PRESIDENTIAL ADDRESS.

By J. J. C. Bradfield, M.E., M.Inst C.E.

(Read before the Sydney University Engineering Society, on the 19th May, 1920.)

As this will be the last Address delivered before the Sydney University Engineering Society, I propose at the outset to review very briefly the history of our Society, to trace the events leading up to its amalgamation with the Institution of Engineers, Australia, and then direct your attention to the great progress made in the Public Works and Services of the State, and in the industrial development of New South Wales, since I delivered my former Presidential Address on April 8th, 1903.

The information placed before you had necessarily to be condensed, but the field covered being of national importance, will, I trust, prove fruitful in matters both useful and interesting.

SYDNEY UNIVERSITY ENGINEERING SOCIETY.

Those of us who look back to the inauguration of our Society on October 9th, 1895, have reason to be proud of the twenty-four years' work accomplished (1895-1919). The Society commenced with 43 members, representing 66 per cent. of the graduates, undergraduates, and the teaching staff of the Engineering School.

The Presidents of the Society have been as follows:—

1895-1897—Prof. W. H. Warren, Wh.Sc., M.Inst.C.E., M.Am.Soc.C.E., LL.D.
1897-1898—G. H. Knibbs, C.M.G., L.S., F.R.A.S.
1898-1899—P. W. Rygate, M.A., B.E., L.S., Assoc.M.Inst.C.E.
1899-1900—H. H. Dare, M.E., M.Inst C.E.
1900-1901—W. M. Thompson, M.A., B.E., L.S., Assoc.M.Inst.C.E.
1901-1902—Prof. Sir S. H. E. Barraclough, K.B.E., B.E., M.M.E. (Cornell), M.I.Mech.E., Assoc.M.Inst.C.E.
1902-1903—J. J. C. Bradfield, M.E., M.Inst.C.E., M.T.P.I.
1903-1904—J. N. C. McTaggart, M.E., M.Inst.C.E.

1904-1905—T. Strickland, B.E., M.Sc., M.Can.Soc.C.E.
1905-1906—J. W. Roberts, B.E.
1906-1907—G. A. Waterhouse, B.Sc., B.E., F.E.S.
1907-1908—R. J. Boyd, M.E., Assoc.M.Inst.C.E.
1908-1909—F. Danvers Power, F.G.S.
1909-1910—H. S. Mort, B.Sc., B.E.
1910-1911—W. E. Cook, M.E., M.C.E. (Melb.), M.Inst.C.E.
1911-1912—Prof. J. P. Madsen, B.E., D.Sc.
1912-1913—J. H. Cardew, L.S., M.Inst.C.E.
1913-1914—J. Vicars, M.E., Assoc.M.Inst.C.E.
1914-1915—W. H. Ledger, B.E. (Syd.), B.Sc. (Ade.), M.Inst.C.E. M.C.E. (Cornwell).
1915-1916—W. Poole, B.E., Assoc.M.Inst.C.E.
1916-1917—W. Poole, B.E., Assoc.M.Inst.C.E.
1917-1918—H. J. Swain, B.E., B.Sc., B.A.
1918-1919—J. P. Tivey, B.A., B.E., B.Sc., Assoc.M.Inst.C.E.
1919-1920—J. J. C. Bradfield, M.E., M.Inst.C.E., M.T.P.I.

All of them, I am happy to say, are alive; and it may interest you to know that the first student to enter the Engineering School, Mr. P. W. Rygate, was also the first Graduate President.

The number of papers contributed by Past Presidents of the Society amount to 51, or more than an average of two papers each, not including Presidential Addresses, which in many cases took the form of a technical paper following a brief address.

The volumes of proceedings printed show that the papers contributed by members of the Society, and engineers not directly connected with the University, have generally reached a high plane of excellence. A pleasing feature has been the number of papers contributed by undergraduate members.

Since my former Presidency in 1902, 85 papers have been contributed to the Society—an average of five papers per session.

The subjects may be roughly classified as follows:—

Mining and Metallurgical	24	28.2	per cent.
Mechanical Engineering & Naval Architecture	5	5.9	„
Civil Engineering and Architecture—			
Design and Construction	43	50.6	„
Electrical Engineering & Electric Rlys.	11	13.0	„
Commercial and General	2	2.3	„
	85	100.0	per cent.

AMALGAMATION WITH THE INSTITUTION OF ENGINEERS OF AUSTRALIA.

