spark gap in a loop of wire, he showed the sparks induced by the electric waves at a distance of ten metres from the transmitter, he said: "It appears impossible, nearly nonsensical, that these sparks should be visible, but in a perfectly dark room they *are* visible."

Since the death of Hertz it can hardly be said that another link in the chain of development has been forged. Our knowledge and study of electric waves have spread and expanded enormously, and the practical utilisation of the same is seen in the modern wireless telegraphy. The possibility, as Marconi has shown, of already sending messages without the use of wires for a distance of 300 kilometres is the direct result of the labours of Hertz. From a theoretical standpoint the work of the many investigators of the last few years has simply increased the burden of proof that the fundamental ideas of the electrodynamical theory are correct. Many points, however, yet remain to be cleared up. In the domain of the ether itself very few difficulties have been encountered. Very different has been the case when the ether pure and simple has been left and the theory and ideas extended to ordinary bodies and materials. Chief among these difficulties must be mentioned the phenomena of anomalous absorption and dispersion, and the relative interaction of mass and ether is to-day one of the most perplexing and yet enticing fields of scientific work. Perhaps here we are, though it is not mentioned in the pamphlet, just commencing the forging of yet an entirely new link, which will be seen in the full development of the corpuscle and electron theories, and the explanation of the many at present very strange phenomena included under these names. Besides being a very interesting address, this booklet would be very useful in serving as an index to the many investigations which have been made and published in this branch of science. C. C. G.

THE CIVILISATIONS OF HALLSTATT AND LA TENE.[1]

THE publications of the Prehistoric Commission of the Imperial Academy of Science in Vienna, in their present form, date from the year 1887, when it was resolved to discontinue the practice of publishing their reports as integral parts of the *Transactions* of the Academy. The primary object of this commission was to prosecute palæo-ethnographical investigations throughout the Austrian dominions, taking special care that the necessary excavations would be conducted in a thoroughly scientific manner. Since 1887 five parts, in all 363 pages, in quarto, with plates and numerous illustrations in the text, have been issued, giving on an average only twenty-eight pages per annum—a rate of progress which, *primâ facie*, does not suggest that such researches are advancing with rapid strides in that part of Europe. Looking, however, at the contents of the various papers and reports, which range over the whole field of prehistoric archæology, I am constrained to say that, in forming a fair estimate of the archæological value of the labours of the commissioners, we must be guided by quality and not by quantity.

The part now before me (No. 5) contains two papers, one by Dr. Moritz Hoernes and the other by Mr. Josef Szombathy, both officials in the prehistoric department of the K.K. Naturhist. Hofsmuseum in Vienna. Dr. Hoernes describes five different groups of antiquities from the vicinity of Vukovar, on the south side of the Danube and not far from the great bend which the river makes in changing its course from south to east. One group consists of the débris of a settlement of the Stone Age, two—one being a hoard—are of the Bronze Age, while the remaining two are respectively interments of the Hallstatt period and of Slavish times (eleventh or twelfth century). The first station, which bears the name Vučedol, is considered of some importance inasmuch as its relics, especially the pottery, illustrate the evolution of ornament; and so the author discusses at some length the points of resemblance and difference between them and those of a number of other analogous stations, such as Butmir (Bosnia), Tordos (Transylvania), Sarvas, near Essegg (Slavonia), the lake-dwellings of Laibach Moor, &c. But as Dr. Hoernes' opinions on these matters are already known, or at any rate accessible, to archæologists through his great work on the history of prehistoric art in Europe ("Urgeschichte der bildenden Kunst in Europa," Wien, 1898), I shall pass on to the next paper, which, having an important bearing on the development of the early Iron Age in Europe, is of some consequence to British archæologists who may be desirous to trace the late Celtic remains of their own country to their proper source.

Mr. Szombathy's valuable monograph, "Das Grabfeld zu Idria bei Bača," takes the form of a report on excavations made, in 1886 and 1887, in forty-seven graves discovered in the valley of the Idria in the Julian Alps. The little cemetery, occupying an area of 5 to 10 metres in breadth and 30 metres in length, is situated on the right bank of the river some 20 metres above the river-bed and about an hour's walk to the south-east of the great necropolis of Santa Lucia—one of the most famous landmarks of the Hallstatt period in Europe. These graves had, on the average, a depth of one metre and a breadth and length of 50 to 80 centimetres; and all of them, with the exception of two, contained interments after cremation. They are numbered in the order in which they were excavated, but in the report they are described in chronological sequence beginning with the oldest, *i.e.* the middle Hallstatt period (about 600 B.C.). As this sequence comes down to late Roman times we have in the contents of the cemetery of Idria a remarkable evolutionary series of remains, extending over a period of nearly 1000 years. The successive stages of civilisation disclosed by the investigation, together with the number of graves assigned to each, are as follows:—Middle Hallstatt represented by 1 grave, late Hallstatt by 13, early La Tène by 2, middle La Tène by 13, late La Tène by 7, early Roman by 8, and late Roman by 2.

