

### Research in Industry.

IN a lecture on "Research in Industry and Rationalisation", delivered before the Society of Swedish Engineers in Great Britain on May 27, Mr. Axel Y. Enström discussed the way in which research and rationalisation have become indispensable factors for the economic development of industry. Science and research have now come to be marshalled among the working tools of industry in daily use, and the post-War period can supply many examples of the fruitful association of scientific and industrial research. Mr. Enström considers that Sweden's ability to attain a position in the world's markets has largely depended on the purposeful incorporation of scientific research, well-equipped laboratories, and a highly qualified staff with her industrial activity. There are now in Sweden about fifty works' research laboratories, which employ some six hundred persons and represent all the large industrial undertakings. The total cost of the industrial research carried on in Sweden is probably about four to five million crowns.

Discussing the special characteristics of scientific and technical research, Mr. Enström suggested that spontaneous research, such as Röntgen's discovery of the Röntgen rays, is typical of the former, and the systematic research which Hertz based on Maxwell's equations is typical of the latter. Even in systematic research, however, fundamental or scientific research, as well as a high standard of scientific technique, may be essential. Disregard of fundamental scientific principles may lead to enormous waste in technical research, especially in experimental plant work. After such technical investigations on a metallurgical process in Sweden, involving an outlay of several millions, had been abandoned as fruitless, scientific investigations on the interaction of ore particles and gases yielded a solution. The importance in technical research of a thorough knowledge of the fundamental physical and chemical sciences cannot be overstressed, but such a combination is difficult to find.

Other factors in technical research which may eliminate much wastage of time and labour are mathematical analysis of the possibilities at an early stage in the investigations, and the thorough study of the information already existing either in the literature or in technical sources before experimental work is undertaken. Related to these factors is the standard of experimental technique of the investigator and his knowledge of the possibilities and limitations of that technique. Similar qualities are increasingly involved in technical analysis and process control, and the essential factor in all the scientific control and development of industry may thus be briefly described as clear thinking.

In this description it is easy to include rationalisation, which, like technical research, aims at improving, increasing, or cheapening production. While suggesting that discussion as to whether the continued displacement of labour by machinery is justifiable is premature, Mr. Enström considered that rationalisation must progress with natural necessity. We have no general view of the correct proportion between direct production for consumption and production of machinery or tools. Economic history suggests that equilibrium is continually re established on a fresh basis when the proportion is disturbed. Standardisation is an important element in rationalisation, and the research work on manufacturing processes not only leads to standardisation of processes and improved efficiency but also may frequently have a far-reaching rationalising effect. The application of scientific principles and methods of investigation to industrial problems inevitably leads sooner or later to the application of the same principles and methods to the conduct of the whole industry. Technical research and scientific management are thus two important aspects of rationalisation, and the future of industry largely depends on our ability to produce industrial leaders competent to evaluate these factors, with the economic, social, and other factors involved.

### The Flying Fox in Australia.

TWO years ago, Mr. F. N. Ratcliffe was appointed by the Commonwealth Council for Scientific and Industrial Research to obtain for it as complete a picture as possible of the flying fox (*Pteropus* spp.) population of Queensland and New South Wales, its significance and extent, the relations of the different species one to another, the nature and cause of their migrations, the individual and collective habits of the animals, and the extent and value of the economic losses involved. Fruit-growers had at times complained loudly of orchard depredation by this pest and demanded governmental action to exterminate it. The Council was somewhat sceptical about the alleged facts: hence this inquiry, which received financial support from the Commonwealth, New South Wales, and Queensland Governments. Mr. Ratcliffe has now completed his work, and furnished to the Council a report which is not only most interesting reading but also is admirably fearless in its criticism of current ideas and practices.

Four species of flying fox are found in Australia: *poliocephalus*, *Gouldi*, *conspicillatus*, and *scapulatus*. They are practically confined to coastal areas, and their numbers, which cannot be accurately assessed, must amount to many millions in the numerous 'camps' scattered along a north-south stretch of some two thousand miles. There has, no doubt, been

a diminution in numbers as settlement has progressed in New South Wales and South Queensland, the present population amounting probably to only about half that of early days. As in the past, so to-day, the principal food of all species is undoubtedly blossom, chiefly of eucalypts, and Mr. Ratcliffe has been forced to the conclusion that the current opinion that the fox is guilty of appalling destruction in fruit plantations is a gross exaggeration, so far at least as the commercial fruit crop of Queensland is concerned. Attacks on orchards are more an indication of general food shortage than evidence that cultivated fruit is an essential part of the animal's food supply. Such fruits as bananas, pineapples, citrus, pawpaws, and apples are, as a matter of fact, too hard for the weak dentition of the little red fox (*P. scapulatus*), which is equal in numbers to all the other species put together. *P. poliocephalus*, however, finds no difficulty in attacking these, when ripe: though here again it is important to remember that normally all these fruits, except perhaps citrus, should be picked for market while still unripe and therefore unattractive to the foxes. In other words, if the growers harvest these particular crops in satisfactory fashion, the loss to the commercial fruit industry in Queensland resulting from flying fox infestation should be almost trifling.

One must not forget, however, that what may be