

has been found necessary to increase the wheel base, and bogies had to be adopted to shorten the rigid wheel base as much as possible so as to allow the engine to enter and run freely on the sharp curves we have had on these lines up to within a few years back, and they also provide a much better means of compensating between the coupled and bogie wheels.

I am afraid to venture a forecast as to the future developments of the Locomotive, the present seems to me at any rate, to show no novelty that comes within the likelihood of practical adoption, except it be that of piston valves which are now being largely experimented upon in England and America, and I hope I will not be accused of "looking backwards" in expressing the belief that we have about reached a fair maximum of the weight and tractive power that can usefully and profitably be laid down for locomotives on these Railways, considering the heavy grades that we have to contend with.

COMPOUND ENGINES.

The question of compounding locomotives has very largely occupied the attention of engineers in England and America for some considerable time, and varied opinions have been expressed as to the advisability of compounding. Some Locomotive Engineers think that there is a great deal to be gained by it, while there are others just as warmly opposed to the practice.

This I think has occurred more in America than in England, for in America it has been very largely adopted for engines on South American Railways, as in that country coal is very expensive, and it is stated that advantages are obtained there that warrant its introduction.

The system has not been very largely used in this Colony, but we have at present two compound express engines, and we also had two American compound en-

gines (goods), but the latter have since been altered to simple engines, and I think to advantage, for it must be understood that little benefit can be got out of the compound engines unless there is a very considerable increase in boiler pressure.

In passing I would like to refer to the different types of boiler now in use as compared with those of the early days of the Railways. During the past few years there has been a great difference in the class of materials used in the construction of the boilers, and in the designs stronger methods have been introduced in the way of welded joints, heavier plates and double rivetting, and within the last few years the Belpaire type of boiler has been introduced into our locomotives here and so far they appear to give general satisfaction.

LOCOMOTIVE AND CARRIAGE AND WAGGON
STOCK, ON N.S.W. RAILWAYS ON 31/1/1899.

	Capital Stock.	Duplicate Stock.	Total
Engines owned	495	88*	583
Passenger stock	1,044	257	1,301
Goods stock	10,476	286	10,763

Average number of engines
in steam daily throughout
the past 12 months 346

*most of these engines are stopped from service.

(Refer to page 16.)

TRAFFIC.

The first timetable only provided for mixed and goods trains, there were five mixed including what was called the Mail, and one goods train per day. In 1856 when the Terminus of the line was at Liverpool, 22 miles from Sydney, the first train, a mixed one, left Sydney at 6 a.m., and arrived at Liverpool at 7.12 a.m., and thus the journey occupied 1 hour and 12 mins. or at the rate of 18 miles per hour, the fares being 7/6, 5/6, and 4/- for the 1st, 2nd and 3rd classes respectively.

The time of journey to Liverpool now by ordinary stopping trains is 50 minutes or at the rate of 26 miles per hour, and the fares are $\frac{2}{4}$ 1st, and $\frac{1}{4}$ 2nd, there being no 3rd class, that having been abolished many years ago.

In 1856 the trains out and in of Redfern Station daily numbered eleven. There are now no less than 323 trains in and out of Redfern Station daily.

When I entered the Service, in 1864, it was very good work to get 20 miles per hour out of the locomotives for the run to Menangle, 40 miles from Sydney, the then terminus of the Southern Line, but now the Melbourne Express runs the trip to Albury (386 miles), taking a load of 240 tons, and maintaining an average speed of 35 miles per hour for the whole trip.

Our advance as regards goods waggons has been on the lines of capacity, and it has been necessary to keep pace with the economical conditions and circumstances of the times. (Refer to pages 18 and 19.)

In regard to the increased capacity of both goods and passenger stock, with the latter the increase in accommodation has also been coincident with a betterment of the surroundings; the adoption of lavatories and sleeping provisions, vestibule trains, including Pullman sleeping cars, and first and second-class corridor cars are now running on the main lines, and make very handsome trains, from which it will be seen the great improvement that has taken place during the last few years.

