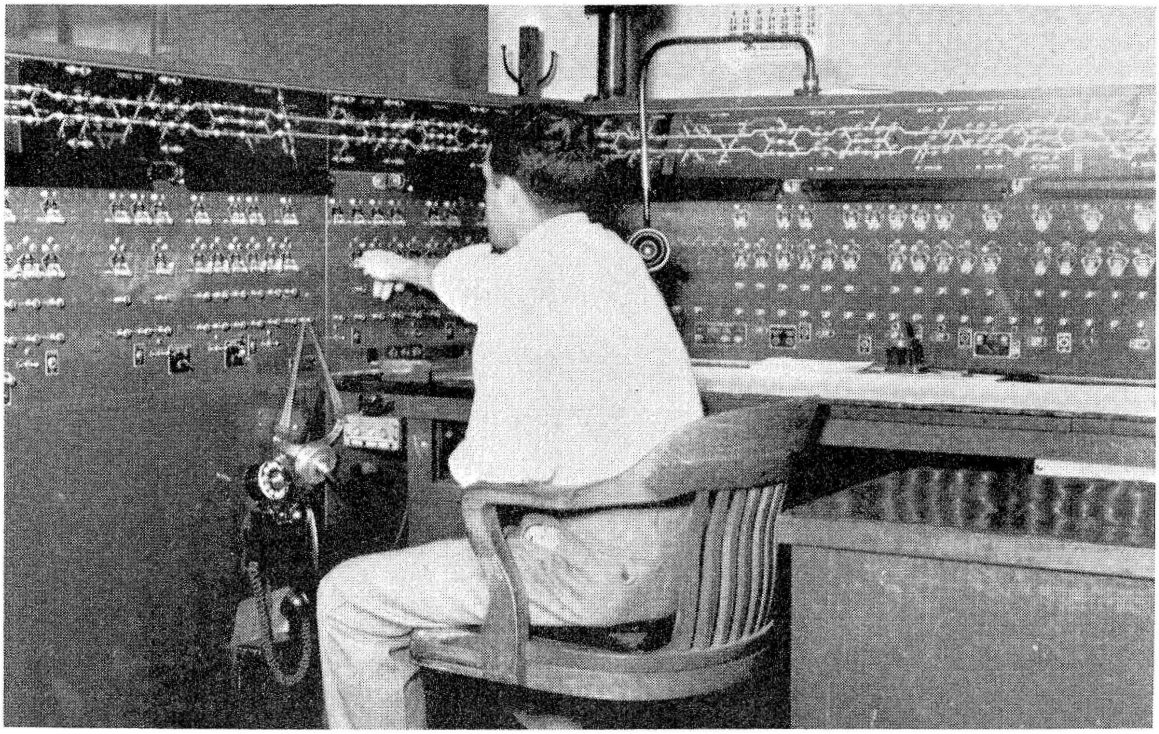
Railway Signaling and Communications



Dispatcher can use microphone or telephone headset (hanging near his knee)

# Remote Control Converted to CTC

**Reverse signaling installed on double-track line with center sidings. Trains now move by signal indication in either direction on both main tracks and sidings**

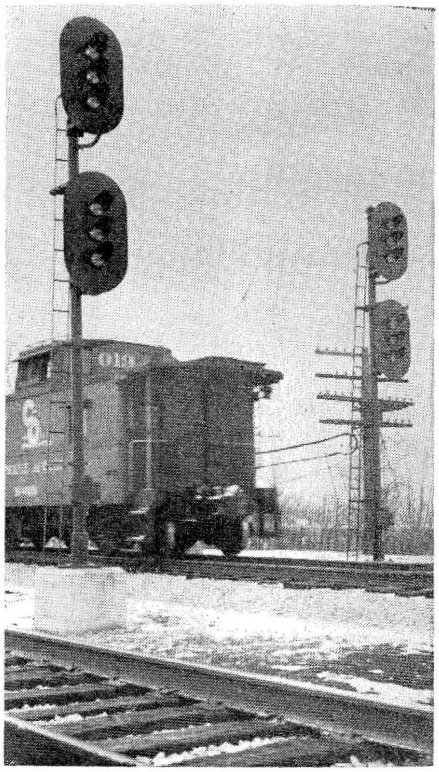
BETWEEN COLUMBUS AND TOLEDO, OHIO, the Chesapeake & Ohio has a heavy-traffic, double-track, trunk line. At Toledo, the C&O has extensive facilities for the transfer of coal from cars to lake boats, and for the transfer of ore from boats to cars. From Columbus, the line runs south to connect with the east-west mainline near Ashland, Ky. From here, lines run east through the industrialized Kanawah Valley and coal fields in West Virginia, and then into Virginia, to Richmond and Newport News, on the Atlantic Coast. Also from Ashland, a line extends south through Kentucky coal fields to Elkhorn City, Ky., where the C&O connects with the Clinchfield. At Russel, near Ashland, the C&O has a large retarder yard where freight cars are classified for routing either north to Toledo, or west to Cincinnati, and Chicago.

