ABSTRACTS.

AUTHOR INDEX.

The numbers refer to Abstract Numbers.

Oilfield Exploration and Exploitation.

Geology.

932. Evolution of Geologic Thought in Prospecting for Oil and Natural Gas. P. H. Price. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 673–697.—After a survey of the various uses of petroleum and natural gas from the earliest historical times, and even before, the beginning of the oil industry in the U.S.A. with the drilling of the Drake well is described.

For some time geologists and the oil industry worked independently of one another; but the oil-men's mistrust of geologists was dissipated by White and Orton, whose theories were first proved by the success of the well drilled at Mannington, West Virginia, in 1889.

As fresh uses for petroleum were found and the demand for it grew, ever greater efforts were made to locate oil and gas accumulations. A summary is given of the technical advances made up to the formation of the American Association of Petroleum Geologists in 1917.

As a result of the impetus given to the oil industry by the 1914–1918 war, large sums of money began to be devoted to research. The beginnings of palæontology and of the science of geophysics are described, and the use of aerial photography which was developed during the war is mentioned.

In conclusion, the principal modern trends of geologic thought are noted, including theories of origin, migration, accumulation, and reservoir traps. The most important advance since the anticlinal theory is stated to be the realization that reservoirs could exist without dip reversals due to deformation, and could result from a change in lithology, giving a stratigraphic type trap reservoir. The consequent complication of the science of petroleum geology called—and calls—for greater specialization; but this must be achieved without, if possible, a corresponding loss of integration. To preserve this integration is the task of the American Association of Petroleum Geologists. E. N. T.

933. Petroleum on Continental Shelves. W. E. Pratt. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 657–672.—The continental shelf can be considered as encircling all the continents except Antarctica in a continuous belt. Antarctica has its own individual continental shelf, which it shares with no other continent. The shelf is usually considered as extending to a depth of 100 fathoms or 600 ft; below it starts the descent into the deep oceanic basins.

The aggregate area of the continental shelves is about 11 million sq. ml. and represents an extremely mobile segment of the earth's crust. It is considered that there are between 50 and 60 million cu. ml. of unmetamorphosed sediments which may contain more than 1000 billion brl of undiscovered oil or approximately 500 times the world's present annual consumption. These reserves are at present being tapped in only a very few localities off the coasts of the United States. It remains to be seen whether the petroleum reserves of the continental shelves will indeed be exploited on a large scale in view of the capital costs involved, particularly as processes of synthesis become increasingly economic. E. N. T.

934. Mechanism of Salt-Dome Formation. G. A. Kosygin. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (5–6), 3–29.—The low density of rock salt is of importance with regard to upward flow. Its plasticity and the fact that deeper burial does not significantly increase its compactness are further important features.

Salt-dome growth is a continuous process under the superincumbent load, and the rate is proportional to the height. The continuity of growth is shown by thickening of beds away from the dome. The shape tends to become more circular with growth. Uneven distribution of the cap-rock leads to irregular salt flow at the top of the dome.

The necessary difference in salt and sediment density may arise only after deep burial. Uneven load localizes the domes. G. D. H.

935. Measurement of Pressure on the Sea Bed. E. G. Richardson. *Phil. Mag.*, 1946. **37**, 25.—Details of the construction and calibration are given of an apparatus, based on the capacity and leak system, for measuring the pressure exerted by the sea on its bed. J. T.

936. Photogeology Aids Naval Petroleum Exploration. N. C. Smith and S. A. Wengerd. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 824–838.—The need for accurate information during the war has resulted in great developments in aerial photographic and interpretational techniques. In particular, photographic surveys were used by the U.S. Navy in the exploration of Naval Petroleum Reserve No. 4 in northern Alaska. The use of photogeology by the Navy in petroleum exploration is described and cited as an example of how this new science can procure preliminary geologic information with the minimum of time and personnel. E. N. T.

937. Fast Pace Being Set in Cotton County Development. P. Reed. *Oil Gas J.*, 23.11.46, **45** (29), 64–66.—The discovery well of the new Cotton County development was in the Essaquanahdale (Bridwell) pool where production was in the Houghton sand. The Cache Creek pool is 3 ml southeast, and the Soldier Creek (Johnson) pool 2 ml northwest. Initial outputs of wells have ranged 25–500 brl. Producing depths range 1300–1630 ft over the entire group. Drilling and completion of a well usually occupies 3 days. Drilling costs average $1.75–$2.00/ft. The wells are usually pumped separately by electric motors.

The development is along a buried northwest–southeast high. The proven area is 1700 acres, and recoveries may be 350 brl/acre-ft. The Walters field, 6 ml northeast of Soldier Creek, was opened in 1917. It produced from the Priddy sand. A few wells have been drilled to the Arbuckle, five being at Bridwell.

At Cache Creek an upper sand produces, and this same sand has a little gas at Essaquanahdale and Soldier Creek, but most production is from the lower Houghton sand. Both sands are in the Pontotoc (Pennsylvanian) and the top of the upper sand is about 200 ft below the base of the Permian. G. D. H.

938. Progress of Oil Search in Georgia. G. Peyton. *Oil Wkly*, 16.9.46, **123** (3), 92.—The northwest of Georgia is not viewed favourably for oil occurrence. Beneath the Coastal Plain are Triassic to Recent beds and over 9,000,000 acres have been leased in this area. Geophysical work has been carried out. The first adequate test went to granite at 4375 ft. Rocks ranging Miocene to Austin were met. In 1939 two shallow wells in Montgomery County had oil and gas shows. A shallow well in Clinch County had shows. Two wells in Dougherty County did not reach basement in 5000 ft, and one showed Claiborne to Tuscaloosa rocks. A well in Early County in 1943 found Wilcox to Lower Cretaceous, and Palæozoic rocks in drilling 7320 ft. Further deep wells were drilled in 1944.

Drilling has demonstrated the presence of Lower Cretaceous in Georgia at depth. Trias has also been found.

The deep wells are listed. A generalized geological map is included, together with an east–west section from Early County to Wayne County, and a generalized columnar section for the Coastal Plain. G. D. H.

939. Status of Micropalæontology in Eastern Gulf Region. H. V. Howe. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 713–730.—Although the larger fossils have been the object of frequent study since the time of John Finch, it is only since 1918 that the study of microfossils has been seriously developed. In the last 30 years, however, economic micropalæontology has been developed to a remarkable degree. Nearly 700 species of *foraminifera*, 150 of *ostracoda*, 580 of *bryozoa*, and 23 of *otoliths* have been described as new in the States of Mississipi, Tennessee, Alabama, Georgia, Florida, and South Carolina, while hundreds of other species have been reported whose type localities are elsewhere.

The formations whose type localities have been fairly thoroughly studied for their microfaunal content are listed, and suggestions for further studies are made.

A bibliography of over 200 papers on the subject is appended to this paper. Of these at least 160 deal mainly with *foraminifera*, 21 with *ostracoda*, 11 with *bryozoa*, and 4 with otoliths. Fossil species described as new in the region are listed in the bibliography. E. N. T.

940. What's Wrong With the Eastern Gulf Coast? J. D. Todd. *Oil Wkly*, 16.9.46, **123** (3), 89.—Florida has been a positive area above or just below sea level over long periods. The sinking which gave at least 38,000 ft of Late Tertiary in Terreborne Parish, has some influence on western Florida. There may be a few salt domes in western Florida under compact gravity minima.

Recent work has shown that the reflection seismograph encounters difficulties in the eastern Gulf Coast. This includes lack of reflections, acute velocity variations, and surface complexities.

40,000,000 acres are under lease in the eastern Gulf Coast area. Quite a lot of exploratory work has been carried out, but a few wildcats have been drilled. Source beds, reservoir, and cap-rocks seem to be present. The section probably has the same components as that of Texas, but in thinner development, and production may be found in the Eutaw, Tuscaloosa, Paluxy, and Smackover, and in the Palæozoic, if present. G. D. H.

941. Geothermal Gradients in Mid-Continent and Gulf Coast Oilfields. E. A. Nichols. *Petrol. Tech.*, Nov. 1946, **9** (6) (*A.I.M.M.E. Tech. Pubn. No.* 2114).—The bottom-hole temperatures of producing wells in the Mid-Continent and Gulf Coast oilfields were measured after being closed in for periods of 1 hour up to 10–12 days. In some instances the temperature recorded will not be the equilibrium value, although it will represent the temperature of value in application to producing reservoirs. The thermal gradient has been taken as the ratio of the temperature difference between the well bottom and the surface (assumed to be 74° F) and the depth. Accurate observations show that the gradient is not uniform, and that in most wells the curves increase in steepness with increasing depth. This is characteristic of areas underlain by sediments. Opposite curvature has been observed in areas believed to be closely underlain by granite or other igneous rocks.

1800 measurements were made in 194 fields, and the mean gradients have been plotted and contoured. The resultant map shows a low-gradient (0·3–0·8 F/100 ft) basin in the New Mexico–West Texas area. Higher gradients occur in the Gulf Coast area, and they increase inland. The general area of the Sabine Uplift is marked by a basin with the gradients decreasing towards the centre. G. D. H.

942. Geophysical History of Typical Mississippi Piercement Salt Domes. L. L. Nettleton. *Geophys.*, 1947, **12**, 30.—Maps and cross-sections are given, showing the development of geophysical and geological knowledge of the New Home and D'Lo domes. Both are shallow, piercement domes in the northern part of the Mississippi salt dome basin. Both were first indicated by gravity surveys, the shallow cap-rock checked by refraction seismograph surveys, cap-rock depths checked by drilling and further seismograph work and drilling then carried out to determine the position of the salt and the attitude of the sediments. The successive items of geophysical work and test drilling have led to a consistent and orderly development of information about these domes.

An additional note is included, with three pairs of gravity maps, showing how strong and definite, but very local, gravity expressions of shallow domes may be missed by reconnaissance surveys. E. I. R.

943. Mississippian Oil in Permian Basin. Anon. *Oil Gas J.*, 2.11.46, **45** (26), 105.—1 Clark, about 8 ml north of Garden City, and on the east side of the Midland basin, was drilled to 10,970 ft, entering granite. The Ellenburger was met at 9840 ft. Production is from perforations at 9740–9755 ft in the Chapel limestone of the Mississippian. On test the flow was 238 brl/day of 56·5° oil, with a gas/oil ratio of 3878 cu. ft./brl. The closed-in pressure was 2334 p.s.i. This limestone produces on the Bend Arch farther east. G. D. H.

944. Marine Sedimentary Cycles of Tertiary in Mississippi Embayment and Central Gulf Coast Area. M. Bornhauser. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 698–712.—The principles of cyclic deposition are briefly reviewed and a tentative classification of marine sedimentary cycles is drawn up. These principles are applied to the Tertiary formations of the Mississippi embayment and the adjoining Gulf Coast area in Louisiana and Mississippi. At least five major cycles, representing incursions of the sea into this area, can be recognized, with a possible sixth in the Miocene section of the Gulf Coast area.

The presence of a submarine plateau in southeast Mississippi bounded by synclines on the north and northwest, is indicated by the facies and thickness distribution of the older Tertiary cycles. A study of three attached isopachous maps shows a progressive expansion of this positive area to the north and northwest during Eocene time, as the bordering synclinal areas shifted in the same direction. This expansion can be explained by the theory that the southeast Mississippi plateau is part of the northern front of the Gulf of Mexico neutral plate, which possibly drifted northwestward in connection with the Tertiary orogenic movements in the Greater Antilles.

The various marine transgressions during the Tertiary are ascribed to epeirogenic movements in the Mississippi embayment and its border-lands. These movements reached their climax in Jackson time, after which the sea retreated finally from the Mississippi embayment. E. N. T.

945. Reservoir Characteristics of Rattlesnake Oil and Gasfield, San Juan County, New Mexico. H. H. Hinson. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 731–771.—The Rattlesnake oil and gasfield is in the Navajo Indian Reservation about 7 ml southwest of Shiprock, in San Juan County, northwestern New Mexico, near the northwest edge of the San Juan Basin.

The structure of Rattlesnake is a northwest–southeast-trending anticline, with a series of minor highs along its axis. The anticline has greater structural relief with depth, and the lower beds thin over the top of the structure. The dip of the older rocks is much greater on the west flank of the structure than on the east flank. The axial plane of the anticline is progressively farther west with depth, and the apex of the anticline is progressively farther south with depth.

The thickness of the sedimentary rocks penetrated by wells on the Rattlesnake field is about 7500 ft. At the surface is the Mancos shale (700–800 ft), which all wells penetrate. Under this is the Dakota sandstone, which is about 200 ft thick and from which most of the oil which has been produced, and all the oil being produced at present in the Rattlesnake field have come. Underlying the Dakota sandstone are several non-oil-bearing formations: the Morrison formation, the San Rafael group, containing several formations, the Wingate formation, the Chinle formation, the Shinarump conglomerate, the Moenkapi formation, and the Cutler and Rico formations. Below the Rico formation, at depths of approximately 5700 to 5800 ft is the Hermosa formation, with a thickness varying from about 1050 to 1200 ft. This formation has produced oil in the Rattlesnake field from two wells. Lower identified strata are the Molas formation, the Ouray limestone, which forms a reservoir for helium-bearing natural gas, the Elbert formation and the Ignacio quartzite which, being Upper Cambrian in age, is the oldest formation reached.

Oil was found in the Dakota sandstone in February 1924. By 1944 over 100 wells had been drilled, and about 36 were still producing in the field. This oil, which is highly volatile, may have a gravity as high as 76° API when fresh, but quickly weathers to a gravity of about 60° to 64° API. Up to the end of 1945, the Dakota sandstone had produced 4,321,753 brl of oil.

Commercial production was obtained from 2 wells in the Hermosa formation. Between them they produced, from two separate porous zones, 489,563 brl of oil between 1929 and 1940.

Although helium-bearing natural gas was found in the Ouray–Leadville formation in June 1942, the first gas well was not completed until a year later. The composition of this gas is very unusual because of its high nitrogen content. The helium content is also high, and in consequence this gas pool is being held as a helium reserve by the Bureau of Mines, U.S. Department of the Interior. E. N. T.

946. Exceptional Oilfields in Rocky Mountains Region of United States. C. E. Dobbin. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 797–823.—Oil accumulations in the Rocky Mountain area have a wide range of qualities and vary considerably in their geological occurrence. This paper deals with representative fields of this area that produce oils of highly divergent character under relatively exceptional conditions. Oil ranging in gravity from 11° to 76° comes from all varieties of traps in Lower Mississippian to Oligocene reservoir rocks. The fields described include domes, stratigraphic traps, highly folded anticlines, faulted domes and anticlines and, lastly, non-faulted anticlines and domes. Oil from pre-Jurassic strata is generally heavy while that from younger strata is generally light, facts which in the main are contrary to conditions elsewhere. It is pointed out that the conditions of oil accumulation in the Rocky Mountain region have in many cases not been satisfactorily explained. E. N. T.

947. Geology and Geophysics of the Odem Oilfield, San Patricio County, Texas. H. McCarver and L. G. West. *Geophys.*, 1947, **12**, 13.—The early exploration of the Odem area by geological, torsion balance, and seismograph methods was followed in 1938 by a reflection seismograph survey. On the basis of this later work the discovery well was drilled in 1939. The proven limits of production conformed closely to the contours of the seismograph map. E. I. R.

948. Oil Resources of South America. Anon. *World Petrol.*, Dec. 1946, **17** (13), 54.—Reserves estimates for South America have been made as follows: 3,700,000,000 brl (Garfias, 1939), 5,200,000,000 brl (Bateman, 1942), and 7,000,000,000 brl (Gester, 1944). Oppenheim has suggested a limit of 30,000,000,000 brl.

There are vast areas of former marine basins. Large areas of Argentina are untested, and these include the Santa Cruz and Magellanes basins of the south, the great Chaco basin of the north, and the area along the Andean front ranges.

Most of Chile is geologically unfavourable, but seeps have been found south of 52° latitude. Shallow wells have found small accumulations, and there are 12 structures on Tierra del Fuego. A wildcat has found commercial production at 7428 ft. Uruguay has one interesting sedimentary basin. No production has been found in Paraguay, but favourable structures may extend into this country from Argentina and Bolivia. Bolivia has three fields, and has not been adequately tested. The territory of Acre is viewed favourably. It has a Cretaceous Tertiary sequence like that of the Agua Caliente field. The petroleum possibilities of the Amazon basin are unknown, only a few tests having been made in the Devonian section. The Permian Iraty shales of the Parana basin are undoubtedly source rocks. The outer part of the basin is overlain by 2000 ft of lava.

Further developments are possible in the Agua Caliente region and also in northwest Peru. The former area is very difficult of access. There are oil-possibilities east and west of the Andes in Ecuador. Favourable structures have been located in the east, and there is a thick Tertiary sequence. The Llanos of Colombia may prove oil-bearing, and other areas outside the Magdalena valley may give production. Many areas in eastern and western Venezuela will ultimately give oil.

At present thirteen major geological areas are giving oil in South America. 90%

of the production is from the Tertiary, the rest is mainly from the Cretaceous. Source rocks are known chiefly in the Tertiary, and to a less extent in the Cretaceous and Devonian. Folds and stratigraphic traps provide the chief sites of oil accumulation.

A map shows the main petroliferous basins and the principal oilfields. G. D. H.

949. Oil Strike Reported in Third Chilean Well. Anon. *Oil Gas J.*, 9.11.46, **45** (27), 40.—No. 3 Spring Hill is now giving high-grade oil after first giving gas alone. G. D. H.

950. Development of Amana Field in Venezuela. R. Watson. *Petrol. Engr*, Oct. 1946, **18** (1), 93.—The first producer at Amana was drilled in 1928, oil being found at 4100 ft. The second producer, Amana No. 3, was drilled to 5300 ft, and production was obtained from two Eocene sands between 3188 and 3955 ft. 31° API oil was produced at 400–500 brl/day. G. D. H.

951. Exploration of Orinoco Delta Fraught with Difficulties of Terrain and Climate. P. Reed. *Oil Gas J.*, 14.9.46, **45** (19), 64.—The oil possibilities of the Orinoco Delta have long been known from seeps, asphalt lakes, the wells at Pedernales, the proximity of the Trinidad oilfields, and the presence of a great thickness of sediments. However, the swampy area with its many difficulties has deterred oil companies. Richmond proposes to make a seismic survey. Experience shows that deep piles may be needed for well foundations. Boats and marsh buggies are essential. Some seismic work has been done.

Beneath the Recent and Pleistocene formations of the delta there are believed to be 8000 ft of Tertiary sandstones and limestones possibly resting on Cretaceous limestones which overlie the basement.

Pedernales has produced over 9,000,000 brl of oil from depths of 5000–6000 ft. G. D. H.

952. Geosynclines, Their Structure, History, and Laws of Development. V. V. Beloussov and V. Gsovsky. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (5–6), 130–164.—During Cambrian and Ordovician times the Caledonian geosyncline of the British Isles was divided into four subsidiary geosynclines, each up to 100 km wide—the North Scottish, Girvanian, and Ettrick Bridge geosynclines ran northeast–southwest, and the southernmost geosyncline was curved, being convex to the southeast, and having the Lake District at its northern end where there may have been a connection with the Ettrick Bridge geosyncline. A geanticline from South Wales to the Pennines separated the Welsh depression from the Brabant geosyncline. The Lewis uplift separated the north Scottish depression from other geosynclines which may have lain in the Atlantic area to the northwest. The depressions sank and extended during the Cambrian and Ordovician, while the intervening uplifts were denuded.

The lower beds (Cambrian) are chiefly clastics, but the Arenig and Lower Bala have rocks of volcanic origin. Limestones appear in the Upper Bala. In the Upper Llandovery new areas of uplift and denudation appeared in the central parts of some of the former downwarps, and around these thick series of flysch sediments were formed. At the same time old geanticlines were submerged. The central uplifts expanded and at the beginning of the Devonian the earlier geosynclines had disappeared. Outward migration of the peripheral downwarpings led to submergence of former geanticlines. The growing mountains provided a large volume of coarse clastics, which at times exceeded the rate of sinking in submerged areas, leading to extensive formation of continental deposits. In the downwarps there were some volcanic outpourings.

The zone of folding moved with the expansion of the central uplifts. After the Caldeonian diastrophism the geosynclinal area of the British Isles was replaced by a geanticline.

The Caledonian geosyncline of the British Isles differs from other geosynclines in its weak folding, absence of overthrusting, absence of batholiths in the cores of the anticlinoria, absence of internal depressions due to sinking of the vaults of the anticlinoria, and the small amplitude of the post-inversion uplift of the subsidiary geosynclines. G. D. H.

953. Study of the Micro-Fauna of the Gensac Field (Haute-Garonne). J. Sigal. *Rev. Inst. franç. Petrole et Ann. des Comb. liq.*, Oct. 1946, **1** (1), 16–32.—Gensac lies 20 km northwest of Saint-Gaudens. Small outcrops of Maestrichtian and Danian occur surrounded by Mio-Pliocene and Quaternary. 3 wells have been drilled, No. 1 and No. 3 being near the axis of the structure, and No. 2, 1·5 km away. No. 2 had a considerable number of cores, especially below 800 m.

The cores were treated in order to recover the micro-faunas, consisting of *foraminifera* and *ostracods.* A series of charts have been constructed showing the distribution and degree of abundance of various genera, while diagrams have been prepared showing the proportion of various species of *Globotruncana* at different depths in No. 2. Studies of the species of the latter confirm the deductions drawn from studies of the entire fauna. G. D. H.

954. Post-war Development Progressing in Holland's Coevorden Field. Anon. *World Petrol.*, Nov. 1946, **17** (12), 66.—Traces of oil were found in Holland in 1923 in sinking a shaft to the Coal Measures at Winterswijk.

A gravimetric survey of the northeastern provinces was followed by a dozen core-holes about 1300 ft deep. These showed a broad structure west of Coevorden.

In 1939 the Germans discovered a gasfield in the Zechstein on an east–west structure near Bentheim.

Further gravimetric work was undertaken, together with refraction work and core drilling, in an area which extended as far west as Delft. The Germans discovered an easterly continuation of the structure known west of Coevorden. In 1942 a second well was commenced 5 ml east of Coevorden, and in 1943 this cored a thin oil zone in the Portland at 2900 ft. The well went to 4172 ft in the Lias. A small amount of oil was pumped from this well. The Germans drilled a well near Emlichheim and in 1943 this was reported to have produced heavy oil at the rate of 240 brl/day from a 100-ft sand topped at 2560 ft. A well on the north flank found 90 ft of fine loose oil-saturated oil sand and was capable of flowing, but rapidly declined due to wax and sand in the tubing. The Germans had completed about 7 wells at the time of the collapse in 1945. In May 1946 there were eight producers and two failures.

Dips are gentle and faults numerous. The limits of the field are known in the west.

The crude is highly paraffinic and viscous. In May 1946 the daily output was 760 brl. The German part of the field was reported to produce 350 brl/day.

A well in Holland west of the Bentheim gasfield has found only doubtful traces of gas, but has not reached the Zechstein. G. D. H.

955. On the Comparative Lithological Method and its Urgent Tasks. N. M. Strakhov. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (3–4), 34–49.—A comparison of ancient sediments with each other and with recent sediments allows the formation of ideas about specific features in the past history of the earth, and the evolution of the earth.

Important tasks awaiting attack by the methods of comparative lithology include the accumulation of data concerning sediments and sedimentation in modern seas, especially in the shelf zones, studies of deposition in the Caspian, the Black Sea, and lakes in arid zones, such as Balkash and Kulundinskye. A consistent description of ancient sediments and of their mode of formation is required. G. D. H.

956. On the Buried Hercynides Eastward from the Caspian. A. L. Yanshine. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (5–6), 30–54.—Gravimetric data in western Kazakhstan reveal a strip of positive anomalies running north from Mangyshlak, across the Buzachi peninsula and the northern part of the Ustyurt plateau. In the east it is connected with a strip of similar anomalies of the Sultan-Uiz-Dag range and other ranges of the south Tian-Shan. On the basis of these data it was supposed that buried Hercynian ranges connecting the Tian-Shan with the European Hercynides pass through the Ustyurt and the Buzachi peninsula.

Coarse deposits in the Permian, Triassic, and Jurassic suggest that the area undergoing denudation lay between Mangyshlak and the Emba region, for the former was an area of deposition. Upper Jurassic and Lower Cretaceous facies again indicate a strip of land between Mangyshlak and the lower part of the Emba. The land was submerged from Turonian times onwards.

