cago & Western Indiana, Chicago; H. H. Harvey, general car foreman Chicago, Burlington & Quincy, Chicago; C. B. Strohm, superintendent of transportation Atchison, Topeka & Santa Fe, Chicago; N. D. Ballantine, superintendent car service, Chicago, Rock Island & Pacific, Chicago.

The joint committee of the Master Car Builders' Association and the Association of Railway Transportation and Car Accounting Officers has been materially assisted in bringing about a practical test of this plan by the members of the American Association of Railroad Superintendents both individually and as a body, and also by the American Association of Freight Agents in the Chief Interchange Inspectors' Association. The men in charge of the work invite railway men to visit the office when in Chicago and see for themselves how it is being handled.

MIKADO LOCOMOTIVES FOR THE ERIE.

The Erie Railroad has been reducing grades and providing additional tracks for several years. The grades are still high, however, on that part of the Cincinnati division between Marion, Ohio, and Kent, about 112 miles, of which a profile is shown herewith. There is now a second track on nearly all of that division, the terminal facilities have been enlarged, and, finally, heavier power has been bought. Consolidation engines of 42,500 lbs. tractive effort and of 200,700 lbs. weight in working order have heretofore been used for power on this division. In considering how this power should be increased the advantages of both the Mallet and mikado types were studied with respect to this particular division. As a result of this investigation, it was found that the mikado would be more practical in this specific case. The designs were made by the road and 35 locomotives were ordered, 20 from the Baldwin Locomotive Works and 15 from the American Locomotive Company.

The locomotives are designed to haul 1,450 tons westbound and 1,520 tons eastbound, which is about 38 per cent. increase in tonnage. The Baldwin engines have been delivered and are performing satisfactory service. They are somewhat similar to those recently built for the Chesapeake & Ohio, described in the *Railway Age Gazette* of February 2, 1912, and the dimensions of which are shown in the accompanying table. These C. & O. engines have shown excellent results; in a recent test made with a dynamometer car they developed a draw bar pull of 27,000 lbs. at a speed of 33 m. p. h., which is equivalent to 2,390 h. p. at the draw bar. In comparing these locomotives with the new Erie engines, it is interesting to note that although they are a little different in their general dimensions, having a smaller driver and cylinders 1 in. larger in diameter, their ratios are very nearly alike, the greatest difference being in the per cent. of fire box heating surface to total heating surface, which is accounted for by the use of a combustion chamber in the Chesapeake & Ohio engines.

