PRESIDENTIAL ADDRESS.

(*Read before the Sydney University Engineering Society, on April 8th*, 1908.)

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Gentlemen,—

The unwritten law that it is the retiring president who should address the annual meeting is one the wisdom of which may be called in question; for it seems more fitting that the President-elect should have an opportunity of defining a policy and of indicating schemes of progress, rather than this being entrusted to one who will not be in the position to afford leading and guidance to the plans he may suggest.

Some reference may be made to our own doings during the year in order that some record of them may be available for distant members.

The proceedings of the Society during the past session have been characterised by the abundance of contributions offered; some of these had perforce to be held over until the forthcoming session.

The following papers were read:—

(1) Magnetic Brakes, by W. A. Prescott, B.E.
(2) Notes on the Alternating Current Transformer, by R. C. Simpson, M.I.E.E.
(3) Cyanide Clean-up at Kalgoorlie, by F. O. McArdle, B.E.
(4) Mine Surveying, by H. T. Garde, B.E.
(5) The Design of Head Frames for Mines, by J. M. C. Corlette, B.E.
(6) The Single Phase Alternating Current Series Motor, by H. R. Halloran, M.M.E.
(7) The Economic Combustion of Fuel, by L. Hey-Sharpe, B.Sc.
(8) Concentrating Mill at Burraga, by L. G. Sewell.
(9) Smelting for Blister Copper at Burraga, by J. L. Mort.

Owing to insufficiency of funds, the Council have very reluctantly been compelled to withhold two of these papers from publication in the Journal.

It will be seen that there was an entire absence of purely Civil Engineering papers; this of course militated against the attendance at meetings of local graduate members.

The Society was to have been favoured during the session with a paper from Mr. L. A. B. Wade, Assoc. M. Inst. C.E., Principal Engineer for Water Supply, etc., Department of Public Works, on the Barren Jack Irrigation Works; but unfortunately, Mr. Wade's illness prevented him from contributing the article. He has, however, kindly promised it for a later period during the forthcoming session.

Of the papers submitted during the year, it is pleasing to record that three were in competition for the Society's prize for the best paper by an Undergraduate member. This prize has been awarded to Mr. L. Hey-Sharpe, B.Sc., for his well-written paper on "The Economic Combustion of Fuel."

The issue of the Journal of Proceedings will be somewhat delayed this year for the old reason that the available funds were insufficient to justify the Council in incurring the necessary expenditure until just recently, when subscriptions have been coming to hand more freely in response to our circulars.

For the same reason the Council has been prevented from sending galley slip proofs of papers to members.

I quite appreciate and can sympathise with the position of members situated far from the home of the Society in their feelings of being out of touch; but it should be remembered that even as an army's movements are dependent on the Commissariat, so a Society's progress is somewhat according to the condition of its banking account. I am sure it is only necessary for me to indicate that an appreciable percentage of the Society's expenditure was on account of second and third reminders on the delicate question of members' personal liabilities to ensure that members even though distant, will, by the prompt discharge of their own liability, place the Society in the position of being able to devote more attention to the real needs of its members. I might also remind you that the Secretary's position is purely honorary; he is a busy individual to whom the Society is under great obligation and, being human, is not infallible; and it is not an unknown thing for letters and books to miscarry in transit. My Council recommend the incoming Council to reconsider the matter of posting galley slips of papers to members, even though it should involve the incurring of expense before the funds to meet same are in hand.

Notwithstanding this slight difficulty, I would like to say that one cannot have had that intimate contact with the Society collectively and individually which has been afforded me during the last six years, without being possessed of a very optimistic view of its future. The Society is yet in its youth, but its influence is widespread; its members are filling important positions in many parts of the world; and in this State, local indifference, ignorance, and prejudice are being overcome as the merits of a sound scientific training are being recognised, and its economic value rightly appraised.

An impartial mind cannot fail to appreciate the experience of the practical man; but without a knowledge of principles he cannot be depended on; and however well he may have appealed to a less enlightened age, he does not answer the call of to-day for an engineer in whom his client's trust may be reposed, and to whose designs his life may be entrusted. On the other hand the University trained man is capable of benefitting to the maximum degree from his practical experiences and is economically of high efficiency.

