Longwy and Verdun, which are necessary for their defence; the possession of the vast quantities of coal, and specially of the bituminous coal, which abounds in the North of France is no less important than the acquisition of the iron-ore mines."

Not long after the outbreak of war the German steel industry was beset by serious difficulties owing to the fact that the imports of manganese ore, one of the essential accessories, were cut off, and it was predicted by more than one authority in this country that the shortage of this ore would cause a crisis in, and the eventual stoppage of, the German steel industry. Confident predictions were made as to the date beyond which, for this reason, the war could not be continued by Germany. These predictions entirely failed to take into account the very considerable deposits of manganiferous iron ore contained in the German Empire. In 1911 $2\frac{3}{4}$ million tons of such ore containing less than 12 per cent. of manganese, and 288,000 tons containing between 12 and 30 per cent., were mined. These constituted, therefore, important sources of production when the pinch came. There is good reason for thinking that about ten months' stocks of high-grade ore were present in the country at the outbreak of war, and these were greatly augmented by the confiscation of supplies found in Belgium and North-east France. The mines producing high-grade ore were stimulated to the utmost activity; means are said to have been devised for recovering the slag produced at the ferro-manganese blast furnaces, and also from basic-steel slag. By the desulphurisation of blast-furnace coke certain economies in manganese are considered to have been effected. There is to-day no evidence that Germany is in serious difficulties with regard to steel production owing to the cutting off of external sources of manganese ore.

In pre-war times Russia produced more manganese ore than any other country. In 1913 the output was 1,175,000 tons; most of this was exported and went through the Dardanelles. How heavily this industry was hit by the war is shown by the fact that in 1915 the production is stated to have been only 9750 tons. India, much the largest source of supply within the Empire, was a close competitor of Russia, and, apart from a drop of output in 1915, production has been well maintained. Much of the Russian export went to the United States of America, and the iron and steel industry in that country has been placed in considerable difficulties in consequence. For a time the deficiency was made good by imports of the high-grade ores mined in Brazil. With the acute shortage of ship tonnage which now exists, however, a most urgent appeal has been made to the iron and steel manufacturers in the United States to utilise home sources of ferruginous manganese and manganiferous iron ores.

The Department of Scientific and Industrial Research is to be warmly congratulated on the publication of a report which gives in a well-arranged and lucid form just the information it set out to collect and systematise. It is to be hoped that it will become one of its standing publications, and that from time to time new editions with the most up-to-date information will be issued. H. C. H. CARPENTER.

PROF. BERTRAM HOPKINSON, F.R.S.

THE death, in a flying accident on August 26, of Col. Bertram Hopkinson, C.M.G., F.R.S., professor of mechanism and applied mechanics in the University of Cambridge, is a grievous loss to science and the nation. Born in 1874, the eldest son of Dr. John Hopkinson, F.R.S., he inherited not a little of his father's scientific insight and genius for bringing science to bear on practical matters. This hereditary aptitude was fostered by close contact with his father's mind in early life; he was his father's frequent companion in work as well as in play. Bertram lived at home, attending St. Paul's School until he went to Trinity, where he took the Mathematical Tripos. An unlucky illness compelled him to take an ægrotat degree in the First Part; but he showed his quality in the Second Part, when he was placed in the First Division of the First Class. He then read for the Bar, devilling in a well-known counsel's chambers, and had been "called" when the tragic death of his father, along with a younger brother and two sisters, while climbing near Arolla in 1898, changed the current of his life. He boldly took up his father's business as a consulting electrical engineer, in association with his uncle, Mr. Charles Hopkinson, and Mr. Talbot, a former assistant. With them he carried out various tramway undertakings during the next four or five years.

In 1903 Hopkinson was elected professor of mechanism and applied mechanics at Cambridge, in succession to the present writer. To many the appointment of so young and comparatively unknown a man must have seemed surprising, but those who knew Hopkinson were confident that the electors had made a wise choice. It was entirely justified by the result. In Hopkinson's hands the Cambridge School of Engineering prospered exceedingly, going from strength to strength in numbers, in academic and professional repute, and, above all, in activity as a centre of research. Hopkinson was himself devoted to research, and could inspire his pupils with a like ardour. In some instances a pupil's name appears as joint author of the published paper; in others the pupil was himself left to complete and publish the work.

