

center only a few days and before the wheels were put in service. The fracture was clean and no defects were apparent on the surface, yet an etching showed a decided segregation. Fig. 9 shows location of sample holes. The following were the results of the analysis:

Hole.	Carbon.	Silicon.	Phos.	Manganese.	Sulphur.
1	.08	.177	.063	.990	.051
2	.08	.177	.063	.990	.051
3	.08	.177	.063	.990	.051
4	.08	.177	.063	.990	.051

The results of the pulling tests of pieces taken from this tire are as follows:

Mark.	Diam. of test pieces.	Ultimate.	Elong. per c't. in 2 in.	Reduction of area, per cent.
2	.641 in.	103,200	10	21
4	.641 in.	130,000	10	13

Mr. H. M. Howe, in his "Metallurgy of Steel" says: "Heterogeneous composition usually implies heterogeneous strength and ductility; and the strength of a heterogeneous substance is usually nearer the strength of the weakest component or part than the average of all the parts; the test piece tends to break down piecemeal, so with ductility." This being so, the character of such tires as are shown is to be judged, not so much by the best results that can be obtained from a section of the tires, but by the poorest.

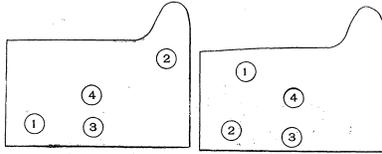


Fig. 10.

Fig. 11.

Fig. 10 is a sketch showing an ingot 5 1/2 ft. long, from which four billets were cut, marked A, B, C and D respectively. These billets were made into tires, the top portion of ingot, or the piece not marked, having been scrapped. These billets ranged in weight from 780 to 800 lbs. Fig. 11 is a print from an etching of a section of one of these tires, and is typical of them all. Figs. 12, 13, 14 and 15 show location of holes from which samples were taken for analyses. The tires were all cooled in air as they came from the mill without being subjected to any further treatment. The chemical analyses show that the carbon, phosphorus, sulphur, silicon and manganese, were very nearly the same at all the points taken, while the ultimate tensile strength varied only from 132,000 to 136,000 lbs. The elongation varied from 8 to 11 per cent, and the reduction from 9.4 to 13.8 per cent., which is in marked contrast to the results from fig. 8.

The results of analyses and tensile tests of samples taken at holes 1 and 2, fig. 10, from tires made from billets taken from long ingots, show practically no variation in composition and but little variation in ultimate strength, elongation and reduction of area. As a result of the writer's investigation, and other experiments, the Standard Steel Works have abandoned the use of short ingots for tires and are now using billets cut from ingots 5 1/2 ft. long of different diameters. The top of pipe end, where segregation occurs, is cut off and scrapped.

Interesting etchings illustrating the effects of segregation on tires were given in a paper by Mr. Godfrey W. Rhodes, Superintendent of Motive Power, Chicago, Burlington & Quincy Railroad, in a paper on Steel Tired Wheels and Their Fastenings, before the Western Railway Club, October, 1890. The mixture used for etching is three parts sulphuric acid, one part hydrochloric acid and nine parts of water.

The Block System on the New York Central.

BY A. T. DICER, Superintendent of Signals, New York Central & Hudson River R. R.

The interlocking and block signals as installed on the New York Central & Hudson River Railroad are now complete from New York to Buffalo, a distance of 440 miles, and thence to Suspension Bridge, 22 miles further. The mechanical interlocking is of the standard type,

as made by the Johnson Railroad Signal Co. and the Union Switch & Signal Co.* The electric lock and block work is of the most advanced type. It is commonly known as "The Improved Sykes." The only feature of the old Sykes that is retained is that the signal lever is controlled by the signalman in the adjoining tower, but the method of carrying this out is essentially different. In the old Sykes there is an electric lock on the lever, controlled or held in the locked position by a permanent (horse-shoe) magnet. Above the permanent is a pair of electromagnets. The operator in an adjoining tower, when asked to unlock by plunging (he can only plunge when his signal lever is at danger) closes a circuit which energizes the electromagnets, neutralizing the attraction of the permanent magnet, allowing the lock to drop free by gravity.

