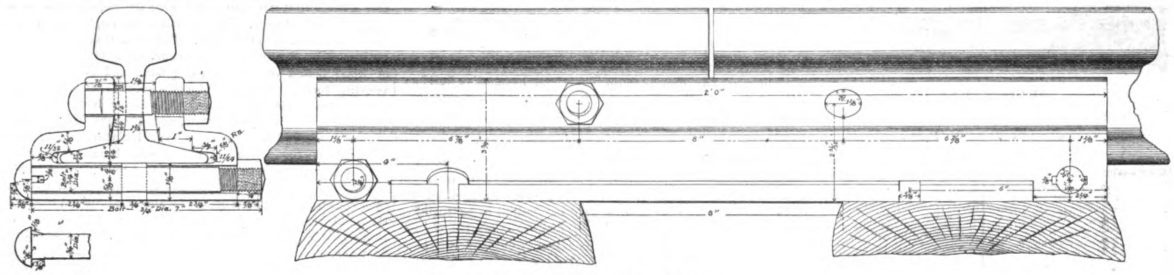


THE THOMSON RAIL JOINT.

Made by the CAMBRIA IRON CO., *Johnstown, Pa.*

graduating the installments as he increases his mileage. The average passenger man will say that is too complicated and will spend hours over some far less productive and far more complicated table of through rates and tours and expensive advertising. I trust I have made myself clear. Perhaps I ought to have kept up the publication of these matters until they had been fully realized and grasped and admitted, but that is something which demanded too severe a criticism of the men and the times and was more than I was able to undertake or justified in undertaking.

Passenger traffic has never yet been studied properly to fulfill its true status in the economy of transportation. It is the means of doing great good and acts as an educator. It has its two mental forms, the narrow or tory side, and the progressive or liberal side; but so long as railroads are organized for stock purposes and not for traffic, for construction profits and not for revenue, so long will the conduct of railroads evince a great lack of any sympathy with men who are students of the economy and science of passenger, or, for the matter of that, of any, transportation.

Feeling this I have decided that time must elapse before progress in the direction of the reforms indicated can be hoped for.

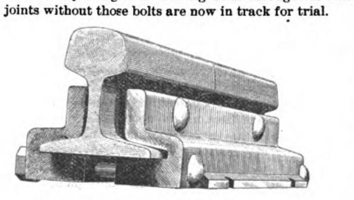
J. FRANCIS LEE.

[The point at issue between Mr. Lee and the *Gazette* is largely a matter of names. On practice, we should probably nearly agree; he simply insists that such practice involves the principle of classification. Perhaps it does; but the form which such a principle would take in passenger business is so different from its recognized application in the freight business that most people would be misled by using the same word for the two things.—EDITOR RAILROAD GAZETTE.]

The Thomson Rail Joint.

The joint shown in the accompanying illustrations was designed about 18 months ago and is patented by Mr. M. W. Thomson, Engineer of Maintenance of Way, Pennsylvania Railroad, and is made by the Cambria Iron Company. It is in use for trial on about two miles of the Pennsylvania, and one mile has just been rolled for the Chicago & Northwestern.

The illustrations show the joint in prospective, a sectional elevation and a side elevation, and no description is necessary. As here shown the joint weighs 80 lbs. The punching of the holes for the bolts through the web is varied. As shown here the joint is punched for the Pennsylvania 4-hole rail. Others are punched 14 in. apart, to fit the middle holes of the 6-hole rail. Other variations from these drawings have not been made so far, but Mr. Thomson has some expectation of dispensing with the long bolts through the base, and joints without those bolts are now in track for trial.



One feature of this joint which is considered particularly valuable is the extent to which it can be adjusted for wear by tightening the bolts. As wear proceeds a tight joint can always be secured by drawing the two parts up on the flange, and this play makes it possible to apply a joint of one section to rails of different weights. It is suggested further that with rails of unusually thin flanges thin packing strips of sheet iron can be inserted. One make of joint can be applied to rails varying between 56 and 75 lbs.

