

springs of various manufacturers, and the Godley spiral spring, the Miltimore wheel and independent axle, and describes at length the Henderson hydraulic brake, which he says is simple in construction and operation. He devotes a section of his report to American locomotives, which receive much commendation. "The most noteworthy exhibit in this class, of the latest style of modern American engines, was by the Baldwin Locomotive Works, of Philadelphia, owned by Messrs. Burnham, Parry, and Williams, and managed by their able partner, Dr. Williams," who, I may remark, may be expected to arrive in Sydney by the incoming mail steamer from San Francisco. Captain Galton, in referring to the performances of engines, adds:—

"In connection with these exhibits of locomotive engines, it is interesting to make some mention of the working arrangements on one of the portions of the Pennsylvania Railway, which I had the opportunity of observing.

"The principle of competition for securing economy of working is put in force as far as possible. The Manager of the Company informed me that they find it preferable to keep the several portions of the line distinct in regard to workshops, both for manufacture and repairs, and limited in respect to size to what one Superintendent can so look after as to know what work every man is doing; the idea being that thus a comparison can be instituted between the cost and quality of the work at the several shops.

"Similarly with the working of the engines, a strict comparison of the cost of running is kept and published among the men, and a system of premium is also adopted. The engineer, or what we term engine-driver, on American railways is a person generally of superior education to those on our railways. The engine itself is fitted up with great comfort in regard to seats and protection from the weather. There are guilds or associations to which the engineers belong.

"A system of premiums is, of course, subject to the difficulty that the engineer may occasionally supplement his supply of coal for the cars by taking coal from the trains or from shunting engines. It was stated that this was not found to be a practical inconvenience, as the number of premiums is sufficient to induce each to watch the others closely in that respect, and only one case of such an occurrence was known.

"There are monthly first-class premiums of 20 dollars to the engineer and 10 dollars to the fireman, and second-class premiums of 15 dollars to the engineer and 7 dollars 50 cents to the fireman, and annual first-class premiums of 100 dollars to the engineer and 50 dollars to the fireman, and second-class premiums of 75 dollars to the engineer and 37 dollars 50 cents to the fireman.

"The premium on passenger engines is based on the lowest cost per car hauled one mile; and for freight engines, the lowest cost per loaded car hauled one mile. The results for premiums are taken from the monthly and annual printed reports of the performances of engines. A mileage of 1,500 miles must be made in the month to entitle to monthly premium, and 18,000 miles in the year to entitle to the annual premium. The time kept is not directly brought into account in the table in awarding premiums, but it was stated that conduct generally was considered. In calculating the mileage of freight cars, five empty cars are counted as three loaded cars. A table given shows the average total cost per mile run, for the year 1875, on the Erie and Pittsburg division of the Pennsylvania Railroad to have been 18 cents."

This last extract will explain how it is that I have been enabled to speak so confidently of the superior capabilities of the American type of locomotive, as the distances run are publicly exhibited for the satisfaction of the engine-drivers. I have a record, on the authority of the companies themselves, of the distances run respectively during 1874 by the total number of locomotives on the four best English railways, and on four of the best American railroads (the Pennsylvania line not being included), by which it is shown that the engines of the American lines run upwards of 10,000 miles a year further than the English, and they do this at less cost per mile. This ought to be evidence enough to prevent £1,000 upon every engine imported being lost to this colony, as is the case at present.

Colonel F. H. Rich, R.E., makes a report on the "water transportation class," which was not large. He describes the dredging-machines of the American Dredging Company, which are spoken of as simple, cheap, and well adapted to the work for which they are designed. The paper boats are referred to as a novelty, and very strong in proportion to their weight. The rowing apparatus, by which the rower faces the bow, is favourably mentioned. He thinks well of Major Mallory's steam yacht, in which the screw not only propelled the vessel, but acted as the rudder. The yacht, which is 95 feet overall, can be turned round the whole circle, in a little more than its own length, in 1 minute and 45 seconds. This invention may probably be usefully applied to dockyard launches and for intricate river navigation, as the screw forms a most powerful and effective rudder. It can be moved to either side in a half circle, as the screw shaft is pivoted near the stern. The ice yacht exhibited by Mr. Irving Grimmel is considered deserving of commendation. It is rigged like a cutter, runs on three skates, and is reported to attain a speed of about 60 miles an hour with a favourable side wind.

Architecture and engineering, as displayed at the International Exhibition, is the subject of an able paper by Sir John Hawkshaw, C.E., F.R.S. He gives an interesting account of the engineering feat at Hallet's Point (Hell's Gate), and adds a full description of the United States steam drilling scow used in removing reefs and rocks under water. The engineering works in the Mississippi, the dredging of channels, erection of jetties, the construction of the harbour on Lake Huron, where the breakwater will be 7,000 feet long, and will enclose an area of 320 acres of 12 feet of water, and the great light-houses of the coast, are dwelt upon in detail; and then Sir John Hawkshaw refers in terms of admiration to some of the American bridges, and makes the following complimentary remarks:—

"From the magnitude and number of the public works in the United States, however, other lessons may be learned than those which tell only of the science and skill of its engineers. From what I have seen, they possess enough of both to fit them for the accomplishment of any work they are likely to undertake.

"The 70,000 miles of railway already constructed; the ramification of the electric telegraph, and its application to uses more extended and varied even than in our own country; the crowd of steam-boats wherever navigation is possible and public convenience can be promoted; the building of cities like Chicago, which, after the great fire, in four or five years has arisen out of its ashes a more beautiful