RAILROAD GAZETTE

FRIDAY, MARCH 9, 1900.

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Contributions.

Cast-Iron Wheels for Locomotive Trucks.

Western Maryland R.R. Co.
Union Bridge, Md., Feb. 21, 1900.

To the Editor of the Railroad Gazette:

In reading over the discussion by the Master Mechanics in Convention at Old Point in June last, I notice that cast-iron wheels are not considered safe for engine truck wheels.

I have been in charge of the Motive Power and Rolling Stock of the Western Maryland Railroad for more than twenty-three years, and I believe my experience with cast iron wheels for locomotive trucks will be interesting, at least to some of your readers.

We have a hilly road, with several ten-degree, reverse curves, and 11 miles of grade from Thurmont to Blue Ridge Summit that average 95 ft. to the mile, part of it being 106 ft. On this mountain grade we have a horseshoe curve and a curve of 10° 30′. We have 61 locomotives weighing from 60,000 to 132,000 lbs., and in the twenty-three years we have had but one accident from cast iron wheels under engine trucks. This occurred with an 18 x 24 in. cylinder Mogul engine. As the truck wheel struck a frog, from some unknown cause, about nine inches of the flange was broken off. This being the only engine we have had to leave the track, there cannot be any other accident that could be charged to cast iron wheels. We use under all of our engines the swing motion truck, and have been using it from the time I entered this company's service. The swing motion truck may be the secret of our success with cast iron wheels under engine trucks.

At present we are using the Lobdell wheel. We have used the Baltimore Car Wheel, Scovill, Whitney, Jackson & Woodin and others with perfect safety. One of our Mogul locomotives with cast iron truck wheels ran a passenger train for three summers without any accident. It is but seldom we remove a truck wheel on account of worn flange; they generally wear through the chill or shell out in spots.

With this record I fail to see how this road can buy any other wheel that would give a result equal to this: One engine truck wheel broken in twenty-three years.

DAVID HOLTZ, M. of M.

An Economical Freight Train Speed.

To the Editor of the Railroad Gazette:

In a communication to the Railroad Gazette (Feb. 2) entitled "An Economical Freight Train Speed," Professor W. J. Raymond presents a very ingenious argument and reaches some interesting conclusions.

An analysis of the article presents the following characteristics: First, an assumption that for all speeds above ten miles an hour the locomotive may be expected to develop its maximum power. Second, that the resistance of a train is near its minimum limit when the speed is ten miles an hour. Third, that the rate of speed should never be lower than that which will allow the locomotive to develop its maximum power.

Justification for the first two of these assumptions is based upon an exhibit of formulae, while that of the third is deemed to be self-evident. Arguing from these assumptions, it is concluded that for maximum efficiency, the speed up the limiting grade should be ten miles an hour, the rate on other portions of the line being greater than this and always such as will permit the engine to develop its maximum power. Mr. Raymond further shows that with a speed of ten miles an hour up a ruling grade of one per cent., a speed of 26.2 miles an hour will be the most economical on the level, and a speed of 39.9 miles on a down grade of one-half of one per cent.

A serious defect in the argument would seem to arise in the assumed or deduced rate of speed up the ruling grade. On this question Mr. Raymond refers to Wellington's formula for train resistance and points out that the resistance as given by this formula is minimum for a speed of six miles an hour; also that an increase of speed to ten miles an hour increases the resistance by only seven per cent. Hence, he justifies assuming a minimum speed of ten miles an hour because it is a rate of speed which is attended by a resistance which is but little above the minimum and is the minimum speed which allows the locomotive to work at its maximum power.

Now, while it is true that an increase of speed from six to ten miles an hour is attended by a slight increase of resistance on a level, the conditions do not hold on an up-grade where the resistance is of two sorts: First, that due to friction, and, secondly, that due to the grade. The power required to overcome the latter varies directly with the speed, and when this increase of resistance is taken into account, it cannot be assumed that an increase of speed from six to ten miles an hour is accompanied by a slight increase in train resistance. The steeper the grade, the wider will be the divergence between the assumption and the fact, and since this assumption is fundamental in the argument which Professor Raymond presents, there would seem to be some question as to the validity of the conclusion which he has reached.

X.

