PRESIDENTIAL ADDRESS.

By James Vicars, M.E.

(Read before the Sydney University Engineering Society, 29th April, 1914).

According to custom, I have now the honour of reading my Presidential Address on vacating the chair.

Frequently on such occasions an attempt is made to review the progress of the Engineering Profession generally during the past twelve months, or at least to refer to some salient examples to epitomise such progress. It is not, however, my intention to do so; but, instead, I propose to briefly review some of the engineering enterprises of our own State, more particularly with the object of drawing the attention of undergraduates and graduates to some of the main avenues that are open to them, and because our graduates have been responsible in no small degree for the work or design of the work referred to.

This course has suggested itself to me from the fact that previously Professor Madsen, in his Presidential Address, dwelt on the training of Engineers.

To this end, I have in most cases confined myself to the tabulating of the records of work done during the past year. At the same time, I have dealt at greater length with work connected with the principal scheme now in progress, the Murrumbidgee Irrigation Scheme.

While such a course is open to the objection that it is largely statistical, yet I have faced this criticism openly for the purpose of showing what can be accomplished by men with special training and education; in fact, what has largely been accomplished by graduates from this engineering establishment, either as principals or assistants. And as it requires a score of years for the youth to attain his manhood, so it has taken just 30 years from the inception of our Engineering School for the graduates to attain to their present prominent positions; and we should endeavour to have our men in the various services qualifying to take their places when the time comes.

Further, although open to the charge of plagiarism, I have briefly recapitulated the history of the P. N. Russell School of Engineering, which is destined to play such an important part in the making of our country.

First, I must refer to the work of the past year of this Society.

During the past year the annual and five general meetings were held, and the following papers read:—

(1) Railway Interlocking, by Charles Wilkin, M.I.M.E.,

(2) Notes on Tramway Curves, by H. S. Mort, B.E., B.Sc.

(3) Hunter River Flood of 1913, by H. H. Dare, M.E., M. Inst. C.E., Chief Engineer for Irrigation.

(4) Linking Sydney and North Sydney, by J. J. C. Bradfield, M.E., M. Inst. C.E., Chief Engineer for Metropolitan Rly.

(5) Discussion on Mr. Bradfield's paper.

These papers were all illustrated by diagrams and lantern slides, and proved most successful. They were followed by good discussions, an extra meeting being devoted to this purpose in the case of Mr. Bradfield's paper, which, it is not invidious to say, was one of the finest within my recollection.

There are 294 ordinary members, 40 life members, and 12 honorary members on the roll; while last year, 25 ordinary members were elected, and one resigned.

Antarctic Exploration.—Prior reference must here be made to the return of Dr. Mawson, B.E., D.Sc.,* and his Antarctic Expedition early this year. After two years' sojourn in this desolate and inhospitable region, after the most strenuous experiences, and a grand display of fortitude and endurance on his lone march back to headquarters over 250 miles of snow and ice in blinding sleet, and with provisions nigh exhausted, having lost his two companions, one through accident, the other through exhaustion, he fought his way through and won. Australia honours him, we are proud of him, and glory in his achievements the more since he is a graduate of the Engineering School of this University. Though two sad fatalities attended the enterprise, two names of perished heroes will live in our hearts, and their names, with the rest of the members of this our own first great national expedition, will be engraved on the enduring scroll of Australia's fame.

The scientific results of the expedition are not yet available, but from the general outline given by the leader we can rest assured they are worthy of our admiration and jealous pride. We wish Dr. Mawson and his newly-wedded bride a long and happy life, and hope he will continue to advance the cause of science in this his native land.

* Now Sir Douglas Mawson, K.B.

Panama Canal.—The completion of the Panama Canal is an event of world-wide importance, and marks an epoch in the annals of engineering, not only for its magnitude, but equally for the skill displayed in its execution, under the worst possible natural conditions. It has been truly a great engineering triumph; in fact, the greatest engineering achievement of the world. It was commenced in 1904, and will be officially opened on 1st January, 1915, the cost being about £100,000,000.

