TECHNICAL PAPERS

†TP 1. The Sampling of Coal in the Mine, by J. A. Holmes. 1918. 22 pp., 1 fig. Describes the sampling methods and sampling outfit devised by the Geological Survey and the Bureau of Mines. (Revised.)

†TP 2. The Escape of Gas from Coal, by H. C. Porter and F. K. Ovitz. 1911. 14 pp., 1 fig. Presents the results of an investigation of the rate of escape of gas from several coals while kept in bottles. Discusses the significance of the results as bearing on mine ventilation and the storage of coal.

†TP 3. Specifications for the Purchase of Fuel Oil for the Government, with Directions for Sampling Oil and Natural Gas, by I. C. Allen. 1911. 13 pp. Gives specifications prepared by the Bureau of Mines and the methods of sampling used by the Bureau.

†TP 4. The Electrical Section of the Bureau of Mines: Its Purpose and Equipment, by H. H. Clark. 1911. 12 pp.

†TP 5. The Constituents of Coal Soluble in Phenol, by J. C. W. Frazer and E. J. Hoffman. 1912. 18 pp., 1 pl. A preliminary technical statement of an investigation of the chemical compounds of coal. Describes the compounds obtained by extracting coal with phenol and isolating fractions by the use of different solvents.

†TP 6. The Rate of Burning of Fuse as Influenced by Temperature and Pressure, by W. O. Snelling and W. C. Cope. 1919. 28 pp. Describes the kinds of fuse and the factors affecting rate of burning.

†TP 7. Investigations of Fuse and Miners' Squibs, by Clarence Hall and S. P. Howell. 1912. 19 pp.

†TP 8. Methods of Analyzing Coal and Coke, by F. M. Stanton, A. C. Fieldner, and W. A. Selvig. 1939. 59 pp., 17 figs. (Revised.) Gives methods used by the Bureau of Mines for analyzing coal and coke for determining heating value, determining sulfur forms and carbon dioxide in coal, agglomerating index of coal, and iron forms in coal-ash slags and clinkers, as well as methods for analyzing coal and coke ashes.

†TP 9. The Status of the Gas Producer and of the Internal-Combustion Engine in the Utilization of Fuels, by R. H. Fernald. 1912. 42 pp., 6 figs. Relates the progress in the application of the gas producer to commercial uses and in the development of gas power.

†TP 10. Liquefied Products of Natural Gas: Their Properties and Uses, by I. C. Allen and G. A. Burrell. 1912. 23 pp. Briefly discusses the liquefaction of certain constituents of natural gas, the results of some experiments, and the properties of the products obtained.

†TP 11. The Use of Mice and Birds for Detecting Carbon Monoxide After Mine Fires and Explosions, by G. A. Burrell. 1912. 16 pp. Discusses the physiological effects of carbon monoxide—a common constituent of the afterdamp from mine fires and explosions—and the results of experiments showing the value of mice and birds as indicators of this poisonous gas. Of interest to miners and mine officials.

†TP 12. The Behavior of Nitroglycerin When Heated, by W. O. Snelling and C. G. Storm. 1912. 14 pp., 1 pl., 2 figs. Gives results of experiments that show the true boiling point of nitroglycerin and describes the apparatus used.

† Out of print.

†TP 13. Gas Analysis as an Aid in Fighting Mine Fires, by G. A. Burrell and F. M. Seibert. 1912. 16 pp., 1 fig. Points out the value of gas analysis in showing the composition of mine atmospheres and the conditions in fire areas in mines. Describes a portable gas-analysis apparatus.

†TP 14. Apparatus for Gas-Analysis Laboratories at Coal Mines, by G. A. Burrell and F. M. Seibert. 1913. 24 pp., 7 figs. Describes easily manipulated apparatus for determining the constituents of mine air.

†TP 15. An Electrolytic Method of Preventing Corrosion of Iron and Steel, by J. K. Clement and L. V. Walker. 1913. 19 pp., 10 figs. Gives results of experiments made to develop an electrolytic method for protecting iron and steel against the corrosive action of acid underground waters.

†TP 16. Deterioration and Spontaneous Heating of Coal in Storage, a Preliminary Report, by H. C. Porter and F. K. Ovitz. 1912. 14 pp.

†TP 17. The Effect of Stemming on the Efficiency of Explosives, by W. O. Snelling and Clarence Hall. Revised by S. P. Howell and J. E. Tiffany. 1928. 21 pp., 11 figs. Shows gain in efficiency be the use of stemming, demonstrated by firing small charges of explosives in boreholes in lead blocks. The pamphlet is of interest to all persons who use explosives for blasting coal or rock.

†TP 18. Magazines and Thaw Houses for Explosives, by Clarence Hall and S. P. Howell. 1912. 34 pp., 1 pl., 5 figs. Describes a magazine and a thaw house, each constructed of cement mortar, and gives the quantity of material required for construction. Points out the features essential for safe storage of explosives. Is of interest to persons who supervise the storage and use of large quantities of explosives.

†TP 19. The Factor of Safety in Mine Electric Installations, by H. H. Clark. 1912. 14 pp. Points out factors that tend to make electrical installations less safe in mines than above ground and gives some general suggestions regarding the adoption and maintenance of a high factor of safety.

†TP 20. The Slagging Type of Gas Producer with a Brief Report of Preliminary Tests, by C. D. Smith. 1912. 14 pp., 1 pl. Describes experiments to determine the value of the slagging type of gas producer in the utilization of high-ash fuels and the conditions under which this type is most satisfactory.

†TP 21. The Prevention of Mine Explosions, Report and Recommendations, by Victor Watteyne, Carl Meissner, and Arthur Desborough. 1912. 12 pp. Gives the recommendations of three prominent coal-mining experts as to safety conditions in coal mines in the United States. Reprint of Geological Survey Bulletin 369.

†TP 22. Electrical Symbols for Mine Maps, by H. H. Clark. 1913. 11 pp., 8 figs. Points out the advantages of uniform practice in using symbols for mine maps and gives proposed symbols.

†TP 23. Ignition of Mine Gas by Miniature Electric Lamps with Tungsten Filaments, by H. H. Clark. 1912. 5 pp. Summarizes briefly the results of experiments to determine the possibility of igniting an explosive mixture of gas and air by the filaments of miniature electric lamps.

†TP 24. Mine Fires, a Preliminary Study, by G. S. Rice. 1912. 51 pp., 1 fig. Gives a comprehensive summary of the causes of fires in mines and the equipment and

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methods to be used for preventing and extinguishing such fires. The pamphlet is addressed chiefly to mine owners and mine officials.

†TP 25. Methods for the Determination of Water in Petroleum and Its Products, by I. C. Allen and W. A. Jacobs. 1912. 13 pp., 2 figs. Describes methods used by different chemists and the method adopted by the Bureau of Mines.

†TP 26. Methods of Determining the Sulfur Content of Fuels, Especially Petroleum Products, by I. C. Allen and I. W. Robertson. 1912. 13 pp. Describes methods used by different chemists and the method adopted by the Bureau of Mines.

†TP 27. Monthly Statement of Coal-Mine Accidents in the United States, January to August 1912, and Statistics for 1910 and 1911, compiled by F. W. Horton. 1912. 24 pp.

†TP 28. Ignition of Gas by Standard Incandescent Lamps, by H. H. Clark, 1912. 6 pp. (See B 131 for later data.)

†TP 29. Training with Mine Rescue Breathing Apparatus, by J. W. Paul. 1912. 16 pp. Superseded by handbook entitled "Self-Contained Mine Rescue Oxygen Breathing Apparatus."

†TP 30. Mine-Accident Prevention at Lake Superior Iron Mines, by D. E. Woodbridge. 1913. 38 pp., 9 figs. Describes labor conditions at iron mines in the Lake Superior region and the general progress in accident prevention.

†TP 31. Apparatus for the Exact Analysis of Flue Gas, by G. A. Burrell and F. M. Seibert. 1913. 12 pp., 1 fig. Describes apparatus devised by the Bureau of Mines. Of interest to engineers and chemists who have occasion to make combustion tests of fuels.

†TP 32. The Cementing Process of Excluding Water from Oil Wells, as Practiced in California, by Ralph Arnold and V. R. Garfias. 1913. 12 pp., 1 fig. Describes the methods of casing off water by the use of cement grouting.

†TP 33. Sanitation at Mining Villages in the Birmingham District, Alabama, by D. E. Woodbridge. 1913. 27 pp., 1 pl., 9 figs. Describes sanitation conditions at iron- and coal-mining villages in the Birmingham district and the welfare work of the mining companies.

†TP 34. Experiments with Furnaces for a Hand-Fired Return Tubular Boiler, by S. B. Flagg, G. C. Cook, and F. E. Woodman. 1914. 32 pp., 1 pl., 4 figs. Describes the tests. Gives suggestions as to possible methods of increasing the capacity of locomotive boilers. Reprint of Geological Survey Bulletin 412.

†TP 35. Weathering of the Pittsburgh Coal Bed at the Experimental Mine near Bruceton, Pa., by H. C. Porter and A. C. Fieldner. 1914. 35 pp. States that results of sampling analysis show that effects of weathering extended 50 feet from outcrop. Tests show slight improvement of coal by weathering.

†TP 36. Preparation of Specifications for Petroleum Products, by I. C. Allen. 1913. 10 pp. Reviews the progress made in arranging for uniform specifications.

†TP 37. Heavy Oil as Fuel for International-Combustion Engines, by I. C. Allen. 1913. 36 pp. Discusses the merits of the Diesel type of engine and the use of heavy oils as engine fuel.

†TP 38. Wastes in the Production and Utilization of Natural Gas, and Means for Their Prevention, by Ralph Arnold and F. G. Clapp. 1913. 29 pp. Discusses the various causes of waste of natural gas and gives precautions and methods by which waste may be prevented.

†TP 39. The Inflammable Gases in Mine Air, by G. A. Burrell and F. M. Seibert. 1913. 24 pp., 2 figs. Discusses the composition of "normal" mine air and the inflammable gases found by analysis.

† Out of print.

†TP 40. Metal-Mine Accidents in the United States During the Calendar Year 1911, compiled by A. H. Fay. 1913. 54 pp. Summarizes data collected through the cooperation of State mine inspectors and metal-mine operators.

†TP 41. The Mining and Treatment of Lead and Zinc Ores in the Joplin District, Missouri, a Preliminary Report, by C. A. Wright. 1913. 43 pp., 5 figs. Summarizes the mining and milling methods used.

†TP 42. The Prevention of Waste of Oil and Gas from Flowing Wells in California, with a Discussion of Special Methods Used by J. A. Pollard, by Ralph Arnold and V. R. Garfias. 1913. 15 pp., 2 pls., 4 figs.

†TP 43. The Influence of Inert Gases on Inflammable Gaseous Mixtures, by J. K. Clement. 1913. 24 pp., 1 pl., 8 figs. Gives the results of experiments undertaken to determine the effect of carbon dioxide and nitrogen on the explosibility of methane in gaseous mixtures.

†TP 44. Safety Electric Switches for Mines, by H. H. Clark. 1913. 8 pp.

†TP 45. Waste of Oil and Gas in the Mid-Continent Fields, by R. S. Blatchley. 1914. 57 pp., 2 pls., 15 figs. Describes conditions in different pools, gives estimates of waste, and makes recommendations looking to its prevention.

†TP 46. Quarry Accidents in the United States During the Calendar Year 1911, compiled by A. H. Fay. 1913. 32 pp.

†TP 47. Portable Electric Mine Lamps, by H. H. Clark. 1913. 13 pp. (See B 131 for later data.)

†TP 48. Coal-Mine Accidents in the United States, 1896–1912, with Monthly Statistics for 1912, by F. W. Horton. 1913. 74 pp., 10 figs. Summarizes data collected through the cooperation of State mine inspectors and mine operators.

†TP 49. The Flash Point of Oils; Methods and Apparatus for Its Determination, by I. C. Allen and A. S. Crossfield. 1913. 38 pp., 2 pls. Discusses the need of uniform methods of determining the flash point and recommends certain forms of testers.

†TP 50. Metallurgical Coke, by A. W. Belden. 1913. 48 pp., 1 pl., 23 figs. Discusses coke manufacture and the properties essential to good metallurgical coke.

†TP 51. Possible Causes of the Decline of Oil Wells, and Suggested Methods of Prolonging Yields, by L. G. Huntley. 1913. 32 pp., 9 figs. Gives a general résumé. (For detailed discussion, see B 177, 194, 195, 228.)

†TP 52. Permissible Explosives Tested Prior to March 1, 1913, by Clarence Hall. 1913. 10 pp. Contains a list of 96 explosives considered by the Bureau of Mines as permissible for use in coal mines in the presence of inflammable dust or gas.

†TP 53. Proposed Regulations for the Drilling of Gas and Oil Wells, by O. P. Hood and A. G. Heggem. 1913. 28 pp., 2 figs.

†TP 54. Errors in Gas Analysis Due to Assuming That the Molecular Volumes of All Gases Are Alike, by G. A. Burrell and F. M. Seibert. 1913. 16 pp. Describes inquiry made to determine the errors that might arise in the combustion method of analysis by assuming that the molecular volume (the quotient of the molecular weight divided by the density) is the same for every gas.

†TP 55. The Production and Use of Brown Coal in the Vicinity of Cologne, Germany, by C. A. Davis. 1913. 15 pp. Treats chiefly of the methods used in the manufacture of brown-coal briquets.

†TP 56. Notes on the Prevention of Dust and Gas Explosions in Coal Mines, by G. S. Rice. 1913. 24 pp. Discusses causes of mine explosions and methods of prevention.

†TP 57. A Preliminary Report on the Utilization of Petroleum and Natural Gas in Wyoming, by W. R. Calvert, with a Discussion of the Suitability of Natural Gas for Making Gasoline, by G. A. Burrell.

1913. 23 pp. Briefly discusses the development of the oil and gas fields in the State and such waste as has attended this development.

†TP 58. The Action of Acid Mine Water on the Insulation of Electrical Conductors. Preliminary Report, by H. H. Clark and L. C. Ilsley. 1913. 26 pp., 1 fig. Presents the results of tests of different insulating coverings.

†TP 59. Fires in Lake Superior Iron Mines, by Edwin Higgins. 1913. 34 pp. 2 pls. Contains notes on a number of mine fires, makes recommendations on preventing and subduing fires in metal mines, and presents analyses of certain black slates that take fire spontaneously.

†TP 60. The Approximate Melting Points of Some Commercial Copper Alloys, by H. W. Gillett and A. B. Norton. 1913. 10 pp., 1 fig. Gives melting points of 10 alloys and describes methods used in tests.

†TP 61. Metal-Mine Accidents in the United States During the Calendar Year 1912, compiled by A. H. Fay. 1914. 76 pp., 1 fig. Summarizes figures received from operators and prospectors and discusses them.

†TP 62. Relative Effects of Carbon Monoxide on Small Animals, by G. A. Burrell, F. M. Seibert, and I. W. Robertson. 1914. 23 pp. Shows that canaries are best suited for use by men exploring mines after explosions or fires.

†TP 63. Factors Governing the Combustion of Coal in Boiler Furnaces, a Preliminary Report, by J. K. Clement, J. C. W. Frazer, and C. E. Augustine. 1914. 46 pp., 26 figs. Describes tests of Pocahontas coal in a specially constructed furnace, the purpose of the tests being to determine the conditions requisite for complete combustion.

†TP 64. Determination of Nitrogen in Coal, a Comparison of Various Modifications of the Kjeldahl Method with the Dumas Method, by A. C. Fieldner and C. A. Taylor. 1915. 25 pp., 5 figs. Describes results of tests to determine relative advantages of the various modifications.

†TP 65. A Study of the Oxidation of Coal, by H. C. Porter and O. C. Ralston. 1914. 28 pp., 12 figs. Discusses the physical-chemical reactions between oxygen and the coal substance.

†TP 66. Mud-Laden Fluid Applied to Well Drilling, by J. A. Pollard and A. G. Heggem. 1914. 21 pp., 12 figs. Treats use of mud for sealing gas or water sands in "dry-hole" drilling with a cable rig.

†TP 67. Mine Signboards, by Edwin Higgins and Edward Steidle. 1913. 15 pp., 1 pl., 4 figs. Recommends the use of universal symbols for signboards.

†TP 68. Drilling Wells in Oklahoma by the Mud-Laden-Fluid Method, by A. G. Heggem and J. A. Pollard. 1914. 27 pp., 5 figs. Discusses use of mud to seal beds in drilling by the "dry-hole" method and describes results of demonstrations at wells in Oklahoma.

†TP 69. Production of Explosives in the United States During the Calendar Year 1912, compiled by A. H. Fay. 1914. 8 pp.

†TP 70. Methods of Oil Recovery in California, by Ralph Arnold and V. R. Garfias. 1914. 55 pp., 7 figs. Describes use of plunger pump, air lift, and other methods of recovering petroleum at California wells. Gives details of equipment and costs.

†TP 71. Permissible Explosives Tested Prior to January 1, 1914, by Clarence Hall. 1914. 12 pp. Gives list of explosives tested and their rate of detonation.

†TP 72. Problems of the Petroleum Industry, by I. C. Allen. 1924. 20 pp. Presents results of conferences looking to the organization of investigations of national scope.

†TP 73. Quarry Accidents in the United States During the Calendar Year 1912, compiled by A. H. Fay. 1914. 45 pp.

†TP 74. Physical and Chemical Properties of the Petroleums of California, by I. C. Allen, W. A. Jacobs, A. S. Crossfield, and R. R. Matthews. 1914. 38 pp., 1 fig. Gives the results of the examination of over 300 samples from different districts.

†TP 75. Permissible Electric Lamps for Miners, by H. H. Clark. 1914. 21 pp., 3 figs. Describes methods followed by the Bureau in testing portable electric lamps for safety and discusses qualities that such lamps should have in order to be acceptable for mine service.

†TP 76. Notes on the Sampling and Analysis of Coal, by A. C. Fieldner. 1914. 61 pp., 6 figs. Discusses factors affecting accuracy of sampling and analysis and outlines methods used by the Bureau of Mines.

†TP 77. Report of the Committee on Resuscitation from Mine Gases, by W. B. Cannon, G. W. Crile, Joseph Erlanger, Yandell Henderson, and S. J. Meltzer. 1914. 34 pp., 4 figs. Points out defects of some mechanical devices for causing artificial respiration and administering oxygen to persons overcome by carbon monoxide. Recommends a special device.

†TP 78. Specific-Gravity Separation Applied to the Analysis of Mining Explosives, by C. G. Storm and A. L. Hyde. 1914. 14 pp. Describes application of the method.

†TP 79. Electric Lights for Use About Oil and Gas Wells, by H. H. Clark. 1914. 8 pp.

†TP 80. Hand Firing Soft Coal Under Power-Plant Boilers, by Henry Kreisinger. 1916. 83 pp., 32 figs. Describes best methods of firing soft coal and handling fires and discusses losses in power generation.

†TP 81. The Vapor Pressure of Arsenic Trioxide, by H. V. Welch and L. H. Duschak. 1915. 21 pp., 3 pls., 2 figs. Gives results of experiments and describes apparatus.

†TP 82. Oxygen Mine Rescue Apparatus and Physiological Effects on Users, by Yandell Henderson and J. W. Paul. 1917. 102 pp., 5 pls., 6 figs. Discusses in detail the defects of apparatus and suggests improvements.

†TP 83. The Buying and Selling of Ores and Metallurgical Products, by C. H. Fulton. 1915. 42 pp. Discusses methods of buying and selling, with especial reference to sampling, assaying, freight rates, smelting, and milling charges.

†TP 84. Methods of Preventing and Limiting Explosions in Coal Mines, by G. S. Rice and L. M. Jones. 1915. 45 pp., 14 pls., 3 figs. Treats of causes and prevention of explosions and describes rock-dust barriers devised by the engineers of the Bureau.

†TP 85. Production of Explosives in the United States During the Calendar Year 1913, compiled by A. H. Fay. 1914. 15 pp.

†TP 86. Ore-Sampling Conditions in the West, by T. R. Woodbridge. 1916. 96 pp., 5 pls., 17 figs. Presents results of an investigation of practices at different mills and sampling plants.

†TP 87. Methods of Testing Natural Gas for Gasoline Content, by G. A. Burrell and G. W. Jones. 1916. 26 pp., 7 figs. Describes methods and results of tests.

†TP 88. The Radium-Uranium Ratio in Carnotites, by S. C. Lind and C. F. Whittemore. 1915. 29 pp., 1 pl., 4 figs. Describes experiments to determine the value and constancy of the radium-uranium in carnotite ores.

†TP 89. Coal-Tar Products and the Possibility of Increasing Their Manufacture in the United States, by H. C. Porter, with a chapter on Coal-Tar Products Used in Explosives, by C. G. Storm. 1915. 21 pp. Discusses the possibility of increasing the production of coal tar and of developing the manufacture of dyestuffs, drugs, and chemicals derived from it.

†TP 90. Metallurgical Treatment of the Low-Grade and Complex Ores of Utah, a Preliminary Report, by D. A. Lyon, R. H. Bradford, S. S. Arentz, O. C. Ralston,

†Out of print.

and C. L. Larson. 1915. 40 pp. Mentions the extent of the ore bodies, the chemical characteristics of the ores, and the proposed methods of treatment.

†TP 91. A Convenient Multiple-Unit Calorimeter Installation, by J. D. Davis and E. L. Wallace. 1917. 48 pp., 6 pls., 13 figs. Describes laboratory experiments to determine thermal value of coal.

†TP 92. Quarry Accidents in the United States During the Calendar Year 1913, compiled by A. H. Fay. 1914. 76 pp.

†TP 93. Graphic Studies of Ultimate Analyses of Coals, by O. C. Ralston, with a preface by H. C. Porter. 1915. 41 pp., 3 pls., 6 figs. Plots carbon, hydrogen, and volatile matter by a system of trilinear coordinates.

†TP 94. Metal-Mine Accidents in the United States During the Calendar Year 1913, compiled by A. H. Fay. 1914. 73 pp., 2 pls., 5 figs.

†TP 95. Mining and Milling of Lead and Zinc Ores in the Wisconsin District, Wisconsin, by C. A. Wright. 1915. 39 pp., 2 pls., 5 figs. Discusses current practice in the district.

†TP 96. Fume and Other Losses in Condensing Quicksilver from Furnace Gases, by L. H. Duschak and C. N. Schuette. 1918. 29 pp., 1 pl., 4 figs. Describes method of determining losses of quicksilver in furnace gases and suggests improvements in furnace practice.

†TP 97. Saving Fuel in Heating a House, by L. P. Breckenridge and S. B. Flagg. 1915. 35 pp., 3 figs. Treats of hot-air, hot-water, and steam-heating plants for dwellings, the factors to be considered in heating a house, and the care of heaters.

†TP 98. Effect of Low-Temperature Oxidation on the Hydrogen in Coal and the Change of Weight of Coal on Drying, by S. H. Katz and H. C. Porter. 1917. 16 pp., 2 figs.

†TP 99. Probable Effect of the War in Europe on the Ceramic Industries of the United States, by A. S. Watts. 1915. 15 pp. Discusses the effect of the war in relation to the ceramic industry abroad, the kaolin resources of the United States, and the probable increase of domestic manufacture.

†TP 100. Permissible Explosives Tested Prior to March 1, 1915, by S. P. Howell. 1915. 16 pp. Contains names of 129 permissible explosives and gives their unit deflective charge and rate of detonation.

†TP 101. Permissible Explosion-Proof Electric Motors for Mines, Conditions and Requirements for Test and Approval, by H. H. Clark. 1915. 17 pp., 2 pls., 1 fig. Presents requirements for approval of motors and a description of the motor already approved.

†TP 102. Health Conservation at Steel Mills, by J. A. Watkins, 1916. 36 pp. Discusses the need of medical supervision of employees, the construction of buildings, and standards of sanitation.

†TP 103. Organizing and Conducting Safety Works in Mines, by H. M. Wilson and J. R. Fleming. 1917. 57 pp., 35 figs. Outlines organizations and discusses measures and equipment.

†TP 104. Analysis of Natural Gas and Illuminating Gas by Fractional Distillation at Low Temperatures and Pressures, by G. A. Burrell, F. M. Seibert, and I. W. Robertson. 1915. 41 pp., 7 figs. Describes apparatus and methods employed and results of tests.

†TP 105. Pulmonary Disease Among Miners in the Joplin District, Missouri, and Its Relation to Rock Dust in the Mines, by A. J. Lanza and Edwin Higgins. 1915. 48 pp., 5 pls., 4 figs. Describes mining methods, conditions injurious to miners, the methods of determining dust in mine air, character of the dust in the mine visited, and the improvement of health conditions.

†TP 106. Asphyxiation from Blast-Furnace Gas, by F. H. Willcox. 1916. 69 pp., 8 pls., 11 figs. Discusses nature and causes of gas poisoning, suggests safeguards, and points out precautions to be taken.

†TP 107. Production of Explosives in the United States During the Calendar Year 1914, with Notes on Coal-Mine Accidents Due to Explosives, compiled by A. H. Fay. 1915. 16 pp.

†TP 108. Shot Firing in Coal Mines by Electricity Controlled from Outside, by H. H. Clark, N. V. Breth, and C. M. Means. 1915. 36 pp. Describes chief features of some outside firing systems in use.

†TP 109. Composition of the Natural Gas Used in 25 Cities, with a Discussion of the Properties of Natural Gas, by G. A. Burrell and G. G. Oberfell. 1915. 22 pp.

†TP 110. Monazite, Thorium, and Mesothorium, by K. L. Kithil. 1915. 32 pp., 1 fig. Discusses occurrences and recovery of monazite, also recovery of mesothorium from thorium residues.

†TP 111. Safety in Stone Quarrying, by Oliver Bowles. 1915. 48 pp., 5 pls., 4 figs. Calls attention to the chief causes of accidents in quarries and the measures and devices for preventing accidents.

†TP 112. The Explosibility of Acetylene, by G. A. Burrell and G. G. Oberfell. 1915. 15 pp. Describes results of experiments made by the Bureau of Mines to determine the limits of complete propagation of flame in mixtures of acetylene and air.

TP 113. Some Properties of the Water in Coal, by H. C. Porter and O. C. Ralston. 1916. 30 pp., 3 figs. Discusses the manner in which water may be held in coal and how its properties and those of the coal are affected by the condition in which it is held. 5 cents.

†TP 114. Heat Transmission Through Boiler Tubes, by Henry Kreisinger and J. F. Barkley. 1915. 36 pp., 23 figs. Third of a series with B 8 and 18. Calls attention to the ease with which heat is transmitted through boiler tubes and the possibility of greatly increasing boiler capacity by proper design.

†TP 115. Inflammability of Mixtures of Gasoline Vapor and Air, by G. A. Burrell and H. T. Boyd. 1915. 18 pp., 2 figs. Describes experiments and gives results of tests.

†TP 116. Miners' Wash and Change Houses, by J. H. White. 1915. 27 pp., 3 pls., 3 figs. Describes types of houses, especially those for large mines.

†TP 117. Quantity of Gasoline Necessary to Produce Explosive Vapors in Sewers, by G. A. Burrell and H. T. Boyd. 1916. 18 pp., 4 figs. Gives the results of tests conducted in the city of Pittsburgh, Pa.

†TP 118. Coke-Oven Accidents in the United States During the Calendar Years 1913 and 1914, compiled by A. H. Fay. 1915. 16 pp. Presents statistics compiled from reports made by coke operators.

†TP 119. The Limits of Inflammability of Mixtures of Methane and Air, by G. A. Burrell and G. G. Oberfell. 1915. 30 pp., 4 figs. Describes experiments and gives results of tests.

