peg, born at Chatham, Ont., Jan. 25, 1879.

S. J. Shannon, Comptroller and Treasurer, Intercolonial Ry., Moncton, N.B., born at Halifax, N.S., Jan. 18, 1865.

J. G. Sullivan, Chief Engineer, C.P.R. Western Lines, Winnipeg, born at Bushnell's Basin, N.Y., Jan. 11, 1863.

Ross Thompson, Chief Engineer, St. John and Quebec Ry., Fredericton, N.B., born at Newry, Ireland, Jan. 1, 1865.

O. C. Walker, Inspector, Refrigerator Service, C.P.R. Western Lines, Winnipeg, born at Newport, Mon., Eng., Jan. 31, 1877.

F. J. Watson, Assistant General Freight Agent, G.T.R., Montreal, born at Toronto, Jan. 12, 1866.

G. H. Webster, M. Can. Soc. C.E., Vancouver, B.C., born at Creemore, Ont., Jan. 31, 1858.

T. H. White, Chief Engineer, Canadian Northern Pacific Ry., Vancouver, born at St. Thomas, Ont., Jan. 27, 1848.

A. Wilcox, General Superintendent, Central Division, C.N.R., Winnipeg, born at Kincardine, Ont., Jan. 2, 1865.

Comparison of Canadian Pacific and Canadian Northern Locomotives.

A subscriber at Winnipeg wrote Canadian Railway and Marine World recently as follows: "To decide a bet will you kindly answer the following question: Are the 2,400 class, 2-8-0 type, locomotives on the C.N.R. more powerful, and can they in all conditions haul more than the 5,000 class 2-8-2 type locomotives on the C.P.R.?"

Data.—Following are the data of the two types of locomotives referred to:

	C.P.R.	C.N.R.
Class	2-8-2	2-8-0
Weight of locomotive	255,500 lbs.	232,000 lbs.
Weight on drivers	197,300 lbs.	208,000 lbs.
Cylinders	23½x32 ins.	24x32 ins.
Boiler pressure	180 lbs.	200 lbs.
Diameter of drivers	63 ins.	63 ins.
Capacity rating	210% or 42,000 lbs.	50% or 50,000 lbs.

C.P.R. and C.N.R. capacity ratings differ in the unit, the C.P.R. unit being 20,000 lbs. for 100%, and the C.N.R. unit 1,000 lbs. for 1%. Hence the wide difference in the percentage capacity rating.

Computation.—The tractive effort of a locomotive is the average maximum tractive force at the tread of the driving wheels, assuming a 100% cutoff in the cylinder. It is given by the following equation:

$$F = \frac{d^2\ p\ s}{D}$$

F is the tractive effort at the driving wheels in lbs.; p, the average maximum pressure in the cylinder in lbs. per sq. in., usually taken as 85% of the boiler pressure; s, the piston stroke in ins.; d, the diameter of the cylinder in ins.; and D, the diameter of the drivers in ins. Hence,

for C.P.R. locos.,

$$F = \frac{(23\tfrac{1}{2})^2 \times (180 \times 0.85) \times 32}{63} = 42{,}918 \text{ lbs.}$$

for C.N.R. locos.,

$$F = \frac{(24)^2 \times (200 \times 0.85) \times 32}{63} = 49{,}737 \text{ lbs.}$$

However, the available tractive effort of the locomotive is limited by the grip of the drivers on the rails, which is only about 23% of the weight of the locomotive on the drivers. Hence, the maximum gripping effect of these locomotives is:

for C.P.R. locos., 197,300 x 0.23=45,379 lbs.
for C.N.R. locos., 208,000 x 0.23=47,840 lbs.

Conclusions.—From the above, it will be seen that the C.N.R. locomotives have a greater gripping effect on the rails than the C.P.R. ones. They also have a greater tractive effort; in both types the tractive effort exceeds the gripping effect. It will, therefore, be seen that the C.N.R. locomotive can start a heavier train load under similar conditions than the C.P.R. ones, and maintain a heavier load at low speed.

However, the principal reason for the introduction of the mikado locomotive, with its reduced proportional weight on the drivers, was the demand for a locomotive with greater boiler capacity, which is possible by lengthening it over the trailing wheels, as at higher speeds the tractive effort is limited by the capacity of the boiler to supply the cylinders with steam, falling much below the gripping effect of the tires on the rails, so that the full extent of the latter cannot be realized. Hence, the C.P.R. locomotives, having a larger boiler capacity, can supply a greater volume of steam, and in consequence, under similar loadings, can maintain higher speeds than the C.N.R. locomotives.

