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## Canadian Pacific Railway Mallet 0-6-6-0 Locomotives.

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In common with the latest developments in motive power additions on United States railways, the C.P.R. has, during the past three or four years, been experimenting with Mallet locomotives for pusher service on the mountain sections of the British Columbia Division, where gradients up to 2.45 and 15-degree curves are to be negotiated. For this service Mallet locomotives are particularly adapted. The locomotives at present working on these gradients are consolidation, with 21 by 28-in. cylinders and 58-in. driving wheels, with a total weight of 185,000 lbs., 168,000 lbs. of which is on the driving wheels. These locomotives, under normal summer conditions, are capable of handling trains up to 424 tons on the accepted rating, and it is to assist such locomotives over the heavy gradients that experimental work on Mallet locomotives has been performed, leading up to the present locomotives herein referred to.

During 1909 an experimental Mallet locomotive was built by the C.P.R., to its own designs, a description of which was given in The Railway and Marine World of Aug., 1909. This locomotive contained many features that were decidedly unique in Mallet construction. Following considerable experimental work and investigation on operating performances, a number of changes were embodied in the design. This remodelled locomotive was described in detail by G. I. Evans, Mechanical Engineer, C.P.R., in The Railway and Marine World of April, 1910. That article also contained an outline and data of test runs made on the gradients near the Angus shops. Following this experimental stage the locomotive was put into service on the B.C. Division under the conditions for which it was designed. Here a very elaborate series of tests under actual operating conditions was performed, the graphical results of which were embodied in an article in The Railway and Marine World for Jan. of this year.

All this experimental work gave the C.P.R. mechanical department a great deal of data upon which to base the design of a further series of five Mallets, a description of which is embodied herewith. This new series which has only recently been finally completed, consists of 4 compounds, 1951-4, and one simple 1955, all of the same general design. The general appearance of the compound Mallets of the series is shown in the accompanying illustration, fig. 1, while fig. 2 outlines the locomotive construction more in detail.

The following table gives the principal dimensions:

| | |
|---|---|
| Type | 0-6-6-0 |
| Gauge | 4 ft. 8½ ins. |
| Service | Pusher |
| Fuel | Bituminous coal |
| Tractive power | 57,000 lbs. |
| Weight, drivers | 259,000 lbs. |
| Weight, total | 259,000 lbs. |
| Wheel base, front engine | 10 ft. 4 ins. |
| Wheel base, rear engine | 10 ft. 4 ins. |
| Wheel base, total, engine | 35 ft. 2 ins. |
| Wheel base, engine and tender | 60 ft. 7 ins. |
| Weight on drivers÷tractive effort | 4.54 |
| Tract. effort×dia. drivers÷equiv. heat. surf.. | 921 |
| Equiv. heat. surf.÷grate area | 62 |
| Weight on drivers÷equiv. heat. surf. | 72 |
| Cylinders, h.p. | 23 x 26 ins. |
| Cylinders, l.p. | 34 x 26 ins. |
| Cylinders (simple engine 1955 only) | 20 x 26 ins. |
| Valves, h.p. | 11 in. Piston |
| Valves, l.p. | 12 in. Piston |
| Driving wheels, dia. | 58 ins. |
| Driving axles, main, 9½x12 ins.; others 9x12 ins. | |
| Boiler | Radial stayed, wagon top |
| Pressure | 200 lbs. |
| Firebox, size | 120 x 69⅞ ins. |
| Firebox, sheets | 5-16, ⅜, 1-12 and 7-16 ins. |
| Firebox, water spaces, sides, 4½ ins.; throat, 5 ins.; back, 3½ ins. | |
| Tubes, 154 2¼-in. dia.; 16 2-in. dia.; and 22 5¼-in. dia. | |
| Tubes, length between sheets | 20 ft. 1½ ins. |
| Heating surface, tubes | 2,589 sq. ft. |
| Heating surface, firebox | 180 sq. ft. |
| Heating surface total | 2,769 sq. ft. |
| Superheating surface | 548 sq. ft |
| Equiv. heat. surf. (=total heat. surf.+super. surf.×1.5) | 3,591 sq. ft |
| Grate area | 58 sq. ft. |
| Tender tank, kind | Semi-water bottom |
| Tender frame sills | Centre, 13 ins.; sides 10 ins. |
| Tender trucks, kind | Equalizer |
| Tender wheels, diar. | 34 ins. |
| Tender axles | 5½ x 10 ins. |
| Water capacity | 5,000 Imp. gals. |
| Coal | 12 tons |

