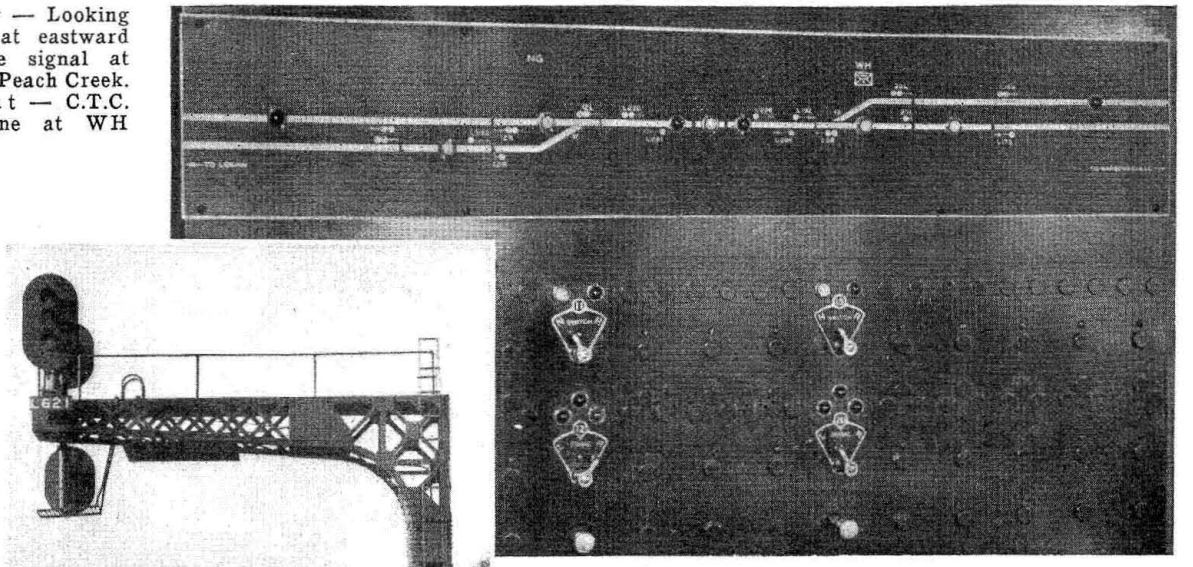
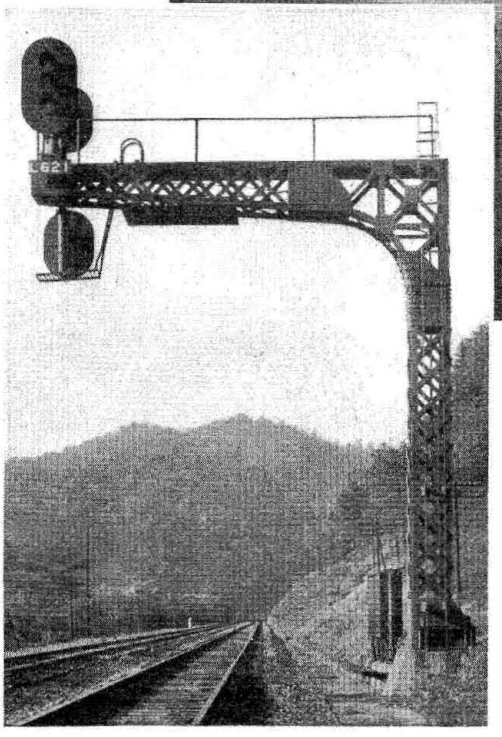
Below — Looking west at eastward home signal at West Peach Creek. Right — C.T.C. machine at WH