The territory is generally level between Columbus and Toledo, with grade and curvature so slight that they do not appreciably affect train speeds. Maximum authorized speed is 75 mph for passenger trains and 50 mph for freight trains.

## Coal and Merchandise Are Big Movements on the C&O

Four general types of shipments are made between Columbus and Toledo: (1) coal, (2) iron ore, (3) merchandise and (4) fruit. Coal moves north to Toledo; iron ore moves south to Portsmouth and Jackson, Ohio; fruit moves north to Toledo and Detroit; and merchandise moves both ways.

During an eight-month period in 1955, the C&O hauled 16,300,000



Home signals approaching center siding

tons of lake coal, 6,000,000 tons of commercial coal and 1,540,000 tons of iron ore over this 114-mile Columbus-Toledo line. Three-unit, 4,500-hp diesel-electric locomotives consisting of two cab units and a power unit, move these trains. Iron ore is handled in 100-car trains averaging 7,500 tons, and coal is shipped in 160-car trains averaging 12,500 tons.

Three merchandise trains are operated each way daily; Toledo-Columbus-Russell, with coal, ore and fruit runs being made as traffic warrants, these latter runs being made as extras. One passenger train is scheduled each way daily. Total traffic will average 20 trains daily, to a maximum of 30 trains during the peak shipping months in the summer when coal and ore movements are heavy.

### Remote Control and Center Sidings Until Mechanized Track Gangs

During the thirties, automatic block signals were installed on this line, as well as center sidings for the passing of trains. Train movements were authorized by timetable and train orders. However, in the post-war period, the greater demand for steel and coal materially increased the C&O's traffic, particularly on the Columbus-Toledo line. As a step to provide greater track utilization and improve train operations, remote control was installed in 1950. Power switches were installed at the ends of all sidings, and center sidings were signaled for train movements in either direction. Power switches and their associated signals at the ends of sidings were controlled from a ctc-type machine in the dispatcher's office in Columbus.

Train operation was by signal indication, right-hand running. Occasionally traffic became so heavy that the dispatcher authorized trains to be run against the current of traffic on short sections, as between two siding locations. Such a move was authorized by a train order, and no more than one train could "reverse run" between adjacent sidings. Besides remote control, centralized traffic control was installed between Delaware, Ohio and Marion. This 20-mile section gave the dispatcher added flexibility in that he could run trains on either track in either direction without resorting to train orders.

This remote control did a good job, but the modern-day practice of mechanized track forces using large on-track machines has created an operating problem. Up to 10 years ago, the track forces worked on the track only part time, that is, they were given the track for an hour or so, and then had to clear for trains. Approximately five years ago, track gangs were given a section of track for an entire day, and temporary telegraph offices were set up to handle train orders for reverse running of trains around the track gang.

Today, track maintenance is scheduled so that there are usually no more than two widely separated detours for track gangs in any one day. From April first through October first, tie renewal and surfacing gangs are out working on the line. Also during this time, a Speno ballast cleaner, and a Sperry rail detector car will be on the line from two to four weeks each year. Rail gangs also are on the line for about two to three weeks each year. Thus the presence of two detours for track gangs during the summer months when coal and ore shipments are heavy, creates "an operating headache." To relieve the headache and keep trains moving the C&O installed centralized traffic control.

### Track and Signal Changes to Convert to CTC

The major work was that of installing reverse signaling on both main tracks, with the exception of the Delaware-Marion, 20-mile section. Also, part of this project was replacing the dwarf signals at the ends of sidings with high signals. In most cases, the additional signals were mounted on existing signal bridges and cantilever brackets.

