ABSTRACTS.

PAGE

Oilfield Exploration and Exploitation.

Refinery Operations.

Products.

AUTHOR INDEX.

The numbers refer to the Abstract Number.

OILFIELD EXPLORATION AND EXPLOITATION.

Geology.

219. Rangely, One-time Shallow Field, now Rocky Mountains' Most Active Area. C. R. Thomas. *Oil Gas J.*, 24.11.45, **44** (29), 90.—The Rangely field lies near the crest of the northwest-trending Rangely anticline. The southwest flank dips at 13–21°, and the northeast flank at lower angles. Northeast-trending faults cross the crest. The shallow oil occurrence is controlled by fracture zones in the Mancos (Cretaceous) shale. Regular production from the Weber (Pennsylvanian) sandstone began in 1943.

The field was discovered in 1902, but production became important only in 1919. The Mancos shale wells had initial outputs ranging from a few to more than 100 brl./day. A few deeper wells may have yielded gas from the Dakota sandstone, but they were soon flooded. In 1933 a well penetrated about 1500 ft into the Pennsylvanian, gas having been indicated in the Morrison and in the Nugget sandstone; oil was obtained in the Weber sandstone at depths of 5704–6320 ft. 13 Weber sandstone producers have now been completed, their outputs ranging 100–400 brl/day. Pressures are 2200–2300 lb/sq. in, and the g.o.r. averages 300–350 cu. ft/brl.

Between 1919 and 1938 the production ranged 10,000–33,000 brl/year, and in 1944 it was slightly under 400,000 brl/year. The Mancos shale oil is of 42° A.P.I. gravity, and that of the Weber sandstone is 33°.

The lower part of the Mesaverde formation is present, and consists of interbedded sandstone and shale, with a few coal-beds. The upper part of the underlying Mancos outcrops, and is made up of grey calcareous shale with a few beds of sandstone and concretionary sandy limestones. The Mesaverde forms scarps round the crest of the anticline, which is 20 ml long and 8 ml wide, with structural closure exceeding 1900 ft.

The Mancos shale oil appears to be in porous parts of calcite veins or in crevices in the fractured shale near the veins.

Recent drilling has revealed possibilities of new producing horizons in the Dakota and Morrison sands. Morrison sand production may be irregular. Water has not been found in the Weber. About 1000 ft of Pennsylvanian rocks and 500 ft of Mississippian and Devonian rocks have yet to be tested. Parts of the Morgan formation afford possibilities as source and reservoir rocks. The Madison limestone produces elsewhere.

G. D. H.

220. New Zone in Wilmington May Increase Reserve 25,000,000 brl. L. P. Stockman. *Oil Gas J.*, 3.11.45, **44** (26), 62.—The Wilmington field of California has produced 275,000,000 brl of oil and has a reserve conservatively estimated at 350,000,000 brl. The new zone is about 450 ft below the base of the Ford zone, and the first well gave 415 brl/day of 30·8°-gravity oil. This zone is known to occur in Blocks 2 and 3, but a well in Block 4 missed it.

The Wilmington field is divided into blocks by faulting, and, since there is no migration across the faults, the sectors can be developed independently. The structure as a whole is a northwest-plunging anticlinal nose. In the most easterly block only the Ranger is productive; in the most westerly area, Block 1, the Ranger and Ford are productive, the latter zone being relatively thin and of low porosity and permeability. In all there are seven producing zones: tar sand, Ranger, Upper Terminal, Lower Terminal, Union Pacific, Ford, and the new zone.

A substantial part of the highly productive Long Beach Harbour block extends southeast under the Pacific. The structure rises under the sea, and much oil may be out of reach beyond the area which can be drained by directionally-drilled wells. At present Wilmington produces about 100,000 brl/day. G. D. H.

221. Exploratory Drilling in September. Anon. *Oil Wkly*, 5.11.45, **119** (10), 34.—During September exploratory wells in U.S.A. were completed at the rate of 88·3/week, the weekly average for the first nine months of 1945 being 83·4. 21% of the September completions were successful; in the first nine months of 1945 the successes were 18·5% of the exploratory completions. During September 34 new oilfields and 11 new oil-pays were discovered, in addition to two new distillate fields and one new distillate pay, and 10 new gas-fields. Extensions were made to 14 oilfields and two gas-fields.

Ellenburger production has been found in the Penrose-Skelly field, Lea County, New Mexico.

The September discoveries are listed with pertinent data, while tables summarize the exploratory drilling results by States and districts, and according to types of discovery. G. D. H.

222. Exploratory Drilling Declines in October. Anon. *Oil Wkly*, 26.11.45, **119** (13), 54.—U.S. exploratory completions in October averaged 80·8 per week, compared with 86·5 per week in September. 13·9% of the October completions were successful, and 21·4% of the September completions. The percentage of successes during the first ten months of 1945 was 18·1.

The October discoveries are listed with pertinent data, and tables summarize the wildcat completion results during October and during the first ten months of 1945. G. D. H.

223. Gas-distillate Well Discovered in Mexico. Anon. *Oil Wkly*, 12.11.45, **119** (11), 110.—A new gas-distillate producing area has been opened in northeastern Mexico across the Rio Grande from Lopeno, southern Zapata County, Texas. The well gave 100 brl of distillate and 20 million cu. ft of gas/day from the Wilcox at 5100 ft. G. D. H.

224. Anzoategui Test May Open New Field in Anzoategui. Anon. *Oil Wkly*, 12.11.45, **119** (11), 110.—La Ceiba 1 in northeastern Anzoategui has reached a depth of 8150 ft, and has cored a sand 75 ft thick with definite signs of oil saturation. Shows have been tested higher, but no production was found. G. D. H.

225. Shell's Colombian Wildcat Reports Shows. Anon. *Oil Gas J.*, 17.11.45, **44** (28), 168.—2 San Martin in the Llanos region is reported to have shown low-gravity oil in a drill-stem test of the Tertiary at a depth of about 6560 ft. G. D. H.

226. Three New Wildcats in Colombia Bring to 23 Number of Rigs Now Being Run. Anon. *Oil Wkly*, 26.11.45, **119** (13), 67.—Recently the wildcat Caraballo 1 was spudded south of Barranquilla, and El Pedral 1 was started across the Magdalena from Socony-Vacuum's Cantagallo concession. Velazquez 1 is to be drilled in western Boyaca.

A well on the Floresanto concession in the Department of Bolivar in extreme northwest Colombia was being tested. Its depth is 6936 ft. The well had a show at 630 ft. G. D. H.

227. Extensive Field Activities Seen as Company Explores Remote Barinas Area. G. O. Ives. *Oil Wkly*, 5.11.45, **119** (10), 54.—The Socony-Vacuum Oil Co. holds concessions over 1,300,000 hectares in the State of Barinas, Venezuela. San Vicente 1, a stratigraphic test in the central part of the State, went to 7000 ft. San Silvestre 1 has reached 7955 ft, and will investigate the whole of the Miocene and Eocene. Yaure 1 is to be drilled in the extreme west of Barinas. G. D. H.

Geophysics and Geochemical Prospecting.

228. Airplanes and Submarines may be Used in Search for Oil. Anon. *Oil Gas J.*, 20.10.45, **44** (24), 94.—The U.S. Geological Survey has been asked to make recommendations for a survey of the continental shelf off the U.S. coast, covering an area of over 750,000 sq. ml. Under-water structures can now be located accurately, and drilling methods can be adapted to tapping under-water oil reserves. Seismic surveys can now be carried out in submerged areas, one survey having extended 26 ml off the Louisiana coast. Magnetic surveys can be made rapidly by aeroplane, while it has been suggested that gravimetric surveys can be made on the sea-floor by submarines in order to locate salt domes. Reflection and refraction seismic surveys could be made from boats and barges with instruments on the sea-floor in order, respectively, to locate deep and shallow salt domes, and even other structures.

The continental shelf in the Gulf of Mexico offers greatest present promise of oil-bearing structures; the shelf off the Pacific coast also is favourable, and there are indications that oil might be found off Alaska. Oil-bearing strata may extend into the Gulf of Mexico. G. D. H.

Drilling.

229. Unitized Mobilized Drilling. K. B. Barnes. *Oil Gas J.*, 10.11.45, **44** (27), 76.—A portable drilling unit fitted on wheels is described and illustrated. A. H. N.

230. Venezuela Deep Well Offers Valuable Data. G. O. Ives. *Oil Wkly.*, 19.11.45, **119** (12), 32–33.—The drilling of a 13,034-ft well in Venezuela for the double purpose of training drilling crews in deepwell drilling and of ascertaining the stratigraphy of the field is described briefly. A. H. N.

Production.

231. Oil Migration. J. Frost. *J. Inst. Petrol.*, Dec. 1945, **31** (264), 486–493.—Oil migration is divided into three phases. These are: (*a*) primary migration—*i.e.*, migration of oil from the source rock (usually a clay, but sometimes a limestone) into the reservoir rock, the reservoir rocks being those of high porosity and high permeability such as sands, sandstones, dolomites, etc.; (*b*) secondary migration—*i.e.*, the segregation of oil into pools within the reservoir rock; (*c*) tertiary migration or the dispersal of oil. These are discussed. A. H. N.

232. Corrosion Inhibitor. K. B. Barnes and C. J. Deegan. *Oil Gas J.*, 27.10.45, **44** (25), 84–86.—Corrosion of well pipes by hydrogen sulphide can be stopped by use of potassium cyanide, carbon monoxide, or formaldehyde. The first two gases are dangerous; formaldehyde is completely practicable. It is believed that savings of up to 2900% over the cost of treatment may be made. The grade used in stopping sulphide corrosion is the standard commercial product, available either in 55-gal drums or in tank-car lots, at prices f.o.b. plants of about 30 cents/gall in tank cars, somewhat higher in drum lots. The method of application in the field is simple. Measured quantities of standard commercial grade formaldehyde solution are injected into the annulus between the casing and tubing, through a simple drip-type lubricator. Initial injections, based on laboratory findings, were at the rate of 1 qt/day of formaldehyde per 25 brl daily production of salt water It was soon found that even this small quantity was more than was required. Present practice is to start with a daily injection of 1 qt of formaldehyde per 50 brl daily salt-water production, continue this for 30 days, then reduce to 1 qt per 100 brl daily salt-water production.

A. H. N.

233. Optimum Rate of Production. Part 9. P. J. Jones. *Oil Gas J.*, 27.10.45, **44** (25), 109.—Other things equal, the optimum rate of producing oil depends on reserve, number of required wells, and operating expenses. Reserves, number of wells, and operating expenses are not completely independent of each other. The relationships among these variables depend on producing and operating methods. Producing methods determine whether oil will be displaced primarily by gas or primarily by water. Operating methods determine the location of wells relative to the source of gas or water. The difference between the reserve for displacement of oil by water and the reserve for displacement of oil by gas is illustrated by an example. If water is available, displacement of oil by water is likely to be a more profitable producing method than displacement of oil by gas. The volume of water required to achieve a desired oil recovery may be reduced significantly by providing sufficient distance between the source of water and producing wells. This point is illustrated by examples. The required distances can be provided under co-operative or unit operations. A. H. N.

234. Optimum Rate of Production. Part 11. P. J. Jones. *Oil Gas J.*, 10.11.45, **44** (27), 91.—Rates of production proportional to reserve are called uniform rates of depletion. A rate of depletion is equal to the rate of production divided by reserve. For uniform rates of production, the rate of depletion increases. Rates of production and cumulative recovery for uniform rates of depletion are illustrated by graphs and examples. The present value of a reserve recoverable at rates of production proportional to reserve is easily estimated. This is one reason why uniform rates of depletion are important from the viewpoint of optimum producing rates. On the other hand, the present value of a reserve recoverable at uniform rates of production is higher than the present value of the same reserve recovered at declining rates of production. This is probably the chief reason why uniform rates of production are of interest from the viewpoint of optimum producing rates. A. H. N.

235. Optimum Rate of Production. Part 12. P. J. Jones. *Oil Gas J.*, 17.11.45, **44** (28), 279.—The present value of a reserve depends on the rate of recovery. The two rates of recovery of particular interest to producers are uniform rates of production and rates of production proportional to reserve. The latter represents uniform rates of depletion. The present value of a producing rate at any time is equal to the rate of production and the corresponding present worth factor. Present worth factors up to 25 years hence are illustrated graphically for interest rates ranging from 2% up to 10%. The present value of reserve recoverable at uniform rates of depletion is also illustrated graphically. The present value of a reserve partly recoverable at uniform rates of production and the remainder at uniform rates of depletion is illustrated by examples. The present values herein considered are before investment, taxes, royalty, and operating expenses. A. H. N.

236. Pressure Maintenance by Water Injection. W. L. Horner. *Oil Wkly*, 19.11.45, **119** (12), 28–31; *Oil Gas J.*, 17.11.45, **44** (28), 105. *Paper Presented before A.P.I.*—The operations of pressure maintenance by means of water injections are discussed. Data obtained at Midway disclose conclusive results, and confirm indications which were outlined before a meeting of the Division of Production of the Institute at Chicago, November 11, 1943. Since that date pressure, production, and cost records have been accumulated—which may be deemed of timely importance. The earlier publications referred to showed that injection into one well, located at the edge of a pool, 1800 acres in area, caused a marked decrease in the rate of pressure decline in the pool. Since then injection has been maintained in four wells, with the result that reservoir pressures have risen—although during the same period allowable and withdrawal rates have been increased substantially. The development of the field is described together with the pressure characteristics of the pool. The suitability of water injection for oil- and gas-pools is discussed, and is believed to be beyond the experimental stage. Although water-drive is widely advocated, there are important instances where gas-cap injection could prove more advantageous. Each pool requires study as early as possible. This would be facilitated first by drilling with wide spacing to define the pool boundaries, then by producing for a period at rates controlled to some extent by engineering requirements. This plan would provide suitable data for predicting results of various exploitation procedures. Thus, factual data will be made available early; and, if wide spacing is to be satisfactory under the procedure accepted, additional drilling can be avoided. A. H. N.

237. Injection of Water into Underground Reservoirs in Michigan. W. E. Shoeneck. *Oil Gas J.*, 17.11.45, **44** (28), 193. *Paper Presented before A.P.I.*—Injection of water in Michigan has been solely for the purpose of disposal, but regulations have been such that in excess of 90% of oil field waters are returned underground. The paper discusses the types of equipment used in injection wells and disposal systems, as well as describing the injection characteristics of each of the seven different formations employed for disposal purposes. Statistics on injection wells by years and by formations are detailed and summarized. A. H. N.

238. Interactions between Interstitial and Injected Water—A Review. A. J. W. Headlee. *Oil Gas J.*, 17.11.45, **44** (28), 219. *Paper Presented before A.P.I.*—An attempt has been made to present quantitative as well as the qualitative aspects of the problem of solids forming in oil and gas-field waters during recovery operations. The purpose is to develop, eventually, sufficient data in one paper so that a balance sheet can be made of the precipitates which may form in any operating system. Many quantitative data remain to be determined. The more common precipitates which form in recovery systems are carbonates, sulphates, sulphides, sulphur, iron oxide, silicates, and organic residues. Although the quantity of these precipitates which may form is small, it is also true that the quantity necessary to cause serious plugging off of a well is quite small. In fact, a fraction of a pound of fine precipitate may cause a considerable decrease in the permeability of a well. The extent of the plugging-off effects will depend not only on the amount of precipitate formed, but also on its nature. The particles may be too large to enter the pores of the sand. Then, again, they may be small enough to circulate freely through the pores. A large amount of research work is necessary to complete the picture. It should be possible to obtain sufficient data to enable one to predict precipitation before it has a chance to lower the permeability of the sand. A. H. N.

239. Behaviour of Water-Input Wells. Part 1. P. A. Dickey and K. H. Andresen. *Oil Wkly*, 19.11.45, **119** (12), 38; *Oil Gas J.*, 17.11.45, **44** (28), 205. *Paper Presented before A.P.I.*—The hydrodynamics of flow through porous media are briefly discussed. Various aspects of the permeability of sands are analyzed. The radial flow into, or from, a well will follow the usual Muskat's formula until two or more wells begin to interfere with each other, when the intake rate of a well will be reduced. It may be assumed that the average intake rate during the time between interference and the complete filling of the pattern is the mean of the rate just prior to interference and the steady rate of the pattern. The time required to reach the steady rate can then be computed, using the additional volume of water which must be injected between interference and fill-up; and the curve can be interpolated. This is illustrated.

A. H. N.

240. Closed System of Intermittent Gas Lift Applied in Single-Well Operation. E. H. Short, Jr. *Oil Gas J.*, 27.10.45, **44** (25), 113.—A 190 brl/day well is produced from 7110 ft by gas lift on 15-min cycles. The system is closed, the gas recycled through the aid of compressor. Consequently there is no need for outside high-pressure gas.

A. H. N.

241. Patents on Drilling and Production. D. Silverman, assr to Stanolind Oil & Gas Co. U.S.P. 2,384,648, 11.9.45. Appl. 14.1.42. Locating bottom of oil production.