Mr. Szombathy's description of the relics, with 212 illustrations in the text, is a model of precision and brevity, without any lack of essential details, and therefore admits of no curtailment. The following remarks will, however, give readers some idea of their salient features.

Ornaments.—Among this class the fibulæ are the most interesting. One or two, of the boat-shaped type, having a long, straight foot, belong to the middle Hallstatt period. The Certosa fibula and its contemporary the cross-bow fibula are respectively represented by fourteen and three specimens. The La Tène fibulæ—early, middle and late forms—are numerous, and well worth careful study by those who have not acquired precise notions of the progressive stages thus designated. Five hinge fibulæ, peculiar to Roman remains, complete the list. Among the early La Tène group there are two very remarkable, if not unique, specimens. These are ornamented with amber beads placed in pairs on five pins projecting from the upper surface of the bow and attached to a bronze wire which, in a succession of small, graceful coils, follows the curve of the bow from head to foot. The middle La Tène specimens have the recurved foot ending in a circular expansion, which appears to have contained a setting of some kind of enamel. Iron fibulæ are scarce. The other objects of personal ornament consist of earrings, studs, finger-rings (one with three twists), bracelets with one or more coils, glass beads and torques.

Vessels.—Bronze caldrons and situlæ with movable handles, round or flat bottoms, and bulging, slanting or upright sides, are well represented. Two bronze dishes, one of the milk-plate type (5½ inches wide and 3¾ inches deep) and the other a small bowl with a ring-handle, have *graffiti* inscriptions on the outside of their rims, said to be in Venetic or old North Etruscan alphabet. A small bronze colander is perforated in such a manner as to form a geometrical pattern consisting of a central rosette surrounded by a fret border. Pottery is not abundant, and only a shallow dish, one or two jars with handles, and a conical vase with expanded base and slightly contracted mouth are figured.

Military Accoutrements.—A bronze helmet, with a projecting rim and central ridge, has an inscription in Roman characters scratched on it which reads *Protemus.*—There are also two iron helmets said to be of Roman workmanship. Among the weapons are a characteristic La Tène sword and sheath, both made of iron. Two other iron blades, also with their sheaths, are supposed to be like the Roman gladius. The iron blade in both specimens is separated from the grip (only the long tang of which now remains) by a circular guard of bronze. The sheaths were imperfect, but they appear to have been made of an iron frame, with panels of bronze and some non-durable material probably wood. There are also several spearheads, a knife-dagger still in its iron sheath and some fragments of shields showing conical bosses—all made of iron.

Industrial remains.—In this category are to be placed a

[1] "Mittheilungen der Prähistorischen Commission der K. Akademie der Wissenschaften in Wien." (Band i., No. 5, 1901.)

varied assortment of iron objects, such as knives, chisels, axes with flanges on one or both sides, axe-hammers with transverse sockets, scythes and sickles very similar to those from Oppidum La Tène, buckles, shears, shovels, ploughshares and coulters, the central portion of a bridle-bit, &c.

A bronze statuette.—One of the late Hallstatt graves contained a bronze figure of a beardless man, 12 centimetres in height. The body is clad in a closely-fitting tunic with a prominent girdle, leaving the neck, forearms and legs exposed. On the left arm is an armlet, on the left leg an anklet, and on the head a helmet. The bare feet rest on a small round pedestal. The gaze is directed to the palm of the upraised right hand, while the left arm is bent sidewards as if the half-closed fist were grasping the handle of an upright spear.

One of the most novel features of the cemetery was the proportionately large number of agricultural and domestic implements which it contained. While analogous cemeteries in other localities, such as the neighbouring necropolis of Santa Lucia, have yielded an endless array of objects of personal adornment, as well as others intended exclusively for votive purposes, here at Idria the grave-goods consisted of utensils, implements, weapons, tools and ornaments actually used in everyday life. Mr. Szombathy, however, observes that this peculiarity was more noticeable in the interments of the later half of the period during which the cemetery was in use.

Another equally noteworthy feature was that objects of different periods were not unfrequently found in the same grave—a fact accounted for by the tendency to continue old customs in secluded mountain valleys, such as that of Idria. This overlapping of different culture periods complicates, to some extent, the task of delineating the successive phases of the early Iron Age civilisation.

As to the racial question, Mr. Szombathy speaks by no means dogmatically. The earlier grave-goods indicate a civilisation so like that of Santa Lucia that its founders were probably of the Illyrian stock; but whether the same people continued in the Idria valley during the intrusion into it of the later Celtic and Roman culture-elements there is no evidence to show. Possibly the deciphering of the inscriptions on the bronzes, of which there are three or four, may help to solve the problem.

