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Geology.

766. Aerial Photographs in Structural Mapping of Sedimentary Formations. L. E. Nugent, Jr. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 478–494.—The proper use of aerial photographs where the geologic–photographic relationships are favourable, can undoubtedly produce satisfactory structural maps more rapidly and economically than any other method.

It has been suggested that in areas of little relief the operator of the aerial plotting instrument should draw the complete map, leaving the topographer only the jobs of field inspection and completing the contours.

Factors controlling the use of aerial photographs in structural mapping are discussed, and the anticipated horizontal and vertical photogrammetric precision is indicated.

E. N. T.

767. Trimetrogon Aerial Photography. R. W. Disney. *Oil Gas J.*, 19.10.46, **45** (24), 112–115.—In trimetrogon aerial photography three cameras are arranged to take one vertical and two oblique photographs simultaneously, at intervals along the line of flight, thereby covering a strip about 35 ml wide in a single run. The inner edges of the obliques overlap the margins of the vertical photograph. Vertical photographs would call for parallel flight lines 3–4 ml apart, compared with 5–10 times this width for the trimetrogon method. The trimetrogon method may require only about one-fifth the number needed with conventional verticals, but there is some loss in accuracy of interpretation. The trimetrogon method is cheaper and quicker than the vertical method. Trimetrogon photographs can be employed to construct large-scale maps from conventional small-scale maps.

The geological interpretation of the oblique photographs is rather more difficult than for the verticals. G. D. H.

768. Development of Structures in Basin Areas of North-Eastern United States. J. R. Lockett. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 429–446.—The Upper Mississippi Valley had, until recently, been studied only in isolated areas, and consequently no general picture of it had been obtained.

As a result of recent work, however, it is suggested that, contrary to former belief, an area comprising Ohio, the southern peninsula of Michigan, Indiana, Illinois, and northern Kentucky should be considered as a distinct structural province. The major and minor features in this province are related, but not as the result of the uplift of either; and there is no evidence that direct lateral pressure caused by the Appalachian orogeny had any appreciable influence on structure west of the Pittsburgh–Huntington basin.

With the aid of stratigraphic evidence, it is suggested that the dominant positive structural features are underlain by the crystalline cores of pre-Cambrian mountain ranges, and that during the whole of the Palæozoic era the principal movement was the continued subsidence of the basins in between.

The effect of the weight of these basins and their drag on the positive features is considered. The drops of various regions have been investigated, and it is concluded that the Cincinnati Arch crest has dropped 2000 ft since the Trenton was deposited, while in the Logansport sag any individual bed is more than 1000 ft below its elevation at each end of the Kankakee–Wabash trend.

The directions of the lines of weakness and their extent are postulated, and the development of structures formed in the overlying sediments in the Pittsburgh–Huntington, Michigan, and Illinois basins is discussed.

Evidence is brought forward to support the opinion that the province in question was shielded from direct pressure by the formation of the Pittsburgh–Huntington basin; in fact, certain of the forces involved are the reverse of compressional, and the features are shown to be mainly the results of differential subsidence.

An experiment is described by which the general pattern of lines of weakness in this area was reproduced on a small scale.

With such an understanding of the history of this structural province, the direction of known trends can be explained. Further work remains to be done on this new basis. E. N. T.

769. California's No. 1 Proven Reserve. H. S. Norman. *Oil Gas J.*, 7.9.46, **45** (18), 70.—45 producers have been completed in Zone 237 and the related conglomerate-schist zones at Wilmington. Currently this zone is producing about 25,000 brl/day.

The field's cumulative production is about 305,000,000 brl, the production late in July averaging 121,180 brl/day. Remaining reserves at the end of June were placed at 329,971,000 brl.

The field has six major faults, and complexities in sand distribution and structure. The extent of the Zone 237 under the Long Beach Harbour waters is not known.

The sand of Zone 237 is coarse and interbedded with shale. Permeability ranges 50–1000 md.

Production at Wilmington was first found in 1925 when seeking to extend the Torrance field, but not until 1932 was commercial production established. Full-scale development began late in 1936. About 1500 wells have been drilled, most of them

producing from the Tar, Ranger, and Terminal pays. The gas/oil ratio has risen to about 1100 cu ft/brl. The original gas content of the reservoirs above Zone 237 is estimated to have been 708,553,510,000 cu ft, and 415,500,000,000 cu ft remain.
G. D. H.

770. Production Report—Salt Creek Pool. H. S. Norman. *Oil Gas J.*, 19.10.46, **45** (24), 136.—The Salt Creek pool of Kern County, California, lies 1½ ml northwest of the Cymric pool. It may be a plunging nose complicated by faults. The proven area is 100 acres, and a recovery of 800 brl/acre/ft is estimated. There is an effective water-drive. Production is from the Carneros (Miocene) and at depths of about 2800–3000 ft. Sand permeabilities of 1000–2500 md have been measured, and producing gas/oil ratios of 125–150 cu ft/brl. Porosities range 30–35%. Currently the production is 1700 brl/day. G. D. H.

771. Drilling at Mattoon. N. Williams. *Oil Gas J.*, 7.9.46, **45** (18), 80.—The Mattoon field of Coles County, Illinois, is about 9 ml long and ½–2 ml wide. Its oil reserve is estimated to be about 25,000,000 brl. Oil was discovered in 1939, but most development has taken place since mid-1945. The initial discovery was in the Cypress sand at 1875 ft. Some 313 wells have been drilled and 3,125,000 brl of oil has been produced. Production is obtained principally from the Cypress, Aux Vases, and Rosiclare. A few McClosky completions have been made. Strong gas flows and oil shows have been found in the Devonian. Sand conditions are variable.

Wells cost $15,000–$17,000 and involve no special problems. When two sands are produced they are not isolated. The crude is 38–40° A.P.I. The Cypress sand alone has a gas cap, and this covers less than 100 acres. G. D. H.

772. Stratigraphy and Structure of Traverse Group in Afton-Onaway Area, Michigan. W. A. Kelly and G. Wendell Smith. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 447–469.—The formations of the Traverse of middle Devonian age which outcrop in the Afton–Onaway area (about 50 sq ml in Cheboygan and west-central Presque Isle counties) are described, and the structural relationships determined from their distribution.

The scattered outcrops are correlated with the better-known sections bordering on the Lake Huron and Lake Michigan areas. The Bell Shale, Rockport Quarry limestone, Ferron Point formation, Genshaw formation, Newton Creek limestone, Koehler limestone, Gravel Point formation, and the Beebe School formation are described. They are correlated mainly on the evidence of the fossilized fauna they contain, but also with the help of sharp lithologic breaks between other subdivisions which are characterized by a uniform composition and texture between their upper and lower boundaries.

The fact that the Traverse in the area described is considerably less thick than the Traverse sections of the east and west is attributed to diastrophism.

A structural contour map based on these stratigraphic divisions is attached. It shows, from east to west, the Pigeon anticline, a small structural nose between two minor synclines, and the Black Lake anticline bordered on the east by the Onaway syncline. E. N. T.

773. Missouri ; Its Oil and Gas Possibilities. F. C. Greene. *Oil Wkly*, 9.9.46, **123** (2), 34.—At the end of 1945 Missouri had 43 active oil wells and 36 gas wells. Production is from the Mississippian, Devonian, and Pennsylvanian. In the southern part of the State there are shallow Pennsylvanian wells with small outputs. Some of them have gone to the pre-Cambrian. Asphaltic residues have been found in the Mississippian in some places. Structures are apparently gentle and some pools are due to lensing. In the northwestern counties potential producing horizons occur in the Pennsylvanian, Mississippian, and Devonian. Glacial drift obscures many of the surface structures. There is an unconformity between the Pennsylvanian and Mississippian. These two features call for well-planned exploratory work.

In southeast Missouri Cretaceous rests unconformably on Ordovician and Cambrian. Geophysical work should be used to discover structures in this area.

Maps show the structure and sites of pools in northwestern Missouri, and a generalized section is included. G. D. H.

774. Sedimentation in Permian Castile Sea. R. H. King. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 470–477.—The Permian Castile formation, having a relatively simple stratigraphy and well-defined boundaries, is a favourable starting point for a study of precipitated marine sediments. It varies in thickness from 1300 ft at the north end of the basin to 2000 ft at the south end, and consists mainly of " banded " or laminated anhydrite, though it also contains some small calcite lenses and some halite. It was laid down in the steep-walled Delaware Basin in southeastern New Mexico and western Texas. The Permian Sea which withdrew to this basin from a wider area at the end of Guadalupe time, was connected with the open sea through a shallow channel throughout Castile time.

It is generally accepted that the anhydrite of which most of the Castile formation consists is a chemical precipitate rather than a detrital deposit.

It is suggested that in the Delaware Basin the water was differentiated into an underlying concentrated brine, below wave base and ponded behind the barrier, and a surface layer of lesser density. In Castile time the more soluble salts passed out of the basin in the reflux of the underlying brine to the open sea ; but the less soluble salts were precipitated.

The preponderance of anhydrite over the halite indicates a scarcity of terrestrial water, and is adduced to support the suggestion that either the top of the barrier was below wave base, or the barrier was permeable.

The calcium sulphate was deposited as anhydrite rather than gypsum on account of the salinity of the Castile Sea. The characteristic lamination of the anhydrite can be ascribed to seasonal variations in temperature.

The theory of reflux is a modification of Ochsenius' bar theory adapted to explain the deposition of the Castile sediments. E. N. T.

775. Western Canada Mid-year Report. C. O. Nickle. *Oil Wkly*, 5.8.46, **122** (10), 3.—54 wildcats, 11 successful, were completed in 1945. 37 wildcats have been completed in the first half of 1946. The proven area of the Viking–Kinsella gas reserve has been extended from 100,000 acres to 250,000 acres. The reserve may be 1,000,000,000,000 cu ft in the Viking sand. On the southeast edge of the gas reserve oil has been found. 60 ml to the southeast gas has been found in the Viking sand and oil in the Lower Cretaceous. The Lloydminster field has been expanded. A flowing well has been completed in the " Taber " sand (Lower Cretaceous) of the West Taber field.

Gas and slight porosity have been found in two slices of Madison limestone on the Brazeau anticline. The upper reservoir gave 500 Mcf and a show of oil with a substantial increase in gas flow on acidization. A further test is expected on this structure.

A Lower Cretaceous gas well has been completed in the Alberta syncline.

The Lloydminster field has been extended into Saskatchewan.

Tables list the Alberta wildcat completions for the first half of 1946 and give the oil production by fields. G. D. H.

776. Depth Record for South America Established Second Time This Year. Anon. *Oil Wkly*, 19.8.46, **122** (12), 31.—Curazao A-2 east of the Cabimas area fields had reached a depth of 13,446 ft early in August. Previously South America's deepest well was Bajada 1 (13,206 ft) in Ecuador. Curazao A-2 is still in the Eocene and has not yet had shows of seemingly commercial importance. G. D. H.

777. Colombian Exploratory Activity. G. O. Ives. *Oil Wkly*, 5.8.46, **122** (10), 12 (International Section).—Concessions totalling 4,931,382 acres are held by 6 active oil companies. In July 14 wildcats were drilling. Velasquez 1 in the Upper Magdalena valley is expected to open a new field. Costa Rica 1 in the Lower Valley has had some shows. La Salena 1 in the Las Monas area has also had shows. Chorrea Manteca 4 is preparing to test sands between 5611 ft and 6795 ft, having been drilled to 7046 ft in the basement.

Some 15 geophysical crews are at work. G. D. H.

778. Tests on Wildcat Which May Open Colombia Field. Anon. *Oil Wkly*, 19.8.46, **122** (12), 31.—Velasquez 1 entered granite at 8450 ft after penetrating about 100 ft of conglomerate immediately at the base of the Tertiary. Oil stains have been noted in the conglomerate and shows in sands cored in the lower part of the Tertiary. The best shows were in the depth range 6400–8265 ft. A drill-stem test at 7254–7274 ft gave 15 stands of 30-gravity oil. G. D. H.

779. Spring Hill 3 Test Commenced by Chile. Anon. *Oil Wkly*, 26.8.46, **122** (13), 29.—Spring Hill 3 has been commenced on Isla Grande, 6 ml from the north end of the Straits of Magellan. Spring Hill 2 was completed dry at over 10,000 ft. Spring Hill 1 has never been fully completed, but latest guesses give its potential as 1500 brl/day. In the foothills to the northwest Pecket 1 is being drilled. G. D. H.

780. Completion Due Soon on Third Chilean Test. Anon. *Oil Gas J.*, 21.9.46, **45** (20), 163.—The third test on the Spring Hill structure is reported to have passed a depth of 7000 ft. It lies ½-ml southwest of the discovery well. G. D. H.

781. Dutch Coevorden Field Now Producing 630 brl Daily. Anon. *Oil Gas J.*, 12.10.46, **45** (23), 61.—At Coevorden the Cretaceous lies at depths of about 1050 ft. About 630 brl/day is being obtained from a sand which averages 75–85 ft in thickness. Richer structures may occur across the border in Germany. G. D. H.

782. " Cradle of Civilization " Scene of Oil Search by Standard of Egypt. W. W. Burns. *Oil Gas J.*, 19.10.46, **45** (24), 95.—The Abu Roash well, some 10 ml west of Cairo, reached granite at 6250 ft. The Sudr wildcat, 40 ml south of Suez, on test gave 22° A.P.I. oil at the rate of 275 brl/day. A second well is being drilled.

El Khabra on the Sinai–Palestine border has reached 5890 ft and is in limestone, possibly of Jurassic age. Wadi-Baba on the Sinai side of the Gulf of Suez has reached 4548 ft, being in schist. A test is to be drilled at Ras Abu Rudeis, 9 km due west.

Currently Egyptian Standard has three geological parties, one gravity meter, and one seismic party at work.

The Western Desert Province has Oligocene, Miocene, and Pliocene beds commonly covered by superficial deposits which render geophysical work necessary. G. D. H.

Geophysics and Geochemical Prospecting.

783. Magnolia Testing Offshore Formations in the Gulf. Anon. *World Petrol.*, 1947, **18** (3), 60–61.—Magnolia have leased 5 blocks of submarine land from Louisiana, which is to receive 12½% of all oil taken and rent for the properties. Two off-shore ventures, including the whole organization and equipment, are described and illustrated. F. S. A.

784. Marine Exploration Develops New Techniques. Anon. *World Petrol.*, 1947, **18** (3), 57–59.—Systematic efforts are being made to determine the presence of submarine oil—especially in the Gulf Coast and Bahamas areas. In addition to the air-borne magnetometer, radar is used to locate positions for gravimetric tests. Diving chambers are used when possible in making gravimetric observations on the ocean floor. Two types are described, together with a number of ingenious ways in which craft of various kinds have been adapted to serve as geophysical bases. The text is illustrated by photographs. F. S. A.

785. Russians Use Bacteriological Analysis in Oil Exploration. Anon. *Oil Gas J.*, 7.9.47, **45** (18), 60.—The presence of hydrocarbon bacteria in near-surface rocks and soil has been utilized to locate an important gasfield at a depth of 628 ft near Mikhailovsky. The bacteria utilize minute quantities of hydrocarbons seeping from the gas accumulation at depth. G. D. H.

Drilling.

786. New Heavy Duty Power Rig. Anon. *Petrol. Times*, 4.1.47, **51**, 22.—The operation of a new British heavy-duty drilling rig capable of drilling to over 16,000 ft is briefly described. R. B. S.

787. Diesel Electric Barge Rig Designed to Drill 15,000 ft Wells. K. M. Fagin. *Petrol. Engr*, Jan., 1947, **18** (4), 49.—The construction and operation of a 2100-h.p. barge rig drilling in the coastal area of Lousiana is described. R. B. S.

788. Seadrome-Type Offshore Foundation for Continental Shelf Operations. E. R. Armstrong. *Oil Wkly*, 27.1.47, **124** (9), 41.—A rig structure which is designed for sea work in depths from 20 to 200 ft and which provides a floating, portable, and seaworthy structure for the drilling operations is described. The principles of designing such structures are very briefly outlined. It is essential that a portable rig be buoyant so that it can be readily moved from one location to another. In an offshore area, such as the Gulf of Mexico, where gales frequently reach hurricane force, whipping up short, high seas of tremendous energy, seaworthiness, and all that the word implies, is of even greater importance than portability. Therefore, to insure the desired portability and seaworthiness in this type of rig, it must not only float, but must be of such strength and form that it will be unaffected by wind and waves while on service duty. This means that when the rig is floating it must have ample stability, capable of meeting all sea conditions without danger and be equally safe when resting on the ocean bottom. Further, it would appear desirable that when serving as a drilling base, the structural weight resting on the bottom should be variable within wide limits. In many locations the safe load-carrying capacity of the ocean floor may vary considerably with the result that if the loading value could not be reduced, settlement would result —with possible disastrous effects on the drilling operation. It is also necessary to be able selectively to adjust the vertical trim, or levelness, of the drilling rig to compensate for possible irregularities in the ocean bottom. Means must also be provided to make reflotation of the rig easy and reliable and to insure ample structural stability during all phases of the operation.

Experiments with a model show an openwork structure with a multiple buoyancy system very suitable for marine drilling. A. H. N.

789. Controlled Directional Drilling of Wells. Part 2. G. L. Kothny. *Oil Wkly*, 27.1.47, **124** (9), 36.—The use of the whipstock, knuckle joint, spudding bits, and of non-magnetic drill collars in orienting a bit for directional drilling is described and illustrated. The use of controlled directional drilling in different American fields is reviewed. The illegitimate application of controlled directional drilling in California was halted in 1935 when the Superior Court of the State of California, in and for the County of Los Angeles, in the case of Alphonso E. Bell Corporation, *et al*, Plaintiffs, *v.* Belleview Oil Syndicate, *et al*, Defendants, decided that one who drills an oil well on his own land and permits the drill to drift into the lands of another, and with knowledge of the bottom puts the well on production, is liable for trespass and for conversion of the oil taken from the other's land. And further, that the fact that at the time of the drilling of such wells, the facilities and applicances had not been perfected and the knowledge of drilling had not advanced so that directional drilling was an art and the drilling of straight holes was unknown, did not justify the operator in drilling into strange lands at a distance of 1500 ft from the surface location and placing his well on production at that point, notwithstanding the pool produced from extended into the lands of the drilling party. This court decision gave quite an impetus to direction drilling and well surveying.

Gylinder drilling refers to the drilling of a well, the course of which is described, and which must be held within a radius of 25 ft of this predetermined course. The course is plotted so as to avoid conflict with existing wells and to provide correct bottom hole spacing. Cylinder drilling is now widely used in California. Over 200 deflected wells with a footage of over 1 million ft have been drilled in the Huntington Beach area. About 40% of these are cylinder drilled holes. The angles of inclination vary from 30° to 65° off the vertical. More than 25 million brls of oil have been produced from directionally drilled wells in this field.

The use of relief wells to kill cratered wells is described. A. H. N.

790. Drilling Rigs are Going to Sea. J. E. Kastrop. *Oil Wkly*, 3.2.47, **124** (10), 33.—Several methods proposed for marine drilling—one of which visualized to be used down to 600 ft of water—are described. Gross designed sloping leg-derricks on skids and vertical derricks; Kirby's tower utilizes an octagonal structure; Robert proposes the use of prefabricated sections which can form a tower; Shrewsbury patented a floating column of 40-ft dia. × 200 ft long. Other designers propose ships, converted Landing Ships, Tanks (L.S.T.) fairlead and seadrome-type platform. Certain of these methods have been tested on model scales. A. H. N.

791. F.M. Radio Communication Aids Operation of Rigs. K. M. Fagin. *Petrol. Engr*, Dec. 1946, **18** (3), 174.—Small portable frequency modulation transmitters and receivers developed during the war can provide an efficient radio-telephone communication system up to a range of 60 ml. The installation and operation of such a system to assist in drilling operations is discussed, and detailed circuit diagrams are presented.

R. B. S.

792. Quick Remedial Work Solves Difficult Blow-out Problem. G. M. Wilson. *Oil Wkly*, 20.1.47, **124** (8), 34.—Several months after completing a well it was noticed that the pressure in the annular space between the 11¾-in. surface string and the 7-in oil string was increasing considerably In a short time the pressure caused the surface equipment to fail; the crew stripped off the whole of the surface equipment and let the well flow. With the well then flowing uncontrolled, but clear of surface obstructions, it was decided to construct a special packer in the form of an inverted liner hanger having inside and outside diameters that would enable it to be lowered down over the 7-in casing, the latter string still being at the top of the well and inside the 11¾-in surface string. Such a seal, it was believed, would effectively shut off the flow through the annulus. An 8⅝-in nipple, 10 ft long, with linear hanger on the lower end, and a 9-in, 6000-lb test-gate valve on the upper end was to be made up. Two 3-in horizontal valves were to be positioned a short distance below the 9-in gate to provide communication to the well after the large gate had been closed. It was believed that this assembly would position the packer about 12 ft below the base plate, a point believed below the ruptured portion of the surface string. The execution of these plans is described.

A. H. N.

793. Diamond Coring at Rangely, Colorado. R. W. Stuart. *Petrol. Engr*, Jan. 1947, **18** (4), 43.—The use of diamond tools for coring the Weber sand in the Rangely field of N.W. Colorado is described. Pressure coring methods were used in some runs.

R. B. S.

794. Controlled Directional Drilling of Wells. Part 1. G. L. Kothny. *Oil Wkly*, 20.1.47, **124** (8), 30.—The application of and principal factors for successful controlled directional drilling are described in this part of the paper. The applications are generally: (*a*) For drilling new wells which cannot be located directly above the desired completion point; (*b*) for redrilling wells where a correction in the natural course of the well is desirable or necessary. Under the first application come wells located beneath the ocean, lakes, or river bottoms, wells located under the piercement type salt dome overhangs, wells located around objectionable locations, where the surface topography makes drilling at an angle from a lower location preferable to deeper drilling through a hill, relief wells for bringing under control burning or blown-out wells, wells drilled on a physically restricted area, such as an island or pier from which a plurality of holes are drilled, from one location wells drilled at an angle into the formation so as to give greater penetration, multiple wells drilled from one location for the purpose of subsurface geological exploration. Under the second application come wells redrilled for the purpose of correcting excessive drift and direction, to straighten the well, to prevent trespass, to sidetrack lost tools, to direct the course toward the productive side of a fault, to direct a well back into a hole which caved in and was lost, and to direct the course of the hole away from edgewater into the productive zone.

The principal requirements are the correct use and interpretation of well surveying instruments and an accurate method of orientation and deflecting tools. Several methods and instruments are reviewed and illustrated.

A. H. N.

795. Directional Drilling in the Mid-Continent Area. C. P. Collins. *Oil Wkly*, 24.2.47, **124** (13), 32–34.—The many applications of directional drilling in the Mid-Continent area fall in the following general classifications: (1) Sidetracking and redrilling; (*a*) Sidetracking lost tools and drill pipe; (*b*) Correction of vertical drift and direction. (2) Drilling to pre-determined points; (*a*) Inaccessible surface locations; (*b*) Relief wells; (*c*) Fault lines; (*d*) Unconformities; (*e*) Gas, oil, and water contacts; (*f*) Geologic exploration and exploitation of stratigraphic traps.

Several illustrative examples are briefly described.

A. H. N.

796. Hydraulic Drives in the Oilfields. N. A. D'Arcy, Jr. *Petrol. Engr*, Feb. 1947, **18** (5), 90. (*Paper presented before A.I.M.E. Petroleum Division*, Los Angles, Oct. 1946.)—Hydraulic drives are of two types: (1) hydro-kinetic drives—which depend on the kinetic energy of the hydraulic fluid—*e.g.*, hydraulic couplings and hydraulic torque converters; and (2) hydrostatic drives—which depend on the pressure of the hydraulic fluid—*e.g.*, hydraulic motors and hydraulic pumps. The basic principles of these two types, and the characteristics, applications, and limitations of hydraulic couplings and torque converters and of hydro-static drives, generally, are each discussed. R. B. S.

797. Chemistry of Acid Treatments for Mud Removal. C. E. Clason. *Oil Wkly*, 24.2.47, **124** (13), 41.—The use of acid to remove mud containing carbonates is twofold in accomplishment, in that a double or greater base exchange is not only possible, but apparently takes place by solution of the carbonates. Muriatic or hydrochloric acid will accomplish this, and if not available, calcium chloride will be much more efficient in washing in wells than plain water in any type of formation. Mud with no carbonate can be more efficiently removed with a mixture of calcium chloride and acid, and calcium chloride alone is also more efficient than plain water. There should be no ingredients in the acid that form insoluble compounds with any of the mud constituents. Any acid whose salts are soluble will work, but hydrochloric is cheaper and universally used. The base exchange will always occur with any mineral acid but the Ca and Mg salts, when carbonates are present, should be soluble also to assist in replacing the Na of the clay. A. H. N.

Production.

798. Development of Well-head Equipment. J. E. Eckel. *Petrol. Engr*, Dec. 1946, **18** (3), 188.—A summary is presented of the development of well-head equipment during the last 20 years. R. B. S.

799. New Method for Increasing the Permeability of Sandstone Layers in Oil Wells. H. J. M. W. De Quartel. *Ingenieur*, 28.3.47, **59** (13), 9.—An electrical method is suggested using the well casing as the cathode, the anode being placed 3–6 ft under the production zone. The method is particularly useful for sandstone containing clay or firmly bound water.

It is also suggested that the method could be used for the breaking of water–oil emulsions. N. C.

800. Some Permeability Experiments on Cores from the Stevens Sand, Paloma Field, California. K. T. Miller, F. Morgan, and M. Muskat. *Producer's Monthly*, Nov. 1946, **11** (1), 31.—Experiments were performed to measure the permeability to oil in clay-containing sands, partially saturated with water or after exposure to water. The experimental procedure is described and the results are shown tabularly and graphically. The average ratios of permeabilities of the unextracted cores (*i.e.*, untreated cores as obtained from the formation) for oil, fresh, and salt water, to the permeability for air were found to follow three empirical rules, viz.—

$$\frac{k_o}{k_a} = 0{\cdot}43 \quad \frac{k_w}{k_a} = 0{\cdot}01 \quad \frac{k_{s.w.}}{k_a} = 0{\cdot}07.$$

The experiments also show that the permeability to oil after flooding with water is much less than prior to flooding. This supports the suggestion that oil-base muds should be used when drilling-in clay containing producing rocks. Six references are given. R. B. S.

