

Delaware, Lackawanna & Western 4-8-4 Type Locomotive Built by American Locomotive Company

# Lackawanna Receives Twenty More 4-8-4 Type Locomotives

New power designed to handle either fast freight or  
heavy passenger traffic

**T**HE latest addition to the motive-power equipment of the Delaware, Lackawanna & Western consists of 20 locomotives of the 4-8-4 type built by the American Locomotive Company at the Schenectady plant in accordance with designs and specifications developed and furnished by the railroad company. These locomotives can best be described as double-purpose engines and will be allocated either to heavy passenger or fast-freight service, operating between Hoboken, N. J., and Buffalo, N. Y., as traffic conditions require. Upon completion of delivery of this order the road will have a total of 55 locomotives of the same general type, all of which have been built by the American Locomotive Company.

The first locomotives of the 4-8-4 type acquired by the Lackawanna were received in 1927 and were designed to handle heavy passenger trains. They were numbered from 1501 to 1505, had 27-in. by 32-in. cylinders, 77-in. drivers, carried 250 lb. steam pressure, weighed 421,000 lb., and had a rated tractive force of 64,500 lb. A description of these locomotives was given in the *Railway Age*, December 3, 1927.

The next lot of 20 4-8-4 type locomotives, numbered from 1601 to 1620, was designed for heavy fast freight service and was received in 1929. They had 28-in. by 32-in. cylinders, 70-in. drivers, carried 235 lb. steam pressure, weighed 418,000 lb., and had a rated tractive force of 71,600 lb. A third lot, 10 locomotives, numbered from 1621 to 1630, was delivered in 1932. They were of the same general design as the previous lot, but contained several improvements in design, including Type E in place of Type A superheaters, and were some-

what heavier, their weight having been increased to 429,000 lb.

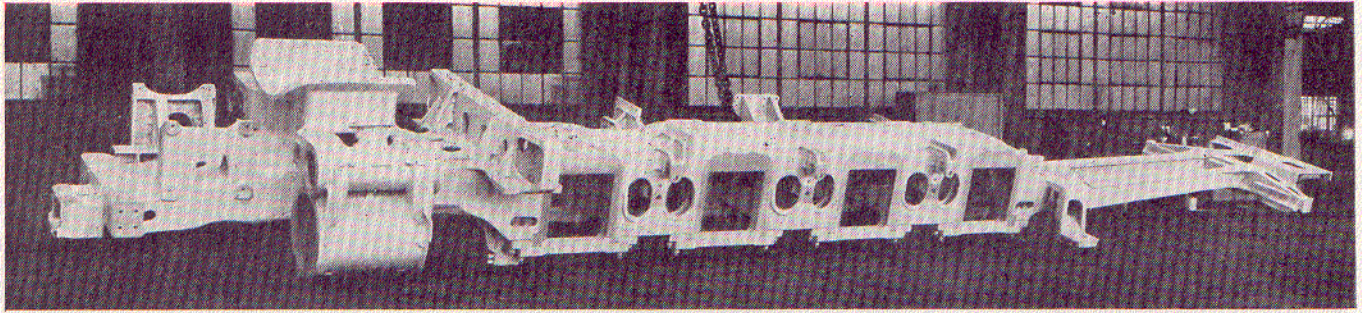
## New Locomotives Designed To Handle Either Passenger or Freight Trains

The locomotives now being delivered are numbered from 1631 to 1650 and, as stated, are intended for handling either passenger or fast freight traffic. Comparing these with the previous ones numbered in the 1600 series, it will be noted from an accompanying table that by an increase in steam pressure from 235 lb. to 250 lb. the tractive force has been maintained with the same size cylinders despite the increase in diameter of the driving wheels from 70 in. to 74 in. The suitability of a properly designed 4-8-4 locomotive for handling both modern fast freight and heavy passenger trains is making the type a closer approach to a general purpose locomotive than any other type that followed the old American, or 4-4-0, type which 60 years ago was practically the universally used wheel arrangement on road engines.