Referring now to the events leading up to the amalgamation of our Society with the Institution of Engineers, Australia; in 1918 there were in existence in Australia the following Engineering Associations:—

Electrical Association of Australia (Federal). (With Sectional Divisions in Queensland, New South Wales, and Victoria).

Australian Institute of Mining Engineers.

Institute of Local Government Engineers (Federal). (With Sectional Divisions in Queensland, New South Wales, and Victoria.)

Victorian Institute of Engineers.
Engineering Association of New South Wales.
South Australian Institute of Engineers.
Queensland Institute of Engineers.
Northern Engineering Institute of New South Wales.
Western Australian Institution of Engineers.
Sydney University Engineering Society.
Melbourne University Engineering Society.
Tasmanian Engineering Institute.

The total active membership of these Societies was about 2,500, of which the Sydney University Engineering Society accounted for approximately 12½ per cent.

The question of amalgamation had been under consideration by various societies for years past, but the year 1917 marked the commencement of the special movement which finally led to the adoption of a Constitution for the Institution of Engineers, Australia, covering the amalgamation of most of the societies referred to.

A conference of representatives from the various Engineering Societies was held in Melbourne on February 12th and 13th, 1918, when Messrs. H. H. Dare, H. J. Swain, and myself represented the Sydney University Society. At this conference the first resolution, that "It was desirable, in the interests of the profession, that the various Australian Societies should combine," was moved by me, seconded by Mr. W. R. Harper, of the Victorian section of the Electrical Association of Australia, and was carried unanimously.

It was further resolved: "That a Provisional Council be elected to consist of two members from each purely State Society, and three from each Federal body."

"That this Council be called together on or before May 15th, 1918, and that its first duty shall be to draft a constitution, and submit same to the associating bodies for consideration."

A meeting of the Provisional Council was held at the Royal Society's House, Sydney, on May 15th and 16th, when the Sydney University Engineering Society was represented by Mr. J. P. Tivey and myself. At this meeting the feeling of the various societies in regard to the proposed amalgamation was clearly indicated, also the general lines on which it was thought possible to frame a workable constitution. With this as a guide, the Sydney delegates, viz., Messrs. J. Vicars, J. P. Tivey, G. A. Julius, T. H. Kirkpatrick, F. Danvers Power, W. Poole, and myself were appointed an Executive Committee, with Mr. Harricks as Chairman and Mr. H. L. Thompson as Hon. Secretary, to draw up a constitution for submission to the various Associations. Messrs. Danvers Power and Poole represented the Australian Institute of Mining Engineers, but withdrew from the commmittee when the Institute notified them that it would not join in the amalgamation.

A very considerable amount of work was thrown on this Executive Committee in arranging a constitution on lines sufficiently broad to take in the professional usages of the societies concerned, and at the same time to make the amalgamation worth while from the professional standpoint.

The constitution as drafted was submitted to the councils of the various Societies for criticism, and Messrs. Forster, Boyd and Larkins were appointed by the Council of the Sydney University Engineering Society to revise the draft constitution as submitted, and to report to the Council. These gentlemen were indefatigable in the work of revision; many valuable suggestions were made by them, which were embodied in the revised draft constitution issued by the Executive Commmittee, and forwarded to the Societies concerned for consideration by their members.

At the time of founding the Sydney University Engineering Society its constitution was drafted without any thought of possible future advantage through merging the Society with others to form a greater Institution, consequently no provision was made for any such action by the Society.

Subject to certain amendments in the draft constitution, particularly in regard to the qualifications for associate membership, your Council were unanimous as to the advantage to be gained, if the Society became a Foundation Society in the Institution of Engineers, Australia. With this in view, a clause, "Amalgamation with Kindred Societies," was submitted

to two general meetings of the Society, and adopted, and then became part of the constitution of this Society. With the draft of the constitution for the proposed Institution before them, a postal ballot of the members of this Society was then taken, which resulted in a unanimous vote in favour of amalgamation, and, on the 21st October, 1919, our Society became a foundation society of the Institution of Engineers, Australia. At that date the roll consisted of 389 members, of whom 250 have already joined the Institution, and it is anticipated that a large percentage of the remainder will become members during the year.

The first Council meeting was held on the 21st October, 1919, at the Royal Society's House, Sydney, Mr. Dare and myself being chosen to represent this Society. Mr. D. F. J. Harricks acted as Chairman, and Mr. H. L. Thompson as Hon. Secretary. The Chairman explained that the Institution of Mining Engineers was the only body at the time that had definitely decided not to join the movement. The chief business was the consideration of the draft constitution in conjunction with the various suggestions forwarded by the societies which had notified their intention of becoming foundation societies.