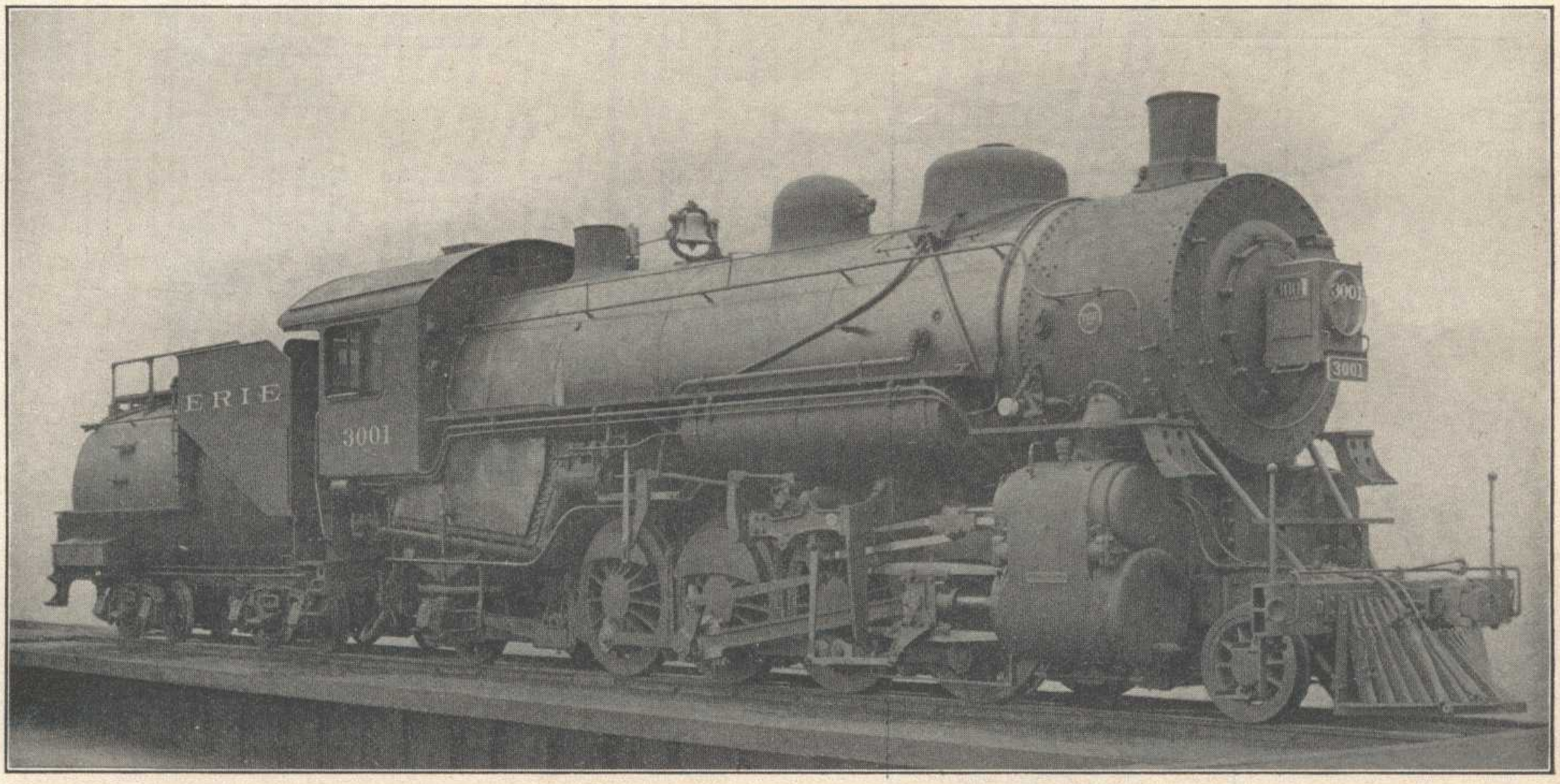
COMPARATIVE DIMENSIONS OF RECENT MIKADO LOCOMOTIVES.

Type	2-8-2	2-8-2	2-8-2	2-8-0
Road	Erie.	C. & O.	G. N.	Erie.
Total weight, lbs.	320,600	315,000	287,000	200,700
Weight on drivers, lbs.	237,150	243,000	220,000	176,400
Percentage of weight on drivers	74	78	76.5	88
Average weight per axle, lbs.	59,288	60,750	55,000	44,100
Tractive effort, lbs.	57,460	60,800	57,460	42,500
Cylinders, diameter and stroke, in.	28 x 32	29 x 28	28 x 32	22 x 32
Diameter drivers, in.	63	56	63	62
Boiler pressure, lbs.	170	170	170	200
Diameter of boiler, in.	84	83¾	82	..
Tubes, number	232	238	326	380
Tubes, number (superheater)	36	40	30	..
Tubes, diameter, in.	2¼	2¼	2	2
Tubes, length, ft.	21	19	21	16
Heating surface, evaporating, sq. ft.	4,155	4,051	4,720	3,340
Heating surface, superheating, sq. ft.	845	832	1,060†	..
Grate area, sq. ft.	70	66.7	78.2	54
Weight on drivers ÷ tractive effort.	4.13	4.00	3.84	4.15
Tractive effort × diameter of drivers ÷ *equivalent heating surface.	666	643	574†	789
Total heating surface ÷ grate surface	59.5	60.7	60.4	61.9
*Equivalent heating surface ÷ grate surface	77.5	79.4	80.7†	..
Firebox heating surface ÷ *equivalent heating surface, per cent.	4.03	5.35	3.94†	5.21
Total weight ÷ *equivalent heating surface	59.1	59.4	45.4†	60
*Equivalent heating surface ÷ volume of cylinders.	238.4	248	277.8†	237
Grate area ÷ volume of cylinders.	3.08	3.12	3.43	3.83

