the development of new machines and providing guidance to manufacturers; and a Mining Research Establishment was set up at Isleworth in 1952. The Safety in Mines Research Establishment of the Ministry of Fuel and Power is still the largest mining research establishment in Britain, and the National Coal Board has inherited very few men experienced in mining research. In the post-war man-power situation, the Board has found difficulty in recruiting the scientific and technical staff it needs, and this is the main limit on the Board's expansion plans. Mr. Wynn emphasized that production depends on the outcome of a race between increased mechanization and falling man-power in the mines. Two other organizations, however, have also been established which can do much to improve productivity. The Scientific Department has established a Field Investigation Group, analogous to the operational research teams of the Service departments, and the Production Department has set up a Method Study Branch. These establishments are in close touch and will play a big part in reducing man-power requirements.

## SOCIAL PROBLEMS OF INDUSTRIAL DEMOCRACY

THE Department of Social Science, University of Liverpool, has published, as Occasional Papers No. 2, "Industrial Democracy: a Revaluation", by W. H. Scott (pp. 40. Liverpool: University Press, 1955; 3*s*. 6*d*.). This essay is intended to meet the needs of industrialists, trade unionists and others who wish to acquaint themselves rapidly with some of the broad conclusions resulting from systematic research and current thought on this topic. It is limited, however, primarily to problems arising at the factory- or plant-level and is essentially a stock-taking. Industrial democracy is regarded as implying the participation, to a greater or lesser extent, of those who work in industry in determining the conditions of their working lives. The review answers the question, "Is industrial democracy desirable?" with an emphatic affirmative, and Mr. Scott also believes that industrial development has justified our faith in the efficacy of democracy to check the arbitrary use of power.

While an extension of the democratic principle at the formal policy-making level of a firm is important, its application in day-to-day executive leadership is equally vital, and these two processes are inter-dependent. Mr. Scott makes some constructive comments here, and on the position of the trade unions, which are of especial interest at the moment. He notes the need to develop "consultative leadership" as part of the administrative routines of a firm at every level, as an essential concomitant to more effective formal procedures at the policy-making level, pointing out that higher management must take and maintain the initiative in both these respects. He also directs attention to the presupposed attitudes of leadership and administrative ability and to the implications in respect of selection and training for such posts. Similar considerations apply to the trade unions, and if the excessively bureaucratic tendencies of some unions are to be checked, and a balance achieved between the need for a measure of centralized administration and the desirability of developing local initiative and responsibility, then similar criteria must be applied to the selection and training of full-time trade-union officials.

Just as the effective working of any new procedures within the firm calls for a capacity for consultative leadership on the part of managers, so the delegation of greater responsibility to lay-representatives by the unions, which is so essential to industrial democracy, requires appropriate attitudes on the part of officials if it is to be used creatively. Moreover, industry does not exist *in vacuo*, and Mr. Scott points out that to achieve stable and enduring changes in industry, we must also concern ourselves with developments in other institutions of our society and particularly those which are basic and most formative of personality.

## FIBRE MICROSCOPY

A WELL-ATTENDED symposium and exhibition organized by the Industrial Section of the Royal Microscopical Society was held at the British Pharmaceutical Society in London on November 16, three sessions of papers being given in the lecture theatre, while an exhibition was staged in the hall. Opening the first session of papers, Dr. R. C. Faust discussed the use of the interference microscope in the examination of fibres. The degree of molecular orientation and closeness of molecular packing at different regions of an anisotropic fibre have been studied by means of multiple-beam interference with the conventional microscope and by means of two-beam interference with the Baker interference microscope. Mr. D. S. Gowers then described the study, by interferometric methods, of the adhesion between fibres. When an artificial point of contact between a fibre and a quartz plate is examined by incident illumination, Fizeau fringes give a contour map of the fibre surface. The area of contact can be determined by the intensity distribution across the central dark spot. The effect of humidity, temperature and contaminants in the fibre was discussed.

The first two papers in the second session were devoted to the methods of producing replicas for use in the electron microscope. With textile fibres it is the surface that is of main interest, and this may be studied by means of replicas of the fibres, examined under the reflexion electron microscope. The curvature of the fibre presents an added difficulty in obtaining a successful replica, and Dr. J. Dlugosz described the various methods of replication investigated to obtain a successful routine method.

A method of producing solid metal replicas of fibres, for use in the reflexion electron microscope, was then described by D. E. Bradley, who discussed the advantages of this method over that of direct examination, and Dr. K. Little considered the use of the electron microscope in conjunction with other techniques, such as X-ray diffraction, histology and chemical investigations, in the study of fibres in human connective tissues. Each method of microscopy has its advantages and its limitations. H. W. Emerton's paper, read by D. H. Page, described how, by using three methods—namely, light microscopy, reflexion electron microscopy and transmission electron microscopy—in the study of natural fibres, a more complete picture can be obtained. By means of a plastic metal replica, the same fibre can be examined by all three methods.

