Heavy lines on the map show where CTC is to be installed on Central

Table indicates that the general purpose of the 8-year CTC program is to reduce all existing 4-track and 3-track main lines to double track CTC with power crossovers, and reduce existing double track to single track CTC with controlled sidings. Total cost $43,000,000

Where outside tracks are taken up the ties will be removed and the roadway graded to provide a service road for m/w trucks and men

Where Two Tracks do the Work of Four

New York Central's $6,000,000 CTC project between Buffalo and Cleveland is now in service. Trains operate on signal indication in either direction on either main track. Double main track crossovers average 6 miles apart

THE FIRST PHASE OF A FIVE YEAR PROGRAM to install centralized traffic control on all main lines of the New York Central is now completed. Other phases of this program are being started as rapidly as money, men and materials become available, and as of this writing three CTC projects are now underway: Toledo-Elkhart, Syracuse-Buffalo, and Pana-Lenox, Ill. This 5 year program is designed to reduce main line trackage, and thereby lower maintenance costs. To increase the capacity of remaining trackage to handle traffic, CTC is being installed.

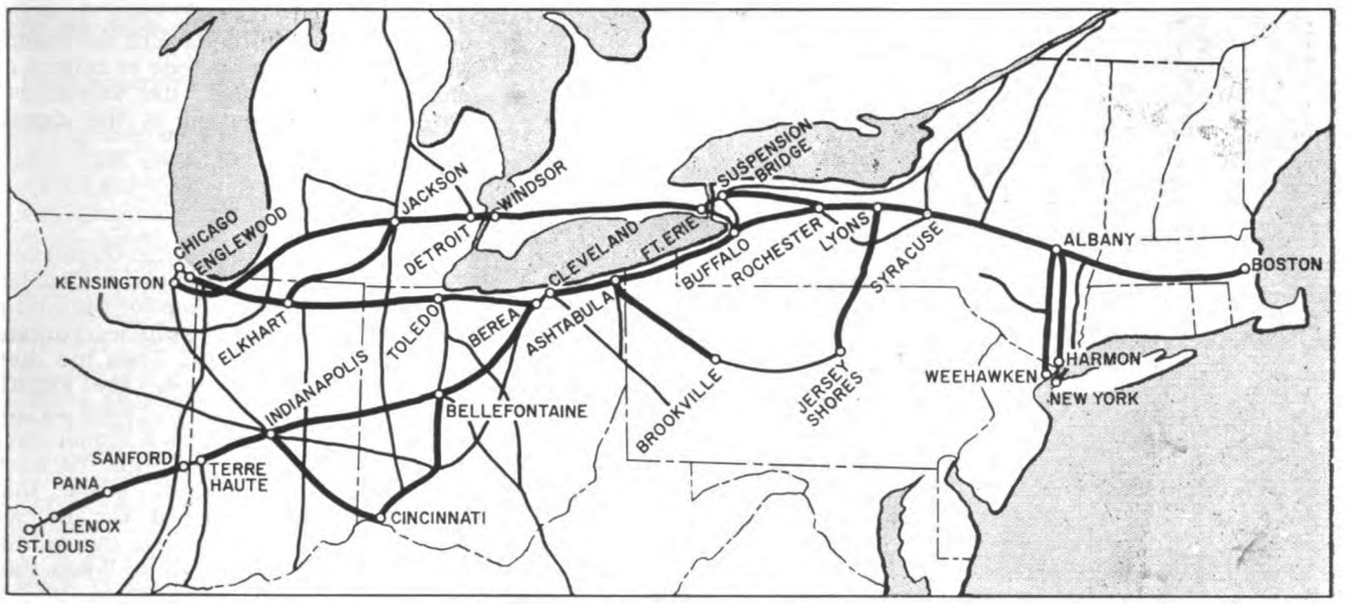
Buffalo to Cleveland is Now Double Track

Between Buffalo and Cleveland, four main tracks were in service on the main line. The two center tracks being high speed main tracks, the two outside tracks being lower speed tracks. The two center tracks, having speed limits of 80 mph for passenger trains and 60 mph for freight trains, were used by all passenger trains and most freight trains. The outside tracks, being signaled for lower speed, were used by slow freights and local trains. All tracks were signaled for one direction operation only. Scheduled trains include 38 passenger and 34 freight daily with extras running the total to 90-100.

