

A. C. Track Circuits on the Norfolk & Western

Describing the Recent Single Track Alternating Current Signaling Installation Through Elkhorn Tunnel

By J. A. BEODDY,

General Signal Inspector, Norfolk & Western

The Norfolk & Western Railway placed in service on July 17, 1912, an installation of A. C. track circuits at Elkhorn Tunnel, W. Va., to overcome the efforts of foreign current in the D. C. track circuits, which had become very troublesome at this point.

This is a single-track tunnel 3,250 ft. long. It is on a two per cent grade, which extends from a point about 400 ft.

their first installation by gravity batteries. When it was put in the tunnel circuit could be operated by three cells of gravity battery in multiple. Since then the coal operators near-by have been gradually installing electric apparatus for handling their mine cars, and serious foreign current troubles have been encountered as a result of the proximity of this electric power. These were first overcome by using more

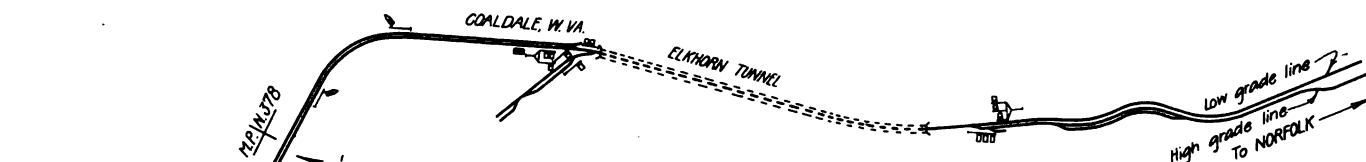


Fig. 1. Showing the Location of the Signals and the Tunnel.

east of the tunnel, four miles west. From this same point eastward are two lines, the old main line, on which the grade is two per cent and the low-grade line, which has a grade of one per cent. The double track from the west extends to the mouth of the tunnel and the two lines east are

battery and higher resistance relays and finally by dividing the circuit and placing the batteries in the center of the tunnel. Clearing relays were tried, but these soon became so corroded by the gases from passing engines that they became inoperative and had to be discontinued. Finally, it

