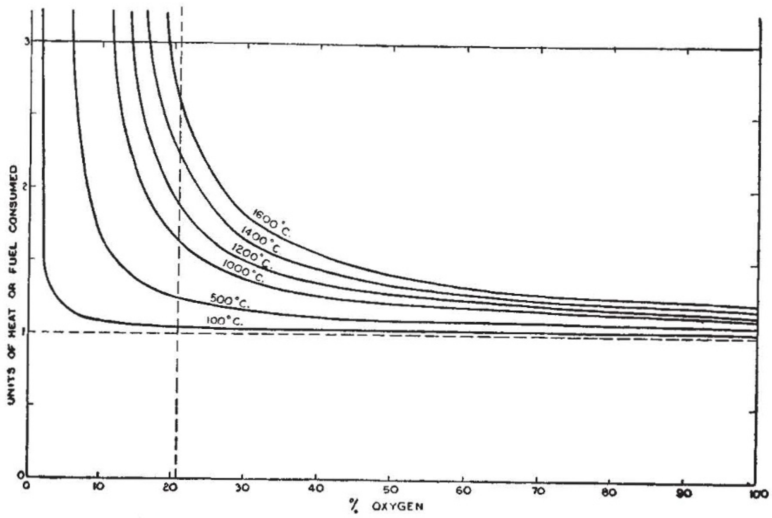

Effect upon fuel consumption of emergent gas temperature for the reaction: $C + O_2 \rightarrow CO_2$

units of fuel consumed for varying percentages of oxygen used in the blast of the furnace, the heat units consumed above one unit being those wasted as sensible heat with the emergent nitrogen. From this chart it will be seen that, for emergent gas temperatures below 1,000° C., little thermal gain can be effected by the use of oxygen enrichment, but that the gain increases rapidly for higher temperatures. Further, it is seen that there is little thermal advantage to be gained by raising the oxygen content of the blast beyond about 40 per cent.

A steel foundry requires molten steel to be supplied intermittently and at a higher temperature than for the production of steel ingots, and at these trials at Leeds, by using 30 per cent oxygen in the blast (as compared with normal approximately 20 per cent in air), it has been found possible to obtain molten steel 50° C. hotter with a simultaneous economy in costly ferro-silicon, which is normally employed as a fuel of high calorific value. Alternatively, advantage has been taken of this gain in thermal efficiency by adding cold steel scrap or ferro-alloys to the steel after the blowing operation. Thus substantial economies have been shown to be practicable, and the way has been opened up for the use of the side-blown Bessemer converter for the production of more highly alloyed steel. Moreover, it has been shown that the use of molten steel of higher temperature does not necessarily mean that there will be any greater attack upon the refractory material of the converter lining or upon the sand of moulds into which the steel is cast; indeed, the penetration of liquid steel between the sand grains has been less than usual, and the surface finish of the castings has been better.

The most striking result of the use of oxygen enrichment is that the flame issuing from the converter is far brighter than usual and the steel is made in about half the usual time. This is a reminder of those early experiments of Priestly which are repeated to this day in school laboratories to demonstrate the enhanced rate of combustion of a wooden splint in oxygen. Normally, during the early stages of blowing a side-blown Bessemer converter, silicon is being oxidized and there is very little flame; and the flame later is associated with the combustion of carbon monoxide at the mouth of the vessel. Using oxygen enrichment and a very low silicon content in the molten metal, the flame is observed right from the commencement of the blowing operation; but it is interesting to note that in spite of the fact that under these conditions the flame is of far greater intensity the agitation of the metal within the vessel appears to be less, as judged by the lower loss of ejected metal. In fact, with higher oxygen contents in the blast there are distinct indications that the metal is not agitated enough to ensure uniform oxidation. These observations are leading to trials of modifications in the design of the vessel, and especially the tuyeres, which may lead to greater efficiency of operation and to the extension of this process of steel-making for bulk ingot steel production.

The industry concerned with the large-scale production of oxygen is making great efforts to keep pace with the rapidly increasing demand; but some idea of the magnitude of the problem is gained when it is pointed out that in the steel foundry referred to about 1,500 cubic feet of oxygen are consumed per ton of steel made, this volume of oxygen weighing about one hundredweight.

At the present time, large consumers of oxygen are supplied with liquid oxygen, which though costing more to produce than oxygen supplied in gaseous form, is much cheaper to transport. However, at the works referred to, about eight tons of oxygen are consumed per week, and this makes necessary a regular shuttle service of lorries carrying liquid oxygen. Thus it appears that the magnitude of the demand is going beyond the economic limit for the supply in liquid form, and extensive plans are being made for the supply of oxygen by some form of gas pipe line to those parts of Britain where the demand for oxygen for such purposes is likely to be great. At the present moment, the high cost of oxygen supplied in liquid form is likely to restrict extensive application of the process to steel foundries where greater advantage can be taken of the technical improvements brought about by oxygen enrichment.

[1] Harrison, J. L., Newell, W. C., and Hartley, A., *J. Iron and Steel Inst.*, 281 (July 1948).

OBITUARIES

Prof. S. W. J. Smith, F.R.S.

SAMUEL WALTER JOHNSON SMITH, formerly Poynting professor of physics in the University of Birmingham, died on August 20 in his seventy-eighth year. His death will be deeply regretted by many former students of the Royal College of Science, London, and of the University of Birmingham, who will remember him gratefully both as a teacher and as a friend.

