and the engineer to carry out surveys of the noise at work places and of the hearing-loss of the people there. With equipment in mobile vans, it now takes only ten minutes to obtain the complete frequency-spectrum of a person's hearing-threshold, and it was pointed out that such a curve may contain a deep 'dip' so narrow that it would be overlooked by measurements at octave-spaced spot-frequencies. Two work places with the same total noise-level but different frequency-distributions (for example, cotton spinning and weaving sheds) may cause very different hearing-losses in the course of, say, ten years; so as well as recording total noise-level, it is necessary to analyse the frequency-spectrum. For places where noise fluctuates, they have developed an instrument which analyses the noise by octave bands and integrates automatically the total time (during a one-hour observation period) for which the noise-level exceeds the first or second of two pre-set levels. Comparable research on the effects of noise is in progress in other countries, including Germany, Sweden and the United States.

The parallel group was concerned with primarily psychological problems; and it appeared that whereas all the countries represented are doing work on physiological problems of interest to industry, competent specialists who can be called engineering psychologists are more or less confined to Britain and the United States. Besides discussions on engineering psychology, especially design of machine controls, and on motivations and satisfactions arising from the nature of the work itself, a day was given to discussing display of information, dealing both with the study of pointer-and-scale and other display instruments and panels and with information from sources not specially intended as such. Mr. J. Spencer, of University College, London, in outlining the various types of display, referred especially to results from his own research on the best forms of graduation for scales. Discussion emphasized the importance of information 'displayed' other than visually—for example, to the kinesthetic sense of position or (especially) to hearing: every machine or process has characteristic sounds which are used by the operators to know how it is going, though design engineers usually overlook the importance and potentialities of this, and much further study is needed of the properties and capabilities of the different senses as information-channels. Both groups joined for a discussion on anthropometry, physiology and psychology applied to working postures and machine-design, which showed marked variety in the interests developed in different countries. Thus, the relation between machine-dimensions and operator-posture was approached from the engineering point of view by Dr. B. Schulte, of Siemens-Schuckert A.G., Germany, and by Mr. B. Hellern, director of the Research Institute of Production Engineering, Oslo. Starting from psychology, researches on the design of machine-controls were described by Mr. R. G. Sell, of the British Iron and Steel Research Association, and Mr. W. T. Singleton, of the British Boot, Shoe and Allied Trades Research Association. Outstanding as an inter-disciplinary exercise was the design of driver's seat and controls for a tractor-mounted hoe developed by the National Institute of Agricultural Engineering, the need being to steer with an accuracy of about half an inch along the line of plants to be hoed; Mr. K. Provins, of the Department of Human Anatomy of the University of Oxford, described the various anatomical and physio-

logical considerations taken into account, while discussion brought out possible psychological effects worth study, due to the relative movement of hoe and plants or to the influence of position and colour of chassis-members in building up the driver's visual field.

Training needs in the field of ergonomics were discussed on the last day. In all countries, trained people are very few. At the Ph.D. level, Prof. S. D. S. Spragg, of the University of Rochester, indicated his training of experimental psychologists; the need is for engineers, physiologists and psychologists thoroughly trained in their own disciplines and with enough knowledge of the other two to collaborate in joint research. The biggest immediate need, however, and one which came out again and again during the whole seminar, is for some simple training in the field of ergonomics for production engineers and designers at the graduate and technologist levels, since straightforward applications of existing knowledge can now lead to big results. Various small-scale but promising beginnings were indicated, notably by Prof. S. Forssman, of the Swedish Employers' Confederation, and by Prof. E. Grandjean, of the Swiss Federal Institute of Technology, Zurich; and the seminar recommended various steps to bring the need and possible courses before universities and colleges of technology.

Altogether the week was profitable and stimulating, justifying the remark that never before in this field had so well-balanced a group met, from so many countries. An informal committee, with Prof. Grandjean as corresponding secretary, was charged with exploring ways of continuing international contact between 'human work' scientists; and there was every sign that the various participants were going from Leyden with fresh ideas and determination to broaden and intensify research in this field in their own countries.

R. G. STANSFIELD

INTERNATIONAL STARCH CONVENTION

THE seventh International Starch Convention was held at the Coreal Research Station, Detmold, Germany, during April 24-26. Among the two hundred and forty chemists who attended, there were eighty from abroad representing twenty-one countries. The papers which were read to the meeting were divided into three sessions, on research and analysis; starch manufacture; and on starch fractions and derivatives.

Following the actual Convention, a conference was held on April 27, attended by representatives from fifteen countries, for the purpose of discussing the possibility of standardizing the analysis of starch, its derivatives and by-products, on an international level. The meeting decided that this could best be done under the auspices of the International Organization for Standardization and that this body should be approached with the request for the organization of the necessary working committees in the various countries. The meeting then discussed the report of two *ad hoc* committees, which had already carried out surveys of methods employed for the determination of protein in starch and the assessment of starch qualities.

