

One of the 4-8-4 type locomotives built by the American Locomotive Company for the Delaware, Lackawanna & Western

Five 4-8-4 type locomotives for the D. L. & W.

Total weight on drivers, 269,000 lb.—Develop tractive force of 64,500 lb. with 77-in. drivers

THE American Locomotive Company recently delivered five 4-8-4 type locomotives to the Delaware, Lackawanna & Western for use in heavy limited passenger train service. As speed was one of the basic requirements for these locomotives, they were built with 77-in. driving wheels, instead of 69-in. or 73-in. drivers as are used respectively on the 4-6-2 type locomotives purchased by the Lackawanna in 1923 and

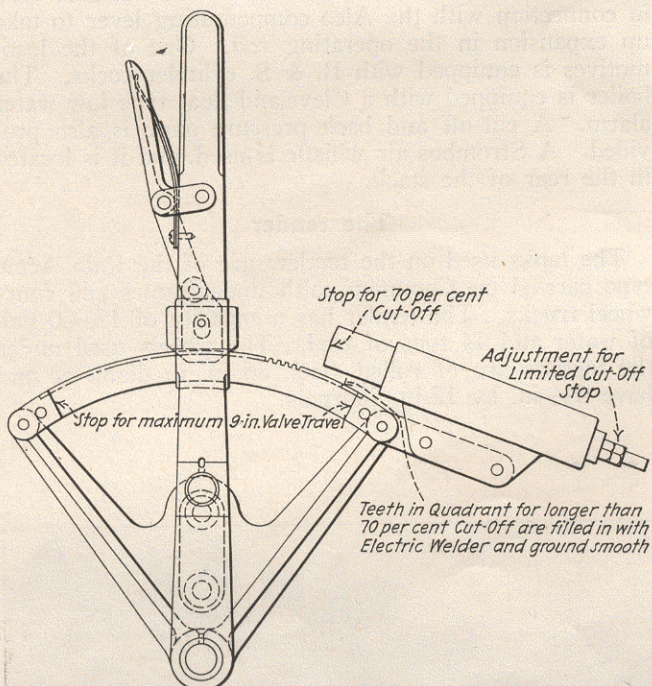
designated by the railroad the "Pocono" type, also exceed in tractive force, locomotives of the same type recently built by the American Locomotive Company for the Grand Trunk Western and the Northern Pacific, excluding the booster in the latter case.

The total weight of the 4-8-4 type locomotive is 421,000 lb. of which 269,000 lb. is carried on the drivers. The cylinders are 27 in. in diameter by 32 in. stroke and the boiler carries a pressure of 250 lb. This, with the driving wheel diameter of 77 in., gives a maximum tractive force of 64,500 lb. and a factor of adhesion of 4.17.

Maximum running cut-off of 70 per cent

These locomotives are built without boosters but the trailing trucks are arranged for their possible further application. The normal maximum running cut-off is 70 per cent but the Walschaert valve gear is designed for a maximum cut-off of 85 per cent which is made available for starting by a novel reverse lever arrangement on which the builders have applied for a patent. This reverse lever arrangement is shown in one of the drawings. The quadrant is only graduated to the extent of 70 per cent cut-off, the lever, however, may be moved further over to give 85 per cent cut-off, but it must be held by hand against spring compression. Release of the hand pressure immediately returns the lever to the position of 70 per cent cut-off. With this arrangement, provision has been made for the possible future application of the booster latch handle on the reverse lever.

Both the engine and trailing trucks are of Commonwealth design, the latter being of the four-wheel Delta type. The top center casting of the engine truck extends across the frames and takes some of the cylinder and frame bolts forming a construction of maximum stiffness which materially lessens the shocks on the cylinders resulting in the side movement of the engine truck and lateral motion of the front drivers. The engine truck is equipped with 33-in. rolled-steel wheels having 7-in. by 14-in. journals. The front wheels on the trailing truck are of rolled-steel 36 in. in diameter and the rear wheels are of cast steel centers, with tires



The reverse lever arrangement

the three-cylinder 4-8-2 type locomotives delivered in April, 1925. Increased tractive force is also provided in the new power, as compared to the three-cylinder 4-8-2 type. The new 4-8-4 type locomotives develop a tractive force of 64,500 lb. as compared to 61,100 lb. for the 4-8-2. The new locomotives, which have been

51 in. in diameter. The journals are $6\frac{1}{2}$ in. by 12 in. and 9 in. by 14 in., respectively.

The maximum length of the main rod was obtained by designing the dish of the piston and cylinder heads

Table of dimensions, weights and proportions of the D. L. & W. 4-8-4 type locomotives