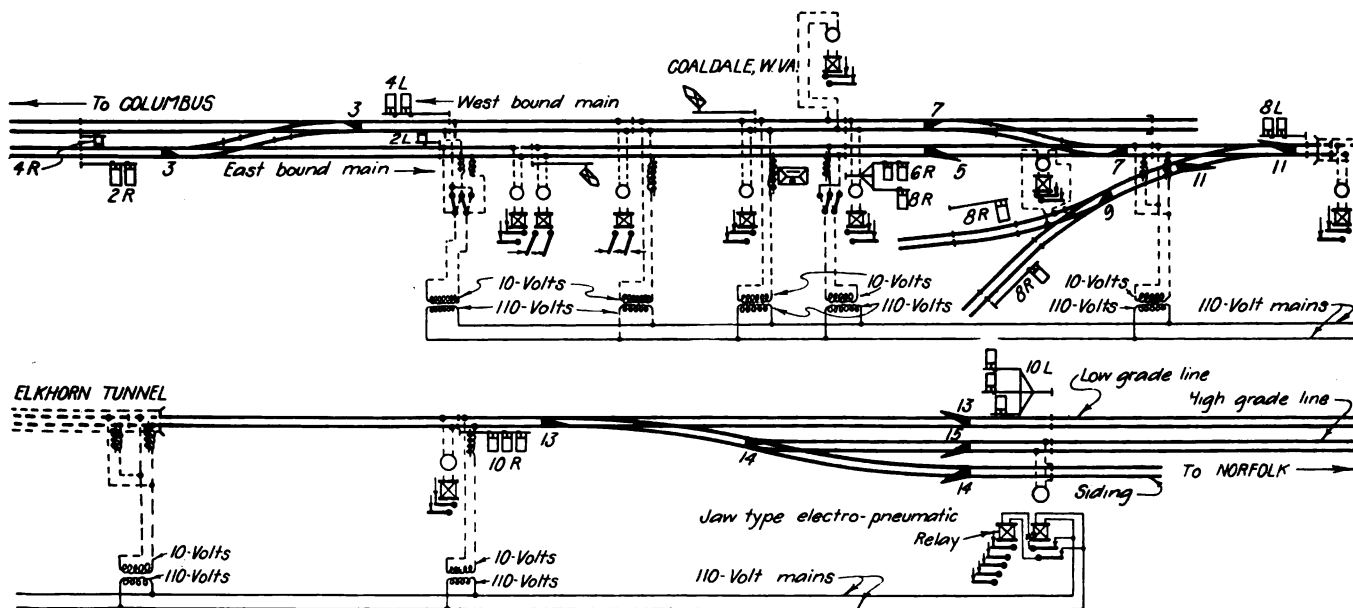


Fig. 2. The Track Circuit Diagram for the Section of Track Shown in Fig. 1.

operated as double track, except in emergencies, although they are provided with single-track automatic signals. These two lines converge at Bluestone Junction, about two miles east of the tunnel, from which point double track is used.

On account of the poor circulation of air in the tunnel, and the fact that east-bound trains cannot move very fast and must work full power, fans are used to blow the smoke ahead of them. The switches and signals are operated by a 17-lever electro-pneumatic interlocking machine, which was first installed in 1902 and remodeled in 1909. The main air line for the operation of the switches and signals on the east side of the tunnel is run on the wall through the tunnel, while the cables carrying the operating wires are carried on the pole line across the mountain.

The track circuits at this point have been handled since

became necessary to install A. C. track circuits to obviate these troubles.

There are 17 electro-pneumatic signals in this installation, controlled from the interlocking, and two 110-volt A. C. electric signals controlled automatically. These are placed between the home signals at the tunnel and the crossover between the main lines, which is 5,300 ft. west of the home signals. The east-bound automatic signal is placed in this position to prevent stopping an east-bound train at the crossover when another train is standing at the tunnel waiting for west-bound traffic to clear the tunnel, which is very frequently the case.

The two-arm signal No. 8L, at the west end of the tunnel, on account of the difficulty in seeing it, encountered by enginemen coming through the tunnel, is not controlled by

the track circuits, and is used only as a shifting signal into the Coaldale Coal & Coke Company's operation. The west-bound automatic signal is placed about 800 ft. from the west portal of the tunnel and the control of signal 10L at the east end is carried to it and through an overlap 1,500 ft. beyond.

The crossover west of the tunnel was not included in the original installation, but was connected up when the plant was remodeled. At that time it was only 2,400 ft. from the tunnel signals. However, in 1911 it was removed to its present location, and it became necessary to place the automatic signals between it and the home signals to shorten the blocks for east-bound trains and give better protection to west-bound trains.

All of the electro-pneumatic signals are of the two-position, lower quadrant type, and the two electric signals are three-position, upper quadrant.

Power for the A. C. apparatus is generated by two 6 in. x 6 in. Giles steam engines, direct connected to 10 K. V. A., 12-pole, 600 R. P. M., 125-volt, 60-cycle, single-phase alternators with belted exciters using steam at 100-lb. pressure from the same boilers which supply power to operate the tunnel fans. These are duplicate sets, one being used to supply the power and the other for use when repairs are necessary, or in case of emergency.

A two-panel switchboard is provided, one panel for each generator, each being supplied with an A. C. voltmeter and ammeter, and a D. C. ammeter for the exciter, and an 80-ampere overload circuit breaker. Both exciter and generator rheostats are mounted on the back of the board, and lamps and connections are provided for synchronizing the machine. The panels are of black enameled slate 1½ in. thick, and mounted on iron pipe frames. There are three 250-volt, 100-ampere, D. P. S. T. feeder switches on each panel.

The power is generated at 115-volts and supplied to both east and west ends of the plant by two lines of No. 6 B. & S. hard-drawn weatherproof copper wire, strung on the telegraph department's pole line. The transformer in the tunnel is supplied by two No. 12 B. & S. rubber-covered copper wires run in iron-armored conduit, supported on the wall of the tunnel by iron brackets. Current for lighting the boiler and engine rooms and interlocking tower and for charging the interlocking battery through a 30-ampere mercury arc rectifier is taken from these mains.