The M W 100 Per Cent. Rail Joint.

Chicago, February 19, 1900.

To the Editor of the Railroad Gazette:

In your issue of January 19 a new rail joint is shown which is interesting to the writer, chiefly because a relation is established between the bending moment of the rail and the bending moment of the joint. The patentee does not state whether the bending moments are inch-pounds or foot-pounds, although it is presumed the latter is intended, and that they are for a concentrated load.

I do not see how the cutting away of the "inbent" portion of the splice ends relieves the ties of the stresses transmitted through the splice from rail to rail; or, if the "inbent" portions were left in the splices, how that would tend to transmit the stresses to the ties; for, in both cases, the stresses transmitted through the splice from rail to rail is transmitted through the central part of the splice which projects down between the ties.

I am also a patentee of a rail joint, but my conclusions differ from the figures of Mr. Thomson. Below are the data for four splices, the nearest to correspond to those of Mr. Thomson. In calculating this table, an excess of 10 per cent. was allowed in the joint above the strength of the rail.

Size of rail.	Length of joint.	Net. wt. of joint.	Rail, safe load in. ft. lbs.	Splice.				
				Safe load.	I	A	C	S
100	14¼	58 66	58 333	63,700	66.88	15.64	4.2	12,000
90	13⅛	45.90	48,866	49,695	49.96	12.57	3.9	12,000
80	12½	36.46	39,400	41,283	37 66	11.47	3 6	12.000
70	11½	32.89	32,333	37,802	31.38	10.32	3 3	12,000

It will be observed that there is a striking difference between the bending moment and the weight, as compared with Mr. Thomson's results. The weight of his joint for a 100-lb. rail is given at 85.4 lbs., and the bending moment at 46,600 lbs., therefore the bending moment per pound of joint is 545 lbs. My figures for a similar joint are over 1,000 lbs. per foot of joint. A similar comparison for all the four splices given shows like differences. The formula to determine the same load is the same, $M = S\frac{I}{C}$.

No more has to be done on this joint (after the section is rolled) than is required in the common fish-plate; that is, cutting to length and punching. I am glad to see this matter taken up by engineers—to whom it properly belongs—and that at least one person has been working along the same lines as myself. The stress per unit area cuts no figure, so long as they are alike in both rail and joint.

R. HINCHLIFFE.

Mr. Thomson comments as follows on the above:

Altoona, Pa., March 1, 1900.

To the Editor of the Railroad Gazette:

I can hardly feel justified in taking sharp issue with Mr. Hinchcliffe; for, while we are working along the same lines and are looking at two structures designed to meet the same end, the conditions under which the two structures have been placed are evidently different. When he gets a higher safe load for his 100-lb. rail, and a higher safe load for his 100-lb. splice, that means nothing more than that he took a distance between his supports less than the 18 in. which I gave. In fact, the length of his splice is only 14¼ in., and his distance between supports would of necessity be somewhat less than that. I have not been made familiar wtih the style of bars to which he is referring, but, in the light of recent practice, they seem very short. How short a grip we can take on the ends of two rails to make a successful and safe splicing has perhaps not been accurately determined. In 1890, or earlier, Mr. Bannister, Chief Engineer of the London, Brighton & South Coast Railway, placed on his 84-lb. bull-head rail a pair of splices that were of 100 per cent. strength, the length of which was only 18 in. His strong form of rail and wide spacing of ties enabled him to do this, and I believe that splice is standard on that road to-day. We, however, with our flat-base rail and our narrow spacing of ties, have different conditions to meet.

Mr. Hinchcliffe seems to have misunderstood what was said about stresses passing to the ties. I was comparing the splicing structure as published January 19 with my earlier pattern, which had the end portions of the depending flanges thrown up to horizontal position, to form wide lugs resting on the ties. I stated that this latter structure was in the nature of a bridge, and that the stresses delivered at the center could be transmitted through the splices to the ties, while in case of the other structure (the one shown Jan. 19) which took no bearing on the ties, the stresses could only pass to the ties as they passed through the rails themselves. This will, no doubt, make the matter clearer, and at the same time indicate that the two forms are radically different in principle.

When Mr. Hinchcliffe refers to our reaching different conclusions or results, I think he only means that we are furnishing figures that are based on different conditions, and that these figures are apt to be misleading until they are explained.