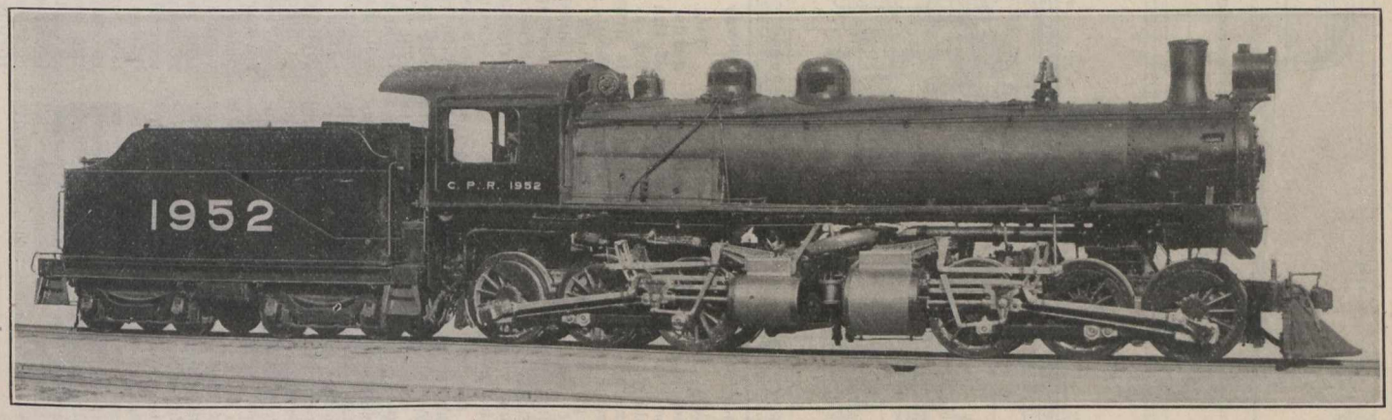


Fig. 1.—Canadian Pacific Railway Mallet 0-6-6-0 Locomotive.

A cursory inspection of both figs. 1 and 2 will show that the construction of these Mallet locomotives is decidedly different from the practice followed by U.S. roads that have added Mallets to their rolling stock. Principal among these points of difference are the arrangement of cylinders and the absence of leading and trailing wheels, placing all the weight on drivers and shortening the wheel base. The usual arrangement is to place the low pressure cylinders at the forward end of the front engine, demanding more flexible and extension joints in the steam pipe lines. The angular movement of the exhaust pipe itself, from low pressure cylinder to exhaust pipe in smoke-box, is very materially reduced by this new arrangement, as may readily be understood, from the fact that the low pressure cylinder, being near the point of swing with regard to the rear engine frame, has but little side motion. The arrangement used will be explained more fully at a later point.

THE BOILER used in this series of locomotives has been changed very materially from that used in the original experimental Mallet. In the latter, the boiler, which was of the wagon-top radially stayed type, had the barrel divided into three sections. The rear section comprised the boiler proper, extending about two-fifths the length of the barrel. In front of this there was a compartment containing the superheater tubes, which projected downward from steam headers into the path of the flue gases. From this compartment the flue gases passed on into a further plain tube section, constituting a feed-water heater. The feed water, warmed in this compartment, passed on to the rear section, was there converted into steam and passed out into the superheater tubes, and thence to the high pressure cylinders through outside pipes passing down each side from the steam dome. In this newer design, a plain wagon-top, radially-stayed boiler is used, this design being found preferable to the three-compartment type used experimentally.

The tube sheets, 20 ft. 1½ ins. apart. provide for flues of a normal length, in contradistinction to some recent U.S. designs, where tube lengths up to 24 ft. are to be found. It is in every sense a plain barrel boiler of the extended wagon-top type, with the possible exception that the corners of the firebox. both inside and outside, are greater than usual to increase the boiler rigidity, as lack of the latter is believed to be re-