

An Imposing View of One of the New 4-8-4 Type Locomotives for the Milwaukee Road.

New Power for the Milwaukee Road

Thirty 4-8-4 Type Locomotives Built by Baldwin Are Now Being Placed in Service

THE Chicago, Milwaukee, St. Paul and Pacific Railroad Company operates a system comprising 11,115 miles of line, extending from Chicago to the Pacific Coast. A map of the system shows a net work of lines in Illinois, Wisconsin, Minnesota, Iowa and the Dakotas, with other lines extending westward to North Pacific Coast points, southwest to Kansas City and southward from the Chicago district into the Indiana coal fields. Over the system, in the year ending December 31, 1936, there was moved a total of 36,233,222 revenue tons of freight. On a percentage basis, the amounts handled by general groups of commodities were as follows:

Products of agriculture	14.9%
Animals and products	5.1%
Products of mines	35.3%
Products of forests	12.7%
Manufactures and miscellaneous	30.2%
All l.c.l. freight	1.8%
	<hr/>
	100.0%

This represents a highly diversified tonnage, a considerable amount of which must be moved at high speeds. Even in the case of such bulky materials as coal and ore, the speeds required today are considerably higher than they were a few years ago.

During the past 20 years, the bulk of the freight traffic on the Milwaukee road has been handled by Mikado (2-8-2) type locomotives.

● It is a pleasure to acknowledge the courtesy of the Railroad Company in furnishing information used in the preparation of this article.—*Editor.*

Of these, there are two principal classes; the L2 group, with 26 x 30-inch cylinders and a tractive force of 54,720 pounds, and the L3 (A U.S.R.A. design) with 27 x 32-inch cylinders, and a tractive force (exclusive of the booster, which is used on some of these locomotives) of 62,950 pounds. These locomotives have rendered excellent service in the face of increasingly difficult operating requirements, but present conditions are demanding units of greater horsepower and speed capacity; and after a careful study of the situation, it was decided to purchase 30 high-power, fast freight locomotives. The new engines, designated Class S2, were ordered from The Baldwin Locomotive Works and are now being delivered. They rank among the largest of their type thus far built, and in design are a modification of Class S1, a 4-8-4 type of which one locomotive was built by The Baldwin Locomotive Works in 1930. The driving wheel diameter (74 inches) is the same in both classes, but the new locomotives are somewhat heavier and develop a higher rated tractive force; while the steam pressure carried is 285 pounds instead of 230 pounds as in Class S1. There has, in fact, been a complete revision of the design throughout.

The Class S2 locomotives will be assigned to service between Bensenville, in the Chicago district, and Council Bluffs, and between Bensenville and the Twin Cities. They will release 25 locomotives of Class L2b and 30 of Class



Photo furnished by Railroad Company.

A Through Freight on the Milwaukee Road, Hauled by a Mikado Type Locomotive, Class L2.



One of the New Class S2 Locomotives Built by Baldwin for the Milwaukee Road.

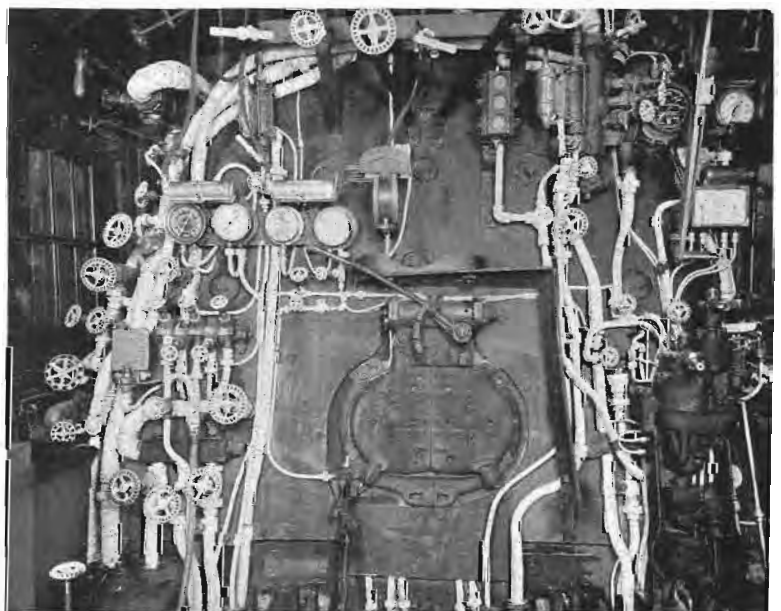
Cylinders	26" x 32"	Tubes—Diameter	3 $\frac{3}{4}$ " & 2 $\frac{1}{4}$ "	Wheel base—		Weight—On drivers ...	282,320 lb.
Drivers, diameter	74"	Number	3 $\frac{3}{4}$ ", 201; 2 $\frac{1}{4}$ ", 66	Driving	19' 3"	Total engine	490,450 lb.
Boiler, diameter	92"	Length	21' 0"	Rigid	12' 10"	Total tender	397,000 lb.
Steam pressure	283 lb.	Grate area	106 sq. ft.	Total engine	47' 4"	Tank capacity	20,000 U. S. gal.
Firebox, length	150"	Water heating surface ..	5,509 sq. ft.	Total engine and		Fuel capacity	25 tons
Firebox, width	102 $\frac{1}{4}$ "	Superheating surface ..	2,336 sq. ft.	tender	96' 0 $\frac{1}{2}$ "	Traetive force	70,800 lb.

