

View southward—Crossover No. 5

Pennsylvania

C.T.C. Installation

REMOTE control, utilizing centralized traffic control equipment, was provided early in 1937 by the Pennsylvania for a small layout on the Maryland division, at Oakington, Md., on the electrified main line from New York to Washington, D. C.

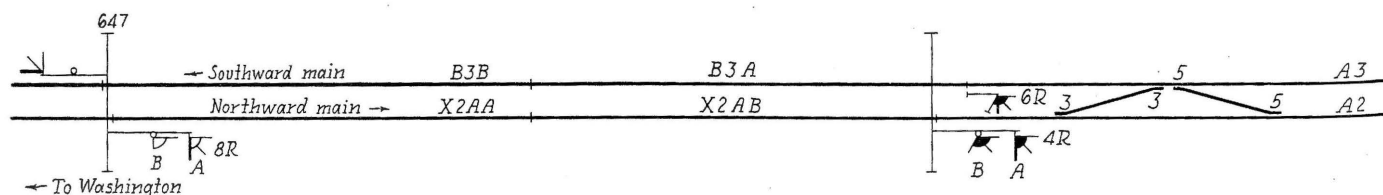
At the remote location, four main-line tracks from the north converge into two tracks on the south, involving two turnout switches. Another turnout, leading to the Havre De Grace race track branch, is located at the north end of the plant, diverging from the outside northward main track. Two crossovers on the south

ton. Prior to the installation of C.T.C., a 24-lever mechanical machine, with 14 working levers, controlling mechanical switches and position-light signals, was in service at Oakington tower, which was open 24 hr. a day.

The Control Machine

The C.T.C. control machine is located in the second floor of the Perryville tower, at the left end of the operator's desk. A 30-lever electric interlocking machine is located in the rear of the second floor, control-

11,000-volt trolley sections at Oakington. These indicators are lighted only when the signalman operates a switch in a key box at Perryville when a trolley section is out of service. The trolley sectionalizing switches at Oakington are operated by direct control from Perryville tower. Trolley section breaks are indicated on the track diagram by an appropriate symbol. Amber lights above the switch levers indicate the positions of the switches, while one red and two green lights above the signal levers are used to indicate signals at stop, and right and left signals displayed, respectively.



The track layout at Oakington

end of the plant between the two main tracks are used to handle special southbound and northbound passenger trains, operated during the race track season, to and from the race track turnout, and for other crossover movements. All switches are operated by electro-pneumatic switch machines with point detectors and CP valves. These switches and nine operative signals, used to control movements through the plant, are controlled by a time-code system of centralized traffic control from Perryville, Md., 3.5 miles north of Oakington.

ling the facilities at Perryville. The C.T.C. control machine consists of a standard 15-station capacity unit, with 5 two-position switch levers and 3 three-position signal levers in service. A track diagram, painted on the machine above the levers, shows the track layout and signal locations.

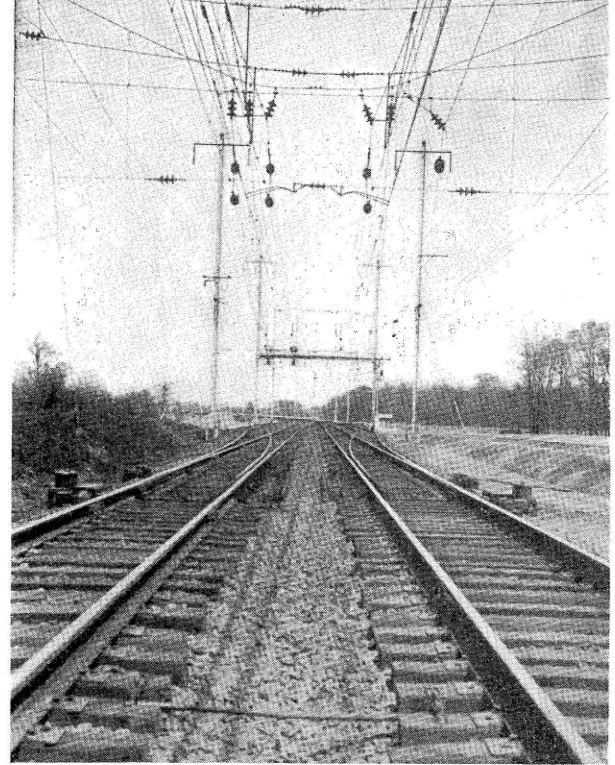
Yellow track-section indicators, controlled over the C.T.C. line, are provided for each interlocking track section and for the approach track sections. Red indicator lights on the track diagram indicate the energized or non-energized condition of the

Red indicators are used, in the lower portion of the panel, to indicate a-c. power off and low air pressure at Oakington, such indications being handled over the code line. A control button on the C.T.C. machine is used to control an air whistle located at the Oakington plant for calling maintainers.