The nature of the rocks in the buried strip of Palæozoic is shown by pebbles in the Permian and Mesozoic of Mangyshlak and the Emba region. There are quartzose rocks, crystalline schists, igneous rocks, and micaceous sandstones. The Albian rocks of eastern Mangyshlak have rounded fragments of argillaceous schists with remnants of Lower Carboniferous fossils.

Most of the Permian and Triassic exposures of Mangyshlak show northwest–southeast folds, while the Tertiary folds are more nearly east–west. The general position of the buried strip of Palæozoic seems to correspond with the oldest strikes of Mangyshlak. Farther south other strips of folded Palæozoic lay.

The Hercynides of the Mugodjars and the buried Hercynides between Mangyshlak and the Emba region represent two branches of the Palæozoic system of the south Tian-Shan. G. D. H.

957. Geological Structure of the Don-bend. N. I. Voronin. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (3–4), 72–95.—Palæozoic beds are exposed in the core of the gentle north–northeast striking anticline of the Don-bend. Mesozoic beds occur on the flanks. The western limb of the anticline has a complication in the form of a sharp subsidiary syncline which passes into a flexure and a fault. There is a lower series of limestones, calcareous breccias, clays, marls, and sandstones, some of these beds being of the Uralian division of the Carboniferous. Overlying these transgressively are a conglomerate and variegated sandy clays, and sandstones with silicified wood. The succeeding beds consist of sands, clays, glauconitic sands, chalk and chalky marls, and grey clays.

The Carboniferous beds have been correlated with similar beds on the river Archeda. G. D. H.

958. Upper Palæozoic Flysch of the River Juriazan. A. J. Ossipova. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (3–4), 111–119.—The fusulinid fauna of the section described permits its assignment to the horizon of *Pseudofusulina moelleri* Schellw. The section is exposed on the right bank of the Juriazan at Moussatova. Its thickness is great, discordances are lacking, the sedimentation is rhythmic, and the amounts of different types of deposits are limited. The fauna is poor, and includes *ammonites*, *nautiloids*, *pelecypods*, *bryozoa*, and *fusulinidae*. Specimens of the first three types occur in the clays and concretions, while *fusulinidae* and *bryozoa* are found in the limestones which at times replace the sandstones of the first phase of the rhythm. Hieroglyphs and ripple marks are present, and remains of terrestrial vegetation. The mineral grains are poorly rounded, and the felspars are fresh, pointing to little transport.

Each rhythm consists of three parts. At the base are small or medium sand grains. There is a gradual passage to the second part with fine sandstones and then to the third part marked by calcareous clays. At times the rhythm is incomplete, the first or second part being absent. Occasionally the first part is marked by fusulinid limestones. The change from the third part to the first indicates a marked change in conditions of sedimentation; often the surface of the clay is irregular due to interruption in sedimentation. The rhythm is not seasonal, for the thickness is too great; variations in the sun may be the cause. Nevertheless, the full section was probably formed rapidly for the quickly evolving ammonites and fusulinidae show the same types throughout. G. D. H.

959. Tectonics and Structure of the Moscow Palæozoic Depression. V. A. Joukou. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (5–6), 74–92.—The axis of the depression first runs southwest–northeast and then turns along the Timan foothills running north and northwest to Tcheshskaia Bay on the Kanin peninsula. The axis is readily shown by the Triassic, Jurassic, and Cretaceous deposits in the interior of the basin. The northern limits of the basin are marked by outcrops of crystalline and Cambrian rocks on the Kanin peninsula.

The broad synclinal structure of the Moscow basin is modified by local uplifts and depressions, the trends of which are generally parallel to the axis of the main depression. The Oka–Tsna high is between the Riazan–Kostroma and Moksha–Oka downwarps in the southern part of the basin; in the northern part are the Soligalitch-Sukhona high, the Viatka high with the Tcheboksary downwarp, and the Viatka and

Sysolsk–Vytchegodsk highs. The amplitude of these features may amount to 200 m. The core of the Oka–Tsna feature consists of Middle and Upper Devonian beds resting directly on the crystalline basement. Carboniferous and Permian deposits overlie the Devonian.

There is evidence that the sinking of the Moscow basin had begun in Middle Devonian times, and reached its maximum rate in Upper Devonian times, and continued with less intensity into the Mesozoic. The area of most rapid sinking varied with time. Local downwarps and highs are possibly associated with basement faults. G. D. H.

960. Ground Features of the Middle Timan Structure. P. E. Offman. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (5–6), 55–73.—The base of the Timan structure consists of metamorphics, and above are Devonian and Carboniferous formations. The structure rises above the adjacent synclines. The Upper Palæozoic shows steps going down to the synclines. There are indications that the structure is largely due to vertical movements. Small domes frequently occur on the steps, and oil and gas are associated with them. G. D. H.

961. Replacement Dolomites in the Upper Palæozoic of the Ural and Volga Regions. G. I. Theodorovitch. *Bull. Soc. des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (3–4), 105–110.—Replacement dolomites take the place of microgranules of calcium carbonate. Most dolomitic limestones are characterized by idomorphism of the dolomite rhombohedra which are of almost uniform size, especially in cases of incomplete dolomitization. When there is complete dolomitization the dolomite rhombohedra are imperfect.

Based on internal structure the following types of replacement dolomites can be distinguished : (*a*) homogeneous grains, (*b*) grains with a purer margin (*c*) grains with a core, (*d*) zoned grains, and (*e*) grains with inclusions in the peripheral zones.

Primary dolomitic grains can be recognized, as well as those formed in consolidated deposits. The degree of idiomorphism of grains of dolomite is a function of the extent of consolidation in the sediments dolomitized. G. D. H.

962. Tectonics of Uralian Karataou and the Oil Zone of Kasayak. B. M. Keller. *Bull. Soc des Naturalistes de Moscou*, 1945, *New Ser.*, **50**, *Sect. Geol.*, **20** (5–6), 93–114.—The Karataou uplift lies in the basin of the Sym and Jouriazan rivers. Internally it shows a series of fractured brachy-anticlines. The northwest part is simple in structure having only two monoclinal blocks. The uplift is due to vertical movements which led to great fractures around the margin and break up the central part. Movement began in Permian times.

South of the Karataou uplift is the pre-Ural depression and the edge of the Russian platform, the two principal features of the northern Ural area. At the edges of these two zones are Lower Permian reefs, which are believed to be connected with brachy-anticlines. When highs crowned by reefs lie in subsiding areas they are of special interest from the point of view of oil accumulation. At the base and between the reefs are thin marly limestones and dolomites. This is contrary to many beliefs concerning sinking areas. G. D. H.

963. China—Its Future in Petroleum. A. D. Small. *Petrol. Engr*, Oct. 1946, **18** (1), 98.—In Taiwan geophysical exploration of alluvium-covered areas will be necessary. Beds of Tertiary age are present. Of seven structures tested three have produced oil commercially—Shikukoko, Kinsui, and Chikutozaki. These structures, together with Chikuto, Gyuzan, Rokusyukei, and Toshikyaku are in the foothills of the mountains. The steeper folds have dips of 70–80°, and the gentler folds 30–35°. 224 wells have been drilled and 143 have produced oil or gas. The deepest test was 9900 ft. The three producing structures have averaged 2500 brl of oil/month and 193,609,390 cu. ft. of gas/month, from 1936 to 1945. Each field has three to seven producing sands of low porosity and permeability. Thicknesses range 30–140 ft.

The main exposures in the Szechuan basin are Cretaceous, with older beds on the uplifts. Oil has been noted in the Cretaceous (especially lower), the Upper and Lower Jurassic, and the Upper Triassic. About a hundred anticlines have been mapped, mainly in the east and south. Shikyoukou No. 1 is on a north–south anticline which has easterly dips of 15° and westerly dips of 35–55°. It is about 25 ml long and 7 ml wide. A seepage of oil occurs. The well was completed in a Triassic limestone at 3690 ft, and on test gave 500,000 cu. ft. of gas per day.

Shentengshan No. 2 gives gas from the Trias at 2468 ft. The anticline trends northeast–southwest, is 7 ml long and 2 ml wide; and has flank dips of 10–16° to the southeast and 15–36° to the northwest. The flow was 5,000,000 cu. ft./day.

A test is being drilled on the Kiaugyu structure where there is an oil seep.

The folds of the Kansu basin are in Tertiary beds. Much of the centre of the basin is covered with thick Quarternary deposits. An oilfield has been developed at Laochunmiao where there are seeps. 26 wells have been drilled since 1939. A number of producing sands occur. Some 12 wells are averaging 120 brl/day each. The producing area may cover 1375 acres, and the reserves may be 89–100 million brl. The oil is very waxy. It is likely that the Wenchushan and Minho structures will be tested.

G. D. H.

Geophysics and Geochemical Prospecting.

964. Gravity-Meter Survey of the Kettleman Hills–Lost Hills Trend, California. L. H. Boyd. *Geophys.*, 1946, **11**, 121.—Maps from a gravity survey over the Kettleman Hills–Lost Hills Area are compared with previously published subsurface contours and cross sections. These show that the three Kettleman Hills Domes each produce a strong and definite gravity high while the Lost Hills Anticline produces a very clear and closely corresponding gravity low. The paper points out the probable cause of this unusual feature as being a transition within the Reef Ridge Formation from punky, diatomaceous shale at Lost Hills to clays and sands at Kettleman Hills. E. I. R.

965. Refraction Exploration in West Texas. S. Harris and G. Peabody. *Geophys.*, 1946, **11**, 52.—A brief historical account of the development of the refraction technique is given in this paper. The differences between the earlier methods and the modern correlation methods (as used in West Texas) are clearly explained. E. I. R.

966. Geophysical History of the Lovell Lake Oilfield, Jefferson County, Texas. A. P. Wendler. *Geophys.*, 1946, **11**, 302.—The following geophysical surveys lead to the drilling of the discovery well of the Lovell Lake oilfield in 1938: torsion balance 1929, refraction fan shooting 1929, reflection seismograph 1933, 1935, and gravity meter regional survey 1936. The results of these surveys and a detailed reflection seismic survey carried out in 1938 after the discovery well had been drilled, are given.

E. I. R.

967. A Resistolog Survey of the Loma Alto–Seven Sisters Area of McMullen and Duval Counties, Texas. T. S. West and C. C. Beacham. *Geophys.*, 1946, **11**, 491.—The authors claim that the electrical properties of the deep horizons can be determined more accurately by their Resistolog Method as the effect of shallow inhomogeneities are eliminated by this procedure. The principle of the method and the results of an experimental survey over the known Loma Alto–Seven Sisters fields are given.

E. I. R.

968. Geophysical Operations in Kuwait. P. H. Boots and A. H. McKee. *Geophys.*, 1946, **11**, 164.—This paper describes a geophysical survey that was successful in discovering oil in Kuwait on the Persian Gulf. Gravimeters and Schmidt vertical magnetometers were used for reconnaissance purposes and the reflection seismograph for detailed work in selected areas. The organization of the party, speed of working in an unexplored area, and the manner in which the operations were adapted to suit the climatic conditions and customs of the people are dealt with. The geophysical results, however, are not included. E. I. R.

969. Interpretation of Isostatic Anomalies South of Java, Using Integral Equations and Crustal Deformation Theories. C. W. Horton. *Geophys.*, 1946, **11**, 183.—The gravity measurements of Vening Meinesz show the existence of a symmetric belt of negative gravity anomalies south of Java. The mass distribution on a surface 40 km deep which will explain the observed anomalies is determined by means of an integral equation. This mass distribution is interpreted as resulting from the deformation of a crust normally 40 km thick. Some comments are also made on Gunn's theory of mountain formation. E. I. R.

970. Planning of a Foreign Geophysical Operation. H. M. Dawson. *Geophys.*, 1946, **11**, 435.—The vital questions of advance preparation, equipment required, and supply system for foreign geophysical operations are thoroughly discussed. In particular, the author stresses the importance of having the area thoroughly inspected by a competent and experienced man before the details of the exploration programme are considered. E. I. R.

971. Review of Geophysical Methods, Devices, and Procedures. C. H. Dresbach and P. Weaver. *Oil Gas J.*, 2.11.46, **45** (26), 79.—In every part of U.S.A. where there are oilfields geophysical prospecting has been tried. At first geography alone led to the choice of territory and no attention was paid to the suitability of the geophysical method to the type of structure involved, and therefore the initial work was frequently disappointing. On the Gulf Coast where the search was for salt plugs the gravity and refraction methods were suitable and the finding rate was good. Elsewhere progress was not satisfactory until the appropriate method was employed. G. D. H.

972. Estimating Depth and Excess-Mass of Point-Sources and Horizontal Line-Sources in Gravity Prospecting. E. G. Kogbetliantz. *Geophys.*, 1946, **11**, 195.—This paper gives solutions for the point- and line-mass gravitational anomalies. The determination of the depth, total excess mass, and error in the regional datum assumed are determined from the observed anomaly by the use of moments of gravity. E. I. R.

973. Depth-Displacement Slide Rule. W. R. Fillippone. *Geophys.*, 1946, **11**, 92.—A slide rule is described, based on formulæ for circular arc ray paths, to compute depth and displacement of seismic reflectors when time of reflection, angle of dip and velocity–depth distribution are known. The rule may be used to compute horizontal and vertical displacement for reflectors on point-plotted sections if dips do not exceed 15°. An alternative is a modification of a standard log–log trig slide rule, which serves the same purpose. E. I. R.

974. The Effect of Velocity of Detonation on the Efficiency of Explosives Used in Seismic Prospecting. J. Taylor, G. Morris, and T. C. Richards. *Geophys.*, 1946, **11**, 350.—Field tests have shown that no significant difference in amplitude or frequency of the first arrivals of refracted waves at distances from 6000 to 20,000 ft, is found from explosives having velocities of detonation in the range 7500 to 1100 m/sec or powers from 61% to 85% blasting gelatine. When a deflagrating explosive was employed there was only a very small decrease in the amplitude of the refracted wave. E. I. R.

975. Electrical Methods in Oil Exploration. V. G. Gabriel. *Petrol. Engr*, Oct. 1946, **18** (1), 216.—There is a wide variation in rock resistivity depending on the lithology and on the age of the rocks. This renders interpretation difficult. Jointing and compression may also influence the electrical properties, and electrical anisotropy may be present. The degree of cementation affects the porosity and with it the resistivity, and the nature and amount of fluid in the pores is of great importance in this connexion. The temperature gradient also is important, and burial to 6000 ft may halve the resistivity.

It has been concluded that a comprehensive three-dimensional analysis of the results of electrical measurements is not yet practicable.

Claims for the direct detection of oil-bearing rocks by electrical methods have been made to a maximum depth of 6000 ft. These claims are based on resistivity differences between productive and non-productive sands, and on comparison with observations in known oilfield areas.

The presence of recognizable electrical key horizons in many areas makes electrical methods valuable in the search for favourable oil structures. Electro-magnetic and radio-frequency, and improved electrical transient techniques may prove to be of value in investigations. G. D. H.

976. Electric Field of an Oscillating Dipole on the Surface of a Two Layer Earth. A. Wolf. *Geophys.*, 1946, **11**, 518.—The electric field of a low-frequency oscillator placed on the surface of a two-layer earth is determined in two special cases, namely, the case in which the conductivities of the two layers are nearly equal, and the case in which the lower layer is a perfect insulator. E. I. R.

977. On the Use of Electromagnetic Waves in Geophysical Prospecting. C. W. Horton. *Geophys.*, 1946, **11**, 505.—An approximate analysis of the behaviour of electromagnetic waves in a conducting medium is given. The approximations consist of replacing pairs of electrodes by dipoles and of using only the first order images in the case of a layered earth. It is shown that under certain conditions one can measure the depth of an electrical interface 6000 ft deep by means of electromagnetic waves. It is further shown that even a thin layer of salt water or oil-bearing sand at a depth of 6000 ft gives an effect that is easily measurable. E. I. R.

978. Fluorescent Techniques in Petroleum Exploration. J. de Ment. *Geophys.*, 1947, **12**, 72.—New methods of petroleum location, detection, and analysis, based on the fluorescence characteristic shown by all crude oils are described. A brief review is given of the available techniques and instruments used in fluorochemical analysis, and emphasis is placed on fluorographic exploration by means of sub-surface soil samples, as well as the fluorologging of wells. The author has not limited himself to a review of the field, but has also pointed out, on the basis of the existing data of fluorochemistry, approaches to problems in the petroleum field which have proved successful in other branches of radiation science. A very complete list of references is given.

E. I. R.

979. Ambiguity in Gravity Interpretation. D. C. Skeels. *Geophys.*, 1947, **12**, 43.—It is shown that contrary to what is stated and implied in much of the literature, gravity and magnetic data cannot, of themselves, be interpreted uniquely. It is shown by means of a two-dimensional example that for a given anomaly and a given density contrast a wide range of possible interpretations can be made, at various depths, and that whereas there is a maximum depth for the solution the minimum depth is zero. E. I. R.

980. Diving Bell for Underwater Gravimeter Operation. E. W. Frowe. *Geophys.*, 1947, **12**, 1.—The recent development of a diving bell, designed to carry a gravimeter and observer, enables the geophysicist to make correct gravity observations on a river, lake, or ocean floor. The structural features and related equipment of a bell designed to operate in depths of water up to 250 ft are described. Data taken from adjacent land and sea areas have been contoured and the smoothness of these contours indicates that the underwater gravity readings are entirely reliable. E. I. R.

981. Disturbing Factors in Geochemical Prospecting. S. J. Pirson. *Geophys.*, 1946, **11**, 312.—A review of the results of over 3000 measurements of soil ethane emanation rate made over the past 5 years has revealed a number of conclusions which have an important bearing on the validity of geochemical methods of prospecting for oil and gasfields. A number of factors have been found to be highly disturbing, namely: earth topography, ground-water percolation and seepage, barometric pressure variations, etc. These effects result in fluctuations of the rate of escape of hyrdocarbons accompanied by horizontal shifts of leakage which give rise to the creation of artificial leakage highs altogether meaningless from the point of view of oil and gas accumulation at depth. Certain qualitative rules are given for correcting for such disturbing factors.

E. I. R.

982. The Airborne Magnetometer. G. Muffly. *Geophys.*, 1946, **11**, 321.—This paper discusses the problem of magnetic exploration for oil from an aircraft. A new type of saturation magnetometer is described. Various orientation and stabilization schemes and their application to submarine detection and geophysical prospecting are discussed. It is shown that total-field measurement is far superior to vertical-component measurement. The newest Gulf apparatus using an automatically-stabilized, continuously-recording, total-field magnetometer is described. E. I. R.

983. Application of Continuous Profiling to Refraction Shooting. A. J. Barthelmes. *Geophys.*, 1946, **11**, 24.—The continuous profiling technique that is in general use for detailed structural investigations by the reflection method is applied to refraction shooting. This results in an increase in the resolving power of the refraction method.

The theory, assumptions, resolving power, shooting procedures, cost, and speed of surveying by this method are given. Sample records and cross sections are given to illustrate the method of routine analysis. E. I. R.

984. Correlation Refraction Method of Seismic Surveying. J. A. Gillin and E. D. Alcock. *Geophys.*, 1946, **11**, 43.—This paper gives details of a form of correlation refraction shooting which was successful in obtaining satisfactory results on the Edwards Plateau, W. Texas, where the reflection method had been unsuccessful. The method is illustrated by the results of an experimental survey. E. I. R.

985. Airplane Noise Interference With Seismic Prospecting. J. M. Kendall. *Geophys.*, 1946, **11**, 82.—The low-frequency sound produced by airplanes is briefly investigated, and its propagation through the atmosphere is considered. Data on a cargo-type airplane are presented. Rough calculations to determine the response of geophones to this sound field indicate that one airplane can blanket an area of several hundred square miles. Measures suggested for minimizing the interference are discussed.
E. I. R.

986. Studies on Seismic Waves. I. Reflection and Refraction of Plane Waves. C. Y. Fu. *Geophys.*, 1946, **11**, 1.—By taking the apparent velocity along the boundary as the parameter instead of the angle of incidence, the equations for the different wave amplitudes may be put in more symmetrical forms. In this way, it is more convenient to discuss both the body waves and the Raleigh waves at the same time. A difficulty in the plotting of the square root of the wave intensity against the angles is also discussed. When the reflection or refraction coefficient is not real, the meaning of the intensity, as obtained by squaring the absolute value of the latter quantity, needs clarification. E. I. R.

987. Studies on Seismic Waves. II. Raleigh Waves in a Superficial Layer. C. Y. Fu. *Geophys.*, 1946, **11**, 10.—Lamb's method in the theory of the plate is extended to the case in which one of the surfaces is not free. The resulting determinantal relation is similar to that of Sezawa. It is then simplified and special cases of the frequency–velocity relation are discussed. Even when the thickness of the layer is as small as a wavelength, the interaction of the upper and lower boundaries of the layer is quite slight and Raleigh waves and Stoneley's waves may be discussed separately. A few points in connexion with the application of this frequency relation to the ground-roll problem are also discussed. E. I. R.

988. Studies on Seismic Waves. III. Propagation of Elastic Waves in the Neighbourhood of a Free Boundary. C. Y. Fu. *Geophys.*, 1947, **12**, 57.—Continuous and spherical harmonic waves are generated at an internal point of the medium. It is shown that near a free surface in addition to the ordinary types of body and surface waves, there are also inhomogeneous waves and surface waves which are not of the Raleigh type.
E. I. R.

989. Informal Discussion of Explosives Hazards on Seismograph Crews. G. M. Kintz. *Geophys.*, 1946, **11**, 148.—This paper clearly shows the need for a standard set of instructions in the safe handling and use of explosives in the geophysical industry. It suggests the appointment of an agency, such as the Bureau of Mines, to collect data regarding accidents and near-accidents in which explosives were involved. The agency would analyse this data and compile a standard set of instructions that should prevent most of the explosives accidents occurring at present. Several accidents which occurred while explosives were being used by the geophysical industry and which were reported to the Bureau of Mines during the last 3 years are discussed and analysed.
E. I. R.

990. Effect of Surface Topography on Seismic Mapping. M. B. Widess. *Geophys.*, 1946, **11**, 362.—The presence of rough-surface topography in a prospect frequently constitutes a source of error in seismic mapping and poses the question of what computational methods can be applied by which seismic maps may be freed of the effect of surface relief. Various aspects of the problem are described. The use of a plane datum–horizon is generally adequate as a solution of the problem. For greater refinement, the structural map may be modified to account for the overburden effect, the approximate magnitude of which is considered. Further modification may be required when lateral variations in subweathering velocity occur. Statistical analysis for determining the degree of conformity between surface topography and mapped structure at depth is useful in gathering data on the influence of surface topography. E. I. R.

991. Seismograph Evidence on Depth of Salt Column, Moss Bluff Dome, Texas. H. W. Hoylman. *Geophys.*, 1946, **11**, 128.—Clear reflections at times of approximately 2·3 and 4·4 sec were obtained consistently on a series of records shot directly over the shallow cap rock of the Moss Bluff dome. There are three possible interpretations :

The first arrival is a reflection from the base of the salt column at a depth of 16,000 ft. The later arrival is either a reflection from the basement complex at 26,000 ft or a multiple reflection from the base of the salt column.

The first arrival is a reflection from a discontinuity within the salt column and the later arrival is a reflection from the base of the salt column at 36,000 ft.

Reasons are given for preferring the multiple reflection interpretation.

E. I. R.

992. On Well Velocity Data and Their Application to Reflection Shooting. P. E. Narvarte. *Geophys.*, 1946, **11**, 66.—This paper gives a practical method of deriving a generalized time–depth relation from well data. The chief advantage of this method is that it does not neglect the stratigraphic effect on the velocity distribution. The routine method of calculation is illustrated by an actual field example. E. I. R.

993. Interpretation of Well Shot Data. Part 3. C. H. Dix. *Geophys.*, 1946, **11**, 457. —This paper outlines a simple method of taking into account any lateral variations in velocity. The problem arising when 3 wells are shot is discussed in some detail. It is shown that by tilting the linear distribution of velocity with depth in a certain way all the well-shooting results can be tied together and a single linear velocity–depth relation used for the whole area. A method is also given for determining the lateral change of velocity by shooting only 1 well, and an approximate method of determining the tilt of the datum plane is discussed. E. I. R.

