PART II.

PAPERS.

10TH MARCH, 1904.

ADDRESS BY THE PRESIDENT.

MR. J. L. C. RAE.

In opening the thirty-fourth Session of the Association I have, first of all, to thank you for the compliment you have paid me by re-electing me to such an honourable position as that of your President.

In my address to you last year, I referred to several matters connected with the affairs of the Association, more especially those connected with its internal economy, and urged members to join with the Council in giving them serious consideration. It was very gratifying to your Council, and myself, to note how this appeal was responded to during last session, and I trust members will again unite in putting forth every effort in the interests of the Association, so that this session may be even more successful than last.

The annual report of your Council, which was agreed to at our annual meeting on 8th October last, and which you have all seen, showed the exact position of our affairs up to 30th September last, the end of our financial year. Since then, in addition to the annual meeting, we have had an extraordinary meeting, several new members have been elected, and other events have happened, to which I now propose briefly to refer, so as to show the exact position of affairs as they now stand.

During last session eighteen new members were elected, five resigned, and one was lost by death, the figures at the close of the session showing that twelve new members had been added to our roll. The member lost by death was Mr. George

McCredie, and reference was made by me, at our first meeting after, to the loss of such an old and highly-respected member as he was.

Since the end of our financial year eight new members have been added (six at the annual and two at the extraordinary meeting), so that twenty-six new names were added to the roll during the year. After making allowance for the losses referred to, the membership of the Association was, therefore, increased by twenty, which is very gratifying, especially as the new members have taken a lively interest in the papers and discussions at our meetings.

During the year 1903 (including the annual and extraordinary meeting) altogether ten meetings were held, at which there was an average attendance of fifty members. Much interest was evidently taken by the members in the papers read, and especially in the discussion thereon.

When it is considered that such questions as "The absence of economy in manufactures in Australia, specially dealing with the motive power end," "Notes on Water Tube Boilers," "Feed water heaters" and "Ebullition, circulation, and the efficiency of steam boilers," occupied the animated attention of members at seven of our meetings, it will be seen that the exchange of opinions was not only varied, but should prove valuable.

The Annual Dinner was held at the A.B.C. Cafe on 30th October, 1903. There was a very good attendance, and the reunion was a very pleasant one.

Regarding finance, it may be stated that after providing for all expenses and writing off £9 8s 9d for unpaid subscriptions, there was a balance of £53 5s 10d at the end of the financial year to carry forward to the credit of the Capital Account.

Under the new arrangement made last session in connection with the printing of our Proceedings, each member received in pamphlet form, a copy of each paper read at our meetings before the discussion on same came on, and, subse-

quently, the discussion also. Members are now, therefore, in possession of all the papers read, and of the discussions which took place at our meetings last session. These pamphlets are set up in the same type and style as was formerly adopted in the pages of our Volume, and, as the cost of binding the pamphlets into a Volume will be small, it will be seen that there will be a considerable saving in the cost of publishing our Proceedings ,as compared with the old system, under which papers were submitted to members in "galley form" before discussion, and had, afterwards, to be reset in a better type for the Volume.

It may be pointed out that the cost of printing the Proceedings during last session, including shorthand-writers' fees for taking full notes of members' extempore contributions to the discussions on papers, amounted to £44 7s 6d, or only about half of the cost of our last published Volume (Vol. XI), which, together with printing of "galley forms," cost £88 4s 2d.

Altogether, I think we may congratulate ourselves on being in a better position, numerically and financially, than when I addressed you a year ago.

This Association has always taken a keen interest in matters affecting technical education, or anything pertaining thereto ; indeed, some of our older members were actually the founders of this class of education here.

Towards the end of last year we received a communication from the Under Secretary (written by direction of the Premier and Chief Secretary) forwarding copy of a communication, with enclosures, that had been received from Lord Jersey, on the subject of a scheme for the delivery here of a series of lectures on British Engineering and other subjects. At the time of his writing, Lord Jersey was acting as Agent General for this State in London, during the absence of the Agent General (Mr. Copeland).

Your Council was so impressed with the importance of the subject, from a national and engineering standpoint, that, after

some correspondence on the matter with the Under Secretary, a deputation was appointed to wait on him in order to express our hearty appreciation of the scheme, and our desire to co-operate, so far as the delivery of the proposed lectures in Sydney was concerned.