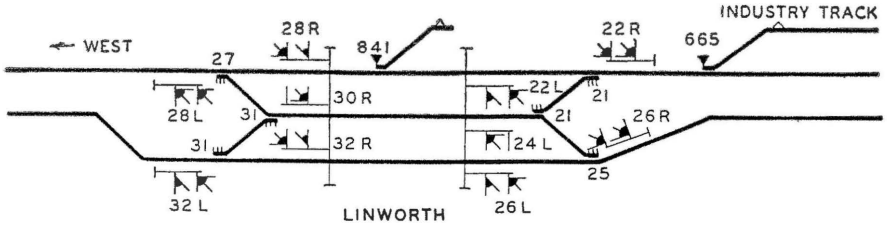
At some locations, extra sidings were removed, leaving only the center siding. For example, at Carey the old east and west sidings were removed, and the center siding left in as the passing track. New power crossovers were added between the two main tracks at several locations to provide flexibility of operations for the local freight. Thus the dispatcher can cross the local freight from one main track to the other without tying up long sections of main line. Most of the new crossovers are in or near concentrations of industry. For example, new crossovers were installed at King Avenue and Mile Post 4 (Columbus), Prospect (center siding removed), Harpster, Lemoyne and VR tower near Toledo.

Electric locks were installed on all main-track, hand-throw switches. At several locations, new T-20 hand-throw switch machines were installed with SL-20 electric locks. Three methods are used to obtain the release of electric locking, each depending upon local circumstances. They are: (1) release after a time delay with a long track circuit (1,000-3,000 ft.) occupied; (2) release without a time delay with a short track circuit occupied; (3) release by lever control by interlocking operator or dispatcher in addition to No. 1 or No. 2. At electric lock locations where the local freight usually gets in the clear for mainline trains, an automatic dwarf signal was installed to govern movement from the side track to the mainline. After a through train has passed and the side track switch is reversed, the dwarf signal will automatically give the block indication (red, yellow or yellow over red aspect).

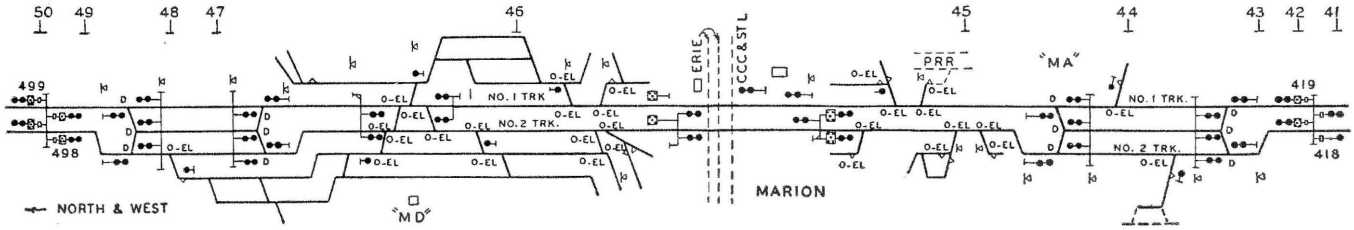
The center sidings are used to pass trains, and also to cross a train from one main track to the other. The turnouts from the main track to the siding are No. 16 with 30-ft. switch points. The turnouts from the siding to the main tracks include a split No. 11 frog and 22-ft. points.

### Call-on for Switching Moves

At locations, especially near towns where center sidings are located and special switching conditions make it necessary, special "call-on" controls are provided either to permit a train to make a following movement into an occupied block or to make a back-up movement against part of the train left on the main track or in the center siding. For example, a westbound train pulls into the center siding at Linworth. The locomotive cuts off with a car to be set out on the industry track (going through crossover 31 normal and switch 27 reversed, then switch 27 normal and crossover 21 normal). After making the set out, the locomotive returns down the right-hand main passing signal 28L. The dispatcher reverses switch 27 and clears signal 28L by pressing the "call-on" button and keeping it depressed