†TP 120. A Bibliography of the Chemistry of Gas Manufacture, by W. F. Rittman and M. C. Whittaker, compiled and arranged by M. S. Howard. 1915. 30 pp.

†TP 121. Effects of Temperature and Pressure on the Explosibility of Methane-Air Mixtures, by G. A. Burrell and I. W. Robertson. 1916. 14 pp., 3 figs. Describes apparatus and gives results of tests.

†TP 122. Effects of Atmospheres Deficient in Oxygen on Small Animals and on Men, by G. A. Burrell and G. G. Oberfell. 1915. 12 pp. Issues warning against use of canaries and mice by exploring parties in mines to show when men unequipped with breathing helmets should retreat, because the atmosphere is low in oxygen.

†TP 123. Notes on the Uses of Low-Grade Fuel in Europe, by R. H. Fernald. 1915. 37 pp., 4 pls., 4 figs. Describes use of high-ash coal and wood refuse and similar material in producers, recovery of byproducts, use of peat, results of low-temperature dis-

†Out of print.

tillation, possibilities of slagging type of gas producer, and use of powdered fuel.

†TP 124. Accidents at Metallurgical Works in the United States During the Calendar Years 1913 and 1914, compiled by A. H. Fay. 1915. 28 pp. Presents statistics compiled from reports of smelting and ore-dressing plants; does not include iron blast furnaces.

†TP 125. The Sand Test for Determining the Strength of Detonators, by C. G. Storm and W. C. Cope. 1916. 68 pp., 2 pls., 5 figs. Presents in detail the results of tests with various grades of detonators and electric detonators.

†TP 126. The Casting of Clay Wares, by T. G. McDougal. 1916. 26 pp., 6 figs. Points out the procedure necessary and the precautions advisable in changing from a plastic to a casting process. Is intended especially for the practical potter.

†TP 127. Hazards in Handling Gasoline, by G. A. Burrell. 1915. 17 pp. Shows need of care in handling and using gasoline and gives precautions to be observed.

†TP 128. Quarry Accidents in the United States During the Calendar Year 1914, compiled by A. H. Fay. 1915. 45 pp.

†TP 129. Metal-Mine Accidents in the United States During the Calendar Year 1914, compiled by A. H. Fay. 1915. 96 pp., 1 pl., 3 figs.

†TP 130. Underground Wastes in Oil and Gas Fields and Methods of Prevention, by W. F. McMurray and J. O. Lewis. 1916. 28 pp., 1 pl., 8 figs. Discusses waste of oil and gas by the flooding of sands with water. Gives reasons for conservation. Describes effects of unsystematic casing of wells.

†TP 131. The Compressibility of Natural Gas at High Pressure, by G. A. Burrell and I. W. Robertson. 1916. 12 pp., 2 figs. Calls attention to the fact that the pressure-volume relation of Boyle's law does not hold for natural gas under high pressure and points out possible errors in measuring natural gas.

†TP 132. Underground Latrines for Mines, by J. H. White. 1916. 23 pp., 2 pls., 7 figs. Discusses need of sanitation in mines in order to prevent disease.

†TP 133. Directions for Sampling Coal for Shipment or Delivery, by G. S. Pope. Revised by N. H. Snyder. 1933. 8 pp., 1 pl. Prepared primarily for the use of Government employees charged with the duty of sampling coal purchased by the Government, describes in detail the various steps necessary in collecting representative samples. (See also B 116 and TP 586.)

†TP 134. Explosibility of Gases from Mine Fires, by G. A. Burrell and G. G. Oberfell. 1915. 31 pp., 1 fig. Presents the results of observations of gases produced during mine fires and the tendency of such gases to form explosive mixtures. (Superseded by B 279, TP 450, and RI 3172.)

†TP 135. Bibliography of Recent Literature on Flotation of Ores, January to June 1916, compiled by D. A. Lyon, O. C. Ralston, F. B. Laney, and R. S. Lewis. 1917. 20 pp.

†TP 136. Safe Practice at Blast Furnaces; Manual for Foremen and Men, by F. H. Willcox. 1916. 73 pp., 1 pl., 43 figs. Studies the causes of accidents and methods for their prevention.

†TP 137. Combustion in the Fuel Bed of Hand-Fired Furnaces, by Henry Kreisinger, F. K. Ovitz, and C. E. Augustine. 1916. 76 pp., 2 pls., 21 figs. Discusses feeding coal and air in four types of commercial furnaces. Describes the gas-sampling and temperature measurements at various depths in fuel bed. Shows relations between air supply and rate of combustion.

†TP 138. Suggested Safety Rules for Installing and Using Electrical Equipment in Bituminous-Coal Mines, by H. H. Clark and C. M. Means. 1916. 36 pp. (Superseded by TP 402.)

†Out of print.

TP 139. Low-Rate Combustion in Fuel Beds of Hand-Fired Furnaces, by Henry Kreisinger, C. E. Augustine, and S. H. Katz. 1918. 54 pp., 19 figs. Discusses the process of combustion in fuel beds of different thicknesses for correct design of coal-burning grates to avoid clinker troubles that attend fusibility of ash. 10 cents.

†TP 140. The Primary Volatile Products of the Carbonization of Coal; A Sequel to B 1, The Volatile Matter of Coal, by G. B. Taylor and H. C. Porter. 1916. 59 pp., 1 pl., 25 figs. Treats of experiments with four different coals and the volatile products obtained by distillation at different temperatures.

†TP 141. Laboratory Determination of the Explosibility of Coal Dust and Air Mixtures, by J. K. Clement and J. N. Lawrence. 1917. 35 pp., 1 pl., 15 figs. Explains laboratory tests in which pressure developed by combustion of dust is taken as measure of flammability.

†TP 142. Vapor Pressure of Various Compounds at Low Temperatures, by G. A. Burrell and I. W. Robertson. 1916. 32 pp., 10 figs. Experiments with ethane, ethylene, propane, propylene, butane, acetylene, ammonia, sulfur dioxide, and nitrous oxide.

†TP 143. The Ores of Copper, Lead, Gold, and Silver, by C. H. Fulton. 1916. 45 pp. Classifies ore types on a metalurgical basis.

†TP 144. The Quick Determination of Incombustible Matter in Coal- and Rock-Dust Mixtures in Mines, by A. C. Fieldner, W. A. Selvig, and F. D. Osgood. 1918. 36 pp., 1 pl., 10 figs. Describes use of rock dust to prevent coal-dust explosions. Explains the use of modified portable Taffanel volumeter.

†TP 145. Sensitiveness to Detonation of Trinitrotoluene and Tetranitromethylanilin, by G. B. Taylor and W. C. Cope. 1916. 13 pp., 1 fig.

†TP 146. The Nitration of Toluene, by E. J. Hoffman. 1916. 32 pp. Discusses experiments and outlines most favorable method.

†TP 147. The Absorption of Methane and Other Gases by Coal, by S. H. Katz. 1917. 22 pp., 4 figs.

†TP 148. The Determination of Moisture in Coke, by A. C. Fieldner and W. A. Selvig. 1917. 14 pp.

†TP 149. Answers to Questions on the Flotation of Ores, by O. C. Ralston. 1917. 30 pp. Gives information regarding many points not discussed at length in existing literature.

†TP 150. Limits of Complete Inflammability of Mixtures of Mine Gases and of Industrial Gases with Air, by G. A. Burrell and A. W. Gauger. 1917. 13 pp., 2 figs. Gives explosive limits for methane, acetylene, ethane, hydrogen, carbon monoxide, illuminating gas, natural gas, and blast-furnace gas.

†TP 151. Coke-Oven Accidents in the United States During the Calendar Year 1915, compiled by A. H. Fay. 1916. 18 pp.

†TP 152. The Inflammability of Aluminum Dust, by Alan Leighton. 1918. 15 pp. Discusses physical and chemical properties of aluminum dust, with especial regard to inflammability, and gives precautions for preventing fire and explosions.

†TP 153. Occurrence and Mitigation of Injurious Dusts in Steel Works, by J. A. Watkins. 1917. 20 pp., 4 pls. Discusses sources of dust, injurious effects of different dusts, and methods of abatement.

†TP 154. Suggestions for Improved Methods of Mining Coal on Indian Lands in Oklahoma, by J. J. Rutledge and Daniel Harrington. 1918. 36 pp., 8 pls., 4 figs. Describes systems used, points out defects, and suggests improvements, especially in the use of modified panel systems.

†TP 155. Gypsum Products: Their Preparation and Uses, by R. W. Stone. 1917. 67 pp., 9 pls., 10 figs. Describes methods of quarrying and dehydrating gypsum, equipment of plants, and gypsum resources of the United States.

†TP 156. Carbon Monoxide Poisoning in the Steel Industry, by J. A. Watkins. 1917. 19 pp., 1 fig. Discusses effects and methods of reducing hazards.

†TP 157. A Method for Measuring the Viscosity of Blast-Furnace Slag at High Temperature, by A. L. Feild. 1916. 29 pp., 1 pl., 7 figs. Describes a new method for determining viscosity and the development of a suitable electric furnace. A number of viscosity measurements illustrate application of the method.

†TP 158. Compressibility of Natural Gas and Its Constituents, with Analyses of Natural Gas from 31 Cities in the United States, by G. A. Burrell and I. W. Robertson. 1917. 16 pp., 9 figs.

†TP 159. Production of Explosives in the United States During the Calendar Year 1915, with Notes on Coal-Mine Accidents Due to Explosives, and a List of Permissible Explosives, Lamps, and Motors Tested Prior to May 1, 1916, compiled by A. H. Fay. 1916. 24 pp.

†TP 160. The Determination of Nitrogen in Substances Used in Explosives, by W. C. Cope and G. B. Taylor. 1917. 46 pp., 1 pl., 4 figs. Discusses Dumas, Kjeldahl, and phosphorus iodide methods for nitrogen and use of nitrometers; contains useful tables.

†TP 161. Construction and Operation of a Single-Tube Cracking Furnace for Making Gasoline, by C. P. Bowie. 1916. 16 pp., 10 pls. Outlines principles involved in the cracking of oils and distillate by the Rittman process; describes construction of furnace used and gives details of operations.

†TP 162. Initial Priming Substances for High Explosives, by G. B. Taylor and W. C. Cope. 1917. 32 pp. Describes the development of primers for high explosives and explains initial priming substances and results of experiments.

†TP 163. Physical and Chemical Properties of Gasoline Sold Throughout the United States During the Calendar Year 1915, by W. F. Rittman, W. A. Jacobs, and E. W. Dean. 1916. 45 pp., 4 figs. Gives results of testing 52 samples of gasoline; also specifications for purchase and sale of gasoline.

†TP 164. Accidents at Metallurgical Works in the United States During the Calendar Year 1915, compiled by A. H. Fay. 1916. 20 pp. The data presented have been collected with the cooperation of the officials and managers of metallurgical companies.

†TP 165. Quarry Accidents in the United States During the Calendar Year 1915, compiled by A. H. Fay. 1917. 77 pp., 1 pl.

†TP 166. Motor Gasoline; Properties, Laboratory Methods of Testing, and Practical Specifications, by E. W. Dean. 1917. 27 pp., 1 pl. Revised as TP 214.

†TP 167. Men Who Received Bureau of Mines Certificates of Mine Rescue Training, July 1, 1914, to June 30, 1916, by D. J. Parker. 1917. 66 pp. Contains names and addresses of the men who received certificates.

†TP 168. Metal-Mine Accidents in the United States During the Calendar Year 1915, compiled by A. H. Fay. 1917. 114 pp., 2 figs.

†TP 169. Permissible Explosives Tested Prior to January 1, 1917, by S. P. Howell. 1917. 19 pp., 1 fig.

†TP 170. The Diffusion of Oxygen Through Stored Coal, by S. H. Katz. 1917. 48 pp., 1 pl., 27 figs. Discusses experiments to determine the effects of the size of the coal pieces and the proportion of voids in a coal pile on the rate at which oxygen can travel by diffusion from the air around the pile to the coal within.

†TP 171. Method of Least Squares Applied to Estimating Errors in Coal Analysis, by J. D. Davis and J. G. Fairchild. 1918. 36 pp., 1 pl., 5 figs. Discusses the probable limits of error in analyzing samples of coal and shows how the method of least squares should be applied.

†TP 172. Effects of Moisture on the Spontaneous Heating of Stored Coal, by S. H. Katz and H. C. Porter. 1917. 25 pp., 1 pl., 8 figs. Explains method of experiment and describes apparatus used.

†TP 173. Coke-Oven Accidents in the United States During the Calendar Year 1916, compiled by A. H. Fay. 1917. 22 pp.

†TP 174. Suggestions for the Safe Operation of Gasoline Engines in Mines, by R. H. Kudlich and Edwin Higgins. 1917. 19 pp., 3 figs. Discusses especially the conditions under which the operation of gasoline motors fouls the mine air.

†TP 175. Production of Explosives in the United States During the Calendar Year 1916, compiled by A. H. Fay. 1917. 24 pp.

†TP 176. Bibliography of Recent Literature on Flotation of Ores, July to December 31, 1916, by D. A. Lyon, O. C. Ralston, F. B. Laney, and R. S. Lewis. 1917. 27 pp.

†TP 177. Preparation of Ferro-Uranium, by H. W. Gillett and E. L. Mack. 1917. 46 pp., 2 figs. Refers to importance of uranium as an alloy in steel and describes experiment in producing ferro-uranium in an electric furnace.

†TP 178. Notes on Lignite: Its Characteristics and Utilization, by S. M. Darling. 1919. 11 pp. Reviews status of lignite utilization in the United States.

†TP 179. Preparedness Census of Mining Engineers, Metallurgists, and Chemists, by A. H. Fay. 1917. 19 pp.

†TP 180. Firing Bituminous Coals in Large House-Heating Boilers, by S. B. Flagg. 1917. 22 pp., 1 pl., 16 figs. Describes experiments to determine best methods of firing coal and savings to be effected.

†TP 181. Determination of Unsaturated Hydrocarbons in Gasoline, by E. W. Dean and H. H. Hill. 1917. 25 pp. Describes various laboratory methods studied and experiments made in the pressure-cracking process in gasoline production.

†TP 182. Flotation of Chalcopyrite in Chalcopyrite-Pyrrhotite Ores of Southern Oregon, by W. H. Coghill. 1918. 13 pp., 1 fig. Presents a preliminary report on experiments on certain low-grade ores for the separation of sulfides by flotation.

†TP 183. New Views of the Combustion of the Volatile Matter in Coal, by S. H. Katz. 1918. 15 pp., 1 fig. Deals with the volatilization of the hydrocarbons in coal and the burning of the volatile matter in the combustion space of the furnace.

†TP 184. Weights of Various Coals, by S. B. Flagg. 1918. 14 pp.

†TP 185. Use of the Interferometer in Gas Analysis, by F. M. Seibert and W. C. Harpster. 1918. 18 pp., 1 pl., 5 figs. Describes the outcome of investigations made by the Bureau of Mines in connection with work on mine gases and natural gas.

†TP 186. Methods for Routine Work in the Explosives Physical Laboratory of the Bureau of Mines, by S. P. Howell and J. E. Tiffany. 1918. 63 pp. Describes laboratory methods used; gives precautions to be observed in handling, storage, and use of explosives, and useful tables in explosives testing. (Superseded by B 346.)

†TP 187. Slag Viscosity Tables for Blast-Furnace Work, by A. L. Feild and P. H. Royster, 1918. 38 pp., 1 fig. Gives data to help blast-furnace operators to reduce losses caused by off-grade pig iron, to improve fuel economy, and to extend present-day practice to meet the increasing need of smelting lean and complex ores.

†TP 188. Corrosion Under Oil Films, with Special Reference to the Cause and Prevention of the After Corrosion of Firearms, by W. J. Huff. 1922. 26 pp., 4 pls. Presents the results of experiments made and discusses the prevention of after corrosion.

†TP 189. Temperature-Viscosity Relations in the Ternary System CaO–Al_2O_3–SiO_2, by A. L. Feild and P. H. Royster. 1919. 36 pp., 1 pl., 16 figs. Gives properties of certain silicates at high temperatures, con-

†Out of print.

fined to that range of composition found in iron blast-furnace slags. Results have a direct relation to many problems outside the field of iron metallurgy.

†TP 190. Methane Accumulations from Interrupted Ventilation, with Special Reference to Coal Mines in Illinois and Indiana, by H. I. Smith and R. J. Hamon. 1918. 46 pp., 2 pls., 5 figs. Describes causes of methane accumulations in mines. Explains tests to determine the rate of accumulation when ventilation is interrupted. Suggests means to prevent accidents.

†TP 191. Central-Station Heating: Its Economic Features with Reference to Community Service, by J. C. White. 1918. 23 pp., 6 figs. Discusses the economies that can be effected by central heating stations.

†TP 192. Production of Explosives in the United States During the Calendar Year 1917, with Notes on Coal-Mine Accidents Due to Explosives and List of Permissible Explosives Tested Prior to April 30, 1918, compiled by A. H. Fay. 1918. 21 pp.

†TP 193. Quarry Accidents in the United States During the Calendar Year 1916, compiled by A. H. Fay. 1918. 58 pp.

†TP 194. Report of the Committee on the Standardization of Mining Statistics, compiled by A. H. Fay. 1918. 39 pp.

†TP 195. The Tars Distilled from Bituminous Coal in Hand-Fired Furnaces, by S. H. Katz. 1918. 20 pp., 2 pls., 3 figs. Describes treatment of samples and the methods of conducting experiments.

†TP 196. Notes on the Black Sand Deposits of Southern Oregon and Northern California, by R. R. Hornor. 1918. 42 pp., 8 pls. Describes examinations made to determine whether deposits contain sufficient platinum and gold to be profitable and to discover if any iron minerals were present.

†TP 197. Use of the Hydrogen-Volatile Matter Ratio in Obtaining the Net Heating Values of American Coals, by A. C. Fieldner and W. A. Selvig. 1918. 13 pp., 4 figs.

†TP 198. Sulfur Dioxide Method for Determining Copper Minerals in Partly Oxidized Ores, by C. E. van Barneveld and E. S. Leaver. 1918. 14 pp., 1 fig. Explains methods for the selective determination of the quantity of copper in the sulfide form and in the form of combined oxides, carbonates, silicates, and native or metallic copper, in partly oxidized ores and in mill products from these ores.

†TP 199. Five Ways of Saving Fuel in Heating Houses, by Henry Kreisinger. 1918. 13 pp., 1 fig. Briefly shows how coal can be saved.

†TP 200. Colloids and Flotation, by F. G. Moses. 1918. 24 pp. Discusses the properties of colloids and the relation of these properties to various problems in the flotation of ores.

†TP 201. Accidents at Metallurgical Works in the United States During the Calendar Year 1916, compiled by A. H. Fay. 1918. 18 pp.

†TP 202. Metal-Mine Accidents in the United States During the Calendar Year 1916, compiled by A. H. Fay. 1918. 91 pp.

†TP 203. Labor Saving at Limestone Quarries, by Oliver Bowles. 1919. 26 pp. Points out the necessity of reducing labor costs at quarries and calls attention to various labor-saving methods and devices.

†TP 204. Economic Operation of Steam Turbo-Electric Stations, by C. T. Hirshfeld and C. L. Karr. 1918. 29 pp., 5 figs. Discusses the economies to be effected in the use of fuel through changes in operating methods at large power plants having turbogenerators.

†TP 205. Saving Coal in Boiler Plants, by Henry Kreisinger. 1918. 24 pp., 3 figs. Describes methods to reduce the consumption of coal without impairing efficiency.

†TP 206. Coke-Oven Accidents in the United States During the Calendar Year 1917, by A. F. Fay. 1918. 19 pp.

†TP 207. Combustion Experiments with North Dakota Lignite, by Henry Kreisinger, C. E. Augustine, and W. C. Harpster. 1919. 44 pp., 1 pl., 13 figs. Gives results of combustion tests of lignite burned in two forms and suggests improvement in design of furnaces for efficient combustion.

†TP 208. How to Improve the Hot-Air Furnace, by C. W. Baker. 1918. 20 pp. Shows how fuel can be saved in heating houses with hot air and discusses some methods of humidifying the air of rooms thus heated.

†TP 209. Traps for Saving Gas at Oil Wells, by W. R. Hamilton. 1919. 34 pp., 3 pls., 16 figs. Discusses construction and advantages of gas traps and their effect upon the yield of oil and gas.

†TP 210. An Analytical Method for Detecting Blown-Out Shots in Coal Mines, by G. F. Hutchinson and J. Barab. 1919. 22 pp. Shows how blown-out shots may be detected by an analysis of the products of combustion left in the borehole.

†TP 211. Approximate Quantitative Microscopy of Powdered Ores, Including the Use of the Camera Lucida, by W. H. Coghill and J. P. Bonardi. 1919. 20 pp., 3 pls. Shows how the microscope can be an aid in the milling of ores.

†TP 212. The Determination of Combustible Matter in Silicate and Carbonate Rocks, by A. C. Fieldner, W. A. Selvig, and G. B. Taylor. 1919. 22 pp., 1 fig. Discusses procedure for combustible matter determination and summarizes results obtained.

†TP 213. Quarry Accidents in the United States During the Calendar Year 1917, compiled by A. H. Fay. 1919. 62 pp.

†TP 214. Motor Gasoline; Properties, Laboratory Methods of Testing, and Practical Specifications, by E. W. Dean. 1919. 33 pp., 2 figs. Revision of TP 166. (See also TP 323B.)

†TP 215. Accidents at Metallurgical Works in the United States During the Calendar Year 1917, compiled by A. H. Fay. 1919. 23 pp.

†TP 216. Vitiation of Garage Air by Automobile Exhaust Gases, by G. A. Burrell and A. W. Gauger. 1919. 12 pp. Points out the danger of running automobile engines in garages.

†TP 217. Saving Coal in Steam Power Plants, by United States Fuel Administration. 1918. 8 pp., 1 pl., 1 fig. Contains instructions for engineers and firemen.

†TP 218. Boiler-Water Treatment, by United States Fuel Administration. 1919. 8 pp., 1 fig. Discusses best methods and treatment.

†TP 219. Combustion and Flue-Gas Analysis, by United States Fuel Administration. 1919. 12 pp., 5 figs. Describes gas-analysis apparatus and method of use; calls attention to economies that can be effected in the use of fuel.

†TP 220. Burning Steam Sizes of Anthracite with or Without Admixture of Soft Coal, by United States Fuel Administration. 1919. 8 pp. Shows how the fuels can be burned most efficiently.

†TP 221. Saving Steam in Industrial Heating Systems, by United States Fuel Administration. 1919. 13 pp., 5 figs. Suggests improvements in the design and operation of steam-heating plants.

†TP 222. Method of Administering Leases of Iron-Ore Deposits Belonging to the State of Minnesota, by J. R. Finlay. 1919. 40 pp., 1 fig. Deals with grades of ore, method of determining royalties, and the fairness of present methods to the landowner and the mine operator.

†TP 223. Cost Keeping for Small Metal Mines, by J. C. Pickering. 1919. 46 pp. Discusses accounting methods and gives samples of forms suitable for small mines.

†Out of print.

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†TP 224. Metal-Mine Accidents in the United States During the Calendar Year 1917, by A. H. Fay. 1919. 80 pp.

†TP 225. The Vapor Pressure of Lead Chloride, by E. D. Eastman and L. H. Duschak. 1919. 16 pp., 2 pls., 2 figs. Discusses results of experiments at the Berkeley (Calif.) station of the Bureau of Mines.

†TP 226. Men Who Received Bureau of Mines Certificates of Mine Rescue Training, July 1, 1916, to June 30, 1918, by D. J. Parker. 1919. 72 pp.

†TP 227. The Determination of Mercury, by C. M. Bouton and L. H. Duschak. 1920. 44 pp., 2 pls., 1 fig. Describes rapid and accurate method for determination of mercury in ores and in fume from volatilization plants.

†TP 228. The Relative Safety of Brass, Copper, and Steel Gauzes in Miners' Flame Safety Lamps, by L. C. Ilsley and A. B. Hooker. 1921. 29 pp., 7 pls., 1 fig. Gives results of experiments and suggests materials to be used.

†TP 229. Accident Prevention in the Mines of Butte, Mont., by D. Harrington. 1920. 59 pp., 2 pls. Describes safety systems and methods employed. Suggests means by which accidents may be prevented.

†TP 230. Determination of Molybdenum, by J. P. Bonardi and E. P. Barrett. 1920. 35 pp. Describes the volumetric and gravimetric method for the determination of molybdenum in ores.

†TP 231. Production of Explosives in the United States During the Calendar Year 1918, with Notes on Coal-Mine Accidents Due to Explosives and List of Permissible Explosives Tested Prior to March 31, 1919, compiled by A. H. Fay. 1919. 21 pp.

†TP 232. Absorption as Applied to Recovery of Gasoline Left in Residual Gas from Compression Plants, by W. P. Dykema and R. O. Neal. 1920. 43 pp., 6 pls., 10 figs. Points advantage of using absorption process to recover small percentages of gasoline from residual gases.

†TP 233. The Properties of Some Stoneware Clays, by H. G. Schurecht. 1920. 41 pp., 1 pl., 23 figs. Presents results of investigations as to the use of clays and occurrence of the clays investigated.

†TP 234. Sensitiveness of Explosives to Frictional Impact, by S. P. Howell. 1919. 17 pp., 2 pls., 1 fig. Describes frictional impact machine used by the Bureau of Mines and points out its value for testing explosives.

†TP 235. Safe Storage of Coal, by H. H. Stoek. 1920. 10 pp. Discusses the advantages of storing coal and points out precautions to be observed.

†TP 236. Abatement of Corrosion in Central Heating Systems, by F. N. Speller. 1919. 12 pp., 2 figs. Discusses corrosion and shows how it can be readily abated by a simple method of deoxidizing the water.

†TP 237. Safe Practice in Using Wire Ropes in Mines, by O. P. Hood and R. H. Kudlich. 1919. 11 pp. Gives precautions to be observed and reasons for them. (See also TP 602.)

†TP 238. Indicators for Carbon Dioxide and Oxygen in Air and Flue Gas, by L. H. Milligan, D. O. Crites, and W. S. Wilson. 1920. 23 pp., 3 pls., 12 figs. Discusses importance of quick methods of determining the proportions of carbon dioxide and of oxygen in the atmosphere of mines and elsewhere and describes apparatus.

†TP 239. Coke-Oven Accidents in the United States During the Calendar Year 1918, by A. H. Fay. 1919. 26 pp.

†TP 240. Boiler and Furnace Testing, by R. T. Strohm. 1920. 23 pp., 3 figs. Shows necessity for testing boilers and describes method.

†TP 241. Blowholes, Porosity, and Unsoundness in Aluminum Castings, by R. J. Anderson. 1919. 34 pp., 5 pls., 1 fig. Gives results of investigations by the Bureau of Mines at its Pittsburgh Experiment Station.

†TP 242. Why and How Coke Should Be Used for Domestic Heating, by Henry Kreisinger and A. C. Fieldner. 1919. 20 pp., 1 fig. Describes advantages of coke as a fuel and points out how coke should be burned in heating houses.

†TP 243. Development of Liquid-Oxygen Explosives During the War, by G. S. Rice. 1920. 46 pp., 2 pls., 6 figs. Gives results of experiments and describes equipment used. (See TP 294.)

†TP 244. Use of Stenches as a Warning in Mines, by S. H. Katz, V. C. Allison, and W. L. Egy. 1920. 31 pp., 1 pl., 4 figs. Describes apparatus; gives results of tests and a discussion of their practical application to operating conditions. (See TP 267.)

