ABSTRACTS.

AUTHOR INDEX.

The numbers refer to the Abstract Number.

OILFIELD EXPLORATION AND EXPLOITATION.

Geology.

1. Theory of Diastrophic Movement. R. C. Tuttle. *Oil Wkly*, 3.9.45, **119** (1), 42.—The earth is an oblate spheroid. If the polar diameter were increased by only 4 ml, this would put the poles 2 ml in the air, giving an accumulation of ice and snow. There would then be a large land area high enough above sea-level and in the frigid zone for glaciation to start.

When a wax-coated rubber sphere was compressed slightly along its axis of rotation the wax coating developed cracks running N.W.–S.E. and N.E.–S.W. The earth shows folds and faults along similar lines. While the sphere was in this oblate condition it was again coated with wax, and thicker coats built up in areas corresponding with the continents. While rotating it was allowed to return to its normal form, and the central parts of the continental masses collapsed and buckled, while their edges curled away from the ball, and the parts corresponding with the ocean beds buckled upwards. Both the collapsing and bulging were elongated in poleward directions. The raising of the continental platforms above sea-level would lead to erosion of stream channels or to canyons through them (cf. submarine canyons). The Atlantic shows a general north–south central ridge.

The earth's centrifugal and centripetal forces are essentially balanced, but this balance might be upset if the tidal influences of the sun and moon were in phase, and if this were combined with the near approach of a star. This might cause the earth to become oblate, leading to enormous equatorial tides which would brake the earth. Together with other factors this might allow a return to sphericity, causing a fall in sea-level in the equatorial regions, spreading waters into newly formed epi-continental seas, and elevating the polar lands. If such a pulsating action recurs in geological time there could be accentuation, modification, or eradication of the effects of earlier pulsations. Tectogenes might develop during the pulsations from sphere to oblate spheroid.

When the earth had a much thinner sedimentary cover, shrinkage, by cooling, to the extent of the thickness of a sheet of paper each year would give 264 ft shrinkage in diameter in 2,000,000 years, causing a loss in area of 5000 sq ml, and a volumetric change of 10,000,000 cu ml. This would account for quite a number of mountain masses. G. D. H.

2. **Exploration in Pacific Northwest Draws Interest.** Anon. *Oil Gas J.*, 11.8.45, **44** (14), 82.—Mechanical difficulties have caused the abandonment of a third test near Aberdeen, Gray's Harbor County, Washington.

Geophysical work is being carried out in the Willamette Valley of Oregon. The Texas Co. 1 Clatskanie is being drilled in Columbia County, Oregon. G. D. H.

3. **Seeligson Field Outstanding on Several Counts, Especially its Multiple Pay-Zones.** C. J. Deegan. *Oil and Gas J.*, 11.8.45, **44** (14), 74.—The Seeligson field on the Jim Wells–Kleberg County line has tentatively shown some 40 separate oil and gas reservoirs in the Frio and Vicksburg, down to 6800 ft. The present proven area is 14,000 acres, with recoverable reserves estimated at 325–500 million barrels, with 1000–1500 thousand million cu. ft. of gas.

The early wells were drilled on reflection seismograph and gravity data, and in 1933 the West Premont field was found. A new geophysical survey showed the main structure to lie the east, and in 1937 the real discovery well of the Seeligson field was completed, flowing 912 brl of 36° gravity oil from the Vicksburg at 6585–6595 ft. The field is an anticline on the Vicksburg Flexure trend. The anticlinal fold is formed by closure on the downthrown side of a regional fault-zone. There are two highs. The lenticular producing sand zones cover a section ranging 4300–6800 ft deep. 21 of the pays give oil and gas; the others may eventually give gas and condensate. The average well finds four gas-zones and three or four oil-zones. The sand development seems better in the south.

Development may eventually be on a 20-acre spacing with dual oil completions, with only one well to 40 acres for any oil-zone.

Reservoir pressures are normal in the shallower zones, but the gas-zones at about 6250 ft are as much as 500 lb/sq in above normal. Average porosity of good oil-sand is 25%, with vertical and lateral permeabilities ranging 0–1200 md. There is no positive evidence yet of water-drive. Production has been about 50,000 brl/lb/sq in pressure drop.

In casing 1000 ft of surface pipe is set, with a 5½-in or 7-in oil-string at 6000 ft. Contract drilling prices are about $3·00/ft. Each well requires about $1000 worth of special muds.

Plans are being made for unitization of the gas and condensate zones. There is a possibility of recycling gas to the lenticular oil-zones. G. D. H.

4. **North Carolina becomes Focal Point of Oil Search after 20-Year Interval.** W. B. Hill. *Oil Wkly*, 17.9.45, **119** (3), 50.—Successful wildcats in Mississippi, Alabama, and Florida have led to leasing on the Atlantic Coast from Florida to Maryland and Delaware. A test near Havelock in North Carolina in 1924 was abandoned in granite at 2415 ft.

In the extreme east of the State about 2,700,000 acres are under lease. Near North Morehead City, Carteret County, a second test has been drilled. It was abandoned in granite at 4044 ft. The Trend Marl Miocene was topped at 335–374 ft, the top of the Cretaceous possibly at 1398 ft or higher, and the Tuscaloosa or younger at 2262–3678 ft.

Only the eastern area of North Carolina is now considered favourable for oil production. Granites and strongly metamorphosed sediments outcrop westwards from Wilson. Two tests have found Miocene, Eocene, Upper and Lower Cretaceous, the latter formation being deemed most favourable for oil production. The Pennsylvanian and Mississippian may also be favourable. The likely structures are fault-traps, shore-line traps, and arches, over granite ridges especially.

A map shows the main areas leased. G. D. H.

5. Wildcat Completions Decline. Anon. *Oil Wkly*, 1.10.45, **119** (5), 49.—During August U.S. exploratory completions averaged 85 per week; the July figure was 90 per week. The average for the first eight months of 1945 was 82·8 per week, a figure which is only 2·8% above that for the corresponding period of 1944.

The August wildcat completion results are summarized by States and districts; comparable figures are given for the first eight months of 1945. The types of discoveries are analysed for July and August, and for the first eight months of 1945 and 1944. The August discoveries are listed with pertinent data. G. D. H.

6. Ratio of Wildcatting Success Betters Eight-Year Average. Anon. *Oil Wkly*, 30.7.45, **118** (9), 47.—11·6% of the strict wildcats drilled in U.S.A. in the first half of 1945 were successful. This is slightly better than the 11% average for the preceding eight years. In the first half of 1945 strict wildcats represented 15·6% of all wells. The corresponding average for 1937–44 was 11%. The proportion of wildcats and the degree of success varied in different states.

No unusually large fields are among the 1945 finds. West Texas has 13 oil discoveries, 3 being in the Devonian. Some of the strikes give high-gravity sweet crudes.

Brief notes are given on the results of wildcatting in the various sectors of U.S.A. during the first half of 1945, and a table summarizes the results and gives comparative figures for the period 1937–44. G. D. H.

7. Wildcat Completions Decline in Rate of Increase. Anon. *Oil Wkly*, 27.8.45, **118** (15), 49.—In the first seven months of 1944 U.S. exploratory completions totalled 2468; in the corresponding period of 1944 the figure was 2422. It is doubtful whether the P.A.W. goal of 5000 wildcats in 1945 will be reached. 464 productive tests have resulted from the 1945 wildcatting. There has been a gain of 125% in new pay discoveries and a gain of 157% in distillate discoveries as compared with the first seven months of 1944.

In 1943 the average cost of drilling a well was about $37,000; in 1940 $27,182 and in 1937 $26,183. In 1944 about 7 out of 10 completions were dry; in 1937–41 the dry-hole ratio was one to every four or five wells drilled.

There were 390 exploratory completions in June 1945 and 355 in July.

Tables summarize the wildcat completion results in July and in the first seven months of 1945. Totals are given for different types of wildcat and of discovery, and the July discoveries are listed with some details. G. D. H.

8. Exploratory Drilling Record to be Near P.A.W. Goal for 1945. Anon. *Oil Wkly*, 30.7.45, **118** (9), 53.—In the first half of 1945 exploratory well completions averaged 81·5/week, and in the first half of 1944 75·7/week. If continued at the same rate, 4600 exploratory wells should be completed in 1945, 400 below the P.A.W. goal. 18·7% of the wells have been productive.

June exploratory completions average 96·3/week, 15·6% being successful. Tables summarize the exploratory drilling results in June and during the first half of 1945 by districts, and classify the overall figures according as they are extensions, and oil, gas, or distillate field or pay discoveries. The June discoveries are tabulated with some details. G. D. H.

9. Who is Drilling the Wildcats? Anon. *Oil Wkly*, 30.7.45, **118** (9), 51.—An analysis of the total and exploratory drilling results in U.S.A. for the first half of 1945 shows that the larger and smaller companies are finding new oil-fields in about the same ratio as that of their total drilling, but the latter have a relatively lower success ratio (16·3% against 24% for the larger companies). Of the total wells drilled by 32 large companies, 13·7% were strict wildcats, while the figure for the rest of the industry was 16·5%. Among the large companies results and figures vary widely. The data are tabulated in detail. G. D. H.

10. English Test Fails. Anon. *Oil Wkly*, 24.9.45, **119** (4), 79.—At North Creake, 7 ml northwest of Fakenham, Norfolk, a test well failed to show oil, and was abandoned in Pre-Cambrian at 2632 ft. G. D. H.

11. British Columbia Reports Showings of Oil and Gas. Anon. *Oil Wkly*, 15.10.45, **119** (7), 70.—The discovery of natural gas and evidences of petroleum in the Boundary Bay region of British Columbia has been reported. G. D. H.

12. Mexican Wildcat Producer Wakens Sleeping Industry. Anon. *Oil Gas J.*, 8.9.43, **44** (18), 80.—1 Soledad has been completed by "Pemex" as a 50-brl wildcat 25 ml west of the Golden Lane. The well reached 6480 ft and found 40-gravity oil in the same sand as is present in the fields of the Tampico area.

1 Mission has opened a new gas-field near Reynosa, only 300 yd from the Texas border. The initial output was 6,000,000 cu ft and 45 brl of distillate.

Exploration is under way in six untested zones: Coahuila, Chihuahu, and Nuevo Leon, in northern Mexico; Tamaulipas, between the San Carlos mountains and the Gulf Coast; parts of Vera Cruz, Chiapas, and the Yucatan Peninsula, southwest Mexico; Oaxaca and Guerrero, southern Mexico; Nayarit and Sinaloa, west coast and southern Lower California. G. D. H.

13. Casabe Pay Proven under Tropical's De Mares Pool. Anon. *Oil Gas J.*, 11.8.45, **44** (14), 78.—1 Galan on the east bank of the Magdalena is reported to have shown about 1000 ft of oil-pay section in an electrical survey, with assurance of production. G. D. H.

14. Sixth Dificil Well Sets Production Record. Anon. *Oil Gas J.*, 25.8.45, **44** (16), 102.—6 Dificil lies 1000 m west and 500 m south of 1 Dificil. It gave 1200 brl/day of 42° A.P.I. gravity oil on a ¾-in choke. The Dificil field, lying 90 ml from the port of La Gaira, has 5 producers with a combined potential of 2750 brl/day. G. D. H.

15. Venezuelan Exploration Covers Extensive Area. M. C. Cody. *Oil Gas J.*, 11.8.45, **44** (14), 76.—Creole has made a discovery, 1 Capacho, 30 km southwest of Mulata. South America's deepest well has reached a depth of 13,033 ft, in the heart of the old Cabimas field on the east shore of Lake Maracaibo. An outpost is being drilled in the newly discovered Mara field which has only one producer and lies 25 km northwest of Maracaibo. 25 km east of Lagunillas, the 1 Ballenato wildcat is drilling at 8350 ft.

The Venezuela Atlantic Refining Co. is drilling 2 wildcats, 1 Morichito and 1 Punta Gorda, north of the Santa Barbara-Jusepin producing area. On the Delta Amacuro concession the Texas Petroleum Co. is drilling a third test. The first well was dry and the second a producer. G. D. H.

16. New Venezuelan Field Discovered by Creole. Anon. *Oil Gas J.*, 28.7.45, **44** (12), 112.—1 Capacho has opened a new field in Anzoategui, 30 ml southwest of Mulata. The production is 150 brl/day of 23° oil from 4410–4470 ft. G. D. H.

17. Brazil has Four Oilfields with 25 Producing Wells. A. I. de Oliveira. *World Petrol.*, Sept. 1945, **16** (10), 74.—Early geological studies indicated favourable structures for oil near La Bahia de Todos os Santos. This region has a graben with Cretaceous, Jurassic, and possibly older beds down-faulted against Archæan. There is folding roughly parallel with the faults. Geophysical work was undertaken. Several dry holes were drilled in Alagoas, but two had oil-showings. In Bahia, the Lobato, Candeias, Aratu, and Itaparica oilfields were found. Lobato is a relatively steep westerly-dipping monocline with a major fault on the east, and subsidiary faults breaking it into blocks. Seven producing wells have been completed, oil being found in a sand at about 650 ft. The biggest well, an 80-brl pumper, has yielded the bulk of the 65,000 brl of oil obtained since 1940. 15 ml north of Salvador is the Aratu field, on an elongated dome. Oil is obtained at 1500–1600 ft, and gas 500 ft deeper. The oil is in a silty sandstone lens at the southern end of the dome, the lens covering 30–40 acres. Three oil-producing wells have a total potential of about 100 brl/day. The gas-sand may cover 1000 acres. Eight gas-wells have potentials ranging 1–8 million cu ft/day. 15 ml to the northwest is the Candeias field, on an asymmetrical anticline with steep easterly dips. The field has 11 producers at depths of 2600–4000 ft. Oil is found in a 100-ft section of hard, coarse grit or sand. The proved area on this structure covers 1000 acres, and is limited on the north and west by wedging out of the sand. The present potential is about 1200 brl/day.

The Itaparica field produces gas from the western end of a lens and oil from the eastern end. There is a deeper oil-sand with oil in the topmost 30 ft. The total potential of the wells in the upper zone is 500 brl/day, and that of the wells in the lower zone 300 brl/day.

Two wildcats within 50 ml of Salvador have had oil-showings. Two wildcats near Maceio found thick sections of depleted oil-sands at depths of 2500–5000 ft.

G. D. H.

Geophysics and Geochemical Prospecting.

18. Structural Interpretation of Micromagnetic and Other Data. W. P. Jenny. *Oil Wkly*, 8.10.45, **119** (6), 40.—The interpretation of micromagnetic surveys at Ravenna (Michigan), Cumberland (Oklahoma), Ganada, Pinehurst, Odem (Texas), and Egan (Louisiana) is discussed, all the surveys having been made prior to discovery of the structure. A few wells had been drilled before the surveys were made at Hawkins (Texas).

Generally micromagnetic local positive anomalies indicate structural highs under certain regional magnetic conditions, and structural lows under others. However, in regions where positive anomalies indicate structural highs a salt uplift may be represented by a local negative anomaly. Faulting may bring in a strongly magnetic bed. In areas where the local micromagnetic anomalies are due to beds in the sedimentary column, these anomalies are essentially produced by the shallowest magnetic bed which is sufficiently displaced from its normal position by the local structural conditions. G. D. H.

19. The War's Influence on Geophysics. A. R. McTee. *Oil Wkly*, 10.9.45, **119** (2), 59.—It is generally believed that no revolutionary or basic change or improvement in geophysical methods or equipment can be expected from the war. However, equipment will be lighter, better controlled, and will probably have greater sensitivity—improvements which are part of the normal growth of geophysics.

War-time developments in electronics may show up in the construction of electronic geophysical equipment. Magnetic surveying instruments for use in aircraft are likely to be developed soon. It may be possible that radar can be used as a correlating medium between geochemistry and geophysics, for it has now been established that the soil character is affected by deposits of oil beneath.

Aerial surveying may make wide use of colour photography as an aid in correlation.

A portable gravity-meter which together with batteries weighs only 45 lb has been constructed.

Geophysical prospecting practice may be changed by war-time developments such as improved transportation, air transport of heavy equipment with its possibilities for isolated regions, the use of light metals in auxiliary equipment, improvements in explosives and the methods of handling them, and advances in communication equipment and procedures.

The comfort of geophysical crews may be increased by war-time developments in clothing, equipment, insecticides, etc.

Experiments are being made on the Gulf Coast by burying thermometers and noting differences in soil temperatures, as a means of locating structures. The idea is based on differences in thermal conductivity. Due to the high conductivity of salt, the soil above salt-domes has a temperature several degrees above that of more remote soil.

During the war there has been a great advance in the use of a gravity-meter for operations in water-submerged areas. G. D. H.

Drilling.

20. Directional Drilling Used as Exploratory Tool in Gulf Coast Well. E. H. Short, Jr. *Oil Gas J.*, 8.9.45, **44** (18), 111.—This article describes a recent application of directional drilling as a means of subsurface exploration. Although the productive horizon sought was penetrated on the second attempt, this particular case illustrates the possibilities in this type of work. The success of the bit-control method employed in the directional drilling of this well is best indicated by the fact that it was necessary to run the directional tool only five times during the complete drilling procedure of the final hole. During this job, when greater inclination was needed, the drill-collar assembly was shortened and drilling operations conducted with more weight upon the bit. If less inclination were desired, the drill-collar assembly was increased to a length slightly greater than 60 ft and less weight was carried on the bit. In the first case the drill-pipe tended to bend, and in the second case it was stiffened and had a tendency to run straight. During the final stages of drilling the inclination of the hole reached an angle of almost 10°, which would have thrown the course off the target. While approximately 500 ft above the target the drag-bit was replaced with a rock-bit and the drill-collar assembly lengthened. After the installation of this equipment the angle of inclination dropped steadily from approximately 10° to approximately 1°, at the point where drilling operations were stopped in the pay section. A. H. N.

