Railway Signaling

C. & O. Combines Two Interlockings in Centralized-Control

Train movements with normal direction of traffic directed by signals with power switches and spring switches, expedite traffic in five-mile area at Ronceverte

AS a means of facilitating train movements and reducing operating expenses in the vicinity of Ronceverte, West Virginia, the Chesapeake & Ohio installed color light signals, spring switches, and power switches controlled from a C.T.C. type machine, the new arrangement not only replacing two mechanical interlockings but also including the operation of one crossover and two switches which were previously operated by hand. This system is now used to direct train movements with the normal direction of traffic by signal indications throughout the five-mile territory of double track.

Methods of Train Operation

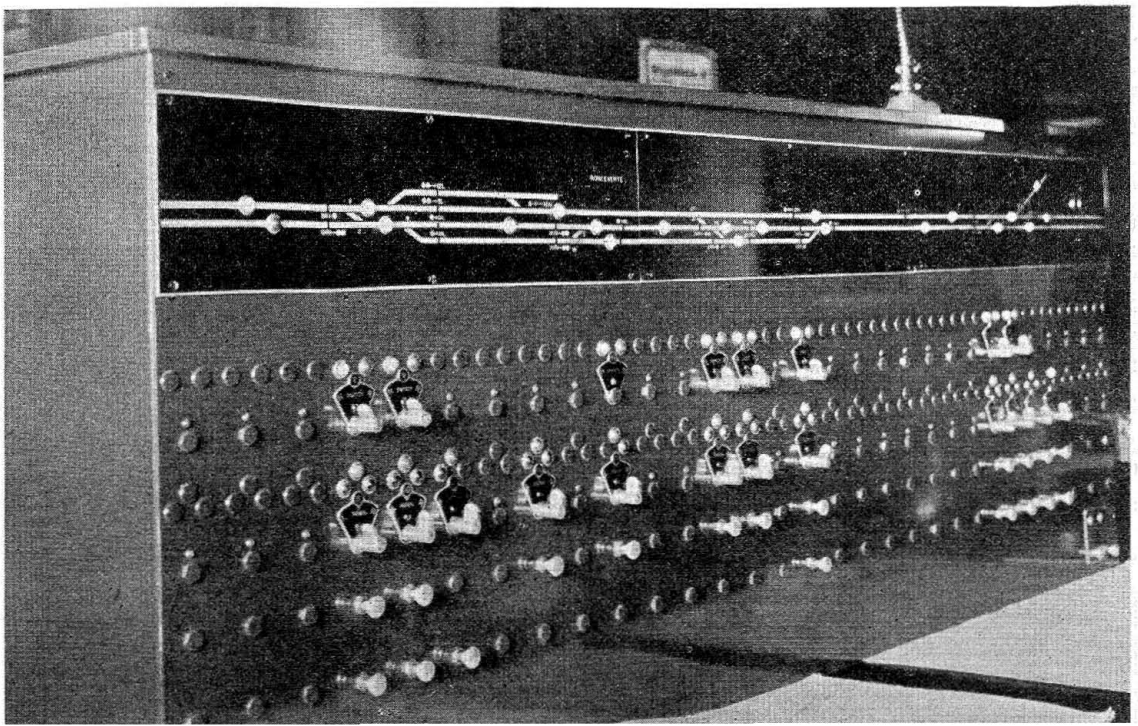
Train operation in the vicinity of Ronceverte is complicated by several factors. In the first place the Greenbrier subdivision, extending eastward for 98 miles to Bartow, W. Va., joins the main line at Whitcomb, 2.8 miles east of Ronceverte. The two passenger trains and one freight train operated daily on this branch terminate at Ronceverte. For a number of years a 20-lever mechanical interlocking had been in service at the junction at Whitcomb to handle the crossover, junction switch, and signals.