Transcontinental Railway.—The construction of this line has been under consideration for many years. It was made a condition of the consent by Western Australia, to enter into the Federal Union. The adopted route was recommended by a Conference of State Engineers-in-Chief, who were appointed for the purpose of reporting on the subject. A preliminary survey was completed and reported upon to the Commonwealth Parliament in 1909, and towards the end of 1911 the construction of the railway received Legislative approval. Immediately afterwards, at the beginning of 1912, steps were taken to collect a staff, prepare working plans and specifications for materials and rolling stock for construction, call tenders for the same, and start the permanent staking of the centre line ready for the work of the construction gangs. Several months of delay occurred in this year, 1912, owing to the necessity of waiting for the necessary Legislative sanction by the States of Western Australia and South Australia for the transfer of the land required for the railway; but between September and November, tenders having been received and considered, contracts were let for supply and delivery of a quantity of permanent way materials, rolling stock, and other items for construction, and depots were laid out at either end. By May, 1913, sleepers were already coming in and rails began to arrive, and within the next few months two American tracklayers were received and got ready for work, and rolling stock, such as wagons and locomotives, for conveying permanent way material, ballast wagons and other plant, the building of which had been much delayed by the manufacturers, became available for use. At the present time, a length of about 100 miles of permanent way has been laid at each end, and tenders have now been called for the earthworks and permanent way of additional lengths of 200 miles.

The estimated cost of the railway, as submitted to Parliament, was about £4,000,000; but many circumstances—as, for instance, the rise in wages and prices of rails and other materials—will tend to bring the actual cost far above this figure. The gauge is 4ft. 8½ins. The ruling grade of the line is 1 in 80, but there will be very little of this, which is nearly all concentrated at the Kalgoorlie end, the worst grades elsewhere being 1 in 100. The sharpest curves are of 20 chains radium, but there are very few of these, the minimum curvature for the most part being 40 chains. The weight of rail adopted is 80lb. per yard, and the sleepers are, as so far ordered, of timber, 10ft. by 10ins. by 5ins.

The country through which the railway passes is, for the most part, exceedingly dry. The average rainfall at Kalgoorlie is about 9¼ins. per annum, and that at Port Augusta a little under 10ins. Between points 150 miles from Kalgoorlie, and say 50 miles from Port Augusta, there is a good deal of country where the average per annum drops below 8ins. or even 7ins. The character of the soil is, on the whole, extremely good, and the country is well covered with saltbush and edible shrubs; but the dryness of the climate precludes its being used for anything but pastoral purposes. For some miles east of Kalgoorlie the gold-bearing greenstone area is traversed; in the neighbourhood of Tarcoola, 200 miles from Port Augusta, gold is obtained in workable quartz reefs. The opening-up of the country may result in the establishment of other industries.

The total length of the railway will be approximately 1060 miles, which it is intended shall be traversed by the passenger trains at an average rate of 50 miles an hour. The best attention is being given in the design of the rolling stock to the comfort of the passengers travelling.

Northern Territory Railways (Oodnadatta to Pine Creek).—The construction of this line was practically agreed to be undertaken by the Federal Government when the arrangement to take over the Northern Territory was entered into between the Commonwealth and the State of South Australia, and when finished Port Darwin and Adelaide will be connected by railway. At present, a section of about 60 miles from Pine Creek South to the crossing of the Katherine River is in hand, and it is the intention of the Commonwealth Government to submit to Parliament a proposal to enter on the construction of about 300 miles from Oodnadatta northward. It is also contemplated to run a branch line eastward to connect with the Queensland railway system at Cammoweal.

I am indebted for the above information to H. Deane, Esq., M.A., M. Inst. C.E., etc., who, until his retirement last year owing to ill-health, was Consulting Engineer-in-Chief to the Commonwealth, and for this work.

Metropolitan Railway.—Surveys and plans are in preparation for the Metropolitan Railway Scheme, and Mr. Bradfield, M.E., M. Inst. C.E., Chief Engineer for the work, is now visiting Europe and America to investigate similar works abroad. Last year a good deal was heard of the proposed Harbour Bridge from Dawes Point to Milson's Point, for which Mr. Bradfield is also the Engineer; but for the present, little progress seems to have been made beyond the adoption of the design and survey of route. It is at least satisfactory that a site so suitable naturally for bridging is not to be connected by tunnels. This is the more fortunate, as recent developments in steamship design and for submarines point to the necessity of a minimum depth of water of 60 feet in the fairway. It is also probable that any less depth at this site would be productive of dangerous scour, which would jeopardise the construction.