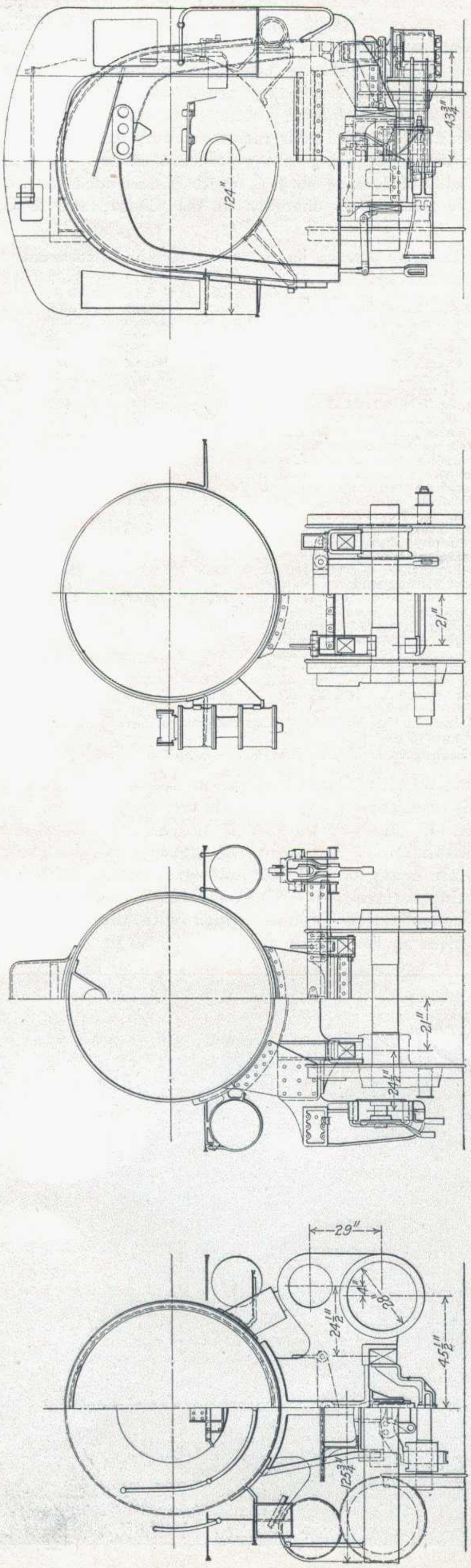
*Equivalent heating surface equals evaporating surface plus 1½ times superheating surface.

†Superheating surface was measured on outside of tubes.

Compared with the consolidation locomotives, the new Erie mikados show an increase in tractive effort of 35 per cent. and 31 per cent. increase in weight on driving wheels. The consolidations use saturated steam while the mikado engines are equipped with Schmidt superheaters. The water evaporating surface of these locomotives is greater than that of the consolidation engines, which with the superheating surface gives an increase of approximately 50 per cent. in rela-