994. Notes on Shot Point Procedure. F. J. Williams. *Geophys.*, 1946, **11**, 443.—Some characteristics of seismic explosives are considered in order to explain the reasons for the suggested shot-point procedure. By the routine use of such a standard procedure the efficiency, safety, and quality of the records are considerably increased. The author attaches particular importance to the preparation of the charges and the use of adequate firing currents. E. I. R.

995. An Observational Method to Overcome Zero Drift Error in Field Instruments. I. Roman. *Geophys.*, 1946, **11**, 466.—By using a four-step oscillating method of observation, four values are obtained for the increment in the measured value between consecutive stations. If the drift or "zero creep" of the instrument is regular, even when large, or not linear, this furnishes a means of improving the reliability of the readings and permits the detection of erratic readings. It is suggested that this method should be used for laying out the network of base stations. An example shows the application of the method to a gravimeter survey. E. I. R.

996. Patent on Geophysics. H. Hoover, Jr., assr by mesne assignments to United Geophysical Co. U.S.P. 2,417,077, 11.3.47. Seismometer—a portable electromagnetic seismometer responsive to transverse vibrations. R. B. S.

997. Geophysical History of the La Gloria Field, Jim Wells and Brooks Counties, Texas. W. C. Woolley. *Geophys.*, 1946, **11**, 292.—This paper presents a historical record of the geophysical activity in the La Gloria Field area. The discovery well was drilled and completed in 1938–39. The results of the following surveys can be compared with the structural contour map prepared from the drilling records : torsion balance 1934–35, correlation reflection seismograph 1936, dip reflection seismograph 1938, correlation reflection seismograph 1938, and gravity meter 1943–44. E. I. R.

Drilling.

998. Drilling the World's Deepest Well. N. Williams. *Oil Gas J.*, 29.3.47, **45** (47), 160; K. M. Fagin. *Petrol Engr*, Mar. 1947, **18** (6), 55.—An account is given of the drilling operations and the problems encountered in drilling the Superior Oil Company's 51-11 Weller well in Caddo County, Oklahoma. Drilling was commenced in April 1946 and by March 1947 the well had reached a depth of 17,236 ft. R. B. S.

999. Modern Rotary Drilling. Parts 1–10. J. Zaba. *Oil Gas J.*, 4.1.47, **45** (35), 75; 11.1.47, 45 (36), 87; 18.1.47, **45** (37), 83; 25.1.47, **45** (38), 287; 1.2.47, **45** (39), 69; 8.2.47, **45** (40) 97; 15.2.47, **45** (41), 107; 22.2.47, **45** (42), 175; 1.3.47, **45** (43), 91; 8.3.47, **45** (44), 95.—These are the first ten of a series of brief articles on modern drilling practice. The sub-titles are : (1) Introduction; (2) Basic Considerations; (3) Rigging Up; (4) Moving In; (5) Location Layout; (6) In-line Layout for Steam Rig; (7) Location Layout for Power Rig; (8) Drilling Derricks; (9) API Substructures; and (10) Non-API Substructures. R. B. S.

1000. Possibilities and Problems of Drilling Beyond the Continental Shelves. H. E. Gross. *Petrol. Tech.*, Nov. 1946, **9** (6) (*A.I.M.M.E. Tech. Pubn.* 2095), 1–7; *Petrol. Engr*, Oct. 1946, **18** (1), 186.—For drilling in water deeper than 500–600 ft rigid foundations would be too costly, and therefore floating foundations would be used. The derrick floor and drilling platform would have to be at a constant level, and fixed in position. The casing and conductor pipe would have to be in constant tension. Ample storage space would be essential. An open sub-structure supported on sealed hulls suitably anchored is proposed. The drilling platform is placed 40–50 ft above sea level so as to be above storm waves. Water could be admitted to or pumped from the hulls to keep the drilling platform at a constant level. Arrangements would be provided for keeping the two hulls on an even keel. Hydraulic rotary tables would keep strings of pipe under constant tension. Tension on the anchor cables would be reduced by controlled propellors attached to the hulls, and these propellors would counteract rotary-table torque. The hulls would afford storage for mud, oil, and water.

1000 h.p. might be needed for stabilizing the structure in big ocean storm waves. Instead of cables for anchoring, buoyant drill-pipe cemented into the sea floor might be used. G. D. H.

1001. Hard Rock Drilling. D. Johnston. *Oil Gas J.*, 5.4.47, **45** (48), 62. (*Abridged version of paper presented before Southwestern District Div. of Production, A.P.I., Fort Worth,* March 1947.)—The geology and drilling problems encountered in the Permian Basin area of W. Texas and New Mexico are outlined and an analysis is presented of the drilling costs and the effect of (1) weight on bit, and (2) mud characteristics, on the drilling rate in the hard formations encountered in this area. Possible future improvements in drilling practices and equipment resulting in reductions in drilling time are also reviewed. Three references are appended. R. B. S.

1002. Deep-Water Drilling on Lake Maracaibo. P. Reed. *Oil Gas J.*, 18.1.47, **45** (37), 36.—The methods described have been designed and developed to drill oil wells anywhere in Lake Maracaibo where the deepest point is from 80 to 90 ft. Barges and caissons are used. Unusual features are employed—*e.g.* all-welded derricks are used with the main drawworks welded to the sub-structure. Caissons have grouted joints and are cast of concrete around cylindrical inner shells fabricated from checkered plate with the rough side out. Reinforcing is provided in 3½-in spiral steel rods. Caissons are moved about the yard by a Whiting 50-ton travelling gantry crane, supplemented by a 15-ton auxiliary hoist. The 80-ton caissons are not driven into the lake bed, but are dead weighted to bearing by a total weight of 200 tons, which is considered sufficient to ensure a desirable factor of safety for handling pulling loads during drilling operations. Caissons penetrate the lake bottom 60 to 100 ft. Maximum rise of the tide in the lake is only 1 ft. Caissons are fabricated in 15-ft sections, which are later assembled for the length required, the longest being 180 ft. More than 1200 wells have been drilled in this lake. A. H. N.

1003. Refitted Boiler Barge Contains Unique Design Features. E. H. Short. *Oil Gas J.*, 8.3.47, **45** (44), 71.—A refitted boiler barge suitable for supplying power for marine drilling operations is described. R. B. S.

1004. Wells Drilled With Horizontal Drain Holes. Anon. *Petrol. Engr*, Feb. 1947, **18** (5), 174.—An account is given of the methods used in drilling horizontal drain holes from a vertical bore by means of flexible drill pipe and a turbine-actuated drilling bit. R. B. S.

1005. Air-Operated Brakes Successfully Used in Gulf Coast Drilling. E. H. Short, Jr. *Oil Gas J.*, 15.2.47, **45** (41), 78.—To reduce crew fatigue, power-operated brakes were introduced and successfully operated in the rig described. Hydraulically controlled, feed-off is accomplished by throttling fluid movement in a simple closed hydraulic system. The conventional hand-brake is modified to leave the handle in its retracted position, but always operable for emergency or auxiliary application. The hydraulic system will permit steady, even feed-off rates of 0 to 65 ft per hr with 10 lines on the blocks. For higher rates of feed-off band slippage is sufficient and a graduating valve is provided to adjust air pressure to band cylinders to the desired rate. The hydraulic system is not used during this high rate of penetration. The air-operated brakes are composed of seven major component units : The main control cabinet ; the band assembly, driller's side ; the band assembly, opposite side ; the air-control manifold ; the hydraulic assembly ; the manual brake linkage, and the air supply. The seven components are described, and illustrated diagrammatically and photographically and their method of use fully discussed. A. H. N.

1006. New Diesel-Electric Barge Rig Designed for Routine Drilling to 15,000 ft. Anon. *Oil Gas J.*, 11.1.47, **45** (36), 59–60.—The rig consists of a power barge and a drilling barge. These are briefly described. Three 700-h.p. 900 r.p.m. super-charged diesel engines, each directly connected to a 375-kw generator with a 60-kw constant-voltage generator mounted on top and driven by V-belts from the main generator shaft, furnish power for the rig. The 60-kw generators are equipped with Thyrite-controlled exciters so that the voltage generated remains constant though the engine speed may vary. Each engine is provided with a closed cooling system consisting of a tube-type heat exchanger and a motor-driven raw-water pump. The jacket water is circulated through the engine and heat exchanger by a pump built on the engine. The raw water is also pumped through a small heat exchanger for cooling the lubricating oil. Of particular interest, in connection with the power plant, is the use of electro-hydraulic governors which automatically adjust the engine speed as the load demand varies. The speed of the engines therefore may vary from 450 to 900 r.p.m., depending upon the load demand. Since the electro-hydraulic governors permit use of the lowest possible engine speed under any given load demand, engine wear, and fuel consumption are held to a minimum. Details of the speed control are given. During hoisting all three generators are employed. The derrick, mud-pumps, blow-out preventers, and other equipment are briefly described. A. H. N.

1007. Controlled Directional Drilling of Wells. Part I. G. L. Kothny. *Producer's Monthly*, Feb. 1947, **11** (4), 28. (*Paper presented at National Conference on Petroleum Mechanical Engineering, A.S.M.E., Tulsa, Okla.*, Oct. 1946.)—See Abstract No. 794 (1947).

1008. Controlled Directional Drilling of Oil Wells. Part II. G. L. Kothny. *Producer's Monthly*, Mar. 1947, **11** (5), 27. (*Paper presented at National Conference on Petroleum Mechanical Engineering, A.S.M.E., Tulsa Okla.*, Oct. 1946.)—See Abstract No. 789 (1947).

1009. Drillable Bridging Plug as Shooting Tamp. J. D. Dunigan and C. B. Snodgrass. *Oil Wkly*, 3.3.47, **125** (1), 39.—A brief description is given of a drillable bridging which has been used to set above nitroglycerin shots in open hole and in perforated or unperforated pipe sections. The casing above the shot-hole is kept in place by the plug.
R. B. S.

1010. Larger Drill-Pipe Results in Greater Speed in Drilling Gulf Coast Wells. E. H. Short, Jr. *Oil Gas J.*, 22.2.47, **45** (42), 147.—The larger pipes give greater circulation rates for the drilling fluid which is particularly necessary in the deeper wells drilling nowadays. Graphs illustrate the characteristics obtained with the 5-in o.d. as compared with 4½-in o.d. drill-pipes. Greater penetration rates have been recorded through the increased circulation possible with larger pipe and it is expected that stuck drill-pipe with be greatly reduced. The 5-in drill-pipe offers 33% more torsional strength than the 4½-in and it is also expected that part of the wear usually absorbed by tool joints will be distributed over the drill-pipe. One of the questions raised during the preliminary investigation of the 5-in was with regard to the possibility of excessive pressure drop in the annular space between the 5-in o.d. drill-pipe and the 9⅝-in casing. Engineering observations on a Humble well drilling in Galveston Bay with 5-in drill-pipe showed that at no time during drilling were there indications of lost returns in addition to those normally observed while drilling with 4½-in drill-pipe. Other data show no more trouble with gas-cutting with the larger than with the smaller pipe.
A. H. N.

1011. Rotation of Casing During Cementing. R. E. Edwards. *Oil Wkly*, 17.2.47, **123** (12), 24–26.—Laboratory and large-scale experiments are described in which the benefits of rotating the casing while cementing appear to be that they give better distribution of the cement around the casing. A. H. N.

1012. Interchangeable Dual Pump Mounting. E. Sterrett. *Oil Wkly*, 3.3.47, **125** (1), 41.—Interchangeable mountings for compounding mud pumps with a minimum of trouble are briefly described. R. B. S.

1013. Patents on Drilling. C. B. Aiken, assr to Schlumberger Well Surveying Corpn. U.S.P. 2,411,843, 3.12.46. Compensating Means for Electrical Borehole Apparatus.—An electrical well-logging apparatus which automatically compensates for temperature variations.

D. Silverman, assr to Stanolind Oil and Gas Co. U.S.P. 2,412,363, 10.12.46. Well Logging.—An apparatus for detecting the location and character of produced well fluids.

A. Frosch, assr to Standard Oil Development Co. U.S.P. 2,412,575, 17.12.46. Well logging.—An apparatus for simultaneously measuring two physical properties of formations traversed by a borehole (presumably porosity and permeability).

F. S. Crane. U.S.P. 2,412,875, 17.12.46. Pipe-Screwing Device.—A combined pipe elevating and screwing collar.

B. W. Sewell, assr to Standard Oil Development Co. U.S.P. 2,412,915, 17.12.46. Pressure Core Barrel.—A pressure retaining coring assembly for bringing a core to the surface at formation pressure : consists of a core barrel which can be lowered into and raised completely out of a string of drill-pipe during normal drilling operations, and having an automatic valve which closes when the core barrel is lifted out of the coring position.

J. S. Morgan and D. A. Murphy, assrs to the National Superior Co. U.S.P. Reissue Re 22,825, 24.12.46. Swivel.—A swivel for rotary drilling.

E. F. Aston. U.S.P. 2,412,939, 24.12.46.—Core drill.

H. B. Deckert. U.S.P. 2,413,297, 31.12.46. Pipe Holder.—A drill-pipe racking device for use in derricks.

L. A. Courter, assr to the Dow Chemical Co. U.S.P. 2,413,435, 31.12.46. Method of Determining Permeability of Earth Formations Penetrated by Well Bores.—A method of permeability determination by introducing into the well two liquids of varying density so that the fluid interface is originally located above the formation to be tested, and then measuring the rate of fall of this interface under a known applied pressure by means of a logging instrument which is also patented.

W. C. Scrivener and A. G. Brewer. U.S.P. 2,413,658, 31.12.46. Base Construction for a Mast and Derrick.—A pivoting union for anchoring a mast or portable derrick.

E. G. Gartin, assr to Joy Manufacturing Co. U.S.P. 2,415,204, 4.2.47. Adjustable Support.—A triple clamping device.

C. W. Savitz, assr to Halliburton Oil Well Cementing Co. U.S.P. 2,415,221, 4.2.47. Well Surveying Instrument.—A device for surveying a well to determine the extent and direction of its deviation from the vertical.

G. L. Kothny, assr to Sperry Sun Well Surveying Co. U.S.P. 2,415,249, 4.2.47. Well-Surveying Instrument.—An instrument for making a continuous record of bore-hole inclination.

W. D. Mounce, assr to Standard Oil Development Co. U.S.P. 2,415,364, 4.2.47. Logging Bore Holes.—An alternating current method of electrical well logging.

J. J. Santiago, assr to Grant Oil Tool Co. U.S.P. 2,415,608, 11.2.47. Hydrostatic Bailer for Wells.—An automatically controlled hydrostatic well bailer.

E. A. Johnson, assr to Standard Oil Company. U.S.P. 2,415,636, 11.2.47. Method and Apparatus for Logging Wells.—An electrical method of continuously logging bore-hole diameter.

W. B. Costin. U.S.P. 2,416,613, 25.2.47. Fishing Tool for Deep Wells.

S. Krasnow, assr to Geophysical Development Corpn. U.S.P. 2,416,702, 4.3.47. Apparatus and Method for Measuring Bore-Hole Radioactivity.

C. M. O'Leary, assr to H. C. Otis. U.S.P. 2,416,842, 4.3.47. Well Cementing Apparatus.—An apparatus for selective cementing.

G. E. Cannon, assr to Standard Oil Development Co. U.S.P. 2,417,235, 11.4.47. Drilling Fluid.—A method of reducing water loss by filtration by suspending a water-soluble starch ester of a low molecular weight aliphatic acid in the drilling fluid.

R. B. S.

Production.

1014. Classification of Oil Discoveries and Fields. Anon. *Petrol. Engr*, Jan. 1947, **18** (4), 124.—The following terms are defined : pool, area, field, group, district, region, zone, sand, interval, formation, reservoir, and fault block or block. These definitions are discussed and examples are given of each. It is suggested that this system of classification should be strictly adhered to, in order to avoid confusion which arises when these terms are inappropriately used. R. B. S.

1015. New Well-Completion Technique. T. S. West. *Petrol. Tech.*, Sept. 1946, **9** (5) (*A.I.M.M.E. Tech. Pubn. No.* 2094), 1–17.—Only four ways can be postulated whereby a high gas–oil or water–oil ratio can initially arise in a well when the zone exposed for production is entirely within the oil column. These are as follows :—

(*a*) Failure of the cementing material;
(*b*) Vertical coning;
(*c*) Failure along the boundary between the cement and the wall of the well;
(*d*) Failure of the formation forming the wall of the well. Cement failures are probably almost always due to contamination with mud. The frequent occurrence of thin impermeable streaks in sand sections suggests that vertical coning may be less common than is generally assumed. It is unlikely that the mud filter-cake is completely removed from the well walls before cementing, and its presence between the wall and the cement is a possible source of failure if it should flow out under the applied pressure differential. Formation erosion is a further possible mechanism of failure.

The histories of 3 wells in the Oakville area of Live Oak County, Texas, suggest that the failures were due to movement of solid material, and that coning was not the cause of the high water–oil ratios. An open-hole gravel-pack type of completion procedure has been devised to prevent failures of this kind by preventing movement of all solid material in the space in which completion is made. Gravel is dumped around a slotted liner which extends above the bottom of the casing, and when sufficient gravel is in place a mixture of quick-setting cement and sand is placed on top as an impermeable plug. With this arrangement any flow of drilling mud or sand tends to be self-annihilating. Experiment has shown the effectiveness of plugs of this type. The average time of making the installation is about 6 hr if the cement sets in 2 hr.

It was found that the gravel size for approximating complete prevention of sand production had an average particle size about six times the sand grain size at the 10% point on a sieve analysis curve. Experiment has indicated that completely filling the space to be gravel-packed, thereby preventing the liberation of silt as a result of disintegration of the oil sand will permit the use of gravel sufficiently small to provide complete screening action without danger of plugging, regardless of the character of the sand. The use of even a very small gravel leads to a relatively small decrease in the rate of production under the usual conditions of application. G. D. H.

1016. Purpose of Acidizing Sand Formations. E. N. Jones. *Oil Gas J.*, 22.3.47, **45** (46), 295 (*Engineering Fundamentals No.* 278).—The purpose of acidizing, and the data needed in planning acidizing operations are discussed. A simple method of estimating the amount of acid needed is briefly described. R. B. S.

1017. Plotting Back-Pressure Open Flow Curves. W. F. Martin. *Petrol. Engr*, Mar. 1947, **18** (6), 78.—The author has devised a chart for computing the open flow of gas wells from back-pressure tests which reduces calculation to a minimum. This chart is explained and its use is illustrated by several examples. R. B. S.

1018. Calculations of Bottom-Hole Pressure. F. C. Fowler. *Petrol. Engr*, Mar. 1947, **18** (6), 88.—An equation is derived which permits the direct calculation of bottom-hole pressures in gas wells. The necessary data consist of well-head pressure, well depth, temperature gradient of well, and gas composition or gravity (either of which can be used to determine pseudo-critical temperature and pressure). The use of this equation is illustrated by an example : its accuracy is comparable to that of the trial and error methods proposed by other investigators, and in addition the calculations are less laborious. Six references are appended. R. B. S.

1019. Core Analysis—Practical Application to Oil and Gas Reservoirs. J. H. Campbell. *Petrol. Engr*, Dec. 1946, **18** (3), 100.—The fundamental principles of core analysis and reservoir behaviour are briefly discussed. R. B. S.

1020. Central Treating Plant Performs Dual Function. N. Williams. *Oil Gas J.*, 1.3.47, **45** (43), 56.—A description is given of a treating plant which is used not only for oil–water separation, but also for the treatment of separated water for water injection purposes. The treating plant, the method of water separation, and the settling, chemical treatment, and filtration of the water are each described. R. B. S.

1021. Heating and Cleaning Santa Maria Heavy Crude. R. L. Lauenstein. *Petrol. Engr*, Mar. 1947, **18** (6), 67.—The gravity of crudes produced in the southeast portion of the Santa Maria Valley field ranges from 7° to 14° API and the viscosity of the heaviest may be as high as 2,000,000 sec—23 days—(Saybolt Universal). These crudes have to be heated to about 130° F in order to enable sand and water to separate out : this heating also enables most of the natural gas to break free and thus prevent foaming in the gas–oil separators. A typical flow-line heater for this purpose is described. R. B. S.

1022. Gun Perforation Design for Uniform Productivity. W. J. Jackson. *Petrol. Engr*, Mar. 1947, **18** (6), 113.—The effect of gun perforations on well productivities are discussed and experimentally determined curves are presented relating relative productivity to the number of perforations per foot for ¼-in and ½-in perforations in 6-in and 12-in casing : the relative productivity is defined as the ratio of the productive capacity of the cased and perforated well to that of an uncased well of the same diameter. The relative productivity increases with the number of perforations per ft and with the size of the perforations, but decreases with increasing casing diameter. The use of this chart to determine the best number of perforations per ft for any well is described. Six references are appended. R. B. S.

1023. Increasing Dually Completed Gas Well Production. P. L. Shelton and J. M. Clark. *Oil Wkly*, 3.3.47, **125** (1), 31.—The results of tests on dually completed gas wells characterized by unstable flow conditions are described. These results show that the problem of increasing daily production in such deficient wells in a dual completion can be resolved into one of decreasing the effective flow area, and thus increasing the velocity of the flowing gas.

A method was devised which decreased the effective flow area of the upper section and also reduced the area through which the lower section was to produce, thus ensuring a high flowing velocity from both sections. This method consisted of snubbing a macaroni inside the tubing under pressure with special equipment. The lower section was then produced through the macaroni string and the upper section through the annular space between the macaroni string and the tubing.

Special tools and well-head equipment had to be designed which could be adapted to the existing Christmas-tree and tubing string for this type of completion. These are described. R. B. S.

1024. Carthage Engineers Fight Hydrates. G. Weber. *Oil Gas J.*, 5.4.47, **45** (48), 58. —The conditions in the gas-gathering system in use in the Carthage field are such as to cause serious hydrate plugging at ordinary winter temperatures. The method which has been employed in this field to prevent these troubles consists mainly of the installation of heaters : these installations are described. R. B. S.

1025. Effect of Crude Gravity on the Performance of Gas Drive Reservoirs. M. Muskat and M. O. Taylor. *Petrol. Engr*, Dec. 1946, **18** (3), 88.—Calculations of ultimate recovery, free-gas saturations and maximum gas–oil ratios as functions of crude gravity are presented. Reservoir pressure, gas–oil ratio, and productivity index were also calculated as functions of cumulative recovery for five crudes of 10°, 20°, 30°, 40°, and 50° API gravity. The effects of gas solubility, oil viscosity, and oil shrinkage were all taken into account in the calculations. These properties of the oil and gas as functions of crude gravity and the permeability–saturation relations were taken from the experimental results of previous investigators. In all cases the same permeability–saturation curve was used with an assumed equilibrium gas saturation of 10% and with a connate water saturation of 25%.

The results of these calculations showed that the ultimate free-gas saturation developed during pressure depletion increases uniformly with API gravity of the crude. The ultimate recovery, as a fraction of the initial oil content also increases with the API gravity, although the curve flattens at higher gravities. The absolute recovery, expressed as a fraction of the pore space, shows a maximum at about 40° API gravity. The maximum gas–oil ratio developed during pressure depletion is greatest for the 10° API gravity crude, falls to a minimum at about 22° API gravity, and then rises uniformly with increasing crude gravity. The productivity index at depletion, expressed as a fraction of its initial value, decreases with increasing crude gravity.

Six references are given, R. B. S.

1026. Liner Job Well Remedial Work in East Texas Field. D. W. Akins. *Petrol. Engr*, Jan. 1947, **18** (4), 96. (*Paper presented before A.P.I.*)—See Abstract No. 801 (1947).

1027. Composition of Mud Acid and its Function in Sand Horizons. E. N. Jones. *Oil Gas J.*, 5.4.47, **45** (48), 107 (*Engineering Fundamental No.* 280).—Regular mud acids consist of a mixture of : (1) fluorine which attacks and dissolves the mud and sand ; (2) hydrochloric acid to maintain a low pH after the fluorine has reacted ; (3) detergents which improve the acid penetration by removing grease ; (4) emulsion breakers to prevent emulsion formation ; and (5) alcohols to reduce the surface tension and hence increase the penetration. The functions of mud acids are (1) to increase the well-drainage area ; (2) to clean liners or perforations and open void spaces ;

(3) to increase the life of flowing or pumping wells; and (4) to clean the sand face and prepare the formation for squeeze cementing jobs. R. B. S.

1028. Setting Multiple Packers. Anon. *Producer's Monthly*, Mar. 1947, **11** (5), 11.—A method of setting multiple packers is briefly described and illustrated by a diagram. R. B. S.