The joint has the great advantage of getting the bearing on the foot of the rail instead of under the head, and offers a large bearing surface. Not only is the wear of the joint thus reduced, but most of strain is taken off the bolts. A certain advantage is claimed, and will probably be realized, in that the spring of the plates will keep a uniform elastic strain on the nuts, dispensing, perhaps, with nut locks. The joint is unusually deep, and has great vertical strength, but whether or not it will need added strength in the middle, at the top of the vertical member, remains to be proved. This could easily be provided by giving it a flange. The two parts are symmetrical and interchangeable, and the whole joint, as will be seen, comprises but the two bars and four bolts. As has been said, it is proposed to try to dispense with the lower bolts.

The following transverse tests were made of a Pennsylvania Railroad standard 75-lb. rail and a joint composed of this rail with Pennsylvania standard 1887 six-hole angle splice bars, and the same rail with the Thomson joint, showing the Thomson joint to have 70 per cent. of the elastic limit of the solid rail 4¾ in. high, and 47 per cent. more than that of an extra heavy ordinary form of angle joint, with correspondingly great stiffness both under and above the elastic limit. Ends of rails from $\frac{3}{16}$ in. to ¼ in. apart in all cases:

	Laboratory No.	Elastic limit.		Max. resistance.		Distance centre to centre of bearings. In.
		Load. Lbs.	Deflection. In.	Load. Lbs.	Deflection. In.	
75-lb. steel rail, 4¾ in. high, 4½ in. base	2,904	116,000	.0653	140,000*	.137	20
Penn. R.R standard six-hole iron splice bars, 51½ lbs., 34 in. long, on same rail	2,944	45,000	.1173	78,000*	.548	20
Thomson splices, 80 lbs., 24 in. long, on same rail	2,905	85,000	.0909	145,000†	.185	20

* Test discontinued with load still rising.
† Load still rising. At 146,000 sudden slip with loud noise first occurred. Test discontinued.

Interlocked Switches and Signals.

BY CHARLES R. JOHNSON, C. E.

II.

The growth of interlocking in the past two years has been principally at small places, that is junctions, grade crossings, draw-bridges, etc., and this has been mainly due to the introduction of cheaper appliances for operating switches and signals at such points.

The know-nothing stop has been a source of annoyance and expense to railroads for a long time, and any safe means of avoiding it was eagerly sought for. It is doubtful if any real safety is obtained from the know-nothing stop. Collisions have frequently occurred notwithstanding obedience to the rule. If an engine man has no proper signals, or disregards them, a disastrous collision may occur notwithstanding a stop 500 or 1,000 feet from a crossing.

Several states have passed laws authorizing railroads to run their trains over draw-bridges and grade crossings provided interlocking signals are fixed at such points, and have been examined and approved by an officer duly appointed by the state. These laws have been taken advantage of quite extensively, and many bridges and crossings equipped with interlocking.

DERAILING SWITCHES.

The first question to arise in connection with this subject was the desirability of using "derailing" or "throw-off" switches. Notwithstanding the safeguards that are used with facing switches, it is almost an axiom with signal experts to avoid facing switches where possible, and for this reason and the fact that unless signals are obeyed by enginemen, accidents will occur, signal engineers are almost, if not quite, unanimous in their opposition to derailing switches in the main track of a railroad, except for draw-bridges and intervolved track on a bridge, and then only when the "derailing switch" leads on a siding where an overrunning train has an opportunity to stop.