City Council.—After years of waiting and temporising there seems every likelihood of a new Building Act being passed. That steel construction, skeleton buildings, and reinforced concrete for main walls of buildings have so long been impossible, I would almost say prevented, is a charge against the local authorities, and has unnecessarily cost the citizens of Sydney thousands of pounds annually. With Alderman Richards, M. Inst. C.E., as Lord Mayor, we may be sure that every effort will be made to amend the present unsatisfactory position in this respect.

Although graduates occupy positions as Engineers in many shires, it is peculiar that none is found in the employ of the City Council. This avenue might be noted in future.

Rainfall.—The year just past will be specially remembered on account of the extremely heavy rainfall experienced in March, 1913. In Sydney the record for 3 minutes 20 seconds was a half-inch, or at the rate of 9 inches per hour. A great deal of damage was done and much litigation ensued. Other parts of the State also recorded phenomenal falls. In March, 1914, again Sydney was visited by an almost equally violent storm.

Hunter River Flood.—In May, 1913, occurred the highest and most disastrous flood in the Hunter River since the great flood of 1893. A great part of Maitland was feet under water, miles of the railway line were submerged, and in places washed away. The maximum surface velocity in the river, gauged at the Belmore Bridge, was about 17.88 feet per second, and the mean velocity over the whole cross section, was estimated at 12.95 feet per second; and the maximum discharge was estimated at 206,780 cusecs. During the period from 7 a.m., on the 14th, to 9 a.m., on the 22nd May, the total estimated flood discharge was 41,240,000,000 cubic feet, equivalent to a run-off of 42% of the rainfall over the catchment of 7090 square miles, or 29 cusecs per square mile.

HARBOUR WORKS, NEWCASTLE.

Northern and Southern Breakwaters.
Extension of Carrington Street Wharf, 800 feet.
Coal loading jetty.

WATER SUPPLIES COMPLETED.

Broken Hill-Umberumberka: Dam completed.

Casino: Pumping plant. Capacity, 25,000 gallons per hour.

Kempsey: Pumping plant. Capacity, 40,000 gallons per hour; and steel storage tank of 250,000 gallons capacity.

Junee: Two settling tanks, 350,000 gallons each, 12 inch rising main, half a mile long, and duplicate pumping plant of capacity of 24,000 gallons per hour each.

Muswellbrook: Concrete service reservoir, duplicate pumping plant, 15,000 gallons capacity, each driven by suc. gas engines.

Hunter River District Water Supply Works: Pumping plant. Capacity, 150,000 gallons per hour, including steam power plant.

Cordeaux Dam: Hydro-electric pumping machinery, turbo-generator at Mount Nebo, with connecting transmission line 4½ miles long.

RAILWAYS.

Light Lines of Railway: 60lb. rails on round backed sleepers, unballasted, except at stations and bridges.

Completed.

Moree to Garahi (Section No. 1): 36½ miles.

Under Construction.

Ballasted Lines	201 miles 52 chains	.....	£2,295,714
Light „	478 „ 15 „	....	2,091,356
		Total,	£4,387,070

Railway Extensions Authorised:—

Condobolin to Broken Hill: Not started. 373 miles.
Tullamore to Tottenham: Completed. 33 miles 59 chains.
Barellan to Mirrool: Completed. 34 miles 12 chains.
Wyalong to Cudgellico: Completed. 71 miles.
Glenreagh to Dorrigo: Not started. 42 miles.

Tramway Extensions Completed:—

Darley Road to Little Coogee: 2 miles 47 chains.
Patton Street, South Broken Hill, to Racecourse: 1 mile.
Brookvale to Collaroy Beach: 3 miles 25 chains.
Marrickville to Undercliffe: 1 mile 2 chains.
Carrington Tramway, Newcastle: 50 chains.
Goods Depot, Brookvale: 19 chains.
Goods Depot, Fisher Street, on Spit to Manly Line: 8 chains.
Petersham Railway Station to Livingston Road: 29 chains.
Dulwich Hill to Wattle Hill: 70 chains.
Rosebery Park Racecourse to Bunnerong Road: 62 chains.
Suspension Bridge: 22 chains.

SYDNEY HARBOUR TRUST.