801. Liner Job Well-Remedial Work in the East Texas Field. D. W. Akins, Jr. *Oil Wkly*, 13.1.47, **124** (7), 32.—Due to the shale streaks in the Woodbine sand being non-uniform in thickness, the production problems from this field are complex. The problems discussed in detail are, however, specific to the field and reference should be made to the charts and diagrams to understand the special solutions to them. The steps taken to exclude water or reduce it to a minimum are discussed in detail. A. H. N.

802. Influence of Temperature on Oilfield from Uncemented Sands under Gravitatonal Flow. S. L. Zaks. *Petrol. Engr*, Nov. 1946, **18** (2), 147. (*Translated by A. A. Boehtlingk from paper published in Izvestiya Akademii Nauk S.S.S.R.* (*Otdelenie Tekhnicheskikh Nauk Bull Acad. Sci. U.R.S.S., Cl. Sci. Techn.*).)—The surface tension, viscosity, and adhesion tension of crude oil all decrease with increase of temperature, irrespective of the composition of the crude (provided this remains constant) or of the reservoir sand. There is, however, another factor to be borne in mind; it is that temperature increases will result in decreasing the volume of gas dissolved in the crude (thus varying its composition) and cause an increase in the viscosity of the oil, which will probably offset the expected decrease in viscosity due to rise of temperature. Experiments, which are described, were therefore devised for measuring the overall effect of temperature on oil yield. The crude used in these experiments was a light Maikop crude (S.G. 0·832) and the sand used was in two grades both being loose, uncemented sand having a porosity of 41·42%, but one having a grain size of 0·25–0·10 mm and the other having a grain size of 0·10–0·01 mm: the temperature range studied was from 20° C to 100° C, and the slope of the sand-packed tube was varied from 5° to 40°.

The results of these experiments, which are presented tabularly and graphically, show that increasing the temperature increases the oil recovery and that the maximum rise in % recovery was observed for increases in temperature from 20° C to 60° C. The temperature effect was also found to increase with decrease in grain size and with decrease in slope. The author concludes that heating oil sands, particularly those having small grain size and containing a high viscosity crude, would profitably increase the % recovery. Six references are appended. R. B. S.

803. Quick-Freezing Seals Fluid Content in Cores. J. D. Wisenbaker. *Petrol. Engr*, Jan. 1947, **18** (4), 75.—The usual methods of core cutting result in the flushing of cores by drilling mud and the expulsion of some fluids by the release and expansion of gas as the core is withdrawn to the surface. However, these processes are usually sufficiently consistent for a given set of reservoir conditions, that measurements of fluid saturations, porosity and permeability, if made upon the core *immediately on reaching the surfaces*, can be used to interpret the production to be expected. If, on reaching the surface, the core is not immediately attended to, it will begin to absorb more water from the drilling mud, and, on exposure to the atmosphere, it will begin to lose oil and water by evaporation: thus the value of a core analysis rapidly deteriorates with the delay. Research has shown that the most satisfactory method of preserving cores for a delayed analysis was by the use of a quick-freezing process.

Porosity and permeability measurements were made on a variety of consolidated sand cores before and after quick freezing (*a*) with cores fully saturated with water and (*b*) with cores partially saturated with gas, for various gas saturations up to 55% of pore space. The effect of quick freezing on oil and water saturation was also examined. The results are presented tabularly and graphically. They show that: (1) No appreciable change in porosity was caused by quick-freezing samples fully or partially saturated with water; (2) No appreciable change in permeability was noted for samples above 10% gas saturation; (3) Samples fully saturated with water but having permeabilities above 10 millidarcys showed no substantial change in permeability; (4) Samples fully saturated with water, but having permeabilities below 10 millidarcys showed some change in permeability; (5) The fluid saturations of cores appear to be preserved indefinitely: saturation analyses on cores at times varying from 20 hr to 30 days after freezing failed to detect any variation in fluid saturations.

The author concludes that the physical characteristics and fluid content of cores can be preserved almost indefinitely by quick freezing fresh-core samples as they are taken from the well. R. B. S.

804. Chemical Resolution of Oil-in-Water Emulsions. L. T. Monson. *Petrol. Engr*, Dec. 1946, **18** (3), 116.—The most common petroleum emulsions are the water-in-oil type, but in certain circumstances wells have been known to produce oil-in-water emulsions. High water–oil ratios, soft and somewhat alkaline waters, and dense crudes, are all conducive to this type of emulsion. They are less stable than the water-in-oil type and although the amount of emulsified oil remaining after settling is often very small it is usually sufficient to cause pollution of surface waters if run to waste; prevention of this is the chief reason for its removal.

Increased settling time alone is not sufficient. Attempts were made by the use of alum and similar salts to produce a floc which would collect the oil by a filtering action as it settled to the bottom or rose to the surface. Unfortunately these reagents were very corrosive, and the oil recovered retained so much water that it had to be passed through the water-in-oil emulsion treating plant: however, the presence of the metallic floc electrolytes in the recovered oil completely upset the normal electrical and chemical methods of dehydration of water-in-oil emulsions and made them unworkable. The results forced the complete abandonment of this process. However, the use of several proprietary chemical reagents of undisclosed but complex chemical composition was found satisfactory for treating-oil-in-water emulsions: these reagents seem to present the only satisfactory solution to the problem. R. B. S.

805. Pressure–Temperature–Gravity Relations in Wells Producing Oil and Gas. Part 1. F. K. Beach. *Oil Wkly*, 17.2.47, **124** (12), 18–23.—In wells producing liquid phase oil and gas, the sp. gr. of gas in a static column is likely to be lighter than in a moving column even after removal of liquid oil in a separator; the gravity of the gas appears to be a function of the temperature gradient in the wells and the equilibrium conditions between liquid and gas hydrocarbons at the time static conditions are set up by shutting a well in. When a well produces only gas and condensate, gravitational sorting is insufficient to lower the gas gravity. When computing the weight of a gas column, the mean of conditions at 2–8/10 of the depth can be used to integrate for mean conditions in the column. From one family of curves representing pressure gradient in gas columns having a stated specific gravity and temperature gradient, corrections are developed for other gravities and temperatures. Conversely, given any two of the variables, the other can be found.

Methods used for determining the temperature and pressure gradients down a well and for calculating the gravity of the gas column as affected by these two factors as well as by water vapour and H_2S content and by the deviation of the compressibility of the gas from theoretically ideal states and laws are described. A. H. N.

806. Pressure–Temperature–Gravity Relations in Wells Producing Oil and Gas. Conclusion. F. K. Beach. *Oil Wkly*, 24.2.47, **124** (13), 35.—The mathematical derivation of the formulæ used for calculating the weight of a gas column in a well are given. Actual gradients of pressure in several wells are presented and analysed. Comparison with theory are made and practical application is suggested. A. H. N.

807. Recent Advances in Air–Gas Drive Recovery. D. E. Menzie, R. F. Neilson, and S. T. Yuster. *Producer's Monthly*, Dec. 1946, **11** (2), 14. (*Paper presented at the 10th Annual Secondary Recovery Conference, School of Mineral Industries, Pennsylvania State College.*)—Experiments were performed to determine the effect of absolute pressure (as distinct from pressure differential) on the performance of air–gas drive reservoirs. The results of these experiments showed that the absolute pressure has no effect on the time (*i.e.*, production rate) nor on the gas volumes as measured at the mean pressure. Experimental work also showed that increasing the water saturation at the same time as gas injection tended to increase oil recovery. Although these experiments were carried out on cores which were initially 100% oil saturated it seems that this general conclusion would apply at least to sands having a high initial oil saturation. Three references are appended. R. B. S.

808. Production from Long Cores by Air–Gas Drive. R. J. Day. *Producer's Monthly*, Jan. 1947, **18** (3), 16. (*Paper presented at 10th Annual Secondary Recovery Conference, School of Mineral Industries, Pennsylvania State College*).—Experiments are described for estimating saturation distributions in cores by measuring pressure distributions and relative permeabilities. These experiments showed that, in the case of certain sands, production was faster and less gas was required to reach a certain saturation when flowing from a higher to a lower permeability than when flowing in the reverse direction: applications of this fact to field practice are suggested. The use of diaphragms which are impervious to gas or to water and gas is also discussed. Six references are appended. R. B. S.

809. Corrosion Problems in High-Pressure Distillate Wells. R. L. Hock. *Oil Wkly*, 27.1.47, **124** (9), 33.—The cost of corrosion in producing from high-pressure distillate wells is briefly indicated. Several methods are followed in the Cotton Valley distillate field to detect corrosion. Some of these are: (1) During regular field work it is customary to inspect the field lines, tubing, valves, or equipment for corrosion as they are being changed, or worked upon. Experience has taught the field men which points and places are most likely to be attacked, thus aiding in detection. (2) Line walkers are used to continually patrol the pipelines, checking junctions, Christmas trees, and pipeline equipment. (3) Well checkers, whose principal function is regulating flow of wells, check every regular producing well at least twice a day for small leaks and report them when found. (4) Visual examination and checks of meter runs, flow lines, and equipment are made periodically by the welder and field crews by cutting them open for inspection where practical. (5) Penetron survey has been made on all regular producing wells, some of the expansion bends, gathering system junctions, and injection system loops. This type of survey permits inspection of lines without having to cut them open and allows normal operation of the lines while being tested. (6) Electrical surveys to determine need for insulating wells from flow lines. (7) Use of tubing calipers.

Several methods of reducing corrosion are available; at present sodium chromate is used in one well and a 5% by vol of naphthenic acid in seal oil is being found effective in preventing corrosion in 2 wells. Corrosion is found to increase with rate of production. A. H. N.

810. New Technique Combats Electrolysis. R. B. Walter. *Oil Wkly*, 3.2.47, **124** (10), 18–21.—With certain qualifications, corrosion may be said to be caused by chemical and electrolytic action. Some electrical action occurs whenever chemical compounds are dissolved and/or ionized, and new ones formed, so that to assert that one type of corrosion is purely chemical is incorrect. Nor can it be said that corrosion is purely electrolytic since there is an attendant chemical action when an element is dissolved by the electrolyte. Several chemicals or chemical compounds are now being used to combat chemical corrosion with varying degrees of success. About a year ago a new technique employing a mechanical or metallic treater was introduced to combat electrolytic corrosion or electrolysis, as it is properly called. The initial field of operations was an area in Southern California where electrolysis was so severe that only a two weeks' run for a pump was not uncommon. The treater, which was installed in a "hot" well and where electrolytic corrosion was more severe, consisted of a 15-ft rod threaded at each end, on which was strung an alternating series of copper and zinc plates, which began and ended with the former, so that there was one more copper plate than zinc. Each plate was separated from the next by a brass spacer ring. The plates and spacer rings were drawn together and held by nuts screwed on to each end of the rod. Several tests were made on very corrosive wells which show that the well equipment is protected at the expense of the zinc plates which are dissolved. The number of pulling jobs per month were consequently reduced. The action of the treater is explained. A. H. N.

811. Conversion Graph for Open Flows of Gas Wells. W. F. Martin. *Petrol. Engr*, Dec. 1946, **18** (3), 49.—Natural gas volumes are frequently reported at a pressure base of 16·4 p.s.i., whereas these data are often required based on a pressure of 14·65 p.s.i. (*i.e.*, atmospheric pressure). Conversion can be carried out rapidly by means of a slide rule or a conventional graph, but such computations are not sufficiently accurate for most purposes. The author has designed a graph to convert volumes based on a pressure of 16·4 p.s.i. to a pressure base of 14·65 p.s.i. This graph, which is illustrated, is capable of reading accurately to three decimal places, and its use is demonstrated by four examples. R. B. S.

812. Design, Installation, and Operation of Gas-Lift Equipment. L. F. Davis. *Petrol. Engr*, Dec. 1946, **18** (3), 60.—Gas-lift equipment is usually one of three main types. These are: (1) the automatic differential controlled flow valve, (2) the sp.-gr. controlled flow valve, and (3) the surface controlled intermitters and flow valves.

The automatic differential controlled flow valve is usually spring actuated; and is designed so that the valve opens to admit gas over a predetermined range of differential pressure between the gas in the annulus and the fluid column in the tubing. The sp.-gr. controlled flow valve depends for its action on the differential pressure between a light oil and the fluid column in the tubing : when the sp. gr. of the fluid in the tubing is greater than that of the light oil, a diaphragm which separates them is flexed inwards so that the valve is open. The sp. gr. of the light oil is such that it is less than that of the static fluid column but greater than that of the aerated fluid column. Thus, when the fluid becomes aerated so that its sp. gr. is less than that of the light oil, the diaphragm is flexed outwards and the valve closes. Three types of intermitter valves are also discussed ; these are : (1) wire line controlled, (2) casing pressure controlled, and (3) tubing controlled valves.

In designing a gas-lift installation the necessary data are : (1) the static liquid level, (2) the producing liquid level, (3) the submergence, (4) the gravity of the liquid, and (5) the gas pressure available. The various formulæ for determining valve spacing are briefly discussed.

Finally, the operation of gas-lift equipment is discussed and several examples from field tests are given. R. B. S.

813. Use of Plugging Agents. H. T. Kennedy. *Producer's Monthly*, Dec. 1946, **11** (2), 25. (*Paper presented before A.P.I.*, Chicago, Nov. 1946.)—See Abstract No. 356 (1947).

814. Pumping Unit Design Lowers Rod Acceleration. J. B. Wrigley. *Petrol. Engr*, Jan. 1947, **18** (4), 92.—The author derives the following expression for polished rod acceleration :

$$a = \frac{w^2rL}{l}\left[\cos\theta + \frac{c\cos 2\theta + c^3\sin^4\theta}{(1 - c^2\sin^2\theta)^{3/2}}\right]$$

where a = polished rod acceleration w = angular velocity of wrist pin, r = crank radius, L = distance of polished rod from samson post measured along walking beam, l = distance of upper pitman bearing from samson post θ = wt, crank angle from vertical, c = ratio of crank radius to pitman length : all dimensions are in feet, seconds, and radians. Using this formula the author suggests a new design for pumping units having a lower ratio of crank radius to pitman length, and with crank and pitman on the same side of the samson post as the well. This design would reduce the polished rod acceleration resulting in increased sucker rod life. R. B. S.

815. Power Distribution Systems for Oilfield Pumping Service. Part 3. W. C. Bloomquist and J. N. Moore. *Oil Wkly*, 13.1.47, **124** (7), 46.—In this, the concluding part of the paper, extensive tabulated and graphical data are presented for line resistances and voltage drops, transformer bank requirements, loads and voltage drops, and for costs. Typical oilfield installations and costings are analysed in some detail and problems solved in full. A. H. N.

816. Secondary Recovery and Natural Gasoline Industry are Developments of Bradford Field. G. G. Bauer. *Producer's Monthly*, Nov. 1946, **11** (1), 22.—The developments of water-flooding practices and of the methods for the extraction of natural gasoline in the Bradford field are briefly reviewed. R. B. S.

817. A Study of the Possible Application of Capillary Diaphragms in Secondary Recovery. K. W. Smith and S. T. Yuster. *Producer's Monthly*, Nov. 1946, **11** (1), 39. (*Paper presented at the* 10*th Annual Secondary Recovery Conference, School of Mineral Industries, Pennsylvania State College.*) The existence of semipermeable diaphragms is well known in the laboratory : these may be regarded as consisting of a bundle of minute capillaries which allows the passage of a wetting fluid under any positive pressure but resists the passage of a non-wetting fluid at all pressures below the displacement pressure. The displacement pressure is defined as the pressure necessary to cause a non-wetting fluid to penetrate a permeable medium which is 100% saturated with the wetting fluid : it can be defined mathematically by the equation :

$$P = \frac{1}{r}\,2T\cos\sigma$$

where P = displacement pressure, r = radius of capillary, T = interfacial tension,

σ = contact angle; thus if r is very small (as in a semipermeable diaphragm) P is very large, and the diaphragm is effectively impermeable to non-wetting fluids at all ordinary pressures.

Research has been carried out in an attempt to find a diaphragm that would permit the passage of oil and not of gas or water, and that could be adapted to field use (*i.e.*, to line the face of a producing sand). It is not sufficient to make the sand face oil-wet since the displacement pressure is only small (the radius of curvature factor for a permeable sand being large): in fact the gas–oil or water–oil ratio would be expected to increase under these circumstances since the effective permeability of a non-wetting fluid is always greater than that of a wetting fluid.

A diaphragm adaptable to field use must therefore meet two essential requirements: (1) the displacement pressure must be in the range of hundreds or thousands of p.s.i. (*i.e.*, above the reservoir pressure; otherwise water—the non-wetting fluid—will also pass through it) and (2) it must be stable under these high pressures. Calculations show that permeabilities of the order of 10^{-5} to 10^{-6} md are necessary to produce diaphragms having a displacement pressure of 200 p.s.i., but it should be noted that: (1) the thickness of the diaphragm is very small and the production rate *may* not be affected to the extent that this low permeability may suggest, and (2) the displacement pressure is not a function of thickness so this may be as small as is consistent with stability.

The problem of getting a diaphragm in the well may be solved by the use of one of three methods: (1) injection of fluids which will react and precipitate a diaphragm on the sand face, (2) supporting the diaphragm on a liner, and (3) injecting suitable materials with the cement to build a sheath around the well bore. Preliminary laboratory and field experiments have so far indicated that it is possible to form diaphragms having a permeability to oil of 0·1 md corresponding to a displacement pressure of 6 p.s.i. by two methods: (1) injection of a 1% amine acetate solution followed by a 1% sodium disilicate solution and a 0·1% solution of octadecylamine, and (2) supporting an aggregate of finely ground galena (treated with either potassium amyl xanthate or sodium oleate) and colloidal graphite or carbon black on a liner; antimony sulphide could be used in place of galena. Carbon-black diaphragms, having displacement pressures up to 60 p.s.i. were made, but these were unstable when tested in the field. Other substances were tested, notably silicones, but without satisfactory results.

Diaphragms for field use need to have displacement pressures much above 60 p.s.i. It is believed that further experimentation could produce a diaphragm having the required displacement pressure, but it may not be possible to produce them sufficiently thin to prevent much effect on production.

Four references are given to papers, and 8 to patents. R. B. S.

818. Secondary Recovery Production Research. (A Monthly Review). Low pH Waters Show High Throughput Rates in Laboratory. R. V. Hughes. *Producer's Monthly*, Dec. 1946, **11** (2), 8.—The effect of the pH of input waters on throughput rates seems to depend on the principles of base exchange between the water and the clay minerals in the sands, since these govern the degree of flocculation: flocculated clays tend to be more permeable than deflocculated clays. Another factor may be the removal of cementing material by the chemical action of low pH waters.

In general, low pH waters seem to be preferable for water flooding since they are usually conducive to higher input rates and are inhibitory to organic growth. Unfortunately they are corrosive in most circumstances, but promising work has recently been done in the field of corrosion inhibition.

Three references are given. R. B. S.

819. Chemical Agents in Water Flooding. P. L. Terwilliger and S. T. Yuster. *Producer's Monthly*, Nov. 1946, **11** (1), 42. (*Paper presented at 10th Annual Secondary Recovery Conference, School of Mineral Industries, Pennsylvania State College.*)—It is well known that water-soluble surface active agents capable of reducing oil–water interfacial tensions are not suitable for field use owing to the fact that they concentrate at the interface and are absorbed by the sand body. Experiments were therefore carried out to test the value of the following methods for reducing oil–water interfacial tensions: (1) pumping a solution of oil-soluble wetting agent into the sand ahead of the water, (2) injecting reactive gases into the sand before flooding, and (3) using water-soluble surface inactive agents which disperse throughout the water body instead of concentrating at the interface and are less likely to be absorbed. These experiments are briefly described.

The experimental results show that : (1) oil-soluble wetting agents do not increase recoveries, and they are also absorbed by the sand ; (2) reactive gases did not give encouraging results ; and (3) water-soluble surface inactive compounds appeared to have no effect. R. B. S.

820. Capillary Pressure in Secondary Recovery. J. W. Amyx and S. T. Yuster. *Producer's Monthly*, Dec. 1946, **11** (2), 10. (*Paper presented at 10th Annual Secondary Recovery Conference, School of Mineral Industries, Pennsylvania State College.*)—The application of capillary pressure data to secondary recovery problems includes determination of connate, water saturations, residual oil saturations, and similar fundamental properties. The capillary pressure–saturation relations must be considered as involving three phases, *i.e.*, gas, oil, and water. A preliminary study was made of the four basic systems : (1) air into oil, (2) air into water, (3) oil into water, and (4) water into oil.

The preparation of samples and the experimental technique are each described. The principle of operation of the apparatus is that of applying an external pressure to the displacing fluid, thus causing flow of the saturating fluid until equilibrium is reached in the system. At equilibrium the capillary pressure of the saturating fluid is equal to the pressure of the displacing fluid. The volume of fluid displaced is measured by the difference in readings in a pipette, and thus the corresponding fluid saturations could be determined. The relation between capillary pressures and the corresponding fluid saturations was determined for three cores having permeabilities of 2 md, 35 md, and 314 md and the results are presented graphically : these results confirm the findings of other investigators, and it is recommended that further work be done on these lines.

Six references are appended. R. B. S.

821. Bacteria Helps to Produce Oil. Anon. *World Petrol.*, 1947, **18** (3), 76–77.—The paper describes further (see Abstract No. 54 (1947)) the work of ZoBell on the rôle of bacteria in oil production (A.P.I. Project 43A). It has been established that certain bacteria can carry out their life cycles under the conditions prevailing at great depth in the earth's crust, and they can physically displace films of oil from sediment particle surfaces by reason of their marked affinity for solid surfaces. Pennsylvania Grade Crude Oil Association is co-operating in large-scale field trials to use this bacterial detergent action to assist in secondary oil recovery. F. S. A.

822. Unitization Programme for West Cement Medrano. K. M. Fagin. *Petrol. Engr*, Feb. 1947, **18** (5), 160.—The proposed plan of unitization for the Medrano sand pool in the West Cement field of Oklahoma is reviewed. Some brief data are given on production, reservoir data, and recovery estimates for this pool. R. B. S.

823. History of Water Flood Development. D. T. May. *Producer's Monthly*, Nov. 1946, **11** (1), 24.—A brief account is given of the developments in flooding patterns, pressure plant, coring, research, and water treatment in the Bradford field.

R. B. S.

824. Fundamental Chemistry of the Effects of Hydrogen Ions on Water Intake Rates of Oil Sand. L. E. Miller. *Producer's Monthly*, Nov. 1946, **11** (1), 35.—The properties of such clays as are usually found associated with oil sands, and the effects of contacting these clays with various types of water, are discussed.

Clay will absorb water added to it until, when sufficient water is added, a plastic mass is formed, this absorption being accompanied by swelling. Further addition of water causes a separation of the clay particles with the formation of a dispersion. The data examined lead to the following generalized conclusions : (1) The isoelectric points (which define the conditions of minimum swelling) for the clay ampholytoids present in oil-bearing sands are on the acid side of neutrality ; (2) Flood waters of low pH will tend to cause shrinking and flocculation of these clays—this permits greater flood water intake rates ; (3) Neutral flood waters and flood waters of high pH tend to swell and deflocculate the clays; (4) Brines have an effect similar to flood waters of low pH; (5) Flood waters so low in pH as to have entered the zone of increased swelling on the acid side of the isoelectric point are unlikely to be used owing to their extreme corrosivity; (6) It seems probable that the concentration of ions other than the hydrogen and hydroxyl ions may also effect the swelling of clay minerals.

An excellent bibliography of 84 references is appended. R. B. S.

825. Water-Flood Tests on Long Cores. R. A. Morse and S. T. Yuster. *Producer's Monthly*, Dec. 1946, **11** (2), 19. (*Paper presented at 10th Annual Secondary Recovery Conference, School of Mineral Industries, Pennsylvania State College.*)—The paper describes experiments devised to study the effect of pressure gradients (*i.e.*, pressure differentials) on the residual oil saturations of water-flooded cores. The experimental results are shown tabularly and graphically and lead to the following general conclusions: (1) flooding gradients have little effect on the residual oil saturations, and (2) the properties of the oil, and especially its content of polar compounds, effect its recovery by water flooding.

One reference is appended. R. B. S.

826. Following Air–Gas Drive with a Water Flood. R. V. Hughes. *Producer's Monthly*, Jan. 1947, **11** (3), 8.—A brief description is given of some experiments designed to test the effect of flooding cores of Venango sand which have been subjected to gas drive. Although many operators believe that the Venango sands cannot be successfully flooded, these experiments seem to suggest that a water flood following an air–gas drive would be economical for this type of sand. The author suggests that further work be done on the selines to test the validity of these results. Seven references are appended. R. B. S.

827. Control of pH in Flood Water Treatment. Anon. *Oil Wkly*, 24.2.47, **124** (13), 52.—The elements of pH significance, measurements, and control are presented. The effect of pH on corrosion rates are similarly briefly discussed. A. H. N.

Oilfield Development.

828. July Completions Down: Upward Trend Expected. Anon. *Oil Wkly*, 19.8.46, **122** (12), 71.—During July 2328 wells were completed in U.S.A. 1238 found oil and 187 found gas. The average rate of completion up to the end of July was 530 per week compared with 48 per week for the same period of 1945. 2398 wells were completed in June 1946. Compared with 1945, Texas, Oklahoma, Louisiana, Colorado, Illinois, Indiana, Kansas, and Kentucky show increased completion rates, while California, New Mexico, Mississippi, and West Virginia show decreased rates.

A table summarizes by States and districts the U.S.A. completion results for July and for the first 7 months of 1946. G. D. H.

829. New Oil Reserves Discovered in 1946. H. J. Struth. *Petrol. Engr*, Feb. 1947, **18** (5), 43.—A brief review is given of new reserves discovered in the U.S. in 1946: most of these were additions to developed fields. The cost of finding oil is also discussed. R. B. S.

830. Deep Exploratory Wells on Increase. E. Adams. *Petrol. Engr*, Feb. 1947, **18** (5), 51.—The increase in deep exploratory drilling during recent years is briefly discussed. A tabulated summary of data on 325 wells drilled to 12,000 ft and over is also presented. These data consist of (1) total depth and elevation, (2) date spudded, (3) date completed, (4) company and well, (5) location, county, and state, (6) deepest formation, (7) producing formation, (8) casing schedule, (9) initial production (if any), (10) crude gravity, (11) choke diameter, (12) pressure, (13) gas–oil ratio, and (14) other remarks. The table is right up to date, the last entry being the 16,668 ft Pacific Western Well drilling in Kern County, California. R. B. S.