It will readily be seen that any foreign current, as a cross of line wires, lightning, etc., would perform the same office as a plunge. In practice this often occurred and managers lost confidence in the apparatus. In the system, as applied on this road, the lock is applied to the preliminary locking, and unlocking by gravity has been supplanted by the gravity lock, so that the lever is unlocked only when the proper combination is had and all connections are perfect. In any case of failure the lever remains locked.

The train is also made a factor by insulating a short section of track at each tower. After a train has once entered block A B it is impossible for B to unlock for another train, until the train which has entered the block has cleared it and B's signals have been restored to danger. A signalman can plunge but once until he has received an unlock and cleared his signal and restored it to danger. At interlocking towers, where we have a home and an advance signal, the lock is on the advance signal and the plunger on the home signal. We put a track circuit from the home to the advance signal, locking the home signal, so that when anything is standing between the home and the advance signal, it

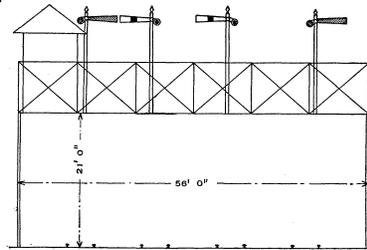


Fig. 2.—Signal Bridge, N. Y. C. & H. R. R. R.

is impossible to clear the home signal. This, with the addition of the automatic slots, or signal replacers, to be applied to the advance signals (as proposed by the signal companies), it was thought would thoroughly cover the ground.

But in the application of the slots great difficulty was encountered, on account of their fine adjustment. Moreover, in case of a failure of the slot, your advance signal may be at danger while the distant signal is clear; and the slot was, after patient experiments, condemned. We were then compelled to cover this point, and, as a matter of necessity, evolved the following to be accomplished either electrically or mechanically: Signals at interlockings can only be cleared in this order—home, advance, distant. You can then receive a train, and after it has passed your home signal you can restore that signal to danger and plunge for another train. You cannot again clear your home signal until the preceding train has passed your advance signal and it has been restored to danger. It is, of course, possible to clear either home or advance signal when the block is clear, but when it is desired to clear both it must be done in the order described.

This system is operated as an absolute system, and * From New York to Spuyten Duyvil block signals have been in operation for many years. From Spuyten Duyvil to Yonkers the apparatus was erected by the railroad company. From Yonkers to Foughkeepsie, 58 miles, the apparatus was put in by the Johnson company and the electric locks are Paternal's patent, described in the Railroad Gazette of May 26 last. A diagram of a part of this section of the road was printed in the Railroad Gazette of Jan. 15, 1892. From Foughkeepsie to the western terminus of the road the apparatus was all put up by the Union Switch & Signal Co.

trains are not permitted to pass signals at danger without a written order being given to the engine man. These orders are of two kinds. The clearance card (white) is used when the block has been reported clear, and it is impossible to clear the signals on account of electrical or other failure. The caution card (green) is used when no communication can be had between the towers, and when necessary to forward a train into a block not yet clear to assist a disabled train, etc. These cards are filled out by the signalman and given to engine men, and upon completion of the trip they are sent to the superintendent's office.

The signals that have been put in recently are provided with lamps having an 8-in. corrugated lens, using a globe on the burner. They are a great improvement on anything hitherto used. They are used only on high signals, the dwarf signals being fitted with 5-in. corrugated lenses.

The electrical control of outlying switches is accomplished by putting a derailing switch in the siding, and connecting the main track switch and the derail to one lever. The lever is placed in a small hut at the switch, and an electric lock, placed on it, is controlled by the man in the tower at the outgoing end of the section. Communication is had between the tower and the hut by a bell, using a simple code. The New York Central & Hudson River was the first road to adopt these locks.

