

in choosing candidates rightly for university entry is the shape of the curve of the candidates' progress up to the time of selection: Was a particular boy or girl likely to develop a great deal, or was he already near his peak? He suggested that the selector must not be professionally and whole-time on the job: he should be made to live with the people he chooses. Selectors should suffer the consequences of their own decisions.

In the discussions on this key subject of selection for university entrance, it is to be noted that the headmistresses were able to speak knowledgeably of the problems of entry to both older and newer universities. No headmaster from a grammar school made a contribution, and the heads of public schools who spoke could only speak about selection for Oxford and Cambridge. One fancies that within the next few years, with the intense pressure on university entry and little chance of any significant increase in the number of students taken at Oxford and Cambridge, the public schools will have to make themselves much more aware of conditions at modern universities. Incidentally, it was pointed out that in Scotland the examinations which determine entrance qualifications to universities start in mid-March each year. But England rarely learns from Scotland in such matters.

The final session of the Conference tackled the problem of academic mobility. The investigation undertaken by the Association of University Teachers in 1956 suggested that too many members of university staffs stayed too long in one place. 22 per cent even of professors have never taught in a university other than that in which they hold their chair. Prof. A. G. N. Flew, of the University College of North Staffordshire, pointed out that a period of university teaching overseas could be of immense value in broadening the mind—in indicating, for example, that the English division of the curriculum into arts and sciences was not part of an inevitable ordering of things. Dr. R. S. Aitken, vice-chancellor of the University of Birmingham, considered that mobility among science staff was about right but that among arts staff it was insufficient.

Discussion in the Conference indicated that there was a widespread feeling that at present there was too great a degree of academic immobility. In

particular, it was held that universities ought to advertise senior lectureships wherever possible, whereas the almost universal present practice is to promote from within the institution. Strong pleas were entered for further exchanges within the Commonwealth: a number of Commonwealth countries are at a critical stage in their university development, and it would be of the greatest value to them that some of the best people should have a period of university service in them. But pleas were also entered for exchanges within the United Kingdom itself: even one term of teaching in a different university might be a great stimulus.

With the rapid increase in numbers of university staff during the past few years, there is to-day an altogether disproportionate number of university lecturers in the 30–40 age group. Some speakers saw a good deal of discontent ahead when many of these people were still lecturers and yet in the 50–60 age group. They suggested that this was an argument for providing more senior posts—more new universities even—for then there would be more chairs for which to compete.

There appear to be great differences between university departments of applied science in the closeness of their contacts with industry. In some, it is standard practice for lecturers in, say, engineering to be taken from industry and to return to industry after a period of teaching and research. In other universities this is rare. But the Conference did not clearly show what its mind was in this matter.

In fact, the Home Universities Conference is much better as an assembly to which thoughtful and challenging contributions can be made either from platform or floor than as a place in which there is a keen to-and-fro discussion. Perhaps this is inevitable when there is a large and representative collection of university dons assembled with their vice-chancellors in the comfortable and dignified—if apparently underground—William Beveridge Hall of the University of London. Be that as it may, British universities in general are in great debt to the University of London for its kindly and hospitable welcome to a Conference which is bringing together, as no other conference does, people from the staffs of all British universities at a time of year when they are prepared to be thoughtful in a creative way.

## AUTOMATIC MEASUREMENT OF QUALITY IN PROCESS PLANTS

**A**UTOMATIC control has been utilized by the process industries for many years; indeed, many commercial processes in use to-day could not function efficiently without its aid. Over the past decade, however, the basic philosophy of automatic control has undergone a marked change as a consequence of the introduction of powerful new instrumental techniques. The function of automatic controllers has hitherto been that of regulating certain basic parameters of a process, in the hope that adherence to fixed values of such parameters—temperature, flow or pressure—would result in an end-product of unvarying quality. The analysis of the end-product has, of necessity, been carried out in laboratories

remote from the plant, with the consequent introduction of long delays between the detection of variations in the end-product quality and the initiation of the appropriate remedial action on the plant itself. The economic benefits which could be obtained by carrying out such analyses directly on the process stream have stimulated the development of a wide variety of instruments for the purpose, many of which have passed the experimental stage and are now accepted as sufficiently reliable for plant use.

The Society of Instrument Technology is to be congratulated on its choice of "The Automatic Measurement of Quality in Process Plant" as the subject of the 1957 Conference, which had as its aim the bringing

together of research workers, instrument engineers and other workers in this field to discuss these developments and their common problems.

Membership of the Conference, which was held at University College, Swansea, during September 23-26, was restricted in order to promote informal discussion; it is noteworthy that a number of the Conference members were drawn from the United States, Germany, Holland, Norway and the U.S.S.R., so that the open discussions provided an international forum for the exchange of ideas.