831. Bradford Field Production. G. G. Bauer. *Producer's Monthly*, Nov. 1946, **11** (1), 29.—A brief survey is given of the production from the Bradford field from the time of the discovery of the Bradford Third Sand in 1871. R. B. S.

832. Third Spring Hill Test Comes in as Gas Well. Anon. *Oil Gas J.*, 26.10.46, **45** (25), 78.—Spring Hill 3 has found the sand 111 ft higher than in the discovery well. The casing is set at the top of the sand and the gas–oil ratio will be too high for the well to be produced in its present condition. A fourth well is to be drilled ½-ml to the east. G. D. H.

833. Sinclair Panama Given 20-Year Concession for Isthmian Production. W. W. Burns. *Oil Gas J.*, 5.10.46, **45** (22), 42.—Sinclair Panama Oil Corp. has recently been granted concessions covering 17,762,500 acres in Panama. A summary of the conditions is given.

A number of dry wells have been drilled in past years, and the Garachine well had some non-commercial production. Gas was struck in one of the wells drilled on Columbus Island. G. D. H.

834. Creole's August Output at 581,519 Brl Daily. Anon. *Oil Gas J.*, 19.10.46, **45** (24), 94.—Creole brought in 23 wells in August, 9 at Bolivar Coastal, 8 at Jusepin, and 1 each at Mulata, Quiriquire, and San Joaquin. There were 3 successful exploratory wells. G. D. H.

835. Europe's Lagging Production. W. N. Small. *Oil Wkly*, 5.8.46, **122** (10), 16.—In the past 2 years Europe's oil production has been below 1938 levels. During the past few years the U.S.S.R. production is estimated to have been 18–25 million metric tons per year. During the war some 3000 wells were destroyed, their annual yield being 5 million tons. Devonian oil has been found in the Samara Bend, in Tuimazy, at Severokamsk, and Shuguarovo. In the Baku area a new oilfield has been found at Buzovny. Tash-Kala is a new field in the Grozny area.

Roumania's production is estimated to have been 4,640,000 metric tons in 1945. This compared with 3,507,000 tons in 1944 and 8,700,000 tons in 1936. 524,400 ft was drilled in 1945, about half the pre-war average. Some refineries were rebuilt in 1945.

In 1944 Austria produced 1,210,000 metric tons of oil. The 1945 output was 550,000 tons according to one estimate. Production is being obtained at Zistersdorf, Hokensruppersdorf, and Muehlberg. Oil deposits are said to be under investigation near Vienna, Graz, and elsewhere in the Alpine foothills.

Hungary's main field is at Budafapuszta. In 1944 the output exceeded 800,000 tons. Bukkszek is a small field in the northeast. Output declined to 650,000 tons in 1945. During 1940 Germany's production may have exceeded a million tons; it declined to about 700,000 tons in 1944, and possibly 500,000 tons in 1945. Poland's production fell from over 500,000 tons/year before the war to 350,000 tons in 1944. The richest producing area was ceded to Russia. Albania's production may have reached 200,000 tons/year, but may have been only 100,000 tons in 1944.

During 1943 Britain produced 100,000 tons; at the end of 1945 the rate was 70,000 tons/year. Germany raised France's production to over 75,000 tons/year; in 1945 the rate was about 56,000 tons. During the war Czechoslovakia's production rose to about 30,000 tons, while Italy's output may have been 12,000 tons/year. The Dutch production at Coevorden is stated to be about 1200 tons/month. Yugoslavia produces relatively small amounts of oil from an area near the Hungarian border.

A table gives the European oil production by countries for the years 1938, 1944, and 1945. G. D. H.

836. Zistersdorf Output. Anon. *Oil Wkly*, 5.8.46, **122** (10), 38 (International Section).—The Zistersdorf area is now reported to be producing at the rate of about 27,100 brl/day. G. D. H.

837. Extensive Prospecting Licenses Promise Further Exploration in Britain. W. A. Macfadyen. *Oil Gas J.*, 21.9.46, **45** (2).—Currently the D'Arcy Exploration holds prospecting licenses covering nearly 13,000 sq ml in England, and Anglo-American holds licenses covering 4,000 sq ml.

A *résumé* of the oilfield developments in Britain is given, together with a map showing the licensed areas. G. D. H.

838. Search for Natural Gas Begun in Czechoslovakia. Anon. *Oil Gas J.*, 12.10.46, **45** (23), 61.—Gas with 90–95% of methane has been found in a large-scale search begun in Moravia, near the Polish border. Several tests, mainly shallow, have been drilled in the Austrian province of Burgenland in the region of the lower Pinka River. G. D. H.

839. France's Exploration Programme Broadened. Anon. *Oil Wkly*, 5.8.46, **122** (10), 20 (International Section).—Pechelbronn is still France's principal oil-producing area. Its March output of 33,500 brl compared with a pre-war average of 45,000 brl/month. Half the production is from wells and half from the tunnels in the oil sand.

The discovery of oil on the Marcet anticline in the Aquitaine basin was made in 1939. At a depth of 6365 ft production of 150 brl of oil and 6½ million cu ft per day was obtained for 4 days. The reservoir is in steeply dipping Jurassic beds. Gas wells have been completed on two domes east of St. Marcet.

The French refining capacity has been raised to 17 million brl/year by reinstating some of the damaged refineries.

The "Pool des Carburants" is being continued. It handles imports of oil and oil products, and acts as a clearing house for all sales and costs and tries to utilize all available facilities for refining, transportation, and distribution.

At present France imports most of her oil from U.S.A., South America, and the Middle East. G. D. H.

840. France Making Strenuous Efforts for Production Within Own Borders. Anon. *Oil Wkly*, 19.8.46, **122** (12), 32.—12 wildcats are being drilled in the south of France and one at Soufflenheim, near Pechelbronn.

The St. Marcet field has 5 gas wells with a potential of 15,000,000 cu ft/day. 1 oil well yields 20 brl/day. G. D. H.

841. Italian Producer Reported. Anon. *Oil Gas J.*, 14.9.47, **45** (19), 63.—A well producing gas and traces of oil has been drilled near the crest of the Lodi structure. 2 wells under way down flank have shown only traces of oil and gas. G. D. H.

842. Roumania's Drilling Activities Slowed. Anon. *Oil Wkly*, 5.8.46, **122** (10), 35 (International Section).—During the first quarter of 1946 Roumania's drilling averaged 27,500 ft/month, 37% below the 1946 average. Oil production averaged 85,500 brl/day; the average for 1945 was 93,000 brl/day. Lack of equipment, coal, and transport is responsible for the drop. Government control on the oil industry has tightened with a view to fulfilling commitments to Russia.

In 1945 the Russians built a 10-in pipeline from Faurei to Reni. This branches from the old Ploesti–Constantza line. A 10-in gas line from Transylvania to Bucharest is planned.

Tables give drilling and production figures. G. D. H.

843. Russia's Oil Projects in Eastern Areas. Anon. *Oil Wkly*, 5.8.46, **122** (10), 27 (International Section).—Russia aims to reach pre-war levels of oil extraction and refining in 1949. Special efforts are to be made in the Urals, Bashkir ASSR, Volga Basin, Sakhalin, Turkmenian SSR, and Ukranian SSR. New refineries and pipelines are to be built, as well as factories for producing oilfield equipment. It is hoped that gas production from coal and shale will be about 67,000 million cu ft by 1950, with natural gas production 295,000 million cu ft. The underground gasification of coal is to be continued, and the conversion of coal and oil shale to liquid fuel is expected to be at the rate of 6,300,000 brl/year by 1950. The oil-shale areas of the Estonian SSR have a capacity of about 65,800,000 brl and those of the Leningrad area 27,000,000 brl. Plans are being laid for an output of 254,880,000 brl annually 5 years hence.

The Baku area still provides more oil than all the other producing areas together. New deep sands have been tapped, and drilling has been begun on reclaimed land. Considerable development has taken place between the Volga and the Urals. area produces from the Devonian in addition to other formations.

Extensive directional drilling is taking place at Samarskaya Luka. There are large oil-bearing areas in eastern Turkmenistan. G. D. H.

844. Russians Plan Development for Eastern Turkmanistan. Anon. *Oil Gas J.*, 14.9.46, **45** (19), 62.—Nebit-Dag produces 13,650 brl/day from 146 wells. A gusher was drilled in 1931 and this is reported to have produced 2,100,000 brl of oil in 18 days.

A 5-year plan is said to visualize the attainment of an output of 420,000,000 brl/year. G. D. H.

845. Russians Plan Exploitation of New Central Volga Area. Anon. *Oil Gas J.*, 14.9.47, **45** (19), 63.—Wells are reported to have been successfully completed recently in Kamchatka and Sakhalin, while exploitation of important oil accumulations near Ulyanovsk, in the central Volga region, is scheduled. G. D. H.

846. Eastern Russian Oil Find is Reported. Anon. *Oil Gas J.*, 21.9.46, **45** (2), 163.—3 wells are reported to have been completed in the Tatarsk area. G. D. H.

847. Russian Writers Say Soviet Reserves World's Greatest. Anon. *Oil Gas J.*, 26.10.46, **45** (25), 78.—Ivanov and Poznanskaya state that in 1937 the Russian oil reserves were estimated at 45,000,000,000 brl, about 55% of the world's "visible" reserves. Production in 1940 is estimated at 217,000,000 brl, and should attain 248,000,000 brl in the current 5-year period. It will reach 420,000,000 brl by 1945.

The Kuibyshev fields have four times their pre-war output. G. D. H.

848. Egypt's 1945 Production Over 9·4 Million Brl. Anon. *Oil Wkly*, 12.8.46, **122** (11), 46.—It has been reported that in 1945 Ras Gharib produced 8,940,113 brl and Hurghada 465,928 brl. Gemsa gave 730 brl and Abu Durba 1900 brl. G. D. H.

849. Iranian Production at 383,366 Brl Daily in June. Anon. *Oil Gas J.*, 19.10.46, **45** (24), 94.—Iran produced about 11,501,000 brl of oil in June, giving a total of 69,475,000 brl for the first half of 1946. G. D. H.

850. Prospecting in the Punjab and the Northwest Frontier Province. E. S. Pinfold. *Petrol. Times*, 1.2.47, **51**, 119.—A brief account is given of exploration in the N.W. Frontier Province from 1866 when the first test wells were drilled in the Attock District. Since then extensive tests have been carried out in some 20 districts of which only 4—Khaur, Dhuhan, Joya Mair, and Balkassar—have so far yielded any significant production. R. B. S.

851. Japanese Oil Production Shows Decline for Year. Anon. *Oil Wkly*, 12.8.46, **122** (11), 46.—During the year ended March 31, 1946, Japan produced 1,482,578 brl of crude, 166,389 brl less than in the preceding year. Production is now hindered by shortage of parts for repairs, and if all suspended wells were put in operation output would probably rise by 10%. G. D. H.

852. 63 Million-brl Reserve is Estimated for Nippon. Anon. *Oil Wkly*, 19.8.46, **122** (12), 32.—It is estimated that reserves in the Hokkaido, Akita, Yamagata, and Niigata areas are 62,900,000 brl. In the 1945–46 fiscal year output was 1,482,500 brl. G. D. H.

TRANSPORT AND STORAGE.

853. Material Economy in Petroleum Storage Installations. G. Daric. *Chim. et Ind.*, 1947, **57**, 228–240.—Tankage represents 20% of the capital cost of refineries and 40% of that of storage installations. At the end of the war French storage capacity was reduced to $10^6 m^3$, a deficit of $1 \cdot 6 \times 10^6 m^3$, which would call for 60,000 tons of steel (excluding tankage at refineries, the figures for which are approximately the same again). The redesigning of damaged storage installations both at the "national" and "local" level on more economical lines, taking full advantage of inter-connection and mutual planning between installations, could effect an economy of 30%. The use of standard tankage of a more economical design is suggested. Evaporation losses and recent tank design for the storage of products of various v.p. are discussed. Tank interconnection to decrease breathing losses is advocated. Pressure tankage of French design is being developed, some details of the " Caquot " type, a specimen of which (3500 m^3) is actually in use, are given. V. B.

854. War-time Underground Oil Storage in Britain. M. Noone. *Petrol. Times*, 15.2.47, **51**, 161.—The design and construction of underground storage tanks used in Britain during the war is described in detail. These tanks consist essentially of steel-lined concrete chambers. R. B. S.

855. Pipeline Technology. H. H. Anderson. *Pipe Line News*, Dec. 1946, **18** (12), 12. (*Paper presented before A.P.I.*, Chicago, Nov. 1946.)—Developments in war-time and post-war pipeline technology are discussed under the following headings : (1) improving older lines ; (2) improving maintenance methods ; and (3) new construction methods. Trends in new line design are also reviewed. R. B. S.

856. Electric Power for Pipeline Pumping. A. N. Horne. *Pipe Line News*, Feb. 1947, **19** (2), 4.—The present trend in pipeline design is toward the use of larger diameter lines, fewer pumping stations, and simplified pumping equipment. The author suggests that electrical pumping methods are adaptable to these changes and that electric power for pipeline pumping is more economical than other sources of power. R. B. S.

857. Railroad Tunnels, Submarine Sections, Climate Pose Rugged Pipeline Problems. P. Reed. *Oil Gas J.*, 8.3.47, **45** (44), 60.—Brief details are given of the design and installation of the 4, 6, and 10-in pipelines laid in the Budg Budg–Tunsuki, Budg Budg–Kalukooda, and Chillagong–Tunsuki districts, and two submarine loading lines at Chillagong, Bengal Bay, India. The methods used in the construction of the latter, which consisted of 8000 ft lengths of 10-in pipe, called for new techniques in the laying. At the terminal, tides ranged from 9 to 17½ ft leaving at low tide 2000 ft of beach exposed. The sea-loading end was planned to lie in 42 ft of water at 8000 ft from high-tide mark. Current flows of 6–7 mph were usual. The construction and launching of the line was accomplished as follows : 6000 ft of rail track was laid inland from high-water limit, and this length of piping was welded and supported on 6½ ft of pipe, fitted with 4 disc guides placed one on the inside of each rail and one on each side of the pipeline. To secure the towing line a nipple of 4-in pipe was welded through the 10-in pipeline close to its " orange peel " welded plug end. The 1½-in towing cable was passed through the nipple and secured by two turns round the pipe and by two wire line clamps. The actual delivery outlet was a 6 ft length of 10-in pipe welded to the main pipe at 45° at the end of which a rotary drilling hose and valve was attached. After launching, a cable was attached to the hose for raising it when required, and this was tied to a marking buoy. Launching the line was made by first pulling the line by 4 tractors 2000 ft at low tide, then welding on the extra 2000 ft required and placing it on the vacated portion of the rail track. At high tide the whole length was towed to its planned position by a 1400 h.p. tug, assisted by 4 tractors on land. Ditching by native labour and an unusual type of plough which was designed on the job, are discussed. W. H. C.

858. Valve Progress in the Oil Industry. G. A. Bennett. *Petrol. Times*, 15.3.47, **51**, 215.—Progress in valve design for use in the oil industry is outlined. The types of valves which are briefly discussed are : (1) Newman–Milliken valves ; (2) general purpose valves ; (3) bar stock-valves ; (4) cast iron and steel gate-valves ; and (5) forged steel valves. R. B. S.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

859. Expansion at Haifa Refinery to Result in Capacity of More than 100,000 Brl Daily. Anon. *Oil Gas J.*, 8.3.47, **45** (44), 42.—A brief outline is given of the Consolidated Refineries, Haifa, refinery jointly owned by the Anglo-Iranian and Anglo-Saxon Com-

panies, which first began operating late in 1939, and of the subsequent extensions made up to 1944. At that date the crude oil topping facilities consisted of 3 × 26,000 brl/day units, affording a throughput of 4,000,000 tons/year. The 360-acre refinery area is situated along the small river Kishon, and is about 3½ ml from Haifa Port. The refinery is served by 12-in pipelines: (1) from Kirkuk–Haifa, and (2) by the Kurkuk–Tripoli line, and then by tanker to Haifa, thence by pipeline to the refinery. The new equipment to be installed includes a fourth crude-oil unit of the same capacity, ordered from Badger and Sons, Boston, and a lub oil plant consisting of 2 vacuum-distillation units to process 24,000 brl/day of reduced crude, designed by Badger and Sons; 2 propane-deasphalting units designed by the Kellogg Co., and the following plant designed by the Lummus Co.; 2 furfural-extraction units; 2 M.E.K.-dewaxing units and a clay contacting plant. Other additional equipment will include new facilities for producing high-quality kerosine, extra storage for 1,800,000 brl, extra laboratories, workshops, offices, and stores; and 2 more 6000 kw/hr turbo-generators; 3 new 150,000 lb/hr Spearing boilers to operate at 500 p.s.i.; and 2 giant parabolic shape water-coolers for 2,000,000 gal/hr water, operated by 30,000 g.p.m. pumps. These coolers are 250 ft high with a base diameter of 250 ft; the new construction will be mainly British.
W. H. C.

860. Refining Processes and Their Automatic Control. Anon. *Oil Gas J.*, 22.3.47, **45** (46), 149.—31 flow diagrams of modern processes with descriptive data and fold-out insert flow diagrams of modern refining processing, combined and correlated with a list of all the principal products obtainable from petroleum are given.

Processes dealt with include atmospheric and vacuum distillation, *cyclo*version, Houdry, suspensoid, thermofor catalytic cracking, hydroform and catalytic polymerization, naphtha polyform, thermal cracking, HF and sulphuric acid alkylation, Girbotol process, Perco copper sweetening, tannin solutizer, unisol and mercapsol processes, phosphoric acid polymerization, Perco and phosphate desulphurization, butane isomerization, Gray-clay treating, duo-sol furfural and phenol solvent extraction, M.E.K. and propane dewaxing, propane deasphalting, Houdry and Universal dehydrogenation, Universal isomerization, and hydrocol processes. G. A. C.

861. Equipment Heat Losses (B.Th.U Per Hour Per Square Foot). (Refiner's Notebook, No. 129.) W. L. Nelson. *Oil Gas J.*, 1.2.47, **45** (39), 71.—The heat losses B.Th.U./hr/sq ft) are given for the following materials when operated at several temperatures, and under various conditions of air temperature and wind velocity: bare metal (breeching, stacks, and pipe); 1-in and 3-in magnesia lagging for vessels and towers; 3 thicknesses of magnesia pipe lagging at 80° F air temperature, for 3, 6, and 12-in pipe; furnaces of different bricks and brick thicknesses, with 3 thicknesses of insulation, or not insulated, with wind at 20 m.p.h., and at 100° F. W. H. C.

862. Draft in 100-ft Stacks. W. R. Nelson. *Oil Gas J.*, 12.4.47, **45** (49), 103.—No. 139 in the *Refiner's Notebook* series gives tables showing approximate friction loss up to 300 ft of stack, effect of altitude up to 8000 ft, approximate effect of weather, and draft produced by 100 ft steel stack under driving rain or snow at sea level. G. A. C.

863. Theoretical Stack Draft. W. R. Nelson. *Oil Gas J.*, 15.3.47, **45** (45), 101.—No. 135 in the *Refiner's Notebook* series discusses theoretical stack draft and displays a conventional table giving average temperature of gases and available static stack draft at sea level. A formula for computing friction loss is given, and a table shows effect of altitude on draft. G. A. C.

864. Transfer-Line Vaporization. (Refiner's Notebook, No. 134.) W. L. Nelson. *Oil Gas J.*, 8.3.47, **45** (44), 101.—Tables are given from which, in conjunction with the temperature drop and pressure drop taking place in the line (*Refiner's Notebook*, Nos. 128 and 132), the transfer-line vaporization can be determined. The tables have been prepared for atmospheric towers operated at 1–15 p.s.i.g., but probably reasonably accurate up to 60 p.s.i.g., and for charge stocks having true boiling-point slopes of 4·0 and 7·0, the throughput is based on the cold velocity (60° F) in the line. The approximate % vaporization taking place in the transfer line is obtained as follows: Estimate vaporization in tower; compute the cold velocity in the line; compute equivalent length of line, and read the % vaporization that occurs in the transfer line. The vaporization at pipe-still outlet equals tower vaporization less the vaporization occurring in the transfer line. W. H. C.

865. Transportable 150-h.p. Hoists. Anon. *Petrol. Times*, 12.4.47, **51**, 326.—The construction and operation of transportable 150-h.p. hoists is described. These hoists are designed for the erection of refinery equipment, such as fractionating towers and columns of various types up to a weight of 225 tons. R. B. S.

Cracking.

866. Catalytic Cracking of Petroleum Oils. D. A. Howes. *Industr. Chem.*, 1947, **23**, 217–225.—A general summary of cracking processes is given, together with a description and illustration of the electrically operated 100 gal/day fluid catalyst pilot plant of Anglo-Iranian Oil Co. at Sunbury-on-Thames. It is separately housed in a 55 ft high building with its own control laboratory. Six 500 gal feed and product tanks are housed under an adjoining shelter and an extensive instrument panel is provided. F. S. A.

867. New Delayed Coking Unit Increases Intermediate Distillate Yields. R. Maass and R. E. Lauterbach. *World Petrol.*, 1947, **18** (1), 48–52.—Owing to the market demand for gas oil the General Petroleum Co., in keeping with the general trend, has installed a Kellogg delayed coking unit to process 300–700 S.S.F./122° F straight-run residuum. Details of the plant, including materials of construction, layout, and operation are given, together with a simplified flow diagram and photographs. Delayed coking is accomplished by designing each of the two furnaces for high throughput and heat transfer. Each furnace has 2 coke drums for continuity. 1 coke drum is taken off-stream every 12 hrs and is on-stream again after 24 hr. The clearing process is described in some detail. At present the unit is charged with 15,000 brl/day 700 S.S.F./122° F straight-run residuum from Wilmington Crude (recycle/fresh feed ratio is 0·31 : 1). Some 22% de-butanized high sulphur gasoline, 53% gas oil (two grades), and 19% coke are produced, together with some gas. The plant is 75% self-supporting for steam. F. S. A.

868. Regeneration of Spent Catalyst in Fluid Catalytic Cracking. J. F. Snuggs. *Oil Gas J.*, 15.3.47, **45** (45), 88.—A review of descriptions of the oil, air, and catalyst flows in the several types of fluid catalytic cracking systems is given.

Principle variables affecting the design of a fluid catalyst regeneration system include temperature of regeneration, type of catalyst analysis of catalyst deposit, residence time, and regeneration pressure.

Regeneration temperature in commercial units ranges between 1000° F and 1200° F. Catalyst used affects design and operation of regeneration equipment; and carbon content of sulphur-free deposit varies from about 93 to 87 weight-% and hydrogen content from about 7 to 13 weight-%.

Weight-% of catalyst deposit on spent catalyst charged to regenerator varies between less than 1 to more than 2%. Residence time of catalyst within regenerator ranges between 10 and 20 min in commercial units. Regenerators operate at pressures between 1 and 13 p.s.i.g.

4 tables and 3 figures illustrate the article. G. A. C.

869. Combustion of Coke Deposit on Synthetic Bead Cracking Catalyst. W. A. Hagerbaumer and R. Lee. *Oil Gas J.*, 15.3.47, **45** (45), 76.—The combustion of coke deposits from flowing beds of cracking catalysts has been investigated. Major process variables, affecting the rate of carbon burning were found to be oxygen concentration, temperature, and the concentration and distribution of carbon on the catalyst particles. Graphical methods have been used to correlate the effects of these variables. Tables show physical properties of bead catalyst and typical operating data for T.C.C. kiln regenerating bead catalyst. The correlated data have been applied successfully in designing kilns for commercial T.C.C. units.

The article is illustrated by 11 figures. G. A. C.

Polymerization.

870. Manufacture of Synthetic Gasoline Nearing Commercial Application in U.S. G. Roberts and J. A. Phinney. *Oil Gas J.*, 15.3.47, **45** (45), 72.—The engineering aspects of commercial synthetic gasoline plants in Germany and of the proposed plants in the United States are reviewed.

One process uses natural gas under pressure, preheated with oxygen, the gases being converted to hydrogen and carbon monoxide. These gases are cooled and enter the synthesis reactor to produce liquifiable hydrocarbons.

Use of aluminium for the process equipment in the oxygen plant presents some unusual problems in the welding of aluminium plate in thicknesses greater than 1 in. The design of the synthesis converters includes provision of adequate cooling surface within the reaction vessel without interference in turbulence, and presents problems. One design calls for a vessel of approximately 3400 cu. ft. volume to produce 1000 brls of synthetic oil daily.

Fractionating and recovery equipment is mostly conventional. G. A. C.

Chemical and Physical Refining.

871. Technology, Operation, and Results from Linde Copper Sweetening Process. G. L. Mann. *Oil Gas J.*, 22.3.47, **45** (46), 195.—The process for oxidizing mercaptans in light distillates by means of copper chloride and molecular oxygen is described and two methods for removing all traces of copper compounds from the treated hydrocarbons are discussed.

The process has been in use many years and possesses advantages over the doctor sweetening method. Oxygen is added to a copper chloride–clay–water slurry to regenerate the chloride reagent continuously. 0·10 cu. ft. of oxygen is added for each 0·01% of mercaptan sulphur in the distillate, per brl of distillate processed. Advantages of the process lie in T.E.L. savings, higher quality products, lower operating costs, and elimination of material losses.

Typical installations include those at Socony-Vacuum Oil Co.'s Augusta, Kan. refinery and the Cities Service Oil Co.'s refinery at East Chicago, Ind. G. A. C.

Special Processes.

872. The Catarole Process. II. F. Kind. *Times Rev. Ind.*, 1947, Apr., 21.—The first plant (at Partington, near Manchester) will deal with 50,000 tons p.a. of charging stock; an additional capital expenditure of 25% would increase this to 100–120,000. The capital investment at present represents £2700 for each of the 700 employees, and the increase in value of the raw material is over £3000 per head. The development of new industries using products of the Catarole process, and their place in the national economy, is discussed. V. B.