†TP 245. Quarry Accidents in the United States During the Calendar Year 1918, by A. H. Fay. 1920. 52 pp.

†TP 246. Water-Gas Apparatus and the Use of Central District Coal as Generator Fuel, by W. W. Odell. 1921. 28 pp., 1 pl., 2 figs. Discusses tests made while considering the possibility of substituting Indiana and Illinois coal for coke in water-gas generator sets and describes apparatus.

†TP 247. Perforated Casing and Screen Pipe in Oil Wells, by E. W. Wagy. 1920. 48 pp., 6 pls., 12 figs. Describes methods of applying perforation principles and discusses their advantages and disadvantages.

†TP 248. Gas Masks for Gases Met in Fighting Fires, by A. C. Fieldner, S. H. Katz, and S. P. Kinney, with a chapter on the Effects of Gases on Men and the Treatment of Various Forms of Gas Poisoning, by Yandell Henderson. 1921. 56 pp., 9 pls., 5 figs. Gives information regarding the use of the Army type of mask in mines, in mineral industries, and in fire fighting. Describes breathing apparatus other than gas masks, most of the gases met in the industries, and method of treating persons who have been gassed.

†TP 249. The Determination of Oxides of Nitrogen, by V. C. Allison, W. L. Parker, and G. W. Jones. 1921. 13 pp., 2 figs. Describes method; discusses physiological effects of oxides of nitrogen, symptoms of poisoning by fumes, and treatment.

†TP 250. Metal-Mine Accounting, by C. B. Holmes. 1920. 63 pp. Discusses accounting methods and gives samples of forms and vouchers.

†TP 251. Ventilation in Metal Mines, a Preliminary Report, by D. Harrington. 1921. 44 pp. Shows the advantage of good ventilation and treats of related metal-mining subjects dealing with the health and efficiency of miners.

†TP 252. Metal-Mine Accidents in the United States During the Calendar Year 1918, compiled by A. H. Fay. 1920. 118 pp.

†TP 253. Effects of Gasoline Removal on the Heating Value of Natural Gas, by D. B. Dow. 1920. 23 pp., 2 figs. Presents data on heating values of gas before and after treatment and gives analyses of gas samples. Discusses advantages and disadvantages of gasoline plants in their effects on heating value of the gas treated, the function of such plants with respect to maintenance of pressure in gasolines, and the losses by leakage.

†TP 254. The Analysis of Sulfur Forms in Coal, by A. R. Powell. 1921. 21 pp., 1 fig. Discusses methods used in experiments.

†TP. 255. Chlorination of Natural Gas, by G. W. Jones, V. C. Allison, and M. H. Meighan. 1921. 44 pp., 9 figs. Describes apparatus used in experiments with the so-called "dry gases."

†TP 256. Accidents at Metallurgical Works in the United States During the Calendar Year 1918, compiled by A. H. Fay. 1920. 23 pp.

†Out of print.

†TP 257. Waste and Correct Use of Natural Gas in the Home, by S. S. Wyer. 1920. 23 pp., 7 figs. Points out the necessity of checking natural-gas waste and gives information as to its correct use in the home.

†TP 258. Production of Gasoline by Cracking Heavier Oils, by E. W. Dean and W. A. Jacobs. 1922. 56 pp., 5 figs. Describes in detail experiments made and gives a concise statement of important facts not generally recognized by those developing or operating cracking processes.

†TP 259. Production of Explosives in the United States During the Calendar Year 1919, with Notes on Coal-Mine Accidents Due to Explosives and a List of Permissible Explosives Tested to March 31, 1920, by W. W. Adams. 1920. 31 pp.

†TP 260. Miners' Consumption in the Mines of Butte, Mont., by D. Harrington and A. J. Lanza. 1921. 19 pp. Reviews the general results of investigations of miners' consumption in the years 1916 to 1919 and recommends methods to decrease health hazards.

†TP 261. Oil-Camp Sanitation, by C. P. Bowie. 1921. 32 pp., 3 pls., 4 figs. Describes sanitation conditions at "boom" oil camps and improvements by which the working efficiency of the men would be increased.

†TP 262. Certain Interfacial Tension Equilibria Important in Flotation, by W. H. Coghill and C. O. Anderson. 1923. 55 pp., 1 pl., 20 figs. Discusses graphic analysis of the interfacial forces acting at the common meeting line of three immiscible fluids (a gas, such as air, being regarded as one of the fluids) in contact with each other.

†TP 263. Design and Operation of a Low-Pressure Absorption Plant, by W. P. Dykema and A. A. Chenoweth. 1923. 55 pp., 1 pl., 20 figs. Deals with the main features and operation of plant at the Cushing oil field in Oklahoma and presents data on the latent heat of absorbed gases and a proposed means of overcoming the increase in temperature of the oil as it circulates through the towers.

†TP 264. Preliminary Investigations of Storage-Battery Locomotives: Specifications, Laboratory Tests, Permissible Schedule, by L. C. Ilsley and H. B. Brunot. 1920. 35 pp., 2 pls., 4 figs. Deals with the development of specifications for Schedule 15 and gives data to assist those who are developing apparatus to meet the requirements of this schedule.

†TP 265. Mesothorium, by Herman Schlundt. 1922. 57 pp., 4 figs. Gives a review of the published investigations on mesothorium, with a list of references and results of experiments during the year 1917–18 at the Golden (Colo.) station of the Bureau of Mines and at the plant of the Welsbach Co., Gloucester, N. J.

†TP 266. Coke-Oven Accidents in the United States During the Calendar Year 1919, by W. W. Adams. 1920. 25 pp.

†TP 267. Stenches for Detecting Leakage of Blue Water Gas and Natural Gas, by S. H. Katz and V. C. Allison. 1920. 22 pp., 2 figs. Supplements information contained in TP 244.

†TP 268. Preparation and Uses of Tar and Its Simple Crude Derivatives, by W. W. Odell. 1922. 84 pp., 4 pls., 11 figs. Constitutes a general treatise on the utilization of coal tars and water-gas tar.

†TP 269. Analyses of Iowa Coals. 1921. 28 pp. Gives analyses and describes samples.

†TP 270. The Detection and Estimation of Platinum in Ores, by C. W. Davis. 1921. 27 pp. Is intended as a ready reference to assayers; summarizes methods for the detection of the metal; and gives a selected method for the commercial estimation of platinum in ores.

†TP 271. State Mining Laws on the Use of Electricity in and About Coal Mines, by L. C. Ilsley. 1920. 53 pp., 1 fig. Shows by comparison the relative attention given by the law-making bodies of the different States to safe use of electricity in coal mines, and lists and explains purpose of the more important regulations. Cites examples of regulations now in effect.

†TP 272. Permeation of Oxygen Breathing Apparatus by Gases and Vapors, by A. C. Fieldner, S. H. Katz, and S. P. Kinney. 1921. 24 pp., 4 pls, 3 figs. Gives results of tests.

†TP 273. Smoke Abatement, by Osborn Monnett. 1923. 31 pp., 12 pls., 4 figs. Calls attention to the need of civic interest in smoke abatement. Discusses effect of atmosphere pollution upon health, vegetation, and property and gives results of experiments.

†TP 274. Efficiencies in the Use of Bituminous Coking Coal as Water-Gas Generator Fuel, by W. W. Odell. 1923. 39 pp., 1 pl., 9 figs. Gives details of experiments conducted with coal generator fuel to determine the advantages of using bituminous coal. See TP 284.

†TP 275. Quarry Accidents in the United States During the Calendar Year 1919, by W. W. Adams. 1921. 66 pp.

†TP 276. Safe Mechanical Equipment for Use in Shaft Sinking, by R. H. Kudlich. 1922. 12 pp., 1 pl., 6 figs. Recommends the use of equipment and gives precautions that should be followed to reduce hoisting dangers in shaft sinking.

†TP 277. Application of the Geophone to Mining Operations, by Alan Leighton. 1922. 33 pp., 2 pls., 14 figs. Describes the geophone; gives instructions for its use and results of experiments.

†TP 278. The Sugar-Tube Method of Determining Rock Dust in Air, by A. C. Fieldner, S. H. Katz, and E. S. Longfellow. 1921. 42 pp., 2 pls., 9 figs. Describes tests and apparatus used.

†TP 279. The Economic Combustion of Waste Fuels, by D. M. Myers. 1922. 51 pp., 20 figs. Discusses waste fuels, methods of combustion, and describes furnaces.

†TP 280. Accidents at Metallurgical Works in the United States During the Calendar Year 1919, by W. W. Adams. 1921. 31 pp.

†TP 281. Use of Electrolytes in the Purification and Preparation of Clays, by H. G. Schurecht. 1922. 47 pp., 1 pl., 25 figs. Deals with the relation between the percentage of alkali necessary to maintain minimum viscosity in clay slips. Gives results of tests. Points out precautions necessary in purification of clays and methods for changing their properties by special treatments in their preparation.

†TP 282. Analysis of Detonating and Priming Mixtures, by C. H. Taylor and W. H. Rinkenbach. 1922. 33 pp., 1 pl., 2 figs. Describes methods used in practical work. Is intended especially for chemists analyzing explosive compositions and desirous of results that are accurate within the limits of the variation of the mixtures themselves.

†TP 283. Tests of Low-Grade and Complex Ores in Colorado, by W. H. Coghill and C. O. Anderson. 1923. 67 pp., 4 figs. Describes results of joint investigation and experimentation of the Bureau of Mines and the Colorado School of Mines.

†TP 284. Coal and Coke Mixtures as Water-Gas Generator Fuel, by W. W. Odell. 1921. 32 pp., 4 pls., 2 figs. Presents the results of experiments conducted to determine the effect of a stand-over period on capacity and possibilities in the use of the blow-run method of operating with mixed fuels, coal, and coke. See TP 274.

†TP 285. Compressed-Air Illness and Its Engineering Importance, with a Report of Cases at the East River Tunnels, by Edward Levy. 1922. 48 pp., 13 pls., 10 figs. Deals with physiological problems arising in mining and underground engineering developments.

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†TP 286. Metal-Mine Accidents in the United States During the Calendar Year 1919, by W. W. Adams. 1921. 99 pp.

†TP 287. Preparation of Light Aluminum-Copper Casting Alloys, by R. J. Anderson. 1922. 44 pp., 6 pls., 1 fig. Outlines principles involved; discusses methods employed and results of experiments.

†TP 288. Coal-Mine Fatalities in the United States, 1920, and Coal-Mine Statistics Supplementing Those Published in Bulletin 115, and a List of Permissible Explosives, Lamps, and Motors Tested Prior to January 31, 1921, by W. W. Adams. 1921. 112 pp.

†TP 289. Change Houses in the Lake Superior Region, by C. E. Kindall. 1923. 31 pp., 12 pls., 9 figs. Describes types of houses and recommends improvements in construction and equipment.

†TP 290. Inclusions in Aluminum-Alloy Sand Castings, by R. J. Anderson. 1922. 25 pp., 7 pls. Gives analysis of information gathered from a number of aluminum-alloy founders. Presents results of examination of samples of castings and suggests methods to prevent hard spots.

†TP 291. The Production of Explosives in the United States During the Calendar Year 1920, with Notes on Mine Accidents Due to Explosives, by W. W. Adams. 1921. 44 pp., 4 figs.

†TP 292. Tests of Gas Masks and Respirators for Protection from Locomotive Smoke in Railroad Tunnels, with Analyses of Tunnel Atmospheres, by A. C. Fieldner, S. H. Katz, and S. P. Kinney. 1922. 27 pp., 3 pls., 3 figs. Describes tests made at the Pittsburgh Experiment Station of the Bureau of Mines and in tunnels. Discusses physiological effects of flue-gas constituents, symptoms of poisoning, and first-aid treatment. Describes type of mask best suited for use in tunnels.

†TP 293. Coke-Oven Accidents in the United States During the Calendar Year 1920, by W. W. Adams. 1921. 32 pp.

†TP 294. Progress of Investigations on Liquid-Oxygen Explosives, by S. P. Howell, J. W. Paul, and J. L. Sherrick. 1923. 91 pp., 6 pls., 18 figs. Describes tests and discusses results. (See TP 243.)

†TP 295. Quarry Accidents in the United States During the Calendar Year 1920, by W. W. Adams. 1922. 66 pp.

†TP 296. Size and Character of Grains of Nonmetallic Mineral Fillers, by W. M. Weigel. 1924. 44 pp., 14 pls., 6 figs. Gives in detail a method for the fairly rapid determination of the average particle size of finely ground minerals where the limiting range of size is so large as to make ordinary methods of microscopic measurement impracticable, also where the particles are nearly all too small for analysis by sieves.

†TP 297. Accidents at Metallurgical Works in the United States During the Calendar Year 1920, by W. W. Adams. 1922. 28 pp.

†TP 298. Methods for Testing Petroleum Products, a Handbook for Testing Laboratories, adopted by the Interdepartmental Petroleum Specifications Committee. 1922. 58 pp., 21 figs. See TP 323B for later data on methods.

†TP 299. Metal-Mine Accidents in the United States During the Calendar Year 1920, by W. W. Adams. 1922. 99 pp.

†TP 300. The Universal and the Fireman's Gas Masks, by S. H. Katz, J. J. Bloomfield, and A. C. Fieldner. 1923. 22 pp., 2 pls., 6 figs. Describes gas masks suitable for use in metallurgical, chemical, and other industries where noxious gases or fumes occur and outlines test requirements for all gas masks used by the Bureau of Mines in its investigations.

†TP 301. Proposed Method for Reducing Mineral Waste in the Wisconsin Zinc District, Wisconsin, by W. H. Coghill and C. O. Anderson. 1922. 66 pp. Gives the results of an investigation to reduce waste in the mining and treatment of lead and zinc ores in the district and suggests improvements in methods of milling.

†TP 302. Coal-Mine Fatalities in the United States, 1921, by W. W. Adams. 1922. 72 pp.

†TP 303. Value of Coke, Anthracite, and Bituminous Coal for Generating Steam in a Low-Pressure Cast-Iron Boiler, by John Blizard, James Neil, and F. C. Houghton. 1922. 56 pp., 22 figs. Discusses results of tests and describes the boiler used.

†TP 304. Water-Gas Tar Emulsions, by W. W. Odell. 1923. 51 pp., 6 figs. Presents a laboratory study of tars and emulsions collected from different plants and produced under different operating conditions.

†TP 305. Specifications for Petroleum Products, Adopted by the Interdepartmental Petroleum Specifications Committee. Effective January 23, 1922; Amended March 1, 1922. 1922. 40 pp. (Superseded by TP 323B.)

†TP 306. Operation and Maintenance of Electrical Equipment Approved for Permissibility by the Bureau of Mines, by L. C. Ilsley. 1922. 23 pp., 2 figs. Gives detailed instructions for maintenance of permissible equipment. Calls attention to rules relating to specific schedules.

†TP 307. Permissible Explosives, Mining Equipment, and Apparatus Approved Prior to March 15, 1922, by S. P. Howell, L. C. Ilsley, D. J. Parker, and A. C. Fieldner. 1922. 21 pp., 1 fig. Contains names of 151 explosives that were tested by the Bureau of Mines prior to March 15, 1922, and descriptive data; also list of mining equipment and apparatus.

†TP 308. Analyses of Kentucky Coals. 1922. 92 pp., 1 fig. Gives analyses and describes samples.

†TP 309. Recent Progress in the Thawing of Frozen Gravel in Placer Mining, by Charles Janin. 1922. 34 pp., 5 pls., 4 figs. Describes methods evolved in Alaska and the Yukon Territory.

†TP 310. Recovery of Gasoline from Uncondensed Still Vapors, by D. B. Dow. 1923. 53 pp., 10 pls., 11 figs. Discusses operating methods to increase gasoline yield. Presents results of studies made at 13 refineries in various refining centers.

†TP 311. Factors in the Spontaneous Combustion of Coal, by O. P. Hood. 1922. 9 pp., 8 figs. Gives a brief discussion of the factors involved. (See also IC 7074.)

†TP 312. Leaching Nonsulfide Copper Ores with Sulfur Dioxide, by C. E. van Barneveld and E. S. Leaver. 1923. 91 pp., 5 pls., 11 figs. Defines problem, gives results of tests, and discusses technique of the process.

†TP 313. Production of Explosives in the United States During the Calendar Year 1921, with Notes on Mine Accidents Due to Explosives, by W. W. Adams. 1922. 25 pp.

†TP 314. Metal-Mine Fires, by D. Harrington, B. O. Pickard, and H. M. Wolfiin. 1923. 20 pp., 7 pls. Points out how metal-mine fires start and how the fire hazard can be lessened.

†TP 315. Comparative Tests of Byproduct Coke and Other Fuels for House-Heating Boilers, by Henry Kreisinger, John Blizard, H. W. Jarrett, and J. J. McKitterick. 1923. 21 pp., 2 pls., 8 figs. Gives results of tests made to compare byproduct coke, bituminous coal, and anthracite as fuels for small boilers.

†TP 316. Tests of a Powdered-Coal Plant; a Report of Investigations at the Power Plant of the St. Joseph Lead Co., Rivermines, Mo., by Henry Kreisinger, John Blizard, C. E. Augustine, and B. J. Cross. 1923. 22 pp., 1 pl., 9 figs.

†TP 317. Silver in Chloride Volatilization, by C. M. Bouton, W. C. Riddell, and L. H. Duschak. 1924. 56 pp., 3 figs. A study of the possible causes for the

†Out of print.

low extraction of silver during chloride volatilization. Gives results of experiments.

†TP 318. Coke-Oven Accidents in the United States During the Calendar Year 1921, by W. W. Adams. 1922. 34 pp.

†TP 319. Methods of Decreasing Evaporation Losses of Petroleum, by J. H. Wiggins. 1923. 57 pp., 11 pls., 22 figs. Describes in detail some up-to-date practices.

†TP 320. The Bureau of Mines Orsat Apparatus for Gas Analysis, by A. C. Fieldner, G. W. Jones, and W. F. Holbrook. 1925. 18 pp., 1 pl., 4 figs. Describes apparatus used at the Bureau of Mines gas laboratory at Pittsburgh, Pa., for the complete and partial analysis of gas.

†TP 321. Anhydrous Aluminum Chloride, by O. C. Ralston. 1923. 38 pp., 12 figs. Gives information on various processes for aluminum chloride manufacture.

†TP 322. Experiments in the Use of Back Pressures on Oil Wells, by T. E. Swigart and C. R. Bopp. 1924. 66 pp., 5 pls., 4 figs. Treats of production tests and describes mechanical details of the work.

†TP 323. Specifications for Petroleum Products and Methods for Testing, Federal Specifications Board, Standard Specification No. 2. 1924. 88 pp., 21 figs. (Superseded by TP 323B.)

†TP 323A. United States Government Specification for Lubricants and Liquid Fuels and Methods for Testing, Federal Specifications Board, Standard Specification No. 2c. 1924. 89 pp., 21 figs. Superseded by TP 323B.

†TP 323B. United States Government Master Specification for Lubricants and Liquid Fuels and Methods for Sampling and Testing, Federal Specifications Board, Specification No. 2d. 1927. 121 pp., 33 figs. (Supersedes TP 214, 298, 305, 323, and 323A.) Gives specifications and data on methods.

†TP 324. Uses of Water in the Oil-Shale Industry, with Particular Reference to Engineering and Sanitary Requirements, by J. J. Jakosky, with a chapter on The Sanitation of Oil-Shale Camps, by A. L. Murray. 1923. 57 pp., 8 figs. Points out what factors must be considered and suggests methods by which they may be considered most advantageously.

†TP 325. Natural-Gas Manual for the Home, by R. A. Cattell. 1922. 30 pp., 8 pls., 9 figs. Discusses supply, production, and distribution of natural gas and suggests means whereby waste may be prevented.

†TP 326. Fires in Steamship Bunker and Cargo Coal, by H. H. Stoek. 1923. 52 pp., 4 figs. Presents data of interest to steamship owners and to shippers and buyers of water-borne coal.

†TP 327. Accidents at Metallurgical Works in the United States During the Calendar Year 1921, by W. W. Adams. 1923. 31 pp.

†TP 328. The Motor-Gasoline Surveys of 1920 and 1921, a sequel to B 191, by N. A. C. Smith. 1923. 41 pp., 4 figs. Points out the changes that have taken place since the publication of B 191.

†TP 329. Quarry Accidents in the United States During the Calendar Year 1921, by W. W. Adams. 1923. 90 pp.

†TP 330. Small Hose Streams for Fighting Mine Fires, by L. D. Tracy and R. W. Hendricks. 1925. 23 pp., 5 pls., 9 figs. Describes tests made to ascertain the equipment and pressures with which a man of average weight and strength, without assistance, could fight a mine fire most effectively.

†TP 331. Metal-Mine Accidents in the United States During the Calendar Year 1921, by W. W. Adams. 1923. 96 pp.

†TP 332. Conditions Affecting the Activity of Iron Oxides in Removing Hydrogen Sulfide from City Gas, by W. A. Dunkley and R. D. Leitch. 1924. 33 pp., 9 figs. Describes tests to determine the effects of certain conditions on oxide activity.

†TP 333. Permissible Explosives, Mining Equipment, and Apparatus Approved Prior to January 1, 1923, by S. P. Howell, L. C. Ilsley, D. J. Parker, and A. C. Fieldner. 1923. 22 pp., 1 fig.

†TP 334. Mine Rescue Standards, a Tentative Study, prepared by a committee appointed at the International Mine Rescue Standardization Conference, September, 1921. 1923. 44 pp. Discusses physiological requirements for breathing apparatus, effect of gases found in mines, and appliances and methods for the quick determination of gases in mines. Also gives information as to procedure in mine fires and explosions.

†TP 335. Bituminous Coal as Generator Fuel in Large Water-Gas Sets with Waste-Heat Boilers, by W. A. Dunkley. 1925. 43 pp., 6 pls., 4 figs. Describes tests made in the plant of the Coal Products Manufacturing Co. at Joliet, Ill., up to January 1, 1923, shows the practical efficiencies obtained, and discusses economic phases of the process.

†TP 336. The Oxidation of Zinc Vapor by Carbon Dioxide, by B. M. O'Harra. 1924. 22 pp., 6 figs. Treats of experiments to determine accurately the ratio of carbon dioxide to carbon monoxide required to oxidize zinc under conditions approaching as nearly as possible those in the ordinary zinc condenser.

†TP 337. Carbon Monoxide Hazards from House Heaters Burning Natural Gas, by G. W. Jones, L. B. Berger, and W. F. Holbrook. 1923. 31 pp., 1 pl., 7 figs. Describes tests of six common types of house heaters or stoves burning natural gas and presents suggestions for minimizing the quantity of carbon monoxide emitted under certain conditions.

†TP 338. Smoke-Abatement Investigation at Grafton, W. Va., by Osborn Monnett and L. R. Hughes. 1924. 29 pp., 13 pls., 3 figs. Discusses atmospheric conditions in Grafton, W. Va., with special reference to smoke, and makes recommendations on methods to be employed to reduce smoke to the minimum. Is intended as a guide in campaigns to free communities suffering from smoke-laden atmosphere due to inefficient use of high-volatile coal.

†TP 339. Coal-Mine Fatalities in the United States, 1922, by W. W. Adams. 1923. 97 pp.

†TP 340. Production of Explosives in the United States During the Calendar Year 1922, with Notes on Mine Accidents Due to Explosives, by W. W. Adams. 1923. 25 pp.

†TP 341. Metallurgical Treatment of Zinc-Retort Residues, by B. M. O'Harra. 1925. 25 pp., 1 fig. Describes various methods for the treatment of zinc-retort residues and summarizes information collected by the Bureau of Mines in making the survey.

†TP 342. Methods for the Recovery of Platinum, Iridium, Palladium, Gold, and Silver from Jewelers' Waste, by C. W. Davis. 1924. 14 pp. Separates methods for recovery of metals into two classes and discusses manipulations and chemical procedures.

†TP 343. Georgia and Alabama Clay as Fillers, by W. M. Weigel. 1925. 35 pp., 2 pls., 7 figs. Describes tests to ascertain the uses to which the clays could be most efficiently put. Is intended especially for owners and operators of clay deposits.

†TP 344. Analyses of Ohio Coals. 1923. 40 pp., 2 figs. Gives analyses and describes samples.

†TP 345. Analyses of Utah Coals. 1925. 90 pp., 1 fig. Gives analyses and describes samples.

†TP 346. Properties of Typical Crude Oils from the Producing Fields of the Western Hemisphere, by A. J. Kraemer and L. P. Calkin. 1925. 43 pp. Gives the results of the examination of samples from countries other than the United States, groups crude oils of similar nature in each country, and points out

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analogies which indicate similarity to a typical crude oil of the United States. (See RI 2807.)

†TP 347. Analyses of Alabama Coals. 1925. 111 pp., 3 figs. Gives analyses and describes samples.

†TP 348. Gas Masks for Gasoline and Petroleum Vapors, by S. H. Katz and J. J. Bloomfield. 1924. 37 pp., 8 pls., 7 figs. Gives results of tests of gas masks, hose masks, and self-contained oxygen breathing apparatus to determine the degree of protection afforded against vapors of petroleum or petroleum products.

†TP 349. Coke-Oven Accidents in the United States During the Calendar Year 1922, by W. W. Adams. 1923. 37 pp.

†TP 350. Accidents at Metallurgical Works in the United States During the Calendar Year 1922, by W. W. Adams. 1924. 31 pp.

†TP 351. Electrical Manufacture of Carbon Black, by J. J. Jakosky. 1924. 42 pp., 8 pls., 10 figs. Discusses tests of the effects of electric arcs on petroleum and the production of carbon black. (See also TP 375.)

†TP 352. Detection of Small Quantities of Petroleum Vapor with the Burrell Methane Indicator, by G. W. Jones and W. P. Yant. 1924. 19 pp., 1 pl., 4 figs. Describes tests and apparatus.

†TP 353. Quarry Accidents in the United States During the Calendar Year 1922, by W. W. Adams. 1924. 61 pp.

†TP 354. Metal-Mine Accidents in the United States During the Calendar Year 1922, by W. W. Adams. 1924. 72 pp.

†TP 355. A Carbon Monoxide Recorder and Alarm, by S. H. Katz, D. A. Reynolds, H. W. Frevert, and J. J. Bloomfield. 1926. 35 pp., 3 pls., 13 figs. Describes the carbon monoxide recorder developed by the Bureau of Mines and the results of tests with this and other recorders.

†TP 356. Analyses of Tennessee Coals. 1926. 94 pp., 1 fig. Gives analyses and describes samples.

†TP 357. A Critical Study of the Burrell Indicator for Combustible Gases in Air, by L. H. Milligan. 1925. 40 pp., 1 pl., 11 figs. Discusses principle and operation, gives results of a few typical mine tests, and describes use of the indicator for other purposes.

†TP 358. Production of Explosives in the United States During the Calendar Year 1923, by W. W. Adams. 1924. 32 pp.

†TP 359. The Purification of Copper Sulfate Solutions, by G. S. Tilley and O. C. Ralston. 1924. 45 pp., 5 figs. Reviews previous work on this subject and supplies data lacking therein.

†TP 360. Vapor Pressures of the Common Metallic Chlorides and a Static Method for High Temperatures, by C. G. Maier. 1925. 54 pp., 14 figs. Presents a method to determine vapor pressures up to 1,250° C. Furnishes technical data on the vapor pressures and heats of vaporization of the metallic chlorides at high temperatures.

†TP 361. Cleaning Tests of Illinois Coals, by Thomas Fraser and H. F. Yancey. 1925. 23 pp., 6 figs. Gives a practical illustration of methods of examination and describes tests.