1029. Mud Changes Formation Permeability and Productivity. E. N. Jones. *Oil Gas J.*, 29.3.47, **45** (47), 179 (*Engineering Fundamentals No.* 279).—The deleterious effects of drilling mud on the permeability and productivity of producing formations are discussed and a method of mud removal by acid treatment is briefly described. R. B. S.

1030. New Method to Determine Permeability. J. C. Calhoun, Jr. *Petrol. Engr*, Feb. 1947, **18** (5), 103.—An equation is derived for determining the permeability of porous media to gases from a knowledge of: (1) the initial and final pressure differentials through the porous medium, (2) the area of the porous media perpendicular to the line of flow, (3) the length of the porous medium, (4) the volume and viscosity of the gas, and (5) the time of flow: it is assumed that the gas is incompressible and that steady state conditions prevail. A laboratory apparatus and procedure designed to measure permeability using this equation is described. The results of these experiments show that the permeability to gases as measured by this method vary according to the nature of the gas, as has been found by other methods. These results also confirm the fact that the permeability to all gases tends to the same value at infinite pressure, this limiting value being equivalent to the permeability to liquids. R. B. S.

1031. Selective Plugging by Smokes. R. F. Nielsen. *Producer's Monthly*, Feb. 1947, **11** (4), 16.—See Abstract No. 224 (1947).

1032. Evaluation of Pressure Maintenance by Internal Gas Injection in Volumetrically Controlled Reservoirs. E. C. Patton. *Petrol. Tech.*, Nov. 1946, **9** (6) (*A.I.M.M.E. Tech. Pubn. No.* 2098), 1–41.—A comprehensive study has been made of a proposed method of using the basic physical data for tight volumetric-type reservoirs and their fluids in order to assess the practicability of undertaking gas injection, and to estimate the profit which may be expected from such an operation. A method is described for correlating laboratory permeability data with field performance history, and using these to predict future performance from past performance. This involves the substitution into the material-balance equation of a factor intended partially to take into account deviations from ideal behaviour resulting from non-homogeneity of the reservoir rock. The theoretically most nearly correct method of applying flash and differential laboratory data in their appropriate places in the material-balance equations is described.

Equations are presented for converting material-balance predictions directly to a time basis, together with methods of predicting the time at which the field economic limit will be reached and of estimating the relative number of pumping wells at any time under pressure maintenance as compared with primary performance. The various equations and methods may be used to predict the relationship between gas-production rate and time in order to establish a basis for the design of suitable gasoline or compressor plants to cater for the entire fields, as well as to estimate the economically most favourable time for beginning gas injection.

The sale of residue gas obtained in the operation of a reservoir by natural depletion in certain circumstances may be more profitable than pressure maintenance by gas injection with the expected resultant increase in ultimate oil recovery. In this connexion the relationship between the price of gas and the price of oil, and the magnitude of the saving due to deferring of the date of commencing pumping are important.

Although it is practically impossible to make an absolutely accurate forecast of the future under any given scheme of operation, the discussion provides a means whereby a reliable prediction may be made of the relative benefits of a gas-injection pressure maintenance programme as compared with normal depletion for a volumetric-type reservoir. G. D. H.

1033. Benton Unit Approaches the Ideal Pressure-Maintenance Project. G. Weber. *Oil Gas J.*, 11.1.47, **45** (36), 56.—The field is of the high pressure gas-condensate type and plans for recycling were made from the start of the development of the field. Unitization under a model agreement was completed when the field comprised but 3 wells. Under its provisions the unit is being drilled with a minimum number of wells which will serve the dual purpose of providing sub-surface data for fixing the unit area and equities in it, and serving as producing and input wells for the pressure-maintenance programme. Production has been almost completely shut in, awaiting completion of the cycling plant now building. The pressure-maintenance programme involves injection of water as a make-up for shrinkage of processed gas. As a result of these far-sighted provisions, the Benton field, on the basis of reserves in place, should provide a new record for recovery at a development cost unmatched in the cycling industry. No evidence of water exists in either reservoir, since pressures declined even with limited withdrawals. At the original reservoir pressure of 3745 p.s.i. at 8000 ft in the " D " sand, " liquid " recovery is calculated from the laboratory tests on recombined samples to equal 71·5 brl/million cu. ft. With pressure mantenance it is estimated that 91% of liquids in place in the reservoirs may be recovered, whereas the pressure-depletion method of production would net only 57% of liquid reserves. The added recovery expected through unitized cycling operations amounts to more than 5,000,000 brl of liquid products valued in excess of $6,000,000.

The history of the field and the methods adopted for equity are described. A. H. N.

1034. Pressure Maintenance at Richard King Designed to Handle Approximately 3,000,000 cu. ft. of Gas Daily. N. Williams. *Oil Gas J.*, 15.2.47, **45** (41), 76.—The history and development of the Richard King field of South Texas are given. The field is under a dissolved gas drive and plans to increase the ultimate recovery called for large quantities of gas to be injected in the reservoir. These plans are briefly discussed. A. H. N.

1035. Computations of Plunger Travel. Part I. E. A. Stephenson. *Oil Gas J.*, 1.3.47, **45** (43), 93 (*Engineering Fundamentals No.* 275).—The Marsh–Coberly formula for calculating the stretch of sucker rods (and hence the plunger stroke) is discussed. The method is illustrated by examples and it is shown how to simplify the solution of problems by this method with the use of graphs.

One reference is appended. R. B. S.

1036. Computations of Plunger Travel. Part II. E. A. Stephenson. *Oil Gas J.*, 8.3.47, **45** (44), 97 (*Engineering Fundamentals No.* 276).—Rieniet's method of calculating plunger stroke is discussed and illustrated by an example. Two references are appended. R. B. S.

1037. Importance of Clay Studies in Water Flood Operations. Part I. R. V. Hughes. *Producer's Monthly*, Feb. 1947, **11** (4), 13.—Modern methods of X-ray diffraction analysis, thermal analysis, and electron microscope examination, have shown that clays are composed almost entirely of crystalline matter, even though most of the particles are so small as to be of colloidal dimensions. The most common clay minerals are kaolinites, montmorillonites, and illites : the characteristics of these minerals are briefly discussed.

The three related properties of clays which are of outstanding importance in secondary recovery operations, especially water flooding are : (1) base exchange, (2) absorption and retention of water, and (3) deflocculation and flocculation. Base exchange is that property of clays which enables an exchange of cations between the clay and a surrounding solution to take place without destroying the lattice structure of the clay. Water is retained by clays in three ways and is denoted as : (1) crystal water—an integral part of the clay crystal ; such water can only be removed by heating above 500° C ; (2) broken-bond water—water which becomes adsorbed at the broken edges of clay particles in order to satisfy ions in those positions which become unsaturated by division of the particles; temperatures of over 300° C are often required to remove this water; and (3) planar water—water which is adsorbed between the planar surfaces of the clay crystals; it is this water which accounts for the extreme swelling characteristics of some clay minerals. Deflocculation is defined as the state of a dispersion of a solid in a liquid in which each solid particle remains geometrically independent and unassociated with adjacent particles: *e.g.* the clay in a colloidal suspension is in a deflocculated state. Flocculation is defined as the formation of clusters of particles separable by relatively weak mechanical forces or by changes of a chemical nature at the interface between the particles and the suspending phase.

Seventeen references are appended. R. B. S.

1038. Importance of Clay Studies in Water Flood Operations. Part II. R. V. Hughes. *Producer's Monthly*, Mar. 1947, **11** (5), 12.—The common clays may be classified as: (1) hydrogen clays, (2) calcium clays, and (3) sodium clays. Hydrogen clays are those which have undergone extensive leaching and dehydration. They possess acidic characteristics and are most often found as surface and near-surface exposures in poorly drained areas: these clays seldom cause serious trouble to the secondary recovery producer. Calcium clays are normal constituents of the better agricultural lands: these clays are flocculated by fresh waters and remain permeable to them indefinitely, but they are deflocculated by oilfield brines unless converted to true sodium clays: sodium clays, however, are more easily converted into calcium clays (by thoroughly leaching a sodium clay in a dilute solution of a calcium salt thereby causing a base exchange reaction) than vice versa. As calcium clays are flocculated in the presence of fresh water and are therefore granular and more permeable to fresh waters, the presence of calcium clays in sands under (fresh) water flood, either naturally or through base exchange reactions, may be advantageous if recognized early during the life of the flood. Sodium clays are believed to indicate deposition in or contact with salt waters: a base-exchange reaction will take place between a calcium clay and a sodium chloride solution forming a sodium clay. It may be assumed that all clays and shales associated with producing sands of marine origin are sodium clays. Thus many troubles will occur around the well bore and within the producing sand if unfavourable base exchange reactions are allowed to occur at any time. Sodium clays are deflocculated and thus swell in the presence of fresh waters, but tend to become flocculated and thus permeable in the presence of salt waters.

Seven references are appended. R. B. S.

1039. Oil Production by Water. Part 10. Injection Well and Water Requirements. P. J. Jones. *Oil Gas J.*, 11.1.47, **45** (36), 78.—When a reservoir is saturated with producing wells produced at capacity, a decline in reservoir pressure is accompanied by a decline in producing rate. So the burden of maintaining producing rates is placed on injection wells. However, differences between producing and injection wells as to interference factors, permeability, completion in pay, and fluid viscosities usually favour a higher operating reservoir pressure, more injection wells, and fewer producing wells. As a rule, the optimum reservoir pressure is the pressure which requires the least total number of wells. Differences in operating expenses as between pumping and injection wells may also favour a greater number of injection wells. The total volume of water handled depends primarily on how much oil is produced before water appears in production. The dry oil reserve is a measure of water injection requirement. The greater the distance between injection and producing wells, the higher the oil recovery before water appears in production. A. H. N.

1040. Oil Production by Water. Part 11. Migration of Oil. P. J. Jones. *Oil Gas J.*, 18.1.47, **45** (37), 64.—Due to migration the production of oil by water will differ for the different rows of wells producing. Formulæ are developed giving the production of the different rows and graphs illustrate the results. A. H. N.

1041. Oil Production by Water. Part 13. Location and Spacing of Wells for the R-I Reservoir. P. J. Jones. *Oil Gas J.*, 15.2.47, **45** (41), 81.—The producing capacity at MER for the R-1 reservoir is 14,200 brl/day. About 60 producing wells saturate the reservoir. The optimum spacing for producing wells is the least distance between wells commensurate with depth. The optimum location for 60, or less, wells is within

the 140-ft contour. The optimum location for injection wells is along the water contact. A procedure for estimating producing and injection well capacities is indicated.
A. H. N.

1042. Oil Production by Water. Part 14. Two-Pay Intervals. P. J. Jones. *Oil Gas J.*, 22.2.47, **45** (42), 130.—The characteristics of a radial reservoir having two pay intervals and the per-interval capacity to produce oil at MER by edge water are indicated. Control of per-interval producing rates will be considered in the next article.
A. H. N.

1043. Results of Water-Flooding Oil Sands in North and North-Central Texas. D. B. Taliasferro and R. K. Guthrie. *Producer's Monthly*, Mar. 1947, **11** (5), 15. (*Paper presented at Annual Meeting, North Texas Oil and Gas Association, Wichita Falls, Texas*, Mar. 1947.)—A brief description is presented of the results obtained in field investigations of eleven typical water flood projects in Texas. An effort has been made to select projects that have been in operation for several years so that an estimate of the ultimate recovery by water-flooding can be made by extrapolating the production decline curves to an estimated economic limit. Each project is illustrated by: (1) a map of the property, showing the location of all producing, input, and abandoned wells as of January 1st, 1947; and (2) a graph showing the production history, the monthly volume of water injected, and the average injection pressure: this graph also indicates the volume of oil which has been recovered by water flooding to date that would not have otherwise been recovered.
R. B. S.

1044. Utilization of Old Wells. W. A. Heath. *Producer's Monthly*, Feb. 1947, **11** (4), 18. (*Paper presented at Annual Meeting, A.P.I., Chicago*, Nov. 1946.)—The utilization of old wells in water-flooding operations and in air and gas-injection projects is reviewed from a historical standpoint. The difficulties encountered in the use of old wells, and the reconditioning of them for these purposes are then discussed. The various reconditioning methods are: (1) use of clean-out tools, such as wall scrapers, etc.; (2) shooting with nitroglycerin or marble shots; (3) application of heat to remove paraffin by steaming, circulating hot air, chemical reaction or electrical heating; (4) use of paraffin solvents; and (5) use of hydrochloric and mud acids. Twenty-one references are appended.
R. B. S..

1045. Performance of Bottom Water-Drive Reservoirs. M. Muskat. *Petrol. Tech.*, Sept. 1946, **9** (5) (*A.I.M.M.E. Tech. Pubn. No.* 2060), 1–31.—A theoretical study has been made of the behaviour of wells and reservoirs producing by bottom-water drive. Assumptions were made that the pressures remained above the bubble-point and that the permeability to viscosity ratio of the water in the flooded zone was the same as for the oil in the oil-saturated pay. The treatment was based on the homogeneous fluid potential theory, and the effect of the difference in density between the oil and water was neglected. The proper potential distributions were derived and the nature of the rise of the oil–water interface below the producing wells was calculated.

The primary clean-oil production phase was expressed as a function of the displacement efficiency, defined as the fraction of the pay flooded out by the rising water-table at the time of first water entry. The variation of this displacement efficiency was calculated as a function of the well-spacing, pay thickness, the ratio of the horizontal to the vertical permeability, and the well penetration. The important parameter, other than the well penetration, was found to be the ratio of the well separation to the pay thickness multiplied by the square root of the ratio of the vertical to horizontal permeability. The displacement efficiency was found to decrease continuously as this parameter increases and for values of the latter exceeding 3·5 the efficiency varied inversely as the square of the parameter. It also increased with decreasing well penetration. It was concluded that in order to explain the delay in entry of water in wells producing by bottom water drive for periods longer than a few days' normal production, with drawdowns large compared with the differential density head between the oil and water it is necessary to assume that the vertical permeability is a very small fraction of the horizontal permeability.

The production history after water had broken through also was analysed, on the assumption that the production mechanism and details of the flow distribution continue to be the same as during the phase of clean-oil production. The water cut was found to increase at an accelerated rate as production proceeds. The water–oil ratio at a given cumulative oil recovery per well would increase with increasing well penetration and increasing well spacing.

In the range of practical well spacings and physical parameters defining the producing system, the increments in clean-oil production per additional well decreased with increasing well density, and because of the limited gains in total economic oil recovery as the well density was increased, the optimum value of the spacing would be determined largely by economic considerations. G. D. H.

1046. Recent Innovations in Lease Work Barges. E. H. Short. *Oil Gas J.*, 5.4.47, **45** (48), 61.—Marine operating barges especially equipped for paraffin removal from tubing strings and lead lines are briefly described. R. B. S.

1047. Patents on Production. F. J. Norton, assr to General Electric Co. U.S.P. 2,412,470, 10.12.46. Production of Water Repellent Materials.—A method of making a solid body water repellent by treating with a mixture consisting of from 2·8% to 99·2% by weight of trimethyl silicon chloride and of from 97·2% to 0·8% by weight of silicon tetrachloride.

E. Buddrus and S. C. Carney, assrs to Phillips Petroleum Co. U.S.P. 2,412,765, 17.12.46. Recovery of Hydrocarbons.—A method of producing oil from partially depleted fields by injecting into the formation condensible hydrocarbon vapours consisting essentially of propane and butane: these vapours condense in the formation and render the crude oil more favourable to production: the method of recovering the light hydrocarbon vapours from the produced crude is also patented.

R. E. Edwards, assr to Halliburton Oil Well Cementing Co. U.S.P. 2,412,876, 17.10.46. Wire Brush for Use in Oil Wells.—A wire brush suitable for cleaning well casing, etc.

C. E. Zobell, assr to The American Petroleum Institute. U.S.P. 2,413,278, 24.10.46. Bacteriological Process for Treatment of Fluid-Bearing Earth Formations.—A method of increasing or facilitating the recovery of oil from oil-bearing formations by subjecting the formation to the action of *Desulfovibrio halohydrocarbonoclasticus*.

F. E. Dana. U.S.P. 2,415,729, 11.2.47. Method of Cleaning Oil Wells.—A method of removing paraffin deposits from oil-well tubing.

S. T. Yuster, assr to The Bradford District Pennsylvania Oil Producer's Association. U.S.P. .2,416,077, 18.2.47. Well Torpedo.—A well-shooting torpedo in which the charge is contained in an annular space having an outside diameter substantially as great as that of the bore-hole to be shot.

G. A. Thompson and S. A. Cejka. U.S.P. 2,416,359, 25.2.47. Apparatus for Lifting Fluid.—A special type of gas-lift apparatus.

C. E. Trautman and H. A. Ambrose, assrs to Gulf Research and Development Co. U.S.P. 2,416,360, 25.2.47. Prevention of Foaming of Hydrocarbon Oils.—A process of suppressing foaming in hydrocarbon oils by producing in the oil a fine stable dispersion of a liquid organo-germanium oxide which is substantially insoluble in the oil and not in sufficient amount to produce deleterious effects.

J Grant and J. J. Santiago, assrs to Grant Oil Tool Co. U.S.P. 2,416,441, 25.2.47. Determination of Well-Pipe Perforations.—An instrument having a thin outer shell which can be lowered into a well opposite a perforated section and then expanded against the casing to form indentations corresponding to the perforations.

C. E. Trautman and H. A. Ambrose, assrs to Gulf Research and Development Co. U.S.P. 2,416,503, 25.2.47. Prevention of Foaming in Hydrocarbon Oils.—An active defoaming compound consisting of a dehydrated silicon oxide condensation product.

C. E. Trautman and H. A. Ambrose, assrs to Gulf Research and Development Co. U.S.P. 2,416,504, 25.2.47. Prevention of Foaming in Hydrocarbon Oils.—A process of suppressing foaming in hydrocarbon oils by adding to them a liquid organo-silicol condensation product in excess of that which dissolves in the oil so as to produce a dispersion therein.

D. B. Collins, assr to Shell Development Co. U.S.P. 2,417,152, 11.3.47. Oil-Well Screen.—A special type of oil-well screen having inwardly diverging slots.

J. Caldwell, assr to The James Morrison Brass Manufacturing Co. U.S.P. 2,417,181, 11.3.47. Oil-Well Pressure Control System.—A new design of well-head equipment for withstanding high pressures. R. B. S.

Oilfield Development.

1048. Carthage Approaching Full Gas Production. G. Weber. *Oil Gas J.*, 29.3.47, **45** (47), 137.—The development of the Carthage gas and condensate field discovered in 1936 in Panola County, Texas, is reviewed. The total gas production by the end of March 1947 exceeded 200 billion cu. ft. R. B. S.

1049. South Texas Giant. C. J. Deegan and N. Williams. *Oil Gas J.*, 9.11.46, **45** (27), 60–64.—It is possible that the separate pools from Agua Dulce to La Gloria may eventually become a big field, 50–55 ml long and 3–7 ml wide. It may then be second only to East Texas as an oil reserve, and second to the Amarillo-Hugoton area as a gas reserve. The estimates of potential reserves are 1250–1750 million brl of oil, 12–15 million million cu. ft. of gas and 300–400 million brl of distillate. Shallow gas and oil were discovered at Agua Dulce in 1928; the Stratton field followed in 1931, Seeligson in 1937, La Gloria in 1939, Tijerina and Canales in 1944, and Monte Negra and Borregas in 1945. Merging is not quite complete, and a few dry gaps may persist.

The cumulative production at the beginning of July 1946 was 55,000,000 brl. The present allowable is 85,000 brl/day. Production is from numerous lenticular sands extending through the Frio-Vicksburg section. At Seeligson the depth range is 4600–7000 ft. Some sands have gas, some oil and gas, some gas and distillate. Over 85 distinct reservoirs have been noted. A series of structures occur along the Vicksburg flexure. In parts of the area the average well encounters four separate gas zones and three or four oil zones.

Apart from gas and condensate wells there are over 1100 producers.

The trend of developments is described. Tables give the annual production from 1938 for the entire area, and give some data on the separate pools. Part of a cross-section and a stratum contour map are included. G. D. H.

1050. Canadian Developments—1946. F. K. Beach. *Petrol. Engr*, Oct. 1946, **18** (1), 67.—At Turner Valley more than a million million cu ft of gas have been wasted, but a third of this quantity has been marketed.

In a third test of the Jumpingpound structure gas has been found in the top of the Rundle and saltwater lower. In the Brazeau area a well has reached 11,689 ft, finding two slivers of Rundle with gas, condensate, and water in the upper one. Imperial Shell Stolberg also found two Rundle slivers in drilling to 13,747 ft. The lower sliver has salt water.

Gas flows have been found in Roxana 3 K below 5000 ft. A hole near Lundbreck has had numerous oil shows and is fishing at 9912 ft. Royalite De Winton, 12 ml east of Turner Valley, had a good oil show in the Brown sand of the Fernie (Jurassic). Oil shows have also been found in the basal Blairmore, 18 ml north of Calgary. An oil discovery has been made a few miles northeast of the Wainwright field. Imperial's Provost discovery of oil was in the top of the Lower Cretaceous. McColl Frontinac and Union jointly discovered a big gas flow in eastern Alberta just north of the Montana border.

Geological and geophysical work continued in Alberta.

A wildcat is being drilled 40 ml north of Halifax, Nova Scotia. Tests are being drilled on the Gaspe Peninsula. On the Galt anticline there has been a gas show. G. D. H.

1051. Canada has Intense Exploration Programme. R. Sneddon. *Petrol. Engr*, Oct. 1946, **18** (1), 145.—15% of Canada's oil needs are supplied by the output of Norman Wells and Turner Valley, the latter now yielding 20,000 brl/day. The oil deficiency, and the cost of obtaining supplies elsewhere make urgent the investigation of Canada's further oil resources. The Fischer–Tropsch process and successful exploitation of the

Athabaska tar sands would contribute to the supplies. The oil possibilities of Western Canada are far from fully tested. Indeed, it has been stated that of the 1600 wells drilled in this area to date less than a dozen have been deep enough to test all the possibilities of the sections. Hence scarcity of good results in terms of production is not entirely discouraging. Exploration in Eastern Canada has not been successful.

G. D. H.

1052. Mexico To-day—Exploration and Production. Anon. *Oil Gas J.*, 2.11.46, **45** (26), 42.—The Mexican oil industry is handicapped by a serious labour problem. Much equipment is in urgent need of replacement. Labour costs have nearly trebled since the expropriation. Antiquated transport constitutes a further handicap. Finance has been lacking for adequate prospecting. Only 23 wildcats have been drilled since 1938, two having found oil and two gas. 75% of the reserves are at Poza Rica. 17 geological crews and 11 geophysical crews (6 seismic, 4 gravity-meter, 1 electric) are in the field.

Poza Rica produces 68,076 brl/day, providing 54% of the Mexican output. In mid-1946 the cumulative production was 248,100,191 brl of oil and 258,249,000,000 cu. ft. of gas. Production is from the Tamabra (Cretaceous) which averages 296 ft in thickness, and has a porosity of 10%.

In the northeastern area (an extension of the Rio Grande basin) 23 wells have been completed, the cumulative production being 7615 brl of distillate and 33,229,000,000 cu. ft. of gas. Production in this Mission gasfield is from the Vicksburg (Oligocene) at depths of 5800 ft. The porosity is 20% and the initial reservoir pressure was 2760 p.s.i.

On the flanks of the complex El Plan salt dome Pemex discovered the Concepcion and Encanto sands which produce elsewhere in the area. G. D. H.

1053. Brazil's Latest Discovery Spurs Interest in Oil Development. Anon. *World Petrol.*, Nov. 1946, **17** (12), 58.—Drilling in Bahia during the past 5 years has revealed 4 oilfields with about 30 producing wells. Lobato was the first discovery. Aratu has an oil horizon and a gas horizon. Itaparico and Candeias are the other fields. The combined output has not exceeded 2000 brl/day. Recently a well in the Candeias field found 200 ft of pay, and in a 24-hr test gave 1800 brl/day. 16 other producers in this area range 25 to 100 brl/day and average 60 brl/day. A still more recent well has a potential of 1000 brl/day. The sand appears to be lenticular. G. D. H.