A constitution satisfactory to all the Societies represented at this first Council Meeting was adopted. After the adoption of the constitution, the business was the election of the first President of the Institution.

The Chairman, Mr. Harricks, emphasised the fact that it was considered very much in the interests of the Institution that Professor Warren should be elected the first President. He was unquestionably a man of extended scientific attainments, and one whose reputation extended throughout Australia and well beyond. Professor Warren was unanimously elected President.

I may remind members that Professor Warren was the first President of our Society in 1895, and a fitting recognition of his services to the engineering world was made by his election as first President of the Institution of Engineers, Australia.

At this Council Meeting, Mr. Tivey was elected Treasurer of the Institution, the Council recognising his valuable services whilst a member of the Provisional Council.

The amalgamation of the various Australian Engineering Societies into a true co-operative body follows somewhat on similar lines to those adopted in America, where permanent co-operation of the Societies has been considered vitally necessary, and adopted, with the result that already some 35,000

engineers of high standing are tied together for the consideration of all matters of general interest to the profession.

THE CENTENARY OF INSTITUTION OF CIVIL ENGINEERS, LONDON.

An event of great interest in engineering circles was the centenary of the Institution of Civil Engineers, which occurred on 2nd January, 1918. Happening as it did during the war period, members of the institution resident in Australia did not then consider it fitting to mark the occasion in any special manner; but when peace was assured, arrangements were made for an Australasian gathering of members, which was held in Sydney in October last, Professor Warren being Chairman of the New South Wales Advisory Committee to the Council of the Institution, and the author, the Hon. Secretary.

The six States of the Commonwealth, and New Zealand, were represented at this gathering. In addition to the many social events provided for the visiting members, the event was made of considerable engineering importance by visits to many engineering works, and by papers on engineering developments in Australia.

Arrangements were made at this conference for similar interstate gatherings to be held biennially in each State in rotation.

MANUFACTURING INDUSTRIES.

COMMONWEALTH DEVELOPMENTS, 1903-1917.

The expansion of Australian industries during the years 1903-1917, is shown by the following tables:—

TABLE NO. 1.

Manufactures of the Commonwealth

Item	Year		Increase per cent
	1903	1917	
Total Manufactories	11,559	15,179	31.3
Horse Power in Factories	180,906	560,261	209.7
Number of employees in Factories ..	195,943	321,670	64.2
Value of Factory Land & Buildings..	£20,915,883	£43,212,437	106.6
Value of Plant and Machinery in ... Factories	£18,639,778	£47,315,863	153.8

TABLE NO. 2.

Manufactures of New South Wales

Item	Year		Increase per cent
	1903	1917	
Total Manufactories	3,476	5,356	54
Horse Power in Factories	72,400	236,830	227
Number of employees in Factories...	65,633	117,997	80
Value of Factory land and Buildings	£8,029,890	£18,920,057	135
Value of Plant and Machinery in ... Factories.	£7,009,806	£20,364,122	190

THE IRON AND STEEL INDUSTRY.

The first attempt to produce pig iron in New South Wales was made in 1848, when a company was formed for the purpose of erecting a blast furnace and rolling mills near the town of Mittagong. The works erected were closed down in 1855 as unprofitable. Attempts to reopen these mills were made from time to time, but the pig iron cost about £6 per ton to produce, whilst imported pig iron was landed in Sydney at less than £5 per ton. In 1866 the company was finally wound up.

Another company was formed in 1875, and a blast furnace erected at Lithgow. In 1878 the blast furnace was producing about 100 tons of pig iron per week from clay bands occurring in the district, and brown and magnetic ores from Newbridge and Blayney. Mr. Wm. Sandford, who had leased the Mittagong works for a short time, went to Lithgow and secured a lease of the works there in 1886, and made a profitable business by re-rolling rails for mining purposes. The production of pig iron from the Lithgow blast furnace had, however, ceased. In 1882, about 4,300 tons of pig iron were produced, when it was decided to discontinue operations as being unprofitable. The intermittent running of the furnace from 1876 to 1882 resulted in about 22,000 tons of pig iron being produced. The furnace was then pulled down to make room for other plant.

Up to the year 1890, Mr. Sandford made a profitable business of the Lithgow Rolling Mills by re-heating and rolling iron scrap, of which large quantities were then available.