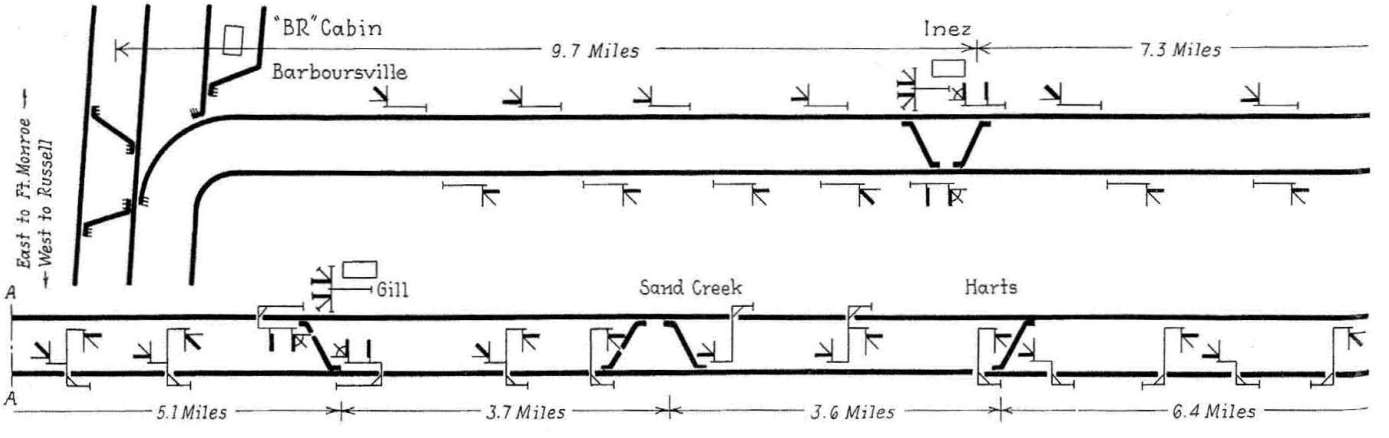
Automatic Block and

FROM Barboursville, W. Va., on the main line of the Chesapeake & Ohio, a branch known as the Logan Subdivision extends eastward 62.4 miles to West Peach Creek which is the west end of a large yard. From Barboursville to WH Cabin, 19 miles, the line is double track; from WH to NG, 11 miles, single track; from NG to the west end of Peach Creek Yard, 32.4 miles, double track, and West Peach Creek to Peach Creek, 1.1 miles, single track.

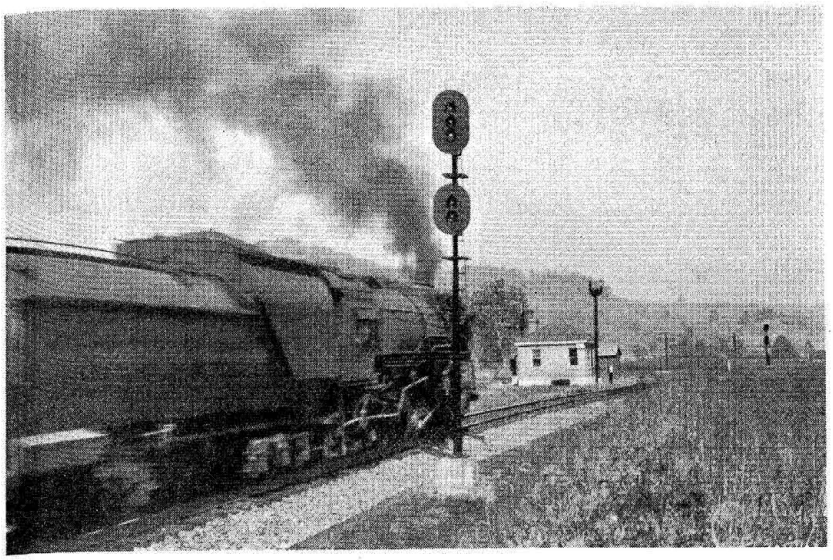
Practically all this territory from Barboursville eastward is mountainous, but the line was constructed up through the valley of the Guyandot river so that it is at river grade not exceeding .85 per cent ascending eastward. Curves ranging up to 8 deg. are numerous, but these do not require speed reductions below the present maximum authorized speeds which are 35 m.p.h. for freight trains and 45 m.p.h. for passenger trains.

Track Facilities

From Peach Creek, separate lines extend up valleys in five different directions, each line having numerous branches connecting to coal mines. Loaded coal cars from these branches are assembled in trains in Peach Creek yard. These trains, each consisting of about 140 cars, are operated on the Logan subdivision from Peach Creek yard to Barboursville, where they enter the three-track main line and run on westward 29.4 miles to a large classification yard at Russell, Ky. In this yard, trains are made up of empty coal cars and are operated on the return trip to Peach Creek yard. During peak seasons, up to 28,000 cars of coal are handled each month, westward out of Peach Creek yard. The operations of the mines



Track and signal plan of the territory



Eastbound train passing westward home signal at WH the west end of the single-track territory.