21. Special Mechanical Safeguards Installed on Deep Drilling Rig. N. Williams. *Oil Gas J.*, 8.9.45, **44** (18), 86.—Safety measures in use on this large steam-powered rig include dual installations for main operating units. Among these are an auxiliary and standby draw-works and engine, a spare rotary, an extra swivel, and duplicate main mud-circulating lines, as well as steam lines in some cases. Steam power for the rig is supplied by five 125-hp 350-psi working-pressure boilers, equipped with automatic water level, fuel-feed, and blower controls. A. H. N.

22. Substructure-Design Innovations Feature Modern Diesel-Powered Rig. N. Williams. *Oil Gas J.*, 20.10.45, **44** (24), 125.—The devices and practices adopted for controlling and protecting wells during drilling by means of two diesel-powered rigs are described in some detail. A. H. N.

23. Rowan Initiates Post-war Diesel-Electric Rig Layout. E. H. Short, Jr. *Oil Gas J.*, 13.10.44, **44** (23), 100.—The rig is designed for deep drilling in localities where water and gas are scarce. The paper is photographically illustrated. A. H. N.

24. Two 24-Cylinder, 2-Cycle Quad Diesel Units Drilled Oklahoma's Deepest Well. K. B. Barnes. *Oil Gas J.*, 15.9.45, **44** (19), 103.—Details of the drilling engines, and of their controls and maintenance are given. A. H. N.

Production.

25. The Optimum Rate of Production of Oil, Condensate, and Natural Gas. Part 1. P. J. Jones. *Oil Gas J.*, 1.9.45, **44** (17), 50–52.—The optimum rate of production from reservoirs depends on several factors. The reserve is probably the most important. A reserve varies with producing and operating methods, but it may also depend on the rate of production. Reservoirs for which reserves vary with the rate of production are said to have a maximum efficient rate or MER. The MER may influence optimum rates of production through the size of reserve, operating expense, and required investments. The rate of production for which the present value of a reserve after taxes, royalty, operating expenses, and investment is a maximum defines the optimum rate of production. The investment in reservoirs, required in order to produce at optimum rates, depends on the ratio of annual/well producing rate to/well investment. This ratio and the income/thousand cu ft, or barrel, of gross production after taxes, royalty, and operating expense fix the optimum rate of production for a reserve recoverable at declining rates of production is higher than for a reserve recoverable at uniform rates of production. The initial rate of production corresponding to optimum conditions ranges from about 5 up to about 11% per year of an initial reserve. Some of the elements of optimum producing rates are illustrated. A. H. N.

26. The Optimum Rate of Production. Part 2. P. J. Jones. *Oil Gas J.*, 8.9.45, **44** (18), 103.—The optimum rate of production from reservoirs usually does not exceed the maximum efficient rate of production, the MER. Other things equal, the MER varies with the distribution of reserve in reservoirs. The initial MER depends on the initial distribution of reserve. The MER corresponding to, say, 50% of the initial reserve depends on the distribution of reserve after 50% of the initial reserve is recovered. The MER may vary with time. It depends on the variation with time of reserve distribution. The distribution of reserve in a reservoir at a given time may vary areally and sectionally. Areal and sectional variation of reserve depends on the direction of advancement in reservoirs. The direction of most interest to producers is the one parallel to dip. A decrease of productive area/ft of updip advancement represents areal convergence of reserve. It also represents areal divergence in the downdip direction. A decrease of pay thickness/ft of downdip advancement would represent sectional convergence of reserve. It would also represent sectional divergence for the updip direction. Reservoirs may be classified according to the shape of their productive area as linear or radial. Linear reservoirs have no areal convergence. Radial reservoirs have areal convergence of reserve in the updip direction. Both types of reservoirs usually have a variable pay thickness—that is, sectional convergence is commonly in the downdip direction. The effect of areal and sectional convergence on the distribution of reserve is illustrated by examples. A. H. N.

27. The Optimum Rate of Production. Part 3. P. J. Jones. *Oil Gas J.*, 15.9.45, **44** (19), 81.—The optimum rate of production from reservoirs usually does not exceed the maximum efficient rate, the MER. The MER for displacement of oil by water may be variously expressed. But the rate of advancement of oil–water interface parallel to bedding probably has more applications than any other method. Field experiences with displacement of oil by water under various conditions indicate that 200 ft/year parallel to bedding is about the maximum rate of interface advancement for most reservoirs. However, an exceptionally cavernous limestone reservoir and a homogeneous sandstone reservoir, if one were discovered, could have a faster rate of water advancement without bypassing oil. The rate of oil production, the MER, corresponding to a 200-ft/year rate of interface advancement depends primarily on areal and sectional convergence of reserve. The MER may influence the size of an initial oil reserve and well-producing capacity. The latter, in turn, influences investments in reservoirs and operating expenses. For these reasons, the MER is a significant element in producing some reservoirs at optimum rates. This article is limited to displacement of oil by water at reservoir pressures which are higher than the saturation pressure for oil. The corresponding MER for linear and radial reservoirs is illustrated by examples. A. H. N.

28. The Optimum Rate of Production. Part 4. P. J. Jones. *Oil Gas J.*, 22.9.45, **44** (20), 317.—The MER for displacement of oil by gas may be variously expressed. But the rate of advancement of gas–oil interface parallel to bedding probably has more applications than any other method. Gravity may displace oil relative to gas provided the downdip rate of gas–oil interface advancement is not too fast. The rate of oil displacement by gravity relative to gas is highest at no free gas saturation. After a gas–oil interface invades a given section of pay, the rate of oil displacement by gravity from that section decreases rapidly. Gravity does not increase oil recovery. It reduces the volume of gas required to achieve a desired oil recovery, provided gas–oil interfaces advance downdip and the rate of advancement is not too fast. Field experiences with displacement of oil by gas under viscous conditions indicate that 200 ft/year parallel to bedding is about the lower limit of interface advancement for most reservoirs. If gravity is not effective at 200-ft/year rate, it is not likely to be significantly more effective at a slower rate. In reservoirs having a comparatively high permeability or a steep dip, gravity may be effective at rates of interface advancement faster than 200 ft/year is included. The MER corresponding to 200-ft/year is illustrated by examples. The MER varies with the initial position of a gas cap. The MER for displacement of oil by gas may influence optimum rates of production through size of reserve, required investments, or operating expenses. A. H. N.

29. The Optimum Rate of Production. Part 5. P. J. Jones. *Oil Gas J.*, 29.9.45, **44** (21), 111.—Optimum rates of production vary with investments. Other things equal, investments in reservoirs depend on well-producing capacity. The well-producing capacity for a reservoir declines with a decrease in the number of producing wells and with a decrease in per-well producing capacity. The relationships between well-producing capacity and reserve are characterized by reserve raised to some power p. Cycling and pressure maintenance projects may be defined by small values of p. Production of oil by evolved solution gas may be defined by values of p which are large compared to those for cycling operations. The relationship between well-producing capacity and the reserve for a given reservoir depends primarily on producing and operating methods. If wells are produced at capacity, the relationship between well-producing capacity and time may be obtained from that reserve and well-producing capacity. Some of the relationships found in practice are illustrated graphically. A. H. N.

30. The Reserve for Displacement of Oil by Gas at Declining Pressures. Part 7. P. J. Jones. *Oil Gas J.*, 13.10.44, **44** (23), 119.—The reserve for displacement of oil by gas at declining pressures may range from as low as 15% of the oil initially in place up to about 45% of the oil initially in place. This possible threefold range of oil recovery by gas displacement at declining pressures results from the wide variation found in the field as to the properties of fluids, characteristics of reservoirs, and producing and operating practices. This article reviews the effects of gas–oil ratios, pressures, and location of wells on oil recovery by gas displacement. From the viewpoint of the optimum rate of production, the effect of distance from the source of gas to producing wells should be emphasized. Other things equal, the volume of gas required in order to achieve a desired oil recovery may be reduced significantly by providing sufficient distance between the source of gas and producing wells. The required distance can be provided under co-operative or unit operations. A. H. N.

31. The Optimum Rate of Production. Part 8. P. J. Jones. *Oil Gas J.*, 20.10.45, **44** (24), 147.—The initial reserve for displacement of oil by water at declining pressures may increase with free gas saturation up to about 10% of porosity. On the other hand, a decline in reservoir pressure is accompanied by a decrease of well-producing capacity. Consequently, if wells are produced at capacity, the increase in recovery from some reservoirs may not offset the increase of investment necessitated by the declined well-producing capacity. But, if per-well producing rates are limited to, say, 20% of their initial producing capacity, it may be advantageous to decline reservoir pressure down to a value at which enough solution gas evolves to occupy about 10% of porosity, provided the resulting rate of water advancement does not exceed about 200 ft per year parallel to bedding. The possible variations of initial reserve for displacement of oil by water at declined pressures are reviewed. A. H. N.

32. Peak-Torque Method of Rating Oilfield Belting. D. O. Barrett. *Oil Wkly*, 8.10.45, **119** (6), 52–53.—In a well pump in which W = well load, lb; CB = counterbalance, lb; a = distance of centre of gravity of beam counterbalance from fulcrum of beam, ft; A = distance of load from fulcrum, ft; r = radius of crank-throw, in; R = radius of bandwheel, in; K = belt width, in; ST = static tension/in width of belt = (usually) 125 lb; MR = manufacturer's rating of belt loading/in width, lb; then :—

$$\text{Net } CB \text{ effect} = \frac{CB \times a}{A} = NCB;$$

$$\text{Peak torque} = (W - NCB) \times r = PT;$$

$$\text{Net belt pull} = \frac{PT}{R} = NBP;$$

$$\text{Net belt pull/in Width} = \frac{NBP}{K} = PIW;$$

and

$$\text{Total belt load/in Width} = PIW + ST = TBL.$$

Loads should be such that $TBL = MR$, where MR is based on 100 million shock loads, which corresponds to a life of 5 years at 20 strokes/min on a beam pumping-well. A. H. N.

33. Marble Torpedoes Prove their Worth. A. Gibbon. *Oil Wkly*, 8.10.45, **119** (6), 36–39.—Although primary interest in the marble torpedo was its ability to clean thoroughly the face of the well-bore by removing congested solids and permitting the well so treated to respond to its full capacity, new uses and rather surprising results have been reported during the past year. Some of the best results have been obtained in old fields where wells have been producing for 30 or even 40 years. One small well near Caney, Kansas, had been producing for years at the rate of ½ brl of oil daily, but after a marble shot it increased to 8 brl/day, and the owner is now preparing to treat additional wells. Near Drumright, Oklahoma, was a well that had been producing for a number of years and which ten years previously had been given a heavy shot of liquid explosive which increased production at the time to 25 brl/day, and later declined to 2 brl with the immediate field of vacuum. It was given a " marble shot " some months ago, immediately increasing the production to 50 brl/day, which has since settled to 31 brl/day. In New York State a 46-year-old gas-well making 10,000 cu ft of gas daily increased production to 83,000 ft of gas daily, after it was given a 5-ft " marble shot." The marbles torpedo has proved equaly effective in soft, muddy wash. A wash-well in the Bowers pool in the Panhandle area, which is also a low-pressured mud area, became congested and paraffined and was about to be abandoned. When tubing was pulled the complete liner was found to be cemented with salt and gyp, and was pulled up with the tubing. The paraffin and salt made it impossible to distinguish either the collars or perforations in the liner. When the well was cleaned there was only a slight increase of seepage from the congested walls. The well was treated with 80 ft of marbles and cleaned out without the difficulty expected in continuous caving as from a conventional shot. The well has averaged 132 brl of oil daily for several months. The theory and operation of the torpedoes are given.

A. H. N.

34. Glass Marble Torpedo Used to Shoot Wells. J. Gordon Burch. *Petrol. Engr*, Sept. 1945, **16** (13), 216.—The cleaning of wells by shooting with marble-packed torpedoes is described in detail. The development of the scheme is given. In the first experiment, in 1944, ordinary glass marbles were used. A hole 14-in in diameter was dug in black top soil, and the first " agate " torpedo was exploded. The walls of the hole, other than showing a regular pattern of hits, were not disturbed. After carefully peeling back the bank for several feet, the marbles were found still round, but disintegrated to white sand by the heat of penetration. They had not changed in size, and retained a gloss coating, but they could be pulverized easily by squeezing them with the fingers. From many experiments much was learned about marbles. Common glass has a much greater crushing strength than any oil-producing formations, and it is very elastic. A glass marble was thrown against seasoned concrete without breaking. Then the shot in a shot-gun shell was replaced with a marble, and at distances of 15–25 ft it was fired against seasoned concrete, and in no case did the marble break. Chips of cement the size of a saucer were knocked off, but the marble was unharmed. In a well where the marbles were propelled by nitroglycerin, however, the marbles reach the wall of the well with such high velocity that they penetrate even the hardest formation to some extent. When the resistance of the formation checks the speed of the marbles, they disintegrate violently with a blasting effect towards the centre of the well-bore. The marbles break up into particles of glass about the size of a pinhead. Evenly-sized heat-treated glass marbles are now being used to lace around the explosive container to avoid the slightest overlapping.

In shooting in shallow, large-diameter cement vats, where the explosive gases could escape readily, the marbles alone destroy the surface of the solid cement to a depth of 2 in. The destructive force of the marble is even greater where the explosive gases are retained, as in a well. The method of running the torpedoes and detonating it are given.

A. H. N.

35. Salt-Water Disposal in East Texas. Anon. *Petrol. Engr*, Sept. 1945, **16** (13), 86.—A discussion of centrifugal pump characteristics, working with water, is given. Installation and maintenance of pumps and prime movers are discussed. A. H. N.

36. Salt-Water Injection for Pressure-Maintenance in East Hackberry Field, Louisiana. M. L. Euwer. *Oil Gas J.*, 29.9.45, **44** (21), 100–102.—A co-operative project of water injection for pressure maintenance undertaken jointly by three concerns is described. The development of the field is reviewed together with its production history and methods.

A. H. N.

37. Water Injection in the Chatham Field, Medina County, Ohio. R. B. Lyon and J. Cashell. *Oil Gas J.*, 1.9.45, **44** (17), 58.—The Chatham field is relatively small, the sand conditions are far from uniform, and the injection of water under pressure for secondary recovery has been carried on for only 5 years. Based on cable-tool and diamond-core analyses, the average conditions warrant the use of water injection for the development of this field. The unusually erratic occurrence of the sand, wide range of permeabilities, had great variation in saturations result in a wide range of input volumes of water which must be regulated annually at the individual well-head. The varied sources of water supply require chemical treatment and sand filtration. It is found that water pressures on the sand face of 1 psi/ft of overburden can be used in flooding the Berea sand in the Chatham pool if there is no channelling action. Satisfactory results are obtained by using a shot in all wells of 1 qt of nitroglycerin/ft of sands. Selective shooting has not definitely proved a satisfactory equalizer of vertical sand characteristics, and does not control the flood-front to an effective degree. A brine-disposal problem will always exist; therefore, filtration and treatment equipment must be set up to take care of this water, so that it can be used as a pressure medium in the Berea sand by recycling. When brine is used as a pressure medium, corrosion is present, and must be reduced to a minimum if water-pressure systems are to continue to operate throughout the life of the field. Corrosion can be prevented by treating the water with lime at the filtration plant and deo-oxygenization. The low price received for oil in this field makes certain portions of the field unfloodable.

A. H. N.

38. Periodic Tests Insure Injection-Water Quality. J. R. Wright. *Oil Gas J.*, 15.9.45, **44** (19), 78–79.—It is widely known that a perfectly clear water may not be entirely suitable for injection purposes. However, the exact nature of reactions which occur due to injection and mingling of waters is not well understood. Application of stability-index calculation shows the characteristics of a stable water at formation temperature, and provides a definite control for quality of injected water. Some examples are shown which illustrate in a practical manner the results of injecting unstable water and the use of stability index calculations for corrective and preventive measures.

A. H. N.

39. Secondary Recovery in California. R. Sneddon. *Petrol Engr*, Sept. 1945, **16** (13), 66.—An experimental project of water-flooding the Chapman Zone of Richfield in California is described and a number of conclusions, based on experience to date, are reached. First, it is seen that oil in the Chapman zone at Richfield can be displaced with water, and that water-flooding is an effective medium for secondary recovery in that section of the reservoir. Second, it has been demonstrated that water injection can be sustained over a considerable time if flocculable material is first removed. No report has yet been forthcoming on the economics of the process—and it is therefore impossible to say whether or not the experiment as conducted on a small scale can be profitably conducted on a large scale. A. H. N.

40. Some Factors Entering into Pumping Unit Walking Beam Selection. R. N. Mills. *Petrol Engr*, Sept. 1945, **16** (13), 112.—Velocity and acceleration diagrams and data on torque and peak loads for different layouts of a pumping unit are presented and analyzed. The peak torque values obtained indicate that for the conditions investigated the beam-working centres have little effect on torque values, as the indicated result is a reduction in the peak torque load. As this investigation did not include all types of unit geometry, definite dimensional limitations cannot be drawn, but it should be noted that relatively long pitmans were used on all machines investigated. These long pitmans were used because it is believed that the length of the pitman is one of the predominating factors affecting the operation of the pumping unit. This belief is based on the fact that the motion of the upper end of the pitman would be simple harmonic if the pitman length were infinite.