In the second place the through freight trains stop to take water and in some instances coal, the coaling station being located about 900 ft. east of the passenger station, while water cranes are located near the passenger station and at the east end of the eastward passing siding. The through main-line traffic includes 10 passenger trains, 24 freight trains, and about 6 light engines daily. It is often necessary for trains to take siding at this point, and in order to eliminate the necessity of eastward freight trains having to stop before entering the siding, a 20-lever mechanical interlocking machine was formerly in service at the west end of the passing siding at WR Cabin, the plant including two siding switches, a crossover, and the necessary signals.

Trains Delayed at Switches

It will be noted from the plan that the eastward passing siding extends from M.P. 321 plus 2,148 ft. to M.P. 324, crossovers being provided at the coaling station and just west of the passenger station so that this long track can be used as two passing sidings. However, these crossovers, as well as the switch at the extreme east end of the passing siding, were formerly all hand-thrown, and even though there was a mechanical interlocking at each end of the five mile area between Whitcomb and WR Cabin, the operation of trains in the intermediate area was not coördinated, and as a result train delays were excessive.

As a means of facilitating train movements, increasing

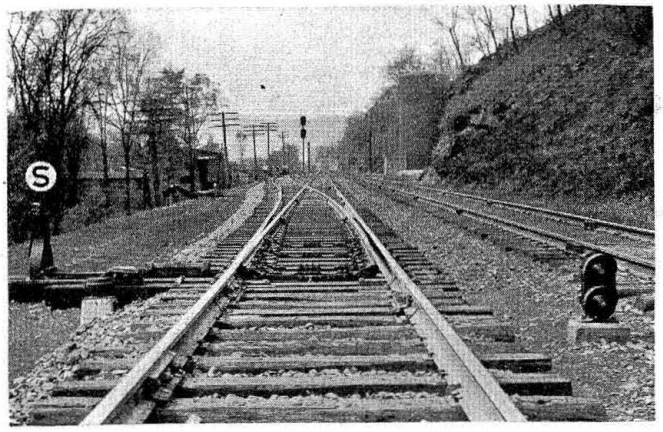


The centralized traffic control type of machine with illuminated track diagram is located in the dispatcher's office at Ronceverte

the safety of train operation, and reducing operating expenses, it was decided to replace the two mechanical plants by power-operated remotely-controlled switches and signals, and to include either spring switches or power-switch operation for one intermediate crossover and two passing-siding switches, all of which was to be controlled from a C.T.C. type control machine located in the dispatcher's office at Ronceverte.

Mechanical Plants Removed

Attention might be called to the method of operating the switches, in that power switch machines are applied for all switches where a selection of routes is desirable, but at switches where movements in one direction prevail on one route, spring switches are used. For example, a spring switch is used at the east end of the eastward



A spring switch is used at the east end of the eastward passing track. A marker is mounted on the shaft of the stand

passing siding. As the first section of the eastward siding normally extends from the west switch at M.P. 324 to the crossover east of M.P. 323, the west end of this crossover is normally set for the crossover movement. A spring switch was, therefore, applied as a means of operating the other end of this crossover to eliminate the necessity for a train stopping when pulling out of this siding.

Each switch, whether power- or spring-operated is protected by "two-arm" high signals or dwarf signals which present standard interlocking signal aspects. With this signaling arrangement, all train movements in the normal direction of traffic in the entire five-mile area are directed by signal indications. A special feature is, that signaling is provided to direct trains in either direction on the westward track between Whitcomb and White Sulphur, a distance of 7.6 miles. This extra facility is very helpful in allowing eastward passenger or manifest trains to run around slow freight trains which in most instances, eliminates the stopping of either. Normally this track is used for westward trains, but as the grade is ascending from Whitcomb to White Sulphur, occasions arise when it is desirable to use both tracks for eastward trains. In this case, the operator at Ronceverte gets a release from the operator at White Sulphur, and then lever No. 53, which is for traffic-direction control on the westward track between these points, is reversed, which holds all westward signals at White Sulphur at stop. If no trains are occupying the block, either signal 50R or 48RB can be cleared to run an eastward train on the westward track to White Sulphur. This arrangement has proved to be a decided advantage in reducing delays.

