cent. cutoff. The average value of frictional horse power for speeds of 40, 80, 120 and 160 r.p.m. was 83.1, 132.5, 187.2 and 224.2, respectively. The machine efficiency ranged from 72.89 to 84.82 per cent. The maximum evaporative power of the boiler was between 25,000 and 26,000 lbs. of dry steam per hour, which is equivalent to a rate of evaporation of between 10 and 11 lbs. per sq. ft. of heating surface per hour.

The record of the tests is given in admirably complete form, by aid of tables and diagrams; the pamphlet also includes a detailed record of the data, drawings illustrating the engine, indicator cards and summaries of results. Those interested in the development of the American locomotive should procure copies of this record, as it is impossible to properly present the results in an abstract.

This locomotive was one of eight tested at the exposition, and the final results, affording an opportunity for comparisons, will be awaited with the greatest interest.

STEEL CAR DEVELOPMENT.

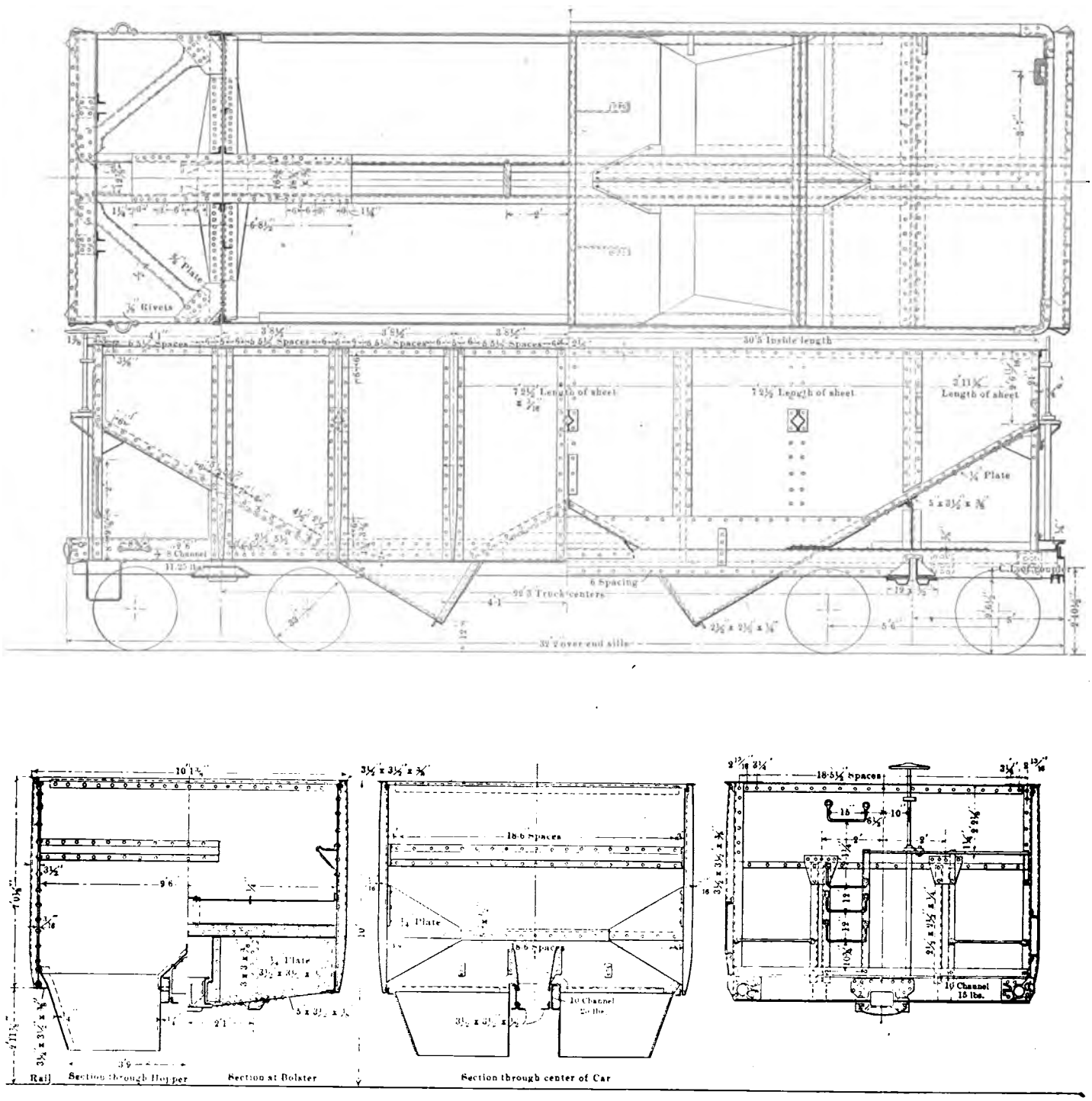
PENNSYLVANIA RAILROAD.

