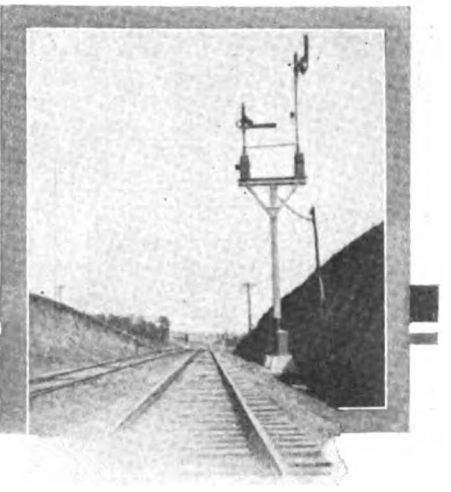
A. C. Signals on the N. & W.

West End of Passing Siding on Belt Line



East End of Passing Siding on Belt Line

Automatics on Two Single-Track Lines Between Burkeville, Va., and Pamplin and Two Electric Plants

By J. A. Beoddy,
General Signal Inspector

THE Norfolk & Western completed during the summer of 1916 the installation of a. c. automatic signals on its two single-track lines between Burkeville, Va., and Pamplin, also a. c. electric interlocking plants at the junctions at these points. All passenger and westbound freight trains are operated over the old line, 36 miles long. On a part of this line the grade eastbound is very heavy, requiring pusher service for freight trains so that the heavy eastbound coal traffic is all handled over the new line which has a maximum grade of 0.1 per cent eastbound. This new line, 37 miles long, was completed early in 1916, and is remarkable for its easy grades in a rather heavy country and the fact that there are no bridges in the entire distance. It is used almost entirely for eastbound traffic, but is signaled for both directions and may be used for other traffic at the discretion of the dispatcher.

There are seven passing sidings on the old line and four on the new. Of these, two on the old and all on the new are double sidings, capable of holding two 100-car trains and having crossovers at the center to give free movement in both directions. At the end of each passing siding, a bracket signal having a high doll for the main line and a low doll for the siding movement is located at the fouling point and a single-arm signal for traffic in the opposite direction is located from 50 to 150 ft. from the switch point. At double length sidings with crossovers in the center a single-arm signal is located at the fouling point of the crossover.

Between sidings, east and westbound signals are located together whenever possible, but when the alinement of the track makes it necessary, they are staggered sufficiently to give the engineman the best and longest view possible. There are in all 17 double and 3 staggered locations on the old line, all on the new line being double. The blocks between passing sidings are approximately 4,500 ft. long, but none are over 4,800 ft., it being thought best to shorten them to 4,000 ft. rather than to go over this length. Altogether there are 16 bracket and 60 one-arm signals on the old line and 8 bracket and 76 one-arm signals on the new, not including any of the signals at the interlocking plants.