Centralized Traffic Control

on the Chesapeake & Ohio

Installation on 63.5-mile territory, including C. T. C. on 11 miles, expedites all the train movements

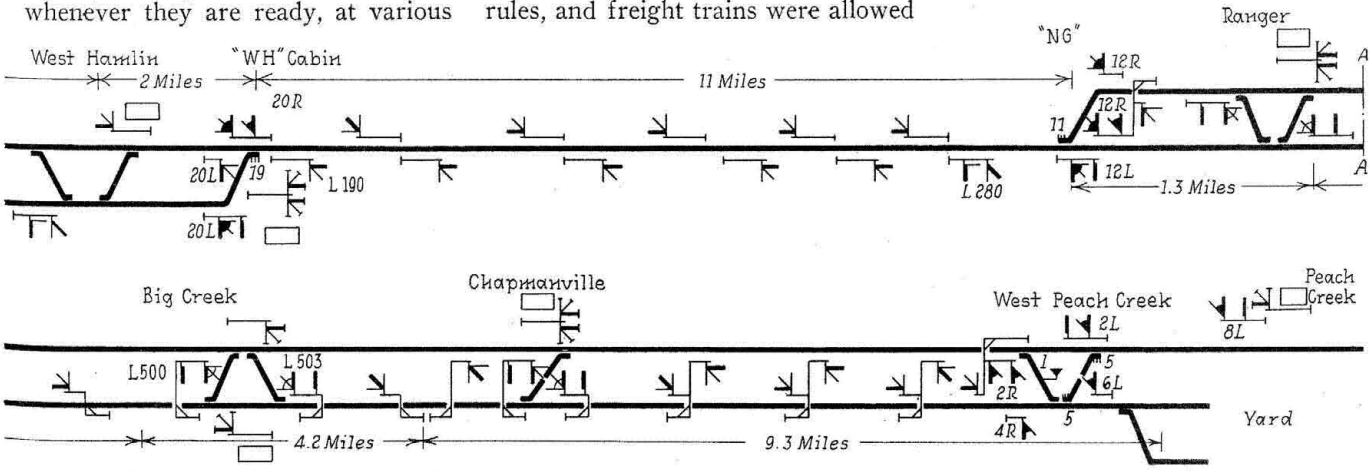
vary from day to day, and over each week-end, but on the average about six to eight loaded trains are operated westbound daily, and the same number of trains of empty cars are operated eastbound. Two local passenger trains are operated each way daily, and a local freight train is operated eastbound one day and westbound the next day, daily except Sunday. The four passenger trains are scheduled, but all freight trains are operated as extras, and depart from the terminals whenever they are ready, at various intervals during the 24-hour period. The ideal operation is a uniform flow of traffic so that there will be no congestion in the Peach Creek yard, and so that the classification yard at Russell can be operated at uniform speed throughout the 24-hr. period.

Methods of Train Operation

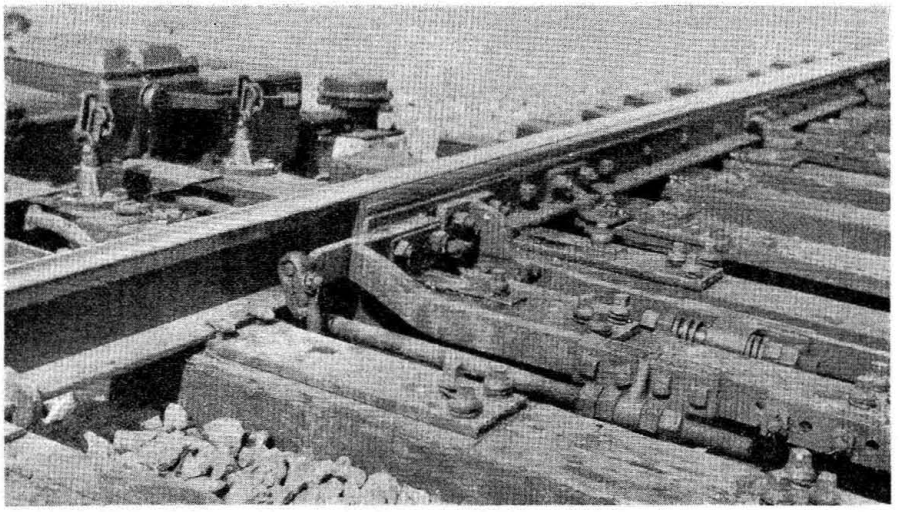
Prior to the recent signaling improvements, trains were operated by train orders and manual block system rules, and freight trains were allowed to follow freight trains in a block on a permissive signal. This operation was not entirely satisfactory, especially during foggy and stormy weather when the sighting distances of some of the manual block signals were short, which necessitated the speed of trains being reduced when approaching the signals. Likewise, when freight trains were following one another in a block on a permissive signal, the speed was necessarily reduced because the sighting distances were short on account of the curves.

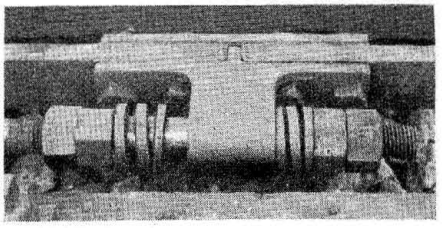
When operating long trains, especially trains of loaded coal cars, once the train's brakes are applied and the speed reduced, it is often necessary to stop the train before releasing the brakes, otherwise the release of the brakes on the forward portion of the train would cause a surge forward, which might break the train in two. On account of these circumstances, trains were operating at reduced speed and were sometimes stopped for a portion of the time enroute, so much so that the track capacity was reduced by these factors.

