

radiate more heat than one made of boiler-plate, since the roughness increases the surface exposed to the air and to the oil in which the transformer is immersed. This is true so far as the heat conducted from the oil is concerned, but as the great bulk of the heat is carried away by convection currents in the air, it is of importance to increase these currents as much as possible, and so a rough surface may be a disadvantage.

(3) The principles that have to be taken into consideration when designing power systems are discussed. The advantages and disadvantages of the various systems are clearly stated, and will be a help to young engineers. Specimen record forms are given. These are apparently American in origin, as the lineman is warned not to "throw on the current" until he receives the signal. The consumer also gets his lamps free.

### Modern Metallurgy.

*The Metallurgy of Iron and Steel.* Based mainly on the Work and Papers of Sir Robert A. Hadfield. Compiled by the Editor of Pitman's Technical Primers. (Pitman's Technical Primer Series.) Pp. xv + 122. (London: Sir I. Pitman and Sons, Ltd., 1922.) 2s. 6d. net.

THIS small volume, which is written in a very interesting manner, gives the reader a clear idea of the developments made in the metallurgy of iron and steel in recent times. The work contains seven chapters, the first of which deals with the possibilities of an approaching exhaustion of the supplies of both iron ore and coal at some future date; the author, however, points out that, as regards coal, substitution may be arranged by employing the energies of waterfalls, tides, solar radiation, plant life, winds, and finally the enormous power contained in the atoms may some day be released for useful work. Reference is made to the anxiety of the German industrial leaders and others during the Great War of 1914-1918 for the retention of the iron-fields of Northern France, thereby indicating the value that was placed on the commercial prosperity due to iron and steel manufactures.

Chapter 2 contains a brief account of the work of the pioneers in scientific metallurgy. Details are given of the Delhi Pillar, a solid column of nearly pure iron 24 ft. in length and weighing  $6\frac{1}{2}$  tons, which was erected about sixteen centuries ago. The author points out that "the finest armour and swords made during the Middle Ages cannot be excelled to-day without using special alloys." Nevertheless, these fine results were obtained empirically, and it was not until recent times that any exact knowledge of the reasons for the various methods of treatment were understood.

Tribute is paid in an appendix to the early British workers who have done so much to elucidate these matters, and in more recent years to Faraday, Heath, Percy, Bessemer, Gilchrist, Thomas, Able, Sorby, Lothian Bell, Roberts-Austen, Stead, Arnold, Hadfield, and many others.

Chapter 3 deals with iron ores and the manufacture of iron and steel, while chapter 4 is devoted to hardening, heat treatment, and microstructure. In chapter 5 alloy steels are considered, and here the work of Sir Robert Hadfield is frequently referred to, especially in connexion with nickel and manganese steels. It has been stated by the well-known German writer Mars in "Die Spezialstahle" that: "The most extensive experimental researches, which may be said to have laid the foundation of our entire knowledge of steel alloys, were carried out by Hadfield in the 'eighties of the last century." Reference is also made to the direct and indirect saving effected by alloy steels of low hysteresis discovered by Sir Robert Hadfield about twenty years ago. Mr. T. W. Yensen, of the American Westinghouse Electric Company, estimates that the total saving effected to the world by the use of this material amounts to about 340,000,000 dollars.

Fuel economy and research are dealt with in chapters 6 and 7 respectively, and the work is concluded with two appendices, one containing a list of early workers in scientific metallurgy, and the other a list of research papers and scientific addresses by Sir Robert Hadfield from 1888 to 1921.

The little book is both interesting and useful, and should certainly find a place in every metallurgical library.

W. H. M.

### The British Association Addresses of 1922.

*The Advancement of Science: 1922.* Addresses delivered at the 90th Annual Meeting of the British Association for the Advancement of Science, Hull, September 1922. Pp. 15 + 9 + 24 + 30 + 15 + 12 + 27 + 17 + 14 + 15 + 14 + 11 + 15 + 34. (London: John Murray, 1922.) 6s. net.

UNDER the title of "The Advancement of Science," the British Association now issues in collected form, and as a separate volume of a convenient size, even before the conclusion of the annual meeting, all the addresses, presidential and sectional, which have been delivered at that meeting. Although, perhaps, some exception might be taken to the appropriateness of the main title, as not sufficiently indicative of the actual contents of the volume, any ambiguity is removed by the subsidiary title, which