PRESIDENTIAL ADDRESS.

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(A Paper delivered before the Sydney University Engineering Society, on Tuesday, November, 21st, 1916.)

The unprecedented lot has fallen to me to occupy the position of President for two years.

During 1915 the attendances at the meetings and the revenue of the Society materially decreased. Many members enlisted or were otherwise occupied in duties resulting from the war.

At the beginning of this year your Council specially considered the position of the Society, and on its recommendation, the Society, at a special meeting, decided to remit the dues of members on active service. It was considered preferable to maintain an interest in the Society by holding meetings, instead of suspending the Society till the end of the war.

It was left in the hands of the Council to make the best arrangements to carry on the work of the Society, and to incur as little expense as possible.

It was also decided that the Council of 1915 should continue in office for the year 1916. One special meeting, and including this meeting, six general meetings were held during the year.

Great occurrences, such as the spread and peaceful penetration of Christianity, the fall of the Western Roman Empire, and at a much later date, of the Eastern Empire, the Mohammedan Conquests, the Renaissance, the Reformation, the Discovery and Settlement of America, the French Revolution and its subsequent Napoleonic Wars, have made strong and permanent deflections in the flow of European civilisation.

In like manner, the Great World War which is raging with increasing intensity cannot avoid leaving deep and permanent alterations in the boundaries of many nations, and in the political, religious, economical, and social lives of all the peoples of the European civilisation, and, to a lesser extent, of the rest of the world.

The Great War found the British Empire a geographically scattered and politically loosely attached Central Kingdom, oversea dominions and dependencies, and all of them quite unorganised and unprepared, except in regard to the Fleet, to enter into a world struggle. It is unthinkable that the control

and defence of this vast Empire and its relations to other powers shall be vested entirely in the hands of a domestic political party in Britain, elected on points of domestic policy with which the rest of the Empire has no concern and little interest. No doubt the genius of our race will devise some method by which the control of internal relations, defence and foreign policy, will be responsible to the whole Empire, instead of to the heart, which was formerly the whole realm. The natural resources of the Empire should also be organised, so that they may be developed.

While in no way advocating an imitation of the unscrupulous autocratic militarism of the German Empire, nevertheless, the great advance in power, industry, commerce and social welfare of that Empire is a standing memorial to the centralised control and organisation of the factors above-mentioned, viz., internal relations, foreign relations, and defence of a number of kindred States, many of them utterly weak and helpless.

History has shown that our race has developed increased national vigor at and following periods of national struggle, e.g., the wars with Spain in the times of Elizabeth, and with France under Louis XIV. and Napoleon.

The present Great War will also be followed by an output of increased vigour and keenness, which will be very noticeable in manufactures and commerce. This war greatly resembles the Civil War in United States in many features. Both Great Britain and the Northern States suddenly found themselves involved in a gigantic war, and totally unprepared to meet the huge demand for war material of all kinds. In both cases large quantities of munitions and supplies of all kinds had to be obtained from abroad until the home manufacture of such was organised and fully brought into operation.

In both cases the great demand for men for the fighting army made it necessary to make use of factory organisation and the employment of machinery to an extent far surpassing that previously in vogue.

In U.S.A. the great plants and their keen organisation were afterwards utilised in manufacturing for commerce instead of for war, and were directly responsible for the enormous well-equipped commercial expansion which has taken place since that time. A very large proportion of the steel rails, machinery, hardware, thread and woven goods were imported from Britain into the U.S.A. previous to the Civil War, but that is a chapter of commerce which has practically closed.

In like manner, the huge war plants of the Empire and their intensely efficient and keen organisation will be directed to commerce after the war.

There will be a great expansion of industry in Australia, and it will be essential to obtain the best utilisation of the raw products of the Commonwealth and of the waste products of the industries.

In order to do this, it will be necessary to more efficiently train our young men for all classes of professions, business occupations, and trades. The object should be to obtain the highest and most efficient result for our efforts, both in the training itself and afterwards in general industry and commerce, as the result of such training.

Technical education in its widest sense is such a broad subject that it is obviously impossible to adequately traverse the subject in a single address. I shall therefore confine myself to trade and professional engineering education, and briefly refer to the others.

At a very early stage in a boy's life his parents begin to consider the important question: "What shall we do with him?" In answering this question, they are frequently handicapped by an imperfect knowledge of the avenues of employment which will enable him to rise above the level of unskilled employment.