The intent of the new project is to secure more intensive use of the two center tracks, each being signaled for either direction operation, and power crossovers spaced an average of 6 miles apart are used to divert trains from one track to the other. Forty-two main track crossovers were installed between the two center tracks; No. 1 westbound and No. 2 eastbound, minimum spacing being 1.6 miles and maximum spacing being 11.5 miles. These crossovers have No. 20 turnouts, good for 50 mph, and are so signaled.

Outside tracks No. 3 and No. 4 were removed except for two-mile sections which remain in service as "work sidings," being located at towns where considerable local switching is performed. House tracks and industrial tracks are connected to these "work sidings" through hand-throw switches. The capacity of these "work sidings" is such that a 150-car train entering the siding at 30 mph has braking distance in which to stop short of the leave-siding dwarf signal. Therefore the signal aspects are arranged accordingly. The CTC territory includes 22 of these "work sidings."

Seven interlockings, formerly all on local control, and three remote control interlockings are now part of the CTC installation. The entire CTC is now controlled from two machines in the dispatcher's office at Erie, Pa. One machine controls switches and signals between Bay View, N. Y., (near Buffalo) and Girard Jct., Pa., (95 miles) with one break at Erie. The break is for 11 miles between Harbor Creek and Dock Jct., these two points being CTC controlled. The west end CTC machine controls from Girard Jct., to "BR" tower at Nottingham, Ohio (Cleveland) (68 miles) with a 5-mile break through Ashtabula, Ohio. Previously existing locally controlled interlockings were retained in these "break" areas because of the large number of local and industrial switching moves.



Longer Blocks, Fewer Aspects

The previous single-direction automatic signaling on all four tracks included four-aspect signals with blocks about 5,200 ft. long. The new automatic signaling for both directions on each of the two tracks uses three aspects with blocks about 10,000 to 12,000 ft. long. In approach to stations where passenger trains stop, shorter blocks with four-aspect signals are used so that trains can close up without being required to make unnecessary stops. The intermittent inductive train stop system, including wayside inductors at all main track signals, has been revised according to the new locations and controls.