Graduates in Mechanical Engineering of but a few years standing will recognise a great change for the better in the order of things when it is pointed out that during the year Sydney University Engineering Undergraduates have through the kindness of the responsible people concerned, carried out exhaustive trials under ordinary and even extraordinary conditions of the engines and machinery of the Port Jackson S.S. Co's. ferry-steamer "Bingarra," and conducted governor trials at the works of the Colonial Sugar Refining Co., Pyrmont.

These things suggest to me the feeling that the good time is fast approaching when all the graduates of our School will find a career in the land of their birth, and I trust that the day is not far distant when every youth who is desirous of entering the profession from honest conviction of his aptitude for it, will find the opportunity for a University training, and when without a certificate of having undergone that or an equivalent scientific training he will be refused the right to practise, as a safeguard to the general public.

My Council have felt that there are in practice in New South Wales many engineers upon whom fortune did not smile as she did upon us in the way of affording opportunity for a thorough scientific training at an Engineering School, but who are worthily endeavouring to uphold the traditions of a great profession. It has been felt that to debar these gentlemen from participating in membership of this Society, is a loss to them and to ourselves. Accordingly, a Committee has just drafted some slight alterations to the Constittuion which will be submitted to the next General Meeting for your consideration, providing for the election, subject to Council's approval, of any such persons desirous of joining the Society.

Among the events of the year which may be chronicled as evincing Engineering progress in New South Wales, and which specially interests us, is the erection of the P. N. Russell School of Engineering, thanks to the munificence and loyalty of the late Sir P. N. Russell. The new building of which I trust some account will be given to members through the Journal, is now nearing completion, and gradually during the year the moving-in process will be completed. There is a brightening prospect of finding accommodation for the Society's Library and

Secretary's belongings, and of giving to our airy nothing a local habitation and a name. We may be permitted the expression of the sincere hope that the possession of more space with extended facilities for experiment and research will conduce to even greater efficiency in the training of the Sydney University Engineer. The noble example of the late Sir Peter Nicol Russell is one which should commend itself forcibly for imitation and emulation to those who have amassed affluence and wealth under Australian skies. I can think of scarcely any better way of perpetuating one's memory. There is a common tendency to blame our Governments and Parliaments for niggardliness in their attitude to education; but these bodies are representative of the people, and indicate public opinion, or the lack of it. Private examples of beneficence to educational establishments are worth more in their influence upon the local governing bodies than columns of appeal.

During the year, the Society paid a tribute to one of its honorary members, and asserted its broad interest in scientific enterprise by tendering a farewell dinner to Professor David on the eve of his departure with the British expedition to the Antarctic under Lieutenant Shackleton.

It was understood at the time, that Professor David would return with the "Nimrod" toward the end of March; but he has since accepted Lieutenant Shackleton's offer to remain for another year braving the rigours of the frigid zone.

Our Society is also represented by Mr. D. Mawson, B.Sc., B.E., who is to be one of the adventurers who propose to make the attempt in the face of storm and tempest to reach the South Pole.

Lieutenant Shackleton, the commander, is a member of a great British engineering firm, and is a splendid type of the keen-witted, brave, and imaginative race that inhabit the Emerald Isle.

Perhaps, to engineers, the most interesting feature of the expedition is the proposed use of a specially constructed motor car. To withstand the climate, the wheels are made of hickory and steel. To negotiate the soft snow, the front wheels may be locked, and wide sledge runners screwed on. The rear or driving wheels have wide rims on which can be screwed cogs of various sizes, according to the snow encountered.

The engine is cooled by air; the exhaust gases are utilised for warming in turn the carburetter, engine, and a footwarmer, and then are available to melt snow to procure necessary water. If this motor car breaks down—and motor cars have been known to fail under less trying conditions—the despised equine, in the shape of Manchurian ponies, is expected to be able to go to the rescue.

The past year has been marked with great successes and a great failure in engineering and scientific enterprise. Perhaps the greatest achievement has been in the domain of naval achitecture and marine engineering, where all records have been broken by the new Cunard liners, "Lusitania" and "Mauretania," which were placed in commission in the latter half of last year.

