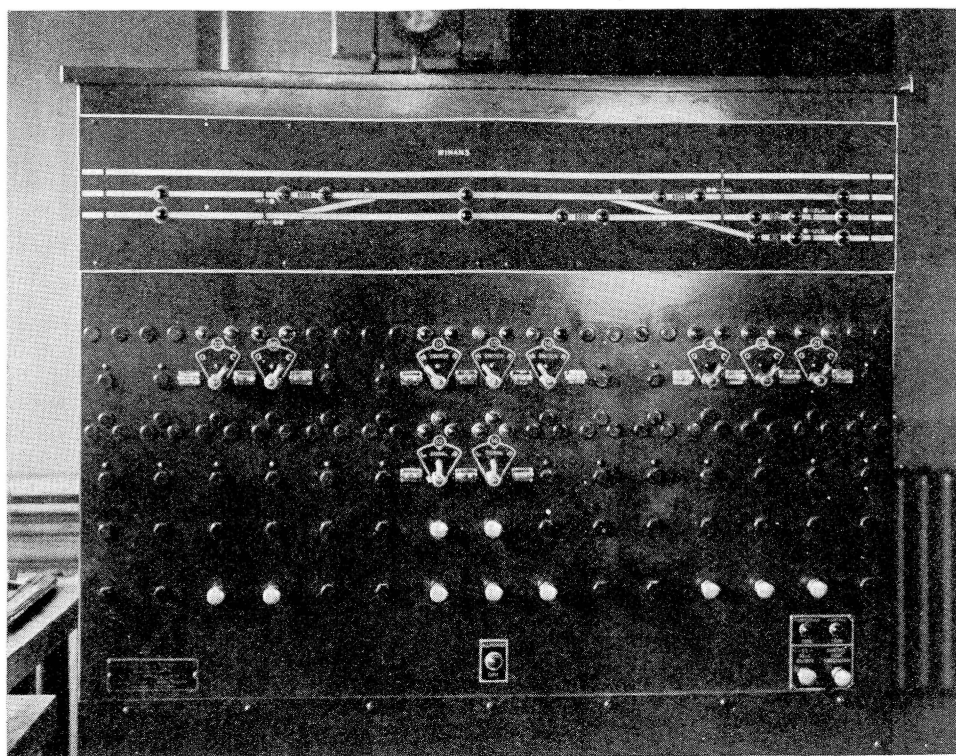




C.T.C. type control machine at Gwynn's Run

Remote Control On the Pennsylvania

AT THREE outlying locations involving switches where the number of main tracks changes from four to three, the Pennsylvania has replaced mechanical interlockings with power switches and signals which are controlled remotely from two C.T.C. type control machines, code apparatus being used to control the field functions and to bring in the indications. These three remote-control installations, at Big Elk, Del., North East, Md., and Winans, are all on the main-line electrified territory between Philadelphia, Pa., and Washington, D. C., the daily traffic including 65 passenger trains and from 40 to 45 freight trains.

The Big Elk-North East Project

Three main tracks extend 9 miles southward from Wilmington, Del., to Davis, at which point there is an electro-mechanical interlocking, in-

C.T.C. type of control used for two installations, eliminating three outlying interlockings

cluding an arrangement of one crossover, two turnouts to sidings and five main-line crossovers, one leading to a fourth main track which extends 5.1 miles to Big Elk where a single switch layout again joins the fourth track to the adjacent main track. The three main tracks extend on southward 7.4 miles to North East, where there is a junction from three to two tracks, including a single switch and two main-line crossovers. The accompanying track plan for Big Elk and North East show the single switches and crossovers as well as the four high signals and four dwarfs, all of which are controlled by the C.T.C. type control machine in the tower of the Davis interlocking.

Under the previous arrangement,

the switch at Big Elk was included in a 12-lever, mechanical interlocking which, prior to the electrification from Wilmington to Washington, also handled one additional turnout and two crossovers, together with the necessary facing-point locks and signals. At North East, there was formerly an electro-mechanical interlocking, having 9 mechanical and 3 Style S-8 electric working levers.