†TP 362. Incomplete Combustion in Natural-Gas Space Heaters, by G. W. Jones, W. P. Yant, and L. B. Berger. 1925. 22 pp., 4 figs. Gives results of tests and suggests means for obtaining efficient combustion.

†TP 363. Lessons from the Fire in the Argonaut Mine, by B. O. Pickard. 1926. 39 pp., 4 pls., 5 figs. Gives data on the mine before the fire, an account of the disaster, and suggests preventive measures.

†TP 364. Permissible Explosives, Mining Equipment, and Apparatus Approved to January 1, 1924, by J. E. Crawshaw, L. C. Ilsley, D. J. Parker, and A. C. Fieldner. 1924. 30 pp., 1 fig.

†TP 365. Analyses of Virginia Coals. 1926. 75 pp., 2 figs. Gives analyses and describes samples.

†TP 366. Analyses of Missouri Coals. 1926. 41 pp., 1 fig. Gives analyses and describes samples.

†TP 367. Value of Bituminous Coal and Coke for Generating Steam in a Low-Pressure Cast-Iron Boiler, by C. E. Augustine, James Neil, and W. M. Myler, Jr. 1925. 45 pp., 1 pl., 19 figs. Discusses results of tests conducted during 1922 and 1923 at the Pittsburgh Experiment Station of the Bureau.

†TP 368. Paraffin Wax and Its Properties: Methods of Testing Wax and of Analyzing Oil-Wax Mixtures, by L. D. Wyant and L. G. Marsh. 1925. 26 pp., 4 pls., 6 figs. Reviews methods now in general use and describes a new method.

†TP 369. Mechanical Safeguards in Rotary Drilling, by H. C. Miller. 1925. 38 pp., 30 figs. Discusses safeguards used in the oil fields of California and suggests means to prevent accidents. (See also B 272.)

†TP 370. The Bowie-Gavin Process: Its Application to the Cracking of Tars and Heavy Oils, Also to the Recovery of Oil from Oil-Soaked Sands or Shales, or from Oil Shales, by C. P. Bowie. 1926. 42 pp., 14 figs. Gives a detailed description of the process and apparatus.

†TP 371. Coke-Oven Accidents in the United States During the Calendar Year 1923, by W. W. Adams. 1924. 35 pp.

†TP 372. Silicosis Among Miners, by R. R. Sayers. 1925. 24 pp., 10 pls., 8 figs. Discusses causes and means of prevention.

†TP 373. The Pyrotannic Acid Method for the Quantitative Determination of Carbon Monoxide in Blood and in Air, by R. R. Sayers and W. P. Yant. 1925. 18 pp., 2 pls., 1 fig. Describes method and apparatus used.

†TP 374. Accidents at Metallurgical Works in the United States During the Calendar Year 1923, by W. W. Adams. 1925. 31 pp.

†TP 375. Effects of Corona Discharge on Petroleum, by J. J. Jakosky. 1926. 21 pp., 10 figs. Discusses experiments to determine the effects that high-voltage alternating-current electricity in the form of the corona discharge has on petroleum vapors. Supplements TP 351.

†TP 376. Permissible Explosives, Mining Equipment, and Rescue Apparatus Approved Prior to January 1, 1925, by J. E. Crawshaw, L. C. Ilsey, D. J. Parker, and A. C. Fieldner. 1925. 35 pp., 1 fig.

†TP 377. Red Iron Ores and Ferruginous Sandstones of the Clinton Formation in the Birmingham District, Alabama, by W. R. Crane. 1926. 41 pp., 23 figs. Describes the ore in the four ore beds in Red Mountain.

†TP 378. Precipitation of Gold and Silver from Cyanide Solution on Charcoal, by John Gross and J. W. Scott. 1927. 78 pp., 10 figs. Gives results of experiments and an appendix of pertinent literature.

†TP 379. Strength of Ore and Top Rock in the Red Iron Ore Mines of the Birmingham District, Ala., by W. H. Crane. 1926. 22 pp., 9 figs. Discusses the study of the strength of the ore and top rock in the hematite mines of the Birmingham district to determine the size of pillars adequate to support the roof as the mines grow deeper.

†TP 380. Production of Explosives in the United States During the Calendar Year 1924, with Notes on Mine Accidents Due to Explosives, by W. W. Adams. 1925. 35 pp.

†TP 381. Heavy Liquids for Mineralogical Analyses, by J. D. Sullivan. 1927. 25 pp., 10 figs. Presents data on experiments to obtain better heavy liquids.

†TP 382. Accidents in the California Petroleum Industry in 1923, by H. C. Miller and C. E. Steidel. 1926. 30 pp.

†TP 383. Blasting to Lessen Boulders in Hard-Ore Stopes, by E. D. Gardner and S. P. Howell. 1926. 22 pp., 8 figs. Summarizes results of an investigation to assertain the most efficient grade of explosives to

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use and to develop an efficient method of blasting in hard-ore stopes.

†TP 384. Passage of Solid Particles Through Rotary Cylindical Kilns, by J. D. Sullivan, C. G. Maier, and O. C. Ralston. 1927. 42 pp., 20 figs. Discusses the factors that influence the rate of progress of crushed materials through a kiln.

†TP 385. Typical Methods and Devices for Handling Oil-Contaminated Water from Ships and Industrial Plants, by F. W. Lane, A. D. Bauer, H. F. Fisher, and P. N. Harding. 1926. 64 pp., 15 figs. Discusses typical methods and devices.

†TP 386. Explosibility of Coal Dust from Four Mines in Utah, by H. P. Greenwald. 1927. 19 pp., 2 figs. Describes tests made at the Experimental mine of the Bureau of Mines and gives a summary of the results.

†TP 387. Engine Service Tests of Internal-Combustion Engine Lubricating Oils Made from California Crude Petroleum, by M. J. Gavin and Gustav Wade. 1926. 30 pp., 9 figs. Deals with engine tests made at the San Francisco laboratory of the Bureau of Mines in cooperation with the American Petroleum Institute.

†TP 388. Coke-Oven Accidents in the United States During the Calendar Year 1924, by W. W. Adams. 1925. 38 pp.

†TP 389. Lead Poisoning in the Mining of Lead in Utah, by A. L. Murray. 1926. 40 pp. Discusses means to reduce the lead hazards and methods of treatment.

†TP 390. Occurrence, Distribution, and Significance of Alkali Cyanides in the Iron Blast Furnace, by S. P. Kinney and E. W. Guernsey. 1926. 37 pp., 12 figs. Describes method developed at the furnace of the Central Iron & Coal Co., at Holt, Ala., to determine the alkali cyanide content of gases at different points in the interior of the furnace.

†TP 391. Iron Blast-Furnace Reactions, by S. P. Kinney, P. H. Royster, and T. L. Joseph. 1927. 65 pp., 34 figs. Discusses method and apparatus used and gives results of tests.

†TP 392. Accidents in the Petroleum Industry of Oklahoma, 1915–24, by H. C. Fowler. 1926. 29 pp., 15 figs. Shows the need for continued study to prevent accidents and present data on the study of the problem in the district.

†TP 393. Utilization of Manganiferous Iron Ores, by T. L. Joseph, P. H. Royster, and S. P. Kinney. 1926. 28 pp., 17 figs. Discusses tests made and describes experimental blast furnace at the Bureau of Mines station, University of Minnesota.

†TP 394. Dust Respirators, Their Construction and Filtering Efficiency, by S. H. Katz, G. W. Smith, and E. G. Meiter. 1926. 50 pp., 49 figs. Describes representative types of dust respirators used in industry and presents the results of laboratory tests to determine their filtering efficiencies and resistances to air flow.

†TP 395. Accidents at Metallugical Works in the United States During the Calendar Year 1924, by W. W. Adams. 1926. 37 pp.

†TP 396. Low-Temperature Carbonization of Coal, by A. C. Fieldner. 1926. 46 pp., 40 figs. Discusses carbonization processes and principles and describes three types of retort.

†TP 397. Composition of Materials from Various Elevations in an Iron Blast Furnace, by S. P. Kinney. 1926. 21 pp., 11 figs. Describes methods used and discusses results of tests.

†TP 398. Cooking of Oil Shales, by W. L. Finley and A. D. Bauer. 1926. 10 pp., 6 figs. Discusses the tendency of oil shales to coke when heated and describes means of preventing the formation of dense hard coke.

†TP 399. Recovery of Molybdite from the Ore, by H. A. Doerner. 1926. 12 pp., 10 figs. Discusses the utilization of molybdite.

†TP 400. Accidents Due to Explosives in Metal Mines of the Southwest, as Shown by Records in Arizona, by E. D. Gardner. 1926. 28 pp. Points out the procedure necessary to prevent accidents.

†TP 401. Blast-Furnace Gas Studies, by J. F. Barkley. 1927. 9 pp., 8 figs. Deals with studies to discover relation between the amount of gas produced and the pounds of coke used per ton of iron, also to determine variations between gas actually produced and amount found by calculation from the furnace charges.

†TP 402. Safety Rules for Installing and Using Electrical Equipment in Coal Mines, Sponsored by United States Bureau of Mines and American Mining Congress. 1926. 21 pp. Treats methods for safe electrical installation in coal mines. (Supersedes TP 138.)

†TP 403. Hydraulic Classification: Its Theory, Mechanical Development, and Application to Ore Dessing, with a chapter on Methods of Determining the Densities of Liquids and Ore Pulps, by A. W. Fahrenwald. 1927. 51 pp., 20 figs. Gives results of a study of hindered-settling classification and its relation to gravity concentration.

†TP 404. Identification of Oil-Field Waters by Chemical Analysis, by C. E. Reistle, Jr. 1927. 24 pp., 3 figs. Discusses present systems of reporting analyses and shows their advantages and disadvantages; gives actual examples of how waters may be identified.

†TP 405. Analyses of West Virginia Coals. 1928. 343 pp., 1 fig. Gives analyses and describes samples.

†TP 406. Production of Explosives in the United States During the Calendar Year 1925, with Notes on Mine Accidents Due to Explosives, by W. W. Adams. 1926. 39 pp.

†TP 407. Development, Mining, and Handling of Ore in Folded and Faulted Areas, Red Iron Ore Mines, Birmingham District, Alabama, by W. R. Crane. 1927. 27 pp., 27 figs. Deals with the development and handling of ore as affected by folds and faults in the ore bed and considers changes that may be desirable or necessary in future mining practice.

†TP 408. Coke-Oven Accidents in the United States During the Calendar Year 1925, by W. W. Adams. 1926. 39 pp.

†TP 409. Spontaneous Heating of Coal, by J. D. Davis and D. A. Reynolds. 1928. 74 pp., 20 figs. Presents assembled results of investigations made by the Bureau of Mines and their correlation with those of other investigators. Gives a critical review stressing the more recent laboratory studies on spontaneous combustion.

†TP 410. Falls of Roof in Bituminous-Coal Mines. Influence of the Seasons and Rate of Production, by J. W. Paul. 1928. 40 pp., 25 figs. Considers fatal accidents from falls of roof in each of the 24 States producing coal in relation to the tonnage produced, and suggests methods to prevent disintegration and consequent falls of roof.

†TP 411. Analyses of Oklahoma Coals. 1928. 62 pp., 2 figs. Gives analyses and describes samples.

†TP 412. Accidents at Metallurgical Works in the United States During the Calendar Year 1925, by W. W. Adams. 1927. 39 pp.

TP 413. Roasting of Lead Carbonate Ores Preliminary to Gravity Concentration, by Virgil Miller and R. E. Head. 1929. 16 pp., 2 figs. Presents data on low-temperature roasting of lead carbonate ores and describes method of treatment.

†TP 414. Methods of Dealing with Paraffin Troubles Encountered in Producing Crude Oil, by C. E. Reistle, Jr. 1928. 39 pp., 16 figs. Deals with the factors that cause accumulations of paraffin, describes methods

†Out of print.

that have proved satisfactory in preventing them, and sets forth ways of removing paraffin after it has accumulated.

†TP 415. The Function of Steam in the Limekiln, by E. E. Berger. 1927. 43 pp., 5 figs. Discusses results of tests and describes apparatus used.

†TP 416. Analyses of Arkansas Coals. 1928. 26 pp., 1 fig. Gives analyses and describes samples.

†TP 417. Analyses of Indiana Coals. 1927. 57 pp., 2 figs. Gives analyses and describes samples.

†TP 418. Electric-Furnace Cast Iron, by C. E. Williams and C. E. Sims. 1928. 48 pp., 10 figs. Discusses advantages of the electric furnace and gives results of tests.

†TP 419. Safe Practices at Oil Derricks, by H. C. Miller. 1927. 69 pp., 27 figs. Describes installations and use of mechanical equipment.

†TP 420. Geophysical Methods of Prospecting, a Brief and Elementary Account of the Principles Involved, by A. S. Eve and D. A. Keys. 1927. 26 pp., 27 figs. Is intended especially for geologists, mining engineers, and others who desire a concise and simple explanation of the more important physical principles that underlie the various methods of geophysical prospecting.

†TP 421. State Laws Relating to Coal-Mine Timbering, by J. W. Paul and J. N. Geyer. 1928. 57 pp.

†TP 422. Prevention of Pipe-Tool Accidents at Drilling and Producing Wells, by H. C. Fowler. 1928. 47 pp., 19 figs. Describes use and correct handling of pipe tools.

†TP 423. Cyanide Extraction of Gold and Silver Associated with Arsenic and Antimony in Ores, with Especial Reference to Those in Nevada and South Dakota, by E. S. Leaver and J. A. Woolf. 1928. 52 pp., 6 figs. Discusses results of tests.

†TP 424. The Thermodynamic Properties of Oxygen and Nitrogen, by R. W. Millar and J. D. Sullivan. 1928. 20 pp., 2 figs. A collection of thermodynamic data on these two substances. The calculations are limited to pressures not exceeding 60 atmospheres. The report is accompanied by Mollier charts on oxygen and nitrogen.

†TP 425. Production of High-Alumina Slags in the Blast Furnace, by T. L. Joseph, S. P. Kinney, and C. E. Wood. 1928. 32 pp., 6 figs. Discusses the function of blast-furnace slag and gives results of a 2-week test with a 6-ton experimental blast furnace. Gives a brief résumé of tests made in full-size furnaces on high-alumina slags and discusses economic possibilities of producing high-alumina slags in the blast furnace.

†TP 426. Production of Explosives in the United States During the Calendar Year 1926, with Notes on Mine Accidents Due to Explosives, by W. W. Adams. 1927. 46 pp., 1 fig.

†TP 427. Propagation of Flame in Mixtures of Natural Gas and Air, by H. F. Coward and H. P. Greenwald. 1928. 28 pp., 13 figs. Gives the results of experiments to determine the exact differences between methane and natural gas as to the ease with which they may be ignited and the speed with which they propagate flame.

†TP 428. A Study of the Less-Volatile Oils in Salt Creek (Wyo.) Crude, by H. M. Smith. 1928. 28 pp., 7 figs. Presents data to verify conclusions reached that there are two distinct groups of oils in the lubricating stock of Salt Creek petroleum—one, relatively insoluble in acetone, has low viscosity-gravity ratios, low carbon-hydrogen ratios, and relatively low unsaturation; the other, extremely soluble in acetone, has high viscosity-gravity ratios, high carbon-hydrogen ratios, and considerable apparent unsaturation.

†TP 429. Permissible Single-Shot Blasting Units, by L. C. Ilsley and A. B. Hooker. 1928. 24 pp., 18 figs. Gives essential details of the investigations of the eight single-shot units approved prior to July 1, 1927.

†TP 430. Accidents at Metallurgical Works, 1926, by W. W. Adams. 1928. 38 pp.

†TP 431. Studies in the Fractional Distillation of Crude Petroleum, by M. B. Cooke and H. P. Rue. 1928. 54 pp., 16 figs. Describes a series of experiments to demonstrate some of the most essential principles involved in the continuous distillation of crude petroleum, and presents these principles in nontechnical language.

†TP 432. A System of Analysis for Oil-Field Waters, by C. E. Reistle, Jr., and E. C. Lane. 1928. 14 pp.

†TP 433. Experiments in Underground Communication Through Earth Strata, by L. C. Ilsley, H. B. Freeman, and D. H. Zellers. 1928. 60 pp., 35 figs. Records Bureau of Mines experiments. Greater emphasis and details are given those phases of the work that seemed to promise a possible ultimate solution of the problem.

†TP 434. Geophysical Prospecting: Some Electrical Methods, by A. S. Eve and D. A. Keys. 1928. 41 pp., 33 figs. Includes results of tests with certain standard methods and with the new "leapfrog" method devised by the authors.

†TP 435. Production of Explosives in the United States During the Calendar Year 1927, by W. W. Adams. 1928. 49 pp.

†TP 436. The Sulfur Problem in Burning Coal, by J. F. Barkley. 1928. 7 pp., 1 fig. Gives analyses of sulfur content of coal samples from different districts, analyses of sulfur dioxide and sulfur trioxide content of products of combustion taken from a furnace, and effect of equipment.

†TP 437. Coke-Oven Accidents in the United States During the Calendar Year 1926, by W. W. Adams. 1927. 40 pp.

†TP 438. Bentonite: Its Properties, Mining, Preparation, and Utilization, by C. W. Davis and H. C. Vacher. 1928. 51 pp., 1 fig. Revised as TP 609.

†TP 439. Geophysical Investigations of the U. S. Bureau of Mines at Caribou, Colo., by C. A. Heiland, C. W. Henderson, and J. A. Malkovsky. 1929. 45 pp., 13 figs. Shows the charting of magnetic currents in ground underlain by magnetite deposits.

†TP 440. Measuring the Variation of Ground Resistivity with a Megger, by F. W. Lee. 1928. 16 pp., 12 figs. Discusses results of tests.

†TP 441. Factors Governing the Entry of Solutions into Ores During Leaching, by J. D. Sullivan, W. E. Keck, and G. L. Oldright. 1929. 38 pp., 15 figs. The first of a series of reports and experiments conducted by the Bureau of Mines. Covers the first step—penetration of the leaching medium into the body of the ore particles. (See also TP 498.)

†TP 442. The Blast-Furnace Stock Column, by S. P. Kinney. 1929. 148 pp., 62 figs. Discusses another step in the Bureau of Mines investigations of iron blast-furnace operation. Gives results of observations made on a 700-ton furnace.

†TP 443. Coke-Oven Accidents in the United States During the Calendar Year 1927, by W. W. Adams. 1929. 40 pp.

†TP 444. Graphical Terrane Correction for Gravity Gradient, by D. C. Barton. 1929. 10 pp., 7 figs. Gives a graphical method that is as accurate as possible under the conditions of ordinary field surveying with the torsion balance. Tells how to use the charts.

†TP 445. Specific Heats of Gases at High Temperatures, by E. D. Eastman. 1929. 27 pp., 11 figs. Presents the results of the major work on specific heats of gases at high temperatures.

†TP 446. Terminology in Coal Research, by Reinhardt Thiessen and Wilfrid Francis. 1929. 27 pp., 15 figs. Gives the meaning of the different terms used in the literature of the several countries on the subject of the constitution of coals.

†Out of print.

†TP 447. Experiments on Mine-Fan Performance, by G. E. McElroy and A. S. Richardson. 1929. 61 pp., 32 figs. Describes and analyzes the tests of a fan, in place, to determine fan performance and of fans, in place, to obtain data on the ventilating system.

†TP 448. Coal-Dust Explosions in Mines, Causes, Effects, and Recommendations for Prevention, by G. S. Rice. 1929. 24 pp. Defines coal dust and states in detail what causes it to enter into explosions. Discusses the factors that tend to cause explosions.

†TP 449. A Study of the Crude Oil Produced in the Salt Creek Field, Wyoming, by H. P. Rue and I. N. Beall. 1929. 27 pp., 5 figs. Gives methods of analyzing and distilling a typical intermediate-base crude of the type found throughout the Rocky Mountain and Mid-Continent fields.

†TP 450. Inflammability of Mixed Gases, by G. W. Jones. 1929. 38 pp., 6 figs. Deals with experiments made on the inflammability of gas mixtures consisting of methane, hydrogen, carbon monoxide, nitrogen, and carbon dioxide combined in varying proportions. (See also B 279R and RI 3172.)

†TP 451. Calcium Sulfate Retarders for Portland Cement Clinker, by E. E. Berger. 1929. 35 pp., 8 figs. Discusses studies to determine whether the type of anhydrite or its degree of fineness would affect its action as a retarder for portland cement.

†TP 452. Safety Organizations in Arizona Copper Mines, by E. D. Gardner and D. J. Parker. 1929. 49 pp. Outlines safety organizations and gives accident records.

†TP 453. Factors Governing Removal of Soluble Copper from Leached Ores, by John D. Sullivan and Alvin J. Sweet. 1929. 26 pp., 13 figs. The second of a series of reports of experiments conducted by the Bureau of Mines. Covers the second step—the factors governing the removal from the ore of the soluble copper salts produced by reactions in leaching. (See TP 472.)

†TP 454. Permissible Junction Boxes, by L. C. Ilsley and R. A. Kearns. 1929. 19 pp., 5 figs. Presents requirements for approval of junction boxes and describes two boxes already approved.

†TP 455. Analyses of Kansas Coals. 1929. 52 pp., 2 figs. Gives analyses and describes samples.

†TP 456. Classification and Tabling of Difficult Ores, with Particular Attention to Fluorspar, by W. H. Coghill. 1929. 40 pp., 21 figs. Discusses results of tests.

†TP 457. Centrifugal Concentration: Its Theory, Mechanical Development, and Experimental Results, by H. A. Doerner. 1929. 39 pp., 12 figs. Deals with an investigation of centrifugal concentration, especially its application to the treatment of the slime portion of tailings from mills that use gravity-concentration methods.

†TP 458. Accidents at Metallurgical Works in the United States During the Calendar Year 1927, by W. W. Adams. 1929. 37 pp.

†TP 459. Effect of Sized Ore on Blast-Furnace Operation, by S. P. Kinney. 1930. 92 pp., 35 figs. Another of a series of reports of experiments with the blast furnace. Includes data on gas consumption and static and velocity pressures obtained from the in-wall to the center of the furnace on two planes in the shaft of the furnace.

†TP 460. Design and Operation of Gas-Well Siphons, by I. B. Williams, R. R. Brandenthaler, and Morgan Walker. 1929. 45 pp., 12 figs. Concludes that the cheapest and best method for removing water from gas wells is by means of a siphon where applicable. Includes a discussion of the fundamental physical laws involved in the study and operation of the siphon, as well as theoretical deductions which have been derived. Presents a résumé of laboratory and field work.

†TP 461. Salvage of Material in the Oil Industry, by C. P. Bowie. 1929. 32 pp., 25 figs. Describes the methods of salvaging used equipment as practiced by various companies.

†TP 462. Safety at Natural-Gasoline Plants, by G. B. Shea, 1929. 169 pp., 36 figs. The fifth of a series of reports intended to disseminate information on methods that tend to reduce accidents and monetary losses due to accidents and fire in the petroleum industry.

†TP 463. Depth Attainable by Electrical Methods in Applied Geophysics, by A. S. Eve, D. A. Keys, and F. W. Lee. 1929. 58 pp., 58 figs. Includes a description of the megger, discusses theory and methods, and gives examples of successful applications.

†TP 464. Coal-Dust Explosibility Factors Indicated by Experimental Mine Investigations, 1911 to 1929, by G. S. Rice and H. P. Greenwald. 1929. 45 pp., 4 figs. Classifies and summarizes the knowledge gained from more than a thousand experiments, the details of which have been given in previous reports. Stresses the need of efficient generalized rock dusting to prevent coal-dust explosion disasters.

†TP 465. Analyses of Maryland Coals. 1930. 89 pp. Gives analyses and describes samples.

†TP 466. Effect of Manganese on Distribution of Carbon in Steel, by B. M. Larsen. 1929. 31 pp., 26 figs. Discusses results of a study of the characteristics of low-carbon manganese steels and of the effect of manganese on abnormality in case-carburizing steels.

†TP 467. Production of Explosives in the United States During the Calendar Year 1928, by W. W. Adams and L. S. Gerry. 1930. 51 pp.

†TP 468. Coke-Oven Accidents in the United States During the Calendar Year 1928, by W. W. Adams and L. Chenoweth. 1930. 37 pp.

†TP 469. The Wire Saw in Slate Quarrying, by Oliver Bowles. 1930. 31 pp., 16 figs. Describes equipment. Discusses factors affecting special conditions that prevail at different quarries.

†TP 470. Results of Air Repressuring and Engineering Study of Williams Pool, Putnam-Moran District, Callahan County, Tex., by H. B. Hill. 1930. 69 pp., 28 figs. Records past history of the field; outlines the interpreted surface conditions; presents data, tables, curves, and diagrams showing steps involved in the application of air to the wells in the Williams pool; and gives the results obtained.

†TP 471. How Leakage of Current from an Electric Shot-Firing Circuit Causes Misfires, by L. C. Ilsley, A. B. Hooker, and D. H. Zellers. 1930. 16 pp., 12 figs. Gives results of tests.

†TP 472. Acceleration of Extraction of Soluble Copper from Leached Ores, by Morris Guggenheim and J. D. Sullivan. 1930. 30 pp., 10 figs. Continues the series on factors involved in the leaching of ores. (See TP 453.)

†TP 473. Chemistry of Leaching Chalcocite, by J. D. Sullivan. 1930. 24 pp., 5 figs. Presents experimental data on the dissolution of chalcocite in various common solvents.

†TP 474. Accidents at Metallurgical Works in the United States During the Calendar Year 1928, by W. W. Adams. 1930. 34 pp.

†TP 475. Ignition of Natural Gas-Air Mixtures by Heated Surfaces, by P. G. Guest. 1930. 59 pp., 38 figs. Deals with an investigation undertaken with a view to throwing more light on the subject of establishing facts experimentally that might assist in answering questions concerning the possible causes of gas explosions in mines.

†Ont of print.

†TP 476. Stock Distribution and Gas-Solid Contact in the Blast Furnace, by C. C. Furnas and T. L. Joseph. 1931. 73 pp., 47 figs. Correlates laboratory and such operating data as are available and presents the results of tests made on small models to study the effect of changes in charging upon size distribution at the stock line. Presents data on some phases of flue-dust production. Outlines some ideas regarding the most effective means of making favorable changes in size composition of burden by means of crushing and sintering.

†TP 477. A Study of the Lubricant Fractions of Cabin Creek (W. Va.) Petroleum, by H. M. Smith, with chapters on the Action of Solvents on the Heavy Constituents of Petroleum, by F. W. Lane, I. H. Nelson, J. M. Devine, and H. M. Smith. 1931. 48 pp., 25 figs. Presents a detailed study, by solvent extraction and fractional distillation, of lubricating oil prepared from Cabin Creek crude. Discusses other applications of the solvent-extraction method.

†TP 478. Production of Explosives in the United States During the Calendar Year 1929, by W. W. Adams and L. S. Gerry. 1931. 51 pp., 2 figs.

†TP 479. A Study of the Production of Activated Carbon from Various Coals and Other Raw Materials, by A. C. Fieldner, R. E. Hall, and A. E. Galloway. 1931. 30 pp., 11 figs. Discusses methods for producing activated carbon, the relative values of cheap raw materials for the purpose, and the properties of the activated carbons so produced.

†TP 480. Intensities of Odors and Irritating Effects of Warning Agents for Inflammable and Poisonous Gases, by S. H. Katz and E. J. Talbert. 1931. 37 pp., 13 figs. Describes one phase of an investigation of warning agents for fuel gas.