One logical means of increasing the capacity of the existing tracks was to provide automatic block signaling, by means of which trains could be spaced closer and kept moving at the speeds consistent with safety at all



between Peach Creek and Barboursville





Above—Typical power switch layout with dual-control. Left —Special springs which eliminate strains on parts

times when the tracks immediately ahead were unoccupied, and to give information concerning these conditions by wayside signals located well in advance of where action need be taken by the engineman. With this signaling, the speed of trains can, in most instances, be controlled gradually by using the locomotive brakes. With such braking, if conditions ahead change so that a train receives a "better" signal aspect, the locomotive brakes can be released and the train can be accelerated without the necessity of stopping and without any likelihood of breaking the train in two. Thus the provision of wayside automatic block signals, including advance information, permits the use of the ideal method of handling these heavy trains, so as to eliminate unnecessary stops and also permit smooth handling, as well as permit higher average train speeds with safety. Additional advantages of the signaling is the protection provided to detect broken rails, misplaced main-line switches and cars on turnouts fouling the main line.

Arrangement of Signaling

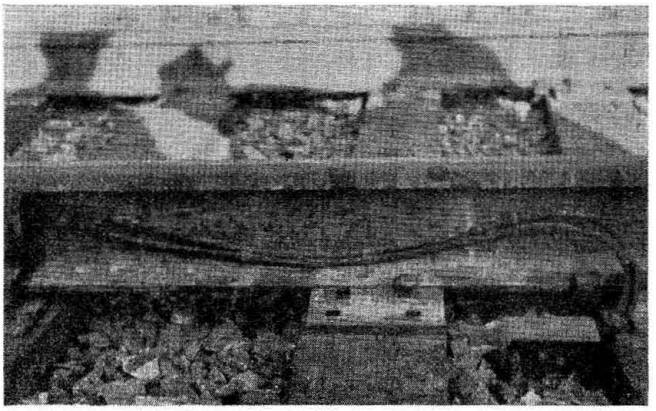
The automatic block signals are spaced about two miles apart. These signals display the standard three aspects: namely, red, yellow, and green. When running on the clear aspect (green), following trains can, if necessary, close up to a spacing of about 4 miles, which at 35 m.p.h. represents about 7 min. This spacing not only provides adequate track capacity, but also flexibility to permit efficient handling of the trains with safety.

Trains are operated right-hand running on the double track between Barboursville and WH. The switches and signals involved in the junction between the double-track Logan subdivision and the three-track main line at Barboursville are included in an electric interlocking which has been in service for a number of years. The switch and signals at the end-of-double track at WH, and the switch and signals at the end-of-double track at NG are power operated and are controlled in a C.T.C. system with the control machine located at WH Cabin.

The Peach Creek yard, from which the trains of loaded cars are dispatched, is located on the south side of the main line. In order to eliminate the necessity of operating these westbound trains across an eastward track, thus introducing delays, left-hand running is in effect between NG and West Peach Creek. Passenger trains in both directions use the single track between West Peach Creek and Peach Creek. Likewise, eastbound trains of empty coal cars use this section of single track to a yard located east of Peach Creek. The westward passenger trains from this single track are crossed over through crossover No. 5 at West Peach Creek to operate left-hand running to NG.

The second crossover, No. 1, at this same layout, was provided for use in case trains are operated against the normal direction of traffic on the double track and when necessary to route eastward trains into the west yard. Such moves are made only in cases of emergency, and, therefore, this crossover is equipped for operation by hand, both ends being operated by a centrally located machine with one mechanical lever. The switches are locked in both normal and reverse positions with facing point locks. Operation of the one lever unlocks the switches, operates them to the opposite position and again locks them. An electrically controlled lock prevents operation of the mechanical lever from the normal position until released as will be explained later.

The power switch machines for crossover No. 5, the electric lock on the mechanical lever for crossover No. 1, and also the signals controlling train movements over this West Peach Creek layout are controlled remotely by a miniature lever type machine in the dispatcher's office at Peach Creek, 1.1 mile east.