Further correspondence has taken place, and only the other day, at the request of other members of your Council, I called upon the Under Secretary with a view to expediting the matter. Your Council trust that the scheme may be matured and arrangements made for the delivery of the lectures here, before the end of the present Session. Other of our kindred societies were approached, and your Council expressed willingness to co-operate with them in the matter, but, as further delay is to be deprecated, immediate steps will be taken to express the willingness of the Association to make arrangements for all the lectures being delivered here under its auspices.

Briefly, the scheme as submitted to us is as follows:—"Lectures will be prepared on particular subjects by eminent engineers and experts in various leading lines of manufacture, and each lecture will be printed and copies forwarded (by previous arrangement) for reading before Technical and Trade Societies, Chambers of Commerce, Colleges, Schools, and other Educational and trading bodies in British Colonies and leading centres of trade in Foreign Countries. It will be a "special feature" that each lecture will be illustrated with Lantern Slide Views of the Machinery or other subject dealt with therein, and for this purpose a set of Lantern Slides will accompany each printed Lecture. It will be realised that by means of this graphic method of illustration, added interest will be given to each Lecture, and novel points of utility and design will be more easily emphasised."

In the branch of Engineering the following Lectures are in the course of preparation:

BRITISH PROGRESS IN ELECTRICAL WORK, by Sir Wiliam H. Preece, K.C.B., Queen Anne's Gate. Past President of the Institute of Civil Engineers. Author of many standard works.

BRITISH PROGRESS IN MECHANICAL ROAD TRACTION, by Col. R E. Crompton, M. Inst. C.E., Past Pres, Inst, E.E., Thriplands, Kensington Court, W. Author of numerous important contributions to Engineering Literature.

BRITISH PROGRESS IN STEAM GENERATION, by Prof. W. Ripper, M.I., Mech. E., University College, Sheffield. Author of "Steam Engine Theory and Practice," etc.

BRITISH PROGRESS IN STEAM BOILER CONSTRUCTION, by F. J. Rowan, A.M. Inst. C.E., M.I,E,S,, Ex-Vice-Pres, Fed, Inst, M.E., Ex-Mem. Council Soc. Chem. Industry, Author of "The Practical Physics of the Modern Steam Boiler," and other works.

BRITISH PRCGRESS IN MACHINE TOQL MANUFACTURE, by John Ashford, M.I., Mech. E., Manager, Robey & Co., Ltd,, Lincoln. Author of "Light Lathes and Screw Machines," etc.

BRITISH PROGRESS IN MUNICIPAL ENGINEERING, by William H. Maxwell, A.M. Inst. C.E., Borough Surveyor and Engineer, Tunbridge Wells. Author of "Refuse Destruction," etc.

BRITISH PROGRESS IN STEAM ENGINE CONSTRUCTION, by J. H. Dales, A.M., Inst. C.E. Finsbury Pavement House, Consulting Engineer. Author of "High Speed Engines," etc.

BRITISH PROGRESS IN MINING MACHINERY, by W. H. Shaw, Chief Engineer, New Kleinfontein Mines, Benoni, Transvaal.

BRITISH WORKSHOPS AND THEIR EQUIPMENT, by Ben. H. Morgan, Orchard House, Westminster. Engineering Trades Commissioner. Author of "High Speed Steam Engines," "Compressed Air and its Application," "Modern British Engineering Practice," etc.

PNEUMATIC TOOLS AND APPLIANCES, by Ewart C. Amos, M.I., Mech. E., Queen Victoria Street, E.C. Author of "Machine Tools," and numerous papers on Pneumatic Tools.

THE SELECTION OF BOILERS, by C. E. Stromeyer, Chief Engineer, Manchester Steam Users' Association. Author of several important works on the construction, care and working of Steam Boilers.

When I addressed you last year, the country was suffering from a very severe and prolonged drought, and the pastoral outlook, and that of all industries and business connected therewith, was gloomy in the extreme.

Since then, we have, fortunately, had an abundant rainfall, and the land has given ample proof of its wonderful recuperative power. The wheat yield, which it is estimated will reach 26,000,000 bushels, promises to be a record one, and, apparently, the capacity of the rolling stock and storage sheds of our railways is being fully taxed. The stock losses during the drought were so heavy that it has been estimated that the number of sheep in the State at the end of the year 1902 was only 26,000,000, whereas in 1891 (the record year), it was 61,000,000. It will take some excellent years before that standard is again reached.