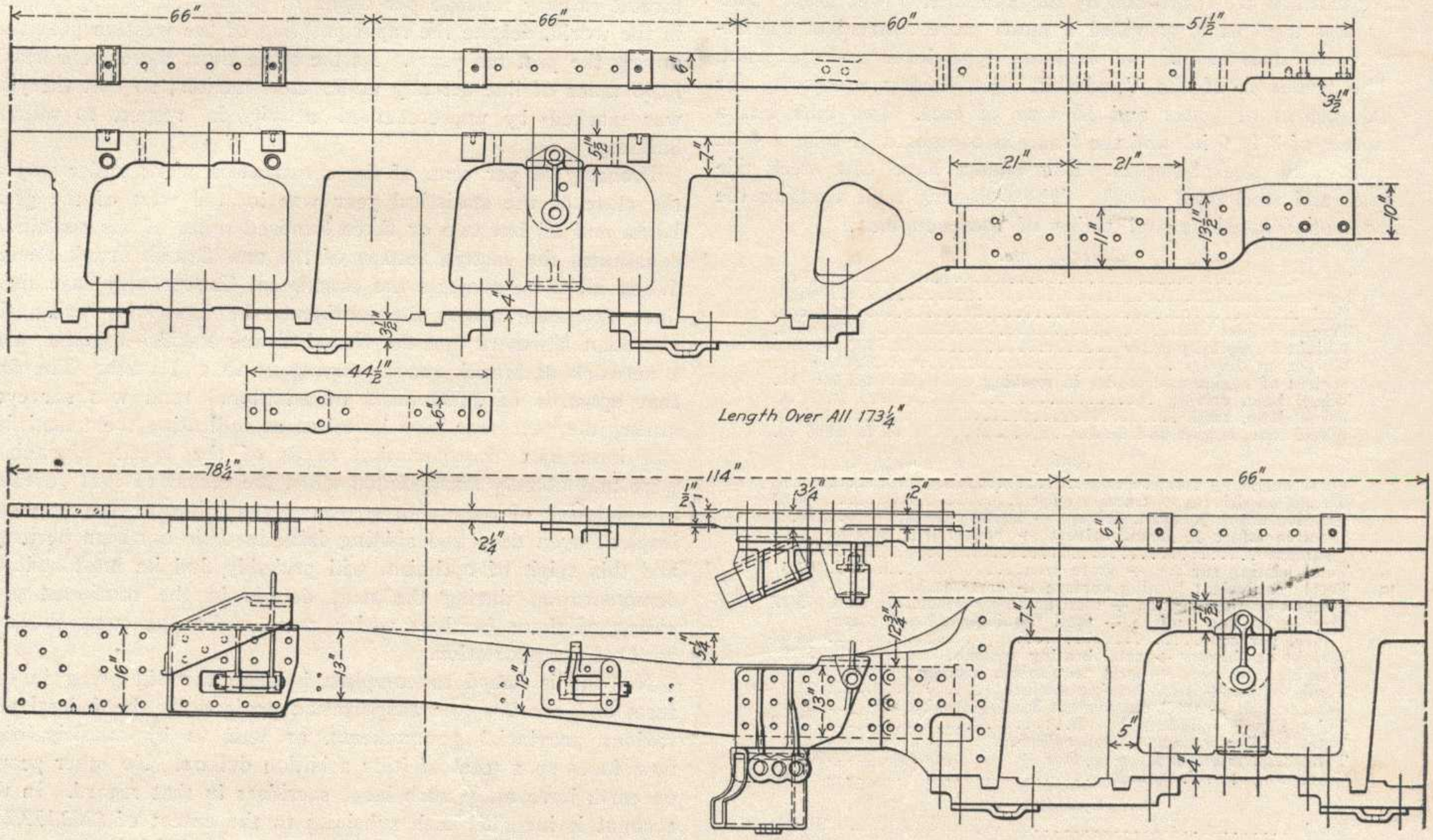
160-Ton Mikado Locomotive for the Erie Railroad.



Mikado Locomotive for the Cincinnati Division of the Erie Railroad.

tive boiler capacity. This means increased hauling capacity for the new engines plus the added advantage of taking the larger tonnage at a higher speed than could be maintained by the consolidated locomotives.