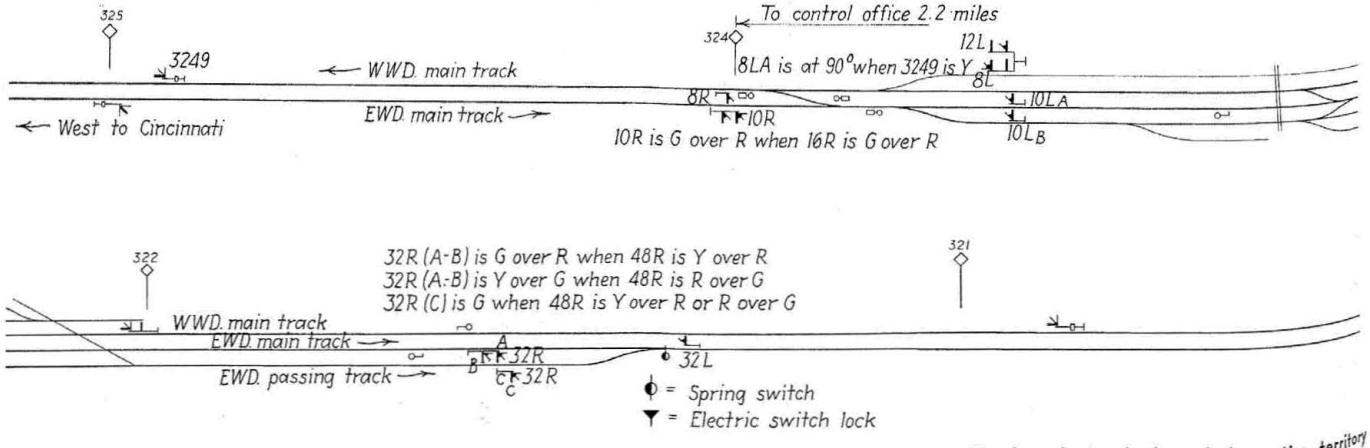
Special Block Control

Another rather unusual feature is that signal 52R at Whitcomb is a remotely-controlled manual-block signal controlled by a lever in the Ronceverte machine. When this signal is cleared, it indicates that the manual block is clear to the next open block office on the Greenbrier subdivision; when displaying yellow it indicates permissive, and when displaying red it indicates stop.

The new signaling system was placed in service on November 24, 1933, and the results being effected in reducing train delays and train stops are very satisfactory. Aside from the betterment in train operation, the new facility permits a reduction of $8,150 annually in operating expense. The installation cost was approximately $60,000, of which $24,000 was charged to capital account.

The control machine in the office is of the C.T.C. type, using miniature levers. At the top of the machine panel, as shown in the illustration, there is an illuminated track diagram. Each track circuit is repeated on the track diagram by a miniature lamp which is illuminated only when the track circuit is occupied. The top row of levers is for switches. Five levers are used to control the operation of the three power-operated crossovers and two single switches. Lever No. 27 is for the control of the electric switch lock on the west end of crossover No. 27.

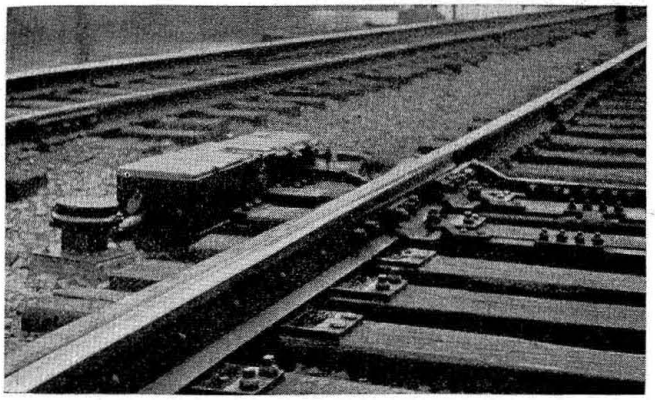
In this installation the C. & O. has introduced a new idea, in that a lever is used for each of the two spring-switch layouts. For example, lever No. 31 has to do with the control of train movements over the spring switch located at the east end of the eastward siding near M.P. 321. This lever stands normally at the left for movements on the eastward main track. If a train is to be moved out of the siding, lever No. 31 is moved to the