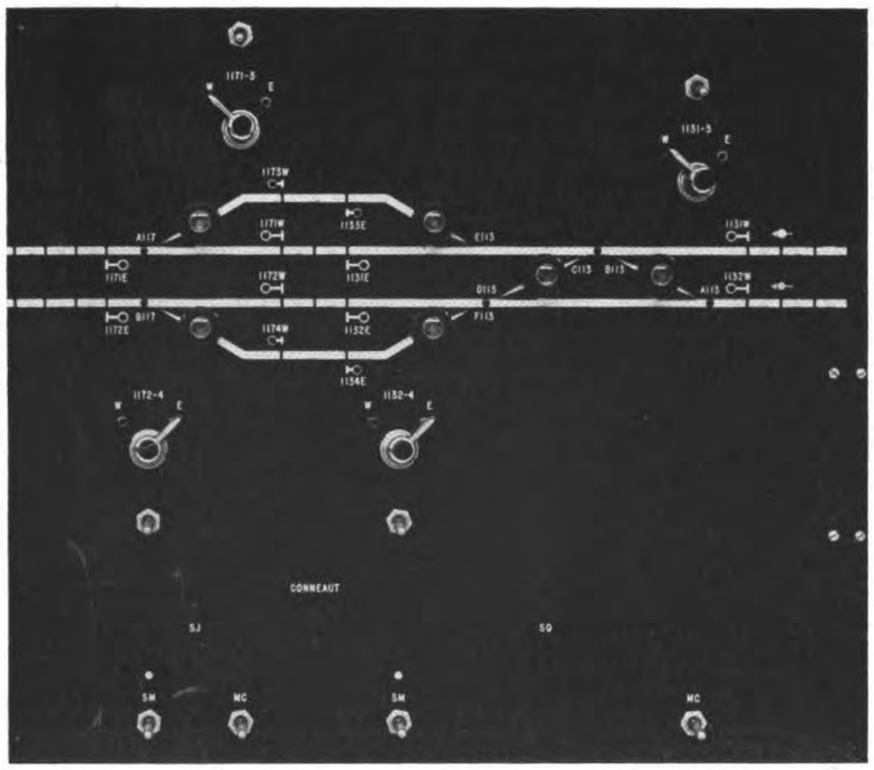
Flashing-Aspects for Crossover Routes

In order to direct enginemen to bring their trains up to and through the crossovers at the speeds for which they are designed, special aspects are included in this new CTC project. If a route includes a diverging move on a No. 20 crossover reversed (good for 50 mph), the home signal aspect is red over flashing-green over red, which indicates "proceed, limited speed within interlocking limits." If only one block ahead is unoccupied, the home signal aspect is red over flashing-yellow over red, indicating "proceed at limited speed, prepared to stop at next signal." Limited speed is defined as 50 mph. The approach signal will display yellow over flashing-green to indicate "approach the next signal at limited speed."

If the turnout is a No. 16, then

NEW YORK CENTRAL CTC PROGRAM

From	To	Miles	Was	Will Be	Completion Date
Buffalo	Cleveland	163	4 trk	2 trk double x-overs work sidings	1956
Toledo	Elkhart	133	4 & 3 trk	2 trk double x-overs work sidings	1957
Pana	Lenox	75	2 trk	1 trk sidings	1957
Syracuse	Buffalo	137	4 & 3 trk	2 trk double x-overs work sidings	1958
Boston	Albany	195	2 trk	1 trk sidings	1958
Rochester	Suspension Bridge	75	2 trk	1 trk sidings	1958
Berea	Toledo	90	4 & 3 trk	2 trk double x-overs work sidings	1958
Elkhart	Jackson	120	1 trk	1 trk sidings	1958
Sanford	Pana	85	2 trk	1 trk sidings	1958
Syracuse	Albany	135	4 & 3 trk	2 trk double x-overs work sidings	1959
Indianapolis	Terre Haute	65	2 trk	1 trk sidings	1959
Kensington	Jackson	188	2 trk	1 trk sidings	1959
Albany	Harmon	105	4 & 3 trk	2 trk double x-overs work sidings	1960
Elkhart	Englewood	88	4 & 3 trk	2 trk double x-overs work sidings	1960
Indianapolis	Belle-fontaine	138	2 trk	1 trk sidings	1960
Jackson	Detroit	70	2 trk	1 trk sidings	1960
Weehawken	Albany	138	2 trk	1 trk sidings	1961
Lyons	Jersey Shores	169	1 trk sidings	1 trk sidings	1961
Ashtabula	Brook-ville	125	1 trk sidings	1 trk sidings	1961
Bellefontaine	Berea	126	2 trk	1 trk sidings	1961
Windsor	Fort Erie	220	2 trk	1 trk sidings	1961
Cincinnati	Indianapolis	103	2 trk	1 trk sidings	1962
Cincinnati	Belle-fontaine	105	2 trk	1 trk sidings	1963



Toggle levers immediately above and below signal levers are for setting up fleet controls. Short white section has lamp for an automatic block occupancy

the home signal will display the medium-speed aspects for crossover moves: i.e., red-green-red indicating "proceed, medium speed within interlocking limits"; red-yellow-red, to indicate "proceed at medium speed preparing to stop at next signal." The approach signal will display yellow-green to indicate "approach the home signal at medium speed." Medium speed is defined as 30 mph.