If it is decided that a boy shall follow a professional, teaching, or Public Service career, etc., he is naturally sent to a Secondary School, such as the District High School or Grammar School. If the boy is going on the land, it is better that he be sent to an Agricultural School, and perhaps later to an Agricultural College. On the other hand, it may be desired that a boy shall continue his education along technical lines, so that he may eventually qualify as a tradesman or craftsman, and in this case he should go to a Junior Technical School.

It should be clearly understood that the High School, Junior Agricultural School, Junior Commercial School, Junior Technical School, or other schools of that type, do not teach a boy a profession, business occupation, rural calling, or trade. They prepare him to efficiently enter the training of one of them. Modern economic conditions have made it necessary for our lads to be efficiently trained if they wish to rise above the mere "rank and file." It is therefore the duty of parents to their sons to see that they receive such a training.

Pastoral Industry and Agriculture.—The Pastoral and Agricultural Industry in its various branches of stock, grain, vegetables, fruit, bees, dairying, etc., covers the whole of the rural districts. Its importance is as great as it is widespread. Agricultural Colleges and Experimental Farms have been established in most of the States, Agricultural High Schools in New South Wales and Victoria, and University Courses in Sydney, Melbourne, and Perth. Primary Education in this work should be undertaken by adding elementary work and

small experimental plots at country schools. Elementary Instruction of this nature would be valuable in itself, but much more so in awakening widespread interest, as has been found to be the case in U.S.A.

Commercial Education.—The necessity of a proper commercial education is not so fully appreciated by commercial men as its importance demands. Elementary instruction in such clerical work as bookkeeping, shorthand, and typewriting is undertaken in almost every town of any size, the instruction being provided by the State or Public Institutions or by private enterprise. Business colleges have been established by private enterprise in the cities and other large centres of population. The number of such private colleges is an indication of the need and demand for such instruction. They supply a want which the public educational systems of the various States have lamentably failed to meet. It is, however, to be feared that in many cases they are largely exploiting the public. Systematic training for professions, trades, and crafts is recognised and being steadily and systematically supplied, and it is equally necessary to supply similar advantages for commercial positions. A very fine course of instruction in Economics and Commerce is now given by the University of Sydney.

Junior Technical Schools.—The Junior Technical School forms a continuity of study between the primary stages of education and the stage at which the lad will directly seek employment in some trade or industry, requiring the skilful use of his hands, and also the subsequent period of study at a Trade School or Technical College. The primary education of a boy should have made sufficient progress to enable him to enter a Junior Technical School at about 14 years of age. His main general education should be continued while classes to train the eye and hand are introduced. The course of instruction should be spread over two years, and it is usually expected that the boys will have left school before the completion of the second year to be apprenticed in some trade. The mathematics should be utilitarian and practical in application, the arithmetic being largely mensuration, the geometry, partly descriptive, but largely graphical, and sufficient of the elements of Algebra to enable a boy to understand and use a simple formula.

Freehand isometric and the elements of perspective drawing should enter largely into the course. Such work is valuable training for the eye and fine movement of the hand, besides being of great utilitarian value in their life's work.

The manual classes are usually elementary wood-work and sheet-metal work. This work teaches the boys how to use their hands and to think in solids. The elements of a science, by preference physics, is valuable. This work should be almost

entirely taught by demonstration by the instructor and by working experiments undertaken by the boys themselves. The object of the work should not be so much the teaching of the elements of the science as the instructing of the boys how to make accurate measurements and observations while learning some of the elementary facts of mechanics, property of matter, etc.

The training in these drawing, manual and elementary science classes is a valuable preparation for entering a trade or craft, as a boy then obtains the facility of using his hands before they have become heavy, and his fine touch blunted by the drudgery of the work of his trade. A course of instruction in freehand, isometric, perspective and model drawing, should also form an essential feature in the preliminary training for all branches of pure and applied science. It is notorious how few engineers and scientists can make a good sketch of anything in connection with their work.

Trades and Crafts.—Provision has been made in many centres for a number of years to give instruction in various trades and crafts. The necessity for this instruction has become increasingly greater, due to the establishment of the factory system of industry and the decay of the old apprenticeship system, in which a lad was really taught the handicraft of his trade. It is essential that the course of instruction should contain the essential principles which under modern conditions cannot be obtained in the workshop. The technical instruction of the apprentice, together with his actual trade experience, should make him in the end an efficient tradesman.