The third session was opened by Dr. A. E. J. Vickers with a short historical survey of the pro-

duction of quartz fibres, accompanied by a demonstration. Their physical properties, and their recent use in optics for the rapid transmission of images, were discussed. H. M. Appleyard described how the causes of faults in textiles, many of which are not obvious until the fabric has been dyed and finished, can be ascertained by microscopical examination. Faults may be due to adulterant fibre in the blend or to solid matter attached to the fibres, such as pieces of skin. Identification tests include normal histological techniques or microchemical tests followed by examination under the conventional or phase-contrast microscope. The systematic study of the removal, from a variety of textile fibres, of compounds of the same type as those found in fatty dirt from worn garments was described by R. E. Wagg. He discussed the action of several different classes of detergent, builders and other additives.

The measurement of the diameter of glass fibres, either mechanically drawn or steam-blown fibres, can be carried out by means of a projection microscope, and A. Pimblett described this method, together with the techniques required to prepare mounts of cross-sections of fibres. By this method of viewing, variations in diameter and cross-sectional shape, and the bonding together of steam-blown fibres to form insulation products, are revealed. The appearance and handle of acetate fabrics are profoundly affected by the cross-sectional shape and surface of the filament. These characteristics require to remain constant in a given spinning run, and L. Krause described how, as a method of control, yarns are examined microscopically for lustre and cross-sectional shape.

At the exhibition held in conjunction with the symposium, D. E. Bradley showed electron-micrographs of various fibres examined under the reflexion microscope by means of replicas. Faults causing electrical failure in thin oriented polystyrene-film capacitors have been identified microscopically as particles of dandruff introduced by the machine operators, and H. F. Church exhibited several of these faults, together with photomicrographs illustrating their structure. Dr. M. Dempsey and Miss B. M. Haines demonstrated a melting-point apparatus, adapted for measuring microscopically the shrinkage temperature of isolated leather fibres, and H. W. Emerton, J. Watts and D. H. Page showed photo- and electron-micrographs of various paper-making fibres.

The penetration and distribution of stain in a damaged rayon fibre can determine the type of damage, and Dr. D. G. Drummond and J. E. Ford exhibited photomicrographs illustrating the different types of fibre damage. Electron-micrographs of the surface of textile fibres made by the replica technique in the transmission electron microscope were also shown. Photographs of apparatus and of Fizeau fringes around points of contact between fibres and a quartz plate were shown by D. B. Gowers, while C. F. Griffiths exhibited specimens and photomicrographs of glass fibres containing crystalline inclusions; the inclusions may originate from the raw materials, or the refractories of the furnace or devitrification of the glass itself, and they can be identified by means of the polarizing microscope or by the X-ray diffraction method.

Photomicrographs illustrating the differences between textile fibres of vegetable origin were contributed by C. J. Jarman; from the size of the cell and the number of cells to a fibre it is possible to identify the fibre. Photo- and electron-micrographs of the fibres in human connective tissues were shown by Dr. K. Little, and J. A. Mason displayed samples of 'Perspex' and polythene that had been used for insulations and were exhibiting erosion and breakdown in the form of dendritic channels formed by local stress and heating by electrical discharges. T. S. Millen and R. S. Page demonstrated the use of the electron microscope for the examination of the surface of fibres by the reflexion method.

Slides and photomicrographs were used by A. Pimblett for demonstrating the method of measuring the diameter of glass fibres, and Dr. F. Stern showed photomicrographs and X-ray diffraction patterns of coir fibre, demonstrating the special fibrillar orientation of the cellulose microfibrils. Quartz fibres and photographs illustrating the methods for producing the fibres were exhibited by Dr. A. E. J. Vickers, and R. E. Wagg and Miss Gayner Stephens showed by means of photomicrographs the effect of various detergents on fatty dirt contaminating textile fibres. C. R. Watts contributed photomicrographs illustrating various yarns and fabrics, including modern developments in bonded and coated fibres; some common faults and their causes were also shown.

Electron micrographs and stereomicrographs showing the surface characteristics and microfibrillar texture of keratin fibres were exhibited by Mr. H. J. Woods and Dr. J. Sikorski. Miss E. Frei and Prof. R. D. Preston exhibited longitudinal and transverse sections of coniferous woods 300 A. thick for study in the electron microscope; the electron-micrographs showed the fine spiral structure of the various layers of the wall.

## RHEOLOGY OF PROTEINS

A SYMPOSIUM on the "Rheology of Proteins" was held in London on January 20 by the British Society of Rheology. Four papers were presented, each of which aroused considerable discussion. The chairman, Mr. A. G. Ward (British Gelatine and Glue Research Association), in his opening remarks, outlined the wide scope covered by the title of the symposium. Proteins, the mechanical properties of which play a vital part in their functioning in living organisms, include serum proteins, epidermal and connective tissue proteins, muscle proteins, many cellular proteins, mucoproteins and mucopolysaccharides, etc. The rheological properties of certain of these also contribute to their subsequent use in meat, egg and other protein foods, in protein fibres, in gelatin and animal glue, and in other products. In the background, for all these substances, rest the two common problems of the covalently bonded structure of the protein molecules and the secondary forces—ionic, hydrogen bonding, and van der Waals interactions—which link the molecules together to form macroscopic aggregates. Only by isolating the simplest systems will it be possible to solve the many complex problems.

Dr. E. J. Ambrose (Chester Beatty Research Institute), in his paper on the formation of structure in protein solutions, was concerned with the conditions in which a two-phase system can be formed, the protein or related component being organized or ordered in the concentrated phase. The properties of a macromolecule determining its tendency to form such structures are particle size and flexibility, the