

and still more the physicists, lest the engineers swamp our index, though they should indeed predominate in the early decades, according to the history of invention in America. Accordingly, we assign weights of 1 to an engineer, 3 to a chemist and 6 to a physicist. The original percentages according to our data, with the assigned weights and resultant proportions, may be read off from table 4,⁹² below, for each of the 3 professions, at 4 different periods.

[75] Among the students preparing for the three professions, engineering students naturally vastly outnumber the Ph. D.'s in Chemistry and Physics, and are far less significant per capita for invention, since they include many who went to college but a year or two, and who never made an invention, joined a professional society, nor realized any ambition but to operate machines or instruments. So for each one of them we weight the Doctors 150 in Chemistry and 187 in Physics, and thus preserve some influence in our combined index, for these sciences whose discoveries, particularly physical, are so pervasively potent for enabling further invention (principle 2). We have also lagged these educational data, in chart 4 though not in the earlier charts, so as to apply them to the later period when those students would have become most active in invention and discovery—15 years later for engineering students and 11 years for the Doctors.⁹³ The resultant subtotal lines of chart 4 are more strikingly straight and parallel than before.

[76] Next we apply the same general principles of weighted averaging to obtain our index of Input, or Inventive Effort (chart 4). To the measures of technical schooling (lagged), and of society membership, which somewhat duplicate each other, we give a weight of 1 each. From 1920 on we have what should be the best single index on inventive effort, the total Professional Staff employed on organized R&D. So we give this a weight of 3, making it a three-fifths factor in the totals from 1925 on. To connect it up with the prior data we in effect, for the averaging purpose only, slide it up the page just enough so that its 1920 foot settles at the average of the others. This

⁹² See the following table:

TABLE 4.—Original proportions and weighting for Chart 4

[For preparing the subtotals, of society members, and of technical schooling lagged. 4 sample years.]

Year	Engineering			Chemistry			Physics		
	Percent found	Weight	Resulting per-cent	Per-cent found	Weight	Resulting per-cent	Per-cent found	Weight	Resulting per-cent
1880	Society members, 84.6	1	64.7	15.4	3	35.3	-----	-----	-----
1910	Society members, 77.2	1	50.8	20.6	3	40.6	2.2	6	8.6
	Technical schooling, 99.6	1	60.2	.3	150	26.7	.1	187	13.0
1920	Society members, 72.8	1	46.5	24.8	3	45.3	2.4	6	8.2
	Technical schooling, 99.7	1	57.4	.3	150	25.8	.06	187	16.7
1955	Society members, 64.8	1	34.0	30.3	3	50.2	4.8	6	15.8
	Technical schooling, 99.4	1	50.4	.44	150	33.8	.17	187	15.8

⁹³ A survey of the Am. Chem. Soc. reported the average age at entry into the profession as 23, and the median age of members as 36. The chemical doctors in *Am Men of Sci.* got their degree at 25 (mean av.), the writer finds. 36—25=11. *Chem. & Engg. N.* 34:1731-81, 1956.