O. Hammer, assr to Security Engineering Co., Inc. U.S.P. 2,384,675, 11.9.45. Appl. 28.9.42. Apparatus for multiple stage cementing.

G. Herzog, assr to The Texas Co. U.S.P. 2,385,857, 2.10.45. Appl. 29.1.44. Cushioning device for radiation detectors.

M. De Groote and B. Keiser, assr to Petrolite Corpn., Ltd. U.S.P. 2,385,969, 2,385,970, 2.10.45. Appl. 9.4.43. Process for breaking petroleum emulsions.

R. Cross. U.S.P. 2,386,036, 2.10.45. Appl 6.9.43. Method for secondary recovery of oil.

G. R. Watson, assr to Bucyrus-Erie Co. U.S.P. 2,386,281, 9.10.45. Appl. 7.5.43. Tool-guide for cable tool-drills.

J. C. Stokes, assr to Reed Roller Bit Co. U.S.P. 2,386,514, 9.10.45. Appl. 11.6.42. Side-hole coring device.

W. P. Munk. U.S.P. 2,386,564, 9.10.45. Appl. 9.6.41. Oil and gas separator.

C. C. Carter, assr of 25% to C. T. Stewart. U.S.P. 2,386,593, 9.10.45. Appl. 18.4.42. Activator for wells.

E. E. Harton, Jr., and P. Lyon, assr to The Pure Oil Co. U.S.P. 2,386,605, 9.10.45. Appl. 15.10.43. Treatment of oil-wells.

E. F. Cooke, assr to Beaumont Iron Works Co. U.S.P. 2,386,841, 16.10.45. Appl. 7.10.41. Well completion apparatus.

C. E. Bannister. U.S.P. 2,387,002, 16.10.45. Appl. 24.6.42. Apparatus for cementing the wall of an earth boring.

C. H. Barnes, assr to Lane-Wells Co. U.S.P. 2,387,003, 16.10.45. Appl. 4.8.41. Double seal packer.

E. A. Stephenson, assr to The University of Kansas Research Foundation. U.S.P. 2,387,361, 23.10.45. Appl. 29.6.43. Method of treating oil-wells.

G. F. Wislicenus, assr to Worthington Pump and Machinery Corpn. U.S.P. 2,387,377, 23.10.45. Appl. 2.3.44. Deep-well pump.

J. S. McDonald and W. E. A. Ruska. U.S.P. 2,387,456, 23.10.45. Appl. 23.6.42. Controlling device for well tools.

C. A. Brokaw. U.S.P. 2,387,493, 23.10.45. Appl. 1.3.43. Means for cementing wells.

E. J. Roach and E. F. Cooke, Jr. U.S.P. 2,387,610, 23.10.45. Appl. 16.12.41. Well control head.

J. G. Richey. U.S.P. 2,387,682, 23.10.45. Appl. 1.9.42. Rotary jar and safety joint.

T. B. Wayne. U.S.P. 2,387,694, 23.10.45. Appl. 27.3.36. Treatment of drilling fluids.

V. F. Every, U.S.P. 287,725, 30.10.45. Appl. 28.1.44. Well-screen.

G. G. Harrington, assr to Reed Roller Bit Co. U.S.P. 2,388,141, 30.10.45. Appl. 4.1.43. Electrical logging apparatus.

M. C. Johnson. U.S.P. 2,388,416, 6.11.45. Appl. 17.9.43. Casing centring device.

T. F. Moore, U.S.P. 2,388,640, 6.11.45. Appl. 17.12.43. Well point.

R. R. Hays. U.S.P. 2,388,741, 13.11.45. Appl. 29.4.44. Hydraulic drilling device.

C. B. Aiken, assr to Schlumberger Well Surveying Corpn. U.S.P. 2,388,896, 13.11.45. Appl. 28.1.42. Electrical method and apparatus for logging boreholes.

J. G. Smylie. U.S.P. 2,388,938, 13.11.45. Appl. 31.8.44. Firing head for gun perforators.

W. P. Orr, assr to Standard Oil Development Co. U.S.P. 2,389,208, 20.11.45. Appl. 22.1.43. Side-wall sample-taking apparatus.

H. J. Woolslayer, E. A. Campbell and C. Jenkins, assr to L. C. Moore & Co. U.S.P. 2,389,226, 20.11.45. Appl. 10.4.44. Fast sheave mounting for oil-well masts.

D. Silverman, assr to Stanolind Oil & Gas Co. U.S.P. 2,389,241, 20.11.45. Appl. 26.4.44. Well logging.

G. A. Humason. U.S.P. 2,389,512, 20.11.45. Appl. 28.1.43. Tester for wells.

A. L. Armentrout. U.S.P. 2,389,710, 27.11.45. Appl. 12.8.41. Jarring tool.

A. L. Armentrout. U.S.P. 2,389,711, 27.11.45. Appl. 13.8.41. Well jar.

J. T. Phipps, assr to Vernon Tool Co. Ltd. U.S.P. 2,389,869, 27.11.45. Appl. 9.2.45. Locking and setting device.

G. E. Justice, F. M. Thurston and F. N. Young, assr to Houston Oil Field Material Co, Inc. U.S.P. 2,389,985, 27.11.45. Appl. 23.5.41. Retractable packer.

G. F. W.

Oilfield Development.

242. **Summary of September Completions.** Anon. *Oil Gas J.*, 27.10.45, **44** (25), 170.—U.S.A. had 2640 completions during September. 1389 gave oil and 292 gave gas. A table summarizes the completion results by States and districts, and gives footages and numbers of wells in different depth ranges. G. D. H.

243. **Completions Show New Decline.** Anon. *Oil Wkly*, 19.11.45, **119** (12), 46.—During October wells were completed in U.S.A. at the rate of 499 per week, the lowest rate since May. In September the rate was 542 per week. It is likely that the 1945 total will be 25,600 wells. Wildcatting is expected to be continued intensively.

During the first ten months of 1945, 21,574 wells were completed, compared with 20,067 in the same period of 1944. The corresponding figures for Texas were respectively 6146 and 5084. Louisiana had 38% more completions than in the first ten months of 1944.

A table summarizes the U.S. well-completion results during October and during the first ten months of 1945. G. D. H.

244. Mexico's Oil Production Increases 20 per cent. Anon. *Oil Gas J.*, 8.12.45, **44** (31), 66.—In the second quarter of 1945 Mexico produced 11,172,153 brl of crude, output in the first quarter being 9,361,728 brl. G. D. H.

245. Worth of Las Mercedes Field may be Revealed Soon by Pipe-line Outlet. Anon. *Oil Wkly*, 12.11.45, **119** (11), 110.—Las Mercedes 16, 14 km east and a little north of the proven field, has been completed at 6400 ft, where it had been testing for several weeks.

Las Mercedes 2 opened the field in 1941, being a dual completion with gas in one horizon and oil in another. A second producer was completed in 1943. 12 producers have been drilled and several pays established. Most wells are about 4600 ft. deep. A pipeline may be built in the near future. G. D. H.

246. Pemex Plans Vigorous Exploration Programme. L. J. Logan. *Oil Wkly*, 5.11.45, **119** (10), 43.—Pemex is employing 17 geological parties, 4 gravity, 6 seismic and one electrical party, and will increase the total to 36 in 1946. 30 exploratory and 45 development wells per year are planned, a doubling of the activity. The present production of 115,000 brl/day comes from 932 wells, 747 of which flow naturally. Since 1938, 315 million brl of oil have been produced. Within that period reserves have been added mainly by extensions and new pay-zones. The total known reserves have been stated to be 870 million brl, over 500 million brl of which apparently belong to Poza Rica. Since 1901 Mexico has produced nearly 2,200,000,000 brl of oil, mainly from a comparatively small developed area within a much greater area with good oil possibilities.

About a quarter of Mexico has geological conditions more or less favourable for oil occurrence. This area includes western Lower California, a coastal area in Sinaloa, and the coastal belt along the Gulf of Mexico. In northeastern Mexico five gas and gas-distillate areas have been found. Further tests are to be made there, for the area is believed to have oil possibilities. The Tampico-Tuxpan area has given 2000 million brl of oil, and includes the fields of the Panuco district, the Golden Lane and Poza Rica. Several wildcats are being drilled. West of the Golden Lane the Soledad discovery well was completed in June 1945. Shows have been logged at Castillo, also in the Tamabra limestone (Lower Cretaceous), which produces at Poza Rica. The Panuco area has numerous pools producing heavy oil from faults and fissures on a broad arch in the Tamaulipas limestone (Lower Cretaceous) under water drive. The cumulative production is 750 million brl and the reserves about 75 million brl. The Golden Lane pools extend for about 50 ml. The high-sulphur oil comes from highs on a narrow anticline, and from the El Abra (Lower Cretaceous) limestone. There is a very effective water drive. 20 ml to the south is the Poza Rica field, which produces from a porous patch of limestone of Lower Cretaceous age, on an anticlinal nose. This field covers about 14,000 acres. There is a very effective water drive.

The third major oil region covers the Yucatan Peninsula and the northern half of the Isthmus. The present fields are in the northern part of the latter area in a saline basin. They produced from Miocene sands on the tops and flanks of salt structures. About 30 salt structures are known; some have yet to be tested. Six have non-commercial production and five produce commercially. The salt-dome tops are irregular. No commercial production has been obtained from the cap-rocks. Some 125 million brls of oil have been produced, and the reserves are estimated at 50 million brl. Except for El Plan, the fields of the Isthmus are drilled up. Wildcats are being drilled on the La Venta and Tecuanapilla structures. G. D. H.

247. Production Occurs in Two Coastal Areas. Anon. *Oil Wkly*, 26.11.45, **119** (13), 38.—Mexican oil production is obtained from the Tampico-Tuxpan and the Isthmus of Tehuantepec areas. The Panuco fields are on the continuation of the Sierra Tamaulipas. Production began in 1904, and in 1938 527 wells were operating to give an average production of 20,000 brl/day. 54 wells have been drilled since 1938, slightly increasing the total productive capacity.

Out of 1055 wells drilled on the " Golden Lane " up to 1938, 527 were then productive, and averaged 23,160 brl/day. Since 1938 the production of the area has been irregular due to varying demands.

Between 1930 and 1938 18 wells were drilled in the Poza Rica field, and the maximum production was 64,705 brl/day. A total of 52 wells have been drilled. This is one of the world's largest fields.

On the Isthmus of Tehuantepec the fields are associated with salt domes. Production began in 1923. Most of the wells produce less than 100 brl/day, but those at El Plan were better producers, and in 1943 a deeper horizon with good possibilities was discovered at 6069 ft.

Out of 13 wildcats drilled between 1941 and mid-1945, two were producers. Mission 1 was completed in April 1945 for 6,000,000 cu. ft of gas and 45 brl of distillate/day, from 6040 ft. Mission 1 is near the Texas border. Soledad 1 was completed in July 1945. It lies west of the " Golden Lane," and gave 40 brl/day of 40-gravity oil from 6480 ft.

Maps show the location of the fields, and tables give the production in recent years, the tank-storage capacity at the various fields, and brief notes on the more recent wildcats. G. D. H.

248. The Oil Situation in Colombia. Anon. *Oil Wkly*, 5.11.45, **119** (10), 12.—In 1944 seven wildcats were completed in Colombia ; one found gas, and the rest were dry. Eight dry wildcats were completed in the first half of 1945 ; six wildcats were in progress at the end of July. The Casabe field has 30 producers, and the Dificil tract two shut-in oil wells and a gas-distillate well. On the east bank of the Magdalena opposite the Casabe field the Galan 1 wildcat has extended production into the De Mares concession. The initial output was 1200 brl/day. The Infantas and La Cira fields are almost completely drilled up.

Two dry wildcats were drilled on the Retiro concession before its abandonment. Four dry holes have been drilled on the La Dorada tract. Tests are to be drilled on the Caraballo and Pinto tracts. A wildcat will be drilled in extreme western Boyaca, and one near Barranquilla. It is reported that work will be carried out in Putumayo and Caqueta, near the Ecuador border.

The Socuavo dome is being systematically developed, and it is likely that a deep Cretaceous pay will be exploited in the whole Tibu area if a test on the Tres Bocas dome is successful. Moderate commercial production has been developed on the Cantagallo tract, west of Puerto Wilches. G. D. H.

249. Crude Output in Argentina shows 5·9 Per Cent. Drop. Anon. *Oil Gas J.*, 1.12.45, **44** (30), 50.—During the first quarter of 1945 private companies in Argentina produced 306,332 cu. m of oil, and Government wells produced 626,969 cu.m. G. D. H.

250. Russia Expands. W. B. Hill. *Oil Wkly*, 5.11.45, **119** (10), 3.—The utilization of natural gas is undergoing extensive expansion in Russia. Several important gas pipelines have been laid, and others are under construction or planned. The 500-ml 10- and 12-in line from Saratov to Moscow will have a capacity of 80 million cu. ft/day. Gas from the new Cherdin field, near Bereznovi, passes 400 ml to steel plants at Sverdlovsk. A 450-ml line from Daszawa to Kiev is planned. Kuibyshev is supplied from Buguruslan. In Central Asia Andizhan is connected to nearby oil- and gas-fields. Gas reserves have been found near Morshansk in the Moscow Basin, Western Urals, Penza region, Kalmyk Steppes, northern Caucasus, the Saratov–Volga districts, Kuban, and the Crimea. An oil pipeline is being built from the Ploesti area to Odessa, and one is to be built from Bacau to Odessa.

2000 geologists and geophysicists are at work with a view to establishing new reserves to meet further requirements. During the war new fields have been found in the Ural-Volga region, where, until mid-1944, the fields tapped Upper Palæozoic pays at depths of 1000 to over 3000 ft. At least 10 major fields were being developed in the Kuibyshev Combine area. Four promising fields were being developed in the Kama River valley. Two important fields were found at Ust Uchta and Izhma near the Arctic Circle, and they probably produce from the Palæozoic. At the beginning of the war the Ural–Volga region gave 45,000 brl/day; at the beginning of 1945 the output exceeded 225,000 brl/day. Late in 1944 a wildcat was completed at 9600 ft in the previously shallow field of Tuimazy, west of Ufa, giving oil from the Devonian.

A Devonian test midway between Syzran and Kuibyshev found oil at 8500 ft. Hopes are entertained that Devonian production will be found elsewhere, possibly in stratigraphic traps in some cases. Devonian production has been found near Molotov.

Buguruslan is the largest of seven new fields in Bashkiria, but the most important producer is Kinzebulatovo, near Ishembai, opened late in 1943.

In the Baku region wells have been drilled 4½ ml offshore, and seismic work has revealed two trends with closed areas offshore. Offshore wells are drilled from barges sunk on to piles. Further structures have been defined on land, and a new field has been opened near Maklach-Kala.

Deep drilling has opened excellent new pays in several old fields south and southeast of Samarkand. New fields have been discovered in the Fergana Valley. Drilling has been carried out in the Kazakh Republic, Yakutsk area, and the Kamchatka Peninsula.

Secondary recovery methods are to be applied in fields such as Grozny, Krasnokamsk, Krasnodar, and Kazakhstan. G. D. H.

251. Egyptian Exploration being Conducted on Broadest Front in History. C. O. Willson. *Oil Gas J.*, 1.12.45, **44** (30), 56.—Several geological parties are at work in Northern Egypt, and 4 wildcats are being drilled. At present the two producing fields, Hurghada and Ras Gharib, yield 26,000 brl/day, the former field contributing 1400 brl/day. In seven years Ras Gharib has produced about 40% of its initial reserve, estimated to have been about 110 million brl.

During the spring South Mediterranean Oilfields, Ltd., completed a dry hole at Khatatba, 25 ml northwest of Cairo. The company's interests are to be taken over by other companies.

Exploration for oil, and shallow drilling began in 1885 in the Gemsah area. The first producer in this area was completed in 1909, and the field had a small output until 1927. The Hurghada field was opened in 1913, and Ras Gharib in 1938. A test is being drilled 15 ml northwest of Ras Gharib. Another is under way 15 ml east of Suez, about 1½ ml from 1 Ayun-Musa, which was drilled to 5500 ft and ultimately completed as a shallow water well. A test is to be drilled near Ras Matarma. Eight tests have been drilled in the Ras Shukhair and Desht-el-Daba area. Six have been drilled north of Ras Gharib.

The Gulf of Suez and the Red Sea area is geologically a zone of subsidence, dating from the Miocene. Large amounts of gypsum, anhydrite, rock salt, dolomite, and in places globigerina marls were deposited. Asymmetrical fault blocks are the main structures. At Ras Gharib the Miocene rests on Cretaceous and Carboniferous, the latter beds giving the bulk of the production.

Two tests have been drilled in North Sinai, and a third is under way. The El-Nekhl test, 70 ml east of Suez, was abandoned at 5566 ft. Darag 1, 6 ml to the southeast, was drilled to 2768 ft. 1 Abu Samth lies 5 ml northwest of the Nekhl well. 1 Khabra is to be drilled 6 ml from the Palestine border.