†TP 481. Re-Treatment of Mother Lode (California) Carbonaceous Slime Tailings, by E. S. Leaver and J. A. Woolf. 1931. 20 pp. Discusses process for ore treatment and tabulates results of tests.

†TP 482. Toxic Gases from 60 Percent Gelatin Explosives, by G. St. J. Perrott, L. W. Babcock, C. D. Bitting, and G. W. Jones. 1931. 30 pp, 13 figs. Describes tests and tabulates results.

†TP 483. Re-Forming Natural Gas, by W. W. Odell. 1931. 54 pp., 16 figs. Discusses the study of re-forming hydrocarbon gases, including refinery gas, with relation to the production of gas suitable for city distribution. Also considers the possible recovery of a byproduct carbon.

†TP 484. Analyses of Wyoming Coals. 1931. 159 pp., 2 figs. Gives analyses and describes samples.

†TP 485. Timbering Regulations in Certain Coal Mines of Pennsylvania, West Virginia, and Ohio, by J. W. Paul, J. G. Calverley, and D. L. Sibray. 1931. 41 pp., 19 figs. Gives the rules and regulations in force in a selected number of mines in western Pennsylvania, eastern Ohio, and northern West Virginia operating in the Pittsburgh coal bed and sketches illustrating the manner of placing roof support in the different mining operations, such as entry and room-and-pillar work.

†TP 486. Chemistry of Leaching Bornite, by J. D. Sullivan. 1931. 20 pp., 7 figs. Is one of a series of reports on various fundamental factors involved in the leaching of copper ores. Presents experimental data on the dissolution of bornite in various common solvents.

†TP 487. Chemistry of Leaching Covellite, by J. D. Sullivan. 1930. 18 pp., 7 figs. Fifth of a series of papers on the chemistry of leaching copper ores. Describes procedure and results of experimental work on the effect of particle size on rate of dissolution; the effect of the concentration of ferric iron in the leaching solution; the effect of the concentration of sulfuric acid in the leaching solution; the effect of temperature; the rate of dissolution of covellite in ferric chloride solutions; the rate of dissolution of covellite in sulfuric acid; and the mechanism of dissolution of covellite in ferric sulfate solutions.

†TP 488. Resistivity Measurements of Oil-Bearing Beds, by F. W. Lee and J. H. Swartz. 1931. 12 pp., 11 figs. Discusses results of an experiment to test the theory that oil-impregnated sands offer a very much greater resistance than salt water-impregnated sands. May serve as an experimental guide to parties interested in locating oil at shallow depths.

†TP 489. Coal-Mine Safety Organizations in Alabama, by R. D. Currie. 1931. 48 pp., 12 figs. States that effective safety organizations have been responsible for reducing accidents in many Alabama mines. Points out the methods by which good results were made possible.

†TP 490. Separation and Size Distribution of Microscopic Particles—An Air Analyzer for Fine Powders, by P. S. Roller. 1931. 46 pp., 31 figs. The present investigation was undertaken in connection with problems concerning dependence of the physical and chemical reactivity of certain substances, notably anhydrite, on the particle size.

†TP 491. Analyses of Washington Coals. 1931. 203 pp., 1 fig. Gives analyses and describes samples. (See also TP 512 and 618.)

†TP 492. Deoxidation of Steel with Silicon, by O. H. Herty, Jr., G. R. Fitterer, and C. F. Christopher. 1931. 42 pp., 17 figs. Discusses the more important results of cooperative laboratory and plant tests to determine the effects on the quality of steel deoxidized with silicon.

†TP 493. Bibliography of United States Bureau of Mines Investigations on Coal and Its Products, 1910–30, by A. C. Fieldner and M. V. von Bernewitz. 1931. 56 pp. Revised as TP 576.

†TP 494. Copper and Zinc in Cyanidation Sulfide-Acid Precipitation, by E. S. Leaver and J. A. Woolf. 1931. 63 pp., 8 figs. Explains what happens during cyanidation of ores for the recovery of precious metals containing various forms of copper and zinc. Gives a proposed process that fills the need for a commercial method of recovering precious metals associated with minor copper values and is applicable to ores that are under smelting grade or ores in which the copper will not pay for a separate treatment for its recovery.

†TP 495. Coke-Oven Accidents in the United States During the Calendar Year 1929, by W. W. Adams and L. Chenoweth. 1931. 35 pp.

†TP 496. Accuracy of Manometry of Explosions: Comparative Performance of Some Diaphragm-Type Explosion Manometers When Using Hydrogen-Air Mixtures, by C. M. Bouton, H. K. Griffin, and P. L. Golden. 1931. 52 pp., 48 figs. Describes a continuation of a similar cooperative investigation by the Safety in Mines Research Board of Great Britain and the United States Bureau of Mines.

†TP 497. Electromagnetic Absorption by Rocks, with Some Experimental Observations Taken at the Mammoth Cave of Kentucky, by J. W. Joyce. 1931. 28 pp., 19 figs. Discusses the question of the penetration of electromagnetic fields or waves into the ground. Concludes that the fact that such waves actually penetrate rock has been definitely established. The results of this investigation show that a frequency of 500 cycles per second is well suited for electromagnetic prospecting. Absorption, although present, does not materially limit the applicability of this method.

†TP 498. II. Factors Governing the Entry of Solutions Into Ores During Leaching, by J. D. Sullivan and E. O. Ostrea. 1931. 23 pp., 3 figs. Continues the series on factors involved in the leaching of ores conducted by the Bureau of Mines. Considers measurements of

†Out of print.

the rate and distance of penetration of solutions into capillary and small-bore glass tubes filled with gases of different solubilities, measurements of the rate and volume of penetration of solutions into the voids within particles of ore as affected by (*a*) solubility of the gas within the voids, (*b*) size of the particles of ore, and (*c*) use of different penetrating solutions, and measurements of the rise of solutions in glass tubes filled with crushed ores. (See TP 441.)

†TP 499. Treating a Complex Ore: Data from Experimental Work on Ores in the Denver Laboratories of the Complex Ores Recovery Co., by G. L. Oldright. 1931. 101 pp., 1 fig. An account of the more salient features brought out in developing a process for the treatment of the ore of the Flin Flon mine in northern Manitoba. Describes experiments on the crude ore and the tests on the zinc and copper concentrates that were made after the work on the crude ore was abandoned.

†TP 500. Relationship Between Volatility and Consumption of Lubricating Oils in Internal-Combustion Engines, by Gustav Wade and A. L. Foster. 1931. 52 pp., 7 figs. Tabulates results of tests.

†TP 501. Results of Electrical Resistivity and Electrical-Induction Measurements at Abana Mine, Quebec, Canada, by E. V. Potter, with Explanation of Some Factors Associated with Induction Method, by F. W. Lee. 1931. 28 pp., 22 figs. The two methods described are based on widely different principles. The resistivity method is necessarily slow, but very detailed results are obtainable from its correct use. The alternating-current method is good for rapid work, but does not reveal the details, such as depth, slope, etc., nearly so well. Suggests combination of two such methods in making a survey over new country, the alternating-current method being used for a preliminary survey and the resistivity method for a detailed survey in interesting points.

†TP 502. How to Compute Tables for Determining Electrical Resistivity of Underlying Beds and Their Application to Geophysical Problems, by Irwin Roman. 1931. 44 pp., 2 figs. A detailed discussion of the derivation and results, together with numerical tables, in the case of a single infinite plane separated from two adjacent mediums by parallel planes.

†TP 503. Accidents at Metallurgical Works in the United States During the Calendar Year 1929, by W. W. Adams. 1931. 34 pp.

†TP 504. Engineering Report of Cotton Valley Field, Webster Parish, La., by J. S. Ross. 1931. 69 pp., 23 figs. Discusses history and development; geology of oil field, including stratigraphy and structure; producing horizons—the Blossom sand, Anhydrite gas horizon, Tilman and Bodcaw sand lenses, and miscellaneous sands of Davis horizon; water conditions, including discussion of main water sands, water encroachment in productive sands, and character of waters; production of oil, natural gas, and natural gasoline; development methods; and production practices in Blossom and Trinity horizons.

†TP 505. Influence of Fractionation on Distribution of Sulfur in Gasoline, by R. H. Espach and H. P. Rue. 1931. 24 pp., 11 figs. Describes results of an investigation to determine the effect good fractionation would have on the manufacture of gasoline from crude oil containing sulfur.

†TP 506. Microscopic Study of Elkhorn Coal Bed at Jenkins, Letcher County, Ky., by Reinhardt Thiessen, G. C. Sprunk, and H. J. O'Donnell. 1931. 30 pp., 20 figs. Describes investigation and summarizes results.

†TP 507. Explosions in Washington Coal Mines, by S. H. Ash. 1931. 52 pp. Presents data on conditions that bear directly on the prevention of explosions and discusses mining conditions and practices that relate to ventilation, gas, and dust at Washington mines.

†TP 508. Coke-Oven Accidents in the United States During the Calendar Year 1930, by W. W. Adams and L. Chenoweth. 1932. 33 pp.

†TP 509. Production of Explosives in the United States During the Calendar Year 1930, by W. W. Adams and L. S. Gerry. 1931. 51 pp.

†TP 510. Results of Some Magnetic Measurements on Dikes, with Experiments Upon Geophysical Differentiation of Nickel-Ore Deposits in the Sudbury District, Ontario, Canada, by F. W. Lee. 1932. 18 pp., 20 figs. Directs attention primarily to distinguishing a nickel ore body or vein from other magnetic material existing in the same locality and gives some magnetic observations on dikes. This paper may be considered a continuation of IC 6235.

†TP 511. Carbonizing Properties of Davis Bed Coal from Garrett County, Md., and of Mixtures with Pittsburgh Bed Coal, by A. C. Fieldner, J. D. Davis, E. B. Kester, W. A. Selvig, D. A. Reynolds, and F. W. Jung. 1932. 39 pp., 33 figs. The third of a series covering a survey of the gas-, coke-, and byproduct-making properties of American coals which is being conducted by the Bureau in cooperation with the American Gas Association. Discusses effect of blending various percentages of low-volatile coal with high-volatile coal.

†TP 512. Friability, Slacking Characteristics, Low-Temperature Carbonization Assay, and Agglutinating Value of Washington and Other Coals, by H. F. Yancey, K. A. Johnson, and W. A. Selvig. 1932. 94 pp., 38 figs. A companion report to TP 491. Presents the results of special studies made to meet the demand of producers, consumers, and various organizations for information bearing upon the physical as well as other properties of coals that has not been provided in reports published by the Bureau heretofore.

†TP 513. Studies on Determination of Sulfur in Gasoline, by R. H. Espach and O. C. Blade. 1932. 22 pp., 2 figs. Presents a study of a lamp-method test for determining amount of sulfur, by weight, contained in motor fuels. Several lamp-method tests are discussed. Results of sulfur determinations are also discussed.

†TP 514. Accident Experience and Cost of Accidents at Washington Metal Mines and Quarries, by S. H. Ash. 1932. 35 pp. Includes operating statistics, industrial insurance law, accident-prevention regulations, and cost of medical aid.

†TP 515. Safety Organization at Lake Superior Iron Mines, by F. S. Crawford. 1932. 32 pp. Gives information on forms of organizations and the work done by safety committees of iron-mining companies in the Lake Superior region.

†TP 516. Natural Ventilation of Michigan Copper Mines, by G. E. McElroy. 1932. 40 pp., 5 figs. Discusses methods and practices for Michigan copper mines as obtained by brief personal surveys in July 1928 and July and August 1930, supplemented by information furnished by the mine managements.

†TP 517. Transportation of Gasoline by Pipe Line, by C. P. Bowie. 1932. 24 pp., 10 figs. Treats of the design and construction of a pipe-line system. Compares cost of transportation by pipe lines with cost of barging and trucking.

†TP 518. Construction of Master Mechanical Oscillator for Testing Seismic Recorders and Other Allied Apparatus, by F. W. Lee and G. A. Irland. 1932. 17 pp., 15 figs. Gives specifications and discusses principle of operation, optical measuring system, measurement of constants, and elementary mathematical relations controlling vibration of table.

†TP 519. Carbonizing Properties and Constitution of Washed and Unwashed Coal from Mary Lee Bed, Flat Top, Jefferson County, Ala., by A. C. Fieldner,

†Out of print.

J. D. Davis, R. Thiessen, E. B. Kester, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1932. 78 pp., 60 figs. The fourth of a series of papers covering a survey of the gas-, coke-, and byproduct-making properties of American coals being conducted by the bureau in cooperation with the American Gas Association. Shows the effect of washing upon the yield and quality of carbonization products of washed and unwashed coal from the Mary Lee bed at Flat Top, Ala.

†TP 520. Falls of Roof and Coal in Mines Operating in the Sewickley Coal Bed in Monongalia County, W. Va., by J. W. Paul and J. N. Geyer. 1932. 31 pp., 17 figs. The second of a series of three papers devoted to mines at the Fairmont mining district of West Virginia. Gives the results of studies conducted in coal mines to ascertain the nature of the safety measures used to prevent injury to the workmen from falls of roof and coal. (See also TP 522 and RI 3110.)

†TP 521. Oil Prospecting in Kentucky by Resistivity Methods, by J. H. Swartz. 1932. 23 pp., 16 figs. Summarizes results of a study of resistivity measurements as applied to petroleum prospecting.

†TP 522. Falls of Roof and Coal in Mines Operating in the Pittsburgh Coal Bed in Marion and Monongalia Counties, W. Va., by J. W. Paul and J. N. Geyer. 1932. 43 pp., 24 figs. The last of three papers covering mines in the Fairmont mining district of West Virginia. Relates to six coal mines in Marion County and three mines in Monongalia County. Summarizes the individual reports of the operators. (See also TP 520 and RI 3110.)

†TP 523. A Study of High-Manganese Slags in Relation to the Treatment of Low-Grade Manganiferous Ores, by C. H. Herty, Jr., J. E. Conley, and M. B. Royer. 1932. 36 pp., 14 figs. Presents results of investigation for purpose of obtaining a fluid slag conforming to the requirements of a ferrograde ore.

†TP 524. Carbonizing Properties and Constitution of No. 6 Bed Coal from West Frankfort, Franklin County, Ill., by A. C. Fieldner, J. D. Davis, R. Thiessen, E. B. Kester, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1932. 60 pp., 35 figs. Gives results of carbonizing Orient coal at both low and high temperatures and compares the results with those obtained on the same coal in gas retorts and coke ovens.

†TP 525. Carbonizing Properties and Constitution of Pittsburgh Bed Coal from Edenborn Mine, Fayette County, Pa., by A. C. Fieldner, J. D. Davis, R. Thiessen, E. B. Kester, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1932. 60 pp., 39 figs. Describes investigation that was made primarily because this coal is being carbonized unmixed with low-volatile coal in byproduct ovens in the vicinity of Pittsburgh, and the results from these ovens were available for comparison with the Bureau test results.

†TP 526. Coke-Oven Accidents in the United States during the Calendar Year 1931, by W. W. Adams and L. Chenoweth. 1932. 15 pp.

†TP 527. Compressibility and Bearing Strength of Coal in Place: Tests of Lateral Compression of Pittsburgh Coal Bed, by H. P. Greenwald, S. Avins, and G. S. Rice. 1933. 12 pp., 8 figs. Gives results of investigation of compressibility and bearing strength of pillars needed to support important surface structures and of adequacy of barrier pillars and dams to resist water pressure from abandoned adjacent workings.

†TP 528. A Magnetic Study of Some Iron Deposits, by E. F. Stratton and J. W. Joyce. 1932. 32 pp., 20 figs. Describes the operation of the magnetometer and gives possible interpretations of anomalies determined by its use which would have practical value to the geologist and mining engineer; presents as examples the results of magnetic studies in certain important iron districts east of the Mississippi River.

†TP 529. Analyses of Montana Coals. 1932. 129 pp., 2 figs. Outlines coal fields; presents data on production, markets, and transportation; analyzes coal samples and delivered coals; and describes samples.

†TP 530. Accidents at Metallurgical Works in the United States During the Calendar Year 1930, by W. W. Adams. 1932. 36 pp.

†TP 531. Carbonizing Properties and Constitution of Black Creek Bed Coal from the Empire Mine, Walker County, Ala., by A. C. Fieldner, J. D. Davis, R. Thiessen, E. B. Kester, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1932. 44 pp., 27 figs. One of a series covering survey of gas-, coke-, and byproduct-making properties of American coals being conducted by the Bureau in cooperation with American Gas Association. Describes carbonization tests and states yield and quality of carbonization products in detail. Chemical and physical properties of the coal are ascertained in results of chemical analyses and tests. Results of petrographic examination of column sample of the coal are also described and illustrated.

†TP 532. Accidents at Metallurgical Works in the United States During the Calendar Year 1931, by W. W. Adams. 1933. 14 pp.

†TP 533. Statistical Microscopic Examination of Mill Products of the Copper Queen Concentrator of the Phelps Dodge Corporation, Bisbee, Ariz., by R. E. Head, A. L. Crawford, F. E. Thackwell, and Glen Burgener. 1932. 48 pp., 7 figs. A summary of results is followed by tabulated data, with a description and brief discussion preceding each table. Graphs and photomicrographs assist in visualizing conditions described in text. A more expanded discussion of various phases of the problem is assembled in appendix form under miscellaneous headings. Notes on methods of examination and information of interest and possible significance obtained during study are considered. (See also RI 3236, 3288, and 3290.)

†TP 534. Falls of Roof and Coal in Mines Operating in Pittsburgh Coal Bed, Panhandle District, W. Va., by J. W. Paul and J. N. Geyer. 1932. 34 pp., 17 figs. Summarizes results of studies in six coal mines opened in Pittsburgh coal bed in Brooke, Ohio, and Marshall Counties.

†TP 535. Crater Wells, Richland Gas Field, Louisiana, by H. B. Hill. 1932. 37 pp., 28 figs. Presents history of craters in Richland gas field; discusses equipment and methods of control. Photographs show surface conditions at various intervals in the life of the craters. Subsurface conditions are interpreted by graphic logs and cross sections.

†TP 536. Pneumatic Tabling of Coal; Effect of Specific Gravity, Size, and Shape, by H. F. Yancey and C. B. Porter. 1932. 18 pp., 3 figs. Discusses investigation of fundamental principles involved in pneumatic cleaning of coal with object of assisting coal producing and consuming public to profit by advantages and economies inherent in use of clean, efficiently prepared coal.

†TP 537. Maintenance of Electrical Mine Equipment from the Viewpoint of the Safety Inspector, by E. J. Gleim and H. B. Freeman. 1932. 22 pp. Includes inspection questionnaire, outlines inspection procedure, and discusses safety aspect of more common defects in permissible mine equipment and their relation to maintenance. Examples of practices adopted by operators to promote safety by combating neglect and carelessness in maintenance of equipment are also noted.

†Out of print.

†TP 538. A Survey of the High-Sulfur Crude Oils (Black Oils) Produced in Wyoming, by H. M. Thorne and Walter Murphy, 1932. 56 pp., 3 figs. This preliminary survey includes a brief history of black-oil fields in Wyoming, together with potential and actual production of each field; a Bureau of Mines Hempel analysis of each crude; and a discussion of different products that may be obtained from these crudes, as indicated by analyses.

†TP 539. Deviation of Natural Gas from Boyle's Law, by T. W. Johnson and W. B. Berwald. 1932. 29 pp., 7 figs. Presents part of findings based upon cooperative work of Bureau of Mines and American Gas Association. Previous authoritative reference in literature to deviation of natural gas from Boyle's law was confined largely to Technical Papers 131 and 158, but the data presented were for relatively low pressures. In the present work the pressures are of range found in high-pressure natural-gas transmission lines and in underground reservoirs.

†TP 540. Production of Explosives in the United States During the Calendar Year 1931, by W. W. Adams and L. S. Gerry. 1932. 42 pp.

†TP 541. A Study of Mine Roof of the Pittsburgh Coal Bed in the Pittsburgh Mining District, by J. W. Paul and L. N. Plein. 1932. 97 pp., 33 figs. Discusses study made by Bureau of Mines to determine to what extent system of mining, method of roof support, and regulations and practices respecting timbering influence falls of roof and coal which injure or kill miners, and calls attention to preventive measures. (See also TP 550 and RI 3113.)

†TP 542. Carbonizing Properties and Constitution of Chilton Bed Coal from Boone No. 2 Mine, Logan County, W. Va., by A. C. Fieldner, J. D. Davis, R. Thiessen, E. B. Kester, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1932. 60 pp., 34 figs. Another of series covering survey of gas-, coke-, and byproduct-making properties of American coals being conducted by the Bureau in cooperation with American Gas Association.

†TP 543. Comparison of Small- and Large-Scale Experimental Carbonizing Apparatus; Tests of Pittsburgh Bed Coal from Allison Mine, Fayette County, Pa., and of a Coal from the Michel Mine, British Columbia, by A. C. Fieldner, J. D. Davis, E. B. Kester, W. A. Selvig, D. A. Reynolds, and F. W. Jung. 1932. 34 pp., 23 figs. Gives description and properties of coals and tabulates results of carbonizing tests.

†TP 544. Explosive Properties of Acetone-Air Mixtures, by G. W. Jones, E. S. Harris, and W. E. Miller. 1933. 26 pp., 11 figs. Describes one phase of an investigation conducted to determine the limits of flammability of acetone-air mixtures at laboratory and elevated temperatures, effect of water vapor on the lower flammable limit, pressures developed when flammable mixtures of acetone in air are ignited at laboratory and elevated temperatures, and speed of flame propagation of acetone-air mixtures.

†TP 545. Silicosis and Tuberculosis Among Miners of Tri-State District of Oklahoma, Kansas, and Missouri–I, for the Year Ended June 30, 1928, by R. R. Sayers, F. W. Meriwether, A. J. Lanza, and W. W. Adams. 1933. 30 pp., 12 figs. First of a proposed series dealing with data obtained by physical examination of men employed in lead and zinc mines of Picher mining district of Oklahoma and Kansas; describes technique of X-ray photography and explains specimens given to illustrate stages of disease. 5 cents.

†TP 546. Theory of Torsion Balance, with Preliminary Study of Modification of Instrument to Decrease Time of Gravity Measurements, by J. W. Joyce. 1933. 46 pp., 21 figs. Presents theoretical discussion of principles and properties of gravity field and interrelation of physical quantities involved in torsion-balance equation; considers some practical features of torsion balance; and describes an investigation of problem of reducing free period of balance system.

†TP 547. Falls of Roof in Mines Operating in Pittsburgh Coal Bed, West Virginia, by J. W. Paul and J. N. Geyer. 1933. 23 pp., 10 figs. Summarizes studies in 20 mines in Pittsburgh coal bed in Fairmont and Panhandle districts, W. Va. Discusses methods and practices which afford workmen greatest protection against falls of roof and sides, with particular reference to application in other mines.

†TP 548. Carbonizing Properties and Constitution of No. 2 Gas Bed Coal from Point Lick No. 4 Mine, Kanawha County, W. Va., by A. C. Fieldner, J. D. Davis, R. Thiessen, E. B. Kester, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1933. 52 pp., 31 figs. One of series covering survey of gas-, coke-, and byproduct-making properties of American coals being conducted by Bureau in cooperation with American Gas Association.

†TP 549. Unwatering Flooded Coal Mines in Washington, by S. H. Ash and Thomas Murphy. 1933. 18 pp., 7 figs. Discusses specific instances of successful unwatering by operators. Describes pump installations, including types, rooms, capacity, power required, electrical systems, and fire protection. A few drainage costs are given.

†TP 550. A Study of Roof in Pennsylvania Mines Contiguous to Monongahela River, by J. W. Paul and J. G. Calverley. 1933. 31 pp., 16 figs. Third paper on groups of representative mines in Pittsburgh coal bed in western Pennsylvania. Covers study at seven mines adjacent to Monongahela River, lists commendable features, and recommends safety measures respecting care of roof. (See also TP 541 and RI 3113.)

†TP 551. Safety at Petroleum Cracking Plants, by R. L. Marek. 1933. 92 pp., 26 figs. Reviews principles underlying good design of cracking equipment and outlines fundamental factors that influence design of safe cracking equipment; safe operation of cracking plants, and methods of inspection and maintenance refiners are using to assure safety of their workmen and plants. Data were obtained from study of conditions at cracking plants and have been augmented by search of related literature.

†TP 552. Silicosis and Tuberculosis Among Miners of the Tri-State District of Oklahoma, Kansas, and Missouri–II, for Year Ended June 29, 1929, by F. V. Meriwether, R. R. Sayers, and A. J. Lanza. 1933. 28 pp. Second of proposed series dealing with data obtained from physical examinations of men employed in lead and zinc mines of Picher field, in Oklahoma and Kansas, of Tri-State district. Deals with relation of certain infectious diseases to silicosis, production rate of silicosis, and progress in controlling silicosis and tuberculosis in Picher district.

†TP 553. Protection of Equipment Containing Explosive Acetone-Air Mixtures by the Use of Diaphragms, by G. W. Jones, E. S. Harris, and B. B. Beattie. 1933. 24 pp., 19 figs. Describes one phase of investigation conducted to determine explosive characteristics of acetone-air mixtures formed by use of acetone in cellulose acetate wire-coating machines. Deals with protection of equipment from effects of explosions by use of definitely rupturable diaphragms.

†TP 554. Solubility and Liberation of Gas from Natural Oil-Gas Solutions, by Ben E. Lindsly. 1933. 65 pp., 16 figs. Gives specific data on gas solubility in three different types of fields—Oklahoma City, Kettleman Hills, and Ventura Avenue, California—and lays groundwork for further study of this important subject in many producing areas by engineers in industry. Better oil and gas laws and regulations pertaining to conservation can be formulated on basis

†Out of print.

of this increased knowledge regarding gas which comes out of oil when pressure is reduced.

†TP 555. Viscosity of Natural Gas, by W. B. Berwald and T. W. Johnson. 1933. 34 pp., 9 figs. Discusses briefly viscosity of fluids; shows from data of previous experimenters that same general laws of fluid motion apply to analysis of flow of either liquids or gases; discusses method developed from these general laws of fluid motion for measuring viscosity of natural gases accurate and practical enough for use in natural-gas engineering. Gives application of viscosity data to analysis of some gas-engineering problems in addition to experimental results obtained, results of study of published data pertaining to viscosity of pure gases and gas mixtures, and effect of temperature and pressure on gas viscosities.

†TP 556. A Study of Some Seismometers, by G. A. Irland. 1934. 48 pp., 25 figs. Presents results of an experimental investigation of seismometers developed by the Bureau of Mines; these are especially adapted to measure vibrations caused by blasting or similar disturbances. The work presents an effort to develop a simple, lightweight, portable instrument that will measure these vibrations accurately. Explains the design of certain horizontal and vertical recorders and describes tests of the vertical recorder on a mechanical oscillator, the motion of which is accurately known, so as to show the reliability and accuracy of the instrument.

†TP 557. Accidents at Metallurgical Works in the United States During the Calendar Year 1932, by W. W. Adams. 1933. 15 pp.

†TP 558. Production of Explosives in the United States During the Calendar Year 1932, by W. W. Adams and L. S. Gerry. 1933. 26 pp.

†TP 559. Coke-Oven Accidents in the United States During the Calendar Year 1932, by W. W. Adams and L. Chenoweth. 1933. 15 pp.

†TP 560. Corrosion of Steel by Gases Containing Traces of Hydrogen Sulfide; Effect of Pressure and Moisture Conditions, by John M. Devine, C. J. Wilhelm, and Ludwig Schmidt. 1933. 20 pp., 4 figs. Gives first authentic information on a type of corrosion which, if not controlled, may necessitate large expenditures for replacement of pipe and equipment. Range of usefulness of data presented in this paper extends to entire natural-gas industry and to others who may transport gases containing traces of hydrogen sulfide.