The sidings are track circuited, not only to control track-occupancy lamps on the dispatcher's panel, but also to control signals. The turnouts to sidings are No. 20, signaled for entry at 30 mph. The aspect for a train to enter an unoccupied siding is red-yellow-red, "proceed at medium speed, preparing to stop at next signal." The approach signal will display yellow-green to indicate "approach next signal at medium speed." If the siding is occupied, the dispatcher can still line a route into it, in which case the home signal will display red-red-yellow to indicate "proceed at restricted speed" (15 mph). The approach signal will display yellow-red to indicate "proceed prepared to stop at next signal, trains exceeding medium speed must reduce to that speed." The leave-siding dwarf may display three aspects: flashing-green, "proceed at limited speed within interlocking limits"; flashing-yellow, "proceed at limited speed, prepared to stop at next signal"; and red for "stop."

Machines Have "Fleet Controls"

Although these CTC machines look like the conventional type, several features make them different. On the diagram, each switch is controlled by a rotating knob containing an indication lamp in its face. The knob is mounted in the ¼-in. white line representing the track where the "turnout" joins the "straight track." For a crossover, the knob is at the center of the white line representing the crossover. As a further aid to the dispatcher to "see" the routes which he is lining up, the ¼-in. track lines include small triangular sections which are moved to repeat the operation of switches, so that the route being lined is indicated by a full width ¼-in. white line.

The signal levers are located adjacent to the symbol for the track on which the signal governs, there being two horizontal rows of signal levers—one above the track diagram and the other below. Their associated indication lamps are located on the diagram at the places corresponding to the signals in the field.

Another feature of these CTC machines is that the usual row of code starting buttons has been eliminated. Instead, these buttons are placed in the face of the signal levers. To send a code to control a switch or signal, the dispatcher presses the button in the signal lever.

Lining Up Routes

To line a route, the dispatcher rotates the switch knobs so that he has a solid white line for the route he desires, either switches normal or switches reverse. Then the dispatcher will operate the signal lever, right for an eastward signal or left for a westward signal, and presses the code button in the face of the signal lever. While the switches are in transit, the indication lamp in the barrel of the switch knobs are lighted white. When the switches are over, these white lamps are extinguished. After all switches are in the desired positions, a full-width white line shows the route, and all switch indication lamps are dark. When the signal clears, its indication lamp will be lighted green, and switch knob indication lamps will be lighted red to show that the switches are locked. As the train passes the signal, the signal indication lamp is extinguished and as the train enters the "OS" section the red track-occupancy lamp lights, and a single stroke bell sounds. When it leaves this section, the red lamp is extinguished.

If two or more following trains are to use the same route through a CTC interlocking (crossovers or end of a work siding), the dispatcher can set up "fleet control" by clearing the signal, and then raising a toggle switch immediately above that lever. This removes "stick control" so that after the passage of one train, the signal will again clear for the next one, without further attention by the dispatcher. To control a call-on aspect, to allow a train to enter an occupied block, no manipulation, other than ordinary operation of a signal lever, is required.

In many previous CTC projects, train occupancy of the section of several miles between crossovers or siding layouts is indicated by only one or perhaps two track-occupancy lamps on the dispatcher's panel. In order that the NYC dispatchers may know exactly of the location and progress of each train, the new CTC machines have a track-occupancy lamp corresponding with each automatic block. Each CTC machine is also equipped with an automatic pen graph recorder to indicate the pas-

sage of trains at the "OS" sections at the various CTC interlockings.

High Speed Switch Machines

The switch machines installed at the main track crossovers are the model 5C with 110-volt d. c. motors, providing fast operation which is considered necessary because of the high density of traffic. The machines at the work sidings are also model 5C. Dispatcher controlled General Electric 440-volt a.c. snow melters are used on all power operated switches. The heating rods are installed under the ball of and on the gage side of the stock rails. These units are rated at 300 watts per ft. totaling 23,000 watts per switch.

At the previous hand-throw main track switches the old hand-throw stands were replaced with new Model 9 GRS hand-throw switch-and-lock machines including electric locks. To enter a house track so equipped, the unlock is obtained by occupancy of a 300-400 ft. track circuit in approach to the switch.

