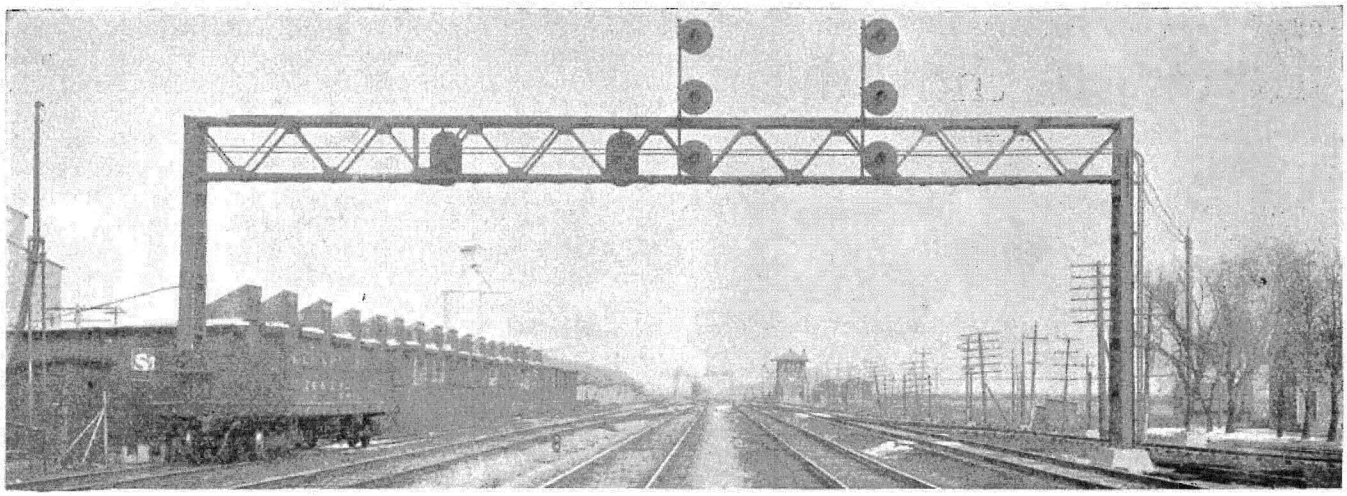


North Bound Signal Bridge at Peotone, Ill.

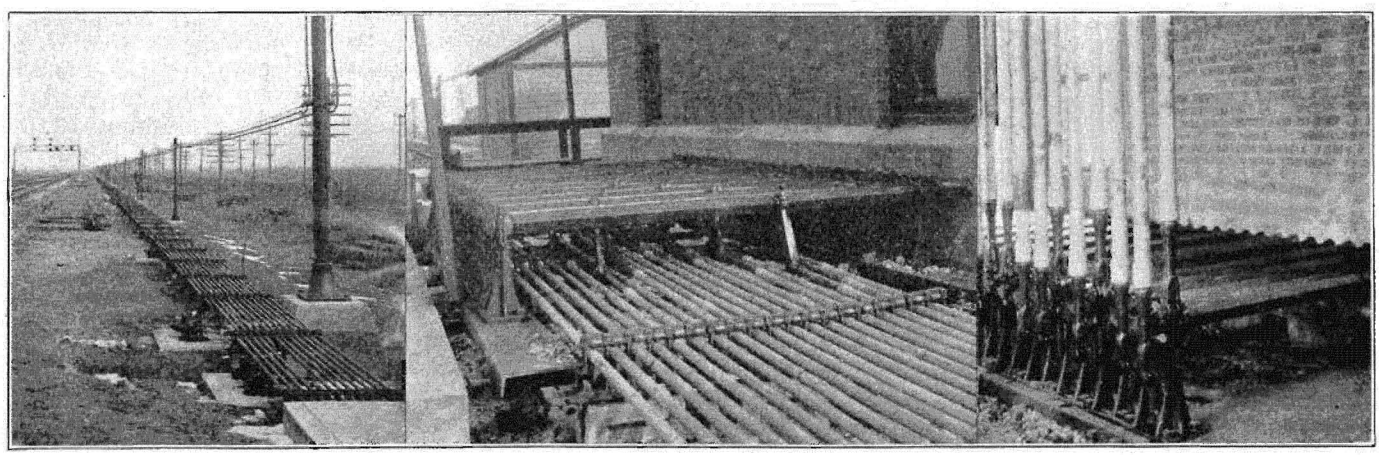
Signaling Increases Capacity of Three Tracks

I. C. Installs Light Signals on Twenty-One Miles of Three-Track with Five Electro-Mechanical Interlockers

ON the 21-mile stretch of third track, now nearly completed on the Illinois Central between Monee, Ill., and Kankakee, the automatic signaling and the interlockers play an important part in handling the traffic.

