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The June Railway Mechanical Conventions at Atlantic City.

The two great railway conventions of the year, the American Railway Master Mechanics' Association, and the Master Car Builders' Association, were held at Atlantic City, N.J., the former on June 11 to 13, and the latter on June 16 to 18. The most important features of these annual conventions are the reports of the standing and special committees and the individual papers presented, the principal ones of which are given on this and following pages, either in full or in abstract.

Individual Paper on Tests of Superheater Locomotives.

By C. H. Benjamin, Dean of Purdue University, Lafayette, Ind.

The work done by the author reported to the Association in 1911, showed a comparison of locomotive performance under different degrees of superheated steam. The Schmidt superheater was the last one which was installed. The work this year is a continuation of that accomplished upon the Schmidt superheater and shows the increased power of the superheater locomotive over the ordinary locomotive when both are using the same amount of coal. Last year a brief statement of the progress of the work was made, but no definite results were given. It was stated at that time that plans were under way to get a larger set of cylinders for the Purdue locomotive. This, however, was not done, and so the report this year only gives the increased power produced by superheating with the same sized cylinder. The work as outlined for the use of large cylinders remains yet to be carried out at a future time.

EQUIPMENT.—The locomotive known as Schenectady no. 2, for the saturated tests, and no. 3, for the superheated tests, was used in all the work. When used with saturated steam the locomotive was in normal condition. When the Schmidt superheater was installed the number of small 2 inch flues was reduced from 200 to 107, and 21 large 5 inch flues were installed. The original water-heating surface in Schenectady no. 2 was 1,322 sq. ft. The change in the flues made necessary by the installation of the Schmidt superheater reduced the water-heating surface to 1,080 sq. ft. The heating surface of the Schmidt superheater is 324 sq. ft., making a total water and superheating surface of 1,404 sq. ft. for Schenectady no. 3 after it was equipped with the Schmidt superheater. The nominal dimensions of Schenectady no. 3 as used in the tests with the Schmidt superheater installed are as follows:—

Type	4-4-0
Total weight (lbs.), about	109,000
Weight on four drives (lbs.), about	61,000
Driving-axle journals:	
Diameter (inches)	7½
Length (inches)	8½
Drivers, diameter (inches)	68.99
Valves (type, Richardson balanced):	
Maximum travel (inches)	6
Outside lap (inches)	1⅛
Inside lap (inches)	0
Ports:	
Length (inches)	12
Width of steam port (inches)	1.5
Width of exhaust port (inches)	3
Total wheel base (feet)	23
Rigid wheel base (feet)	8.5
Cylinders:	
Diameter (inches)	16
Stroke (inches)	24
Boiler (style, extended wagon top):	
Diameter of front end (inches)	52
Number of 2 inch flues	107
Number of 5 inch flues	21
Length of flues (feet)	11.5
Heating surface in flues (sq. ft.)	956.5
Heating surface in fire box (sq. ft.)	123.5
Total water heating surface (sq. ft.)	1080.0
Length of fire box (inches)	72.06
Width of fire box (inches)	34.25
Depth of fire box (inches)	79
Grate area (sq. ft.)	17
Thickness of crown sheet (inches)	7-16
Thickness of tube sheet (inches)	9-16
Thickness of side and back sheet (inches)	⅜
Diameter of stay bolts (inches)	1
Diameter of radial stays (inches)	1⅛