1054. Estimates of Russian Oil Resources. E. Adams. *Petrol. Engr*, Oct. 1946, **18** (1), 178.—It has been estimated by Perejda that the U.S.S.R. oil production in 1945 was about 149 million brl. The 1939 production was 217 million brl. In 1940 the Baku area supplied 70% of the Russian output, but the Baku production later declined by about half. Maikop and Grozny provided 16% of the 1940 total, and the former fell into German hands, while the latter was greatly damaged. Elsewhere the production rose from 31 million brl in 1940 to 45 million brl in 1945; the changes in this period for various areas were Ural–Volga, 14 to 21 million brl, Emba 5 to 7 million brl, and Sakhalin 3 to 6 million brl.

In 1937 available reserves in Russia were about 6000 million brl. All geologists agree that Russia may have more unproved reserves than any other country, and may have two or three times as much sedimentary rock of a petroliferous type as U.S.A.

Of proved reserves, U.S.A. controls about 60%, Great Britain 23%, and Russia about 11%, the Netherlands 5%, and France less than 2%.

Transport is one of Russia's main obstacles in developing proved reserves. Climate provides other difficulties. G. D. H.

Transport and Storage.

1055. Design of Long Distance Natural Gas Transmission Lines. R. G. Strong and T. H. Beals. *Oil Gas J.*, 19.4.47, **45** (50), 88.—Origin, terminus, market requirements, size of pipe, number and size of compressor stations, geography of country, character and corrosivity of soil must be taken into account when designing high-pressure transcontinental pipeline systems. New lines are solid welded. Special consideration has to be given to river crossings, and isolation valves provided. The most economical combination of pipe and power has to be determined for which purpose tables are provided for 24, 26, 28, and 30-in pipe and 1250 h.p. horizontal compressors, based on formulas for line flow, horse-power, and Barlow's formula. G. A. C.

1056. Transport of Liquid Fuel by Pipeline. Anon. *Petroleum*, 1947, **10**, 64 (*Condensed translation by R. Hammond of* "*Transporte de combustibles por tuberia*," *published in* "*La Ingeneria*," 1946, **50**, 537–539).—A plan for the co-ordination of all pipelines in the Argentine Republic is being considered by the Government. Within the general plan one new gas pipeline and four oil pipelines are considered essential. The projects are in the hands of Yacimentos Petroliferos Fiscales (Y.P.F.) and the National Gas Directorate who will jointly study to provide a comprehensive solution of the economic transport of liquid fuels. The projects will involve legislation, and after the law has been promulgated the pipelines will function as public carriers, subject to Government control regarding charges, etc.

The surface transport of liquid fuel in Argentina is carried out uneconomically. Although it occupies seventh place as a world producer of petroleum and has long distances to cover there are, at present, only 400 km of pipe-line in the country.

Considering individual Argentine petroleum deposits, that at Comodoro Rivadavia is extensive and this also possesses large reserves of natural gas. Much of this gas has been, in the past, discharged to the atmosphere, for lack of a pipeline to transport it economically.

There are important gas and petroleum deposits in Mendoza, the output from which has to be conveyed to coastal refineries and is at present transported by rail. Gas reserves at Plaza Huincul remain dormant for lack of transport by pipeline and petroleum from this source is transported to Buenos Aires by rail.

The relative costs of surface and pipe-line transport show the latter to be the more economical as proved by American statistics. Pipeline transport also has advantages as regards safety and regularity and there are also vital military advantages.

F. W. H. M.

1057. Approximate Performance of Centrifugal Pumps. W. L. Nelson. *Oil Gas J.*, 3.5.47, **45** (52), 107.—No. 142 in the *Refiner's Notebook* series gives curves which indicate the approximate head and power for single-stage centrifugal pumps of either single or double suction. Reference is also made to No. 136 in this series. An example is provided and worked out. G. A. C.

1058. Applying Plastic Coating to Oil Tanks. W. J. Davis. *Petrol. Engr*, Jan. 1947, **18** (4), 182.—The advantages of plastic coating over other methods of protection against corrosion for oil-tanks is discussed. The procedure generally adopted for preparing tanks and carrying out the plastic coating operation is then described.

R. B. S.

1059. Patents on Transport and Storage. F. Sutton, assr to Saunders Valve Co., Ltd. U.S.P. 2,412,105, 3.12.46. Fluid Controlling Valve.—A self-closing and self-locking diaphragm valve having no stuffing box.

J. H. Wiggins. U.S.P. 2,415,322, 4.2.47. Pressure Control Mechanism for Fluid Storage Apparatus.—A variable volume storage tank for automatically maintaining fluid contents at a constant pressure. R. B. S.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1060. Centrifugal Compressors for Gas Pipe-lines. M. C. Shaw and E. T. Neubauer. *Oil Gas J.*, 8.3.47, **45** (44), 65.—The merits and demerits of centf compressors for pumping natural gas from producing fields to consumers, are discussed. The technique is that of using low pressure ratios whilst handling large quantities of gas, a process especially suited to the centf compressor. It is generally possible to eliminate the use of large gear ratios and this is an advantage when compared with the high-speed multi-stage axial flow compressor. The centf has the advantage of variable capacity, when driven at constant speed, according to the demand on the system. Six methods of regulation of centf compressors are discussed, of which the by-pass method is the simplest. Operation, lubrication, shaft seals, materials, and costs conclude an excellent review. I. G. B.

1061. Cooling-Tower Performance Evaluated for the Operator. J. G. De Flor. *Oil Gas J.*, 29.3.47, **45** (47), 129.—Atmospheric and mechanical draft towers are described, and their performance discussed.

Mechanical Draft Towers.

The two types are :—

(*a*) Forced draught, now losing favour, where air is forced in the bottom and discharged at the top.

(*b*) Induced draught, where air is pulled upwards from the top, and discharged at high velocity.

In both types, performance is governed by ratio of weights of air to water, and time of contact between water and air. These depend on the following factors, of which the required tower size is then a function.

(1) Cooling range (hot water temp minus cold water temp).
(2) Approach to wet bulb temp.
(3) Quantity of water to be cooled.
(4) Wet bulb temp.
(5) Air velocity through the cell.
(6) Tower height.

A series of diagrams and curves is given illustrating the relationship between these conditions, and a number of examples worked out to show how cooling tower performance may be deduced from the curves.

Atmospheric Cooling Towers.

Water is pumped to the top of the tower, and then discharged through a distributing system. Air passes horizontally through the tower. Performance is limited by position, *e.g.* it must be in an exposed area and broadside on to the prevailing wind. The problem of excessive spray loss has now been solved by incorporating drift eliminators into the louvers.

Cooling capacity varies with water concentration, and this depends on :

(1) Temp range.
(2) Approach to wet bulb temp.
(3) Tower height.
(4) Wind velocity.
(5) Wet bulb temp.

The effect of these factors is discussed, and illustrated by curves, and examples are included. W. M. H.

1062. Insulation Technique for Oil-Refinery Structures. S. S. Parker. *Oil Gas J.*, 25.4.47, **45** (51), 160.—The use and advantages of silicate fibres (mineral wool) as insulating material for refinery plant over a 10-year period at Ashland, Ky., is discussed.

The blanket form of insulation materially decreases time and expense of application, and at a lower unit and cost. Repairs can be rapidly carried out, whereas the brick method consumed days of time. Chemical wool is easily applied and retains shape and properties in service. Blankets are held in place, for example, on four asphalt oxidizing tanks by heavy wires butt-welded to the steel plate prior to application of insulation, 2-in thickness of the wool being employed.

Multiple layers of installation can be used, and on large units it is essential that the insulation be applied when dry and be protected from water.

High-pressure steam lines are among other refinery equipment which have been successfully insulated with mineral wool, losses over a distance of more than ½ ml being between 10° and 15° F at 225 p.s.i. at 550° F. G. A. C.

1063. 50-Ft. Steel Stacks. Refiners' Notebook, No. 137. W. L. Nelson. *Oil Gas J.*, 29.3.47, **45** (47), 177.—Temperature of flue gas is correlated with length of stack and prevailing weather, according to the formula

$$\frac{T_2 - T_A}{T_1 - T_A} = \frac{37\sqrt{V} - 0{\cdot}89\ UH}{37\sqrt{V} + 0{\cdot}89\ UH},$$

where T_2 = inlet temp ° F, T_1 = outlet temp ° F, T_A = air temp ° F, V = volume of flue gas, H = height of stack, U = overall heat-transfer rate, B.Th.U./sq ft/hr/° F temp difference.

A table is included, showing draft produced by 50 ft steel stacks at sea level, with inlet temp of 300° F to 900° F, air temp 0° F to 100° F. For this table, a value of 1·3 is adopted for U, corresponding to conditions of rain and wind; values of U are also given for differing weather conditions. W. M. H.

1064. Stack Size—Furnace Draft. W. L. Nelson. *Oil Gas J.*, 19.4.47, **45** (50), 135.—No. 140 in the *Refiners' Notebook* series shows the size of stacks commonly used when firing gas and oil fuels with chart based on the use of 40% excess air and an average flue gas (60° F) velocity of approximately 7–5 ft per sec. Other notebooks relating to stacks are also listed. G. A. C.

1065. Indian Engineer Assistance Group. The Anglo-Iranian Oil Co., Abadan, Iran. D. A. Goldfinch. *Roy. Engrs J.*, 1947, **61**, 147–153.—When, in 1943, civilian labour available in Iran became inadequate to meet the needs of the Abadan refinery expansion scheme, the Anglo-Iranian approached the British military authorities for assistance from Engineer troops. Information is given regarding the programme of work, organization and technical control, costing and construction records, and various aspects of the operations. G. S.

Cracking.

1066. Modern Refining Processes. Part 16.—Thermal Cracking of Residual Feed Stocks to Liquid Residues. G. Armistead. *Oil Gas J.*, 19.4.47, **45** (50), 94.—Many routine operating arrangements in thermal cracking processes are important in present day practice, although advances are not frequent. Thermal cracking of residual feed stocks led to the use of viscosity-breaking operations with improved yields.

The gas oil cracking steps are an integral part of the process, and tendency to production of coke-limits crack per pass to about 20% of the charge, but this may be considerably raised on selected stocks.

Different type stocks should be segregated in order that each may be cracked under optimum conditions. In two-coil operations employing viscosity breaking on units built by the Kellog Co. coil temperatures may range from 870° F in the heavy oil coil to 1025° F with light virgin gas oil. Cracking rates of 7–10% per pass for heavy oil is desirable.

The permissible crack-per-pass rates may be increased from 9 to 10% to 15% by addition of light hydrocarbons to the cracking stock as in gas reversion of polyform operations.

Six flow sheets illustrate the article. G. A. C.

Polymerization.

1067. On the Catalytic Hydrodimerization of Acetylene under Atmospheric Pressure. L. I. Anzus and A. D. Petrov. *Comptes Rend.* (*Doklady*) *Acad. Sci. URSS*, 1946, **53**, 619 (in English).—Previous work by the same authors on the hydropolymerization of acetylene over nickel and mixed catalysts at both atm and high pressure had shown that a liquid product, mainly mixed hydrotrimers and hydrotetramers, was obtained, the composition of which was determined. With mixed nickel–zinc catalyst at high pressures, hydrodimers only were obtained, *e.g.* 70% *iso*butylene and 6% divinyl, based on acetylene. The aim of the present work was to obtain a similar yield of *iso*butylene in atm pressure operation. Using a mixed nickel–cobalt–kaolin catalyst at 170° C, a 4 : 1-hydrogen–acetylene feed and a litre-hour-space-velocity of 400–500, the sole product of the reaction is *iso*butylene, as 15% by volume of the exit gas, the remainder being hydrogen. With a nickel–zinc–kaolin catalyst at 170°, a 1 : 1-hydrogen–acetylene feed and a L.H.S.V. of 200, the products are 15% ethylene and 4% divinyl and no liquid hydrocarbons. The results obtained with variations of these conditions are tabulated. The mechanism of low-temp catalytic hydropolymerization of acetylene proposed to explain these results is compared with the high-temp hydropolymerization-cracking scheme proposed by Sheridan, which is claimed to be inadequate in the present case. G. H. B.

Alkylation.

1068. On the *cyclo*Pentylation of Aromatic Hydrocarbons. P. Cagniant, A. Deluzarche, and G. Chatelus. *Compt. Rend.*, 1947, **224**, 1064.—The *cyclo*pentyl group can be linked to the nucleus of an aromatic hydrocarbon by reacting the latter with *cyclo*pentene at 0° C in the presence of aluminium chloride as catalyst, using good agitation and a reaction time of *ca.* 10 min ; with solid aromatic hydrocarbons carbon disulphide is used as a solvent. The reaction is exothermic. The products are mainly mono- and di*cyclo*pentyl, and in some cases, the tri*cyclo*pentyl derivatives. The products obtained from benzene, toluene, *o*-, *m*-, and *p*-xylenes, 1 : 3 : 5-trimethylbenzene, diphenyl, hydrindene, acenaphthene, and anisole are described. The constitution of all the mono*cyclo*pentyl derivatives have been established by permanganate oxidation, and in some cases by an alternative synthetic method. G. H. B.

Special Processes.

1069. Rubber Chemicals from Petroleum. Anon. *India-Rubber J.*, 1947, **112**, 496.—A brief description is given of a new plant for the production of chemicals from petroleum, for use in many industries, including rubber and plastics, which is being erected by the Shell Chemical Manufacturing Co., Ltd., at Thornton-le-Moors, Cheshire. C. N. T.

Metering and Control.

1070. Application of Automatic Control to Gasoline Plant and Refinery Processes. E. H. Reynolds, W. Troutman, and G. Lawn. *Oil Gas J.*, 5.4.47, **45** (48), 66.—The various types of temp, pressure, flow, and liq level instruments are described and the application of automatic control in gasoline plant and refinery processes are discussed for the following : For operation of : (*a*) a de*iso*butanizer column ; (*b*) a de*iso*pentanizer column ; (*c*) for maintaining the pressure in a refinery fuel–gas system by burning the excess gas under steam boilers ; (*d*) automatic means for limiting variations of fuel–gas pressure by the use of a duplex pressure controller which will allow make up gas to go to a system when the pressure drops to a set point, or will vent gas to air if the pressure rises to a predetermined point. Flow charts for these four cases show the points for fixing and types applied. W. H. C.

Safety Precautions.

1071. Fire Control Methods Learned in War. R. B. Tuttle. *Oil Gas J.*, 19.4.47, **45** (50), 84.—Tests with the sub-surface injection method of tank-fire extinguishing are described.

The original method was developed in England in the early days of the 1939–45 war involved injecting chemical foam into the tank through its product lines, and was successful against fuel oil fires.

To combat gasoline and other fuel fires two changes in the original method were made, to produce a foaming liquid with chemical activity which would produce a blanket on the surface of combustible hydrocarbons, using a device which would deliver homogeneous foam under pressure.

Tests were made with a positive displacement pump, a centrifugal pump, compressor and velocity turbulence foam mixer, the unit producing foam from a maximum of 4000 g.p.m. at 50 p.s.i.g. to 3000 g.p.m. minimum for reduced rates.

The foam fluid used is a hydrolized protein solution containing 38% solids and the necessary compounds to react in the presence of heat to give the blanket required. Five fire tests were made, on crude oil, gasoline, and residues from these, using foams of maximum fire-fighting ability (containing from 23 to 33% water). In test 1, for example, on crude oil at 16 ft 4 in above foam inlet, with pre-burning for 3 min, foam applied at 0·47 g.p.m. per sq. ft. for 7 min, the fire was extinguished in 8 min 15 sec. A temp of 675° F was reached as extinguishment began; this fell to 120° F 3 min afterwards, when the fire was under control. G. A. C.

Refining Patents.

1072. Patents on Refining Processes and Products. C. Arnold (S.O. Dev. Co.). B.P. 586,871, 16.4.47. Lub. oil compositions.

J. C. Arnold (S.O. Dev. Co). B.P. 586,848, 16.4.47. Manufacture of triptane.

Standard Oil Development Co. B.P. 586,839, 16.4.47. Normally solid metal-fabricating lubricants.

Standard Oil Development Co. B.P. 586,841, 16.4.47. Inhibition of oxidation in hydrocarbon oils.

Usines de Melle. B.P. 586,829 and B.P. 586,831, 16.4.47. Hydration of olefines.

T. O. Wilton. B.P. 586,798, 16.4.47. Distillation and fractionation of tars, oils, and like liquid hydrocarbons.

E. Zimkin. B.P. 586,790, 16.4.47. Refining of benzole.

C. Arnold (S.O. Dev. Co.). B.P. 587,080, 23.4.47. Process and apparatus for the low-temperature polymerization of olefines.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,088 and B.P. 587,013, 23.4.47. Motor fuels.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,048, 23.4.47. Destructive hydrogenation of petroleum.

J. G. Fife (Shell Dev. Co.). B.P. 586,945, 23.4.47. Catalytic processes.

Standard Oil Development Co. B.P. 586,914, 23.4.47. Production of hydrogen.

Standard Oil Development Co. B.P. 586,992, 23.4.47. Treatment of shale.

Aladdin Industries Ltd. B.P. 587,207, 3.4.47. Burner construction for gasoline mantle lamps.

C. Arnold (S.O. Dev. Co.). B.P. 587,168, 30.4.47. Production of aromatic amines.

C. Arnold (S.O. Dev. Co.). B.P. 587,193, 30.4.47. Preparation and employment of catalytic materials.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,241, 30.4.47. Treatment of hydrocarbon mixtures to effect segregation of desired hydrocarbons.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,258, 30.4.47. Manufacture of greases.

Eagle Oil and Shipping Co. Ltd., R. G. Mitchell and H. C. Tait. B.P. 587,279, 30.4.47. Emulsifying agents.

Shell Development Co. B.P. 587,161, 30.4.47. Preparation of catalysts.

Standard Oil Development Co. B.P. 587,151, 30.4.47. Catalytic dehydrogenation of hydrocarbons.

Standard Oil Development Co. B.P. 587,273, 30.4.47. Diesel fuel compositions.

C. Arnold (S.O. Dev. Co.). B.P. 587,396, 7.5.47. Catalyst manufacture.

C. Arnold (S.O. Dev. Co.). B.P. 587,476, 7.5.47. Catalytic cracking.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,395, and B.P. 587,475, 7.5.47. Low-temperature polymerization processes.

I.C.I. Ltd., I. L. Clifford, E. G. Williams, and R. B. Richards. B.P. 587,391, 7.5.47. I.C.I. Ltd., E. Hunter, C. G. P. Feacham, and R. B. Richards. B.P. 587,378, 7.5.47. Polymerization and interpolymerization of ethylene.

Shell Development Co. B.P. 587,413, 7.5.47. Break in fuel and method for breaking in I.C. engines.

Shell Development Co. B.P. 587,482, 7.5.47. Well-drilling fluid.

J. G. Fife (Shell Development Co.). B.P. 587,314, 7.5.47. Addition of amines to stabilize gasoline.

Standard Oil Development Co. B.P. 587,310, 7.5.47. Lubricating greases.

Standard Oil Development Co. B.P. 587,472. 7.5.47. Production of motor fuels by catalytic cracking.

W. W. Triggs (International Catalytic Oil Processes Corpn.). B.P. 587,456, 7.5.47. Preparation of reduction products of the oxides of carbon.

Anglo-Iranian Oil Co., Ltd. (Soc. de Raffinage des Huiles de Petrole). B.P. 587,561, 14.5.47. Refining of hydrocarbons.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,618, 14.5.47. Manufacture of polymers.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,624, 14.5.47. Production of lub. oils.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,762, 14.5.47. Conversion of carbonaceous materials.

J. C. Arnold (S.O. Dev. Co.). B.P. 587,767, 14.5.47. Catalytic cracking.

Lummus Co. B.P. 587,568, 14.5.47. Recovery of phenol from phenol–brine mixtures by distillation.

Shell Development Co. B.P. 587,557, 14.5.47. Synthetic resins.

Shell Development Co. B.P. 587,584, 14.5.47. Process and catalysts for the production of olefine oxides.

Standard Oil Development Co. B.P. 587,569, 14.5.47. Treatment of bituminous materials.

Standard Oil Development Co. B.P. 587,615, 14.5.47. Isomerization of paraffin hydrocarbons.

Standard Oil Development Co. and J. C. Arnold. B.P. 587,623, 14.5.47. Catalytic treatment of hydrocarbon oils.

E. W. M. Fawcett and J. H. Beynon, assrs to Anglo-Iranian Oil Co. Ltd. U.S.P. 2,410,024, 29.10.46. Liquid-phase isomerization of normal paraffins with $AlCl_3$ in solution in *tetra*chloroethane at an elevated temperature under suitable pressure.

E. L. Luacas, assr to Chemical Development Corpn. U.S.P. 2,410,034, 29.10.46. Method of reclaiming hydrocarbon and other solvents by distillation and active carbon adsorption.

G. R. Bond, Jr., assr to Houdry Processes Corpn. U.S.P. 2,410,042, 29.10.46. A hydrocarbon oil containing styrene is refined by treatment with gaseous SO_2.

R. E. Burk and E. C. Hughes, assrs to Standard Oil Co. (Ohio). U.S.P. 2,410,044, 29.10.46. An aromatization process using an oxide complex of tin aluminium and chromium as catalyst.

R. E. Burk and T. J. Walsh, assrs to Standard Oil Co. (Ohio). U.S.P. 2,410,045, 29.10.46. Design of a laboratory fractionating column head.

D. L. Campbell, assr to S.O. Dev. Co. U.S.P. 2,410,048, 29.10.46. An absorption process for the recovery of diolefins.

A. W. Horton, assr to Socony Vacuum Oil Co. U.S.P. 2,410,070, A. W. Horton, J. W. Brooks, and A. A. O'Kelly, assrs to Socony Vacuum Oil Co. U.S.P. 2,410,071, and A. A. Horton, J. W. Brooks, and A. A. O'Kelly, assrs to Socony-Vacuum Oil Co. U.S.P. 2,410,072, 29.10.46. Alkylation processes using a gaseous catalyst, such as a halide derivative of a hydrocarbon.

C. H. Hughes, assr to Hughes by-Product Coke Oven Corpn. U.S.P. 2,410,074, 29.10.46. Process of cracking heavy petroleum oils and tars in a refractory coking oven to obtain coke and aromatic hydrocarbons.

R. E. Meyer and F. B. Otto, assrs to Socony Vacuum Oil Co. U.S.P. 2,410,096, 29.10.46. Manufacture of high mol. wt. aliphatic ketones.

A. N. Sachenen, A. A. O'Kelly, and C. G. Myers, assrs to Socony Vacuum Oil Co. U.S.P. 2,410,107–8, 29.10.46. High temperature and pressure catalytic alkylation processes.
G. R. N.

Products.

Chemistry and Physics.

1073. Acid Quality—Plant and Laboratory. W. L. Nelson. *Oil Gas J.*, 26.4.47, **45** (51), 183.—No. 141 in the *Refiners' Notebook* series gives three columns of figures relating pounds 66° Baume sulphuric acid per brl of oil with % by liq vol and ml of acid per litre of oil. Recent *Notebooks* in the series of particular interest to chemists are also listed.
G. A. C.

1074. Purification, Purity, and Freezing Points of 8 Nonanes, 11 Alkyl*cyclo*pentanes, 6 Alkyl *cyclo*hexanes, and 4 Butylbenzenes of the A.P.I. Standard and A.P.I.-N.B.C. Series. A. J. Streiff, E. T. Murphy, J. C. Cahill, H. F. Flanagan, V. A. Sedlak, C. B. Willingham, and F. D. Rossini. *Bur. Stand, J. Res., Wash.*, 1947, **38** (1), 53.—Continuing work on purification and freezing points of hydrocarbons, this report describes the determination of purity and freezing points of a further twenty-nine compounds, including nonanes, alkyl*cyclo*hexanes, alkyl*cyclo*pentanes, and butylbenzenes. Information regarding source, quantities, and dist is given in tabular and graphical form, and a list of references is appended, from which may be obtained details of the procedure followed.
W. M. H.

1075. Normal Co-ordinate Analysis of the Vibrational Frequencies of Ethylene, Propylene, *cis*-2-Butene, *trans*-2-Butene, and *iso*Butene. J. E. Kilpatrick and K. S. Pitzer. *Bur. Stand. J. Res., Wash.*, 1947, **38** (2), 191.—In order to make accurate thermodynamic calculations for olefins it is necessary to understand the forces operating round the olefinic double bond. A complete vibrational assignment is available for ethylene and deuteroethylene, and constants determined from this have been used directly, or modified, to calculate vibrational frequencies of propylene and *cis*-, *trans*-, and *iso*-butenes. In some cases, spectral data provided many of the vibrational frequencies of these molecules.

