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Research Man or Engineer?

A Discussion of the Selection of Men for Research

By L. A. HAWKINS*

This article is the conclusion of the lecture: Management of Engineering Developments and Research, which was given by Mr. Hawkins on October 27 at the University Chapel as a part of the program of Management Week. It is unfortunate that we do not have space to publish the entire lecture for it was certainly of interest to the man who contemplates research.

In the last part of his lecture, Mr. Hawkins discusses the selection of men for research work, comparing the talents required for scientific research with those necessary to the successful engineer. This part seems to be of particular interest to those students who face the choice between practical engineering or research. The entire lecture will be published in the minutes of Management week, and we recommend it to our readers.

I have left to the last the discussion of the most difficult and also the most important of an industrial laboratory's problems,—the selection of the personnel. I have already said that the foremost factor in the success of a laboratory is its director. Next to him in importance, far outweighing organization plans, facilities, or accounting methods, is the quality of the research staff. First class research men are much rarer than first class engineers. Research and engineering require different aptitudes for success.

In our experience we have seldom found in one man special aptitude for both engineering and research. The mental attitude required is wholly different. The successful engineer is the type that likes to deal with certainties. He likes to utilize materials whose properties he knows and has confidence in, and to produce therefrom concrete results in the way of new structures, new devices. He likes to see the tangible result of his labors. The research man is primarily interested in the unknown. He seldom has the patience to carry a new idea through to a finished design. He differs from the engineer as the explorer differs from those who follow him to develop what he has found. The ceaseless urge toward the unknown which marks the research man is well expressed in Kipling's poem "The Explorer" —

"Till a voice, as bad as conscience, rang interminable changes
On one everlasting whisper, day and night repeated; so—
Something hidden. Go and find it. Go and look behind the ranges,
Something lost behind the ranges. Lost and waiting for you. Go!"

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It is this restlessness in the fact of the unknown, which Kipling elsewhere characterizes as "satiableness curiosity," that drives the research man to continual experiment. If an engineer is temperamentally inclined to experimentation, he cannot too often "obey that impulse" without jeopardizing the conservatism of his designs.

Again, the research man needs the habit of questioning everything, of seeing the unknown in the familiar. Herbert Spencer in his autobiography attributed whatever eminence he attained in philosophy to the inculcation in him as a boy, by his father, of the practice of taking nothing for granted but of seeking the why and how of everything.

The same habit is needed for successful research. Just as, to the poet, the "primrose by the river's brim" was something more, so to the research man the commonplace phenomenon must shout its question. Newton's falling apple and Watt's dancing kettle lid may be apochryphal, but they are none the less veridical. They typify the significance of the commonplace to the mind having natural aptitude for research.

The engineer, for economic reasons, must be a devotee of standardization. His interest in the exceptional is in bringing it into conformity with standards. To the research man the exceptional is an inspiration and a guiding light. He is ever on the lookout for it, and when he finds it he seeks to develop its peculiarities to the fullest extent. It was by observing the slight difference in weight between atmospheric and chemically prepared nitrogen that Lord Rayleigh was led to the discovery of argon. It was said of Charles Darwin that he possessed to an exceptional degree "the power of never letting exceptions pass unnoticed."

In the relative importance of optimism and balanced judgment, research and engineering are far apart. There is no vocation in which optimism is more essential than in research. It is easy to think of many reasons why a proposed experiment would be futile, but the man who makes the discoveries is the man who goes ahead and tries it just the same. Lord Kelvin said in 1896 that man could never fly in a heavier-than-air machine. In 1900 it was authoritatively declared that the incandescent lamp with carbon filament as perfected by Edison could never be improved. In each case the accomplished fact followed closely on the heels of the denial of its possibility. No truth in metallurgy seemed more firmly established than the utter refractoriness and unworkability of tungsten, but tungsten wire is now being drawn at speeds of two hundred feet a minute and down to a diameter of a seventh of that of a human hair. Optimism to research is what vitamins are to the animal organism.

In the engineer, optimism is of value, but it must be sternly ruled by sound judgment. He

has not the safeguard of the research man, whose optimism, if excessive, is promptly and harmlessly checked by laboratory experiment. The engineer's mistakes, like the doctor's, may be disastrous to others, and, since, unlike the doctor, he cannot bury them, they are disastrous to the engineer himself.

Imagination, but of different types, is an important asset to both research man and engineer. The research man's imagination should be of the philosophical type, to enable him to co-ordinate his observations into hypotheses for experimental verification or disproof. The engineer, too, should be able "to see things," but the pictures his imagination is called upon to draw are usually of the tangible, mental presentations of the devices he is to design. The imagination that depicts a Liberty motor or a Roosevelt dam has a technique different from that used in dealing with the quantum of Planck or the atom of Bohr.

Of course there are many characteristics which should be possessed by both the research man and the engineer, but these are mostly characteristics essential in any profession, such as intellectual honesty, clear thinking, industry, resourcefulness, perseverance, etc. What I have tried to do is to bring out those features which distinguish the true research man from the successful engineer. Now suppose we should list them and ask anyone who was ignorant of the nature of our discussion what vocation would require such aptitudes. The list is, an intellectual restlessness, the ability to see wonders in the commonplace, quick perception of, and interest in, the exceptional, a high optimism, and a philosophic imagination. Might not a probable answer be that we were listing the attributes of a poet? And does this mean that great research men, like great poets, are born, not made? Is a Faraday as impossible to produce by education as a Shakespeare, a J. J. Thomson as a Robert Browning? I do not know. I know only that, just as there are hundreds capable of writing acceptable magazine verse, to one who is capable of great poetry, so there are hundreds who can do useful laboratory work to one who can blaze the trail into a broad new land of knowledge. I know that there is a great over-supply of men who wish to work in laboratories, and a great dearth of truly capable research men. How far education can redress this unbalanced state of things is not for me to attempt to say. I wish only to express the hope that the growth of research work in the colleges and universities will lead to a more general appreciation of its requirements, a quicker perception of real research ability in students, and a better opportunity to encourage and develop that ability.

For the man with real aptitude and the requisite scientific training, research is by far the most attractive field I know. The successful research man may gain no greater financial rewards than the successful members of other professions, but in his work he shares with the artist the joy of creation, with the explorer the thrill of continual new discovery, with the scholar the zest of intellectual struggle and the triumph of intellectual achievement, and with the philanthropist the satisfaction of contributing to humanity's welfare. The problem of research management is not how

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to hold its best research men, but how to find them in the first place.

We need more and greater research centers in our universities, centers where there are such able men and such keen scientific endeavor as to attract and inspire the ablest students. Sir William Osler, in relating how during his life-time the center of medical research shifted from Vienna to Berlin, pointed out that this was the result of the presence at Berlin of two or three great men, and said, "Where the devotion, not the numbers, of her worshippers is greatest; where the incense rises highest from her altar; there Science builds her temple." The greatest need of American industry today is the presence of a goodly number of such temples in American universities.

L. A. Hawkins.

 NOT NEEDED

Merchant—"Before I engage you, you will have to pass an intelligence test."

Girl Candidate—"Intelligence test? Why, the advertisement said you wanted a stenographer."

 IT'S ALL THE SAME TO HIM

Passers-by—"Dear me, my good man, did you fall down the steps?"

Drunk—"Yea, but it's all right. I was going down anyway."