873. Production of Chemicals from Petroleum. Anon. *Engineering*, 28.3.47, **163**, 248.—A general description is given of a proposed plant to be built in Cheshire for the manufacture of ketones, alcohols, ethers, solvents, and other chemicals by cracking petroleum at temperatures up to 700° C. Initial production is estimated at 24,000 tons p.a. Existing chemical plants at Stanlow and Shell Haven are to be extended: the former is engaged on the manufacture of sodium higher alkyl sulphates and the latter produces insecticides, fungicides, and other agricultural products. Brief particulars of various applications of some of the chemicals produced in these plants are given. G. P. K.

874. Emulsifiers. F. Appell. *Chim. et Ind.*, 1947, **57**, 241–249.—This first part of an illustrated review of the published literature (chiefly patents) on mechanical industrial emulsifiers deals with the production of emulsions by agitation, injection, and grinding. In addition to mechanical agitation some details are given regarding ultrasonic emulsification. Emulsifiers depending on a grinding action are divided into colloid mills and homogenizers, which latter, together with further types of emulsifiers, are to be considered in a subsequent instalment. V. B.

875. Some Notes on Methane Conversion and Ancilliary Processes. Anon. *Rev. Inst. Franç. Petrole,* 1947, 2, 38–48.—This is an extract from a French report on German industry. The processing of methane is considered from the standpoint of its conversion into synthesis gas and into acetylene, the latter being used as a source of acetone. The purification of methane and the catalysts used in its conversion are described and the yields of products, in various modifications of the process, are given in tabular form. Mention is made of a few control instruments, including those operating on physical principles (absorption in the infra-red and the paramagnetism of oxygen). The purpose of the article is to indicate the scope of the fuller information contained in the records of the French Oil Mission to Germany in 1945–46. V. B.

Refining Patents.

876. Patents on Refining Processes and Products. C. Arnold, assr to S.O. Dev. Co. B.P. 584,386, 29.1.47. Shale distillation process.

Standard Oil Development Co. B.P. 584,428, 29.1.47. Polymerization of hydrocarbons.

J. C. Arnold and S.O. Dev. Co. B.P. 584,557, 29.1.47. Cutting oils.

H. G. C. Fairweather (Air Reduction Co., Inc.). B.P. 584,601, 29.1.47. Production of butadiene.

Gas Research Board, F. J. Dent, and L. A. Moignard. B.P. 584,393, 29.1.47. Method of conducting catalytic gas reactions and apparatus therefore.

National Oil Products Co. B.P. 584,500, 29.1.47. Detergents.

S.O. Dev. Co. B.P. 584,370, 29.1.47. Process and apparatus for the manufacture of aluminium greases.

S.O. Dev Co. B.P. 584,426, 29.1.47. Catalytic polymerization of mono-olefins.

J. C. Arnold (S.O. Dev. Co.). B.P. 584,800, 5.2.47. Production of addition agents for lubricants.

J. C. Arnold (S.O. Dev. Co.). B.P. 584,876, 5.2.47. Apparatus for the countercurrent treatment of liquids.

J. C. Arnold (S.O. Dev. Co.). B.P. 584,892, 5.2.47. Process and apparatus for the countercurrent contacting of liquids of different gravities.

J. G. Fife (Shell Dev. Co.). B.P. 584,746, 5.2.47. Process for the catalytic conversion of hydrocarbons.

Du Pont de Nemours & Co. B.P. 584,794–5, 5.2.47. Manufacture of polymers and interpolymers of ethylene and other olefines.

S.O. Dev. Co. B.P. 584,850, 5.2.47. Lubricating grease composition.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,076, 12.2.47. Production of *m*-xylene.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,211, 12.2.47. Separation of diolefins from mixtures with other hydrocarbons.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,213, 12.2.47. Surface coating compositions and containers lined therewith.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,238, 12.2.47. Lead alkyl compounds.

E. Mandel, H. Steiner, and S. Whincup. B.P. 585,166, 12.2.47. Separation of aromatic hydrocarbons having conjugated unsaturated side groups from their mixtures with other aromatic hydrocarbons.

C. Arnold (S.O. Dev. Co.). B.P. 585,420 and B.P. 585,434, 12.3.47. Catalytic polymerization processes.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,435, 12.3.47. Catalytic polymerization of olefines.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,497, 12.3.47. Production of aviation gasoline.

E. P. Newton (International Bitumen Emulsion Corpn.). B.P. 585,319, 12.3.47. Manufacture of bitumen emulsions.

Shell Dev. Co. B.P. 585,339, 12.3.47. Manufacture of aviation fuels.

S. O. Dev. Co. B.P. 585,352, 12.3.47. Production of motor fuel and aromatic hydrocarbons from oils *ex* the Fischer synthesis.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,578, 12.3.47. Purification of aromatic hydrocarbons.

S. C. Johansson. B.P. 585,643, 12.3.47. Lub. oils, fuel oils, and gasolines.

Standard Oil Dev. Co. B.P. 585,571, 12.3.47. Catalytic treatment of hydrocarbons.

C. Arnold (S.O. Dev. Co.). B.P. 585,735, 19.3.47. Foam inhibiting agents.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,702, 19.3.47. Application of lubricants to bearings.

J. G. Fife (Shell Dev. Co.). B.P. 585,742, 19.3.47. Process and catalyst for the conversion of hydrocarbons.

Anglo-Iranian Oil Co., S. F. Birch, J. Habeshaw, and C. B. Collis. B.P. 585,850, 19.3.47. Production of *cyclo*hexane and benzene from petroleum naphtha or other feed stocks.

C. Arnold (S.O. Dev. Co.). B.P. 585,803, 19.3.47. Addition agents for mineral lub. oils.

C. Arnold (S.O. Dev. Co.). B.P. 585,923, 19.3.47. Lube oil compositions.

C. Arnold (S.O. Dev. Co.). B.P. 585,931, 19.3.47. An alkylation process.

J. C. Arnold (S.O. Dev. Co.). B.P. 585,872, 19.3.47. Addition agents for E.P. lubricants.

I.C.I. and D. H. P. Peel. B.P. 585,958, 19.3.47. Dehydrogenation of naphthenes to aromatic hydrocarbons.

Trinidad Leaseholds and E. Hene. B.P. 585,808, 19.3.47. Condensation products.

C. Arnold (S.O. Dev. Co.). B.P. 586,130, 26.3.47. Manufacture of soap-thickened petroleum distillate compositions.

C. Arnold (S.O. Dev. Co.). B.P. 586,161, 26.3.47. Production of aviation fuels.

Distillers Co. and A. J. V. Underwood. B.P. 586,027, 26.3.47. Method of carrying out cracking, pyrolysis, and partial oxidation reactions.

H. Schou. B.P. 586,109, 26.3.47. Manufacture of thermally stable water-in-oil dispersions.

S. O. Dev. Co. B.P. 585,990, 26.3.47. Method and apparatus for catalytic hydrocarbon conversion reactions.

J. C. Arnold (S.O. Dev. Co.). B.P. 586,333, 26.3.47. Anti-oxidants for lub. oils.

Kodak Ltd. B.P. 586,368, 26.3.47. Stabilizing motor fuels.

J. C. Arnold (S.O. Dev. Co.). B.P. 586,473, 2.4.47. Process for *iso*-olefin-diolefin interpolymers.

J. C. Arnold (S.O. Dev. Co.). B.P. 586,474, 2.4.47. Separation of hydrocarbon mixtures.

J. C. Arnold (S.O. Dev. Co.). B.P. 586,483, 2.4.47. Process for the conversion of gaseous olefins to liquid hydrocarbons.

I.C.I. and F. J. L. Bentley. B.P. 586,494, 2.4.47. Alumina catalysts.

N. V. de Bataaf. Pet Mitj, W. C. Webber, R. S. Airs, and T. P. Hughes. B.P. 586,461, 2.4.47. Lub. oil compositions.

S. O. Dev. Co. B.P. 586,512, 2.4.47. Manufacture of hydrocarbon oil compositions.

C. Arnold (S.O. Dev. Co.). B.P. 586,609, 10.4.47. Adhesive polymeric materials.

C. Arnold (S.O. Dev. Co.). B.P. 586,669, 10.4.47. Coating compositions for the prevention of corrosion.

J. C. Arnold (S.O. Dev. Co.). B.P. 586,716, 10.4.47. Process for the production of synthetic rubber-like materials.

J. C. Arnold (S.O. Dev. Co.). B.P. 586,697, 10.4.47. Catalytic alkylation of *iso*-paraffins with olefins.

I.C.I. and A. E. Rout. B.P. 586,732, 10.4.47. Nitration of aromatic hydrocarbons.

B. V. de Bataaf Petr. Mij and D. H. Japes. B.P. 586,679, 10.4.47. Anticorrosion oils.

Shell Dev. Co. B.P. 586,754, 10.4.47. Catalytic oxidation of ketones.

S. O. Dev. Co. and C. Arnold. B.P. 586,615, 10.4.47. Separation of acetylene from mixtures.

L. Wickenden. B.P. 586,766, 10.4.47. Treatment of waste oil refinery sludge coke.

R. E. Burk and E. C. Hughes, assrs to S.O.C. Ohio. U.S.P. 2,405,184, 6.8.46. The catalytic conversion of non-benzenoid hydrocarbons to aromatics at 850° to 1100° F in the presence of hydrogen.

G. R. Lake, assr to Union Oil Co. U.S.P. 2,405,258, 6.8.46. Azeotropic distillation using acetone to separate thiophane from thiophene.

R. B. Greenburg, assr to Allied Chemical and Dye Corpn. U.S.P. 2,405,300, 6.8.46. Non-aromatic hydrocarbons are removed from xylene concentrates by azeotropic distillation with ethylene diamine.

H. R. Markley, assr to Phillips Petroleum Co. U.S.P. 2,405,364, 6.8.46. A process and apparatus for the catalytic vapour phase isomerization of *n*-butane.

I. L. Wolk, assr to Phillips Petroleum Co. U.S.P. 2,405,386, 6.8.46. Catalytic isomerization of *n*-butane.

G. T. Atkins, Jr., assr to S.O. Dev. Co. U.S.P. 2,405,393, 6.8.46. An improved form of batch fractional distillation.

W. H. Bahlke and M. T. Carpenter, assrs to S.O.C. Indiana. U.S.P. 2,405,395, 6.8.46. The catalytic conversion of hydrocarbons to acetylene at 1800° F.

G. C. Connolly, assr to S.O. Dev. Co. U.S.P. 2,405,408, 6.8.46. Method of preparing a metal oxide–silica gel for use as a cracking catalyst.

K. C. Laughlin, assr to S.O. Dev. Co. U.S.P. 2,405,436, 6.8.46. Catalytic dehydrogenation of hydrocarbons in the presence of steam to retain the activity of the catalyst.

E. J. Martin assr to General Motors Corpn. U.S.P. 2,405,441, 6.8.46. Isomerization of an olefin at 150° to 700° F in the presence of a sulphide of nickel or tungsten.

J. C. Zimmer and A. J. Morway, assrs to S.O. Dev. Co. U.S.P. 2,405,482, 6.8.46. Chlorinated paraffin wax is reacted with 2–5% by wt phosphorus sesquisulphide at 250–370° F.

J. A. Chenicek and R. B. Thompson, assrs to U.O.P. Co. U.S.P. 2,405,490, 6.8.46. Two-stage olefin alkylation of an isoparaffin using $AlCl_3$.

H. Pines, assr to U.O.P. Co. U.S.P. 2,405,516, 6.8.46. Isomerization of a hydrocarbon with $AlCl_3$ in the presence of a monocyclic aromatic hydrocarbon containing more than 8 carbon atoms.

J. M. Campbell, assr to General Motors Corpn. U.S.P. 2,405,560, 13.8.46. About 0·1% tributyl phosphite is added to a leaded-gasoline.

E. W. M. Fawcett and G. I. Jenkins, assrs to A.I.O.C. U.S.P. 2,405,565, 13.8.46. A two-stage isomerization cum alkylation of normal paraffins using a halide catalyst.

D. T. Rogers, assr to S.O. Dev. Co. U.S.P. 2,405,607–8, 13.8.46. A stabilizer for lub. oil is obtained by the reaction between a phosphorus sulphide and the product obtained by the action of a phenol on the sulphur chloride derivative of an olefin.

N. F. Linn, assr to S.O. Dev. Co. U.S.P. 2,405,660, 13.8.46. Pure toluene is obtained by a multistage treatment of the product from the hydrogenation of carbon monoxide, including distillation, catalytic cracking, catalytic reforming, and solvent extraction.

M. de Groote and B. Keiser, assrs to Petrolite Corpn. U.S.P. 2,405,737, 13.8.46. Manufacture of water soluble surface active agents, such as the sulpho succinates.

W. E. Bradley, assr to Union Oil Co. U.S.P. 2,405,775, 13.8.46. A substantially pure *iso*paraffinic oil of boiling range 350° to 800° F is used as an insecticide and fungicide.

G. W. Ayers and D. M. Barton, assrs to The Pure Oil Co. U.S.P. 2,405,872, 13.8.46. Oils are treated with an aqueous solution containing 5% free caustic soda and a sufficient amount of the soluble reaction product of an alkali and high b.p. tar acids to extract weakly acid sulphur compounds.

E. F. Bullard, J. Anderson, and S. H. McAllister, assrs to Shell Dev. Co. U.S.P. 2,405,874, 13.8.46. An aromatic hydrocarbon is alkylated under 250 lb pressure in the presence of a solid catalyst.

H. Schindler, assr to The Pure Oil Co. U.S.P. 2,405,905, 13.8.46. An olefinic C_4 cut is polymerized with 65–70% sulphuric acid at 20–45° C under liquid phase conditions. The polymer is desulphurized by contact with a siliceous solid adsorbent.

H. Schindler and L. M. Henderson, assrs to The Pure Oil Co. U.S.P. 2,405,906, 13.8.46. An oxidation and rust inhibitor for turbine oils is extracted from spent caustic solution obtained in treating gasoline containing phenolic and sulphur compounds.

J. B. Wyman and H. D. Loeb, assrs to Shell Dev. Co. U.S.P. 2,405,922, 13.8.46. A method of bringing on stream a fluid catalyst cracking unit.

J. A. Anderson, Jr., assr to S.O. Dev. Co. U.S.P. 2,405,935, 20.8.46. Aromatics are obtained by subjecting the 150–350° F cut of a cracked gasoline to thermal cracking and hydroforming.

W. F. Gresham, assr to Du Pont de Nemours & Co. U.S.P. 2,405,948, 20.8.46. Dihaloalkanes are obtained by the action of hydrochloric acid and formaldehyde in propylene.

W. E. Hanford, assr to Du Pont de Nemours & Co. U.S.P. 2,405,950, 20.8.46. Gaseous olefins are polymerized in the presence of a catalyst selected from the class of hydrazine compounds.

P. E. Kuhl and R. M. Shepardson, assrs to S.O. Dev. Co. U.S.P. 2,405,959, 20.8.46. Super Filtrol is used as a cracking catalyst.

C. S. Lynch and H. G. Codet, assrs to S.O. Dev. Co. U.S.P. 2,405,968, 20.8.46. The alkylation of ethylene with *iso*butane using $AlCl_3$ as catalyst.

R. E. Burk, assr to S.O.C. Ohio, U.S.P. 2,405,993–7, 20.8.46. Boron trifluoride–hydrofluoric acid catalyst is employed to " average " C_6 cuts and *iso*pentane, propane, and pentane, and de-aromatizing and modifying hydrocarbon mixtures.

J. T. Dickinson and A. R. Moorman, assrs to S.O.C. Indiana. U.S.P. 2,406,065, 20.8.46. A continuous disc filter.

W. A. La Lande, Jr., and H. Heinemann, assrs to Porocel Corpn. U.S.P. 2,406,081, 20.8.46. Olefins are polymerized with the aid of activated bauxite.

C. B. Linn, assr to U.O.P. Co. U.S.P. 2,406,086, 20.8.46. Hydrofluoric acid containing hydrogen cyanide is used as an alkylation catalyst.

L. Schmerling, assr to U.O.P. Co. U.S.P. 2,406,110, 20.8.46. Branched-chain paraffins are obtained by hydrogenation of the reaction product from the treatment of a mono-olefin with a methyl halide in the presence of lead oxide.

W. A. Schulze, assr to Phillips Petroleum Co. U.S.P. 2,406,112, 20.8.46. A catalytic cracking process in which steam is injected into the charging stock and a water resistant contact catalyst is employed.

A. B. Welty, Jr., assr to S.O. Dev. Co. U.S.P. 2,406,117, 20.8.46. A catalytic reforming process employing free hydrogen.

C. D. Cantrell, Jr., assr to Phillips Petroleum Co. U.S.P. 2,406,192, 20.8.46. A sampling apparatus for liquid hydrocarbons.

O. W. Cass, assr to Du Pont de Nemours & Co. U.S.P. 2,406,195, 20.8.46. Preparation of the higher chlorides of methane.

R. M. Cole, assr to Shell Dev. Co. U.S.P. 2,406,200, 20.8.46. A conditioned heavy metal sulphide catalyst is employed in the hydrogenation of sulphur containing hydrocarbon oils.

S. W. Ferris, assr to The Atlantic Refining Co. U.S.P. 2,406,210, 20.8.46. A method of controlling the sweating of wax by employing a melting point–refractive index chart.

J. C. Marancik and R. F. Mildrum, assrs to S.O. Dev. Co. U.S.P. 2,406,234, 20.8.46. An expansion joint for pipe conveying fluid carrying injurious materials, such as suspended solids and corrosive materials.

J. M. Barron, assr to The Texas Co. U.S.P. 2,406,312–3, 27.8.46. A combination thermal cracking and coking process.

D. E. Badertscher, H. G. Berger, and R. B. Bishop, assrs to Socony-Vacuum Oil Co. U.S.P. 2,406,339, 27.8.46. Hydrogen fluoride is used as a catalyst in making light-coloured resins by the phenol–formaldehyde reaction.

W. N. Hoyte, assr to Foster Wheeler Corpn. U.S.P. 2,406,375, 27.8.46. A fractionating column.

R. H. Newton, assr to Houdry Process Corpn. U.S.P. 2,406,394, 27.8.46. Narrow-cut gasoline fractions are subjected to catalytic cracking and blended to give aviation gasoline.

H. B. Weiser, E. A. Smith, and J. S. Mackay, assrs to Houdry Process Corpn. U.S.P. 2,406,420, 27.8.46. Manufacture of stable alumina and alumina–molybdenum oxide catalysts.

E. Solomon and L. C. Rubin, assrs to The M. W. Kellogg Co. U.S.P. 2,406,477, 27.8.46. Manufacture of an $AlCl_3$ catalyst.

E. R. Johnson, assr to Texaco Dev. Co. U.S.P. 2,406,544, 27.8.46. Iron pentacarbonyl is used as an antiknock agent in an aviation fuel.

P. E. Kuhl and A. B. Welty, Jr., assrs to S.O. Dev. Co. U.S.P. 2,406,547, 27.8.46. A modified catalytic cracking process.

E. Lieber, assr to S.O. Dev. Co. U.S.P. 2,406,549, 27.8.46. A pour-point depressant is obtained as a product of a Friedel–Crafts condensation of an aromatic compound and a saturated ester.

H. Z. Martin, assr to S.O. Dev. Co. U.S.P. 2,406,555, 27.8.46. A catalytic cracking process for residual oils.

D. T. Rogers and J. G. McNab, assr to S.O. Dev. Co. U.S.P. 2,406,564, 27.8.46. A lub. oil additive is obtained by reacting sulphur with a metal phenate.

D. W. Young and H. D. Hineline, assrs to S.O. Dev. Co. U.S.P. 2,406,575, 27.8.46. A lub. oil additive is obtained by treating a cyclicized polymer of a polyolefin with phosphorus pentasulphide.

E. C. Lee and C. L. Thomas, assrs to U.O.P. Co. U.S.P. 2,406,613–4, 27.8.46. A composite silica–alumina–zirconia catalyst is used in conversion of hydrocarbons.

J. M. Mavitz, assr to U.O.P. Co. U.S.P. 406,622, 27.8.46. In a hydrocarbon isomerization process a metal is incorporated in the aluminium halide catalyst to prevent the formation of a hydrocarbon–aluminium halide complex in the catalyst bed.

H. Pines and V. N. Ipatieff, assrs to U.O.P. Co. U.S.P. 2,406,620–2, 27.8.46. Methods of preparing *cyclo*-olefinic and aromatic hydrocarbons involving the use of glycol, mono-olefins, and monohydric alcohols.

L. Schmerling and V. N. Ipatieff, assrs to U.O.P. Co. U.S.P. 2,406,639, 27.8.46. An alkoxy aluminium halide catalyst is used in the conversion of hydrocarbons.

P. Siecke, assr to Gulf Oil Corpn. U.S.P. 2,406,640, 27.8.46. A thermal cracking process employing high rates of heat input and avoiding excessive coke formation.

C. L. Thomas, assr to U.O.P. Co. U.S.P. 2,406,645, 27.8.46. A thermal reaction between an olefin and a polynuclear aromatic compound.

G. M. Webb and M. A. Smith, assrs to U.O.P. Co. U.S.P. 2,406,646, 27.8.46. Manufacture of alumina catalysts.

A. R. Bax, H. F. Kielhorn, and W. E. Forney, assrs to Cities Service Oil Co. U.S.P. 2,406,655, 27.8.46. A process for the manufacture of lithium-base greases.

L. A. Clarke, assr to The Texas Co. U.S.P. 2,406,667, 27.8.46. An aviation fuel which includes 2 : 3-dimethylbutane as a component.

H. Diamond, assr to Shell Dev. Co. U.S.P. 2,406,671, 27.8.46. A cutting oil which contains an organo silicon compound as a foam-reducing agent.

N. B. Haskell, assr to The Texas Co. U.S.P. 2,406,681, 27.8.46. A butane isomerization process.

A. W. Horton and J. Kellett, III, assrs to Socony Vacuum Oil Co. U.S.P. 2,406,688, 27.8.46. 2 : 3-Dimethylbutenes are obtained by passage of neohexane over a chromium oxide catalyst at 800–1200° F.

G. R. Lake, assr to Union Oil Co. U.S.P. 2,406,695, 27.8.46. In distilling narrow cut hydrocarbon mixtures an aliphatic ketone is employed to separate one component as a distillate while simultaneously using a phenolic compound to retain a second component in the residue.

E. F. Pevere, assr to The Texas Co. U.S.P. 2,406,709, 27.8.46. Isobutane is alkylated with ethylene using $AlCl_3$ catalyst under conditions that give an alkylate containing neohexane.

N. L. Dickinson, assr to S.O.C. Indiana. U.S.P. 2,406,748, 3.9.46. A method and apparatus for desalting reduced crude by means of liquid propane.

W. K. Griesinger, assr to The Atlantic Refining Co. U.S.P. 2,406,763, 3.9.46. A method of purifying oil soluble petroleum sulphonates containing inorganic salts and water.

J. B. Kirkpatrick, J. J. Somers, and A. N. Sachanen, assrs to Socony-Vacuum Oil Co. U.S.P. 2,406,776, 3.9.46. An improved form of the alkylation process.

W. E. Kruse, C. W. Nysewander, and J. A. Bolt, assrs to S.O.C. Indiana. U.S.P. 2,406,778, 3.9.46. The isomerization of C_4–C_6 paraffins with particular reference to the use of $AlCl_3$ slurry.

R. B. Day, assr to U.O.P. Co. U.S.P. 2,406,810, 3.9.46. A method of distilling volatile hydrocarbons from hydrocarbon solids in a retort.

J. E. Fratis and E. H. Oakley, assrs to American Bitumals Co. U.S.P. 2,406,823, 3.9.46. High mol wt petroleum acids are added to an asphalt to render it emulsifiable with caustic soda.

A. K. Redcay, assr to Standard Catalytic Co. U.S.P. 2,406,851, 3.9.46. Improvements in the Fischer synthesis.

C. L. Thomas, assr to U.O.P. Co. U.S.P. 2,406,864, 3.9.46. A compound catalyst is employed to increase the antiknock value of the Fischer synthesized hydrocarbons as they are formed.

C. O. Jongberg and H. J. Hall, assrs to S.O. Dev. Co. U.S.P. 2,406,868, 3.9.46. A small amount of a naphthene is employed in the isomerization of *n*-butane.

J. D. Upham, assrs to Phillips Petroleum Co. U.S.P. 2,406,869, 3.9.46. Manufacture of the Friedel–Crafts catalyst.

A. C. Mohr, assr to Chemical Construction Corpn. U.S.P. 2,406,890, 3.9.46. The production of sulphur dioxide from alkylation sludge.

J. W. Teter, assr to Sinclair Refining Co. U.S.P. 2,406,929, 3.9.46. An amination catalyst comprising about 40–60% cobalt in suspension on a carrier of hydrated magnesium silicate.

C. B. Linn, assr to U.O.P. Co. U.S.P. 2,406,954, 3.9.46. Hydrofluoric acid containing a selected fluoride or oxyfluoride is used as a catalyst in the alkylation of an *iso*paraffin.

H. Pines, assr to U.O.P. Co. U.S.P. 2,406,967, 3.9.46. Isomerization of a liquid paraffin in the presence of a polynuclear aromatic.

A. A. O'Kelly, J. Plucker, and R. W. Work, assrs to Socony-Vacuum Oil Co. U.S.P. 2,407,033, 3.9.46. Catalytic alkylation of a paraffin at 590–850° F at pressures up to 500 p.s.i. in the presence of an organic cyclic oxygen compound.

W. A. Bailey, Jr., and B. S. Greensfelder, assrs to Shell Dev. Co. U.S.P. 2,407,052; 3.9.46. Two-stage catalytic cracking to produce high octane gasoline.

E. Lieber and A. F. Cashman, assrs to S.O. Dev. Co. U.S.P. 2,407,087, 3.9.46. An auto-condensation of an aliphatic ketone is used as a pour-point depressant.

L. A. Clarke, assr to The Texas Co. U.S.P. 2,407,136–7, 3.9.46. A method and apparatus for continuous alkylation.

S. F. Birch, F. A. Fidler, and L. S. Thornes, assrs to A.I.O.C. U.S.P. 2,407,214, 10.9.46. Production of *cyclo*pentane from the forerunnings of coal-tar benzol by polymerization, distillation, depolymerizing, and hydrogenation.

L. S. Galstaun, assr to Tide Water Associated Oil Co. U.S.P. 2,407,231, 10.9.46. Removal of moisture in the process of isomerization.

C. S. Lynch and H. G. Codet, assrs to S.O. Dev. Co. U.S.P. 2,407,311, 10.9.46. Improvements in the alkylation of ethylene with an *iso*paraffin.

