OILFIELDS OF THE UNITED STATES*

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THE modern petroleum industry in the United States of America dates from the drilling of the first commercial oil well in 1859. Up to the present, about a million wells have been drilled for oil and gas, and the total production of petroleum has been 22,452,498,000 barrels, which has been contributed by twenty-three of the forty-eight States.

Statistics of the supply and demand of crude petroleum and refined products for the United States for 1939, as published by the Bureau of Mines, United States Department of the Interior, are :

	Thousands of barrels.
Domestic production (crude petroleum)	1,264,256
Imports (crude petroleum)	33,095
Imports (refined products)	25,804
Exports (crude petroleum)	72,073
Exports (refined products)	116,909
Domestic demand (refined products)	1,228,069
Total demand (crude petroleum and refined products)	1,417,051

Much is known concerning the geology of the oilfields of the United States, and additions to our geological knowledge of them are being made continually by the 3,000 or more petroleum geologists in the country. Data on the structure and stratigraphy of the oil-bearing rocks are supplied in large measure by the wells that are drilled for oil and gas and also by geophysical methods of exploration. Many of the wells exceed 10,000 ft. in depth and the deepest, which was completed in 1938 in California, reached 15,004 ft. The depths explored by geophysical methods exceed 30,000 ft.

The oil-bearing rocks of the United States are widely distributed and are of many different ages. They occur in all parts of the geological column from the Ordovician to the Pliocene. The common reservoir rocks are sand, sandstone, limestone, dolomite, and chert.

The relation of oil to geological structure was noted so early as 1860 in the United States, but oil companies did not employ great numbers of geologists before the present century, when the demand for petrol increased rapidly because of the growing number of motor-vehicles.

Anticlines were first sought as favourable structural features on which to locate drilling sites for oil ; but, with further drilling and the consequently increased knowledge of the occurrence of petroleum, it was learned that oil pools are associated with many other types of structural features, which include faults, salt domes, and buried hills. In addition, oil reservoirs like those of the east Texas field in Texas and the Coalinga and Midway-Sunset pools in California belong to a type recently designated as stratigraphic traps. Such reservoirs may be due to lensing, to unconformities, and to various lateral gradations in porosity and permeability of the reservoir rocks.

Estimates of the proved reserves of petroleum in the United States at the beginning of 1940 range from 18,500 to 19,700 million barrels. The estimates include the amount of petroleum recoverable by current methods of production from pools already proved by drilling. They do not include the as yet unknown amounts of petroleum that will be discovered in the future in new fields or in deeper zones or extensions of the present producing fields.

With the greatly increased depths to which wells have been drilled in recent years, the proportion of oil reserves found at the greater depths has increased. The first production below 10,000 ft. was obtained in 1935 at Binger, Oklahoma, where the output has averaged 30 barrels per day. During 1937–39 substantial amounts of oil between 10,000 ft. and 13,266 ft. have been discovered and developed in forty fields, of which eight are in California, five are in the Gulf Coast region of Texas, and twenty-seven are in the Gulf Coast region of Louisiana.

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EARTHQUAKES AND STRUCTURES

UNDER this title, there is published in the *Journal of the Royal Society of Arts* (August 23, 1940) the text of a paper read by Mr. D. Laugharne Thornton in which he gave an account of the salient features to be observed in the design of structures for regions subject to earthquakes. Mr. Thornton, an authority on vibration, has treated the behaviour of earth waves in his recent book "Mechanics Applied to Vibrations and Balancing". The subject of his paper was primarily of interest to engineers, to whom the problem set by earth phenomena is how to mitigate the great loss of life and property attendant on them. It concerns also those charged with public safety, to whom several of his inferences and conclusions are likely to be of moment, such, for example, as the care which must be taken to ensure that the form of structure, the choice of materials, and the nature of the loading permitted must be adapted to the local conditions.

On the engineering side, the matter is one of dealing with stresses of great intensity and with materials in which the seismic waves suffer so little damping that they may be felt hundreds of miles from the epicentre. In general, the information gathered by seismologists does not satisfy the needs of the engineer, who requires data regarding 'near' earthquakes, for it is in the vicinity of the disturbance that the destructive effects on buildings occur. To this end, instruments would require to be placed on the foundations as well as in the principal parts of

a structure during an earthquake so that their records would help in the interpretation of the results of experiments made on models attached to 'shaking tables'.

Mr. Thornton gave much detailed information about the nature and causes of the destruction which occurred in the earthquakes at Quetta, Anatolia, Antiqua and elsewhere, and discussed the effects produced on different buildings. The immediate consequences on foundations depend on the elastic properties of the subsoil, and the wide range of the values of these was shown in a table giving the velocity of compressional waves in typical strata. The effects of faulty distribution of loading were pointed out, the danger of heavy roofs, the general advantage of light rather than heavy construction, and the need for good material and workmanship and strictly appropriate design. In conclusion, he emphasized the need for more information regarding earthquakes, and suggested the collaboration of seismologists and engineers in examining the problems by means of records taken by instruments suitably designed for the purposes of both.

THE TRANS-CANADIAN HIGHWAY

THE last western link in the Trans-Canadian highway—the Big Bend section in the Revyl-stoke district of British Columbia—was opened officially by the Premier of British Columbia, Mr. T. D. Patullo, a few weeks ago. The road provides motorists for the first time with an all-Canadian direct route from the prairies to the Pacific coast. The ceremony took place at Boat Encampment, where David Thompson first saw the Columbia River and began its exploration in 1906.

