



Digitized by Google

MAINTENANCE AND SIGNALING NOTES ON THE QUEEN & CRESCENT ROUTE.

The composition of this line is peculiar, since it involves three distinct railway companies, namely, the Cincinnati Southern, the Alabama Great Southern and the New Orleans & Northeastern. Of these, the last is owned and operated entirely independently from Meridian to New Orleans, while the two former are operated by the Cincinnati New Orleans & Texas Pacific Railway, which is merely an organization and leases the Cincinnati Southern, built and owned by the city of Cincinnati, while the Alabama Great Southern is operated under a contract with the owners.

The Cincinnati Southern is the busiest portion of the line and extends from the city of that name to Chattanooga, Tenn., a distance of 336 miles. With so little double track as to be a negligible quantity in the scheme of operation; with frequent curves of six degrees; with gradients reaching in many places 70 feet to the mile, nevertheless this line earned at the rate of more than \$20,000 per mile in the year ending on June 30, 1904. When it is stated that the speed of the trains is very high; that owing to the lightness of the bridges the important passenger trains are double headers, and that, nevertheless, the operating expenses average but about 73 per cent of the gross earnings, a question is aroused as to how this is possible. The answer is simple, and should be known by every railway operating officer in the United States:-Signals. Up to the year 1889 there were long periods when collisions occurred every day, and in one month of 30 days there is a record of 31 collisions. Yet to-day they are almost unheard of, although the traffic amounts to 30 trains each way every 24 hours (and in actual operation this amount often is exceeded); although trains run with remarkable regularity, wrecks are scarcely known and collisions have practically disappeared as a class of accident. The reason for this still is:-Signals.

Physical Characteristics.

The most difficult part of the line is the Chattanooga division, from Somerset southward to Chattanooga, a distance of 177 miles, which embraces nearly 40 per cent of curvature and $4\frac{1}{2}$ per cent of bridges and tunnels. On this 177 miles nearly 28 miles of passing track exist, and by this means only is it possible to handle the traffic. From an engineering standpoint, the line is magnificent, and except in very few cases the investigations which have been made to improve it—lessen the grades or reduce the curvature—have shown that few alterations, even at very great cost, would ameliorate the conditions. As one officer expressed it, "We always ran out, either against a mountain with a 2-mile tunnel, or a 500-foot precipice and a million dollar bridge."

To make such speed as is the rule on passenger trains, the attention devoted to maintenance of way must be very great, and the manner in which a train moving at the rate of 60 miles an hour enters and leaves a 6-degree curve is a sufficient demonstration of the effectiveness of the methods. Two of these are significant: All curves are spiraled according to the Searles formula, and the track is laid with Weber joints. Stone ballast prevails on the Cincinnati division, while on the Chattanooga division and on the Alabama Great Southern furnace slag derived from Birmingham is universal. It would be difficult to discover a more perfect riding track than is to be found on the line between Chattanooga and Birmingham, and this must not be taken as detracting from the quality of track north of Chattanooga, since that is of an unusually high character; but traffic there is very great and south of Chattanooga the traffic is comparatively light. The surprise exists in the fact that, with so light a traffic, the line and surface, instead of being pretty good, could be improved upon scarcely, if at all.

Although, as a whole, the Chattanooga division from Somerset southward is the most difficult, there is a rather broken country south of Lexington, where the line winds in and out through the mountains and crosses several great

bridges, among which is that over the Kentucky River, which for many years ranked as the highest in the world. North of Lexington the line is through a rolling country, much of it contained in the beautiful blue grass region. In the vicinity of Cincinnati and for some distance southward the surface geologically is almost wholly argillaceous, which, owing to its instability, is the source of much trouble. On fills of any magnitude it has been found necessary to drive a line of piles about three-fourths of the distance down the bank, and although this seems to be effective in most cases, instances are observable where even the piles show signs of failure. It is because of this unstable material that so many long and high bridges exist which otherwise would have been filled up and obliterated many years ago. This, again, accounts for the use of double headers as the only effective means of securing a heavy tractive effort, since the bridges are nearly 30 years old, and although of a high standard for the period of their construction are now too light for the most modern types of locomotives.

Many interesting practices are to be found along the Queen & Crescent route, and among these is the clear and unmistakable way in which the right of way is delimited: Large cedar fence posts, painted white, mark every change in direction. This is attributed to the ex-president of the line, Mr. S. M. Felton, Jr., and it is said, also, that where the right of way was uncertain through the southern portion, he fixed the width arbitrarily at 100 feet and the center line of the track as the center line of the right of way, without regard to anything but existing conditions. There is some humor in this, but it is not so arbitrary as first appears, since where this practice was followed the land is almost uninhabitable for anything but "razor backs" and worthless for any purpose other than a right of way.

