EASTBOUND FREIGHT TRAIN on track No. 4 passing interlocking tower

Yard Operations Improved

by New Interlocking and Car Retarders

In Baltimore & Ohio yard at Connellsville, Pa., a revised track layout permits trains to enter or leave the yard while cars are being humped—Interlocking reduces train delays—Retarders expedite classification and reduce operating expenses

AS A MEANS OF expediting yard operations and increasing operating efficiency at the yard in Connellsville, Pa., the Baltimore & Ohio has made track changes and installed a modern electric interlocking at the east end of the yard, and has installed power switches and car retarders in a fifteen-track gravity classification yard used to classify and weigh loaded coal cars.

Connellsville. which is 58 miles east of Pittsburgh, Pa., on the main line of the B&O between Washington and Chicago, is a division point where freight train crews are changed. A few of the fast-schedule manifest trains stop on the main track while crews and cabooses are changed, but the remainder of the freight trains go through the yard to set out or pick up cars, as well as to change crews. About 12 through, main-line freight trains are operated each way daily, and 12 to 14 main-line passenger trains are operated daily.

At Greene Junction, which is the east end of Connelsville yard, a secondary line, known as the FM&P, branches off to the southwest through coal fields to Morgantown, W. Va., and Fairmont, W. Va. No passenger trains are operated on this branch; however, about 350 to 400 loaded cars of coal are brought into Connellsville daily from this line, and about the same number of empty coal cars are returned to the mines. This requires 3 to 4 trains each way daily to and from the FM&P.

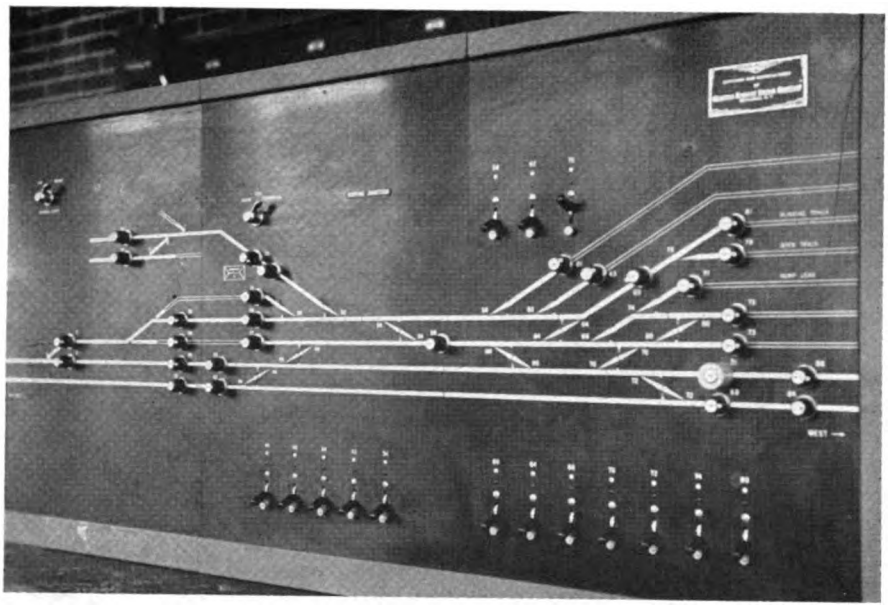
In the Greene Junction area, hand-throw stands were previously in service at the switches, and were operated by switch tenders under the direction of the telegraph operator. In recent years, delays to freight trains have increased because of interference between humping operations and trains entering or leaving the west end of the yard. Therefore, a program was adopted to revise the track layout, and to install a new interlocking at Greene Junction, as well as power switches and retarders in the fifteen-track yard where the loaded coal cars are classified.

Track Layout Improved

The first part of this program was to make track changes at the west end of the yard, the objective being to minimize interference between: (1) Main line trains entering and leaving the yard; (2) Humping operations; and (3) FM&P trains entering or leaving the yard.

As shown on the track plan, the first two tracks on the north side are the westbound and eastbound mains. The next two tracks, No. 41 and No. 43, are the westbound receiving tracks. The next is the lead for pushing cars west to the hump of the classification yard. Next is a track that is kept "open" to be used either way, and the next is also a running track. Tracks No. 32 and No. 34 on the south are eastbound leaving tracks.