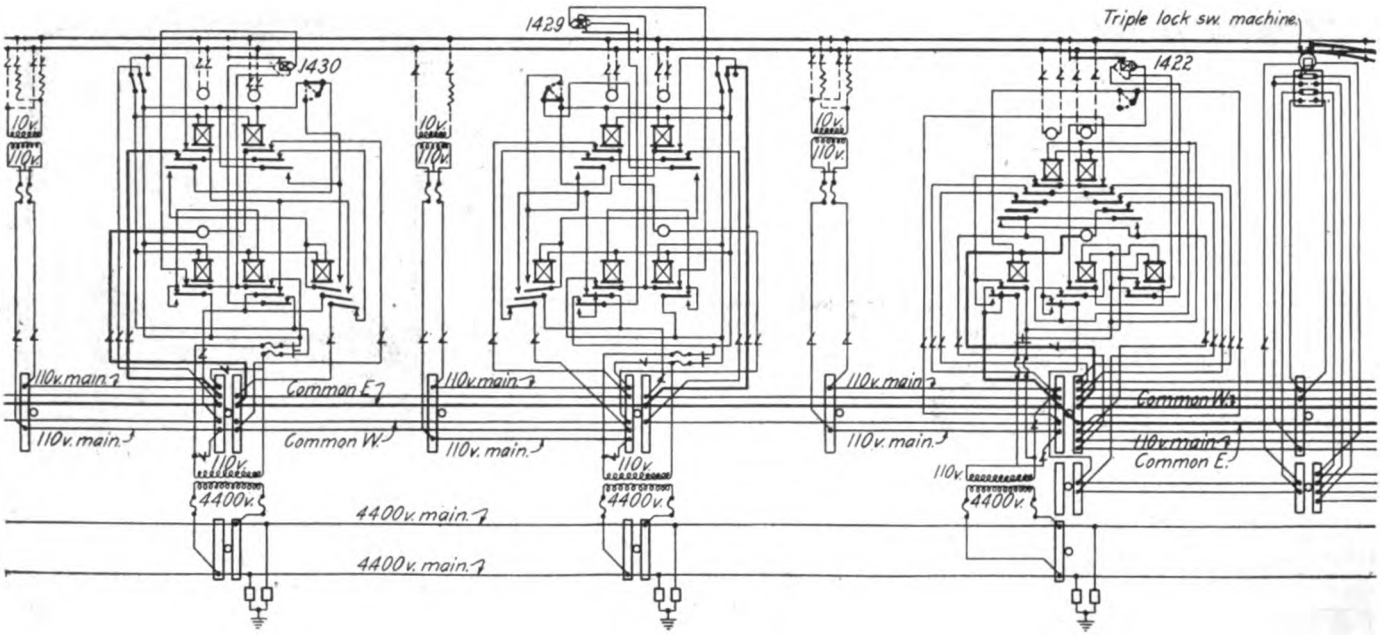
The signals are U. S. & S. style S., three-position, upper-quadrant, 110-volt, 25-cycle, single-phase a. c. and all relays, track transformers, switch indicators, etc., are of the same manufacture. Model 15 polyphase vane type relays having local coils wound for 110 volts and track coils for 0.4 volt are used on all track circuits. Model 15 polyphase vane type, three-position relays having both local coils and line coils wound for 110 volts are used for the polarized line circuits. On line circuits requiring only a two-position relay the single-phase vane type is used.

Track transformers are of 100 v.a. capacity and feed the circuits through 3-ohm resistance units, most of the transformers supplying two circuits. The rails are 100 lb. section, bonded with two No. 6 B. & S. copper-clad wires per joint, and fitted with six-hole Keystone insulating joints. Connections from the rails to track transformer and relays are No. 9 B. & S. stranded rubber-covered wire. All line circuits, track transformers and track relays are protected by G. E. vacuum lightning arresters.

Power for these signals is secured from the signal generating sets at Crewe, a division terminal about 5 miles east of Burkeville. These sets also supply current for the double-track signals between Jack and Burkeville, about 46 miles, and from Pamplin to Evergreen, 8 miles west of the single-track territory They consist of two 175-kv.a., 4,400-volt, 25-cycle, single-phase Westinghouse generators direct connected to Fleming Harrisburg 200-hp., 300-r.p.m. steam engines with exciters mounted on the generator shafts. Steam for the operation of these sets is taken from the shop boilers to which one 200-hp. unit was added when the machines were installed.

The switchboard consists of three panels of blue Vermont marble, one for each generator and an extra one for necessary switches for the belt line feeder circuit. A synchronism indicator is used and ground detectors provided for each feeder circuit so that a grounded circuit may be quickly located. There are three feeder circuits leaving the power house, one for the double-track signals east of Crewe, one for the belt line signals, and one for the double-track signals between Crewe and Burkeville, the single-track signals on the old line and the double-track signals west of Pamplin. Oil switches are provided so that these latter signals may also be fed from the belt line transmission line.

Switches are provided on the switchboard for feeding any circuit from either generator, but normally one generator only is operated, the other being held for emergencies. Each feeder circuit consists of two No. 2 B. & S. hard drawn solid copper wires run on 5,000-volt glass insulators on the railway company's pole line. The signal control wires and the company's telephone wires are also carried on these poles.