A list of 15 references is appended.
W. M. H.

1076. Infra-red Absorption Spectra of Seven *cyclo*Pentanes and Five *cyclo*Hexanes. E. K. Plyler, R. Stair, and C. J. Humphreys. *Bur. Stand. J. Res., Wash.*, 1947, **38** (2), 211.—Infra-red absorption spectra have been measured in the region of 2 to 15 microns for *cyclo*pentane, methyl*cyclo*pentane, 1 : 1-dimethyl*cyclo*pentane, *trans*-1 : 2-dimethyl*cyclo*pentane, *trans*-1 : 3-dimethyl*cyclo*pentane, *cis*-1 : 2-dimethyl*cyclo*pentane, and *cis, trans, cis*-1 : 2 : 4-trimethyl*cyclo*pentane; *cyclo*hexane, methyl*cyclo*hexane, 1 : 1-dimethyl*cyclo*hexane, *trans*-1 : 2-dimethyl*cyclo*hexane, and *cis*-1 : 2-dimethyl*cyclo*hexane.

The spectrometer used was a Perkin–Elmer model, with a sodium chloride prism, General Motors amplifier, and Brown recorder. The apparatus and method of use are described, the slit control mechanism in detail.

All hydrocarbons used were highly purified, and wavelengths of all observed absorption bands are tabulated, with a graph of percentage transmission over the wavelength region of each substance. In all cases, a note is made of the bands best suited for distinguishing purposes.

The four dimethyl*cyclo*pentanes proved of special interest, since, although the structural positions of the substituted methyl groups are only slightly different, there is a marked spectral difference. Absorption spectra of 1 : 1-dimethyl*cyclo*pentane, *cis*-1 : 2-dimethyl*cyclo*pentane, *cis, trans, cis*-1 : 2 : 4-trimethyl*cyclo*pentane, and 1 : 1-dimethyl*cyclo*hexane are here measured for the first time.

Eleven references are given.
W. M. H.

1077. Kinetics of the Catalytic Oxidation of Propylene. P. J. Butyagin and S. J. Elovich. *Comptes Rend. (Doklady) Acad. Sci. URSS*, 1946, **54**, 603 (in English).—The oxidation and adsorption of propylene was studied by a static method on a barium sulphate-supported platinum catalyst conditioned at 420° C. Adsorption isotherms were obtained for propylene over temperature and pressure ranges of $+17°$ to $-65°$ C and 10^{-4} to 1 mm mercury respectively, and for oxygen at $-183°$ C over the same pressure range. From the results it was concluded that the catalyst surface was not uniform with respect to the heats of adsorption involved. At higher temperatures the adsorption of both substances varied with time. Oxidation rates were determined for a stoicheiometric propylene–oxygen mixture over the pressure and temperature ranges 0·06–0·8 mm and 40–180° respectively, in which reaction to give carbon dioxide and water was found to be complete. From experiments with packed reactors, etc, it was concluded that the oxidation was a gas-phase process, the rôle of the catalyst being to produce reactive intermediates which were partly desorbed to take part in the gas-phase reaction which was probably of a chain character. This view was shown to be consistent with the observed differences in the forms of the adsorption and rate equations. G. H. B.

1078. Structure of Ethylene Oxide and *cyclo*Propane. C. A. McDowell. *Nature*, 1947, **159**, 508.—The formulæ of ethylene oxide and *cyclo*propane advanced by Walsh (*Nature*, 1947, **159**, 164; see Abstract No. 617 (1947)) are stated to be incorrect because these structures cannot give rise to the known Raman and infra-red spectra, which, however, can be explained by means of the classical formulæ for these substances.

Reply by A. D. Walsh, *Nature*, 1947, **159**, 712.

The structural formulæ previously put forward are defended on wave-mechanical grounds. It is claimed that all the salient facts stated by the critics can be explained qualitatively on this basis. H. C. E.

1079. Molecular Weights in Practice and Theory. A. V. Brancker. *Petroleum*, 1947, **10**, 66.—This is the concluding article of Part II of this series and is called " General Discussion." The first two instalments of Part II reviewed the theory of dilute solutions and the derivation of $\theta = Km$ (where θ is the temperature change, K a constant, and m the molality) from fundamental thermodynamic equations. A modified equation $\theta = Km^b$ was introduced, where b is a constant approaching unity.

Association and dissociation are discussed in this last article and the case of the acetic acid and benzene system is taken up. The author has recalculated published data on this system using the modified equation and obtains constant molecular weights within the limits of experimental error.

The case of p-cresol in benzene is also discussed in a similar manner.

Many other cases have been studied on the basis of the equation $\theta = Km^b$ and consistent molecular weights have been found where anomalies previously existed using the classical equation $\theta = K_f m$.

In all cases of solutes in a variety of solvents so far studied the modified equation has given consistent results, and for this reason is recommended at least for routine determinations of molecular weights. F. W. H. M.

1080. Set Time and Particle Size. F. H. Garner, A. H. Nissan, and F. Mayo. *Nature*, 1947, **159**, 708.—In order to dissolve substances of high molecular weight in hydrocarbon solvents, agitation of the suspension for a " set time " (T) until the viscosity of the medium is such that the undissolved particles no longer settle out may be followed by a period during which the remainder of the solute dissolves without further shaking. This idea is developed mathematically, and an equation involving T and the representative size of the original particles is shown to hold in the case of an aluminium soap. H. C. E.

1081. Vibrational Frequencies of Semi-rigid Molecules : A General Method and Values for Ethylbenzene. W. J. Taylor and K. S. Pitzer. *Bur. Stand. J. Res., Wash.*, 1947, **38** (1), 1.—Accurate values for vibrational frequencies are needed for calculation of thermodynamic functions of molecules. A mathematical analysis is given which shows that it is often easier to calculate the kinetic-energy matrix than the reciprocal kinetic-energy matrix of semi-rigid molecules. Formulæ are given reducing calculation of kinetic-energy matrix to masses, moments of mass, and moments of inertia of the rigid groups. Calculations illustrating this are included for ethylbenzene, using force constants determined from propane and toluene, and values for the vibrational frequencies of ethylbenzene have been assigned on a semi-empirical basis from these calculations and spectroscopic data. W. M. H

1082. Antoine Vapour-Pressure Equation for Mononuclear Aromatic Hydrocarbons. N. Corbin, M. Alexander, and G. Egloff. *J. Phys. and Colloid Chem.*, 1947, **51**, 528.—Variations of the constants *A*, *B*, and *C* of the Antoine equation

$$\log p = A - \frac{B}{t + c}$$

with the number of carbon atoms has been investigated for the purpose of estimating the vapour pressures and boiling points of compounds for which experimental data are inadequate. The results show that these properties can be reasonably predicted for the normal alkylbenzene series and the 2-methyl-2-phenylalkane series. For other types of alkylbenzenes the variations are too great. The vapour pressure and boiling point can, however, be predicted for phenyl-substituted normal alkanes if the boiling point at 760 mm is known.

The constants *A* and *B* are evaluated and related to the number of carbon atoms at several values of *C* for the *n*-alkylbenzene and the 2-methyl-2-phenylalkane series. The relationship of *A* and *B* to *C* are given for the *n*-alkylbenzene series. Application of the results for estimation of vapour pressures at different temperatures or boiling points at pressures of 10 to 800 mm are discussed. J. T.

1083. Influence of Spray Particle Size and Distribution in the Combustion of Oil Droplets. R. P. Probert. *Phil Mag.*, 1946, **37**, 94.—A theoretical examination of the evaporation of liquid sprays is made using the law of size distribution and the law concerning the effect of size on the evaporation of single droplets. The mean diameter of a spray and the rate of evaporation of given distributions and then variation of liquid volume of a spray during the evaporation are given. The investigations deal only with the effect of distribution and size and not with the mechanism of evaporation. The effect of distribution on combustion intensity and the desirable characteristics of a spray from the point of view of combustion is discussed. Graphs useful for correlating data on the flame length from atomizers and on combustion losses are given. J. T.

1084. Kinetic Energy Correction for the Flow of Plastic Liquids Through Circular Pipes. T. R. Lomer. *Phil. Mag.*, 1946, **37**, 571.—Starting with the general equation of Schofield and Scott-Blair relating the rate of flow of a plastic liquid through a circular pipe to the shearing stress at its walls, the derivation of a kinetic energy correction is fully given. J. T.

1085. An Effect of Electron Bombardment Upon Carbon Black. H. L. Watson. *J. App. Phys.*, 1947, **18**, 153.—A change is reported in the mean particle size and shape characteristics of carbon-black due to specimen contamination while under examination in electron microscopes. The effect is described for a number of commercial blacks and examples are given in graphical form to show the variations in mean particle size with continued bombardment at normal focusing intensities. The effect is also observed in other materials, but is more pronounced in carbon-black. Suggestions are made for minimizing the effect. J. T.

Analysis and Testing.

1086. Study of Asphaltenes by Extraction with Selective Solvents. M. Bestougeff and R. Darmois. *Compt. Rend.*, 1947, **224**, 1365.—Asphaltenes precipitated by petrol ether from a Middle East crude and a Venezuelan asphalt were successively extracted with gasoline fractions of increasing boiling range followed by blends of gasoline and benzene. The yields, temperatures of immediate fusion, molecular weights, and elementary composition (C, H, S, O + N) of the extracts and residues were determined. At comparable molecular weights the Middle East fractions were less fusible than those from Venezuelan asphalt. The colours of the fractions were not black, but ranged from clear brown-red to deep blue-black. The elementary composition of various Middle East fractions did not differ significantly. The initial fractions were partly distillable (40–50%) without decomposition up to 250° C at 10^{-4} to 10^{-5} mm mercury. It was concluded from the properties of the solvent-extracted fractions that asphaltenes are part of the heterocyclic constituents of petroleum and asphalt which follow heavy hydrocarbons in a sequence of increasing molecular weight. G. H. B.

1087. Use of Ferrocyanide as a Reducing Agent in Analysis. Application to the Determination of the Saturation Index by Chlorination by the McIlhiney Method. V. Sinn. *Chim. Anal.*, 1947, **29**, 84.—When chlorine is substituted for bromine in the McIlhiney test the determination of excess chlorine and of the hydrochloric acid formed can conveniently be carried out by absorption in a ferrocyanide solution of known strength. 20 ml of $N/3$ potassium ferrocyanide is fed through the bromine funnel into the reaction flask, maintained at 0° C. After vigorous shaking the acid is titrated with $N/10$ NaOH using phenolphthalein as indicator. There is then added 60 ml of water, 10 ml of 20% H_2SO_4 and 2 drops of phenanthroline indicator and the excess ferrocyanide is titrated with $N/10$ cerium sulphate. A clear colour change from orange to yellow-green is observed at the end-point. A blank test is carried out at the same time.
V. B.

1088. Gas Blending System. A. Langer. *Rev. Sci. Instrum.*, 1947, **18**, 101.—Details are given of an apparatus for making mixtures suitable for calibration of mass and infra-red spectrometers. The apparatus comprises a multiple volume gas pipette, a sintered disc valve impervious to mercury, but pervious to gases, and a pressure gauge. In principle, the pressure of each component is measured separately before transferring it to a storage vessel; and it is claimed that the composition of mixtures as blended and by determination with a mass spectrometer agree within $\pm 0{\cdot}5\%$. H. C. E.

1089. Strength of Solutions of Doctor, Caustic, and Carbonate. W. L. Nelson. *Oil Gas J.*, 5.4.47, **45** (48), 105.—No. 138 in the *Refiner's Notebook* series gives nomographs which may be used to determine the percentage of strength and weight of chemical in doctor and caustic solutions.

Examples for lead oxide, caustic, and carbonate are illustrated.

The scales may be used to determine lb of chemical in a gal of liquid. G. A. C.

1090. Infra-Red Absorption Analysis of Gases and Vapours. R. Quarendon. *Petroleum*, 1947, **10**, 54.—This article will be published in six instalments and will give a review of the general features of limited radiation analysers, commercial instruments of the L.R. type and precautions in their use, total radiation analysers, and a selected bibliography.

Instalment 1 is a general introduction. The application of infra-red absorption analysis is discussed. Theoretical considerations relating to absorption phenomena are given in some detail. It is stated that the essential condition for the absorption of infra-red energy at any particular frequency is that the atomic or molecular vibration shall result in a periodic change in the dipole moment of the molecule.

Two types of infra-red gas analysers are mentioned, they are limited radiation and total radiation analysers. In the former, the measurements are made at a very narrow range of wavelengths, the instrument being usually known as a spectrophotometer. The latter makes no attempt to sort out the radiation into its wavelengths, but relies on other methods for the necessary selectivity to be obtained, thus conferring the same effect as would be obtained with high resolution. F. W. H. M.

1091. Analysis of a Standard Sample of Natural Gas by Laboratories Co-operating with the ASTM. M. Shepherd. *Bur. Stand. J. Res., Wash.*, 1947, **38** (1), 19.—Subcommittee VII of Committee D-3 of the ASTM has undertaken, in co-operation with thirty laboratories, the standardization of analysis of gaseous fuels. This report describes the volumetric analysis of a standard sample of natural gas by absorption and combustion methods; diagram and description of apparatus, together with details of analytical procedures, are given. Results are shown as frequency distribution plots, from which analyses from all laboratories may be compared easily, and calculated heating value and specific gravity are included and compared with values measured by the National Bureau of Standards. The data show that standardization of methods of analysis is very necessary. W. M. H.

1092. Rheology of Asphalt. J. W. Romberg and R. N. Traxler. *J. Coll. Sci.*, 1947, **2**, 33.—The viscosities of asphalts, measured in a rotary viscometer, can be compared at a rate of shear of 0·1 sec^{-1}, but in certain cases convergence of stress/shear (F/S) curves may lower or effect a reversal of the true viscosities; the same objections apply to viscosity measurements at constant shearing stress, as in the falling coaxial cylinder viscometer. By comparing viscosities at constant power input per unit volume of sample, FS, these ambiguities can be avoided, and in the experiments described $FS = 1000$ has been chosen. The superiority of this method over others is illustrated.

Complex flow may be evaluated by the expression $M = F/S^c$, where c is the slope of the log F/log S plot and M is the value of F when $S = 1$. When $c = 1$ the equation reduces to the simple viscosity relationship.

The elasticity of asphalt, which deforms continuously under stress, can be measured by: (1) Subjecting the sample to alternating stresses the frequency of which is high compared with the relaxation time; (2) Comparing heat losses during viscous flow, measured by the damping effect on a torsional vibration, with the total energy input; (3) Application of Maxwell's equation for deformation of materials $F = GDe^{-t/T}$, where G is the modulus of elasticity in shear, D is the strain in shear in time t, and T is the relaxation time; (4) Measurement of relaxation by following the decrease in shearing stress after shearing is stopped. It is found that (3) is useless for asphalts, for T is a function of temperature, F, and the sample size. If the time for F to decrease to half its original value (relaxation one-half time) is evaluated at values of $FS = 1000$ the elastic effects of different asphalts can be compared.

Nutting's Law of deformation is examined for asphalt, and the physical significance of the constants indicated. It is shown that Nutting's equation cannot hold for all deformations, and if it is simplified, holding F constant, the errors involved are still of the same order as in the original equation, indicating that inaccuracies lie mainly in the shear–time relation. H. C. E.

1093. Review of the Rheology of Bituminous Materials. R. N. Traxler. *J. Coll. Sci.*, 1947, **2**, 49.—The flow of bitumen is discussed under the following heads: measurements of viscosity, simple and complex flow, age hardening, temperature susceptibility, thixotropy, elasticity, filled asphalts, and rheological aspects of (*a*) penetration test, (*b*) ductility test, (*c*) ring and ball softening point.

Viscosities should be measured in a rotating coaxial cylinder viscometer and the results expressed as a rheology diagram (see Abstract No. 1092, *J. Coll. Sci.*, 1947, **2**, 33).

The penetration test is criticized in that the magnitude of necessary corrections exceeds the true value of the consistency, and the adhesiveness of asphalt to steel, for which no correction is possible, is also measured. The ring-and-ball softening point measures consistency, density, thermal conductivity, and heat capacity, all of which vary with temperature. The ductility test likewise depends on factors other than consistency and hence is of little value.

The paper ends with a discussion on the colloidal aspects of asphalts in relation to their rheological properties. A comprehensive list of references is given. H. C. E.

1094. Centrifugal Method of Measuring the Surface Tensions and Interfacial Tensions of Liquids. W. Meyerstein and J. D. Morgan. *Phil. Mag.*, 1946, **37**, 41.—Formulæ for calculation of surface tension and theoretical consideration of the variants of a centrifugal method of measuring the surface and interfacial tension of liquids are described. In this method a tube containing the liquid is placed radially on a horizontal revolving table and the speed of the table at which movement of the liquid occurs is noted. J. T.

1095. Variable Speed Rotational Viscometer. R. Buchdahl, J. G. Curado, and R. Braddicks, Jr. *Rev. sci. Instrum.*, 1947, **18**, 168.—Details of the design and construction of a variable speed rotational viscometer, suitable for measurement of viscosities from 0·1 to 10,000 poises are given. Errors which occur when using the instrument are discussed, and it is claimed that the overall accuracy of viscosity measurements is about ±1%. H. C. E.

1096. Bingham Viscometer and Viscosity Standards. J. F. Swindells. *J. Coll. Sci.*, 1947, **2**, 177.—The primary standard employed is the viscosity of water at 20° C.

The Bingham Viscometer, the method of measurement, and precautions to be observed, are briefly described. To calibrate the instrument with water times of flow t are measured for various applied pressures P, and the product Pt is plotted against $1/t$, when the slope and intercept of the resulting straight line lead to the constants of the instrument. When viscometers have capillaries too large to enable the time of flow of water to be measured accurately, sucrose solutions of known concentration, or special oils, the viscosities of which have been carefully compared with that of water, may be used. A table of viscosities of water at increasing temperatures is given for the calibration of instruments at temperatures other than 20° C.

The change in viscosity with dissolved air and with pressure are discussed, and it is concluded that whilst in the former case the rate of diffusion of air into oil is not normally rapid enough to affect the viscosity, changes in pressure may be corrected for by applying the equation : $F = \frac{1}{\eta}\frac{d\eta}{dF}$, where F represents the fractional change in viscosity η for unit change in pressure P. H. C. E.

Gas.

1097. Application of Liquified Petroleum Gases. H. W. Gustafson and M. G. Cook. *J. Western Soc. of Engrs*, 1947, **52**, 27.—The description, history, and application of the liquified petroleum gases and the general trends in this industry are given. J. T.

1098. Mobile Laboratory for Gas-Condensate Studies. E. H. Koepf. *Oil Gas J.*, 26.4.47, **45** (51), 108.—A mobile laboratory equipped to study various problems relating to gas and gas-condensate systems is described and data obtained in two gas-condensate fields presented.

The unit was used in absorption studies at 1500 to 3000 p.s.i. and can be used at 6000 p.s.i.

Determinations of phase condition of reservoir fluid, dew-point pressures of rich-gas systems, and of pressure, temperature, and % liquid relationship for gas-condensate systems were among studies made.

The equipment includes a 40-h.p. engine driving a 3-phase 12 k.v.a. generator, an instrument air compressor, and special gas compressor, lean-oil pump, and refrigeration compressor. A 40-point indicating potentiometer is included in the control compartment ; the rear compartment housing the high-pressure vessels and lines through which the hydrocarbons flow.

An assortment of sharp-edged nozzles are used to find the proper method of sampling two-phase well-streams and to study the effect of changes in sampling rate upon gas–oil ratio ; and tables are given showing this effect.

Studies were made in another field to determine the phase condition of the initial reservoir material and to obtain data on condensation of liquid in the reservoir with pressure decline ; results show that the material entering the bore is in a single vapour phase, with a dew-point more than 120, but less than 550 p.s.i. below the initial pressure.

Six figures and two tables illustrate the article. G. A. C.

1099. Purification of Natural Gas in Northwestern New Mexico. Van Thompson and R. A. Graff. *Oil Gas J.*, 19.4.47, **45** (50), 116.—The natural-gas purification plant built by Southern Union Gas Co., in the Barker-Dome, New Mexico, is described. The gas contains 15·0 mol % of CO_2 and 1·0 mol % of H_2S.

Purification is by the organic amine process employing a water solution of monoethanolamine. After purification the gas is passed through a glycol-type dehydration plant and rendered safe for pipeline distribution by depressing the dew-point approximately 45° F. Some of the effluent is introduced into the pipeline and the remainder used for repressuring the Dakota sand gas wells. G. A. C.

Engine Fuels.

1100. Motor-Fuel Trends in Relation to Anti-Knock Requirements. T. H. Risk and J. F. Jordan. *Oil Gas J.*, 5.4.47, **45** (48), 78.—The initial upward trend of octane numbers, begun in 1945 following removal of all U.S. government restrictions, has been resumed.

It is predicted that regular-grade fuels of 80 motor method and ·88 research, and premium fuel of 85 motor and 95 research rating are likely by 1950.

It is expected that for the next 2 years fuel requirements will follow the pattern of previous years.

The relation of trends in engine design and the anti-knock characteristics of fuels can be investigated by the border-line method of road-knock testing, using a car specially equipped with fixed distributor, an electronic or stroboscopic indicator to determine spark advance and a tachometer. Figures showing borderline knock curve, effect of advanced spark timing on octane rating, etc., are given to illustrate the method.

It is thought that higher compression ratios and improved automatic transmissions will be two car-design changes in 1949 or 1950, and these will influence fuel requirements. For example, fluid torque converters tend to produce vehicles with lower fuel requirements than the same engines with conventional transmission.

The substitution of olefinic blending agents (shown in a figure) makes an improvement in low-speed anti-knock performance of a base fuel, and such a fuel is unlikely to give trouble when the engine requirement increases.

High sensitivity gasolines, made by catalytic and thermal cracking, were studied, and it was found that it is the composition of the lightest and heaviest fractions of the fuel which is of significance. A series of tables giving anti-knock data and hydrocarbon-type analysis are shown, from which it is seen that wide variations in road performance are obtainable with catalytically cracked gasolines depending on type of charging stack catalyst, cracking temperature, and severity of operating conditions. Thirteen figures and 5 tables illustrate the article. G. A. C.

Lubricants.

1101. Rise of Air Bubbles in Lubricating Oils. J. V. Robinson. *J. Phys. and Colloid Chem.*, 1947, **51**, 431.—The mechanism by which additives in a lubricating oil circulating through a high-speed gear pump stabilize the " emulsified " air is investigated by measuring the velocity of rise of air bubbles in a quiescent column of oil containing no additives and in the same oil containing foam inhibitors, and in an oil containing lubricating additives. In an oil containing no additives the bubbles obeyed Stokes' law, but they rose much more slowly in oils containing additives and, moreover, the rate of rise decreased with increasing length of the path. Additives in lubricating oils may impede the rise of air bubbles by forming shells of liquid with a quasi-solid or gel structure around the bubble. A method is given for calculating the thickness of this liquid shell. The maximum thickness of shell calculated from the observed velocities was equal to the bubble radius. J. T.

1102. Investigations on the Synthesis of Hydrocarbons and Oils with Lubricating Properties by the Alkylation of Polycyclic Aromatics. P. Cagniant, A. Deluzarche, and M. Colomb. *Ann. des Mines et des Carburants*, 1945, (4), 456–472.—It is considered that the lubricating oil hydrocarbons of petroleum are composed predominantly of: (*a*) condensed aromatic ring structures carrying substituent groups varying with the viscosity and viscosity index of the oil, possibly with some hydro-aromatic rings involved; (*b*) alkylated polynaphthenes, especially polycyclopentanes. These two hydrocarbon types predominate in " aromatic " and " naphthenic " lubricating oils respectively. The preparation of synthetic lubricating oils of type (*a*) is therefore based on the alkylation of polycyclic aromatic hydrocarbons with alkyl chlorides and α-olefins using Friedel–Craft catalysts. Previous work on the Friedel–Craft alkylation of aromatics is reviewed in detail with special reference to the effect of experimental conditions on the isomerization and polymerization of the initial reaction products. The characteristics of a satisfactory lubricating oil are discussed in relation to chemical structure and the influence of polar groups on " oiliness " considered.