**Special call-on aspect allows engine of local freight to back down on its train**



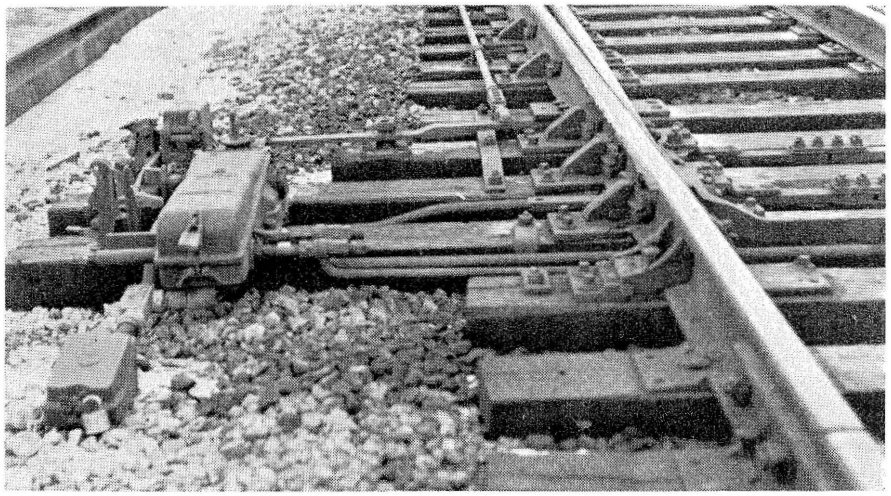

**Operator at "MD" controls switches and signals at both ends of center sidings either side of Erie crossing**

while the control code is being sent to clear signal 28L. The signal will then display the Restricting aspect (red over yellow), which directs the engineer to back down on his train. This would apply if the engineer had left his train on the main track, and had backed through the center siding to make the set out.

## New Interlocking at Marion Yard

At Marion, Ohio, the double-track C&O line is crossed by the Erie's double-track mainline and a single-track line of the Big Four (NYC). The C&O has a yard at Marion, and also does considerable interchange with the Erie, NYC and PRR, as well as industrial switching. The Pennsylvania interchange track and a center siding are south of the Erie crossing, and the yard and another center siding are north of the crossing. Counting yard engine moves, as well as road train moves, as many as 200 train movements have been made in a 24-hr period over the crossing. Two locally controlled interlockings were in service prior to the changeover to CTC. MA cabin, south of the Erie crossing controlled switches at the center siding and their associated signals as well as the northward home signals for the crossing. MD cabin north of the crossing controlled the signals governing southward movements toward the crossing. As part of the conversion to CTC, a new relay interlocking was installed with the control machine in a new masonry tower at MD. Switches and signals of the center sidings on either side of the Erie crossing are controlled from the new machine, as well as the electric locks on main-track hand-throw switches in the yard.

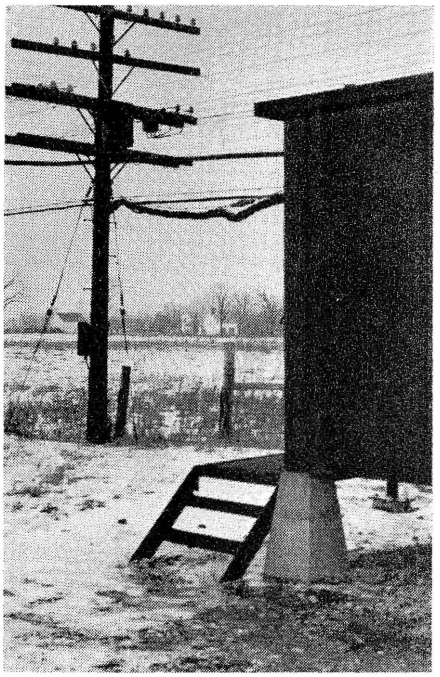
The control machine is in the dispatcher's office in the C&O offices in downtown Columbus, approximately ½ mile from the railroad (shortest route), and two miles from the beginning of the CTC. To assure continuous operation of the code line, the railroad has leased two Western Union cable pairs. One pair connects to the code line on the pole line at LM interlocking about ½ mile from the dispatcher's office, and the other pair connects to the pole line at MV where the CTC begins. If one cable pair develops a short or an open, a relay in the field drops, completing a circuit through the other cable pair which actuates a detector buzzer on the CTC machine. The dispatcher, being so informed of a cable failure, operates a toggle switch to put the code line over on the other cable pair.