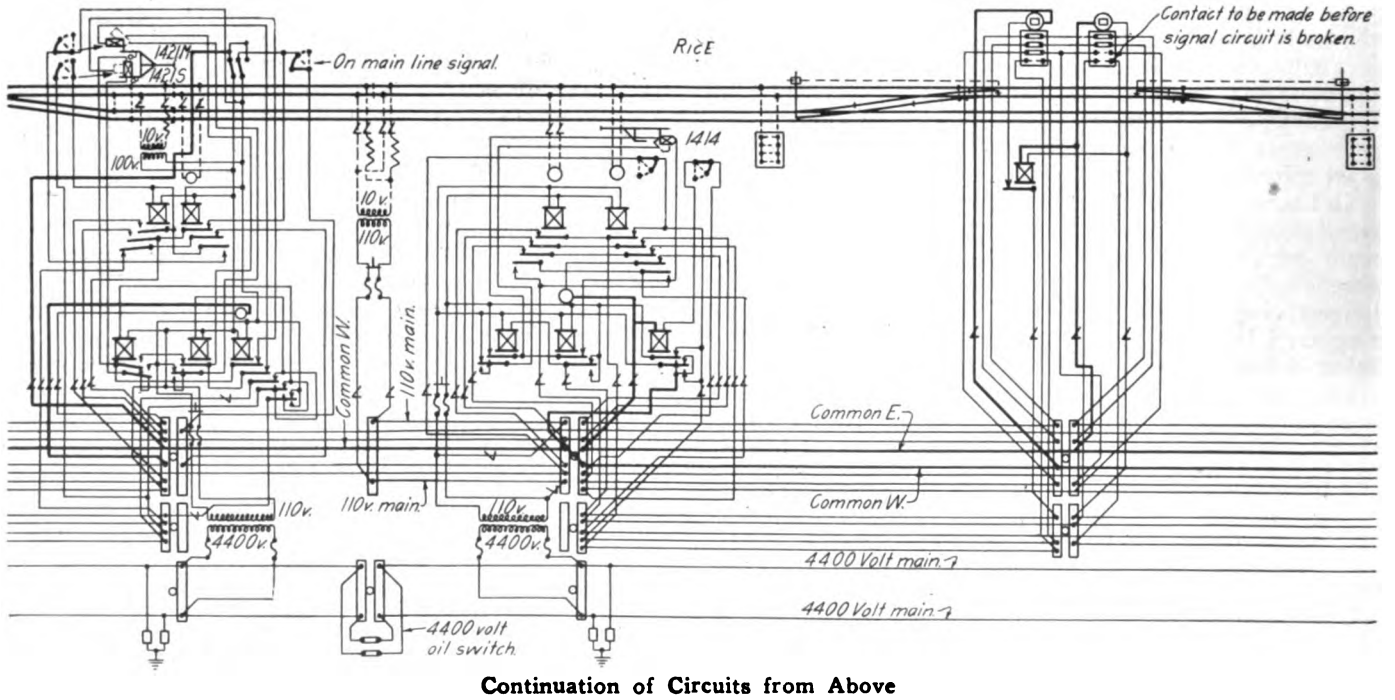


Typical Single-Track Automatic Signal Circuits

At every fourth mile post on the old line and at the end of each passing siding on the new line the transmission line is broken on strain insulators and passed through a double-pole hand-operated oil switch on the pole. A telephone connected to the dispatcher's circuit, which is also connected with the power house, is located at each of these points, so that in case of trouble on the transmission line, the maintainer may cut the current off as near to it as possible. Trouble may be quickly located by the maintainer by opening these switches and communicating with the power house by telephone. The signal control wires are No. 10 B. & S. weatherproof copper-clad and are run on cross-arms two gains below the high tension line. A 1-kv.a. G. E. type H, 4,400-110-volt transformer is used at each signal location. Primary taps are made through 6,600-volt cutouts having expulsion fuse holders, and two 4,400-volt graded shunt resistance multigap lightning arresters are installed at each transformer, placed on the opposite side of the pole from the transformer, and connected directly to the high tension line.