The son of a well-known railway engineer, Smith was born in Scotland in 1871 and went first to school in Tayport and Dundee, completing his early education at Rutherford College, Newcastle-upon-Tyne. In 1887 he entered the Royal College of Science with a national scholarship, and after completing the course there went to Trinity College, Cambridge, in 1891 with a major scholarship. He obtained a first in Part 1 of the Natural Science Tripos in 1892 and in Part 2 he had the rare distinction for those days of obtaining a double first, in physics and chemistry. Afterwards he was appointed Coutts-Trotter Student and worked in the Cavendish Laboratory under Sir J. J. Thomson until 1896.

Upon leaving Cambridge, Smith returned to the Royal College of Science, London, as senior demonstrator in physics and became assistant professor in 1912. He obtained the D.Sc. degree of London in 1908 and was elected a fellow of the Royal Society in 1914. During this period at South Kensington, he took a prominent part in the work of the Physical Society of London, being honorary secretary from 1908 until 1916 and vice-president during 1916–19. In addition to his heavy secretarial and teaching work, he did a great deal of research in this phase of his career and it was probably his most fruitful period.

In 1919 he succeeded Poynting as professor of physics at Birmingham and undertook the difficult task of coping with the many problems arising from the First World War, particularly those resulting from a great increase in the number of students. Somewhat later, about 1924, he organised a new honours course in physics, as up to that time only a general degree had been awarded. He was dean of the Faculty of Science from 1929 until 1932. In 1936 he retired and was appointed emeritus professor, and from that time until his death he lived a quiet and somewhat secluded life.

In his researches, Smith devoted himself almost exclusively to two fields of work. His first investigation arose quite naturally from his training in both physics and chemistry; he selected it himself and worked at it in the Cavendish with very little guidance. It dealt with the contact difference of potential arising at a mercury – electrolyte interface, and necessitated a great deal of careful observation using various types of capillary electrometer; the conclusions were published in the *Phil. Trans. Roy. Soc.* of 1899. Later, at South Kensington, with the assistance of collaborators, he extended and amplified this work, turning to problems of electrolytic resistance and ionic migration. The results of these experiments were published in a series of papers in the *Phil. Mag.* and the *Proceedings of the Physical Society*.

The second and perhaps the more important field of Smith's work started from a problem in ferromagnetism suggested to him at South Kensington by Sir Arthur Rücker, who surmised that an examination of the magnetic properties of meteoric iron might throw some light upon the cause of terrestrial magnetism. It soon became clear, however, that this was no problem in terrestrial magnetism but rather a problem from the domain common to geology, metallurgy and physics. The meteoric irons are, in fact, examples of iron – nickel alloys which have cooled with extraordinary slowness and show structural characteristics not reproducible by artificial means. Smith worked alone on this question for a number of years, using a method of investigation simple in principle but requiring great skill and care in execution. He published the results of his observations in an important memoir appearing in the *Phil. Trans. Roy. Soc.* for 1908.

This work was continued at Birmingham where, in addition to extensions of the magnetic technique, metallographic and X-ray methods were called into service. During these years a great deal of assistance was given by the late James Young, who published a number of papers dealing with the results of the X-ray examination of some of these meteoric specimens. The magnetic and metallographic work was carried out under Smith's direction, and there exists a great deal of unpublished material. It is probable that towards the end of his life Smith was searching for some far-reaching synthesis of the observations which he failed to discover. In March 1939 he published in *Nature* a very brief summary of the work and of his tentative conclusions.

Smith was a man of great personal charm with a manner at once disarming and dignified. Over many younger men he exercised a special fascination, arising from a genuine gift of sympathy and also from the interest of his conversation. As a teacher he was held in the highest esteem throughout his life. In 1900 he married Dorothy Muriel Stamp who, together with an only daughter, survives him.

M. L. Oliphant
A. A. Dee

King Ferdinand of Bulgaria

Ex-King Ferdinand of Bulgaria, who died recently at Coburg at the age of eighty-seven, was born a prince of Saxe-Coburg Gotha. From early youth he had a passion for natural history; but he was no mere amateur, and his studies of botany, entomology and ornithology were serious and scientific. Of the three, his chief interest lay in ornithology, and he first made his appearance among ornithologists at the age of thirteen, under the guidance of Crown Prince Rudolf of Austria, himself an ornithologist of repute. In 1887 Prince Ferdinand joined the Deutsche Ornithologische Gesellschaft, of which Society he remained patron until his death; in later years he was elected an honorary member of the Royal Hungarian Institute of Ornithology and also of the British Ornithologists' Union. In 1879 he made an official visit to Brazil the opportunity for studying the bird-life of South America, and on becoming Tsar of Bulgaria he gave every encouragement to the study of the ornithology of the Balkans and the collection of specimens. The museums and zoological gardens of Sofia are further and concrete evidence of his active interest.

After his abdication, he retired to Coburg, where he devoted most of his time to his private museum and large collection of living birds, though he frequently visited his castle in the Carpathians. The aviaries at Coburg contained more than eight hundred specimens, including many rare species, most of which had been collected by King Ferdinand himself, and he knew where each one had been obtained or purchased. He would spend hours in his aviaries studying the habits of the birds. A section of the gardens was set aside for wild-flowers which the King had either collected himself or had had given to him, from every part of the world; and, as with the birds, he knew the history of each plant.

In 1927–28 King Ferdinand made a collecting trip to South America and described his experiences in his book "Der König reisst". In 1929 he made an expedition, accompanied by his niece, Princess Victoria, Countess of Solms-Rödelheim, a keen botanist, and his museum curator, Dr. Hans von Boetticher, to Victoria Nyanza and the mountains of equatorial Africa. His account of the expedition,