given much thought to the nature of the examinations and administrative tests used for selecting candidates for the higher classes of the Service, but for the majority of candidates a general written examination still seems to be the most objective test of intellectual powers and capacity for self-expression, and, in conjunction with their records, the fairest way of selecting for interviews and group tests.

On the scientific and engineering classes, the Commissioners comment on the distribution of successful candidates among the older and the newer universities and over different parts of the United Kingdom, no university having a share greatly out of proportion to its numbers. While the Commissioners appear to have only moderate success in filling established posts which are notified to them, many of these posts are, in fact, occupied by people in a temporary capacity. This is not a disadvantage to the Scientific Civil Service, as the Zuckerman Report noted, and it is often preferred by the scientist. The recruitment of engineers appears to be less satisfactory although a small number of very good candidates has obtained professional qualifications through departmental student apprenticeship and other schemes. It must be several years before this source contributes significantly to the strength of the professional engineering class and meanwhile in the Works Group, including architects and surveyors, a large proportion of the basic grade vacancies remains unfilled. However, most of the vacancies for posts in grades above the basic level have been filled satisfactorily from competition.

Encouraging results were obtained following the decision to hold separate competitions for scientific staff for the Patent Office, 59 out of 75 declared vacancies being filled by this means in 1961.

Since June 1960 some of the larger departments have had authority to recruit up to half their entitlement of Research Fellows directly, and of 96 Research Fellows recruited in 1960 and 1961, 18 were appointed through departments. During 1961, 10 permanent appointments were made to the scientific officer class through the Interviewing Board, acting jointly for the Civil Service Commission and the Atomic Energy Authority, which visited Canada and the United States to see British scientists who desired to return to the United Kingdom, and 9 Research Fellows were also appointed.

BRITISH UNIVERSITIES DURING 1957–61

UNIVERSITY GRANTS COMMITTEE INTERIM REPORT*

ALTHOUGH the interim report of the University Grants Committee on University Development in the years 1957–61* was published five weeks after the Chief Secretary to the Treasury made his statement on March 14 regarding the recurrent grants for the next quinquennium, it may be assumed that the contents of this report were available to the Government when its decision was taken, and the Committee indeed expresses the hope that the record will be of assistance in considering the provision to be made for the quinquennium 1962–67. The present quinquennium has been one of increasingly rapid development in the universities: student numbers rose by 20 per cent in 1956–61 compared with 2 per cent in 1951–56, and staff by 18·4 per cent. Although total university expenditure rose by 61 per cent compared with 46 per cent and recurrent Treasury grants by 72 per cent, from £28·2 million in 1956–57 to £48·4 million in 1960–61, and non-recurrent grants from £9·1 million to £22·1 million, or 143 per cent, the universities have not been able to achieve all that was hoped for when the grants for the quinquennium were announced in 1957. Besides relatively greater expansion in the pure and applied sciences and in research, the continued decline in the value of money has been an important factor. Building programmes have steadily increased in size since 1957, and although supplementary recurrent grants for the last three years of the quinquennium were approved in 1959 and other supplementary grants to cover the cost of increases in academic salaries in 1957 and 1960 the strain on university finances has been great.

At the beginning of the quinquennium, the Committee's grant list included 21 universities and 3 university colleges; to these the University of Sussex, which first appeared in the grant list in 1960–61, has been added, and the University College of North Staffordshire is applying for a Royal Charter as a university, while authority has been given for the establishment of six more universities. By October 1961 the number of students had grown from 50,000 in 1938–39 and 100,000 in 1958–59 to 111,385 compared with the 102,000 visualized at the time of the quinquennial settlement. Omitting the University of London, with 22,574 full-time students, the Universities of Oxford and Cambridge with 8,800 and 8,934, respectively, and counting separately the two divisions of Durham, the five constituent colleges of the University of Wales, and St. David's College, Lampeter, at October 1961, three of these institutions had less than 500 full-time students; one, 500–999; one, 1,000–1,499; ten, 1,500–1,999; four, 2,000–2,999; three, 3,000–3,999; two, 4,000–4,999; and four, 5,000 and more. Of the 31,671 students entering for the first time in 1961–62, 8,433 were in science, 5,118 in applied science, 2,530 in medicine, 663 in dentistry, 560 in agriculture, and 255 in veterinary science; for 1956–57 the corresponding figures were 5,888; 3,842; 2,441; 692; 562; and 227, respectively. For the distribution of all full-time students by faculties the corresponding percentages were 25·2; 15·2; 11·2; 2·7; 1·8; and 1·1 in 1961; and 22·2; 13·9; 14·4; 3·0; 2·1; and 1·3 in 1956–57, respectively. The Committee is basing its authorizations for building plans on the assumption that this tendency will continue and that two-thirds of the increase in student numbers in the coming years will be in pure and applied science.

