PRESIDENTIAL ADDRESS.

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It has been the common practice on these occasions for the President to take as his subject the particular branch of Science in which he is actively engaged in the prosecution of his professional duties, and, following on these lines, I propose this evening to say a few words in connection with the very important subject of transport. Mr. Thomas Telford, the first President of the Institution of Civil Engineers, when applying for a Charter in 1828, defined an engineer as one "who directs the great sources of power in nature for the use and convenience of man," and certainly in no way has the engineer justified that definition of his calling more fully than in the skill and energy shown in providing for the transport of passengers and merchandise to almost every known place on the earth's surface. Transport includes many branches of engineering, harbours, breakwaters and docks for the protection and accommodation of vessels engaged in transport by sea; railways, with their tunnels, viaducts and other important and costly works, for rapid conveyance by land; and lastly, but by no means of less importance, roads which provide means of communication for the conveyance of goods and passengers to even the most remote parts of the country. Then we have other great groups of engineers in the shipbuilders; the locomotive constructors; the electrical engineers; the motor car builders; and may I add the designers and constructors of aeroplanes and other flying machines, all working with the one object of providing efficient means of transport by water, land and air. Few people, I think,
realize the vast improvements that have been made in this direction of recent years, and it may be interesting to compare the easy and rapid means of communication enjoyed at the present time with those of a comparatively few years ago.

Some interesting articles have lately appeared in one of the American magazines on the subject of the invention of the steamboat, and the honour of having constructed the first steamboat of any commercial value is claimed for Robert Fulton, an energetic American, who in 1807 built and successfully navigated a steamboat on the Hudson River. So far as I can ascertain from the records at my disposal, a Mr. Miller, as far back as 1788, made some successful experiments in Scotland with a twin boat fitted with a small engine made by William Symington and propellled by a paddle wheel placed in the space between the twin boats; with this a speed of three miles an hour was obtained. Some few years later Mr. Symington constructed a steamer for the purpose of towing barges on the Forth and Clyde Canal. This vessel, which was named the "Charlotte Dundas," had a small engine with one horizontal cylinder twenty-two inches in diameter and four feet stroke, with connecting rod and crank which worked a single paddle wheel placed in a well-hole at the stern of the vessel. The vessel proved a success, but as the proprietors of the canal objected to the use of the paddle wheel, the wash of which they alleged would injure the banks, she was abandoned in 1802. For some years previous to this numerous attempts had been made in England, Scotland, America and France to utilize steam as a motive power for boats. Among the many experimenters were Messrs. Robert Fulton and Robert Livingstone, who commenced their experiments with a steamboat on the Seine in 1802, but the weight of the engine broke the vessel in two and
the boat was precipitated to the bottom. Fulton subsequently visited Scotland and it is said, was taken for a trip in the “Charlotte Dundas,” and with the knowledge thus gained he returned to America to further prosecute his experiments. In August 1803, Fulton wrote to Boulton and Watt to order a steam engine for a boat to be launched in America, and he evidently anticipated the great difficulty he subsequently experienced in persuading the authorities to allow the engine to be sent to America from England. With our modern ideas of detailed specifications Fulton’s order for this engine seems to be simplicity itself. It was as follows:—“If there is not a law which prohibits the exportation of steam engines to the United States of America, or if you can obtain a permit to export parts of an engine, will you be so good as to make me a cylinder of twenty-four horse power, double effect, the piston rod making a four foot stroke; also the piston and piston rod. The valves and movements for opening and shutting them, the air pumps and rod, the condenser with its communications to the cylinder and air pumps etc.” It was only after much correspondence and many interviews with the authorities in England, that a permit was granted to export this engine from England, which on arrival was placed in the vessel constructed to receive it. Fulton’s own description of the “Clermont” is as follows:—“My first steamboat on the Hudson River was 150 feet long, 13 feet wide, drawing 2 feet of water bow and stern 60°; she displaced 3,640 cubic feet, equal 100 tons of water; her bow presented 26 feet to the water plus and minus the resistance on one foot running four miles an hour.” On the 17th August, 1807, the “Clermont” made her first voyage on the Hudson River and shortly afterwards became a regular trader between New York and Albany, a distance of 150 miles, doing the trip in from 30 to 36 hours. It will thus be seen that, although Symington’s steamer, the
“Charlotte Dundas,” was successfully employed towing barges in 1802, Fulton’s “Clermont” was the first steamer employed for regular passenger traffic in 1807, for it was not till 1812 that the first regular steam passenger boat made its appearance on the Clyde, the “Comet” in that year running regularly between Glasgow and Greenock at a speed of five miles an hour. The “Comet” was 42 feet long and 11 feet beam with a four horse power engine, placed on one side of the boat and a small wrought iron boiler on the other side.