New type of bootleg outlet made of a section of angle iron

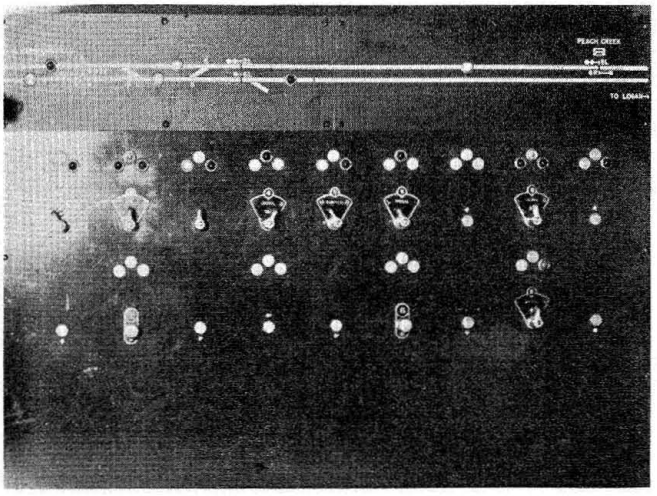
Method of Directing Train Movements

The main line and the Logan subdivision dispatchers are located in the same office at Huntington, W. Va., 9.5 miles west of Barboursville on the main line, and receive their information concerning approaching trains from each other. The operator at Barboursville works under the direction of the main-line dispatcher and also blocks trains with the operator at WH who works under the direction

of the Logan subdivision dispatcher. The dispatcher of the branch lines east of Peach Creek is located at Peach Creek and handles the control machine for the facilities at West Peach Creek.

Authority Conveyed by Signals

The eastward semi-automatic home signal, No. 20L, at WH, and the westward semi-automatic home signal, No. 12R, at NG, serve not only to govern trains over routes involving the ends of double-track switches, but also to authorize train movements in either direction through the single track section between WH and NG. Likewise, in the single-track section Peach Creek to West Peach Creek, the semi-automatic home signals controlled by the Peach Creek dispatcher serve the purposes explained above. Similarly, semi-automatic home signals in the Barboursville interlocking and the WH, NG, and West Peach Creek layouts direct trains on routes over the switches involved and for movement in the normal direction of traffic in accordance with rules for double-track operation in automatic block signal territory, subject to any train orders that may be necessary for such operation. All these are absolute signals normally displaying the Stop aspect, red-over-red without a number plate, Rule-292.



Control machine in the office at Peach Creek for control of West Peach Creek

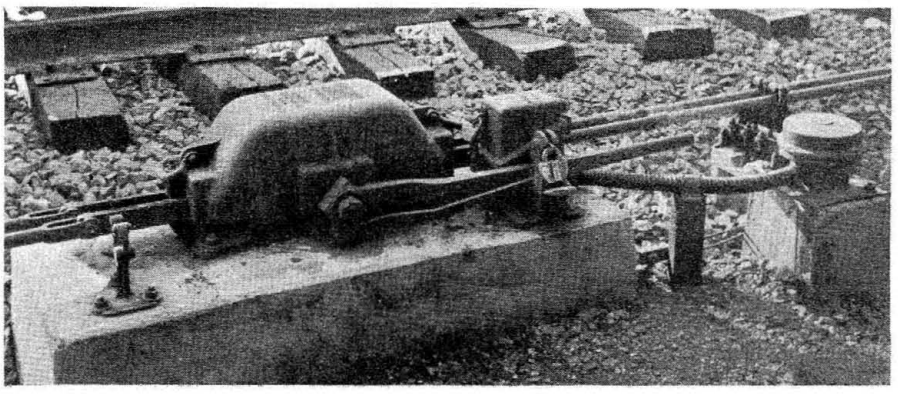
The turnout at WH, for example, has a No. 16 frog; therefore, eastward train movements from the eastward main to the single track are limited to medium speed, and for this reason the best aspect which is displayed by the eastward home signal is Clear-Medium, red-over-green. In order to authorize an eastward train to be accelerated to maximum authorized speed as soon as it is clear of the turnout, provided the next two automatic blocks are unoccupied, advance automatic block signal No. L190 was provided as shown on the diagram.

For each semi-automatic home signal on which the best possible aspect is Clear-Medium, red-over-green, the signal in approach thereto is of the two-unit type. When the home signal is displaying the Clear-Medium aspect, the "distant" signal displays the Approach-Medium aspect, yellow over green, which indicates that the train is to approach the home signal at not exceeding medium speed. When the home signal is displaying the Stop aspect, the distant signal displays the Approach aspect, yellow-over-red, indicating that a train is to at once reduce to medium speed and prepare to stop at the next signal. The use of four aspects, rather than only three, on the home and distant signals, permits the trains to be brought up to and through the switches at the speeds for which the turnouts are designed, whereas with a three-aspect signal using the Approach aspect when the Clear-Medium is displayed on the home signal, the train speed would have to be reduced to medium speed through the approach block. As explained previously, once the train brakes are applied on these long trains, a stop is usually made to release the bakes. The use of the four-aspect signals, therefore, does eliminate train stops and consequent delays.