It will thus be seen that for low speeds, the C.N.R. locomotives are more powerful, but as the speed increases beyond the point where the tractive effort and gripping effect lose their balance, the C.P.R. locomotives, on account of their greater boiler capacity, have a greater capacity.

After the foregoing answer had been prepared in Canadian Railway and Marine World's office, copies of it were sent to H. H. Vaughan, Assistant to Vice President, C.P.R., Montreal, and to S. J. Hungerford, Superintendent of Rolling Stock, C.N.R., Winnipeg for criticism or suggestions. Mr. Vaughan replied that it was satisfactory to him, and that he had no suggestions to make. Mr. Hungerford has written as follows: "In general our locomotive was designed to haul bulk freight at a maximum running speed of 25 miles an hour, as experience has shown the economy of handling ordinary freight traffic in heavy trains at moderate speed. We believe that this statement is true in relation to the coal consumption, but it is also true in respect to wear and tear on equipment and track. Beside this there is the important advantage of greatly reducing the element of danger; the ordinary type of freight car truck not being safe at high speeds.

"I take exception to the assumption that the gripping effort upon the rails is 23% of the weight thereon, as experience has shown a great diversity of results. The factor of adhesion of the Canadian Northern locomotive is practically 4.16 (24%, Editor C. R. and M. W.), admittedly low, but the results in service have been entirely satisfactory, and on a dry rail the full tractive effort can be employed without slipping. The actual adhesion upon slightly wet, muddy or greasy rails varies so widely that no factor can be safely assumed, but with modern sanding appliances this trouble is almost entirely overcome and the employment of the highest possible tractive effort is undoubtedly justified.

"The boilers of the Canadian Northern locomotives have proved their ability to supply all the steam required by the cylinders when working at maximum cut off at speeds under 10 miles an hour, and also when working at the speed limit at an economical cut off.

"It should be borne in mind that nearly all railways are more or less undulating, and only a few lines have very long continuous grades of maximum rise. The result of this is that under usual conditions a locomotive in freight service is only required to supply the maximum amount of steam for a comparatively short period, and the average consumption of steam over a subdivision is greatly below the maximum requirements.

"A careful consideration of the above facts led us to the decision that it would be unwise to adopt the mikado type with its greater gross weight, higher initial cost and subsequent maintenance while the consolidation type was amply capable of performing the work under our conditions, particularly as the question of employing longer and stronger turntables and increasing the size of roundhouses had to be considered. It is freely admitted that for very high speed service approximating passenger service the mikado type is preferable, on account of greater ultimate boiler pressure, but we do not believe that any considerable portion of the freight in this country is handled under such conditions.

"On the whole our locomotives have shown their ability to furnish all the steam required under all ordinary conditions, and in addition have shown a high efficiency in connection with the consumption of fuel. Reducing the whole proposition to its simplest terms, why should large additional expense be incurred to provide abnormal power that is not required by the service, as conclusively shown by extensive experience?"

Rogers Pass Tunnel Construction, Canadian Pacific Railway.

Canadian Railway and Marine World for December had, on pg. 537, a progress diagram of the work on this tunnel in the Selkirk Mountains up to Oct. 9, and also particulars of the work up to Oct. 31. Following is the record for construction for November:

East and centre heading, 588 ft., schist with some quartzite.

East and pioneer heading, 529 ft., quartzite with some schist.

West end pioneer heading, 817 ft., slate with small quartzite bands.

West end centre heading 654 ft., slate with small quartzite bands.

The west end pioneer heading footage is believed to be the American record, and was driven down grade through rock that could not be broken over 6 ft. per round. The greatest footage in one day was 37 ft.

The work is in charge, for the contractors, Foley Bros., Welch and Stewart, of A. C. Dennis, M. Can. Soc. C.E., Superintendent, Jos. Murphy, Assistant Superintendent, east end, and Jos. Fowler, Assistant Superintendent, west end.

A notable bridge replacement has been carried out on the Victorian Government Railways, in Australia, at Maribyrnong River bridge, between South Kensington and Footscray, Melbourne. The old bridge consisted of three girders, one heavy middle span and two lighter outside ones; the total length being 216 ft. In 1911 it was determined to do away entirely with the old box girder bridge, by replacing it with a modern lattice girder bridge. There were special reasons which made it necessary to exercise the utmost care in doing the work, the main one being that the bridge carried over 320 trains a day during ordinary traffic conditions. The stoppage of running over the bridge would have meant the cutting off of all the Victorian Railways traffic to the west of the Bendigo lines. No attempt was made to provide any temporary diversion; and, in addition to the total renewal of girders, the line at the bridge had to be lifted 5¼ ft. during the progress of the works.