North Sinai represents the southwestern continuation of the Syrian-Palestine belt. Jurassic beds are well developed and there are great asymmetrical anticlinal uplifts which have been surveyed gravimetrically and seismically.

In the Western Desert province many exploration permits have been taken out, but very little drilling has been done. The Leon well near Mersa Matruh went to 2000 ft, the Daba well to 6000 ft, and the Khatatba well to 7000 ft. All were dry. Oligocene, Miocene, and Pliocene beds are exposed, but many areas are covered by wind-blown sand and alluvium, calling for geophysical exploration. Near Giza Lower Cretaceous and Upper Eocene outcrop.

In the Eastern Desert there is a well-exposed Tertiary area, with one or two small Cretaceous inliers.

Brief notes are given on the regulations covering oil exploration, and a map shows the areas taken up under exploration permits. G. D. H.

252. Oil Production in Egypt comes from Two Fields on Suez Gulf Shores. C. O. Willson. *Oil Gas J.*, 8.12.45, **44** (31), 62.—Anglo-Egyptian Oilfields, Ltd., first found production in 1908, in Gemsah No. 1, on the west coast of the Gulf of Suez between

Ras Gharib and Hurghada. 22 wells were drilled, 10 being producers, and in 16 years from 1911 the cumulative output was 1,300,000 brl. Hurghada was discovered in 1913, and during 32 years it has produced 40 million brl. The present output is 1400 brl/day, of 22–24° A.P.I. oil. Oil occurs in the Nubian sandstone, lying unconformably below the Miocene, at depths of 1700–2200 ft. The current output is 93% water.

Ras Gharib has produced 45 million brl, and has remaining reserves estimated at 55 million brl. The field was opened in 1938, and for some time has averaged 24,000 brl/day. This rate is undoubtedly too high for efficient operation. In 1921 and 1923 two dry holes were drilled a little to the south of the present field. Work was renewed in 1937 after a gravity-meter survey, and the first well was completed at a depth of 2560 ft. The section shows 700–1000 ft of sands and grits, underlain by 1000 ft of anhydrite and shale, with local limestone development which shows signs of giving a small settled production. These Miocene beds rest unconformably on Cretaceous and Carboniferous, the former having minor sand bodies with small oil production, and the latter providing the main oil output. There is an easterly-dipping monocline of pre-Miocene beds faulted on the west and south, with a covering dome of Miocene which is also affected by the main faults. Oil trapping in the upper Carboniferous sands is by the nonconformity, and in the lower sands by non-conformity and faulting.

Drilling is done by diesel-powered rigs. Rock bits are used extensively, and lost circulation causes trouble at 300–700 ft. At present there are 26 flowing wells, 13 gas-lift wells, and 42 pumping wells. The field is under hydrostatic control, with no gas-cap. Part of the production requires dehydration.

A wildcat is being drilled 15 ml north of Ras Gharib, and one 15 ml east of Suez and 1½ ml east of the large Ayun-Musa water well.

The Suez refinery includes skimming and cracking plants. G. D. H.

253. Bahrein Island Produces 20,000 brl and Refines 70,000 brl/day. C. O. Willson. *Oil Gas J.*, 20.10.45, **44** (24), 110.—The Bahrein Island discovery well was completed in 1932, and 74 producers have been drilled to outline a structure 7½ ml long and 2½ ml wide. The axis of the structure runs north–south. Dips range 3½–6°. There is no evidence of faulting. Oil is obtained from three pays, and their aggregate producing thickness is 500 ft. The first and second pays lie 1800–2200 ft deep. The initial reservoir pressure was about 1200 lb/sq. in, and the oil is undersaturated with gas, its bubble-point being 250–350 lb/sq. in. There is an active water drive. Several years ago it was found that the water advances did not maintain the pressure when the optimum production rate of 20,000 brl/day was used, and the injection of gas was begun to balance oil withdrawal against water advance, and so maintain pressure. In the deeper horizon several of the thick limestone members contain dry gas, while others have a large gas-cap area and a narrow ring of black oil. The dry gas is at 2100 lb/sq. in, and is used directly for injection into the first and second pays.

The refinery at Awali processes 70,000 brl/day, 50,000 brl/day of oil being obtained from the mainland of Saudi Arabia. The main equipment includes two low-pressure atmospheric tower crude-oil distillation plants; one low-pressure atmospheric and vacuum tower crude-oil distillation unit; one fluid-type catalytic cracking plant; two thermal re-forming plants; two thermal cracking plants; one thermal gas-recovery plant; one fluid-type isomerization plant; one sulphuric-acid-type alkylation plant. These plants are briefly described. G. D. H.

254. Saudi Arabian Petroleum Operations are Rapidly Reaching Major Proportions. C. O. Willson. *Oil Gas J.*, 3.11.45, **44** (26), 70.—The Arabian American Oil Co. has concession rights over an area of 611,200 sq. ml in Saudi Arabia. The first producer in the Dammam field was completed in 1936 at a depth of 2109 ft. It was soon discovered that this sand would not support commercial oil development, and deeper exploration gave a large well at a depth of 4727 ft, in 1938. This well produces 2500 brl/day, and has given over 4,200,000 brl. 23 wells have been completed in this, the Arab zone, and have proved an area 5 ml by 4 ml. They yield 70,000 brl/day, the oil passing to the Bahrein and Ras Tanura refineries.

The discovery well of the Abu Hadriya field was completed in 1940 at a depth of 10,200 ft. It lies 100 ml northwest of Dammam. This is believed to be a major reserve. Abqaiq is the largest field, and was opened in 1941. The first well was completed at 6180 ft, in the D member of the Arab zone. It lies 50 ml southwest of

Dammam. The A and B members are wet, the C member gives 30°-gravity oil, and the D member 37–39°-gravity oil. Five wells have been completed in the field which is at least 7 ml long and 3 ml wide, the limits not having been defined in any direction. A 14-in pipeline to Dammam will be built. The discovery well of the Qatif field was completed in the C and D zones of the Arab zone at 7360 ft. The field is 22 ml north and a little west of Dammam.

The western part of Saudi Arabia consists of pre-Cambrian crystalline rocks which topographically and probably structurally slope gently northeast, east and southeast. The eastern areas are covered by gently-dipping sediments which include early Palæozoic, and exceptionally complete representation of the Mesozoic. To the east are Tertiary and later deposits. The eastern part of the Nejd area west of the province of Hasa where the present production is found consists of a series of sediments ranging in age from early Palæozoic to Lower Eocene. In Hasa the exposure consist of Lower and Middle Eocene and Mio-Pliocene, with subordinate Pleistocene. The Eocene is almost wholly calcareous; the Mio-Pliocene is generally continental, only slightly disturbed and masking the underlying structures. The rocks overlying the Arab zone are Lower Cretaceous. In the coastal area of Hasa the monocline is disturbed by low domes such as those of Dammam, Abqaiq, and Abu Hadriya. Bahrein and the producing structures of Qatar are similarly placed. All the Saudi Arabian production is from limestones. The most extensive and highly productive facies of the Arab zone is a slightly cemented oolite.

Saudi Arabia and Bahrein are estimated to have proved reserves of 2000 million brl, a figure which recent developments have probably made most inadequate.

In some cases two horizons are produced together; in others dual completions are made. Lost circulation is a serious problem in drilling. The crude passes through two separators, and then through gas-traps to a weathering column. The vapour from the weathering operation passes to the stage gas compressors and then to the gas rectifier. This operation completes the stabilization of the crude, and gives a maximum recovery of light hydrocarbons.

A small refinery is operated at Ras Tanura, and is designed to give maximum yields of diesel and fuel oils. There will be two 25,000-brl units providing for atmospheric and vacuum fractionation, and two 7000-brl re-forming units. G. D. H.

255. Plans Under Way to make Qatar a Major Source of Petroleum. C. O. Willson. *Oil Gas J.*, 15.12.45, **44** (32).—The first exploratory test (1 Dukhan) on the Qatar Peninsula was begun in 1938, and completed in limestone in 1940, with an initial output estimated at 5000 brl/day of 36° A.P.I. oil. 2 Dukhan completed 10 ml to the south in 1941 had a similar production. On deepening gas production was obtained at 6206 ft. 3 Dukhan, 2½ ml east of 1 Dukhan, was in edge-water. Threat of invasion caused the wells to be plugged.

Production is from a Mesozoic limestone on a north–south anticline, which is 4½–5 ml wide and possibly 50 ml long in the surface beds. The subsurface structure is smaller. No. 1 and No. 2 limestones in the Zekrit formation are thin and barren; No. 3 is about 100 ft thick, and gave oil in the first two wells and water in the third. The No. 4 limestone is 330 ft deeper, giving gas in 2 Dukhan and water in 3 Dukhan.

Drilling is difficult. A water-string is set at about 4000 ft, and wells are completed with an 8⅝-in string cemented at the top of the producing horizon, the wells producing from open hole after drilling in. G. D. H.

256. Oil Production Resumes on Tarakan. Anon. *Oil Gas J.*, 8.12 45, **44** (31), 66.—Oil production on a limited scale has been resumed on Tarakan. In 1940 and 1941 the output was, respectively, 807,821 and 698,284 tons.

On invasion in 1942 most of the wells were destroyed. When the Allies invaded in 1945 the Japanese had failed to destroy one-third of the wells in the Pamusian area, and almost half the wells drilled by the Japanese were in working order. The Japanese drilled 140 wells. G. D. H.

TRANSPORT AND STORAGE.

257. Design of Oil Pipelines. Part 3. F. Kargo. *Petrol. Engr*, May 1945, **16** (8), 76.—Design and heat loss calculations are discussed and Gill's chart for the temperature drop of hot oil in pipes is given. Plotting the temperature gradient over the pipeline length, the viscosity at the mean temperature of the successive sections, and the progressive sums of the pressure drops against the length of the line will show irregularities in the calculations. Flow in most heavy heated oil lines passes through the so-called unsteady region between the upper and lower critical limits, and it is shown how much the calculated pressure drop will increase by following the turbulent flow factor curve to the lower critical limit. Discussion of the Docksey " S " transition curve is made, and it is recommended that an investigation be made on the above lines to determine the distance between the critical limits and the pressure drop, through this distance, for the friction factors along the turbulent and streamline flow curves. It is probably safe to use an intermediate value between the two.

Heavy oils must always be pumped fast to prevent the line freezing, especially in winter. It is advisable always to determine the temperature gradient and pressure drop for a smaller flow than the designed rate. If operations do not allow continuity, to prevent blocking of the line, the following action can be taken : (1) displacement by lighter oil, if available, and the line warmed up by displacing the light oil, with heated light oil before pumping the heavy oil ; (2) the line can be kept fluid by pumping hot oil back and forth during the shutdown period ; (3) hot water can also be used for the purpose.

Tapering a line means a larger-diameter pipe is laid down for the unsteady and streamline portion of the line ; such tapering has proved very satisfactory, and has the advantage that lighter pipes can be used as the pressure is lower. A graph is given showing temperature-pressure gradients for 1500 brl/hour, Santa Maria crude oil. From such graphs it is shown how easily the location, length, and size of the larger pipe (the tapered section) can be found by simply drawing in two triangles and reading the points of intersection. The subject is discussed and a problem is solved. Heaters, pumps, and yearly costs of operations are briefly surveyed and discussed. Special problems are also reviewed. When a line becomes too small, the question whether to replace it by a larger one or parallel it with a line of equal or different size becomes an economic issue. Multiple lines are called loops. W. H. C.

REFINERY OPERATIONS.

Refineries and Auxiliary Refinery Plant.

258. Peacetime Utility of Wartime Petroleum Refining Processes. F. D. Parker. *Refiner*, Nov. 1945, **24** (11), 443–449. *Paper Presented before California Natural Gasoline Assoc.*—The utility of the war-built plants in the manufacture of peacetime refined products is of interest not only to the refiners who installed one or more of these units for the production of aviation gasoline, but also to those refiners who, through consideration of individual economic, geographical, or transportation factors, were not in a position to participate in the 100-octane programme, or phases of the toluene and synthetic-rubber programmes, and now find themselves entering the post-war period with pre-war refining facilities operating in competition with more modern facilities of other refiners. While the problem of what plants can be operated economically is one that must ultimately be reviewed by each individual refiner in the light of conditions peculiar to his situation, there are certain more or less general technico-economic considerations. The paper deals with this latter aspect of the problem. It is concluded that : (1) The most generally applicable refining tool commercialized during the war is catalytic cracking ; (2) Thermal of catalytic polymerization of C_3 and C_4 unsaturates otherwise disposed of to fuel gas or low-priced liquefied petroleum gas is, as before the war, an economical operation for virtually all refiners conducting cracking operations ; (3) Alkylation of C_3 and C_4 unsaturates and *iso*butane to the extent that they are available in excess of specification-vapour-pressure gasoline (and hence disposed of to low-priced fuel gas) is economical for large refiners and marginal for small refiners ; (4) Isomerization of normal butane to *iso*butane for subsequent use in alkylation is justifiable economically only if field or refinery *iso*butane costs 1–2 cents/gallon more than normal butane, and alkylate produced therefrom is incremental, and hence of low unit cost ; (5) Isomerization of normal pentane to *iso*pentane for octane improvement is economical only where suitable normal pentane charge can be easily segregated (as from straight-run gasoline) and in relatively large capacity units; (6) Hydroforming, in the present stage of development, does not appear economically justifiable for upgrading octane of naphtha for motor fuel, but may be suitable for certain specialized operations such as aromatic chemical production.

A. H. N.

259. Caribbean Refineries were Closely Geared to Allied War Operations. Anon. *World Petrol.*, Nov. 1945, **16** (12), 62.—A review of the activities of refineries in the Caribbean area, which has made the largest contribution of oil from territories outside the United States; 700,000 brl of crude being processed daily towards the latter part of the war.

The largest of four plants operated by the Royal Dutch-Shell Group was at Curaçao, with a daily throughput of 300,000 brl; where a wide range of products, including substantial quantities of 87 octane and about 12,000 brl daily of 100-octane aviation gasoline were made.

A successful thermal cracking process, the Avaro, was developed to produce a highly aromatic aviation blending agent from a crude naphtha cut. This permitted a reduction in the total alkylate content of the 100 octane blend, and the incorporation of lower octane base stocks.

Plant for the production of cumene, and alkylation units were also developed.

United Kingdom requirements of high-quality tractor fuel were supplied from Curaçao. Large quantities of light fuel from Venezuelan crude for the Allied Navies were produced, which involved discarding some 11,000,000 brl of hard asphalt. A single refinery produced 5,000,000 brl of thin combat fuels monthly.

Substantial amounts of naphthenic oil residues formed a base for a highly efficient rot-proofing material. A process was developed for the greater recovery of vanadium from deposits in furnaces burning Venezuelan oils, some 323 tons of metal being obtained.

An increase in throughput to 280,000 brl daily on a plant designed to run at 230,000 brl was obtained by careful study of each operating unit, and the large increase in throughput generally, necessitated fastest possible tanker turn-around.

The San Lorenzo Refinery on Lake Maracaibo, Venezuela, doubled its daily intake of 19,000 brl. The Arend refinery on Aruba, designed for throughput of 5000 brl/day, was closed down in 1942 and reopened in March 1945, operating on an increasing output.

The United British Oilfields of Trinidad refinery increased its runs from 18,500 to 25,000 brl daily, and modifications made to produce asphalt and naphthenic oil residue. The Royal Dutch-Shell are building a complete refinery with a daily capacity in excess of 40,000 brl near Punta Cardon, Venezuela. G. A. C.

260. Products of Industry's Largest Manufacturing Unit have most Widespread Distribution. C. O. Willson. *Oil Gas J.*, 13.10.45, **44** (23), 86.—A description of the Anglo-Iranian Oil Co's refinery at Abadan, Iran, which has a daily throughput of 360,000 brl and ranks as the world's largest not only in regard to throughput, but also in accumulated output, crude runs to stills having passed the one-billionth brl mark in July 1943. Its products, which are distributed over a large part of Europe and the remainder of the Eastern hemisphere, conform to the varying specifications of many countries. In addition, products serving a specific purpose and limited in demand to one area are manufactured.

The crude oil is drawn from the following fields: Masjid-I-Sulaiman, Haft-Kel, White Oil Springs, Gach Saran, and Agha Jari, and normally has a specific gravity of 0·846 with 3½% to 75° C, 8½% to 100° C, 21% to 150° C, 32% to 200° C with a total distillate (sp. gr. 0·773) of approximately 54% up to about 300° C.

A full description and a flow-sheet of all the refinery operations are given. These include crude-oil distillation, cracking and reforming, superfractionation, alkylation and isomerization, polymerization, SO_2 extraction, and preparation of special products. Regarding chemical treatments the methods used are mainly peculiar to the company's operations. Extensive use is made of the Holley–Mott type of washer, in which advantage is taken of the difference in gravities of oil, chemical, and oil/chemical emulsions. This type is used for acid-washing for sulphur removal, and hypochlorite sweetening. Conventional methods are used for plumbite and caustic-soda treatments.

