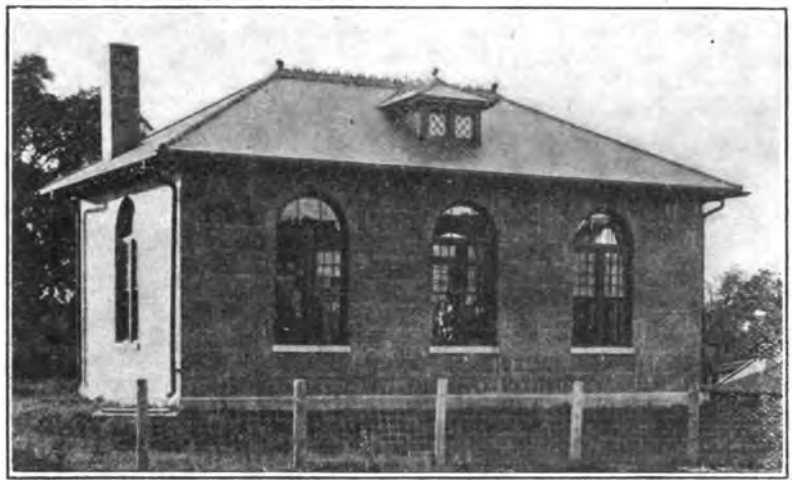
lighting load, this fluctuation is of little importance; the switch on rear of board is closed, and the lighting and motors supplied from the same balancer. In the evening, when the lighting load increases, both balancers are used, and the switch on the rear of the board is opened, so that the lighting and variable speed motors are then independent of each other. The result of this change is very noticeable in the life of lamps, besides a much improved lighting service.

Tunnels.—A tunnel which carries the electric wires and piping leads from the power house to the various buildings. It is 6 ft. 6 ins. high and 6 ft. wide at the power house and 5 and 4 ft. wide at other points, according to the demand for space. The tunnel is concrete, and the roof is 6 ins. thick, reinforced by expanded metal. At points where tracks in the yard cross the tunnel the roof is strengthened by old rails



PUMPING PLANT—EAST MOLINE SHOPS.

laid crosswise. At suitable intervals openings 2 ft. 8 ins. wide and 8 ft. long are located for the purpose of introducing lengths of pipe. These openings are covered by substantial grids. The aggregate length of the tunnel is 2,120 ft., and suitable provision is made for ventilation and drainage. The pipes are carried at one side and the electric wires at the other. At intervals of 6 ft. upright pieces of 6 by 4-in. oak are set into the concrete sides, and cast iron brackets, which carry cast iron chairs for the pipes, or glass insulators for the wires, are secured to them by lag screws.

Lockers and toilet arrangements for the power house force are provided in one corner of the boiler room.

We are indebted for information and drawings to Mr. C. A. Seley, mechanical engineer, and Mr. C. H. Wilmerding, consulting engineer, of Chicago.

LOCOMOTIVE TESTING PLANT.—A locomotive testing laboratory is to be built in Germany at the Grunewald Works, on similar lines to that at the St. Louis Exposition. It is to be in charge of the well-known locomotive designer, Professor Von Borries.

ELECTRIFICATION OF THE DULUTH, MISSABE & NORTHERN RAILWAY.—It is reported that as soon as possible this road will adopt electricity as a motive power. The plans will probably include the use of electrical apparatus for unloading the large steel ore cars at the docks.

SHOP TELEPHONE SYSTEMS.—One of the most valuable adjuncts to a well-organized shop is a telephone system for every foreman, and if it were possible to figure accurately the time so saved every railroad shop of medium or large size would be equipped with a telephone system. If the shop was quite small—handling only three or four engines—it might not be a good investment, but in any shop holding five or more engines it will give large returns.—*Mr. M. K. Barnum, before the Western Railway Club.*

STEEL CAR DEVELOPMENT.

PENNSYLVANIA RAILROAD.

VIII.

(*For previous Article See Page* 358.)

FLAT AND GONDOLA CARS.

The class designated as FM is a very strong flat car of 100,000 lbs. capacity, built of steel with a wooden floor, and having stake pockets. It is built for concentrated loads which in this series of cars provide for carrying two-thirds of the capacity of the car on a line across the floor or anywhere between the cross bearers. The FM and GB classes are both built for such loads, while the GS classes, of which there are four, GS, GSA, GSB, GSC, are built for uniformly distributed loads.