Once again the Committee reports that generally the proportion of outstandingly good and outstandingly weak students remained lower, while that of good second-class students was higher than it was

* University Grants Committee. University Development: Interim Report on the years 1957 to 1961. Pp. 28. (Cmd. 1691.) (London: H.M.S.O., 1962.) 1s. 6d. net.

before the War. A further inquiry in 1958–59 into the success or failure of students who entered universities in October 1955 to study arts, pure science, applied science or agriculture and forestry showed that the proportion who left without success on account of academic failure was 9·9 per cent, compared with 11·3 per cent in a similar study for October 1952. The proportion of full-time advanced students continued to increase: in 1960–61 they numbered 17,836 compared with 13,379 in 1956–57, and the proportion of higher degrees to first degrees in pure science was 21·4 per cent, and in applied science 19·6 per cent. Of 11,608 (or 10·8 per cent) full-time students taking courses of a year's duration or longer in 1960–61 coming from homes outside the United Kingdom (compared with 9,907 in 1956–57 and 5,213 in 1938–39) about 60 per cent came from within the Commonwealth, while the British Post-graduate Medical Federation had a further 2,013 students from overseas out of 2,994 taking courses of less than a year.

There has been little change in the proportion of full-time students who live in colleges or halls of residence; although the numbers increased, from 24,652 in 1956–57 to 29,474 in 1960–61, the percentage remained 27·4. On the other hand, both the numbers living in lodgings, and the percentage, increased: from 41,291 in 1956–57 (46·0 per cent) to 54,614 (50·7 per cent) in 1960–61. Moreover, the University Grants Committee points out that the supply of lodgings for university students is becoming exhausted and in some places is likely to contract. The position varies widely, and in 1960–61, 53·4 per cent of full-time students at Cambridge and Oxford lived in colleges or halls of residence and only 1·9 per cent at home; for Scotland, the corresponding figures were 12·4 and 49·3, and for London, 18·3 and 27·9; for other institutions in England and Wales they were 27·6 and 17·2. Nor do these figures indicate the full extent of the variations, from the University College of North Staffordshire, where virtually all students are residential to Birmingham, or the Manchester College of Science and Technology, where almost all students live in lodgings or at home. Lack of capital admittedly has so far prevented the building of more halls of residence, but the University Grants Committee has already pledged fullest possible support for more ample provision for halls of residence in the coming quinquennium.

On academic staff this report merely records an increase in full-time personnel in teaching departments from 10,485 in 1956–57 to 12,921 in the autumn term, 1961; for professors, the corresponding figures are 1,459 and 1,684; for readers, assistant professors and independent lecturers, 757 and 926; for senior lecturers, 4,903 and 1,604; for lecturers, 4,903 and 5,959; and for assistant lecturers and demonstrators, 1,176 and 1,559. These figures do not, however, include staff of the rank of senior lecturer or below at Oxford and Cambridge. The report gives the rates of academic salary current in 1954, 1957 and 1960, but makes no comment beyond indicating that further proposals were submitted to the Chancellor of the Exchequer in July 1961 and that the Chancellor approved a recommendation for revision of the existing scheme for supplementing superannuation benefits which came into effect on April 1, 1960. Incidentally, in a written answer in the House of Commons on April 19, Mr. H. Brooke estimated the cost of the new scales for lecturers and assistant lecturers under the 3 per cent increase in the total salary bill for university teachers at about £1 million a year. At the same time he repeated his view that the university financial position should be reviewed in about two years time.