The first session of the Convention was opened by Prof. M. Samec (Ljubljana, Yugoslavia), who

discussed the influence of various starches and starch derivatives on the mechanical strength of paper. In general, he found that wheat and rice starches were more efficient in this respect than starches from other plants. Fractionating individual starches, it was found that sizes made from amylose produced paper of greater strength than amylopectin sizes. Investigations had also been undertaken to decide whether it was more advantageous to add the requisite starch size to the cellulose pulp in the beater or whether the paper sheets should be dipped into the size solution (tub size). It was found that by adopting the latter procedure the mechanical strength of paper could be increased up to 900 per cent. Properties which were tested included folding endurance, stretch, and tearing and tensile strength. Some relation was also found between the infra-red spectrum of starch, the rate at which the starch was adsorbed by the cellulose fibres and the accompanying increase of mechanical strength.

Prof. J. Holló (Budapest) showed that during the amperometric titration of starch with iodine there was some free iodine present in the solution before the end-point of the titration had been reached. The concentration of the free iodine was proportional to the concentration of potassium iodide, to the degree of polymerization of starch and to the temperature. The heat of reaction was calculated and corresponded to the formation of hydrogen bonds between iodine and hydroxyl groups.

An account of the action patterns of starch-metabolizing enzymes was given by Dr. W. J. Whelan (Lister Institute, London). He presented a scheme showing how amylose and amylopectin might be synthesized and deposited side by side in the starch granule. By treating native starch with the appropriate enzyme, it was possible to de-branch the amylopectin component, thus producing a polysaccharide with the characteristics of amylose. With other enzymes it was also possible to ramify the otherwise linear amylose molecule, thus giving the starch the properties of amylopectin.

Dr. E. Dux (Richmond, Surrey) described the use of electrophoresis for the investigation of industrial starch and dextrine products. Using strips of fibre-glass paper in a ridge-pole type tank at relatively low voltages, the method was found suitable for the classification of white and pyro-dextrins. It was also useful for the detection of polar groups in starch products and the separation of polysaccharides and monosaccharides for quantitative analysis.

The analysis of the constituents of glucose syrups, manufactured for food purposes by acid hydrolysis of starch, was described by Prof. F. Schneider (Brunswick). Using paper chromatography, the mono- and oligo-saccharides present in such syrups could be readily resolved, and details were given of suitable solvents and developers. The method was used for following the mechanism of degradation and reversion reactions occurring during manufacture of starch syrups. Mention was especially made of the analysis of oligosaccharides which were formed by the heat treatment of glucose and fructose in acid or alkaline media.

Prof. W. Smirnow (Leningrad) reported his investigations concerning the products formed by the acid hydrolysis of starch. The dextrins which appeared during the reaction had been isolated, and their properties determined. The decomposition of glucose in acid medium was investigated and the pH limits for maximum stability were given. Reversion products and coloured substances produced by the acid decomposition of glucose have also been isolated and characterized.

It has been known for some time that the discoloration of starch syrups is due to two causes: first, the Maillard reaction between proteins and their degradation products with aldehydes (sugars), and secondly, the decomposition in light of hydroxymethyl furfural. It has now been found by J. Borud (Lillehammer, Norway) that the amount of soluble amino-acids present in starch hydrolysates could be appreciably reduced by employing initial starch suspensions of considerably higher concentration than hitherto common. The remaining nitrogen-containing substances were present in the syrup as insoluble protein which did not cause discoloration.

Another method of purifying starch syrups was explained by Dr. G. de Jong (Amsterdam). Here the hydrolysate was passed through a system of four ion-exchange resins arranged in series. Preliminary decoloration was carried out with a porous and strongly basic resin. Remaining amino-acids were then removed by anion and cation exchange resins. Lastly, hydroxymethyl furfural was removed by an anion exchange resin which had been saturated with sulphur dioxide.

Various methods used for the determination of water in starches were discussed by Dr. E. Eberius (Duisburg). Mention was made in particular of the Karl-Fischer method and its application to the field of starch. Two variations of this technique were used, namely, the direct titration of ungelatinized starch granules with the reagent, or preliminary dispersion of the granules in anhydrous methanol. It was found that the former method gave values for the water content which were consistently 0.15 per cent less than values from the latter. The water content obtained by direct titration also corresponded to that given by oven drying. It was considered likely that methanol caused some diffusion of water out of the interior of the starch granules.

All papers presented to the Convention and the discussion which followed each one will be published in due course in the journal *Die Stärke*.

E. DUX

COLONIAL DEVELOPMENT CORPORATION

REPORT FOR 1956

THE annual report of the Colonial Development Corporation* for the year ended December 31, 1956, records a surplus of £572,809 after paying all outgoings, including £416,173 Colonial Office interest, the net operating profit from direct projects and subsidiaries being £371,718, compared with £113,165 in 1955. The only substantial loss was on re-opening the Macalder-Nyanza Mines, Ltd., but better results are expected when the initial difficulties are overcome and the efficiency improved, provided that the price of copper does not fall much further. Eight new projects were initiated by the Corporation during the year, bringing the total to sixty-six continuing projects and investigations, compared with sixty-

* Annual Report and Statement of Accounts of the Colonial Development Corporation for the year to 31.12.56. Pp. v+57. (London: H.M. Stationery Office, 1957.) 3s. net.