

mum magnetisation is determined by the stoichiometric composition, especially where several compounds of the same components exist. Manganese, for example, has a maximum in the trivalent condition with such elements as can themselves be trivalent.

Several papers deal with the Heusler alloys. Dr. Ross describes a series of magnetic investigations from which it is concluded that the magnetism of these alloys is associated with the occurrence of solid solutions having the intermetallic compound Cu_3Al as one constituent, and probably Mn_3Al as the other. The theory is supported by evidence gathered from examination of the microstructure and from cooling curves. Drs. Knowlton and Clifford, in their paper, also appear to favour the hypothesis of a series of solid solutions as best suiting their magnetic results, but Drs. Heusler and Take still adhere to their belief in a series of ternary magnetic compounds of the general formula $\text{Cu}_x\text{Mn}_y\text{Al}_z$, where x and y can have any of the values 1, 2, . . . , and $x+y=3z$. It seems now to be certain that these Heusler alloys—despite their very small hysteresis loss under certain conditions of thermal treatment, &c.—do not give promise of practical applications in electrical measuring instruments. Their extreme variability, their hardness, and their brittleness are strongly against all commercial applications.

THE ASSOCIATION OF TECHNICAL INSTITUTIONS.

THE twentieth annual general meeting of the association was held in Birmingham on January 31, when Mr. J. H. Reynolds, of Manchester, the new president, delivered his presidential address, in the course of which he discussed the progress of elementary education since the Act of 1870, and contrasted the abundant provision of the present day with the meagreness which prevailed anterior to the Act. He detailed the causes which operated to prevent the realisation of the full fruits of the great Imperial and local expenditure incurred in the establishment and maintenance of elementary education with special reference to the early age of leaving school, and to the absence of proper measures for securing the continued attendance of the children upon suitably designed courses of instruction and training in evening schools during the years of adolescence. He urged the abolition of half-time and the extension of the school age until fourteen, unconditionally throughout the urban and rural areas of the kingdom, and discussed the demand made that the curriculum of the elementary school should be confined to "the three R's," maintaining that there should be made the fullest possible provision for the education and training of the worker's child for his future life as a producer and as a citizen. He further directed attention to the poor physical condition of many thousands of children in the public elementary schools, and appealed for smaller classes and better trained teachers. He dwelt upon the importance of this question of elementary education, since until it is well considered and effectually provided, secondary education cannot be adequately established, and any technical education and training of real value directly concerned with a livelihood and based upon scientific principles are impossible.

Education is one, and indivisible, and if there is to be a satisfactory superstructure the foundations must be carefully laid, and the whole scheme made organically complete from the elementary school to the university.

Out of a child population between the ages of thirteen and seventeen amounting to upwards of

1,800,000, there were only 325,117 enrolled in evening schools. Measures should be enacted requiring all employers to give facilities for the continued education of their employees between the ages of fourteen and seventeen; until that age was reached the child should remain the ward of the schoolmaster.

The Act of 1902 unified under one responsible authority all forms of education, and for the first time in the history of English education gave the means for the provision of a properly organised system of secondary education. The operations of the Technical Instruction Act of 1889 had awakened a new and serious interest in education, derived from the fact that the ill-prepared educational condition of the students made it impossible to impart successfully any satisfactory training in science or technology.

Under the provisions of the Education Act of 1902 numerous old endowed schools all over the country which had become effete for want of effective public control, and of the means to meet the demands of modern requirements, have been revived, and large numbers of new secondary schools, well staffed and equipped, have been provided. The great drawback to their efficiency is to be found in the short school life, extending to not more than two years and nine months, contrasting unfavourably with the school life of the German gymnasium and the *Ober-Real-Schule*, extending to nine years, and ending in a leaving examination, admitting without further test to any technical high school or university in Germany. Measures should be taken to ensure a satisfactory length of school life in English secondary schools, concluding with a school-leaving examination giving admission at once to any institution for higher learning.

We have further so to systematise our secondary education that in going from one large urban or other centre to another the scholar will be sure to find a school of similar standing to that he has left. It is to the improvement of the product of the elementary school and in the extension of the school age until fourteen, to a large increase in the number of secondary schools and in the extension of the length of the school life therein, so as to approximate to that of the German and Swiss secondary schools, that we must look for the future growth and efficiency of technical institutions.

Having regard to English conditions these institutions have done an immense service in the past in providing the means of continued education and training for the great mass of the youths engaged in our trades and industries, and English manufacturing industry owes much of its pre-eminence, especially the engineering industries, to the work and influence of these evening schools. In this connection the work of the Department of Science and Art and of the City and Guilds of London Institute has been of high importance and value.

The opportunity of further instruction and training of this character in day classes is much to be desired.

It is satisfactory to note that many of the more important firms, especially in the engineering and chemical industries, are encouraging the admission of a much better type of educated and trained man into their works, and are offering facilities and inducements based on training age and attainments. As industries grow in respect of the number and varied equipment of the men employed, and in the extent and complexity of the production, a higher type of man is required, characterised by a better general education, more expert knowledge and practical ability. It is realised that "the day of the trained man has come; that of the untrained man is past."