In 1819 the “Savannah” crossed the Atlantic; this vessel was 380 tons and had been built as a sailing ship, but was fitted with auxiliary steam power, the paddle-wheels being designed so that they could be unshipped when the vessel was under sail. Under steam she obtained a speed of six knots, but the engines were only used on 18 days during the trip of 35 days, and after this voyage the engines and boiler were removed. The first iron paddle steamer, the “Aaron Manby,” crossed the English Channel in 1821. The “Sirius,” which left London on the 4th of April, 1838, arrived at New York on 22nd, after a voyage of seventeen days, and was the first steamer to cross the Atlantic from Great Britain, obtaining this distinction only by a few days, for the “Great Western” a wooden steamer of 212 feet long, 38½ feet beam and 23½ feet deep, built under the advice of Mr. J. K. Brunel, left Bristol 8th April and arrived at New York only a few hours after the “Sirius.”

In 1852 the P. and O. Company undertook the first regular mail service to Australia, running once every two months via Singapore; in 1864 the service was increased to one sailing a month, and in 1874 arrangements were made by which the mails were to be carried through the Suez Canal which had been opened for traffic a few years
previously, viz., in 1865. Gradual improvements were made from time to time in our mail services, but as late as 1877 the passage from Southampton to Sydney was still long and tedious. Thirty-three years ago I left England for Australia in the P. and O. Company's s.s. "Poonah," a vessel of 3,130 tons, then engaged in the Indian mail service. At Point de Galle the Australian mails and passengers were transhipped into the s.s. "Tanjore," a vessel 2,263 tons; on arrival at Melbourne we were again transferred to another of the company's steamers, the "Avoca," a poorly equipped little craft, more suitable for a collier than a passenger boat, finally reaching Sydney after a passage of fifty-two days. In 1877 the Orient Company's steamer "Lusitania" paid her first visit to Sydney and she was followed by the "Chimborazo" and the "Cuzco," vessels of 3,847 to 3,883 tons, making the trip from England via the Cape in fifty-three days, and returning via the Suez Canal. How incomparably superior are these Companies' mailboats of to-day, steamers of from 11,000 to 12,500 tons, equipped with every modern appliance for the handling of cargo and the comfort of the passengers leaving and arriving at their terminal ports each week with clockwork regularity, and completing their trips in less than forty days, plying to and fro like the shuttle in the loom, weaving the thread of commerce from Great Britain to Australia and back from our island continent to the Mother Land.

The record of speed and of size is at present held by those splendid Cunarders the "Lusitania" and the "Mauretania" engaged in the Atlantic trade. These vessels are 790 feet long with a registered tonnage of 32,500 tons. They are fitted up with all the luxury and comfort of an up-to-date hotel, and equipped with every modern appliance that skill and science could devise. On her contract trials the "Mauretania" maintained an
average speed of 26.04 knots for a distance of a little over 1,200 knots, the steaming time being rather less than forty-eight hours, and on at least two occasions she has exceeded this speed on her ordinary trips across the Atlantic. The regularity of speed maintained by the "Mauretania" on a long sequence of consecutive passages is truly remarkable. In February of last year, in fourteen trans-Atlantic passages to and fro, made of course under varied weather conditions, some of them against strong winds and high seas, the average speed for the fifteen trips, approaching 45,000 sea miles in length, was 25 1/2 knots. The trips made by the "Lusitania" are run with similar regularity.

Even these ships are shortly to be eclipsed by the two White Star leviathans now being built by Messrs. Harland and Wolff, in Belfast. The "Olympic" and the "Titanic" will be 860 feet long with a registered tonnage of 45,000 tons and a displacement of 60,000 tons, they will be run by a combination of turbine and reciprocating engines and are expected to develop a speed of twenty-two knots, crossing the Atlantic in seven days. The carrying capacity of these great liners will exceed that of any vessel now afloat by at least one-third, and the scientific appliances for use in case of collision or fire are most complete. The opening and closing of the doors in the bulkheads is controlled from the bridge, and by a series of thermostats fixed throughout the framework, the officer on the bridge is at once made aware of an outbreak of fire in any part of the ship. Some idea of the dimensions and weight of these vessels may be formed from the fact that the weight of the stern frame castings alone is over seventy tons, and the shaft brackets supporting the after propellers' weight about seventy-five tons, while the upper part of the stern-frame is 63 feet high and 22 feet wide.

