PART II.

PAPERS.

8th March, 1900.

PRESIDENTIAL ADDRESS.

Mr. H. B. Howe.

Gentlemen,—In opening the 30th Session of this Association, the first duty—a very pleasant one—that I feel it incumbent on me to carry out is to express my very best thanks to the council and members for the support they have given me by contributing papers, their regular attendance at the meetings, and in many other ways, which resulted in the past Session being one of the most successful that our Association has seen. I can say this without egotism, for it must be patent to you all that I as an individual could do but very little without your support. The papers read were most able and interesting, and evoked discussions that I am sure will prove of value to us all.

I must further thank you for the honour you have again conferred upon me by re-electing me as your President, and I am sure you will all accord me the same hearty support and co-operation that you did during the past Session.

In my last address I departed from the orthodox lines that are usually followed, and gave you an outline of the history of the rise and progress of the New South Wales railways. Unfortunately, there were many important points that I could only touch on in the most superficial manner without making the paper of such great length that it would probably have wearied you.

The subject of my last address having—so I am assured—proved so interesting to you, I have, after mature consideration, decided that I cannot do better than give you some further information thereon.

The most important factor in connection with railways is unquestionably the traction part of the business, and this evening I purpose giving you a brief description of the locomotives of the colony and their development, and also a comparison of what is done in other colonies and other parts of the world.

For many years it was the practice to work most of the railways of the world with somewhat light locomotives compared with those of the present day. This was the case on the New South Wales railways until within the last ten years, when the necessity for engines of increased power became manifest, and it has been put into practice and continued up to the present with great advantage, particularly as the alteration of a number of steep grades and curves have very largely contributed to the benefit derived from the use of heavier engines.

To the American locomotive engineer is largely due the rapid strides that have been made in increasing the power of locomotive engines, and in that country the development has been very great, and so far as I can ascertain with considerable advantage.

The English engineers, until very recently, apparently do not seem to have given the subject much thought; at all events, they did not attempt to put it into practice until about the middle of last year, when a large ten-wheeled express engine was built for the North-Eastern Railway Company to the design of Mr. Worsdell. This engine is intended to run between York and Edinburgh; the service required is the heaviest and one of the fastest in England, the trains at times consisting of 20 loaded carriages, which run 124½ miles at an average speed of 53 miles per hour, without stops. The weight of the train is about 420 tons, and the grades vary from 1 in 96 to 1 in 200. This class of engine is intended to do away with double-headers, and it is a noticeable departure from the English practice, viz., large outside cylinders, 20in by 26in, with extended piston rods, six coupled driving wheels 6ft 1¼in diameter, and four-wheeled bogie. The weight in working order is 140,000 pounds, or 105 tons.

The general dimensions are as follows:—

Six-coupled Express Engine, North-Eastern Railway, by Mr. Wilson Worsdell, M. Inst. C.E., engineer.

Six Coupled Wheels ...	6ft. 1¼in. in diameter
Bogie Wheels	3ft. 7¼in. in diameter
Cylinders	20in. x 26in.
Length of Boiler ...	15ft.
Diameter of Boiler ...	4ft. 9in.
Heating Surface ...	Tubes, 1639 sq. ft. Fire-box, 130 sq. ft. Total, 1769 sq. ft.

Length of fire-box, 8ft.
Area of fire grate, 23 square ft.
Centre of boiler stands 8ft 7in above the rail level.
Working pressure, 200lbs per square inch.

Weights—	Tons.	Cwt.
On bogie......................	16	10
On leading coupled wheels	16	0
On driving ,, ,, ...	17	10
On trailing ,, ,, ...	16	0
Weight of engine	66	0
Weight of tender	39	0

Engine and tender in working order, 105 tons. This is, of course, greatly in excess of anything hitherto seen in British locomotive practice.

Total wheel base 48ft 4⅜in
Length over buffers 58ft 4⅜in
Capacity of tender: Water, 3782 galls
Coal, 5 tons.

The tendency at the present time is, I believe, towards largely increasing the size and power of their engines.