On income and expenditure generally, the report records an increase in the aggregate income of the universities from £41·656 million in 1956–57 to £67·467 million in 1960–61, of which 69·8 per cent and 72·7 per cent, respectively, was from Parliamentary Grants; 10·8 per cent and 9·4 per cent from fees; 4·0 and 2·8 per cent from endowments; 3·1 per cent and 2·0 per cent from grants from local authorities; 6·5 per cent and 8·9 per cent from payments for research; and 1·2 per cent and 0·6 per cent from donations and subscriptions. Earmarked grants presented a minor feature in the quinquennium, but rose from £11,000 in 1959–60 to £39,230 in 1960–61 and £36,250 in 1961–62; of the latter figure, £8,000 is a contribution to the Institute of Criminology, Cambridge; £12,000 for postgraduate courses in radiobiology at Birmingham; £8,000 for post-graduate courses in conservation studies at University College, London; £4,000 for developments in management studies at Bristol (with a further £1,250 for developments at Cambridge); and £3,000 for postgraduate courses for youth leaders at Manchester. Proposals for increased fees were put to the universities which have proved generally acceptable and will take effect in 1962–63.

Expenditure rose from £41·841 million in 1956–57 to £67·163 million in 1960–61. Of this, administration represented 7·0 per cent and 6·7 per cent, respectively; for salaries and superannuation of teaching staff the corresponding figures are 43·2 and 44·2, respectively; for departmental wages (technicians and laboratory assistants) 11·4 and 11·4; for departmental and laboratory maintenance, 13·1 and 13·8; for repairs and maintenance of buildings, 6·3 and 3·1; and for rates, insurance, heat, light, water, porters' wages, 6·5 and 9·8. Special reference is made to rates, discussion of which was necessitated both by the decision to exclude universities and colleges in receipt of Exchequer grant from the mandatory relief of 50 per cent recommended by the Pritchard Committee and which was given effect by the Rating and Valuation Act, 1961, and also by the uncertainty as to the basis on which university property should be valued. The report does not refer in detail to the test cases which have been proceeding but merely notes the decision that the universities should be reimbursed for their expenditure on rates during the next quinquennium (estimated at £1·5 million in 1961–62) by earmarked grants.

Of the non-recurrent grants totalling £92·363 million for the four years 1957–58 to 1960–61, £69 million was approved for buildings and professional fees, £18·7 million for furniture and equipment and £4·65 million for sites and properties, the actual expenditure for these purposes being £54 million, £10·8 million and £4·7 million, respectively. Of the total, 7 per cent was for buildings associated with arts subjects, 62 per cent for buildings for pure and applied science and 31 per cent for general service buildings such as libraries, student unions, refectories, halls of residence and the like. A major departure from the normal practice of recommending grants only for the initial furnishing and equipping of new accommodation has been in the authorization of provision of about £2 million over a period of years towards the cost of new electronic computers. With the contributions the universities themselves will make, this will ensure that in due course practically all universities will have

their own computers and the one or two others will have access to computers. Besides the action taken in accordance with the recommendations of the Gater Committee and of Sir Arthur Rucker, the University Grants Committee has suggested to universities standards of accommodation of various types on which they can base their applications for grants for new accommodation, and has adopted new methods, based on cost analyses, of assessing grants for halls of residence and for science buildings, which encourage economy and flexibility. Finally, the Committee refers to the new arrangements put into effect as a result of criticism from the Public Accounts Committee, under which the Comptroller and Auditor General has full access to the records maintained by the Treasury for their control purposes. These arrangements were considered by the Committee of Public Accounts for the Session 1960–61 to have worked satisfactorily and the Committee recommended they should remain in force.

