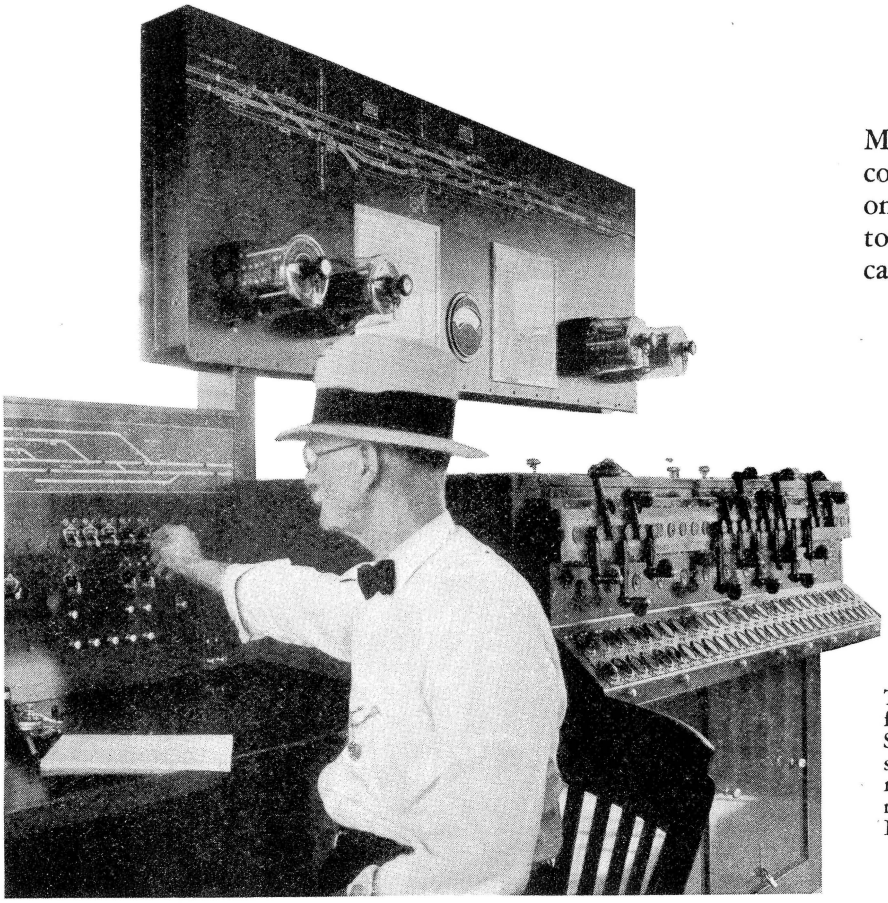


Modern equipment and construction methods used on extensive installation to replace two mechanical plants at Elmira, N.Y.

The C.T.C. machine for the control of the Southport layout is set at the end of the regular interlocking machine for the Fifth Street plant

Interlocking and Remote Control

As a part of a grade separation program in Elmira, N.Y., the main tracks of the Erie have been elevated throughout the principal business and residential sections of the city, a total of 10 streets and the passenger station area being included in the project. Under the previous arrangement, there was a mechanical interlocking with 27 working levers located near Fifth street, at the west end of the station layout, to control the switches for the passenger tracks as well as for passing tracks and house tracks. At Southport Junction, one mile east of the station, there is a junction where a single-track line of the Pennsylvania from Williamsport, Pa., connects with the Erie main tracks. The Pennsylvania trains are operated through Elmira on Erie tracks and use the Erie passenger station. Formerly a mechanical interlocking with 14 working levers was in service at Southport Junction.

On account of the changes in track elevation, brought about by the grade separation program, it was impracticable to utilize the mechanical interlocking facilities and, therefore, as a part of the changes, these plants were replaced, an electric interlocking being installed at the same location as the old plant near Fifth street at the west end of the station, while at Southport Junction power switches and signals were installed and are controlled remotely by C.T.C. code system from the Fifth Street tower.