The frequency with which the generic expressions "Hallstatt" and "La Tène" are now used in the archæological literature of Europe renders it essential for British antiquaries to acquire precise ideas of the culture-elements represented by them. For the origin of the word "Hallstatt" we have to go back to the investigation of a cemetery in a small valley of the Noric Alps in the vicinity of Lake Hallstatt, and for that of "La Tène" to the well-known station of that name at the north end of Lake Neuchâtel. Subsequently these terms were used to designate similar remains found in widely-separated districts, just in the same way as the term "Mycenæan" is no longer restricted to the discoveries at Mycenæ. Practical researches have now greatly extended the culture-elements, both in number and types, which have to be classified under Hallstatt and La Tène, and it has often been mooted whether a better nomenclature could not be devised. I do not think it would now be advisable to make any change in this respect. What, however, is urgently required with regard to these terminal links in the development of the Iron Age in Europe is an authoritative work dealing with the essential characteristics of the relics discovered within their respective archæological areas. For records of the rich finds made in Central Europe since the appearance of "Das Grabfeld von Hallstatt" by v. Sacken, and in the cemeteries of Glasinac and Jezerine in Bosnia, as well as in those of the Istrian peninsula and the valley of the Po, we have to hunt in the *Transactions* of so many societies that they are, practically, inaccessible to all but a few specialists. Knowing the competency of Austrian archæologists for executing such a work, and the ample resources, by way of illustrations, at their command, I trust this suggestion will not remain fruitless.

ROBERT MUNRO.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE difficulty in connection with Mr. Carnegie's offer to found a National University (see p. 164) has been solved by the donor's arranging to convert into Government bonds the ten million dollars' worth of United States Steel Corporation bonds, the acceptance of which was an obstacle to the adoption of the scheme.

OUR national deficiencies in regard to provision for higher scientific and technical education are obvious to all who take the trouble to inquire into the matter. For many years men of science have been watching with a feeling akin to envy the opportunities provided for scientific instruction and investigation by foreign nations, and comparing them with the elementary efforts at technical education here. The facts which have been given in these columns week after week have made our readers familiar with existing conditions of technical education; and it is impossible not to be dismayed at the country's prospects in the industrial wars of the future when the inadequate way in which our industrial leaders are trained is understood. A pamphlet just published by the Association of Technical Institutions, giving a comparison of technical education at home and abroad, again brings the subject before the attention of the public. In the matter of buildings and equipment for the highest kinds of technical work we are still far behind Germany, Switzerland and America. Two diagrams published in Nature in 1898 (vol. lviii. p. 54) show clearly how Continental institutions for instruction and research work in technical or applied science are provided on a scale which vastly exceeds ours both as regards areas of sites and areas of buildings. Both these diagrams are reproduced in the pamphlet just mentioned, and also those which

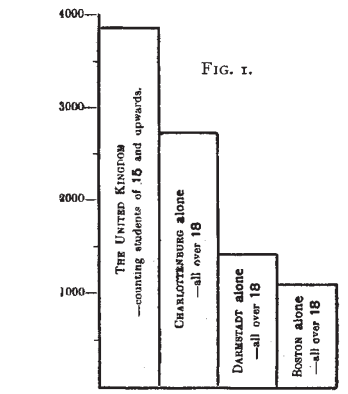

FIG. 1.

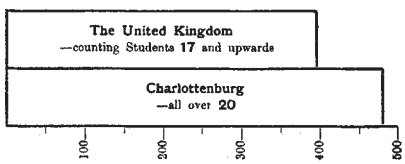

FIG. 2.

FIG. 1.—Diagram comparing approximately the number of Students above 15 years of age taking complete Day Technological Courses in the whole United Kingdom, with the numbers of similar Students above 18 in single Institutions in Germany and America.

FIG. 2.—Diagram comparing approximately the number of third and fourth year Students above 17 years of age taking complete Day Courses in Engineering in the United Kingdom, with the number of similar Students above 20 in a single German Institution.

accompany this note. In these diagrams we have some results of an inquiry made by the association as to the number of day students fifteen years of age or more who are taking complete regular day technological courses of not less than twenty hours a week. Statistics were obtained from Universities, University Colleges, technical schools and all similar institutions where day technological courses are given. The results of the inquiry show that in comparison with other countries our attempts at technical education are utterly futile. In the whole country there are only 555 third-year students of technology satisfying the conditions described, and 113 fourth-year students. The total number of third-year students in engineering is only 347, and of fourth-year students 52, and this number is only obtained by counting students who begin their studies at the immature age of fifteen. As the accompanying diagram (Fig. 1) shows, there are more than two-thirds as many regular day students above eighteen years of age at the Charlottenburg Technical High School, Berlin, as there are above fifteen years of age taking