VI.

(*For previous article see June, 1904, page 209.*)

This series of descriptions of Pennsylvania Railroad steel cars has been interrupted, and will now be brought down to date. Previous articles will be found in the volume of 1903, pages 352, 402, 435, and in 1904, on pages 3 and 209.

The latest design is Class GLA, which is a development of the GL class, described on page 435 in December, 1903. The latter design has remained until recently the single standard coal car of this road. The type was brought out in pressed steel on the Bessemer & Lake Erie Railroad, and its adoption



100,000 STEEL HOPPER CAR, CLASS GLA, PENNSYLVANIA RAILROAD.

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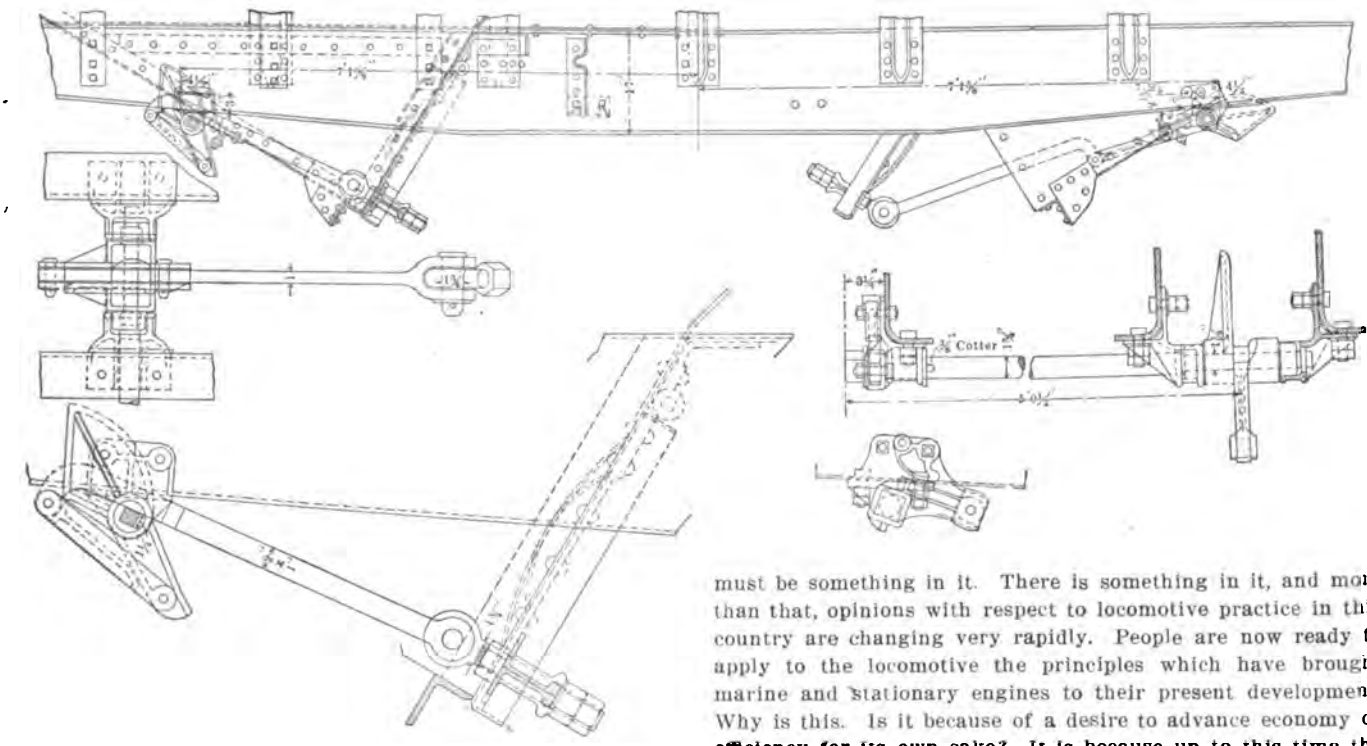
by the Pennsylvania settled the form and type of the largest number of steel cars built in this country. The type resulted from the Class GG, wooden car. The design of the GL was simultaneous with the GM car, shown in November, 1903, page 402. The weight of the GL is 39,150 lbs.; the cubical capacity, 1,897 cu. ft., and its ratio of paying to dead load, 36.4 per cent. For the construction the description of this car may be consulted.