After a train of loaded coal cars arrives, a hump engine is coupled



to the east end of a string of these cars and pulls back east through a set of hand-throw crossovers leading to the hump lead, to the Greene Junction interlocking, and onto track 3 east of the interlocking. This pull-back move is controlled by the hump conductor through a flashing-red aspect on the searchlight-type hump and hump-repeater signals. The Greene Junction operator must give the hump engine a signal to enter the interlocking limits from the west. It is not necessary for the hump engine to pull a cut of cars to clear on the east end of the interlocking limits if he is pulling back on the hump lead to track 3. By means of turn-and-push features on signal levers 47 and 59, a restricting indication can be given with the cut on the plant. However, the hump engineer must have proceed indications on both 47 and 59 dwarf signals and on the hump-repeater signal before he can begin to push ahead.

Track 4 east of the interlocking is an eastbound departure track and connects with the eastbound main track at a spring switch which is 4 miles east of the interlocking. At this switch, train movements are governed by signals 5 and 7, controlled from the interlocking machine.

The FM&P branch line is single track from Greene Junction interlocking across the bridge over the Youghiogheny River, and to O&B junction which includes an end of double track with a spring switch. This junction is protected by interlocking signals 55, 37 and 39. Train movements on the FM&P are authorized by manual block, and signal 55 serves as a manual block signal as well as an interlocking signal.

In the Greene Junction interlocking, signal 59 is located about midway between the overall interlocking home signal limits. The purpose for this signal 59 is to provide for a switch engine to take a caboose off the rear of a westbound train on tracks 41 or 43, and set the caboose on the open or running track without being required to go all the way back beyond the westbound home signals. To eliminate the possibility of blocking tracks 32 or 34 with a westbound FM&P train headed for 41 or 43 track, the circuits are set up so that signal 59 must first be cleared before signal 57 can be cleared.

Panel-type Interlocking Machine

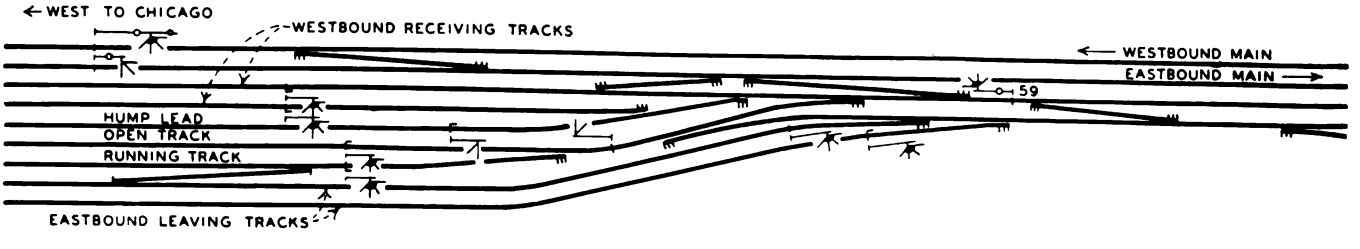
The interlocking is of the all-relay type, using a panel-type control machine. On this panel, each track is represented by a white line ¼ in. wide. In these white lines are white lamps that are lighted when corresponding sections of track are occupied. Switches are controlled by toggle-type levers located in horizontal rows, above and below the track diagram, the normal position being downward. Above each lever there are two lights; one a red light which indicates that the switch is locked and cannot be operated; the other an amber light which indicates that the switch is in transit seeking correspondence with its lever. Movable switch-point indicators, located in the track diagram, show the route lined by a continuous white line. If a switch lever is thrown while electric locking is in effect, the lever must be returned to its original position in order to regain control. Switch controls cannot be pre-conditioned.

Signal levers are the push-pull-turn type located in the track diagram which corresponds with the location of the signal on the ground. To clear a signal, the desired route is established and the signal control lever is pushed. This will cause the indicator light within the signal lever to be lighted red. After the switches have completed their movement and the signal displays proceed, the indicator light will change to white. After the train passes the signal, the signal is automatically returned to stop, indicated by the absence of a light in the signal lever. If a signal which has been cleared is to be taken away, the corresponding lever is pulled. The circuits are similar to AAR Signal Section Typical Plan 8043-A.

