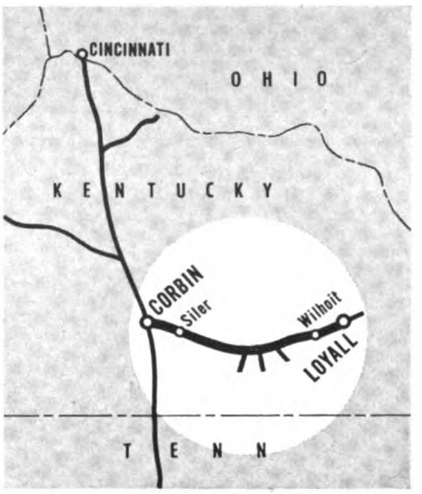
Railway Signaling and Communications

March, 1958

Space at left in front of housing was formerly occupied by second main track



Corbin is on Cincinnati-Atlanta line

CTC Saves Time and Money

. . . . for the Louisville & Nashville

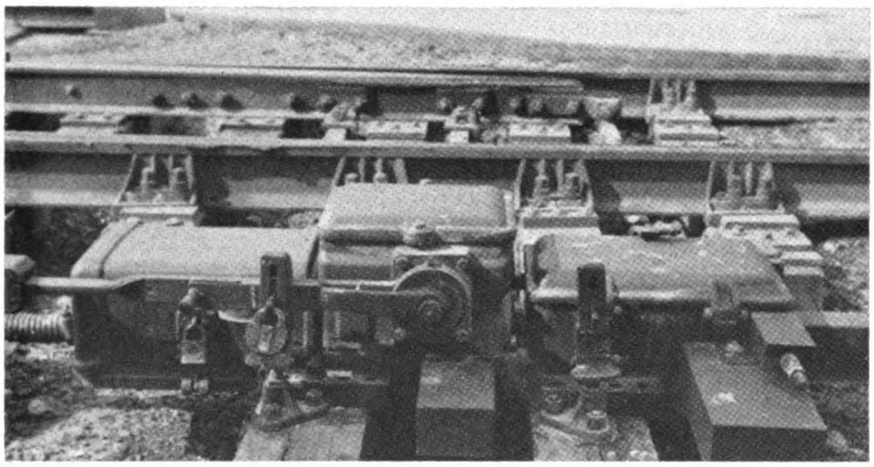
THIS CUMBERLAND VALLEY division between Loyall and Corbin goes through the eastern Kentucky bituminous coal fields, and is a source of much coal traffic. The 20 to 24 trains daily include one local passenger each way, two local freights each way except Sunday (they only go halfway from Corbin toward Loyall) and two fast freights each way, the remainder being coal trains; loads from Loyall to Corbin, and empties the other way. Mine runs bring loads down to Loyall during the afternoon and early evening, where they are made up into solid trains, 100-120 cars, for movement to Corbin. Here they are moved north to Cincinnati and Louisville, or south to Knoxville and Atlanta. Empties are moved to Loyall during the afternoon and evening so that the mine runs can pick them up at Loyall when they bring down loads, and return empties to the mines ready for loading the next morning. Thus the busiest 8 hr on the line is the second trick; 4 pm to midnight.

Traffic density studies on this line revealed that the double track was idle much of the time, particularly from midnight to 8 am, and also during much of the day. Redispatching studies, based on CTC operation on single track, showed that present and foreseeable traffic could be moved expeditiously, with a possible reduction in running time of some trains. A third factor in favor of CTC was that, by removing second main track, annual savings on track maintenance would be considerable. Also on this line considerable rail and tie renewals were due, which would be unnecessary or greatly lessened if CTC were installed. Thus a decision was made to convert from double track to one main track with CTC.

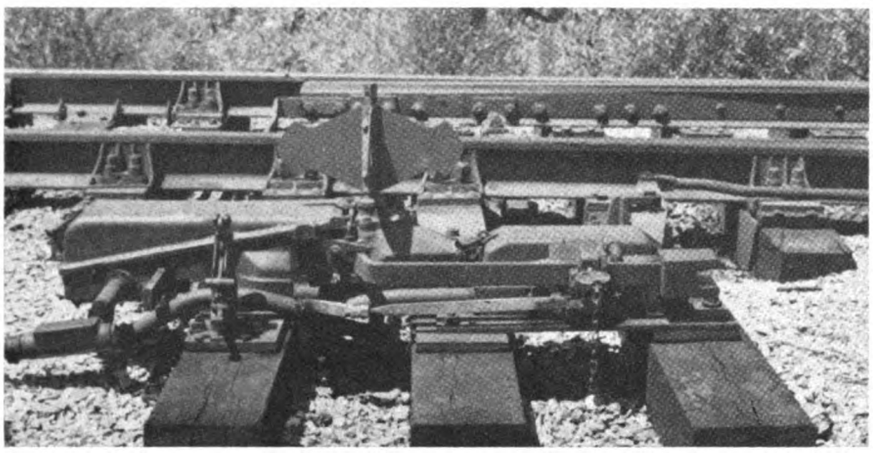
From Corbin yard, double track extends about 3 mi to Siler. From here single track extends for 63 mi to Wilhoit, with double track 1.7 mi on to Loyall yards. On the 63 mi, 11 mi of the previous second track was left in place for seven sidings which have the full complement of controlled signals and power switches. Another 8 mi of the former second track was left for various industry spurs, these tracks being equipped with hand-throw switches and electric locks. The spacing between passing sidings ranges from a 4 mi minimum to a 14 mi maximum, and car capacity is from a 106 car minimum to a 190 car maximum.