Although the lowest acceleration rate was found on geometric layouts with long working centres, the difference between the values of the acceleration factors is small. The effect of acceleration on well load is not a definite quantity. According to the best theory, polished rod acceleration is unimportant, because its contribution to the total well load is very small. The only disadvantage of the short-beam long-stroke

pumping unit is the fact that it is limited to wire-line-type beam hangers. The wire-line-type beam hangers will not give satisfactory service if the well load becomes zero at any point in the pumping cycle. This fact places a definite limitation on the pumping speed, because when an oil-well is pumped at a speed exceeding about 26–30 spm, the well load will be zero at some point in the stroke, and wire-line failures will occur. If a pumping unit with a short walking beam is applied to the problem of pumping an oil-well at a slow speed with a long stroke, however, this disadvantage will not exist.
A. H. N.

41. Significance of Declining Productivity Index. C. V. Millikan and H. Beardmore. *Oil Gas J.*, 29.9.45, **44** (21), 123. See Abstract No. 1295 (1945). A. H. N.

Oilfield Development.

42. World's Oil Position as the War Ends. R. Sheldon. *World Petrol.*, Sept. 1945, **16** (10), 52.—A table gives the production to date, the present proven reserves, the probable ultimate resources, and the division of the ownership of the oil in U.S.A., the Caribbean Basin, the rest of South America, Canada, Alaska, Russia; rest of Europe, Middle East, Africa, Southwest Pacific, and the rest of Asia.

The world production to date exceeds 46,600 million brl; proven reserves total 63,000 million brl, 32% of which are in U.S.A., 42% in the Middle East, 9% in Russia, and 13% in the Caribbean Basin. U.S.A. owns 57·7% of the world's reserves, Russia 9%, and the British and Dutch together 28·7%. G. D. H.

43. Average Well Depth Greatest in History. Anon. *Oil Wkly*, 30.7.45, **118** (9), 50.—In the first half of 1945 the average depth of the 12,142 U.S. completions was 3568 ft compared with 3314 ft for the whole of 1944. Sharply increased development in California, and in Texas and other States in the southwest is mainly responsible for the increased average footage per well in 1945 and 1944.

322 wells completed in South Louisiana in the first half of 1945 averaged 4385 ft each. The Upper Gulf Coast of Texas had an average of 7277 ft/well.

Data on completions, footage, and average depths are tabulated by States and districts, and U.S. over-all figures are given from 1925 onwards. G. D. H.

44. Production Increases 56,440,000 Brl. C. J. Deegan. *Oil Gas J.*, 28.7.45, **44** (12), 124.—In the first half of 1945, Texas, California, Oklahoma, and Wyoming showed substantial increases, while Illinois, Kansas, and Pennsylvania showed declines in output.

Tables give the production by States in the years 1940–44 and in the first halves of 1944 and 1945; the monthly outputs of the Districts of Texas in the first halves of 1944 and 1945; and a list of the Texas fields which have shown substantial rises in production. G. D. H.

45. Completions Near P.A.W. Schedule of 27,000. Anon. *Oil Wkly*, 30.7.45, **118** (9), 58.—In the first half of 1945 completions averaged 467/week, 12·4% more than in the first half of 1944. The number of rigs in action has been consistently higher than in 1941, but worn rigs, less efficient labour, greater depths, etc., have given a lower completion rate. Compared with 1944, completion rates have risen in Texas (26%), Louisiana (40%), Colorado (11%), California (11%), and Michigan (26%).

Tables give the weekly average rate of completing wells and the numbers of active rigs in U.S.A. monthly from 1941 onwards, and completion details in June 1945 and during the first half of 1945. G. D. H.

46. More Wells Proposed by Industry in Second Six Months. H. S. Norman. *Oil Gas J.*, 28.7.45, **44** (12), 118.—There are indications that 15,000 wells will be drilled in U.S.A. in the second half of 1945, thus giving a total for the year in excess of the 27,000 proposed by P.A.W. Over 2500 wildcats are expected to be drilled, compared with 2055 in the first half of 1945.

Data on completion types in the first half of 1945 are given by States and districts, with predicted figures for the second half. G. D. H.

47. Well Completions Increase 12·9 Per Cent First Half of 1945. C. J. Deegan. *Oil Gas J.*, 28.7.45, **44** (12), 121.—12,820 wells were completed in U.S.A. in the first half of 1945. The figure for the first half of 1944 was 11,356. Wildcats totalled 2055. Texas had 3551 completions, 35·6% more than in the first half of 1944; California had 1147 completions and Oklahoma had 1272.

A new pool was opened 2 ml west of Kevin-Sunburst. The Rangely field of Colorado was extended, possibly by 10,000 acres. Elk Hills and Buena Vista Hills were the most active areas in California. Oil-pools were opened at Halsey Canyon, La Habra Hills, and Ramona, and gas-pools at Kirby Hills and North Rio Vista. Eocene production was developed at Capitan, Santa Barbara County.

10 new fields, 7 new pays, and 13 important extensions were made in West Texas. Southeast New Mexico had 5 oil and 1 gas-strike. The Hub, Langsdale, and Sosa fields were opened in Mississippi, and the Falls City gas-field was discovered in Oklahoma. There were 10 new pools in Illinois.

Madison production has been obtained in the Princess-Steveville area of Canada.

The well-completion results in the first half of 1945 are summarized by States and districts, and similar data are given for wildcat completions. The completion results are compared with those of the first half of 1944 for 9 of the leading States.

G. D. H.

48. Summary of July Completions. Anon. *Oil Gas J.*, 25.8.45, **44** (16), 173.—2312 wells were completed in U.S.A. during July, 1233 finding oil and 251 gas. The completion results are summarized by States and districts, and data are given on rigs, footage, and the numbers of wells in different depth ranges. G. D. H.

49. August Rate of Completions Very Little Above Last Year. Anon. *Oil Wkly*, 17.9.45, **119** (3), 67.—The well-completion rate in U.S.A. in August was 504 per week, 54 per week less than in July. The August 1944 figure was 498. 16,916 wells were completed in the first eight months of 1945, 10·2% more than in the corresponding period of 1944.

In the first week of September the production fell to 4,530,000 brl/day; the all-time peak in mid-July was 4,944,000 brl/day.

A table summarizes U.S. well completion results in August and during the first eight months of 1945, by States and districts. G. D. H.

50. Weekly Well Completions. Anon. *Oil Gas J.*, 8.9.45, **44** (18), 129; 15.9.45, **44** (19), 135; 22.9.45, **44** (20), 337; 29.9.45, **44** (21), 157; 6.10.45, **44** (22), 133; 13.10.45, **44** (23), 161.

Week Ended 1945	All Wells Oil	All Wells Gas	All Wells Total	Wildcats Oil	Wildcats Gas and Distillate	Wildcats Total
Sept. 1	258	56	476	7	5	61
,, 8	284	56	557	16	2	91
,, 15	303	54	536	10	4	76
,, 22	308	67	596	8	5	90
,, 29	323	58	583	15	1	88
Oct. 6	283	57	552	10	2	92

51. South American Exploration Activity in Full Swing. K. J. Langley. *Oil Gas J.*, 15.9.45, **44** (19), 60.—Colombia produces 65,000–70,000 brl/day from about 1400 wells in three areas. Barco gives 17,000, and De Mares and Casabe, in the Middle Magdalena Valley, 45,000 and 8500 brl, respectively. 16 wildcats are drilling, and at El Dificil high-gravity oil has been found. 2 San Martin is reported to have struck oil east of the Andes.

Venezuela produces about 960,000 brl/day, one-third of this from Eastern Venezuela. Drilling 9–12 ml out in Lake Maracaibo is not considered impossible. Three new refinery projects of 40,000–50,000 brl each have been announced.

Trinidad yields about 60,000 brl/day from some 7000 wells. There are two important refining units with a combined capacity of 75,000 brl/day.

Four fields in the State of Bahia, Brazil, produce about 800 brl/day. There are 5 small refineries, having a total throughput under 2000 brl/day. Uraguay possesses a 6000-brl refinery. Argentina produces about 64,000 brl/day from 4100 wells. Comodoro Rivadavia gives 46,000 brl/day from 3300 wells. There are 19 refineries capable of processing a total of 100,000 brl/day. Bolivia has 6 small fields, about 950 brl/day being obtained from the 3 in operation. Chile produces 40,000 brl/day, 33,000 brl/day coming from the La Brea–Parinas area. Considerable interest is being shown in Peruvian areas east of the Andes. Ecuador yields about 7500 brl/day from 900 wells. Tests are being drilled east of the Andes. G. D. H.

52. Venezuelan Production Record—958,394 Brl Daily. Anon. *Oil Gas J.*, 28.7.45, **44** (12), 112.—In the week ended July 16 the Venezuelan oil production averaged 958,394 brl/day. Creole produced 506,445 brl/day, Shell 235,966 brl/day, Mene Grande 171,212 brl/day, and Consolidada about 29,000 brl/day. G. D. H.

53. Creole Venezuelan Well Completions Hold Steady. Anon. *Oil Gas J.*, 1.9.45, **44** (17), 46.—In July Creole completed 20 oil-wells, 1 gas-well, and a dry hole in Venezuela. The daily production reached the average of 504,163 brl, 58,441 brl/day more than in June. The Lake Maracaibo area gave 340,393 brl/day. G. D. H.

54. Colombian Exploration Costs are Revealed. Anon. *Oil Gas J.*, 11.8.45, **44** (14), 78.—Figures for one company's exploration costs show that drilling expenses for each of 13 wildcats averaged $387,000, excluding capital investments, giving a cost of $65·7 per foot. Out of total exploration costs of $11,000,000 in 11 years, surface exploration (geology, geophysics, and mapping) accounted for $3,180,000.

G. D. H.

55. War Problems of Canadian Oil Industry. F. G. Jackson. *World Petrol.*, Sept. 1945, **16** (10), 66.—In 1944 Canada produced 8,500,000 brl of oil, but her military and essential civilian requirements were 71,000,000 brl.

Early in the war an organization was created to control the Canadian oil industry. The constitution and aims of this organization are briefly noted. 2 alkylate and 3 cumene plants were built. Wherever possible refineries were modernized, and a 10,000-brl refinery was erected at Clarkson, Ontario. A synthetic rubber plant was built. A number of lake- and ocean-going tankers were constructed.

Increased oil requirements and declining domestic crude production caused steps to be taken to promote exploratory drilling. Leasing and royalty regulations were revised, tax concessions granted, a geophysical exploration programme formulated, and funds were set aside for investigating the Athabaska tar-sands. Many test-wells were drilled, but few were successful. A well in Hillsboro Bay, Prince Edward Island, has reached a depth of 12,800 ft. Little production was obtained from a few shallow wells drilled in western Ontario, and the same was true of Saskatchewan. 54 producing wells were completed in the Norman Wells field. Several wildcats on other structures were dry.

Heavy crude was found at Vermilion and Taber. Conrad is capable of commercial production of 25°-gravity oil, and Lloydminster shows promise of heavy oil production. These fields are, however, unlikely to offset the production decline at Turner Valley. 35°-gravity production has been obtained in the Devonian at Princess, and distillate in the Mississippian at Jumping Pound. Jumping Pound is structurally similar to Turner Valley, and may be a major find.

Turner Valley has produced 73,000,000 brl. Estimates of the ultimate recovery range 105–200 million brl.

It seems clear that only a negligible amount of petroleum products can be obtained from the Athabaska tar-sands within the immediate future, and these only at a cost above that of the present world petroleum supplies.

Gasoline rationing was instituted in Canada in 1942. G. D. H.

56. Alberta Gas Resources. F. K. Beach. *Oil Wkly*, 17.9.45, **119** (3), 47.—About 20–25% of Alberta's total population is served with natural gas for domestic fuel. The Calgary–Lethbridge supply system is connected to Turner Valley, and to Bow Island and Foremost; Jumping Pound and Princess may be connected later. In 1944 the consumption was 23 million M.c.f., 11 million M.c.f. being consumed by the Alberta Nitrogen Plant and fields. 18 million M.c.f. was lost in scrubbing and extraction of natural gasoline and in other ways. Turner Valley reserves are estimated at 300–400 million M.c.f. Bow Island and Foremost each have 15–20 million M.c.f. of reserves. Princess produces from the Sunburst sand of the basal Lower Cretaceous. Its reserves may be 40–100 million M.c.f. In the Sweetgrass Hills area a 50,000-M.c.f. well was completed in 1924, obtaining gas from 3 horizons. The lowest was in the top of the Palæozoic. 2 other wells failed to give gas, but a big gas-flow was found some distance east. It is thought that the large batholith which uplifted the Sweetgrass Hills gave rise to many dykes and sills which have broken up the region into small pockets, so preventing extensive migration, but increasing porosity.

Jumping Pound has 1 producer. It is considerably deeper than Turner Valley, and is unlikely to contain as much gas.

In 1944 the Edmonton system consumed 7 million M.c.f. of gas. Estimates of the reserves of the Viking–Kinsella area range 205–600 million M.c.f. An area running north from the town of Athabasca has shown large gas-flows in wells drilled for oil. It is probable that there is a good reserve, if needed, for Edmonton.

There is a proposal to extend the Viking–Edmonton system as far south as Red Deer.

There are few records of gas consumption for the Medicine Hat–Redcliff area, but the present consumption may be 4 million M.c.f. per year. The limit of the field seems to have been determined in the south and southeast, but not in other directions. Most wells have penetrated only the top of the gas-sand. No sand cores have been taken. It is hoped that the reserves may be 75–125 million M.c.f.

There are other small gas-distributing systems in Alberta. G. D. H.

57. 1944 Middle East Oil Output at 155 Million Barrels. Anon. *Oil Wkly*, 24.9.45, **119** (4), 79.—During 1944 the Middle East oil production was 155 million brl, 30 million brl more than in 1939. The expansion of refining facilities makes it likely that the production in 1945 will exceed 200 million brl. The Saudi Arabian production is expected to reach 40–50 million brl during the next year. Oil may soon be shipped from Kuwait. G. D. H.

58. Anglo-Egyptian Nearly Doubled Yield during War. Anon. *Oil Gas J.*, 1.9.45, **44** (17), 46.—During 1944 Anglo-Egyptian Oilfields produced 8,048,540 brl of oil, compared with 4,355,280 brl in 1939. During the past 6 years 98 wells, including 3 dry holes, were completed at Ras Gharib. The average depth was 2292 ft. Hurghada produced 881,640 brl in 1939 and 474,225 brl in 1944.

The company drilled 7 unsuccessful wildcats from 1939 to 1944. Two small producers were drilled in the old Gemsah field. Other companies drilled 18 unsuccesful wildcats in the same period.

Production rates at Ras Gharib have been excessive, and nearly 72 million brl has been produced. G. D. H.

59. One Netherland Well Yields 260 Brl Daily. Anon. *Oil Gas J.*, 15.9.45, **44** (19), 66.—1 of the 3 wells in Drenthe Province is yielding 260 brl/day. The first producer was completed at about 2500 ft. G. D. H.

60. Texas Oil Man Visits England's New Oilfield. E. J. Muth. *Petrol. Engr*, Sept. 1945, **16** (13), 191.—The search for oil in England has involved the drilling of 380 wells of varying depths, in testing 45 separate structural areas. 250 of the wells are producers. Nearly 3 million brl of oil of gravities ranging 19·2–40·1° has been obtained.

The Eakring field is a simple dome with minor faulting and several, sometimes lenticular, oil-sands. Including North Eakring and Duke's Wood, it covers an area 2 ml by ½ ml. All wells are completed in 2 or more of the 4 sands. The oil-horizons are in the Millstone Grit and basal Lower Coal Measures. Porosity ranges up to 20%, and permeability 2–1000 md. The well-spacing is uneven, but averages one well to 2–3 acres.

Drilling has been carried out by heavy-duty steam and diesel rigs, and by light-weight units.

Gas/oil ratios have ranged 56–112 cu ft/brl, and initial pumping production 7–375 brl/day. The gas production is 175,000 cu ft/day. Wells declined rapidly in output until the saturation pressure of the crude was reached.

The high wax content of the oil is troublesome, especially in the top 800 ft. of the wells. Consequently the top 1000 ft of tubing has been insulated with wooden insulators, and this tubing can be heated electrically to 110° F. by a portable generator, to remove the wax.

Water now represents 60% of the total fluid production. The pumps are electrically driven. G. D. H.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

61. Recent Progress in the Mitigation of Underground Corrosion. K. H. Logan. *Oil Gas J.*, 13.1.45, **43** (36), 78.—A brief account is given of the activities of various institutions, societies, and industrial organizations in combating corrosion, particularly as applied to underground pipe lines. The methods employed are discussed under three sections : (*a*) the use of materials which offer greater resistance to corrosion than ordinary ferrous materials—*e.g.*, small percentages of copper, nickel, or chromium in a ferrous alloy impart increased resistance to attack, probably because of formation of a protective film ; such films are seldom continuous and their breakdown results in large cathodic and small anodic areas with accelerated pitting. Copper or alloys rich in copper are more resistant to all soils than ferrous alloys, except those containing high amounts of nickel and chromium. A cement-asbestos pressure pipe is reported, after 4 years exposure to different acids and alkaline soils, to have acquired a slightly higher crushing and bursting strength. (*b*) Cathodic protection. The various methods of its application and different methods of testing are outlined. In sulphur containing earth anodes remain effective until they are consumed, in cases where a higher potential difference is required than obtained between zinc and iron, magnesium can be used instead of zinc. (*c*) Protective coatings. Tests made on lines coated with coal-tar-base materials and asphalt-mastic are recorded, and by the use of the Stearn's Electronic Holiday Detector (briefly described) a marked improvement in protective coatings has been made, the detector showed only one unprotected spot, per mile, one year after the application and laying. W. H. C.

