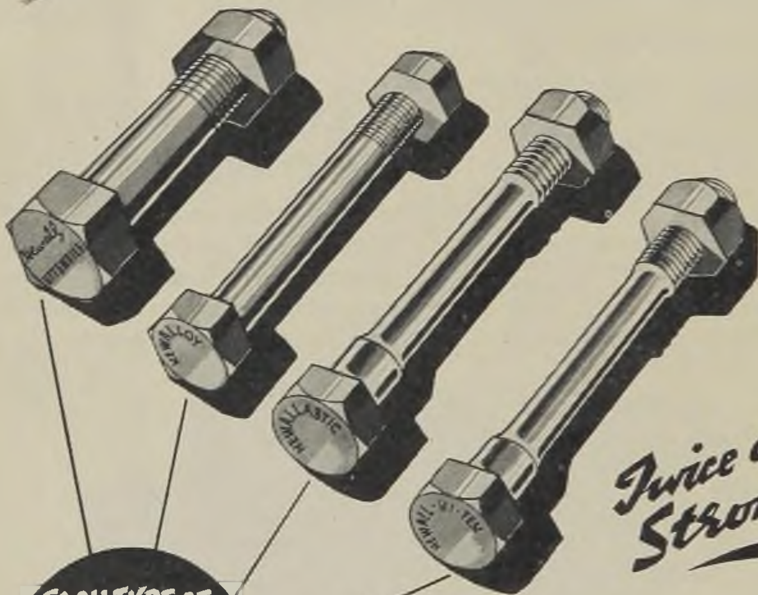

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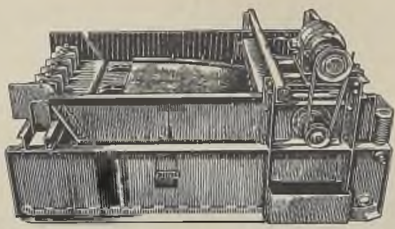

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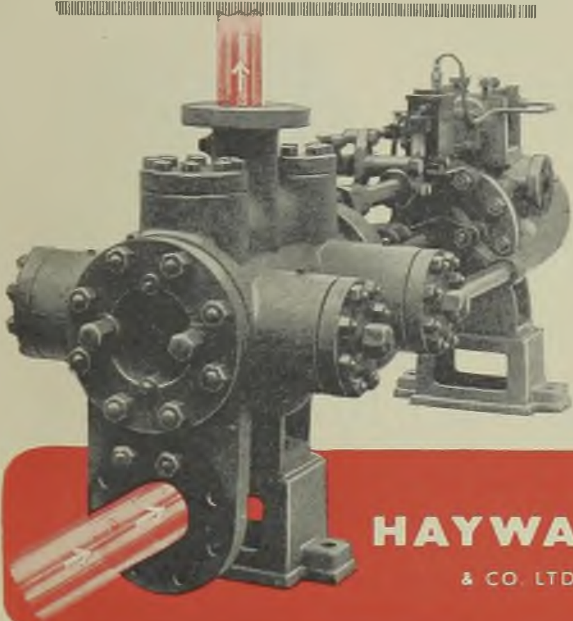

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