A concise statement of the financial position of the Trust indicates that its operations are of a very extensive nature, and are carried out on a strictly commercial basis:—

Receipts for year ending 30/6/13	£450,281	14	11
Revenue Expenditure	124,930	4	6
Renewals and Replacements	29,610	1	6
Capital Expenditure (Loans)	398,591	18	11
Interest	221,049	4	2
Surplus (to Sinking Fund)	76,654	3	7
Capital Debt	£6,535,853	6	10
Sinking Fund	£253,666	3	7

Jetties, Wharves and other works have been carried out during the past year at:—

Gas Works site, Woolloomooloo Bay, Jones' Bay, Circular Quay, widening Sussex Street, Glebe Island Jetty.

Proposed New Wharfage Scheme: 42,600ft. to accommodate 71,600 feet vessels.

Dredging: 1,875,925 cub. yds. to 40 feet depth at low water, with possibility of deepening to 50 feet.

Scheme for lighting the Port has been completed.

Fire Fighting: "Hydra" added. Capacity, 3000 gallons per minute. Last year there were 13 calls to fires.

Tonnage of the Port:—

9673 vessels; tonnage, 8,714,062. Increase, 149 vessels; tonnage, 522,979.

Value of overseas and interstate imports, £42,300,000.

Remarks.—There can be no doubt that the Harbour Trust is an energetic, live and vigorous body, and are deserving of great credit for the thoroughness of their work; and the work carried out shows that they are prepared to lead in the matter of design. I would specially refer to their vigorous policy in the adoption of reinforced concrete for harbour walls, pile protection, and last, the large pontoon just floated, for use at No. 7 Jetty, Circular Quay. It is 120ft. x 70ft., tapering to 50ft., the largest attempted in the world.

There is still room for improvement in wharf design in the direction of the use of reinforced concrete piles and decks, which I hope will soon be recognised as the proper construction for important works.

I am particularly indebted to Mr. Walsh, B.A.I., M. Inst. C.E., Engineer-in-Chief to the Trust, for information and slides.

ARTESIAN BORING.

In this connection it is of interest to note that distributing drains from bores have been cut by means of horse team and delver for less than £17 per mile, while other drains have been cut by tractor plant for £9 per mile.

At Beaubah, 38¼ miles, and at Munna Munna, 29½ miles of drains have been completed with tractor.

On 30th June, 1913, there were 391 flowing bores in this State, the total flow being estimated at 102,665,597 gallons daily. In many bores a diminution of flow has taken place after some few years, and experimental bores are now being sunk to determine the cause.

It is to be hoped that the work of delimiting the Artesian Basin, as recommended by the Interstate Conference, will be diligently prosecuted.

WATER CONSERVATION AND IRRIGATION (Other than Murrumbidgee Irrigation Scheme: Works Completed).

Barooga Water Trust.—District south of town of Berrigan, on north of Murray River, comprises an area of 84½ square miles, is chiefly wheat growing country. Water is pumped from the Murray into an excavated tank, from which it is conveyed by means of a main channel 30 miles long to the town of Berrigan. There are also 23 miles of subsidiary channels. One depression on the line is crossed by a wood pipe syphon 2 feet diameter, 4077 feet long, and another by means of 955 feet of iron fluming on trestles. The pumping plant consists of two contrifugal pumps, each capable of delivering 2000 gallons per minute, driven by two 70 B.H.P. suction gas-engines.

Little Merran Water Trust.—District situated west of the town of Barham, north of Murray River. Area, 246 square miles, chiefly grazing; supply is effected by means of a cutting 5600 feet long from Little Murray River into Little Merran Creek.

Hay Irrigation Works. Additions.—A new plant has been installed on Murrumbidgee River, half a mile up stream from original site. There are two centrifugal pumps, each capable of delivering 2000 gallons per minute, driven by suction gas-engines, each of 50 B.H.P.

Gunningbar Creek Weir.—This is a timber overshot weir, constructed on a cutting leading from the Gunningbar Creek.

Works in Hand: Great Anabranch Cutting, Darling River.—This cutting is 18¾ miles long, and will supply water to a large area west of the Darling.

BURRINJUCK DAM.

There is now a depth of about 90 feet of water impounded behind the dam, which, when full, will be over 200 feet. The height of the concrete on the northern and southern sides is about 140 feet from the finished level, and in the middle, about 10 feet below finished level. Progress at the ends of the dam has been retarded by the necessity for removing a considerable quantity of defective granite rock, which was encountered at the height now attained.