In the past, technical classes have not been made use of to the extent that they deserved. The reasons were many, but among them were the workshops were poorly equipped, the courses were often not drawn up by tradesmen, the instructors were sometimes only amateurs and not tradesmen, the results were not satisfactory, so that employers were frequently indifferent and sometimes hostile to their work. As the employers saw little benefit in these classes, there was no inducement to apprentices and improvers to take advantage of them. They were frequently used by outsiders to obtain a side entrance to the ranks of tradesmen instead of by the regular method of apprenticeship.

The first institution in Australia to move in the direction of confining the classes to trades students was the Workingman's College in Melbourne. It was done there because there were more students than they could in many cases accommodate. Preference was therefore given to trade students, and in many classes there is never any room for others. This principle has been much extended in this State. The Techni-

cal College has undergone great reorganisation. Advisory Committees, which include representatives of the employers and tradesmen, have been formed for kindred groups of trades. The members of the committees visit the classes within their sphere of interest, and meet and discuss with the superintendent and heads of Departments matters relating to the maintenance of the highest standard of efficiency in the equipment and teaching. The committees, however, have no voice in the administration. This is a wise restriction, as committees are usually much more interested in administration than teaching efficiency, and their influence and interference are often not beneficial.

The trade courses are divided into two parts, viz., Lower and Upper. The lower courses generally cover a period of three years, and are given in trade schools.

The work in all technical schools through Australia has, in the past, been seriously handicapped, because many students have been without the preparatory knowledge which was essential to their getting a full grasp of what they were being taught. A simple test is now applied, and if the applicant fails, he is advised to go to a continuation school until he obtains the necessary preparatory instruction. The courses usually embrace three subjects, viz., trade calculations, trade drawing, and practical work. Each trade has its own syllabus of instruction. Trade Schools are being established in centres of population where there will be a supply of students to keep them going.

The higher courses, which extend over two years, require more expensive equipment and more expert knowledge on the part of the teachers. On this account these courses have to be restricted to the more centralised establishments known as Technical Colleges. Of these there are only three, viz., Central College, in Sydney, Newcastle, and Broken Hill. Trade courses are restricted to those actually engaged as apprentices and journeymen in that or allied trades.

A careful record is kept of the work and progress of each student. A job card is issued with each piece of practical work. Particulars as to work, time allowed, accuracy, etc., are recorded on this job card, and the results are entered into the roll book. Short class examinations are used to test progress at lecture subjects, and the results recorded. Job cards, or similar records, are very useful in systematising and increasing the efficiency of the work. There is, however, the danger that too much of the instruction time will be taken in attending to them.

Each student has allotted to him a summary card in the Record Office. On the face is a record of his class-work ex-

amination for the whole of his course. On the back are entered brief half-yearly accounts of the actual experience of student gained during the day at his trade.

Apprentices and journeymen may have reports sent to their employers if they so wish. The masters are invited to fill in a form, giving a brief account of the work and progress of their apprentices during each half-year. It has been found that these reports to and from the masters are having a very beneficial influence, the masters taking keen interest in their apprentices and work, and the lads themselves are spurred on to keener efforts. Classes for apprentices are also held in the afternoons, but it is necessary for students to attend for two evenings for each afternoon. Some masters make arrangements for their apprentices to attend afternoon instruction, but other masters, especially those employing running machinery, are opposed to it. Students who do not make reasonable use of their opportunities are excluded from classes. Science is not taught in the trade courses.

Trade students may, on doing certain defined work, qualify to enter the higher technical or diploma course to which their trade belongs. The diploma courses may also be entered by persons who possess the "School Leaving Certificate," or who pass a special entrance examination. It is also a necessary qualification for entrance that their occupation is such as to allow of one of the diploma courses being useful, i.e., they must be engaged in that class of work.

Industrial regulations compel masters to pay full minimum journeyman's wages as soon as the apprentice reaches 21 years of age, irrespective of whether he has finished his apprenticeship or not. Masters consequently will not accept apprentices after they are about 16 years of age. These regulations produce harsh, unjust, and injurious conditions. Unless a boy leaves school by the time he is 16 years old, he will not be accepted as an apprentice. If he is not engaged in a trade, he will not be admitted either to the trade or associate courses of the Technical College, and he is for all time shut out from such work. These conditions prevent a boy receiving a good Secondary Education, and they also rob the Technical High School of its undoubted value.