The table also includes a comparison with the mikado engines built for the Great Northern, described in the *Railway Age Gazette* of December 15, 1911, which when directly compared shows that the Erie engine is of considerably greater weight for practically the same power and, judged on the basis of heating surface, it has a smaller boiler. A more careful study of the

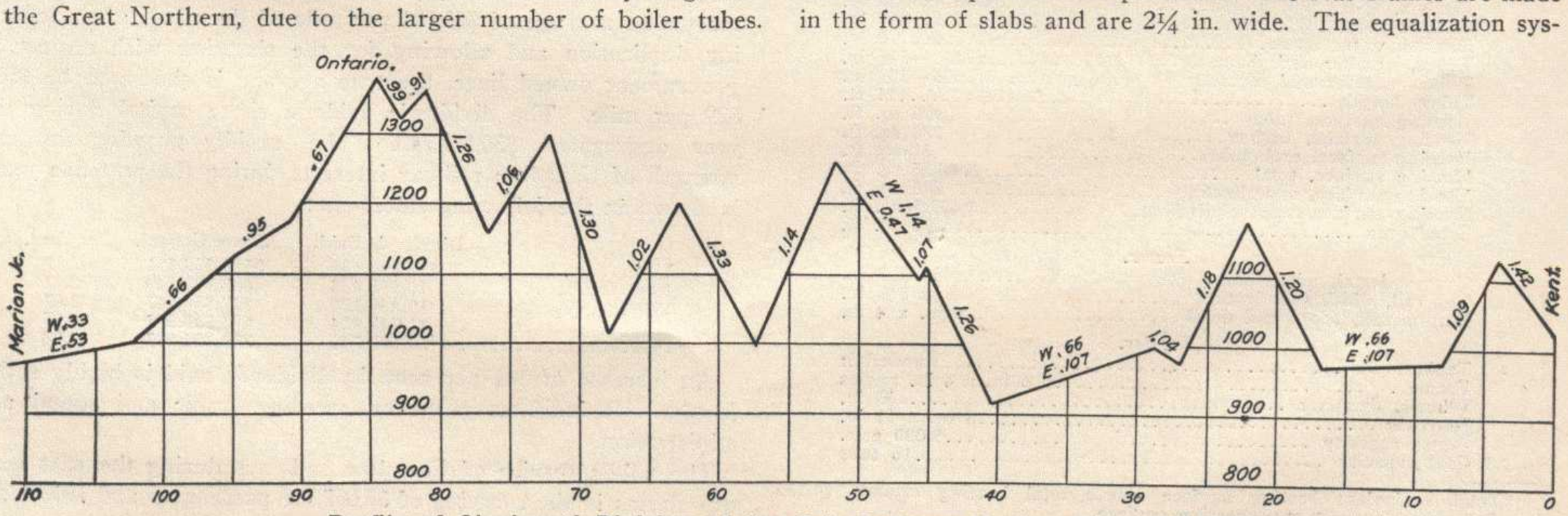


Heavy Vanadium Steel Frames for Mikado Locomotive.

details, however, shows that the greater total weight is largely accounted for in three features; first, the use of frames 6 in. in width as compared with 5 in. in the Great Northern; the 84 in. boiler has sheets 15/16 in. in thickness as compared with an 82 in. boiler with ⅞ in. sheets on the Great Northern; there is a smaller number of 2¼ in. tubes giving a considerably greater water capacity and hence increased weight in the boiler. The Erie superheater has 36 elements as compared with 30 in the Great Northern, but the tubes in the latter case are 1⅝ in. diam. as compared with 1 7/16 in. on the Erie. The ratio of superheating surface to evaporate surface, is considerably larger on the Great Northern, due to the larger number of boiler tubes. One very striking difference in the two designs is found in the 13 in. piston valves on the Great Northern as compared with 16 in. on the Erie.

The boilers of the mikado are 84 in. in diameter which increases to 87¾ in. at the firebox. The firebox is radially stayed, and the front end of the crown is supported by four transverse rows of flexible bolts, which are used instead of the customary arrangement of T-irons and expansion links. The depth of the throat, measured from the under side of the barrel to the bottom of the mud ring, is 25 in. This provides ample room for the Security brick arch, which is supported on four 3-in. water tubes. The superheater provides 845 sq. ft. of superheating surface, and the elements are located in 36 tubes each 5½ in. in diameter. The dome base and body are flanged from a single piece of steel plate. The longitudinal seams are all placed on the top center line, and are welded at the ends, having diamond shaped welt strips on the inside.