Maximum authorized speed is 45 mph for passenger trains and 35 mph for freight trains. The track is 132 lb rail with crushed rock ballast. The line is at river grade, not over 0.5 per cent, but has numerous curves, many ranging up to 6 or 8 deg, and several of 10 deg and over.

In addition to the conventional annunciator track circuit, more in-



Power switches, mounted on ties, were hauled to the field for installation



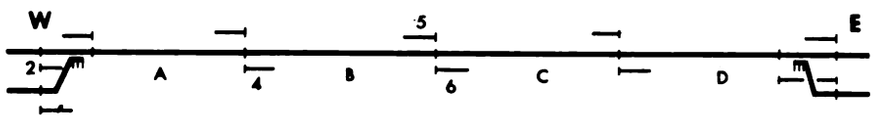
Electric lock on hand-throw switch, locks the hand-throw lever

formation is provided. When a train in Loyall yard or in Corbin yard is ready to depart the yardmaster presses a pushbutton which causes a single-stroke bell to sound and a lamp to be lighted on the CTC control machine at Corbin. Thus the dispatcher knows that when he clears the signal, the train will be there to accept it and depart promptly.

Searchlight Signals Throughout

Dwarfs as well as high signals are the H-2 searchlight type. The dwarfs are continuously lighted, while the high signals are lighted when the dispatcher clears signals for a route, with the exception that the entering signal and the leaving signal are approach lighted. Single-filament 10-volt, 18-watt bulbs are burned at 9 volts. Dwarf signal lamps are changed every 30 days, and high signal lamps, because of the approach lighting, are changed every six months. Concrete foundations for these signals were poured in the field, using a portable concrete mixer, hauled to the site by a truck or track motor car.

Power switch machines are dual-control, model M23B, having 24-volt d.c. motors, power being supplied by 13 cells of Exide 80-a.h. storage battery. Mounted on two dapped ties, at construction headquarters, the switch machines were hauled to the end of sidings in a work train and set in place by a crane. Turnouts are No. 12 with 22-ft switch points. The sidings are thrown over to 19-ft centers to provide clearance for maintrack leaving signals. Graphite lubricant is "painted" on the switch plates to ease operation and prevent rust.



How coded track circuits provide block indications

New T-20 hand-throw switch stands with SL-25 electric locks were installed at all industry spurs. The 100-ft release circuit in approach to a hand-throw switch is fed by one cell of Edison 1,000-a.h. primary battery. The electric lock is fed by eight cells of Edison B1H nickel-iron alkaline storage battery. Derails on these industry spurs are pipe-connected to the hand-throw switches.

Conventional d.c. track circuits are used for: (1) the OS detector section at power switches; (2) short release circuit in approach to hand-throw switches; and (3) control of highway crossing protection equipment. Coded track circuits are used elsewhere on the main track.

Coded Track Circuits Give Block Indications

Direct-current coded track circuits are used for four reasons: (1) to permit the use of longer track circuits than with conventional d.c. track circuits; (2) reduce the number of line wires that would be required for block indication; (3) to check to see that an entire siding-to-siding block is unoccupied before changing the direction of traffic in such a block; and (4) to split each siding-to-siding block into two parts for control of two separate track-occupancy indications on the CTC control machine. This latter point is important because it more accurately locates trains for the dispatcher, and allows him to plan moves with greater accuracy.

With such circuits, code at 180 pulses per minute normally feeds to the track in both directions from the center double intermediate signal location (5-6 on diagram) in the siding-to-siding block. Thus the 180-code is received at the controlled signals at each end of this block (W-E), which causes indications to be sent to the control machine that the siding-to-siding block is unoccupied, and to allow the direction of traffic to be established and signals cleared for either direction.

After the dispatcher has lined a route (W to E), and prior to the train passing the station-leaving signal 2, the 180-code will still feed through the siding-to-siding block which will cause the signals cleared by the dispatcher to show the green aspect. When a train has cleared block A beyond station-leaving signal 2, 120-code will be fed through block A toward signal 2. This sets up a condition which if the dispatcher desires to clear signal 2 for a following move, that signal will clear to the yellow aspect.