Electric Plant at Fifth Street

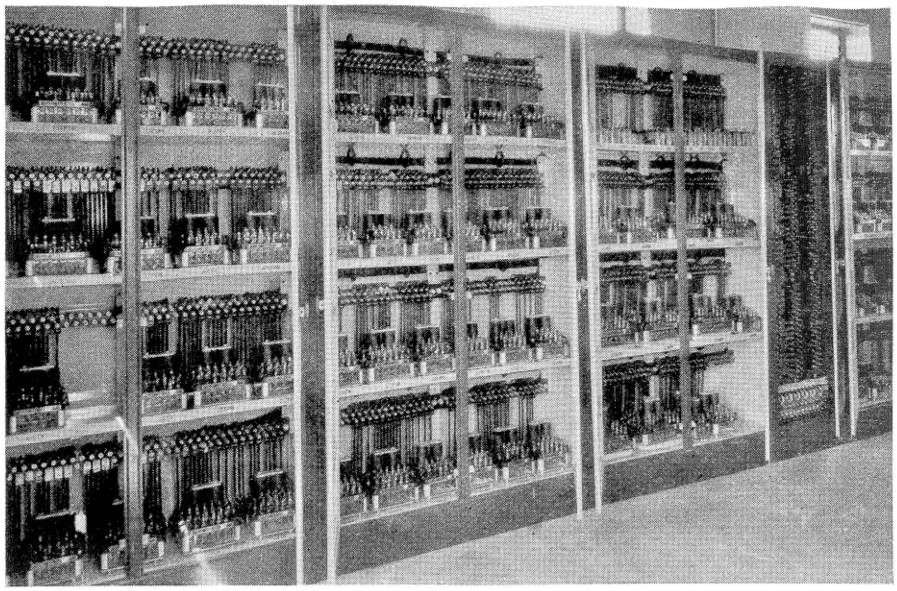
The Fifth Street interlocking is the Union Switch & Signal Company's all-electric Type-F, with Model M-2, 110-volt switch machines and Type-F controllers, and Style-H searchlight-type signals. The interlocking machine has a 27-lever frame, with 8 levers for 19 signals and 7 levers for 14 switches. A new idea in mounting an illuminated diagram was used for the interlocking machine application. Vertical supports or risers, made of welded sheet metal, were made up as a part of the metal case of the interlocking machine, the illuminated diagram being mounted on these two risers, which serve also as wiring ducts to run wires up to the diagram. The track area controlled by this electric interlocking extends from westward home signal R14 to eastward home signal L32.

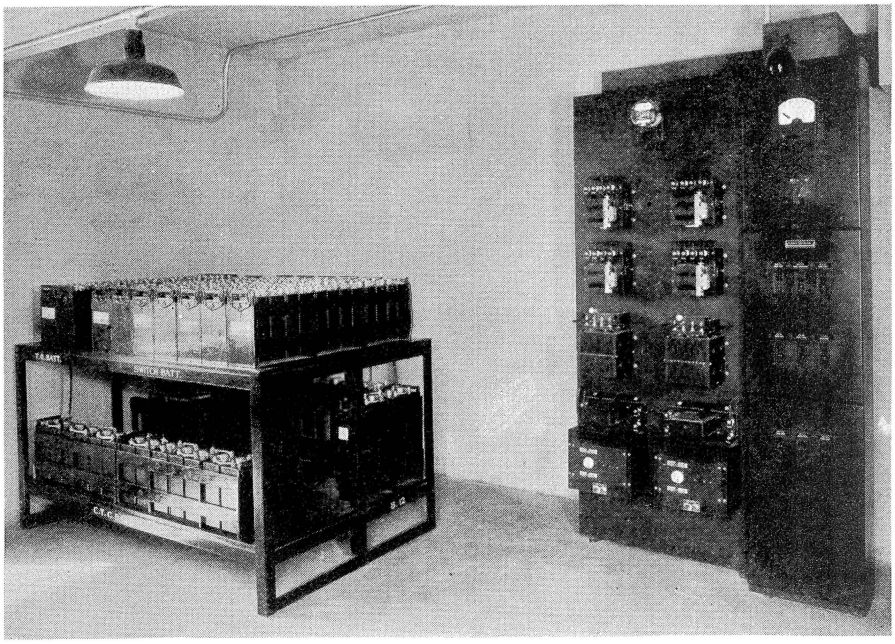
The track layout is so arranged that a train approaching on either of the two main tracks can be routed to any one of the three passenger station tracks and, when leaving, can be routed to either of the main tracks. Furthermore, when a passenger train is standing at the station, a freight train can be run around. When necessary, trains can be routed into the westward passing track. The leaving end of this passing track is equipped with a Ramapo-Ajax spring switch mechanism so that a train can pull out without incurring delay to handle the switch. Including through trains of the Erie and the Pennsyl-