Hydrochloric acid is manufactured for use on the refinery as well as lime, and sulphuric acid using vanadium pentoxide catalyst can be produced at 264 tons per day. 63 boilers have a capacity of 4,750,000 lb/hr. and the power plant consists of 10 units with a total capacity of 91,500 k.w.h. T. M. B. M.

261. Design of Class 1 Pressure Vessels. E. J. Heeley. *Refiner*, Nov. 1945, **24** (11), 467–476. *Paper Presented before the Inst. Mech. Eng.*—The fusion-welded mild-steel pressure vessels generally known in Great Britain as "Class 1" welded pressure vessels are those of a sufficiently high standard of manufacture to comply with the requirements of certain recognized specifications, such as those referenced in the paper. Such vessels are constructed of good-quality mild-steel plate joined together by a metallic arc fusion-welding process. A radiographical examination is made of the full length of all the main seams, which are machined or dressed so as to be level with the surfaces of the plate on either side of the joint, and specified mechanical tests are carried out to ensure that the quality of the welded joint is of the required standard. The vessels receive a stress-relieving heat treatment on completion of the welding operations. The magnitude of the stress in the material is a dominant factor in the design of a pressure vessel, but difficulties arise in connection with the design of Class 1 fusion-welded pressure vessels on account of the different viewpoints of various authorities on the stress to be applied to the welded joint. The extent of these differences is shown in the paper by a comparison of vessels designed in accordance with the specification requirements of four leading authorities (two British and two American). An analysis is made of the factors involved in the formula employed by these authorities for determining the wall thickness, and it is shown that the formulæ have been based on the riveted form of construction despite the very different conditions of stress at Class 1 welded joints. The characteristic physical properties of such joints are discussed in conjunction with the results of recent investigations on their behaviour under fluctuating stress conditions. A recommendation is made for a much-needed simplification in design formulæ to take into consideration the actual characteristics of the welded form of joint. Illustrations are given of typical welding groove preparations for the attachment of flanges, branches, etc., designed to provide adequate accessibility for manipulation of the welding rods. A. H. N.

262. Heat-Exchanger Design for Modern Refinery Processing. S. Kopp. *Petrol. Engr.*, June 1945, **16** (9), 108.—The accepted codes for heat-exchanger equipment and standard of the Tubular Exchanger Manufacturers' Association (T.E.M.A.) are briefly reviewed. Heat-exchanger systems, types, their designed duties, components, measurements, tolerances, dimensions and thicknesses of tubes, corrosion allowances, construction and maintenance are outlined or discussed, and illustrated under the following sections: shell and multi-tube; floating head; fixed-tube sheet; u bend; double pipe and open section designs. Sketches with measurements are shown of a kettle-type reboiler; test-ring assembly; miscellaneous attachments of clamp-type exchangers; and tube-hole grooving in a tube sheet. Floating-head types are shown by nine sketches, and illustrations are given of, and the following are discussed: Air-cooler unit; Contactor cooler unit (Stratco); Tubeflow cooler. Other sections discussed relate to low-temperature and high-temperature service exchangers and extended surface exchangers, corrosion resistance, and the use of bi-metalllic linings or tubes. The method of installing bi-metallic tubes is given in a dimensioned sketch.
W. H. C.

263. Properties and Applications of Saran Pipe. D. R. Williams. *Chem. Met. Eng.*, 1945, **52**, 113.—Saran resin is a thermoplastic vinylidene chloride-vinyl chloride copolymer combined with suitable plasticizers and pigments. It has been used for the construction of piping ranging in diameter from ½ to 4 ins. Saran pipe has proved very satisfactory in the handling of corrosive substances—*e.g.*, bromine vapour, warm 8%HCl, water containing SO_2, and phenol, etc. Its high electrical resistance enables it to be used for water lines between Hg arc rectifiers and in natural gas lines where electrolytic corrosion may ensue. Its main defects are its low thermal conductivity and low softening point (240–280° F), but this property enables repairs or joins to be effected very readily. Full details concerning the resistance of the material towards chemicals, its physical properties, and the strength, etc., of Saran pipe are given in the paper. L. B.

264. Heat Transfer Coefficients for Pipe and Wire. I. J. Hooks and F. Kerzer, Jr. *Chem. Met. Eng.*, 1945, **52**, 117.—Nomographs for the determination of forced convection heat-transfer coefficients for pipe and wire, and a chart for the determination of the coefficient of heat transfer by radiation, are given. L. B.

265. Sampling Regenerator Outlet Flue Gas to Determine Change in Oxygen Content. R. A. Rowe. *Petrol. Engr*, May 1945, **16** (8), 187.—The precautions necessary in sampling flue gases from a catalyst regenerator are discussed; they form an important part of this paper. It is necessary to prevent any entrained catalyst from entering any part of the sample withdrawal line and at the same time allow free and continuous flow of the gas to be sampled. The gas flow must be at a rate sufficient to eliminate any cooling problem and also allow the rapid registration of change in oxygen content of the gas. The arrangements for this purpose are described and shown in a diagram. The sampling tube, 24 × ¼ in, must be of 18–8 stainless steel, has at the regenerator end a ball stone filter (aluminium oxide aerator stone), which, after cementing on, is ground to a cylindrical shape 5/8-in diameter. This tube is inserted in a 1-in connector to the regenerator outlet line, so that the end of the stone filter cylinder is ½ to ¾ in from the flowing stream in the regenerator outlet.

The manner of fitting the sampling tube by a ferrule to the 1-in connecting tube which is constructed with a 1-in gate valve, two tees, and three valves; the functions of the latter, and the method of inserting the sampling tube and establishing its correct position before connecting it to the electrical oxygen detector, are described. The train of filtering, drying, and constant-pressure bottles is described. One of the two $CaCl_2$ drying bottles contains a ball-stone filter (not ground to a cylinder), the first and the last constant pressure bottles are open to the atmosphere and hold water to give 4½ and 3-in pressure, respectively.

The equipment for checking the electrical oxygen detector is shown in a sketch and is described. Samples are taken in football bladders fitted with a tube and clip, the equipment shows the needle valve and rubber connections, a filter and dryer consisting of a 4-oz bottle 1/3rd filled with $CaCl_2$, with ¼-in copper inlet and outlet tubes, the latter having a ball stone filter ground to a 5/8-in cylinder.

The procedure for taking a sample of the flue gas in the rubber bladder and thence to the Orsat burette is described. Periodic checks of the detector instrument are made. A calibration chart is shown. W. H. C.

Cracking.

266. U.O.P. MS-Type Catalytic Cracking Unit. N. K. Anderson and M. J. Sterba. *Petrol. Times*, 22.12.45, 1080.—The U.O.P. MS-Type Catalytic Cracking Unit is specially designed to meet the needs of the smaller refiner. It retains all the advantages of the original fluid-type operation, but installation and running costs are greatly reduced by the fact that: (1) the regenerator and reactor are combined in a single vessel; (2) the large regenerator riser has been eliminated and the regenerator standpipe shortened; (3) all equipment for secondary catalyst recovery has been eliminated; (4) use of additional distribution grids has improved efficiency of reaction and regenera-

pipe shortened; (3) all equipment for secondary catalyst recovery has been eliminated; (4) use of additional distribution grids has improved efficiency of reaction and regenera-

tion; (5) air for the combustion passes through the regenerator countercurrent to the flow of the catalyst. A flow diagram, and tables giving yields and costs for operation at three different throughputs and with three different types of catalyst, are incorporated in the paper. L. B.

267. Combustion-Gas Turbine in Houdry Process. J. E. Evans and R. C. Lassiat. *Refiner*, Nov. 1945, **24** (11), R 461–466.—The thermodynamics and operational characteristics of combustion-gas turbines are discussed and analyzed. Reviewing briefly the operating data and observations reported, it is evident that variations in turbo-compressor air-delivery performance due to seasonal factors has proved to be of minor importance in the Houdry application—particularly in view of the savings in power resulting from use of the gas turbine. In consequence of process requirements, the machines have been subject to a certain amount of cyclic variation, in spite of which, operating factors of 98% have been averaged over many years of service.

Considering this on-stream time efficiency, maintenance costs which amount to about 3% of capital investment per year have been quite satisfactory. In the future other process industries may well wish to avail themselves of the unique properties of the turbo-compressor, particularly as the self-powered air compressor. The discussion of turbo-pressure-volume characteristics and seasonal variations should serve as a useful guide in synthesizing the performance charts needed in process exploratory work.

A. H. N.

268. High-Capacity Operations on Fluid Cracking Units. E. V. Murphree, E. J. Gohr, H. Z. Martin, H. J. Ogorzaly, and C. W. Tyson. *Refiner*, Nov. 1945, **24** (11), 423–426. *Paper Presented before A.P.I.*—Fluid catalyst cracking was developed originally by Standard Oil Development Co. as a means of increasing the yield and quality of motor gasoline and other saleable products which could be obtained from crude oil. However, with the advent of World War II the possibilities of this process for production of such important war materials as aviation gasoline, butylenes for rubber manufacture and toluene for explosives, became fully appreciated. As a result many plants were quickly designed and constructed throughout the United States in order to provide the Army and Navy with the desired large quantities of these materials. As the war progressed the demands for these strategic materials increased considerably. Because of their flexibility many of the fluid-cracking plants were able to make extensive increases in capacities above the design values, and thus aided significantly in preventing a shortage of petroleum products. There are in operation at the present time 34 fluid-catalyst cracking units, and about nine additional plants are undergoing design or construction. Of this total of 43 plants, all but six are located in the United States. The nominal design cracking capacity for these plants is about 540,000 brl/day, in many cases based on the more severe operations for production of aviation gasoline components. However, it is estimated that under the less severe operating conditions which are best suited for maximum yield of motor gasoline the total feed capacity of these plants would be approximately 720,000 brl. As was stated above, these values are estimated on the basis of the design carbon-burning capacities of these plants. The downflow plants of the affiliates of the Standard Oil Co. (New Jersey) originally were designed for a feed rate of 15,500 brl/day when operating under conditions advantageous for the production of the wartime products. At the time the units were designed it was estimated that under conditions for motor-gasoline production the feed capacity would be about 20,000 brl.

The paper describes the means by which difficulties were overcome. A. H. N.

269. Liquid-Charge Technique in TCC Processing. T. P. Simpson, S. C. Eastwood, and H. G. Shimp. *Refiner*, Nov. 1945, **24** (11), 436–442. *Paper Presented before A.P.I.*—An adaptation of the TCC process, called liquid-charge technique, is described for catalytic cracking of the heaviest types of petroleum charge stocks. High yields of high-quality motor gasoline and distillate fuel oils are produced. The reactor used is the concurrent solid-bed downflow type with provision for introducing the feed at the top and removing the cracked products from the bottom. The charge may comprise total liquid or mixed liquid-vapour feed. Catalyst-to-oil ratios need not be high to achieve this desired conversion with reasonable oil and catalyst inlet temperatures. Studies on a number of stocks show that catalyst-to-oil ratios of 1·8–4·0, by volume, are adequate. Overcracking may occur at higher catalyst-to-oil ratios, resulting in a rapid increase in coke and gas production with a loss in gasoline yield and liquid recovery. Charge stocks should be below about 4% by weight Conradson carbon residue to maintain coke tendency at reasonable levels. Heavy asphaltic stocks give excessive coke, and should be deasphalted before they are charged to the cracking unit. Deasphalting greatly reduces the coke tendency, and results in improved yields of motor gasoline from a given capacity unit. Data are given to demonstrate that the liquid charge technique catalytic reaction proceeds extremely rapidly, with about 70% of the cracking occurring at a point representing only 12% of the total path through the reaction zone.

A. H. N.

270. Economic Survey of Thermofor Installations in Socony-Vacuum Lubricating Oil Refineries. H. C. Meyers and R. M. Owen. *Oil Gas J.*, 4.8.45, **44** (13), 93.—The operating data, capital invested, and royalties paid are given for Thermofor kiln regenerators of 30, 50, and 110 tons/day rated capacity, operated at five Socony-Vacuum refineries. Costs are shown for the regeneration of various refining earths: (A) fullers' earth, Thermofor regenerated, in comparison with regeneration in multiple-hearth rotary kilns, after operation on (1) Pennsylvanian cylinder stocks, S.A.E.-20 motor oil, and petrolatums in 40% naphtha; (2) Mid-Continent bright stocks, neutrals, petrolatums, waxes, and cerasins both straight and in naphtha solutions; and (B) Bauxite Thermofor regeneration compared with bone char regeneration in Deely-Kent retorts, after Mid-Continent wax filtrations. Basic labour, repairs, maintenance and utilities, adsorbent losses and discard costs, and the savings due to the Thermofor method are shown. The installation of Thermofor kilns has shown substantial lowering of operating expenses, and the reactivated earths retain their efficiency after repeated regenerations far better than the methods formerly used. The extent of savings depends on the size of plant, effect of previous absorbent employed, and the method of regeneration. The economies resulting from the Thermofor process indicate an average amortization period of from 8–9 months. The quantities of earth replacement necessary and the number of regenerations possible are shown. W. H. C.

Alkylation.

271. Corrosion in Hydrofluoric Acid Alkylation. M. E. Holmber, and F. A. Prange. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1030–1033.—The number of desirable materials of construction for anhydrous hydrofluoric acid service is comparatively small. Carbon steel is the basic material, and is adequate for pressure vessels up to a temperature of approximately 150° F; Monel metal or Monel-clad steel is the desirable material for higher temperatures. Cupronickel might be particularly suitable in heat-exchanger tubes. Monel metal is the desired material for valve trim in severe service. Materials to be avoided can be divided into three classes. The first class is made up of straight chrome stainless steels and copper alloys (except cupronickel), which are velocity sensitive in anhydrous hydrofluoric acid, and in high concentrations of the acid. The second class, materials which may be attacked by intergranular corrosion, includes Hastalloy A and B, cast iron, and high-zinc, uninhibited brasses. The third class, materials used for piping and fittings that are brittle or notch-sensitive, includes free-machining steel, high-phosphorus steel, and others of similar properties. A. W.

Metering and Control.

272. Unit Coefficients for Orifice Meters. T. K. M. Smith. *Refiner*, Nov. 1945, **24** (11), 477–478. **Maintenance of Orifice Meter Plates and Tubes.** W. Bostrom. *Refiner*, Nov. 1945, **24** (11), 478–479. **Temperature Determinations in Orifice Meter Runs.** M. McIlvaine. *Refiner*, Nov. 1945, **24** (11), 479–480. **The Orifice-Meter Fitting.** G. B. Reece. *Refiner*, Nov. 1945, **24** (11), 480.—These are parts of the Southern California Meter Assoc. Meter Course. A. H. N.

Safety Precautions.

273. Safety in Arc Welding. R. F. Wyer. *Refiner*, Nov. 1945, **24** (11), 481–484.—A discussion of the hazards and the safety precaution to be taken in arc welding is presented. A. H. N.

PRODUCTS.

Chemistry and Physics.

274. A New Hydrocarbon. M. Nierenstein and C. W. Webster. *J. Amer. chem. Soc.*, 1945, **67**, 691.—A new tri-nuclear hydrocarbon, "Ellagene," $C_{20}H_{14}$, has been prepared by zinc-dust distillation of the pyridine insoluble fraction of ellagic acid prepared according to Perkin and Nierenstein. Ellagene has m.p. 197° C., picrate 117° C., benzylidene deriv. 107° C. J. H. P.

275. Solubility of Water in Alcohol-Hydrocarbon Mixtures. C. B. Kretschmer and R. Wiebe. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1130–1132.—Critical solution temperatures with water have been studied for a number of blends of ethyl alcohol with a single hydrocarbon, or representative paraffins, olefines, and naphthenes being chosen. The solubility of water in several blends containing ethyl alcohol in a mixture of two hydrocarbons have also been determined, together with the effect of small proportions of stabilizers on the C.S.T. of an *iso*octane, alcohol and water blend. It is shown that the more volatile gasolines will have higher water tolerances, and that higher alcohols seem the most suitable agents for increasing the water tolerance of a gasoline-alcohol blend. A. W.

276. Cyclic Dimerization of *iso*Butylene. J. B. McKinley, D. R. Stevens and W. E. Baldwin. *J. Amer. chem. Soc.*, 1945, **67** 1455–1459.—A cyclic dimer identified as 1 : 1 : 3-trimethyl*cyclo*pentane results as the main product of the polymerization of *iso*butylene at high temperatures and pressures. A conventional synthesis of the trimethyl*cyclo*pentane is described in the course of which a new substance, optically inactive 1-chloro-1 : 3-dimethyl*cyclo*pentane was isolated. J. H. P.