Assuming a train is moving toward E, when this train has passed out of block A, 120-code will be fed through block A toward station-leaving signal 2. When the train has passed block B, 120-code will be feeding through this block toward signal 4, and 180-code will be feeding through block A toward signal 2. When the train has cleared block C, the track-occupancy indication lamp for the first half of the siding-to-siding block will be extinguished, thus indicating that the train has cleared blocks A and B. This condition is set up when 180-code is flowing through these blocks.

The code line is No. 6 Copperweld with polyethylene insulation, and is looped through the concrete bungalows at the ends of the sidings. On the terminal board inside each of these bungalows is one disconnect switch and one cut-out switch. The disconnect switch will cut off the code line beyond this particular location, i.e., opening the disconnect switch terminates the code line at this location. The cut-out switch will cut out only this particular location. The code line is fed by 44 cells of Exide 2CME3 8-a.h. storage cells. No carrier is used for the code line.

Crossing Circuits Extended

With train operation, right-hand running, on double track, circuits for highway crossing protection equipment consisted of a 100-ft absolute circuit across the highway on each track with a 1400-ft start or approach circuit in the normal running direction and a 300-ft start circuit for reverse running. As part of the CTC program, and as a result of the removal of one main track at many of these crossings, the 1400-ft normal approach circuit was set up on both sides of the crossing with a 100-ft absolute circuit over the highway itself. These are conventional d.c. track circuits fed by 1,000-a.h. primary battery. One wig-wag crossing signal was replaced with two flashing-light signals.

Signal Power Line Is 550 Volts

The 550-volt a.c. signal power line is fed commercial power at 2400 volts a.c. at several locations, from each of which the signal power line feeds about 12 mi in one direction and 8 mi in the other. The signal power line is not continuous, in that sections of the line from two adjacent commercial feed points will end approximately one track circuit apart, about one or two miles. Pole mounted air-cooled transformers at the ends of sidings are rated at 300 v.a., and at intermediate signals and cut sections at 100 v.a. These transformers are protected by pellet-type arresters, also pole mounted.

The relays, storage battery and coding equipment at the ends of sidings are in 6 ft by 6 ft or 6 ft by 8 ft concrete bungalows made by Massey Concrete Products Co. At electric lock locations and intermediate signals, steel instrument cases are used.

Control Machine at Corbin

The CTC control machine is in an air-conditioned office in Corbin. It is of the conventional type with a track diagram, indication lamps, switch and signal levers with associated indication lamps. Two track-occupancy lamps are used for each siding-to-siding block. The sidings are not track circuited, so that to keep himself alert concerning trains on sidings, the dispatcher moves a toggle below the siding in the direction a train is moving when it enters the siding. This lights an indication lamp in the "siding" on the track diagram. After the train leaves the siding, the dispatcher returns the siding-occupancy indication lamp toggle to center.

The dispatcher's pushbutton telephone selector panel was incorporated into the CTC machine panel, as is a loudspeaker connected to the message, dispatch and CTC code line. Normally a train crew calls in on the dispatcher's circuit, which comes into his panel. Double-pole, double-throw switches in the wayside pole boxes or telephone booths connect the phone to either the dispatch or message circuit. Station agents call him on the message circuit. The signal maintainers normally call the dispatcher on the code line. A voice-actuated relay in the control machine responds to the maintainer's call, sounding a buzzer and lighting an indication lamp on the panel. When the dispatcher raises the maintainer's call toggle, and codes out to a particular location, a single-stroke bell inside the bungalow sounds, and a lamp on the outside of the bungalow is lighted. Thus if the maintainer is working inside the bungalow, he receives an audible indication that the dispatcher wants to talk to him.

L&N Did the Work

This installation was engineered by the L&N signal department under P. P. Ash, Superintendent Communications & Signals, and the installation work was done by signal department construction forces directed by H. L. Petty, Assistant Signal Engineer (deceased). The major items of signaling equipment were furnished by the Union Switch & Signal Division of Westinghouse Air Brake Company.

Memo for Management:

What CTC Did for the L&N

By converting double-track to single-track CTC, L&N freight trains have cut as much as 20 min. off their running time on the 64 mi. from Loyall to Corbin, Ky. In addition:

- **Estimated cost was $1,563,895 of which signal work accounted for $1,287,895 and track work for $276,000.**
- **Salvage of rail, ties, etc., on the 44 mi. of second main track that are to be removed, is $1,536,000.**
- **Estimated net cost is $27,895.**
- **Estimated annual savings are $170,330 giving a return on capital investment of 12.7 per cent.**