In addition to the improved rolling stock that have been placed on our lines, the whole of the stock has been equipped with the Westinghouse automatic quick-acting brake, although most of the carriages were fitted prior to the advent of the present Commissioners, it is only within the last seven years that the whole of the goods stock, including engines, have been fitted

PARTICULARS OF SOME PASSENGER CARRIAGES, NEW SOUTH WALES GOVERNMENT RAILWAYS

Reference No. of Diagram.	Description of Vehicle.	Date Commenced Running.		Length over Body.	Width over Body.	Wheel Diameter.	Bogie Wheel Base.	Outside Wheel Base	Compartments.				Passenger Carrying Capacity.	Tare of Vehicle.	Remarks.
		Yr.	ft in						ft in	ft in	ft in	ft in			
		Length between Partitions.	Width.	Height Floor to Ceil.	at Cen										
1	Vestibule Sleepers	1891	61 0 9	4 1 1/4	3 0 1/2	10 0	5 6 0	6 2	8 6 1/2	9 0 3/4	28 Sleepers	35 10	6	Wheeled Bogies	
2	Old Type Sleepers	1880	45 6 8	10	3 0 1/2	6 6	4 2 0			8 9 1/4	20 "	18 7	4	" "	
3	Old Type 4 Wheel Sleepers	1878	22 0 8	10 1/2	3 0 1/2		12 0	7 1	7 8	8 7 1/2	12 "	9 10	4	Wheel Rigid Wheel Base	
4	1st Class Corridor Cars	1897	81 0 9	4 3/4	3 0 1/2	10 0	5 6 0	6 9	6 5 1/2	9 0 3/4	45 Seats	36 10	6	Wheeled Bogies	
5	" Lavatory Carriages	1890	46 0 8	6 3/4	3 0 1/2	5 9	3 9 6	7 1	7 9 1/2	7 8 1/2	40 "	21 11	4	" "	
6	" Redfern Type	1884	36 8 8	3 1/2	3 0 1/2	5 6	3 1 6	5 11	7 6 1/2	7 0	48 "	14 0	4	" "	
7	" 6 Wheel Radial	1878	27 0 7	9	3 0 1/2		16 0	6 7	7 2	6 6	32 "	11 5	6	" Radial	
8	Sub. American Car (new type)	1890	44 0 8	10	3 0 1/2	5 9	3 9 9		8 3	8 5 1/2	60 "	18 10	4	" Bogies	
9	" " (old type)	1879	44 0 8	10	3 0 1/2	6 6	4 0 0		8 2 1/2	8 5	60 "	17 0	4	" "	
10	Compo. Express Lavatory	1891	46 0 8	6 3/4	3 0 1/2	5 9	3 9 6	7 1	7 9 1/2	7 8 1/2	24-1st class seats	20 14	4	" "	
								6 5	7 9 1/2	7 8 1/2	20-2nd " "				
11	Compo. Ashbury	1879	54 0 8	0 3 0 1/2	10 6	4 6 6		7 3	7 5	8 4 1/2	24-1st class seats	24 12	6	" "	
								5 11 1/4			40-2nd " "				
12	2nd Class Express Carriage	1890	46 0 8	6 3/4	3 0 1/2	5 9	3 9 6	6 5	7 9 1/2	7 8 1/2	70 Seats	20 1	4	" "	
13	" Lavatory Carriage	1897	49 3 3	6 3/4	3 0 1/2	5 9	4 2 9	6 6	7 9 1/2	7 8 1/2	60 "	22 10	4	" "	
14	" Redfern Type	1884	36 8 8	3 1/2	3 0 1/2	5 6	3 1 6	5 0 1/2	7 6 1/2	7 0	70 "	15 0	4	" "	
15	" Corridor	1899	61 0 9	4 3/4	3 0 1/2	10 0	5 6 0	6 0 1/2	8 6 1/2	9 0 3/4	64 "	19 10	6	" "	
16	Express Brake Vans	1890	46 0 8	6 3/4	3 0 1/2	5 9	3 9 6			7 8 1/2	10-2nd class seats	31 4	4	Wheeled Bogies	
17	Redfern Type Brake Vans	1884	36 8 8	3 1/2	3 0 1/2	5 6	3 2 6			7 0	" "	16 2	4	" "	

PARTICULARS OF SOME GOODS WAGGONS—N.S.W. GOVERNMENT RAILWAYS.