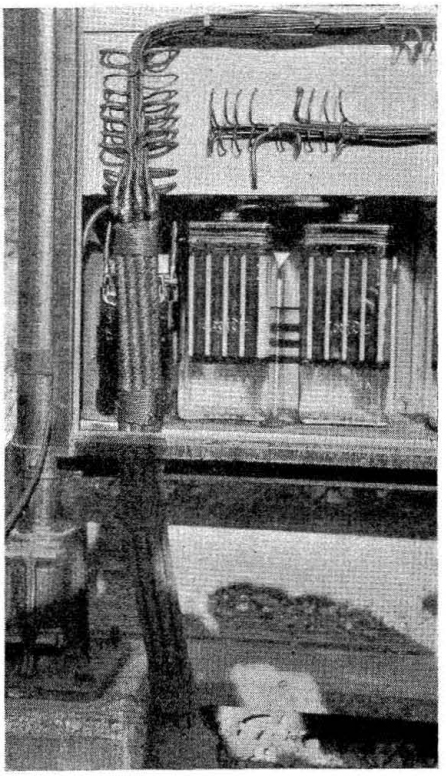
Special Holding Signals

The local freight train and the four local passenger trains are operated during the daylight hours. The first passenger train entering the territory leaves Barboursville at 7:33 a.m., and the last passenger train, an eastbound, leaves the territory at Peach Creek at 5:56 p.m. During the remainder of each 24-hour period, that is, from 5:56 p.m. to 7:33 a.m., the line between Barboursville and Peach Creek is available for the operation of the long freight trains without any interference from other trains.

Although short spurs and sidings are provided at several locations on the Logan subdivision, no passing tracks long enough to hold a train of 140 cars are available. Therefore, when one of the trains of either loaded or empty coal cars leaves a terminal yard, it must stay on the main line until it reaches its far terminal. This means that the local freight train has to clear for the long freight trains, and that the four passenger trains must, when occasions arise, be operated around the long freight trains by running against the normal direction of traffic. For example, if a westbound freight train is out of West Peach Creek just ahead of a westbound passenger train, the passenger train would be operated against the normal direction of traffic to pass the freight train and again resume normal-direction operation at the hand-operated crossover at Big Creek. Special "hold-out" signals such as L500 and L503 which are manually controlled by the operator at Big Creek were provided as a means for stopping trains at the crossovers, and similar signals are provided at Inez,



Hand-operated switch and lock movement for operation of crossover 1 at West Peach Creek



Case with rear panel cover removed showing the cable construction

Ranger, Gill, and Chapmanville. All movements against the current of traffic are authorized by train orders.

Signal Equipment

The signals on this installation are the color-light type. A double-filament 10-volt lamp is used in each unit. At the signals located on curves, 30-deg. spreadlite lenses are used, with lamps rated at 10 volt, 30 plus 6 watts. Signals on tangent track are equipped with standard lenses and 10-volt, 18 plus 3.5-watt lamps are used. The semi-automatic home signals at Barboursville, WH, NG, and West Peach Creek are lighted continuously. On double track, the automatic block signal lamps are approach lighted, using a 60-ohm normally energized relay, in series with the HD circuit for the signal behind, thus giving full block approach lighting. At double locations on single track, each signal is lighted by controlling the light circuit through a back contact of the HD relay for the opposing signal. All signals on single track are lighted when either of the semi-automatic, manually-controlled entering signals is cleared. All signals are lighted whenever the control is such that the red aspect is displayed.

Light-Out Checking

On a single-unit automatic signal the absence of a light is accepted by an engineman as the most restrictive aspect of that signal. On a two-unit home or distant signal a burned-out lamp in the upper unit, which would result in the display of a more favorable indication than is intended, actuates a "light-out" relay to prevent this condition. At each such signal, the operating coil of the "light-out" relay is connected in series with the energy feeding the lamp which it is desired to check in the top unit so that the relay is energized at all times unless this lamp is burned out. The circuit for the desired lamp in the bottom unit is then fed through a front contact of the light-out relay so that if no lamp is lighted in the top unit, the relay is released, thus extinguishing any lamp which may be burning in the bottom unit other than the red lamp which is then directly lighted over a back contact of this relay.

The lamps are rated at 10 volts but are normally fed at about 8.5 to 9 volts, thus lengthening their useful life. Continuous burning lamps are replaced after a burning life of approximately 6,600 hours, and those in approach-lighted signals are replaced every two years. The lamps are not changed from one color position to another, but are left in the unit in which they were originally installed until they are removed.