Standby Power When Normal Fails

The code line is operated on 180 volts d.c., 5 amp. Power is normally supplied by Nobatrons made by Sorensen & Co., Inc., which operate off 110 volts a.c. To insure continuity of power for the code line and for the CTC machines, an Onan 5CW (5kw) electric plant was installed in a separate housing at Erie. The generator, driven by a gasoline engine, delivers 110 volts at 60 cycles. This plant has an automatic cut in, should the commercial power fail, and stays on from 5 to 7 min. after the commercial power returns, so as to insure against fluctuations.

Electric snow melters are on all power switches; heating rod is on stock rail

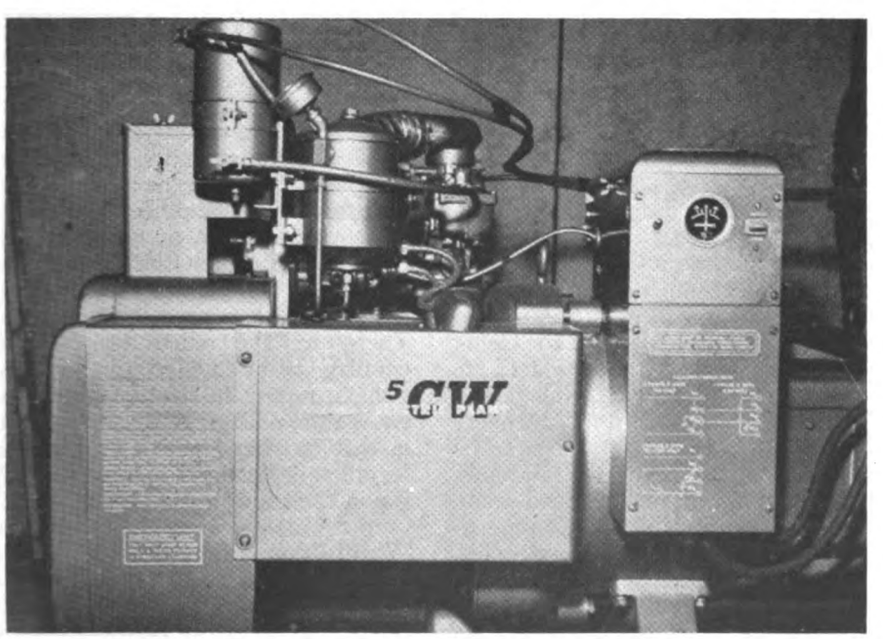
The code line is No. 8 Copperweld, 40 per cent conductivity, with Okonite-Hazaprene insulation, and is transposed, using a point-type transposition bracket at every seventh pole. Other wire and cable in this installation was supplied by Anaconda Wire & Cable Co., and the Kerite Co.

This is the first large installation employing Syncrostep for the transmission of controls and Syncroscan for the transmission of indications. Controls are sent in 1½ sec. Scanning of field stations gives the dispatcher a continuous check of indications with a maximum delay of 4 sec. after change. The system is duplex in operation, in that controls and indications may be transmitted simultaneously without interference.

To insure continuous operation of the Syncroscan (indication transmission from the field), Cornell-Dubilier vibrator-converters were installed at all field stations. Should the commercial power fail, these C-D vibrators will operate off the storage battery to provide the necessary a.c. for the Syncroscan equipment.

Construction work was handled by eight gangs, each gang consisting of 14 men and a foreman. Construction headquarters was at Erie with work being directed by L. A. Jackson, field signal engineer. O. H. Steffans, signal construction supervisor (now assistant field signal engineer) had charge of four gangs working west of Erie, and J. V. Hancock, signal construction supervisor, had charge of four gangs doing work east of Erie. The CTC was cut into service in sections of 8 to 10 miles long, beginning at Cleveland and Buffalo and working toward Erie. After each cut-in was made, sections of the two outer tracks were removed and the roadbed was graded as a service road for off-track maintenance equipment. Another important phase of the installation work was that of re-arranging track circuits for the highway crossing protection equipment for high-speed train movements in either direction on both main tracks.

The engineering, circuit design and installation work was done by railroad forces under the jurisdiction of H. A. Scott, chief signal engineer. The major items of signaling equipment were furnished by the General Railway Signal Company.



Gas-engine generator supplies standby power for CTC machine and code line