I refer to these questions, not only by way of comparison with the remarks I made on them in my address to you last year, but because I am sure you will admit they are worthy of mention.

As engineers we may be apt to look on crops, wool, etc., as being matter too soft for our consideration, but when we think of the many branches of our profession whose prosperity almost solely depends on work connected with railways, ships, etc., for the carriage, and machinery for the turning of the produce of the land into useful effect, it will be brought home to us that it has a very great deal to do with "making the wheels go round."

The drought has, however, served a useful end in certain directions, for has it not been the means of much necessary work being done in connection with our water supply? The large new reservoir now being constructed at Cataract is an example of this.

But what about irrigation? Can we say that the grievous lessons of the drought are being seriously taken to heart either by the community, as a whole, or by those most interested? While the land was parched, and stock dying in millions, irrigation—or the want of it rather—was a burning question; now it seems quite the reverse. Our water holes, creeks, rivers and reservoirs are, at present, full, but how long can we be sure that they will remain so? Praiseworthy, and, it may be taken for granted, highly remunerative efforts have, no doubt, been made in individual cases to irrigate properties, but surely greater effort is required, generally, throughout the State in this directon. It is to be hoped that it will soon be made.

The most notable irrigation work of recent times is, without doubt, the Assuam Dam across the Nile. It was completed, after four years' work, in August, 1902, and is reported to have cost £4, 800,000. It is described as being 6,000ft. long, 76ft. high, and capable of holding back the water for a distance of 140 miles, to the estimated extent of 1,000,000,000 cubic yards.

Without doubt, the question of irrigation has been attacked in India in a way far surpassing that of any other country. The irrigation canals there, and their branches, are reported to have a total length of some 14,000 miles, and the area irrigated is calculated at some 28,000,000 acres. The embankments along the river Indus and in the Ganges delta, for restraining floods, are very extensive, and are said to have a total length of about 1,500 miles. On the top of all this, it was only recently reported in our daily papers that the Irrigation Committee of India proposed to raise loans, chargeable to the famine fund, for the expansion of irrigation, the intention being to expend £30,000,000 spread

over a period of 20 years, for the construction of protective works, of which one-half would be indirectly productive. It was also stated that it was proposed to devote £500,000 a year to loans for private works, and as free grants for unproductive protective works.

India, with her teeming millions of people and huge snow-fed rivers, offers, however, a very different field to the irrigation engineer than this country, and we can only hope to emulate her example in a feeble way.

Probably, American ideas and achievements are more in keeping with our conditions, and we might do worse than take a leaf out of the American book.

Some valuable papers on this subject were read last year at the meetings of one of our kindred Societies, i.e., the Engineering Section of the Royal Society of New South Wales.

We have heard a great deal, lately, about the question of population (it has indeed, been the subject of inquiry by a Royal Commission, whose report was only published the other day), and there is no doubt but that the welfare of the country in general, depends, to a very large extent, thereon. With our enormous area and meagre population, how can we expect much further development in any direction? If the inland areas were more thickly populated, does it not stand to reason that the people themselves would give more attention to the question of irrigation? And, if so, how much would the State be benefitted?

In addressing you last year I touched on the question of population in an indirect way. In speaking of the annual output of coal in this State, I pointed out that although it was only some 6,000,000 tons, it ranked, per head of population, next to that of Great Britain, where the annual output is about 220,000,000 tons, and exceeded, by nearly one ton per head, that of the United States of America, where the output is fully 260,000,000 tons per annum.

Anyone, who gives these figures serious thought, must see that we cannot hope for much expansion in our coal trade, unless our home consumption is increased; for how can we, with our high rate of wages, and distance from the chief consuming centres, expect to compete in other markets, with the rest of the world? When it is considered that our climate is milder than that of Great Britain or America, it will be seen that our position, in this respect, compares more unfavourably with these countries than the figures even show. And if this is the case in the coal trade, is it not so in all others? Nearly all our manufacturing industries are in need of encouragement, and that, again, really means increased home consumption, which, in other words, means increased population. We want more people in Australia to secure the development of our great natural resources.