Factors Affecting Train Operation

The grade of the line in the territory between Davis and North East is undulating, with short stretches of level track and rolling grades of from 0.21 per cent to 0.6 per cent. For example, a northward freight train when turning out from track

No. 2 to track No. 1 at Big Elk is ascending a grade of about 0.3 per cent, and as the train pulls on northward the grade increases to 0.6 per cent. In the vicinity of North East, the grade is ascending about 0.4 per cent northward. The turnout and the crossovers at North East are No. 20, the speed limit for train movements from southward main No. 4 to southward main No. 3 being 30 m.p.h. The turnout at Big Elk is a No. 15, but this is used by trains making local stops and for run-around movements.

The switch at Big Elk is operated by a Style M-2 electric switch ma-

chine equipped for operation on 110-volt rectified a-c. The single switch and the two crossovers at North East are operated by Type A-5 electro-pneumatic switch machines, compressed air being furnished by a unit having two independent motor-driven compressors of 3-cu. ft. capacity each.

The C.T.C. type control machine, which controls the Big Elk and North East layouts from the Davis tower, was installed at the south end of the operator's table. This machine has four levers to control two switches and two crossovers, and

The Winans Remote Control

At Gwynns Run, 3.5 miles south of Baltimore, Md., there is an electro-pneumatic interlocking involving

terlocking, which was abandoned in favor of the new power-operated remote control facilities.

On the three-track territory, track No. 2 is used by northward passenger as well as freight trains, some freight trains and local passenger trains being diverted to track No. 1 at Winans. From Winans north through Gwynns Run, track No. 2 is for through trains only, under normal operating conditions. Normally, track No. 3 is used for southward passenger trains, and No. 4 for southward local passenger and freight trains. Each track is signaled for normal train operation in

Signals and power switches at Winans with concrete instrument house in background



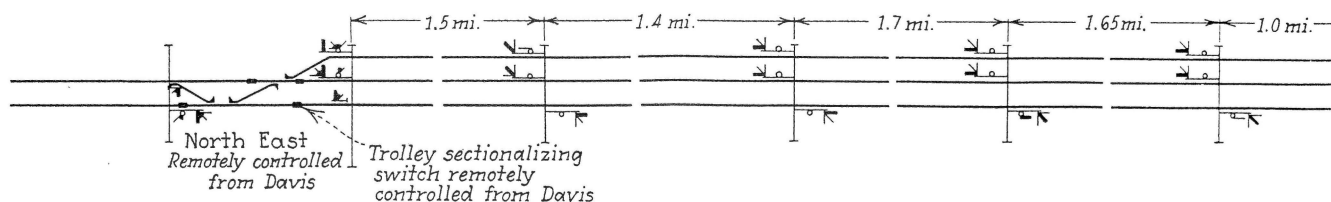
four through main tracks, six main-line-crossovers, two turnouts to sidings and one crossover to an industry track. From Gwynns Run, the four main tracks extend southward 4.3 miles to Winans, where there is a four-track three-track junction layout, including a No. 20 turnout connecting No. 1 track to No. 2 track, and two No. 20 crossovers, one facing for each direction, between tracks No. 2 and No. 3.

This new track layout represents a slight revision to the previous end-of-four-track arrangement, operated by a 16-lever mechanical in-

one direction only. The purpose of the two crossovers between tracks No. 2 and No. 3 at Winans is to permit the use of tracks No. 2, No. 3 and No. 1 for other than normal direction operation for movements in the territory between Gwynns Run and Winans.