The following information, as to levels, etc., gives a fair idea of the size of the dam:—

	R.L.
Lowest level of foundations	949.53
Approximate lowest point in river bed....	972.00
Invert of tunnel (now closed)	975.00
Invert of four 4ft. 6in. outlet pipes	980.00
Invert of two stoney sluices	1,050.00
Full supply level	1,180.00
Top of main dam	1,192.00
Top of parapets	1,196.00

Length of dam, 752 feet.

Capacity of storage at R.L., 1180 is 33,612,671,000 cubic feet.

The wall of cyclopean concrete is progressing rapidly towards completion. The quantity of concrete placed during last year, was 85,000 cubic yards, against 47,000 cubic yards the year previous.

The closing of the tunnel, which had been provided to pass the river flow during the early construction period, was a very creditable undertaking, which was successfully accomplished. The tunnel was 20 feet square, and at the time it was closed the discharge was 216,000,000 gallons per day, about seven times the daily maximum supply of water to Sydney. This conveys some idea of the difficulty of the job.

The township in which reside the men and their families is very well looked after, and sanitation has received careful attention. When the dam is full, this township—or the site of it—will be entirely submerged.

YANCO.

In connection with this irrigation project, several townships have been laid out, but at present, Leeton township is the only one being actively pushed on.

Already an electric power and lighting plant of 70 K.W. has been installed, and generates three phase current at a pressure of 2200 volts, at a frequency of 50 cycles per second. The power is supplied to butter factory and workshops at Yanco Siding and for the pumping station at Leeton.

The extent of operations may be judged from the areas surveyed to the middle of last year:—

	Yanco.	Mirool.	Total.
Contoured	126,615	106,758	233,373
For sub-division	26,151	30,180	56,331
For channel design	26,151	10,348	36,499

Irrigable areas	84,080	acres.
Dry areas	40,630	„
Total,	124,710	„

At the present time over 30 miles of channel work have been completed at Yanco, and over 40 miles at Mirool, with all necessary outlets, regulators, bridges, etc.

MURRUMBIDGEE IRRIGATION SCHEME.

That closer settlement in a sparsely populated country like Australia is a sound policy cannot be doubted; but the natural configuration of the country and the absence of perennial streams for the most part have heretofore largely determined the question of natural occupation in the pastoral direction and broad acres. In recent years, however, the success of irrigation schemes in India, Egypt and America has made it apparent that by such means and intense cultivation the resources of this fertile Continent could be enormously developed, and at the same time settlement of a vast population would be insured.

It is, therefore, highly desirable that the present state policy of irrigation be energetically followed up, with farms in its wake.

In 1887, Mr. McKinney, M. Inst. C.E., advocated the irrigation of the lowlands of the Murrumbidgee basin in the Royal Commission's report of that year. In the year 1897, Colonel Holme also advised the Government of the day as to the advisability of such a course.

Following on Colonel Holme's report, Mr. McKinney, then Chief Engineer for Water Conservation, made a minute examination of the course of the Murrumbidgee River for the most suitable sites for a storage reservoir, and selected the site at Burrinjuck as the most obvious for a commencement. It may be said that this scheme was under investigation from 1884, the year in which the late Sir William Lyne's Royal Commission was appointed, to 1905, full 20 years. In this period of marking time, the records and data which were compiled, can be relied upon to ensure the ultimate success of the undertaking. Thus it can now be certainly stated that the maximum supply available from Burrinjuck, supplemented by the flow from the Tumut River during the irrigation season, October to May, will be not less than 2000 cusecs, in addition to water required for stock. According to Mr. L. A. B. Wade, M. Inst. C.E., Irrigation Commissioner, one cusec will irrigate 120 acres, and on this basis, the scheme has a capacity sufficient for the irrigation of 240,000 acres, say 400 square miles. This area, under intense cultivation, would make twice the area suitable for occupation in conjunction therewith. With this object in view, Parliament has wisely resumed an additional 1,000,000 acres, making in all 1,250,000 acres, or 2000 square miles available. When completed, there will be 7000 farms embraced in this great scheme, and probably a population of 30,000. Settlers are to be liberally assisted, in that Government offers to build their houses and sheds, etc., on the equitable basis of repayment in 12 years, with interest at 5%, the half-yearly instalments during first four years being each half the amount of subsequent instalments. Also cost of initial work of preparing the land, fencing, stocking, etc., may be arranged for on equally equitable terms. In addition, a butter factory has already been erected, and facilities for disposal of produce will be provided. The town of Leeton provides all necessary adjuncts for such a population, as is anticipated, including banks, schools, churches, etc.