†TP 561. Mechanical Equipment Used in the Drilling and Production of Oil and Gas Wells in the Oklahoma City Field, by Gustav Wade. 1935. 89 pp., 32 figs. Deals with drilling equipment and practices. Describes surface equipment used at wells and on leases for production operations and maintenance of the wells. Gives data that pertain to items required on the wells and their costs, from the time the location is staked until the well reaches the pumping stage. Includes a short description of the lay-out of the system for disposing of salt water produced with the oil in this field. Illustrations supplement the description of new or unusual equipment.

†TP 562. Carbonizing Properties and Constitution of Alma Bed Coal from Spruce River No. 4 Mine, Boone County, W. Va., by A. C. Fieldner, J. D. Davis, R. Thiessen, E. B. Kester, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1935. 41 pp., 25 figs. The eleventh of a series of papers covering survey of gas-, coke-, and byproduct-making properties of American coals being conducted by the Bureau in cooperation with American Gas Association. Gives the yield and quality of products obtained at carbonizing temperatures of 500° to 1,100° C. and the results of chemical, physical, and petrographic studies of the coal. This high-volatile gas coal is the sixteenth in the series being tested.

†TP 563. A Study of Mine Roof in the Coking District of Western Pennsylvania, by J. W. Paul and L. N. Plein. 1935. 34 pp., 23 figs. Gives data on 12 mines. Shows the number of persons killed and injured by causes. Cites commendable features which have been introduced in the interest of prevention of injury from falls of roof. Lists 30 items suggested to protect further against injury from falls of roof and coal.

†TP 564. Microscopic and Petrographic Studies of Certain American Coals, by Reinhardt Thiessen and G. C. Sprunk. 1935. 71 pp. The object of the work described is to solve the complexity of coal and add to the knowledge of the nature of its constituents. It concerns the petrography and microscopy of six coals studied in connection with the Bureau's work on the carbonizing properties and constitution of American coals. These coals are from Green River bed, Green River mine, Muhlenberg County, Ky.; Upper Freeport bed, Wildwood mine, Allegheny County, Pa.; Pittsburgh bed, Consolidation No. 68 mine, Marion County, W. Va.; Pratt bed, Wylam No. 8 mine, Jefferson County, Ala.; Sewell bed, Summerlee mine, Fayette County, W. Va.; and Sewell bed, Cranberry mine, Raleigh County, W. Va.

†TP 565. Reduction of Evaporation Losses from Gasoline Bulk-Storage Stations, by Ludwig Schmidt and C. J. Wilhelm. 1935. 35 pp., 19 figs. Gives the results of evaporation tests of several typical bulk stations to determine the evaporation losses under different operating conditions and with equipment of different degrees of tightness and general upkeep, and deals primarily with the reduction of evaporation losses of gasoline from bulk storage stations equipped with tanks having a capacity of 10,000 to 12,000 gallons.

†TP 566. Flame-Arresting Limitations of Flat Joints and Plain Bearings in Explosion-Proof Mine Equipment, by E. J. Gleim and R. S. James. 1935. 26 pp., 6 figs. Presents data obtained in the Bureau's study of the limits of flange and bearing protection; also gives data by which to compare the protection required in natural-gas atmospheres with that required in gasoline-vapor atmospheres.

†TP 567. Preventing Accidents by the Proper Use of Permissible Explosives, by D. Harrington and S. P. Howell. 1936. 43 pp., 15 figs. Gives in detail present status of use of permissible explosives compared with previous years and with nonpermissible explosives for anthracite, bituminous, and all coal mines.

†TP 568. Hazard of Igniting Coal by Electric Circuits in Mines, by H. B. Freeman. 1936. 31 pp., 4 figs. Presents the result of the Bureau's study to determine the ease of igniting coal as a measure of the hazard of mine fires caused by electric circuits and equipment.

†TP 569. Analyses of New Mexico Coals. 1936. 112 pp., 1 fig. The nineteenth of a series on coal analyses. Gives analytical data showing the composition and quality of the coals of the State, description of the geologic structure of the coal basins, typical mining conditions in the different districts, and principal economic data of the industry. Presents salient facts regarding the occurrence, reserves, quality, characteristics, production, and uses of the coals of the State.

†TP 570. Carbonizing Properties and Petrographic Composition of Clintwood Bed Coal from Buchanan Mines Nos. 1 and 2, Buchanan County, Va., by A. C. Fieldner, J. D. Davis, R. Thiessen, W. A. Selvig, D. A. Reynolds, F. W. Jung, and G. C. Sprunk. 1936. 34 pp., 19 figs. The twelfth of a series of papers covering survey of gas-, coke-, and byproduct-making properties of American coals being conducted by

†Out of print.

the Bureau in cooperation with American Gas Association. Gives the yield and quality of products obtained at carbonizing temperatures of 500°, 600°, and 700° C., using a retort 13 inches in diameter, and at 800°, 900°, and 1,000° C., using a retort 18 inches in diameter. It also gives results of chemical, physical, and petrographic studies of the coal.

†TP 571. Carbonizing Properties and Petrographic Composition of Pittsburgh Bed Coal from Pittsburgh Terminal No. 9 Mine, Washington County, Pa., by A. C. Fieldner, J. D. Davis, R. Thiessen, W. A. Selvig, D. A. Reynolds, G. C. Sprunk, and F. W. Jung. 1936. 33 pp., 21 figs. Gives the yield and quality of products obtained at carbonizing temperatures of 500°, 600°, and 700° C., using charges of 85 pounds, and at 800°, 900°, and 1,000° C., using charges of 185 pounds. It also gives results of chemical, physical, and petrographic studies of the coal.

†TP 572. Carbonizing Properties and Petrographic Composition of Millers Creek Bed Coal from Consolidation No. 155 Mine, Johnson County, Ky., and the Effect of Blending Millers Creek Coal with Pocahontas Bed and Pittsburgh Bed (Warden mine) Coals, by A. C. Fieldner, J. D. Davis, R. Thiessen, W. A. Selvig, D. A. Reynolds, G. C. Sprunk, and C. R. Holmes. 1937. 50 pp., 27 figs. The fourteenth of a series of papers covering survey of gas-, coke-, and byproduct-making properties of American coals being conducted by the Bureau in cooperation with American Gas Association. Gives the results of chemical, physical, and microscopic examination and the yield and quality of gas, coke, and byproducts obtained on carbonizing, by the BM–AGA method, high-volatile A coal (60.1 percent dry, mineral-matter-free fixed carbon and 14,380 moist, mineral-matter-free B. t. u.) from the Millers Creek bed, Consolidation No. 155 mine, in Johnson County, Ky., and blends of this coal with Pocahontas No. 4 and Pittsburgh bed coals.

†TP 573. Origin and Petrographic Composition of the Lower Sunnyside Coal of Utah, by Reinhardt Thiessen and G. C. Sprunk. 1937. 34 pp., 20 figs. The coals thus far studied in the Bureau of Mines survey of American coals are found in the deposits of Upper Paleozic times. Lower Sunnyside coal is from the Upper Cretaceous. It is geologically separated from the former by a long time interval. This paper discusses geology, macroscopic appearance, and microscopic appearance.

†TP 574. Analyses of Colorado Coals, by R. D. George, E. H. Denny, W. H. Young, N. H. Snyder, A. C. Fieldner, H. M. Cooper, and R. F. Abernethy. 1937. 327 pp., 2 figs. The twentieth of a series on coal analyses. Gives analytical data showing the composition and quality of the coals of the State, description of the geologic structure of the coal basins, typical mining conditions in the different districts, and principal economic data of the industry. Presents salient facts regarding the occurrence, reserves, quality, characteristics, production, and uses of the coals of the State.

†TP 575. Tests of the Compressibility and Bearing Strength of Potash Salt, by H. P. Greenwald and H. C. Howarth, with foreword by George S. Rice. 1937. 32 pp., 16 figs. Describes tests made at the Carlsbad (N. Mex.) potash mines, first, in a compression machine, second, by a hydraulic jack placed horizontally, and third, in a special hydraulic-pressure machine, from which strength of pillars can be estimated to determine suitability of any proposed method of mining. Also describes tests of roof salt, suggests possibilities of application of conclusions of tests to mining operations, and stresses importance of studies of compression of the salt.

†Out of print.

†TP 576. Bibliography of United States Bureau of Mines Investigations on Coal and Its Products, 1910–35, by A. C. Fieldner, Alden H. Emery, and M. W. von Bernewitz. 1937. 145 pp. Revision of TP 493. Lists nearly 2,000 reports on subject by members of Bureau of Mines personnel. Includes index by subjects and authors. (See also TP 639 and 698.)

†TP 577. Chemistry of the Anhydrous Chlorides of Chromium, a Thermodynamic Investigation, by H. A. Doerner. 1937. 51 pp., 13 figs. Part of study undertaken by Bureau of Mines to devise ways of utilizing relatively low grade chromite deposits of the United States.

†TP 578. Relative Value of Gypsum and Anhydrite as Additions to Portland Cement, by Paul S. Roller and Murray Halwer. 1937. 15 pp., 4 figs. Effectiveness of anhydrite relative to gypsum was investigated as regards setting, tensile strength, and compressive strength of mortars. Basis of study was conditioning of cements so that they absorbed slight amounts of water vapor such as they, in all likelihood, would in plant mill practice. Quantitative conclusions were drawn as to effect of anhydrite on setting and strength and as to permissible limits of its use in admixture with gypsum for purpose of obtaining slow set.

†TP 579. Suggested Procedure for Conducting First-Aid and Mine Rescue Contests, by G. W. Grove. 1937. 51 pp., 10 figs. Revised as handbook, Suggested Procedure for Conducting First-Aid and Mine Rescue Contests.

†TP 580. West Virginia Coal-Mine Accident Costs and Data, July 1, 1929, to June 30, 1934, by C. W. Owings. 1937. 51 pp. Data and cost figures presented here indicate clearly that accident incidence in West Virginia is entirely too high and that State officials, mine managements, and coal-mine workers must cooperate to reduce exceptionally high accident rate, which on man-hour basis is about twice that of neighboring State of Pennsylvania; operating conditions in both States are similar. Cost of compensation in West Virginia has increased steadily, as evidenced by annual increase in compensation rates.

†TP 581. Ball-Mill Grinding, by Will H. Coghill and Fred D. DeVaney. 1937. 56 pp., 9 figs. Reviews work of a few earlier investigators who used ball mill in laboratory or plant. Present paper discusses important points in fine grinding, as disclosed by experiments, and innovations in fine grinding. Tests described show that successive changes in set and induced variables in ball milling produce traceable and orderly changes in products. Because friction loss can be estimated, the ball or rod mill is believed to surpass all other devices for finding fine-grinding characteristics of sample of significant size; energy input may be measured without extraneous effects beclouding results.

†TP 582. Methods for the Detection and Determination of Carbon Monoxide, by L. B. Berger and H. H. Schrenk. 1938. 30 pp., 8 figs. Discusses various methods now used rather generally for detection and determination of carbon monoxide, range of concentrations that may be determined, and accuracy of determination. Describes briefly reactions or principles upon which methods are based and technique of operation. Publications cited describe methods in greater detail, but no attempt has been made to compile a complete bibliography.

†TP 583. A Study of a Solvent Analytical Separation of Waxes from Petroleum and Its Lubricating Fractions, by Joseph W. Horne and W. C. Holliman. 1938. 16 pp., 3 figs. Discusses principal methods given in literature for quantitative determination of wax in petroleum and its fraction by use of selective solvents; describes apparatus and procedure that may be adapted successfully to analysis of almost all

types of petroleum wax-oil mixtures, except heavy still bottoms and asphaltic products; and presents experimental data that show scope, applicability, and reliability of method. Also discusses some factors that must be considered in a quantitative separation of this type.

†TP 584. Carbonizing Properties and Petrographic Composition of Upper Banner-Bed Coal from Clinchfield No. 9 Mine, Dickenson County, Va., and of Indiana No. 4-Bed Coal from Saxton No. 1 Mine, Vigo County, Ind., and the Effect of Blending These Coals with Beckley-Bed Coal, by A. C. Fieldner, J. D. Davis, R. Thiessen, W. A. Selvig, D. A. Reynolds, R. E. Brewer, and G. C. Sprunk. 1938. 81 pp., 52 figs. One of series of papers covering survey of gas-, coke-, and byproduct-making properties of American coals being conducted by Bureau of Mines in cooperation with American Gas Association. Gives results of chemical, physical, and petrographic examinations of coals and yield and quality of carbonization products as determined at low, medium, and high carbonizing temperatures by Bureau of Mines-American Gas Association (BM-AGA) method. Also gives results of high- and low-temperature carbonization assay tests by United States Steel and Fisher methods, respectively. Blending tests, in which 20 and 30 percent of Beckley-bed low-volatile coal was used, were made at 900° C.

†TP 585. Flotation for Recovery of Scheelite from Slimed Material, by E. S. Leaver and M. B. Royer. 1938. 24 pp., 1 fig. Investigation described in this report was confined to recovery of tungsten minerals from slimed material. Experimental work was done directly on slimed material produced during milling of contact-metamorphic ores, and methods evolved pertain especially to such ores. They include various gravity methods (centrifugal concentration, vanners, tabling, and blanket concentration), dispersion followed by flocculation to obtain stratification of various minerals according to their specific gravity, and nonsulfide flotation.

TP 586. Notes on the Sampling and Analysis of Coal, by A. C. Fieldner and W. A. Selvig. 1938. 48 pp., 6 figs. These notes apply particularly to coal in place in mine or outcrop and are intended to supplement information already published by Geological Survey and Bureau of Mines. Bureau of Mines TP 133 gives information regarding sampling of coal deliveries. (See also B 116.) 15 cents.

†TP 587. Studies Pertaining to the Catalytic Hydrogenation of Pyrolytic Tars, by Harold M. Smith, Harry T. Rall, and Peter Grandone. 1938. 36 pp., 18 figs. In pyrolytic processes a considerable quantity of tar is formed concurrently with the more desirable light oil; this black viscous material is of no particular worth in itself. Distillation analyses of numerous tar samples indicated that the fraction boiling below 230° C., containing approximately 20 to 25 percent of the tar, was composed largely of napthalene. Object of work reported here was to convert this napthalene fraction of tar into liquid products by means of hydrogenation and thereby increase total yield of liquid products from pyrolysis of natural gas by approximately 25 percent. Hydrogen formed in cracking reactions was used to convert naphthalene to tetrahydronaphthalene in continuous process where hydrogenation followed pyrolysis. Under conditions imposed benzene vapors passed through catalyst chamber unhydrogenated, and therefore two major products of process were benzene and tetrahydronaphthalene.

TP 588. Metallurgical Developments at Mercur, Utah, by W. J. Franklin and Virgil Miller. 1938. 42 pp., 15 figs. Furnishes data and general operating information on treatment of gold-tailing dumps and ores in Mercur (Utah) district. Many metallurgical problems were encountered, and considerable research was done. Data are presented in condensed form and should be valuable to metallurgists faced with similar problems. 10 cents.

†TP 589. Cost of Coal-Mine Fatalities and Some Permanent Disabilities in Ohio, January 1, 1930, to December 31, 1934, by C. W. Owings. 1938. 31 pp. One of series of papers covering accident costs in various mining States. Statistics and analyses presented should bring forcibly to attention of all coal-mine operators cost of accidents and should point out steps necessary to further reduction of accident costs. In some States compensation laws fail to allow substantial reduction in mines where accident rate is low. The Ohio coal-mine operator who succeeds in reducing accidents benefits by reduction in his compensation-insurance payments through merit system of Ohio Industrial Commission.

TP 590. Analyses of Pennsylvania Bituminous Coals, by George H. Ashley, Albert L. Toenges, Robert L. Anderson, W. E. Rice, C. M. Stull, N. H. Snyder, R. J. Swingle, H. M. Cooper, and R. F. Abernethy. 1939. 503 pp., 5 figs. One of series of papers on coal analyses. Discusses geologic structure of coal basins and typical mining conditions in different districts. Presents analytical data showing composition and quality of coals; principal economic data of industry; and salient facts regarding occurrence, reserves, quality, characteristics, production, and uses of bituminous coals of State. (See also TP 645.) 50 cents.

†TP 591. Federal Placer-Mining Laws and Regulations, by Fred W. Johnson, and Small-Scale Placer-Mining Methods, by Chas. F. Jackson. 1938. 49 pp., 26 figs. Section 1 is an authoritative résumé by Commissioner of General Land Office, United States Department of the Interior, of laws governing staking of claims and regulations covering requirements for holding them and obtaining title in fee to placer ground. Section 2 is largely a revision of Bureau of Mines IC 6611, Small-Scale Placer-Mining Methods. Discusses geology and types of placer deposits, minerals associated with placer gold, size of gold particles, prospecting, placer-mining methods, and marketing gold. Includes bibliography.

†TP 592. Flow of Air and Natural Gas Through Porous Media, by T. W. Johnson and D. B. Taliaferro. 1938. 55 pp., 16 figs. Study shows that factors governing flow of gases may be expressed quantitatively by means of general empirical formulas, which, over range of observed experimental data, are for practical purposes independent of type of flow. During investigation flow conditions were varied to include straight-line, transitional, and turbulent flows. Empirical flow formulas in this report are based on flow of dry air and natural gas through porous media over wide range of pressures and temperatures.

†TP 593. Allaying Dust in Bituminous-Coal Mines with Water, by D. Harrington, J. J. Forbes, F. E. Cash, E. H. Denny, C. A. Herbert, D. J. Parker, C. W. Owings, and A. U. Miller. 1939. 55 pp., 21 figs. Enumerates dust-producing sources and describes practical methods of using water—one of the most effective known agents for allaying dust in bituminous-coal mines. Describes practices in various sections of the United States, including methods of conducting water to working places and applying it to coal and rock.

†TP 594. Carbonizing Properties and Petrographic Composition of Pittsburgh-Bed Coal from Bureau of Mines Experimental Mine, Bruceton, Allegheny County, Pa., by A. C. Fieldner, J. D. Davis, R. E. Brewer, W. A. Selvig, D. A. Reynolds, and G. C. Sprunk. 1939. 43 pp., 26 figs. Bureau of Mines-

†Out of print.

American Gas Association (BM–AGA) method for determining gas-, coke-, and byproduct-making properties of coal was applied in tests on Pittsburgh-bed coal from Experimental mine. This report gives yield and quality of products obtained, as well as results of chemical, physical, and petrographic studies of coal; also includes results of tests on expanding properties of coal and effect of mild oxidation on its coking properties.

†TP 595. Carbonizing Properties and Petrographic Composition of Washed and Unwashed Lower and Upper Kittanning-Bed Coals from Mines 72 and 73, Johnstown, Cambria County, Pa., by A. C. Fieldner, J. D. Davis, R. Thiessen, W. A. Selvig, D. A. Reynolds, and C. R. Holmes. 1939. 83 pp., 53 figs. BM–AGA method was applied in testing samples of Lower and Upper Kittanning coals from mines 72 and 73, Cambria County, Pa. This report gives yield and quality of products obtained at carbonizing temperatures of 500°, 600°, 700°, 800°, and 900° C. with 13-inch retort and at 800°, 900°, and 1,000° C. with 18-inch retort. Also gives results of chemical, physical, and microscopic examinations and of blending tests with 70 and 80 percent of high-volatile (Pittsburgh-bed) coal from Warden mine, Allegheny County, Pa.

†TP 596. Carbonizing Properties and Petrographic Composition of Pond Creek-Bed Coal from Majestic Mine, Majestic, Pike County, Ky., by A. C. Fieldner, J. D. Davis, W. A. Selvig, D. A. Reynolds, G. C. Sprunk, and H. S. Auvil. 1939. 46 pp., 28 figs. Gives yields and quality of carbonization products obtained by BM–AGA method at 500°, 600°, 700°, 800°, 900°, and 1,000° C. from 100 percent Pond Creek coal and for blends of Pond Creek with 20 and 30 percent Beckley-bed coal at 900° C. Also shows effect of mild oxidation on carbonizing properties of coal and gives results of practical expansion tests and petrographic examination.

†TP 597. Physical and Chemical Properties of Cokes Made or Used in Washington, by H. F. Yancey, R. E. Zane, R. W. Fatzinger, and J. A. Key. 1939. 44 pp., 16 figs. Deals with properties of Washington coke as evaluated by standard tests now used in industry. Gives comparative information on physical and chemical properties of coke that can be produced from Washington coals.

†TP 598. Burning of Coal in Down-Draft Ceramic Kilns and Burning Characteristics of Some Ohio Coals, by W. E. Rice and C. R. Austin. 1939. 34 pp., 16 figs. Discusses equipment and procedure of tests, coal used, and design of furnaces. Investigation was conducted jointly by Bureau of Mines and Ohio State University; it was supported in part with funds contributed by various kiln operators.

†TP 599. Carbonizing Properties and Petrographic Composition of High Splint-Bed Coal from Closplint Mine, Closplint, Harlan County, Ky., by A. C. Fieldner, J. D. Davis, D. A. Reynolds, W. A. Selvig, G. C. Sprunk, and H. S. Auvil. 1939. 38 pp., 25 figs. Gives results of microscopic, physical, and chemical examinations and yield and quality of products obtained from carbonizing high-volatile A coal by BM–AGA method. Also gives results of blending tests with 20 and 30 percent of Beckley-bed coal.

†TP 600. Review of the Literature on the Construction, Testing, and Operation of Laboratory Fractionating Columns, by C. C. Ward. 1939. 36 pp., 2 figs. Presents and discusses material cited in 86 references. Report is divided into four parts: (1) General consideration of fractionating-unit design and operation; (2) evaluation of columns, giving examples showing how number of theoretical plates can be determined by graphical or analytical methods and giving vapor-liquid equilibria data for some common binary test mixtures; (3) discussion and tabulation of details of construction, operation, and evaluation of various fractionating units; and (4) conclusions as to principal factors to be considered when designing an efficient fractionating unit.

†TP 601. Carbonizing Properties and Petrographic Composition of Sewell-Bed Coal from Wyoming Mine, Wyoming County, W. Va., and the Effect of Blending This Coal with Alma-Bed Coal, by A. C. Fieldner, J. D. Davis, W. A. Selvig, R. E. Brewer, C. R. Holmes, D. A. Reynolds, and G. C. Sprunk. 1939. 45 pp., 25 figs. Gives results of chemical, physical, and petrographic examinations of Sewell-bed coal from Wyoming mine and yield and quality of carbonization products as determined at low, medium, and high carbonizing temperatures by BM–AGA method.

†TP 602. Inspection and Maintenance of Mine Hoisting Ropes, by L. C. Ilsley and McHenry Mosier. 1939. 27 pp., 5 figs. Includes valuable suggestions from B 75 and TP 237, which are no longer available, together with abstracts of and references to data published since they were written.

†TP 603. Phenomena in the Ignition of Firedamp by Explosives. I. Particles from the Detonation, by S. L. Gerhard and Wilbert J. Huff. 1940. 17 pp., 12 figs. Deals with examination of phenomena occurring when an explosive is fired into gas-air mixtures. Gives results of experimental studies to determine character and properties of particles emitted.

†TP 604. Carbonizing Properties and Petrographic Composition of Pocahontas No. 3-Bed Coal from Buckeye No. 3 Mine, Wyoming County, W. Va., and of Pocahontas No. 4-Bed Coal from No. 4 Mine, Raleigh County, W. Va., by A. C. Fieldner, J. D. Davis, D. A. Reynolds, L. D. Schmidt, R. E. Brewer, G. C. Sprunk, and C. R. Holmes. 1940. 65 pp., 44 figs. Gives results of physical, chemical, and petrographic examinations of Pocahontas No. 3 and No. 4 coals from Wyoming and Raleigh Counties, W. Va., respectively, and yield and quality of products obtained from carbonizing these coals by BM–AGA method. Also gives results of blending tests with 70 and 80 percent of Pittsburgh-bed coal and shows effect of atmospheric oxidation at 99.3° C. on carbonizing properties.

†TP 605. Experiments on Strength of Small Pillars of Coal in the Pittsburgh Bed, by H. P. Greenwald, H. C. Howarth, and Irving Hartmann. 1939. 22 pp., 10 figs. Describes methods of testing seven small pillars in place in Experimental mine; all pillars were square in horizontal cross section. Paper is summary of progress in an investigation which, insofar as authors know, has had no previous counterpart. (See also RI 3575.)

†TP 606. Production of Explosives in the United States During the Calendar Year 1938, by W. W. Adams, V. E. Wrenn, and L. S. Horton. 1939. 28 pp., 2 figs.

†TP 607. Tabulated Analyses of Texas Crude Oils, by A. J. Kraemer and Gustav Wade. 1939. 37 pp., 1 fig. Comprises analyses formerly available in RI 3252, together with analyses made by Bureau of Mines since that report was compiled.

†TP 608. Safety Factors in Construction and Ventilation, Wawona Vehicular Tunnel, Yosemite National Park, Calif., by S. H. Ash. 1940. 34 pp., 21 figs. Deals primarily with safety factors involved in driving and operating Wawona vehicular tunnel. Gives cost of construction and operating specifications for construction of tunnel, discusses accident experience and costs, and describes ventilating system.

†TP 609. Bentonite: Its Properties, Mining, Preparation, and Utilization, by C. W. Davis and H. C. Vacher. Revised by John E. Conley. 1940. 83 pp., 2 figs. (Revision of TP 438.) Covers investigation undertaken to add to general information on properties

†Out of print.

and uses of bentonite. Includes brief compilation of its geologic and geographic occurrences, study and discussion of its nature (definition and composition), study of properties of different samples of bentonitelike material, and compilation of known and suggested uses, including list of United States patent literature.

†TP 610. Correlation Index to Aid in Interpreting Crude-Oil Analyses, by Harold M. Smith. 1940. 34 pp., 4 figs. Discusses meaning of correlation index and application to Bureau of Mines Hempel analyses of crude oils. Presents facts upon which index is based and develops fundamental equation for its calculation. Includes tables to facilitate determination of correlation index for Bureau of Mines Hempel analyses. Appendix discusses classification of crude oils and relationship between classification systems and correlation index.

†TP 611. Friability, Grindability, Chemical Analyses, and High- and Low-Temperature Carbonization Assays of Alabama Coals, by E. S. Hertzog, J. R. Cudworth, W. A. Selvig, and W. H. Ode. 1940. 59 pp., 11 figs. Investigations described are part of general program of Alabama coal studies undertaken by Bureau of Mines in cooperation with University of Alabama. This study of friability and grindability of samples from 47 mines in Alabama coal fields is first attempt to obtain relatively large number of friability and grindability data from an area in which coals are of nearly same rank.

†TP 612. Explosion Hazards in Storage-Battery Rooms, by G. W. Jones, John Campbell, R. E. Dillon and O. B. Benson. 1940. 16 pp., 4 figs. Presents results of investigation to determine amounts of hydrogen present in various large, stand-by-type storage-battery rooms of Boston Edison Co. and to work out satisfactory methods of ventilation where hazardous conditions were found. Results show average and maximum concentration of hydrogen present in 23 stand-by-type battery rooms, both when batteries were being charged and when they were on "float." Survey was part of cooperative manhole investigation undertaken by Bureau of Mines, Boston Edison Co., and Boston Consolidated Gas Co.

†TP 613. Developments in Coal Research and Technology in 1937 and 1938, by Arno C. Fieldner. 1940. 95 pp. Continues review of developments in coal research and technology formerly published in Minerals Yearbook.