The GLA car is mainly a structural instead of a pressed steel car, and it has straight (instead of "fish-bellied") longitudinal sills, of 10-in. channels, reinforced at the lower flanges with 3½ by 3½ by ½-in. angles, as shown in the sectional views. It has no side sills between the bolsters, the short 8-in. channels reach only from the end sills to the bolsters. This is the first hopper coal car of 50 tons' capacity on this road, built in large numbers, utilizing the side plates in carrying the load. The GM hopper car (November, 1903, page 402), however, was constructed in this way, and established this principle in 1896.

The GLA design is similar to the GL in size and general features. It has the following dimensions:



SIMONTON DOOR OPERATING GEAR.

CLASS GLA HOPPER COAL CAR.

Total length over end sills	32 ft. 2 ins.
Length inside	30 ft. 5 ins.
Length between truck centers	22 ft. 3 ins.
Total height above rail	10 ft. 0 ins.
Total width	10 ft. 1⅜ ins.
Width inside	9 ft. 6 ins.
Weight	38,600 lbs.
Cubical capacity, level full	1,683.4 cu. ft.
Cubical capacity, heaped	1,900 cu. ft.
Ratio dead to paying load	35.1 per cent.

The weight is 550 lbs. less than that of its predecessor. For the first time on the Pennsylvania a single plate body bolster is employed in this type of car. It is secured to the inclined floor between two 5 by 3½ by ⅝-in. angles. To provide for end shocks the center sills have a cover plate 6 ft. 8½ ins. long, extending from the hood of the hopper to a point more than half-way from the bolsters to the end sills. The diagonal bracing of the ends of the frame is shown clearly in the plan view. In the center of the car diagonal plates stiffen the construction, as indicated in the side elevation. Instead of ¼-in. side plates on the preceding design, the GLA has plates only 3 16-in. thick, which still further lightens the construction.

These cars are equipped with the Simonton door operating gear, which is illustrated because it is an inexpensive gear, which has proved entirely satisfactory in service. A large number of these have been in use for several years without one having opened accidentally. This gear is operated by a squared shaft extending across the car. The door links terminate at their upper ends in the form of hooks. These hooks, when in the closed position, are drawn down over the shaft castings, locking the doors securely.

The GLA car is presented out of its order in this series, because it is the latest design of the Pennsylvania Railroad.

CAPACITY IN LOCOMOTIVES.

Seldom has a subject connected with locomotive practice been acorded the genial reception which is given quite generally to that of superheating. Thus far only two roads on this continent pretend to know superheating from experience, but everybody having to do with locomotives is ready to talk about it, and those who have no superheaters appear to know most about the principle. Was there ever before an improvement of the locomotive which impressed people as this has? There must be something in it. There is something in it, and more than that, opinions with respect to locomotive practice in this country are changing very rapidly. People are now ready to apply to the locomotive the principles which have brought marine and stationary engines to their present development. Why is this. Is it because of a desire to advance economy or efficiency for its own sake? It is because up to this time the locomotive has grown mainly by increasing size in order to increase capacity. Details of small engines which give no trouble are exceedingly troublesome when made bigger for the powerful engines of to-day. Weights have increased to the point of jeopardizing cool running even with the very best designs. Merely increasing size is unwise, unscientific and wrong. The time has come for making the most out of the weights which must be used and improvements, such as superheating, are accepted and gladly accepted because they offer means for increasing capacity.

Compounding has never been appreciated by locomotive men until now, when it is clearly understood to be a source of increased capacity. Improved valve gears have had the "cold shoulder" for many years, but nowadays people are talking about them and they frequently ask which of several recently developed is the best and most likely to justify trial. Ten years ago a man with an automatic stoker would have been politely (perhaps) bowed out of the office. Now many are looking eagerly for the man who has a feasible plan to suggest for mechanical stoking.

All this has come rather suddenly. It all points in one direction—toward the greatest period of development of the locomotive and it justifies great hopes for the immediate future.

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