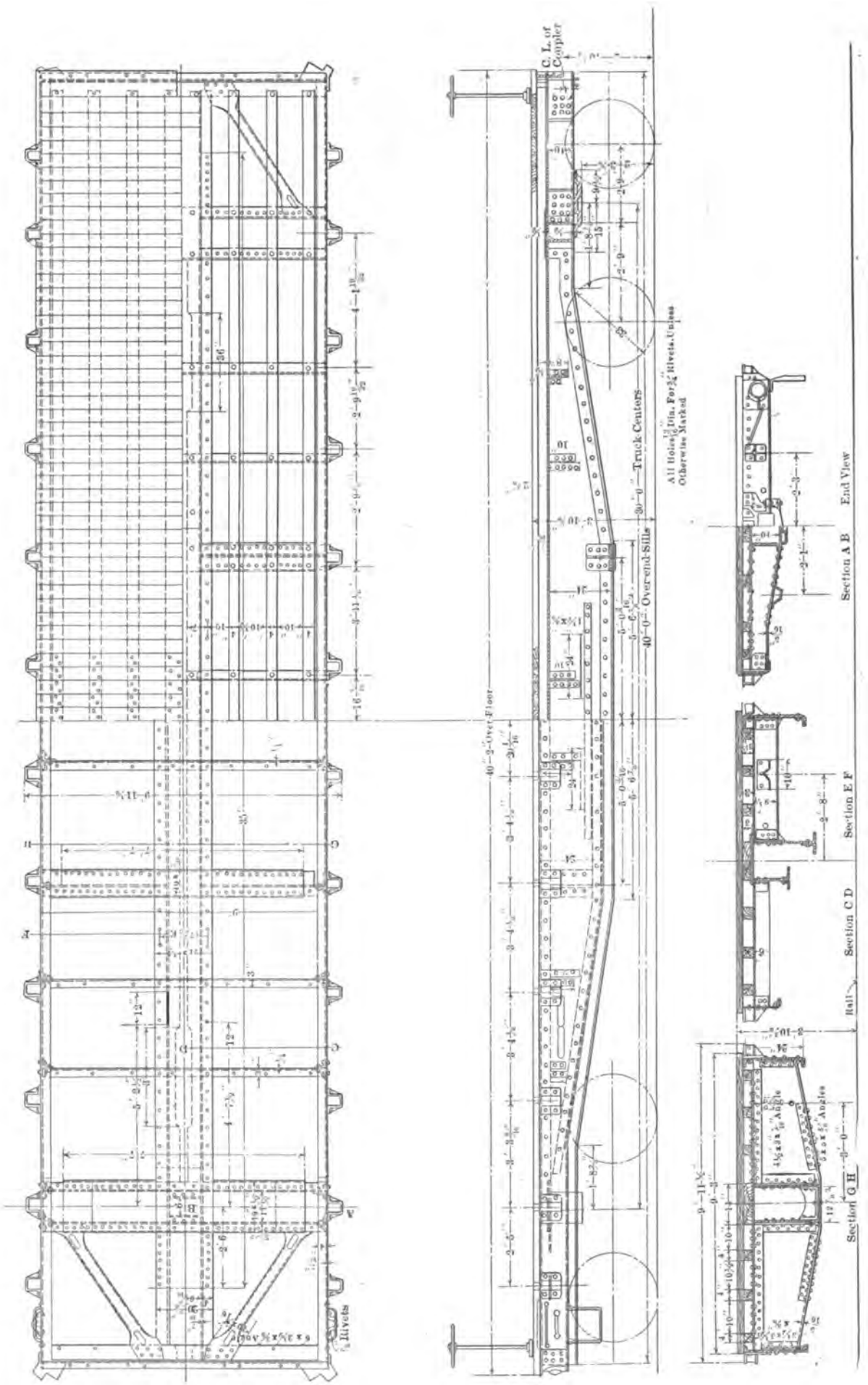
The FM car has pressed steel center sills 24 ins. deep at the center and 10 ins. deep at the bolsters. These are reinforced by angles at the lower flanges and they are covered with a 21 by ½ in. cover plate, which extends between the bolsters and to a distance of 2 ft. 6 ins. beyond the bolsters at each end. The side sills are also pressed steel channels 24 ins. deep, with their lower and upper flanges reinforced with angles extending between the bolsters. The upper flanges of the side sills are higher than those of the center sills, they turn in just under the flooring while the floor stringers rest upon the cover plate of the center sills at the center of the car. The drawings illustrate the construction of the bolsters, the end sills and the large cross bearers, two of which cross the frame between the bolsters. The cross bearers have 10 by 7-16 in. cover plates. In addition to these the floor is also supported by smaller cross bearers of 10 and 8 in. pressed channels, as indicated in the drawings of the FM car. In the engravings the section at A-B shows one of the cross bearers and E-F shows a bolster and end sill. The general plan of the frame illustrates the corner bracing and the substantial gussets and cover plates over the bolsters. The FM car weighs 40,000 lbs. for a capacity of 100,000 lbs.