62. Corrosion Problems in the Petroleum Industry. 4. Zinc as an Anti-Corrosive Pigment. Some Divergent Views. A. H. Stuart. *Petroleum*, Oct. 1945, **8** (10), 197.—The corrosion of ferrous metals under atmospheric conditions is an electrolytic phenomenon, but the behaviour of zinc and graphite pigments indicates that the problem is complex. Zinc associated with iron, as in an electric cell, will inhibit its corrosion, whereas graphite will promote it, provided the exact conditions are obtained.

In zinc galvanizing a layer of iron–zinc alloy is formed between the iron and the outer surface of the zinc with different properties from those of zinc ; being very brittle. Hence water entering through a crack provides conditions for electrolytic action, the extremely thin film of zinc is soon dissolved and protection ceases.

Tests with zinc and steel in water demonstrate that protection is afforded either by absorption of dissolved oxygen by the zinc, or by zinc ions saturating the water. This second type of phenomenon may be responsible for the many cases where zinc gives protection. Doubt exists as to the anti-corrosive efficiency of zinc pigments, since paint films have a very high electrical resistance. Electrolytic action is impossible if zinc dust is used, as the metallic particles are encased in a self-insulating film, and the chances of the zinc exercising adequate protection are very low. A convenient film for experimental investigations was made from " Aquadag," zinc dust, and water carrying gelatine, the film being electrically conducting.

Sheet iron and steel rods, painted with this mixture, and exposed to water, were free from rust, whilst untreated metals were effected. Such tests showed that zinc is an efficient protective agent provided it is free to exert its electrical and chemical properties. G. A. C.

63. Evaluation Curves. W. L. Nelson. (The Refiners Notebook No. 26.) *Oil Gas J.*, 13.1.45, **43** (36), 91–92.—The percentage yields of products, or fractions, obtainable from a crude may be assessed from the curves plotted from distillation data, and may be expressed in any suitable terms, such as vapour pressure, gravity, octane number, sulphur, etc.

Two convenient methods for their construction are described, and are illustrated by graphs from the tabulated data on the properties of fractions from distillation, and properties of blends: (a) the instantaneous, stream, differential or mid per cent data—*i.e.*, the property of the stream at any instant during the distillation; (b) the cumulative, yield, integral, or summation data representing the average properties of an accumulation of the distillate—*i.e.*, of a cut or fraction between two percentages of the crude oil.

The graphs are shown in the form of (a) mid per cent and yield evaluation curves; (b) isoproperty continuous curves, which show the yields on the ordinate and the mid per cent data along a 45° line.

Refiners Notebook No. 31 will also indicate the use of these curves under the title Realization. W. H. C.

Distillation.

64. Extractive and Azeotropic Distillation. I. Theoretical Aspects. M. Benedict and L. C. Rubin. *Nat. Petrol. News Tech. Sect.*, 5.9.45, **37** (36), R.729.—Extractive and azeotropic distillation processes by which the separation of closely boiling hydrocarbons may be obtained, are defined and described. In both methods a solvent is added to increase the volatility between the key components, and the quantity added must be such that an appreciable concentration of the solvent exists in the liquid phase throughout the column. In azeotropic distillation the function of the solvent is to form a constant-boiling mixture with one or more of the key components, and it consequently forms part of the overhead distillate. In extractive distillation the solvent selected is less volatile than the key components of the mixture to be separated, and for effective separation must be added at the top of the column.

Applications of the two methods and examples are discussed and described, and flow diagrams are given showing the extractive distillation of a *n*-butane–butene mixture with acetone as the solvent, and the azeotropic distillation of mixtures of hydrocarbons, (1) with which the solvent is partially miscible with the overheads, and (2) with which the solvent is miscible with the overheads, and therefore requires additional facilities for separating the solvent from the overheads.

Graphical and algebraic methods are described for ascertaining the changes in concentration of the solvent and the components in the different sections of the system employed. In azeotropic distillation the distribution of the solvent is determined by the phase relationships in the mixtures of solvent and key components; in extractive distillation the distribution of the solvent throughout the column is determined by heat and charge input, as in a conventional absorber.

The main advantages of the two processes are:

Extractive distillation: (1) The heat input for a given separation is lower because the solvent is not distilled over; (2) a greater variety of solvents are available because the precise nature of phase relationships in mixtures of solvent and key components is not critical to the success of the process.

Azeotropic distillation: (1) When the proportion of overhead is small, less solvent is required; (2) in batch processes all the solvent required may be added to the system at the commencement of distillation. W. H. C.

65. The Refiners Notebook. Stripper and Bottom Temperatures. W. L. Nelson. *Oil Gas J.*, 21.7.45, **44** (11), 147.—With few exceptions, bottom temperature is dependent on the following: (a) inlet temperature to stripper; (b) self-cooling by evaporation; (c) heat losses through insulation; and (d) cooling by steam. Methods of calculating these are described and examples and graphs are given. T. M. B. M.

Cracking.

66. First 3-Coil Thermal Cracking Unit in U.S. Goes on Stream at Sunray Refinery. Anon. *Nat. Petrol. News Tech. Sect.*, 5.9.45, **37** (36), R.676.—A brief account is given of the rebuilding of the original plants for topping and a one-coil Dubbs unit installed in 1934, to which in 1937 was added a second cracking coil, and recently a third furnace for thermal cracking, thus increasing the capacity from 4500 b/d to 7500 b/d. The revamped system now consists of heaters for heavy and intermediate feed-stocks operating at 900° and 920° F. and 600 and 500 psi, respectively. These streams join as they enter the top of reactor No. 1, working at 300 psi, passing out from the bottom and joining the stream from the Light oil-furnace operating at 1020° F. and 500 psi on entering the top of reactor No. 2, which is operated at 250 psi. The stream from the bottom of reactor No. 2 is passed to a flash-chamber, operated at 105 psi, down which a stream of preheated crude oil flows over side-to-side trays for refluxing, a side stream from under the trays feeds the heavy oil-heating coil, and the bottoms flow out through an exchanger to heavy fuel-oil storage. The overheads pass on to the pressure distillate tower operated at 60 psi, entering low in the column, and pass through 4 bubble, 8 side-to-side, and 16 bubble trays to the overhead. A side stream is taken at mid-tower as the feed of the light oil coil and the residue from the bottom forms the feed of the intermediate heating coil. The overhead stream of pressure distillate preheats the crude stream serving as reflux in the flash-chamber before condensing, and is further processed in the stabilizing and polymer units. The flash-tower has the dual function of crude topping (preparing heavy cracking stock) and as a conventional flash-chamber, and the fractionator separates light and intermediate stocks for the other two cracking stocks and a pressure distillate as mentioned, the whole providing exceptional flexibility of operation and control through the use of the three heaters. The subsequent processing of the pressure distillate into fractions for the production of polymer gasoline, codimer, and straight-run naphtha, for aviation gasoline blending, is briefly described. The topping unit comprises two crude distilling columns and one furnace containing two separate coils, each processing 2500 b/d of crude oil. Each column produces 550 and 300 b/d and 300 and 275 b/d of gasoline and tractor distillate, respectively. The residuals (reduced crudes) are combined by passing through a heat-exchanger which preheats the oncoming crude to the second tower; the crude feed to the first tower is preheated in the base of the first tower. Each crude feed-stream is passed through a salt settler, after preheating, before entering the respective furnace. Operating data, net plant yields based on the charge of the two crudes processed and the properties of the stabilized pressure distillate are given. W. H. C.

67. **Cracking of Latin American Crude Oils. 7. Argentine Oils.** G. Egloff. *Oil Gas J.*, 13.1.45, 43 (36), 73.—Crude oils from the Comodoro Rivadavia district vary in character from paraffinic to asphaltic base, their gravities range from 0·8708 to 1 at 60° F. The properties of, and distillation of typical Argentine oils (*a*) a light paraffinic crude, and (*b*) a mixed base crude, from the region noted are given. Two-coil cracking operations on the reduced crude (*a*) and on the whole crude (*b*) were made under the following conditions: (*a*) at 940° F. and 200 psi in the heavy coil, and 970° F. at 250 psi in the light coil, and under the same charging rates, to give 400° F., end-point gasoline and No. 6 A.S.T.M. fuel. The yields were 40·5% gasoline of A.S.T.M. octane rating 67, containing 0·04% sulphur; 53·9% residuum, and 5·6% loss. The cracked gases contained 11·9% propylene, 1·7% *iso*butane, and 4·0% *n*-butane, from which 2·8% polymer gasoline or 5·1% alkylates could be produced. (*b*) Three runs were made at slightly varying temperatures and about the same pressures; the relative charging rates were: (1) 3·05; (2) 3·19; (3) 2·21. The gasoline yields were 28·9%, 32·5%, and 36·3%, of A.S.T.M. octane values, 72, 72, and 71, respectively. Operation (3) gave gases containing 17·9% C_4 and higher olefins which would give 2·7% polymer gasoline, and the cracked residuum from this operation, 61·6%, had a Saybolt Furol viscosity at 122° F. of 272 sec. Gasoline from operation (2) was treated by sweetening and also by liquid-phase clay, after which the following results were obtained:

Treatment	None	Sweetened	Liquid-phase clay
Reid vapour pressure, psi	8·2	7·8	7·0
Gum, copper dish, mgr/100 ml without inhibitor	299	349	9
With 0·025% No. 1 inhibitor	—	236	8
Induction period, minutes, without inhibitor	110	85	240
With 0·025% No 1 inhibitor	—	145	450

Four runs were made on a topped highly paraffinic Comodoro Rivadavia crude in the two-coil unit, to produce gasoline of 392° F., E.P. and a fuel residue of varying gravities. The temperatures and pressures used were 920–950° F., at 150 psi heavy coil, and 960–970° F. and 300 psi light coil. The yields and product qualities are tabulated. All the gasolines had A.S.T.M. octane values of 69. Run No. 3 produced

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52·2% gasoline, which had an end-point of 402° F. and a Reid vapour pressure of 9·8 psi, and 31·2% residuum of 169 seconds Saybolt Furol viscosity at 122° F., with a cold test of 55° F. and 16·6% gas and loss. The gasoline after the treatments stated gave the following results :

Acid, lb/brl	None	None	1	4
Sodium plumbite	None	3	1	1
Gum, copper dish, mg/100 ml without inhibitor	154	189	12	1
With 0·025% No. 1 inhibitor	—	132	1	1
With 0·05% No. 1 inhibitor	60	—	—	—
Induction period, minutes without inhibitor	110	90	160	265
With 0·025% No. 1 inhibitor	—	160	450	890

The Sosneado crude from the Mendoza province is an asphaltic base oil. This crude was cracked in a single-coil unit at 941° F. and 151 psi to produce a 392° F. E.P. gasoline and a heavy residuum, and yielded 31·5% gasoline, 60·9% residue with 7·6% loss. The gasoline contained 0·27% sulphur and 164 mg/100 ml, gum; it had an octane value of 83. The residue had a Saybolt Furol Viscosity at 122° F. of 2594 sec. Treatment with 10 lb/brl acid gave a 7% loss and reduced the sulphur content to 0·16%, and gum content to 18 mgr/100 ml. Its octane value was 79. W. H. C.

Chemical and Physical Refining.

68. Russians Recover 90–95% of Sulphuric Acid from Sludge, Obtain Valuable By-products. Anon. *Nat. Petrol. News Tech. Sect.*, 5.10.45, **37** (36), R.688.—The information contributed has been translated from various Russian literature published in 1938 and 1941–42, and shows that 90–95% can be reclaimed from acid sludge, and its concentration raised to 80% or higher by various processes. Valuable by-products, including naphthenic acids, sulpho-naphthenic acids, fuel oil, and sulphur dioxide, can be obtained from the organic portion of the sludge. Likhushin states that the organic material from a water-diluted sludge can be extracted by solvents, such as the residue from re-running pressure distillates, xylene, or dichlorethane. Pre-treatment of residual oils with sulphonic acids before treatment with sulphuric acid makes possible subsequent recovery from acid sludge of up to 81% of acid up to 30% strength, and leaves a fuel almost sulphur free. A Soviet patent of 1942 relates to an electrolytic method by which an acid of satisfactory colour is obtained from a sludge and is afterwards concentrated to 92% by evaporation. Acid sludge from the treatment of benzene and toulene from cracking operations has been used for refining xylene for over 13 years at one Russian refinery, and can be used as the first acid wash of benzene and toulene with a saving of 20–25% of fresh sulphuric acid. From the literature it appears that research is directed towards the production of drying oils, detergents, alcohols, demulsifying agents, and electrical insulating materials from acid sludge organic matter. W. H. C.

69. *iso*Pentane Produced by Liquid-Phase Isomerisation. L. S. Galstaum. *Chem. Met. Eng.*, 1945, **52**, 109.—Since the latter half of 1944 the Tide Water Associated Oil Co. has successfully operated a plant for the isomerization of pentane. The reaction, which is conducted on a contactor provided with efficient stirring equipment, is catalyzed by $AlCl_3$ dissolved in molten $SbCl_3$. HCl to the extent of 5 mol-% on the hydrocarbon feed, is also fed in with the catalyst. The reaction temperature is 200° F. and pressure 300 psi. H_2 representing a partial pressure of 60–70 psi is introduced into the system to suppress cracking. Above the level of the mixture in the contactor is situated a baffle above which the liquid is quiescent. Undissolved catalyst separates out from this layer in the form of a dense phase, and returns to the turbulent zone through slots in the baffle. In operation, a small amount of $AlCl_3$–hydrocarbon complex is produced. To prevent the accumulation of the latter a small volume of catalyst is continuously removed from the system and the $AlCl_3$ and $SbCl_3$ extracted from it by means of hot pentane feed, in a catalyst scrubber column. Reacted pentane mixture plus H_2 and HCl are separated from the $AlCl_3$–$SbCl_3$ solution by distillation, the latter being fed back to the system. HCl containing some hydrocarbon is next separated from the pentane in an HCl stripper (as a top product) and returned to the reactor, whilst the bottoms are cooled and soda-washed to yield the *iso*pentane. The equipment in which pentane, catalyst complex, and HCl are handled together is constructed of C-steel, but in the contactor itself, in which turbulent conditions exist, the equipment must be Ni-clad. All valves in catalyst service are of Hastelloy trim.

L. B.

Special Processes.

70. British Research on Petroleum Substitutes. 8(2). Methane. R. M. Bridgwater. *Petroleum*, Oct. 1945, 8 (10), 183.—The Lurgi process for gasifying lignite in steam and oxygen at 20 atm. yields a town's gas with a calorific value of 450–500 BTU. British coals gave a satisfactory product at 900–950° C., the yield depending on rate of heating, hydrogen rate, and total pressure. Both high- and low-temperature cokes gave similar yields under optimum conditions of hydrogenation temperatures. Researches conducted on a small-scale refractory lined steel tube heated in an electric furnace indicate that coal may be so hydrogenated so that just sufficient coke is left to be gasified in steam and oxygen to give a gas containing enough hydrogen to effect the hydrogenation. Methane has a calorific value 15% higher than Grade I petrol, and a very much higher octane number, but there are difficulties of the use of methane as a fuel in specially designed engines having compression ratios exceeding 10 : 1, one being the availability of supplies, and another in the method of storage of the gas, the weight of gas-cylinder equipment being considerable. However, the weight of container and liquid for liquid methane might amount to only 10–12 lb/equivalent gal of petrol, and this method of transport is suitable for vehicles in use for long periods each day. An Austin 4-cyl 12 hp van operated successfully on bottled gas containing 58% methane.

G. A. C.

71. Fischer–Tropsch Commercial Process Announced by Kellogg. A. L. Foster. *Oil Gas J.*, 13.1.45, 43 (36), 48.—The exploitation of the Fischer–Tropsch synthesis is possible according to an announcement made by M. W. Kellogg Co., who are in a position to provide plants necessary for the synthesis of hydrocarbon oils from carbon monoxide and hydrogen produced from the methane from natural gas by catalytic oxidation. It is stated that one of the major difficulties surmounted was the temperature control of the reaction, which is exothermic in character, and that motor gasoline obtained from the products of the synthesis has a clear octane rating of 75 A.S.T.M., and 83 by the research method, which by the addition of 1 cc lead tetraethyl is increased to 80 and 89, respectively. The yields are up to 80%, compared with European yields of 30–40% with octane values around 25. The cost is stated to be 5 cents/gal, on the basis that 1000 cu ft of gas costs 5 cents, with a plant depreciation of 10% per annum. W. H. C.

72. The Preparation of Olefines from Aldehydes and Ketones. R. H. Griffiths. *J. Chem. Soc.*, 1945, 715.—Olefines may be prepared by passing the vapours of the corresponding aldehyde or ketone, together with excess hydrogen, over a molybdenum oxide catalyst at 400°. Both the temperature of catalyst and quantity of hydrogen must be controlled to ensure no further hydrogenation. The method has been found applicable in the preparation of styrene, heptene-1 and heptene-3. B. H. K.