Signaling.

No attempt will be made to describe the signaling methods in detail, and it is therefore sufficient to say that the line is continuously controlled by block signals from the southern side of the Ohio River to Chattanooga. Interspersed are various interlocking plants, among which are several electric installations erected by the General Railway Signal Company. The block signals constitute literally and figuratively a history of the automatic form, beginning with the ancient but honorable clockwork, passing through the enclosed disc type, and finally reaching the purely electric and the electrogas semaphores as the present standards. It is interesting and comforting to those who were enthusiastic for the clockwork signal some 20 years ago that no signal of whatever character has a more splendid record than this obsolete form. It is working under the same inspection and conditions as are the later forms, and, at small cost for maintenance compared with even the enclosed disc, is performing satisfactory service after nearly 20 years of faithful work.

Because of the difficult line and the immense expense involved in construction, there are several short pieces of single track interposed between other short pieces of double track, and here the staff system is used. This was very fully described in The Railway Age of March 18, 1904, and no further reference is necessary here. A peculiar arrangement exists in the neighborhood of Harriman Junction, where the double track merges into single track through tunnels 25 and 26, and again over the Emory River bridge. At all four of the resulting junction points, 24-foot switches and No. 18 frogs are used, and the traffic over the single track is controlled by automatic block signals, absolutely irrespective of train rights and entirely without train orders; in other words, first come, first served. A singular condition obtains here in the fact that on one part of the double track trains are run righthanded, while on the other portion they are run lefthanded. This is due to the heavy grade from Emory River to Emory Gap, where the southbound double track swings outside of tunnel No. 27, which is not only very difficult to maintain and on a sharp curve, but is the heaviest part of the grade. Since the tonnage is principally southbound,







trains are run around the tunnel, while northbound trains are able to drift through the tunnel without danger of stalling. An inspection of the types and locations of signals at and near Harriman Junction, as shown in one of the illustrations accompanying this article, will make clear the ingenious arrangements which obtain at this point.

On the Cincinnati division, the arrangement of signals approximates as nearly as possible to the ideal one desired by the operating department, and its efficiency falls very little below the theoretical perfection which follows the physical peculiarities of the line. On the Chattanooga division, however, this state of affairs is not yet approached, although the plans are perfected and every change made in the location of a signal is toward the final end. The reason for the inferiority for the arrangement on the Chattanooga division arises from the fact that the first considerable installations of automatic block signals were for the protection of trains at isolated points, such as tunnels and sharp curves at the bottom of heavy gradients. Gradually these gaps have been filled in, with results which are less perfect than would have been the case had the line been studied as a whole from the beginning.

Reverting again to the southernmost end of the double track south of Emory Gap: Here the automatic signals are used both for blocking trains and for showing the position of the switches. All of these signals are controlled by track circuits and by circuit controllers, which latter are attached to a facing point lock lever, so that signals cannot resume a proceed position until the switch is set and locked for the desired route, and also until the track on the block in advance is clear. This reduces the number of interlocking levers at this place, and is an illustration of how necessity becomes the mother of invention. There was here a surplus of material of various kinds which had been taken out of service at another place, and by relocating some of the automatic signals the use of the small existing interlocking machine was possible without the purchase of any new material.

No distant switch signals are used between Cincinnati and Chattanooga, because the block signaling arrangements are complete and all block signals are electrically connected with every switch which concerns them. On difficult or dangerous parts of the line, where watchmen are maintained, plugs governing the signal circuits are placed in each watchman's shanty for use in case the track should be obstructed by falling rock or a slide. This has proved of great value in many instances. The signals themselves are of the motor type styles "B" and "C" of the Union Switch & Signal Company, while the power is derived from batteries furnished by the Electric Storage Battery Company of Philadelphia. All circuits are polarized, with no line wires, and the maintenance of the system is therefore reduced to its simplest form.

South of Chattanooga, on the Alabama Great Southern, there are no automatic signals, but here all switches are protected by distant signals, which are interlocked with the switchstands. A very clear form of target is used, with a rather high target rod and targets, with the blades placed in planes which are at right angles to each other.