277. Volume of Mixing and the Thermodynamic Functions of Binary Mixtures. II. Benzene*cyclo*hexane. S. E. Wood and A. E. Austin. *J. Amer. chem. Soc.*, 1945, **67,** 480–483.—The volume change on mixing benzene and *cyclo*hexane at constant pressure over the composition range from 15° to 75° has been determined and the changes of the thermodynamic functions on mixing at constant volume calculated. The volume of mixing is positive, and generally increases with temperature, and the excess entropy over that of an ideal solution on mixing at constant volume is also positive over this temperature range. J. H. P.

278. Reaction of Aromatics in Presence of Dehydrogenation Catalysts. I. Action of Chromia—Alumina on Benzene, Toluene, Butylbenzenes, and Bibenzyl. W. J. Mattox and A. V. Grosse. *J. Amer. chem. Soc.*, 1945, **67,** 84–86.—The conversion of various types of hydrocarbons into aromatics by dehydrogenation or aromatization catalysts raises the question of what action such catalysts exert on the aromatics formed. The authors summarize typical data obtained in such processes in the case of benzene and substituted benzenes having up to 8 carbon atoms in 2 or more alkyl groups. J. H. P.

279. Non-benzenoid Aromatic Hydrocarbons. W. Baker. The Tilden Lecture, *J. Chem. Soc.*, 1945, 258–267.—The literature of the non-benzenoid aromatic hydrocarbons is critically reviewed. The monocyclic *cyclo*butadiene, *cyclo*octatetraene, and the fulvenes; the dicyclic pentalene and azulene systems; and the tricyclic diphenylenes are discussed in detail and compounds with four-membered rings fused to a benzene nucleus are also noted.

The evidence for the non-existence of *cyclo*butadiene is not sufficient, and the possibility of its preparation from 1-bromo-Δ^2-*cyclo*butene by halogen elimination and subsequent exhaustive methylation must be borne in mind.

The preparation by Willstätter in 1911 of a hydrocarbon believed to be *cycolo*ctatetraene from γ-pelletierine has received new and widespread attention following the observation that its properties strikingly resemble those of styrene. The only known cases of genuine *cyclo*octatetraenes are the recently prepared benzo-derivatives tetraphenylene (1 : 2 : 3 : 4 : 5 : 6 : 7 : 8-tetrabenz-$\Delta^{1:3:5:7}$-*cyclo*octatetraene and 1 : 2 : 3 : 4 : 5 : 6-tribenz-$\Delta^{1:3:5:7}$-*cyclo*octatetraene. The absorption spectra of these compounds gives evidence of the possible existence of *cyclo*octatetraene itself.

The simplest bicyclic aromatic system apart from *cyclo*butadiene which might exist is " pentalene " having two fused fulvene rings and resembling naphthalene. Recent work shows that naphthalene is a unique dicyclic hydrocarbon, and that the *bicyclo*octatetraene has no aromatic characteristics. This is in part accounted for by the fact that in pentalene there are only four electrons not necessarily involved in covalency formation in each ring, whereas in typical benzenoid compounds there are six.

The azulenes are comparatively stable, and there is no evidence of their conversion into the isomeric naphthalenes. It is now known that the azulenes have lower bonding and resonance energies than naphthalene.

" Diphenylene " or *cyclo*butadibenzene is isomeric with acenaphthylene, and has long been considered as a possibly aromatic type. Five arrangements of the bonds are possible, four dibenzenoid and one doubly *ortho*quinonoid. Recently it has been established that diphenylene may be regarded as a unique type of molecule, in which the butadiene structure is stabilized by fusion with the two benzene rings, and in which the expected instability due to strain is countered by increased stability due to resonance. It is probably the only type of molecule having an aromatic nucleus fused to a four-membered ring. J. H. P.

280. Catalytic Cracking of Pure Naphthene Hydrocarbons. B. S. Greensfelder and H. H. Voge. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1038–1043.—Continuing cracking studies of pure hydrocarbons over a silica–zirconia–alumina catalyst under certain conditions similar to those in the commercial cracking of petroleum fractions, eleven naphthenes containing 6–18 carbon atoms were studied. It was found that naphthenes are quite susceptible to the action of the catalyst, the rate of cracking being mostly dependent on molecular weight, both ring and any side-chains all contributing to the total cracking. Hydrocarbon fragments of three or more carbon atoms are preferentially produced, the products of cracking being more saturated than those of paraffins or aliphatic olefines. Isomerization of C_6 to C_5 rings occurs and there is considerable dehydrogenation of C_9 or higher *cyclo*hexane types to aromatics. Compared to the thermal cracking of naphthenes the catalytic treatment gives a considerably faster reaction, more saturated products, higher liquid–gas ratio, less hydrogen formation from C_{10} and higher naphthenes, and smaller amounts of condensation products. A. W.

281. Butadiene Purification by Solvent Extraction. A. S. Smith and T. B. Braun. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1047–1052.—An apparatus and a method used to investigate solubility and distribution in C_4 olefin-solvent systems are described. Mixtures of components were used to obtain solvents of desirable characteristics, and data are presented for three types, miscible, immiscible, and a miscible solvent mixture containing complex-forming salts. The small differences in physical properties between butadiene and the C_4 mono-olefins preclude the possibility of an ideal solvent. The choice of solvent must be made on an economic basis. There is a discussion on the general applications of extraction processes and on quaternary systems. A. W.

282. Studies in the Terpene Series. H. Hydrogen Disproportionation of Limonene. V. N. Ipatieff, H. Pines, and R. C. Olberg. *J. Amer. chem. Soc.*, 1945, **67**, 694.—Cyclic *mono*olefines and *p*-cymene resulted on distillation of *d*-limonene in the presence of small amounts of organic bromides; owing to hydrogen disproportionation. The effects of other catalysts on the degree of hydrogen transfer are discussed.

J. H. P.

283. Catalytic Dehydration of 1-Hexanol and 1-Octanol. V. I. Komarewsky, S. C. Uhlick and M. J. Murray. *J. Amer. chem. Soc.*, 1945, **67**, 557–558.—Vapour-phase dehydration of 1-hexanol and 1-octanol over alumina, gave 1-hexene and 1-octene, respectively. The products were identified by their physical constants and Raman spectra and by hydrogenation to corresponding paraffins. J. H. P.

284. Effects of Temperature on the Polymerization of Styrene. S. G. Cohen. *J. Amer. chem. Soc.*, 1945, **67**, 17–20.—The polymerization of styrene catalyzed by benzoyl peroxide was studied. The rates of polymerization and the molecular weights of the products increased with rise in temperature of reaction, the rates rising more rapidly than the molecular weights. It was concluded that a reaction of lower activation energy than that of chain growth was the dominant factor, chain transfer reactions being of minor importance only.

Important theoretical and practical implications of these results were noted.

J. H. P.

285. Preparation of 1 : 3- and 1 : 4-Pentadienes from Furfural. L. E. Schniepp and H. H. Geller. *J. Amer. chem. Soc.*, 1945, **67**, 54–56.—By the pyrolysis of the diacetates of 1 : 2- and 1 : 5-pentanediols obtained as hydrogenation products from furfural, pure 1 : 3- and 1 : 4-pentadienes may be prepared. The pyrolysis proceeds via the intermediate pentene-olacetates. J. H. P.

286. Preparation and Physical Constants of Acetylenic Compounds. A. L. Henne and K. W. Greenlee. *J. Amer. chem. Soc.*, 1945, **67**, 484–485.—A series of acetylenic derivatives was prepared from sodium acetylides by condensation reactions in liquid ammonia. The experimental conditions described gave high yields, and enabled accurate determination of the physical constants of the products to be made. J. H. P.

287. N.G.A.A. Standard Table of Physical Constants for Paraffin Hydrocarbons. Anon. *Oil Gas J.*, 13.10.45, **44** (23), 115.—A table of physical constants of the *n*-paraffins up to *n*-decane is given. The constants include formula, molecular weight, melting point, boiling point, density of liquid and vapour, critical conditions, heat of combustion, explosive limits, heat of vaporization, specific heat, vapour pressure, aniline point, and refractive index.

A reference bibliography and other general constants are included. T. M. B. M.

288. Vapour Pressures and Boiling Points of some Paraffin, Alkyl*cyclo*pentane, Alkyl*cyclo*hexane, and Alkylbenzene Hydrocarbons. C. B. Willingham, W. J. Taylor, J. M. Pignocco, and F. D. Rossini. *Bur. Stand. J. Res., Wash.*, Sept. 1945, **35**, 219.—Measurements of vapour pressures and boiling points over the range 47–780 mm of mercury and above about 12° C have been made on 52 hydrocarbons prepared and purified in connection with the work of the A.P.I. Research Project 6 at the National Bureau of Standards.

The apparatus consisted of an electrically heated boiler (a full description and drawing of which is given) having a vapour space with a vertical re-entrant tube containing a platinum thermometer having a resistance of 25 ohms, and a condenser.

Measurements of the temperature of the liquid–vapour equilibrium were made at 20 automatically maintained fixed pressures. The value of the fixed pressures were determined by calibration of the apparatus with water by using the vapour pressure–temperature tables prepared at the N.B.S.

The purity of the compounds investigated is listed, and from the method of preparation and purification it is concluded that, (*a*) the remaining impurities were substantially isomeric and close boiling, and (*b*) their amount was such as to have no significant effect upon the measurements.

The experimental data on the hydrocarbons examined were correlated, the method of least squares being used, with the three-constant Antoine equation for vapour pressures; $\log P = A - B/(C + t)$ or $t = B/(A - \log P) - C$. Experimental data, together with the values of the three constants of the Antoine equation, applicable over the range of measurement, are tabulated. The hydrocarbons examined were 30 paraffins (two pentanes, five hexanes, three heptanes, 17 octanes, and *n*-nonane, decane and dodecane), *cyclo*pentane and three alkyl*cyclo*pentanes (methyl-*n*-propyl-, and *iso*propyl-), *cyclo*hexane and nine alkyl*cyclo*hexanes (methyl-, ethyl-, *cis*- and *trans*-1 : 2-dimethyl-, *cis*- and *trans*-1 : 3-dimethyl-, *cis*- and *trans*-1 : 4-dimethyl- and *n*-propyl-) together with benzene, toluene, and ethylbenzene, the three xylenes, and *n*-propyl and *iso*propyl-benzenes. T. M. B. M.

289. Mechanism of Hydrogen Fluoride Catalyzed Alkylation of Toluene by *t*-Butyl Chloride. W. H. Pearlson and J. H. Simons. *J. Amer. chem. Soc.*, 1945, **67**, 352–362.—The effects of water, methanol, diethyl ether, and hexamethylacetone as promoters in the reaction between toluene and *t*-butylchloride, catalyzed by hydrogen fluoride, has been studied in detail. It was found that the reaction rate increases with increased concentration of the promoter, but that the four promoters gave essentially the same effect at the same molar concentration. Experiment confirmed that the amphoteric medium effect contributes to the mechanism of the reaction. In an exhaustive discussion of the theoretical considerations involved the authors demonstrated that a one step, condensed phase, catalyzed, and promoted reaction is the essential factor in the mechanism of the reaction, and that the postulates of ions or free radicals as intermediates are inadmissible.

Details are given of the special apparatus employed and of the method for the intensive drying of toluene using sodium triphenylmethyl; metallic sodium or phosphorus pentoxide being found to be inadequate for this purpose. J. H. P.

290. Acidic Constituents of Degras. A New Method of Structure Elucidation. A. W. Weitkamp. *J. Amer. chem. Soc.*, 1945, **67**, 447–454.—The isolation and identification of 32 acids originally present as sterol esters in a sample of commercial degras is described. They comprise: nine normal fatty acids, C_{10} to C_{26}; two optically active 2-hydroxy-acids, C_{14} and C_{16}; ten *iso*-acids, C_{10} to C_{28}; and eleven dextro-rotatory anteiso acids C_9 to C_{27} and C_{31}.

The method of structure elucidation which is applicable to acids or amides with simple branched chains is based on the transition points in the solidification point curves of binary mixtures of the branched acid or amide with normal fatty acids or amides. J. H. P.

291. A Kinetic Study of the Dehydrochlorination of Substituted 2 : 2-Diphenylchloroethanes Related to D.D.T. S. J. Cristol. *J. Amer. chem. Soc.*, 1945, **67**, 1494–1498.—The dehydrochlorination reactions with sodium hydroxide of 11 2 : 2-diarylchloroethanes related to D.D.T. were found to be of the second-order E_2 type. The rate constant for the *o* : *p*′-D.D.T. isomer, the principal impurity in technical D.D.T., is 1/67th that of the *p* : *p*′-D.D.T. isomer, which is the principal insecticidal agent.
J. H. P.

292. Chemical Composition of Technical D.D.T. H. L. Haller and co-workers. *J. Amer. chem. Soc.*, 1945, **67**, 1591–1602.—Theoretically 45 isomeric dichlorodiphenyltrichloroethanes exist, but the term " D.D.T." is restricted to the condensation product of chloral and chlorobenzene in the presence of sulphuric acid. There are three standard qualities of D.D.T. : technical D.D.T., purified or aerosol D.D.T. and pure D.D.T. which is specially prepared as a pharmacological standard and is of m.p. 108·5–109·0° (corr.).

Fractional crystallization, chromatographic, and cryoscopic methods showed technical D.D.T. to be a complex mixture containing over 70% of 1-trichloro-2 : 2-bis-(*p*-chlorophenyl)-ethane. The major impurity is the *o* : *p*′-D.D.T. isomer but 12 other organic impurities were isolated and identified.

In the course of the work all six isomeric dichlorobenzophenones with one chlorine atom on each ring were prepared. The *o* : *p*′- and *m* : *p*′-isomers of *p* : *p*′-D.D.T. are also described. J. H. P.

293. Crystal Behaviour of Paraffin Wax. S. W. Ferris and H. C. Cowles. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1054–1062.—It is believed that the many conflicting explanations given for the crystal behaviour of paraffin wax are often contradictory because of the erroneous assumption that petroleum waxes are chemically homogeneous. From photomicrographic studies, convincing evidence is presented in support of the following theory :

" Petroleum waxes consist of mixtures of hydrocarbons belonging to various homologous series. The members of each series crystallize similarly, as either plates, malcrystals or needles. If but one type (plate, mal or needle) is present, the crystal form remains the same regardless of such factors as amount or kind of solvent. If the types are mixed, and if the solubility relations are such that more than one type can crystallize simultaneously, either the needle or mal can impress its form on the plate. If, on the other hand, sufficient solvent is present to maintain needles and mals in solution until plates are well established, mals and needles can then deposit upon, and thus take the form of plates." A. W.

294. Oxidation of Lubricating Oils. C. H. Denison and P. C. Condit. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1102–1108.—A previous paper has demonstrated that the oxidation stability of normally refined petroleum lubricating oils is the result of small quantities of natural sulphur compounds. Work has been continued by studying the reactions by which organic sulphur compounds stabilize these lubricants against oxidation. Monothioethers, which contain at least one aliphatic or naphthenic group attached to the sulphur atom, appear to be the most effective sulphur-type antioxidants tested, their effectiveness varying, apparently, with the rapidity with which they reduce peroxides. The thioethers studied were relatively resistant to autoxidation, but susceptible to oxidation by peroxides. Thioethers function as inhibitors as the result of reducing peroxides, thus breaking the oxidation chain. In this reaction thioethers are converted to sulphoxides and probably to sulphones. By autoxidation these latter two types of compounds are in part converted to sulphonic acids.
A. W.

295. Adsorption of Water Vapour on Carbon Black. P. H. Emmett and R. Anderson. *J. Amer. chem. Soc.*, 1945, **67**, 1492–1494.—After high-temperature degassing typical carbon blacks gave water isotherms resembling those found for steam activated charcoal. It was established that the samples did not develop porosity or increase in surface area during degassing. J. H. P.

296. The Present Era in Combustion. D. T. A. Townend. *Chem. and Ind.*, 1945, 346–351.—A survey of recent researches into combustion phenomena.
C. F. M.

Analysis and Testing.

297. An Improved Gas Absorber for Determination of Butadiene. P. J. Elsing and T. L. Stein. *Industr. Engng. Chem. Anal.*, Nov. 1945, **17** (11), 722–723.—An absorber of the contact type is described, which can be used to determine butadiene in gaseous mixtures that are suitable for analysis by the Tropsch-Mattox or similar absorber. It is applicable to other methods of gas analysis where a minimum amount of reagent is to be used with efficient absorption. A. W.

298. Copper Alkyl Phthalates for the Estimation of Mercaptans. E. Turk and E. E. Reid. *Industr. Engng. Chem. Anal.*, Nov. 1945, **17** (11), 713–714.—The preparation and use of copper alkyl phthalates for the titration of mercaptans are described. Two important advantages of this method over the iodine titration are: (*a*) the reaction takes place in homogeneous solution, and (*b*) there is no interference by unsaturates. Of the two phthalates investigated, copper octyl phthalate is very soluble in hydrocarbons and may be more convenient for the estimation of mercaptans in petroleum products, than copper butyl phthalate. Primary, secondary and tertiary mercaptans can all be satisfactorily estimated, the results being in substantial agreement with those using the iodine method. No interference from compounds such as hydrogen, cyanide, organic thiocyanates, organic sulphides and terpenes, was observed. The method is, however, not applicable when hydrogen sulphide is present in the mercaptan solution, and two mercaptans, thioglycollic acid and dithioethylene glycol are not amenable to titration. A. W.