Roads and Road Construction of September 22 states that the completion of a Trans-Canadian highway, long the dream of Canadians, who have to motor through the United States to get to Manitoba from Ontario, may await the end of the War, although only a small stretch now remains uncompleted. Two highways are proposed in north-western Ontario, either of which would, when completed, constitute the final link between British Columbia and Nova Scotia, but according to a statement made by Mr. R. M. Smith, Ontario Deputy Highways Minister, "it depends on the War when we can get back to heavy work on the projects". He added that War-time economics have cut down capital expenditures to almost nothing and stated that the date on which work can be resumed is indefinite.

The route most likely to be completed first is the far northern one, on which about two hundred prisoners housed in road camps are at present working between Long Lac and Hearst. The work involves about 135 miles, and from about a million to $1\frac{1}{5}$ million pounds will be necessary for the completion of the work after the prisoners have cleared the land and undertaken preparatory work.

The other route, on which constructional work was suspended in 1936, lies between Schreiber, on the north shore of Lake Superior, east to White River, and south-east to the Montreal River, in the Timiskaming district, a distance of approximately 250 miles. The Deputy Minister estimated that completion of the work will cost between five and six million pounds.

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Scientific Proceedings of the Royal Dublin Society. Vol. 22, (N.S.), No. 31: Salmon of the Ballisodare River. 1: History of the Ballisodare Fishery. By Arthur E. J. Went. Pp. 289–306+plate 7. 2*s*. 6*d*. Vol. 22, (N.S.), No. 32: Soil and Fresh-Water Iodine-Content in Ireland in relation to Endemic Goitre Incidence. By James C. Shee. Pp. 307–314. 1*s*. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) [59

New Leadership. By Garth Lean and Morris Martin. Pp. 22. (London: William Heinemann, Ltd.) 3*d*. [109

King's College: Dove Marine Laboratory. Report for the Year ending July 31st, 1939. (Third Series, No. 7.) Pp. 32. (Cullercoats: Dove Marine Laboratory.) [109

Éire: Roinn Talmhaidheachta (Department of Agriculture): Brainse Iascaigh (Fisheries Branch). Report on the Sea and Inland Fisheries for the Year 1938. (P. No. 4055.) Pp. 36. (Dublin: Stationery Office.) 9*d*. [109

Tyneside: the Social Facts. By Dr. David M. Goodfellow. Pp. 80. (Newcastle-upon-Tyne: Co-operative Printing Society, Ltd. 1*s*. [179

Medical Research Council. War Memorandum No. 2: Notes on the Diagnosis and Treatment of Gangrene; with a Suggested Scheme for the Bacteriological Investigation of War Wounds. Pp. ii+14. (London: H.M. Stationery Office.) 3*d*. net. [179

Other Countries

Denkschriften der Schweizerischen Naturforschenden Gesellschaft. Band 74, Abh. 1: Geologie des Voirons. Par Dr. Augustin Lombard. Pp. vi+112+5 plates. (Zürich: Gebrüder Fretz A.G.) [29

Smithsonian Institution: United States National Museum. Bulletin 175: Variations and Relationships in the Snakes of the Genus Pituophis. By Olive Griffith Stull. Pp. vi+225. (Washington, D.C.: Government Printing Office.) [29

N.Z. Department of Scientific and Industrial Research: Christchurch Magnetic Observatory. Annual Reports for 1934, 1935, 1936. Pp. ix+132. (Christchurch: Magnetic Observatory.) 7*s*. 6*d*. [39

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 97: The Shrinkage of Australian Timbers. 2: Shrinkage Data for 170 Timbers. By W. L. Greenhill. (Division of Forest Products: Technical Paper No. 35.) Pp. 48. Pamphlet No. 98: The Prevention and Treatment of Blowfly Strike in Sheep. Report No. 2 by the Joint Blowfly Committee. Pp. 48. (Melbourne: Government Printer.) [59

Ceylon. Paper 4: Education, Science and Art (F). Administration Report of the Acting Director of the Colombo Museum for 1939. By P. E. P. Deraniyagala. Pp. F16. (Colombo: Government Record Office.) 15 cents. [59

Ministério da Educacao e Saude. Anuário publicado pelo Observatório Nacional do Rio de Janeiro para o ano de 1940. (Ano 56.) Pp. xiii+460. (Rio de Janeiro: Observatório Nacional.) [59

N.Z. Department of Scientific and Industrial Research: Apia Observatory, Apia. Annual Report for 1936. Pp. iv+143. 6*s*. Annual Report for 1937. Pp. iv+131. 6*s*. (Wellington: Government Printer.) [109

U.S. Department of the Interior: Office of Education. Bulletin 1939, No. 9: Residential Schools for Handicapped Children. By Elise H. Martens. Pp. vi+103. (Washington, D.C.: Government Printing Office.) 15 cents. [109

South Australia: Department of Mines. Mining Review for the Half-Year ended 31st December 1939. (No. 71.) Pp. 125+5 plates. (Adelaide: Government Printer.) [109

Report on the Progress of Broadcasting in India up to the 31st March 1939. Pp. xiv+230+21 plates. (Delhi: Manager of Publications.) 3 rupees; 5*s*. [179

Ceylon. Part 4: Education, Science and Art (G.). Administration Report of the Acting Marine Biologist for the Year 1939. By P. E. P. Deraniyagala. Pp. G9. (Colombo: Government Record Office.) 10 cents. [179

Forest Research in India and Burma, 1938–39. Part 1: The Forest Research Institute, Dehra Dun. Pp. iii+111. (Delhi: Manager of Publications.) 2.14 rupees; 4*s*. 9*d*. [179