L3, which will be assigned to other districts. This will permit further reassignments all along the line finally resulting in the scrapping of 17 units and placing 54 in reserve. It is also the intention to use some of the Class S2 locomotives in passenger service between Minneapolis and Harlowton, a distance of 914 miles. The 4-6-4 type locomotives of the F6 group, which were built for the Milwaukee by The Baldwin Locomotive Works in 1930-31, cannot handle more than twelve cars on the Olympian's schedule on this run; and during the season of heaviest passenger travel, it has frequently been necessary either to run the train in sections or to double head. The new locomotives can easily handle 18 cars on the Olympian's schedule; and as the heaviest freight movement does not begin until after August 1, they will be available to assist in handling passenger traffic during the peak period which is usually reached in July.

Including such necessary cost

items as strengthening bridges, installing longer turntables, lengthening roundhouse stalls, and improving shop facilities, it is estimated that the new power will earn at least a 12 per cent return on the investment.

As compared with Class L3 (the heaviest of



Looking Into the Cab of a Class S2 Locomotive.

the Mikados), the Class S2 locomotives show the following:

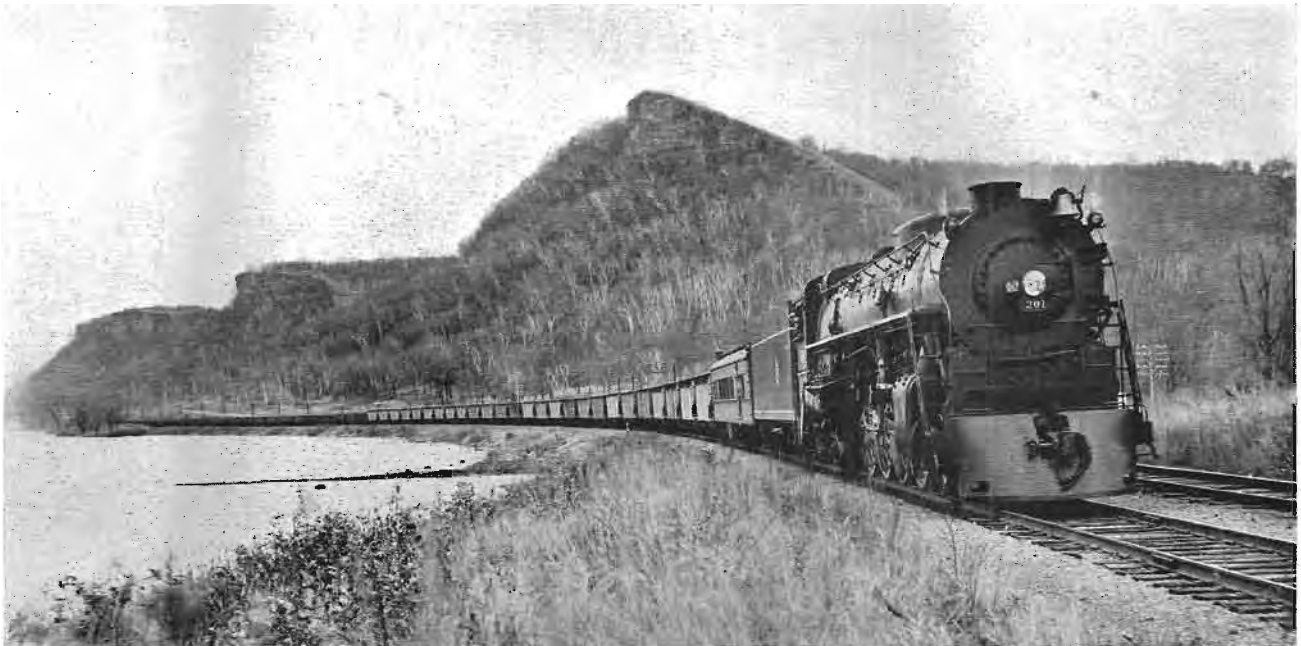
Increase in weight on drivers	21%
" " total weight	48%
" " rated tractive force	12%
" " steam pressure	43%
" " grate area	51%
" " water heating surface	28%
" " superheating surface	135%