The Lackawanna, in designing these new locomotives, has followed its customary practice of making detail parts as far as possible the same as on previous locomotives, but this practice was not permitted to interfere with the inclusion of improvements when they could be made with assured advantage.

Clearance and weight limitations restricted the height to 15 ft. 4 in., the width to 11 ft., and the weight per driving axle to 68,500 lb. With 28-in. by 32-in. cylinders, 250 lb. steam pressure and 74-in. driving wheels,





The Locomotive Bed for D. L. & W. 4-8-4 Type Locomotives

the locomotives develop a rated tractive force of 72,000 lb. A booster has not been applied to the trailing truck, but provision has been made in the design for its application at some future time should its addition be found advisable. The total weight of these locomotives is 447,000 lb., of which 274,000 lb. is on the driving wheels, 79,500 lb. on the leading engine truck, and 93,500 lb. on the trailing truck—45,000 lb. on the front axle and 48,500 lb. on the rear axle. The combined length of the locomotive and tender is 90 ft. 8½ in.

**Foundation and Running Gear**

The locomotive is built on a cast-steel bed furnished by the General Steel Castings Corporation which follows current general practice and includes cradle and cylinders with integral back heads. The main air reservoir is made a part of the bed casting for the first time on a Lackawanna locomotive. In addition to the usual brackets, including those for the air compressors at the front deck, an integral bracket has been added for the power reverse gear. The incorporation of the main reservoir and the support for the Alco Type G1 reverse gear as a part of the bed casting has made possible the elimination of a considerable number of attachment studs in the boiler shell. By care in designing the shipping weight of the locomotive bed has been kept down to approximately 68,900 lb.

The Boxpok double-disc driving wheels are of a new design, in the development of which the American Loco-

motive Company and the General Steel Castings Corporation collaborated.

The driving axles and the main crank pins are of the hollow composite type developed on the Lackawanna. A description and drawings of axles and pins of this type was given in the 1934 report of the A.R.A. Committee on Locomotive Construction. Another innovation is the introduction of a snubber spring of the coil type

**Comparison of Lackawanna 4-8-4 Type Locomotives**

Road Nos. ....	1501 to 1505	1601 to 1620	1621 to 1630	1631 to 1650
Date .....	1927	1929	1932	1934
Tractive force, lb. . . . .	64,500	71,600	71,600	72,000
Weight of engine, lb. . . . .	421,000	418,000	429,000	447,000
Weight of drivers, lb. . . . .	269,000	262,000	271,000	274,000
Cylinders, in. . . . .	27 by 32	28 by 32	28 by 32	28 by 32
Drivers, diam., in. . . . .	77	70	70	74
Steam pressure, lb. . . . .	250	235	235	250
Heat surface, firebox, total, sq. ft. . . . .	493	515	511	496
Heat surface, tubes and flues, sq. ft. . . . .	4,700	4,621	4,934	4,992
Tube length, ft.-in. . . . .	21-6	21-6	21-6	21-6
Superheat surface, sq. ft. . . . .	1,324	1,324	2,243	2,180
Grate area, sq. ft. . . . .	88.2	88.2	88.2	88.2
Superheater, type . . . . .	A	A	E	E
Tender, water, gal. . . . .	12,000	15,000	15,000	16,000
Tender, coal, tons . . . . .	14	22	22	26

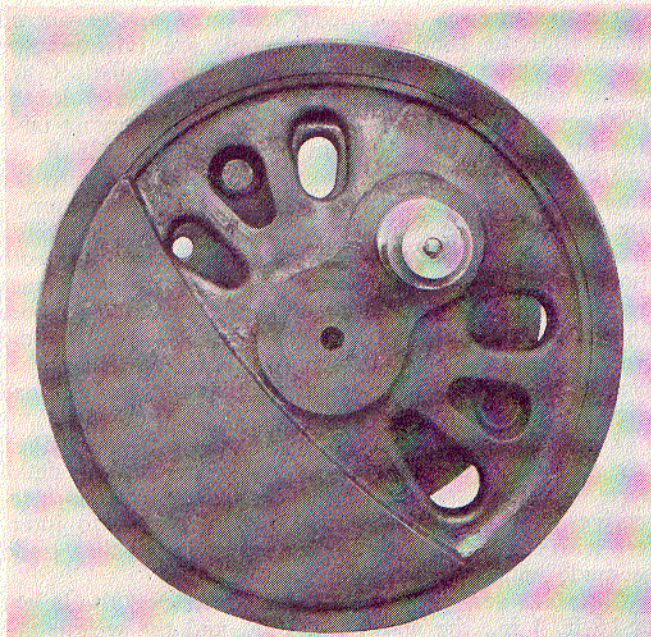
at the bottom of the rear trailer spring hanger. This was adopted in order to improve, if possible, the vertical riding qualities of the engine. The driving springs are of the reverse camber type.