Modern Relays—Power Supply

The relays in this interlocking are the plug-in type, mounted in racks. The 110-volt d.c. for operating the switch machines is fed from a set of 55 cells of 80-a.h. storage battery. The local 12-volt circuits are fed by a set of six 120-a.h. cells, and the 24-volt circuits are fed by twelve 120-a.h. cells. Each track circuit is fed by one 120-a.h. cell. The transformers and rectifiers are mounted on a panel made of ¾" plywood on a frame made of 2" × 2" × 3/16" angle iron. A similar board is used to mount the terminals and arresters, on which incoming cable wires are terminated.

The floor is of pre-stressed concrete beams with 3" metal pipes through the floor for the cables, sealing compound being packed around the cables in these pipes.



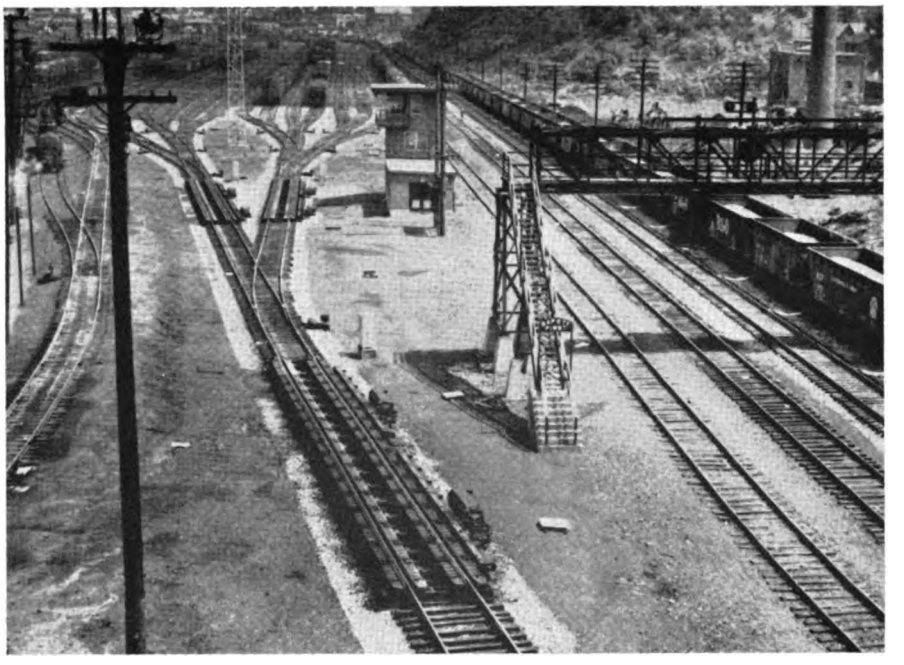
wall. When installing the cables, the trenches were dug by a power trenching machine. The cable to each switch machine includes three No. 9 and nine No. 14 wires. Two of these wires are for a telephone circuit.

A phone jack is located in each switch machine and in each relay case. The maintainer has a portable telephone, known as the monophone type made by Automatic Electric Company. By plugging in this phone, he can call the towerman from any one of numerous locations on the plant.

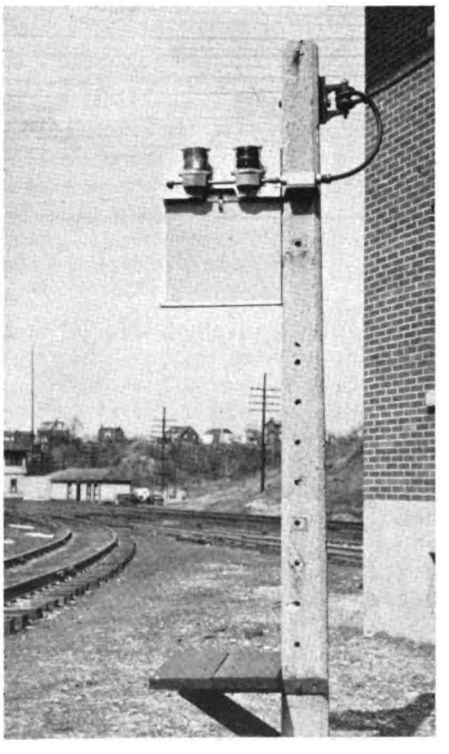
The switch machines are the Model 5C with 110-volt d.c. motors. Each switch machine is controlled by a biased neutral controller in the switch machine. Electrical heater coils, rated at 75 watts, are located in the controller compartment of each switch machine and in brake compartments. These heaters are fed by 110-volt a.c. during cold weather, thus preventing frost trouble. The signals are the B&O standard color-position-light type.