At the present time over 700 farms, comprising some 12,000 acres, have been taken up, and the population already exceeds 4000.

When one thinks of the vicissitudes in the history of this, our initial undertaking in this respect, and the great success of similar undertakings in countries much less favoured otherwise, one might well deplore our lost opportunities. This, however, is no time to deplore the irrevocable past, but rather to stimulated us to redoubled energy, and we have in our midst men capable of handling the enterprise.

P. N. RUSSELL SCHOOL OF ENGINEERING.

Regarding the history of the Engineering School, now the P. N. Russell School of Engineering, I find from the records that although as early as 1849 the founders of our University suggested a Chair of Experimental Philosophy and Civil Engineering—perhaps the first suggestion of Engineering as a University subject in the Empire—yet the suggestion, for some reason, did not materialise till a quarter of a century later. Up to 1880 the statutory endowment of the University was £5000 per annum, providing for four chairs of classics—mathematics, chemistry and physics, geology and mining, and administration and other expenses. In that year an additional sum of £1000 was granted by the Government, and the Senate appointed two assistant lecturers and one demonstrator to the general staff. In this year, also, it became known that the Challis bequest would be received by the University, and the establishment of additional chairs, Engineering being one, and the opening of the

Medical School were agreed upon by the Senate. In 1882 the University's development was accelerated by the Challis gift and the increase of the Government Endowment to £10,000. In this year a separate Faculty of Science and a sub-department of Engineering was established, a Lectureship in Engineering being attached to the Department of Physics, but afterwards made an independent Lectureship. In 1883 Engineering was raised to a Professorship, and in 1884 transferred to the Challis foundation.

In 1887 a Lectureship in Architecture was established, and in 1890 a separate Lectureship in Surveying, previously taught by Prof. Warren.

The remaining Lectureships comprised in the Engineering curriculum in its present form were established under the "P. N. Russell" foundation, and are enumerated below.

The Engineering Classes were at first held in the Main Building, but were very soon afterwards transferred to separate quarters erected on the western side of the main guadrangle. In 1891 the Engineering portion of this building was very much enlarged, in addition to the usual accommodation provided for the housing of the necessary teaching apparatus and appliances, including lathes and other machinery, machines for testing the strength of materials and for cement testing. an experimental steam-engine and boiler, etc.

In 1909, this having become too small, the present Engineering School was opened, the old one being demolished to make way for the Undergraduates' Union Building.

Although by-laws had provided for the degrees of Master (M.E.) and Bachelor (B.E.) in both Civil and Mechanical Engineering, the teaching was practically confined to Civil Engineering until 1892, when the Government School of Mines cooperated with the University, and it established a School of Mines by the appointment of lecturers in Mining and Metallurgy and Assaying, and a degree in Mining Engineering and Metallurgy.

In 1897 the course in Mechanical Engineering was revised and made into a four-year course, in combination with classes in Electrical Engineering. To-day the degrees granted after examination are in (1) Civil, (2) Mining and Metallurgy, or (3) Mechanical and Electrical Engineering.

The Benefactions which the Engineering School enjoys are:—

ENDOWMENTS. I.—Challis Bequest, 1880. A portion of the revenue from this provides for Challis Chair of Engineering.

II.—P. N. Russell Bequest, £100,000, 1896-1904. For the endowment of the School and Scholarships, to be named after the donor, Sir Peter Nicol Russell. The following offices have been established from this foundation, and are now known as the "P. N. Russell Lecturers," etc.:—In (i.) Mechanical Engineering, (ii.) Surveying, (iii.) Geodesy, (iv.) Mining, (v.) Metallurgy, (vi.) Architecture, (vii.) Electrical Engineering, (viii.) Design (Assistant Lecturers and Demonstrators in Civil and Mechanical), (ix.) Mechanical Instructor.

FELLOWSHIPS. I.—Walter and Eliza Hall, £300 per annum, 1914. Tenable for three years, the first two of which are to be spent abroad in post graduate work in a techniral manufacturing works, (b) research laboratories, or (c) special engineering enterprises, and the third in delivering a course of lectures at the School or other approved work. Its object is "to promote the science and practice of Engineering in Australia, by enabling distinguished graduates in Engineering of the University of Sydney to obtain special experience abroad, and subsequently to return and give the advantage of such to the Engineering School."