†TP 614. Coke-Oven Accidents in the United States During the Calendar Year 1938, by W. W. Adams and V. E. Wrenn. 1940. 16 pp., 1 fig.

†TP 615. Splint Coals of the Appalachian Region: Their Occurrence, Petrography, and Comparison of Chemical and Physical Properties with Associated Bright Coals, by G. C. Sprunk, W. H. Ode, W. A. Selvig, and H. J. O'Donnell. 1940. 59 pp., 38 figs. Gives information on origin, petrography, geographical distribution, geological occurrence, and hydrogenation of typical splint coals from Appalachian region. Samples of splint separated from columnar samples of 17 different coal beds were analyzed and tested for agglutinating value and for yield of coke and by-products by Fischer low-temperature assay. Duplicate tests were made on samples of bright coal selected from same beds so that effect of both type and rank could be studied more carefully throughout range of coking coals. Data were obtained in connection with Bureau of Mines survey of gas-, coke-, any byproduct-making properties of American coals.

†TP 616. Carbonizing Properties and Petrographic Composition of Lower Banner-Bed Coal from Keen Mountain Mine, Buchanan County, Va., and the Effect of Blending This Coal with Pittsburgh-Bed (Warden Mine) Coal, by A. C. Fieldner, J. D. Davis, D. A. Reynolds, R. E. Brewer, G. C. Sprunk, and L. D. Schmidt. 1940. 47 pp., 26 figs. Gives results of chemical, physical, and petrographic examinations of Lower Banner-bed coal from Keen Mountain mine and yield and quality of carbonization products as determined at low, medium, and high carbonizing temperatures by BM–AGA method.

†TP 617. Characteristics of Fuel Pitches and Their Explosibility in Pulverized Form, by Irving Hartmann, H. C. Howarth, and H. P. Greenwald. 1940. 45 pp., 20 figs. Describes work done in investigation of inflammability of pitch dust undertaken by Bureau of Mines in cooperation with Barrett Co., New York City. Calls attention to explosive nature of dispersions of fine pitch dust in air and makes recommendations as to proper handling thereof. Concerns principally inflammability of hard pitches, which can be pulverized at room temperature and burned as fuel. Also summarizes briefly process of manufacture, properties, and uses of pitch.

†TP 618. Analyses of Washington Coal. Supplement to Technical Paper 491, by H. F. Yancey and M. R. Geer. 1941. 81 pp., 1 fig. Contains analyses of samples collected by Bureau of Mines in 1938 and 1939 and analyses of samples of coal delivered to Government since 1929. In addition to analytical data, includes brief statement of progress in mine mechanization and coal preparation and information on production, distribution, and use of coal in State.

†TP 619. Mining Practices and Safety at the Lava Cap Gold Mining Corporation Mines, Nevada City-Grass Valley District, California, by S. H. Ash. 1941. 36 pp., 16 figs. Describes many safety practices in gold mining which, if adopted, would make lode-gold mining a much safer branch of mineral industry, save thousands of dollars of wasted dividends in gold mining, and prevent much human suffering. Lava Cap enterprise conducts its mining operations on safer plane than average lode-gold mine and because of its size among metal mines has material influence on industry as a whole.

†TP 620. Accidents in the Oklahoma Petroleum Industry in 1937, by C. F. McCarroll. 1941. 141 pp., 15 figs. (Supplement to RI 3446.) Reviews accident experience of Oklahoma petroleum industry for 1937 and analyzes data in as much detail as is consistent with their source. Data presented, together with accident experience of individual organizations, should aid in formulating practices that will reduce number and cost of accidents; they also furnish basis of comparison for determining trend of results of past efforts and serve as reference for comparing results of similar studies in future. Study was conducted by Bureau of Mines in cooperation with State of Oklahoma.

TP 621. Carbonizing Properties and Petrographic Composition of Upper Freeport Coal from Morgantown District, Monongalia County, W. Va., and of Lower Freeport Coal from Eastern Indiana County near Cambria County, Pa., by A. C. Fieldner, J. D. Davis, W. A. Selvig, D. A. Reynolds, R. E. Brewer, G. C. Sprunk, and C. R. Holmes. 1941. 77 pp., 47 figs. Gives results of study of carbonizing properties and composition of coal from Upper and Lower Freeport beds, Monongalia County, W. Va., and Indiana County, Pa., respectively. Investigation included complete chemical and petrographic analyses, physical tests, assays at high and low temperatures, and carbonization tests by BM–AGA method at 500°, 600°, 700°, 800°, 900°, and 1,000° C. Effects of atmospheric oxidation at 99.8° C. on carbonizing properties of both coals were studied, as likewise were effects of blending them with Pittsburgh (Warden mine) and Pocahontas No. 4 coals. 15 cents.

†TP 622. Hydrogenation and Liquefaction of Coal. I. Review of Literature, Description of Experimental

†Out of print.

Plant, and Liquid-Phase Assays of Some Typical Bituminous, Subbituminous, and Lignitic Coals, by H. H. Storch, L. L. Hirst, C. H. Fisher, and G. C. Sprunk. 1941. 110 pp., 31 figs. First of series describing results obtained in an investigation of production of liquid fuels from coal by hydrogenation process. Describes small, continuously operating experimental plant for assaying American coals as to their amenability to liquefaction by hydrogenation. Plant has a daily capacity corresponding to hydrogenation of 100 to 200 pounds of coal. (See also TP 642, 646, 654, and 690.)

†TP 623. Coke-Oven Accidents in the United States During the Calendar Year 1939, by W. W. Adams and V. E. Wrenn. 1940. 17 pp., 1 fig.

†TP 624. Increasing the Concentration of Sulfur Dioxide in the Effluent Gases from Dwight-Lloyd Sintering Machines Treating Lead Products, by Virgil Miller, R. Bainbridge, and R. Ellison. 1941. 34 pp., 16 figs. Describes experimental work conducted at smelter of Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, British Columbia, to obtain uniform and rich sulfur dioxide effluent gas from Dwight-Lloyd sintering machines. Presents results of plant tests and laboratory work conducted with stationary equipment.

†TP 625. Thermodynamic Properties of Gypsum and Its Dehydration Products, by K. K. Kelley, J. C. Southard, and C. T. Anderson. 1941. 73 pp., 13 figs. Presents new experimental data and methods of preparing samples; correlates available thermodynamic data; and, as an elementary application of these data, analyzes heat utilization in gypsum-plaster kettle process.

†TP 626. Analyses of West Virginia Coals, by Paul H. Price, E. T. Heck, Albert L. Toenges, R. L. Anderson, N. H. Snyder, H. M. Cooper, R. F. Abernethy, E. C. Tarpley, and R. J. Swingle. 1942. 341 pp., 10 figs. One of series of papers on coal analyses. Presents principal facts regarding occurrence, reserves, quality, characteristics, production, and uses of coals of State.

†TP 627. Production of Explosives in the United States During the Calendar Year 1939, by W. W. Adams, V. E. Wrenn, and L. S. Horton. 1940. 30 pp., 2 figs.

†TP 628. Carbonizing Properties and Petrographic Composition of No. 1-Bed Coal from Bell No. 1 Mine, Sturgis, Crittenden County, Ky., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals, by J. D. Davis, D. A. Reynolds, R. E. Brewer, G. C. Sprunk, and L. D. Schmidt. 1941. 45 pp., 26 figs. Gives results of physical, chemical, and petrographic examinations of No. 1-bed coal from Crittenden County, Ky., and yield and quality of products obtained from carbonizing this coal by BM–AGA method. Also gives results of blending tests with 20 and 30 percent Pocahontas No. 3- and No. 4-bed coals. Fischer low-temperature and United States Steel Corporation high-temperature assays were included in investigation of carbonizing properties.

†TP 629. Collecting and Examining Subsurface Samples of Petroleum, by Peter Grandone and Alton B. Cook. 1941. 68 pp., 24 figs. Discusses various factors that affect subsurface-oil samples preparatory to and during sampling; describes self-closing subsurface-oil sampler designed to trap liquid phase of well fluid as it exists at sampling point in well and to retain fluid intact until it can be transferred to other apparatus for laboratory examination; outlines laboratory methods employed for examining samples of subsurface oil in laboratory; and considers several physical properties of subsurface oil. Work was done in cooperation with State of Oklahoma.

†TP 630. Carbonizing Properties and Petrographic Composition of Powellton-Bed Coal from Elk Creek No. 1 Mine, Emmett, Logan County, W. Va., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals, by J. D. Davis, D. A. Reynolds, G. C. Sprunk, and C. R. Holmes. 1941. 45 pp., 25 figs. Gives results of study of composition and carbonizing properties of Powellton-bed coal from Logan County, W. Va. Investigation included chemical analyses, physical tests, microscopic examination, assays at high and low temperatures, and carbonization tests by BM–AGA method at 500°, 600°, 700°, 800°, 900°, and 1,000° C. Effects of blending 20 and 30 percent Pocahontas No. 3- and No. 4-bed coals on carbonizing properties of Powellton coal likewise were determined.

†TP 631. Coal Paleobotany, by Reinhardt Thiessen and George C. Sprunk. 1941. 56 pp., 44 figs. Presents highlights of previous research on paleobotany of coal. Brings to notice of paleobotanists fact that coal contains an enormous amount of material in a remarkably good state of preservation and that it comprises constituents or components that invariably have retained some of original plant structures, many of which may be assigned to certain plants. Discusses identity of these plants and of remains. Observations recorded are outcome of work related to coal petrography; no intensive work on paleobotany has been attempted.

†TP 632. Theoretical Calculations for Explosives. I. Explosion Temperatures and Gaseous Products and the Effects of Changes in Carbonaceous Material, by F. W. Brown. 1941. 21 pp., 2 figs. First of series of papers on theoretical calculations for explosives. Computes approximate explosion temperatures and gaseous products for typical high-ammonium nitrate permissible explosive and a 60-percent gelatin dynamite. Examines in detail effect of pressure on explosion temperature and gaseous products and considers effects of changes in wrapper and carbonaceous combustible material. (See also TP 643.)

†TP 633. Technical and Economic Study of Drying Lignite and Subbituminous Coal by the Fleissner Process, by L. C. Harrington, V. F. Parry, and Arthur Koth. 1942. 84 pp., 32 figs. Presents detailed record of experiments on steam-drying various lignites and subbituminous coals and summarizes engineering and economic studies concerning commercial possibilities of process under American conditions. Work was done under cooperative agreement between Bureau of Mines and University of North Dakota.

†TP 634. Carbonizing Properties and Petrographic Composition of Lower Hignite-Bed Coal from the Atlas Mine, Middlesboro, Bell County, Ky., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals, by J. D. Davis, D. A. Reynolds, G. C. Sprunk, and C. R. Holmes. 1942. 47 pp., 28 figs. Gives results of investigation of carbonizing properties of high-volatile A, Lower Hignite-bed coal from Bell County, Ky. Investigation included chemical and physical tests, microscopic examination, high- and low-temperature assays, and carbonization tests by BM–AGA method at 500°, 600°, 700°, 800°, 900°, and 1,000° C. Blends of Lower Hignite- and Pocahontas No. 3- and No. 4-bed coals were carbonized at 900° C.

†TP 635. Design of Air-Blast Meter and Calibrating Equipment, by A. T. Ireland. 1942. 20 pp., 18 figs. Describes evolution of design of air-blast meter to be used for measuring air pressures from quarry blasts and design and application of equipment required for calibration thereof.

†TP 636. Production of Explosives in the United States During the Calendar Year 1940, by W. W. Adams, V. E. Wrenn, and L. S. Horton. 1942. 30 pp., 2 figs.

†Out of print.

†TP 637. Index of Coals Tested in the Bureau of Mines Survey of Carbonizing Properties of American Coals, by James E. Wilson and Joseph D. Davis. 1942. 10 pp. Serves as index to coal numbers that were assigned to various coals tested. Forty-two different coal beds have been tested, including 16 from West Virginia, 5 from Pennsylvania, 7 from Kentucky, 4 from Virginia, 3 from Alabama, 2 from Washington, and 1 each from British Columbia, Colorado, Illinois, Indiana, Maryland, and Utah. (See also RI 3760.)

†TP 638. Photomicroscopy of Salt in Petroleum, by Lloyd F. Christianson and J. W. Horne. 1942. 56 pp., 21 figs. Discusses and presents microscopic data relating to physical state of salts in some oils being produced in Mid-Continent area. Describes apparatus, photomicroscopic procedure, and method of reporting hypothetical combination of elements as salts. Chemical analyses were made to determine quantities of predominating salts and to find total quantity of water-soluble chlorides in oils. Photomicrographs illustrate variation in emulsions, action of demulsifying agents, and physical forms in which salts crystalize from demulsified oils.

†TP 639. Bibliography of Bureau of Mines Investigations of Coal and Its Products, 1935 to 1940, by A. C. Fieldner. 1942. 43 pp. Supplements TP 576, which covers preceding 25 years. Paper is survey of Bureau's interest in this field. Lists more than 400 reports on subject by members of Bureau of Mines, including those published by Bureau, by journals of various societies, and by technical press. Contains index by subjects and authors. (See also TP 698.)

†TP 640. Coke-Oven Accidents in the United States During the Calendar Year 1940, by W. W. Adams and V. E. Wrenn. 1942. 19 pp.

†TP 641. Analyses of Illinois Coals, by Gilbert H. Cady, Albert L. Toenges, Earl R. Maize, Thomas Fraser, R. L. Anderson, J. W. McBride, N. H. Snyder, H. M. Cooper, R. F. Abernethy, E. C. Tarpley, and R. J. Swingle. 1942. 245 pp., 11 figs. One of series on coal analyses. Presents principal facts regarding occurrence, reserves, quality, characteristics, production, and uses of coals of State.

†TP 642. Hydrogenation and Liquefaction of Coal. II. Effect of Petrographic Composition and Rank of Coal, by C. H. Fisher, G. C. Sprunk, A. Eisner, H. J. O'Donnell, L. Clarke, and H. H. Storch. 1942. 162 pp., 52 figs. Second in series covering hydrogenation and liquefaction of coal. Results of investigation described give fairly complete picture of relationship between nature of coal and many of its hydrogenation characteristics. Data obtained in hydrogenation of about 130 samples of pure constituents of coal or coals of known petrographic composition show that some constituents differ markedly in ease of liquefaction and yield of various products. Paper summarizes briefly these differences and effect of rank on liquefaction yield (100 minus percentage of acetone-insoluble residue equals percentage of liquefaction). (See also TP 622, 646, 654, and 690.)

†TP 643. Theoretical Calculations for Explosives. II. Explosion Pressures, by F. W. Brown. 1942. 26 pp., 12 figs. Second in series on theoretical calculations for explosives. Critically examines present methods for estimating explosion pressures and, by using limited high-pressure-gas data available and existing theories of intermolecular forces, attempts to obtain better estimate of magnitude of explosion pressures and variation of pressure with composition and density of explosive. (See also TP 632.)

†TP 644. Carbonizing Properties and Petrographic Composition of Bakerstown-Bed Coal from No. 23 Mine, Coketon, Tucker County, W. Va., and the Effect of Blending This Coal with Pittsburgh-Bed (Warden Mine) Coal, by J. D. Davis, D. A. Reynolds, G. C. Sprunk, and C. R. Holmes. 1942. 46 pp., 24 figs. Gives results of study of carbonizing properties and composition of Bakerstown-bed coal from Tucker County, W. Va. Investigation included complete chemical and microscopic analyses, physical tests, assays at high and low temperatures, and carbonization tests by BM–AGA method at 500°, 600°, 700°, 800°, 900°, and 1,000° C. Blends containing 70 and 80 percent Pittsburgh (Warden mine) coal were carbonized at 900° C. Effect of oxidation on carbonizing properties also were studied.

†TP 645. Analyses of Pennsylvania Bituminous Coals. Supplement to Technical Paper 590, by N. H. Snyder and R. J. Swingle. 1942. 19 pp. Contains analyses made from July 1, 1937, to June 30, 1941. For earlier analyses and economic data for industry, geology of coal deposits, mining methods, and preparation practices in State see TP 590.

TP 646. Hydrogenation and Liquefaction of Coal. III. Characterization of Assay Oils, by L. L. Hirst, A. Eisner, J. H. Field, H. M. Cooper, R. F. Abernethy, and H. H. Storch. 1942. 27 pp., 8 figs. Third in series covering hydrogenation and liquefaction of coal. Presents results of preliminary work on analysis of coal-hydrogenation oils. (See also TP 622, 642, 654, and 690.) 10 cents.

TP 647. Production of Industrial Explosives in the United States During the Calendar Year 1941, by W. W. Adams and V. E. Wrenn. 1942. 30 pp., 2 figs. 10 cents.

†TP 648. Mineral Matter in Coal, by George C. Sprunk and H. J. O'Donnell. 1942. 67 pp., 48 figs. Gives results of petrographic examination of mineral matter in more than 3,000 thin sections of coal, representing about 100 beds. Illustrations clearly reveal manner in which such minerals as kaolinite, calcite, siderite, quartz, and pyrite are associated with coal constituents. From thin sections not only the kind but approximate amount and distribution of each mineral constituent can be determined. It is believed that these results may have practical application in problems relating to mining, preparation, and utilization of coal.

†TP 649. Carbonizing Properties and Petrographic Composition of No. 2-Bed Coal from Bartoy Mine and No. 5-Bed Coal from Wilkeson-Miller Mine, Wilkeson, Pierce County, Wash., by J. D. Davis, D. A. Reynolds, G. C. Sprunk, C. R. Holmes, and J. T. McCartney. 1942. 46 pp., 29 figs. Gives results of study of carbonizing properties and composition of coal from No. 2 bed and No. 5 or Miller bed, Pierce County, Wash. Investigation included chemical and petrographic analyses, physical tests, assays at high and low temperatures, and carbonization tests by BM–AGA method at 500°, 600°, 700°, 800°, 900°, and 1,000° C.

TP 650. Carbonizing Properties and Petrographic Composition of Taggart–Bed Coal from Mines 30 and 31, Lynch, Harlan County, Ky., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals, by J. D. Davis, D. A. Reynolds, G. C. Sprunk, and C. R. Holmes. 1943. 45 pp., 25 figs. Gives results of study of carbonizing properties and composition of Taggart-Bed Coal from Harlan County, Ky., and of blending this coal with that from two Pocahontas beds in West Virginia. Investigation included complete chemical and microscopic analyses, physical tests, assays at high and low temperatures, and carbonization tests by Bureau of Mines-American Gas Association method at 500°, 600°, 700°, 800°, 900°, and 1,000° C. 10 cents.

†Out of print.

TP 651. Coke-Oven Accidents in the United States, Calendar Year 1941, by W. W. Adams and V. E. Wrenn, 1943. 19 pp., 3 figs. 10 cents.

†TP 652. Analyses of Kentucky Coals. 1944. 323 pp., 13 figs. Presents principal facts regarding the occurrence, reserves, quality, characteristics, production, and uses of coals of State.

†TP 653. Explosion Hazards of Combustible Anesthetics, by G. W. Jones, R. E. Kennedy, and G. J. Thomas. 1943. 47 pp., 21 figs. Explains factors conducive to explosions, describes limits of flammability, discusses flammability of anesthetic mixtures, and gives results of clinical investigations. Work was done by Bureau of Mines, St. Francis Hospital, Pittsburgh, and a committee under direction of the Department of Anesthesia and Industrial Hygiene, School of Medicine, University of Pittsburgh.

†TP 654. Hydrogenation and Liquefaction of Coal. IV. Effect of Temperature, Catalyst, and Rank of Coal on Rates of Coal-Hydrogenation Reactions, by H. H. Storch, C. H. Fisher, C. O. Hawk, and A. Eisner. 1943. 50 pp., 23 figs. Report deals with scientific appraisal and analysis of effect of temperature, catalyst, and rank of coal upon rates of reactions that take place in hydrogenation of coal. Results show that rate-determining step for absorption of hydrogen varies with temperature. (See also TP 622, 642, 646, and 690.)

†TP 655. Carbonizing Properties and Petrographic Composition of Thick Freeport-Bed Coal from Harmar Mine, Harmarville, Allegheny County, Pa., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals, by J. D. Davis, D. A. Reynolds, G. C. Sprunk, C. R. Holmes, and J. T. McCartney. 1943. 46 pp., 24 figs. Describes results of tests similar to those described under TP 650 on coal from Pennsylvania and blends of this coal with that from two West Virginia beds.

TP 656. Analyses of Virginia Coals. 1944. 159 pp., 5 figs. Presents principal facts regarding occurrence, reserves, quality, characteristics, production, and uses of coals of State. 15 cents.

†TP 657. Dilution of Stack Effluents, by G. E. McElroy, C. E. Brown, L. B. Berger, and H. H. Schrenk. 1944. 46 pp., 33 figs. Describes investigations made upon the request of the New York City Tunnel Authority of the Brooklyn-Battery vehicular tunnel to obtain information on degrees of dilution of gaseous stack effluents to be expected close to a particular stack. Gives approximate data that have general practical application to all types of stacks.

TP 658. Production of Industrial Explosives in the United States During the Calendar Year 1942, by W. W. Adams and V. E. Wrenn. 1944. 24 pp., 2 figs. 10 cents.

†TP 659. Analyses of Pennsylvania Anthracitic Coals. 1944. 271 pp., 10 figs. Presents principal facts regarding occurrence, reserves, quality, characteristics, production, and uses.

†TP 660. Coke-Oven Accidents in the United States, Calendar Year 1942, by W. W. Adams and V. E. Wrenn. 1944. 21 pp., 3 figs.

†TP 661. Electrical Devices Applied to Metallurgical Research, by E. V. Potter. 1944. 30 pp., 25 figs. Gives information of value to engineers, scientific schools, and research laboratories interested in application of electrical devices to dust and fume flocculation, magnetic testing of metals, induction furnaces, and chemical and spectrographic analyses.

†TP 662. Thermodynamic Properties of Carbides of Chromium, by K. K. Kelley, F. S. Boericke, G. E. Moore, E. H. Huffman, and W. M. Bangert. 1944. 43 pp., 4 figs. Gives previously unavailable thermodynamic data on the carbides of chromium and their application to the decarburization of chromium or ferrochrome.

†TP 663. The Flow of Coal-Ash Slag on Furnace Walls, by P. Cohen and W. T. Reid. 1944. 22 pp., 7 figs. Gives complete details of a method for calculating the thickness of slag deposits and presents illustrations of the application of the method to slagging furnaces. The report should be useful as a guide in comparing the behavior of different coal ashes in the same furnace under similar operating conditions or in predicting the effect of change in these conditions on the action of a given coal ash, and as an aid in improving the design of large steam-generating units by industry.

†TP 664. Differential Thermal Analysis, Its Application to Clays and Other Aluminous Minerals, by Sidney Speil, Louis H. Berkelhamer, Joseph A. Pask, and Ben Davies. 1945. 81 pp., 35 figs. Discusses the applications and limitations of the thermal analysis method to the study of various clays, bauxites, and aluminous minerals. Bibliography is included. Work was done in cooperation with the Tennessee Valley Authority, the University of Alabama, and the University of Washington.

†TP 665. Production of Industrial Explosives in the United States During the Calendar Year 1943, by W. W. Adams and V. E. Wrenn. 1944. 26 pp., 2 figs.

TP 666. Bureau of Mines Research on the Hydrogenation and Liquefaction of Coal and Lignite, by Arno C. Fieldner, Henry H. Storch, and Lester L. Hirst. 1944. 69 pp., 30 figs. Presents a review of the Bureau of Mines research during the past 8 years in making gasoline and oil from coal and lignite. Explains in detail the experiments conducted at the Bureau's laboratory-scale plant at Pittsburgh, a continuous unit capable of hydrogenating 100 pounds of coal in 24 hours, and gives chemical-process information obtained in a large number of batch-hydrogenation tests in small steel autoclaves or bombs. Varying yields of gasoline and oil from 15 coal beds in 11 States and Alaska are given in tabular form. Bibliography included. 15 cents.

TP 667. Carbonizing Properties of Western Region Interior Province Coals and Certain Blends of These Coals, by J. D. Davis, D. A. Reynolds, J. L. Elder, W. H. Ode, C. R. Holmes, and J. T. McCartney. 1944. 138 pp., 91 figs. Gives results of investigation of carbonizing and petrographic properties of nine Western Province coals. Includes bibliography. 20 cents.

†TP 668. Low-Temperature Carbonization of Alaskan Coals, by W. A. Selvig, W. H. Ode, and Joseph D. Davis. 1944. 16 pp. Results of an investigation to determine the potential use of certain Alaskan coals as a source of synthetic liquid fuels are described in this publication, which reports in detail on a small-scale, low-temperature carbonization assay of 14 coals from the Board Pass, Fortymile, Matanuska, and Nanana districts of the Territory. Tests were made in connection with a general survey of the physical and chemical properties of Alaskan coal, and the publication discusses how this research work fits into the picture of increasing demands for petroleum products in Alaska.

†TP 669. Rare and Uncommon Chemical Elements in Coal, by F. H. Gibson and W. A. Selvig. 1944. 23 pp. Summarizes available published information on rare and uncommon elements in the coals of the United States and other countries. Includes bibliography of 103 references.

†TP 670. Carbonizing Properties of Pocahontas No. 3-Bed Coal from Kimball, McDowell County, W. Va., and the Effect of Blending this Coal with Pittsburgh-Bed Coal, by J. D. Davis, D. A. Reynolds, W. H. Ode, and C. R. Holmes. 1944. 35 pp., 22 figs. Gives results of an investigation of the composition and carbonizing properties of Pocahontas No. 3 coal. Investiga-

†Out of print.

tion included chemical analyses, agglutinating and plasticity tests, assays at high and low temperatures, expansion tests, and BM–AGA tests. Includes bibliography of other publications of this series.

†TP 671. Analyses of Tennessee Coals (Including Georgia). 1945. 243 pp., 3 figs. Presents the principal facts regarding the occurrence, reserves, quality, characteristics, production, and uses of coals of each of the two States.

†TP 672. Carbonizing Properties and Petrographic Composition of Hazard No. 4 Coal from Columbus No. 4 Mine and High-Temperature Carbonizing Properties of Hazard No. 7 Coal from Hardburly Mine, Perry County, Ky., by J. D. Davis, D. A. Reynolds, W. H. Ode, C. R. Holmes, J. L. Elder, and J. E. Wilson. 1945. 46 pp., 23 figs. Gives results of an investigation of the composition and carbonizing properties of coals from Hazard No. 4 bed, Columbus No. 4 mine, and from Hazard No. 7 bed, Hardburly mine. Physical, chemical, and petrographic methods were used to examine these coals, and the BM–AGA method was used to determine the high-temperature carbonizing properties at 900° C. Bibliography included.

†TP 673. Reserves, Bed Characteristics, and Coking Properties of the Willow Creek Coal Bed, Kemmerer District, Lincoln County, Wyo., by Albert L. Toenges, J. D. Davis, Louis A. Turnbull, and J. M. Schopf. 1945. 48 pp., 14 figs. Seeking additional sources of fuel for western blast furnaces and wartime steel production, the Bureau of Mines drilling program proved a reserve of 15,345,000 tons of coking coal in the Kemmerer district, of which an estimated 11,215,000 tons in the Willow Creek bed are considered recoverable. Describes the exploration, carbonization results, and plan for development of this western coal field.