Track and signal plan of the entire territory

right-hand position, and when lever No. 32 is operated to the right, dwarf signal 32R-C clears. In other words, the lever used for the spring switch selects the control for the signals, thereby eliminating complicated control circuits for the signals. Above each switch lever are two lights. The one to the left shows white when the switch is in normal position and locked, while the one to the right shows red when the switch is reversed and locked.

There are 12 levers located in the second row on the control machine, 11 of which are for the control of 22 signals and 1 for traffic-direction control between Whitcomb and White Sulphur. Three indicator lights are arranged over each signal lever. The one in the center shows red when the corresponding signals are indicating "Stop," and the one at the left or the right shows amber when the corresponding signal displays a proceed indication. The upper row of buttons below the levers is



At switch machines the underground cable is terminated in a cast-iron junction-box outlet

used to control the call-on indications of the signals, and the lower row of buttons is for initiating the codes after the levers are set to position.

Code Control Used

The C.T.C. time-code system is used for the control of all functions with the exception of signals 16R&L and 20R, located just west of the control office, and crossover 25 and signals 26R&L and 28R&L, located just east of the control office, which are direct-wire control. In order to reduce the cost of coding equipment the line code circuit is arranged with three wires west and two east, the entire circuit being in series. The circuit can be sectionalized so as to by-pass any of the three controlled stations separately or more than one at a time.

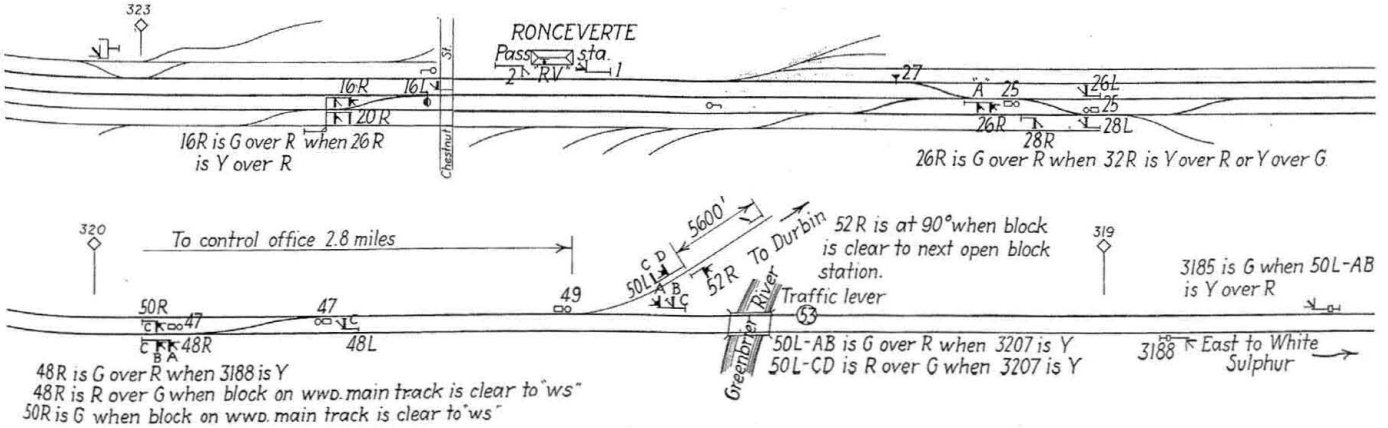
As the control office is on the opposite side of the main