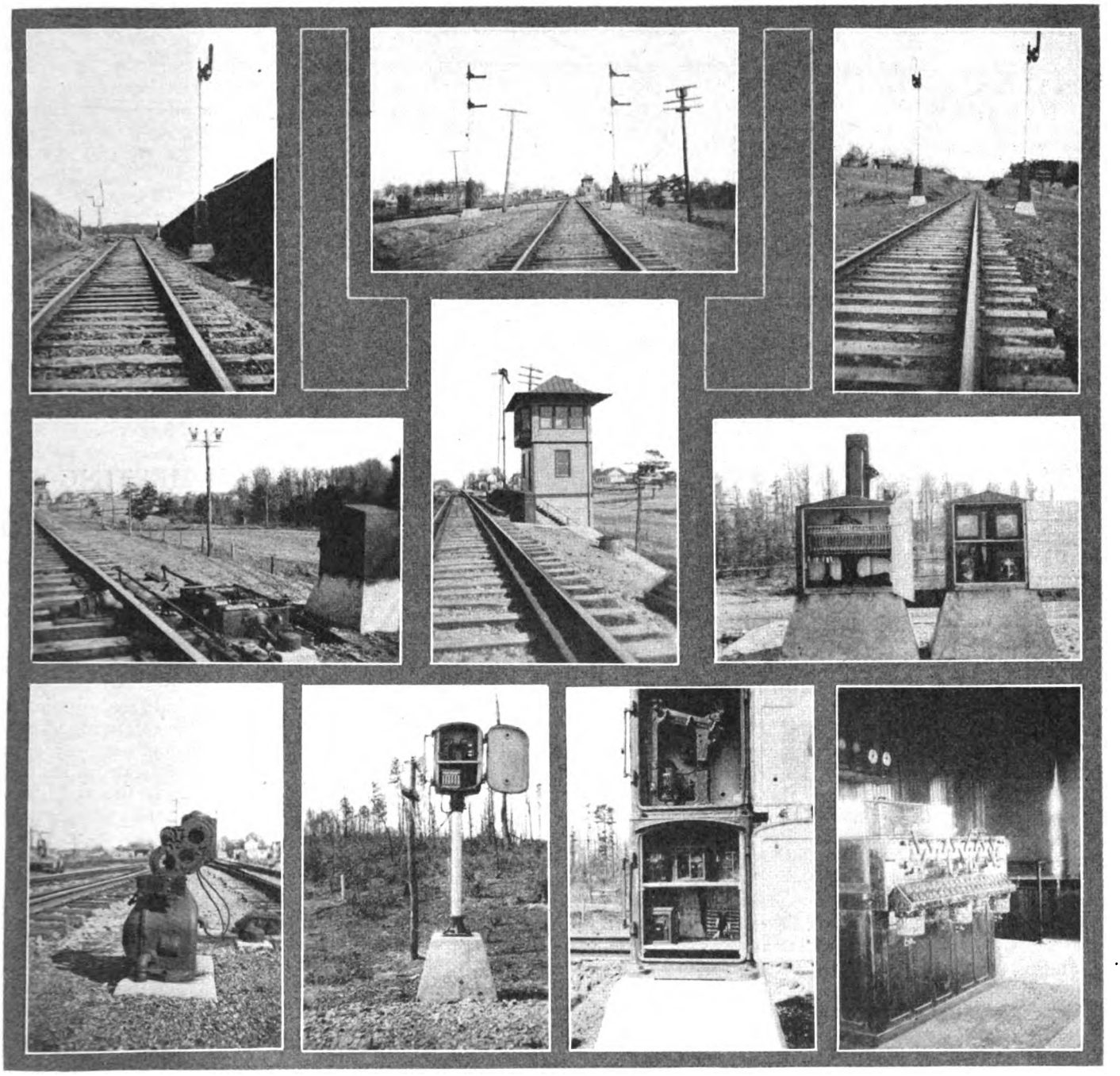
Wires between the pole line and signals or relay boxes are run in cable rings on a 5/16 in. messenger wire where the signal or relay box is on the same side of the track as the pole line. When the signal is on the opposite side of the track, the wires are run in fiber conduit. All track wires are run in fiber conduit and are brought out of it through a cast iron bootleg set in concrete, and soldered to a short piece of copper bond wire, which is bonded to the rail at both ends. All track wires are No. 9 stranded copper.