Train-Order Board

Train orders are delivered to some trains at Greene Junction tower, and, therefore, train-order boards were installed as part of the new project. One of the pictures shows one of these boards mounted on a concrete post beside the track. Each "board" consists of two fresnel lens lamps (one red and one yellow), mounted above a square white panel 22" × 28". Other panels, colored yellow on one side and red on the other, can be inserted to cover the white panel. When no orders are on hand for an approaching train, the white panel is displayed, with no light. When Form 31 orders are on hand for a train, the red board is displayed and the red lamp is lighted above it. When Form 19 orders are to be picked up by a passing train, a yellow board is displayed with a yellow light.



VIEW looking west on hump lead; mainline is to right



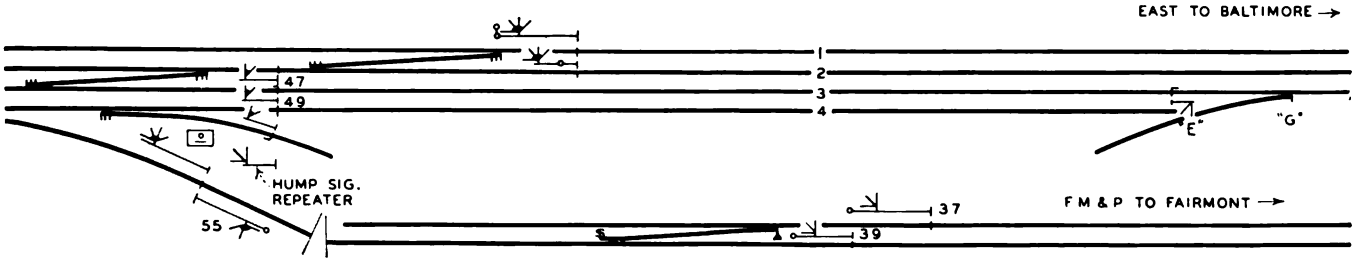
TRAIN ORDER BOARD at Greene Jct. tower

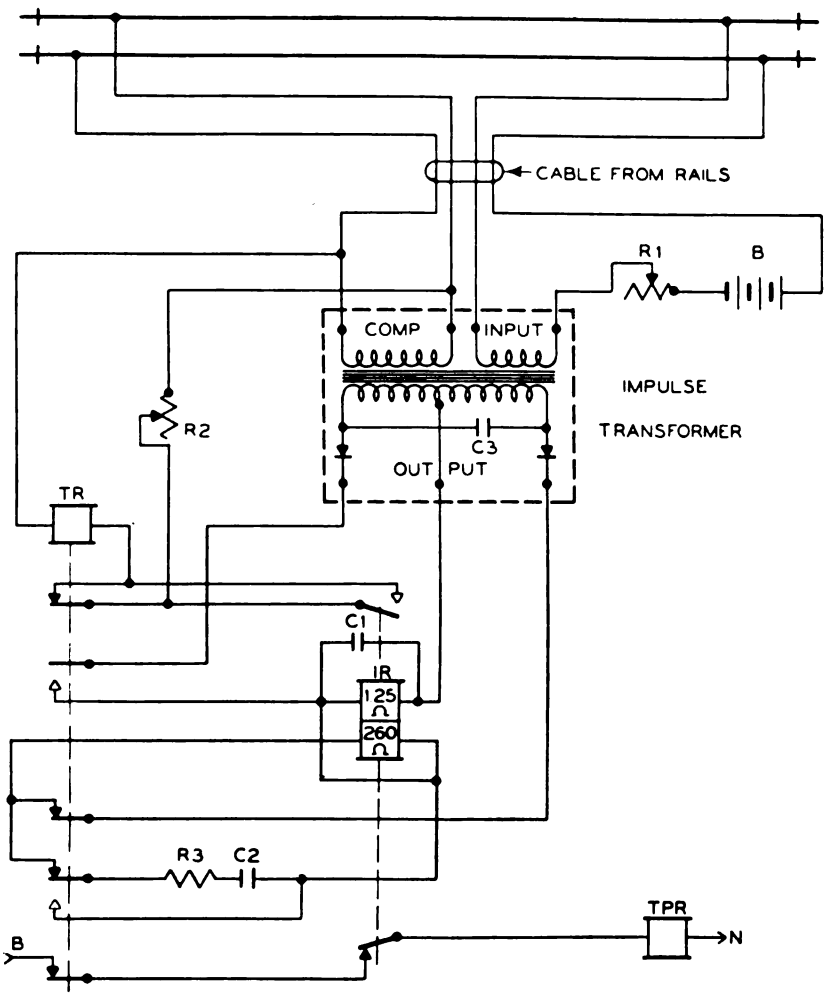
Features in Retarder Yard

In the gravity-type yard for classifying loaded coal cars, the switches were previously operated by hand-throw stands. Prior to installing the power switches and car retarders, the grades were revised and the track layout changed from a ladder arrangement to two groups—one with 8 tracks and the other with 7. The leads from these groups connect to one lead down the hump.

Motors in the switch machines are rated at 130 volts d.c. and the retarder motors are rated at 265 volts d.c. A set of 120 cells of 160-a.h. Gould lead storage battery are connected in series to supply the 265 volts. The 130 volts is fed by a split battery connection. The power source for charging is obtained from a 3-phase, 2,300 volt source. This is stepped down through a transformer bank to 440 volts, 3-phase. One phase of the 440 supply is stepped down to 110-80 volt supply source for furnishing power for lighting, for charging the 10-volt track battery and for the 24-volt control energy.

The 120 cells for storage battery are charged by constant voltage Flotrol units selenium-type rectifiers made by Lorain Products Company. Each of these rectifiers is rated at 440 volts, 25 amp. input, and 265 volts, 35 amp. output. At 265 volts, the normal operating current for a retarder reaches a peak of 60-80 amp. When closing a retarder on a moving car, the peak may reach 150