It is widely held that it is necessary, especially for Mechanical Engineers, that they should serve an apprenticeship or its equivalent in an Engineering Workshop. The concensus of opinion at a Conference held by the Institution of Civil Engineers was that such training should follow a good technical education. This course would now be impracticable in this State. The result will be Mechanical Engineers of two types, the one practically trained with a limited education, and the

other an academical engineer of small practical training, instead of having men of good education and a high technical and full practical training.

It is essential that several conditions which greatly influence technical education should be modified. Many boys leave school at the minimum age of 14 and take miscellaneous juvenile work for a year or two before being apprenticed. When at length they go to a trade school at about 16 years of age they have forgotten much of what they knew, and have to a certain extent lost the art of learning. Compulsory partial education should be introduced to carry the period of training up to 16 years of age. It would be necessary for the boy during this period to attend a few classes during the day or in the evening.

Regulations should be made to enable a lad to be apprenticed at 18 years of age and serve a full apprenticeship. This will enable him to remain at school to get the full benefit of secondary education and to obtain the Leaving "Certificate."

Engineering Schools.—These may be divided into two classes, viz., Schools of Mines and Technical Colleges giving Associate and Fellowship Diplomas, and University Schools giving Degree. There is, however, no line of demarcation between these two classes of schools nor in the nature and efficiency of their work. Some of the Schools of Mines Diploma Courses gave more useful professional instruction than some University Courses.

The first of the non-University Engineering Institutions was the Ballarat School of Mines, established in 1870, followed by that at Bendigo in 1872, and at Adelaide in 1889. It is of interest to know that it was seriously proposed to call the first-mentioned the Ballarat Technical University; the name of School of Mines was adopted in preference, because the Mining and Metallurgical courses of the Royal School of Mines were of higher standard, and the degree of more public value than those similarly obtained at any University in the United Kingdom. This distinction undoubtedly still holds good.

It was due to the great success of the Ballarat School of Mines, which for many years attracted students from all the Australian States and also from abroad, that most of the technical schools in Victoria and some of the other States have been called Schools of Mines, even if they gave little or no mining or metallurgical instruction.

Most of these Technical Schools (i.e., including Schools of Mines) have entrance examinations, in name at least. This examination should consist of English and Mathematics to Junior Public Standard, together with freehand, geometrical and isometrical drawing, to at least elementary standard. Boys

who have successfully completed a two years' course at a Junior Technical School will have reached a stage of instruction which, though not high, is a useful introduction to diploma courses at Technical Schools and Schools of Mines.

The work undertaken at some of these schools is of a wide and high order. At Ballarat the following diploma courses are given, each one to meet a demand:—Mining Engineer, Metallurgy, Electrical Engineering, Municipal and Hydraulic Engineering, Applied Chemistry, Irrigation Engineering and Mechanical Engineering. These are three years' courses of instruction, but a student may take as long as he desires or requires, i.e., a full-time student would do the work in three years and part-time evening student in five to six years. These courses also require 12 months' practical works experience before the certificate is issued. There are also certificate courses for Assayer, Chemist, Mine Manager, Electrician, Municipal Engineer, Battery Manager, Cyanide or Chlorination Works Manager. These certificate courses also require one to five years' works experience. These courses were, in most cases, drawn up to prepare students for State certificates. The certificate for Mine Manager exempts the holder from further examination for the State certificate in Victoria and Queensland. There are also certificate courses of instruction for Engineering, Surveying and Lithographic Draughtsmen. The objects of these Courses is to prepare students to enter as beginners the draughting offices of Government Departments and public bodies. Students who finish such courses find ready employment, as they are able to neatly and expeditiously execute such drawings and tracings as are entrusted to beginners.

The Queensland State School of Mines, at Charters Towers, issues associate diplomas in Mining and in Metallurgy, and a Certificate as "Assayer." The whole of the work of this institution is confined to education in the mineral industry. It is the only body that does so in the Commonwealth. The South Australian School of Mines, usually known as the Adelaide School of Mines, issues Fellowship diplomas in Mining, Metallurgy, Mechanical Engineering, and Electrical Engineering, and Associate Diplomas in Mechanical and Electrical Engineering (one combined course), Mining and Metallurgy.