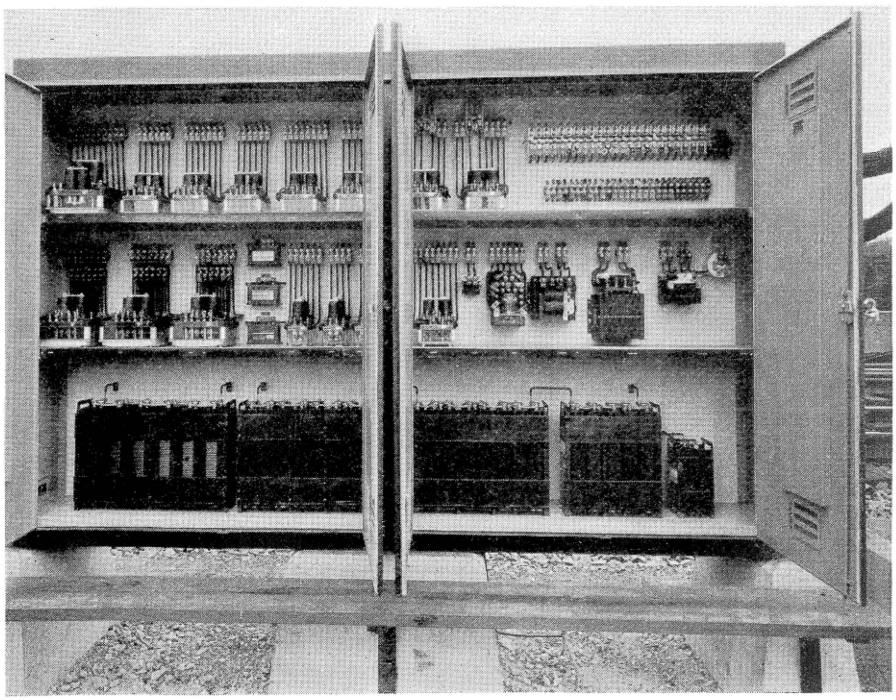
Top view shows relay cabinets and terminal cases in the tower

Center view shows battery and power board in the basement

Bottom view shows sheet-metal relay and battery case at a signal







on Erie

vania, as well as switching operations, there are about 100 train movements over this plant daily.

Southport Junction Layout

The track layout at Southport Junction includes one crossover and four single switches, all of which are required for train movement to and from the Pennsylvania line or into or out of sidings on the Erie. Therefore, the handling of this junction layout, from the standpoint of train operation, is entirely separate from that of the Fifth Street plant. For this reason, as well as on account of the distance from the tower, it was decided that it would not be practicable to control the functions at Southport Junction from levers in the Type-F electric interlocking machine and, therefore, a separate C.T.C. type machine and code control system was provided for the control of the Southport Junction layout. This C.T.C. control machine, located at the east

end of the Type-F interlocking machine, has 3 levers for the control of 12 signals and 5 levers for the control of 4 single switches and 1 crossover.

Signaling Arrangement

The interlocking and automatic block signals throughout the new Elmira installation are of the searchlight Style-H type. In the Fifth Street plant, high signals are used for the two home signals, R14 and L32, as well as for the two station leaving signals, L12 and R30. These signals display standard code indications for stop, restricting, approach, approach-medium or proceed. The remaining 10 interlocking signals in this plant are dwarfs, operating to two positions. The aspects displayed by the dwarfs are purple for stop and yellow for restricted speed.

The eastbound approach signal for Fifth street, 274-2, is a two-unit color-light signal mounted on a bracket mast and arranged to display stop, approach, approach-medium or proceed aspects. Since this signal is located near the entrance to an eastbound passing siding, the entering switch of which is operated by a hand-thrown stand, a position-light telephone train order signal is mounted on the automatic signal mast below the two searchlight units. This type of signal is used on the Erie to direct a train with reference to action to be taken at a main track crossover or entrance to a passing siding equipped with hand-operated switch stands. Where color-light automatic signals are in use, a position-light unit is used for the telephone train order signal to differentiate between this signal and the automatic signal indications. When the telephone train order signal is not in the "clear" position, the automatic signal above it indicates *stop and proceed*. The rule governing the use of this signal is:

509d. Telephone train order signals are located at points as designated in the timetable. Their functions are as follows:

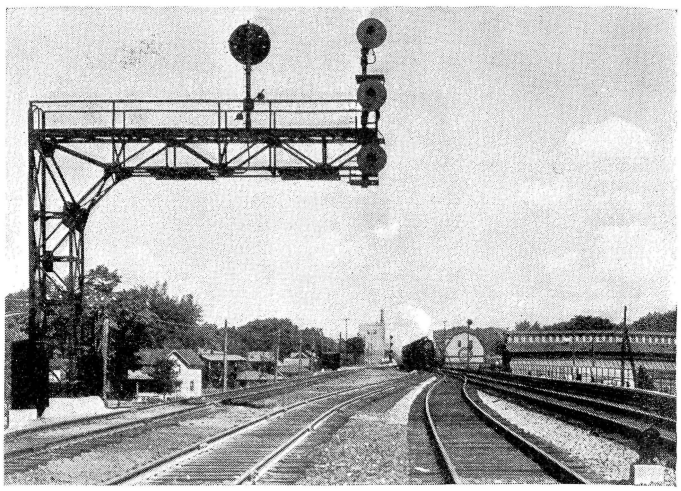
(a) Arm horizontal—red light—indication: Stop on main track and report for instructions. It is forbidden to use a crossover at any point where a telephone train order signal is located without permission.

(b) Arm 45 deg. above horizontal—yellow light—indication: Take siding and when clear of main track, report for instructions. Passenger trains will report before pulling in siding.

(c) Arm 90 deg. above horizontal—green light—indication: Proceed regardless of following superior trains until otherwise ordered.

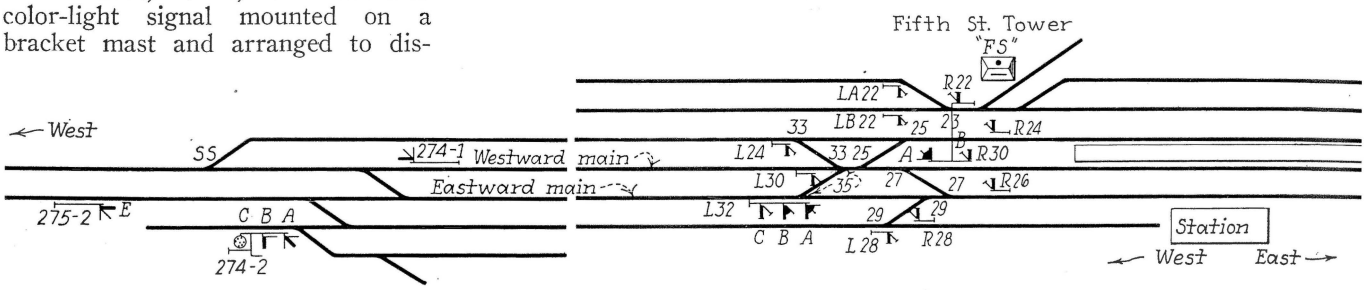
It is forbidden to accept the proceed indication (Paragraph "c") if there is any known cause that will prevent making usual running time. When a train accepts the proceed indication (Paragraph "c") and for any cause is unable to make usual running time, the train must be protected as prescribed by Rule 99.

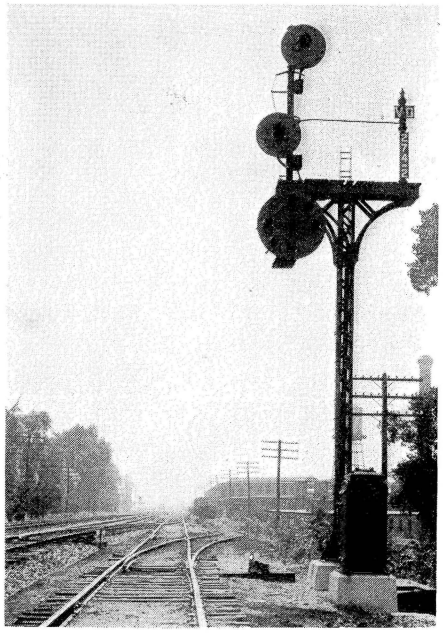
View at Southport Junction looking west



An interesting feature of this new plant, as may be seen in the illustration of the tower building, is the installation of two Union Style-D electric semaphore lamp units (10-volt, 10-watt lamps), which are equipped with visors and are mounted at each end of the tower just above the windows of the operating room. These lamps are used in place of a red or yellow flag by day or lantern by night (Standard Code Rule 221) to indicate orders to be delivered to a train. Control switches on the C.T.C. panel, with indicating lamps, are used to display a red or yellow light when "31" or "19" orders are to be delivered. The lamps at the east end of the tower are focused toward the westward home signal and those on the west end toward the eastward home signal. When train orders are to be delivered, the operator operates the train order lamp switch controlling the desired light and waits until the engineman acknowledges that he has observed the train order lamp by two short blasts of the whistle, after which the signal may be cleared to authorize the train to pull up to the tower for orders. The indicating lamps on the panel below the control switches are in series with the train order lamps so that the operator can tell if the outside lamp has burned out or failed.