With a length of 40 ft. and concentrated loads the neutral axis of the sills would be too low and the strength insufficient unless the pressed steel channels were reinforced by angles at the bottom and, in the case of the side sills, angles also at the top and cover plates over the center sills. The side sills of the FM car are each designed to carry about one-sixth of the total load.

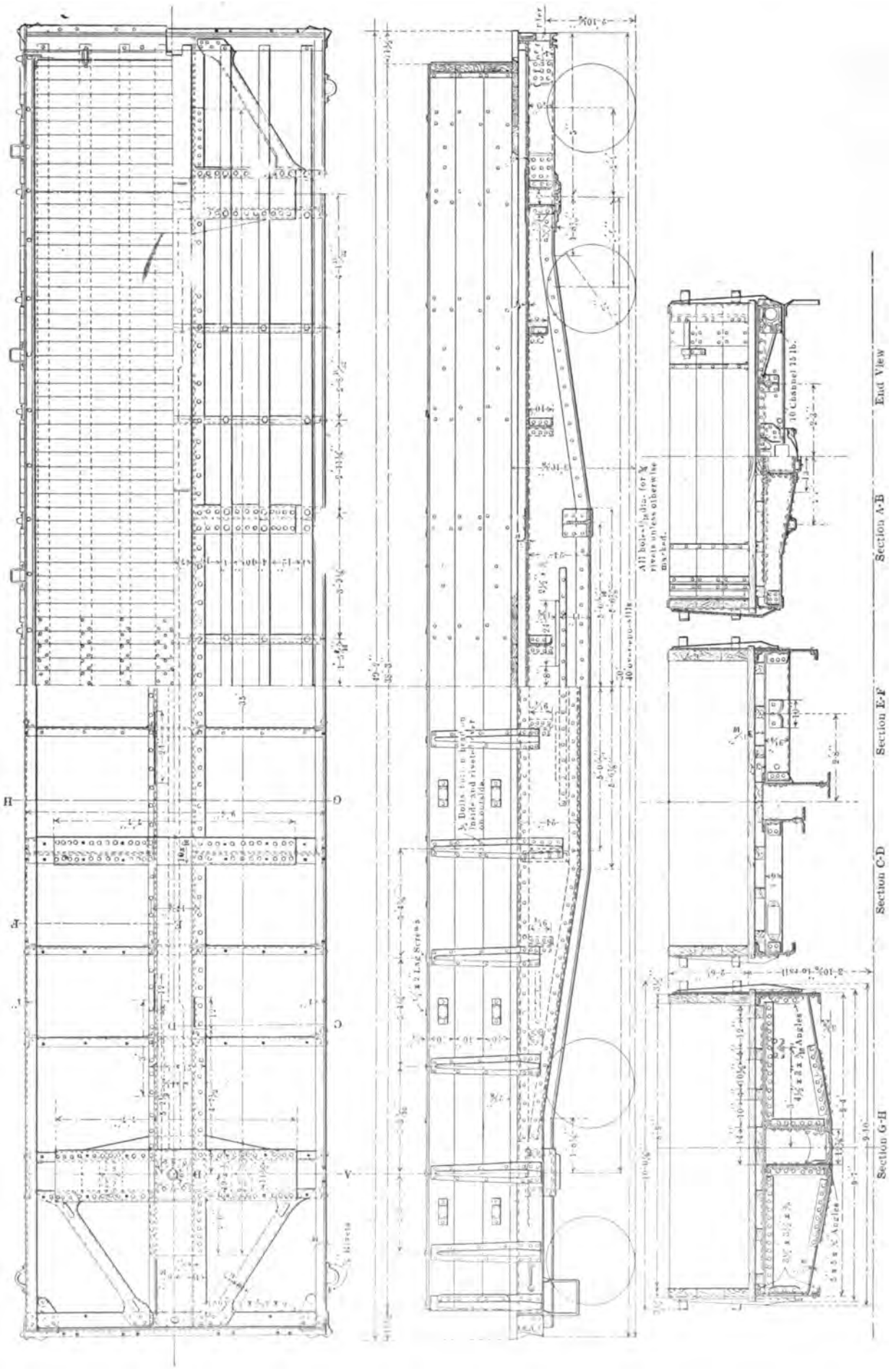
The GB class, also built for concentrated loads, has steel underframing and wooden gondola sides, with pressed steel stakes. This car is as wide as it could be built and the members of the underframe are generally similar to those of the FM class. This class is also 40 ft. long. The inside dimensions are 37 ft. 8¼ ins. by 8 ft. 9 ins., and the sides are 30 ins. high.

