cent of the science graduates and 3·9 per cent of those in technology) going into the Scientific Civil Service; 7·5 per cent went into commerce, 4·2 per cent into the universities, 4·1 per cent took up law, and 3·6 per cent went into local government service, including 8·3 per cent of the technologists. Of the technologists, 45·4 per cent went into manufacturing industry, 8·8 per cent into building, contracting and civil engineering, 6·5 per cent became consultant engineers and 6·1 per cent entered public utilities.

Industry claimed the highest proportion (23·7 per cent) of first-class honours graduates as well as second-class honours men (20·8 per cent) and 26·4 per cent of others, but over the past four years lost about 10 per cent of its entrants; the Scientific Civil Service claimed 11·0 per cent of first-class honours men and 5·5 per cent of those with second-class honours. Since 1950 it has lost 7 per cent of its intake. The universities, however, which claimed 17·8 per cent of first-class honours men, increased their share of graduates by nearly 4 per cent, whereas school teaching, which by contrast only attracted 2·8 per cent of first-class honours men in mathematics and science, 4·6 per cent of second-class honours men and 10·3 per cent of others (the corresponding figures for arts men being 6·5, 20·6 and 15·2) lost 7 per cent of its original entrants.

Commerce lost 25 per cent of the graduates who started in it; but in general there was a high degree of stability in occupation. Figures for the research associations, which took 2·9 per cent of the science graduates (as compared with 6·0 per cent for the universities) or 1·4 per cent of first-class and 1·7 per cent of second-class honours men, do not suggest that they absorb as yet any considerable proportion of the country's scientific man-power, but rather that their influence may be out of proportion to the numbers, like that of the universities, owing to the high quality.

ENGINEERING RESEARCH IN THE IMPERIAL COLLEGE, LONDON

THE report on research work in the City and Guilds College, 1952–55*, which represents engineering within the Imperial College of Science and Technology, London, where the number of engineering students now exceeds a thousand, appears appropriately when the expansion of the College is being widely discussed in relation to the need for engineers in Britain. Intended for the non-specialist and arranged in six sections, the report gives a readable and illustrated account of the many-sided contribution to national welfare and industrial advance which is already coming from the Departments of Aeronautics, Chemical, Civil, Electrical and Mechanical Engineering and Mathematics. In supersonics, while much effort has gone to the design of the new supersonic wind tunnel for the Roderic Hill Building, some theoretical work has been done on the pressures and forces acting on aircraft fuselages as they move through the air at supersonic speeds; detailed measurements are being made in a 5 ft. × 1 ft. wind tunnel on a jet ejected normal to a stream to determine how and why the jet turns along wind. General methods of analysis of aircraft structures have been developed, including the effects of non-linear elastic behaviour of materials and initial strains which arise with non-uniform heating of a structure. A systematic programme of tests over the past two years on riveted and redux-bonded joints indicates that the glued joints have better fatigue properties than their riveted equivalents, and that alloys of high static strength currently used in aircraft structures may be inferior under repeated loadings, particularly in regions of high-stress concentrations, such as joints, to the lower-strength alloys.

In chemical engineering, in connexion with the design of plant for purifying and liquefying natural gas on a large scale, the physical properties of the gas mixtures present are being further investigated, and an experimental plant has been erected for studying the distillation of liquid air. Problems of mass-transfer in solid–gas, solid–liquid, gas–liquid, and liquid–liquid systems, the drying characteristics of solids, the sedimentation of concentrated suspensions of particles in a liquid, fluidization of particles by means of an upward current of liquid, and transport by means of a gas or liquid are also being investigated, and an apparatus has been set up for studying both the sublimation of pure solids and the technical process of freeze-drying. The growth of an organic crystal from the melt has been investigated by a method in which the growth of individual faces is measured directly with a travelling microscope. The compressibilities of mixtures of steam and carbon dioxide have been measured up to 100 atmospheres and 650° C. In the high-speed fluid kinetics laboratory, the high-pressure supersonic flow through nozzles and the design of such nozzles for hot and cold gases are being studied, as well as the formation and disintegration of jets and sheets and the design of nozzles for atomization. Methods for concentrating low-grade iron ores have been examined, and an experimental technique has been designed for subjecting typical blast-furnace charges to the conditions they would encounter in descending the furnace. Other researches have been concerned with the basic chemical physics of gases and vapours, the melting of crystals containing organic molecules, mechanical wear and lubrication, the abrasion of copper and iron surfaces, flame spectroscopy and the accurate and detailed analysis of the peroxides, aldehydes, ketones, olefins and other intermediate products in the oxidation of hydrocarbons; and a fruitful study has been made of engine crank-case explosions.