At Southport Junction, eastward high home signal L10 has a three-position top unit to govern over the Erie eastward main line, and a three-

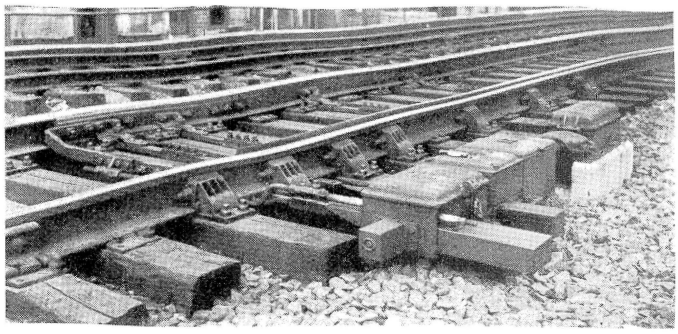




Eastward approach signal on the Erie with position-light telephone train order signal

position second unit which governs over the turnout to the Pennsylvania main track, the clear position being displayed only when the Pensylvania manual block signal, controlled from Kendall, the next Pennsylvania block office, is clear. The lower arm is a call-on.

Westward home signal R2, governing from the Pennsylvania main track to the Erie, has a fixed red top unit, a three-position second unit and a two-position bottom call-on unit. On this same bridge, there is an eastward Pennsylvania manual block signal controlled from Kendall, as mentioned above. This signal is of the position-light type, displaying three aspects, vertical, horizontal and 45 deg. in the lower right quadrant.

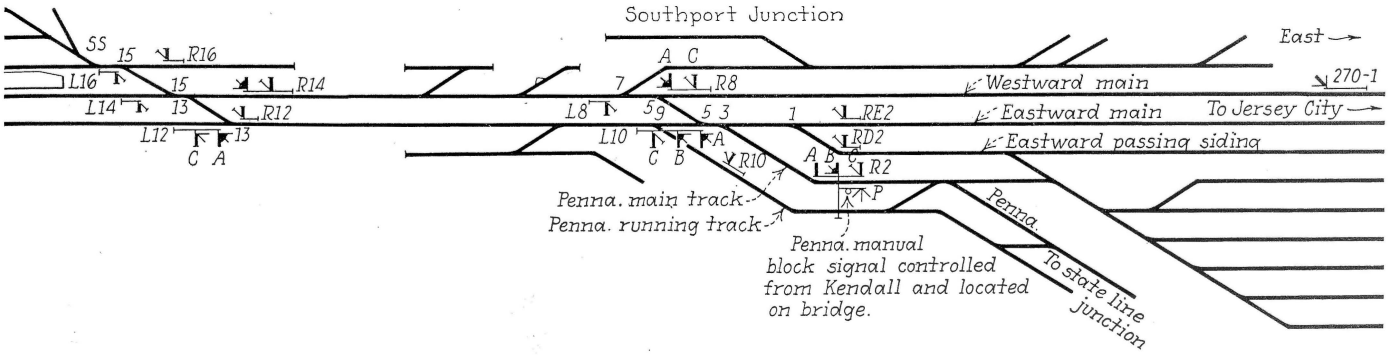


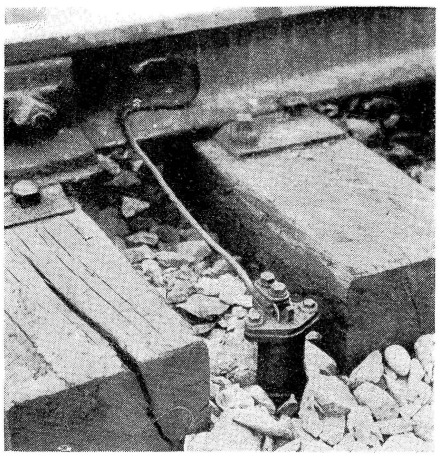
The switch layouts are well constructed

Operation of the Plant

As may be seen from the illustration of the interior of the control room, the C.T.C. control machine is located at the left end of the interlocking machine. Separate illuminated track diagrams are provided for the two layouts but the two diagrams reproduce the entire track area throughout Elmira, so that the operator has continuous indication of the location of trains. The two control machines are, of course, not interlocked mechanically; however, electric check locking circuits are provided. When a control relay for a home signal at either layout is picked up, a route locking relay is released and this automatically sets up a traffic direction circuit which prevents clearing the opposing signals.