Railroad	Delaware, Lackawanna & Western
Builder	American Locomotive Company
Type of locomotive	4-8-4
Service	Heavy passenger
Cylinders, diameter and stroke	27 in. by 32 in.
Valve gear, type	Walschaert
Valves, piston type, size	12 in.
Maximum travel	9 in.
Outside lap	$1\frac{1}{2}$ in.
Exhaust clearance	None
Lead in full gear	$\frac{3}{8}$ in.
Cut-off in full gear, per cent	70 per cent
Weights in working order:	
On drivers	269,000 lb.
On front truck	62,500 lb.
On trailing truck	89,500 lb.
Total engine	421,000 lb.
Tender	216,000 lb.
Wheel bases:	
Driving	20 ft.
Total engine	46 ft. 8 in.
Total engine and tender	82 ft. 2½ in.
Wheels, diameter outside tires:	
Driving	77 in.
Front truck	33 in.
Trailing truck, front	36 in.
Trailing truck, rear	51 in.
Journals, diameter and length:	
Driving main	$12\frac{1}{2}$ in. by 14 in.
Driving, others	$11\frac{1}{2}$ in. by 14 in.
Front truck	7 in. by 14 in.
Trailing truck, front	$6\frac{1}{2}$ in. by 12 in.
Trailing truck, rear	9 in. by 14 in.
Boiler:	
Type	Extended wagon top
Steam pressure	250 lb.
Fuel, kind	Soft Coal
Diameter, first ring inside	$84\frac{1}{4}$ in.
Firebox, length and width	132 in. by $96\frac{1}{4}$ in.
Combustion chamber, length	$66\frac{1}{16}$ in.
Tubes, number and diameter	285—2 in.
Flues, number and diameter	50— $5\frac{3}{8}$ in.
Length over tube sheets	21 ft. 6 in.
Grate area	88.2 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	377 sq. ft.
Arch tubes	28 sq. ft.
Siphons	88 sq. ft.
Tubes and flues	4,700 sq. ft.
Total evaporative	5,193 sq. ft.
Superheating	1,324 sq. ft.
Combined evaporative and superheating	6,517 sq. ft.
Tender:	
Water capacity	12,000 gal.
Fuel capacity	14 tons.
Wheels, diameter outside tires	36 in.
Journals, diameter and length	$6\frac{1}{2}$ in. by 12 in.
Maximum rated tractive force	64,500 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	64.1
Weight on drivers ÷ tractive force	4.17
Total weight engine ÷ total heating surface	64.5
Boiler proportions:	
Tractive force ÷ combined heating surface	9.91
Tractive force × diam. drivers ÷ combined heating surface	76.2
Firebox heating surface, per cent of evap. heating surface	7.26
Combined heating surface ÷ grate area	73.9

toward the front. Floating bushings are used in the back end of the main rod and main connection in the side rods, the flanges being on the inside. The main driving boxes are of the Alco supplemental bearing type, suitable for straight axles, and all other driving box cellars are arranged for narrow grease cakes of the same size as used with similar size journals on other locomotives.

The front driving axle is arranged for lateral motion. Normalized carbon vanadium steel was used in the manufacture of the main and side rods, piston rods, eccentric rods, radius bars, combination lever, combination link and valve stems.

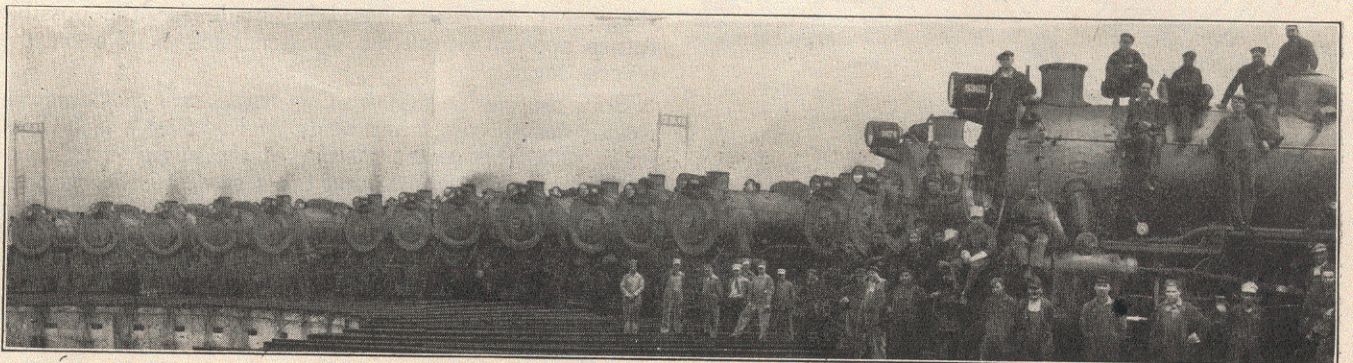
The bumpers are of pressed steel, U-shaped to surround a cast steel bracket which houses a Miner A-18-S friction draft gear and short shank coupler.

The boiler is of the radial stay, extended wagon top type, $84\frac{1}{4}$ in. inside diameter at the front and 95 in. outside diameter at the throat. The barrel contains 50 $5\frac{3}{8}$ -in. diameter flues and 285 2-in. tubes, 21 ft. 6 in. long. A Type A superheater having 50 units is used. The firebox which is lagged and jacketed below the running board, is 132 in. long by $96\frac{1}{4}$ in. wide inside the sheets, which gives a grate area of 88.2 sq. ft. It is fitted with two Nicholson thermic siphons and a brick arch which is carried on two arch tubes and the siphons. Alco flexible staybolts are used in the throat, sides, back-head and combustion chamber of the firebox. The fuel used is soft coal fed by DuPont stokers, the engine for which is located on the locomotive.

The total evaporating surface of 5,193 sq. ft. is made up of 4,700 sq. ft. in the tubes and flues, 377 sq. ft. in the firebox and 116 sq. ft. in the arch tubes and siphons. The total superheating surface is 1,324 sq. ft. making a combined evaporative and superheating surface of 6,517 sq. ft. The Chambers front end throttle valve is used in connection with the Alco compensating lever to take up expansion in the operating rod. One of the locomotives is equipped with B. & S. cylinder cocks. The boiler is equipped with a Cleveland float type low water alarm. A cut-off and back pressure gage is also provided. A Strombos air whistle is used, and it is located in the rear of the stack.

The tender

The tanks used on the tenders are of the Ralo Acme type carried on Commonwealth underframes and four-wheel trucks. The tender has a capacity of 12,000 gal. of water and 14 tons of coal. The wheels used under the tenders are of rolled steel, 36 in. in diameter and have $6\frac{1}{2}$ -in. by 12-in. journals.



Locomotives on the Ft. Wayne division of the Pennsylvania at Crestline, Ohio, on September 22 awaiting assignment to Tunney-Dempsey prize fight trains bound for Chicago