All new lamps from the manufacturers are received at the signal shop at Barboursville where they are carefully examined for defects, and the filament checked for proper light center length and axial alinement, after which they are given a short trial burning test before being distributed to the maintainers. Experience has shown that the majority of defective lamps can in this manner be eliminated, and the number of lamp failures in service is thereby reduced to a minimum.

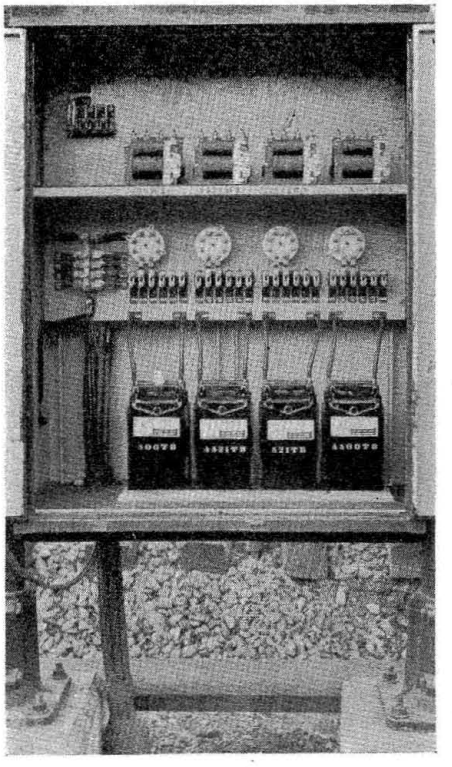
Power Switch Layouts

The power switches at WH and NG are operated by low-voltage d-c. machines which are equipped with dual control so that they can be operated by hand if necessary. The standard arrangement of facing-point locks and lock rods, as well as point detectors, is provided. A special feature of the power-switch layouts on the Chesapeake & Ohio is the use of two coil springs on the operating rod, one on either side of the switch adjustment bracket. The purpose of these springs, one for the normal and one for the reverse operation, is to provide a cushion so that the mechanism can complete its full stroke operation without producing excessive strain on switch points, connecting rods or their connections under slightly varying conditions of adjustment.

The cross section of the spring is 5/16 in. by 5/16 in., and it is formed with a 1¾-in. inside diameter. The nuts are normally adjusted so as to hold the spring within approximately ¼ in. of being fully compressed and so that if it should break, less than ¼ in. slack would occur. As a matter of fact, none of the springs purchased under the present specifications have broken, although many of them have been in service for several years.

Control Circuits

The automatic block signals are controlled by double-wire, double-break polar line circuits, using retained neutral polarized line relays.



Track feed location

The power switch and semi-automatic home signals at WH are controlled by direct-wire circuits from the cabin. The power switch and semi-automatic home signals at NG are controlled by a two-wire time code system, the coding apparatus consisting of one office line coding unit and one office storage unit at WH, and one line coding storage and one storage unit at NG.

Power Supply Facilities

The entire signaling system normally operates from direct current supplied by storage batteries. The

signals are lighted normally through transformers fed from the a-c. source, but in case of an a-c. power outage, these lamps are fed from storage batteries.

Pole Line Construction

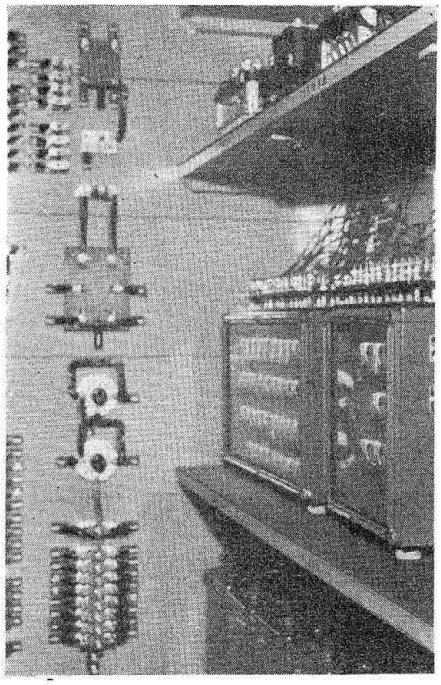
The previously existing pole line in this territory, owned by the Chesapeake & Ohio, had a 6-pin crossarm in the top gain. A second 10-pin arm was added in the second gain to carry the signal line circuits and the 440-volt a-c. power distribution circuit. All line wires have double braid impregnated weatherproof covering. The signal control wires are 40 per cent conductivity, No. 10 copper-covered steel, on glass insulators, and the two 440-volt alternating current power wires are No. 6 hard-drawn copper on porcelain insulators.