The interlocking machine is equipped with the standard arrangement of indication lamps. The signal lever, such as that for signal R30, controls the operation of the top arm "A" as well as the lower arm "C" which is the "call-on," restrictive speed signal. When the track section ahead is occupied and it is desirable to display the call-on, the rule requires that the train be brought to a stop after which the operator can clear the call-on by placing the lever in the reverse position and then pushing a button located under the lever. The call-on is, of course, not track circuit controlled but the control is so arranged that the switch or switches in the route must be locked in position, corresponding to the positions of the levers.





Parkway cable bootleg outlet with stranded rail connection

Batteries

As a part of the improvement, a new tower was built consisting of a concrete foundation and basement and two stories of brick construction. The battery and charging equipment are located in the basement. All of the battery on this project are of the Edison nickel-iron type. The main battery for the operation of the 110-volt switch machines on the Fifth Street plant consists of 83 Type-B4H cells, which is on charge through a Union RP-21 rectifier so as normally to have 125 volts at the battery.

A battery of two sets of 12 cells each, Type-B4H, is used to feed the 4 telephone train order signal controls on a split battery scheme. A set of 13 cells of Type-B6H battery is used to feed the C.T.C. code relay equipment. As stand-by for the signal lamps in the vicinity of the tower, there is a set of six cells of Type-G4H battery, a similar set of various ampere-hour capacities being used at each of the outlying signal locations. The G-type of storage battery is designed to maintain close voltage regulation under continuous heavy current discharge under extreme temperature conditions. The normal current rating is 50 per cent more than that of types A or B. Each track circuit is fed by one Type-B6H cell.

After the plant was in service, a test was conducted to determine the range of voltage on which the equipment would operate. The data indicates that all of the apparatus, including coder relays, ordinary relays, switch machines, etc., will operate satisfactorily, the voltage at the battery being reduced to a minimum of one volt per cell. In the case of the 83-cell, high-voltage battery for high-speed switch mechanisms, it has been found that 5-sec. operation is obtained normally at 120 volts. Further tests conducted in connection with this same battery indicate that the same switches operate satisfactorily in 10 sec. with only 67 volts at the battery. This latter value of 67 volts

is, of course, far below the minimum voltage of the 80-cell Edison storage battery.

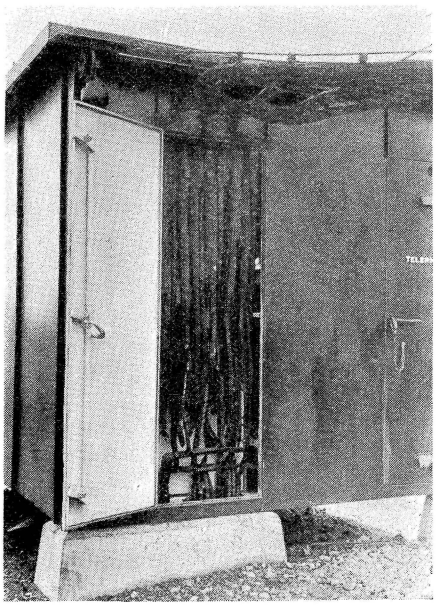
Construction in Tower

All of the batteries in the tower are set on a battery table or rack made up with 2-in. angle-iron uprights and cross beams, using ¾-in. transite board for shelving, this shelving being painted with two coats of acid-proof paint. Each of the various sets of battery is charged with a Union copper-oxide rectifier, of the proper capacity to meet the requirements, a duplicate rectifier being provided as stand-by for the main switch operating battery. These rectifiers are mounted on a panel of ebony board attached to angle-iron uprights. A switch board, alongside the rectifier board, includes instruments and switches. A voltmeter, mounted at the top, can be used to read the voltage of the main battery as well as to serve as a ground detector. In the two lower panels of this board, there are nine manually-restored automatic circuit breakers, also used as switches, in the various incoming a-c. power-circuits and the power distribution and lighting circuits. This complete panel and equipment is of General Electric Company manufacture.

The second or track level floor of the tower is used to house the relays which are located in Union Style-L4080 sheet metal cases, with doors fitted with glass. As the doors fit tightly, the cases are practically dust-proof, an important point because the boiler for the heating plant for the building is located on this floor.

