SUMMARIES OF ADDRESSES OF PRESIDENTS OF SECTIONS

PHYSICS AND TECHNOLOGY

IN his presidential address to Section A (Mathematics and Physics), Sir George Thomson stresses the need for more young people to be trained in physics and mathematics, since these branches of science are becoming increasingly important in technology. Advances are being made within existing technologies by using devices based on physics and on methods depending on mathematical, especially statistical, analysis, and fresh branches of technology are arising which depend on new scientific discoveries. In industry to-day there are both engineers and physicists, and the number of physicists is increasing exponentially. The value of the physicist to the industrialist lies in the fact that he is prepared to look at things from first principles, to try a variety of quite different modes of attack and to get the thing to work somehow, though the product he makes is likely to be scrappy and to go wrong. The engineer uses his background of experience of design to tidy this product up and to make something which can be used by the ordinary person.

In the early days, technology owed little to science—the smelting of metals, for example, was discovered before science existed. Physics, too, arose largely from curiosity—the study of odd phenomena like the reflexion of one's face in a pool or the attraction of rubbed amber for pieces of chaff. Nevertheless, there was always some interplay between technology and science, as witness the impetus given to the study of heat by the invention of the steam engine. But the real influence of physics on technology started with the advent of electricity. From Faraday came the dynamo; from Maxwell and Hertz radio; and from J. J. Thomson the television tube; and in many of our newer industries based on physical processes the physicist is still the one in charge. Technology thus owes a considerable debt to physics; but this debt has largely been repaid, for without the many machines and devices, such as the mechanical vacuum pump and the innumerable electronic components which technology has developed, progress in physics would have been impossible.

Four particular applications of physics are singled out by Sir George for discussion: the peaceful uses of nuclear energy; the electronic computer; the transistor; and the earth-satellite to be launched by the United States during 1957. First in importance in the peaceful applications of nuclear energy is the production of electricity. Nuclear energy, at present, can be applied only in the form of heat. The reactor, in which the chain reaction takes place by which the uranium or plutonium atoms are split with the release of enormous amounts of heat, is essentially a furnace the heat from which must be transformed by some conventional method into electricity. In the Calder Hall piles, for example, the heat is removed by carbon dioxide gas, transferred through heat exchangers to water and steam, and the steam goes into turbines which drive the dynamos generating the electricity to be fed into the national grid system. In accordance with the programme for the development of nuclear energy in Britain, it is expected that, by 1975, 40 per cent of the, by then, considerably increased generation of electricity in Great Britain will come from nuclear power, thus saving approximately 40 million tons of coal per annum. Only a small part of the cost of the new power will be represented by the uranium fuel, and it is considered that there need be no fears about the possible future shortage of fissile material, whether this be natural uranium or obtained from thorium in a breeder reactor. Sir George forecasts that in the not very distant future electrical energy will be derived directly from the thermonuclear reaction between deuterium nuclei (the basis of the hydrogen bomb), thus eliminating the inefficient heat engine which must occur in the uranium system.

The chief limitation to the wide application of nuclear power is the cumbrous, though essential, radiation shield. This may rule out the nuclear-powered motor-car and possibly also the nuclear-powered aeroplane, since for an Atlantic crossing the saving in weight of fuel through using nuclear power would be balanced by the added weight of the necessary biological shield.

Turning to the use of radioisotopes, Sir George cites two examples, one from medicine of the use of sodium-24 to determine the rate of flow of blood, and the other from engineering of the measure of wear of a bearing.

The electronic computer, because of its versatility and wide range of application in science, medicine and commerce, is considered by Sir George to be comparable in importance to nuclear energy. Its importance arises from, first, its power of discrimination, that is, its ability to influence itself by what itself has found, and second, its speed and the consequent large number of operations it can perform in a given time. The transistor is a device consisting of a minute slice of germanium or silicon, replacing in many cases the thermionic valve, with the added advantage of great reduction in size and probably cost of electronic equipment. It was the result of research in pure physics.

The proposed earth-satellite is regarded by Sir George as an admirable example of the interplay of physics and technology. Its immediate purpose is to make measurements outside the Earth's atmosphere; but it is hoped that it will lead to the overcoming of gravity so that men may travel to other planets. The spherical satellite, some 20 lb. in weight, will be launched by a three-stage rocket and move at a height of 300 miles around the Earth at a speed of nearly 18,000 miles per hour, where it should stay for several weeks sending out continuous messages of the measurements it is taking.

STEEL-MAKING SINCE BESSEMER

SIR CHARLES GOODEVE'S presidential address to Section B (Chemistry) discusses the chain of chemical development which was started by Bessemer, namely, the making of steel by pneumatic processes. The problem to-day is the same as that faced by Bessemer: the preferential deoxidation of the iron oxides in ore with the minimum of other elements, followed by the preferential oxidation under different conditions of the other elements in the impure metal. The usual deoxidizing element is carbon in the form