1914—Burn, A. P., B.E., M.Sc.

SCHOLARSHIPS. I.—P. N. Russell. Three of £75 per annum, 1904. Awarded at Matriculation, and tenable for four years, in Mechanical and Electrical Engineering:—

1905—Carleton, G. B.
Ada, W. L.
Ranclaud, A. B. B.
1906—Norman, E. P.
McKeown, E. W.
Lloyd, A. S.
1907—Hebblewhite, W. R.
Wilkins, T.
1908—Taylor, E. P.
Dennis, C.
1909—Smith, R. G.
1910—Pike, W. E.
Mackinnon, J. Y.
Dowling, B. S.
1911—Stafford, F. D., æq.
Thorne, H. H., æq.
Tandy, P. E.
1912—Wright, J. L.
Wright, A. H.
Campbell, E. F.
1913—Elliott, M.
Degotardi, J. B.
Bill, W. G.
1914—Sims, A. R.
Mann, G. H.
Dunster, R. W.

II.—Royal Commissioners of 1851 Exhibition. £150, tenable for 2 years. Awarded in Faculty of Science to undergraduate of three years' standing, "for the prosecution of study and research in some branch of science, with a view of developing the manufactures and industries of his country."

Awarded to Engineering in 1907—Taylor, T. G., B.E., B.Sc.
" " 1909—Swain, H. J., B.Sc., B.A.
" " 1910—Davidson, C F., B.E.

III.—William and Jane Graham, £1,000, 1905. £40, tenable for one year. Awarded since 1908 at graduation in Mechanical Engineering:—

1906—Burnell, J. G., æq.
May, H. W., æq.
1907—Carter, E. M., æq.
Davidson, G. F., æq.
1908—Lloyd, A. S., æq.
Norman, E. P., æq.
1909—Davidson, G. F.
1910—McKeown, E. W.
1911—Hebblewhite W. A.
Norman, E. P., *pro r. acc.*
1912—Taylor, E. P.
1914—Mackinnon, J. Y.

IV.—Science Research, 1912. £150, tenable for one yearly and renewa'. Awarded in Faculty of Science for post graduate research. Awarded to Engineering—

1912—Holloway, Rupert Arthur, B.Sc., B.E.
1914—Bourne, C. A., B.E., B.Sc.
Pike, W. E., B.E.

MEDALS I.—Bronze University, 1889. Given at M.E. and B.E. degrees in the various branches of Engineering:—

M.E.—1892, Vicars, J., Gold Medal in Civil Engineering, Architecture and Building Construction; 1894, Dare, H.H., Civil Engineering, Architecture and Building Construction; 1896, Bradfield, J. J. C., Civil Engineering, Architecture and Building Construction.

B.E.:
1886, Thompson, W. M., M.A.
1888, Dare, H. H.; Vicars, J.
1889, Bradfield, J. J. C.
1892, Stephens, C. T.
1893, Ledger, W. H.
1894, Seale, H. P.
1895, Doak, W. J.; Jackson, C. F. V.
1897, Strickland, T. P.
1907, Atkinson, J. †
Norman, J. L. ‡
Tivey, J. P. ‡
1908, May, H. W. ‡
1909, Davidson, G. F. ‡
Sewell, L. G. †
1911, Burn, A. P. ‡
1912, Taylor, E. P. ‡
1914, Massie, R. J. A. *
Pike, W. E. ‡

II.—P. N. Russell. Value, £20, 1901. Tenable by graduates in Science or Engineering of between 1 and 4 years' standing. Its object is to encourage post-graduate study in Engineering:—

1901—Madsen, J.P.V., B.E., D.Sc.
1903—Boyd, A., B.E., B.Sc.
1905—Weston, P. L., B.E., B.Sc.
1912—Swain, H. J., B.Sc., B.A.

PRIVATE ANNUAL PRIZES. I.—Descriptive Geometry: Prize of £2 2s., given by Asst. Prof. S. H. E. Barraclough, B.E., M.M.E., M.I.M.E., A.M.I.C.E., for proficiency in this subject:—

1908—Hebblewhite, W. R.
1906—Ada, W. L.
1907—Lloyd, A. S.
1910—McKinnon, J. Y.
1912—Stafford, W. C.

NOTE.—* = Civil. † = Mining and Metallurgy. ‡ = Mechanical and Electrical.