These figures clearly illustrate how the basic proportions of the modern freight locomotive differ from the best practice of 20 years ago. The increases in tractive force and weight on drivers are far less than those in steam pres-

sure, grate area and heating surface—especially superheating surface. In addition, it should be noted that the driving wheel diameter of Class L3 was only 63 inches, as compared to 74 inches in Class S2. This means a higher speed capacity for the new locomotives when handling full tonnage, and also increased efficiency, due chiefly to a reduction in the fuel rate per square foot of grate, and to higher steam pressure and temperature.

combustion chamber is 72 inches long, and the combined heating surface of the firebox proper, combustion chamber, two arch tubes and three syphons, is 578 square feet. A modified Type E superheater is used, in combination with an American Multiple front end throttle. Further boiler accessories include a Cleveland low water alarm, Superior flue blower, Elesco tangential steam dryer, and Wilson sludge remover, Type "C." Four smoke consumer tubes, fitted with steam jets, are placed on each side of the firebox. Firebar grates are used, and the stoker is a du Pont Simplex, modified type B.

The ash pan has two large hoppers, and is



Sixty-seven Loads of Coal, Hauled by a Class S2 Locomotive, en Route from La Crosse to St. Paul.
The train weighed 5,165 tons. The coal was mined by the Republic Coal & Coke Co., who kindly furnished the photograph.

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The new locomotives have boilers of the conical type, with a maximum diameter of 100 inches. The three boiler courses, together with the firebox roof and side sheets, and all the welt strips, are of silico-manganese steel. The com-

designed to meet the Forestry Laws of the State of Minnesota. The pan is welded, with high side flares, and cast steel hoppers having tightly fitting swing doors of the same material. Three flushing systems are provided, one for the back of the pan and one for each side.

Class S2 has a one-piece bed, furnished by the General Steel Castings Corporation. The cylinders (including back cylinder heads), air reservoirs, and brackets for supporting the two air compressors, valve motion bearers, and the power reverse gear cylinder, are cast in one piece with the bed. The front truck is of the constant resistance type, designed to swing $6\frac{3}{4}$ inches on each side of the center line, and hav-

ing a one-piece frame of cast steel. The rear truck is of the Delta type. The Alco lateral motion cushioning device is used on the front driving axle, and the flange clearances and truck swings are sufficient to enable the locomotives to traverse curves as sharp as 19 degrees.

"Boxpok" type centers, cast by the Standard Steel Works Company, are used on the driving wheels, and the driving and truck axles are Standard forgings. Timken roller bearings are used on the driving and front truck axles, and the American Steel Foundries roller bearing unit on the rear engine truck and the tender truck axles.

The machinery details of these locomotives are as light as is consistent with the required strength. Walschaerts valve motion is used, and the valves are set with a maximum travel of $7\frac{1}{2}$ inches and a lead of $\frac{1}{4}$ inch. The steam lap is $1\frac{1}{4}$ inches and the exhaust clearance $\frac{1}{8}$ inch. In full gear, steam is cut off at approximately 85 per cent of the stroke. Fifteen of the locomotives are fitted with the Baldwin power reverse gear, and fifteen with the Alco gear.

The piston heads, of rolled steel, were supplied by the Standard Steel Works Company. The cross-heads are of light design, and of the underhung type, working in multiple-bearing guides; and the main and side rods are of low-carbon nickel steel, machined and highly finished all over. Floating bushings are used on all the crank pins. Forty per cent of the reciprocating weights are balanced, and the main driving wheels are cross-balanced.

Each locomotive is fitted with two mechanical lubricators, the one on the right side feeding oil to the cylinders, valves and stoker engine, and that on the left side to the guides and driving boxes. Alemite grease lubrication is

provided on the rods, valve gear, truck pedestals and various other details. Flange oilers are applied to the leading drivers.

The cab is of welded construction, and is of the vestibuled type, providing excellent protection for the crew; and steam heat equipment is applied for train heating. Further equipment includes a speed recorder furnished by the Chicago Pneumatic Tool Company, and two whistles, one blown by steam and one by air. The air whistle is mounted on the left side of the smokebox. The headlight generator is placed on the left side of the front engine deck.

The tender has a one-piece water-bottom frame, arranged for the application of a Wilson feed-water heater (the Locomotive Water Conditioner), which is placed in the tank between the trucks. The tank is of welded construction throughout, and is electrically welded to the frame. The tender trucks, as well as those under the locomotive, are fitted with clasp brakes.

These locomotives are built with a height limit of 16 feet and a width limit, over cylinders, of 10 feet, $10\frac{1}{2}$ inches. The actual length of the locomotive and tender, measured over the bumper faces, is 116 feet $2\frac{3}{4}$ inches.

This order, both on account of the size and design of the locomotives and the number of units involved, is one of the most notable that has been placed for several years. It is anticipated that the new locomotives, in freight service, will make a record quite as notable as that achieved by the 4-6-4 type locomotives of the F-6 group, 22 of which are in fast passenger service. The Milwaukee Road will thus shortly have in service over 50 high-power Baldwin locomotives of the most modern design, which will do their share in maintaining the excellent reputation which has long been enjoyed by this prominent railroad.