A new science has come into being, namely "the

science of industrial management," demanding special qualities and the amplest training, the aim being to secure "a large increase in the wage-earning capacity of the workman," and "a still larger decrease in the labour cost of his product." But not only is it necessary to consider the efficiency of the workman as such, but thought must be given to his life as a citizen; in short, not only economic but ethical considerations must have place, since industry demands the humanising influence of the most cultivated intelligence to ensure its complete success. In the words of Prof. Smithells: "Professions and business vocations are more and more becoming learned callings, each developing a special body of knowledge, which requires for its full mastery and effective use an intellectual training of what may be called the university standard."

The demand for this in respect of the great engineering and chemical industries has long been recognised and met in Germany. Hence the importance given to chemical and physical science, and the lavish provision made for its teaching in nearly all her great universities, and to engineering in her technical high schools, of which, if the Polytechnikum at Zurich be included, there are now twelve with upwards of 13,000 day students taking full four-year courses, nearly all of them as a condition of entrance demanding from engineering students at least one year's experience in a works, and no admission except to duly accredited students from a gymnasium or school of equal standing. These schools are all—*vide* Dr. Nicolson's recent report—largely increasing their engineering equipment, so as to bring it up to the latest advance in engineering science and equipment, and with a view to further investigation and experiment in the service of the industries. Having regard to this equipment, to the spirit of investigation and research, and to the large body of highly educated students, we cannot be surprised at the position Germany now takes in the world of applied chemistry and engineering.

It is further stated upon high authority that the exceptional expenditure on new plant and buildings at eight German technical high schools, including that of Zurich, during the last five years has been 785,000*l.* If Englishmen mean to maintain their great industrial position they must follow in the steps of Germany, since in many important spheres of engineering practice she even now takes the lead. It would be an interesting inquiry, perhaps somewhat disquieting in its results, to learn how many German patents are at this moment being worked in this country under licence.

During the last few years there has been a definite movement on the part of certain of our large technical institutions towards a closer connection with the universities within their own area, of which there are now thirteen in England and Wales, compared with three teaching and self-examining universities prior to 1880, marking an immense progress in the organisation of higher education within a generation. Of such institutions may be named Manchester, Bristol, Glasgow, Edinburgh, Belfast, and certain of the London technical institutions. Students in each of these institutions fulfilling the required conditions are now eligible for the degrees of their respective local universities to which they are attached. It is to be observed also that the ancient universities of Oxford and Cambridge have now strong technological departments, which help to put English institutions, though still far behind as a whole, in a much more favourable light than would at first appear on a comparison with Germany.

In this connection it is convenient to note the

wisdom and liberality of the policy of the Royal Commissioners for the Exhibition of 1851, whose scheme of science scholarships has been so fruitful in result, in the establishment in 1911 of the scheme of industrial bursaries to enable graduates of certain defined institutions to enter upon industrial work at the close of their ordinary university course, thus enabling those men whose qualifications fitted them well to take part in the application of science in the industries, but who were often diverted to less suitable employment by the necessity of earning a livelihood, to be relieved from constraint in their choice of occupation, and to enter into positions more suitable to their training and abilities. Eighteen bursaries were awarded, the payments ranging from 35*l.* to 100*l.* per annum, varying according to salary and circumstances.

It is gratifying to note the great progress which has been achieved in scientific and technical education during even the last twenty years, the more sympathetic attitude of employers in the important industries, the increased liberal support, still far from the amount the circumstances demand, of the Imperial Government, and generally the growing appreciation by the public of the value and necessity of the best possible education in due degree for all the children of the nation.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—At the annual meeting of the Court of Governors, Prof. G. Barling was elected Vice-Chancellor of the University to fill the vacancy caused by the death of Alderman C. G. Beale. It is understood that in consequence of his election to this position, Prof. Barling will resign the chair of surgery, which he has held since the foundation of the University. He recently resigned his post of dean of the faculty of medicine, which he had held for six years, being succeeded by Prof. Peter Thompson.

The council, having received an offer from the Board of Agriculture of a grant-in-aid, to be expended in carrying on a research department in agricultural zoology, has appointed Prof. F. W. Gamble, F.R.S., as director of the new department. An assistant director is to be appointed, who will devote his whole time to the duties, under the supervision of Prof. Gamble. It is understood that the department will specialise in helminthology.

CAMBRIDGE.—Prof. H. F. Newall has conveyed to the Vice-Chancellor, on behalf of a donor who desires to be anonymous, an offer to the University of an endowment for the professorship of astrophysics. In the course of his letter, Prof. Newall remarks:—"The transfer of the Solar Physics Observatory to Cambridge introduces into the University a new study. The fresh opportunities and obligations which it opens up can better be met by fresh endowments sufficient to secure permanently the services of a professor of astrophysics (who would also be responsible for solar physics) than by any measure that involves the diversion of the services of the Plumian professor from the development of dynamical astronomy and from the training of men in that department of knowledge. If such a permanent professorship of astrophysics be established, it is desirable that its emoluments should be sufficient to attract really able men, and to raise it to a high rank among university posts." This statement of the position of the subject was placed before the anonymous benefactor, who has empowered Prof. Newall to convey the following offer to the Vice-Chancellor:—"Should the University concur in the views you have expressed to me, I am