**Hand-throw switch layouts include electric locks and pipe-connected derails**

## C&O Practice for Code Line

The CTC code line circuit is carried on two No. 8 Copperweld line wires, and is sectionalized at one end of each passing siding for testing purposes. Two No. 6 hard-drawn copper line wires are used throughout for a 440-volt power distribution system with a local power supply at approximately 10-mile intervals. Each supply point normally feeds about five miles in each direction, but distribution lines are sectionalized so that in event of a power interruption on one section it can be fed from the power supply on the adjacent sections. Open line wire circuits are all two-wire circuits except for a few non-vital circuits with No. 10 Copperweld line wire being used throughout. All open line wires have double-braid weatherproof covering.



**Multiconductor cable for local controls**

Where the number of circuits required is more than the capacity of a single crossarm (between ends of a center siding), asbestos braid covered aerial cable is used. Aerial cables are supported by a ⅜-in. stranded Copperweld messenger with cable rings.

Pole mounted step-down transformers, rated at 460/115 volts, are

*(Continued on page 29)*

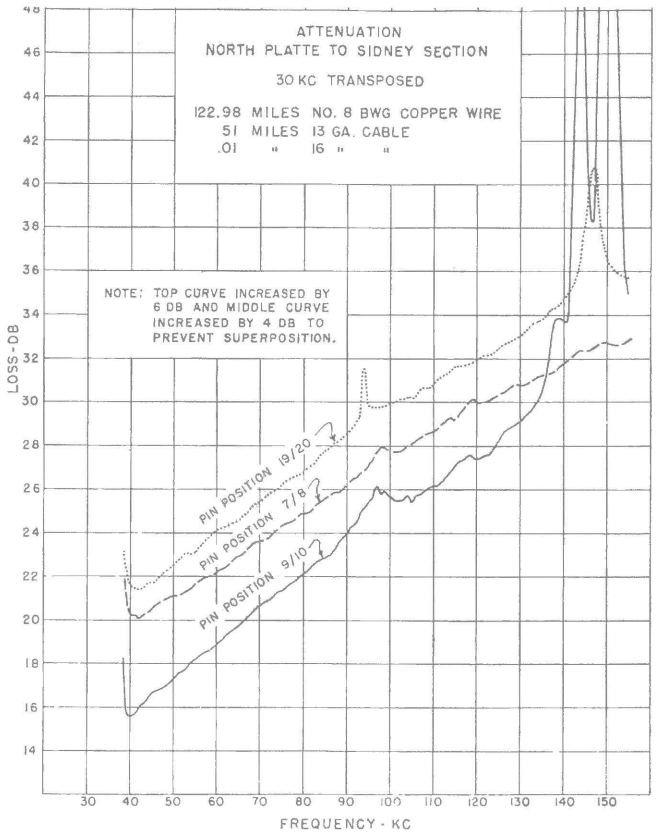



**FIG. 10 OLD: Note the loss in the circuit on pins 9/10. Much checking and rearranging of junction transpositions has taken place. Hole shown for circuit on pins 19/20 was eliminated by rearrangement of junction transposition after drawing was made**

