on an equality with administration and that this would constitute a major advance. It suggests that there is complete justification for the claim that the post of deputy chief scientific officer should rank with that of under-secretary in the administrative class; that of senior principal scientific officer should rank with that of assistant secretary, while the senior scientific officer grade should be abolished or combined with that of principal scientific officer to rank with that of principal in the administrative class. The scientific officer grade should rank with that of assistant principal, and a considerable increase in the number of posts in grades above that of principal scientific officer is necessary to make the career open to the scientist sufficiently attractive compared with that open to the administrator.

As regards the works group of professional classes, whose position was reviewed by the Gardiner Committee in 1951, the Institution submits that a wholesale change is necessary to put such professional officers on a basis that reasonably recognizes the degree of responsibility they carry compared with that of the administrative class. It is suggested that the main grade should be equated with the administrative principal, the senior grade with the assistant secretary and the superintending grade with the under-secretary in the administrative class. As regards the experimental officer class, the Institution submits that a broad comparison should be made between the assistant experimental officer and the executive officer, the experimental officer and the higher executive officer, the senior experimental officer and the senior executive officer and between the chief experimental officer and the chief executive officer, with salary scales favouring the experimental officer class in view of the higher standard of qualification, the inferior promotion prospects and the increased responsibilities. For the assistant (scientific) class, the Institution submits that the assistant (scientific) and the senior assistant (scientific) grades should be placed on salary scales sufficiently higher than those of clerical officer and higher clerical officer to be attractive in competition with the careers and salaries available to officers in those grades. It is also submitted that to provide a proper career for technical officers it is imperative to increase the scales of these classes to a basis of parity with the executive class. Other proposals relate to the admission to the appropriate professional scales of those who have obtained professional qualifications after entry to the Civil Service and for the simplification and reduction of the number of salary scales.

BRITISH WELDING RESEARCH ASSOCIATION

THE ninth annual general meeting of the British Welding Research Association was held on July 14 at the Association's Engineering Research Station at Abington, near Cambridge, under the chairmanship of the president, Sir William J. Larke. At the subsequent luncheon, a toast to the Association was proposed by Dr. O. Wansbrough Jones, chief scientist, Ministry of Supply, and acknowledged by Sir Charles S. Lillicrap, chairman of the Council. In his speech, Sir Charles made reference to the annual income, which had reached £113,000 (being an increase of £20,000 over that for the previous year), and also to the new terms of the grant from the Department of Scientific and Industrial Research, which had again been agreed for the next two years at the level of £100 for each £100 of membership subscription. Nevertheless, it was pointed out that, in order to qualify for this grant after the end of the period, it would be necessary for the annual subscription income to be raised by £10,000 to £50,000. He was sure that this would be possible, if the goodwill of members was secured. Mention was also made of the Association's intention to move the metallurgical researches from London to Abington in the near future. For this purpose a provision of £40,000 has been made for new laboratories, and a housing association has been formed.

During the day an exhibition was staged of metallurgical work in progress, and the engineering laboratories were open to view. The metallurgical work is to be the subject of a separate open day in the autumn, and the examples illustrated were confined to the micro-analysis of hydrogen in metals and weld deposits, and the development of a suitable cracking test for light alloy welds with various parent materials and filler alloys. Associated work has shown the important influence of silicon dilution of the filler alloy by the parent plate, as a cause of cracking in welds made in the heat-treatable aluminium alloy H.10.

In the fatigue laboratory tests were shown in progress on butt welds in heavy sections of steel plate and tube. Various welding methods are being investigated, together with the effect of deliberately introduced faults. An interesting effect of one such fault—lack of penetration—which introduces the equivalent of a sharp notch, is that although the joint fatigue strength is much impaired, the relative scatter of results is reduced to negligible proportions. In another test, conducted co-operatively with the Department of Metallurgy, University of Cambridge, large steel specimens which have been fatigue-tested to destruction have been sub-divided so as to avoid the main fracture faces, for further fatigue tests on a smaller scale. Such specimens have shown no diminution of fatigue life as compared with otherwise identical control specimens taken from the unstressed ends of the larger specimens.

Although the work of Prof. J. F. Baker and others at the Department of Engineering, University of Cambridge, on the plastic design of welded steel frames has reached fruition, in that buildings so designed are giving satisfactory service (including the fatigue laboratory already mentioned), full-scale investigations continue to take place. On an outdoor site a full-scale portal frame was shown which had been loaded to destruction. This particular test convincingly demonstrated that the additional stiffening effect of fully encastered feet could be obtained with simple and economical concrete foundations.

In past years the use of welding has made possible the construction of pressure vessels and pipelines to suit exacting operating conditions in the steam, oil and chemical industries. In such cases the technicalities of welding and design are inseparable, and much attention is paid by the Association to stress analysis, particularly with regard to the reinforcement of openings in pressure vessels, and the behaviour of pipeline components such as bends and branches where expansion movements have to be sustained. Tests on a number of such components were on view. Experiments on the reinforcement of openings were represented by a steam drum for

stress analysis containing six nozzle openings, each with a different type of reinforcement; a pulsating pressure test on small vessels of about 0·3 m.³ capacity to determine the efficiency of different types of nozzle weld preparation; and a pressure cell in which a portion of plate 3·0 m. × 2·4 m. containing a manhole opening 60 cm. diameter had been tested under hydrostatic pressure, simulating the loading which would be sustained when present in an oil-storage tank 40 m. in diameter. This test could not be made on a smaller scale since it was necessary to determine the reserve of ductility as well as the stress distribution in the plate containing the manhole.

