education but also for industrial research. The right of an individual to expect advances in his living standards, or even to expect to maintain them at their present level, must depend upon his willingness to co-operate in productivity.

Besides the main addresses at the Conference a number of sectional meetings were held to discuss topics like the closed shop, the development of sandwich courses, liberal education and technical training, the recruitment and training of young workers and the cost and changing place of fringe benefits in salary and wage agreements. The latter was addressed by J. Simons, a director of the Package Sealing Co. (Export) Ltd., who showed how the term 'fringe benefits' is one that has crept into industrial jargon in recent years to describe all those items other than hard cash in the pay packet which are of tangible value to employees, whether they cost real money or not to the employer. Two main factors which have brought about this situation are: the influence of taxation on earnings, and competition for labour in the period of full employment that has existed since the War. The first factor has had particular effect on the value of benefits attached to appointments at high executive level where tax becomes heavy. At these levels the provision of supplementary or 'top hat' pension schemes, substantial life assurance, education grants, and even the provision of housing, become important items in the total assessment. The second factor, competition for labour, accounts for the fact that initiative to add to fringe benefits has tended to come from management, rather than from trade unions, though the latter have brought pressure to bear on a number of factors, particularly holidays with pay, compensation for redundancy, guaranteed work-week, and in more recent years, pensions.

Though the provision of fringe benefits has grown in the past twenty years, it is still seldom that one finds them mentioned specifically in employment agreements as part of the contract of employment, even for executive appointments, and still less at operative-levels. Items within the field of fringe benefits are beginning to feature more and more in negotiated agreements between unions and selected industries.

In examining the costs of fringe benefits a number of aspects have to be considered. No clear picture has yet emerged on the correlation between the size of the company and the cash value per employee of the benefits provided; there is, however, some indication that the larger the industrial unit the greater is the range—and hence the cost per employee—of the benefits available.

One survey covered some sixty companies of varying size. It directed attention to the wide variation in the cost of certain items (pension, sick pay, life insurance, canteen subsidies and travelling allowances). For these items, the variation in cost among the companies covered by the survey was as follows:

Percentage of companies covered by the survey	Cost of all fringe benefits as per cent of total pay-roll
9	under 2½
14	2½–5
28	5–10
18	10–20
12	20–30
3	over 30
16	not disclosed

A more recent survey covering some fifty companies showed that the total cost of benefits varies between 12 and 25 per cent of the total employee remuneration —the median being just under 15 per cent.

In those cases where the cost is high, the biggest single item is usually pension contributions; it is here that many companies could secure better value for their money than they do. Those concerns that have made a close study of the provision of pensions, and have established internal funds with wide investment powers, are better placed to keep pace with inflation than those with insured schemes, and usually at lower cost.

The way to control 'fringe benefit' costs might be to predetermine an overall cost factor expressed as a percentage of the pay-roll, and from the proceeds to cover the costs of those benefits which the company, as a matter of good business policy, would wish to provide, leaving the residue to be used on additional benefits of the employees' own choice. It would have the merit of creating in the minds of both employers and employees a greater awareness that the provision of benefits costs money and that such costs require to be controlled. Such an arrangement would have the merit of controlling the costs of benefits in the simplest possible way; it would take them out of the realm of miscellaneous overheads and enable them to be treated as a definite cost item in the same way as wages and salaries.

MEASUREMENT AND CONTROL IN ELECTRICAL ENGINEERING

THE ever-widening interests and knowledge of electrical engineers as a body have their effects on the organization and division of the activities of the Institution of Electrical Engineers. Originally founded as the Society of Telegraph Engineers in 1871, it soon became necessary to indicate its wider interests by a change of name, first to the Society of Telegraph Engineers and Electricians in 1880 and then in 1888 to the Institution of Electrical Engineers.

Later it became necessary to make administrative provision for the presentation of specialist papers, and the Meter and Instrument Section came into being in 1928. Like its parent body, the interests of this specialized Section widened year by year, and its name was changed first to the Measurement Section and later to the Measurement and Control Section.

The most recent change is the institution of five panels concerned with particular aspects of the activities of this Section. Mr. J. K. Webb, in his address as chairman of the Section, delivered at the Institution on October 4, has most appropriately directed attention to recent technical advances in the branches of knowledge covered by the separate panels.

The first panel is concerned with fundamentals, standards and laboratory measurements, and Mr. Webb pays his tribute to the M.K.S. system while skilfully avoiding the more controversial aspects of the subject. The accuracy of definition of the fundamental units of mass, length and time has now been brought to about one part in 10^9 for mass, one part in 10^8 for length and one part in 10^{11} or better for time. Enthusiasts for new systems of units who

favour a single arbitrary standard in place of the present three will have no difficulty in selecting time for this purpose.