Two very large engines have recently been built for the Illinois Central Railroad, one by the Rogres Locomotive Company of Patterson, N.J., the other by the Brooks Locomotive Works, Dunkirk, N.Y. They are similar in dimensions, but the Brooks locomotive is slightly heavier. It would perhaps be interesting to give some of the general dimensions of these engines. They are intended to haul a load of about 1700 tons up grades of 1 in 150, and, as will be seen, there is very slight difference between them :

	Rogers.	Brooks.
Cylinders	23 x 30	23 x 30
Wheels	57in dia.	57in. dia.
Boiler pressure	210lbs.	210lbs.
Diameter of boiler	80in.	82in.
Length of firebox	11ft.	11ft.
Width of firebox	3ft. 6in.	3ft. 6in.
Number of tubes	417ft. 2in.	424ft. 2in.
Heating surface	3203 sq. ft.	3500 sq. ft.
Grate area	38½ sq. ft.	37½ sq. ft.
Height of centre above rail	9ft. 2in.	9ft. 8in.
Weight of engine and tender		364,000lbs. = 162 t., 0 c., 3 qr., 18 lbs.

One very noticeable feature of the Brooks engine is that the driving axles are of nickel steel. It will no doubt be remembered that during the last Session Professor W. H. Warren, Challis Professor of Engineering at the Sydney University, read a very interesting paper on the qualities of nickel steel, and this will show that our American friends have not been slow in adopting that material where excessive weights are to be carried, as in this instance, and a reference to Professor Warren's paper shows that he then strongly advocated its use for the construction of axles and boilers.

The Brooks locomotive, as will be seen from the figures quoted, is slightly heavier than the Rogers engine. The tractive power of each is the same; the boilers are of the Belpaire type (which has been adopted on our railways). The Brooks engine is fitted with piston valves, and the height of the centre of boiler above the rail level is 9ft 8in. This is a noticeable feature, as on the last occasion I addressed you I had something to say re the raising of the centre of gravity of locomotives, and I believe that this is higher than any yet attained.

Coming back to the colonies, which we in Australia are more closely associated with, very little development has taken place excepting in this colony, and from the tabulated statement attached (see Appendix A) the vast difference will be seen in the weight and power of the locomotives of the different colonies.

The heaviest engine and tender is—

	Tons c. q. lbs.
New South Wales	107. 5.0.0
Victoria	73
New Zealand	64.18.0.0
South Australia	64. 2.1.0
West Australia	58. 9.0.0
Queensland	51.14.0.0
Tasmania	50. 5.0.0

And when we compare these with some of the American engines, we find that in the latter these weights are exceeded to the extent of more than double, with the exception of New South Wales. reaching a total weight of over 162 tons.

One of my reasons for referring to the Rogers and Brooks engines is to show that while our American friends have been making rapid strides in the increased size, weight, and consequently the hauling capacity of their locomotives, we in this colony have not been so far behind them, while at the same time we have been very much ahead of the English engineers. The engine recently designed for the North-Eastern Railway Company is approximately 105 tons when ready for the road, and the engines of the New South Wales railways designed by the Chief Mechanical Engineer, W. Thow, Esq., are 91 tons P. Class; T. Class, a heavy goods engine, 107 tons 5cwt; and another passenger engine, designed by the same gentleman, will be approximately 107 tons.

"P" Class (Express Engine).

Outside cylinders	20 x 26
Wheels	5ft diameter
Boiler pressure	160lbs.
Diameter of boiler	4ft 8in
Length of fire-box	8ft 7½in
Width of fire-box	4ft 0¾in
Number of tubes (1⅞in)	269
Heating surface	1144ft.
Grate area	21ft.
Height of centre above rail	7ft 8in
Weight of engine and tender ...	91 tons
Tractive force	22,187lbs.

New "P" Class Heavy Express Engines (not yet built).

Cylinders		21 x 28
Diameter of wheels		5ft 9in
Working pressure		175lbs per sq. inch
Tractive power		25,054lbs
Bogie	Tons	17.0.0.0
Leading	,,	16.5.0.0
Driving	,,	16.15
Trailing	,,	16.0.0.0

Total weight of engine, net, 66 tons.

Total weight of engine and tender (with water and coal), 107.10.0.

Compound wheel base of engine, 14ft 7in.

The total wheel base of engine, 26ft 7in.

The total wheel base of engine and tender, 52ft 1¼in.

Centre of boiler from rail, 8ft.