A letter signed "A" appeared in the Railway Age on March 3, and while asking some questions concerning the operations of these signals, animadverted rather strongly upon some mistaken premises. It is not possible here to correct all of the misconceptions or to answer all of the questions, but Mr. W. A. D. Short, superintendent signals of the Queen & Crescent route, undoubtedly will be happy to relieve "A" of his remaining doubts. Certainly and without qualification, if "A" has a serious purpose and is not a purely academic inquirer, an inspection of the line under actual conditions of operation will clear many of his uncertainties and give him an entirely new idea as to safe single track operations. Usually, the most difficult person to convert from an adherence to ancient train dispatching methods is the train dispatcher, whose whole education and experience have been gained under that system, but there are no more enthusiastic advocates of the methods adopted on the Cincinnati Southern than the train dispatchers themselves. A 31 order is given only to the superior train, and 19 orders are given merely for the guidance of trains, which are run often three minutes apart; two fast trains on one portion of the line, although scheduled 10 minutes apart, are usually not much more than four minutes apart.

It is not an exaggeration to say that, for safety of method combined with simplicity of operation, the 336 miles from Cincinnati to Chattanooga is not equaled or even approached on any other railway in the United States and probably not in the world. It is an object lesson for those who wish to know, as well as for those who ought to know, what can and should be accomplished upon the railways of the United States toward securing the safety of their trains.

RAILWAY BOOKKEEPING IN DIFFERENT COUNTRIES.*

BY CHEVALIER AUGUSTE VON LOEHR, AUDIT-CHIEF, KAISER FERDINANDS NORDBAHN.

The question which this report discusses reads: "Bookkeeping generally; description of the different existing systems; comparison from the double point of view of efficiency and economy: the question of adopting one uniform system on the different rallways." The same writer, reporting on a similar subject at the sixth session of the International Railway Congress at Paris, in 1900, stated that no satisfactory results could be achieved in connection with bookkeeping and accountancy questions by the usual method of sending a list of questions to the different railway managements, and he therefore adopted the plan of sending a description of the system in use on one road to serve as a model for the answers. Few replies, however, were received, and the revorter continues:

however, were received, and the revorter continues: "The limited amount of information I have received has confirmed the conviction I already expressed in my report to the sixth session, that it would be quite futile to look for a system of accounts which would be generally applicable to all countries and under all conditions; for any system must always be in intimate relation with the laws, the concessions, the finance and the tariffs, that is to say with conditions which differ radically in the case of every country and every management, which vary according to whether the railway is owned by the state or by a company, and which even depend on the habits and customs of the different people. Consequently there can be no question of uniformity, except as far as a few general principles are concerned. It is just as impossible to take a system which has given excellent results in some countries, and apply it in its entirety to another set of conditions; for once it is detached from its basis, from its interconnection with the other services, and transplanted to a foreign soil, it loses all its coherence, even its meaning and its efficacy." From the information received the reporter finds it to be the

From the information received the reporter finds it to be the general rule that bookkeeping is strictly divided into two sections. the expenditures and the receipts, each looked after by the head of a different department. This separation is considered necessary on account of the essentially different nature of the two branches, but a wide difference in methods is found, and the question is raised whether it would not be advisable to have one office or department in connection with the general management to deal with all the accounts.

counts. It will no doubt be generally admitted that (every allowance being made for the differences due to the special conditions of each individual management) only a very limited number of the possible systems can be looked upon as being suitable and correct. As a rule, in the case of smaller concerns, the complete centralization of all the business in connection with the accounts, in one office, is to be recommended; whereas, it would in the case of the larger railways be advisable to adopt a certain decentralization, which is however really unavoidable, were it only on account of the greater extent of the railway system; but such subdivision should by judicious arrangements be limited to a strict minimum and should only apply to the really local business of these district offices. In the head offices, however, even in the case of the larger railways systems, all the operations in connection with the accounts should be vigorously centralized in one large independent department. Only in this way proper carrying on of business. On the continent of Europe the greatest centralization is to be

On the continent of Europe the greatest centralization is to be found in the case of the Kalser Ferdinands-Nordbahn at Vienna. There everything in connection with the accounts is dealt with by one separate independent department, which is responsible to the general manager only. This department not only attends to the audit proper (checking and classifying, charging), but also makes up the monthly accounts; it consists of two principal sections, one for expenditure and one for revenue, which again are each divided into a number of subsidiary offices. A great contrast to this system is to be found, for instance, in the organization adopted on the Vienna-Aspang Rallway (Austria). In this case the audit of the different departments is attended to by the departments which the vouchers concern. Be-

*Abstract of a report to be presented at the seventh session of the International Railway Congress to be held in Washington in Max, 1905, and published in the Bulletin of the congress, February, 1905.