Operating Problems

Approximately 42 freight trains and 58 passenger trains are handled over this territory daily. Of the four main tracks on the north, two tracks

Layout at Oakington, Md., involving two cross-overs, three turnouts, and nine operative signals, is controlled from Perryville tower, a distance of 3.5 miles. Twenty-four-lever mechanical machine removed.



View northward—Turnouts No. 7 and 9

are used for northbound movements, and two for southbound movements. The center two tracks are classified as northbound and southbound freight tracks, respectively, and the two outside tracks are classified as northbound and southbound passenger tracks. On the double-track section, one track is normally for northbound trains and one is for southbound trains. On days on which races are held at the Havre De Grace race track, during a total of 24 days a year, 11 days in April and 13 days in September, special race trains are operated

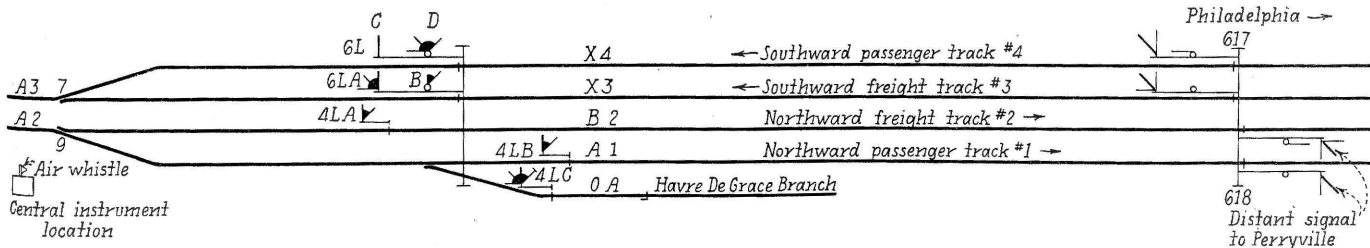
northward. From the number of trains involved and the movements made, therefore, it will be appreciated that speed of operation and flexibility was one of the important requirements to be met.

The Signaling Layout

All turnouts and crossovers are No. 20, except the race track connection, which is a No. 10. The main line is provided with 152-lb. rail and the branch with 130-lb. rail. The No. 3 crossover on the south end was in-

the new system of continuously coded a-c. track circuits. In this system a 100-cycle track circuit current is coded, continuously, to control the aspect displayed by each automatic signal, the aspect displayed depending upon the frequency with which the track circuit current is interrupted, this in turn depending upon conditions of block occupancy. The wayside signal indications are repeated in the engine cabs.

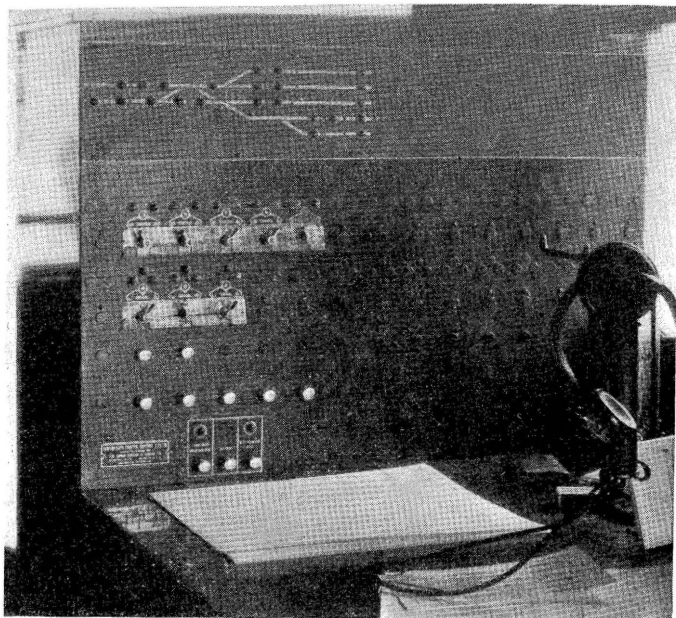
Interlocking rules apply for movements over the controlled layout at Oakington. Within the interlocking