amp. The battery, in combination with the rectifier power supply, furnishes this peak current.

In case of an a.c. power failure, a 5 KVA d.c.-a.c. motor-generator is started automatically to supply the emergency lighting needs. This set was built by the Electric Products Corporation. The stand-by equipment is good for about 8 hours of continuous hump operation by battery operation alone. In the event of a major power interruption of longer duration, facilities are provided for connecting a diesel locomotive into the plant to charge the main battery bank indefinitely. The main power switchboard is of the dead-front type, and was furnished by the Westinghouse Electric Corporation.

Impulse Track Circuit

The detector track circuits in this yard are the new high-sensitivity impulse type, which provides greatly improved protection against loss of shunt. Each track circuit is about 55 ft. long, with 16 ft. in approach to the point of the switch, and the remainder through the switch.

The new track circuit, Fig. 2, uses a conventional battery (5 cells of lead or the equivalent voltage) and a 4-ohm track relay with series resistance, but employs, in addition, an impulse transformer and an impulse relay of the code responsive type. The impulse transformer has three windings; input, compensating and center-tapped output. The input winding is in series with the feed to the track. The compensating winding is connected across the track at the relay end. The output winding, in conjunction with half-wave rectifiers, operates the impulse relay.

Operation—When a car enters the track circuit, the shunt, even though it may be intermittent and of high resistance, causes the current in the input winding of the impulse transformer to increase, and the current in the compensating winding to decrease. Since the magnetism produced by the current in the compensating winding opposes that produced by the input winding, these current changes act in the same direction magnetically. The resultant magnetic change produces a voltage in the output winding, such that the right-hand terminal, Fig. 1, is positive. As a result, current flows from this terminal through the right-hand rectifier, a front on track relay TR, and both coils of impulse relay IR in series, returning to center tap of the output winding. IR picks up, opening the circuit to track repeater relay TPR to indicate track occupancy.