The accuracy of establishment of the electrical units is perhaps somewhat disappointing, being about 1,000 times worse than the lowest accuracy of the fundamental units. It is therefore interesting that consideration should be given to the possibility of establishing a calculable standard of capacitance. To obtain an improvement in the establishment of electrical units by this method, it will be necessary to measure a capacitance of the order of 1 $\mu\mu$F. to an accuracy of 1 $\mu\mu\mu$F.—no mean feat of measurement.

The second panel is concerned with materials and components and there can be little doubt that Mr. Webb was justified in selecting, as the feature of greatest interest at the present time, the commercial production of germanium and silicon with impurity contents of less than one part in 10^8.

Measuring techniques, devices and instruments are covered by the third panel. This is a wide field where choice would be difficult. However, electrical joints occur in most electrical apparatus, sometimes in very great numbers.

The soldered joint made by a skilled operative has been long established and is still of great value, but occasionally a dry joint is obtained which may give trouble. Wrapped joints have now been developed, with a life expectancy of forty years, which can be made by unskilled operatives at great speed. The bound joint is an interesting variant in which wires of various diameters are bound together with binding wire of fixed diameter. This should simplify the design of wrapping tools.

The fourth panel is concerned with data processing, including analogue and digital computers. A vital component of the computer is the memory, which is often either a magnetic tape, a magnetic drum or a large number of magnetic elements such as ferrite toroids or straight magnetic wires.

The latest development involves the trapping of magnetic flux in a superconductor. This method holds out the hope of providing an access time about 1,000 times less than the fastest of the magnetic devices, but as the necessary equipment includes a helium liquefier the capital and operating costs of the memory may prove to be very high.

The fifth panel covers servo-mechanisms and control systems, a subject of some antiquity but one in which recent developments have occurred at a great rate.

The sensitivity and speed of response of modern servo-mechanisms are aptly illustrated by the possibility of controlling a magnetic field so that a piece of iron is held stationary between the upward pull of the field and the downward pull of gravity. Satisfactory damping has been achieved for this device.

A useful list of references is an unusual addition to a chairman's address, making it possible for the interested reader to go deeper into any subject of special interest to him. A. H. M. ARNOLD

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, NEW ZEALAND

ANNUAL REPORT

THE annual report* for the year ended March 31, 1958, of the Department of Scientific and Industrial Research, New Zealand, includes the usual statement by the Minister, the brief report of the Council and the longer report of the Secretary, together with reports from the branches and incorporated research associations. Some notes are included on grant-aided research at Canterbury Agricultural College, the Cawthron Institute, Massey Agricultural College and the University of Canterbury Industrial Development Department. Lists of publications are appended to the various departmental reports. Substantial effort was again devoted to the work of the International Geophysical Year, and a senior officer of the Department visited the New Zealand territories in the Pacific Islands to assess the agricultural problems to be solved if production is to meet the requirements of growing populations and satisfy the need for modern services and amenities.

Expenditure in 1957–58 was £1,535,000 gross, compared with £1,404,000 in 1956–57, the latter figure being 0·137 per cent of the national product. The Council believes that the future development of New Zealand depends very materially on scientific research and development, and urges that the percentage of national income should be increasing and not decreasing: during 1949–50 it was 0·173 per cent of the national product, and during 1951–52, 0·152 per cent. The professional staff of the Department at March 31, 1958, was 383, compared with 369 in the previous year, but was nineteen fewer than six years previously. In particular, the need to increase the work in nuclear science carried out by the Division of Nuclear Sciences and by the universities is emphasized, and the Council, after considering the position, envisages expenditure of some £500,000 to install and operate equipment to meet New Zealand's needs. Grants to research and allied institutions totalled £141,031, including £30,000 to universities and colleges of agriculture, and the Council is also concerned to extend the assistance at present given to industry.

The Secretary's report is mainly concerned with research completed during the year and includes a fairly full summary of the scientific activity in the Ross Dependency and in connexion with the International Geophysical Year. Scientific assistance given to the Police Department has included the use of paper chromatography for the separation and identification of barbiturates. The Philips electron microscope was installed at the Dominion Physical Laboratory in April 1958. The radiocarbon technique has been used to examine an ocean profile from the New Caledonian Trench, and preliminary investigations indicate that the method can also be used to study the circulation time and direction of underground water flow at Wairakei, while a

* Report of the Department of Scientific and Industrial Research for the year ended 31 March, 1958. Pp. 90 (H.34.) (Wellington, Government Printer, 1958.)