73. Heat Deactivation of a Palladium Catalyst. D. T. Gibson. *J. Chem. Soc.*, 1945, 713.—A heat-deactivated palladium–barium sulphate catalyst is described which has been used to hydrogenate ethynyl*cyclo*hexanol at atmospheric pressures to form the corresponding ethylenic alcohols in good yield. B. H. K.

Products.

Chemistry and Physics.

74. Studies on Phosphorylation, Part II. Reaction of Dialkyl Phosphites with Polyhalogen-Compounds. F. R. Atherton, H. T. Openshaw, and A. R. Todd. *J. Chem. Soc.*, 1945, 660.—A reaction of dibenzyl phosphite with strong amine in the presence of carbon tetrachloride, to form stable aminophosphonates, has been described. The reaction has general application, and the carbon tetrachloride may be replaced by hexachlor- or pentachlorethane. Evidence indicates that, unlike trialkyl phosphites, which cannot be used under these conditions, dibenzyl phosphite has a co-ordinated phosphonate structure. B. H. K.

75. **The Present Era in Combustion.** D. T. A. Townend. *Chem. and Ind.*, 1945, **44**, 346–350.—This general survey of modern theories of combustion describes how industry may benefit from recent developments. It is indicated how heats of combustion could be used to calculate equilibrium constants using more accurate methods than provided by the Nernst equation. Factors determining slow combustion and spontaneous ignition, which had hitherto been little understood, were now becoming less obscure since the development of the new theory of chain reactions due to pioneer work of Semenoff and Hinshelwood. In a particular reaction activated species were at first considered to be energized molecules, but the discovery of photo sensitization led to the view that they were probably atoms or free radicles. The author further discussed variations of ignition temperature with pressure and the phenomena of cool flames, normal flames, and violent explosions with their corresponding inflammability ranges. Present theories of the spontaneous oxidation of coal postulated the formation of organic peroxides. Finally, mention is made of the luminescence phenomenon associated with refractory oxides under flame impact. G. P. K.

Analysis and Testing.

76. **Gum Content of Distillate Diesel Fuels.** L. W. Dickey and R. Henry. *Ind. Eng. Chem.* (*Anal.*), **16** (11), 710–712; **Determination of Gum Content of Diesel Oils.** Anon. *Oil Gas J.*, 13.1.45, **43** (36), 84.—The procedure of the test is described; briefly it consists of measuring 25 ml of the sample into a 50 ml Erlenmeyer flask, and connecting it to a condenser and receiver. With the flask in an oil-bath, the sample is evaporated by a stream of inert gas at the rate of 250 ml per minute, under a reduced pressure of 50–55 mm mercury. The bath is maintained at such a temperature that the sample will be evaporated to dryness in 45 ± 5 min. This temperature will generally be 150° F. below the 90% point of the A.S.T.M. D.158 distillation method. After this period of heating the flow rate is increased to double, and the temperature is increased 50° F. for 10–15 min. The pressure is allowed to become normal, the flask is removed and 25 ml of a 50 : 50 mixture of carbon tetrachloride and acetone is added, and then evaporated off on a water-bath. The flask is again connected for vacuum operation on the oil-bath, under the same conditions for 15 min, after which it is removed, cleaned ,dried, and weighed. Mg gum per 100 ml = Mg gain in weight $\times$ 4. By varying the temperature employed as defined, the pressure given is adequate for the evaporation, in about 1 hr, of samples varying in respect to their distillation range. The addition of the mixed solvents eliminates hold-up of evaporation due to " skin " formed by the gum, and secures reproducibility of results. An accelerated gum test very similar to the U.S. Government test for aviation fuel has been adopted by the authors. The test has given reproducibility with samples containing up to 1400 mg gum per 100 ml. W. H. C.

77. **Mercurous Perchlorate as a Volumetric Reagent for Iron.** W. Pugh. *J. Chem. Soc.*, 1945, 588.—The quantitative reduction of ferric thiocyanate to the colourless ferrous salt with mercurous perchlorate has been suggested as a volumetric procedure for the estimation of iron. Solutions of mercurous perchlorate reagent are found to be stable and the colour change at the end-point is sharp. Although results are said to be accurate for estimating high iron contents, no indication of the applicability of the method to determination of small quantities of iron is given. B. H. K.

Lubricants.

78. **Lubrication Vade Mecum. 3(3). Alphabetical Index of Machines.** E. W. Steinitz. *Petroleum*, Sept. 1945, **8** (9), 178.—The alphabetical index of machines is completed in connection with the lubrication charts on classification of machinery and uses.

G. A. C.

Bitumen, Asphalt and Tar.

79. Bitumen and the Bitumen Industry with Special Reference to Asphaltic Bitumen. 3(2). Properties and Composition. J. S. Jackson. *Petroleum*, Aug. 1945, **8** (8), 150.—The discussion of some of the more important tests relating to the properties of bitumen, and their significance, is continued.

Indication of the composition is given by solubility in carbon disulphide, benzene, carbon tetrachloride (highly carbonaceous matter, impurities, etc.), and petroleum spirit (asphaltenes).

The Fraas breaking-point apparatus has been developed to test the behaviour of bitumen at low temperatures and determines the temperature at which a film of bitumen will crack on binding. The " Loss on Heating Test " gives a measure of the volatility of any bituminous product when heated for 5 hr at 163° C. in a specially designed oven; the test including the determination of the penetration after heating. Microscopic wax crystals have been observed in bitumens, but the amount normally occurring is quite small, and is determined by the Holde method, which involves destructive distillation.

Knowledge of the very complex composition of bitumen is limited, and methods of determination resolve themselves into breaking the product down into arbitrarily defined groups of hydrocarbons, such as asphaltenes, resins, and oils, a particular procedure being that of Strieter. A table is given with the Strieter analyses of some typical bitumens. Resinous bitumens, referred to as Albino bitumens, are usually light in colour.

Asphaltenes contribute both to the structure and hardness of bitumens, whilst asphaltic resins impart to the bitumen the characteristic property of ductility.

G. A. C.

80. Bitumen and the Bitumen Industry, with Special Reference to Asphaltic Bitumen. 4(2). Asphaltic Bitumen in Road Construction. J. S. Jackson. *Petroleum*, Oct. 1945, **8** (10), 190.—Cutbacks, spread at the rate of 6 sq yd to the gallon, followed by a dressing of dry, hard, tough chippings, are extensively used for the surface-dressing of roads under dry atmospheric conditions. The volatile flux quickly evaporates, the viscosity of the binder increasing, and, after rolling, a hard-wearing carpet is formed.

Using a cutback, or a soft grade of bitumen, as binder, thin chipping carpets are now constructed with a life equivalent to three or four surface dressings.

Control is essential for the success of these processes. Tests on portions of the finished road carpet indicate whether the correct amounts of the various constituents are present, and the properties of the constituents can be examined. The bitumen is recovered by a solvent such as carbon disulphide, and all traces of this must be removed after extraction, and apparatus has been devised to this end.

The development of bitumen emulsions enabled a " cold " process to be used. The " batch " method of preparation soon led to the use of a colloid mill for the continuous manufacture of the emulsion, the dispersion of the bitumen being mechanical. The emulsifier consisted of a soap prepared from such materials as liquid rosin, oleic, or naphthenic acids.

Specifications are in force for emulsions—for instance, the water content must not exceed 50% by weight.

These emulsions are stable in storage and transport, and resistant to frost, and little sedimentation occurs. They break readily when applied to the road surface, due to the rapid concentration of the emulsion as water is lost by evaporation. These labile (unstable) emulsions are easily applied, and the absence of heat treatment obviates any change in the properties of the bitumen. Bitumen emulsions can be adjusted to suit other forms of road construction, semi-stable and stable varieties being commercially obtainable.

G. A. C.

Special Hydrocarbon Products.

81. The Larvicidal Action of D.D.T. on *Anopheles quadrimaculatus*. J. D. Maple. *J. Econ. Ent.*, Aug. 1945, **38** (4), 437.—It has been shown that D.D.T. acts on anopheline larvæ as a nerve poison disorganizing movement, so that they cannot retain contact with the water surface. Owing to the feeding habits of larvæ, D.D.T. is generally ingested, but death also results from contact with D.D.T. solutions. Small quantities upset nervous equilibrium sufficiently to cause death by drowning, whereas with larger quantities fatal derangement of all nervous reactions takes place.

C. L. G.

82. Larvicidal Aerosols Containing D.D.T. H. A. Jones, C. C. Deonier, R. W. Burrell, and E. F. Knipling. *J. Econ. Ent.*, Aug. 1945, **38** (4), 432.—Laboratory and field tests on anopheline larvæ in water have been carried out with aerosols from D.D.T. in methyl chloride containing fatty acids. Application at the rate of 0·1 lb D.D.T. per acre to the surface of ponds gave nearly 100% larvæ control, a standard aerosol bomb containing pyrethrum and sesame oil in Freon 12 at a dosage of 0·2 lb of pyrethrins per acre gave only 62% kill. Complete control was obtained up to 60 ft from the point of release of the aerosol. It is considered that adaptation to application by air is particularly promising. C. L. G.

83. D.D.T. Sprays Mechanically Dispersed for Control of Anopheline Mosquito Larvæ. C. B. Wisecup, R. W. Burrell, and C. C. Deonier. *J. Econ. Ent.*, Aug. 1945, **38** (4), 435.—Owing to the small dosage of D.D.T. required for control of mosquito larvæ, application by conventional spray methods is not suitable. Tests have therefore been made with mists from paint-sprayer equipment and decontamination-type spray cylinders using solutions of D.D.T. in light solvents and in fuel oil No. 2. Using a power sprayer, 9½ quarts of a 5% solution of D.D.T. in fuel oil (at the rate of 0·15 lb D.D.T. per acre) gave complete control over a swamp area at a distance of 700 ft from the point of application. The prevailing wind is the limiting factor in applications of this type, variable winds reducing the distance controlled to 50–100 ft. If carefully applied, mechanically dispersed mists should be valuable for area treatments where complete coverage of small depressions and pools is difficult to obtain by local treatment.

C. L. G.

84. Toxicity of Distempers Containing D.D.T. S. Barnes. *J. Oil Col. Chem. Assoc.*, Sept. 1945, **28** (303), 181.—Toxicity tests have been carried out on house-flies and bed-bugs in contact with films of distemper containing varying percentages of D.D.T. It was found that a distemper film in which 0·4% D.D.T. had been incorporated after milling was more effective on bed-bugs than those in which the D.D.T. was added before milling, but the kills were much lower than in the case of flies. The addition of D.D.T. as large particles gave better results than when the ground product was added, and the toxicity was maintained for 6 months. It has also been shown that to obtain 100% kill on flies a dry D.D.T. deposit of 0·01 mg/sq cm from a kerosine solution is sufficient, whereas in a distemper 0·4 mg/sq cm is required. Similarly with bed-bugs, a deposit of 0·2 mg/sq cm from a kerosine solution is more effective than a deposit from a distemper containing 1·4 mg D.D.T./sq cm. C. L. G.

85. Grub Control on Dairy Cattle in the North East. J. G. Matthysse. *J. Econ. Ent.*, Aug. 1945, **38** (4), 442.—Excellent control of cattle grubs, particularly warble fly, was obtained with pyrophyllite-cube dusts, containing 1·05% rotenone, while wettable sulphur containing 2·1% rotenone gave lower control, possibly owing to poorer penetration of the latter into the cysts owing to its more hygroscopic nature. Two treatments are recommended, the first about 1 month before the cattle are turned out to pasture, and the second immediately before. Phenothioxine and yam bean gave little control. Spraying the legs of the cattle with D.D.T. solutions, emulsions, or suspensions was found of no value. C. L. G.

Derived Chemical Products.

86. Chemicals in War-time Germany. Part 11. Anon. *Chem. Tr. J.*, 19.10.1945, **117**, 449.—Three plants produced 80,000 tons of synthetic fatty acids, and a fourth was under construction. The acids produced were utilized as follows: formic acid for treatment of fodder silos; acetic and butyric acids for esterification of cellulose; propionic acid, in the form of the calcium salt, as bread preservative; C_5–C_9 acids for production of alcohols for glyptal-type resins; C_5–C_9 acids for Foamite-type fireextinguishers; C_9–C_{11} acids for mineral flotation; C_{10}–C_{18} acids for soap production; C_9–C_{16} acids for synthetic fats; C_{18}–C_{21} acids in the form of salts for lubricating greases, softening agents for leather, and lubricants for plastic mouldings; and the pitch residues after ketonization and hydrogenation for petroleum-jelly substitutes.

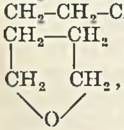
Methane from coke-oven gas was chlorinated to methyl and methylene chloride, chloroform, etc. Vinyl chloride and higher chloro-hydrocarbon derivatives were obtained from acetylene. 25,000–70,000 tons per annum of ethylene was produced from acetylene for ethylene oxide conversion to glycols or detergents of the Leonil, Genapol, or Igepon types. 500 tons per month of synthetic lubricating oil of viscosity 3–6° E. at 100° C. was produced from the polymerization of ethylene.

A number of synthetic insecticides were developed—*e.g.*, difluorodiphenyl trichloroethane (Gix), which was claimed to be more easily emulsified and more effective than D.D.T., though more expensive; phenylchlorophenyl trichloroethane; ω-chloromethyl-4-chlorophenyl sulphone (claimed to be more active than D.D.T. on lice and bugs, though less active on flies), a chlorinated derivative of ethyl chlorbenzene (Lucex—cheaper than D.D.T.); hexa-ethyl ester of tetraphosphoric acid (Bladan—a nicotine substitute); tetranitrocarbazole (Nirosan), and 1-sulphocyano-2 : 4-dinitrobenzene (fungicides); and polychloronitrobenzenes (as soil and seed disinfectants). Diethyl phthalate was used as mosquito repellent and a new product trichloro-acetylchloroethyl amide was being tested. Further moth-repellants of the eulan type—*e.g.*, triphenyl 3 : 4-dichlorophenyl phosphonium chloride—were developed.

A synthetic polymer, vinyl pyrrolidone (Periston), was used as a blood substitute for shock treatment, and new sulpha drugs developed. Higher alcohols were produced from lower aldehydes by condensation and hydrogenation, and used as lacquer solvents. Thiodiglycol for mustard-gas production was obtained from ethylene oxide and hydrogen sulphide in large quantities. Ketones were converted to diazoaminobenzene and azo-substituted compounds as additives for sponge-rubber compounding.

C. L. G.

87. New Fields for Development Offered by Acetylene-Aldehyde Reaction. Anon. *Chem. Industries*, Sept. 1945, **47** (3), 456.—The possibilities of the acetylene-aldehyde reaction, using metal acetylides as catalysts, are discussed, with particular reference to the production of butadiene, of which 20% of the German requirements were made by this method. The production of butadiene, as described by Dr. Reppe of the I.G. in 1940, consists in reacting acetylene with technical 30% formaldehyde producing first propargyl alcohol ($HO–CH_2–OH + HC\equiv CH \longrightarrow HO–CH_2–C\equiv CH + H_2O$) and then butyne 2 diol ($HO–CH_2–C\equiv CH + HO–CH_2–OH \longrightarrow HO–CH_2–C\equiv C–CH_2OH + H_2O$). The butyne 2 diol is then hydrogenated to butanediol $OH–CH_2–CH_2–CH_2–CH_2–OH$, which is dehydrated in two steps, first to tetrahydrofurane,



, and then to butadiene, $CH_2=CH–CH=CH_2$.

The basic reaction between acetylene and formaldehyde using metal acetylide catalysts is applicable to other aldehydes and ketones. Control of reaction conditions, in view of the danger of explosion from acetylene and copper acetylide, is very important, typical conditions being 3 atm at 100° C. and pH controlled to 2–7. By this reaction butynediol is produced as a 35% solution, the considerable heat of reaction being removed by evaporation of water, which is separated from unreacted acetylene by condensation and the acetylene recycled. Propargyl alcohol and methanol are removed by distillation. Hydrogenation of butynediol is carried out at 200 atm, using nickel catalyst. The butanediol is dehydrated quantitatively to tetrahydrofurane on heating with dilute phosphoric acid at 300° C. under 100 atm. The product is separated from water by distillation, and passed with water vapour over a catalyst at 260–280° C. to produce butadiene.

The availability of cheap propargyl alcohol by this process has led to its hydrogenation to allyl alcohol. Using the normal hydrogenation catalysts in acid medium, *n*-propanol is obtained, and in alkaline medium, propionaldehyde. By hydrogenation of the aldol followed by dehydration, *iso*prene is obtained. Propargyl alcohol is also readily converted to chlorallyl alcohols monomers for synthetic resins. Oxidation of butenediol in solution produces erythritol, used in alkyl resins, and in the vapour phase, maleic acid. On dehydrogenation of butanediol over copper catalyst, γ-butyrolactone is produced, instead of succenic aldehyde, and this forms the basis of a large new synthetic field, including glutaric acid, piperidine, heavy metal phenoxybutyrates (used as driers) and *N*-vinyl pyrrolidone, used as monomer for synthetic resins, thickener, or adhesive. Tetrahydrofurane, besides being a valuable solvent for high polymers, can be converted to 1 : 4-dichlorobutane, from which hexamethylenediamine is obtained for conversion into polyamides. Reaction with ammonia produces pyridine and substitution products useful as anti-oxidants, pesticides, and vulcanization accelerators. Tetrahydrofurane may also be polymerized to rubbery or resinous products.

