

Descriptive.  
N. & W. Ry.  
Columbus.

*Railway Signal Association.*  
Power supply.—Line.

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**NORFOLK AND WESTERN RAILWAY,\* COLUMBUS TO  
CHILLICOTHE, OHIO.**

The Norfolk & Western Railway installed, during 1911, from Bannan, Ohio, to Chillicothe, Ohio, forty-three miles of double-track a.c. automatic block signals. The original intention was to continue these from Bannan to "C. X." tower, Columbus, five and one-half miles, which will be done when extensive improvements, now under way through the city of Columbus, have been completed.

**Power Supply.**

Power for this installation is generated at Dorney, a coaling station, fifteen miles from Chillicothe, by two 35-K.W. Fort Wayne, single-phase, 60-cycle generators, direct connected to two 50-horsepower Reeves horizontal steam engines, running at 300 r.p.m. The generators are excited by two 6-K.W., 125-volt generators, belted to the shafts. These are duplicate sets, one generator being able to take care of the entire load. Steam is supplied by one of the two 100-horsepower boilers, that also supply steam for pumping water.

Switchboard equipment consists of two panels, each of which has an a.c. voltmeter, a.c. ammeter, indicating and integrating wattmeters, d.c. ammeter for exciters, electrostatic ground detector, and two 2500-volt, 15-ampere oil switches equipped with overload tripping coils. A General Electric Company synchronism indicator is located above the two panels.

The power is generated at 2300 volts and fed directly to the main transmission lines in both directions, through the oil switches, means being provided to run either generator in either direction or to cut out either end of the system. The wiring between switchboards and generators is run in fibre conduit set in the concrete floor. A General Electric Company automatic voltage regulator is used to maintain a constant voltage at the power house.

**Line.**

The transmission line consists of two number 6 B. & S. gauge hard-drawn copper wires the entire length of the system, with two extra number 4 B. & S. gauge copper wires between Dorney and Lockbourne, to take care of the heavy line drop occasioned by some station lighting, the installation of eleven solenoid type highway crossing alarms, operated by 110-volt, 60-cycle, a.c., and 30-ampere, 110-volt mercury arc rectifier at Circleville, Ohio, not provided for when the system was installed. These wires are carried on special porcelain insulators and five-eighth-inch W. U. T. Co. steel pins and are placed twelve inches apart to reduce the effect of the current

\*For description of similar installations, see page 380, Journal, 1911, or cloth-bound Volume VIII.

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Signals, relays, lighting, interlocking.

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on the company's telephone wires which are carried on the same poles. General Electric Company double-pole lightning arresters are installed one mile apart, and about every four miles the line is run through a double-pole oil break switch so that a maintainer having to repair the high tension line can cut the current off from the power house without putting more of the system out of service than is absolutely necessary.

#### Signals.

The Union Switch & Signal Company's style "S" three-position, upper quadrant, 110-volt signal is used throughout. The blocks average four thousand five hundred feet in length, a few being longer on account of special conditions. Three cut sections are installed in places where the blocks are more than five thousand feet long.

A Westinghouse 1.32-K.V.A., 2200, 110-volt Type "S" oil-cooled transformer is used at each signal location, connected to the high-tension line through fusible cut-outs. These are provided with 2090-volt and 1980-volt taps in the primary and extra 115-volt and 120-volt taps in the secondary, to take care of line drop. A special secondary coil supplying current at 10 volts is provided for track circuit operation. All current for operating motors, slots, lamps, indicators, slow-release relays, etc., is taken from the 110-volt coil.

#### Relays.

Galvanometer type, three-position relays are used throughout for track circuit work. These have their field coils energized by 110-volt current and operate at 2 volts on the track coil. The track circuits are fed through pole changers, and no line control wires for the distant indication are necessary except where crossing alarms are installed, which necessitates short track sections and line control for both home and distant indications. The signals are controlled through slow-acting, vane-type relays, operated by the track relays. Vane-type relays are used in all cases where a line relay is necessary. All bonding is done with one iron and one copper wire per joint.

#### Lighting.

Signals and indicators are lighted by 10-watt, 110-volt carbon filament lamps, the wires for lighting the indicator lamps being run on the pole line from nearest transformer.

Vane type illuminated disc switch indicators are used at all main line switches. There are about sixty of these on the installation. Control wires are number 12 B. & S. gauge copper-clad steel.

#### Interlocking.

This installation runs through three interlocking plants at present and will run through two more when completed. A twenty-three lever, 110-volt d.c. electric plant with a.c. indication, of the Union Switch & Signal Co. type is installed at the crossing with the C. &

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M. V. at Circleville. This machine operates eight derails, four home signals, four distant signals (110-volt d.c.), and four dwarf signals. Power for charging storage batteries at this plant being taken from the a.c. transmission line through a 30-ampere mercury arc rectifier. A 20-ampere rectifier is installed for charging two sets of 10-volt indicator batteries, which are used to operate the indicators, electric locks, etc., on the plant. Home and distant signals on this plant are operated from the main battery in the tower, the control wires passing through a.c. line relays which are controlled by the track circuits.

At Valley Crossing, Ohio, a thirty-five lever Union Switch & Signal Co. 110-volt d.c. electric interlocking with a.c. indication is installed at the crossing with the Hocking Valley Railroad. This machine operates six switches, twelve derails, nine home signals, four distant signals (110-volt d.c.), and nine dwarf signals.

In connection with this, an interesting feature is the indication used on the distant signals. As this is three-position signaling, the zero to forty-five degree position on the distant signal works automatically, the forty-five to ninety degree position working from a lever in the tower, and as it is necessary to get an indication anywhere through the zero to forty-five degree position, the regular scheme of a.c. indication will not work. A circuit taken from the 110-volt coil of a line transformer at the signal was passed through a zero to forty-five degree circuit-breaker and carried to the tower where the voltage is stepped down to 22 volts through the regular indication transformers and used to operate the indicator motor. This has proved very satisfactory in service.

No power for this plant is taken from the a.c. lines at present, as the plant was installed for some time before and gas engines provided for charging the batteries, but it is the intention in the near future to replace these engines with mercury arc rectifiers to charge both main and indicator batteries.

At Bannon, Ohio, at the crossing with the Toledo & Ohio Central Railway, a twenty-four lever mechanical plant is installed. This operates six derails, four switches, five home signals, four distant signals, three three-position, upper quadrant style "S" (110-volt a.c.) and four dwarf signals. The main line mechanical signals were replaced by a.c. electric signals, and a.c. track circuits were substituted for d.c. The d.c. electric locks and indicators were not placed, but a mercury arc rectifier installed to charge a set of storage batteries to operate them. The same arrangement will be used at Woodland Avenue, Columbus, the crossing of the Baltimore & Ohio South Western and at "C. X." Tower, the connection with the C. A. & C. Railway.

All of the track relays for these circuits are of the galvanometer type working in two positions and the automatic signal circuits are controlled through them by line circuits and vane type relays.