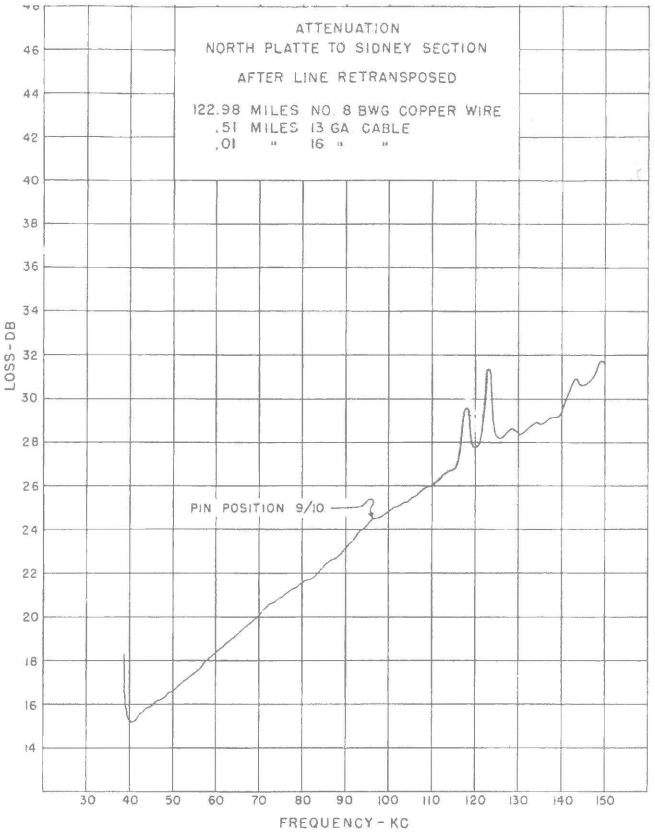



**FIG. 10 NEW: Shows attenuation curve after line retransposed (9/10 pins). Removal of about 80 transpositions from the regular 30 kc transposition pattern for this pin position in this section**

# C & O

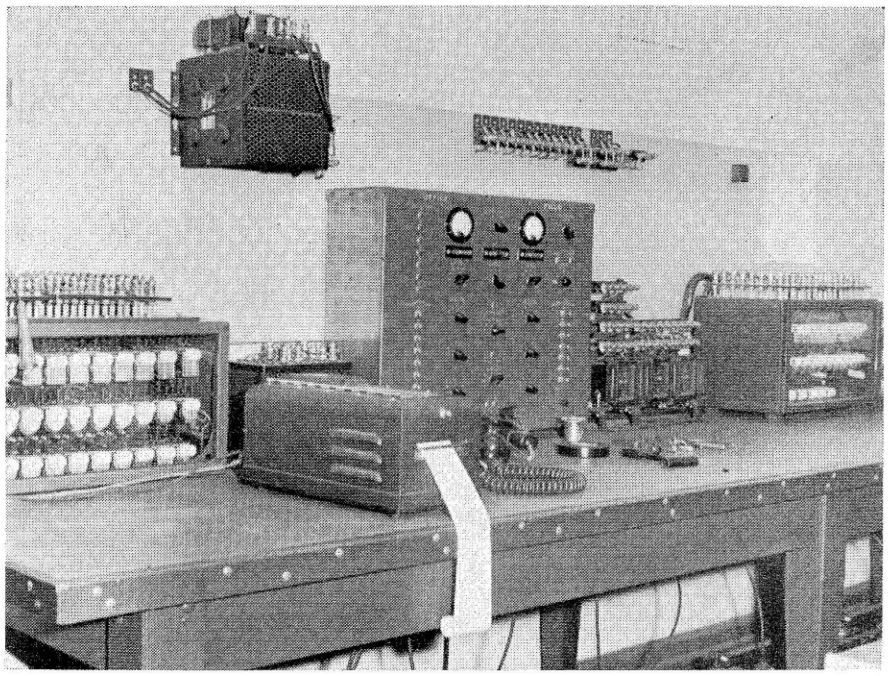
## Traffic Control

(*Continued from page* 23)

used at each location to provide power in the relay housing. The capacity of these transformers is dependent on the load to be handled, 500-va transformers being used at ends of sidings and at crossovers, and 75, 150 or 250 v.a. transformers at intermediate locations. Rectifiers for battery charging are operated from 115-volt supply in relay housings, and lamp circuits are fed from a suitable capacity 115/14 volt case-type transformer located in the relay housing.

Each relay housing is equipped with a telephone which can be connected to either the block line or code line. These telephones are equipped with 1,000-cycle buzzers which will operate a call detector on the CTC machine to enable the maintainers to contact the dispatcher. In the supervisor's office in an adjoining room at Columbus, there is a talk-back speaker connected to the code line which places the signal supervisor in direct contact with the maintainers. This talk-back speaker is also valuable in detecting changes in line conditions, as the amplifier is so adjusted that any unusual condition, such as a short or partial short on the line, will be audible.

Engineering and installation was done by the C&O signal department under the jurisdiction of W. N. Hartman, recently retired general superintendent—communications and signals. Signal equipment was furnished by the Union Switch & Signal Division of Westinghouse Air Brake Company.



**Pen-graph recorder and code test equipment in maintainer's shop in Columbus**