At such a time as this it may be interesting to briefly review the growth of the world's mercantile marine, as propelled by steam power. In 1707, Denis Papin experimented on River Fulda with a paddle wheel steam boat. James Ramsey, in 1785, in America, propelled a boat with steam through a stern pipe, and in the same year Robert Fitch, also in America, propelled a boat with canoe paddles fixed to a moving beam. Three years later, Robert Miller and Symington produced a double hull stern wheel steam boat. In 1802, the first practical steam tug-boat, the "Charlotte Dundas," was designed by Symington. In 1804, the "Phœnix," designed by Stephens in New York, was the first steamer to achieve the distinction of making a sea voyage. Seventeen years later, in 1821, the first iron steamer, the "Aaron Manby," was built. Seventeen years more elapsed before the first passage across the Atlantic Ocean was made by an iron steamer, the "R. F. Stockton," fitted with Ericson's propellor.

The progress in the design of steam boats may thus be broadly classified:—

Period.	Leading type of vessel built.
1833—1858	Wooden Paddle Boats.
1856—1862	Iron Paddle Boats.
1845—1883	Iron Screw Steamers.
1879—1886	Steel Screw Steamers.
1888—1907	Steel Twin Screw Steamer.

The first Atlantic steamship with compound engines was the "Italy," built in 1868. The following year saw the "City of Brussels," the first Atlantic steamship with steam steering gear.

The first vessel to exceed 5,000 tons, excepting the "Great Eastern," was the White Star liner "Britannic," in 1874. Electric light was first thoroughly installed on a steamship in 1875, on the "City of Berlin." The "Great Eastern," launched on the Thames in 1858, was the marvel of her time, and was ahead of her times as regards her dimensions. This was an iron steamship 680 feet long, with paddle engines of 1,710 h.p., and screw engines of 1,000 h.p., tonnage 18,918, speed 14 knots, consumption of coal 300 tons a day, longest day's run 333 knots. It will be seen that her coal consumption was very small relative to her carrying capacity.

The "Rotomohana," 1,763 tons, owned by the Union Co., of New Zealand, and launched in 1879, was the first steel ocean steamship.

Propulsion by means of steam turbines was first adopted on the Allan liner "Victoria," in 1904.

The accompanying tables and diagrams illustrate the development of steamships as regards length and tonnage.

TABLE I.—LENGTH OF STEAMSHIPS.

1838 First to exceed 200ft., "Great Western," 1,340 tons.
1845 First to exceed 300ft., "Great Britain," 2,084 tons.
1858 First to exceed 680ft., "Great Eastern," 18,918 tons.
1871 First to exceed 400ft. (except "Great Eastern"), "Oceanic" (I), 3,807 tons.
1881 First to exceed 500ft. (except "Great Eastern"), "Servia," 7,392 tons.
1893 First to exceed 600ft. (except "Great Eastern"), Campania," 12,952 tons.
1899 First to exceed 700ft., "Oceanic" (II), 17,247 tons.
1904 First to exceed 725ft., "Baltic," 23,000 tons.
1907 780 x 88 x 77 feet, "Lusitania," 30,822 tons.

TABLE II.—TONNAGE OF STEAMSHIPS.

1874 First to exceed 5,000 tons "Great Eastern excepted), "Britannic."
1888 First to exceed 10,000 tons ("Great Eastern" excepted), "City of Paris."
1899 First to exceed 15,000 tons ("Great Eastern" excepted), "Oceanic."
1901 First to exceed 20,000 tons, "Celtic."
1907 First to exceed 30,000 tons, "Lusitania."

TABLE III.—PROGRESS OF ATLANTIC STEAM SHIPPING.

Year.	Average Speed Knots.	Displacement.	I. H. P.	I. H. P. per ton Displacement.	Coal burned per 100 ton Displacement propelled 1 knot.
1840	8½	2,050	710	0·346	22 lbs.
1850	12	3.620	2,000	0·552	21
1860	12½	7,130	3,000	0·505	18
1870	14½	6,900	3,000	0·434	12
1880	15¼	9,900	6,300	0·626	10
1890	20	13,000	18.000	1·42	12
1900	23½	23.020	40,000	1·69	12
1907	25	38,000	68,000	1·79	11

These figures indicate that in the last 47 years the average speed has doubled, while the ratio I.H.P. to displacement has increased one and a half times. In 67 years the speed has increased three-fold, while the coal consumed per 100 tons displacement propelled one knot has been reduced 50 per cent.

Comparing the figures for 1890 with those of 1907 we find that to obtain 25 per cent. increase of speed, the length has been increased 50 per cent., the displacement nearly 300 per cent., and the horse power nearly 400 per cent., all of which seem to indicate that the limit of size will soon have been reached.