The valve gear is of the Walschaert type and operates 12-in. piston valves with 7½-in. travel. The crossheads and guides are of the multiple-ledge Laird suspended type. The throttle is of the American multiple-valve design.

**All Locomotive Axles Have Roller Bearings**

A feature of especial interest is the fact that all 20 locomotives are equipped throughout—engine trucks, driving axles and trailer trucks—with roller bearings. The first 18 have Timken bearings and the last two, SKF bearings. The decision to use roller bearings was based on previous experience with two engines fitted with Timken bearings which have operated satisfactorily for upwards of 225,000 miles.

The boiler, which is of conventional design, is of liberal proportions in order to provide ample generating capacity to sustain a maximum of 4,025 potential horsepower over long continued periods. The inside diameter at the first course is 84¼ in. The firebox is 132 in. by 96½ in. inside, which gives a grate area of 88.2 sq. ft. The grates are of the Firebar type. Bituminous coal is used as fuel and is fed by a B-K Standard automatic stoker. Two Nicholson thermic syphons and three arch tubes are fitted in the firebox and one additional syphon in the combustion chamber which is 66¼ in. long. There are 82 tubes, 2¼ in. in diameter, and 202 flues, 3½ in. in diameter, 21 ft. 6 in. long. This gives a heating sur-



Boxpok Double-Disc Driving Wheel



face of 496 sq. ft. in the firebox and combustion chamber and 4,992 sq. ft. in the tubes and flues, or a total of 5,488 sq. ft. evaporative heating surface.

The superheater is an Elesco Type E with 2,180 sq. ft. of surface and is of a capacity to deliver the required amount of steam at a final temperature of between 700 and 750 deg. F. Worthington feedwater heaters are applied on the first 18 locomotives and Elesco exhaust-steam injectors on the last two locomotives. Superior

weight is 313,000 lb. The tank is mounted on a General Steel Castings Corporation water-bottom underframe weighing 31,000 lb. It is carried by six-wheel trucks of General Steel Castings design. Brake rigging is of the clasp type furnished by the American Steel Foundries.

In appearance these locomotives have an unusually clean and smooth appearance, both above and below the long straight running board, which reflects great care in designing and will serve to reduce wind resistance and thus increase efficiency.

One of the tables shows a comparison between the several lots of Pocono type locomotives ordered at different times by the Lackawanna, while another table gives the more important weights and dimensions of these locomotives.