The basic reaction is applicable to acetaldehyde, which yields analogues of butadiene, and to higher aldehydes. Reaction of ketones and acetylene produces alkyneols, for which alkalis, alkaline-earth, or alcoholates are used as catalysts, instead of the metallic acetylides. C. L. G.

88. B Methallyl Chloride as a Fumigant for Insects Infecting Stored Corn. C. H. Richardson and H. H. Walkden. *J. Econ. Ent.*, Aug. 1945, **38** (4), 471.—Fumigation of stored corn with 12·5–16% B methallyl chloride solutions in carbon tetrachloride at the rate of 2 gal per 1000 bushels gave satisfactory control of red flour-beetle, saw-toothed grain-beetle and rice weevil without effecting germination of the wheat. The major impurity in B commercial methallyl chloride, *iso*crotyl chloride, is significantly less toxic, but there was no significant difference between the commercial and the pure grades. Carbon tetrachloride alone gave a lower control. With reasonable precautions, owing to the inflammability and toxicity, no ill effects should result from the use of B methallyl chloride. C. L. G.

89. Propylene Dichloride for Peach-Tree Borer Control. Second Rept. O. I. Snapp. *J. Econ. Ent.*, Aug. 1945, **38** (4), 419.—Tests over several years have shown that aqueous emulsions containing 9% of propylene dichloride applied to the soil around peach trees gives excellent control of peach-tree borer. There is no danger of damage to the bark, and the propylene dichloride is twice as effective as the ethylene dichloride previously tested. C. L. G.

Miscellaneous Products.

90. Plastics and Petroleum Work Together. Part I. S. R. O'Dette and R. E. O'Dette. *Modern Plastics*, Oct. 1945, **23** (2), 142.—The part played by petroleum products—lubricants, hydraulic fluids, heat-exchange medium, and auxiliary process materials—in plastics production and processing will be surveyed in a series of articles, of which this serves as an introduction. The information is based on actual studies in factories, and includes recommendations made to obtain the best results. The factors influenced or controlled entirely by lubrication are listed, and will be discussed in detail later in relation to specific units of machinery. In the use of hydraulic fluids in the plastics industry particular problems are encountered, including excessive pump wear in hydraulic presses from ferrous oxide, plastic dust particles, sludges, and varnishes from the hydraulic fluid, and corrosion from water-soluble acids from oil decomposition. It is recommended that where possible only oxidation-resistant hydraulic oils containing corrosion preventatives should be used. If not possible, a 1 in 60 dilution of a soluble oil should be used. More attention should also be paid to filtration. For heat-exchange oils, modern practice is to use relatively light, highly refined oxidation-resistant oils instead of steam refined cylinder oils. These can be used in open systems at up to 350° F. and under pressure at up to 500° F. While oils can be used at higher temperatures for short periods, a heat-exchange fluid, such as Dowtherm, is advisable. For plastics mills and roll calenders of normal design operating at below 350° F., a lubricant of lower viscosity than the usual steam refined cylinder oils is preferred, but it should possess high oiliness and load-carrying properties. For rolls carrying temperatures of 550° F., or operating under refrigeration conditions, specially selected hydrocarbon lubricants will be required. The selection of suitable lubricating greases should not present any difficulty. The availability of rust preventatives should reduce problems in the protection of mould platens and machinery. The necessity of thorough purification of air used for cleaning mould surfaces requires the use of minimum quantities of air-compressor lubricants, so that selection of the correct type is of great importance. C. L. G.

91. Selective Weed Killers. Anon. *Chem. Tr. J.*, 12.10.45, **117**, 401.—The development and large-scale testing of methoxone (Agroxone) as a selective weed killer are discussed. Investigations into the nature of plant hormones which control growth in nature led to the testing of naphthyl acetic acid for hastening the rooting of seedlings, preventing pre-harvest drop of apples, and producing seedless fruits. This was also found to prevent or retard seed germination and early growth of some weeds without affecting cereals. Of many related compounds produced, 4-chloro-2-methylphenoxy-acetic acid (methoxone) was found to be outstandingly active, the use of 8 oz per acre killing charlock, pennycress, and corn buttercup without damaging the cereal crop. The action is not yet understood, but absorpion into the plant or root arrests growth and causes distortion and splitting, finally resulting in death. Methoxone is non-poisonous, non-inflammable, and not unpleasant to handle. It is best applied as soon as the cereal is established. Further work is required to establish its use on pastures and lawns. Very extensive trials, covering 13,000 acres, have confirmed earlier results and established the particular weeds which can be controlled. These include the most important affecting cereal crops. C. L. G.

92. Synthetic Rubber in Germany. J. W. Livingstone. *Chem. Tr. J.*, 2.11.1945, **117**, 508; *Chem. Eng. News*, 25.9.1945, **23** (18), 162.—The total capacity of the German synthetic rubber industry amounted to 175,000 ton per annum, but of the 5 plants, 1 (Auschwitz) was never in operation, maximum total production being below 120,000 tons per annum. Production of butadiene from acetylene was more expensive than U.S. production from alcohol. Ethylene for styrene production was also derived from acetylene. The main types produced were Buna S and S3; these were too tough to be processed directly in Banbury mixers, and required heat softening before use. Tyres produced commercially from German Bunas were considered inferior to those from American GR-S. At the end of the war only smaller tyres were made from Buna S3, high proportions of natural rubber being used in the larger sizes. Inner tubes made earlier in the war from Buna SS were unsatisfactory, and those produced later from a mixture of Bunas and natural rubber were not entirely satisfactory. Only experimental quantities of polymers of the butyl or neoprene types were produced, the latter mainly for cements and other special uses. C. L. G.

93. Silicone Rubber. Anon. *Chem. Industries*, Sept. 1945, **47** (3), 474.—Dow Corning Corpn have announced the commercial availability of Silastic, a silicone rubber produced in various stocks for moulding, extruding, coating, and laminating. The rubber remains elastic after heating to 500° F. and is flexible at −70° F. It is also highly resistant to oil and brine at high temperatures, and has excellent electrical properties. C. L. G.

94. Cellulose Propionate. Anon. *Chem. Tr. J.*, 2.11.45, **117**, 500.—The Celanese Plastics Corpn of Bishop, Texas, announces the development of a new plastic, Forticel, which will be in large-scale production in 1947. Propionic acid is obtained from natural gas in commercial quantities and at reasonable prices by a process that has been developed. Cellulose propionate is claimed to have a greater toughness and higher impact strength than any other cellulose ester. It is thermoplastic, odourless, easily coloured and printed, and the finished products from injection or extrusion moulding display unusual surface lustre and brilliant finish without mechanical polishing. C. L. G.

95. Polyvinylidene Chloride. J. Taylor. *Brit. Plastics*, Dec. 1945, **17** (199), 490.—A review is given of the manufacture of polyvinylidene chloride, the forms in which it is used and their application. Commercial production began in the U.S. in 1939, the monomer being produced from trichloroethane by reacting with aqueous alkaline earth hydroxides under heat. If pure and free from oxygen, vinylidene chloride polymerizes very slowly, but in the presence of oxygen, as with the usual benzoyl peroxide catalyst, acid chlorides are formed which catalyse the polymerisation. The monomer is frequently co-polymerized with, *e.g.* vinyl, styrene, or acrylic derivatives. The polyvinylidene chloride may be moulded by compression, injection, or extrusion, and is available in the form of moulding powder, films, filaments, or tubing. The standard grade has a softening point of 115–140° C., and the mouldings from it are resistant to acids and alkalis, except concentrated ammonium hydroxide, and to most solvents, except dioxane and *cyclo*hexanone, whilst it is softened by chlorinated hydrocarbons. In processing, care must be taken to avoid contact with iron at high temperatures, which causes decomposition, and to allow for its low thermal conductivity. In the U.S. it is available in a wide range of sizes of piping and tubing of excellent flexibility and solvent resistance. Extruded filaments have been made up into highly wear resistant upholstery fabrics, window-screens, etc. Sheets are used for anti-corrosion tank linings, and new semi-soluble types of polyvinylidene chloride show promise in the coating of textiles, paper, leather, and metals. It has also been produced as a transparent film, useful for packaging. C. L. G.

Engines and Automotive Equipment.

96. Bearing Development up to Date. H. Luetkemeyer. *Nat. Petrol. News Tech. Sect.*, 5.9.45, **37** (36), R.718.—Despite the immense advancements in science and in the types of prime moving engines, with enormously increased power and speeds, and requiring greater resistance to wear and improved design in bearings, Babbitt's selection of a bearing alloy, 106 years ago, still remains as an example of the basic characteristics with but very little change. In general, bearing life is characterized by three qualities : (*a*) resistance to fatigue ; (*b*) surface action ; (*c*) corrosion or wear. These fundamentals are analysed and discussed—the extremes of fatigue resistance are those on Babbitt's metal and electroplated silver ; surface action is affected by hardness, machinability, weldability, imbeddability, and wettability ; corrosion or wear is generally a combination of chemical and mechanical removal of bearing surface, but either may occur separately. Failure or partial failure of a bearing surface attributable to these three qualities is shown by photographs of bearings and journals. The following bearing metals are described and discussed : white metal alloys ; cadmium base alloys ; copper–lead base alloys ; aluminium ; silver, and silver with a layer of indium-treated lead, analogous to the early tri-metal construction of steel with an intermediate layer of leaded bronze and a surface layer of tin-base alloy ; powdered metals in which recent progress has been made by their use in the form of a trimetal construction—*i.e.*, an intermediate layer of powdered metal between steel and a working surface of some soft, cast, or plated bearing metal. Trimetal and micro bearings are discussed, the construction of the former entails many difficulties, but precision plating of layers appears to offer a solution. The bonding of alloys to steel, etc., and the Kolene process are outlined, the latter permits the bonding of tin and lead base alloys to cast iron, and is a distinct advance, particularly for diesel engine bearings. Bearing loads (the maximum load in lb/sq. in, based on the projected area) of some of the alloys are shown in a table, grouped under various vehicles, aircraft, and diesel engines ; and analyses of the bearing alloys are given. Oil grooving is considered and illustrated, elaborate grooves have been displaced by simpler forms which maintain a maximum bearing area. Testing technique is discussed ; the Chevrolet test gives constructive help ; the Underwood bearing testing machine is being used for studying surface action, and has given satisfactory results for this purpose, as well as for fatigue testing. Some important observations on design are included. W. H. C.

97. First U.S. Gas Turbine Demonstrated. J. H. Kunkel. *Petrol. Engr*, Sept. 1945, **16** (13), 98.—The first large gas turbine built in the United States for continuous service is described. This turbine is the first to be used for ship propulsion. It burns 47 lb per hp hr of No. 2 distillate, develops 2500 useful hp, weighs and occupies 30 lb and 3·5 cu ft per hp respectively.

The units comprise a high- and a low-pressure combustion chamber, high- and low-pressure compressors, high- and low-pressure turbine, a regenerator and intercooler to give maximum theoretical efficiency of 32·5% with an actual efficiency of 29%.

The low-pressure compressor takes in free air and compresses it to a pressure of 43 lbs per sq in absolute at a temperature of 300° F., which latter is reduced by a water cooled intercooler to about 90° F. before passage into the high-pressure compressor, where its pressure is increased to 96 lb per sq in absolute, and the temperature to about 280° F.

In the high-pressure combustion chamber, " spitter " injected fuel oil is burned directly in this air stream, reaching a temperature of 1230° F. at the entrance to the high-pressure turbine, where expansion provides power to drive the low-pressure compressor. In the low-pressure combustion chamber, the air from the high-pressure turbine exhaust is reheated to about 1200° F., and then expanded in the low-pressure turbine to develop 5000 hp, half of which is used by the high-pressure compressor, the remaining 2500 hp being available power.

The combustion chamber is a simple right angle in a pipe-line, operates at a maximum pressure drop and can cover a wide range of load without burner replacement.

The use of streamline and nesting tubes decreases the pressure drop and increases the surface density for a given size of tubing. "Creep" phenomenon in construction material when under load, demanded careful choice of the materials and loadings; for example, a special grade of nickel that could be spun was produced for the torroidal joints. Welding is extensively used, and new electrodes were developed.

Steel shafts were used in the Elliot-Lysholm compressors, the joint between rotor and shaft being made by low temperature brazing. Temperature expansion problems presented difficulties, and special methods were employed to prevent free conduct of heat to undesired locations. These included the use of heat dams and oil and air cooling at bearings and pin rings. A special colloidal compound was devised for the threads of nuts and bolts to enable the machine to be dismantled after operation.

The gas turbine has future applications in mobile power plants and a number of reaction turbines have been successfully employed in catalytic cracking units.

G. A. C.

Miscellaneous.

98. United Kingdom Petroleum Trade 1938–44. Anon. *Petrol. Times*, 1945, **49**, 692.—Detailed information is given regarding the amount and value of petroleum products imported by the United Kingdom during the war period, although direct imports by the Armed Forces are not included in the figures quoted.

Import figures are listed for the years 1935–44, classified into: (*a*) crude oil; (*b*) motor spirit; (*c*) spirit other than (*b*); (*d*) kerosine; (*e*) lubricating oil; (*f*) gas oil; (*g*) fuel oil; and (*h*) other products. Imports for paraffin wax, asphaltic bitumen, and bituminous emulsions are given for the years 1938–44. The effect of war on imports is also illustrated graphically.

Total imports of petroleum into the United Kingdom during 1944 reached a figure of 5,560,787,000 Imp. gal an increase of 39·1% over 1943 and 73·6% over 1938. The corresponding value at £222,192,319 was 44·7% higher than in 1943 and an increase of 383·2% on the 1938 value. The far greater increase in the 1944 figure as against 1938 is for gas oil, which has almost quadrupled in the period, with a rise of 291·3%. In the case of motor spirit and fuel oil, the increases are 99·2 and 94·5%, respectively. Kerosine and lubricating oil imports were reasonably steady, with a slight upward trend. Crude oil declined steadily until 1944, when it showed a 28·9% increase over the 1938 figure. Paraffin wax increased in quantity and value during the middle war years, but later declined in quantity to less than the pre-war figure. Asphalt and bitumen declined until, in 1943, imports were less than one-sixth of the 1938 imports. Bitumen emulsions declined almost to vanishing point.

C.i.f. values of United Kingdom imports in pence per Imp gal, for crude petroleum and refined products are also given from 1919 to 1944, and shown in graphical form. These figures show that all refined petroleum products had their c.i.f. values more than doubled in 1944 as against 1938, while that for crude oil was trebled. For paraffin wax and natural asphalt the values were more than doubled during the same period, while for bituminous asphalt and emulsions it was nearly quadrupled. T. M. B. M.

BOOKS RECEIVED.

Industrial Toxicology. By D. Hunter. Pp. 80. Oxford, 1944. 10*s*.

The Croonian Lectures for 1942 of the Royal College of Physicians of London. A detailed review, with bibliography and index, of the effects of toxic substances encountered in industry.

Reference Books of Inorganic Chemistry. By Wendell M. Latimer, Prof. of Chemistry, University of California and Joel H. Hildebrand, Prof. of Chemistry, University of California. The Macmillan Co., New York, revised edition, 1940, reprinted 1944.

This is a revised edition of a book first published December 1928, and is as the title implies, essentially a reference book. It has been brought up-to-date in so far as development in atomic, molecular, and crystal structure, bond energies, etc., are concerned. Is intended as a reference book for students to aid in the reading of chemical literature.

The Chemistry of Organic Compounds. J. B. Conant. Pp. 680 + x. Revised edition, 1939. The Macmillan Co., New York.

"The chemistry of organic compounds" presents material covering a year's course. While including much that is characteristic of elementary textbooks an attempt is made to give some indication of new advances in biological chemistry, and the application of physical chemistry to the study of organic reactions.

High-Speed Diesel Engines. By A. W. Judge. 4th Edition, reprinted and enlarged. Chapman and Hall, London, 1945, 25*s*. net.

This book of 525 pages deals in fourteen chapters with all types of high-speed compression-ignition engines, including cylinder-head design, fuel injection systems, fuels and supercharging. About 100 pages of up-to-date information has been added to the 1941 edition.

BIBLIOTEKA POLITECHNIKI ŚLĄSKIEJ

INSTITUTE NOTES.

JANUARY, 1946.

CADMAN MEMORIAL LECTURE.

The Institute has been appointed Trustee of a Fund comprised of contributions received from those associated with the Anglo-Iranian Oil Company, Ltd.

The object of the Fund will be to commemorate the work of the late Lord Cadman relating to Petroleum, and the Institute will arrange for a lecture to be delivered so far as is practicable every year, but in no case less than once in every three years.

The First Cadman Memorial Lecture will be delivered by Sir William Fraser, C.B.E., at the Royal Institution, Albemarle Street, London, W.1, on Wednesday, March 27, 1946.

Admission will be by ticket only. Further details in regard to the Lecture will be announced later.

FORTHCOMING MEETINGS.

Wednesday, February 13, 1946. **Presidential Address,** by Professor F. H. Garner, O.B.E.

Wednesday, March 13, 1946. **"The Development of Fluid Catalytic Cracking,"** by Dr. J. F. Walter.

The above meetings will be held at 26 Portland Place, London, W.1., at 5.30 p.m.

STANLOW BRANCH.

Wednesday, February 20, 1946. **"Lubricating Oil Additives,"** by Dr. A. J. Ham.