299. Colourimetric Determination of D.D.T. M. S. Schechter, S. B. Soloway, R. A. Hayes, and H. L. Haller. *Industr. Engng. Chem. Anal.*, Nov. 1945, **17** (11), 704–709.—A colorimetric method has been developed for the estimation of D.D.T. down to about 10 micrograms. The method involves intensive nitration and the production of colours by the nitrated products in benzene with methanolic sodium methylate. This colour reaction is being applied to the analysis of spray residues and water samples, and can also be used as a test for degradation products of D.D.T. and some related compounds.
A. W.

300. Deterioration of Analytical Weights. *Letter by* A. F. H. Ward. *Chem. and Ind.*, 1945, 393.—Attention is drawn to observations on the deterioration of precision weights made by Manley (*Phil. Mag.*, 1933, **16** (7), 489). It was shown that over a storage time of one year the change in mass of gold-plated brass weights was 24 times that of chromium-plated weights. Detailed recommendations were also made for improvements in weight boxes which reduced the rate of corrosion about 30-fold.
C. F. M.

301. Note on an Improved Falling Sphere Viscometer for Use with Opaque Liquids. C. A. McDowell and B. Y. Walker. *Chem. and Ind.*, 1945, 323.—Passage of the sphere is detected by means of coils wound on the viscometer-tube. These coils (placed at either end of the fall) are incorporated in oscillating circuits and the disturbance in frequency of oscillation caused by the sphere gives rise to a change in the note audible on headphones. It is claimed that the circuit given is more sensitive than those previously described. C. F. M.

302. A New Method to Determine Paraffin Wax in Asphalt. J. Muller and D. Wandycz. *Refiner*, Nov. 1945, **24** (11), 458–460. (Translated by E. J. Barth from *Asph. u. Teer* (*Strassenbautechnick*), **32** (36), 108–111).—By a series of differential solvent extraction and chilling, a pure paraffin wax is obtained from asphalt. This is used for analytical purposes. A. H. N.

Engine Fuels.

303. Effect of Organic Chlorine and Sulphur on Octane Number and Lead Susceptibility of Gasoline. C. Holloway and W. S. Bonnell. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1089–1091.—Work has been carried out to ascertain whether organic chlorine in gasoline has a similar effect to organic sulphur, small proportions of which lower the octane number and lead susceptibility. Synthetic samples containing from 0 to 1·0 wt % chlorine as organic chlorides were prepared and tested for motor-method octane number, lead susceptibility, corrosion and gum. The gum and corrosion tests were negative at chlorine concentrations of 0·1 wt % and lower; the effect of organic chlorides on lead susceptibility was so great as to indicate that, above 0·001 wt %, chlorine should not be tolerated in gasoline. This figure may, however, be modified slightly depending whether normal, secondary or tertiary chlorides are present, since the results obtained show that a primary chloride has a smaller effect on lead susceptibility than its tertiary isomer.

Work with another gasoline, and using 1-C aviation-method octane ratings has indicated about the same permissible concentration, both for organic chlorides and for a number of organic sulphur compounds. A. W.

Gas Oil and Fuel Oil.

304. Peacetime Fuel Oils from War Equipment. A. E. Pow, Jr., J. B. Hill and J. R. Bates. *Refiner*, Nov. 1945, **24** (11), 450–452. *Paper presented before A.P.I.*—A brief study of domestic burners and their requirements is given, followed by a description of the principal properties required in fuels for burners and of the methods of producing such fuels. A. H. N.

Lubricants.

305. Oil for the Post-war Car. H. L. Hemmingway. *Refiner*. Nov. 1945, **24** (11), 453–457.—The engine manufacturers indicate that in post-war engines the crankcase capacity will remain about the same, oil-change periods the same or longer, oil temperatures the same or higher, piston temperatures the same or higher, and more effective oil and air filters will be used. Babbitt bearings will predominate in passenger cars, with hard-alloys or new heavy-duty type bearings in heavy-duty engines. It would appear that a smaller percentage of engine bearings would be subject to oil corrosion than was the rule in prewar equipment. The manufacturers will recommend the same SAE grades as before the war, or lighter in some cases. " Regular " straight mineral oils or intermediate type (API " Premium " classification) oils will be recommended for passenger cars, while the manufacturers of heavy-duty engines prefer the full detergent " Heavy-Duty " or 2-104 B type. The general preference is for oils of 90 viscosity index or better, although some manufacturers prefer the 50 to 90 range, and some have no preference. They feel that the most needed improvement in oils should be along the lines of reducing engine deposits, increasing oil life, and reducing bearing corrosion.

To meet these requirements, the United States petroleum industry has a 35% increase in solvent refining capacity, as compared with 1939. Additive capacity is available to treat all of the expected postwar truck and bus demand as full heavy-duty (2-104 B) type, and at least 80% of the passenger-car demands as the intermediate or " premium " oil types. The war-sponsored investigations of low-temperature properties and the increase of 140% in U.S. solvent dewaxing capacity during the last seven years should result in improved low-temperature performance of lubricating oils. The manufacturing capacity for viscosity-index-improver types of additives has been increased and the stability of these products improved. Effective anti-foam agents have been developed. Both types of additives should find increased application postwar. New synthetic lubricants having unusual properties have been developed during the war period. While these materials probably will displace petroleum lubricating oils in special applications, the high cost of these materials at present precludes competition with petroleum oils for engine lubrication.

New developments in the field of fundamental research on lubricants should place the oil refiner in an improved position to meet the problems of lubricating postwar automotive equipment. A. H. N.

306. Correlation of Chemical Constitution and Oxidation Susceptibility of Lubricating Oil Components. S. F. Kapff, J. R. Bowman, and A. Lowy. *J. Inst. Petrol.*, Dec. 1945, **31** (264), 453–474.—This paper presents a study of the influence of chemical constitution on the susceptibility to oxidation of the several general types of components in petroleum lubricating oils. A fractionation of a Pennsylvania lubricating oil-stock has been effected by distillation and extraction. The physical properties of the fractions and their chemical constitutions as calculated by Waterman's method are reported. Selected fractions were oxidized, and the extent of oxidation was measured by the acidity developed and by the increase of viscosity. Similar treatment was then applied to a different stock; fractions from the two stocks gave the same behaviour on oxidation. From the collected data, some generalizations have been made concerning the dependence of oxidation susceptibility on chemical constitution. A. H. N.

307. Contact Inhibition or Lubrication. C. Ridley. *Petrol. Times*, 22.12.45, 1076.—It is recognized by engineers that lubrication is the weakest link in an engine. The pure lubricant not only does not prevent scoring of surfaces when moving parts start up from rest, but is also incapable of withstanding adequately the conditions of high temperature and pressure arising from the greatly increased duties demanded of modern engines. The incorporation of suitable additives in the oil overcomes many, but not all, of the defects. Various methods for preventing metallic contact between moving surfaces have been recommended. One claim is for the " lubrication " of a 4 in shaft rotating at 20,000 r.p.m. by means of compressed air supplied at 30 p.s.i. Other methods involve: (1) the addition of 0·1-mm hard steel balls to the oil; (2) the flotation of the spindle in its bearing by oil supplied under pressure; (3) the suspension of the shaft in its bearing by means of magnets. L. B.

Asphalt, Bitumen and Tar.

308. Co-operative Research in the Road Emulsion Industry by the Technical Sub-Committee of the Road Emulsion and Cold Bituminous Roads Association. E. R. Hatt and W. R. Peard. *J. Soc. chem. Ind.*, 1945, **64**, 243–253.—The paper describes the work which has been done to determine the conditions and emulsion compositions which lead to the formation of emulsion residues, or coagula which exhibit lack of binding power, and hence to indicate those compositions and conditions to be avoided in practice. Films of emulsion made with bitumens of different penetration and containing varying amounts of emulsifier and excess alkali are dried under precise conditions in a temperature- and humidity-controlled cabinet, and at intervals the films are weighed and examined both visually and by probing. During drying the emulsions pass through several distinct stages before the final adhesive film of binder is produced; one of these stages may correspond to a condition of poor mechanical strength. It was established that the hardness of the bitumen at the drying temperature was a considerable factor in the formation of non-ductile residues of weak binding power, and that the rate of drying and the type of emulsifier were of lesser importance. However, at low temperatures sodium soap emulsifiers may be unsuitable and excess free alkali is to be avoided. F. J. W.

309. Physical Properties of Road Aggregates as Affecting Road Performance. B. H. Knight. *J. Soc. chem. Ind.*, 1945, **64**, 254–259.—The physical properties of road aggregates and their significance in relation to road performance are discussed.

Particular attention is given to the following :—

Shape and size of aggregates; abrasion tests; absorption of water by aggregates; attrition tests; aggregate crushing tests; impact tests; soundness tests; rolling tests; degradation of aggregates during compaction and under traffic; adhesion of binders to aggregates. F. J. W.

310. Chemistry and Constitution of Asphalts. B. A. Murphy. *J. Inst. Petrol.*, Dec. 1945, **31** (26), 475–485.—The probable structures of different broadly-classified components of asphalt are discussed, and a general structural formula of complex substituted rings is proposed. A. H. N.

Special Hydrocarbon Products.

311. Corrosive Action of Benzole Absorption Oils. C. M. Cawley and H. E. Newall. *J. Soc. chem. Ind.*, 1945, **64**, 285–290.—The corrosion which occurs in plant used for stripping benzolized wash oil has been found to be due to the presence in solution or in suspension of water-soluble salts which are associated to a large extent with asphaltic material possibly as an adsorbate.

Analyses of aqueous extracts of corrosive oils indicate the presence of ammonium thiocyanate and chloride. While the latter is the more powerful corrosion agent, the former is present in greater concentration, and is considered to be the agent chiefly responsible for corrosion. These two salts are slightly soluble in creosote, but insoluble in gas oil. The presence of water enables suspensions of aqueous solutions to be formed, but such suspensions in gas oils are stable only on the rare occasions where soluble asphalt is present. Thus samples of used gas oil were found to be non-corrosive when examined in the laboratory.

At least some of the ammonium thiocyanate is probably formed by reaction between ammonia and carbon disulphide in solution in the wash oil.

It has been demonstrated that both iron sulphide and Prussian blue (which are often associated with corrosion of benzole absorption plants) are formed by the reaction of iron with ammonium thiocyanate in the presence of water and dissolved air. C. F. M.

312. Residual Toxicity of D.D.T. H. L. Sweetman. *Soap*, Dec. 1945, **21** (12), 141.—In view of the conflicting evidence as to the periods for which D.D.T. residues from sprays remain toxic, a series of tests has been carried out on firebrats, silverfish and cockroaches, in which the insects were left in contact with paper which had been sprinkled with D.D.T. dust and exposed to varying temperature and humidity conditions for different periods. There were definite indications that insects coming into contact with treated surfaces, rapidly reduced the effectiveness thus also reducing the residual effective period. Temperature conditions of 32–37° C. and high humidities definitely reduce its period of toxicity, but in colder or drier conditions this period may amount to 70 days. C. L. G.

313. Effect of pH on Fungistatic Activity of Dinitro-o-Cresol. P. W. Brian. *J. Soc. chem. Ind.*, 1945, **64**, 315–316.—It is shown that the fungistatic activity of dinitro-*o*-cresol solutions decreases with increase of pH and that it is closely related to the concentration of undissociated D.N.O.C. present. It is suggested that the increased insecticidal effectiveness of D.N.O.C.-petroleum oil washes at low pH can be accounted for by the increased concentration of undissociated D.N.O.C. rather than the increased concentration of D.N.O.C. in the oil phase. F. J. W.

314. Action of Certain Insects of Fabrics Impregnated with D.D.T. H. Hayhurst. *J. Soc. chem. Ind.*, 1945, **64**, 296.—Experiments show that impregnation of sacking with amounts of D.D.T. of the order of 1% effects a considerable measure of control on certain pests of stored products. *Calandra oryzae* and *Tribolium confusum* die after only a short exposure. *Ptinus tectus* is much more resistant, but control is effected by reducing the rate of reproduction and prolonged exposure appears to be fatal. C. F. M.

Derived Chemical Products.

315. Ethyl Alcohol made from Refinery Ethylene. Anon. *Chem. Met. Eng.*, 1945, **52**, 96.—In 1935 the Standard Alcohol Co. developed a process for the hydration of refinery ethylene, and eight years later, in collaboration with the Standard Oil Development Co., designed and constructed a large-scale plant at Baton Rouge for the manufacture of 190–192 proof EtOH. In this, ethylene produced from the cracking of ethane-propane stock is, after suitable purification, contacted with 90% strength H_2SO_4 in an absorber. The resulting mono- and diethyl sulphates are hydrolyzed with water to ethanol and the crude product processed on a stripper from which aqueous alcohol, ether, and a small amount of acidic material are taken off overhead, and water and acid as a bottom product. The distillate is scrubbed with soda, and the ether separated from the aqueous alcohol on an ether-stripper. Any alcohol in the ether is extracted with water, the washings being admixed with the bulk of the ether-free alcohol and the whole fed to an efficient fractionating column. The 95–96% pure ethanol obtained from the latter is next denatured. A feature of the process is the process for recovery of concentrated H_2SO_4 from the dilute solution obtained at the crude alcohol stripper. This is initially concentrated to 70% strength in a reboiler. Further concentration is effected on a Simonson–Mantius two-stage vacuum acid concentrator, the first stage operating at an absolute pressure of 2·5 in mercury and the second at 0·4 in mercury. The concentrators are vertical cylinders, heated by Dowtherm A (20 p.s.i.) supplied to Hastelloy D tubes inserted through the walls of the vessels. A flowsheet of the process is provided, and various sections of the plant are illustrated by photographs. L. B.

316. Synthetics from Petroleum. B. H. Weil. *Petrol. Engr.*, May 1945, **16** (8), 198.—The position of the petroleum and chemical industries in respect of the production of chemicals from petroleum gases, etc., is surveyed and the possibilities and prospects discussed. The simple chemicals first produced at refineries included ethanol, isopropanol, ethylene glycol, acetone, etc. U.S. Tariff Commission figures are given for 1943 for several important chemicals produced from petroleum (See Abstract 521, 1945). The gases from thermal cracking are compared with those from catalytic operations. The latter contain about half the ethylene and from three to five times the propylene that thermal gases do, and as the yields of C_3 and lighter products are from 6% to 14·5% of the feed stocks, and the C_4 fraction (5–12·8% of the charge) contains about 32% of C_4 olefins, vast amounts of olefins could be available for conversion into chemical products. At one refinery alone the catalytic gases contain 75,000 lb ethylene and 300,000 lb propylene/day.

Products other than gases are also sources for chemical production, *e.g.*, cracked kerosine cuts for making detergents; naphthas also are extracted for toluene, which considerably augmented war supplies.

The various petroleum and chemical firms manufacturing chemicals from petroleum products are discussed, but the total production probably does not exceed 1% of the outputs, excluding butadiene and aviation gasoline components. Brief descriptions of the final synthetics and their uses and outlines of the product transformed are given with respect to the following: polyethylene resins (polythene); two allyl plastics, from propylene (a diallyl phthalate polymer and " Allymer C.R. 39 "); polyvinylidine chloride resins (" Saran "); a vinylidine chloride-vinyl chloride co-polymer (" Plioflex "); Geon resins, a similar co-polymer. A process is mentioned which produces trichlorethane which is easily converted into vinylidine chloride. An outline is given of other plastics derived, at least in part, from petroleum, including styrene, the acrylic resins (Plexiglas and Lucite), ethyl cellulose and (at least potentially), nylon phenolic and urea plastics. A table of such materials derivable from petroleum or natural gas is given. A plant is building for production of phthalic anhydride for the synthesis of phthalic alkyd resins, and a promising process for manufacturing carbon disulphide is announced; another process is for producing thiophene at an economic price, and developments are under way for the manufacture of ethylene oxide, acetic and maleic anhydrides. The more important processes for ammonia, methanol, and carbon blacks are surveyed. It is anticipated that at the end of the war production of carbon blacks will be over 1,000 million lb/year, roughly half being furnace-type blacks, which are satisfactory for synthetic rubber, but little used so far with natural rubber. One company has constructed a plant to produce blacks from degraded oils. A brief survey is given of the synthetics used as aviation components and synthetic rubber. The alkylates and butadiene are the two synthetics in greatest world-wide production. W. H. C.