DIAMONDS CONTAINING CONTROLLABLE IMPURITY CONCENTRATIONS

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THE presence of considerable quantities of impurities in natural diamond has recently been confirmed[1,2]. This led Frank[3] to remark that multiple techniques of examination must be used on such material. In view of the report of Yoneda[4] concerning possible effects of nitrogen on the X-ray diffraction patterns of diamond, it seems worthwhile to us to comment further on some of the results which we have gained by the deliberate introduction of a given impurity into laboratory-grown diamond. We shall limit ourselves to a qualitative examination of the electron spin resonance spectra of a few specimens, in the belief that the profundity of the effects suffices to establish that progress in this area is now limited by the composition variability of natural diamond.

Samples of diamond were prepared in the following way. A uniaxial press system[5] was used in conjunction with an indirectly heated sample holder[6]. The reaction space was filled with extruded rods of spectrographic graphite powder mixed with the powdered transition metal catalyst. The static pressure applied during extrusion was 500 lb./in.^{2}. The impurity to be introduced into the growing diamond was present either in elemental form in the mix or as an alloy component with the transition metal. Thus, in the series of experiments reported here, pure nickel was used as the catalyst, and pure boron or aluminium powder was added in the requisite amount to the reaction mixture. All the materials used in the reactions were pre-fired in vacuum and cooled in argon. Cell assembly was carried out under dust-free conditions. Diamond was produced by subjecting these samples to pressures in the vicinity of 57 kb. and temperatures in the range 1,400°–1,600° C. (slightly different temperatures and pressures are utilized with the different catalyst compositions, since the equivalent alloys melt at different temperatures).

The product diamond was recovered by acid dissolution of the metal and residual graphite, followed by extensive washing. The crystals made using pure nickel consisted of attractive, light-green octahedra, whereas the aluminium-containing diamond was colourless (using a 33 atomic per cent aluminium in nickel mix) and the boron-containing material was a deep indigo (using a 5 atomic per cent boron in nickel mix). Both the boron- and aluminium-doped diamonds were electrical conductors. Resistivities were between 5×10^0 and 5×10^9 Ω-cm., depending on the conditions of preparation.

Doped diamond was also prepared by high-pressure, high-temperature diffusion of the doping elements into existing man-made diamond, both in the presence and absence of a transition metal catalyst. Lightly coloured or colourless conducting diamond was recovered from these experiments. The concentrations of boron and aluminium introduced by these techniques ranged up to 10^{21} atoms/c.c., as determined by chemical analysis, for example, by alkali titration of boron trioxide resulting from combustion.

Samples of these materials were examined by electron spin resonance spectroscopy. All v-mode, derivative spectra were obtained using a Varian Associates *V*-4500 ESR spectrometer, a *V*-4007 6 in. electromagnet, a *V*-4547 Multi-purpose cavity system and a Moseley *X*–*Y* recorder. Spectrometer frequency was maintained at 9152 ± 5 mc.p.s. (field calibration was obtained with *V*-4210*A* NMR spectrometer equipped with water sample). Low-temperature spectra were obtained by maintaining sample temperatures (measured with a thermocouple) to ± 2° C. in a flow of pre-cooled, dry nitrogen gas. Any possible radio-frequency saturation was checked by varying the klystron output over the available 20 decibel range, during which no changes in paramagnetic susceptibility or line contours were observed.

The electron spin resonance spectrum of our commercially available General Electric 'Man-Made' diamond 'RVG' (nickel-based) is shown in Fig. 1. There are two major features of interest: the broad band *a* (curve I) is typically that to be expected from transition metal impurities: we therefore assign it to nickel. The size of the absorption is consistent with the estimated concentration of nickel, namely $< \sim 10^{20}$ atoms/c.c. The detail *b* is shown on curve II with × 2 dispersion and × 5 amplification compared with curve I. The main structure of *b* appears to be

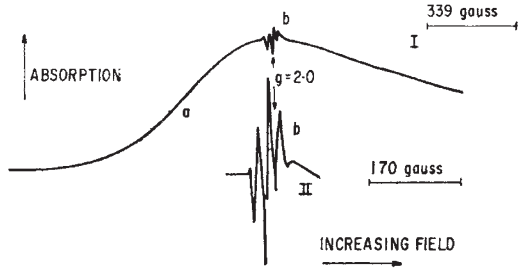

Fig. 1. Electron spin resonance of man-made diamond 'RVG'