Signals at the west end at the crossover just west of Whitcomb Junction

line from the pole line, the circuits are carried over the tracks in braided aerial cables, made up of No. 14 copper with 5/64-in. insulation wall, and are suspended in galvanized rings from a 3/8-in. stranded phosphor-bronze messenger. Over each track the cable is enclosed in a fiber duct eight feet long which serves as a protection from the heat and gases of locomotive blasts. Aerial cable of the same general construction extends west along the track to signal location No. 20R and east to switch location 25. Beyond these points open line wire construction is used except for local runs. The code line wires are No. 8 hard-drawn copper with double-braid weatherproof covering run on brown-type glass insulators. The 440-volt a-c. power wires are No. 6 hard-drawn copper with the same type of weatherproof covering, and are run on porcelain insulators. The signal control circuits are of No. 10 hard-drawn copper-covered steel with weatherproof covering, run on glass insulators. At each signal location and track feed a 440 110-volt line transformer is used to step down the voltage for charging storage batteries and furnishing normal lighting for the signals.

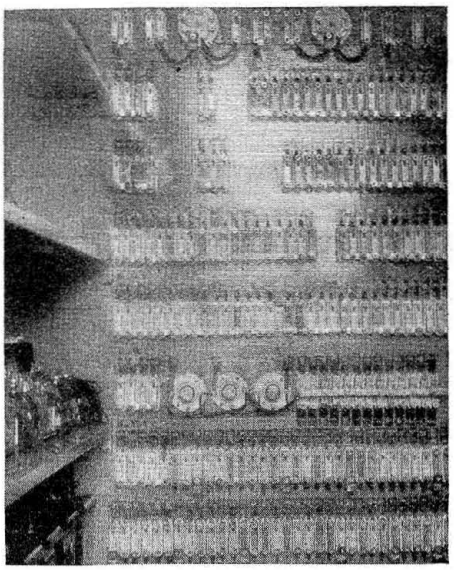
Sheet-Metal Instrument Houses

Sheet-metal houses are used at Whitcomb, near switch No. 25, and at the west-end layout to house the instru-

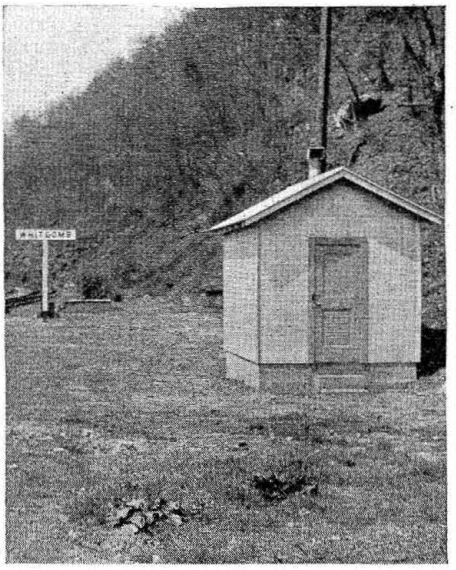


controlled from the c.t.c. machine at Ronceverte

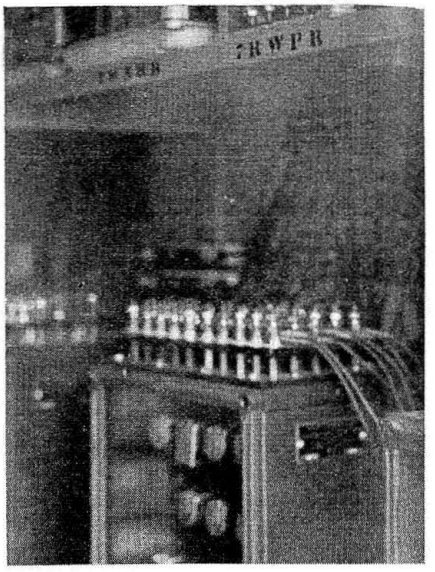
ments and batteries. These houses were constructed by signal forces and are 8 by 10 feet outside dimensions. First, a concrete foundation was built, with a concrete floor sloping to the center where a brass bell-type 4-in. drain was installed. The house was then constructed, using 2 by 4 in. studdings and 1 by 8 in. ship-lap sidings and roof. The exterior and roof were covered with heavy-gage corrugated galvanized sheet iron. As a means of reducing fire hazard, the studdings were set so that the sheet iron siding fits closely to the concrete foundation.