Reference No. of Diagram.	Description of Waggon.	Date commenced to run.	Length over Body.		Width over Body.		Height Inside.		Wheel Diameter.		Bogie Wheel Base.		Outside Wheel Base.		Tare.	Carrying Capacity.	Remarks.	
			ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.				Tns.	Cwt.
1A	4-wheel D. Waggon—Old Type...	1858	15	0	7	10	2	3	3	0	...	8	6	4	15	8 tons	Timber-framed waggon	
2A	4-wheel D. Waggon—New Type	1892	16	0	8	8 $\frac{1}{2}$	2	9 $\frac{1}{2}$	3	0	...	9	0	...	...	10 tons	Composite "
3A	Bogie D. Waggon ...	1892	32	0	8	8 $\frac{1}{2}$	2	10 $\frac{1}{2}$	3	0	5	6	26	6	11	7	24 tons	
4A	4-wheel Sheep Van ...	1862	18	0	7	6	6	8	3	0	...	10	0	6	16	100 sheep		
5A	Bogie Sheep Van ...	1896	36	2	8	6	6	11 $\frac{1}{4}$	3	0	5	6	29	6	14	10	200 "	
6A	4-wheel Cattle Truck ...	1862	18	0	8	6	6	10	3	0	...	10	0	6	4	12 cattle		
7A	Bogie Cattle Truck ...	1891	36	2	8	6	7	0	3	0	5	6	29	6	12	11	24 "	
8A	"C." Covered Goods Waggon ...	1879	15	0	7	6	7	0	3	0	...	8	6	5	15	7 tons		
9A	"C." Louvred Goods Waggon ...	1897	18	0	8	6	7	0	3	0	...	10	6	...	...	8 "	
10A	Covered Bogie Goods Waggon ...	1891	34	8	8	8	7	6	3	0	4	10	28	10	11	10	19 "	Tubular type
11A	Timber Trucks—4-wheel...	1859	13	4	7	4	...	...	3	0	...	7	6	4	5	8 "	
12A	Bogie Timber Trucks ...	1897	32	0	9	0	3	0	5	6	26	6	11	0	22 "	
13A	Refrigerator Cars—Old Type	1891	34	0	9	0	6	9 $\frac{1}{2}$	3	0	5	6	27	9	15	11	13 "	
14A	Do. —New Type ...	1895	34	0	9	0	8	7 $\frac{3}{4}$	3	0	5	6	28	6	17	10	540 carcasses of mutton	
15A	Bogie Goods Brake Van ...	1891	36	0	8	6	7	8 $\frac{3}{8}$	3	0	5	9	29	9	16	13	Carries 20 2nd class passens. & goods
16A	Caboose Brake Van ...	1894	20	0	8	3	7	1	3	6	...	11	0	18	18	.....	

with this brake. This provision has added very materially to the safety in working, and effected considerable economy.

I would also like to mention that the old system of colza oil lamps that were in use at the opening of the Railways, and for many years after, has been entirely abolished, and at present the whole of the passenger stock is lighted by gas, on what is known as the Pintch's system, In addition to the improved light, this tends to make travelling much more pleasurable than in the old days, and all through trains, both mail and express, are fitted with electrical communications between the guard and the passengers.

In connection with the remarks on lighting of the carriages with gas, it was found necessary to erect a gas works at Redfern, but in consequence of the increase in the number of vehicles fitted with the gas apparatus, and the consequent increased consumption of gas, a more extensive plant has been erected at Macdonaldtown, where the gas is made and conveyed to Redfern, where it is compressed and supplied to the carriages. Smaller gas plants have been laid down at Newcastle and Werris Creek, on the Northern Line, Bathurst on the West, and Junee on the Southern Line. At each of those places, with the exception of Newcastle, the whole of the station yard, engine sheds, etc., are lighted with the gas, but at Newcastle it is reserved for the carriages. The other depots are supplied where necessary by travelling gas holders.

