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STEEL RAILS IN CANADA.

By. F. P. Gutelius, General Superintendent Lake Superior Division, C.P.R.

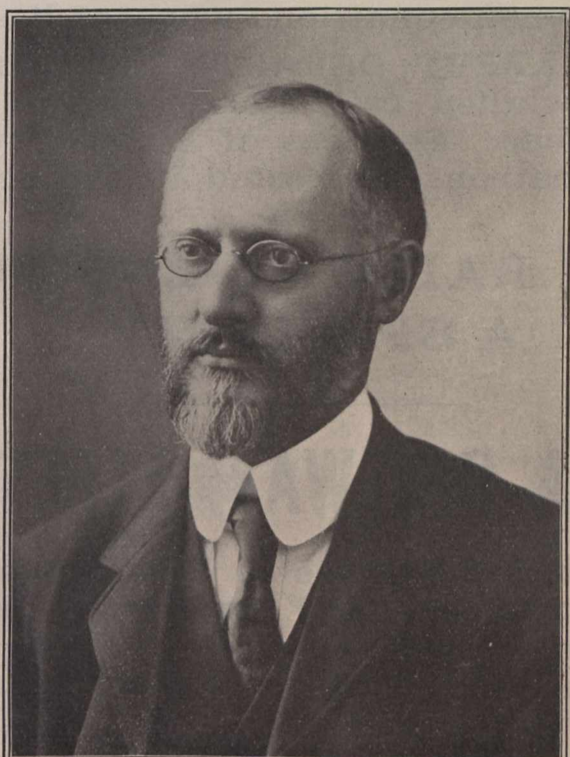
Steel rails are manufactured in this country at Sydney, N.S., by the Dominion Iron & Steel Co., and at Sault Ste. Marie, Ont., by the Algoma Steel Co. The rails manufactured at Sydney are all basic open-hearth. The size of their ingots is 18 by 21 ins. In reducing the ingot to a finished rail the steel makes 30 passes through the rolls. At Sault Ste. Marie 75% of the product is acid Bessemer, and 25% basic open-hearth. In this mill 28 passes are given in reducing the steel from 16 by 17 ins. ingot to finished rail. The capacity of these two steel companies is about equal to the requirements for new steel in this country.

The method of manufacturing steel rails in Canada can best be described by reference to the C.P.R. specifications for the manufacture of Bessemer and open-hearth steel rails, which were prepared after an agreement with the mills had been made for 1908 rails, copies of which are hereto appended. The standard weight of C.P.R. rail for 1908 is 85 lbs. The section is known as the C.P.R. 1908 85-lb. rail section, as per diagram shewn herein. (See pg. 3.) This new section can best be described by comparing it with the American Society of Civil Engineers 80-lb. section, which has 5-in. base, and is 5 ins. high. C.P.R. 1908 85-lb. rail has ⅛-in. added to the thickness of the base. The radius of the web has been decreased from 12 to 8 ins., thus giving a wider web where it joins the head and the base. The sides of the head are slightly inclined, and the radius of the top of the head is 8 ins., instead of 12. The new section, therefore, has a 5-in. base, and is 5⅛ ins. high. It differs from the new section recommended by the American Railway Association in that the base has not been narrowed. I do not feel that in the redistribution of material in the new rail section, which all rail section designers consider is necessary, that the narrowing of the base is justifiable, as it makes the rail more unstable, introducing an element of danger which cannot be counterbalanced by the advantage that would be gained by the more uniform cooling of the half-inch narrower flange. The C.P.R. has had 85,000 tons of rails of this section rolled, which are now in the track. Following are tabulated particulars:

VERTICAL INERTIA 29.492. HORIZONTAL INERTIA 7.139.

	AREA PERCENTAGES	COOLING PERC'TGES	VERTICAL SECTION	HORIZ'TAL MODULUS
HEAD	36.77	1.965	10.425	
WEB	22.21	3.081		
BASE	41.02	2.875	12.84	2.855
TOTAL	100.00	2.586		

The advantages of this section, from the mill standpoint, are that the finished rail, when approaching the hot saws, is of more even temperature in all parts of the section, and, as a result, the temperature of the head is very much less than in the old section, giving a finer grain of steel, therefore greater wearing quality. Second, the more equal distribution of material between the head and base exemplifies the cold straightening process to such an extent that the mill people advise that the work of straightening is less than 40% of what was required in the old section. The straightening of rails under the cold press is a punishment which seriously impairs the strength of the rail, and frequently appears to open defects or starts fractures which would never be known in ordinary wear during the life of the rail.



G. T. BELL

General Passenger and Ticket Agent G.T.R. and President American Association of General Passenger and Ticket Agents.

In designing a rail for use in Canada the conditions of winter roadbed must be provided for. The roadbed, when frozen, is absolutely rigid, and, in the process of freezing, ties under which there is a quantity of moisture heave on account of the action of the frost to such an extent as to require wooden shims on the adjoining ties to maintain an even bearing for the rail, and give proper surface to the track. At the time the shimming becomes necessary the rails must bend sufficiently to receive their proper support from the low ties, and, if the rail be too rigid, or too hard, it is liable to break. For this reason, we deemed it wise to limit the height of the rail to 5 or 5⅛ ins., and place the additional strength on those portions of the rail which are most liable to crack or break. This conclusion was arrived at after an experience of seven years with about 50 miles of A. S. C. E. section of 100-lb. rail, in which, with an equal amount of heaving and equally rigid track, more square breaks occurred with the 100-lb. rails than did with an equal mileage of 80-lb. rails of the same section, handling the same traffic, under like climatic conditions.

The composition specified by the C.P.R., in which the average carbon for Bessemer rails is .58%, and for open-hearth rails is not less than .60%, gives a harder rail than that manufactured under commercial specifications, or demanded by most of the American railways, in which the carbon content is from 5 to 10 points lower. In the introduction of this additional carbon the C.P.R. has arranged to reduce the phosphorus in Bessemer to .085%, and in open-hearth to .06%, whereas the average American specification allows .10% phosphorus in Bessemer, and for open-hearth the standards are practically the same. This combination gives the C.P.R. rail greater hardness, and the same or greater toughness than is secured under the American specifications. The advantages are a better wearing rail and one which does not readily flatten at the joints under traffic. The reason for the difference in the carbon and phosphorus for open-hearth and Bessemer rails under the C.P.R. specifications is the inability of the acid Bessemer rail manufacturers in the United States to produce, at commercial prices, a low phosphorus rail, so that where phosphorus is .10% the carbon should be kept below .50%, whereas with phosphorus .085%, the carbon should not exceed .63%, and should average about .58%. It must be remembered, however, that the composition of steel in rails is not the only feature to be considered. In fact, my experience has shown that some of the best rails in service are of the poorest composition. In other words, the heat treatment which steel receives during its manufacture into rails is of greater importance than the exact chemical composition.

To insure as nearly as possible that railway companies receive rails of proper composition test analyses are being made continually, and pieces of finished rail are tested by means of a falling hammer, known as a drop-testing machine. If steel in rails were absolutely uniform and homogeneous, these tests would be sufficient to prove the quality of all rails manufactured, but unfortunately this steel is not absolutely uniform and homogeneous, which we note in our micro-photographs, in acid etchings, and in fractures, in the indi-