This district is just south of the four track Chicago suburban zone. However, all of the traffic of this road between Chicago and southern points, including a heavy coal tonnage from southern Illinois, is handled over this district and there is also considerable traffic from the St. Louis line which connects with the New Orleans line at Gilman, 25 miles below Kankakee. In addition to its own traffic the Illinois Central handles all trains of the Cleveland, Cincinnati, Chicago & St. Louis over this line between Kankakee and Chicago. There is an average of approximately 32 passenger trains and 58 freights a day handled over this line. The preponderence of traffic is northbound between 4 a. m. and noon and southbound approximately the remainder of the 24-hour period.

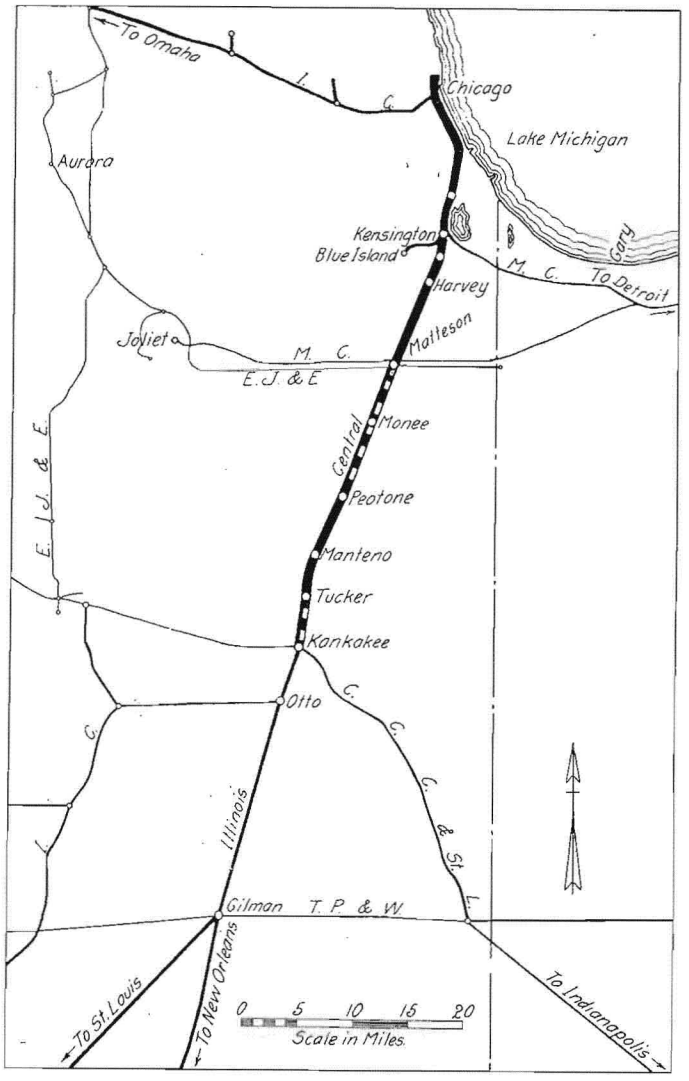
During the summer of 1922 this stretch of track was reconstructed and grades reduced. While ample facilities were available for handling the traffic, as well as the heavy suburban business between Matteson and Chicago in the presence of a long stretch of practically level track, increasing from four to eight tracks in the direction of the city, the conditions were not so favorable in the 27 miles between Kankakee and Matteson. In the first place, traffic over this section was confined to two tracks, except for a distance of 11 miles between Tucker, four miles north of Kankakee, and Peotone, where a third track was laid three years ago. The grades were also adverse over this section, especially for northbound tonnage. Almost immediately upon leaving Kankakee, a 0.4 per cent grade extended for about 2½ miles to Tucker. Beyond this point more favorable grades were encountered until near Monee, where a 0.425 per cent grade extended nearly two miles to the top of the hill, 160 ft. above Kankakee. This summit constituted a similarly formidable obstacle to trains proceeding southbound, as it was approached by long 0.4 per cent grades. Added to these obstacles were



Aerial Cables and Supports | Rocker-Shaft Leadouts | Two Inch Up and Down Rods

grade crossings with the Elgin, Joliet & Eastern and the Michigan Central at Matteson.

To improve conditions and give greater capacity, it was decided to extend the four track system from Matteson, south for about seven miles to Monee. As a third track