The Fellowship Courses take four years, and if a student has matriculated and conformed to certain regulations, he is, on completion of the course, also granted a B.E. Degree at the University. The Associates Courses take three years. These two sets of Courses are of interest, as they are drawn up by a faculty conjointly appointed by the University and the School of Mines. Certain subjects are taken at the University,

and the others at the School of Mines. The results are satisfactory, and a high standard of efficiency has been obtained. The graduates, both Associate and Fellowship, are regarded by the managers at Broken Hill, etc., as making exceedingly useful assistants.

In the past the results of the diploma technical courses in this State have not compared favourably with those in some institutions in other States, and have not been in proportion to their great financial support and wealth of equipment. There were day and evening classes open to students without occupation qualification. The courses have been reorganised, in general limited to evening classes, and the students, except in pure science, must have a trade or suitable occupation qualification. This is a restriction not applied in other States, where it should be remembered such diploma work has been for many years more widespread and successful. It used to be very gratifying when I visited widely-distributed centres to find Sydney B.E. Graduates more than holding their own against other University men; but among the many diploma men from various States who were Mine or Mill Managers, Metallurgists, Assayers, Mine Surveyors, etc., I only found one Sydney Technical College man. He was a rara avis even in a New South Wales mining field, and even he was not a fully-qualified associate. The occupation qualification is desirable, perhaps necessary, in trade courses to present amateur journeymen imposing on the public. I am of opinion, from my own intimate personal knowledge of associate educational work in two States and a general knowledge of two other States, that an occupation qualification is not necessary, and it may be even injurious to the welfare of the State and to the institution itself. The object of such training is not to produce a fully qualified professional or semi-professional man, but merely to qualify him to enter such work, and such qualification is often demanded before they can make a start.

It is frequently asked: Is there any necessity for Associate Courses at Technical Schools? Cannot the Universities undertake the technical education of all classes of engineers? No doubt the work of the two classes overlap, and always will overlap, if the Associate and Certificate Courses of Technical Schools are to be thoroughly efficient. Nevertheless, these schools meet a need which the Universities do not, and I think never will satisfactorily meet. The University Course demands a high educational qualification; it takes up the whole of a student's time for four years, is very expensive in fees, so that a youth of slender means cannot go through unless he is brilliant enough to win scholarships. All students must come to the University, of which there is only one in each State.

The degree courses enable an engineer to undertake the highest class of design or investigation.

The Associate Course asks for a good but easily-reached educational qualification; the instruction may be obtained at many centres, the fees are moderate, and the student by taking a longer period may, if he desires, or it is necessary, work for his living while obtaining his training. This class of graduate will readily take many positions in the industrial world which the University graduate considers beneath him, e.g., positions leading to Works Manager, Mill Manager, Mine Manager, etc., assistants in small Power Plants, Surveyors, Draughtsmen, Assayers, Technical Inspectors of many kinds of work, etc. All these positions are very necessary, and are much more numerous than those for highly qualified men, and if not so filled, it would be necessary to promote to them superior workmen or tradesmen without technical qualification.

The work undertaken in Associate Courses in Institutions which are provided with adequate equipment and a capable teaching staff, should be given fuller recognition in University Degree Courses.

The University of Sydney allows the lectures and laboratory work of certain subjects to be taken at the Technical College, and will admit the student, if matriculated, to its own First Year Examination in those subjects.

The University of Melbourne grants two years' exemption in four year Engineering Courses to Associate Graduates of approved courses in approved Technical Schools, provided such graduates matriculate at the University. These two years exemption do not mean the first and second University years en bloc, because an investigation showed that the necessary extra work was more largely higher mathematics and pure science of the first and second years than of purely professional work.

None of our Universities grant to students of Technical Colleges or Schools of Mines as full recognition as the amount and standard of their work justly entitle them to receive. It should be definitely recognised that Technical Colleges (including Schools of Mines) and the Technical Branches of our Universities are essential features in the Technical Education of the community.

The work of both classes of institutions should be brought into beneficial co-relation, so that the work of the Colleges, without injuring the essential features and objects of the College Courses, may be recognised to its fullest extent by the Universities.

The greatest difficulty will be to induce the Universities to recognise this principle. If the principle is granted, a working