M. W. THOMSON.

Signaling As It Is and As It Might Be.

THE PRESENT.

BY A. H. RUDD.

(*Continued from page* 98.)

On a number of trunk lines the foreman stage is passed, and Signal Engineers in fact, if not in title, are in charge. Two systems are in vogue. Either each division has its own organization, or there is one general head for the entire road. Let us consider the first condition in two phases: under a close and under a liberal Superintendent.

In the first instance everything is sacrificed to saving in expense. This perhaps does not appear particularly in installation, although new work must be put in at the lowest figure, or all future work is vetoed. But in maintenance every nerve is strained to keep the figures down. Maintainers must be called upon to assist in construction work, neglecting their proper duties; and consequently inspections are kept at a minimum; and if the number of failures is not too pronounced, the condition is considered satisfactory. Not the Engineer, but the Superintendent is in fact the head of the department. A controlled manual system recently came under the observation of the writer where locks were tied up or failed to drop in place, towermen had keys to release their instruments, and track relays were habitually plugged because the Superintendent insisted that "we must get our trains over the road," while at the same time he failed to provide the requisite inspection force, and then pointed with pride to the record his signal expert was making in economy of maintenance. He really thinks his department is about perfect.

"Eternal vigilance is the price of safety," but this poor "signal sharp" never commands the price; and some day, when one of those trains "gets over the road"—and all over it, at that—the cause of the occurrence will be a seven days' wonder. Thoroughly competent inspectors cannot be obtained at the wages paid on the road in question. They are either men of steady habits and little knowledge, who cannot cover their sections in the allotted time and do their work thoroughly; or else skilled men who cannot be depended upon, perhaps on account of their bad habits, and who neglect their duties from lack of interest. The conditions here noted obtain also under a general organization in some instances, and for the same causes.

Under a liberal official, however, this plan of organization, while not always providing a bed of roses, is for the Signal Engineer an almost ideal one, in some respects. His force is usually a small one, he is perfectly acquainted with its personnel, and with all the details of the work in his limited territory; and he can give his personal attention to inspection and installation to a very large degree. With men enough to do the work without waste, but in the best possible manner, with the knowledge that his maintainers are attentive to their duties and can be trusted, he has confidence amounting almost to certainty that all will be well. Consequently his worries are few but—the salary is small. If he just fits the place, well and good. If, however, he is fitted for a much larger field, he becomes surfeited with the wealth of detail and the delicacies of the work, has unpleasant symptoms and at last falls into a rut, and usually a narrow one.

Even under the most favorable conditions there is one great defect in this system, viz.: lack of standards. Take as a fair illustration a road having five or six divisions. Each division head has his own ideas. There are four or five types of interlocking machines prominently on the market, and it is a fair supposition that each division will have not less than two of them. More probably each division has to carry three styles of machine parts in stock, and the same condition exists regarding nearly all material; while each man has a different method of installation. It is a good thing for the signal companies who first furnish the material, but a mighty poor one for the road barred from the market. Each division has its storehouse or houses. Several might be combined at a central point if the lines converge or intersect, and the cost of storekeeping and stock accounts decreased. By a general organization of the proper sort, the salaries of its higher official could be paid, with a handsome surplus remaining, by making these changes alone.

In the general organization, as it usually exists to-day, the head of the department reports either to the Chief Engineer or the General Manager or Superintendent. He establishes standards, orders material (passing upon the division requisitions as well as upon all new work, for which latter he prepares plans), and when the work is installed, it is turned over to the divisions for maintenance and manipulation. Here his work ends. If the plants are improperly maintained he cannot be held responsible, as the maintenance force reports to the Division Superintendent, who is not and, as previously shown, cannot be expected to be an expert. Is there not a flaw here? The same course is pursued in other departments, but the best sentiment is opposed to it, and the tendency is all against divided responsibility, with its resultant evils.

Resorting again to analogy—after locomotives are acquired by the motive power department, are they run by men selected solely by the Division Superintendents? Are they repaired in shops under his charge? Who is responsible for the inspection of rolling stock, of air brakes, and other elaborate machinery? Is responsibility divided between the Division Superintendent and the building and engineering departments?