ROLLING STOCK.

	Loco.	Passenger.	Goods.
1855	4	37	55
1864	25	177	345
1899	583	1,050	10,503

PERMANENT WAY.

The battle of the gauge was fought as fiercely in

Australia as in England, and with similar unfortunate results. It is somewhat remarkable that each Engineer-in-Chief for Railways recommended an alteration in the gauge advocated by his predecessor.

In 1848 the Secretary of State recommended the adoption of a uniform gauge for the Australian Colonies, and suggested that a 4ft. 8½in. was the best for the purpose. In 1850, the Engineer for the Company strongly advocated the adoption of the Irish gauge, 5ft. 3in., and in 1852, Act 16, Vic. No. 5 was passed, fixing the gauge at 5ft. 3in. This was also communicated to the Colonies of South Australia and Victoria, and it would have been well for the interests of the different Colonies if the question had then been definitely settled.

In 1853, with a change of Engineer-in-Chief, who was fresh from England, and who strongly deprecated 5ft. 3in. gauge, another change was made, and the 4ft. 8½in. was finally adopted for the Railways of New South Wales.

The trunk line from Sydney to Parramatta was first laid with Barlow patent rails, 75lb. per yard; but soon after this rail was replaced by the double-headed type, which has, in turn, had to give way to the more modern T rail.

The Barlow rails of 18 and 20 feet lengths gave place to the double-headed rail of 21 and 24 feet lengths, and later on steel rails of the same description, but heavier (80lb) were introduced; those in turn gave place to those now in use of the Vignoles section, 80lb per lineal yard, and 40 feet lengths; but the time is not far distant when in all probability these will be replaced by the 100lb rails of the same type, by possibly of greater length; for at the present American railway engineers are using 60 feet lengths, and on

some lines experiments have been made with a continuous rail by electrical welding.

As no doubt many present will remember, most of our lines were nearly all single track, but within the last few years eight and a half miles of suburban lines have been quadrupled, and 154½ miles duplicated, the remainder being single lines.

One very important departure that has been made is the alteration of the curves by straightening them, also the reduction of the grades by cutting down, thereby increasing the usefulness of our engines. This cannot be better illustrated than by referring to the alteration between Hilltop and Mittagong, on the Southern Line, where the length of the trains before the alteration was made in '88, was for goods trains 306 feet, and the load taken 156 tons, exclusive of the engine and tender, but after the alteration the length of the trains was increased to 900 feet, and the load increased to 450 tons. (See Plate II.)

In order to provide for the safe working of our lines, the interlocking system of points and signals have been in progress for some years, but within the last few years the whole of our lines, double and single, have been fully equipped with the interlocking gear, thereby enabling the traffic to be worked with the greatest possible safety. There are at present 1,411½ miles worked under the absolute block system, and 998 miles worked with the electric staff and the train tablet system. Both of these systems are an almost absolute block.

The increased weight of the trains necessitated the altering of a number of bridges, which were originally built of colonial hardwood, and which have been replaced by bridges with plate or lattice girders on brick or stone piers, or in some cases iron cylinders filled with concrete.

One notable example of this is the renewing of the viaduct at Wagga, which was of timber, and has been replaced by a steel superstructure and steel trestles on concrete foundations, the renewals were carried out without interfering with the traffic. The length of this viaduct is $1\frac{3}{4}$ miles.

WORKSHOPS.

The first workshops in connection with the Railways were erected in the Redfern yard, and at the time were more than ample for requirements of the Service; but it was not long before they were found to be inadequate, and although frequent additions were made, they were still too small for the rapid increase of the work, and in effecting repairs to the rolling stock; and, in consequence, the cost of same was very much increased, by frequent handling. And it was not until the year 1879 that 61 acres of the Chisholm Estate at Eveleigh were purchased for the purpose of erecting new workshops on a more extensive scale. These shops were erected and occupied in 1887, the locomotive shops being separated from the carriage and waggon shop by the Main Line. The shops referred to now cover an area of nearly 12 acres, and are equipped with many special labor-saving machines and appliances for dealing expeditiously with the repairs and renewals of all classes of rolling stock, and by these means the cost of the work has been considerably lessened.