In the experimental section, the products obtained from the reaction of benzene, naphthalene, acenaphthene, diphenyl, fluorene, phenanthrene, fluoranthrene, chrysene, pyrene, and carbazole with, *inter alia*, heptene-1, dodecene-1, ethyl oleate, erucate, and undecylate, *n*-butyl, hexyl, *n*-heptyl, decyl, tetradecyl, and hexadecyl chlorides are described, using aluminium chloride as catalyst in all cases. The products were distilled at 200–300° C at 10^{-3} mm from a modified Kraft flask, and the distillate fractions and residues characterized by molecular weight, viscosity, and viscosity index. It is concluded that the viscosities of the products are in accordance with expectations based on previous work, and especially with the finding of Mikeska that the viscosity index increases with the length of the substituent group. The products obtained from olefins are also suitable for use as Paraflow-type additives. G. H. B.

1103. Immersion of a Cylinder into a Viscous Medium Contained in an Axially Symmetrical Receiver. S. M. Targ. *Comptes Rend. Acad. Sci. URSS*, 1946, **54**, 305 (in French).—The equations developed by Reynolds to describe the process of hydrodynamic lubrication are applied to a system comprising a cylinder moving at constant speed into a receiver partly filled with a viscous fluid which it displaces by forcing it between the wall of the receiver and the cylinder (*e.g.* an oil-filled shock absorber—Abstractor). Expressions are obtained for the force acting on the cylinder for the cases in which the receiver is either cylindrical or conical. G. H. B.

1104. The Generalized Equations of Reynolds. N. A. Slezkin and S. M. Targ. *Comptes Rend. (Doklady) Acad. Sci. URSS*, 1946, **54**, 205 (in English).—The approximate solutions of the equations of Reynolds' theory of lubrication can be made more exact, using the method of Leibenson, by taking into account the quadratic inertia terms, on the basis of Prandtl's equations. Prandtl's equations have now been modified by a partial averaging method to give new equations which are also applicable to problems previously studied only by Reynolds' equations. The application of the new expressions to some particular problems, including flow past a plane plate, is briefly discussed. G. H. B.

1105. On the Problem of Refining the Solutions of Reynolds' Equations. N. A. Slezkin. *Comptes Rend. (Doklady) Acad. Sci. URSS*, 1946, **54**, 121 (in English).—A previous suggestion by Leibenson for increasing the accuracy of Reynolds' approximate equations for lubricating films was examined. It was first shown that Reynolds' equations could also be applied to systems involving high Reynolds' numbers (Prandtl's equations). The solutions were refined according to Leibenson, to give the result that, from the third approximation onwards, it is necessary to consider both the variation of pressure across the thickness of the film and the viscosity terms neglected in the second and third approximations. These refinements are not possible with the curtailed Prandtl equations. G. H. B.

1106. On the Existence of Several Regimes in which Viscous Forces are Linear Functions of the Velocity. J. Huetz. *Compt. Rend.*, 1947, **224**, 1205.—A previous study of the abnormal phenomena encountered during the measurement of the viscosity of a liquid, using a rotation method, had shown that the resulting torque was initially proportional to the angular velocity, but above a certain critical velocity this proportionality was not maintained. The relations between the torque, angular velocity, and viscosity have now been studied with a spindle oil over a range of temperature using two spheres of different diameters in a concentric spherical enclosure. The curves of torque against angular velocity, containing viscosity as a parameter, are found to be composed of several sections, intersecting at well-defined points at which the slopes change. In general, the slopes of the segments are greater than the calculated values, but with an oil of greater viscosity a segment with the calculated slope and passing through the origin of the co-ordinates is obtained. It is suggested that the groups of segments found arise from the existence of a distribution of velocities in the system of two concentric spheres in relative rotation. G. H. B.

1107. On the Viscous Torque Between two Concentric Spheres. M. Aubert and J. Villey. *Compt. Rend.*, 1947, **224**, 1271.—Previous work had shown that the viscous torque developed across the above system filled with a viscous liquid, when one sphere was rotated at a uniform velocity about a diametrical axis, was greater than that calculated from classical hydrodynamic theory, but that the anomalies disappeared at high fluid viscosities. The basis of the classical calculation is considered and the factors responsible for the discrepancies are considered to be : (*a*) inadequacy of Stokes' law due to fluid slip at the surfaces of the spheres, and (*b*) the existence of non-classical, possibly helical trajectories of fluid motion. The value of visual observations of fluid trajectories

(Charron, *Compt. Rend.*, 1946, **223**, 1078; 1947, **224**, 373) is indicated, and it is suggested that this may indicate in what respects Stokes' equations may need to be modified. It is pointed out that Charron observed circular trajectories for fluids of high viscosity, in agreement with classical theory and the existence of a normal viscous torque. G. H. B.

1108. A Tribometric Method of Measuring Adsorption on a Solid-Solution Interface: Application to the Study of the Lubricating Action of Adsorbed Layers. B. Derjaguin and M. Smoliansky. *Comptes Rend.* (*Doklady*) *Acad. Sci. URSS*, 1946, **54**, 137 (in English).—An improved method for studying the small concentration changes encountered in the adsorption of a solute from solution at a solid-solution interface was devised by: (*a*) reducing the volume of solution used to a thin film, and (*b*) calculating concentration changes in the solution after adsorption equilibrium had been established from measurements of the coefficient of static friction (μ) across the solution film. The lubricant films used were solutions of fatty acids or higher alcohols in vaseline free from polar impurities, and were deposited on flat steel test-plates by a method based on the controlled passage of the meniscus of a solution of the lubricant in benzene along the test-plate by a siphoning technique. The benzene evaporated to leave a lubricant film of known thickness, calculable from a previously established equation. The concentration of polar solute in the lubricant film after adsorption equilibrium had been established was determined from the value of μ, determined by a slider method, the relation between μ and solute concentration having been determined in preliminary experiments with thick films of known solute concentration. From experiments over a range of initial solute concentration and film thickness, adsorption isotherms for stearic, palmitic, myristic, and caproic acids, and octyl and cetyl alcohols, all on steel at 12–15° C, were determined. The relation between the solute concentrations in the adsorbed films and the frictional characteristics were determined, and it was concluded that some degree of metal-to-metal contact between the slider and plate persisted until the adsorbed solute layer was completely established. G. H. B.

1109. Friction and Wear. E. J. W. Whittaker. *Nature*, 1947, **159**, 541.—When a material comprising 69% wt calcite and 31% *o*-cresol formaldehyde resin was rubbed under standard conditions against mild steel, 726 k-cals of frictional work resulted in the abrasion of 1 g of material. The amount of work required for abrasion is a maximum if all the material is removed as single atoms, and a calculation shows that the heat of atomization of 1 g of the composite material is 10·6 k-cal. Therefore, the maximum proportion of frictional work to be ascribed to abrasion is 1·4%. No allowance was made for wear of the steel member. H. C. E.

1110. Rheology of Lubricants. R. B. Dow. *J. Coll. Sci.*, 1947, **2**, 81.—Improvement in the lubricating properties of oils obtained by adding chemical compounds is discussed from a physico-chemical standpoint. Thus the efficacy of benzotrichloride or tricresyl phosphate in E.P. lubricants is attributed to the liberation of chlorine or phosphorus atoms which unite with the metal surfaces to give low wear qualities.

The susceptibility of lubricants to oxidation is briefly discussed, and it is shown that although mononuclear aromatics cause oils to have poor oxidation resistance, polynuclear aromatics are very stable.

The effect of pressure on the viscosity characteristics of lubricants is discussed at length. Attempts have been made to combine the pressure and temperature effects on viscosity into a single equation, so far without marked success; although equations resting on a semi-theoretical basis are presented. The pressure coefficient of viscosity, a, defined as $a = \frac{1}{P}(\log \eta - \log \eta_0)/\log \eta_0$ where η and η_0 are the 100° F viscosities at pressures P and atmospheric respectively, is found to bear a linear relation to the aniline point in ° C of mineral oils from widely differing sources.

A study of viscosity at high pressures by compressing the oil between anvils and measuring the torque required to twist the anvils under a given thrust shows that, after a sharp initial rise, the shearing stress increases slowly with angle of shear. Results on mineral oils with and without additives, and fatty acids, are given. At high pressures the viscosity becomes infinite and the oil solidifies.

The paper closes with a short theoretical section on the rheology of lubricants, and with a list of 30 references. H. C. E.

1111. Some Recent Advances in Non-Newtonian Viscosity. H. Eyring and G. Halsey. *J. Coll. Sci.*, 1947, **2**, 17.—The paper discusses deviations from normal stress/shear relationships in terms of a mechanical model. H. C. E.

1112. Use of a Blowing Method for Characterizing the Fluidity of Lubricating Oil Films as a Function of Temperature. M. Koussakov. *Comptes Rend.* (*Doklady*) *Acad. Sci. URSS*, 1946, **54**, 145 (in French).—A film of oil on a highly polished surface is made to assume a wedge form by directing on it a stream of air from a suitable slit system. When the film is sufficiently thin, light reflected through it forms a system of interference fringes, the spacing of which depends, *inter alia*, on the fluidity of the oil and the pressure gradient of the air stream. If a temperature gradient is maintained across the film normal to the direction of the air stream, the interference fringe system is curved instead of parallel, due to the variation of film fluidity with temperature. By calibrating a given apparatus under fixed conditions with an oil of known fluidity–temperature characteristics, the corresponding data can be obtained for other oils. By examining photographs of the interference fringe system with a microphotometer, oil fluidities can be measured with a precision of 1–2%. G. H. B.

1113. Crankcase Oil Filtration in Motor Vehicles. E. A. Smith. *Petroleum*, 1947, **10**, 58.—The various functions and designs of filters are discussed, and comparison is made of filter elements with their efficiencies.

The filter elements discussed include pure wool felt, asbestos or slag wool, cotton flock, cotton waste, thin metal plates or leaves, magnetized annuli. Their microscopic structure, pore sizes, and special features are tabulated.

Efficiency of filter elements is assessed on the type of foreign matter removed under service conditions with particular reference to road dust, metal, and asphaltic material. F. W. H. M.

1114. Fouling of Engines. J. L. Van den Minne. *Ingenieur*, 18.4.47, (16), 27.—It is suggested that the fouling of engines is due to the breakdown of the lubricant in one of three ways.

(*a*) Oxidation in the liquid phase forming deposits precipitated by petroleum ether.
(*b*) Oxidation in the vapour phase forming lacquers.
(*c*) Oxidation to carbon.

In order to diminish these reactions the addition of anti-oxidants, detergents, peptizing agents or lubricating oil additives of the calcium di-*iso*propylsalicylate type is recommended. Several photographs of the effect of peptizing agents are appended.

These additives and other agents are not recommended for use in jet and turbine engines. N. C.

Special Hydrocarbon Products.

1115. Waxes and Similar Substances in the Rubber and Allied Industries. W. S. Penn. *Petroleum*, 1947, **10**, 56.—The second instalment of this article is entitled "Other Applications." Paraffin wax is used as an electrical insulator because, since it consists of hydrocarbons, it has no polar groups. It is therefore unaffected by electric currents particularly of the high-frequency type. Paraffin wax does not possess good mechanical properties, its melting point is comparatively low, it has inferior tensile strength and is easily scratched, etc.

Polythenes, although otherwise very similar to paraffin wax, have good tensile strength, excellent flexibility, and are fairly resistant to deformation. Although both paraffin wax and polythene possess the same empirical formula, the former contains only about 30 carbon atoms whereas the latter can contain several thousand.

Polythene is used extensively in high-frequency applications—*e.g.* Radar. Owing to its excellent resistance it is used as a protective coating.

Polythene is prepared by polymerization of ethylene at high temperature and pressure in the presence of oxygen as catalyst.

Its properties are :

Tensile strength p.s.i.	8000
Impact strength ft lb/in of notch	Very high
Volume resistivity ohm/cm³	3×10^{17}
Electric strength 50 c/s	1000
Dielectric constant 50 c/s	2·4
,, ,, 10^6 c/s	2·3
Power factor 50 c/s	0·0001
,, ,, 10^6 c/s	0·0002
Sp. gr. between +100° C and −100° C	0·85–0·96

It retains its flexibility down to −70° C. Compared with paraffin wax it is so tough that a plasticiser is required for extrusion work, poly*iso*butylene being usually employed.

Other thermoplastics and insulators include P.V.C., polystyrene, perspex, and nylon which have well known applications. They are wax-like materials and are very useful in the electrical and allied industries, particularly where ordinary waxes, such as paraffin wax, refuse to function. The electrical properties of these materials are :

	Nylon	Perspex	Poly-styrene	P.V.C.
Tensile strength	7000	8000	7000	3000
Impact strength ft lb/in of notch	—	0·25	0·4	—
Volume resistivity ohm/cm³	10^{13}	10^{15}	10^{15}–10^{19}	1–3 × 10
Electric strength 50 c/s	—	500	600	600–2000
Dielectric constant 50 c/s	3·2	3·35	2·6	7·5
,, ,, 10^6 c/s	3·6	3·2	2·7	—
Power factor 50 c/s	0·01	0·07	0·0002	0·10
,, ,, 10^6 c/s	0·022	0·03	0·0003	—
Sp gr at 25° C	1·10	1·18	1·06	1·2–1·6

Waxes can be used as anti-tack as well as tack-producing compounds. Synthetic rubbers, such as GR-S, lack tackiness. This can be remedied by addition of tackifiers. In extensive use are tars, shellac, liquid petroleum residues, coumarone, indene and polystyrene resins and thermoplastic phenolics. The latter was first used by the Germans in their Bunas.

In order to obtain a highly polished finish on plastic or rubber compounds, wax is either incorporated into the formulæ or the finished article is impregnated with wax.

The mix for rubber flooring, for instance, contains 3% of paraffin wax. The wax is usually incorporated in the formulæ for rubber compounds. For polishing plastics wooden pegs are treated with a wax mixture and introduced into a rotary barrel with the articles to be polished. This is rotated at 30 r.p.m. for about ½ to 1½ hr.

Wax-like materials used as adhesives for bonding purposes include polyvinyl acetate, shellac, and other thermoplastics.

Introduction of paraffin wax into rubber mixtures reduces deterioration due to oxidation. Polyvinyl alcohol is used as a sizing agent in textiles Waxes and synthetic resins are often used jointly as water-proofing agents.

Waxes and synthetic resins are used to make laminated boards.

It is concluded that waxes of all types are indispensable in the rubber and allied industries. Including thermoplastics among the waxes, the usefulness of waxes may be expected to grow. Purity of the waxes, as regards presence of polar impurities, is adjudged of prime importance, especially in the electrical industries. F. W. H. M.

Derived Chemical Products.

1116. Carbon-Black Faces Progressive Changes. G. Weber. *Oil Gas J.*, 3.5.47, **45** (52), 94.—The transition of the carbon-black industry from channel to furnace process is discussed.

The furnace process gives higher yields, a wider range of products, and has possibilities for further development.

Recent technique has improved the quality of furnace blacks so that they now compete with blacks from the channel process, although there is still a great demand for the latter product from rubber manufacturers.

The furnace process originated in 1920, and for 15 years played a minor rôle, but in 1946 nearly half the total output was from this process, over 514 million lb being produced in 1945.

16 plants operate the furnace process as against 59 channel units.

In the furnace process the free flame method is used, temperatures exceeding 2000° F being reached when the gas is burnt. Quenching takes place at about 1200° F, with final contact with water sprays to reduce the temperature to 450° F. Settling takes place in the electrical field of the precipitator, cyclones deal with black entrained in the gas flow.

Close control is necessary to ensure uniformity of product.

Initial cost of a furnace plant is twice that of the channel unit of same output.

G. A. C.

Miscellaneous Products.

1117. Hydrocarbon Polymer Derivatives. Anon. *Paint Technol.*, Feb. 1947, **12**, 64.—The production of high-mol wt hydrocarbon polymers, containing both chlorine and sulphur, is described in U.S. Patent No. 2,283,627 granted to A. H. Gleason, assigned to Jasco Incorp., Barton Rouge. An example given takes 50 g polybutene, dissolves it in CCl_4 and makes it up to 1 l. To this 50 cc sulphur monochloride dissolved in CCl_4 is added and the solution is kept at 77° C, chlorine being passed in for 4 hr. It is then cooled to room temp and on addition of *iso*propyl alcohol a tough rubbery product is precipitated which contains 1·64% sulphur and 16% chlorine. Such products have particularly high resistance to acids, alkalis, and oxidizing agents, and may be used for coating and impregnating agents or to replace rubber, either wholly or partly, for such purposes as the lining of tanks, etc. W. H. C.

1118. Sulphur Dioxide-Olefine Products (Resinous Polymers). Anon. *Paint Technol.*, Feb. 1947, **12**, 75.—U.S. Patent No. 2,283,900 issued to M. M. Barnett and assigned to Freeport Sulphur Co., New York, gives details of the manufacture of resinous polymers by the action of SO_2 on olefins (ethylene, propylene, butene-1, and butene-2) by polymerization, in the presence of a catalyst, at low temp in a pressure bomb. The rate of reaction and yields are stated to be increased if the catalyst employed is a mixture of a terbene peroxide and a halogen acid, or a material that hydrolyses to give a halogen acid. An example is given in which 0·5% ascaridole, followed by 1% HCl in alcohol, is added to a mixture of butene-1 and SO_2 in mol ratio of 2 : 1 cooled by dry ice and ether. Reaction is completed in about 30 min on allowing the container to rise to room temp. Yields of 85–90% are claimed. The presence of acid results in better coloured products for coating materials. W. H. C.

Engines and Automotive Equipment.

1119. Chromium-Treated Cylinders. Anon. *Oil Engine and Gas Turbine*, 1947, **14**, 384.—The electrolytic plating of cylinder bores, to a thickness of from 0·004 in to 0·020 in, results in an improvement in surface hardening and wearing properties. It is essential that the bores are concentric, and are properly cleaned and prepared in order to prevent the chromium peeling off after application. After plating, the bores are honed and are then cleaned by a jet of high-pressure steam to remove any particles left from honing.

With chrome-hardened bores, oil consumption and ring wear are slightly above normal for the first 1000–1500 miles of running, after which they become less than normal, an improvement which is maintained far longer with the common bore materials. Cast iron piston-rings give the most satisfactory results, used in conjunction with either aluminium or cast iron pistons. Chromium-plated cylinders do not require so much " bedding-in " as plain cast iron bores, and pistons and rings should, therefore, be fitted with larger clearances.

In oil engines, the quality of the fuel when chromium-hardened cylinders are used is apparently immaterial, as chromium is resistant to wear of both abrasive and corrosive types. In certain cases, lower quality lub. oil may also be used, providing it does not cause varnishing of the bore.

If no distortion is present the average life of a cylinder bore is increased from four to ten times by chromium plating. C. D. B.

1120. Silencing Internal Combustion Engines. J. G. Peirson. *Oil Engine and Gas Turbine*, 1947, **14**, 399.—Noise in the exhaust of an I.C. engine can be produced by (1) direct impact of the exhaust gas " wad " upon the atmosphere, when that wad reaches the end of the exhaust pipe, (2) reversation in the exhaust pipe of the noise produced by the above impact, and (3) resonance in the exhaust pipe caused by the air inrush after the departure of the high velocity wad of gas.

To prevent this noise, silencers of various types have been designed : (1) a resonator type, in which various kinds of resonator chambers are used, (2) an absorption type, in which the exhaust noise is absorbed by means of an air-celled sound-absorbent material, such as " glass silk " surrounding a perforated steel tube, (3) a combined absorption-resonator type, and (4) a diffuser and expansion type, in which the exhaust gases are " diffused " through perforated tubes in one chamber, and by-passed for further diffusion and expansion in another chamber or chambers. C. D. B.

1121. Guide to Aircraft Power-Plant Selection. A. L. Lowell. *Aero. Engng Review*, April 1947, **6**, 22.—Deals with increasing number of practical methods of propulsion available to aircraft designer, viz. and draws the following conclusions :

(1) The rocket is not an economical prime mover for aircraft, other than short-range missiles, in the above speed and altitude range.

(2) The subsonic ram-jet is economical only for ranges of the order of 200 miles or less. Assisted take-off and acceleration to operating speed will be required for this power plant.

(3) The turbo-jet is an economical aircraft prime mover at high speeds and low ranges. Comparatively low take-off thrust characteristics may require assisted take-off for overload conditions.

(4) The turbo-prop is the most economical power-plant type for moderate to long ranges at cruising speeds now considered appropriate for bombers and high-speed transports. Take-off thrust characteristics are good.

(5) At speeds corresponding to maximum efficiency for conventional airframes, the reciprocating engine is the most economical power plant. This power plant is most suitable, therefore, where transportation in terms of ton–miles is the primary requirement. As in the case of the turbo-prop, take-off thrust characteristics are good. I. G. B.

1122. Performance Calculation for Jet-Propelled Aircraft. R. K. Page. *J. R. Aero. Soc.*, 1947, **51**, 440.—An analytical method is developed for calculating the speed and climb performance of jet-propelled aircraft, given the drag and thrust data. A method is also given for dealing with the effects of compressibility and the results in a typical example are included to illustrate the form of curves obtained. I. G. B.

1123. Systematic Analysis of Thermal Turbo-jet Propulsion. Anon. *J. Aero. Sci.*, 1947, **14**, 197.—The propulsion unit is divisible into six sections : free inflow, intake, compressor, heat chamber, turbine, and exit nozzle. It is treated uniformly by the quintuple system of dynamic and thermodynamic flow equations with their power or heat inputs, the conditions of change of state (cycle), the continuity equations and the thrust equation. These equations also comprise in each section the retarding forces and the heat creation of turbulent flow and the loss of mechanical power and of heat leakage. They form successive sets of equations, and their solution is derived in terms of the required data of altitude, flying speed, thrust, pressures in front and at the exit of the compressor, permissible entrance temperature at the turbine, and permissible ratio of power of compressor and turbine to heat input. I. G. B.

Miscellaneous.

1124. Petroleum Reserves Brought Up to Date. Anon. *Petrol. Engr*, Mar. 1947, **18** (6), 245.—Statistical data are presented on the discoveries, production, and reserves estimations of oil in the United States during recent years. Within the continental limits of the United States there are 24,194,587,000 brl of proved liquid hydrocarbon reserves and 160·6 trillion cu. ft. of proved natural gas reserves, as of December 31, 1946. R. B. S.

1125. Petroleum Industry in Chicago Area. G. Egloff. *J. Western Soc. of Engrs*, 1947, **52**, 16.—The history of the 8 oil companies located in the vicinity of Chicago is given. These are the Standard Oil Company (Indiana), Sinclair Refining Company, Globe Oil and Refining Company, Cities Service Company, Pure Oil Company, and Universal Oil Products Company. J. T.

1126. Position of Penn Grade Industry is Improved in 1946. G. G. Bauer. *Producer's Monthly*, Feb. 1947, **11** (4), 24.—Statistical data are presented on the well completions, average daily crude oil production, and average daily crude runs to stills for the Pennsylvania region during 1945 and 1946. R. B. S.

1127. Venezuela Maintains Second Place Amongst Petroleum Producing Countries. A. N. Sutton. *Ind. Min.* (*Argentina*), 1947, **6** (67), 31–35.—Venezuela became the second largest oil producer in the world in 1945, with a production of 323,361,000 brl. This figure was surpassed in 1946 with a total of 391,482,000 brl, an increase of 21%. The three principal producing companies (Creole, Shell, and Mene Grande) accounted for 95% of this total. Details of exploratory drilling and production of the various fields, together with maps of the localities covered, are given. A. C.

1128. Petroleum Highlights in Venezuela. H. H. Power. *Petrol. Engr*, Oct. 1946, **18** (1), 124.—A general description is given of the country and conditions, together with a short account of petroleum concessions, investments, drilling and production practice, pipe-line, and port facilities. G. D. H.

1129. United Kingdom Petroleum Trade in 1947. Anon. *Petrol. Times*, 10.5.47, **51**, 427.—Details are given of United Kingdom petroleum imports and exports for March and the first quarter of 1947, together with comparative figures for corresponding periods of 1946 and 1938. R. B. S.

1130. The Italian Petroleum Industry and its Rehabilitation. Anon. *Petroleum*, 1947, **10**, 52.—The rehabilitation of the petroleum industry is a problem of great importance to Italian economic reconstruction. Appreciable methane resources have been discovered which could possibly be used to replace oil for certain transport and heating requirements. Statistics show that in pre-war years Italy tended to buy crude oil and refine it at home. Increased duty on refined products fostered the construction of new refineries.