All of the cables coming into the tower as well as the wires going to the machine and battery are terminated on terminals in a case that is made up as a part of the instrument cases. The standard A.A.R. terminal posts are mounted on sections of ¾-in. by 3-in. Bakelite terminal boards, set vertically on an iron frame. Circuits on which arresters are used terminate on Raco No. 300-6 arresters, mounted in a horizontal row on a transite board at the bottom of the terminal case. An advantage of this terminal arrangement is that every wire coming into the tower can be located here readily for testing. This terminal case is equipped with a door the same as the instrument cases.

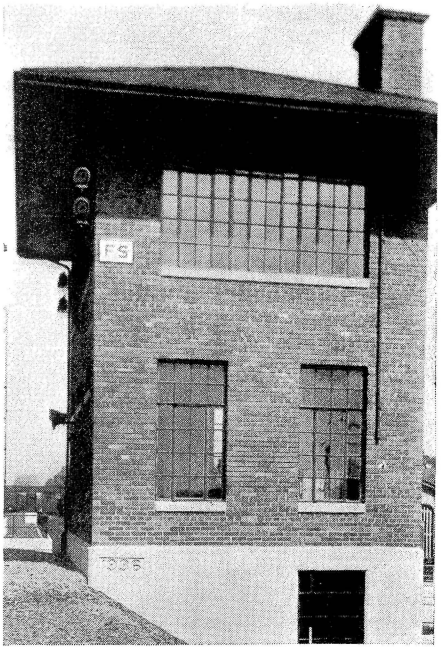
There are two staggered rows of terminals mounted en bloc on a Bakelite board in each shelf section of the instrument cases. As will be noted, the wiring is arranged to present a neat appearance, this result being accomplished by using No. 9 solid copper wire so that it will stay in place. This wire has 5/64-in. insulation with single braid covering only, the tape being eliminated so as to reduce the overall size of the wire.



A separate outside door opens to the rear of the terminal board of the instrument house at Southport Junction

Cable lead from pole to instrument house at Southport Junction

The relays are all of the most modern types made by the Union Company, the neutral relays being the DN-11 type and the switch indication relays being the DP-17 type. The wiring from the instrument case up to the interlocking machine is run in a chase made up of ⅜-in. transite board bolted together on angle iron. The insulation covering on all of the wiring in the tower is treated so as to be flame-resisting.



The lamp units serving as train-order signals are mounted on the track side of the tower at the Fifth Street interlocking

Outside Wiring Distribution

The main runs for distributing circuits over the plant are in underground parkway cable, the protection including steel tape and jute but no lead. The cable is laid in trenches, at least two feet deep, and is surrounded by a layer of loam or clay. On the bridges over the streets, the ballast is only a few inches thick under the ties so that it was not practicable to bury the cables. At such locations the cable was run in trunking made of creosoted pine lumber 2½ in. thick. The trunking was set so that the top was level with the surface of the ballast, and 3/16-in. copper-bearing sheet iron was used over the capping.

At the instrument cases the cable is brought up through a hole in the concrete foundations, and after the cable is all in place, the voids are filled with clay and the top is sealed with two inches of pot-head compound. At each dwarf signal the cable is carried into the signal. At high signals the cable runs up to a cast-iron box mounted on the mast just below the signal unit, the outer protection being pot-headed in this box and the insulated conductors extending on through flexible metal conduit to the signal. At the switch machines the parkway cable is pot-headed in a cast-iron box mounted on the same concrete foundation with the Type-F controller. The track connections are No. 9 single-conductor parkway, brought up to the rail

through Raco No. 336 bootleg outlets which are connected to the rail by a 30-in. American Steel & Wire Co. Type-S-4 copper rail connector which is plugged into the rail.

Welded Sheet-Metal Housings

The instrument cases at the central points on the plant and at signal locations are of the welded sheet-metal type made by the Union Company. Light-out protection at the two and three-unit signals is provided by using Union DN-22L relays in series with the signal lamps. Each signal lamp is rated at 8 volts and has a double filament, the main filament rated at 13 watts and the secondary filament at 3.5 watts. The voltage at the lamp is regulated to 7.2 volts. The relay cases are set on concrete foundations, made with a vertical chase for bringing in the underground cables. The battery is housed in the bottom shelf and the relays and other instruments in the other shelves.

At Southport Junction, a Union 8-ft. by 10-ft. sheet-metal house lined with celotex is provided for housing the battery, coding apparatus, relays and other instruments. The apparatus is arranged on four sets of shelves, one against each side wall and two back to back down the center of the house, there being two aisles for access to the equipment. The relay racks in this building are made up of shelves of sheet iron bolted to cross pieces and uprights of angle iron. The code equipment in this house includes one field line coding unit and three storage units, the two-wire time coding system being used. A total of 99 relays are also located in this house.