C. R. Clark, assr to Allied Chemical and Dye Corpn. U.S.P. 2,407,364, 10.9.46. An ether of ethylene glycol is used in the azeotropic distillation of the appropriate hydrocarbon fraction to separate pure toluene.

K. K. Kearly, assr to S.O. Dev. Co. U.S.P. 2,407,373, 10.9.46. A process for the catalytic dehydrogenation of butene to butadiene.

H. W. Scheeline, assr to S.O. Dev. Co. U.S.P. 2,407,386, 10.9.46. Improvements in the separation and concentration of a secondary olefin from a hydrocarbon mixture using 75–90% sulphuric acid.

C. H. Watkins, assr to S.O. Dev. Co. U.S.P. 2,407,390, 10.9.46. The alkylation of propylene with *iso*butane.

G. E. Jodell, assr to Electroflux Pty, Ltd. U.S.P. 2,407,426, 10.9.46. A wick-type kerosine burner for use in refrigerators.

J. F. T. Blott and P. Alexander, assrs to Shell Dev. Co. U.S.P. 2,407,470, 10.9.46. Preparation of bitumen compositions containing mineral aggregates having improved load-bearing capacities.

L. G. Hall and H. G. Boucher, assrs to Shell Dev. Co. U.S.P. 2,407,492, 10.9.46. A combination thermal cracking and hydro-refining process to produce gasoline.

W. A. Stover, assr to Socony Vacuum Oil Co. U.S.P. 2,407,584–5, 10.9.46. Alkylation of a paraffin in the presence of the carbon dioxide with or without admixture of water.

E. W. M. Fawcett, assr to A.I.O.C. U.S.P. 2,407,637, 17.9.46. Production in the vapour phase of branch chained paraffins by isomerization.

L. C. Huff, assr to U.O.P. Co. U.S.P. 2,407,700, 17.9.46. A simplified apparatus for catalytic cracking.

R. F. Marschner, assr to S.O.C. Indiana. U.S.P. 2,407,716–7, 17.9.46. A super-aviation fuel consisting of (i) *cyclo*pentane and neohexane, (ii) *iso*octane and 1 : 1 : 2-trimethyl*cyclo*propane.

R. F. Marschner and D. R. Carmody, assrs to S.O.C. Indiana. U.S.P. 2,407,718, 17.9.46. A super-aviation fuel consisting of *iso*octane and an azeotropic mixture of di*iso*propyl and acetone.

J. H. Perrine and H. L. Johnson, assrs to Sun Oil Co. U.S.P. 2,407,766, 17.9.46. An acidic product from oxidized lub. oil is used in alkyd resin manufacture.

H. A. Cheney, assr to Shell Dev. Co. U.S.P. 2,407,813–4, 17.9.46. Manufacture of cobalt and nickel catalysts.

A. V. Danner, assr to Socony-Vacuum Oil Co. U.S.P. 2,407,817, 17.9.46. A combined catalytic cracking and refining process.

E. L. Durrum, assr to Shell Dev. Co. U.S.P. 2,407,820, 17.9.46. A combination extraction and azeotropic distillation process to separate aromatic hydrocarbons.

F. E. Frey and R. D. Snow, assrs to Phillips Petroleum Co. U.S.P. 2,407,825, 17.9.46. A continuous process of separating conjugated diolefins from the corresponding olefins and paraffins using the sulphone reaction in the distillation column.

E. Gorin, assr to Socony Vacuum Oil Co. U.S.P. 2,407,828, 17.9.46. Production of aliphatic chlorides using aliphatic hydrocarbons and hydrogen chloride in contact with cuprous chloride.

G. C. Ray, assr to Phillips Petroleum Co. U.S.P. 2,407,848, 17.9.46. Production of acrylonitrile by a catalytic process.

I. L. Wolk, assr to Phillips Petroleum Co. U.S.P. 2,407,861, 17.9.46. An oxidation inhibitor is introduced in the fractionating zone in the distillation of a readily polymerizable organic compound.

B. L. Evering, E. L. d'Ouville, and D. R. Carmody, assrs to S.O.C. Indiana. U.S.P. 2,407,873, 17.9.46. Polymerization of olefins using $AlCl_3$ as catalyst.

W. A. Bailey, Jr., and J. Burgin, assrs to Shell Dev. Co. U.S.P. 2,407,914, 17.9.46. Preparation of boric oxide–alumina catalyst and its use in catalytic cracking.

J. Burgin, assr to Shell Dev. Co. U.S.P. 2,407,918, 17.9.46. A catalytic cracking process using boric oxide admixed with an inert carrier as catalyst.

M. R. Fenske and G. H. Cummings, assrs to Rohm and Haas Co. U.S.P. 2,407,954, 17.9.46. An oil-soluble polymerized ester is used as a lube oil additive.

J. A. Patterson, assr to S.O. Dev. Co. U.S.P. 2,407,997, 24.9.46. Isoprene is separated from cracked stocks by azeotropic distillation with aqueous acetone then extractive distillation with acetone then fractional distillation.

E. F. Wadley and J. T. Horeczy, assrs to S.O. Dev. Co. U.S.P. 2,408,010, 24.9.46. Ethylene is separated from propylene by scrubbing their mixture with a boron fluoride–sulphuric acid catalyst under conditions in which the propylene is selectively polymerized.

D. C. Walsh, Jr., and E. Q. Camp, assrs to S.O. Dev. Co. U.S.P. 2,408,011, 24.9.46. To prevent corrosion during distillation an alkali metal salt of a phenol is added to an acid treated oil.

S. Musher, assr to Musher Foundation Inc. U.S.P. 2,408,090, 24.9.46. A phosphatide and a mononuclear aromatic sulphur compound are added to lub. oil to retard sludge formation.

H. G. Smith, T. L. Cantrell, and J. G. Peters, assrs to Gulf Oil Corpn. U.S.P. 2,408,102–3, 24.9.46. An oil-soluble trivalent metal salt of *N*-alkylol *o*-phthalamidic acid is used as a corrosion inhibitor for lube oil.

A. Voorhees, Jr., assr to S.O. Dev. Co. U.S.P. 2,408,131, 24.9.46. Aluminium oxide–chromium oxide–nickel oxide catalyst is used in the dehydrogenation of low-boiling hydrocarbons.

C. L. Gutzeit, assr to Shell Dev. Co. U.S.P. 2,408,139–40, 24.9.46. In the dehydrogenation of a mono-olefin to a diolefin the catalyst employed as iron oxide admixed with potassium oxide and bismuth oxide or chromium oxide, in the presence of steam.

K. K. Kearly, assr to Jasco Inc. U.S.P. 2,408,146, 24.9.46. Mono-olefins are dehydrogenated to diolefins in the presence of steam using magnesium oxide–chromium oxide–alkaline oxide catalyst.

A. L. Foster, assr to Phillips Petroleum Co. U.S.P. 2,408,164, 24.9.46. Preparation of $CaCl_2$–$AlCl_3$ catalyst.

H. J. Hepp, assr to Phillips Petroleum Co. U.S.P. 2,408,167, 24.9.46. Alkylation of an aromatic with an olefin employing a silica–metal oxide catalyst.

M. P. Matuszak, assr to Phillips Petroleum Co. U.S.P. 2,408,173, 24.9.46. Alkylation of an aromatic employing hydrofluoric acid as catalyst.

H. V. Atwell and H. H. Gross, assrs to The Texas Co. U.S.P. 2,408,186, 24.9.46. An isomerization process using $AlCl_3$ catalyst.

H. V. Atwell, assr to The Texas Co. U.S.P. 2,408,187, 24.9.46. Manufacture of an $AlCl_3$–kerosine complex for use as a catalyst.

A. D. Garrison and K. C. Ven Brink, assrs to Texaco Dev. Corpn. U.S.P. 2,408,207, 24.9.46. Treatment of montmorillonite clay to improve its adsorptive characteristics.

G. H. Keating, assr to The Texas Co. U.S.P. 2,408,215, 24.9.46. Manufacture of alumina–silica gel catalyst.

H. G. Smith and T. L. Cantrill, assr to Gulf Oil Corpn. U.S.P. 2,408,232, 24.9.46. Manufacture of an aromatic amine salt of 3-methyl-butyl 2-ethyl-hexyl orthophosphate.

S. C. Carney, assr to Phillips Petroleum Co. U.S.P. 2,408,294, 24.9.46. Conversion of hydrocarbons using $AlCl_3$ as catalyst and recovering the latter by extraction with $SbCl_3$.

R. H. Cubberley and F. W. Yeager, assrs to The Patent and Licensing Corpn. U.S.P. 2,408,297, 24.9.46. A bituminous composition of a flexible nature is obtained by mixing solid asphalt, cetylacetamide wax, and poly*iso*butylene.

J. R. Meadow, assr to Socony-Vacuum Oil Co. U.S.P. 2,408,329, 24.9.46. In the HF alkylation of a paraffin a halogen is introduced into the reaction zone.

E. L. Flood, assr to Consolidated Vultee Aircraft Corpn. U.S.P. 2,408,385, 1.10.46. A drill lubricant comprising soda-base grease, paraffin wax, turpentine, and aluminium stearate.

H. S. Bloch, assr to U.O.P. Co. U.S.P. 2,408,548, 1.10.46. Conditions for the operation of an $AlCl_3$ isomerization process.

D. Read, Jr., assr to U.O.P. Co. U.S.P. 2,408,580, 1.10.46. A combination thermal and catalytic cracking process for heavy oils.

A. D. Smith, assr to Jenkins Petroleum Process Co. U.S.P. 2,408,584, 1.10.46. Minimization of corrosion in a cracking still is effected by the addition of calcium hydroxide to the incoming charge.

C. H. O. Berg, assr to Union Oil Co. U.S.P. 2,408,600, 1.10.46. A catalytic cracking process in which the charge and catalyst flow is countercurrent.

H. M. Smallwood, assr to U.S. Rubber Co. U.S.P. 2,408,696, 10.1.46. Finely divided hydrogen containing carbon-black is treated with a halogen.

M. M. Sprung, assr to G.E.C. U.S.P. 2,408,700, 10.1.46. A synthetic wax is obtained as the product of the reaction between an aliphatic polyamine and a halogenated aromatic mono-carboxylic acid.

J. C. Bailie and R. V. Shankland, assrs to S.O.C. Indiana. U.S.P. 2,408,724, 8.10.46. Toluene is obtained by cracking a selected naphtha cut in the presence of hydrogen and an alumina–molybdenum oxide catalyst.

A. Belchetz, assr to The M. W. Kellogg Co. U.S.P. 2,408,725, 8.10.46. An alkylation process using sulphuric acid.

R. E. Burk, assr to S.O.C. Ohio. U.S.P. 2,408,752, 8.10.46. A two-stage $AlCl_3$ isomerization process applied to C_5–C_8 normal and slightly branched chain paraffins.

R. E. Burk, assr to S.O.C. Ohio. U.S.P. 2,408,753, 8.10.46. A combination high temperature thermal cracking isomerization and alkylation process to manufacture high-octane gasoline.

R. N. Meinert, assr to S.O. Dev. Co. U.S.P. 2,408,798, 8.10.46. An *iso*paraffin is alkylated with a mixture of different olefins using $AlCl_3$.

S. C. Riecke. U.S.P. 2,408,812, 8.10.46. Design of a machine to wax fruit and vegetables by brushing them with powdered wax.

H. E. Drennan, assr to Phillips Petroleum Co. U.S.P. 2,408,920, 8.10.46. Mercaptans are separated from the crude reaction product of the catalytic addition of hydrogen sulphide to tertiary olefin polymers by the use of a liquid hydrocarbon diluent and caustic soda.

T. W. Evans, R. C. Morris, and E. C. Shokal, assrs to Shell Dev. Co. U.S.P. 2,408,922, 8.10.46. *Iso*Propylamine is used as the azeotropic component in the separation of isoprene by distillation.

J. O. Iverson, assr to U.O.P. Co. U.S.P. 2,408,933, 8.10.46. Recovery of hydrogen fluoride used in alkylation.

J. S. Mahan, assr to Phillips Petroleum Co. U.S.P. 2,408,940, 8.10.46. The ester of a carboxylic acid is obtained by reacting a nitrile and an olefin in the presence of water and a strong acid.

L. A. Mekler, assr to U.O.P. Co. U.S.P. 2,408,943, 8.10.46. A method of regenerating the catalyst after use in a catalytic cracking operation.

H. S. Nutting and L. H. Horsley, assrs to The Dow Chemical Co. U.S.P. 2,408,947, 8.10.46. Ammonia is employed as the azeotropic component in separating by distillation the C_2–C_7 saturated and unsaturated hydrocarbons.

C. L. Ocon and E. A. Ocon. U.S.P. 2,408,948, 8.10.46. The catalytic reforming of low-boiling gasoline in the presence of a hydrogen-bearing gas.

H. Pines and H. S. Bloch, assr to U.O.P. Co. U.S.P. 2,408,950, 8.10.46. Conversion of hydrocarbons in the presence of hydrogen halide and a solid adsorbent.

T. F. Doumani and D. A. Skinner, assrs to Union Oil Co. U.S.P. 2,408,970, 8.10.46. Acetylenes are removed from their mixture with diolefins in the form of oxygen derivatives by treatment with water in the vapour phase in the presence of a catalyst.

G. W. Duncan, assr to S.O. Dev. Co. U.S.P. 2,408,971, 8.10.46. A slushing oil composition.

A. H. Gebauer, assr to Tide Water Associated Oil Co. U.S.P. 2,408,977, 8.10.46. Separation of an oil–wax mixture by a filtration process in which the de-oiled wax is continuously discharged.

M. H. Kollen, assr to Union Oil Co. U.S.P. 2,408,983, 8.10.46. A hydraulic fluid is composed of a major proportion of high boiling *iso*paraffins and a small amount of a high mol wt olefine polymer to change the viscosity index.

M. M. Marisic and A. C. Schmitt, assrs to Socony-Vacuum Oil Co. U.S.P. 2,408,986, 8.10.46. Manufacture of inorganic oxide gel catalysts in the form of beads.

M. P. Matuszak and G. H. Morey, assrs to Phillips Petroleum Co. U.S.P. 2,408,987, 8.10.46. Manufacture of a granular catalyst from an ammonium containing salt of chromic acid.

R. L. Parker, Jr., and H. C. Huffman, assrs to Union Oil Co. U.S.P. 2,408,996, 8.10.46. Regeneration of a spent cracking catalyst.

A. E. Robertson, assr to S.O. Dev. Co. U.S.P. 2,408,999, 8.10.46. A small amount of a gaseous paraffin or naphthene containing 3 to 5 carbon atoms is added to a branched alkanol containing 3 to 5 carbon atoms to produce a motor fuel of suitable vapour pressure.

W. O. Webber, assr to S.O. Dev. Co. U.S.P. 2,409,005, 8.10.46. De-salting of crude oil by water treatment.

J. V. Montgomery, L. B. Goodson, and R. W. Henry, assrs to Phillips Petroleum Co. U.S.P. 2,409,059, 8.10.46. Mineral oils are extracted with a solvent comprising a mixture of a hydrogenated pyridine fraction and acetone.

C. M. Thacker and R. T. Bell, assrs to The Pure Oil Co. U.S.P. 2,409,080, 8.10.46. Benzene is alkylated by reaction with alkyl mercaptans or sulphides in the presence of copper pyrophosphate.

R. E. Woodward, W. P. Hawthorne, and J. R. Meadow, assrs to Socony-Vacuum Oil Co. U.S.P. 2,409,090, 8.10.46. The hydrogen fluoride alkylation of an *iso*paraffin with ethylene.

W. A. Schulze and R. C. Alden, assrs to Phillips Petroleum Co. U.S.P. 2,409,156–7, 8.10.46. A leaded aviation fuel which consists of an *iso*paraffin mixture having 5, 6, 7, 8, and 9 carbon atoms per molecule together with either *iso*propylbenzene or a mono-butyl benzene other than the normal isomer.

P. L. Veltman, assr to Texaco Dev. Corpn. U.S.P. 2,409,167, 8.10.46. The product obtained by heating together an olefin and a metal carbonyl is used as an antiknock agent.

P. L. De Verter, assr to S.O. Dev. Co. U.S.P. 2,409,171, 8.10.46. Hydroquinone and quinhydrone are used to inhibit the formation of precipitates in leaded motor fuels.

M. H. Arveson, assr to S.O.C. Indiana. U.S.P. 2,409,234, 15.10.46. Regeneration of earth used in the decolorization of oils.

H. V. Atwell, assr to The Texas Co. U.S.P. 2,409,235, 15.10.46. A continuous cyclic process for the catalytic formation of liquid compounds from carbon and hydrogen by the action of a solid hydrogenating catalyst containing a carbide-forming metal.

J. W. Brooks, A. A. Kelly, and R. H. Work, assrs to Socony-Vacuum Oil Co. U.S.P. 2,409,247–8, 15.10.46. Mono fluo- and difluo-phosphoric acids are employed as catalysts in the polymerization of olefins.

T. F. Doumani and R. F. Deering, assrs to Union Oil Co. U.S.P. 2,409,259, 15.10.46. A thermal process for producing conjugated dienes boiling below 43° C.

E. L. d'Ouville and B. L. Evering, assrs to S.O.C. Indiana. U.S.P. 2,409,260, 15.10.46. A butane isomerization process.

R. F. McCleary, assr to The Texas Co. U.S.P. 2,409,296, 15.10.46. A lub. oil additive consisting of an oil-soluble sulphurized derivative of a partially hydrogenated cardanol.

J. R. Morris and R. F. McCleary, assrs to The Texas Co. U.S.P. 2,409,303, 15.10.46. A lub. oil additive.

P. H. Williams, assr to Shell Dev. Co. U.S.P. 2,409,329, 15.10.46. Organic thiocyanic compounds.

D. L. Wright and C. W. Bohmer, Jr., assrs to S.O. Dev. Co. U.S.P. 2,409,332, 15.10.46. A white-oil composition containing a linear polymer of an oxygen containing aliphatic compound.

D. W. Young, assr to Jasco Inc. U.S.P. 2,409,336, 15.10.46. Polybutene is the chief component of a chemical-resistant coating material.

M. P. Matuszak, assr to Phillips Petroleum Co. U.S.P. 2,409,372, 15.10.46. Organic fluorine is removed from hydrocarbon mixtures by treatment with an active metal oxide catalyst in the presence of ammonia.

E. B. Peck, assr to Standard Catalytic Co. U.S.P. 2,409,382, 15.10.46. Cracked gasoline is subjected to superfractionation, hydrogenation, and aromatization to produce high octane fuel.

C. R. Ringham, assrs to Phillips Petroleum Co. U.S.P. 2,409,389, 15.10.46. Di-*iso*propyl is obtained by the alkylation of *iso*butane with ethylene in the presence of $AlCl_3$ catalyst.

W. E. Ross and P. Pezzaglia, assrs to Shell Dev. Co. U.S.P. 2,409,390, 15.10.46. A process for simultaneously isomerizing and separating *cyclo*paraffins from acyclic paraffins by means of an aluminium hydrocarbon complex.

J. D. Morgan and R. E. Lowe, assrs to Cities Service Oil Co. U.S.P. 2,409,443, 15.10.46. A lubricant for instrument bearings is composed of equal weights of tricresyl phosphate and ethylene glycol monobenzyl ether.

J. D. Morgan and R. E. Lowe, assrs to Cities Service Oil Co. U.S.P. 2,409,444, 15.10.46. A clock lubricant comprises a mixture of tricresyl phosphate, dibutyl phthalate, and triethylene glycol di-2-ethyl butyrate.

G. D. Creelman and J. F. Crowther, assrs to M. W. Kellogg Co. U.S.P. 2,409,476, 15.10.46. A method of conducting catalytic vapour-phase conversions.

G. H. Keating, assr to The Texas Co. U.S.P. 2,409,494, 15.10.46. Manufacture of catalysts in ring form.

L. A. Clarke, assr to The Texas Co. U.S.P. 2,409,544, 15.10.46. Catalytic alkylation of *iso*butane with ethylene to give 2 : 3-dimethylbutane.

A. S. Ramage, assr to A. A. F. Maxwell. U.S.P. 2,409,587, 15.10.46. A combination hydrocarbon dehydrogenation and hydrogenation process to give an aromatic product.

R. H. Hill and C. H. Watkins, assrs to S.O. Dev. Co. U.S.P. 2,409,681, 22.10.46 Preparation of an $AlCl_3$ catalyst for an alkylation process.

J. G. McNab and D. T. Rogers, assrs to S.O. Dev. Co. U.S.P. 2,409,686–7, 22.10.46. Complex lub. oil additives containing sulphur.

E. W. S. Nicholson and A. K. Redcay, assrs to S.O. Dev. Co. U.S.P. 2,409,690, 22.10.46. Desulphurization of hydrocarbon oils using hydrogen and a catalyst.

F. G. Noble, assr to S.O. Dev. Co. U.S.P. 2,409,691, 22.10.46. A two-stage absorption process for extracting gasoline from high-pressure gas.

K. C. Laughlin, assr to S.O. Dev. Co. U.S.P. 2,409,695, 22.10.46. Aromatization of gasoline in two stages using hydrogen and (*a*) molybdenum oxide–alumina and (*b*) chromium oxide–alumina, as catalysts.

F. E. Reinhardt, assr to Richfield Oil Corpn. U.S.P. 2,409,705, 22.10.46. Design of a filter leaf for discontinuous, stationary, leaf-type filters.

C. Winning and J. G. McNab, assrs to S.O. Dev. Co. U.S.P. 2,409,726, 22.10.46. A petroleum lubricant for machinery which contains minor amounts of a metal salt of a polybasic inorganic acid and a higher alcohol.

G. C. Bailey, assr to Phillips Petroleum Co. U.S.P. 2,409,727, 22.10.46. Polymerization of di-*iso*butylene to tetra-*iso*butylene using phosphorus pentoxide as catalyst.

T. W. Evans and A. G. Cattaneo, assr to Shell Dev. Co. U.S.P. 2,409,746, 22.10.46. Methyl *tert.*-butyl ether is added to a selected hydrocarbon mixture for use in supercharged engines.

C. G. Gerhold and J. E. Burgess, assrs to U.O.P. Co. U.S.P. 2,409,751, 22.10.46. Method of regenerating a cracking catalyst.

D. B. Luten, Jr., and A. De Benedictis, assrs to Shell Dev. Co. U.S.P. 2,409,773, 22.10.46. Two-stage distillation for the separation of ortho-substituted conjugated ring compounds.

L. A. Mekler, assr to U.O.P. Co. U.S.P. 2,409,780, 22.10.46. Design of a reactor.

V. Mertz, assr to Phillips Petroleum Co. U.S.P. 2,409,781, 22.10.46. In extractive distillation with furfural an alkali metal bicarbonate is added to the solvent to prevent corrosion of the equipment.

E. N. Roberts, assr to S.O.C. Indiana. U.S.P. 2,409,799, 22.10.46. Lub. oil additives consisting of a polyaminopoly–aryl methane and a neutral phosphorus–sulphur–hydrocarbon complex.

L. Schmerling, assr to U.O.P. Co. U.S.P. 2,409,802, 22.10.46. Ethylbenzene is produced from benzene, ethyl alcohol, and ethylene in the presence of phosphoric acid catalyst.

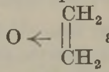
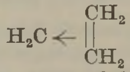
C. K. Viland and H. Y. Hyde, assrs to Tide Water Associated Oil Co. U.S.P. 2,409,815, 22.10.46. Amylenes are produced by the high temperature thermal cracking of *n*-hexane in the presence of C_2–C_3 hydrocarbons.

R. L. May, assr to Sinclair Refining Co. U.S.P. 2,409,877–8, 22.10.46. Lub. oil inhibitors are made from the reaction product of an alkylated phenol with the condensation product of turpentine and phosphorus pentasulphide. G. R. N.

PRODUCTS.

Chemistry and Physics.

877. Boron-Trifluoride Catalysed Reaction of Di-*iso*butene. A. G. Evans and M. A. Weinberger. *Nature*, 1947, **159**, 437.—At low pressures and room temperature di-*iso*butene vapour, purified by distillation over sodium, does not react on mixing with boron trifluoride, but a small amount of added water or acetone combines with the trifluoride in equal molar quantities and polymerization of the hydrocarbon occurs. Ammonia reacts but produces no polymerization, which, however, is induced by subsequent addition of water vapour. Oxygen, hydrogen sulphide, and hydrogen chloride do not combine with the boron trifluoride, but the addition of water vapour in all cases produces rapid reaction. H. C. E.

878. Structures of Ethylene Oxide and *cyclo*Propane. R. Robinson. *Nature,* 1947, **159**, 400.—Walsh's communication (*Nature,* 1947, **159**, 165; Abstr. No. 617) is criticized because: (1) It is incorrect that trimethylene oxide is less stable than ethylene oxide; (2) The reactions of ethylene oxide are not similar to those of ethylene, but to those of acetaldehyde; (3) The broad conception of electron donation by bonding electrons is not novel; (4) The formulæ  $\mathrm{O} \leftarrow \begin{array}{l}\mathrm{CH_2}\\ \|\\ \mathrm{CH_2}\end{array}$ and  $\mathrm{H_2C} \leftarrow \begin{array}{l}\mathrm{CH_2}\\ \|\\ \mathrm{CH_2}\end{array}$ for ethylene oxide and *cyclo*propane are unsatisfactory in that the dipole moment of the former structure is much greater than the experimental value; and an analogous formula for azoxy compounds has been proved incorrect. H. C. E.

879. Development and Maintenance of Pure Hydrocarbon Standards. R. G. Alden and J. W. Tooke. *Oil Gas J.*, 1.2.47, **45** (39), 42.—An account is given of the development and maintenance of pure hydrocarbon standards. The methods and operations involved in the manufacture of such standards by the two main routes: (1) from naturally occurring mixtures and (2) by synthesis, are outlined, and brief reference is made to the degrees of purity attained by the A.P.I. and the Bureau of Standards. The effects of impurities on hydrocarbon standards are discussed and shown in a table. A typical pure hydrocarbon storage installation is illustrated and its design and layout for the avoidance of contamination throughout manufacture and the maintenance of purity of the final products are discussed. Emphasis is placed on the following: care and periodic inspection of the equipment to avoid contamination by leaks through valves, lubricants in pumps and valves, etc.; necessity of sufficient tanks, each with individual lines, etc., to ensure time for testing each before transfer to final storage; final tanks should be sealed with blind flanges and have separate gravity flow-lines for filling containers, and their contents should be protected from air oxidation by the use of an inert gas. The use of inhibitors for protecting the standards from oxidation or polymerization is discussed. Shipping containers and loading procedures are surveyed from the aspects of cleanliness and inspection, etc. Testing methods and equipment for the control and analysis are discussed, *e.g.*, calorimeters, freezing-point and melting-point apparatus and precise controlled water-baths, the Mass and Infra-red spectrometers, etc. Ten literature references are given. W. H. C.

