

of thousands of technical writers, editors, and abstractors, who were contemporaries of those inventions and discoveries, throughout the whole epoch. We have sought to do this in charts 1-3, by counting the abstracts of scientific papers that seem to have been authored by Americans, mostly on inventions, or chemical or physical discoveries such as lead to inventions, published since the several starts of the international journals of abstracts, *Chemical Abstracts*⁶⁷ and its older German contemporary *Chemisches Zentralblatt*,⁶⁷ (chart 2), likewise *Physical Abstracts*⁶⁸ with its predecessors (chart 3), *Electrical Engineering Abstracts*⁶⁹ (chart 2), *Nuclear Science Abstracts*^{69a} (chart 2), and *Engineering Index*⁷⁰ (chart 1). It might be objected that these notices on articles, just as with patents, deal mostly with unimportant inventions and discoveries, and often repetitiously, rather than with the few important inventions. Actually, a great invention or discovery always attains expression in a multitude of minor items, so that repetition helps us by weighting the important. And we think that repetition is likely to be a factor fairly constant through time, and therefore permissible to ignore.

[61] To the foregoing tallies of reports on inventions and discoveries, and of the men and money devoted to making them, let us now add three counts of the men training to man the inventive professions. We can find data on three types of students who can probably serve as fairly good indices of the whole, data sufficiently uniform and going back to 1883 for Engineering Students^{71, 72} on chart 1, Engineering Doctorates⁷³ conferred only since 1922, on chart 3, Physics Doctorates⁷⁴ conferred, on chart 1 back to 1899, and Chemistry Doctorates⁷⁴ on chart 2. Such men are largely inventors, as we detail in ¶ 63. Since our preparation of these data Blank and Stigler⁷⁵ have presented much more on the education and census counts of our technologists, by year; and Melman⁶⁵ as noted (¶ 59) has used professional counts from the Census and reports on research and development, for comparison with the rate of patenting.

[62] Finally, let us add indices of the sorts of men working to produce most of the inventive progress, viz., the chemists, on chart 2, represented by the membership of the American Chemical Society,⁷⁶ the physicists⁸⁰ in the American Physical Society (chart 2) and the engineers. For the last we have added together on chart 3 the members of the five oldest and largest engineering societies.⁸¹ Such men are presumably a more intellectual and inventive group than those belonging to no major society. Our five associations are the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Mining, Metallurgical, and Petroleum Engineers, American Institute of Chemical Engineers, and the Institute of Electrical and Electronics Engineers, including its two principal predecessors, the American Institute of Electrical Engineers, and the Institute of Radio Engineers. These include altogether about 340,000 of the 875,000 engineers estimated to be in the country.⁸² We hesitate to use the Census counts of "engineers" because of doubt about what the word meant in each decade.⁸³ The omission of the 130

⁷¹ Engineering students as well as doctorates were counted because the last degree was not awarded until about 1910.

⁸² The 1950 census reported 261,428 engineers in the experienced labor force, and 245,288 so employed, while the subtotals for experienced civil, electrical, and mechanical engineers were 2.47 times greater than for the three corresponding societies. "Chemists, assayers and metallurgists" were censused as 60,000 experienced and 57,000 employed.