The foregoing describes what occurs immediately after the car occupies the detector track circuit, even though the shunting is very poor. The operation of IR is interlocked with the operation of TR. If the shunt is good, IR releases immediately after TR drops and the circuit acts as a conventional d.c. track circuit.

However, if the shunting conditions are such that TR does not drop promptly, or if the shunt conditions become so poor that TR can again pick up if once down, IR takes over to provide the occupancy indication and keep the circuit to TPR open. With TR up, shunt variations which occur while the car is moving through the track circuit result in variations in the magnetization of the input and compensating windings. Each time such a variation occurs, IR receives another impulse to pick it up or hold it up if already energized. With TR up, condenser C2 (with limiting resistor R3) is shunted across the lower winding of IR, making IR slow release so that it holds up between impulses from the impulse transformer. However, if the shunt becomes sufficiently good to release TR, the energy to IR is cut off by means of contacts on TR, and IR immediately drops.

When a car which has dropped TR leaves the track circuit, the magnetic change in the impulse transformer is in the direction to make the left-hand output terminal positive. This picks up IR through the left-hand rectifier, a back contact on TR, and the upper coil of IR returning to the center tap of the output winding. With IR up, TR follows, through an IR front contact. Stored energy in condenser C1 prevents losing IR during the crossover of the TR front contact.

It is not possible to pick up TR, because of the open stick circuit, unless IR comes up to close the pick-up circuit. Pick up of TR therefore checks that IR is operating as intended. With TR again up, the circuit to the upper coil of IR is opened at a back contact of TR, and IR drops to complete the circuit to TPR.

Electric Retarders

The car retarders in this yard are type "E" electric, furnished by the

General Railway Signal Company. These retarders are all of the double-rail type, and each unit consisting of a section 49 ft. 6 in. long is operated by a separate mechanism, controlled by a separate lever. The hump retarder and the two group retarders each consist of two units totaling 99 ft. Thus the 3 retarder locations include 6 units totaling 297 track feet.

The 15 switches in this classification yard are operated by model 6 electric switch machines. These are high-speed switch machines and operate in approximately 0.6 seconds. No lock rods are used, and the machine is arranged so that it can be trailed through without damage, and is designed with a cam arrangement which will, with the spring mechanism, definitely force and hold the switch points in the trailed position.