In 1828 the British Empire owned 293 steamers aggregating 32,000 tons, and during that year 31 steamers of
less than 2,300 tons were added to the register. Last year there were 22,522 steamers entered in Lloyds' register, and during 1909, exclusive of war ships, 465 steamers of 972,799 tons were launched in the United Kingdom. Practically the whole of the tonnage launched was built of steel.

The vital problem for the future of ocean transport, as indeed of all forms of transport, is that of economy of the motive power. The most efficient types of steam engines now used for marine work only realise in the propeller shaft from 10 to $11\frac{3}{4}$ of the total heat value of the coal consumed. A consumption of coal equal to 1 lb. per indicated horse power per hour can be obtained with reciprocating engines, but only under the best conditions. Under usual service a consumption of $1\frac{1}{2}$ lbs. per horse power is considered a very good performance even with turbine engines, but in point of fact 2 lbs. is much nearer the mark in general practice.

Experience on shore with producer gas engines has shown that this type of prime mover is capable of developing a brake horse power on a consumption of 1 lb. of coal or less per hour, while about $17\frac{1}{4}$ of the heat value of the fuel consumed is turned into useful work at the engine shaft, or nearly twice as much as can be obtained from the reciprocating steam engine, and about one and a half times that which is yielded by the steam turbine. The sum of the two principal losses in the steam plant, namely, the funnel and the condenser losses, is nearly equal to the sum of the two most important losses in the gas plant—the water jacket and exhaust losses. But whereas there is little chance of utilising the heat thus lost in the steam plant, there is promise of utilising at least a portion of that lost in a gas plant.

It seems inevitable that a system of generating power which both theoretically and practically offers such a
marked economy in fuel consumption will in the end survive the steam power plant.

The type of producer plant used on land is manifestly not suited for marine work, as it weighs as a rule over 200 lbs. per brake horse power, but producer plants designed especially for marine work can be built weighing from 75 to 90 lbs. and occupying a floor space of \( \frac{2}{3} \) to \( \frac{1}{2} \) of a square foot per B.H.P. It is therefore evident that the marine gas producer has a decided advantage both in weight and space occupied per B.H.P. over the steam plant, which for passenger and cargo service weighs a trifle under 200 lbs. and occupied about \( \frac{1}{3} \) square foot per B.H.P.

The importance to Australian trade of the development of the marine producer gas plant can hardly be overestimated. There are at present several vital difficulties that have to be overcome before the suction gas plant can be made as flexible as the steam plant. These, however, are being seriously grappled with and everything points to the fact that this form of obtaining energy is rapidly coming to the front. A large vessel has lately been built and equipped with such plant in the United States, but particulars as to her effectiveness have not yet come to hand. Locally a lighter was recently built and equipped with a producer gas plant.

Coming next to the question of Harbours and Wharfage for the protection and accommodation of this ever-increasing volume of shipping, it is interesting to note the progress that is being made in this direction. All over the world the evolution of shipping, which shows as yet no signs of working itself out, is causing great activity in marine engineering; indeed it is scarcely too much to say that for many reasons it is difficult, if not impossible, for harbour works to keep even pace with the increasing requirements of over-sea shipping. What was a few years ago sufficient
in accommodation, strength and draft of water, is to-day inadequate. As far as this country is concerned, even at the leading ports of each State, a considerable portion of the wharfage which a few years ago was ample for the trade is now becoming obsolete, and though every effort is being made to keep pace with shipping requirements, the difficulties that inevitably arise and delays that cannot be obviated, make progress appear slow.