The valves of this engine are of the piston type, fitted in the ordinary way with a series of rings at each end of the pistons. Provision is made in the body of the valves to permit live steam passing through the centre of the pistons to either end of the steam chests, and so maintain the valves in an almost perfect state of equilibrium. They are so designed with the object of reducing the friction, and consequently the wear and tear, to a minimum.

Working Pressures of the Boilers of the following Classes of Engines:—

Class.	lbs. per square inch.
A 93	140
A 5	150
B 205	140
B 55	150
C	140
CC	150
D 255	140
D 261	140
E	150
F	140
H	130
I	150
J 131	130
J Wearne	150
J. Belpaire	130
J 483	150
K	140
L 304	140
L 436	140
M	150
O	160
P	160
Q	140
R	140
T	160

Return showing the total miles run by the following classes of engines, and the average miles run per engine, during the 12 months ending 31st December, 1899:—

Mileage.

Class of Engine.	Number of engines in each class.	Total miles run during the 12 months ending 31.12.99.	Average miles run per engine.
A	69	1,504,921	21,810
B	95	2,467,287	25,971
C	54	889,626	16,474
CC	12	346,577	28,881

Class of Engine.	Number of engine in each class.	Mileage. Total miles run during the 12 months ending 31.12.99.	Average miles run per engine.
D	47	1,135,535	24,160
E	12	254,230	21,186
F	18	347,874	19,326
H	12	227,480	18,957
I	20	383,368	19,168
J	15	231,833	15,455
J 483	20	307,153	15,358
K	10	133,040	13,304
L	10	194,222	19,422
L 436	10	294,586	29,458
M	15	564,128	37,608
O	12	287,509	23,959
P	50	1,805,118	36,102
Q	6	169,655	28,276
T	20	594,988	29,749

Duplicates in "Z" class are included in the average for all classes, but not given in classes.

Engine Mileage to 31st January, 1900.

Class B 55. No.	Commenced running.	Miles.		Class B 205. No.	Commenced running.	Miles.
62	13.3.91	215.346	....	205	.1.82	470.642
77	2.5.91	218.709	....	207	.1.82	473.133
78	10.4.91	231.221	....	210	.2.82	476.117
388	8.5.91	220.087	....	211	.3.82	474.549
392	7.5.91	234.203	....	214	.3.82	478.492
408	20.8.91	213.034	....	219	.5.82	491.846

Class P (10-wheel express). No.	Commenced running.	Miles.		Class M (suburban tank). No.	Commenced running.	Miles.
7	18.2.92	289.998	....	40	24. 9.91	343.195
8	3.2.92	305.777	....	42	7.10.91	348.475
9	23.2.92	301.022	....	43	12.10.91	347.047
460	22.3.92	308.294	....	44	16.10.91	345.354
467	23.6.92	315.864	....	48	27.11.91	340.897
510	8.3.93	298.344	....	49	1.12.91	343.791

Class T (heavy consolidated).				Class D 255 and 261 (4-wheel express).		
No.	Commenced running.	Miles.		No.	Commenced running.	Miles.
524	17.6.96	96.409	....	255	.11.82	514.975
525	10.6.96	103.220	....	256	.12.82	531.495
526	3.6.96	105.220	....	257	.12.82	531.607
527	27.5.96	98.802	....	258	.1.83	529.633
528	15.5.96	99.996	....	259	.1.83	551.531
				260	.1.83	537.358
				272	.12.83	442.465
				275	.3.84	449.428

Engines Supplied to and in Course of Construction for the New South Wales Railways since 1890.

Supplied	10 L 436	
	25 B Dubs	
	12 E	
	20 I	
	4 J Wearne's	
	20 J 483	
	15 M	
	12 O	
	50 P	
	20 T	
		—188 Engines.
Building	25 P	
	25 T	
		—50 Engines.
	Total	238

ENGINES.

Referring to the wear and tear and maintenance of locomotive engines on the New South Wales railways, anyone glancing at the cost might be somewhat struck at first with its apparent greatness, but a little reflection from an engineering point of view will at once explain how it is brought about.

The conditions under which they have to work, the nature of the country or roads over which they are employed, the high price of labour, and many other points, all have a bearing on the cost of their maintenance.