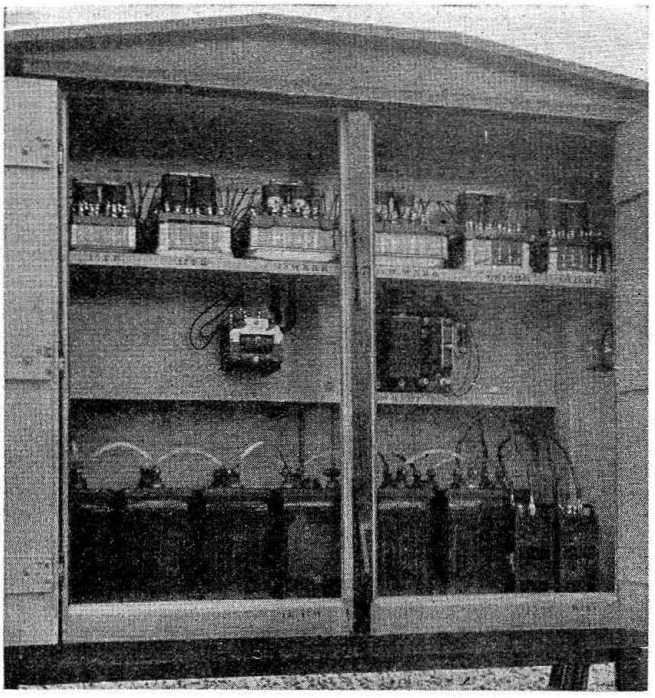
Terminals on rear wall of house



Sheet-metal house at Whitcomb



Code instruments on shelves



Wooden instrument case at signal location

The door is of steel construction with screened ventilator openings in the lower panel. Mounted in the cone of the roof is an eight-inch ball-bearing exhaust ventilator.

In order to allow space for a man to get behind the relay racks in the house, the racks on the rear and two sides of the house are set out 19 in. from the wall. The racks are built up solid from floor to ceiling of 1-in. boards bolted to ¼ by 2 by 2 in. angle-iron uprights. All incoming cables and wires are brought into this outer compartment, and the wires are run through small holes to porcelain terminals which are mounted on the rear wall of the house. Distributing wires from the terminals to the various instruments are run back through the wall, thence through porcelain bridle rings in the wire way to a point where they again pass through holes to the instrument terminals. In this way all the wiring runs are out of sight, and yet there is adequate space behind the board to install or inspect the wiring.

All of the porcelain terminals, arresters, limiting resistances, fuses, etc., are mounted on the rear wall of the house. Track and line circuits are equipped with Turret-type shunt arresters, while Type 60-AP arresters are used on the code circuits. A 5-ohm adjustable resistor is used for the track circuits and a 3.5 ohm adjustable resistor is used for the signal lamp circuits. All battery connections to the code units are fused with 10-amp. fuses.

The TH-10 thermal relays for effecting the time- and approach-locking are mounted at the left and the track, line, and local relays are arranged in standard grouping, all relays being placed on shelves.

Power Supply System

The a-c. floating system of power supply is used on this installation, using a 440-volt power distribution line. One nickel-iron storage cell is used for each track circuit, and lead cells for other purposes. Each switch-operating set consists of 13 cells of storage battery, 90-a.h. capacity, and each line and local signal stand-by consists of 5 cells of storage battery, 160-a.h. capacity. All cells are on floating charge through copper-oxide rectifiers.

The signals on this installation are the color-light type, using 8⅜ in. lenses and 10-volt, 18-watt lamps. The switch machines are the Model-M and M-2 low-voltage type for operation on 20 volts d-c. and are equipped with point detectors.

This installation was planned and installed by signal forces of the Chesapeake & Ohio, the signaling equipment and other materials being furnished by various manufacturers.