†TP 674. Semi-Pilot-Plant Investigations of Nitrogen Dioxide Process for Beneficiation of Manganese Ores, by A. L. Fox, A. E. Back, C. J. Chindgren, K. E. Tame, and D. Kaufman. 1945. 26 pp., 4 figs. Experiments by metallurgists and chemists at the Bureau's Salt Lake City Experiment Station indicate that the nitrogen dioxide process for producing high-grade manganese dioxide appears feasible and merits further investigation on a larger scale. One in a series of investigations of this method of beneficiating low-grade manganese ores, the paper reports further development work, involving the construction and operation of a small-scale continuous pilot plant.

†TP 675. Coke-Oven Accidents in the United States, Calendar Year 1943, by W. W. Adams and V. E. Wrenn. 1945. 20 pp., 3 figs.

†TP 676. Energy Requirements and Equilibria in the Dehydration, Hydrolysis, and Decomposition of Magnesium Chloride, by K. K. Kelley. 1945. 26 pp., 9 figs. Discusses practical implications of the equilibria. From recently determined heats of formation, specific heats, and entropies of magnesium chloride and its hydrates, a thermodynamic investigation is made of the several distinct reaction steps in the dehydration, hydrolysis, and decomposition of magnesium chloride.

†TP 677. Detonators: Initiating Efficiency by the Miniature-Cartridge Test, by R. L. Grant and J. E. Tiffany. 1945. 34 pp., 13 figs. Describes a new and more representative method called the "miniature-cartridge test," for measuring the relative initiating efficiency or "strength" of commercial and military detonators. Briefly reviews other detonator tests and shows that the new method combines the best features of the sand test and the TNT-iron oxide insensitive powder test.

†TP 678. Design of Injectors for Low-Pressure Air Flow, by G. E. McElroy. 1945. 50 pp., 13 figs. Presents and discusses methods of designing injectors for low-pressure air flow, with special reference to their use in mine and tunnel ventilation.

†TP 679. Analyses of Ash from Coals of the United States, by W. A. Selvig and F. H. Gibson, 1945. 20 pp. Gives the chemical analyses of 200 coal-ash samples representing all of the major coal-producing areas of the Nation. Discusses the nature and occurrence of ash-forming mineral matter in coal and the relationship of ash composition to the liquefying properties of ash.

†TP 680. Resins in Coal, by W. A. Selvig. 1945. 24 pp., 5 figs. Describes the nature and mode of occurrence of resins in coal and reviews published information regarding the occurrence, properties, and possible commercial uses of resins found in coal, with particular reference to coals of the United States and Canada.

†TP 681. Relative Spontaneous Heating Tendencies of Coals, by J. L. Elder, L. D. Schmidt, W. A. Steiner, and J. D. Davis. 1945. 24 pp., 3 figs. Discusses the relative spontaneous heating tendencies of coals and describes a test method and apparatus which have been developed to study spontaneous heating. Investigations have been made at the Bureau of Mines Pittsburgh Station to determine the relative tendency of coals to heat spontaneously during storage and also to evaluate the effect of storage and oxidation upon their coking properties. During these investigations, 46 samples of coal varying in rank from low-volatile bituminous to lignite were examined.

†TP 682. Analyses of Alaska Coals. 1946. 114 pp., 1 map. Alaska has enough coal reserves to meet the immediate fuel requirements of its expanding industrial and commercial economy, according to this report. Coal deposits totaling nearly 100 billion short tons, chiefly of lignite and subbituminous rank, underlie extensive areas of the Territory. The geological structure of Alaska coal fields, typical conditions of mining and preparation, production, distribution, use and other major economic facts of the industry are discussed.

†TP 683. Carbonizing Properties of Powellton-Bed Coal from Coal Mountain Mine, Guyan, Wyoming County, W. Va., by D. A. Reynolds, J. D. Davis, W. H. Ode, R. E. Brewer, and C. R. Holmes. 1945. 44 pp., 21 figs. Gives results of a study of the composition and carbonizing properties of Powellton-bed coal from Coal Mountain mine, Guyan, Wyoming County, W. Va. The investigation included chemical and physical tests, carbonization by the BM–AGA method at 500°, 600°, 700°, 800°, 900°, and 1,000° C., oxidation tests, expansion tests, and assays at low and high temperatures. Bibliography is included.

†TP 684. The Bicarbonate Process for the Production of Magnesium Oxide, by H. A. Doerner, W. F. Holbrook, and Otis W. Fortner. 1946. 48 pp., 19 figs. Process described appears to have most attractive possibilities for recovering technically pure MgO from low-grade magnesite or dolomite ores. A quantitative study was made to determine optimum conditions for economical application of process, which were tested in a continuous leaching system using equipment of a type suitable for large-scale industrial operation. Evaluation of economic feasibility of process and engineering data required for design of a large industrial unit were main objectives of investigation. Work done in cooperation with State College of Washington.

†TP 685. Procedure and Apparatus for Determining Carbonizing Properties of American Coals by the Bureau of Mines–American Gas Association Method, by D. A. Reynolds and C. R. Holmes. 1946. 35 pp., 8 figs. Information on processes and changes in

†Out of print.

equipment used in Bureau of Mines–American Gas Association method for experimentally determining the carbonizing properties of American coals has been brought up to date in this publication. BM–AGA method for testing the gas-, coke-, and byproduct-making properties of coals was adopted as a recognized standard in 1929.

†TP 686. The Thermodynamic Properties of Manganese, by K. K. Kelley, B. F. Naylor, and C. H. Shomate. 1946. 34 pp., 4 figs. Presents thermal data for manganese in its four crystalline, liquid, and gaseous states. First two sections report new experimental work, including measurements of low-temperature specific heats and entropies of two crystalline forms of electrolytic manganese and high-temperature heat contents of all four crystalline modifications. In third section, the known electronic energy levels of manganese gas are utilized in obtaining its specific heat, heat content, and free energy to temperatures as high as 5,000° K. Data are combined in deriving a rectified vapor-pressure curve of liquid manganese, together with heat, entropy, and free energy of vaporization.

†TP 687. Exploration, Composition, and Washing, Burning, and Gas-Producer Tests of a Coal Occurring Near Coaldale, Esmeralda County, Nev., by Albert L. Toenges, Louis Turnbull, James M. Schopf, H. F. Yancey, K. A. Johnson, M. R. Geer, and L. L. Newman. 1946. 79 pp., 21 figs. Wartime investigation of coal deposits near Coaldale, Esmeralda County, Nev., to provide fuel for nearby Army camps and for local consumption revealed that conditions were not favorable for development of coal mines in that area. Coal had a high ash content, and its use in industrial stokers and gas producers was largely a matter of economics. Gives complete information on exploration, origin, and constitution of the coal deposits, and results of washing, industrial and domestic stoker burning, and gasification tests, with chemical analyses, logs, and numerous tables and illustrations.

†TP 688. Thermodynamic Properties of Ammonium and Potassium Alums and Related Substances, with Reference to Extraction of Alumina from Clay and Alunite, by K. K. Kelley, C. H. Shomate, F. E. Young, B. F. Naylor, A. E. Salo, and E. H. Huffman. 1946. 104 pp., 8 figs. Assembles and correlates basic thermal data available for compounds in the ammonium alum and potassium alum systems. Shows energy requirements and relationships in extracting alumina from clay and alunite.

†TP 689. Washing Characteristics of the Pittsburgh Coal in a High-Sulfur Area in Greene County, Pa., by Thomas Fraser and William L. Crentz. 1946. 85 pp., 36 figs., 10 data sheets. Gives results of intensive study of characteristics of coal in a typical area of Greene County to obtain information on sulfur content and degree to which it can be reduced by washing.

TP 690. Hydrogenation and Liquefaction of Coal. V. Characterization of Light Oil, by E. H. Kaplan, H. H. Storch, and Milton Orchin. 1946. 18 pp., 5 figs. Paper shows that main product of the hydrogenations is heavy oil and that the light oil represents 6 percent of the coal used. Gives a summary of the approximate composition of the light oil. This paper is a preliminary characterization of light oil, and further work will be done utilizing chemical and spectroscopic methods as well as physical constants to identify individual components. (See also TP 622, 642, 646, and 654.) 10 cents.

†TP 691. Carbonizing Properties of Eagle-Bed Coal from Prospect Shaft, Carbon, Kanawha County, W. Va., by D. A. Reynolds, J. D. Davis, W. H. Ode, R. E. Brewer, and G. W. Birge. 1946. 43 pp., 23 figs. Gives results of a study of the composition and carbonizing properties of Eagle-bed coal. Investigation included chemical and physical tests, carbonization tests by the BM–AGA method, expansion tests, oxidation tests, and assays at low and high temperatures. Bibliography included.

TP 692. Carbonizing Properties of Western Coals, by D. A. Reynolds, J. D. Davis, R. E. Brewer, W. H. Ode, D. E. Wolfson, and G. W. Birge. 1946. 79 pp., 13 figs. Gives results of a study of composition and carbonizing properties of 106 coals from 7 Western States. Investigation included carbonization tests by BM–AGA method, plasticity tests, agglutinating tests, and laboratory assays at low and high temperatures. Bibliography included. 20 cents.

†TP 693. Yields and Properties of Gases from BM–AGA Carbonization Tests at 900° C., by D. E. Wolfson and D. A. Reynolds. 1946. 12 pp., 2 figs. Bureau of Mines-American Gas Association (BM–AGA) carbonization test has been used to determine carbonizing properties of a large number of American coals, and yields of coke, gas, tar, and light oil at low, medium, and high temperatures are measured by this method. Correlates yields and properties of high-temperature-carbonization gas with rank of coal.

†TP 694. Prospecting for Mineralization in Steeply Dipping Beds Covered by Glacial Till, Talus, and Weathered Zones, by F. W. Lee, H. L. Scharon, and C. H. Sandberg. 1946. 19 pp., 14 figs. Describes electrical prospecting technique tested in the field for prospecting for mineral deposits covered by glacial till, sediments, and volcanics. Explains and discusses details of methods of applying technique and gives results of field tests in the Kirkland Lake area of Canada and in the Newtown Flats area of California.

†TP 695. Carbonizing Properties of Velva Lignite from Ward County, N. Dak., and Monarch Coal from Sheridan County, Wyo., by D. A. Reynolds, J. D. Davis, W. H. Ode, D. E. Wolfson, and G. W. Birge. 1946. 41 pp., 17 figs. Gives results of tests to determine carbonizing properties of Velva lignite and Monarch coal. Investigation included chemical tests of carbonization tests by BM–AGA method, plasticity tests, and agglutinating tests, and assays were made on Monarch coal.

†TP 696. Analyses of Arizona, California, Idaho, Nevada, and Oregon Coals. 1947. 83 pp., 4 figs. Gives analytical data showing composition and quality of coal, by States; of interest to producers, consumers, and general public. Includes brief description of geologic structure of coal basins, typical mining conditions in districts, and principal economic data of the industry.

†TP 697. Carbonizing Properties of Elkhorn No. 3-Bed Coal from Wheelwright Mine, Floyd County, Ky., by D. A. Reynolds, J. D. Davis, R. E. Brewer, W. H. Ode, and D. E. Wolfson. 1947. 41 pp., 20 figs. Gives results of a study of composition and carbonizing properties of Elkhorn No. 3-bed coal from Wheelwright mine, Wheelwright, Floyd County, Ky. Investigation included carbonization tests by BM–AGA method, plasticity tests, agglutinating tests, and assays at low and high temperatures. Bibliography included.

†TP 698. Bibliography of Bureau of Mines Investigations of Coal and Its Products, 1940 to 1945, by A. C. Fieldner, P. L. Fisher, and Marjorie B. Pollock. 1947. 53 pp. Supplements TP 576 and 639. Lists more than 500 reports by members of the Bureau (including those published by the Bureau, by journals of various societies, and by the technical and trade press). Contains index by subjects and authors.

TP 699. Exploration, Reserves, Bed Characteristics, and Strip-Mining Possibilities of a Lignite Deposit

†Out of print.

Near Toledo, Lewis County, Wash., by Albert L. Toenges, Louis A. Turnbull, and Willard A. Cole. 1947. 55 pp., 13 figs. Reconnaissance of an area in Lewis County, Wash., indicated a large bed of lignite that could be mined by strip methods; opening of a large mine in this area would supply fuel to Portland, Oreg., Tacoma, Wash., and other nearby centers. 35 cents.

TP 700. Analyses of Michigan, North Dakota, South Dakota, and Texas Coals, 1948. 106 pp., 5 figs. Gives analytical data that show composition and quality of coal, including lignite, by States. Discusses coal fields, mining methods, and production, distribution, and use of coal. 35 cents.

TP 701. Preparation Characteristics of Maryland Coals, by W. L. Crentz and Thomas Fraser. 1947. 65 pp., 27 figs. A study of preparation characteristics of lower coal beds underlying Pittsburgh (Big Vein) bed in Maryland was undertaken to determine minable reserves and characteristics of these low-volatile coals and to extend the life of the coal-mining industry in this State. Gives washing characteristics of coals. 15 cents.

TP 702. Effect of Oxidation Upon the Carbonizing Properties of Pocahontas No. 3- and No. 4-Bed Coals from Eastgulf, Raleigh County, W. Va., by J. D. Davis, D. A. Reynolds, R. E. Brewer, B. W. Naugle, and D. E. Wolfson. 1947. 18 pp., 2 figs. Gives results of an investigation of effects of oxidation upon carbonizing properties of Pocahontas No. 3 and No. 4 coals. Study included chemical analyses, plasticity tests, agglutinating tests, carbonization tests by BM–AGA method, and expansion tests. Bibliography included. 10 cents.

TP 703. Carbonizing Properties of Hill-Bed Coal from Hickey No. 1 Mine on Lookout Mountain, Cherokee County, Ala., by J. D. Davis, D. A. Reynolds, W. H. Ode, R. E. Brewer, D. E. Wolfson, and G. W. Birge. 1947. 40 pp., 22 figs. Gives properties of coal from Hill bed and yields and properties of byproducts of carbonization. 15 cents.

TP 704. Dust Problems in the Mines of the Pennsylvania Anthracite Region, by Leland H. Johnson. 1947. 34 pp., 23 figs. Adequate ventilation and liberal use of water sprays are two best ways to control coal-dust hazards in anthracite mines and protect workers from dreaded respiratory disease known as anthracosilicosis, according to this publication covering a survey of dust conditions in 38 collieries in the Pennsylvania anthracite region. Discusses individual protection against dust and most efficient types of water pipelines, sprays, and pumps. Includes routine dust sampling and analyzing, use of a wet-type pneumatic drilling machine, removal of coal and rock dust from roadways, and use of water in fighting mine fires and removing harmful gases from blasting. 15 cents.

†TP 705. Bibliography of Bureau of Mines Publications Dealing with Health and Safety in the Mineral and Allied Industries, 1910–46, by Sara J. Davenport. 1948. 154 pp. Publications on health and safety in the mineral and allied industries, prepared in the Bureau during the past 28 years, are described briefly. There are 1,684 publications listed under such headings as accidents in the mineral industries, accident statistics, dusts, explosives, equipment, fires and explosions, first aid and mine rescue, gases and vapors, health and safety in the petroleum industry, radium, respiratory protective devices, safe practices, safety investigations, smoke abatement, stream pollution, tunneling, and ventilation. A subject index and an author index are included. (See also B 558.)

†Out of print.

TP 706. Analyses of Iowa Coals. 1949. 65 pp., 2 figs. Gives analytical data showing composition and quality of coals and discusses coal fields, mining methods, and production, distribution and use of coal. 25 cents.

TP 707. Minable Reserves, Petrography, Chemical Characteristics, and Washibility Tests of Coal Occurring in the Coos Bay Coal Field, Coos County, Oreg., by Albert L. Toenges, James J. Dowd, Louis A. Turnbull, J. M. Schopf, H. M. Cooper, R. F. Abernethy, H. F. Yancey, and M. R. Geer. 1948. 56 pp., 18 figs. Describes the mines, outcrops, and prospects examined in the Coos Bay area. Washability tests on Beaver Hill coal indicate that the coal can be washed successfully with a yield of approximately 80 percent. Appendix contains detailed logs of cores from all holes drilled and results of chemical analyses of coal cores recovered. 50 cents.

†TP 708. Aromatic Cyclodehydrogenation, by M. Orchin, L. Reggel, R. A. Friedel, and E. O. Woolfolk. 1948. 40 pp., 15 figs. Presents a comprehensive review of experiments that have been performed in the Synthetic Liquid Fuels laboratory of the Bureau in obtaining highly condensed aromatic compounds from compounds of a simpler structure, which were produced during the carbonization and hydrogenation of coal.

TP 709. Synthetic Liquid Fuels From Hydrogenation of Carbon Monoxide. Part 1—Review of Literature; Bureau of Mines Research on Effect of Catalyst Preparation, Reduction, and Induction Procedures on Activity; Correlation of Physical Properties of the Catalysts With Their Activity, by H. H. Storch, R. B. Anderson, L. J. E. Hofer, C. O. Hawk, H. C. Anderson, and N. Golumbic. 1948. 213 pp., 47 figs. Production of gasoline, diesel oil, and wax by the catalytic hydrogenation of carbon monoxide was developed and applied on a large scale in Germany during the period 1932–45. Process was greatly improved by industrial development work in United States during 1938–44. Contains detailed record of experimental work done in 1943 to 1946 on the effect of mode of catalyst preparation, reduction, and induction on activity in the synthesis and on boiling range of the product and includes data on the X-ray diffraction patterns, magnetic susceptibility, surface area, and porosity of the catalysts. Detailed indexes. (See also B 578.) 50 cents.

TP 710. Acid Mine Water in the Anthracite Region of Pennsylvania, by E. W. Felegy, L. H. Johnson, and J. Westfield. 1948. 49 pp., 13 figs. Determines the effect of acid mine drainage on the receiving streams at the present time and indicates the effect on the streams if any program for mine-flood prevention or control is undertaken in the future. Includes analyses of water samples. 15 cents.

TP 711. Carbonizing Properties of No. 5 Block-Bed Coal From No. 5 Mine, Montcoal, Raleigh County, W. Va., and of Pocahontas No. 6-Bed Coal From Birdseye Mine, Sewell, Fayette County, W. Va., by J. D. Davis, D. A. Reynolds, R. E. Brewer, D. E. Wolfson, and W. H. Ode. 1949. 65 pp., 42 figs. Provides data needed to determine suitability of No. 5 Block coal, a high-volatile A coal, and Pocahontas No. 6 coal, a medium-volatile coal, for production of coke, gas, and byproducts in manufactured-gas plants or byproduct coke ovens. 20 cents.

TP 712. Carbonizing Properties of Beckley-Bed Coal From Stanaford No. 1 Mine, Mount Hope, Raleigh County, W. Va., by J. D. Davis, D. A. Reynolds, R. E. Brewer, D. E. Wolfson, W. H. Ode, and G. W. Birge. 1949. 38 pp., 19 figs. Describes carbonizing properties of Beckley-bed coal and gives results of tests at various temperatures, effects of blending Beckley-bed coal with Pittsburgh-bed coal, properties of re-

covered products, and results of assay-distillation tests. Includes bibliography. 15 cents.

TP 713. The Coal Industry of Brazil. Part 1. General Economy, Production, and Marketing, by John E. Good, Alvaro Abreu, and Thomas Fraser. 1949. 38 pp., 11 figs. Although it has ample coal reserves, Brazil depends heavily upon imported coals to meet its expanding industrialization and rising costs of substitute fuels, according to results of a cooperative survey of coal industry in Brazil. At request of Brazilian Government, survey was conducted to investigate methods for increasing domestic coal production by American coal specialists of Board of Economic Warfare and Foreign Economic Administration and was completed by Foreign Minerals Branch of Bureau of Mines. General economy, production, and marketing of coal in Brazil are described. 20 cents.

TP 713. The Coal Industry of Brazil. Part 2. Technology of Mining and Preparation, by John E. Good, Alvaro Abreu, and Thomas Fraser. 1951. 110 pp., 46 figs. For many years to come, Brazil will rely chiefly on coal for energy even though hydroelectric power potentials are tremendous in that country, according to this report of a cooperative survey of the coal industry in Brazil, conducted at request of Brazilian Government. The organization of the industry, natural conditions affecting mining, plants, mining systems, working methods, ventilation, illumination, mine safety measures, preparation practice, and labor are described. 65 cents.

†TP 714. Amine Volatility and Alkalinity in Relation to Corrosion Control in Steam Heating Systems, by A. A. Berk and J. Nigon. 1948. 63 pp., 15 figs. First report on series of studies of chemical treatment of boiler water to control corrosion in steam heating systems. Tests described were conducted with Army Engineers at an Army post where the central heating plant served an area about one-third of a mile square. Describes steam system of post and presents and discusses data gathered during six test runs. Gives recommendations regarding the volatility and alkalinity of amines most desirable under varying conditions.

TP 715. A Method of Resolving Oil-Field-Waste Emulsions, by J. W. Horne and J. Wade Watkins. 1949. 47 pp., 23 figs. Describes study undertaken to find method of recovering a valuable oil from pit-waste emulsions and to discover additional sources of microcrystalline (high-melting-point) waxes. Method of resolving such emulsions and thereby recovering oil was developed in Bureau of Mines laboratory and perfected in field pilot plant. Discusses laboratory tests and analyses that differ from standard methods. Includes photomicrographs illustrating physical characteristics of emulsions, recovered oils, and waxes and shows demulsification reactions. Work done in cooperation with Kansas State Board of Health under special cooperative agreements with Cities Service Oil Co., Bartlesville, Okla., and Bareco Oil Co., Barnsdall, Okla. 50 cents.

TP 716. Tests on the Ignition of Natural Gas-Air Mixtures by Permissible Explosives in the Experimental Coal Mine, by H. P. Greenwald, H. C. Howarth, John Nagy, and Irving Hartmann. 1949. 38 pp., 15 figs. Describes tests made to determine whether the charge limit for permissible explosives used in coal mines could be increased with safety from 1.5 to 3 pounds per shothole to facilitate increase in production of coal. Between 1943 and 1947, 654 tests were made in Bureau's Experimental coal mine at Bruceton, Pa., with charges of explosive fired in presence of an explosive mixture of natural gas and air. 15 cents.

†Out of print.

TP 717. Asphalts From Rocky Mountain Crude Oils: Laboratory Preparation and Comparison, by K. E. Stanfield and Rethel L. Hubbard. 1949. 77 pp., 22 figs. Discusses preparation and testing by standard methods of a series of straight-run asphalts prepared from each of 25 different crude oils. In all, 117 asphalts were prepared; each was analyzed by separation into 3 constituents—asphaltenes, oils, and resins. Discusses crude oils used in investigation, preparation of asphalts, methods of testing, experimental data, and temperature susceptibility. Prepared in cooperation with University of Wyoming. 25 cents.

TP 718. Chemical and Thermomagnetic Studies on Iron Catalysts for Synthesis of Hydrocarbons, by H. Pichler and H. Merkel, translated by Ruth Brinkley, with preface and foreword by L. J. E. Hofer. 1949. 108 pp., 56 figs. Contains many of the data supporting recent German views on importance of carbides in iron Fischer-Tropsch catalysts. This study is, to date, the only extensive experimental series of investigations of changes occurring in catalyst structure during induction and synthesis. 25 cents.

TP 719. Investigation of Coal Deposits in the Fairview and Coal City Basins, Coosa Field, St. Clair County, Ala.; Reserves, Petrography, and Chemical Properties of Coals; Washability Characteristics of Coal From Fairview Bed; and Geology of Area, by Albert L. Toenges, Louis A. Turnbull, Theodore R. Jolley, Joseph J. Shields, H. L. Smith, H. J. O'Donnell, H. M. Cooper, R. F. Abernethy, B. W. Gandrud, H. L. Riley, and Howard E. Rothrock. 1949. 104 pp., 24 figs. Gives results of Bureau's diamond drilling in Coosa field, with descriptions of reserves, chemical properties of coals, and geology of area. 50 cents.

TP 720. Carbonizing Properties of Lower Banner Coal From No. 56 Mine, Dante, Russell County, Va. by J. D. Davis, D. A. Reynolds, R. E. Brewer, W. H. Ode, B. W. Naugle, and D. E. Wolfson. 1949. 45 pp., 23 figs. Gives results of carbonization and assay-distillation tests and describes geology and occurrence, chemical properties, friability and agglutinating value, and plastic properties of Lower Banner coal. Includes bibliography. 20 cents.

TP 721. Reserves, Petrographic and Chemical Characteristics, and Carbonizing Properties of Coal Occurring South of Dry Fork of Minnesota Creek, Gunnison County, Near Paonia, Colo., and the Geology of the Area, by Albert L. Toenges, James J. Dowd, Louis A. Turnbull, J. D. Davis, H. L. Smith, and Vard H. Johnson. 1949. 48 pp., 17 figs. An area south of Dry Fork of Minnesota Creek was investigated by diamond drilling to determine whether the coal was suitable for manufacture of metallurgical coke and the reserves of coal in area. Describes investigation and gives reserves, petrographic and chemical characteristics, and carbonizing properties of coal occurring in area. 30 cents.

†TP 722. Composition of Petroleum: Properties of Distillates to 600° F., by W. C. Holliman, H. M. Smith, C. M. McKinney, and C. R. Sponsler. 1950. 55 pp., 16 figs. Presents data concerning determined properties and computed functions of 10 selected crude oils and their distillate fractions and describes apparatus and methods of testing. Also presents Bureau of Mines routine analyses of the same crude oils.

†TP 723. Semipilot-Plant Tests on Treatment of Manganese-Silver Ores by the Dithionate Process, by S. F. Ravitz, A. E. Back, K. E. Tame, W. F. Wyman, and J. F. Dewey. 1949. 45 pp., 7 figs. Gives results of pilot-plant research in recovering manganese and silver from native low-grade ores

by dithionate process and describes pilot-plant equipment and operating procedures.

TP 724. Preparation Characteristics of Illinois Coals, by William L. Crentz. 1949. 112 pp., 63 figs. Reports washability and screen analyses of important Illinois coals, showing quality of product that results when raw coal is subjected to preparatory treatment. 30 cents.

TP 725. Investigation of Lower Coal Beds in Georges Creek and North Part of Upper Potomac Basins, Allegany and Garrett Counties, Md.: Reserves, Petrographic and Chemical Characteristics of Coals, and Stratigraphy of Area, by Albert L. Toenges, Louis A. Turnbull, Lloyd Williams, H. L. Smith, H. J. O'Donnell, H. M. Cooper, R. F. Abernethy, and Karl M. Waage. 1949. 142 pp., 31 figs. (With maps in box.) Gives results of Bureau's diamond drilling in lower coal beds in Georges Creek and north part of Upper Potomac Basins, with descriptions of reserves and chemical and petrographic properties of coal. $4.75.

TP 726. Carbonizing Properties of Thick Freeport and Pittsburgh Coals From Pennsylvania, Elkhorn Coal From Kentucky, and America and Mary Lee Coals From Alabama, by J. D. Davis, D. A. Reynolds, B. W. Naugle, D. E. Wolfson, and G. W. Birge. Application of BM-AGA Carbonization Tests Results to Byproduct Practice, by C. H. Flickinger and J. P. Graham. 1949. 58 pp., 27 figs. Presents results of carbonization tests on nine coals from beds in Pennsylvania, Kentucky, and Alabama. Includes observations on correlation of these carbonization tests and yields with results obtained in commercial slot-type coke ovens. 20 cents.

TP 727. Water Pools in Pennsylvania Anthracite Mines, by S. H. Ash, W. L. Eaton, Karl Hughes, W. M. Romischer, and J. Westfield. 1949. 78 pp., 50 figs. Disclosed results of survey made in 1945–48 by Bureau engineers of the number and size of underground water pools in anthracite region. Includes maps, plans, cross sections, and longitudinal sections of the underground water pools. 55 cents.