It is to be noted that the wooden sides are made 3½ ins. thick, and the height limited to 30 ins. This is for the purpose of better adapting the car for carrying top loads of long structural material, the car being primarily designed to serve the steel mill district, where such top loads are becoming more and more frequent and where long loads on top of high sides are objectionable.

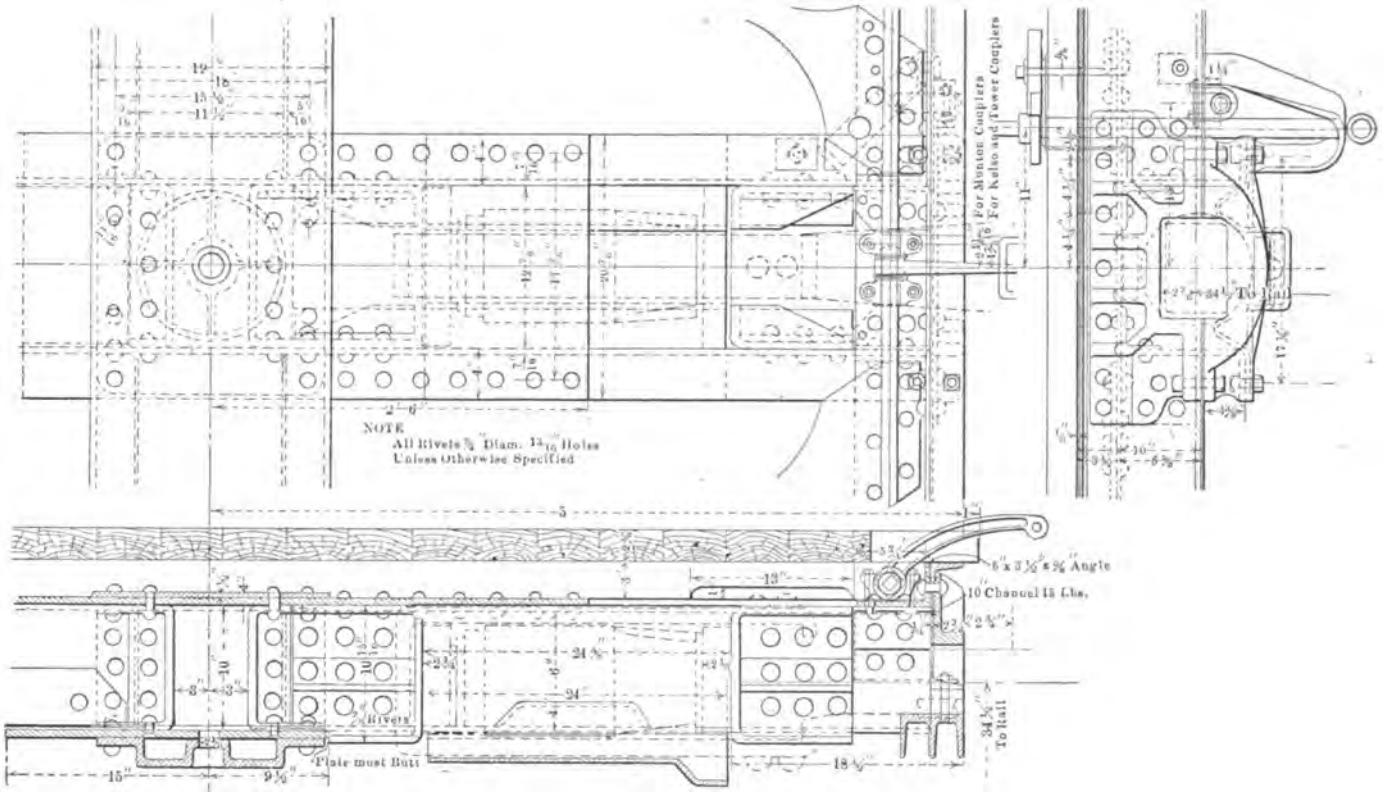
These cars weigh 44,000 lbs. and carry 100,000 lbs., making the ratio of dead weight to paying load 44 per cent. These cars have drop ends. They are fitted with Westinghouse friction draft gear, the arrangement of which is indicated in the detail engraving which applies to both the GB and the FM classes. This draft attachment has been found perfectly satisfactory in service on a large number of steel cars.