How can a Signal Engineer know whether his standards require modification and how keep abreast of the times, no matter how good his judgment may be, if, after installing them, he never receives reports of their performances? In some cases he is favored with this data, but unless he knows the conditions at the time of report he cannot get a clear idea of their merits or defects or properly study failures. He must keep in touch with the maintenance force, and know that the work is properly cared for. What advance would there have been in locomotive construction if no data concerning the performance of new devices were accessible to the designer?

Present practice is so varied that a brief summary of the different methods of organization will be of interest. The list may not be absolutely correct as to titles, but these are immaterial in the comparisons desired to be made.

Chicago & North Western.
Signal Engineer reporting to Chief Engineer. All mechanical and electrical forces report to Signal Engineer.

C., C., C. & St. L.
Signal Engineer reporting to Chief Engineer, making all plans and periodical inspections, and deciding all signal questions. Division Foremen in charge of division work.

C., N. O. & T. P.
Superintendent of Telegraph. Two general foremen of signals (one for each district), under whom are all the mechanical and electrical forces.

Erie Railroad.
Signal Engineer reporting to Assistant Chief Engineer; establishes standards and has general charge of all signal work. The actual maintenance and construction forces report to the different Division Engineers.

Illinois Central; Michigan Central; Chicago & N. W.
Signal Engineer, reporting to Chief Engineer. Supervisor of Electric Signals in charge of all electrical forces; Supervisor of Mechanical Signals in charge of all mechanical forces, except that on Illinois Central some lampmen report to Road Department.

Long Island.
Signal Engineer. Under him, (a) Signal Foreman, in charge of all mechanical forces and lampmen, and (b) Electrician, in charge of all electrical forces.

Lake Shore & Michigan Southern.
Signal Engineer, reporting to Principal Assistant Engineer; establishes standards and makes plans. All maintenance and construction forces report to two Master Carpenters, who in turn report to the Principal Assistant Engineer. Levermen report to Division Superintendents.

Lehigh Valley.
Signal Engineer, reporting to Engineer Maintenance of Way. Under him (a) Supervisor of Electric Signals, in charge of all electrical forces, and (b) Supervisor of Mechanical Signals, in charge of all mechanical forces. The Signal Engineer has absolute charge.

New York Central & H. R.
Assistant Superintendents of Signals, reporting to Division Superintendents. Electrical and Mechanical Repairmen, and Foremen, Levermen and Lampmen reporting to the same.

New York, N. H. & H., Eastern District.
Supervisor of Interlocking, in charge of Division Foremen and all mechanical forces. Electrician, in charge of Division Foremen and all electrical forces. Both heads report to the General Superintendent.

New York, N. H. & H., Western District.
Two Signal Engineers, reporting to their Division Superintendents. Under them are all signal forces. Lampmen on one division report to Signal Engineer; on the other, to Section Foremen, Levermen, Station Agents, etc., according to location of signals. A third division has a Foreman of Interlocking and an Electrician, both reporting to the Division Superintendent.

Philadelphia & Reading.
General Signal Foreman, Chief Signal Inspectors, Division Signal Foremen, to whom report all maintenance and construction forces and Lampmen.

Pennsylvania.
Signal Engineer, reporting to Engineer of Maintenance Way. He establishes standards, makes plans and orders material. Supervisors of Signals report to Division Assistant Engineers and have full charge of construction and maintenance forces, carrying out plans of Signal Engineer.

Comparative Table of Wages.

Wages of Signal Forces prevailing under present practice:

	Per month.	Per day.
Signal engineers	$80 to $150	$2.66 to $5.00
Electrical supervisors	70 " 90	2.33 " 3.00
Interlocking supervisors	55 " 75	1 83 " 2 50
Division foreman, interlocking	55 " 75	1.83 " 2.50
Gang foremen, interlocking	50 " 75	1 66 " 2.50
Gang fitters, interlocking	50 " 68	1.66 " 2 27
Gang helpers, interlocking	30 " 40	1.00 " 1.33
Electrical repairmen	40 " 75	1.33 " 2.50
Electrical batterymen	40 " 55	1.33 " 1.83
Lampmen	30 " 40	1 00 " 1.33
Tower operators	25 " 65	.83 " 2.17

Average wages as shown by Interstate Commerce Commission report:

	Per day.
Locomotive engineers	$4 47
Conductors	3.67
Other trainmen	2.65
Station agents	2.42
Section foremen	2 22
Machinists	2.91
Station help	2.18
Carpenters	2.77
Other shopmen	2.34
Trackmen	1.39
Telegraph operators, despatchers	2.76
Switch, flag and watchmen	2 57

The above comparisons are made as nearly as possible between classes of labor requiring similar capacities (except in the first item) and carrying somewhere nearly like responsibilities. They speak for themselves.