Speaking of our coal production leads one to consider our mining industry in general, and some remarks thereon, will, I hope, be of interest. I am indebted to the recently published returns furnished by the Department of Mines for the figures embodied in the following four paragraphs.

In 1903 the total value of our mineral production is stated as £6,059,486, an increase of £421,341, as compared with the previous year, and the aggregate value of our output to the end of 1903 is stated as £158,339,798.

The returns show that the value of gold won in the State during the year 1903 was £1,080,029, an increase of £395,059, as compared with the previous year, and the total value of the gold won to the end of 1903 is stated as £51,822,617.

The gold won by dredging during the year is valued at £104,303, the same operation having yielded stream tin of a value of £20,100, making a total of £124,403, and showing an increase for the year 1903 of £18,212. In silver, lead and zinc, the value of last year's output is put down at £1,626,576, an increase of £128,114, as compared with the year 1902, while the output of copper is valued at £431,186, an increase of

£122,263, and of tin £124,893, an increase of £71,187.

As regards coal, the output in the State during the year 1903 was 6,354,846 tons, valued at £2,319,660 1s 9d, as compared with 5,942,011 tons valued at £2,206,598 during the preceding year, thus showing an increase in output of 412,835 tons, and in value of £113,062 1s 9d.

It may however, be considered that the year was a favourable one for our export coal trade, for we all know that on account of the drought a large quantity of wheat had to be imported, and, as we had very little produce for export, many of the ships which brought wheat sailed again with coal cargoes. The big wheat yield this year has, no doubt, affected shipping and will, in that way, affect our coal trade.

Great developments have been made in the opening up of the Maitland coal field during the past year or two, but specially last year. The seams being developed are the Greta series, the lowest of our coal measures.

Between the outcrop near Maitland and that at Greta there is a large, somewhat oval-shaped area, under which no coal exists. It is practically certain that this area was once covered with strata, and its shape naturally suggests that there must have been a rise in practically all directions, thus forming, as it were, a more or less isolated huge mound. Further, it is equally certain that the top of this mound, including the coal seams, was removed by denudation, or volcanic action, in ages past. In proof of this, the measures at Greta and Maitland are found dipping in nearly opposite directions. In this denuded area—part of which, at least, I happen to know particularly well—marine fossils can be found close to the surface which, according to our best geological information, are not to be found on the surface before reaching the region of the Clyde River on our South Coast. Under Sydney, it is reasonably safe to say that the strata exposed between Maitland and Greta lies at a depth far beyond the present power of human endurance to reach by sinking.

The dip of the seams now being worked varies considerably; generally, it is comparatively slight, though in one case, at least, it has an angle of about 45 degrees. The thickness varies from 12ft. to 34ft., the latter great thickness having been recently proved by a bore being put down near Cessnock. There, no doubt, the seams have united and formed one thick bed.

The area of coal-bearing land in this field has been estimated at about 20,000 acres, and the coal underlying it at about 699,000,000 tons.

The recent development of these mines has certainly been of great value and interest, and it is practically certain that there is a great future before them.

A special point of interest is that coal-cutting machines have been installed, to a more or less extent, at most of these collieries. In some cases, the machines are worked by compressed air, in others by electricity, and though this is not absolutely their first introduction here, it must be said that these mines have been the first to employ them to any extent in Australia.

In the United States, about 25 per cent. (equal to about 65,000,000 tons per annum) of the coal won is holed by machines, whilst in Great Britain, it has only happened very recently that more than 1½ per cent. out of the output has been holed in this manner.

At a recent trial at Teralba Colliery, near Cockle Creek, a Diamond machine, worked by compressed air, is reported to have under-cut the coal, 1ft. by 5ft. 6ins., in two minutes. The "Borehole" seam at this Colliery is comparatively thin, and the advantages of machine-holing will, therefore, be apparent.

At some of our collieries, for reasons peculiar to the nature of the coal, etc., coal-cutting machines would hardly be likely to show to advantage, and may never be adopted. However, the machine has found its way into the State, and has, without doubt, come to stay.