**Principal Dimensions and Weights of the D. L. & W. 4-8-4 Type Locomotives**

Railroad .....	D. L. & W.
Builder .....	American Locomotive Co.
Type of locomotive .....	4-8-4
Road Nos. ....	1631—1650
Service .....	Freight and passenger
Rated tractive force .....	72,000 lb.
Cylinders, diameter and stroke .....	2—28 in. by 32 in.
Valve gear, type .....	Walschaert
Valves, piston type:	
Size .....	12 in.
Maximum travel .....	7½ in.
Weights in working order:	
On drivers .....	274,000 lb.
On front truck .....	79,500 lb.
On trailing truck .....	{ 45,000 lb. F. 48,500 lb. R.
Total engine .....	447,000 lb.
Tender .....	313,000 lb.
Wheel bases:	
Driving .....	19 ft. 6 in.
Rigid .....	19 ft. 6 in.
Total engine .....	41 ft. 6 in.
Total engine and tender .....	86 ft. 8½ in.
Wheels, diameter outside tires:	
Driving .....	74 in.
Front truck .....	33 in.
Trailing truck .....	{ 36 in. F. 44 in. B.
Boiler:	
Type .....	Conical con.
Steam pressure .....	250 lb.
Fuel .....	Soft coal
Diameter, first ring, inside .....	84¼ in.
Firebox, length and width .....	132 in. by 96¼ in.
Arch tubes, number and diameter .....	3—4 in.
Combustion chamber, length .....	66⅞ in.
Tubes, number and diameter .....	82—2¼ in.
Flues, number and diameter .....	202—3½ in.
Length over tube sheets .....	21 ft. 6 in.
Grate type .....	Firebar
Grate area .....	88.2 sq. ft.
Heating surfaces:	
Firebox and combustion chamber .....	374 sq. ft.
Arch tubes .....	27 sq. ft.
Syphons .....	95 sq. ft.
Firebox, total .....	496 sq. ft.
Tubes and flues .....	4,992 sq. ft.
Total evaporative .....	5,488 sq. ft.
Superheating .....	2,180 sq. ft.
Combined evaporative and superheating .....	7,668 sq. ft.
Special equipment:	
Superheater .....	Elesco, Type E
Feedwater heater (18) .....	Worthington
Exhaust steam injector (2) .....	Elesco
Stoker .....	Standard BK
Tender:	
Style .....	Rectangular W. B.
Water capacity .....	16,000 gal.
Fuel capacity .....	26 tons

flue blowers, Barco low water alarms, Huron washout and arch tube plugs and Franklin Butterfly firedoors are included as part of the equipment.

On the left-hand side of the cab is a special seat for the use of both the fireman and the head brakeman. As an assistance to safe and economic operation automatic three-light cab signals, made by the Union Switch & Signal Company, are located within convenient range of both the engineman and the fireman. This system provides both visible and audible cab-signal indications.

The air-brake system is the new Westinghouse 8-ET form with brake valves and associated parts pedestal mounted. Two 8½-in. cross-compound air compressors are included. Heretofore, this road has found 11-in. air compressors of sufficient capacity for their requirements.

The tender is of the rectangular type, having a capacity for 16,000 gal. of water and 26 tons of coal, although 28 tons may be loaded by heaping. The loaded

## Advantages of Pooling Box Cars\*

By Olin C. Castle†

SHALL touch on only a few of the questions which have been raised in the recent study of our plan. This should serve to illustrate my point that there is nothing unsound or impracticable in the suggestion that the principles which are today applied successfully in the maintenance and distribution of cars on a single large system or in the co-ordinated operation of large groups of refrigerator cars, may be extended with advantage to include all of the box cars now operating in interchange on a nation-wide basis.

In discussing this subject with shippers I find that the question which is uppermost in their minds is that of maintenance. With box cars pooled, and with a large proportion presumably away from owners' rails, how, they ask, will a road protect its requirements for high-grade cars where the traffic demands a large ratio of such equipment?

The obvious answer to this is that under a practical operation it will be taken care of exactly as it is today. The balance between high-grade box cars and rough loaders is in a state of continual disturbance. This is true with respect not only to local loading but also to interchange traffic.

Such a condition can be met only by the regulation of car repairs to take care of current requirements. If the demands of loading or the inequality of interchange lower the ratio of high-grade cars, the maintenance program must provide for repairing or raising the classification of enough cars to maintain the condition ratio.

In the pool equalization, originating railroads will normally receive in return movement, either loaded or empty, a substantial proportion of their own cars or cars of similar character belonging to roads in the same general territory. Not all of the cars so received will be in the same condition as when delivered. Nor are they under present rules. Each road's repair program must provide for restoring to condition a sufficient proportion to meet loading requirements. The only difference is that today the originator of high-grade commodities bears the burden of his better maintenance, for the partial benefit of the connections to which he delivers his cars, which connections apply them to their own high-

\* From an address before the New York Railroad Club, January 18, 1935.  
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