Power Switch Layouts

Each of the five switches at Winans is operated by a Style M-2 electric switch and lock machine equipped for operation on 110 volts d-c. Each switch-machine motor is



Track and signal plan of the layouts at North East and Big Elk

supplied with direct current by a rectifier located in the switch-machine housing, the rectifier being fed from the 110-volt, 100-cycle a-c. supply. The Type-F controllers are operated by 110-volt, 100-cycle circuits. Each machine is equipped with an automatic overload cut-out, known as an OR-20 relay which operates on load, causing the clutch to slip on a predetermined current consumption. The motor draws about 9 amp. for a moment when starting and 5 to 6 amp. running. However, if the switch points are obstructed by snow or ice, so as to prevent the complete movement of the switch, the automatic overload cut-out will open when the current increases to

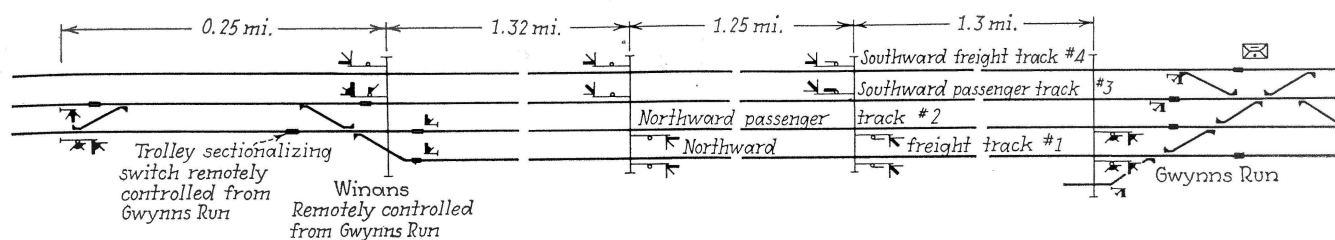
circuit controller is provided to check the position of the switch points at this second location. The speed limit of passenger trains for straight through movements in this territory is 75 m.p.h. on passenger tracks, 60 m.p.h. on freight tracks and for a diverging move over the No. 20 turnout, the speed limit is 30 m.p.h.

Position-Light Signals

As shown in the track and signal plan, position-light type high home signals are provided at Winans for all main-line routes in the normal direction of traffic. The high signals are equipped with a second position-light "arm" to indicate a diverging

house at one location, facilitating testing.

The middle panel on the end-wall board is used for mounting the line switches, etc. As shown in the illustrations, the two black cases at each side of the panel at the top are De-ion automatic circuit breakers connected in the 110-volt a-c. feed circuits, these devices being used instead of fuses. Just beneath these breakers are the meter and switches for testing for grounds, line voltage, etc. Lower down on the board is an arrangement of double-pole, double-throw switches for switching from the normal code line circuit to the standby circuit. The arresters and terminals for the 110-volt and



Track and signal plan of layout at Winans controlled from Gwynns Run

about 9 amp. In this case the operator in charge of the control machine, failing to get the proper indication, can reset the automatic overload cut-out switch by again placing the control lever to the opposite position, thereby operating the switch points. The switch can be operated back and forth in an effort to crush the obstruction, and if this cannot be effected readily, the switch can be restored to its original position until an inspection is made. Each switch layout includes a point-detector set to check the closed positions of the switch within $\frac{1}{4}$ in.

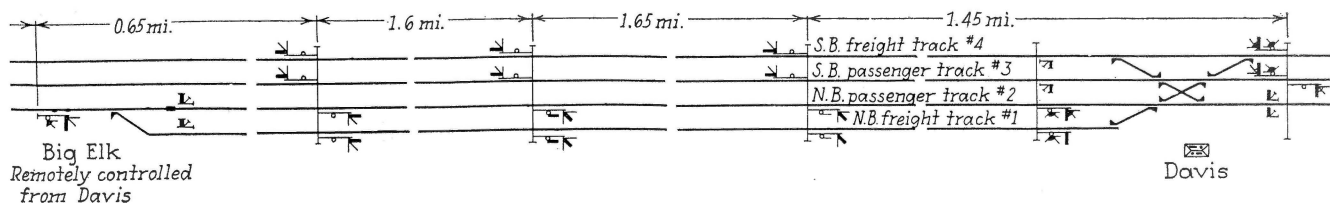
As these are No. 20 turnouts with 45-ft. switch points of 152-lb. rail section, it was not practicable to effect satisfactory operation of the entire length of such long points by one operating connection. Therefore, a pipe connection extends from the operating rod through cranks to a second operating rod attached to the switch points 22 ft. from the point ends. A separate switch cir-

route. Position-light dwarfs are used for train movements in the reverse direction.