Wednesday, March 20, 1946. **"Engine Testing of Lubricating Oils,"** by C. D. Brewer.

Wednesday, April 17, 1946. **"Design, Erection and Operation of Pilot Plants,"** by C. Buck, T. Hayes, and R. C. Williams.

The above meetings will be held at the Grosvenor Hotel, Lower Mersey Street, Ellesmere Port, at 7.30 p.m.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

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

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

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

Membership.

Black, Robert John, Manager, Oil Dept., Jardine Skinner & Co., Calcutta. (*H. W. Chetwin ; S. H. Bean.*)

Duckworth, Donald Matthew, Chemist, Ministry of Supply. (*D. Clayton ; E. R. Redgrove.*)

Goldie, Alexander, Chief Engineer, Sarawak Oilfields Ltd. (*H. de Wilde ; R. B. Wrixon.*)

Hanson, Thomas Kenneth, Research Chemist, Trinidad Leaseholds Ltd. (*W. B. Heaton ; S. M. Blair.*)

Japes, Dudley Herbert, Laboratory Manager, " Shell " Refining & Marketing Co., Ltd., Stanlow. (*R. I. Lewis ; J. S. Jackson.*)

Knight, Robert Harold, Trainee, Shell Refining & Marketing Co., Ltd. (*G. D. Thacker ; Peter Kerr.*)

McGechan, Andrew Campbell, Mechanical Engineer, Anglo-American Oil Co., Ltd. (*E. Evans-Jones ; J. E. Jenkin.*)

Raine, George Thomas, Assistant Chemist, Anglo-Iranian Oil Co., Ltd. (*Eric Dodds ; W. H. Thomas.*)

Slinger, Francis Charles Peter, Geologist, Anglo-Iranian Oil Co., Ltd. (*G. M. Lees ; C. A. P. Southwell.*)

Transfers.

Dewdney, Duncan Alexander Cox, Technical Adviser, Anglo-American Oil Co., Ltd. (*F. H. Garner ; H. C. Tett.*) (*Associate Member to Fellow.*)

Roy, Clarke, Sales Technician, Wm. Butler & Co. (Bristol) Ltd. (*E. R. Redgrove ; J. E. James.*) (*Associate Member to Member.*)

Sasson, Albert, Exploitation Engineer, United British Oilfields of Trinidad. (*G. D. Hobson ; S. E. Coomber.*) (*Student to Associate Member.*)

Sefton, Ronald, Chief Analytical Chemist, Trinidad Leaseholds, Ltd. (*S. M. Blair, W. B. Heaton.*) (*Associate Member to Fellow.*)

Wray, Anthony Tom, Assistant Chemist, Anglo-Iranian Oil Co., Ltd., Abadan. (*Student to Associate Member.*)

WORLD POWER CONFERENCE.

A meeting of the International Executive Council of the World Power Conference was held in London in November, 1945. About twenty countries were represented at the meeting, which was under the Chairmanship of Sir Harold Hartley.

It was decided to hold, if possible, a Sectional Meeting in 1947 to discuss the general question of fuel economy, and also to resume publication of the Statistical Year Book as soon as possible.

A small committee is to be appointed to watch developments and to make recommendations to the International Executive Council as soon as it is practicable to have an effective discussion of the utilization of atomic energy for peacetime purposes.

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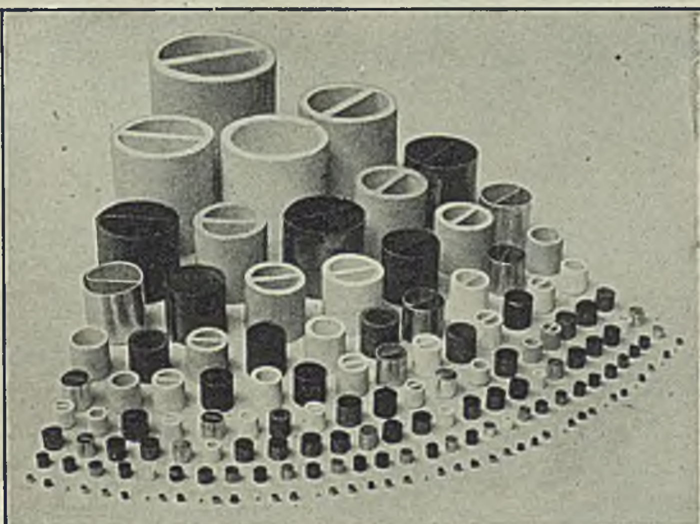

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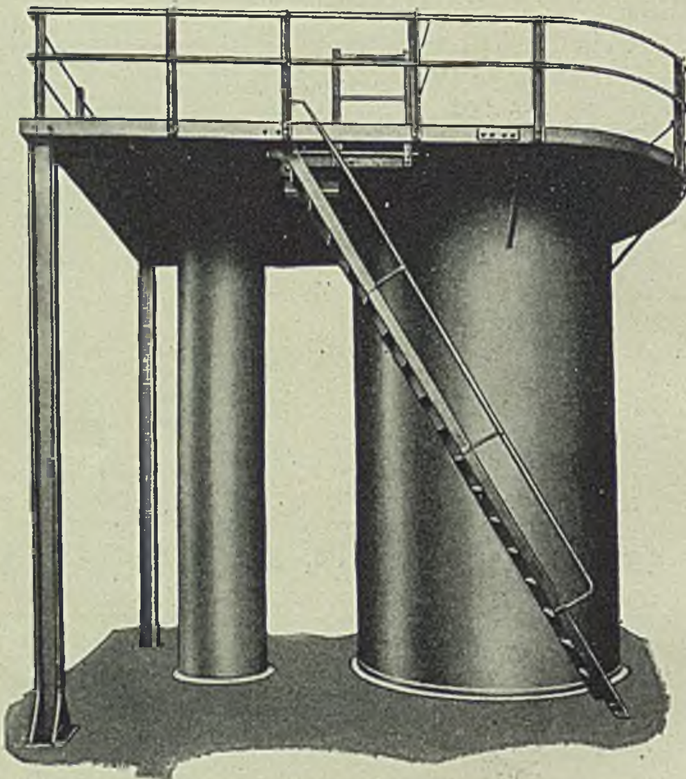

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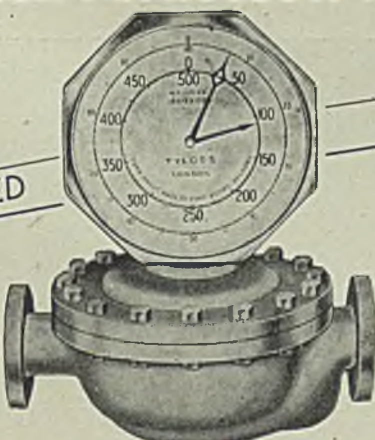

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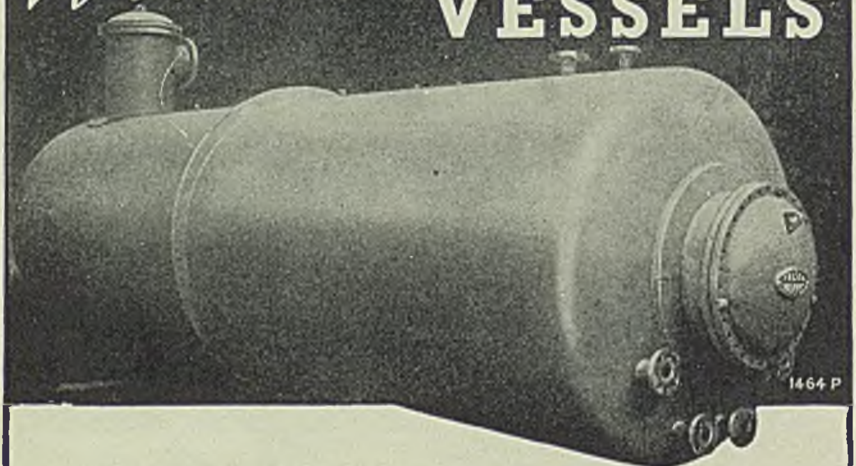

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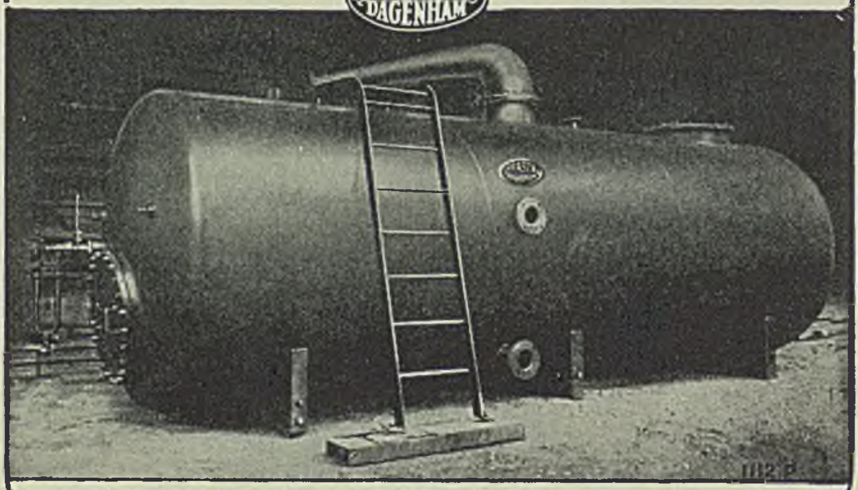

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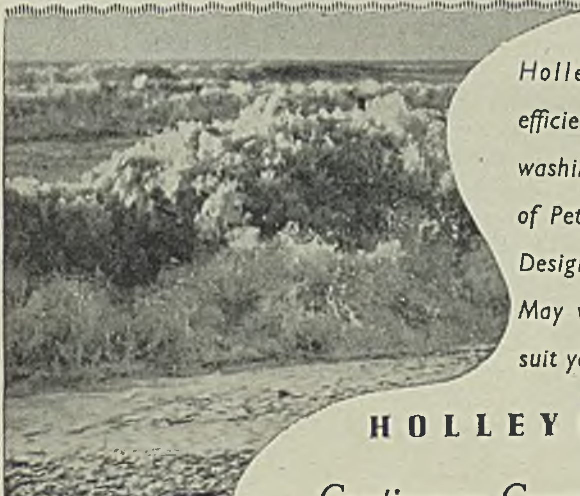

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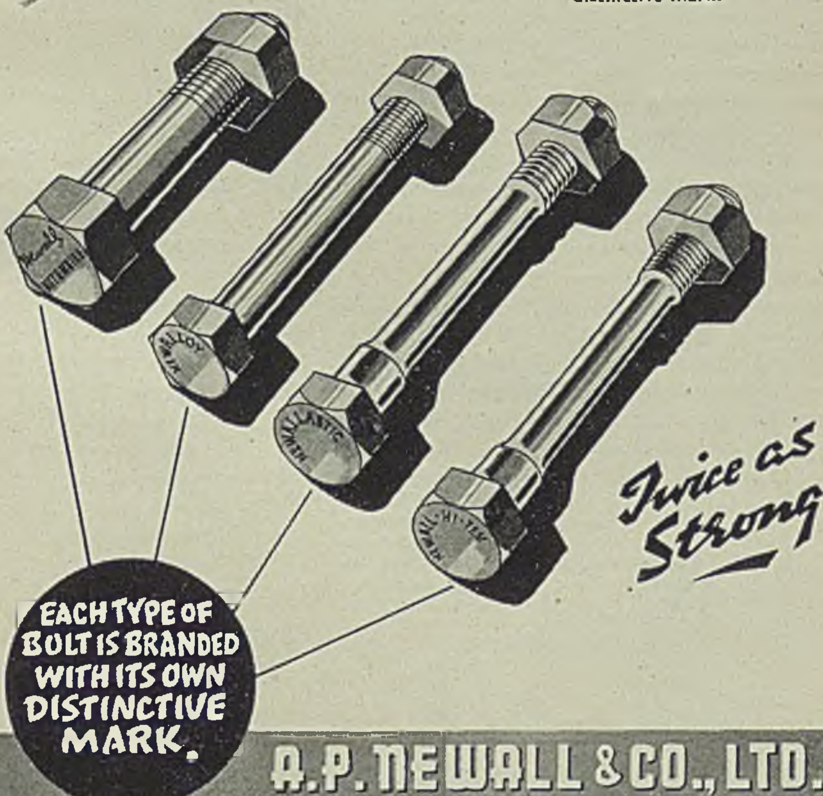

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AGAIN Lummus has been selected—by two more major refiners—to build two complete plants for the production of high yields of high viscosity index, low pour lubricating oils. In the design of these plants—each of which will produce more than 2,000 barrels of finished oil per day—particular study was given to recent developments and the economics of various methods of wax production.

This brings the total of Lummus solvent refining plants to sixteen and Lummus solvent dewaxing plants to twenty-one, a large proportion of the world's solvent refining capacity.

Lummus engineers are ready to study the problems of individual refiners, project processes and plants through semi-commercial scale operation and determine construction and operating costs for a thorough study of the economics of each individual project. Lummus laboratories and pilot plants have every facility for lube oil evaluations including propane deasphalting, solvent refining, solvent dewaxing, and clay finishing.

If you are contemplating the construction of a modern plant for the economical production of premium lubricating oils and wax—put your problem up to Lummus.

For further information on lubricating oil and other processes, write for a copy of "Petroleum Refining Processes" containing last minute data, flow sheets and photographs.

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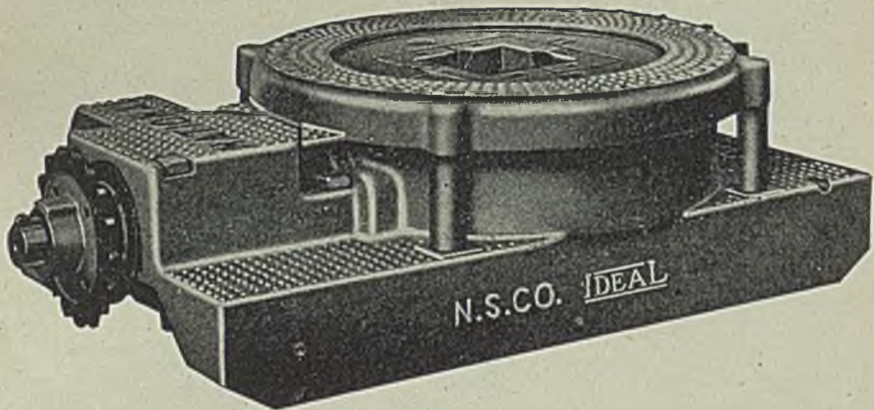

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Additional information furnished on request.

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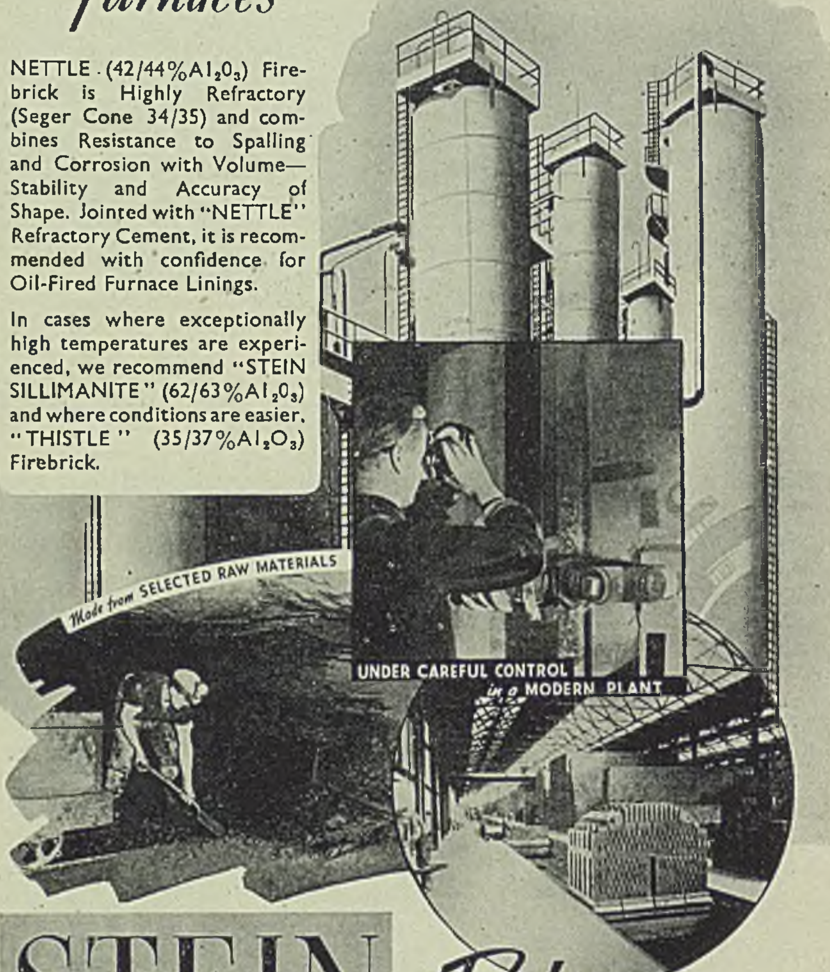
For Oil-Fired Furnaces

NETTLE (42/44% Al_2O_3) Firebrick is Highly Refractory (Seger Cone 34/35) and combines Resistance to Spalling and Corrosion with Volume—Stability and Accuracy of Shape. Jointed with "NETTLE" Refractory Cement, it is recommended with confidence for Oil-Fired Furnace Linings.