to and from points south as far as Washington, and to and from points north as far as Philadelphia. These trains may total 10 a day. In addition, they are bunched in arriving and leaving groups, the major number arriving in a period of 45 min. and leaving in a period of 60 min. Southbound trains scheduled for the race track must be stopped and backed over a crossover and into the Havre De Grace branch. Likewise, trains leaving the race track must be backed out of the branch to the northbound and southbound tracks before proceeding

stalled, at the time the C.T.C. installation was made, to give greater flexibility in the handling of both main line and race track trains. Crossovers 3 and 5, and switches 7 and 9, have 45-ft. switch points. The authorized speed for passenger trains on the main line is 80 m.p.h., signaled with two-block, position-light automatic signals for normal direction of traffic only. The entire main line from New York to Washington, including the section being described, is equipped for continuous cab-signal indication. The automatic signaling is controlled by

limits, standard coded track circuits are employed. With this arrangement standard track circuits are used, track occupancy causing the proper code to be superimposed on the track circuit and the proper coded indication to be displayed in the engine cabs. Coding initiated by track occupancy, rather than continuously coded interlocking track circuits, is used as a safety feature to prevent a proceed aspect of any nature being given in the cab of an engine overrunning the home signal in the stop position. In addition to being controlled over the interlock-



The control machine is located in Perryville tower, 3.5 mi. north of Oakington

ing track section, the "code control" relays used to initiate action of the codes are controlled over the proper signal control relays.

An unusual safety feature provided at this plant involves the use of contacts on a low air pressure repeating relay in the controls of signals 4Ra-b, 4La-b-c, 6La-b, 6Lc-d, and 6R. When the air pressure falls to 20 lb. per sq. in. or less, the air gage will so indicate, and the following aspects only may be displayed on these signals: 4Ra-b, 6La-b, and 6Lc-d, *Stop-and-Proceed* or *Caution Slow Speed*;

4La-b-c, and 6R, *Caution Slow Speed*. Another low air pressure relay controlled over another contact on the air pressure gage, is de-energized when the air pressure falls below a minimum allowable pressure of 55 lb. per sq. in., and is used to control the low air pressure indicator in the control office at Perryville over the code line.

Hold-Out Signal

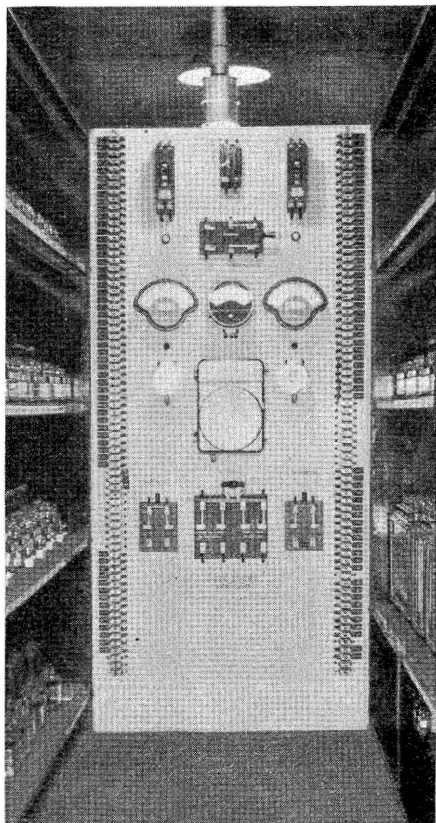
An unusual feature of the layout, provided in connection with the handling of special race and other trains to and from the Havre De Grace branch, is the use of signal 8R as a semi-automatic, non-stick, "hold-out" signal. This feature was required in order to provide a means for holding northbound trains at what would normally be the location of the automatic distant signal to signal 4R, when a train leaving the Havre De Grace branch backed out onto the northward track of the double-track main line, stopped, accepted signal 4R, and proceeded north on either Track 1 or Track 2.

Installation Features

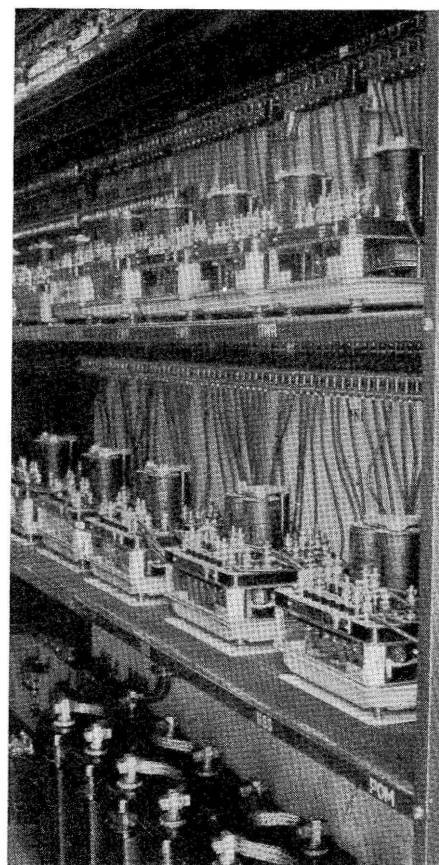
The position-light high signals used on this installation are mounted on special beam type signal bridges provided during electrification, the lower arm extending below the cross piece of the bridge being protected with a special wire screen to prevent a maintainer, or others, from coming into contact with the 11,000-volt catenary system.