The house wiring is No. 14 solid with 3/64-in. insulation and is run in chases made up of transite board. The wires run direct from one instrument terminal post to another or to a terminal in the main board in the west end of the house. A special feature in the arrangement of the house is that the outside door, locked with a switch padlock, gives access to a telephone booth for the use of trainmen as well as the maintainer. An inner door, locked with a signal padlock, gives access to the house proper. Telephones at outlying points on the entire project are provided for use by train crews and maintainers.

All incoming cable wires terminate on a board at the west end of the house, the rear of this board being accessible through an outside door hinged to swing open, thus facilitating construction and inspection. As may be noted from the illustrations, the main wiring distribution in this area is run as aerial cable, made up of separate single conductors and supported from Copperweld messengers by means of Raco cable straps.

In general, the construction at Southport Junction is about the same as at the Fifth Street plant, except for the fact that low-voltage switch machines are used. Three switches are fed from a set of 24 cells of Type-G4H battery in the house, this battery having a center tap for feeding code circuits. A second set of battery of the same type, located in a case at signal L10, feeds the remaining switches.

These low-voltage switches are equipped with overload relays. If a switch is blocked so that the clutch slips more than three seconds, the overload relay kicks out and thus releases the code repeater relay. By indications on the control machine, the operator knows that the switch has not completed its operation. By sending out a code to restore the switch to its previous position, he can again gain control of the switch, thus throwing it back and forth until the obstruction is dislodged, or until he decides that someone must be called to clean out the obstruction. At Southport Junction, TH-10 thermal relays are used in the approach locking circuits for all signals.

The construction of this entire interlocking and signaling project was designed and planned by the signal forces of the Erie, using Advisory Committee standards, and was installed under contract by the Union Switch & Signal Company which furnished the major items of equipment, the insulated wire and cable being furnished by the Kerite Insulated Wire & Cable Company and the Okonite Company.

Discusses Crossing Signals

To the Editor:

Unofficially I would like to offer a few suggestions for the consideration of signal men, or signal companies, if they wish. I have installed a great many flashing-light signals at crossings, and have observed their operation for several years. I believe these signals are more effective for preventing accidents than any other type of crossing protection. However, one handicap to the successful operation of these signals is the loop hole, or deceptive picture to the motorist, when standing at a crossing waiting for a train to pass, and making the mistake of not expecting a second train movement on a second track, wherein this motorist will advance too quickly to a point of danger. There seems to be a need of some additional warning feature in such a case. I am not in favor of crossing gates operated in connection with flashing signals, or otherwise, I think they are a step in the wrong direction. A return to the ancient crossing gate arrangement would only result in more confusion and in striking automobiles with the gates, penning of cars between the gates, and in motorists stalling their engines on the track. It is only necessary to observe a watchman operating gates to find that it is impractical to put a gate down between a string of cars.

One suggestion is a short disappearing arm on the crossing signal mast to be used by the watchman only when the hazard of double train movements exists, the short arm to bear the words "Wait—2 Trains" in attractive illuminated sign letters. This arm could drop horizontally below the lamp units, or operate like a signal arm in the left-hand quadrant. This sign feature could also be arranged to operate automatically for a second train movement. Another suggestion is a loud speaker mounted on the watch house, or signal masts, through which the watchman could in most cases convey audible warning to a driver. I know of many cases where watchmen have called loudly to drivers, and prevented accidents.

Aside from the above, I have a suggestion for the development of a cable post with a base about 18 in. square, made up to usual height in taper shape with angle iron corners, sheet steel sides, properly fabricated frame and weather-proofed, permitting the entrance of parkway cable through a hollow concrete foundation. Too many wires these days are crowded through goose-neck brackets, small pipes into relay boxes, etc., which were formerly designed for rubber-covered wires instead of bundlesome parkway cable. If a standard design cable post, or signal mast, is broken at the base through accident, invariably the wires are ruined at the same point, necessitating splicing, or complete renewal. Why not provide room for easy, practical entrance of parkway cable and make it proof against mice, insects or fire? Consideration of a wireman's problems and elimination of cramped wiring conditions means much in the time consumed in wiring and also makes better maintenance conditions.

E. R. Lindsey,
Signal Supervisor, Chicago & Eastern Illinois, Evansville, Ind.