In civil engineering, in connexion with the design of a large arch dam to be constructed at Dokan, Iraq, on a tributary of the Tigris, the elastic equations governing the stress distribution have for the first time been solved numerically, and the work assisted and confirmed by experimental methods using a material which has only recently become available. Work on thin-walled rectangular box girders conducted for the British Shipbuilding Research Association confirmed that introduction of expansion joints is a practice to be avoided. The Department has also fostered the application of simplified models to the analysis of building frames. Much work has been done on the fundamental strength and deformation characteristics of both reinforced and pre-stressed concrete framework members. Experiments on curved channels have yielded far-reaching results, and definite progress has been made in studying the movement of sediment along a river bed. Of particular interest are the work on the action of wind

* Imperial College of Science and Technology (University of London). Report on research work in the City and Guilds College, 1952–55. Pp. ii+61. (London: Imperial College of Science and Technology, 1955.)

on a water surface, bearing directly on the North Sea floods of 1953, and the construction in the laboratory of a model of the Lynmouth valley with which a relation was established between the quantities of water flowing through the model and the corresponding water-levels. The resulting estimate of the flood was used by the engineer advising on the reconstruction of the damaged parts of Lynmouth. Further investigation of spillways, the fundamental and practical aspects of the shear strength of soils, the stability of earth dams and of clay slopes in railway, road and canal cuttings, the settlement of buildings, the sedimentation of water or sewage, the filtration of water through sand, and a continuing physical, chemical and biological study of new impounding reservoirs are other subjects in which the investigations of the Department directly impinge on public health or safety.

In the Department of Electrical Engineering, studies have been made of the effect of eddy currents in unlaminated materials in electrical machines, of cross-magnetization on the characteristics of a cross-field generator and of saturation and armature reaction on the building-up curve of a d.c. exciter supplying the field-winding of an alternator. Studies in the Power Systems and Computer Laboratories of physical phenomena arising in the transmission and utilization of electrical energy have involved the development of special measuring equipment. Other work has concerned the improvement of methods available for carrying out the numerical calculations required in engineering design and research. Special efforts have been made to develop and extend the statistical methods of control design. The Department has also engaged in research on human perception, especially speech and hearing, as well as various circuit applications of transistors, the distortion of microwaves resulting from the presence of dielectric and conducting cylinders and the determination of the reflexion coefficient of a set of parallel plates similar in form to those used in constructing lens aerials. Work in the Ultrasonics Laboratory is concerned with the behaviour of solids, liquids and gases under the influence of ultrasonic waves of varying frequency. The application of the so-called corona effect of high voltage in dry air has also been studied.

Researches in heat transfer in the Department of Mechanical Engineering have been concerned with the utilization of low-grade heat, with marine condenser tubes, with thermal stresses in steam turbine rotors, and heat transfer to gas turbine blades, as well as with heat transfer from a rotating disk. Other investigations have been concerned with combustion in reciprocating engines, the vibration of propagating flames, combustion in gas turbines and the use of the gas turbine for chemical reactions such as the cracking of methane to acetylene. A theoretical study has been completed of the stresses in and flexibilities of curved pipes, and the axial compression of six expansion bellows of three different types has been examined experimentally by electrical resistance strain-gauge surveys. Some plane strain processes are being examined to determine the region over which plane strain conditions apply, and to establish means for obtaining basic stress–strain curves for metals at deformations much greater than those attainable in the standard tensile test. A programme of research in photoelasticity is concerned with the possible extension of the method to the examination of materials which have been plastically deformed, and under another programme the failure of materials under relatively few cycles of high stress-intensity is being examined with the view of obtaining fundamental knowledge on fatigue as well as design data. Besides the study of the troublesome vibration known as 'oil-whirl' and thin-film lubrication, a vibrational method is being developed for the fatigue testing of metals, and an apparatus has been built for vibrating cantilevers of various shapes in several modes of bending and torsion.

In the Department of Mathematics, a major investigation was concerned with the design of an arch dam, and others with the numerical solution for the flow of a viscous fluid past fixed obstacles, and the temperature distribution in two conductors sliding over one another and generating heat by friction over their area of contact.

SPIRAL PATTERNING OF SOLAR CORPUSCULAR PRECIPITATION

By E. R. HOPE
Defence Research Board of Canada, Ottawa

THE plots of radio blackout distribution in the North American and North Atlantic region, as published by V. Agy[1] and J. H. Meek[2], agree with the isochrons of the 'morning' maximum of magnetic disturbance in the Arctic region, as found by (anonymous) Soviet research[3,4]. Fig. 1 (from ref. 3) shows these isochrons (geographical loci of simultaneous occurrence), which may be explained by a diurnally rotating spiral of solar corpuscular precipitation. Fig. 2 reproduces Agy's Figs. 5 and 6 [1].

To interpret Agy's and Meek's local-time plots, which show peculiar southward lobes centred at about long. 90° W. (as in the right-hand side of Fig. 2), W. R. Piggott[5] tried plotting in G.M.T. the longitudes where the maximum rate of occurrence of blackout (storm-*D* ionization) is found. This plot, extending over the Atlantic-Canada sector only, showed an apparent east-to-west rotation-period of 48 hr., on which basis Piggott suggested that there must be two *D*-region activity centres, separated by 180° of longitude, and rotating around the pole once in two days. Agy[1] then tried changing his local-time plot (Fig. 2, right) to a G.M.T. plot. This eliminated the lobes and clearly displayed the apparent 180° rotation in 24 hr. (Fig. 2, left).

Table 1 shows the G.M.T. isochrons in Fig. 1 and Fig. 2 (left), with the longitudes where they cross the circle of latitude 60° N.

Allowing for the fact that Agy's plot is for the summer season only, while the Russian data are probably for the whole year, the agreement of isochrons 00–14 is excellent. The directions of these isochrons also correspond rather well, as may be judged by visual comparison.