There was also on the works a 4-ton Siemens-Martin open-hearth acid furnace, which was used for the production of steel castings, railway fish-plates, etc.

Mr. Sandford, being confident that with modern machinery and appliances pig iron could be profitably made at Lithgow, formed his business into a company in July, 1901. In October, 1905, a contract was completed between the Wm. Sandford Company and the New South Wales Government for the supply of iron and steel for the use of State undertakings for a period of seven years. This contract may be considered the prime factor leading to the permanent establishment of the iron industry in Australia.

THE IRON AND STEEL INDUSTRY, 1902-1920.

To enable the Wm. Sandford Company to carry out the contract made with the New South Wales Government, plans were prepared for the erection of a modern blast furnace, steel furnaces, and additions to the rolling mills.

The first cast of pig iron from the new furnace was made on 30th April, 1907, and, after running smoothly for a fortnight, the works were officially opened by the then Premier, the Hon. J. H. Carruthers, and the Hon. C. A. Lee, Minister for Public Works, on May 13th, 1907.

The blast furnace from the commencement worked with few interruptions on a weekly output of from about 500 to 700 tons of pig iron of very good quality. Unfortunately it was found, soon after the commencement of iron-making, in 1907, that the capital available by the original Wm. Sandford Company was quite inadequate for carrying on the industry successfully.

It was decided to apply to the Government for a loan, and investigations were made as to the advisability of converting the work into a national undertaking.

Eventually the Government contract was embodied in a new agreement, dated December 31st, 1917, between Messrs. G. and C. Hoskins, the Government, the Railway Commissioners, and the Sydney Harbour Trust, to cover a period of nine years, dating from January 1st, 1908, the original contract conditions being retained. Messrs. Hoskins, Ltd., at once entered upon a scheme of re-organisation, and cabled to England for modern engines and other plant.

By the beginning of 1909 the old rolling mills had been remodelled, new high-pressure steam pipes installed, and new boilers and heating furnaces added. By April, 1909, the 24-inch mill, erected by the Wm. Sandford Company, had also been pulled down and rebuilt on modern lines, operated by a Davy Reversing Engine of 3,000 brake horse-power. The contractors, Messrs. G. and C. Hoskins, then left for England and America to arrange for further additions to the plant. The largest steel furnace in the Lithgow works at this time was a 15-ton Siemens-Martin open-hearth regenerative furnace on the basic principle, with a weekly capacity output of about 150 tons of ingots.

An Act for the encouragement of manufactures in the Commonwealth of Australia was assented to on the 14th December, 1908, and came into operation on January 1st, 1909. Under this Act the contractors received the following bounties:—

Iron made from Australian Ore	12/- per ton	Total amount authorised £150,000.
Puddled Bar made from Australian pig iron	12/- per ton	
Steel made from Australian Iron	12/- per ton	Bounty to expire June 30th, 1914.
Galvanised sheets made from Australian ore	10% on value	Bounty to expire June 30th, 1912.

The Iron Bounty Act, 1914-15, repealed the Act of 1908, and provided for a bounty of 8/- per ton on Australian pig iron. Amount authorised, £60,000. So far New South Wales is the only State where bounty has been claimed.

The Lithgow works have now been entirely re-modelled, large capacity steel furnaces installed, and the rail-rolling mills and the mills for rolling structural steel are fully equipped with modern machinery and appliances for meeting the ever-increasing demands for iron and steel in Australia.

A large quantity of the pig iron produced in the Lithgow blast furnaces is used in the manufacture of cast-iron pipes at Messrs. Hoskins' pipe-making works at Rhodes and Ultimo.

THE BROKEN HILL PROPRIETARY COMPANY, LIMITED.

IRON AND STEEL WORKS, NEWCASTLE.

The steel works of the Broken Hill Proprietary Company were officially opened on the 2nd June, 1915.

The directors had contemplated the erection of works for the manufacture of iron and steel to meet Australian requirements for some years previously, but a decision was not reached until 1912, and a start with the construction of the works at Newcastle definitely made on the 3rd January, 1913.

As early as 1900 the directors of the Proprietary Company had acquired iron-stone leases in South Australia for the purpose of supplying the Port Pirie lead smelters with flux required in the treatment of the Barrier ores, but realising the high quality of the ironstone, the directors, after reference to the shareholders in 1912, decided to embark in the iron and steel industry.