In the City, the denser population naturally gives rise to more activity, and capital, skill and energy are required to provide for the many and varied requirements of every-day life. During the past few years the improvements made, and the extension of the suburbs overlooking the Harbour have been very striking, and, to-day, there is apparently no halt in the onward march. Old buildings which occupied valuable sites are every day being demolished, and replaced by massive and handsome structures, replete with all the improvements and conveniences of modern building construction. Perhaps one of the most notable recent instances of change in this direction has been the conversion of the old Devonshire-street Cemetery and surrounding areas into a site for the new Railway Station, the building of which is now in progress.

Mention of the new Station brings before us a question of considerable public importance, and of special interest to engineers, namely, the proposal of the Railway Commissioners to expend fully £300,000 on 60 new locomotives, to be built in the State. Some of our members are, we know, particularly interested in this question, and the report of the Commission appointed by the Government to inquire into the merits of the various tenders, and equipment of the work-shops of the firms who have tendered, will be awaited with great interest.

The railway and tramway services are so closely allied, that some mention may now be made of the latter. Undoubtedly, Sydney has good reason to be proud of her present tramway service, and can look forward, confidently, to future extensions of the same high class.

When the George-street electric tram was started a few years ago, probably neither the Railway Commissioners nor the general public had any idea of the claim that would be made on it, or the need for such widespread extensions of the electric system as have since been made.

Many of us have had the pleasure of visiting the power house at Ultimo, and seeing the splendid plant there installed.

The present horse power of this plant is about 13,550, and arrangements have, I understand, been made for the addition of a steam turbine driven unit of 1875K.W., at a speed of 1500 revs. per minute. This, when installed, will bring the total horse power at the station up to fully 16,000. There are already one or two turbine-driven plants in the City, but nothing in any way approaching this proposed one in size, and the installation will, therefore, be a particularly interesting one to engineers.

In Great Britain, the steam turbine is evidently making great headway, at any rate, in marine work. When the inventor, Mr. Parson, first fitted his motor in the "Turbinia" the speed results of 34½ knots, caused, naturally, extreme interest to marine engineers. Afterwards, the torpedo-boat destroyer "Viper" easily beat this, having attained a speed of 37 knots. The same class of motor has, apparently, given every satisfaction in the Clyde River steamers, "King Edward" and "Queen Alexandra," and the British Admiralty are now having turbines fitted in the cruiser "Amethyst," and destroyers "Velox" and "Eden." Further, it is understood that turbines may be fitted, as the propelling power in the two proposed new steamers for the Cunard Company. As it is intended that these boats will be larger and faster than any at present afloat, it will be seen that if turbines are employed they will constitute by far the largest plant of the kind at present in existence.

As a proof of the progress the turbine is making, one only wants to look at the report of the Parsons' Marine Steam Turbine Company, which states that the output last year reached 22,000 i.h.p., as against 19,000 i.h.p, in the year 1902. Indeed, according to report, there was only one other firm on the Tyne whose i.h.p. exceeded that of last year. The record of all the other firms showed a reduced output.

Considerable interest is being taken, especially by engineers, in the scheme of the City Council for lighting the City

by electricity. I understand that the first installation will consist of Babcock & Wilcox boilers, each having 58 sq. ft. of grate area and 3,240 sq. ft. of heating area. The engines and generators are three in number, two being of 600K.W. each, and one of 300K.W. The engines are of the Ferranti type, and the generators by Dick & Kerr. There is also a battery of accumulators and sub-station motor generators, transformers, etc. The street lighting consists of some 400 lamps which, it is understood is about half the number required to light the whole of the city. The Council are, it is now understood, giving consideration to tenders for an additional plant of 1500K.W. The progress of this scheme is brought home to even the most casual observer by the inconvenience caused by the pulling up of the pavements, and when it is considered how often our streets have been in like condition during the past year or two, the hope may be expressed that on the completion of this work, they will get a much needed rest.

The North Shore Bridge scheme appears to have been dropped for the present, presumably from lack of funds. However, it is understood that the Advisory Board recommended the tender of Messrs. J. Stewart & Co., Sydney, the price being £1,940,050. The time necessary to construct the bridge was stated as 5½ years.

In this address I have endeavoured to bring before you some matters which I hope will be of interest.

Undoubtedly this country has a great future before it, and, under favorable conditions, will make a rapid progress. It may, however, fall to the lot of the coming, rather than the present generation of engineers, to cope with the requirements of such great expansion as we may feel sure will eventually occur.

They will require to be highly trained men, and, moreover, will have to keep before them all the best traditions of our profession.