To carry out this interlocking and block system on this road 1,633 levers were required, as follows: Hudson Division, 1,081; Mohawk Division, 278; Western Division, 274.

One hundred bridges for signals were used, and on sixty of these signal towers were placed. The design of these bridges was shown in the Railroad Gazette of May 13, 1892, and an outline sketch of one, on which a tower is supported, is shown herewith fig. 2. The illustration shows the signals as they appear to an engine man running east. The northernmost pair of tracks is used by the freight trains, which run "left handed," that is, the trains on the track at the extreme left run eastward. The south pair of tracks is used by the passenger trains, which run "right handed." The forty towers located on the ground are of four different sizes, varying according to the number of interlocking levers which they provide for. The signal bridge is about 9 ft. wide, and so braced as to have ample stiffness. Where there is no signal bridge the home signals are generally located 150 ft. beyond the tower.

In installing this system, an eight-conductor aerial cable was used between Albany and Buffalo, a distance of 301 miles. This is suspended about 12 ft. from the ground (on the Western Union telegraph poles, with an intermediate pole), and is supported by a No. 6 iron wire.

The plan of tracks printed herewith, fig. 1, shows the yard at East Buffalo, which is now being signaled and interlocked, the whole requiring 70 levers. This is the point where all freight is interchanged with the Lake Shore and the Michigan Central railroads, about 2,000 cars a day.

Balancing Slide Valves.

The following paper, by Mr. R. P. C. Sanderson, Division Superintendent of Motive Power, Norfolk & Western Railroad, was read at the September meeting of the Southern & Southwestern Railway Club at Atlanta, Ga.:

The question of balancing slide valves having been raised in conversation between Mr. Pulaski Leeds and myself, and as we were by no means satisfied with the old "rule of thumb" method of balancing slide valves on locomotives, I promised that I would take the time to work it out, and get a clear idea of what proportion of a slide valve should be balanced to obtain the best results.

I have constructed a diagram showing the total pressure on the valves of our consolidated and heavy passenger engines during each portion of the valve travel, supposing them to be entirely unbalanced. I hand you herewith a sketch showing the steam and exhaust ports, and the valve of a consolidation engine in its central position. Second, a sketch showing the steam and exhaust ports with the valve of a heavy passenger engine in its central position. Third, copies of three indicator diagrams, which I think can fairly be considered as typical. The first, for the steam distribution of a heavy freight engine pulling at slow speed. Second, for a heavy passenger engine pulling at moderate speed. Third, for high speed passenger service. Sketch No. 4 shows a Zenner diagram, which has been constructed to suit diagram No. 2. This diagram is not absolutely correct, as it does not take into account the interference to the movement of the valve caused by

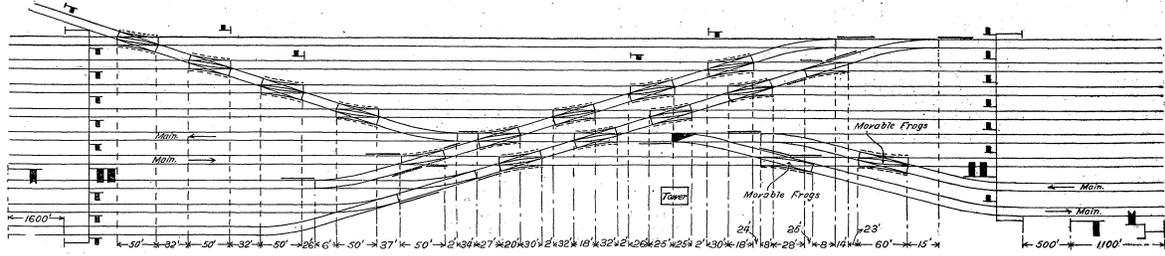


FIG. 1.—EAST END OF BUFFALO YARD.

New York Central & Hudson River Railroad.