What the present local wharfage requirements are, and are likely to become in the future, can best be gauged by a comparison between the ships of to-day and those of forty years ago, to accommodate which most of our harbours were designed. In the seventies the over-sea Australian trade was carried almost entirely in sailing ships of 800 to 1,500 tons. These ranged in lengths from 180 to 270 feet, the draft of water being from 20 to 24 feet. Even so late as the eighties very few in any part of the world foresaw the enormous and rapid increase that was destined to take place in size and draft. Vessels now trading to Australian ports very nearly touch the 14,000 ton mark. Many are upwards of 500 feet in length and require in some instances 32 feet of water to berth.

Judging by the past there can be but little doubt that vessels will at no distant period reach a length of 1,000 feet and a draft of from 35 to 38 feet, and harbour engineers must be prepared to provide adequate accommodation for them. At the present time a vessel of 38 feet draft could be accommodated in only a comparatively few harbours in the world. From available returns I find that there are only sixteen ports that can boast of approach channels of 35 feet and upwards, at the present time, but in many cases the work of providing deeper water is in progress. For this purpose the use of sand pump dredges is being largely availed of; dredges of this class are being built of
very great capacity and enable the engineer to carry on his work at a rate which a few years ago would have been quite impracticable. In connection with the draft of vessels, it may be interesting to note that the depth of channel proposed for the Panama Canal is 35 feet. The present depth of the Suez Canal is 29 feet 6 inches, but it is proposed to deepen it throughout 34 feet 6 inches.

The difficulty in the way of keeping wharf accommodation up to the demands of the times, arises chiefly from the fact that ship building comes first in order of time, while the wharfage necessarily follows shipping developments. Moreover, shipbuilding is by comparison a rapid process. Even the large Trans-Atlantic liners take a relatively short time to construct. Great harbours, wharves, and docks, on the other hand cannot be as quickly completed. Existing wharves have to be demolished piecemeal and new structures of superior size and strength founded at greater depths, and all such works must be carried out without interrupting or hampering the existing trade of the port.

The superiority of the large over the small ship in earning capacity has become so insistently demonstrated, especially on long voyages, that the consequent growth in size of vessels coming long distances to our ports has rendered imperative the reconstruction of practically the whole wharfage of the chief seaports of Australia. It is very essential to us as a trading community that shipbuilding should not be hampered in development by inadequate berthing and docking facilities. How far this has been the case in the past is not easy to say. Probably it has not affected Australian shipping very much yet, but care must be taken that it does not do so in the future.

In our own city an auspicious commencement was inaugurated with the forming of the Sydney Harbour Trust
in 1901. The work of reconstructing the wharfage accommodation was at once taken in hand, and much has been done and is being done to meet the ever increasing trade of the port. When it is remembered that the shipping in Port Jackson has increased from 1,006 vessels of an aggregate tonnage of 385,161 in 1870 to 8,944 vessels of an aggregate tonnage of 6,901,057 last year, it will be realised what a difficult work it has been to provide adequately for the heavy tonnage of to-day at wharves constructed largely by private owners to suit their individual requirements, without system and without due regard to future expansion. The wharves at Circular Quay and at Woolloomooloo were constructed by the Government on lines which were considered at the time ample for many years, but even these have had to be largely reconstructed to meet present requirements. The reconstruction of the shipping accommodation in Sydney Harbour is but a typical example of what is being done in many of the principal harbours of the world. It will be found that in nearly all seaports of any consequence, the reconstruction of the wharfage will necessitate the remodelling of the city frontage streets, just as the developments in land transportation frequently require the remodelling of streets farther back. All this is of course slow and expensive work, but it will have to be done sooner or later.

The problem of the class of wharf construction best suited to the needs of the immediate future is one that has not yet been satisfactorily solved. Timber, which formerly served the purpose, is being largely set aside in Europe for several reasons. In the first place its life is brief owing to decay, and it is difficult to protect it from the ravages of marine borers, as the yellow metal which was at one time durable in salt water cannot now be relied upon.

Deep sea-walls have long been used, but with the increasing draft of vessels, the great height now required renders
such construction very costly and very slow. Iron and steel have been tried with success, but structural steel jetties are very expensive both in first cost and in subsequent maintenance. The latter item becomes a serious consideration, and marine engineers have been seeking for some time past to find a substitute, which, while of sufficient strength, will obviate the heavy maintenance charges.

Reinforced concrete has been devised with this end in view, and there are now many instances in existence which serve to show how successfully the principle can be applied to various classes of engineering work. It is in Europe chiefly, that reinforced concrete construction has been developed and perfected, and the formulae for the computation of strength devised. In the United States, though a great many reinforced concrete structures have been built, the Americans have followed rather than led.