The frames are of vanadium cast steel and the back sections are made of hammered iron. The front frames are single and are cast in one piece with the main frames, which are 6 in. wide, and 7 in. in depth over the pedestals. The rear frames are made in the form of slabs and are 2¼ in. wide. The equalization sys-



Profile of Cincinnati Division of the Erie Between Marion, Ohio, and Kent.

tem is divided between the second and third pairs of driving wheels and the spring links are here held by pins which pass through lugs cast in the frames.

The steam pipes in these locomotives pass out through the sides of the smoke box, and deliver steam directly to the steam chests, thus giving a less complicated and a stronger casting. The steam distribution is controlled by 16-in. piston valves which are driven by the Baker-Pilliod valve gear. The valves are set with a maximum travel of 6 in. and a constant lead of ¼ in. The steam lap is 1 in. and the exhaust clearance 1/16 in. The valve motions are controlled by the Ragonnet power gear. This gear was used as it provided a much more convenient cab arrangement than would the ordinary type lever and quadrant.

The tender is of the Vanderbilt type, having a capacity for 9,000 gallons of water and 16 tons of coal. The tank has a diameter of 8 ft. 9 in., and the frame is composed of 6 in. x 4 in. angles, with steel bumpers. The trunks have cast steel side frames and steel tired wheels. The following table contains the important dimensions and ratios of these engines:

General Data.

Type	2-8-2
Service	Freight
Fuel	Soft coal
Tractive effort	57,460 lbs.
Weight in working order	320,600 lbs.
Weight on drivers	237,150 lbs.
Weight of engine and tender in working order	483,000 lbs.
Wheel base, driving	16 ft. 6 in.
Wheel base, total	35 ft.
Wheel base, engine and tender	66 ft. 10½ in.

Ratios.

Total weight ÷ tractive effort	5.58
Weight on drivers ÷ tractive effort	4.13
Tractive effort × diam. drivers ÷ heating surface	870.
Tractive effort × diam. drivers ÷ *equivalent heating surface	666.
Total heating surface ÷ grate area	59.5
Total *equivalent heating surface ÷ grate area	77.5
Firebox heating surface ÷ total heating surface, per cent.	5.27
Firebox heating surface ÷ total *equivalent heating surface, per cent	4.03
Weight on drivers ÷ total heating surface	57.0
Weight on drivers ÷ total *equivalent heating surface	43.7
Total weight ÷ total heating surface	77.1
Total weight ÷ total *equivalent heating surface	59.1
Volume both cylinders, cu. ft	22.78
Total heating surface ÷ vol. cylinders	182.7
Total *equivalent heating surface ÷ vol. cylinders	238.4
Grate area ÷ vol. cylinders	3.08

Cylinders.

Kind	Simple
Diameter	28 in.
Stroke	32 in.

Valves.

Kind	Piston
Diameter	16 in.
Travel	6 in.
Lead	¼ in.

Wheels.

Driving, diameter over tire	63 in.
Driving, thickness of tire	3½ in.
Driving journals, main, diam	11 in. x 14 in.
Engine truck, diameter	33½ in.
Engine truck journals	6 in. x 12 in.
Trailing truck, diameter	42 in.
Trailing truck journals	8 in. x 14 in.

Boiler.

Style	Straight
Working pressure	170 lbs.
Outside diameter of first ring	84 in.
Firebox, width and length	84 in. x 120 in.
Firebox plates, thickness	⅜ in.
Firebox water space	6 in.
Tubes, number and diameter	232—2¼ in.
Tubes, number and diameter (superheater)	36—5½ in.
Tubes, length	21 ft.
Heating surface, tubes	3,936 sq. ft.
Heating surface, firebox	188 sq. ft.
Heating surface, arch tubes	31 sq. ft.
Heating surface, total	4,155 sq. ft.
Heating surface, superheating	845 sq. ft.
Heating surface, total equivalent	5,422.5 sq. ft.
Grate area	70 sq. ft.