The seven formal sessions of the Conference fell into two complementary groups; a number of papers were devoted to a review of the experience which has been gained with established instruments, while the second group explored the possible plant application of analytical techniques at present utilized only in the laboratory. In addition to the formal technical papers—which will be published with their associated discussions by Butterworths Scientific Press—the Conference heard two informal talks which related its main topic to fundamental issues. Prof. D. P. Eckman considered the basic problem of the optimization of control by on-line computation, while another guest speaker, Dr. W. P. Colquhoun, drew an illuminating comparison between the human senses and automatic instrumentation.

The opening session of the Conference was concerned with the adaptation of laboratory techniques to plant measurement. Laboratory analytical techniques are, for the most part, well established and well understood; it is natural to suppose that an automatic analysis can be carried through by the mechanization of the laboratory method, although such methods are often based on a sequence of discrete measurements and so are not readily adaptable to truly continuous operation. This point was stressed in E. Hodgson's paper, which described an instrument for the determination of the crystallizing point of batch samples. It is clearly advantageous to know the composition of a plant stream throughout the course of a reaction, rather than to know its composition at intervals, and it is therefore an obvious, if difficult, step to make the analysis continuous.

Three papers, which were presented in the following session, described the manner in which this further step had been accomplished for calorimetric measurements on town's gas—a measurement of considerable importance to the gas industry, which is bound by law to maintain certain standards of calorific value and purity in the gas supplied to consumers.

Considerable discussion was aroused by another of the papers presented in this session, in which the authors underlined the difficulty of securing representative samples of gaseous streams—a problem which, it is often said, is more difficult than the analysis itself. It is significant that this theme recurred frequently in papers devoted to a wide range of analytical techniques.

The need for continuous control has resulted in the extensive use of physical methods of analysis; this trend was reflected in the eleven papers, presented on the second day of the Conference, which reviewed the use of such diverse methods as mass spectrometry, vapour phase chromatography and refractometry.

Three of the papers were devoted to existing instruments working in the visible and infra-red region of the electromagnetic spectrum. Infra-red analysis is now well established as a process technique,

in spite of the fact that it is often difficult to find completely characteristic absorptions, and considerable overlapping of the spectra is common. In practice, of course, such imperfections are overcome by corrective procedures, but it is clear that the fundamental power of the method would be greater if it were possible to obtain narrower absorptions and higher resolution. These features are characteristic of microwave spectra, which are also very sensitive to molecular structure. The potentialities of microwave spectroscopy in process control analysis were considered in a paper by Dr. J. Sheridan; a second paper, read by Dr. R. E. Richards, described yet another relatively new branch of chemical spectroscopy—nuclear magnetic resonance, which may well be applied to process stream analysis, although little published information is available on its industrial applications. To the plant engineer, perhaps, these techniques may appear to be too difficult and complex for eventual adaptation to plant use. He would, however, do well to ponder on the implications of the final paper of the day, read by Dr. E. T. Hall. Dr. Hall is well known to the archaeological world for his work on the dating of antiquities by the analysis of their chemical composition. In the course of his research (which has included, among other achievements, the detection of the Piltdown skull forgery) Dr. Hall developed an X-ray fluorescent analysis instrument, which is to be manufactured commercially for process use.

The last session of the Conference was devoted to a review of the uses of radioactive isotopes in quality measurement and a stimulating paper by Prof. W. Fishwick, which provoked considerable discussion, on the possibilities of analysis by physical measurements of an out-of-the-ordinary character. The session ended with an open discussion on the engineering design of instrumentation.

The catholic nature of the papers given at this Conference was in itself an indication of the rapidity with which technologists adapt to their own problems the tools provided for them by research workers in other fields; it is obvious, nevertheless, that the transition from research tool to plant instrument is difficult and expensive. It is essential that an instrument for plant use should function reliably for long periods without attention, and that maintenance should be reduced as far as possible to standard procedures, so that it may be carried out by relatively unskilled personnel.

The development of such instruments must at the same time be accompanied by the development of the associated sampling systems, since both are essential to the successful operation of the analyser on the plant. It is evident that a great deal of effort is at present expended on the design of sampling systems to meet the needs of various sectors of the process industries, each of which must therefore devote in isolation technical man-power to problems which must, in many cases, share many points of similarity. The consequent inefficient use of skilled technologists might well be remedied by the adoption of some coherent plan of attack which would co-ordinate the efforts of both users and manufacturers, both of whom were represented at the Conference; it is to be hoped that the Society of Instrument Technology will act on the suggestion, so well received by the Conference, that the time is ripe for it to establish a working team to codify existing knowledge on sampling techniques and to correlate development work in this field.