The responsibility for a proper organization and the selection of the right man at its head, rests entirely with the general officers. When this responsibility has been met, and the department established, the entire work should come under this official head, who should be held to a strict accountability for its correct installation and perfect maintenance. This leads to the consideration of the Signal Engineer and his forces to-day.

[TO BE CONTINUED.]

Slid-flat Car Wheels.

At the January meeting of the Northwest Railway Club, Mr. F. B. Farmer, of the Westinghouse Air Brake Company, discussed the causes of slid-flat car wheels. He first stated that it seems to be the general experience that the greatest number of wheels are skidded in winter, when the ground is not covered with snow; that the dust and the frost make a combination most favorable for skidding. As to other causes for slid wheels, he said in part:

Some time ago, while investigating the question of slid wheels, my attention was called to a machine that was being used at that time in the Soo shops. They grind cast wheels and mate and remount them. Noticing that a pair of wheels in the grinder had flat spots, and that the wheels were out of true, I asked the man to see if other cases were similar to this, showing that the large part of the wheel was just passing under the brake shoe, when the part having the flat spot would have been in contact with the rail. He followed it up for some time, and found that this is almost invariably true. On a road that had considerable trouble from cast wheels flattening, the matter was given some attention, and a device was got up for quickly testing this feature. They found a few cases where the wheels were bored out of center, traced them, and found a boring mill was responsible for the poor condition; so that I think the two instances cited are sample ilustrations of causes of wheels sliding.

It has been frequently remarked that when a wheel or a pair of wheels flattens, the next time they catch it will be in the same spot. I think this is more often due to such a cause as just mentioned rather than to the flat spot made in the first instance.

It may be of interest to hear of a test that was made on a western road some three years ago. Owing to the large number of flat wheels in a train of loaded cars, a test was made to determine about what pressure was necessary to slide wheels, and the distance necessary to produce a given length of flat spot. A loaded box car weighing 69,000 lbs. at the rails, was charged to 100 lbs. pressure, the brake was applied with full force standing, and the car was pulled for one-half mile. One pair of wheels turned almost the whole distance, two pairs slid intermittently, causing what is termed a "chain" flat, a succession of small flat spots, not serious enough to justify removal. One pair slid the entire distance, and had a 2¼-in. flat spot. Another test was made by applying the brake heavily, and pulling the car 100 ft. on what might be termed an ordinary rail, without sand. Then they examined the spot in contact with the rail and found scarcely any abrasion. The test was repeated on an undamaged spot, using sand the whole distance, and they found, upon examination, a 1-in. flat spot. So this shows how seriously sand may effect the flattening, and it indicates as well the small probability of wheels starting to revolve when sand is used after once locking. Of course, the great weight on the rail, with the car loaded, aided materially in causing this long flat spot, resulting from 100 ft. of sliding.

On the ore-carrying roads much trouble has been experienced from wheels sliding, due to several causes, the most important being that the empties are hauled one way, and the direction is generally an ascending grade. The grade and the empty cars enable the stop to be made with a very light application of the brake. In order to insure a release of applied brakes, the train-pipe pressure throughout the whole length of the train should be raised quickly and considerably. Where the reduction is small, the difference between the main reservoir pressure and the train line at the time of the release is correspondingly less than where the application is heavier. For that reason, holding the brake valve in the full-release position for a short length of time would give a sluggish flow toward the rear end and a lesser raise in pressure. If, to correct that, as far as possible, the brake valve is left in full release for a longer period, the brakes up at the head end are liable to be overcharged, and later on, through the temporary absence of any supply, the brakes may stick.