A stuccoed cinder-concrete-block house, 14 ft. wide and 17 ft. long, was built at Oakington as a central instrument location, situated on the east side of the tracks in the middle of the

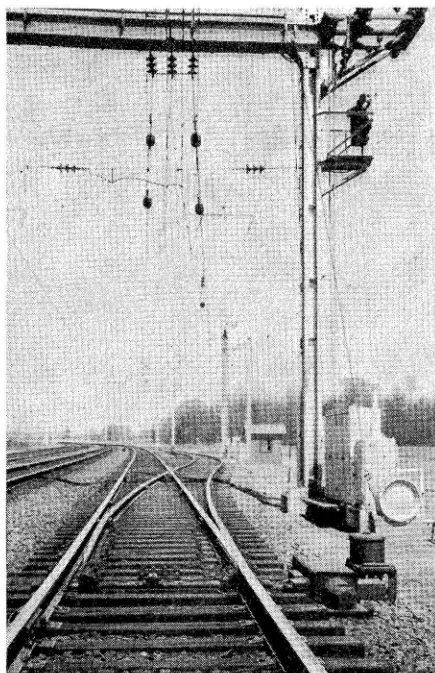
interlocking layout, while sheet-steel, four-door, 9 ft. 8 in. instrument cases were used at each of the home signal locations to house the local control equipment. The central instrument house is equipped with four shelves on either side of a center passageway, with sufficient room behind the shelving to allow access to the local wiring. The shelves were constructed with 1-1/4-in. angle iron and sheet asbestos. Multiple unit, bakelite based A.A.R. terminals were mounted on the asbestos backboards, the jumpers and cable wires being brought in through holes above the terminals, through tags screwed on the backboard, to the terminals. An interesting feature of this wiring is that over 16,000 ft. of No. 14 solid insulated jumper wire was used in the control instrument housing alone. These wires are carried on hangers behind the shelving in cable form. Jumpers from one set of shelves across the center passageway to the other set of shelves, are carried overhead above the top of the top shelf in an open chase made up of 1-1/4-in. angle iron with 1-in. strap iron cross pieces as supports. Rubber matting was provided on each shelf to support the relays, which are shelf mounted with shock absorbing spring base attachments. Metal shelving and asbestos backwards, multiple unit bakelite terminals, and the rubber mats and shelf mounted relays with



Instrument house panel board



Instrument house relays



Home signal location and Havre De Grace Branch turnout

shock absorbers were used in the home signal instrument cases also.

The C.T.C. field apparatus, located in the central instrument location, consists of one line-coding storage unit and four field storage units, representing five stations, 234, 235, 236, 237, and 238, respectively. Station 234 controls and indicates crossover No. 3 and signal No. 4, and indicates A2 interlocking track section and 4LC Havre De Grace branch southbound approach; station 235 controls and indicates crossover No. 5 and signal No. 6, and indicates A3 and B3 interlocking track sections; station 236 controls and indicates switch No. 7 and signal No. 8R, and indicates through two separate indicators on the control office track diagram approach track occupancy, on the northbound track of the double-track line, from signal No. 674; station 237 controls and indicates switch No. 9, indicates interlocking track sections A1 and B2, indicates 4LA and 4LB southbound approach on tracks 1 and 2, and indicates air pressure below the allowable minimum at Oakington; station 238 controls and indicates switch No. 11, indicates approach occupancy on both southbound tracks, Track 3 and Track 4, of the four-track main line, and indicates signal power off at Oakington.

The track circuits within interlocking limits are a-c., 100-cycle track circuits fed from transformers, with centrifugal frequency relays. In general, all d-c. relays have resistances of 1,000 ohms, with the exception of the slow-acting relays with 500 ohms resistance, the approach code control

relays, with two 125-ohm coils in series, the DP-17 relays, with local coils of 300 ohms and operating coils of 400 ohms, and the DT-10 time-element relays, wound for 12 volts.