The application of reinforced concrete to wharf and jetty construction has not anywhere kept pace with the advancement of the same compositions on dry land. The greater number of wharves so built are more or less imitative of timber work. In this part of the world reinforced concrete wharves have been built at Auckland, Tonga, Wellington, Gladstone, Brisbane, and Adelaide, and they are all practically of similar design—pile and deck structures. Nothing of the kind has been essayed, so far, either at Sydney or Melbourne, though, at the latter port, this class of construction was recommended by the engineer engaged to report upon the Port of Melbourne in 1908.

It might be inferred from these facts that we, in Sydney, are getting behind the times, but such is far from being the case. Reinforced concrete has been applied in connection with our wharfage works, but following an entirely new line of development, we have not up to this constructed any reinforced deep water berths, but considerable progress
has been made in the direction of reinforced concrete seawalling.

It may have been remarked that timber wharf and jetty construction still holds its own in Sydney Harbour, though to a large extent abandoned in Europe. Local conditions must, however, always determine the class of construction best suited to the services needed. In some parts of the world a high range of tide renders timber work less suitable than iron or steel, on account of the great length of piles required. Possessing as we do a port with a spring tidal range of only $5\frac{1}{2}$ feet, and undoubtedly the best timber in the world for wharf construction, it is natural that we should make use of that timber as long as the supply lasts and can be obtained at a reasonable cost.

With the present heavy demand for first-class timber for use on our national works as well as for exportation, our forests are rapidly being thinned out, and it is inevitable that unless some drastic measures are shortly taken in connection with reafforestation and exportation, the time will come when sufficient first-class timber with which to carry on our works will be unattainable except at prohibitive cost. During the past year we have used in connection with Sydney harbour works alone 3,450 piles, 3,009 girders, and 1,186,000 super feet of decking and timber for shed-work. This has denuded at least 4,000 acres of our best forest country; when we consider the quantity of timber used in other harbour works, bridge building, and for various other purposes, we can realise how much of our iron-bark, turpentine, and other first class timbers is being cut out annually. Up to the present time no steps have been taken to replenish the supply.

What is locally going to replace timber for jetty construction is a problem that is by no means easy of solution. Timber is still being used in many instances at New York
and other American ports for the largest vessels afloat. As long as timber is available and can be protected from marine borers, or can be used where borers are not destructive, it possesses advantages both economical and structural, that commend themselves to the engineer.

Reinforced concrete wharves and jetties, such as have been built, so far, in Australasia, do not in my opinion afford a solution of the berthing building problem. Personally, I am disposed to deprecate the copying of timber pile construction in reinforced concrete. A timber pile possesses a high degree of resilience and in any lengths in which it can be obtained will bear the bending moment of its own weight while being lifted. A reinforced concrete pile, on the other hand, of 18 inch section, when beyond a comparatively short length, cannot be lifted without danger of fracture unless slung in two or three places. Indeed, the resistance of a reinforced concrete pile however well made is so low that it should never be called upon to resist either flexion or shock, or to sustain a transverse load. Experiments have shown that a reinforced concrete beam is only about a fourth or even less of the strength of an ironbark beam of the same section. Reinforced concrete piles that can only be lifted without fracture from a recumbent to a vertical position for driving, by slinging them in two or three places, certainly do not impress me as the most suitable support for wharves which often have to withstand shock and heavy side thrust from a vessel while berthing.

The use of ferro-concrete in work of this class has yet to stand the trial of time, and many well-known engineers in England are still sceptical as to its efficiency and lasting properties owing to the danger of the concrete becoming detached by shock and leaving the steel bars exposed to the corroding action of the water. It is very difficult to detect
damage of this kind under water, and still more difficult to satisfactorily effect repairs. One thing is quite certain, ferro-concrete structures of this class should only be placed in the hands of experts to carry out, as extraordinary care is necessary to secure reliable work. To allow the work to be executed by persons without considerable knowledge of the principles of its construction is simply courting disaster.

In other parts of the world groups of piles and cylinders have been tried with success, but from what we are able to judge of the cost of such work it seems highly probable that a sea wall could have been built for the same or perhaps even less cost, and would certainly have proved a more substantial class of construction. While offering these criticisms I do not wish to imply that I consider reinforced concrete unadapted to wharf construction. Quite the contrary, but I do think that thoroughly suitable methods have yet to be evolved.