Opinion amongst railroad officers is divided as to the question of using derailing switches in main tracks. In several states railroad commissioners insist upon their use, but in others, notably New York and Massachusetts, the commissioners leave the matter to be decided by the officers of the railroads interested. It is not the object of this article to give the reasons for and against derailing switches, but attention may be drawn to some of the principal ones. Those who favor the use of derails in main tracks argue that if an engine man disobeys his signal he ought to be ditched, and with the knowledge before him that if he does run against a danger signal he will be thrown from the track, he is much more likely to look out for and obey his signals than he would be without such knowledge. Those who oppose derailing switches in the main track say that it is only inviting disaster to throw a train off the track when an engineman disobeys a signal. It certainly does not follow that because a signal is at danger the opposing track is necessarily blocked, and the advocates of reliance on signals only claim that there is no safety except by discipline and absolute obedience to signals. So far as can be ascertained, there have been more cases of enginemen running past danger signals when reinforced by derailing switches than when they have had signals only. If such is the case, it would seem to prove that better discipline is maintained on the roads without derailing switches, although, on the other hand, when an engine is ditched it is generally known at headquarters, whereas men running past a danger signal and causing no damage are not always reported.

The advocates of no derailing switches sometimes carry their theory to the extent of not permitting side tracks to be equipped with them. This would seem to be going too far, because scarcely any damage would be done to a derailed train attempting to leave a siding in the face of a danger signal on account of the slow rate of speed at which the train would necessarily be running.

It seems a very safe and desirable rule to have all sidings equipped with derailing switches arranged in such a way as not to obstruct the main track when a car or engine is derailed, not only to prevent enginemen coming out against their signal, but to prevent the danger of cars being blown or pushed out foul of the main.

With ordinary interlocking appliances the use of derailing switches at grade crossings and drawbridges entails considerable extra expense. For example, at a single track grade crossing with home and distant signals in each direction and without derails, eight interlocking levers only would be required, one being for each signal. If, however, derails are used, fourteen levers would be required to give perfectly satisfactory results, eight levers being for the signals, two for the four switches and four for the four facing point locks, making fourteen levers in all.

There are several ways of reducing this number of levers, but none perfectly satisfactory. The most usual method is to work a facing point lock and home signal by one lever, but this is open to the objection that when a train is stopped for any reason whatever on the facing switch, after having a clear signal, the signal cannot be put to danger so long as the train stands on the switch and the detector bar. In this way the rear of the train is not protected, in fact it may be said that a following train is invited to run into it for a clear signal is shown, although the track is obstructed.

THE CAPSTAN WHEEL.

The cost of equipping grade crossings on the above principle was so high as to prevent railroad companies from taking advantage to any great extent of the laws allowing them to run the crossings without first making a stop.

To reduce the cost to any great extent it was necessary to have a cheaper machine and cheaper connections. This was done by the invention of Mr. Henry Johnson, which consists of capstan wheels instead of levers, and wire connections entirely instead of part wire and part pipe. A large number of these machines has been manufactured and put into service by the Union Switch & Signal Co., and while their actual use has demonstrated some weaknesses, all of which can be remedied, the principle has proved so satisfactory that there is no doubt they will be used almost exclusively for simple systems of signaling.

A complete description of this device will be given at another time, but briefly stated the capstan wheel does the work of four levers. It has five positions and works switch, facing point lock, home and distant signals. When setting the track and signals for a train the capstan wheel is pulled by the operator and first the switch set, then the facing point lock, then the home signal and last the distant signal. By these separate movements the capstan wheel gives exactly the same results as levers would, except that the latter can be handled much more rapidly. For that reason it is probable that levers will always be used at places where trains are required to be handled rapidly. The connections to the switches and signals consist of a continuous cable from the capstan wheel to the distant signal, connecting by means of a motion plate the switch and facing point lock, and the home signal by means of a rotary wheel, of which one is also fixed on the distant signal.

Four of these capstan wheels are required for a plain single or double track crossing having derailing switches. Two capstans only are required when there are no derailing switches. If there are no derailing switches and no distant signals, one capstan wheel will work the four signals, but in this case the two signals that are not conflicting are lowered at the same time.

The interlocking between the wheels is done just as it would be between levers and on the Stevens principle. This arrangement is certainly the cheapest that has been devised giving complete interlocking.