

often may be almost a pure engineering achievement--this leads to much confusion.

This has led to a great misunderstanding by the high-school vocational advisers, and by students themselves from reading non-technical magazines and the press. This is already serious.

On figure 13 we see the year by year figures for the supply of scientists and engineers which underlies the totals reflected in the previous figure. It reveals the fact that the already short annual supply of engineers increased by 18-1/2 percent while scientists increased by 105 percent. It used to be said that it takes three engineers to put into practice the work of one scientist. The problem this presents should be obvious.

Figure 14 shows a percentage distribution of funds for R. & D. by source and industry. It is interesting that only two industries shown have to use more government funds for research than they have funds of their own. We also notice that one of these is electronics, and that the other is missiles and aircraft. This hardly deserves comment.

However it is interesting that a huge industry like petroleum, which is truly enormous, as well as worldwide in its operations, supports almost wholly their own research and development, although they take some contracts principally to cooperate with the Government. Thus when the Government feels it cannot get anybody with all the capability as competent, then they do it.

Figure 15 was done by a scientist for the fifth Coleman lecture at the Franklin Institute. This is the way a scientist sees it. It expresses a very interesting and profound idea, but I will try to point out in a minute one of its limitations.

Back in history at the time of the great British scientist Farraday, who was the discoverer of electromagnetic phenomena, no one knew how to make a device to exploit it. It was 40 years from the time he discovered it till the year it was commercially used. That is the year Thomas Edison built his first electric station at Pearl Street in New York. There were no companies using commercial generators of electricity and there were no commercial motors or electric lighting in general use. Edison accomplished that, 40 years after Farraday developed the underlying science.