I had the good fortune, a short time back, to visit America, and of seeing the best methods of working in their largest establishments. The one thing that struck me as being the most notable advance in shop appliances, was the favor with which compressed air was being regarded in the use of tools and shop appliances.

The advantage to be gained by the use of compress-

ed air has not been lost sight of, and for some time past we have had a number of cranes and pneumatic hoists in use in the workshops, and this system will be largely extended during the next year, as we are about to erect a large air compressing plant (Ingersoll's), in order to get the benefit of the different tools and appliances.

I might say that we have had in use for some years a compressed air machine, for painting our goods stock—a man with this machine can do as much as eight men with the ordinary hand brushes.

At Eveleigh, we have erected a large plant for the purpose of dealing with the washings of sponge cloths and dirty waste, which, after being used in the workshops, running sheds, and the country depots, is sent to Eveleigh for washing, and after that it is sent back to be re-used.

Prior to the advent of the present Commissioners, the rolling stock was allowed to get very low, many of the engines being small and unsuitable for the heavy and increasing traffic, and it was found necessary to obtain a large number of engines at once, and between the years 1888 and 1892, one hundred and eighty-four engines, passenger and goods, have been imported, and four heavy consolidated goods engines have been built in the Eveleigh workshops, and by this means all the important trains, both express and mail, are now worked by one engine, instead of two, as formerly.

During the last few years a large amount of construction work has been done in the Eveleigh workshops, Among other items that may be mentioned are six tender engines have been re-built and converted into serviceable tank engines for suburban main line traffic, thirteen goods engines have been rebuilt and fitted with larger boilers, and in all twenty boilers have

been constructed in the workshop, and we have fourteen more in hand.

During the last financial year, June 30th, 1898, 358 engines were repaired; 200 of them receiving heavy repairs; 333 boilers were overhauled, 184 of them being internally examined, heavy repaired and returned to locomotives; 37 stationary boilers were overhauled, 7 of them receiving heavy repairs, in addition to the foregoing, a very large amount of work was done to maintain the pumping plants in efficient working order.

The greater part of the heavy work has been done at Eveleigh, but Newcastle comes next, and the smaller depots participated in the lighter repairs.

During the year '98, vehicles were rebuilt as replacements in the Eveleigh carriage and waggon shops; 1,386 passenger vehicles were repaired, 292 of them had heavy repairs, and the balance, 1096, received repairs of a lighter character, 42 waggons were rebuilt, strengthened, and converted into bogie bolster waggons; 5,653 waggons and vans passed through the shops, of which 1,864 were heavily repaired; 2,293 axle-boxes of defective design were replaced by the standard boxes.

To facilitate the work in the boiler shop, which was found to be too small for our requirements, a new foundry has been erected, and the ground covered by the old foundry has been added to the boiler shop, by removing the parting wall, thus increasing the boiler shop to double its former size.

There is also in course of erection a new erecting shop, which will be equipped with four heavy electric over-head travelling cranes and motors, for driving the machinery, etc., and when these are in full swing they will materially assist the output of work.

In the year 1855 the Staff consisted of 18 hands in the Loco. Branch, 19 in the Traffic Branch, and about

the same number in the Permanent Way Branch. We now have at the Eveleigh workshops 1,489 hands employed. The total number of hands engaged on the N.S.W. Railways at the present time numbers 10,574 men.

The economy resulting in appliances have enabled the Commissioners to effect such improvements, and at the same time tend to make the Railways a profitable asset to the country.

The financial aspect of the undertaking I do not intend dealing with, except to call your attention to page 6, which most conclusively proves that it is in a sound position, and that under the careful management of the Railway Commissioners, the working expenses are being reduced.

In concluding, I would like to say that there are many points I would like to have dealt much more fully with, but the subject is a large one, and my endeavour has been to touch on all the leading features and yet not to extend my address to such a length as to weary you. In this object I trust I have succeeded.