880. Thermodynamic Properties of Hydrocarbons. II. Numerical Data and Examples. N. Tcherkezoff. *Rev. Inst. Franç. Pétrole,* 1947, **2**, 49–53 (see Abstract No. 735 (1947)).—This concluding instalment gives 7 graphs (2 previously published) illustrating data presented in the previous articles. The graphs compiled by the author show: variation of hydrocarbon entropies at 25° C with the number of C atoms; free energies of hydrocarbons at 25° C as a function of the number of C atoms; free energy of olefins (per C atom) as a function of the temperature; free energies of the C_6 hydrocarbons as a function of the temperature; the true specific heat of gaseous hydrocarbons as a function of their density and of the temperature and the mol specific heat of the vapours of a number of hydrocarbons (at atmospheric pressure) as a function of the temperature. V. B.

881. Recent Developments in Industrial Emission and Absorption Spectroscopy. *J. sci. Instrum.*, 1946, **23**, 292–301. (*Summarized Proceedings of Conference on Industrial Spectroscopy*, London, July 5 to 6, 1946, *organized by the Industrial Spectroscopic Group of the Institute of Physics.*)—In the first paper, "The Significance of Infra-red Spectroscopy in Analysis" (H. W. Thompson), the theoretical and applicational aspects of infra-red absorption spectra were discussed. Examples of typical industrial analytical methods were described, mention being made of new instruments with which continuous analysis can be applied to flow lines or to reaction mixtures.

G. F. Lothian described equipment for infra-red absorption spectrophotometry, and recent improvements in speed and convenience in obtaining spectra. Other speakers described analytical problems involving gaseous mixtures, organic liquids, polymers, etc., recent German developments, and the limitations and advantages of analytical methods based on the Raman effect.

The second half of the proceedings, dealing with emission spectrography, included papers on " Modern Equipment for Emission Spectrographic Analysis " (A. S. Nickelson and F. W. J. Garton) and " Spectroscopic Light Sources for the Analysis of Metals and Alloys " (A. Walsh); other speakers discussed the inadequate specification of sparking conditions, unpublished work abroad, arc and spark discharge phenomena, and the film and plate controversy. The concluding paper dealt with " A Statistical Examination of Sources of Error in the Spectrographic Analysis of Low Alloy Steel " (H. T. Shirley). C. N. T.

882. Evolution of Energy in Jet and Rocket Propulsion. P. Bielkowicz. *Airc. Engng*, 1947, **19**, 19.—The concluding article in this series deals with the dissociation of diatomic gases, explosive reaction, flame speed, and the combustion of CO.
I. G. B.

883. Oil Pipelines. A. Lugaresi. *Riv. ital. Petrol*, Jan., 1947, **165**, 12.—A review is given of the theory of flow of fluids in tubes, from which are deduced expressions for the pressure drop along pipes of given dimensions. D. H. McL.

Analysis and Testing.

884. Engine Testing of Fuels and Lubricants. 3 (2). Fuel Consumption and Power Output. P. H. Moore. *Petroleum*, 1947, **10**, 38.—The control of operating conditions is very important as any difference in fuel properties is likely to be small. Means of effecting such control are discussed. Subsequently details are given of the methods of test for both spark ignition and diesel fuel. K. C. G. K.

885. Molecular Weights in Practice and Theory. II. Theory. 2. Derivation of θ = Km. A. V. Brancker. *Petroleum*, 1947, **10**, 32.—This instalment deals with the derivation of the approximation $\theta = Km$ (where θ represents temperature change, K is a constant and m molality) from fundamental thermodynamic equations. A modified equation, $\theta = Km^b$ is introduced, where b is a constant nearly equal to unity.
K. C. G. K.

886. Physical Research Methods Increase Knowledge of Catalysts, Hydrocarbons. G. M. Webb. *Oil Gas J.*, 22.3.47, **45** (46), 203.—A general review of the use of the electron microscope, X-ray, and electron diffraction; infra-red, ultra-violet and Raman spectroscopy and mass spectrometry as applied to hydrocarbons, catalysts, and other substances is given.

For example, X-ray diffraction methods were applied to the problem of obtaining uniform distribution of molybdena throughout the alumina, which composite is extensively used in the hydroforming process for production of toluene from petroleum. The diffraction methods quickly established that a catalyst of greatly improved heat stability could be prepared by adding molybdenum compound to the wet undried alumina hydrogel.

Radiation cycles used for the various investigations varied from low values of one cycle in hundreds of years to 10,000 million cubed cycles per sec. G. A. C.

887. Second Report on Tests for Soil Stabilization. Soil Stabilization Panel of the Institute of Petroleum Standardization Committee. *J. Inst. Petrol.*, 1947, **33** 113.—The work of the Panel on the following is described : (1) determination of frost resistance of compacted mixes; (2) determination of stabilizer content of mixes; (3) sampling and treatment of samples in field testing; (4) standardization of methods of compaction, applicable to all tests. The appendices to the paper describe the various tests. A. H. N.

888. Greater Trend Toward Petroleum Performance Specifications in 1947. C. M. Larsen. *Oil Gas J.*, 22.3.47, **45** (46), 181.—The stating of chemical and physical properties of petroleum products as measured by laboratory tests is giving way to performance specifications, which latter require a guarantee of future performance in service or " life tests " under actual or similar conditions. For example, the only suitable tests to determine whether or not a gear lubricant is satisfactory for a hypoid axle at high speeds is to put the lubricants in the axle and run the car at the high speeds. Other products discussed are premium oils, motor and aviation gasoline, and fuels for diesels, gas turbines, rockets, and jets; and lubricants for same. G. A. C.

889. Spectroscopic Analysis: Application of the Hydrogen Discharge Lamp to the Analysis of Mixtures of C_8 Aromatic Hydrocarbons. R. R. Gordon, H. Powell, and J. Tadayyon. *J. Inst. Petrol.*, 1947, **33**, 103.—Two methods of using the hydrogen discharge lamp employed by other workers are described and examples of the application given. It is shown that neither of these methods gives accurate analyses. A third method has been developed which, by the use of a microphotometer, makes possible a quantitative measure of the absorption at any wavelength. This method in its present stage of development is not so accurate as the Spekker method normally used, but reasons are given for the opinion that it may be made at least as accurate as the normal method. The method using the microphotometer is not so rapid as the Spekker method for the analysis of isolated samples, but is more rapid when analyses are required on a series of samples whose composition and concentration are known approximately. The accuracy obtained is shown by the analysis of nineteen synthetic mixtures to be approximately ±5%, *i.e.*, 10% ±5%, or 90% ± 5%. A. H. N.

890. Viscometry of Soap-in-Hydrocarbon Systems. G. F. Wood, A. H. Nissan, and F. H. Garner. *J. Inst. Petrol.*, 1947, **33**, 71.—A capillary viscometer of laboratory-scale and its counterpart using steel pipes up to 2 in in diameter for the " capillary " are described. Aluminium soaps dissolved in petrol showed a different inlet loss from Newtonian liquids. In pipes a new phenomenon described as " negative slip " is revealed. The end-effects of rotary viscometers when used on soap-in-hydrocarbon systems may be different from those normally observed, due to secondary flow. In falling sphere viscometry, the evaluation of a mean rate of shear is shown to include functions of both the radius of the sphere and of the full tube. Discrepancies appear to exist between the viscosity measured in a capillary apparatus and that using falling spheres. A. H. N.

Gas.

891. Gas Dehydration at Pecan Island. E. H. Short. *Oil Gas J.*, 12.4.47, **45** (49), 82.—The gas dehydration plant at Abbeville, La, erected by Humble Oil and Refining Co., is described.

5 wells in the gasfield are producing and 3 more are to be drilled. The maximum capacity of the plant is 50 million cu. ft. per day; at present 15 to 40 million cu. ft. of gas per day are processed. Tests show that 1250 lb of water was removed from 45 million cu. ft. of gas. The gas is passed to flow-line heaters equipped with 2-in 5000-lb w.p. tubes. Water removal is accomplished by contacting the gas with diethylene glycol, after passing through a scrubber in the bottom of the contactor. This removes free water and condensate; the gas then passing upward through standard bubble-cap plates where it contacts the diethylene glycol. The third stage consists of removing traces of the glycol in a second scrubber located in the top of the contactor shell. The accumulating glycol solution is dealt with in a heat exchanger, passed to a still where the water is driven off and the glycol recovered for use.

The contactor can operate at a maximum pressure of 1000 p.s.i., and dehydrated gas is delivered from the plant at pressures up to 1000 lb to a consumer 65 ml distant. G. A. C.

Engine Fuels.

892. Vaporization of Fuels for Gas Turbines. Part II. Heat Quantities Required to Vaporize Gas Turbine Fuels. B. P. Mullins. *J. Inst. Petrol.*, 1947, **33**, 44.—The true specific heats in the liquid and vapour states and the latent heats of vaporization of

100-octane fuel and kerosine have been evaluated at various temperatures from empirical relationships and experimental data taken from the scientific literature. The heat contents (above 15° C) of the heated liquid fuels were evaluated, and a method was devised to enable the heat contents of the two standard fuels to be calculated under different total pressure and mixture ratio dew-point conditions. The method was carried out using the dew-point values calculated in Part I of this report, and the results are presented in the form of curves and two nomograms. These results have been converted into forms which may be applied directly to gas-turbine practice. The air temperature necessary to vaporize each of the standard fuels at a given total pressure and given final mixture ratio have been calculated. Further, the fuel temperatures necessary to produce vaporization under similar conditions have been calculated, and the results are presented in the form of 6 nomograms with auxiliary duplex scales. Finally, VOFAM (Vaporization of Fuel–Air Mixtures) were devised, one for each fuel, from which bubble-points, dew-points, heat contents, and air and fuel temperatures for vaporization at given pressures and mixtures ratios may be read off with the aid of a straight-edge. A. H. N.

893. Motor Fuels Used in Sweden. G. Egloff. *Petrol. Times*, 18.1.47, **51**, 64.—The various fuels used in Sweden during the war are reviewed. The most important motor fuels in common usage were : (1) producer gas, (2) alcoholic blends, (3) motor fuel from shale oil, and (4) acetylene. The use of these fuels is briefly discussed. R. B. S.

Gas Oil and Fuel Oils.

894. Burning Index for Distillates. A.P.I. Gravity and Mid-point of Boiling Range Quality Fuels. J. C. Reid and A. B. Hersberger. *Fuel Oil & Oil Heat.* (*Annual Oilheating Analysis and Show Number.*) Jan. 1947, 90–92.—Investigations carried out by the Atlantic Refining Co. to determine whether some readily available properties of an oil could be used to develop a correlation with actual burner performance have resulted in the production of a Burning Index Chart which is presented and described. It is based on the gravity and 50% b.p. of the oil and has been primarily developed for use with oils having approximately the distillation range of No. 2 fuel oil. The oils are burned in a burner-boiler combination set up so that both the air and oil-firing rate may be varied widely. Smoke densities of the flue gases are determined. The data from a series of tests are then plotted as air setting *v.* smoke density for the different firing rates. The curves obtained are then used as the basis for the construction of another graph, which, after the plot points have been completely lined up, encloses a zone, and shows the limiting conditions of burner operation defined by a smoke density of 20, or where that amount of smoke is not formed, by the design of the burner. The area of this zone, which has been termed the combustion envelope, plotted on a fixed scale, is then measured by a planimeter. The oil that shows the largest area is the best for the burner in question. The conversion of this area to constant burning index lines, as plotted in the Burning Index Chart presented is described. The accuracy with which a chart of this nature can be used to predict the burning qualities of an oil, either in terms of combustion envelope area or of burning index, is demonstrated by the tables given, wherein the actually determined values are compared to values read from the charts. A burning index to have maximum usefulness must be such that the index of blends can be predicted accurately from the indices and the proportions of the constituents present in the blend. The index presented handles this phase of the problem correctly as the data given shows. W. H. C.

895. Heavy Oils in Stationary Diesel Engines. M. Zwicky and H. Ringgenberg. *Gas Oil Pwr*, 1947, **42**, 69–72.—The present trend of oil-refining is such that fuels of high O.N. are produced by cracking and polymerization of heavier fractions, and diesel engines must therefore be operated on oil-refinery residues of poor ignition qualities instead of gas oil; but any increase in maintenance costs is offset by the cheapness of the heavier fuel.

Such fuels usually possess low-firing qualities and high Conradson coking number. Low-firing quality, particularly in small cylinders, results in incomplete combustion, leading to lacquer and ringsticking. Oils with high coke numbers lead to formation of deposits and increased wear, both erosive and corrosive. In designing an engine to operate on low-grade fuels the criteria are: (1) large cylinders and moderate speeds, hot cooling of cylinders and covers, and adaptation of injectors and combustion spaces; (2) special cast-iron liners and preheating of fuel; (3) magnetic and other filters in the lubricant circuit. Pressure-charging gives only half the wear which is experienced in a normal engine.

A Sulzer engine designed on these lines is described. H. C. E.

896. Firing Oil. (Refiner's Notebook, No. 131.) W. L. Nelson. *Oil Gas J.*, 15.2.47, **45** (41), 109.—The two steam atomizing type burners used in refineries are (1) outside mix, where oil and steam issue separately from burner, (2) inside mix, more economical of steam, where oil and steam are mixed inside burner, and issue together.

Residual fuels are best, but gas oils, distillate fuels, naphthas, asphaltic residues, and acid sludge mixtures can be used, though acid sludge may corrode the burner. Optimum temperature for viscous fuels is such that Saybolt Universal viscosity is 130–250. Too high temperature may lead to spluttery flame or excessive coking within burner tip.

The best type of pump for steady pressure is rotary. Fuel pressure is often 40–60 p.s.i.g., rising to 125 p.s.i.g. for light gas oil. Amount of atomizing steam ranges from 1·6–4 lb per gal of oil for inside mix, to 10 lb per gal for outside mix.

Burner troubles discussed include spluttery flame, smoky flame, failure of ignition, and excess air. W. M. H.

Lubricants.

897. Apparatus for the Study of the Rheological Properties of Dielectrics. W. Lethersich. *J. sci. Instrum.*, 1947, **24** (3), 66–71.—The rheological properties of materials are usually studied by means of compressive, tensile, and shear tests. Compressive tests are generally made on cylindrical specimens, but these are subject to errors due to friction at the ends, unless the height of the cylinder is at least twice its diameter. An apparatus is described which will measure the compressive strain on specimens 3 cm in length and 1·3 cm diameter. Strains up to 0·12 can be measured to an accuracy of 10^{-5}, and the apparatus can be used without modification for tensile tests. The lateral strain can be determined at the same time, and to a similar order of accuracy.

The shear properties are measured on thin-walled cylinders of material and an apparatus has been constructed for applying the shear stress and measuring the shear strain. This apparatus is particularly suitable for studying relaxation phenomena, since there is no friction after the stress has been removed. Typical results are quoted for polyethylene, bitumen, polystyrene, etc. C. N. T.

898. Unusual Cause and Effect of Corrosion. A. H. Stuart. *Petroleum*, 1947, **10**, 26.—An unusual case of corrosion is described, caused by the iron content of natural graphite. The latter was admixed as lubricant with asbestos serving as packing material in a stuffing-box on the shaft of a large centrifugal pump (operating on river water) which developed a leak at the gland. A hydrochloric acid extract of the graphite revealed an iron content of over 6% (expressed as Fe_2O_3) which caused the accumulation of rust flakes in the stuffing material (both stuffing-box and shaft were of bronze). Results of the examination of other samples of graphite and of graphite substitutes are described. K. C. G. K.

899. Oleophobic Monolayers. I. Films Adsorbed from Solution in Non-Polar Liquids. W. C. Bigelow, D. L. Pickett, and W. A. Zisman. *J. Coll. Sci.*, 1946, **1**, 513–538.—Dilute solutions of eicosyl alcohol in *n*-hexadecane will not wet the grease-free surfaces of glass, platinum, and many other polished metals, which, however, are wetted by the pure solvent. The surfaces, after immersion in the solution, are found to be oleophobic and hydrophobic, and the phenomenon is therefore due to adsorption of the solute. As the solution is diluted, a longer time is required for the effect to develop, from which it was established that the adsorbed layer is monomolecular.

A platinum surface was dipped into a dilute solution of *n*-octadecylamine in dicyclohexyl, the contact angle (θ) between the horizontal surface and a drop of distilled water measured, and the surface cleaned by burning. When, by repeated dipping, θ was reduced below 75° it was assumed that all the solute was removed, and hence the average area per adsorbed molecule was calculated to be 30 Å. The molecular chain, extending at right angles to the surface, terminates in a methyl head to which hydrocarbon molecules adhere only weakly. Increase in temperature or decrease in chain length will increase the solubility of the film. Monocarboxylic acids and primary amines of unbranched saturated paraffins in hexadecane form oleophobic films when the number of carbon atoms per molecule $(N) \geqslant 14$. Compounds where $N < 14$ are oleophobic to the solution but not to hexadecane; when $N < 8$ no oleophobic films are formed. With analogous monohydric alcohols the corresponding values of N are 16 and 10. For a given concentration of solute the tendency to form oleophobic films depends upon the temperature.

The inability of unsaturated acids to form oleophobic films is explained by the V shape of the molecules, which do not, therefore, achieve the close packing of saturated molecules. Rinoleic and ricinelaidic acids, having two polar groups, are wetted by hexadecane, although barely oleophobic to the solution. Compounds containing branched chains do not usually form oleophobic films, and films oleophobic to the solution but not to the solvent are produced by sparingly soluble compounds.

The higher the viscosity of the solvent the longer time is required for complete adsorption. *n*-Octadecylamine forms oleophobic films in a wide range of non-volatile solvents. When the solubility of the substance is high oleophobic films do not form because the molecules are not packed tightly enough; and the solubility limit is reached before a close-packed monolayer is formed when the solubility is low. Certain substances, such as cholesterol, do not form oleophobic films from solvents from which the compound has a low lifetime of adsorption.

In measuring the wetting properties of pure hydrocarbons on monolayers adsorbed from hexadecane on platinum surfaces, θ was found to decrease with the boiling-point of the liquid. θ between a monolayer and each member of a homologous hydrocarbon series decreases with the boiling-point and molecular weight. The time required for the drop to wet the monolayer decreases with chain length.

θ of water on oleophobic monolayers is independent of the nature and location of the polar groups at the end of the oriented molecules, due to the fact that oriented methyl groups are presented to the water droplet. That values of θ for monolayers are smaller than those for solid paraffin waxes at the same temperature is because the latter surface is much rougher than that of a monolayer on a polished surface.

With solutions of oleophobic substances the film spreading on polished, grease-free surfaces is broken up until, finally, the surface is covered with droplets separated by apparently clear areas whose θ with hexadecane and water prove that they are covered with an adsorbed monolayer. The adhesion energy of the monolayer formed at the metal–oil interface is less than that for the metal surface, over which the oils will therefore spread preferentially. When the number of molecules is insufficient an oleophobic film is not formed and even spreading occurs.

The applications of these films and their properties to other problems and to industry include: (1) The surface-active properties of biological substances, such as cholesterol, can be studied by depositing monolayers on suitable surfaces. (2) Although adsorbed oleophobic films exhibit a low coefficient of friction the addition of such compounds to lubricating oils may hinder the wetting of the lubricated surfaces. Suggestions for maintaining oil flow in these circumstances are given; but the non-spreading properties of these oils would tend to keep the lubricant in the vicinity of the bearings. (3) The hydrophobic properties of monolayers can be used to protect metal surfaces from rusting or from corrosion. Data on inhibition of rusting by additives in turbine oils, hydraulic fluids, etc., can be explained on the basis of adsorbed monolayers.

H. C. E.

900. Lubricating Properties of Molecular Layers of Stearic Acid and Calcium Stearate on Metal Surfaces. J. N. Gregory and J. A. Spink. *Nature*, 1947, **159**, 403.—After depositing molecular layers of calcium stearate and stearic acid on copper, platinum, and stainless steel, the coefficient of friction, measured over a range of temperatures, was found to vary at temperatures corresponding to known physical changes in the lubricant. With copper these changes occurred at the melting-point of stearic acid and the softening-point of copper stearate. On stainless steel a change occurred at the softening-point of calcium stearate, and with platinum changes occurred at the phase transformation and melting-point of stearic acid. In general, the frictional effects, and the number of layers required for lubrication, depend on the nature of the metal.

That calcium stearate will lubricate steel but not copper or platinum may be because the latter require three and five layers respectively for lubrication, whereas steel requires only one. H. C. E.

901. Lubrication of Pre-Selective Gear-Boxes. A. T. Wilford. *J. Inst. Petrol.*, 1947, **33**, 1.—The paper deals with the lubrication problem which presented itself following upon the introduction of pre-selective gear-boxes on buses operated in the London Passenger Transport Board's area. Considerable difficulties were encountered attributable to severe oxidation of the oil, leading to drivers' complaints, service delays, and abnormal gear-box maintenance. The trouble, after much investigation, was kept within bounds by the use of a straight mineral oil of Pennsylvanian origin changed every 6000 ml; it was in course of time completely solved by the adoption of an inhibited turbine oil which remains in use throughout the 80,000 ml elapsing between consecutive gear-box overhauls. The results of service tests carried out both prior and subsequent to this satisfactory outcome and involving a variety of lubricants, eight of which contained oxidation inhibitors, are briefly reviewed. The necessity for conducting such tests on an adequate scale and for a sufficient length of time is emphasized, while the need for developing an oxidation test which might serve to reduce the duration of service tests is remarked upon. With the object of widening sources of supply, tests with a further number of inhibited oils have quite recently been commenced, and it is pointed out that those eventually approved as suitable for use as pre-selective gear-box lubricants must be compatible with one another. A. H. N.

902. Steam Turbine Lubrication Problems and Their Solutions. LII (3). Cooling Function of the Oil. A. Wolf. *Petroleum*, 1947, **10**, 30.—If the demulsibility of the oil becomes considerably reduced without being noticed, water leakage into the oil may raise the water content sufficiently to produce thick, custard-like emulsion sludges which may obstruct strainers and fine oil ways. Another danger is that the rate of water leakage may increase suddenly so that the water level in the oil reservoir rises to the pump suction and a mixture of oil and water with inadequate lubricating power is pumped to the bearings.

Serious trouble will arise if the water becomes corrosive through pollution, for the cooler tubes will be attacked. Pin-holes may form because of preferential solution of zinc grains if the tubes are of brass. This may also occur with acid oil. Even copper or bronze tubes will be attacked by sea-water. In such cases an iron rod fixed from end to end of the cooler has proved effective; the rod is very often corroded away by galvanic action. Dirty cooler water greatly reduces oil cooler efficiency due to deposition of slime and dirt. If the cooler capacity is too small, its efficiency may be improved by rendering the oil flow through tubes turbulent in character. Leakage of water from the auxiliary oil-pump, usually directly driven by a small vertical steam turbine mounted on top of the oil-tank must also be guarded against.

The oil-tank or reservoir is the most important unit in the lubrication system after the oil-pump and cooler. Oxidation of the oil is greatly accelerated by the presence of air bubbles, water droplets, and ferruginous solids in suspension and no effort should be spared to remove such impurities as soon as possible.

As regards demulsification, it is stated that inhibited turbine oils may attain emulsion numbers of at least 200 to 300 in service and uninhibited oils number of at least 600 without any apparent bad effect on the working of the turbine. In fact, many units have been successfully operated with uninhibited oils having S.E. numbers of 1200+. Relaxation of the present severe requirements for initial demulsibility has recently become more necessary because of the introduction of "rust inhibited" turbine oils, which contain both an oxidation inhibitor and a rust inhibitor, as the latter destroys some of the demulsibility of the mineral oil base. K. C. G. K.

Bitumen, Asphalt, and Tar.

903. Rubber–Asphalt Joint Fillers. R. H. Lewis. *Public Roads*, Jan.–Mar. 1947, **24** (11), 291.—A review of material extensively used for filling joints in concrete runways, specifications and testing procedure is given.

Rubber–asphalt blends have been satisfactorily used for some time as joint fillers and found superior to the more common types of hot-poured materials. Failure of some rubber–asphalt compounds has been traced to overheating the materials and to maintaining them at high temperature for long periods. Thus chemical changes are caused which alter the physical properties of the material, such as penetration and ductility, and impairs those characteristics desirable in efficient joint fillers. Laboratory experiments show that rubber–asphalt compounds should be heated to controlled optimum temperatures, and batches should not be heated for extended periods. Rapid methods of pouring should be used.

Experiments also show that the softening-point test should replace the prolonged flow test called for in the present specification; also the standard needle test should replace the cone penetrometer method. G. A. C.

Special Hydrocarbon Products.

904. Sulpho-Chlorinated Cutting Oils. D. G. Bagg. *Petrol. Times*, 12.4.47, **51**, 338.—A brief review is given of the development of cutting oils. The latest development is in the use of sulpho-chlorinated or straight oils in place of soluble oils. These straight oils enhance the accuracy of machining and provide better lubrication resulting in economy of power. The improvement in machining accuracy is due to: (1) the superior cooling ability of straight oils which keeps down the temperature and reduces microscopic surface faults due to heat distortion, and (2) the prevention of welding of microscopic chips to the tool by the presence of sulphur and chlorine, thereby increasing the life of the tool and improving the accuracy of machining.

These sulpho-chlorinated cutting oils are produced in concentrated form by the sulphurization and chlorination of mineral oil. They are then blended with a suitable viscosity oil in concentrations of 5–15% depending on the nature of the work. These oils can be recovered by centrifuging, filtering, or settling, without deterioration of characteristics. Their one disdavantage is that they are liable to stain alloy-metals which are more readily attacked by sulphur. R. B. S.

Derived Chemical Products.