317. Chemical Utilization of Natural Gas. B. Miller. *Petrol. Engr*, May 1945, **16** (8), 216.—A report to the Technical and Research Committee, Nat. Gas. Dept., American Gas Assoc. The constituents of natural gas are outlined and the wartime utilization of the vast production amounting to four trillion cu ft per year (weight equivalent to 100 million tons) is reviewed and possible developments are surveyed from an economic viewpoint. Several important uses for the helium occasionally found in natural gas are described. The main portion of the paper relates to the manufacture of carbon black, and the several methods of its manufacture are discussed from the aspects of yields, qualities and applications of the types produced, and the economics of manufacture at source and places nearer the markets. The channel process produces less than 5%, channel blacks which are more suitable for compounding with natural rubber than with synthetic. Furnace production of carbon blacks gives yields of 25% or higher, furnace-type blacks possess properties which make them more suitable for synthetic rubber compounding for tyre manufacture than for natural rubber. Thermal decomposition processes can be operated so that no combustion products are associated with the carbon black. There are various modifications of this method, and the products have properties differing from the channel and furnace blacks, and also among themselves the uses of these thermal blacks have also increased. Hydrogen is produced during thermal decomposition of natural gas. The various types of carbon blacks are not completely changeable, and price differentials therefore exist and can be maintained. Accordingly, research is stimulated both from the producer's and consumer's aspects. These economics are discoursed as to location and type of production, and tied in with higher yields and less gas consumed and the requirements of hydrogen obtained from thermal operations for hydrogenation and other purposes—*e.g.*, ammonia synthesis. Other possibilities are widely discussed. Aviation gasoline production, in relation to the use of products from natural gas. Post-war needs, it is considered, will be only 10% of peak war production. The use of natural gas plays but a minor part in synthetic rubber production. Other non-fuel uses which are expected to increase in quantity and importance are described and discussed: chlorinated hydrocarbons for solvents, etc., nitroparaffins, which may be starting points for a large variety of chemicals, and many oxygenated compounds. A successful process is noted which, by controlled air oxidation of natural gases, gives principally formaldehyde and methanol, and also acetaldehyde and other minor products; a commercial process produces principally acetic acid, a starting point for acetate-type synthetic fibres and plastics; another plant is stated to produce butadiene—it employs the aldol reaction. Aldol can be prepared from natural gas by a process involving partial oxidation. Another possible use for natural gas may yet be found in the Fischer–Tropsch syntheses if the developments anticipated by the Fischer–Tropsch enthusiasts are realized. W. H. C.

Coal, Shale and Peat.

318. Ester Waxes from British Lignite and Peat. C. M. Cawley and J. G. King. *J. Soc. chem. Ind.*, 1945, **64**, 237–242.—During the war the Fuel Research Station undertook an investigation on the possibility of extracting from British lignite and peat a substitute for German montan wax. The extraction of wax from Devon lignite and various English and Scottish peats was studied, and lignite wax extracted with benzole was found to provide a satisfactory substitute of melting point 76–82° C. The yield averages about 5% of the dry lignite. The paper gives an account of the method of extraction and the effect of using different solvents on the yield and properties of the extracted ester waxes. Peat wax differs from lignite wax in being softer in texture, in having a melting point 10–15° C lower and higher acid and ester values. F. J. W.

319. Charcoal Briquettes as a Coal Substitute. H. Greene and T. N. Jewitt. *J. Soc. chem. Ind.*, 1945, **64**, 265–271.—A detailed account of work carried out in the Sudan on the production of a substitute for coal by briquetting a cold wet charcoal-pitch mixture. Gum arabic was used as a primary binder, and in some experiments the briquettes were impregnated with oil. C. F. M.

Miscellaneous Products.

320. Redwood Products as Inhibitors of Oxidation in *cyclo*Hexene and Gasoline. H. F. Lewis, M. A. Buchanan, E. F. Kurth, and O. Fronmuller. *Industr. Engng. Chem.*, Nov. 1945, **37** (11), 1108–1112.—Solvent-purified redwood tannins are effective in preventing the oxidation of *cyclo*hexene but are of little value in protecting gasoline because of their solubility characteristics. Products prepared by the reaction of tannin with benzoyl chloride, caproyl chloride, chloroacetic acid, formaldehyde, and amines are not satisfactory as antioxidants. Condensation of tannin with acetone or other ketone results in a good yield of ether-soluble products which are good inhibitors for *cyclo*hexene, but the addition of water to the treated *cyclo*hexene results in the loss of approximately half the inhibiting action. The acetone–tannin condensation products have poor solubility in gasoline and are of questionable value as gasoline antioxidants. Products obtained by condensing catechol with acetone have excellent inhibiting properties for *cyclo*hexene and appear more promising as antioxidants for gasoline. A. W.

MISCELLANEOUS.

321. Fiscal Support for Manufacture of British Petroleum-Chemicals. Anon. *Petrol. Times*, 8.12.45, **49**, 1031.—The text of the clauses in the Finance Bill (No. 2) 1945 governing amendment as to duty on oils used in British refineries as raw materials in chemical synthesis is given together with a Government explanation. In brief, the act makes provision for the importation of hydrocarbon oils which are to be used for chemical synthesis free of duty or arranges for its rebate in cases where duty has already been paid. T. M. B. M.

INSTITUTE NOTES.

March 1946.

FORTHCOMING MEETINGS.

Tuesday, April 9, 1946. At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C. 2, by invitation of the I.E.E., when the following papers will be read, followed by a general discussion :—

"**The Sludge Test for Transformer Oils,**" by C. H. Barton.

"**A Review of the Mechanism of the Oxidation of Liquid Hydrocarbons,**" by P. George and A. Robertson (Cambridge University).

"**The Influence of Structure on the Oxidation Reactivity of Hydrocarbons,**" by P. George and A. Robertson.

"**Some Developments in the Refining of Transformer Oil,**" by J. C. Wood-Mallock.

"**Survey of B.E.I.R.A. Work on Transformer Oil,**" by P. W. L. Gossling and A. C. Michie.

"**Effect of Water Temperature on the Sludge Test,**" by P. W. L. Gossling and J. Romney.

"**Oxidation Tests for Transformer Oil,**" by A. A. Pollitt.

"**Oxidation and Anti-Oxidation,**" by E. A. Evans.

Wednesday, May 8, 1946. At Manson House, 26, Portland Place, W.1.

"**The Geology of the Guayaquil Estuary, Ecuador,**" by Dr. G. Sheppard.

STANLOW BRANCH.

Wednesday, April 17, 1946. At the Grosvenor Hotel, Lower Mersey Street, Ellesmere Port, at 7.30 p.m.

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

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

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

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

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

Applications for Membership.

Churchfield, Stanley Edward, Student, Royal School of Mines. (*V. C. Illing.*)

Dallow, Frank, Asst. Lubricants Manager, Redline-Glico Ltd. (*G. M. Davies; C. E. Burnett.*)

Evans, William Johnston, Superintendent, Petroleum Board. (*D. Stanley Hill; H. G. L. Wilkinson.*)

Jenkins, Edgar Harold, Engineering Officer, Royal Air Force. (*W. Johnson; J. Mason.*)

Jones, Norman Ellathorne, Chemist, "Shell" Refining & Marketing Co., Ltd. (*P. M. Griffiths; E. LeQ. Herbert.*)

Lee, George Herbert, Engineer, Anglo-American Oil Co., Ltd. (*W. E. J. Broom; K. T. Arter.*)

Murray, Morrice Arthur Kemmis, Engineer. (*E. C. Scott; H. C. W. Johnston.*)

Newton, Henry, Draughtsman, Anglo-Iranian Oil Co., Ltd., Abadan.

Spence, Huntly Gordon, Lubrication Engineer, Berry Wiggins & Co., Ltd. (*N. L. Anfilogoff; David Eve.*)

Spens, Patrick Archibald, Assistant Geologist, British Controlled Oilfields. (*V. C. Illing; G. D. Hobson.*)

Stroud, Alexander Lionel, Manufacturers' Representative.

Thistleton, Paul, Research Physicist, Esso European Laboratories. (*W. E. J. Broom; K. T. Arter.*)

Toomer, David Arthur, Draughtsman, Agwi Petroleum Corporation, Ltd. (*K. Parsonage; G. Noble.*)

Wilde, Marcel Frederick, Chemist and Director, Oiline Refining Co., Ltd. (*P. H. Snow; W. Blackwell.*)

Williams, Kenneth Alan, Consultant Chemist. (*C. S. Windebank; R. S. Teale.*)

Wright, Ernest Peter, Research Student, University of Birmingham. (*F. H. Garner; A. H. Nissan.*)

Applications for Transfer.

Bowen, Clifford Ormond, Flying Officer, R.C.A.F. (*E. A. Evans; J. C. Cragg*). (*Associate Member to Member.*)

Martin, Cyril William Grierson, Fuel Technologist, "Shell" Petroleum Co., Ltd. (*R. I. Lewis; J. S. Jackson*). (*Member to Fellow.*)

PERSONAL NOTES.

Mr. A. Hedley Williams has been released from his appointment as Regional Controller, Ministry of Supply, after holding the post from September, 1939, to date.

LIST OF MEMBERS.

A list of members is now being prepared for early publication and members desiring to make changes are requested to notify the Secretary immediately.

INCORRECT ADDRESSES.

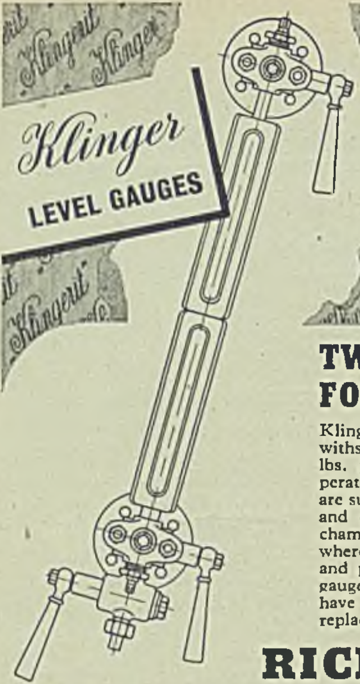
The Secretary would welcome any information regarding the present addresses of any of the members listed below :—

Darrel G. F. Bailey.
D. E. Bookless.
N. M. Brodie.
E. C. Brown.
J. Chapman Brown.
K. Burton.
E. B. Chapelle.
P. B. Clayton.
F. A. J. Cole.
R. F. Connock.
S. Crossley.
J. C. Daniel.
A. K. Davis.
R. F. Douglas.
R. Dunn.
C. H. Edmonds.
M. M. Faingar.
R. R. Ferner.
David Filitz.
A. Frame.
G. W. Furniss.
P. A. Garrett.
V. C. S. Georgescu.
H. Gibson.
A. J. Goodman.
H. A. S. Gothard.
Wm. Hawkins.
Richard S. H. Hebbard.
G. E. Heisch.
H. K. Hekmat.
W. Helmore.
G. O. Higgins.
F. J. Hudson.
L. J. Huggins.
A. G. Hutchison.
R. A. Ijdens.
L. J. Jeffreys.
W. P. Jones.
W. J. Kemnitzer.
J. Khalili.
F. G. Lauchner.
A. P. Lieser.
F. W. Longbottom.
I. Lusty.
J. F. F. McQueen.
Edward T. Marshall.
T. F. Mason.
R. P. Matthews.
Mrs. B. E. Mielnikowa.
T. A. Miller.
S. Moazami.
B. Mostofi.
V. Nercessian.
W. W. Neville.
G. A. O'Neill.
Simon Papp.
E. Poppy.
C. W. M. Read.
L. G. M. Roberts.
A. W. Robinson.
T. W. S. Robinson.
D. L. Ramsay Smith.
H. G. Spearpoint.
J. Tavana.
H. E. Tester.
Percy F. Thurlow.
P. Tonge.
Bernard J. Vavasour.
H. C. G. Vincent.
J. T. Ward.
J. G. Whitney.
Norman E. Wood.

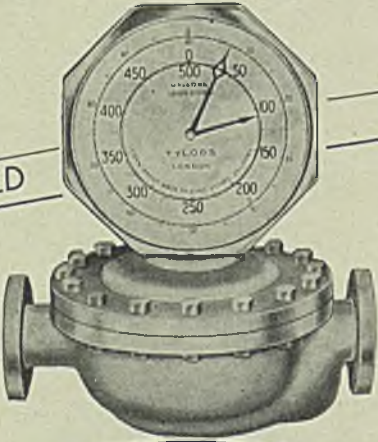
BALLOT FOR COUNCIL.

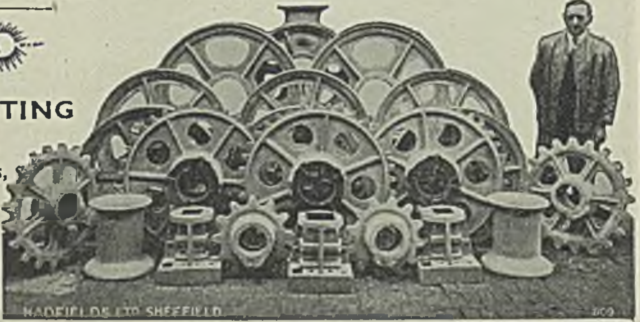
Ballot papers were circulated to 1105 members of the Institute having registered addresses in the United Kingdom and 400 were returned. As the result of the Ballot the following were elected to fill the seven vacancies on the Council for 1946–1947 :—

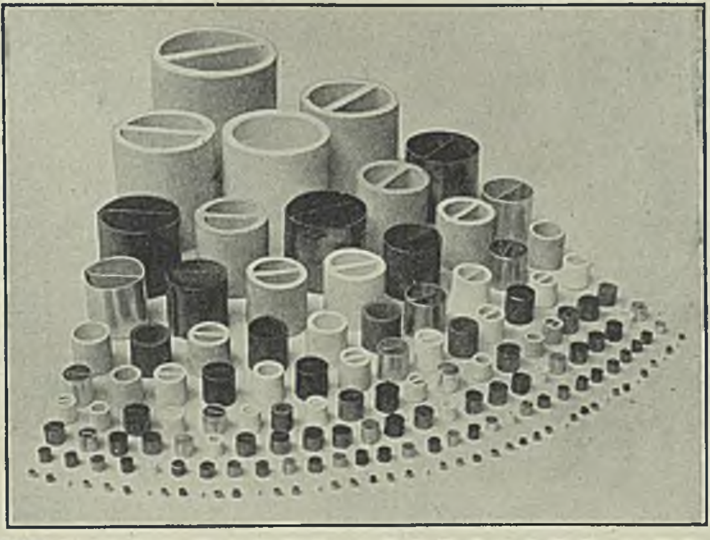
C. Chilvers, B.Sc., F.R.I.C.
E. B. Evans, Ph.D., M.Sc., F.R.I.C.
F. L. Garton, M.A., B.Sc.
C. A. P. Southwell, M.C., B.Sc.
H. C. Tett, B.Sc., D.I.C.
A. Beeby Thompson, O.B.E.
C. W. Wood, F.R.I.C.

