

not have risen so much as the largely scientific *ensemble* reflected in our indices. Dr. R. E. Wilson suggests that perhaps modern inventing looks so far ahead that a 17-year patent is less attractive than formerly.¹¹²

[96] It may be that the generally steep rises we have recorded reflect further large social factors—the great efflorescence of higher education, which should help inventors, the larger scale of businesses, often reaching monopoly or oligopoly; more tendencies and means to communicate; permitting, and even encouraging employees to publish articles; and as to patenting, a more social rather than competitive outlook. But such trends, especially toward more education in science, might be expected to foster invention. And comparison of the various indices does not bear out this theory. Still it seems quite possible that our indices would not climb quite so high if they did not reflect so much of science, and possibly other social trends, and not just invention proper.

[97] Yet there can be no doubt that science, especially Physics, Chemistry, and Metallurgy, is a basis for further inventions. And we must not forget two other important considerations that would make our graphs steeper than drawn, viz., the increasing percentage of our physicists, chemists, and engineers who are employed in the laboratories rather than in less inventive occupations (§ 63, 64) and their being helped by a fast growing supplement of subprofessional-grade assistants (§ 58).

[98] The possibility of a vertiginous rise in invention, such as the 105- or 345-fold indicated (reduced to 29- or 100-fold by the pertinent population growth) is explainable partly by the mathematical theory of combinations and permutations. The more elements of technology and science are known, the more of different new combinations and permutations can be made from them, in steeply stepped up ratio. This does not oblige invention, but invites it. On the other hand, the multifarious proliferation of data and past work to be considered, with the growing requirement of scientific training to master it, tend to make inventing harder (§ 80-84), as economists have pointed out,¹¹³ although this tendency is countered by developments in documentation (bibliography), team research, and longer education. More population and still more inventors in the world would also increase *duplication* of work (countered by communication). Cf. also § 81, 82.

[99] Wilson¹¹² thinks that basic science, for all its rise, has probably, through insufficient cultivation, failed to advance as rapidly as its applicability invites, hence retarding technic progress, below the still vertiginous upsurge that we observe in both science and invention.

[100] The average invention might become more scientific and yet less valuable, and less impressive. The great economic principle of diminishing returns would suggest that as we have come to spend (as demonstrated) vastly more dollars on invention, the marginal dollar spent would bring a product of declining utility, even if the efficiency of the inventors did not fall off as per § 80 when far more men are drawn into the profession. The year 1867 gave us the telephone;¹¹⁵

¹¹² By Danl. Drawbaugh, according to a whole village-full of witnesses, whose unanimous testimony the Supreme Court nonetheless brushed aside (by 4 to 3), because D. was an obscure tinkering and had been slow to assert his claim. The 1876 telephone claims of A. G. Bell, simultaneously rivaled also by Elisha Gray, present apparently an extraordinary history, both of duplicate inventing and most successful patent chicanery: told, with citation of court cases and Government claims, by Petro, *ftN* 9, pp. 354-71. Cf. also § 285 & *ftN* 291.