No one, I think, can read Hopkinson's papers without being reminded of those of his father. There is something of the same freshness of outlook, the same penetration and grasp, the same personal detachment, the same directness in attack, the same unconventionality in method, the same avoidance of side issues and concentration on the essence of the problem. It is impossible to do more here than give the briefest indication of their general scope. One group deals with elastic hysteresis in steel and the endurance of that metal under repeated cyclic variations of stress. For these experiments he designed an ingenious "fatigue-tester" to apply alternations of pull and push at a rate as high as 7000 per minute by using electro-magnetic action to maintain the vertical oscillation of a heavy armature attached to one end of the test-piece. Another important group of papers deals with gaseous explosions. His researches in this subject have done much to clear away earlier misconceptions and to bring out features in the process of explosion that had been overlooked. They disposed of wrong ideas about "after-burning," but at the same time showed how far from uniform is the condition within a closed combustion-vessel at the moment when the maximum pressure is attained.

As joint secretary with Sir Dugald Clerk of the British Association Committee on Gaseous Explosions, as well as by his own experiments, Hopkinson did much to advance our knowledge of an intricate problem. He applied similar methods of inquiry to the analysis of what occurs in an internal-combustion engine; in this connection his optical indicator is of great service. During the years immediately before the war he was engaged in studying the pressure produced by the detonation of high explosives and by the impact of bullets. For this he devised methods of measurement which were admirably simple and effective. They were described in a Royal Institution lecture in 1912, and more fully in the Philosophical Transactions of the Royal Society for 1914. Hopkinson also edited a reprint of his father's scientific and technical papers, and wrote for it a short memoir, which was published in 1901.

On the outbreak of war he threw himself with characteristic vigour into national service, to the exclusion of all other interests. At Cambridge he had been a keen promoter of the Officers Training Corps. He first undertook R.E. duty at Chatham in order to relieve others for active service. Later he was engaged for a time at the Admiralty on work of a kind quite new to him, which he attacked with conspicuously good effect. He had the satisfaction of seeing an invention, which he made to meet one of the bigger difficulties of the war, promptly tested, adopted, and officially recognised. Concurrently with this he acted as secretary of a committee set up by the Royal Society to assist the Government, a position which brought him into touch with many other war questions and with the men busied in them. His attention began to be directed to the equipment of aircraft, and soon he became absorbed in this task, accepting a position in what is now the Royal Air Force. There, perhaps as never before, he found his opportunity. His powers were acknowledged and turned to full account; he received promotion, and the range of his authority was enlarged. He revelled in his work, put everything aside for it, was unsparing of himself. He knew well that flying, especially for a man no longer young, meant a serious risk; but he felt that the risk had to be taken if the work were to be well done. So he flew, from one air station in England to another, or even to France, generally as his own pilot.

All who knew Hopkinson esteemed him for a man of strong character and sane judgment, of unswerving straightness in thought and action, with a rare freedom from egotism or self-seeking or any pettiness. But it was only in the intimacy of the domestic circle that one learnt what a wealth of affection lay behind his reserve. In 1903 he married the eldest daughter of Mr. Alexander Siemens; she survives him with seven daughters. His family life was an ideally happy one save for the calamity of 1898 and for the death of his brother Cecil, a young man of like tastes and of the finest promise, who died last year of a wound received in Flanders. In claiming them both, the War has taken of our very best.

J. A. EWING.

NOTES.

THE Società Italiana delle Scienze (detta dei XL) has awarded the natural sciences gold medal for 1918 to Prof. Filippo Eredia for his work in meteorology. This is the first time that, in Italy, studies in the field of meteorology have been rewarded in this way.

A TELEGRAM received at the Meteorological Office on August 26 from the Director-General of Observatories in India states, with reference to the Arabian Sea and Bay of Bengal, that the monsoon is normal, and that no cyclonic storm has occurred.

WE regret to note that *Engineering* for August 30 records the death of Engineer Rear-Admiral Francis Henry Lister. Admiral Lister was well known in the Service, and was closely identified with the construction of machinery in the contractors' works, not only for the Navy, but also for several ships ranked as auxiliaries to the Navy, including the *Mauretania* and *Lusitania*. His age was fifty-six years, and he had given thirty-nine years to the service of his country in the Navy. He was a member of the Institution of Naval Architects and of the Institution of Mechanical Engineers.

THE principle that every large industrial firm should have its own research laboratory appears to have been accepted more generally in America than it has been in this country, and as a consequence a large proportion of our knowledge of the working of such laboratories comes from American sources. In the August issue of the *Scientific Monthly* there is, for example, a valuable paper on research and industry by Dr. P. G. Nutting, the director of the Westinghouse Research Laboratory at East Pittsburgh. Dr. Nutting points out that in addition to technical research, such as the testing of the materials received and produced, the elimination of works troubles, and the starting of new processes, it is necessary to carry out scientific industrial research on basic principles, and on their relations to the more obscure and fundamental works troubles. He considers that the best preparation for industrial research as a profession is a thorough grounding in principles, followed by research sufficient to justify the award of a doctor's degree in the best American universities.

A ROYAL Commission has been appointed "to consider and report whether it is advisable to make any changes in the denominations of the currency and