The widely varying conditions under which harbour works have to be designed, prevailing winds and currents, rise and fall of tides, nature of material available, etc., make marine works a particularly interesting, as well as a difficult study, and yet perhaps in connection with no other professional work do we find so many amateurs ready to give advice and criticism.

Take for example, the much discussed question of the Sow and Pigs reef, near the entrance to Port Jackson. Some advocate its removal because it disfigures our otherwise beautiful harbour; others because it is a danger to navigation, while on the other hand, we heard an interesting paper read not long ago, advocating the construction at this place of extensive wharves and jetties to accommodate the whole of our over-sea shipping. This reef is some three-quarters of a mile long, at its eastern end,
where it rises in places above low water and dips towards the western channel carrying not more than twenty-six feet of water for some six hundred feet west of the beacon, its removal to give a depth of even thirty-three feet would therefore be a work of very considerable magnitude. We have no record of any vessel having grounded on this reef since the schooner "Isabel" touched there some eight or nine years ago, and she was towed off by the Pilot steamer without damage, so that the reef has certainly not proved itself a danger to navigation, and I am strongly of opinion that its removal would from an engineering point of view be a serious mistake.

At present this natural training wall guides both the ebb and flood tide down the eastern channel, thus creating a uniform scour sufficient to keep it deep enough for our shipping requirements at a very small cost. In other harbour entrances breakwaters have been constructed at a great cost to effect the object that this natural guide wall now serves. The removal of the Sow and Pigs reef undoubtedly would reduce the scour in the Eastern Channel, with the result that frequent dredging would be necessary to obtain the requisite depth for the safe navigation of the harbour.

Another much debated question in this State is that of the improvements of our river entrances and bar harbours. The coast line of New South Wales extends nearly north and south for a distance of some 610 miles, and marine works have, up to this time, been designed and started in connection with nineteen river entrances and estuaries, but in very few cases have any of these works been carried out to completion as rapidly or in the manner that would ensure the best results. This has not been the fault of any of the many able engineers who have had to deal with these works in the past nor of the Ministers presiding from
time to time over our great Public Works Department, but is due to what I would call political expediency. The residents on each river in their, no doubt, justifiable desire for better means of communication to enable them to send their produce to Sydney and other large markets, have persistently advocated the improvement of their various waterways, with the result that the sums of money available each year for this class of work have been divided up so as to keep a number of these river entrance works going as far as possible, but, in many cases, partly completed works have of necessity been suspended for long periods, with the result that owing to the new conditions thus created, large quantities of beach sand have been drawn into the entrance on the flood tide and deposited in the form of new bars by the ebb tide, in some instances making the entrance more difficult than before the works were started. In other cases, owing to insistent agitation, it was found expedient to start those portions of the works which could be most quickly and cheaply put in hand. Two notable instances of this might be mentioned. There is no doubt that from an engineering point of view the southern breakwater at the Manning River entrance and the northern breakwater at Cape Hawke should have been the first works undertaken at these places, but owing to the time required to construct wharves and other preliminary work and to the cost, the breakwaters nearest to the quarries, which could be carried out more rapidly and at the smallest cost, were put in hand first, with the result that so far these works have not effected the improvements anticipated, nor can good results be expected until the works as designed, with probably some additions or modifications necessary on account of altered conditions caused by the works remaining unfinished for so long, are completed. Briefly, the results to be attained by the construction of training walls and breakwaters at our river entrances,

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which in nearly every case consist of a rocky headland on one side and a sand beach on the other, are, (a) by the directing of the ebb and flood tides over the same line, to deepen and maintain river channels, (b) to increase the velocity of the current, so that the silt brought down by the ebb tide may be carried as far as, and be dispersed by, the littoral or coastal currents, (c) to prevent beach sand from entering the river on the flood tide, and (d) for the protection of shipping navigating the entrance.

If after careful consideration of all natural local conditions, tides, currents, winds, flood waters, etc., a scheme is prepared to achieve these objects, it is scarcely to be expected that the carrying out of a portion of that scheme will lead to altogether satisfactory results. Whether the area of agricultural land in the vicinity of some of our smaller rivers or estuaries is sufficient to justify the carrying out of works, which must necessarily involve a considerable expenditure to be successful, is not for me to say, but certainly any work put in hand for the improvement of a river entrance should be carried out to completion as quickly as possible and without interruption during its progress. The ever restless waves and other great forces of nature are constantly at work day and night, and similar activity is necessary on our part to successfully cope with them in work of this class.