The instruments for the entire Winans remote-control layout are located in a concrete house which is 9 ft. by 15 ft. and 8 ft. high inside dimensions. The main terminal board is located on the end wall, as shown in one of the views. This board is made up of panels of $\frac{1}{2}$ -in. asbestos board of various widths and extending full height. On the panels at the sides, all incoming cables are terminated on A.A.R. bakelite-based, two-bolt terminals with link connections. Each wire is brought out through an individual hole to its respective terminal, and from the second post a second wire is run back through the board and around through the wiring space to its respective section of the instrument rack. These terminals on the main board provide for the termination of the cables extending into and out of the instrument and apparatus.

code circuits are located at the bottom of this panel. The use of $\frac{1}{2}$ -in. asbestos board has been very satisfactory for use as panels for terminal and switch mounting, insofar as the mechanical strength and electrical characteristics are concerned.

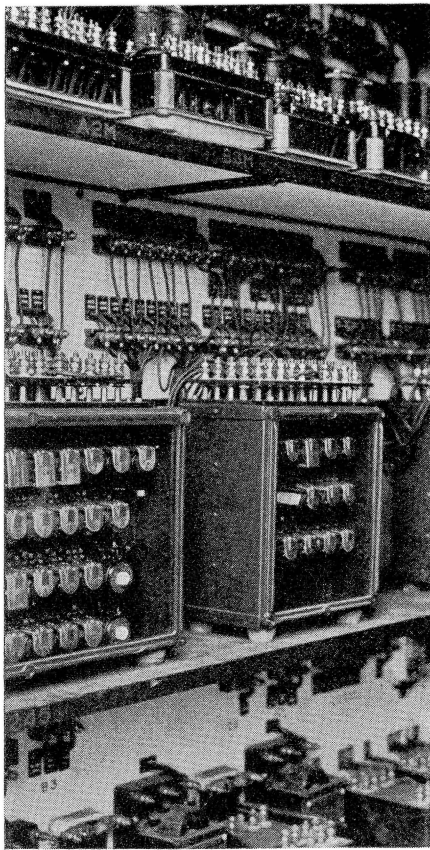
The instruments are placed on shelves on each side wall, the shelf supports being constructed of angle iron and strap iron, using $\frac{1}{2}$ -in. asbestos board for the shelves. Likewise, the terminal board for each shelf is made of $\frac{1}{2}$ -in. asbestos board. The Signal Section standard single-bolt terminals, set in bakelite bases en bloc in units of six terminals, are bolted to the asbestos board. Each incoming wire is brought up in the wiring space back of the rack and out through an individual hole to its respective terminal, from which a flexible jumper extends to the instrument. Not more than two wires are attached to any one terminal. The spacing between shelves permits use of a second



which are remotely controlled by C.T.C. equipment from Davis

row of terminals if needed. Each relay is set on four pieces of sponge rubber, which serves to absorb the vibration caused by passing trains.

Coded track circuits, the same as are used outside of interlocking home signal limits in the Wilmington-Washington electrified territory are provided for track circuits leading up to the home signals at this point. Between home signals, centrifugal frequency relays are used and track circuits are, of course, not coded, except when entered by a train; code is automatically provided for cab signals. However, the control of the operation of the switch machines and the signals is accomplished by means of the C.T.C.