To overcome this the men have been instructed to insure, before attempting to release, a reduction of at least 10 to 15 lbs. On one road they even went so far as to say that before attempting to release, a full service application of 20 lbs. reduction should be made, and at the end of the season, whether from that or more attention being paid to other details, they had a better showing on the flat wheel question than previously. That same difficulty of brakes sticking from a light application has been met with often on passenger trains, particularly when the engineman has applied the brake a little to steady the train around curves. It does not mean that the application made for the purpose of stopping the train at a given point must be any different than otherwise, but before the release is attempted enough should be added to that to insure the desired result.

In discussing this question with some of the air brake men in this part of the country it was demonstrated that one of the principal difficulties attendant on the investigation of slid-flat wheels arose from the insufficient and unreliable information they had to start it with. The Northern Pacific had this matter up several years ago, and improved on the slid-flat wheel report used for several years by the Chicago, Milwaukee & St. Paul road. It first called for certain information from the inspector, telling him of the kind of test to make, and was a very valuable report, inasmuch as it also educated the men to guard against these troubles and thereby prevent wheel sliding. This was the report to be made out by the inspector. It was found, however, that you could not get from him a sufficiently accurate report as to the condition of the triple valve. The triple valve could not be repaired, when defective in the packing ring or slide valve, by the men, and had to be sent to the repair point where there was a competent man with the necessary tools. So, a form was got up to accompany the triple valve. At present the valve is invariably removed from the car in the case of flat wheels. Another one is put on, and, with the report which accompanies it, the removed valve is sent to one of the repair points, where they have plants for making an accurate test and men who are skilled in doing this work. The lower half of the report which accompanies the valve is left blank, to be filled in by the man making the test, and when it is finished, and the results are recorded, he forwards this report to the road foreman of the district. The man that removed the valve from the car makes out his report and forwards it to the road foreman, attaching the air brake defect card turned in by the conductor of the train bringing the car in. This same inspector immediately advises the roundhouse foreman of the train bringing in flat wheels. This foreman has a form calling for the condition of the pump governor, the pump, brake valve, and the brake parts on the engine that might have any bearing on the case. The roundhouse foreman also ascertains from the engineman who handled that train whether there was any burst hose, break-in-twos, or other cases calling for emergency application, that could have had any bearing on the subject. This information is forwarded to the road foreman, who originally spent a good deal of time hunting up this information, or endeavoring to hunt it up, but never getting it accurate or complete. Now, he has to devote no time to that; these reports all come in to him giving all the information that can possibly be gleaned on the subject, and from this he is able to determine, if it can be told, the cause of the flat wheels. The brake leverage of the car is also given on one of the reports. All of the different brake diagrams are printed on the back, and it is easy for the carman, without making any sketch, to show the location of the slid wheels with relation to the hand brake of the car.

In a number of cases it was found that the air brake was in perfect condition, and that the flat wheels were on the hand-brake end of the car. Those familiar with the Master Car Builders' type of brake rigging for freight cars will appreciate that, generally speaking, the hand-brake power is greater on the truck next to the hand brake than on the other; therefore, when these reports finally reach the General Air Brake Inspector, by tabulating them he is able to ascertain the number of cases where the air brake was in good shape and the flat wheels that were on the end of the car nearest the hand brake, which indicates that the cause of the sliding was very probably the hand brake. Then, I believe, a graphic report is made out, which enables one to see at a glance the number of slid-flat wheels, and the comparative record of that month and the corresponding month, or any month, of the same or the previous year.

I might add that the ore roads have very generally adopted what is termed the two-pressure system, which consists of carrying merely a lower train-pipe pressure with their empties and higher than the standard with the loads, which makes both safer, not only from the standpoint of wheel sliding but also from the danger to trainmen resulting from a burst hose or a break-in-two, when a man is trying to pass over the tops of the cars. The combination of those two, lower pressure and heavier applications, has resulted in a great betterment. They find, too—those who have watched the matter—that there are certain particular places where the brakes have stuck most, and that these places are where light reductions have been made. The Duluth, Missabe & Northern and the Duluth & Iron Range, the Lake Superior and Ishpeming and the Butte, Anaconda & Pacific are carrying 55 lbs. with their empties and 80 lbs. with their loads. Eighty pounds is used merely