the troubles due to ash-formation which are associated with the use of coal. The same is, however, not true of residual fuel oils; although ash-formation is much less than with coal, it may give rise to serious problems, as, for example, in the gas turbine, where ash-deposition is a major obstacle in the development of this prime mover to use heavy fuel oils. Fuel oils, of course, still have a great advantage over coal in this connexion; but it is important to realize that the use of oil is by no means entirely free from the problems which attend the use of coal. Thus both fuels contain sulphur, and the fuel oils available for use in Great Britain often have high sulphur contents (two per cent or more) which may cause deterioration of product quality in the steel and metal industries. In this respect, therefore, the advantage frequently lies with coal or the fuels derived from it, namely, producer-gas and coal tar.

The oil flame has a higher radiation efficiency than the gas flame—a property which has contributed to the improved results which have been obtained in the manufacture of steel in the open hearth furnace by conversion to oil firing. Several other factors are, however, also involved, and there was considerable divergence of opinion at the Conference as to the relative merits of oil and coal in this and similar applications. In some instances, conversion to oil firing has shown little advantage; but the bulk of the evidence supports the conclusion that it leads to greater steel production. It is, in fact, probable that the use of oil has made an important contribution to the record steel output in Britain now being obtained. It cannot, however, be immediately concluded that conversion from coal to oil firing is necessarily advantageous to the steel industry.

In the first place, consideration must be given to the cost of any technical advantage, and the differential price of coal and oil in any particular locality is clearly a most important factor. This is illustrated very clearly by the American experience which was recorded in one of the papers contributed to the Conference. The steel industry in the United States was originally based on coal; but oil firing was adopted, at a time when fuel oil was relatively very cheap, with a consequent increase in thermal efficiency and steel production. At present, however, the supply position and the changing price differential have started a reverse trend from oil to coal firing. The combined use of oil and coke-oven gas has given good results, and it is suggested that other combinations, including such fuels as coke breeze and powdered coal, might be used with advantage.

A second factor in the achievement of improved results with oil firing is the greater ease of control which attends the use of oil. Partly in consequence of this, the application of oil firing has usually been made with greater instrumentation and scientific control, and it seems likely that improved results could also be obtained with producer-gas if similar methods were employed. This consideration suggests that the comparison between oil firing and conventional practice with producer-gas has not always been fair to the latter. It is certainly also true that the comparison has sometimes been unfair to oil firing because of unsuitable furnace design. Thus it has been shown that the jet action due to the greater velocity of the oil flame may result in a serious air inleakage which could be avoided in a furnace designed specifically for the utilization of oil.

The use of fuel oil in glass furnaces also gives the advantages of greater ease of control and increased rate of glass melting, but the intense radiation from the oil flame results in increased wear on refractories; and although increased efficiency could be obtained by greater preheat of the combustion air, it is concluded that oil firing is not at present economic in comparison with an efficient producer-gas system. It is evident that the assessment of the relative values of coal and oil firing involves many technical and economic factors.

It is not possible, in this short article, to do justice to the vast amount of technical information which has been provided by the many papers contributed to the Conference. Readers interested, for example, in the application of the Diesel engine to rail traction, in modern developments in agricultural drying processes, or in any of the other modern applications of liquid fuels in the field already indicated, will be well advised to consult the Conference records; when published, these will constitute a valuable work of reference which will perhaps be the major achievement of the Conference.

F. H. GARNER

OBITUARIES

Dr. S. E. Sheppard

SAMUEL EDWARD SHEPPARD died in Rochester, N.Y., on September 29, aged sixty-six. Dr. Sheppard was born in Catford, and was educated at St. Dunstan's College, Catford, and University College, London. There he obtained the degree of B.Sc. by research in 1903, his thesis dealing with the theory of the photographic process and involving a repetition and extension of the earlier work of Hurter and Driffield. This work was greatly extended in his research for the D.Sc. degree, which was granted in 1906 for a thesis which was published in 1907 jointly with that of C. E. K. Mees under the title of "Investigations on the Theory of the Photographic Process". Much of the work had been published in a series of papers in the *Photographic Journal*, the *Transactions of the Chemical Society*, and in the *Proceedings of the Royal Society*.

In 1906 Sheppard was awarded an 1851 Exhibition for two years and went to Marburg, where he worked with Karl Schaum, professor of photo-chemistry and the editor of the *Zeitschrift für Wissenschaftliche Photographie*. Sheppard's work was on the molecular structure of sensitizing dyes and particularly of pinacyanol, the red sensitizer discovered only a short time before by Homolka, of the Hoechst dye-works. The study of the structure and behaviour of dyes like pinacyanol continued to attract Sheppard's attention throughout his entire life. After a year in Germany, Sheppard went to Paris, where he worked with Victor Henri at the Sorbonne on colloid chemistry.

In 1913 Sheppard accepted an invitation to take charge of the sections of physical and colloid chemistry in the Kodak Research Laboratory, which had just been organised under the direction of C. E. K. Mees at Rochester, N.Y.

