

70. *Engineering Index*. Abstracts of Amer. papers in this international series pub. by ASME since 1918, preceded by J. B. Johnson's series of less but growing coverage. The starting count, 775 papers, is the yearly average for the vol. covering 1884-91, and is plotted for the midpoint, 1887.5. Similarly for the next vols., 1896-1900 and 1901-1905, after which came other editors and single year volumes. The Amer. and foreign papers were sample-counted for the years up to 1905 and for 1907, 1914, 1919, 1926, 1935, 1943, 1952, and 1961; for the other years since 1907 the total papers were reckoned and the Amer. share est. by interpolation. Final figure 16,460 Amer. papers.

72. Engineering Students, in professional courses, from U.S. *Biennial Survey of Educ.*, 1900-1954. Previous figures were est. from data of B. B. Burritt: *Prof. Distrib. of Coll. & Univ. Graduates*, U.S. Bur. of Educ. *Bull.* 19 of 1912, p. 143, for the ultimate profession of graduates of 37 colleges, assuming that his destined engineers continued the same ratio to the Engineering students in college as in 1900, when it was .0495. Data smoothed. 1954-60 from W. E. Tolliver and H. H. Armstrong: *Engg. Enrollments & Degrees in Instits. with ECPD-Accredited Curriculums*: 1960; in *Jol. of Engg. Ed.* 51:470, increased by 4.4% to consist with prev. 1954 fig. for all engg. students. 1960 figure 248,000 students.

73. Engineering doctorates. 1927-35 from Nat. Research Council, *Reprint & Circ. Ser.* 1933-49 from *Biennial Survey of Educ.* 1950-9 from Nat. Research Council, Office of Sci. Personnel, for NSF: *The Sci. Doctorates of 1958 & 1959*, p. 25. 1960, 1961 from *Stat. Abstract*. 1961 figure is 1,009.

74. Chemical and Physical Doctorates. Ph. D.'s conferred in Chem., from *Stat. Abstract* and from *Sci. Doctorates*, N 73; earlier from *U.S. Biennial Survey of Educ.*; J. E. Zanetti: *Census of Grad. Research Students in Chem.*, Nat. Res. Council, *Reprint & Circ. Ser.* v. 54, 1924; C. J. West and C. Hull: *Doctorates Conferred in the Arts & Scis. in Amer. Univs.*, same ser., Nos. 42 and 105; 1898-1912 from *Science*, Aug. articles of those years. Phys. doctorates also from U.S. Bur. of Labor Stat. *Bull.* No. 1144: *Employment Outlook for Physicists*. For both scis. in 1954-61 *Sci. Doctorates and Stat. Abstract*, as in N. 73. 1898 figures: 27 in Chem., 11 in Phys., both probably unduly small in the earliest years, when Americans often got the degree abroad.

77. Blank, D. M., & G. J. Stigler: *The Demand & Supply of Scientific Personnel*; Nat. Bur. of Ec. Res., 1957, 200 pp., using census data on professions, p. 5.

79. Chemists; 3-year moving average, annual, from data furnished by the Soc. 1961 figure, 93,637 memberships.

80. Physicists; 3-year moving average for 1918-54. From Amer. Phys. Soc.'s *Bull.* 30:15, October 1955, and from correspondence. 1962 figure is 18,570.

81. *Eng. Societies Yearbook*, 1948, and later data come from Engrs. Jt. Council and IEEE. There is doubtless some duplication between memberships, and inclusion of some foreigners, about 1-6%, exc. in the AIME where they have risen to 18%, and omission of many engineers who are members only of the specialized societies, as of motion picture or refrigeration engineers, esp. in modern times. 1960 membership, 302,850.

82. The Nat. Sci. Foundn's Deutsch & Shea Research Rept. (NSF 60-62) estimates 875,000 engineers for January 1961. For 1960 the Nat. Register of Scientists found 20,882 Physicists, 53,071 Chemists, and 29,315 Engineers. NSF: *Sci. Manpower Bull.*, April 1962. Cf. also Engrs. Jt. Council, Spec. Survey Com'ee: *Demand for Engg. Grads. in 1956*; *Elec. Engg.* 75:886-9, 1956.

Scientists and engrs. increased to 16-fold in 1870-1910, and to 85-fold by 1950, acc. to *Sci. & Personnel Res.*, N 74, pp. 6,7.

84. U.S. NSF: *Scientific Personnel Resources*, 1955, 86 pp. p. 7 and table A-4.

85. U.S. NSF: *Sci. & Engg. in Amer. Indus.*, Final rept. on a 1953-4 Survey, prepared by Bur. of Lab. Stat., 119 pp. Table A-14 used here. Also in N 84, p. 14.

86. U.S. NSF: *Revs. of Data on R&D*, August 1961, p. 4.

87. U.S. NSF: *Scientific & Tec. Personnel in Amer. Indus.*, rept. on a 1959 Survey, 66 pp., p. 21.

89. Chemical Patents, by U.S. to all nationalities, from Stafford (N 156 pp. 507, 517) and by correspondence. His chem. patents embrace 39 Pat. Office classes, incl. petroleum and rubber. 1916 granted 5,632.

90. Papers by Americans per year, in all pertinent sciences and Engg.; last figure on the solid line is 52,735 papers. The dotted line shows the presumed course had mil. secrecy not supervened.

96. Machlup, F.: *The Supply of Inventors and Inventions*: in *Rate* etc., N 46, pp. 143-67, and in *Weltwirtschaftliches Archiv* 85: No. 2, 1960.

97. Sanders, B. S.: *Some Difficulties in Measuring Inventive Activity*: in *Rate* etc., N 46, pp. 53-77, p. 57 ftN.