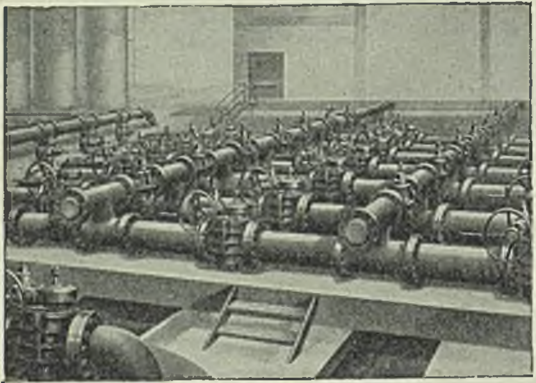

Klinger
LEVEL GAUGES

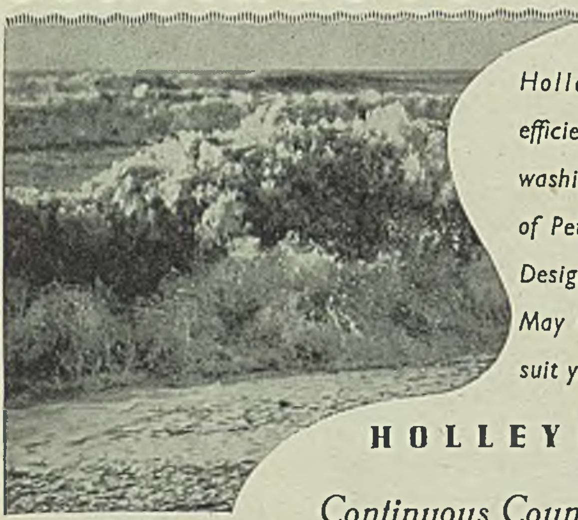

Klingerit
HIGH PRESSURE
JOINTING


0
50
100
150
200
250
300
350
400
450
500
TYLORS
LONDON

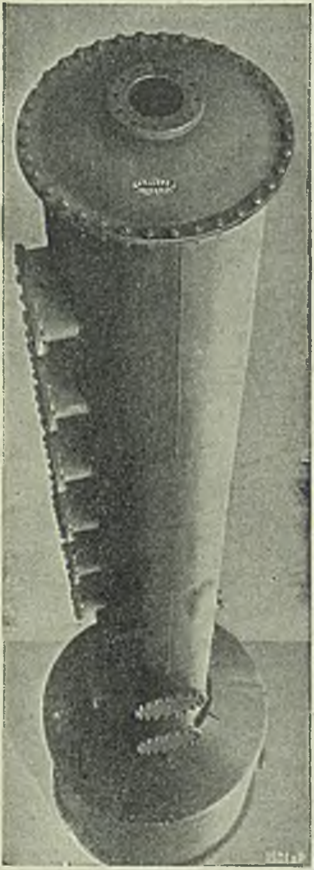

HADFIELDS LTD SHEFFIELD

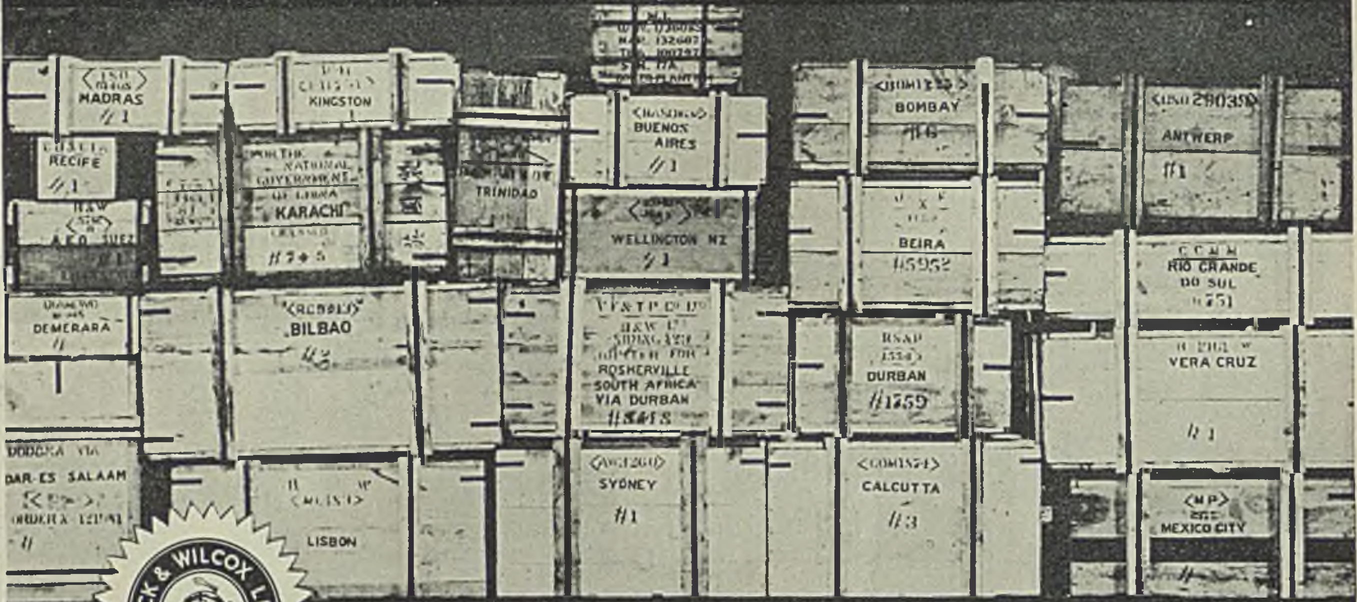






Kindly mention this Journal when communicating with Advertisers.




MADRAS
KINGSTON
RECIFE
KARACHI
TRINIDAD
BUENOS AIRES
WELLINGTON NZ
BOMBAY
ANTWERP
BEIRA
RIO GRANDE DO SUL
DEMERARA
BILBAO
ROSHERVILLE SOUTH AFRICA VIA DURBAN
DURBAN
VERA CRUZ
DAR-ES SALAAM
LISBON
SYDNEY
CALCUTTA
MEXICO CITY

TABLES
FOR
MEASUREMENT OF OIL

"Measurement of Oil in Bulk—Part I—Standard Weights and Measures" was published by the Institute in 1932. "Tables for Measurement of Oil" can be regarded as Part II of the work on this subject.

The book has been prepared to meet the demands of the petroleum industry for authoritative tables for use in computing oil quantities in territories which employ the British (Imperial) system of weights and measures. It will, however, also be found of considerable value to those using American (U.S.A.) units.

The work can be regarded as the official British counterpart of the well-known United States National Bureau of Standards' publication "National Standard Petroleum Oil Tables—Circular C410," but is more extended in scope. It contains full and accurate tables giving weights per unit volume and volumes per unit weight for all the practical units commonly used in the industry.

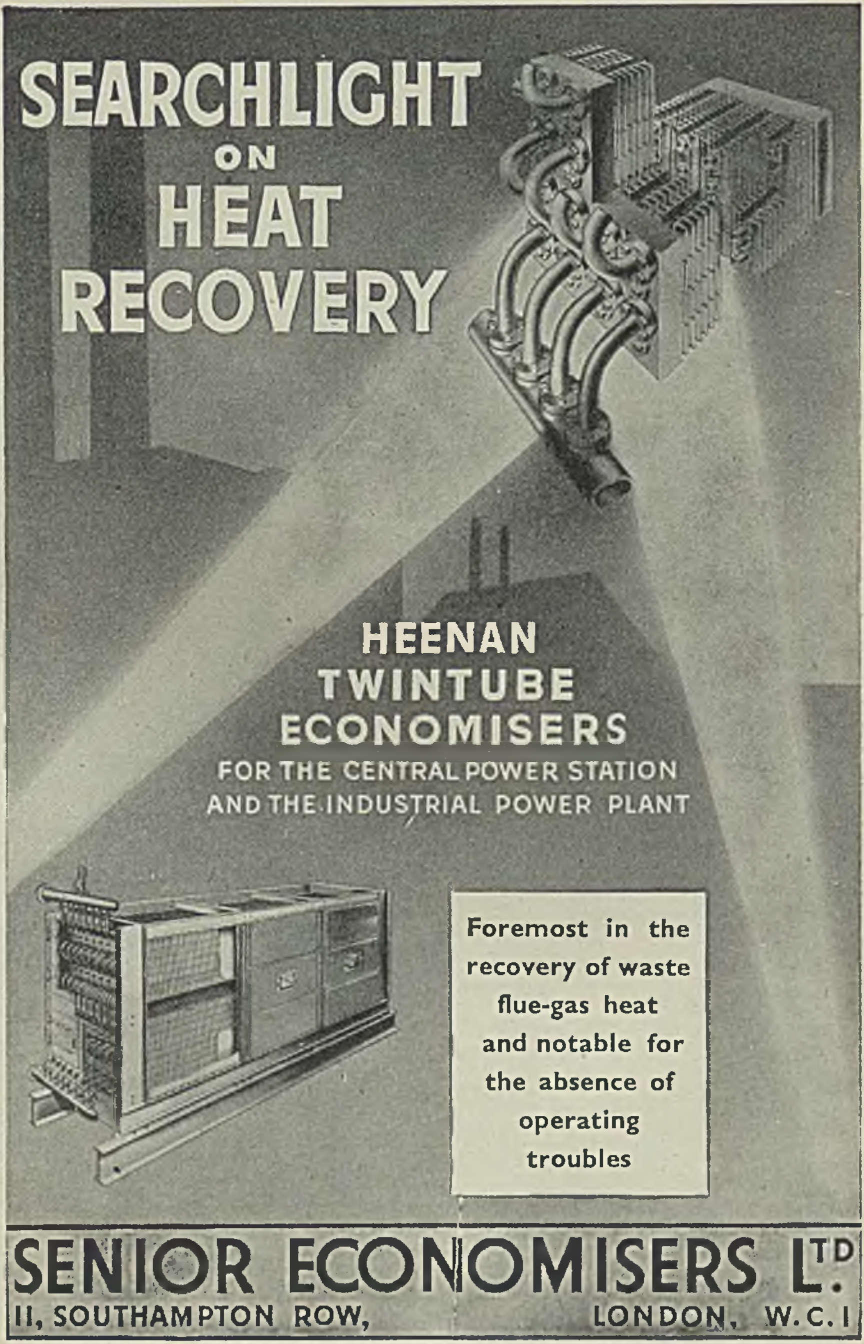
The tables have been calculated using, whenever possible, legally recognised equivalents, but where such equivalents have no legal status, the latest and most accurately determined metrological data were used in the computation of the table concerned.

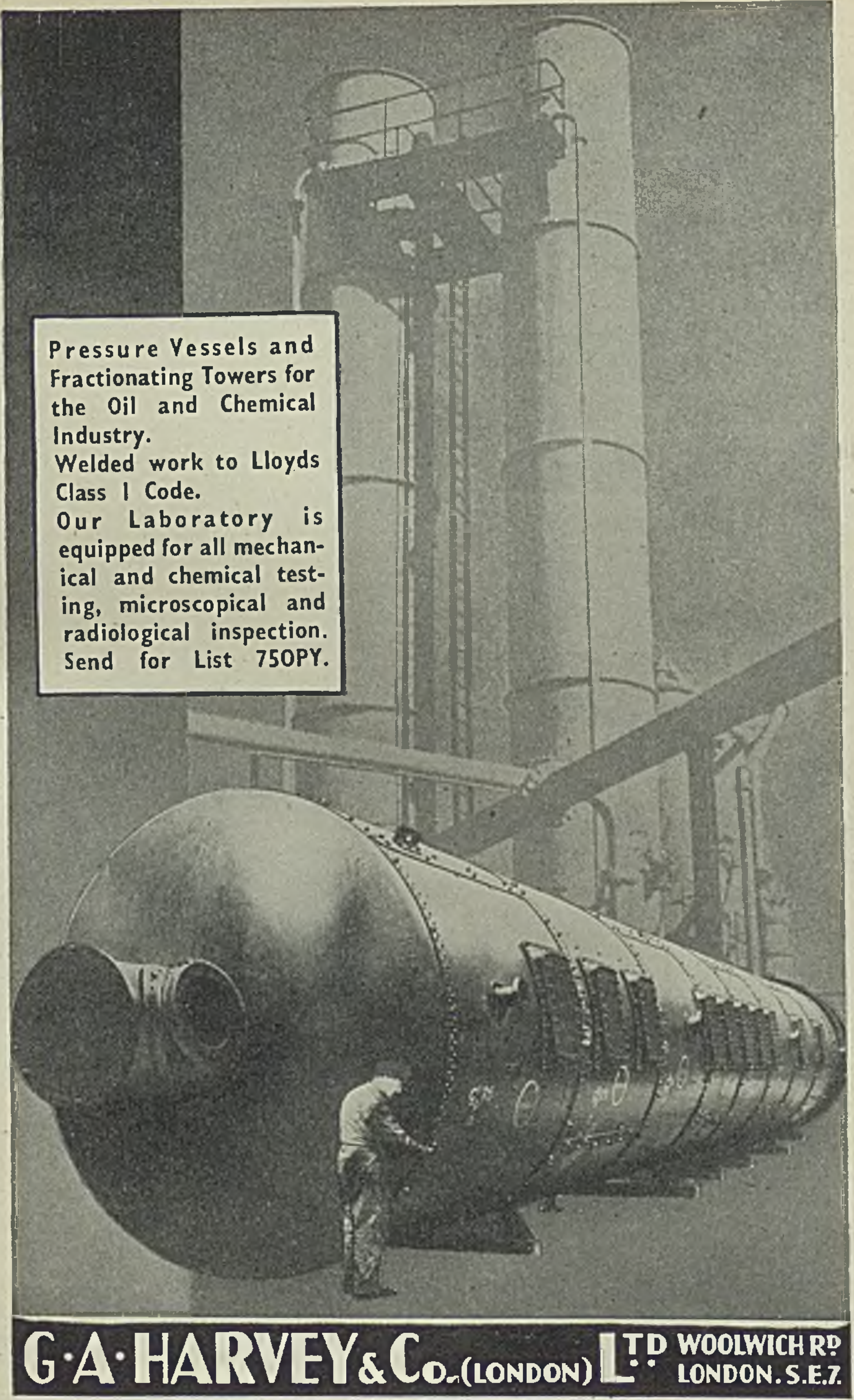
The book comprises some 320 pages and contains 16 tables, each one of which is in regular use by some branch of the petroleum industry. Each table is preceded by its own introductory notes showing, among other things, why the table is necessary and giving examples of correct use.

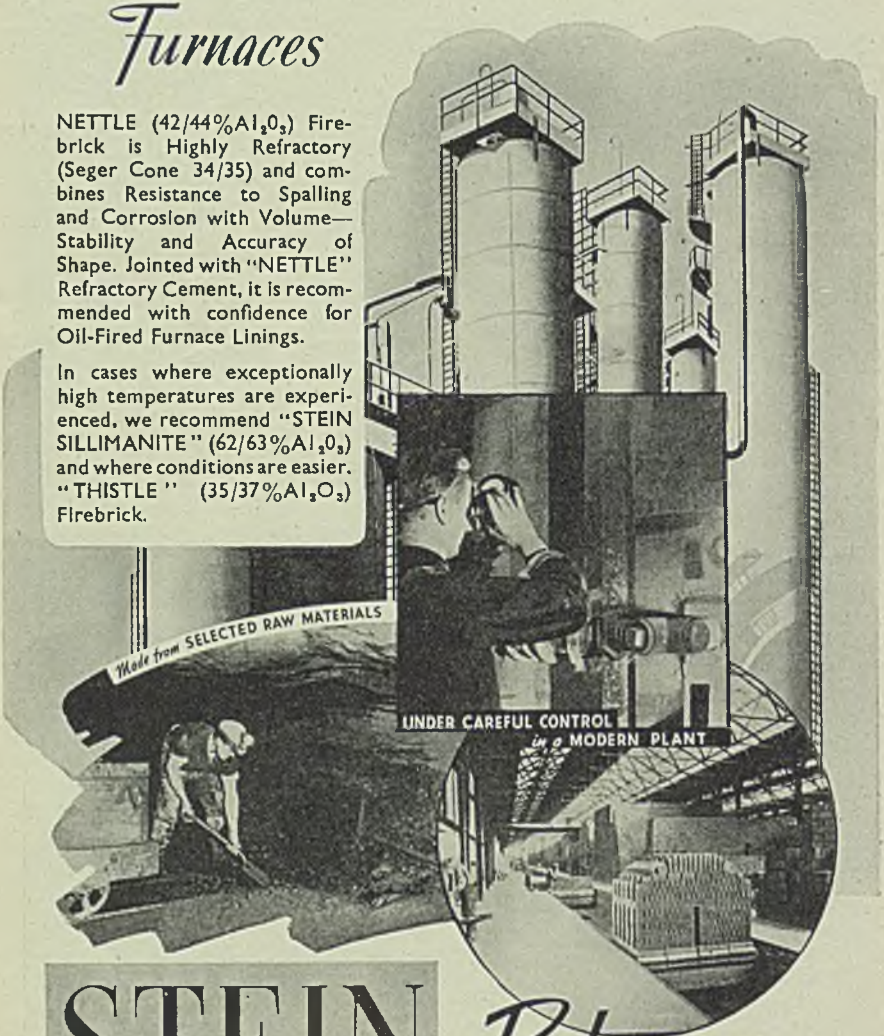
Price **25/-**, *post free*

Published by

THE INSTITUTE OF PETROLEUM
26, PORTLAND PLACE, LONDON, W.1







Made from SELECTED RAW MATERIALS
UNDER CAREFUL CONTROL
in a MODERN PLANT

STARTED UP MAY 12, 1945 . . . .

TIDE WATER ASSOCIATED'S 10,000 B/D TCC UNIT WAS

SHUT DOWN FOR INSPECTION ON **JAN. 7, 1946**

When the 10,000 barrel per day Thermofor Catalytic Cracking unit of the Tide Water Associated Oil Company, Bayonne, was shut down for inspection on January 7, it had been on stream 240 days.

Sprockets on elevator drive were reversed to balance wear. Elevator chains were shortened by removing two links. No major maintenance was necessary. Kiln linings and internals were in perfect condition. The total turnaround labour amounted to approximately 10,000 man hours.

Long initial runs are characteristic of Lummus plants. They reflect sound design, good engineering, careful construction . . . they presage the dependable operation repeatedly demonstrated in the 26 TCC units . . . 8 Polyform plants . . . 3 Houdry plants . . . 10 Alkylation units . . . 6 Isomerization units . . . 5—100 octane plants and many other Lummus installations.

For further information on TCC and other processes, write for a copy of "Petroleum Refining Processes."

If you have the problem of converting existing facilities to meet competition or if you are planning new facilities for the economical production of high octane motor gasoline, Lummus will be glad to co-operate with you in an unbiased study of the processes best suited to meet your refining and marketing conditions.

R. H. DODD

Representing The Lummus Company

78, Mount Street, London, W.1, England

Lummus

PETROLEUM REFINING PLANTS