In cases where exceptionally high temperatures are experienced, we recommend "STEIN SILLIMANITE" (62/63% Al_2O_3) and where conditions are easier, "THISTLE" (35/37% Al_2O_3) Firebrick.



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Details on application

- Particularly applicable to highly pigmented products too viscous for examination in viscosity cups.
- Pan may be loaded to produce a convenient rate of fall of plunger.
- Three plungers supplied: solid, four-hole, and multi-hole.
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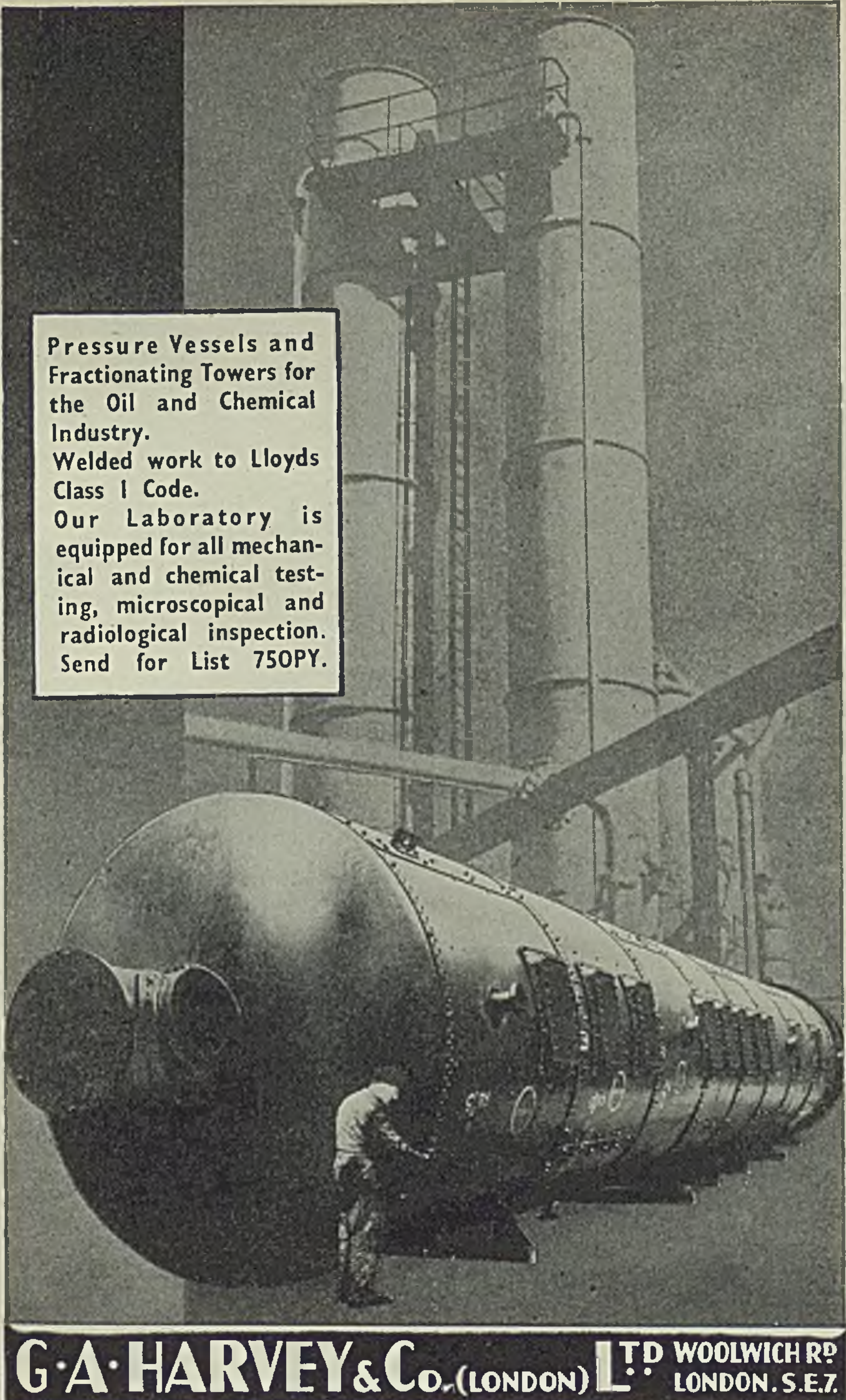

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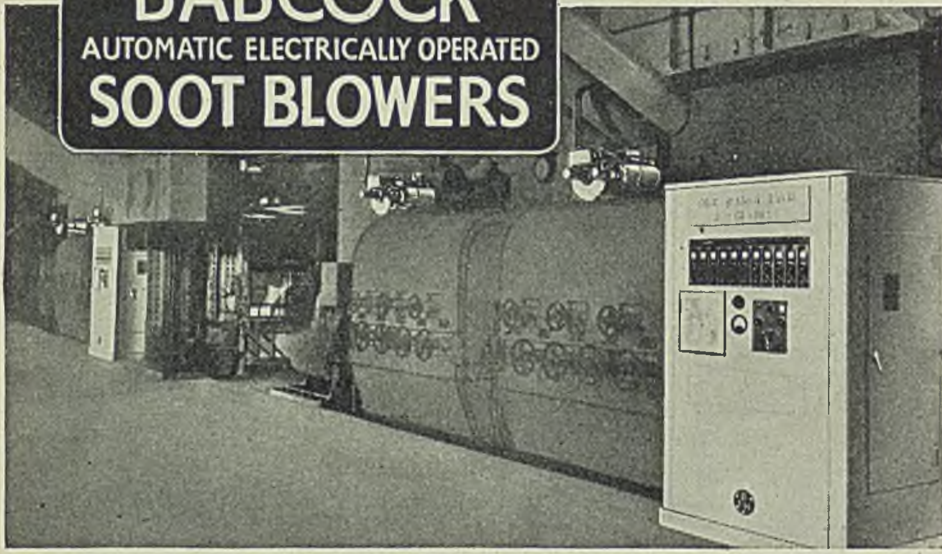

		Number of Boilers
Beds., Cambs. & Hunts. Elec. Coy.	LITTLE BARFORD	2
Belfast Elec. Dept.	HARBOUR STN.	2
Bolton Elec. Dept.	BACK O' TH' BANK	1
Bradford Elec. Dept.	VALLEY ROAD	3
Brighton Elec. Dept.	SOUTHWICK	2
Brisbane Elec. Light Coy.	BULIMBA	1
Calcutta Elec. Supply Coy.	COSSIPORE	6
Cardiff Elec. Dept.	ROATH	4
Carlisle Elec. Undertaking	WILLOWHOLME	3
Castner-Kellner Ltd.	RUNCORN	2
Derby & Notts. Elec. Power Coy.	SPONDON	4
Fulham Metropolitan Borough	TOWNMEAD ROAD	4
Ipswich Elec. Supply & Transport Dept.	CLIFF QUAY	6
Lancashire Elec. Power Coy.	KEARSLEY	8
Lincoln Corpn. Elec. Dept.	ST. SWITHINS	4
Liverpool Elec. Supply Dept.	CLARENCE DOCK	2
London Power Coy.	DEPTFORD EAST	2
N.W. Midlands Joint Elec. Authority	MEAFORD	6
W. Midlands Joint Elec. Authority	OCKER HILL	5
N.S.W. Department of Railways	WHITE BAY	2
Newport Elec. & Transport Dept.	EAST STN.	4
Northern Ireland Government	BALLYLUMFORD	5
North-Eastern Elec. Supply Coy.	NORTH TEES	2
South Wales Elec. Power Coy.	LLYNFI	2
Stalybridge, Hyde, Mossley, & Dukinfield Transport & Elec. Board	HARTSHEAD	2
Thames Board Mills	PURFLEET	1
Other Export Orders		15
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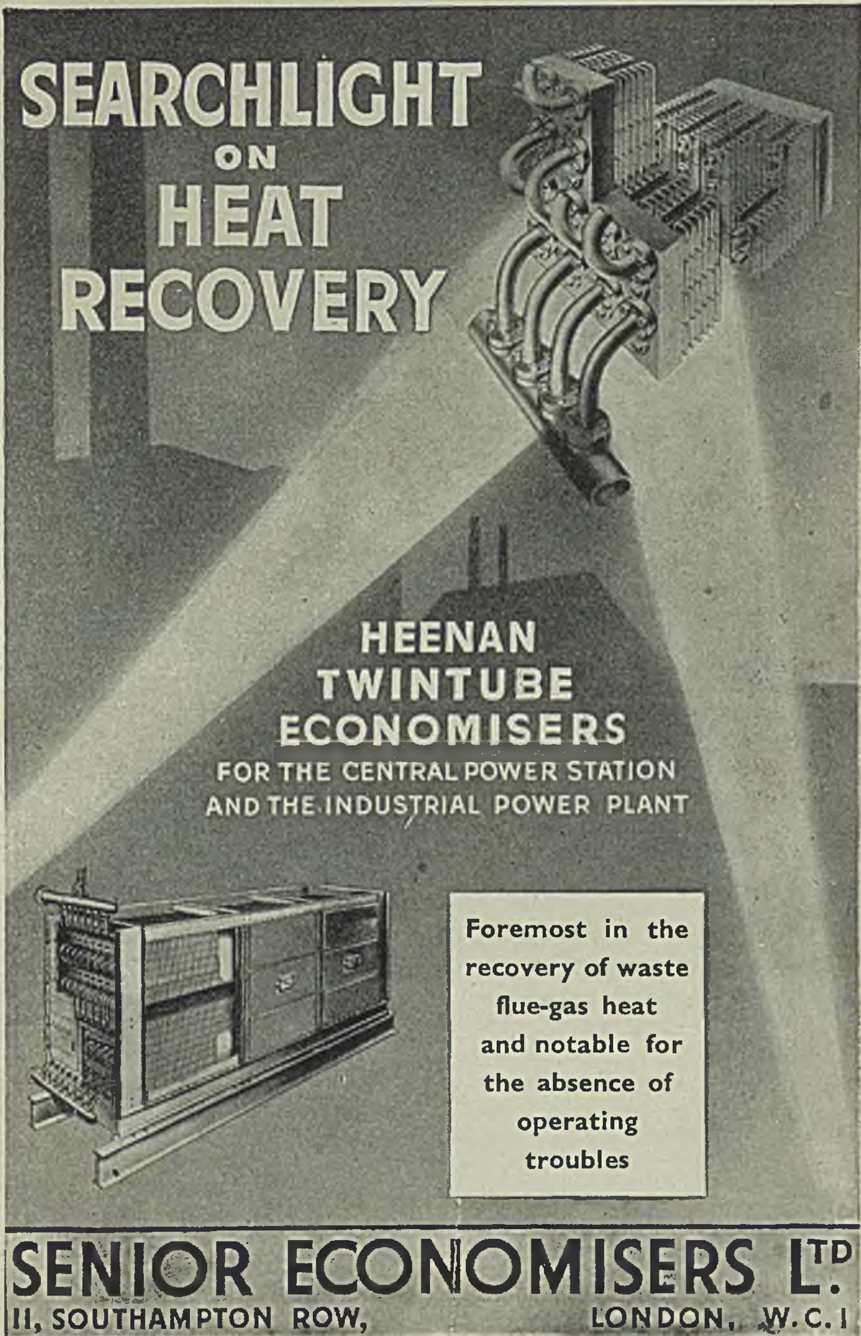
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FOR THE CENTRAL POWER STATION
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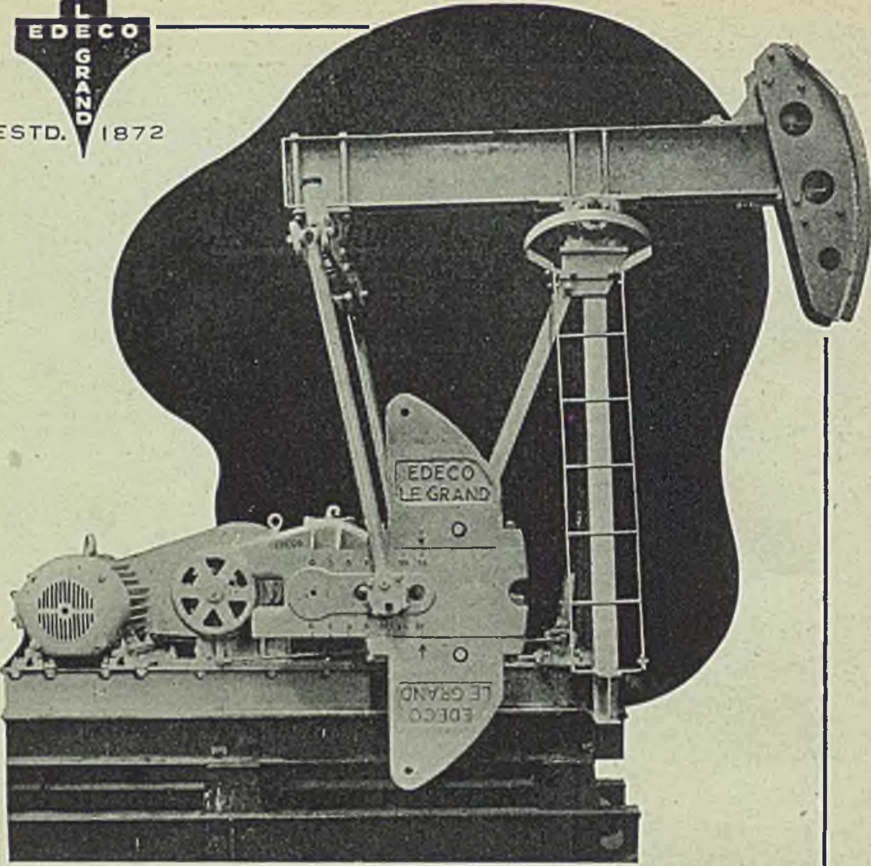

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FULL RANGE COVERING ALL LOADS AND PUMPING CONDITIONS

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OUTSTANDING FEATURES:

Fully Equalised Motion
Roller Bearing Patented Wrist Pin
Complete Dust and Weather Proofing
Easy Accessibility
Minimum Shipping Space
A.P.I. Specification

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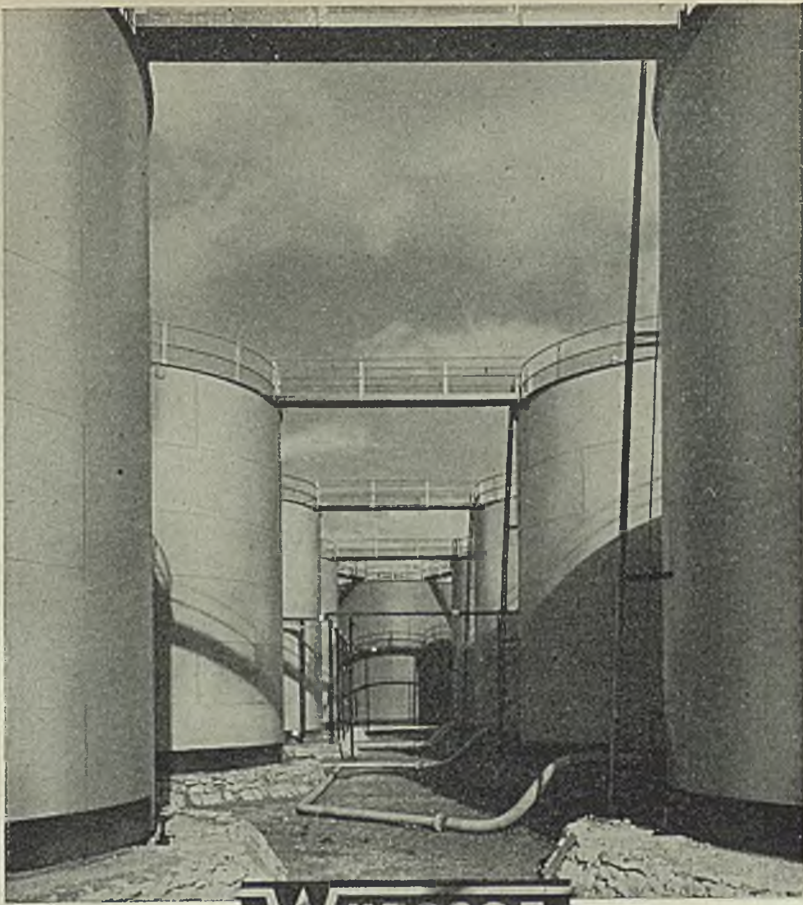

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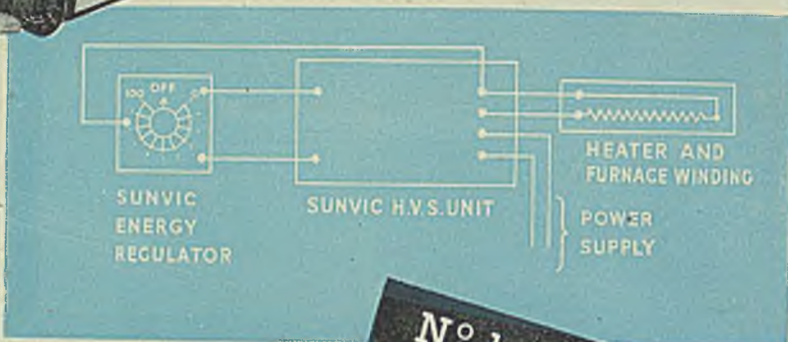

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