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THE

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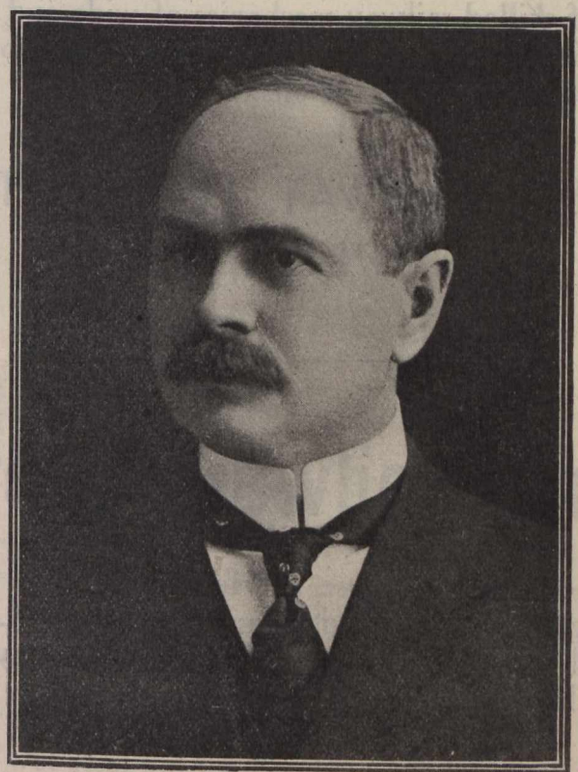
C. P. R. Consolidation Locomotive with Superheater

In the system of standardization of locomotive equipment adopted by the Canadian Pacific Ry., the class M4 has been the standard consolidation locomotive, and with a single exception, the most powerful class of locomotive on the road, being what is termed a 180% engine, the basis (100%) being 20,000 lbs. tractive effort at 80% of the boiler pressure. The locomotives of that class are 21 x 28 in. simple engines having 57 in. drivers and weighing 186,200 lbs., of which 163,700 lbs., or 87½%, is on drivers. The boiler is of the extended wagon top type, 69 in. in diameter at the front end and carries a steam pressure of 200 lbs. All of these locomotives have superheaters, and in some of the later ones the steam pressure is reduced to 180 lbs. and the cylinders enlarged to 22½ x 28 in.

The traffic now demands a more powerful type of locomotive and an entirely new design of consolidation engine, which is known as class N3, has been developed. While, of course, a large number of the former standard parts are used in this design it is, in the main, an entirely new arrangement. It is a 210% engine and has a tractive effort of 42,500 lbs. The total weight is 220,000 lbs. and 195,000 lbs., or 88.6% is on drivers. The cylinders are very large, 24 x 32 in., and a boiler pressure of 180 lbs. with a Vaughan-Horsey superheater, having 450 sq. ft. of heating surface, is employed. The drivers have been enlarged to 63 in. and the boiler has an evaporative heating surface of 2,811 sq. ft. as compared with 2,381 in the class M4. An examination of the ratios shows that while the evaporative heating surface has kept pace with the increase in the weight of the locomotive, as compared with the class M4, the increase in size of the drivers has affected the B D factor very materially, giving a figure of 1,003, as compared with 880. When the B D factor is determined by the use of an equivalent heating surface, the derivation of which will be explained later, it is found that it has a value of 815 as compared with 714 for the class M4. In general, the locomotive will be seen to be a normally conservative design, arranged in many particulars to suit the special conditions under which it is to be operated. An electric headlight on a heavy freight locomotive is somewhat unusual, as is also the location of the air reservoir. The different parts of the locomotive will be considered separately, beginning with the boiler.

BOILER.—A radial stay, extended wagon top type of boiler having a firebox of large volume, with an inclined grate of 49 sq. ft. area, has been applied. Its largest diameter is 79 in. and the smallest 72 in. The throat is but 19¼ in. in depth and the level of the back mudring is slightly above the bottom of the barrel of the boiler, the grate inclining 20 in. in a length of 9 ft. 2¾ in. One of the most noticeable features is found in the use of curves of very large radii at the corners of the mudring, which are gradually decreased toward the top portion of the firebox. The side sheets are both slightly inclined inward from the mudring, which is 4½ in. wide on the side; the distance between the side sheets is increased by 1 in. at the turn of the crown. Both the side and crown sheets and the roof are in one piece.



A. W. CAMPBELL, C.E.,
Deputy Minister of Railways and Canals, and Chairman Government Railways Managing Board.

The location of the tubes, which includes 24 5-in. and 272 2-in., the former being arranged in three rows of eight each for the superheater elements, is shown in one of the accompanying illustrations. The heating surface of the fire tubes is 2,631 sq. ft., which, in connection with 180 sq. ft. in the firebox, gives 2,811 sq. ft. of evaporative heating surface. It has been found, however, that, in comparing a superheater engine with one using saturated steam, to get an equivalent heating surface in the latter it is necessary to multiply the superheating surface by 1.5, which should be added to the total heating surface of the engine as obtained in the ordinary manner. In this case this would show that a boiler of the same capacity as the one applied, if it was not fitted with a superheater, would require 3,486 sq. ft. of heating surface, or a ratio of one square foot to 55.9 lbs. on drivers, which is certainly a guarantee of ample steam capacity.

FRONT END ARRANGEMENT.—A section through the front end and superheater is given in one of the illustrations. This type of superheater has proven to be most satisfactory in every way, after a number of years of trial. It is now the standard type on the C.P.R., where a larger number of superheaters are in operation than on any other railway on this continent. The introduction of the superheater requires the front tube sheet to be set back 2 ft. 9 in. from the centre line of the stack and also the introduction of a special arrangement of diaphragm plates and a damper for cutting off the circulation to the large fire tubes when the engine is not using steam. The arrangement includes a comparatively low exhaust nozzle and long petticoat pipe in two sections. The stack has no internal extension. The presence of two adjustable deflectors admits of an accurate equalization of the draft. The petticoat pipe is arranged to be easily removed to permit access to the superheater elements behind it.

THE CHECK VALVE is located on the top centre line of the boiler, underneath the base of the bell stand. It consists of a double check arrangement, there being one check valve for either feed pipe, the passages from which are combined and enter the boiler through one opening. Each check valve passage is provided with a stop valve, which can be closed to permit the check to be reground when the boiler is under steam. A valve in the centre of the casting closes the passage to a chamber in which there is a connection for a pipe or hose for either blowing down or filling up the boiler. All of these valves are provided with renewable seats. This arrangement of checks on top of the boiler gives a non-freezing discharge pipe from the injector to the checks, and any leakage at the checks will drain back to the injector.

ASH PANS.—An exceptionally novel and interesting design of ash pan is used. It is of the self-clearing type, having two hoppers, and really consists of two separate parts, the hoppers and their operating mechanism being secured to the locomotive frames, and deflector plates, forming the upper part of the pan, being secured to the mudring and extending down inside of the hopper sec-