Frame.

Over pedestal, width and depth	6 in x 7 in.
Top rail, width and depth	6 in. x 5½ in.
Bottom rail, width and depth	6 in. x 4 in.

Tender.

Tank, style	Vanderbilt
Frame	6 in. x 4 in. angles
Wheels, diameter	33 in.
Journals	6 in. x 11 in.
Water capacity	9,000 gals.
Coal capacity	16 tons

*Total equivalent heating surface equals total heating surface (4,155 sq. ft.) plus 1½ times superheating surface.

CANADIAN RAILWAYS IN 1911.

BY J. L. PAYNE,
Comptroller, Department of Railways and Canals.

An increase of 669 miles in the main track railway mileage of Canada during the year ended June 30, 1911, bringing the total up to 25,400, scarcely represents the real growth in that regard; for there were 1,600 additional miles in operation which were officially regarded as being still under construction. These figures leave the Dominion in the unique position of having the largest railway mileage per capita of population of any country in the world, despite the rapid peopling of the western provinces during the past ten years. At the same time, there were nearly 7,000 miles of line actually under construction; so that the year was marked by unprecedented activity in respect to railway building.

Probably 70 per cent. of the construction work under way at the close of the statistical year was located west of the great lakes, and all but two or three hundred miles of the remainder constitutes the eastern section of the new Grand Trunk Pacific. When all these projects are completed, Canada will have three lines extending across the continent—the Canadian Pacific, the Canadian Northern and the Grand Trunk Pacific—together with a network of branch roads running north and south. The fact that upwards of 3,000 miles of additional road was surveyed during the past year may be taken as indicating the unsatisfied and immediate transportation needs of the West. Canadians were undoubtedly disappointed when the census of 1911 revealed a population of only a little over seven millions; but they are inspired by a deep and abiding faith in their northern heritage, and this spirit of optimism will probably find its most striking demonstration during the next decade in the continued providing of these facilities which come under the comprehensive head of transportation.

No one is heard to complain because the aid given in one form and another to transportation projects by the federal and various provincial governments, as well as by municipalities, now foots up a total of fully a billion dollars. No other people on earth have made such large sacrifices in that regard. In the account is included cash subsidies to the extent of $202,179,254, government lines $119,615,000, canals $98,000,000, guarantees $148,336,357, and land grants of 55,256,429 acres. About 20,000,000 acres of these railway lands are still held for sale, and the fact that the price has gone up to from $10 to $30 an acre, and is rising rapidly, affords some notion of the value of the assistance given in this form. At least $100,000,000 might be added for harbor work, terminal equipment, the providing and maintenance of aids to navigation, and the upkeep of inland waterways.

The expansion of railway mileage during 1911 was reflected in an addition of $118,391,514 to capital liability. The total on June 30 amounted to $1,528,689,201, made up of stocks, $749,207,687, and funded debt, $779,481,514. This capitalization represents an average of $60,184 per mile of line; but, after deducting duplication and allowing for the situation with respect to government owned lines, the true average is shown to be $55,829 per mile. The dividends paid on share capital during the year aggregated $30,577,740. The rapidly growing financial strength of Canadian railway interests during the past five years is shown in the following statement:

	Dividends Paid.	Share Capital.	Per Cent.
1907	$12,760,435	$588,568,591	2.17
1908	12,955,423	607,891,349	2.11
1909	19,230,126	647,534,647	2.97
1910	21,747,414	687,557,387	3.16
1911	30,577,740	749,207,687	4.08

An increase of 141 per cent. in dividends paid is highly satisfactory. It indicates efficiency, swelling traffic and sound administration.

The public service of Canadian railways during the past year was shown in the carrying of 37,097,718 passengers and 79,884,282