Where ocean transport ceases and land carriage begins, there arises the problem of changing from one to the other, and much difference of opinion exists as to how this can be effected in the most efficient and economical way. A large majority of the modern cargo-carrying steamers are equipped with appliances suitable for the rapid handling of ordinary merchandise, and it seems to me superfluous to duplicate these appliances on general cargo wharves. In some ports in Australasia numbers of hydraulic and other cranes have
been erected at general cargo berths, but so far as I can ascertain, they are seldom used, and occupy much useful space on the wharves. For the loading of bagged wheat conveyors are most extensively used, and perhaps no better example of this class of gear can be found anywhere than in the port of Sydney at Darling Harbour, where an extensive system of electrically driven conveyors capable of loading some 12,000 tons of wheat a day into seven vessels, has been installed. I may add that in order to keep pace with the rapid increase of our wheat export trade, provision is now being made to largely increase this installation.

The question of coal loading appliances has been so much before the public of this State during the last year that it is not my intention to deal with it at any length this evening. I would, however, point out that the particular trade of a port and the class of vessels to be loaded, must be taken into account quite as seriously as the question of feeding the loading appliances, or the rapid discharge of coal from the trucks. At a majority of the coal-loading ports of England and America, the trade is carried on by steamers specially built for the purpose. These colliers are constructed with no 'tween decks and continuous hatches through which loading can be completed practically without trimming. The rate of loading is therefore largely governed by the capacity of the shore appliances. From other ports, such as those of Australia and New Zealand, coal is taken away for the most part by the ordinary cargo steamer, constructed with two or three decks and comparatively small hatches to suit the general cargo trade. With such vessels it is necessary to start trimming after a few hundred tons of coal have been deposited in a hold, and from that point the rate of loading largely depends on the rate of trimming. With vessels of this class there is often difficulty in depositing the coal without excessive breakage.
Owing to the geographical position of Australia and to the conditions of our commerce, it seems more than probable that for many years to come our coal trade will continue on its present lines. Any additional coal loading appliances to be erected at our ports should therefore be designed to suit that trade.

The question of discharging coal cargoes by mechanical means fitted in the vessel has received much consideration for some time past, and a steam collier with self acting delivery has lately been constructed at Sutherland, which it is said will reduce the cost of discharging a cargo of 3,100 tons to about one-tenth the cost of discharging by hand. The equipment consists of twin belt conveyors carried in a space under the cargo which draw the coal from the hold and deliver it by means of swivelling booms either into trucks on the wharf or into barges alongside the vessel. Discharging coal cargoes by means of conveyors and grabs worked from the shore has been carried on with considerable success for some time, but it is obvious that much better results should be obtained from an equipment fitted in the ship itself.

Owing to the limited time at my disposal for the delivery of this address, I have been able only to touch very briefly on a few of the many subjects connected with over-sea transport. The interesting and equally important question of transport by land must be left for someone better versed in the subject to deal with on some future occasion.

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During the past twelve months we have lost by death one Hon. Member, Professor Simon Newcombe, LL.D., Ph.D., Rear Admiral of the United States Navy; he was elected a member of our Society in 1901 and died on 11th July, 1909. The loss of ordinary members has been more severe. The death roll includes the following:—
The Right Hon. Sir Frederick Darley, P.C., G.C.M.G., Chief Justice and Lieutenant-Governor of New South Wales. Born in Dublin, 18th September, 1830, died 10th January, 1910. Elected a member 1877.

Mr. David Kirkcaldie, Assistant Railway Commissioner in New South Wales, died 5th September, 1909. Elected a member 1892.

The Hon. W. J. Foster, formerly a Judge of the New South Wales Bench, died 16th August, 1909. Elected a member 1881.


Mr. J. U. C. Colyer, died 1910. Elected a member 1876.

In conclusion I have to thank the members for their kind support and consideration during my term of office. The year has been a fairly successful one, and many interesting papers have been read and discussed. I am sure we all look forward with pleasure and interest to the work of the coming year, presided over by so able a scientist as my successor Prof. David.
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