The Schmidt superheater, as used in these

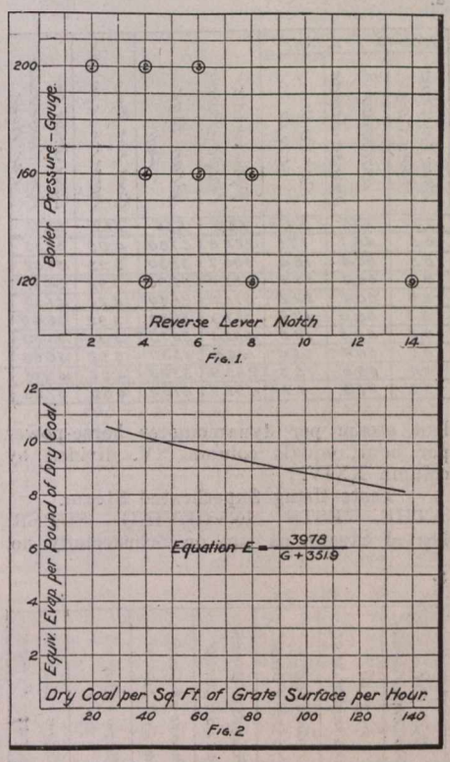

Fig. 1.

Fig. 2.

Fig. 1.—Conditions of Pressure and Cutoff for Saturated Steam Locomotive.

Fig. 2.—Relation Between Equivalent Evaporation per Pound of Dry Coal, and Dry Coal per sq. ft. of Grate Surface per Hour for Saturated Steam Locomotive.

experiments, has the following dimensions:—

Outside diameter of superheater tube (inches)	1⅜
Number of double return loops	21
Average length of the pipes in the double return loops. (ft.)	42.88
Total superheating surface, based on the outside surface of the tubes in sq. ft.	324

The fuel used in all these tests, both superheated and saturated, was Youghiogheny lump. Repeated analyses of this coal show it to have a very uniform heat value.

Tests Using Saturated Steam.

THE TESTS INVOLVING SATURATED Steam, which were used in this report, were taken directly from tables IV. and V. in the report of Dean Goss to the Association in 1909. All the tests were run at a speed of 30 miles an hour, and steam pressures of 200, 160 and 120 lbs. The conditions of pressure and cut off under which the tests were run are shown diagrammatically in fig. 1. The cut off is determined by the position of the reverse lever in notches. Each circle represents a test, and the number within the circle refers to the laboratory number by which the tests are identified. The results of the tests involving saturated steam are shown in tables I. and II.

PERFORMANCE OF THE BOILER.—In the 1909 report of Dean Goss, the relation between the equivalent evaporation per pound of dry coal and the equivalent evaporation per square foot of heating surface per hour for the locomotive using saturated steam is shown by the equation E = 11.305 = .221 H, in which E is the equivalent evaporation per pound of dry coal and H is the equivalent evaporation per square foot of heating surface per hour. This equation is assumed to represent the evaporative efficiency of the boiler when operated under saturated steam. In order to obtain the relation between the equivalent evaporation per pound of dry coal and the rate of firing, an equation was obtained in the following manner: Letting G equal the dry coal per square foot of grate surface per hour, 1,322 is the number of square feet of water-heating surface, 17 the number of square feet of grate surface, and H and E the same as above mentioned. Now, from the above values, the following equation is true: $1{,}322\ H = 17\ E\ G$, or $H = \frac{17\ E\ G}{1{,}322}$

Substituting this value of H in the equation $E = 11.305 - .221\ H$, we obtain the equation $E = \frac{3{,}978}{G + 351.9}$

This equation gives the relation between equivalent evaporation per pound of dry coal and the dry coal per square foot of grate surface per hour when using saturated steam. The graphical representation of this equation is shown in fig 2.

PERFORMANCE OF ORIGINAL LOCOmotive assuming irregularities to have been eliminated. Table II. shows the performance of the locomotive, assuming irregularities due to boiler performance to to have been eliminated. The results in this table were obtained as follows:—

Column XV., which gives equivalent steam supplied to locomotive per hour with feed-water at 60° F., equals pounds of steam supplied to locomotive per hour from original log multiplied by (B. t. u. taken up by each pound of steam minus [60 minus feed-water temperature]) divided by 970.4 (latent heat of evaporation).

Column XVI., which gives the equivalent evaporation per pound of dry coal corrected by equation, was obtained by substituting the values in column VI., table 1, for H in the equation E = 11,305 — .221 H.

Column XVII., which gives dry coal fired per hour corrected by equation, equals column XV. divided by column XVI.

Column XVIII., which gives dry coal per square foot of grate surface per hour,