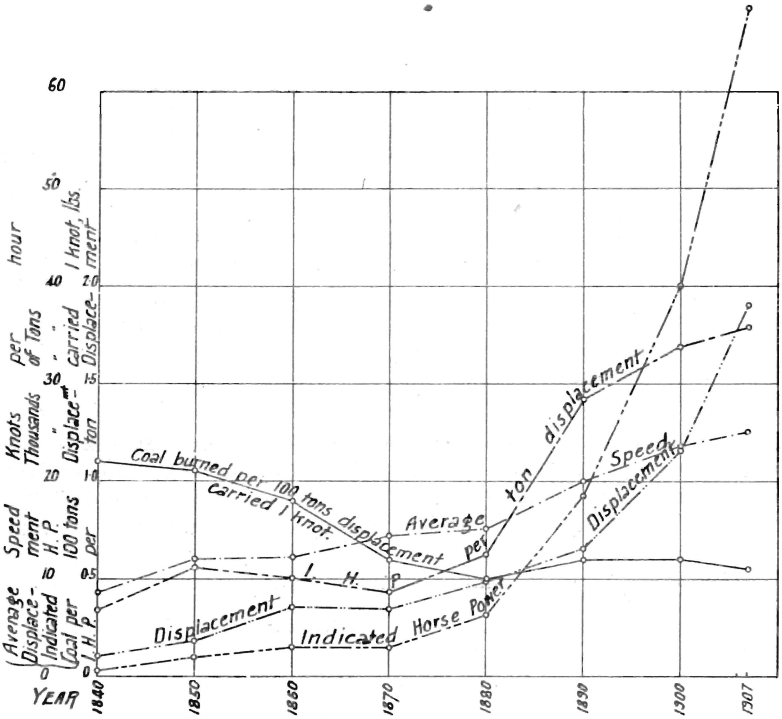

DIAGRAM OF PROGRESS OF ATLANTIC STEAM SHIPPING.

The Cunard liners "Lusitania" and "Mauretania" were built under an agreement with the British Government, the Company undertaking to build for the Atlantic Mail service two liners to steam at a speed of not less than 24½ knots in moderate weather on the Atlantic passage, and to retain them at the call of the Admiralty in time of war. The Government, on the other hand, agreed to lend a sum not exceeding £2,000,000 for the building of these steamers, the sum to be secured on debentures at 2¾ per cent. interest.

In addition, an annual subsidy of £150,000 was to be paid; but should the speed fall short of this gurantee, but still exceed 23½ knots, certain reductions were to be made from the subsidy.

In making contracts for the building of these vessels the Cunard Company stipulated that they should attain a speed of 25¼ knots on trial, and that within a year from going into commission they should make one complete voyage to New York and back at a mean speed of 24¾ knots.

Whilst being sister ships, there are many points of difference between the "Lusitania" and the "Mauretania," the chief of which occur in the machinery details, the hull of the latter being 6 inches greater moulded depth, increasing the gross tonnage by 700 tons. I do not propose to weary you by going into details, but would glance at some features, in order to convey some impression of the magnitude of these vessels:—

The following are the principal dimensions:—

"LUSITANIA."

Length over all	785 feet.
Length between perpendiculars	760 feet.
Beam, extreme	88 feet.
Depth, moulded	60 feet 6 inches.
Gross tonnage	33,200 tons.
Nett tonnage	11,900 tons.
Maximum draught	37 feet.
Displacement at the above draught	43,000 tons.

Compared with existing record dimensions, these liners are 160 feet longer than the Cunarder "Campania," of 1893, 78 feet 6 inches longer than the next fastest of existing ships, the "Kaiser Wilhelm II.," and 80 feet longer than the "Great Eastern."

The passenger accommodation is on a large scale.

	"Lusitania."	"Mauretania.
First Class	560	560
Second Class	500	500
Third Class	1,200	1,200
Officers and Crew	810	938
Total Population	3,070	3,198

The "Mauretania's" crew is composed as follow:—

Navigating Department	69
Engineering Department	393
Personal	476
Total	938

Some idea of the magnitude of the Mechanical Engineering undertaking involved may be gathered from the fact that the rudder weighs 65 tons, and that the stern frame and brackets, which are of special construction weigh 150 tons. Four shafts, one to each propeller, are employed; the outer shafts, which turn inwards, are driven by high pressure turbines, and the inner shafts, which turn outwards, by low pressure ones. The condensers are placed abaft the engines, and outside of the inner shafts. Each propeller requires a fourth of the original horse-power; and at this output, has a speed of 190 to 200 revolutions per minute.