The signals are lighted by 110-volt, 10-watt carbon filament lamps. Two bulbs are used in each lamp, one of which is lighted at a time, with a relay to automatically cut in the second in case of a failure of the first. The circuit to the lamps is connected to the transformer secondary through a switch independently of the signal circuits so that the blowing of a fuse due to trouble



Continuation of Circuits from Above

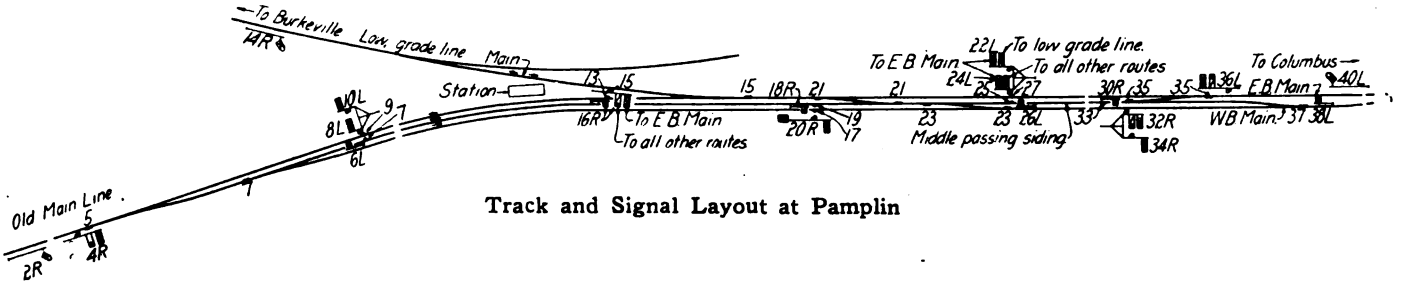
on the signal circuits will not cause a lamp failure. The signal circuits are taken from the secondaries of the line transformers through d.p.d.t. fused knife switches to a terminal strip made of R. S. A. porcelain terminals. Where track circuit feeds are necessary between signals, the track transformers are housed in cast iron relay boxes and 110-volt current for their operation is brought to them on line wires run to the nearest line transformer.



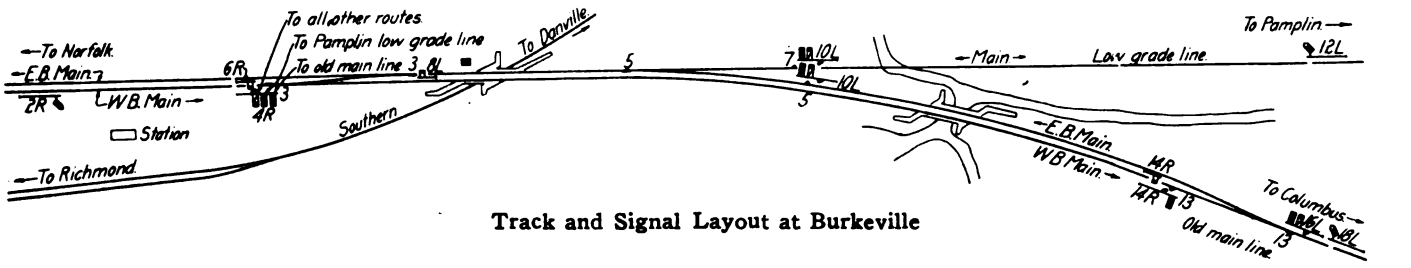
Pull-in Signal
One of the Switch Mechanisms
Dwarf Signal at the Burkeville Plant
Looking East at Burkeville Plant
The Burkeville Tower
Track Circuit Feed at Cut Section
Typical Double Location
Two of the Terminal Boxes
Automatic Signal Mechanism Case
The Burkeville Interlocking Machine

The circuits follow the T. D. B. system of the U. S. & S. Company with some modifications for special conditions. At passing sidings the westbound pull-in-signal is controlled by a conditional overlap beyond the eastbound signal which is effective for opposing but not for following trains. The distant indication of the first signal in the rear of the pull-in signal is controlled by both the pull-in signal and the main line bracket signal at the opposite end of the passing siding, which prevents, in certain cases, a train getting a stop signal without first having received a caution. At sidings having signals in the center, it is necessary to use the conditional overlap for both the westbound pull-in signal and the signal at the crossover in the center.