The 440-volt power line is fed at several locations, the length of sections varying from 8 to 12 miles each. At each signal location a 440/110-volt line transformer is provided, to feed the low-voltage transformers in the cases, which in turn feed the signal lamps and the rectifiers for charging the storage batteries. In case of an a-c. power outage, a power-off relay switches the feed for the lamps to the storage battery. The storage batteries at the signal locations are rated at 144 a.h., those for operating the power switch machines and coding apparatus at 110 a.h., and individual cells for the track circuits at 80 a.h.

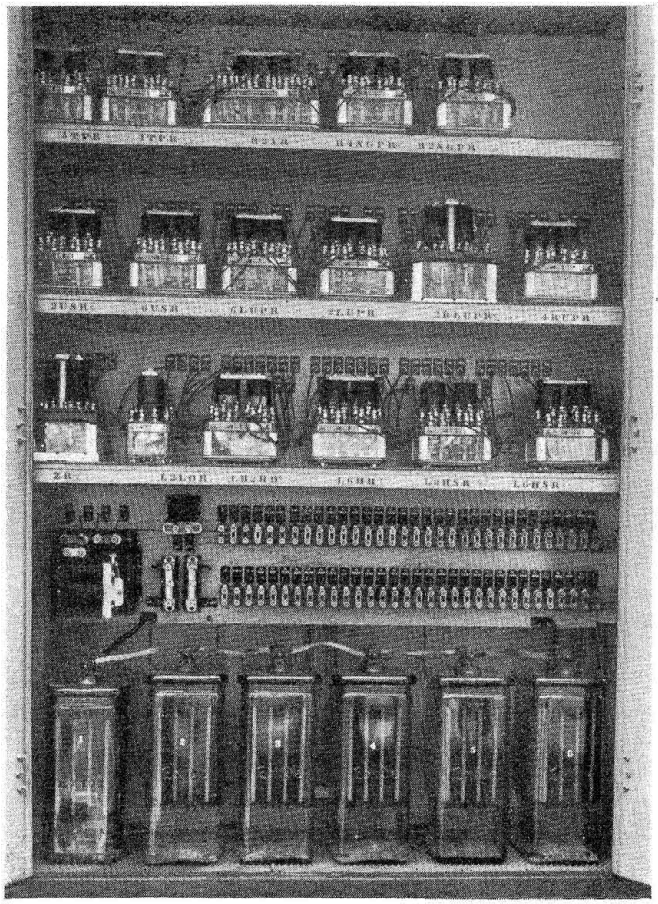
Instrument Housing

WH Cabin is a new one-story building of concrete and brick construction, with a separate room for housing the relays and batteries at that location. The relay rack is made up with shelves and back walls of asbestos boards which are bolted to a framework of angle iron. At NG, the instruments and battery are located in an 8 ft. 9¾ in. by 10 ft. 9¾ in. house of wood frame construction and sheathing, and outer wall coverings and roof of corrugated galvanized sheet iron. The building is set on a floor and foundation of concrete poured in place, the foundation being high enough to bring the floor level about three feet above the ground surface.

At each automatic signal location, the instruments and battery are located in a sheet-steel case which is supported at each end by a 4-in. pipe post in a cast-iron base on a concrete foundation. At places where the entrance cables come up out of the ground they are surrounded by a section of 4-in. or 6-in. vitrified clay tile about 2 ft. long. When the cables are in place the voids are filled and packed with sand to a point about 1 in. from the top, this space being filled with sealing compound which is shaped up as a cone around the cables so as to shed water. Ordinarily the cables are run through the tile sections when being installed. If cables are already in service, a special type of tile, split in half lengthwise, with grooves to fit, is placed around the cables.



Interior of house showing terminals on rear wall and the code apparatus



Interior of case at a typical signal showing relays and storage batteries

Bootleg Outlets

For track connections, single-conductor solid No. 9 cable extends to an A.A.R., Signal Section, bakelite-base, two-post terminal, which is mounted near the top of a riser as shown in one of the views. From this terminal two insulated No. 9 stranded conductors extend to a plug terminal in the rail. Each riser is made of ¼-in. by 3-in. by 3-in. angle iron. The top is formed by cutting out a square section and bending the other half down to form a cover. The terminal is bolted to the riser just below this cover. A square plate of ¼-in. iron, 6-in. by 6-in. is welded to the bottom of the riser to form a supporting base. An advantage of this type of outlet is that the cable, terminal, and wires to the rail are readily inspected, and the top section protects the terminal from dragging equipment.

This signaling installation was planned and installed by the signal forces of the Chesapeake & Ohio.