	Dia. at Drum.	Length of Blades.	Stages of Expansion.	Weight of Rotor Complete.	Overall Length.	Dia. of Hollow Shaft in Turbine External.
	in.	in. in.		tons.	ft. in.	ft. in.
H.P. Turbine	96	$2\frac{1}{2}$ to 12	8	72	45 8	3 0
Low P. ,,	140	8 to 22	8	126	48 $1\frac{7}{8}$	4 4
Astern ,,	104	2 to 8	8	60	30 $1\frac{1}{4}$	3 3

The propeller shafts are hollow, 22¼in. external and 10in. internal diameter.

Maximum peripheral speed of the turbines is 10,000 to 12,000 lin. feet per minute.

Steam is generated by 23 double, and 2 single-ended boilers, the former having 8 furnaces each, and the latter 4, making a total of 192. The larger boilers are 17ft. 3in. diameter, by 21ft. long. Electric motors are employed to drive the fans for the Howden forced draught system which is employed.

The heating surface is 160,000 square feet, the grate area being 4,000 square feet, steam pressure at boilers is 180 lbs. per square inch, and at turbines 160. The boilers are arranged in four stokeholds, 7 to the forward and 6 to each of the others. One funnel serves each group; each funnel rises 152 feet above the keel, and in plan is of the form of an ellipse, whose axes are 23ft. 6in. x 17ft. 6in.

There are no less than nine decks. The water-tight compartments number 175, and it is reasonably claimed that the arrangement of the bulkheads makes these the safest vessels in existence.

As cruisers in time of war these steamships are well protected, the machinery is almost entirely below the water line, placed in separate compartments with coal bunkers along each side; being thus well protected against gun fire. On one of the top decks are carried four 6 inch quick-firing guns, protected by heavy plating. On each side of the promenade deck are four more of these guns on central pivot mountings.

The growth of the world's mercantile marine is a subject of first importance to the citizens of New South Wales. Even though the limit of size may be nearly reached, the tendency in the future will be for the construction of vessels of larger and larger dimensions within that limit. Naturally one's attention is turned to the influence this expansion must have upon this city, sometimes called the Gate of the Pacific.

The following table shows the growth of the shipping of Port Jackson for a few decades back.

Tonnage of shipping of Port Jackson, entered and cleared:—

1870	....	750,000 tons.
1880	....	1,469,794 tons.
1890	....	3,001,221 tons.
1900	....	4,826,390 tons.
1906	....	6,114,530 tons.
1907	....	6,898,887 tons.

In thirty-seven years the increase has been nearly tenfold.

The L.W.S. depth of the eastern channel in Sydney Harbour is as little as 28 to 30 feet at the Heads at the sand bar, extending from Middle Head to the Lightship. The Harbour Trust Commissioners are now dredging this to 32 feet, the depth provided at their wharves. The largest dock, the Sutherland, at Cockatoo Island can accommodate a vessel 600 feet long; the clear width at the entrance is 84 feet, and at high water, the depth on the sill ranges from 29ft. 6in. neap to 32ft. spring tide; its capacity is practically not more than that necessary for a 13,000 ton vessel.

There seems little reason why vessels of much larger capacity should not, within a short time, be fairly common visitors to the Port. During the year, the Government Fitzroy Dockyard has commenced the building of a trawler to the order of the Federal Government; and there is a probability that before long, a start will be made in the building of the smaller types of war vessels.

In view of the possibilities and requirements of the future of the great centre of maritime industry that Sydney is destined to become, it seems fitting to express the hope that the engineering needs of that day will be met by the establishment, in connection with the University, of facilities for the study of naval arctitecture.

Engineers have their failures. Fortunately these are rare occurrences, for they may be of startling proportions, and may involve the loss of human life, a loss that the world can ill afford.

Possibly it is a compliment to the engineering profession that the world takes great notice of these rare mishaps.

The ambitious structure that was designed to bridge the St. Lawrence River, at a point about 8 miles below Quebec, failed during erection on 30th August, 1907, precipitating a train load into the river, and causing the death of 61 men.

Photographs of the wreckage reveal a remarkable jumble of steel twisted into all shapes, as though it had been the centre