At the outbreak of war Italy had 14 distilling and cracking plants with a capacity of about 2 million tons of crude oil a year. Two large hydrogenation plants were also in operation. Roughly one-third of these are now outside Italian territory. For various reasons the demand for oil and petroleum products on the Italian market has now increased. In northern Italy this demand has been partly met by methane-gas production which amounts to 40 or 50 million cu m yearly and which is likely to be increased as a result of the important discoveries made.

After the armistice, Italy received through U.N.R.R.A. about 40–50% of the oil and petroleum products imported before the war. Towards the end of last year the Italian Government and leading oil companies came to an agreement whereby U.N.R.R.A. purchased crude oil overseas and had it refined in Italy.

Reconstruction of the war-damaged refineries is proceeding, but since Italy is losing control of the refineries in the Fiume and Trieste areas, construction of new ones has become necessary to maintain the economics of the country.

The rehabilitation plans for refineries resulting from the agreement between the Italian Government and the oil companies include provision for the reconstruction of catalytic cracking plants.

The financial difficulties of the Italian Government are, however, hampering progress and very little currency is available for purchase of crude oil.

Efforts are being made to rehabilitate the Italian oil wells and an American company has recently been granted an oil concession in Sicily. It is stated that other foreign oil companies are interested in the possibility of prospecting for oil in Italy.

Efforts are also being made by the Soviet Union to share in the Italian oil market through Rumanian and Hungarian owned companies in Italy.

Italy is endeavouring to obtain foreign oil supplies by offering Italian goods in return for petroleum products. F. W. H. M.

1131. Factors Affecting Quality and Supply of Combustion-Engine Fuels. W. N. Holaday, R. E. Albright, T. L. Apjohn, and E. F. Miller. *Oil Gas J.*, 26.4.47, **45** (51), 112.—Consideration is given to past, present, and future petroleum product fuel supply and demand.

Trend in consumption of all petroleum products in the U.S. is presented graphically, as well as relative consumption, fuel oil distribution by type of stock, consumption of motor fuel, distribution of cracked motor gasolines, trends in auto-knock quality, % cars giving trace knock or loss as a function of O.N. and engine speed, Reid vapour pressures, variation of regular-grade motor-fuel volatility, and possible starting temperature. Other tables include characteristics of motor gasoline fractions from catalytic cracking and estimated characteristics of future diesel fuels. The article is illustrated by 4 charts and 13 figures. G. A. C.

1132. Position of Natural Gasoline and the N.G.A.A. in the Petroleum Industry. J. H. Dunn. *Oil Gas J.*, 26.4.47, **45** (51), 121.—A discussion of the current economic condition of the natural-gasoline and cycling industry, with suggestions for meeting some of the problems is presented.

Many natural-gasoline plants have been abandoned because of instability of the market for their products.

Competitive prices for these products on the basis of a steady flow into the over-all petroleum-products picture should enable the independent operator to take his proper place in the industry.

Studies made by the Natural Gasoline Association of America show, for example, that 1,000,000 brl of butane could be added to winter grade motor fuels.

The anti-knock properties of straight-run type fuels and other aspects, such as engine deposits, varnish, and sludge, are being compared with highly cracked stocks.

Plant-control tests are being correlated, and improvement of separation and synthesis processes by spectrophotometric methods are under study.

High-pressure absorption in the 500 to 3000 p.s.i. range, is being investigated, and present specifications and test methods are being reviewed. G. A. C.

BOOKS RECEIVED.

1946 Book of A.S.T.M. Standards Including Tentatives. Parts IIIA and IIIB. Philadelphia, Pa. : American Society for Testing Materials, 1947. Pp. (Pt. IIIA) 1290 + xxv ; (Pt. IIIB) 1360 + xxx.

Normally a triennial publication, exhaustion of supplies of the 1944 edition has necessitated production of the present edition with only a two-year interval. Opportunity has also been taken to divide Part III on Non-metallic Materials into two sections. The first section covers Coal and Coke, Gaseous Fuels, Petroleum, Aromatic Hydrocarbons, Soaps, Water, Textiles, Thermometers, and the second section deals with Electrical Insulating Materials, Plastics, Rubber, Paper, Shipping Containers, Adhesives, Thermometers.

The Chemical Constitution of Natural Fats. T. P. Hilditch. 2nd Edn. London : Chapman and Hall, Ltd., 1947. Pp. 554 + xiii. 45*s*. net.

Following a general survey of the natural fats, succeeding chapters discuss the component acids of fats of (*a*) aquatic flora and fauna, (*b*) land animals, and (*c*) of vegetable fats ; the component glycerides of (i) natural fats, (ii) vegetable fats, and (iii) of animal fats. The biochemistry of fats follows and then chapters on constitution of individual natural fatty acids, and on synthetic glycerides. Finally, there are notes on the experimental technique employed in the quantitative investigations.

Transactions of the Institution of Chemical Engineers. Vol. 21, 1943. London : Institution of Chemical Engineers, 1947. Pp. 60 + xx.

Included in this volume are papers on " Solvent Extraction of Lubricating Oils," by H. Ter Meulen, and " Petroleum as a Base Material for Chemical Industry," by J. C. G. Boot.

Transactions of the Institute of Marine Engineers. Vol. 57, Session 1945–46. London : Institute of Marine Engineers, 1947.

In this volume of the transactions of the Institute of Marine Engineers are included papers on " The Proper Care of Lubricating Oil in Service," contributed by the Marine Lubricants Committee of the Petroleum Board, and " The Evolution of Tanker Design," by W. Lynn Nelson.

Reports on Fuel Economy Since 1939. London : World Power Conference, 1947.

Further reports in the series prepared for the Fuel Economy Conference, 1947, are :

Argentine. Pp. 6. 6*d*.
Australia. Pp. 10. 6*d*.
Austria. Pp. 4. 4*d*.
Czechoslovakia. Pp. 4. 4*d*.
Germany. Pp. 8. 6*d*.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

July, 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.

Bagnold, Brig. Ralph Alger, Director of Research, Thornton Research Centre. (*J. A. Oriel ; Denis Morten*).

Barnes, Kenneth James Upshall, Works Chemist, Agwi Petroleum Corpn. Ltd. (*G. Noble ; F. Mayo*).

Box, James Stuart, Chief Metallurgist, Marconi's Wireless Telegraph Co. Ltd. (*E. A. Goodchild ; H. W. Sutton*).

Caird, Kenneth Campbell, Stocks Clerk, Petroleum Board. (*E. P. Lancashire ; S. C. Pearson*).

De Veulle, Philip Mauger, Executive, Shell Petroleum Co. Ltd. (*H. Hyams ; R. I. Lewis*).

Govindakrishnayya, Pasupuleti, Technical Adviser, Burmah Shell Oil Storage & Distributing Co. of India Ltd. (*R. I. Lewis ; F. L. Garton*).

Murray, Graham Francis James, Combustion Engineer, Anglo-Iranian Oil Co. Ltd. (*W. M. Hurrell ; R. Lessing*).

Nash, Reginald Lancelot, Managing Director, Combustions Ltd. (*G. J. Gollin ; R. J. Bressey*).

Nour, Ahmed el Deen, Chemical Engineer, Shell Co. of Egypt Ltd. (*H. A. Blackmore ; M. S. E. Al-Anwar*).

Preston, Frederick Charles, Area Superintendent, Snowdon Sons & Co. Ltd. (*E. R. Redgrove ; J. E. James*).

Rocke, Harry William, Managing Director, Vacuum Oil Co. Ltd. (*S. J. M. Auld ; A. L. McColl*).

Schmeidler, Jacques, Technical Assistant, Agwi Petroleum Corpn. Ltd. (*G. Noble ; C. R. Young*).

Sherif, Ibrahim Mohammed Ibrahim El, Assistant Chief Chemist, Egyptian State Railways.

Watkins, Frederick Francis Charles, Commandant, Army Fire Fighting Centre. (*E. Thornton ; T. M. Simmons*).

Transfer.

Cragg, John Coles, Production Chemist, C. C. Wakefield & Co. Ltd. (*E. A. Evans ; G. H. Thornley*). (*Member to Fellow*).

Simkins, Clarence Reginald Peers, Refinery Foreman, Bahrein Petroleum Co. Ltd. (*Associate Member to Member*).

NEW MEMBERS.

The following elections have been made by the Council in accordance with the ByLaws, Sect. IV, para. 7.

Elections are subject to confirmation in accordance with the By-Laws, Sect. IV, paras. 9 and 10.

As Fellows.

Coles, G. L.
Pinfold, E. S.

Transfer to Fellow.

Frankel, P. H.
Ross, K. B.

As Members.

Barth, E. J.
Bennett, H. A.
Davies, C. B.
Gilmour, H.
Ham, A. J.
Kelley, J. D.
Kinner, G. H.
Kirby, A. W. W.
O'Donoghue, D. J.

Transfer to Member.

Cooper, A. D.
King, H. E.
Tiratsoo, E. N.

As Associate Members.

Austin, A. E.
Baldry, R. J.
Cohen, Nathan.
Deacon, J. E.
Floyd, G. P.
Gibali, S.
Griffiths, R. G. E.
Gupta, K. L.
Hellewell, D.
Hodgson, M. S.
Hunt, T. W.
Korra, K. E.
Lambert, C. E.
Lenaerts, J.
Lowenstein-Lom, W.
Mackilligin, R. G. W.
Maclachlan, R. I.
McNicol, J. C.
Margetts, D. R. M.
Mason, D. R.
Mills, R. B.
Murray, F.
Padfield, R. J.
Piercy, W. E. K.
Reed, G. W.
Smith, A.
Wardle, Mrs. H.

Transfer to Associate Member.

Frost, J.
Taylor, P. A.

As Students.

Chamberlain, S.
Collenette, P.
Robinson, F. D.
Robinson, M. P.
Sheasby, G. R.
Simpson, G. J. H.

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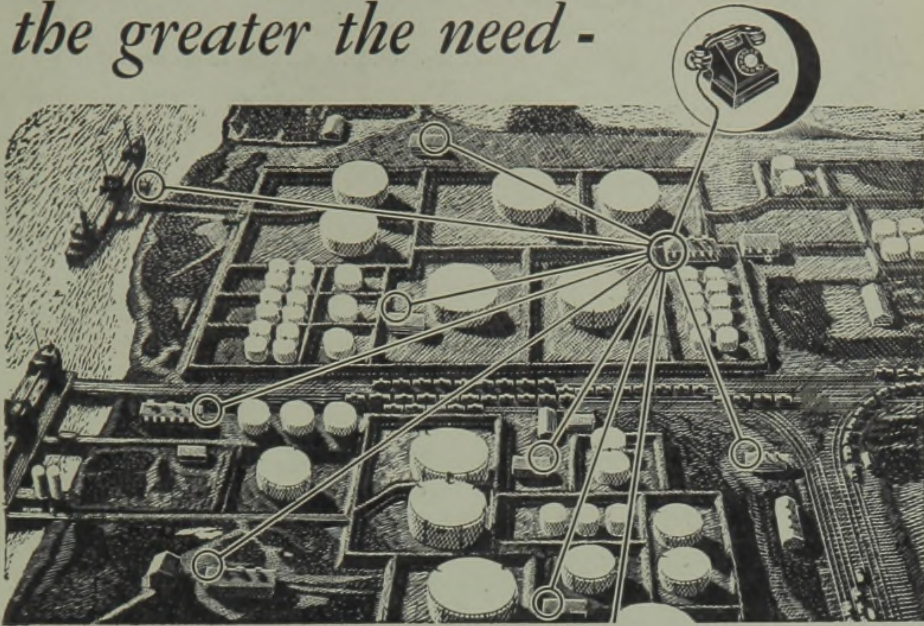

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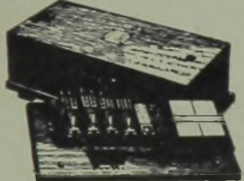

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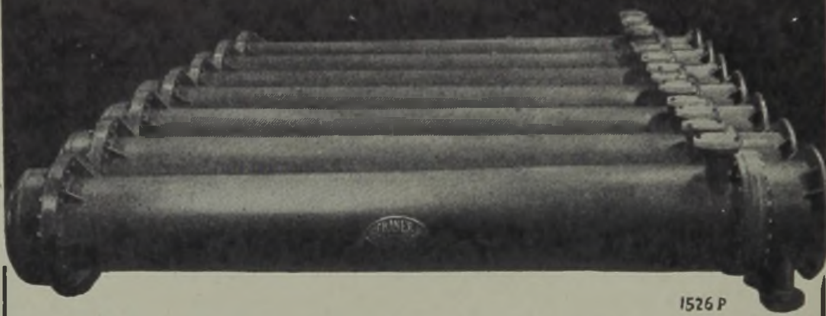

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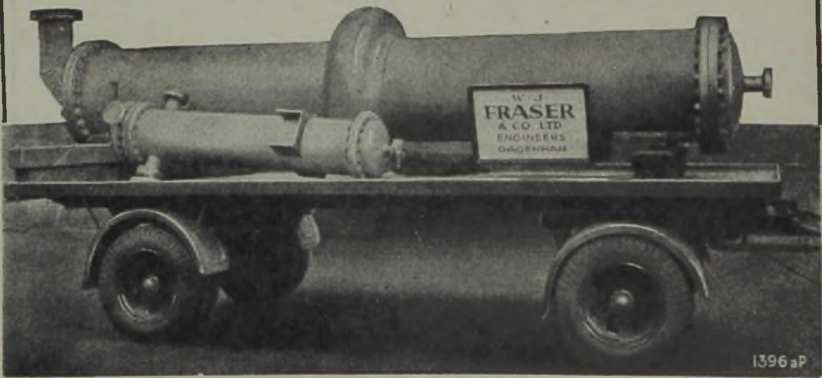

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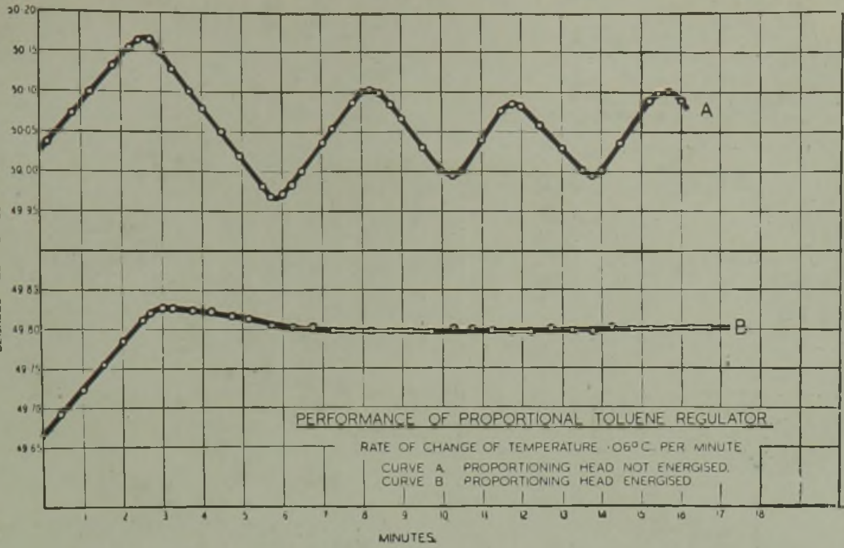

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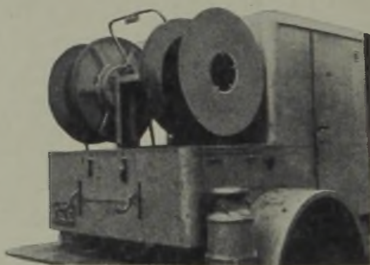

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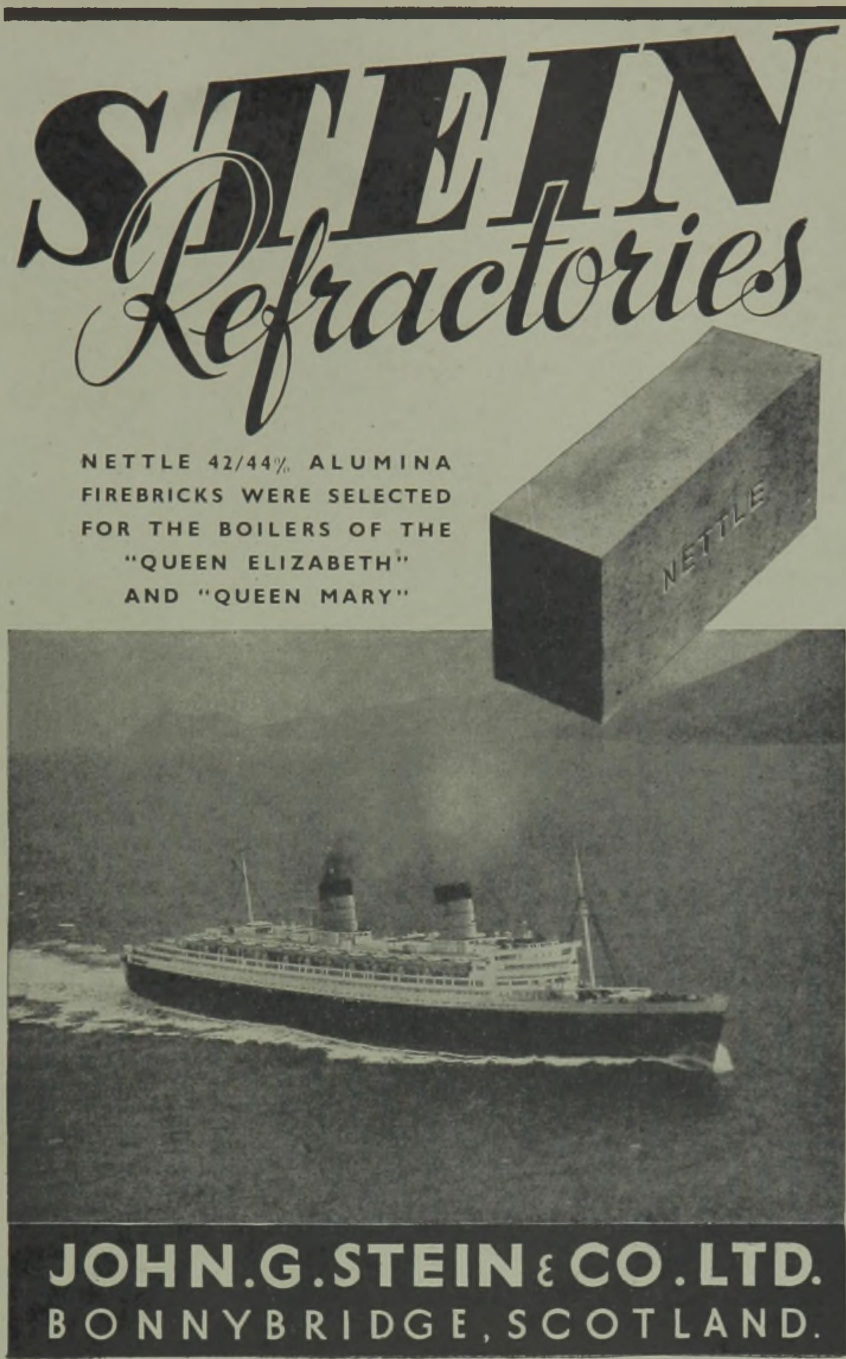
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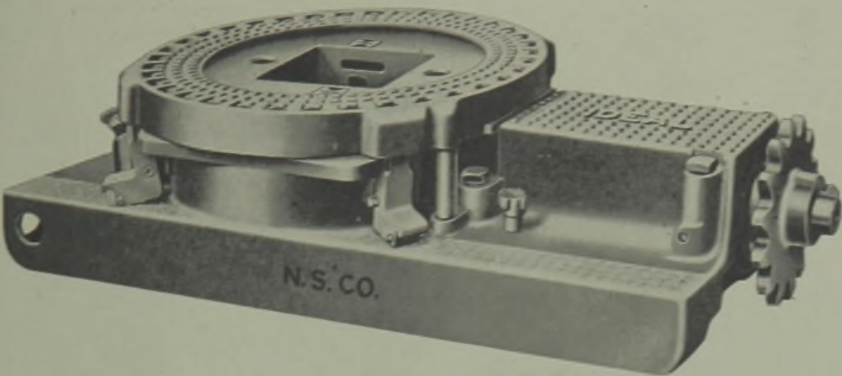

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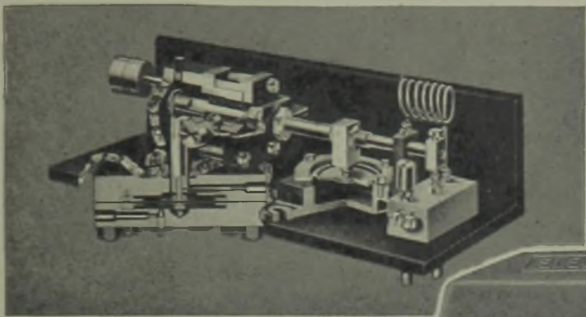

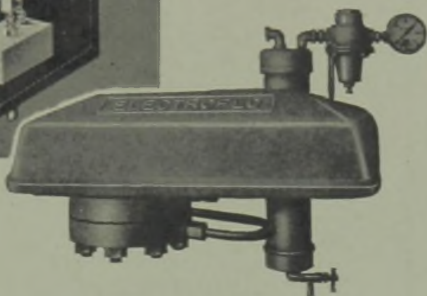

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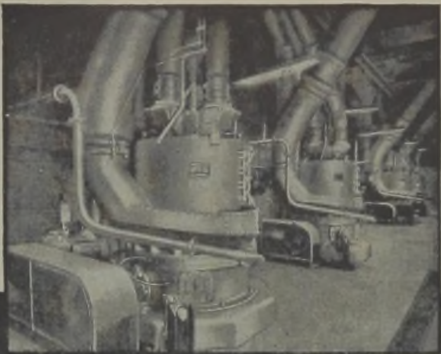

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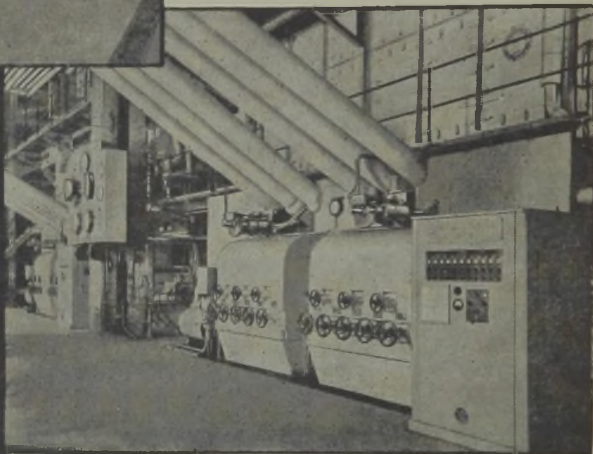

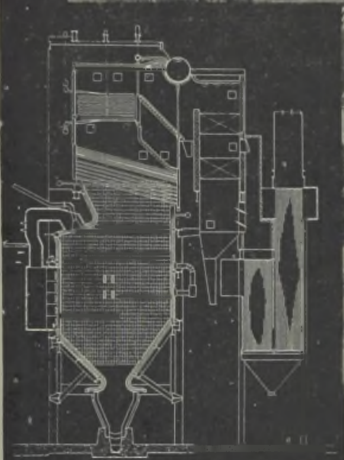

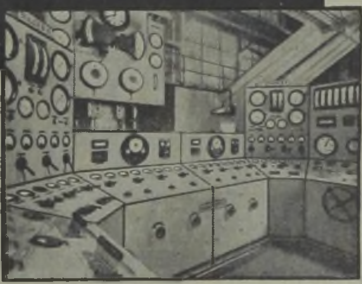

AT the North Tees "B" Power Station of the North-Eastern Electric Supply Company Ltd., there were recently installed two B. & W. High Head Boilers each for an evaporation of 180,000 lb. per hour at 475 lb. per sq. inch and 725° F.

The boilers are fired with pulverised fuel through vertical burners direct from Type "E" Mills and are equipped with Bailey Hopper Bottom Furnaces, Self-draining Superheaters, Flash welded Economisers and Tubular Air Heaters, the boiler drums being of fusion welded construction.

Messrs. Merz & McLellan acted as Consultants for the extensions at this Station.

THE ILLUSTRATIONS SHOW :—

TOP. A view of the B. & W. Type "E" Mills in the basement.

RIGHT.—A view in the firing aisle showing the burner controls and some of the automatic electrically operated soot blowers with the soot blower control panel.

LEFT.—A side sectional elevation through the boiler.

BOTTOM.—One of the boiler control panels.

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