The transformers for supplying track circuits are one K. V. A. capacity, 110-volts primary, and having taps on the secondary for 6, 8, 10, 12 and 15 volts. They are connected to the supply mains through single-pole insulator type porcelain cutouts. Leads are taken from the secondaries through double-pole knife switches and reactance coils to the track circuits.

Track relays are of the galvanometer type, working in two positions, except the two controlling the automatic signals, which are three-position. Line relays are of the vane type, wound for 110-volt operation. On the indicator circuit at the east end of the tunnel where more contacts are necessary than are provided in the ordinary relay on account of the two lines of single-track automatic signals which start at this point, there is a jaw-type electro-pneumatic relay having eight front and seven back contacts. This relay is operated by 110-volt current taken from the supply mains through the contacts on the track relays and no other circuits are controlled directly by this track relay.

The two 110-volt electric signals are the U. S. & S. Company's Style "S," operated by induction motors. All signals on the installation are lighted by 10-watt, 110-volt carbon filament lamps, connected directly to the supply mains.

The A. C. track circuits have given excellent service since their installation and are bound to work very satisfactorily under circuit conditions which would have rendered D. C. circuits inoperative.

NEW HAVEN OFFICERS' SALUTATORY.*

On September 2, 1913, Howard Elliott, one of the signers of this statement, arrived in New Haven after thirty-three years' service with the Chicago, Burlington & Quincy and Northern Pacific roads. On the same day J. H. Hustis, the other signer of this statement, arrived after thirty-five years' service with the New York Central and Boston & Albany roads.

We have both come into the management of the New Haven road to work with and alongside of you.

We have no purpose except to maintain, operate and improve the property so that it may do its work with safety to you and the traveling public, and with efficiency and economy for the shippers and owners.

We hope to make our service for this company our life work.

To-day we are all involved in this awful casualty, and the men, as well as the management, and the public, are in great distress over it.

Terrible as it is, we must face it with courage, keep our heads, and do our duty.

We are fellow employees—our duties and responsibilities only varying in degree. Each one of us has a great responsibility to the public, to his fellow employees and to the thousands of owners of securities. We need your help, and we wish to help you. Each must help the other if this railroad is to be run safely.

The work of the great army of employees is most important, because you are engaged in the detailed work of maintaining the road and in operating trains under the rules and regulations laid down by the public authorities and by the management.

Upon the officers there is imposed by law the duty to adopt and enforce every reasonable rule and practice which experience has shown will help to protect life and preserve property. This is a duty that cannot be shirked, and the management must perform it with firmness and without hesitation.

No railroad can obtain safe operation that does not have the earnest and loyal support of its men in all reasonable efforts to protect and perform the service. There is no question of your loyalty. This loyalty can now be shown in no more practical way than by observing the existing rules and by adopting and accepting cordially any further rules and regulations that make for safety.

It is urged that all employees read and re-read the rules in the timetables and in the books governing the operation of stations, trains, yards, signals, shops, tracks, inspection and care of equipment, in fact everything pertaining to operation, and that they confer with one another and with the officers as to the best means of promoting safety.

Take the case of the accident on the morning of September 2. The public will discuss, and properly so, improved signals and stronger equipment, both of which are necessary and desirable as a help in preventing or lessening the horrors of an accident of this kind.

This accident should not, however, and would not have occurred had the rules of the railroad been observed strictly, and good judgment, born of experience, been displayed. The men on the colliding trains were all of sufficient intelligence and experience to understand their duties and were of good habits so far as is known. Certainly their appearance indicated that to be the case. It is believed they are men of sincere purpose and high character, as are the great body of men in engine and train service—men who would not intentionally do a wrong and who take a pride in their work. They all had proper rest, or had been given opportunity for taking it, and were familiar with the piece of road over which they were running. The airbrakes and the signals performed their functions. The conditions of that morning had been duplicated many times before, and there was nothing unusual about it, except that a heavy holiday business was

*This document, which explains itself, was issued by Messrs. Howard Elliott and J. H. Hustis, president and vice-president of the New York, New Haven & Hartford, on September 6, four days after the disastrous collision at North Haven. Being in some respects of unique character it is reprinted here in full.—Editor.