During the year the resistance welding laboratory has been almost completely re-equipped in order to meet new programmes of work. The main acquisition, through a Mutual Security Aid grant from the United States, has been a Sciaky three-phase spot-welding machine of large capacity for use mainly with light alloys. As a result of previously conducted fundamental work on heat flow, it has been proved possible to calculate optimum and electrical and thermal cycles for spot welds in hardenable steels. Electronic timing equipment has now been installed, so that the work may proceed with examination of complex thermal cycles by means of which individual spot welds may be heat-treated immediately after they are made.

Experience in the welding industry has already shown that the ultrasonic probe is a powerful tool for non-destructive testing, and one which is often more discriminating than radiography. The two methods may best be described as complementary. Nevertheless, the technique for ultrasonic testing is not easily acquired or taught, and the work of the Association is directed towards the choice of the best methods for examining particular designs of welded joints, while using commercially available equipment. Illustrations were on view of the success which has been achieved with quite complex welded joints, including fillets.

In spite of the research effort which has been expended, brittle fracture still takes a certain toll of steel structures fabricated both by welding and riveting. The use of steels with improved notch toughness can undoubtedly reduce the hazard; but the contribution to safety of better methods of fabrication cannot be ignored. In this direction the Association is investigating problems of the mechanics of such fractures. A new galvanometer was shown by means of which it has been possible to measure the surface energy of a propagating fracture by detecting the plastic-flow heat which is evolved. In this string instrument, which is used with thermocouples, extreme sensitivity has been achieved without high electromagnetic damping by using a very small controlling field, and suspending the strings in a deep catenary to secure the minimum tension. The instrument is being used for studying the influence of stored elastic energy from residual welding stresses on the propagation of fractures in notch-brittle steels. For this purpose, since it is impossible to secure complete residual stress systems other than in wide plates, a 600-ton tensile testing rig has recently been constructed and was on view. This rig was designed by Association investigators and donated by a member firm. Calibration of each of the four hydraulic-loading capsules in the rig was carried out in a Baldwin 180-ton universal testing machine which has recently been acquired through Mutual Security Aid funds.

PHYSICAL AND CHEMICAL ASPECTS OF BASIC MECHANISMS IN RADIOBIOLOGY

A VERBATIM report has been prepared on an informal conference of physicists, chemists and biologists held during May 7–9, 1953, at Highland Park, Illinois, to discuss the interaction of radiation and biological systems in its basic aspects*. The foreword emphasizes that "There was no attempt to make the discussions comprehensive; but rather topics of current interest were discussed and analysed". There are five main sections. The first two, dealing with the energy transfer from radiation to matter, were introduced by Robert L. Platzman, of Purdue University. The mechanisms of energy degradation and chemical change and effects of secondary electrons were considered in Section 3, which was introduced by John L. Magee, of the University of Notre Dame. Discussion of the effects of electronic excitation in Section 4 was introduced by Henry Linschitz, of Syracuse University. The final section, which is headed as "Summary: Importance of Radiation Chemical Effects in Radiobiology", was introduced by Martin D. Kamen, of Washington University Medical School, and is, in some ways, the most interesting part of the whole proceedings. The list of references to the individual sections are collected at the end of the papers and deal mainly with work published during and since 1950.

The presentation in the form of a verbatim record, which appears to be very well edited, is a useful way of treating a subject in which there is so much that is problematical. The book deals with those problems which everyone working in these various fields discusses repeatedly, usually without definite conclusions. Probably no single reader will be able to understand the whole of the discussion. The uncertainty of knowledge of the basic physico-chemical mechanisms involved and lack of the necessary experimental evidence is emphasized repeatedly, and often interesting suggestions for further experimental work arise in the course of the discussion.

The basic lack of knowledge is emphasized in connexion with the value of W, the mean energy expended per ion pair. It is useful to quote from p. 5: "All this has a strong moral in radiobiology, and it is one which even the physicist has often taken too lightly . . . namely, that one really knows virtually nothing about the value of W to apply for tissue. Even with a wholesome amount of grains of salt, it seems highly doubtful that this quantity has any present significance in radiobiology". It is interesting that recent experimental evidence tends to confirm Fano's approximate theory of W. Mention is made (p. 2) of the work of Lindhard and Scharff on the theory of stopping-power. The uncertainty of the position concerning the experimental evidence for the stopping-power of α-particles by liquid water is mentioned. Attention is directed to the interesting experiments of Ageno (p. 14) and the whole problem of energy transfer. A practical point of interest is made on p. 19 where Fano points out that, if a 1-MV. photon strikes a water surface, the probability of its emerging

* Physical and Chemical Aspects of Basic Mechanisms in Radiobiology: Proceedings of an Informal Conference held at Highland Park, Illinois, May 7–9, 1953. (Publication 305 of the National Academy of Sciences: Division of Physical Sciences of the National Research Council.) Edited by John L. Magee, Martin D. Kamen and Robert L. Platzman. Pp. vii+145. (Washington, D.C.: National Research Council, 1953.) 1 dollar.