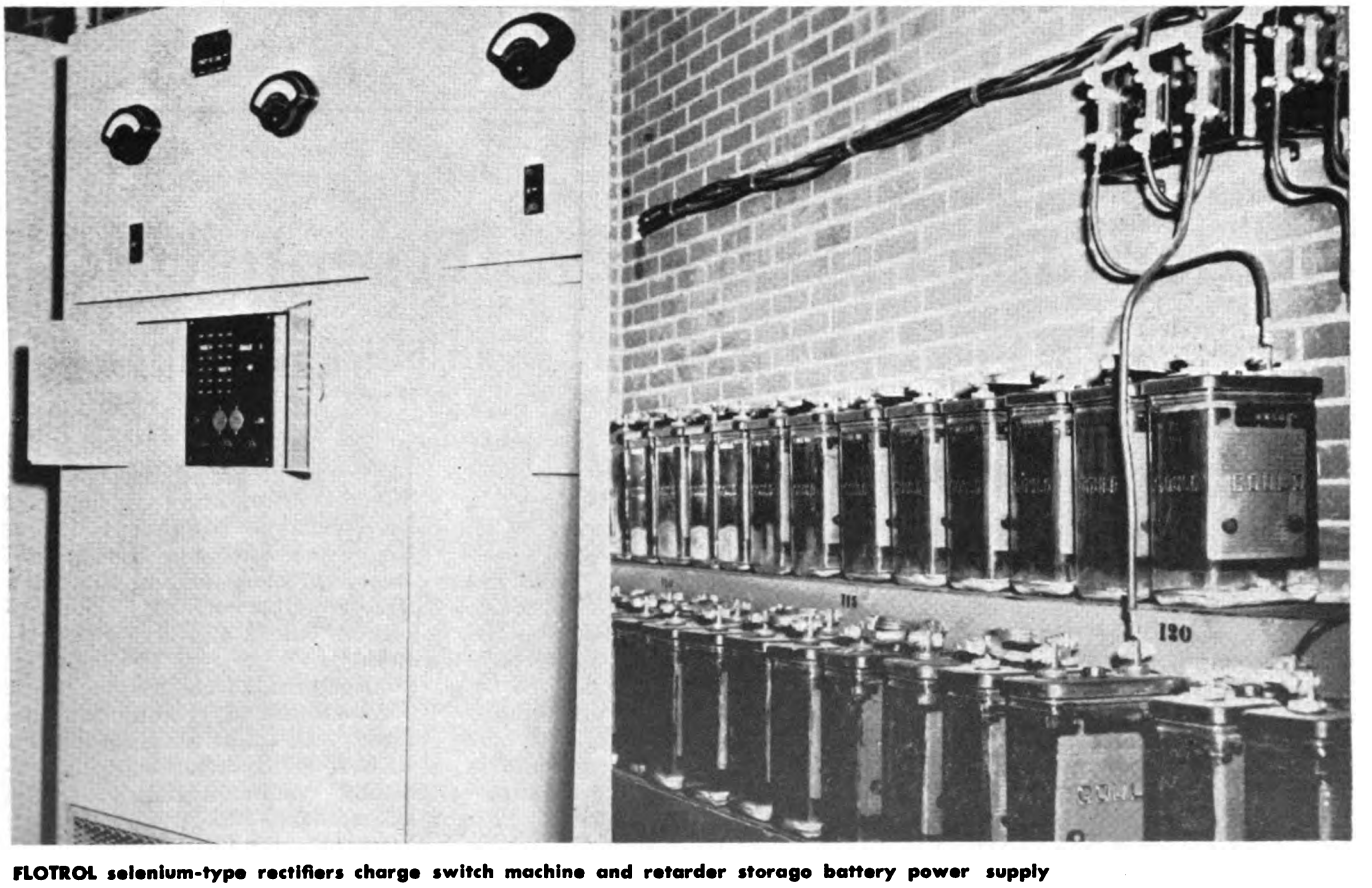
At each switch there is a type P color-light switch target that repeats the position of the switch. This target displays lights in both directions; green when the switch is normal, and yellow when reversed.

The power switches and retarders are all controlled from one machine in a three-story tower located at the north side of the main lead from which the operator has a clear view of the tracks and the retarders. Mounted on an engraved track diagram, the retarder and switch control levers are positioned in the same relation to each other as are their corresponding units in the yard. Each switch lever controls its switch when it is aligned with the track diagram. A red indicator light in the barrel of each switch lever lights when the track circuit at the switch is occupied. An opal indicator light in each diverging track near each switch shows how the switch is lined up.

Hump and trimmer signals are mounted on the same mast. Ordinarily these signals are controlled by the conductor of the crew which is pushing cars over the hump, and he is stationed at a shelter at the hump. However, the operator in the retarder control tower can also control the hump signal to Stop, if some condition in the yard requires that humping be stopped. If the trimmer signal is displaying the "trim" aspect at the same time that the hump signal is displaying a proceed aspect for a string of cars to be pushed from the receiving yard up to the hump, then when the car enters a track circuit about 300 ft. from the hump, the hump signal will change its aspect from Proceed to Stop automatically.

This interlocking and retarder project was planned and constructed by Baltimore and Ohio forces. The design and construction of this yard was under the jurisdiction of K. J. Wagoner, Chief Engineer, and M. S. Norris, Regional Engineer. Interlocking, power switch machines, signals and car retarder installations were under the jurisdiction of A. L. Jordan, Signal Engineer. The major items of equipment were furnished by the General Railway Signal Company.

SIGNAL MAINTAINER has portable telephone to call interlocking operator in tower



FLOTROL selenium-type rectifiers charge switch machine and retarder storage battery power supply