50-TON STEEL FLAT CAR, CLASS FM—PENNSYLVANIA RAILROAD.



50-TON LOW SIDE GONDOLA CAR, WOODEN SIDES, CLASS GB—PENNSYLVANIA RAILROAD.



APPLICATION OF WESTINGHOUSE FRICTION DRAFT GEAR TO FM AND GR CLASSES—PENNSYLVANIA RAILROAD.

CLASSIFICATION OF LOCOMOTIVES FOR TONNAGE RATING PURPOSES.

MR. J. H. LONIE.

In a paper on "A Standard Locomotive Classification," presented before the Master Mechanics' Association in 1901, Mr. R. P. C. Sanderson suggested stenciling on the cabs the hauling capacity of the locomotive in tons on a straight level track at ten miles per hour, together with a letter suggestive of the type of locomotive in question. As these figures would be too long for current use, and as minute refinement is not necessary, it was suggested that the first two figures, representing hundreds, would be sufficient. Thus, a 10-wheel engine capable of hauling 3,700 tons on a straight level track at ten miles per hour would be stencilled T-37. A modification of this system has been successfully used on the Rock Island System for the convenience of the transportation department in loading engines.

The tractive power of each group of engines on the system was first calculated in even thousand pounds (500 lbs. and over being considered as 1,000, and less than 500 lbs. being disregarded), and the tractive power in thousands was then stencilled on the cab together with a letter indicating the type. These letters were chosen more with reference to easy telegraphing than as suggesting types, and are as follows: Simple engines—8-wheel, B; 10-wheel, D; consolidation, C; Atlantic, A; Pacific, N; Mogul, G; suburban, K; 4-wheel switch, H; 6-wheel switch, J. Compound engines—10-wheel, F; consolidation, Q; Atlantic, W. This is known as the road classification and is entirely independent of the motive power classification. Thus, we have 8-wheel engines, from 10,000 to 19,000 lbs. tractive power, known as road class B-10, B-11, B-12, etc.; 10-wheel engines, road class D-14 to D-31; consolidation engines, road classes C-25 to C-40, etc. It was thought preferable to have the two entirely separate classifications rather than to attempt to combine both in one. It is evident that there may be several groups of engines of the same type and tractive power, but differing from each other in detail and each requiring a separate class for the use of the motive power department in ordering repairs, identifying drawings, etc. The transportation department is not interested in these minor differences, and by combining all engines of the same type and tractive power in one group, the number of road classes is greatly reduced. A combined classification is likely to be cumbersome, a burden to the memory and difficult to introduce on a system already having a motive power classification in regular use, while the road classification can be introduced without disturbing the present state of affairs.

The road classification symbols, when once comprehended, give a relative idea of the type and power of the engine, which is mainly what the transportation people want. If they wish to know the motive power class, size of wheels, or other special information, they may get it from the classification register. If a new engine comes on a division, the transportation officials know its tonnage capacity by its road class, though they may have never seen an engine like it before. Engine numbers may be changed so often that their identity is lost, yet so long as the stenciling on the cab remains unchanged, the engine may be properly rated, and no change is necessary in the tonnage rating sheets. The tonnage rating book for each division (the sheet for the division from St. Joe to Fairbury is reproduced) has the columns headed by Nos. 10, 11, 12, etc., up to the highest tractive power of the engines used on the division. The figures in the vertical columns show the rating over the entire division, and this, of course, corresponds to that of the section having the ruling grade for the division. These books show the normal or first rating only, and ratings for wet or stormy weather, fast stock trains, etc., are taken as a fixed percentage of the first or normal rating and an arbitrary allowance made for empty cars.

In making up the ratings, a table was first prepared showing the hauling capacity in tons for each of the different tractive powers and the different grades beginning at zero and advancing by tenths of one per cent. From this table a second was prepared, showing the hauling capacity behind the tender; by substracting from the numbers in the first the *average* weight of all engines, including the tender, having the same tractive power. As an example, from the first table we find that an engine of 19,000 lbs. tractive power would pull on a 1.3 per cent. grade 595 tons. It was found that there were on the system both 8-wheel engines, road class