905. Applications of Petroleum Chemicals. Anon. *Petrol. Times*, 15.3.47, **51**, 206.—The numerous applications of petroleum chemicals in various fields of industry are discussed under the following headings: (1) agriculture and horticulture; (2) building; (3) chemicals; (4) cleaning; (5) engineering; (6) hospitals; (7) leather and fur; (8) paints; (9) plastics; (10) rubber; (11) shipping; (12) textiles and laundering; and (13) miscellaneous.

The chemicals listed are being made available in Britain by extensive developments in the chemical manufacturing plants of the Shell Petroleum Company. R. B. S.

Coal, Shale, and Peat.

906. Retorting Oil Shale by the Fluidized Solids Technique. F. H. Blanding and B. E. Roetheli. *Oil Gas J.*, 15.2.47, **45** (41), 84.—Standard Oil Development Co. undertook in 1942 an investigation into the use of Australian Shale for the production of marine fuel oil by the new fluidized solids technique.

A very rich shale was used, containing 63% carbon and 8% hydrogen by weight, and was crushed to a particle size of ¼ in. Oil was removed by heating to a temperature of 850–1000° F, the fixed-bed type of operation preventing agglomeration which would otherwise have occurred at this temperature.

A small-scale batch-retorting was first carried out followed by pilot plant operation. A flow sheet and description of the pilot plant are given, together with yields and operating conditions. The shale was distilled in a 4-in vertical retort, 10 ft high, containing a fluidized bed of shale ash, maintained in a fluidized condition by air injected into the bottom of the retort. Gases and oil vapours passed into the filter section, to remove shale fines, and, finally, into a condenser and separating drum. The intimate mixing of the solid bed allowed very rapid heating of both shale and air, and insured against hot spots at the air inlet, and consequent formation of large clinkers. Operating temps. ranged from 850° to 1000° F, charge rates from 500 to 1,250 lb shale/hr/sq. ft of reactor cross-sectional area. Removal of hydrocarbons from shale was found to be a function of temp. Heat for distillation was provided by burning, in the reactor, carbon and hydrogen left on the spent shale, and some distilled oil vapours.

Analysis of crude oil and hydrocarbon gases produced are shown. Yields of crude oil were between 2·5 and 3·0 brl per ton of shale retorted, decreasing with increase in operating temps. The oil was relatively high-boiling, 15–25% in the gasoline range, with a gravity of 20–25° A.P.I. and could be made suitable for marine fuel by topping. The spent shale should have a good heating value.

From pilot plant data a process design was prepared, and is described, using a minimum quantity of steel and discarding gas and gasoline fractions as war-time emergency measures.

Costs cannot yet be reliably predicted, but may be competitive with other crude-oil production methods. American shales can be treated by the process as successfully as those from Australia. W. M. H.

Miscellaneous Products.

907. Chemicals from Petroleum. J. E. Bludworth. *Oil Gas J.*, 12.4.47, **45** (49), 76.—A review is given of the various syntheses of petroleum chemicals from the oxidation of hydrocarbons.

The chemical steps in the processes are given in detail and include production of aldehydes for use in plastics; alcohols as solvents; dye, pharmaceutical and other chemical intermediates; ketones for solvents, and acids for all types of syntheses. All the materials used are produced from hydrocarbon gases; many more could be made, but development depends on industrial demand. G. A. C.

908. Colour Lakes. Anon. *Paint Technology*, 1946, **11**, 437.—Two U.S. patents, assigned to the Sun Oil Co., California, by C. Alleman and J. R. Perrine, cover the manufacture of colour lakes from a group of acids of the $C_nH_{2n}\text{-}8{\cdot}0_2$ and $C_nH_{2n}\text{-}10{\cdot}0_2$, and having refractive indices of between 1·49815 and 1·51326, from the residues obtained in the distillation of lubricating oil stocks. The lakes are made by precipitating the water-insoluble salts (Ca, Ba, Zn, Al) from the sodium salts of the crude acids in the presence of suitable water-soluble dyes, and are suitable for use in the production of printing inks, and paints, etc. Specification No. 2,277,194 describes the preparation of dry granular lakes, after first separating the oily matter of the crude acids by treatment of the sodium salts under super-atmospheric pressure, when two layers are formed and separate. In Specification No. 2,056,931, the conditions are given for the production of the colour lakes in the presence of the oily matter. The lakes by this method are tacky, non-drying, and paste-like or semi-solid at normal temperatures, but if incorporated with suitable vehicles they may be employed in the production of printing inks and coating compositions. W. H. C.

909. Waxes and Similar Substances in the Rubber and Allied Industries: Lubricants, Softeners, Extenders, and Insulating Materials. W. S. Penn. *Petroleum*, 1947, **10**, 36.—The term " waxes " is used here not only to cover all kinds of animal, vegetable, and mineral waxes and wax-like hydrocarbons, but various other substances such as fatty acids, metal soaps, asphalts, bitumens, petroleum residues, and a wide range of natural and synthetic thermoplastic materials. Uses of such products in the rubber and allied industries are covered, *e.g.*, the manufacture of tyres, cables, hose, belting, etc., and in those industries mainly characterized by their use of high polymers (plastics, paint and varnish, lacquer, plywood, electrical insulating materials, etc.). The use and nature of internal lubricants both for rubber-like products (elastomers) and plastics is discussed. Typical compositions are given. External lubricants are often necessary to improve the surface appearance of moulded products (elastomeric and plastic). Various waxes are used to cover the surfaces of the moulds for this purpose. Anti-stick compounds are very closely related to such external lubricants. Softeners are used for the internal lubrication of many very hard compounds used in moulding. Plasticization must be distinguished from softening; it must be employed if the intermolecular forces of any polymer are very strong in order to improve the processing properties and to make the plastic more flexible.

Thermoplastics are comparable with waxes having long chains of carbon atoms with 30 to 60 carbon atoms. However, thermoplastic chains may have from 100 to several thousand carbon atoms depending on the type of polymer and the degree of polymerization. Generally, the chains are not joined together, but can flow over each other, *i.e.*, become soft or even sticky in the case of the lower polymers. Synthetic and natural rubbers contain similar chains which are, however, unsaturated, each unit having a double bond (isoprene, butadiene, etc.). Cross-linkage of the chains is here usually brought about with sulphur. Accelerators are used to speed up this curing process with elastomers. Such accelerators are not satisfactory by themselves, requiring the addition of activators. Stearic acid is commonly used for this, but many fatty acid salts may also be employed. Extenders are often used in rubber compounds to reduce cost, *e.g.*, liquid and solid petroleum residues.

One of the most important uses of wax in the plastics and rubber industries is for electrical insulation, particularly in the case of cables, coils, and condensers (paraffin wax, ozokerite, and montan wax). Many thermoplastics used for similar purposes are very important and will be discussed separately. K. C. G. K.

910. Secrets of German Fuel Technology Unearthed. Anon. *Petrol. Times*, 29.3.47, **51**, 282.—The following BIOS final reports are briefly reviewed :

BIOS Final Report No. 642 : German Oil Storage Blending and Filling Installations on WIFO Oil Storage Depots located at Eickeloh, Rüthen, and Nienburg : with particular reference to drum and can filling. (*Note.*—The number of this report is printed as 42, but it seems obvious that it should be 642.)

BIOS Final Report No. 662 : Manufacture of Phenylbetanaphthylamine at I.G. Farbenindustrie, Ludwigshafen. H.M.S.O., 6*d.*

BIOS Final Report No. 666 : I.G. Farbenindustrie Uerdingen : Manufacture of Phthalic Anhydride, Benzoic Acid, etc. H.M.S.O., 1*s.*

BIOS Final Report No. 732 : Lüneburger Wachswerke A.G. Lüneburg-Germany, Waxes.

BIOS Final Report No. 805 : Aspects of the Synthetic Fatty Acid and Synthetic Fat Industries in Germany. 99 pages. R. B. S.

ENGINES AND AUTOMOTIVE EQUIPMENT.

911. Rolls-Royce Eagle. Anon. *Flight*, 1947, **51**, 368.—The new Eagle is a twin-crank flat-H sleeve-valve engine aspirated with a two-stage two-speed supercharger and, in Mk 22 form is equipped to drive an eight blade contra-rotating airscrew. Leading particulars are :—

Bore and Stroke	5·4 in × 5·125 in
Total Swept Volume	46 litres
Cylinder Compression Ratio	6·5 : 1
Max. Internal Comp. Ratio of Supercharger	4·18 : 1
Max. b.h.p.	3500 at 2750 ft
Max. b.m.e.p.	282 p.s.i.
Power-Weight Ratio	0·9 b.h.p./lb

I. G. B.

912. Theseus Air Testing. Anon. *Flight*, 1947, **51**, 273.—Following official test schedules, leading particulars and preliminary performance data are given :—

Reduction Gear Ratio	0·119 Airscrew Turbine Speed (L.H. Tractor)
Compression Ratio (Sea Level Static)	4·4 : 1
Compressor Speed	8200 r.p.m.
Air Delivered by Compressor (Sea Level Static)	30 lb/sec
Power Absorbed by Compressor (Sea Level Static)	3500 b.h.p.
Airscrew Turbine Speed	9000 r.p.m.
Airscrew Speed	1070 r.p.m.
Oil Max. Power	3 pt/hr

	Theseus Series TH. 11 (Without heat exchanger)	Theseus Series TH 21 (With heat exchanger)
	Max. continuous power output and fuel consumptions.	
Sea Level Static	2180 b.h.p. + 600 lb jet (0·80 lb/b.h.p./hr)	1950 b.h.p. + 500 lb jet (0·70 lb/b.h.p./hr)

I. G. B.

913. Some Problems of Cylinder Bore Wear. W. A. Robotham. *J. Instn. auto. Engrs*, 1947, **15**, 115–147.—Drawing on extensive records and experimental data, the effects of a wide range of design and operation variables on cylinder bore wear and oil consumption are discussed. Consideration of the performance of cars 15 and 20 years old under modern traffic conditions shows that in spite of the lack of most features which have been widely publicized as conducive to good cylinder life, they have a better durability than contemporary models. The average wear figure for some hundreds of these veterans is 0·00008 in per 1000 miles—or 100,000 miles between re-bores, which is far better than the results at present being achieved on their successors. Amongst the factors named as being responsible for the reduced cylinder life of the modern car are increased gas pressure and higher piston speeds. The author suggests that bore life can only be improved by way of the cylinder-bore material. A particularly promising treatment is thin chromium plating of the top region only of the bore.
P. T.

914. Recent Developments in Low-Temperature Starting of Petrol and Compression-Ignition Engines. R. Barrington, W. A. Bevis, and K. Brook. *J. Instn. auto. Engrs*, 1947, **15**, 51–82.—A description of work undertaken to ensure that internal combustion engines intended for land forces during the war should start at 0° F or lower. The method of approach is discussed in full giving consideration to lubricant, fuel, dilution of lubricant, carburation, ignition, priming system, manifold, and fuel pump of the petrol engine. For the diesel engine similar considerations are given and the development of apparatus for using ether as an ignition promoter with a simple form of carburettor is described. Finally, a satisfactory starting system for temperatures as low as − 30° F was produced which required in the case of the petrol engine modification of the carburation and ignition system and for the diesel engine the use of a simple form of carburettor and equipment for making use of an ether ignition promotor. The article finishes with a description of the development of batteries for low-temperature operation.
G. P. K.

915. Free-Piston Compressor-Engines. Anon. *Nature*, 1947, **159**, 413.—The free-piston compressor-engine is a reciprocating air compressor driven by a reciprocating two-stroke diesel engine, with the two opposing pistons coupled directly and without a fly-wheel. Energy for the compression stroke is supplied by the compressed air in the compressor cylinder. To improve the balance the engine cylinder has two pistons connected so that their displacements are equal and opposite, and starting is accomplished by bringing them together suddenly. The amount of injected fuel is varied automatically to keep the output air pressure constant, the effect of varying the air–fuel ratio being to change the stroke of the assembly.

The use of such an engine instead of a rotary air compressor in a gas turbine unit is under investigation. All the air pumped by the compressor cylinder is fed to the engine cylinder for scavenging and supercharging, and the hot exhaust gases then pass through a gas turbine. It is claimed that an overall efficiency of 41% is obtainable.
H. C. E.

916. Waukesha–Hesselman Low Compression Engines. Anon. *Gas Oil Pwr*, 1947, **42**, 87–88.—A new range of diesels ranging from 29 b.h.p. to 218 b.h.p. use low-grade fuel. The stroke–bore ratio is almost 1 : 1, and the combustion chamber is formed by a symmetrical dishing of the piston crown. Starting is effected by petrol, and in operation a tar oil or tractor distillate can be used. Aluminium alloy or cast iron pistons are fitted with tapered pressure rings.
H. C. E.

917. 2000-H.P. Gas Turbine Generator Set. Anon. *Gas Oil Pwr*, 1947, **42**, 77–79.—An experimental 2000-h.p. gas turbine generator, weighing 19 lb per h.p., burns bunker C fuel oil and gives an estimated thermal efficiency of 20% on full load. Incoming air is compressed up to 70 p.s.i. and mixed with fuel sufficient to produce a maximum burning temperature of 1350° F. The turbine develops 6000 h.p., of which 4000 h.p. are used to drive the compressor, and the remainder is delivered to a D.C. generator. Detailed descriptions of the compressor, combustion chambers, gas turbine, and generator are given.
H. C. E.

918. A 2000-H.P. Gas Turbine. T. J. Putz. *Motor Ship*, Apr. 1947, **28**, 38.—Extracts from the American Westinghouse open-cycle design are given. Sectional drawings are the longitudinal section through the compressor, a section through the combustion chambers and the gas turbine. A significant feature of the combustion chambers is their ability to burn Bunker C fuel oil although no details are given of the success achieved. I. G. B.

MISCELLANEOUS.

919. The Trend of Fuel Prices. Anon. *Motor Ship*, Apr. 1947, **28**, 10.—Bunker fuel prices quoted in shillings per ton are given for September 3, 1939 and March 1947 at various ports for two classes of fuel (fuel oil and diesel oil). An interesting comparison of the price differential between diesel oil and fuel oil at these two dates is given, diesel oil being 48% dearer than fuel oil in September 1939 and only 31·5% in March 1947. I. G. B.

920. United States Petroleum Industry in 1946. Anon. *Petrol. Times*, 12.4.47, **51**, 346.—Tables are presented of (1) United States production, imports, exports, stocks, and demands of refined products for 1946, and (2) United States crude-oil production by States and principal fields for 1946. Comparative figures for 1945 are also given. R. B. S.

921. Early History of The Bradford Field. G. G. Bauer. *Producer's Monthly*, Nov. 1946, **11** (1), 16.—An account is given of the history and development of the Bradford field from the discovery of the Drake well in 1859 up to the close of the century. R. B. S.

922. Canada's Contribution to Oil Production. Anon. *Petroleum*, 1947, **10** (2), 33.—A survey of Canadian oil production in recent years and its relation to production figures for countries inside the British Commonwealth as well as to those of other countries. K. C. G. K.

923. United Kingdom Petroleum Trade in December. Anon. *Petrol. Times*, 1.2.47, **51**, 125.—Tables are presented of United Kingdom imports and exports of crude oil and refined products for December 1946, together with comparative figures for December 1945. R. B. S.

924. United Kingdom Petroleum Trade in 1946. Anon. *Petrol. Times*, 1.2.47, **51**, 114.—Statistical data are presented on the United Kingdom imports and exports (including oil fuel bunkering of shipping) of crude oil and liquid refined products during 1946, together with comparative figures for 1945 and 1938. The total imports of crude oil and liquid refined products in 1946 was 3,806,064,000 I.G. as compared to 4,289,663,000 gal in 1945 and 3,203,505,000 gal in 1938. The gradual rise of petroleum imports since 1919 and the effect of the war on their general trend is shown graphically. R. B. S.

925. United Kingdom Solid Petroleum Products. Anon. *Petrol. Times*, 15.2.47, **51**, 174.—Statistical data are presented on the United Kingdom imports and exports of solid petroleum products during 1946, together with comparative figures for 1945 and 1938. R. B. S.

926. Shape of U.K. Overseas Trade Becoming Clear. Anon. *Petrol. Times*, 4.1.47, **51**, 19.—Tables are presented of United Kingdom imports and exports of crude oil and refined products for November and the eleven months of 1946. Comparative figures for 1945 and 1938 are also given. R. B. S.

927. United Kingdom Petroleum Trade in 1947 (Details for January). Anon. *Petrol. Times*, 15.3.47, **51**, 233.—Statistical data are presented on United Kingdom imports and exports of crude oil and refined products for January 1947, together with comparative figures for January 1946. R. B. S.

928. United Kingdom Petroleum Trade in 1947 (Details for February). Anon. *Petrol. Times*, 29.3.47, **51**, 287.—Statistical data are presented on United Kingdom imports and exports of crude oil and refined products for February and the first two months of 1947. Comparative figures for the corresponding periods of 1946 are also given. R. B. S.

929. Equipping the Oilfields. H. W. Lane and R. C. Thomson. *Times Rev. Ind.*, 1947, Apr., 6–9.—Considerable potentialities in the field of oil producing and refining equipment are available to British industry, although owing to the big lead by U.S. manufacturers American standards will have to be followed. A list of the main items of oil-producing equipment is given, showing which items are obtainable in the U.K. and which in the U.S.A. only. Features in the design of such equipment are briefly discussed, with particular reference to rock bits. Oil refinery equipment manufacture is handicapped by the lack of clad plate and by the fact that British prices are 25 to 100% higher than American. A plea is made for closer co-operation between the manufacturers of equipment for the oil industry and the oil industry itself. V. B.

930. Combustion in H.M. Navy. S. R. Dight. *Petrol. Times*, 26.4.47, **51**, 375.—The developments in the oil-combustion methods of the Royal Navy are reviewed. The improvements in boiler design are dealt with in most detail: the effect of these improvements on the construction and efficiency of fighting vessels is also discussed. R. B. S.

931. Sulphur from Sour Gas . . . An Added Income. G. Weber. *Oil Gas J.*, 8.3.47, **45** (44), 58.—A description is given of the process used by the McKamie Gas Cleansing Co., Arkansas, for the sweetening of extremely sour natural gas, with recovery of pure sulphur as a by-product. Operation over 3 years has proved practicable and profitable. In this period over 75,000 tons of sulphur, worth $1,250,000 has been recovered from the Dorcheat–Macedonia fields in South Arkansas. Briefly, the combined gases are "Girbotol" treated by contact with monoethanolemine solution at 100° F, and 650 p.s.i.g., yielding sweet dry gas from the column overhead and the extract from the base is then passed to a reactivator column at 225° F and 35 p.s.i.g., where the acid gas is stripped overhead, cooled, and passed to a modified Klaus process plant. Operating details of this section have not been published. The stream at this point contains about 55% H_2S, 43% CO_2, and 2% of hydrocarbon vapours, and is mixed with air and partially burned under air–gas ratio, controlled to the amount required to burn all the hydrocarbons and one-third of the H_2S. The stream is cooled to 530° F and is passed to the converter where it contacts bauxite and reacts as follows: $2H_2S + SO_2 = 2H_2O + 3S$, and passes to the catalyst chamber and to a sulphur wash column, and, again, through a second converter and a wash-tower. In each washer a stream of molten sulphur is circulated and from the base of each washer, the sulphur (at 250° F) produced flows out through a measuring tank before going to the sulphur storage pile. Operational problems are discussed and the peculiarities of melted sulphur are described. These show that temperatures must be controlled within 81° range to assure free operation of the liquid in the packed towers and lines. Several plants are discussed and briefly described, the first, completed in 1939, by the Lion Oil Co., Magnolia, treated 15,000,000 cu. ft./day of gas containing 1500 grains H_2S/100 cu. ft. Another plant treats 60,000,000 cu. ft./day gas from the Dorcheat–Macedonia field, containing 1900 grains/100 cu. ft. Information is given as to the organizations concerned, fields contributing, royalties contracted, and recovery figures. W. H. C.

BOOK REVIEW.

Gas Analysis and Testing of Gaseous Materials. V. J. Altieri, B.S. New York: American Gas Association, Inc. Pp. ix + 567.

In his Preface, Mr V. J. Altieri explains that the object of this book was to meet the needs for information on gas analysis of a variety of people—laboratory workers, chemists, physicists, and engineers, and also executives in the gas industry. Accordingly, the book includes a section on principles and methods for the pure and applied scientist, the principles being all connected with gas analysis and testing of gaseous materials. Detailed descriptions are given of methods for the measurement of quantity and flow of gas, of sampling, and of gas analysis by the apparatus due to Hempel, Orsat, Elliott, and Morehead and Shepherd. The book primarily deals with the methods adopted in the United States, and only briefly refers to the Haldane or Bone and Wheeler apparata.

One chapter deals with methods for the determination of small amounts of such gases as nitric oxide, carbon monoxide, oxygen, olefins, and sulphuretted hydrogen, and gives a description both of indicators and recorders. Liquefaction and distillation methods are also discussed, and methods for the examination of light oils obtained from gas and of the determination of naphthalene are also included.

In each chapter fairly full details are given and there is a comprehensive section dealing with the determination of density and specific gravity of gases, again including fairly full details of various types of specific gravity indicators and recorders.

The final chapter deals with the analysis of waste gases such as are obtained by the pyrolysis of coal, wood, shale, and other products.

There are seventeen pages of appendices, and very complete subject and author indices.

Referring again to the Preface, the author gives here a list of the large representative number of people who have been associated with him in the production of the book, which can be recommended to all interested in the investigation and testing of gas and gas analysis. F. H. G.

BOOKS RECEIVED.

Petroleum Production. Vol. II. The Optimum Rate of Production. Park J. Jones. New York: Reinhold Publishing Corpn., 1946. Pp. 293.

The Recovery of Vapours. Clark Shire Robinson. New York: Reinhold Publishing Corpn., 1942. Pp. 273.

Written with special reference to volatile solvents this book is intended to be a course of study in the basic theory of vapour recovery.

Conversion of Petroleum. A. N. Sachanen. New York: Reinhold Publishing Corpn., 1940. Pp. 413.

Relates to the fundamental principles and practices of converting petroleum into gasoline and other fuels.

Scientific Instruments. H. J. Cooper, editor. London: Hutchinson's, 1946. Pp. 293.

Modern scientific instruments are described by experts for the benefit of the non-specialist in five broad classifications: Optical, Measuring, Navigational and Surveying, Liquid Testing, and Miscellaneous.

B.I.O.S. REPORTS.

423. Appendix. Cyanide Research and Production at Degussa. Pp. 4.
590.* Deutsch Vacuum Oil A.G. Pp. 4.
1008. Rhenania Ossag A.-G., Hamburg. Fuels and Lubricants. Pp. 165.
1038. Ruhrchemie A.-G., Sterkrade-Holten, near Oberhausen, Ruhr. Pp. 14.
1118.* Final Report on the Investigation of the Use of Industrial Glassware for Chemical Plants in Germany. Pp. 4.
1142. Wintershall–Schmalfeldt Process for Manufacture of Synthesis Gas at Lutzkendorf. Pp. 40.
1143.* The Manufacture of α-Nitronaphthalene, α-Naphthylamine, and α-Naphthol at I.G. Farbenindustrie, Leverskusen. Pp. 27.
1144. I.G. Farbenindustrie. (1) Manufacture of Nitration Products of Benzene, Toluene, and Chlorobenzene at Griesheim and Leveskusen. (2) Manufacture of Aniline and Iron Oxide Pigments at Uerdingen. Pp. 33.
1181. German Carbon Industry. Pp. 93.
1193. Activities and Products of the firm of Bopp and Reuther G.m.b.H. Neekargemund with special reference to Fluid Flowmeters. Pp. 7.
1207. Shellac. Stroever & Co., Bremen. Pp. 9.

F.I.A.T. REPORTS.

629. Supercharged Loop Scavenging. Pp. 11.
667. Summary Report on German Automotive Engines. Pp. 25.
845. Research Reports on Benzyl Chloride, Xylylenechloride Triethanolamine, Triethanolamine Fatty Acids, Esters and Methylolacetophenon. Pp. 11.
945. Manufacture of γ-Butyrolactone at I.G. Farbenindustrie A.-G., Ludwigshafen. Pp. 13.
972. Manufacture of Chlorobromomethane Fire Extinguishing Agent " C.B." Pp. 8.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

JUNE, 1947.

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

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

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

Applications for Membership.

BLUNDELL, Laurence Walter, Superintendent, Gas Light & Coke Co. (*W. G. Adam; A. K. Steel.*)

BROOKS, Francis Lano, Technical Assistant, Agwi Petroleum Co. Ltd. (*K. Parsonage; G. Noble.*)

CHARLTON, Douglas Charles, Senior Installation Supervisor, "Shell" Refining & Marketing Co. Ltd. (*J. S. Masters; E. Fay.*)

CRAWSHAW, Stanley Joffre, Technical Assistant, Shell-Mex & B.P. Ltd. (*F. N. Harrap; W. B. Rowntree.*)

GILL, Frank, Physicist, Anglo-Indian Oil Co. Ltd. (*D. A. Howes; F. H. Garner.*)

HILL, John Isaac, Assistant to Chief Chemist, L.N.E.R. (*S. J. M. Auld; E. A. Evans.*)

LEACH, Ronald Francis, Technical Assistant, Shell-Mex & B.P. Ltd. (*F. N. Harrap; W. B. Rowntree.*)

MANLY, Frederick Cecil, Works Manager, The Neasden Oil Co. Ltd. (*R. G. de Ferembre; F. Dakin.*)

MEHTA, Ramkrishan Singh, Chemist, The Attock Oil Co. Ltd.

POLLOCK, John Leslie Nairn, Director, Anglo-American Oil Co. Ltd. (*H. C. Tett; C. Chilvers.*)

ROGALA, Tadeusz R., Chemical Engineer, Polish Resettlement Corps. (*S. Sulimirski.*)

ROMASZKAN, Kazimierz Jan, Petroleum Engineer, Polish Resettlement Corps. (*S. Sulimirski; R. K. Oswald.*)

Transfer.

