THE AUTUMN MEETING OF THE IRON AND STEEL INSTITUTE.

WHEN Buxton was selected as the locality for the autumn meeting of the Iron and Steel Institute doubts were freely expressed as to the suitability of the choice. These doubts proved to be groundless, for the attendance of members was larger than usual, and visits to the Midland Railway works at Derby, the London and North-Western works at Crewe, and to the Staveley Iron Works afforded opportunities for instruction, while the beautiful weather conditions caused the Duke of Devonshire's garden-party at Chatsworth, and other excursions in Derbyshire, to be very successful and enjoyable functions.

From a scientific point of view, the paper which attracted the most attention was that on the theory of hardening carbon steels, by C. A. Edwards, of Manchester. As is well known, metallurgists have long been divided into two camps, the "carbonists" and the "allotropists," and at times much heat has been introduced into the discussions which have taken place. The position advocated by Mr. Edwards is to an extent an intermediate one, as it is based on the assumption of the existence of three allotropic forms of iron, known as α, β, and γ respectively. At the same time, the absolute necessity of carbon for true hardening is maintained. After a clear explanation of the elementary facts connected with the phase rule in its application to alloys in general, and particularly to the iron carbon series, the author concludes that the hardness of carbon steel is due to the retention, by quenching, of the solid solution of carbon, or carbide of iron, in γ iron, and that the β-iron theory, as applied to the explanation of the increased hardness of steel, is untenable. The solid solution of carbon or carbide in γ iron decomposes with slow rates of cooling, and some force must be applied to prevent inversion taking place. The force is mechanical, and is caused by the contraction of the outer shell. There is no constitutional difference between austenite and martensite, the apparent difference being due to the twinning of the γ solid solution as a result of the mechanical pressure.

In the discussion which followed the reading of this paper, Prof. Arnold warmly congratulated the author on his contribution, but contended that more facts were required before generalisations were accepted, and pointed out that the cooling curves as given by himself, and confirmed at Charlottenburg, did not agree with those published by Dr. Carpenter. The latter stated that the difference was not one of observation, but of methods of recording and of interpretation. Prof. Turner asked for evidence of twinning, and suggested that twinning in crystalline rocks or in the brasses was the result of annealing after pressure, but that in the hardening of steels there was no such annealing.

Two papers which also led to an interesting discussion were taken together, and dealt, *inter alia*, with the changes on the length of cast-iron bars when cooling in a sand mould. These papers were entitled "The influence of Silicon on the Properties of Pure Cast Iron," by A. Hague and Prof. T. Turner, and "Manganese in Cast Iron, and the Volume Changes during Cooling," by H. I. Coe. It was pointed out that in Prof. Turner's original papers on silicon in cast iron, published in 1885, the materials used were relatively impure, and though the results have been confirmed by very extended practical application, it was thought well to start with the purest available materials and to observe the temperature and contraction changes and the microstructure, which had not been examined in the earlier tests. White iron, when free from elements other than carbon, shows only two slight arrests in the rate of contraction, and these correspond with the eutectic and the pearlite points respectively. On adding silicon or manganese, the iron, though still white, expands during and immediately after solidification. With more silicon the carbon is thrown out of solution, and a marked additional expansion occurs. Though much manganese tends to make iron white, about 0·5 per cent. of manganese, in presence of silicon, produces more secondary graphite, and thus lowers the combined carbon. In the manganese series of white iron the expansions form a regular curve with the percentages of manganese, and minima are found corresponding with the existence of four definite carbides. In the grey-iron series the expansions were relatively large, and the pearlite point disappeared suddenly with about 3·5 per cent. of manganese.

In the discussion references were made to the great detail involved in such an inquiry, and to the need of further work and generalisation. In a paper by S. Hilpert and E. Colver-Glauert, sulphurous acid was recommended as an etching agent for metallographic work. The acid is used as a saturated solution of sulphurous acid in water. It should be free from sulphuric acid, and should be diluted with water to about 3 or 4 per cent. of such acid. The time taken is said to vary from seven seconds to one minute. S. Hilpert, of Berlin, submitted a useful note on the preparation of magnetic oxides of iron from aqueous solutions, and stated that the production of Fe_3O_4 from aqueous solution is only possible through the precipitated FeO dissolving in the ammoniacal residue. The true magnetic oxide is Fe_2O_3 in the form of ferric ferrate, and the magnetic properties of Fe_3O_4 have their source in the acid properties of Fe_2O_3.

The remaining papers of a varied programme dealt with briquetting iron ores, electric power and electric steel refining, the Hanyang iron works in China, the production of rolled H beams, and experiments on fatigue in metals.

THE GEOLOGICAL CONGRESS AT STOCKHOLM.

THE eleventh International Geological Congress in Stockholm from August 17–25 has been generally pronounced by the members to have been one of the most successful yet held. There was an attendance of about 900, including representatives of all European countries except Portugal, of Australia, China, and Japan, and a distinguished contingent from America. The excursions at this congress have been unusually various and instructive, and they were heartily enjoyed, thanks to their skilful organisation and management. Before the meeting there were excursions to Spitsbergen, Lapland, and central Sweden; during it to the Archæan areas and glacial deposits around Stockholm and Upsala, and to the classical Silurian sections at Gothland; and after it to the chief iron fields and areas of geological interest in southern Sweden. The library of guide-books issued for the excursions forms an invaluable summary of the field geology of Sweden. The Swedes as a people are characterised by the thoroughness of their work and the charm of their manners; the foreign visitors return impressed by the excellence of Swedish contributions to geology and with pleasant memories of the hospitable reception from all classes, from the gracious courtesy with which the King and Queen received us in the palace to the smiling welcome of the peasants in the field.

So much work was done at the congress that no adequate account of it can be given in a short notice. Five sections and various commissions and committees met simultaneously.[1] The discussions were sometimes not influential, for they often followed the reading of several disconnected papers, and many of the speeches were rather further contributions to the subject-matter than discussions of the papers that had been submitted.

The first formal meeting of the congress was held on August 18, when the honorary president, H.R.H. Prince Gustave Adolphe, welcomed the congress in a graceful speech, referring to the dependence of mining on geology and the increasing importance of science now that it is devoting more attention to practical questions. The King of Sweden then declared the congress open. Prof. de Geer was installed as president, and gave a lecture on "The Geochronology of the last 12,000 Years." He remarked the complete failure of previous attempts to measure geological time in years, and described his determination of the length of post-glacial time in the Stockholm district. He noticed there that the marine post-glacial clays

[1] For notes on some of the meetings the writer is indebted to Prof. Hobbs, Prof. Cole, and Dr. J. W. Evans.