

to research methods obtained by engagement on selected research projects. This should carry individual responsibility under the direct supervision of a senior research engineer.

The report concludes with a group of sub-sections offering suggestions as to the structure of apprentice associations, hostel accommodation and the provision of library and study facilities. An appendix gives in tabular form a summary of typical programmes for graduates in a variety of branches of the electrical industry.

There is no revolutionary change in practice in the recommendations of this report. On the other hand, it does provide for balanced schemes of training for sections of the industry in which in the past there was little such provision. It is important to recognize that the British system of education and training differs quite materially from the corresponding systems for professional engineers in the United States, Western Europe and the U.S.S.R. The graduate apprenticeship as it is understood in Britain is not a feature of American industry. On the continent of Europe the five and a half year course of the technical college comprises some of the material which the British graduate acquires during his practical training. All these systems are no doubt open to criticism on one ground or another, but equally they all work comparatively well. It is probably wise in Britain to accept the proverbial virtue in diversity and to endeavour to mould something which has a long native tradition to meet modern requirements. At the same time, when British industry has to meet intense competition in world markets and is experiencing a severe shortage of scientific man-power, it is of supreme importance that the practical training of engineering graduates should be soundly conceived and efficiently executed. The report on the training of graduates which has been produced by the Institution of Electrical Engineers is a most welcome aid to national self-criticism in this important matter. It is, however, not unjustified to ask whether, in the engineering industry as a whole, the profound character of the changes which are taking place have been fully recognized in relation to their effects on training. Nuclear energy, the application of semi-conductors and the use of high-speed electronic computers indicate some of the ways in which fundamental science will increasingly influence engineering practice. Is not this factor one which should affect most strongly the development of engineering training in the immediate future?

THE LIFE AND WORKS OF ARCHIMEDES

Archimedes

By E. J. Dijksterhuis. (*Acta Historica Scientiarum Naturalium et Medicinalium*, Vol. 12.) Pp. 422. (Copenhagen: Ejnar Munksgaard, 1956.) 68 kronor.

IT is curious how few facts of real importance are known about the life and parentage of Archimedes, while the trivial story of his leaping out of his bath shouting "Heureka" is familiar to every schoolboy.

The first record of it, however, is in the works of Vitruvius, written about two hundred years after Archimedes's death, so that there was ample time for the story to have been embroidered, even if it is not a pure invention. It is much the same with the account of his launching a large ship single-handed, saying, "Give me a place to stand on and I will move the earth", and with the myth that he burned the Roman fleet by using mirrors on a sunny day.

These traditional stories, and others, are critically considered in Prof. E. J. Dijksterhuis's book and traced to their original sources; but this constitutes little more than one-twentieth of his book. The rest is a translation of all the known works of Archimedes, preceded by a short account of the origin and history of the various texts and codices. It makes clear what a tremendous contribution Archimedes made to geometry, astronomy, mensuration, statics and hydrostatics, and how very near he came to a formulation of the integral calculus. The method by which he determined the ratio of the circumference of the circle to its diameter by calculating the perimeter of the circumscribed polygon of 96 sides to arrive at his approximate value of $22/7$ can be followed with interest.

Comparison of this new translation with that which Sir Thomas Heath made sixty years ago is inevitable. Prof. Dijksterhuis smooths the way of the reader by including a long preliminary chapter called "The Elements of the Work of Archimedes", in which he collects the basic ideas and elementary propositions which will be applied in the subsequent works. This allows him later to omit some of those introductory and subsidiary propositions which might obscure the main line of Archimedes's argument. In some cases, too, he omits propositions which are redundant because Archimedes proves both the general, as well as a particular, case. At the same time, he continuously adds his own comments where necessary and explains Archimedes's line of attack, whereas Heath produced a more literal and complete translation of the original Greek, confining his explanations mainly to his introductory chapters and making little comment in the translated text.

In his book on the growth and establishment of the mechanical explanation of physical phenomena (called "Die Mechanisierung des Weltbildes"), Dijksterhuis showed his understanding of the processes of thought of early philosophers, and his comments in this translation do much to shed light on those of Archimedes.

The work under review first appeared in Dutch between 1938 and 1944, and Miss C. Dikshoorn has here translated it into English. The English is almost, but not quite, perfect. A further small criticism is that the English reader would, I think, prefer Roman to Greek lettering on the geometrical diagrams, and he will not find the notation generally quite so familiar as that used by Heath. As references in the text are given to earlier chapters and sections rather than pages, it would have been a convenience if the number of the chapter had been printed at the top of each page.

Prof. Dijksterhuis's book will appeal to those with a general knowledge of mathematics who are interested to learn about the methods and achievements of Archimedes, and because Heath's book is long since out of print this new version of the works is to be welcomed.

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