HAWORTH, Alfred John, Geologist, The Texas Oil Co., New York. (*V. C. Illing; N. F. Brown.*) (*Associate Member to Member.*)

LEVI, Richard, Consulting Chemist, Manchester Oil Refinery Ltd. (*E. J. Dunstan; G. H. Harries.*) (*Member to Fellow.*)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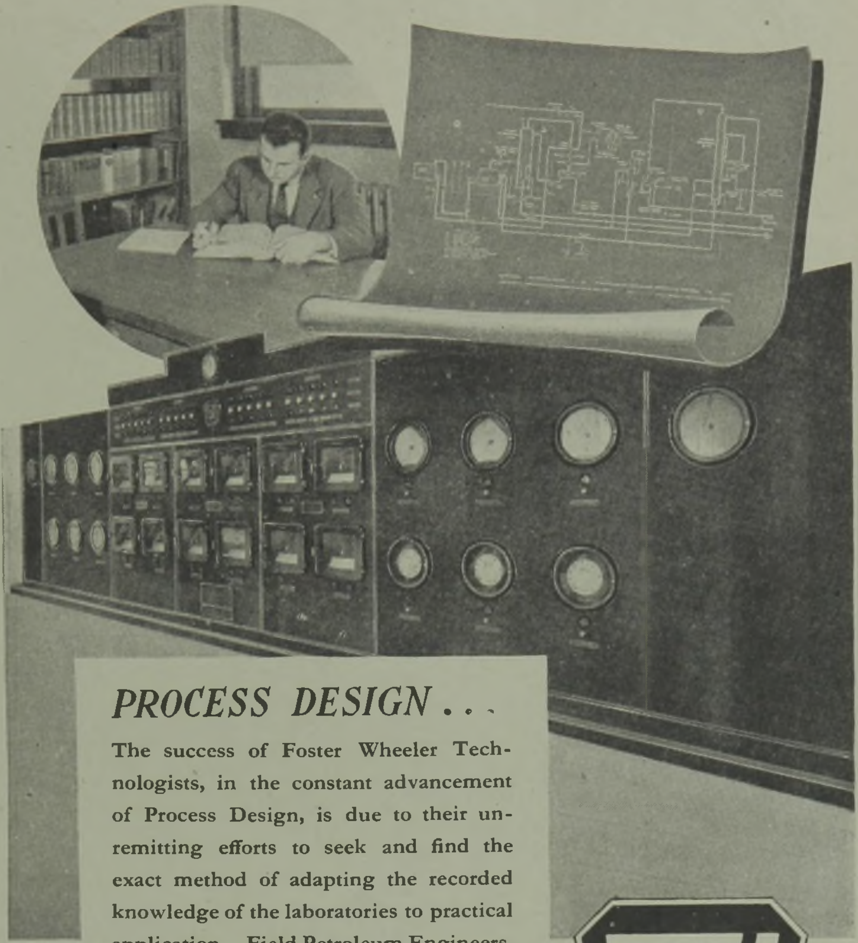

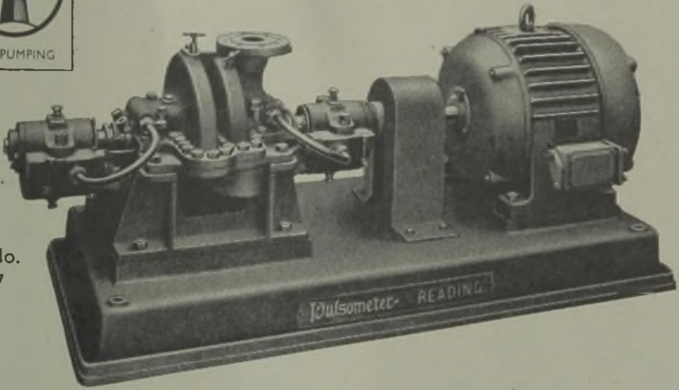
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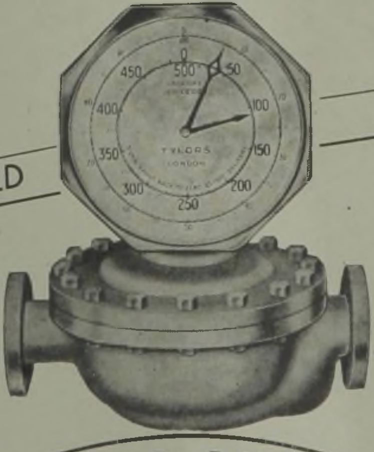
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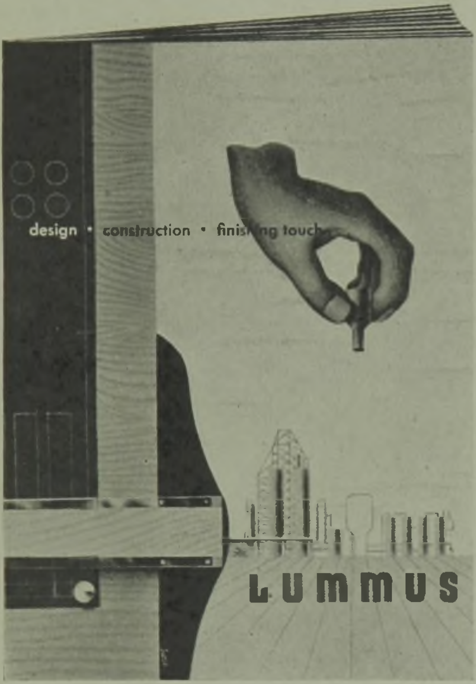
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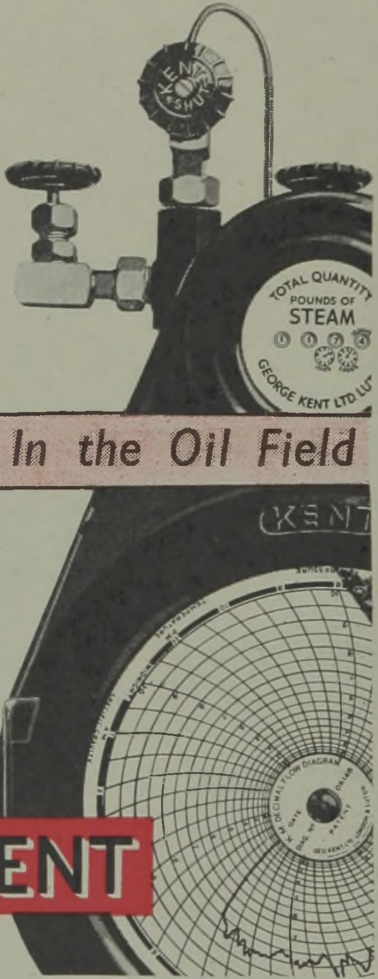
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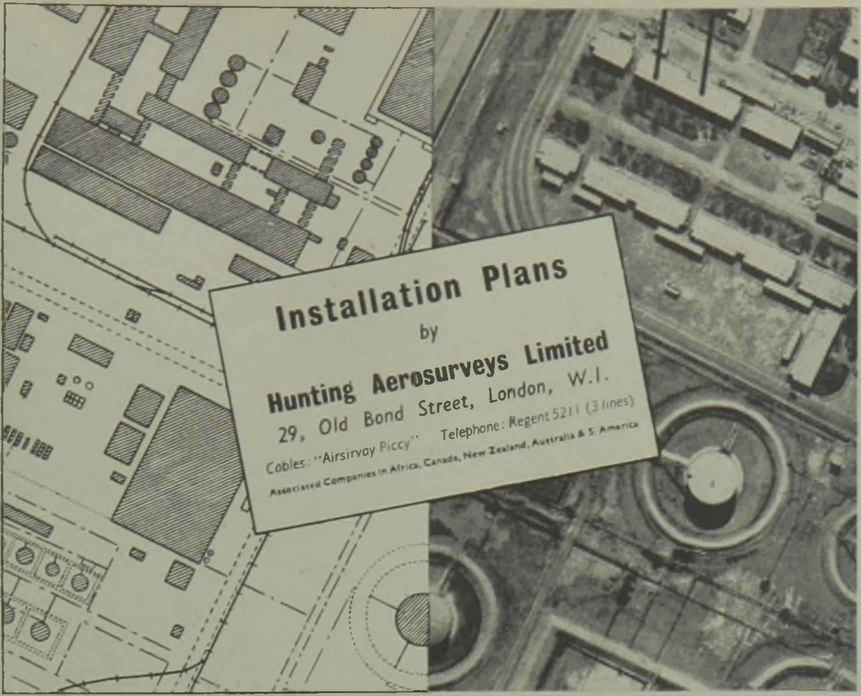

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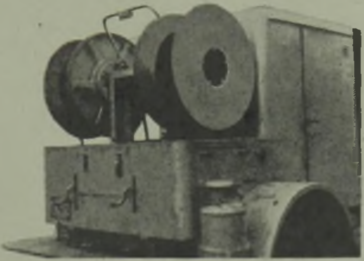

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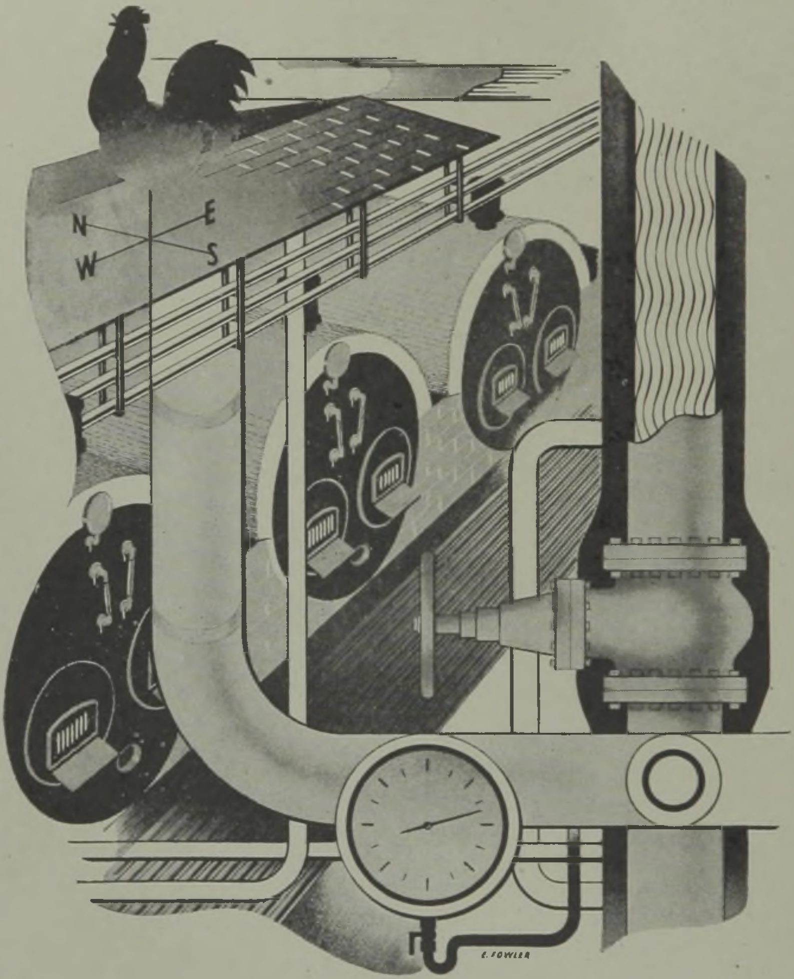

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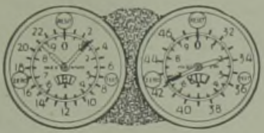

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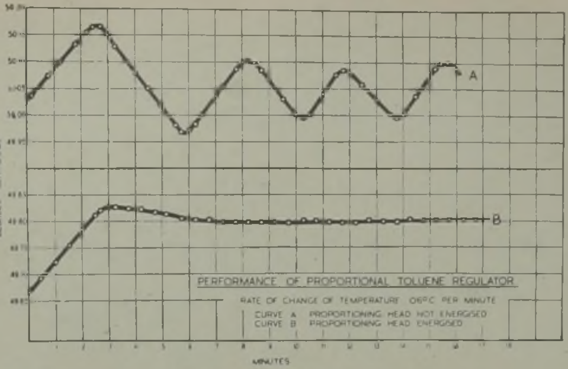

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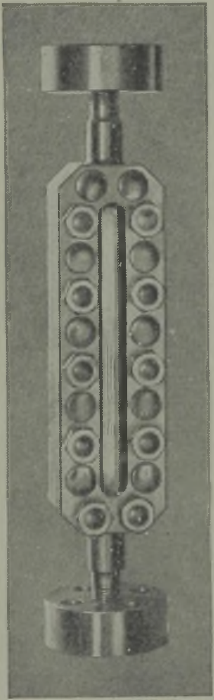

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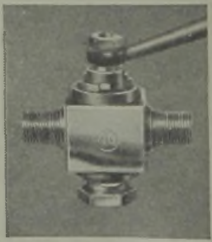

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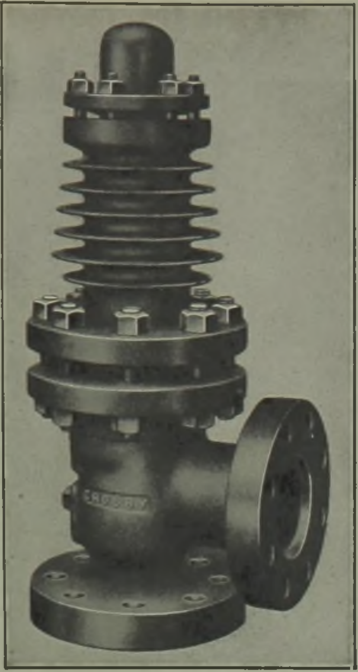

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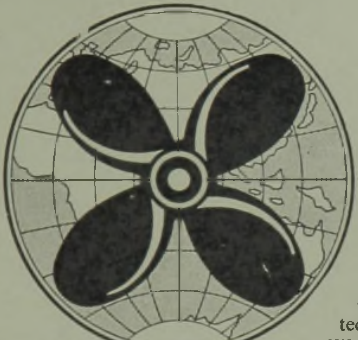

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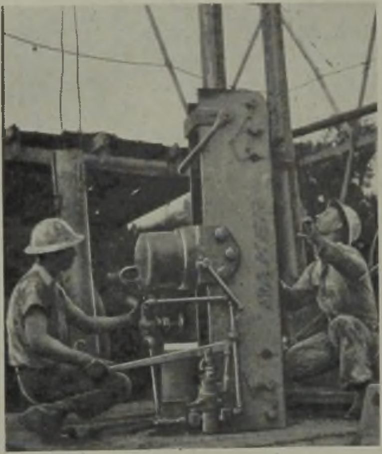

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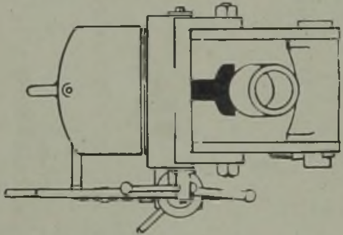
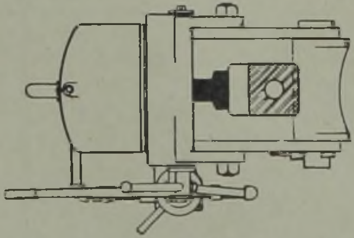
Probably more Kellys are bent in being laid down, picked up, and during transportation, than from any other cause. Frequently a Kelly that has just been straightened in a shop will again be bent during the process of transporting it back to the well, rolling it off the truck, and dragging it into the rig.

EASY TO STRAIGHTEN IN THE DERRICK





When the Baker Kelly Straightener is used, the job is done RIGHT ON THE ROTARY TABLE, with the Kelly hanging in its normal position. In foreign or isolated fields the Baker Kelly Straightener is considered indispensible, as the cost and the loss of time in transporting a bent Kelly or drill pipe to and from a distant shop are serious matters.

An important feature of the Kelly and Pipe Straightener is the fact that it is completely portable. It can be transported readily on a small pick-up truck, or a trailer, and by means of the cat line is quickly set up on the rotary table ready for successful operation by following simple instructions.

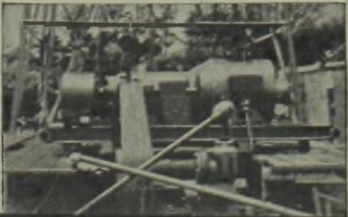
Pressure sufficient to straighten 8¾″ diameter Kellys or drill pipe can be built up without undue exertion, by manual operation of the hydraulic pump. It is safe to use, and the only parts subjected to wear are inexpensive and readily replaceable.

Look on page 422 of the 1946-47 Baker (or Composite) Catalogue for further details, or write to :

BAKER OIL TOOLS, INC.

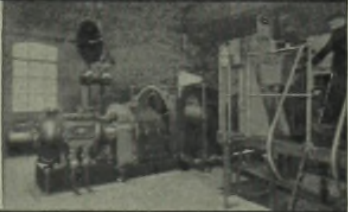
19 Rector Street, New York 6, N.Y., U.S.A.
Box 2274 Terminal Annex, Los Angeles 54, California, U.S.A.

Another Practical and Dependable
BAKER *Product*

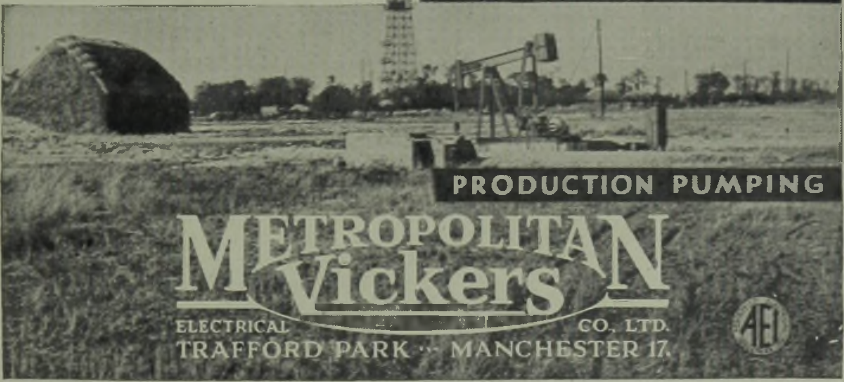


DRILLING

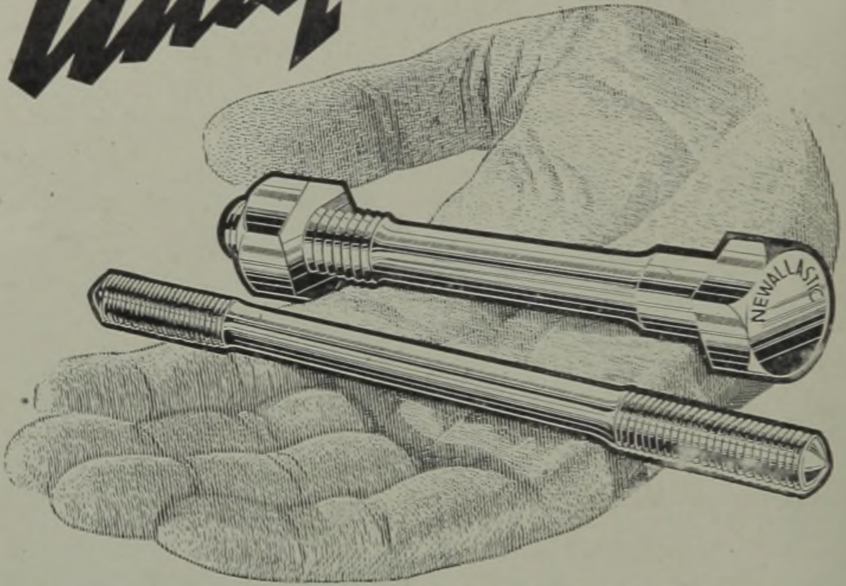
CONTROL *in the* REFINERY

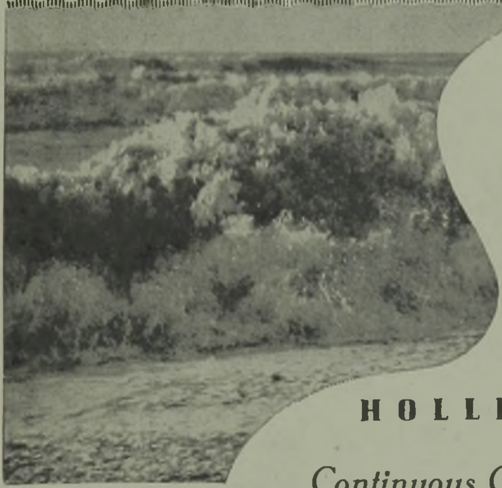


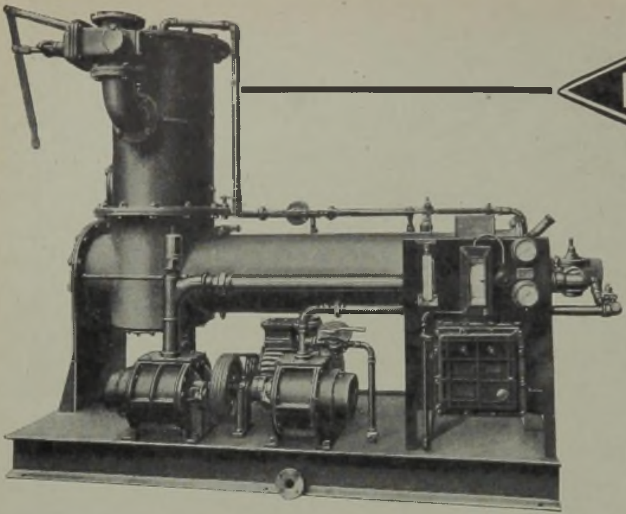
HAULAGE WINDER *for* OIL SHALE

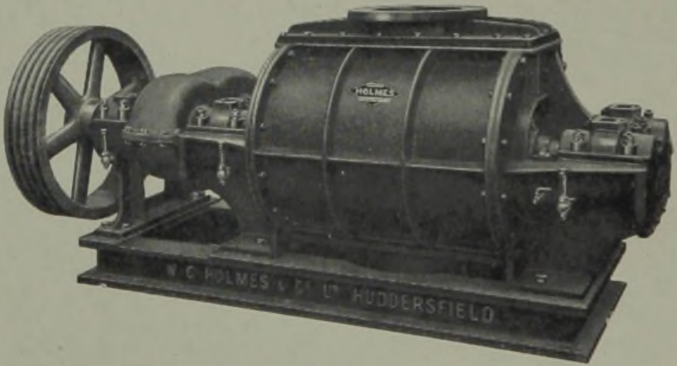


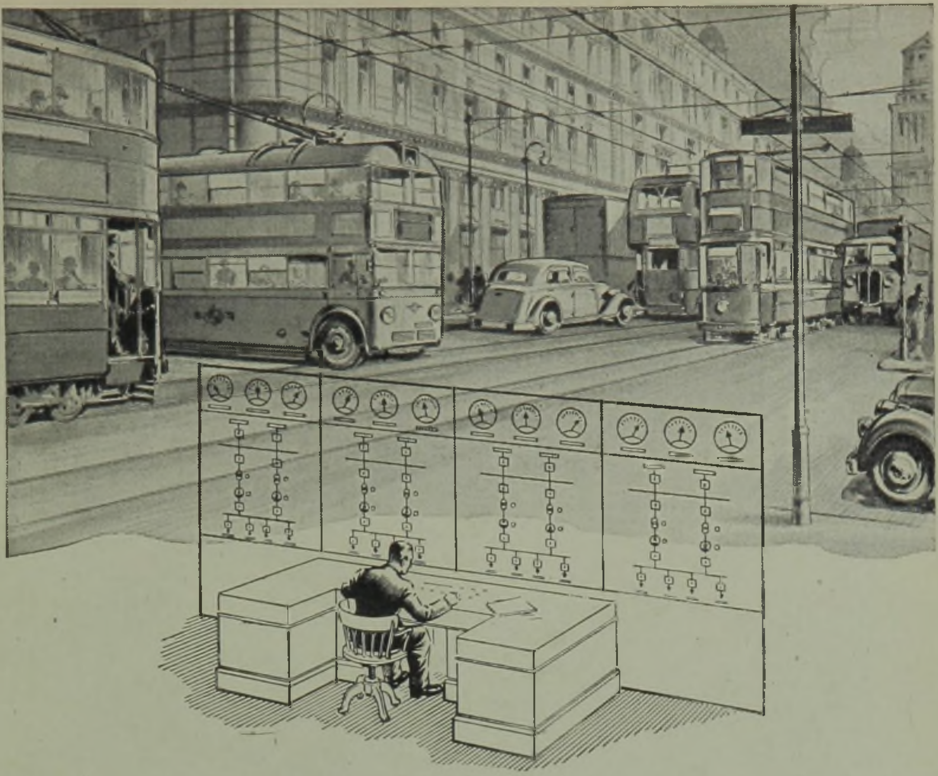
PRODUCTION PUMPING


NEWALLASTIC



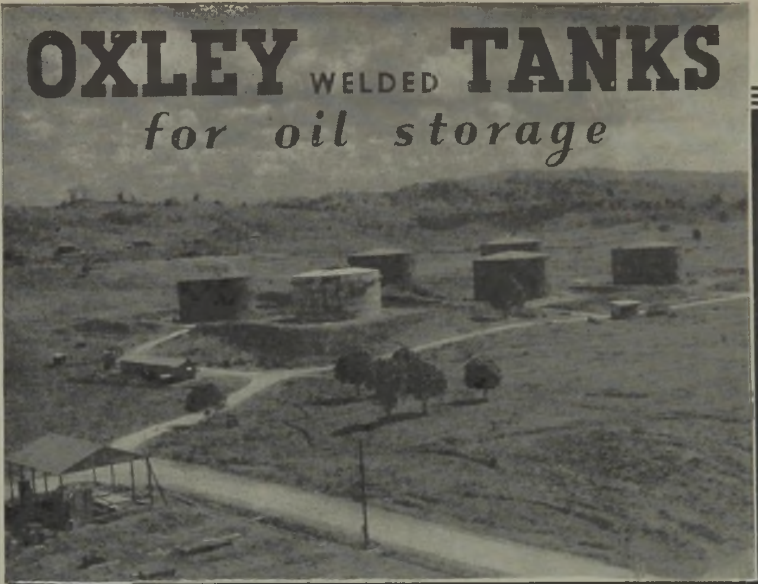



HOLMES
W. C. HOLMES & Co. Ltd. HUDDERSFIELD



OXLEY WELDED TANKS

for oil storage



Erected at home or abroad

Oxley are specialists in the design and erection of tanks. Operators and plant are sent to any part of the world. The illustration shows a group of Arc Welded Tanks for oil storage erected by us in Trinidad. All the work was executed under the supervision of our own engineers on the site.

OXLEY
ENGINEERING CO. LTD.

OXLEY ENGINEERING Co. Ltd., HUNSLET, LEEDS 10

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