The bracket signals at the end of the sidings are "stop and stay" signals, all others "stop and proceed," the reason for this being that a train will always be held at a passing siding by one moving in the opposite direction, but for following movements it is only necessary to use the same precaution as in double-track signaling. A telephone connected to the dispatcher's line is installed at each end of each passing siding so that a train crew



Track and Signal Layout at Pamplin



Track and Signal Layout at Burkeville

stopped may receive instructions with as little delay as possible. The switches at the ends of passing sidings and crossover switches in sidings are equipped with triple-lock switch machines, the siding switch of crossovers being bolt-locked with the main line switch, so that the main line switch must be thrown first by the crew of a train leaving the siding.

The interlocking plants at Burkeville and Pamplin are the U. S. & S. type F equipped for 25-cycle, 110-volt a. c. operation. The towers are frame with tile roofs and have bay windows next to the track. They are built on concrete foundations and have a basement which is equipped for a maintainer's work shop and contains the hot water heating plant. The lower floor of each tower has an office for the maintainer and terminal closet and cabinet for the necessary relays. The second floor is reached by a spiral iron stairway on the inside of the building.

The machine at Burkeville contains 15 working levers, 2 spare levers, and 2 spare spaces. The one at Pamplin contains 33 working and 10 spare levers and controls the switches at the junction with the new line, the end of double track on the old and the ends of the middle passing siding.

Tower indicators are the disappearing disc type operated by vane type mechanisms and have four front and two back contacts. Clockwork time releases are used in connection with the locking circuits. All high speed movements are provided with approach, detector and route locking. The SS system of switch indication and signal control is used, all selecting of signals being done in the machine and the common wires from the signals being brought back through circuit controllers on the signal levers. Model 15, polyphase vane type relays are used for switch indication. These are controlled over independent circuits fed by a 1 to 1 transformer at the switch.

A 1-kv.a. or 3-kv.a transformer, depending on the number of units supplied, is used at each group of switches and signals that are near enough to be supplied by it without excessive drop in voltage. These are connected directly to the high-tension line in the same manner as the automatic signal transformers. Besides the local circuits for the switches and signals, the signal locking and tower indicator circuits and the signal lamps are fed from these transformers.

Switches and derails are operated by Model 13 switch movements and detector bars are used in addition to the detector circuits. The dwarf signals used are the slot arm type operating from the 0 to 45-deg. position. The dwarf signals and all the high signals, both on the automatic territory and at the interlocking plants, are equipped with enameled steel semaphore blades.

The same methods of construction are used at the interlockings as on the automatic signals. Control and indication wires are run in cable on the pole line to terminal boxes at the various groups of switches and signals and from these terminal boxes the wires are run in fiber conduit to the switch movements, relay boxes, signals, etc. All of the wires and cables used are Kerite. The installation was made by company forces.

THE R. S. A. STATED MEETING

THE June stated meeting of the Railway Signal Association will be held in the Hotel McAlpin, New York City, on June 12 and 13, as announced in the April issue of the *Railway Signal Engineer*. It is too early to make a complete announcement of the committee reports which will be discussed at this meeting, but the following had been received up to a few days ago.

Committee I will submit inquiries on several subjects assigned, asking that these be turned over to the various other associations which have committees appointed on the same subjects. These include the following: Report on progress and developments in highway crossing signals; report on requisites for switch indicators, including method of conveying information as to the condition of the block to the conductor or engineman; report on the desirability of having an overlap in automatic signaling, if so, is it best to have two stop indications between trains or two caution indications instead, or the latter in special cases only, such as downgrade tracks; and report on automatic train control.

Committee III will have reports on revised specifications for petroleum asphaltum, and requisites for first-range voltage electric interlocking. Committee VI will present several standards. Committee VII will report on minimum allowances of resistance between relays and track battery. Committee VIII will report on specifications for impedance bonds for electric alternators, for switchboard-power for a. c. signal system, for reactors, for resistors and for transformers, and general clauses to be used in unit specifications.

Committee X will present the matter submitted at the March meeting which was not discussed for want of time and representation from the committee. The special committee on Signaling Requirements of Electric Railways will present a progress report, presenting considerable data, and the special committee on Harmonizing will submit a report in all major specifications, beginning with section 310 up to and including section 553.