His early work there dealt principally with the physico-chemical properties of gelatin, and a number of papers were published dealing with the measurement of the viscosity of gelatin solutions, the measurement of the jelly strength and the elastic properties of gelatin jellies, the setting and melting points of gelatins, the drying and swelling of gelatin, and the structure of gelatin in solution, in the jelly, and in the dry state. These early papers deal primarily with the definition of the properties to be measured, with methods of measurement, and with instruments for making the measurements. As soon as the methods were so perfected that reproducibility was possible, it became evident that further progress in the realm of the physical and chemical properties was dependent on the nature of the sample. This work culminated in 1929 in a description of a procedure for making a standard gelatin by methods easily reproduced in the laboratories. A scientifically valuable by-product of this work was the manufacture and consequent availability of such a standard de-ashed gelatin to laboratories in general, biological as well as chemical.

After the First World War, Sheppard began to turn his attention to the structure and properties of silver halide emulsions, and his first work took the form of a study of the distribution of the sizes of the silver halide grains in an emulsion, the intention being to work out the relation between this distribution and the sensitometric properties of the material. Thus began a long series of studies that are not yet completed, though much progress has been made in the last thirty years. At the same time, working with Dr. Ludwik Silberstein and with Mr. A. P. H. Trivelli, Sheppard began to consider the action of light on the halides and the nature of sensitivity, and about 1923 a series of papers was published on the theory of photographic sensitivity and of exposure, which resulted in the presentation of the concentration speck hypothesis, according to which the sensitivity was related to discontinuities in the silver bromide lattice, presumably due to some foreign substance. At the same time, a very notable group of studies was going forward on the measurement of size frequency distribution, which led to the development of microscopic methods by which the grain-size frequency distribution could be measured for practical silver bromide emulsions.

The well-known sensitizing property of gelatin in the photographic process led to a systematic study of the difference between photographic gelatins in their sensitizing power and the nature of the substance in gelatin which conferred sensitivity. By a painstaking series of analyses, it was found that the sensitizer inherent in natural gelatin was concentrated in the liquors obtained by the acid treatment of the raw material after liming; and eventually it was found that the chemical properties of the sensitizer corresponded to those of allyl thiourea, and that therefore the gelatin sensitizer was essentially one which could produce silver sulphide specks in the silver bromide crystals.

This discovery is perhaps the major advance made in Sheppard's scientific career. All further study of the photographic properties of gelatin, of the nature of the sensitivity of silver halides and of the latent image have been conditioned by it. Its publication won for Sheppard instant recognition. He was awarded the Adelsköld Medal of the Swedish Photographic Society in 1929, the Progress Medal of the Royal Photographic Society in 1928, and the honorary fellowship of the Royal Photographic Society in 1926. In 1928 he delivered the Hurter and Driffield Memorial Lecture to the Royal Photographic Society, and in 1930 received the Nichols Medal of the American Chemical Society.

From that time, Sheppard's scientific work covered a prodigious range of knowledge. Besides the work on the latent image, he studied such matters as the photovoltaic effects, that is, the electrical response of silver halide to light, the colloidal structure of film-base materials and their physico-chemical and elastic properties, the nature of development, and particularly the nature of dye sensitizing, the adsorption of sensitizing dyes to silver halides, the structure of the layers which they formed, and their sensitizing effects.

Sheppard realized that the solution of the problem of dye sensitizing would involve not only the coupling of the dye to the silver halide lattice by absorption, but also an understanding of the nature of the absorption of light by the resonance structure of the dye. Thus he studied the absorption spectra of dyes in various solvents, in vapour phases, and when adsorbed to surfaces. This is the field which was chiefly engaging his attention when his health failed.

While never robust, Sheppard enjoyed good health until a few years ago, when he began to have trouble with his eyes, which culminated in the loss of one eye from glaucoma. At the same time, his heart was affected, and continued to fail until in January 1948 he found it necessary to resign from his position with the Kodak Company.

More than any other single worker, Sheppard has been responsible for our present knowledge of the theory of the photographic process. He explored every section of the chemistry of that process, and everywhere his studies brought light.

C. E. K. Mees

Prof. Kornél de Kőrösy

We regret to announce that Dr. Kornél de Kőrösy, professor of biology in the University of Budapest, died on July 14. Son of the famous Hungarian statistician, Joseph de Kőrösy, he was born at Budapest in 1879. As a student of medicine, he entered the Institute of Physiology in the University of his native city, never to leave it permanently until his death.

Until the First World War he was mainly interested in problems of metabolism, especially in those of resorption, and one of his publications foreshadowed the insulin problem. He spent at that time practically all his summer vacations at some world centre of learning. On one such occasion, in New York, Jaques Loeb invited him to stay at the Rockefeller Institute, where they were working together on osmotic problems; but Kőrösy decided to return to Hungary, which proved fatal for his life and career.

During most part of the First World War and some time after, he was acting director of the Physiological Institute, shouldering an unusual load of teaching in difficult circumstances. Anti-semitic racial prejudice, rising quickly after the War, forced him from this position and practically stopped his experimental work. He turned to genetics and developed a mathematical theory of coupling between genes, published as a long monograph in German. During the last ten years of his life he cleared up important problems on crossing-over interference.

Political terror made him conscious of his Jewish duties, and he soon rose to the presidency of the Hungarian Pro-Palestina Association. The Nazis deported his younger son, who failed to return. The months of terror, the loss of access to his precious library and files, even after the War, hastened his death.

Prof. Kőrösy belonged to those men whose respect for truth and justice was embedded in a nature fond