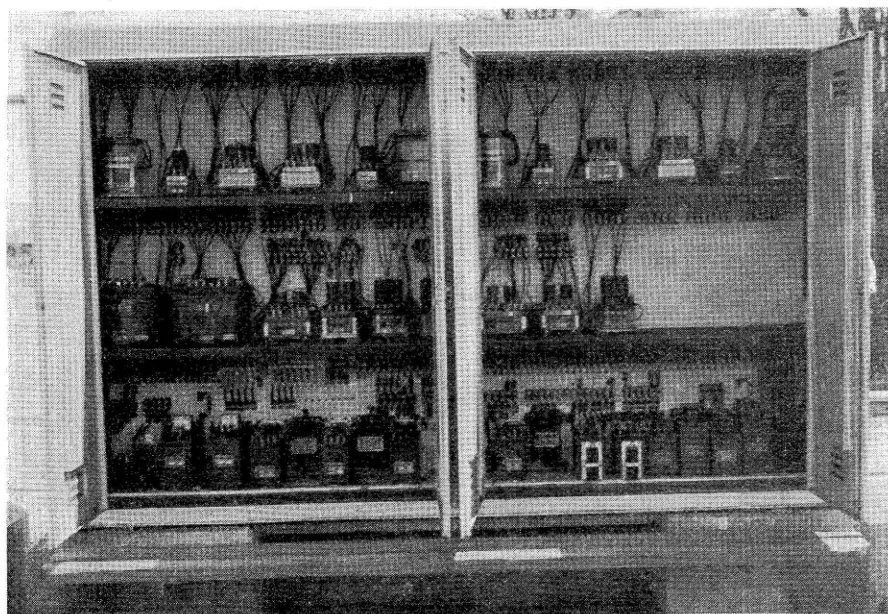
Signal power is obtained from the 6,600-volt signal power transmission line installed during electrification of this territory in 1935. Power is transformed to 110 volts at the central instrument location by means of one of two $7\frac{1}{2}$ k.v.a., 6,600-220-110-volt transformers selected by a sectionalizing switch. These transformers, connected to the 6,600-volt line, are mounted on platforms attached to the catenary poles provided during electrification. Eight cells of lead type battery, floated across an RT-42 rectifier, supply 16 volts for the C.T.C. circuits and the majority of the local field circuits. Each of the home signal locations is fed by a 110-volt line extended from the central instrument housing, and an RQ-30 transformer rectifier supplies power for the local circuits, while a 200 v.a. transformer, with two secondaries, is used to feed the signal lamps at 11.5 volts. The C.T.C. line is supplied with power from 16 lead type cells, while the machine circuits are operated from 8 cells of lead type battery, both batteries being mounted on a board of transite in a support constructed of 2-in. angle iron. A 220-volt line, fed from the 220-volt tap on either of the 6,600-220-110-volt transformers at the central location, as selected by a sectionalizing switch, extends in two No. 4 wires run in parkway cable 36 in. underground to the northbound home signal location as supply for an air compressor outfit located at that point. At the southbound home signal location, a 6,600-220-110-volt transformer supplies 220 volts for an air

compressor unit at that location.

The air compressor equipment at each home signal location consists of two duplicate 3.25 cu. ft. per min. capacity air compressors. The compressors are driven by 220-volt, 100-cycle motors. Condensation tanks are provided at each location. The compressors are connected to a 2-in. pipe distribution system in such a manner that the compressors at the northward and southward home signal locations feed the entire plant.

The code line circuit from Perryville south to Oakington is normally handled in two No. 14 wires in lead-covered signal cables, run in a duct line paralleling the railroad. In case of emergency, this code line circuit may be transferred, by means of two four-pole, double-throw switches, one at Perryville and one at Oakington, to two standby No. 16 wires in a telephone and telegraph cable run in the same duct line. The standby circuit is normally used as a control circuit for an air whistle at Oakington used to summon the maintainer by operation of the button, previously mentioned, on the C.T.C. machine control panel. Track leads are in No. 6 parkway cable, with No. 1842 stranded connectors. All bonds are power bonds. Relay leads are made of No. 16 flexible rubber-covered wire. Circuits between the central housing and the home signal locations were carried in 61-conductor and 51-conductor lead-encased cable run in the duct line.

This installation was designed by the signal department forces of the Pennsylvania, Eastern Region office, under the direction of the superintendent of telegraph and signals, and installed by the Maryland division forces under the direction of the supervisor of telegraph and signals.



Apparatus in sheet-steel case at home signal location