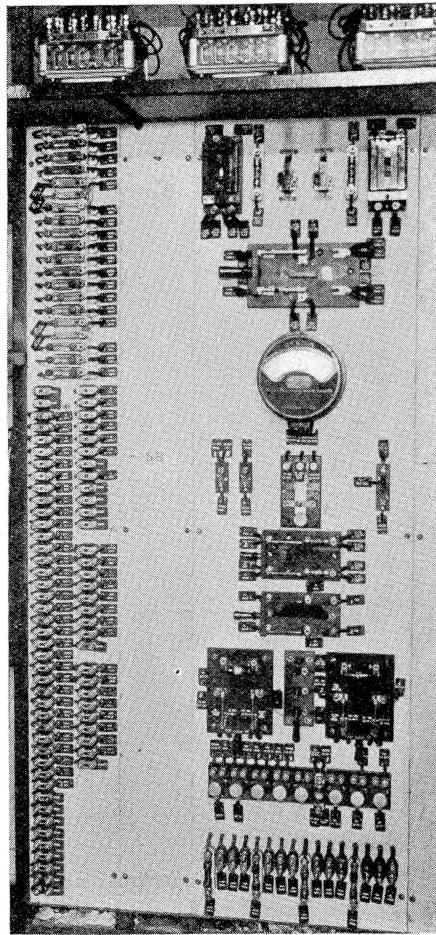


Coder apparatus
at Winans

type of time coding, by means of which all of the field functions at Winans are controlled and indications are returned to the control machine over a line circuit of two No. 14 wires in the signal cable. As a standby for this circuit, two No. 19 spare wires in the telegraph and telephone cable are extended into the instrument house at Winans and to the tower at Gwynns Run, double-pole, double-throw knife switches being so arranged at each place that, in case the normal circuit fails, the standby circuit can be cut in by re-

versing the switches at each end. These code line circuits are protected at each end with lightning arresters.

The code equipment in the instrument house at Winans, for the control of the switches and signals, includes two field storage units and one line-coding unit. Direct current for the C.T.C. and other equipment



The power equipment
on rear wall

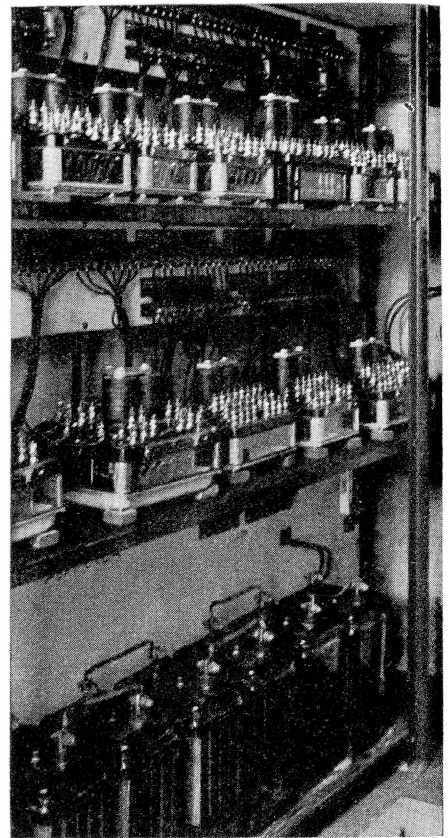
is supplied by eight 80-a.h. capacity lead storage cells which are on floating charge.

The control of each aspect of each signal and both positions of each switch is effected by a neutral d-c. relay. Polar relays are used for switch indication. Time-element relays are used to effect approach locking, the one for one home signal being set at 3 min. 10 sec., and the one for the other being set at 5 min. 37 sec. As may be seen in the illustration, all of these relays are of the most modern types.

The C.T.C. type control machine at Gwynns Run, as illustrated, has three levers for the control of one switch and two crossovers, and two levers for the control of five signals at Winans. The machine is equipped with the usual arrangement of lever

indication lamps and the illuminated track diagram.

The feed of traction power to various sections of the trolley and operation of trolley sectionalizing switches is supervised by the power director at Baltimore. Trolley sectionalizing switches, five in number, within home signal limits at Winans, are controlled from Gwynns Run by the code apparatus, the operators at that point receiving instructions from the power director when switches are to be opened or closed. As may be noted on the face of the control panel at Gwynns Run, the two levers at the left and the three at the right are used for trolley sectionalizing, the codes being transmitted over the same two wires as



Relays and battery
on left rack

are used for the control of the switches and signals at Winans. One line-coding unit and four field storage units are used for trolley sectionalizing.

The remote control installations at Big Elk, North East and Winans were planned and installed by the telegraph and signal department forces of the Pennsylvania. The major items of signaling equipment, such as signals, switch machines, relays, rectifiers, C.T.C. apparatus, etc., were furnished by the Union Switch & Signal Company.