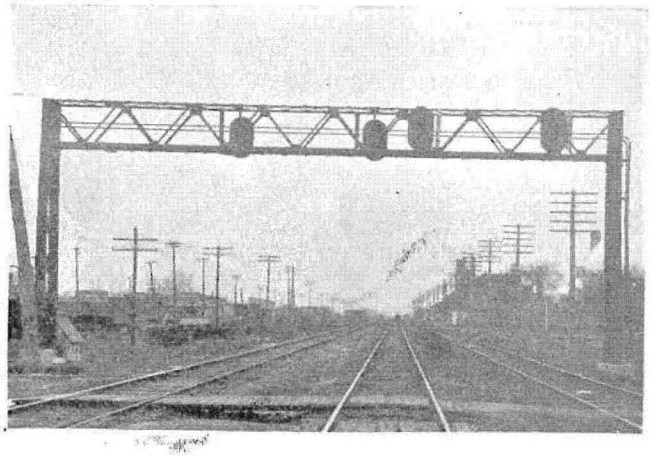
A Part of the I. C. System

was already in service between Peotone and Tucker, it was decided to continue this track north to the end of the four track section at Monee, and to Kankakee on the south and to install interlocking plants at intermediate stations to permit the diversion of trains from one track to another. It was also decided to reduce the 2½ miles of 0.4 per cent grade between Kankakee and Tucker to 0.3 per cent and to reduce the 0.425 per cent grade approaching Monee from the south to 0.3 per cent. As this involved heavy excavation through Monee a large amount of material was available beyond that required for the new tracks and it was further decided to separate the grade crossings at Matteson by carrying the Illinois Central tracks overhead, which eliminated two old mechanical interlocking plants.

This territory as a double track was equipped in 1907 with two-arm semaphore lower quadrant signals of the General Railway Signal Company's Model 5 Type, which are now replaced by three-color indication light signals. The installation of automatic block color light signals extends on north of Monee on the four tracks to Olympia Fields, a distance of six miles. At the four new interlockers and also at the Kankakee junction plant, single unit color-indication light signals are used for the home signals.

Train Movements Are Controlled by Traffic Direction Signals

The two outside tracks are signaled for the normal direction of traffic, the blocks being approximately one mile in length, while the middle track is signaled with one mile blocks for *both* directions of traffic. As shown

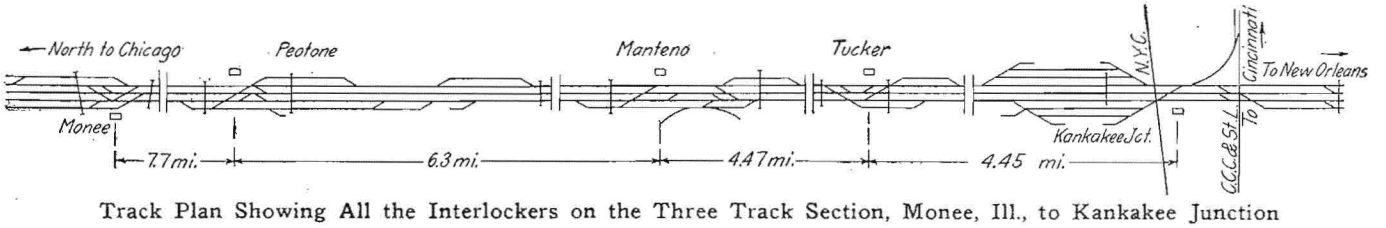


Automatic Block Signal Location on Three Tracks at Bradley, Ill.

in the track diagram this territory is split up by five interlockers, the track layouts and the crossovers being so arranged at these plants that a towerman can switch a train over, from or to, either outside track and the middle track. The advantage of this arrangement is that, for example, with a slow freight going north on the outside track a following passenger can be switched over to the middle track to pass the freight and at the next plant be switched back to the normal northbound track. The middle track being signaled in both directions, may be used for southbound trains in the same manner. An outstanding feature of this installation is that no set rule is established for directions of traffic on the middle track, the routing of trains on the three tracks being left to the leverman in charge of the interlockers.

The advance signals on the middle track, which govern the move out of the interlockers are considered as "traffic direction" signals. An explanation of the control of these signals will show how the duplex signaling of the middle track increases the track capacity of this 21-mile, three-track section.

When a leverman desires to switch a train over from an outside track to the middle track all signals of the plant, governing movements to the middle track, must



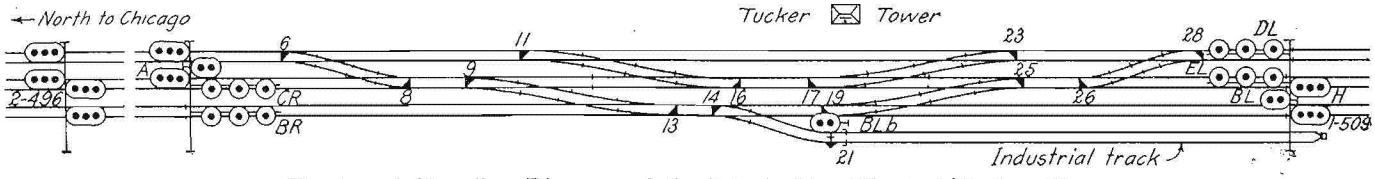
Track Plan Showing All the Interlockers on the Three Track Section, Monee, Ill., to Kankakee Junction

be placed at danger. In order to reverse the lever to clear the advance signal governing the entrance to the middle track it is necessary to get an "unlock" from the leverman at the tower in advance. For example, to clear northbound signal A at Tucker, the leverman at Tucker must first phone to the leverman at the Manteno interlocking, requesting an "unlock;" when the Manteno leverman pushes the "unlock" button, a lamp at Tucker indicates that all is clear. The Tucker leverman must then reverse the lever A before the button at Manteno is released. This lever A remains in the reversed position until a change in the direction of traffic over the middle track is necessary.

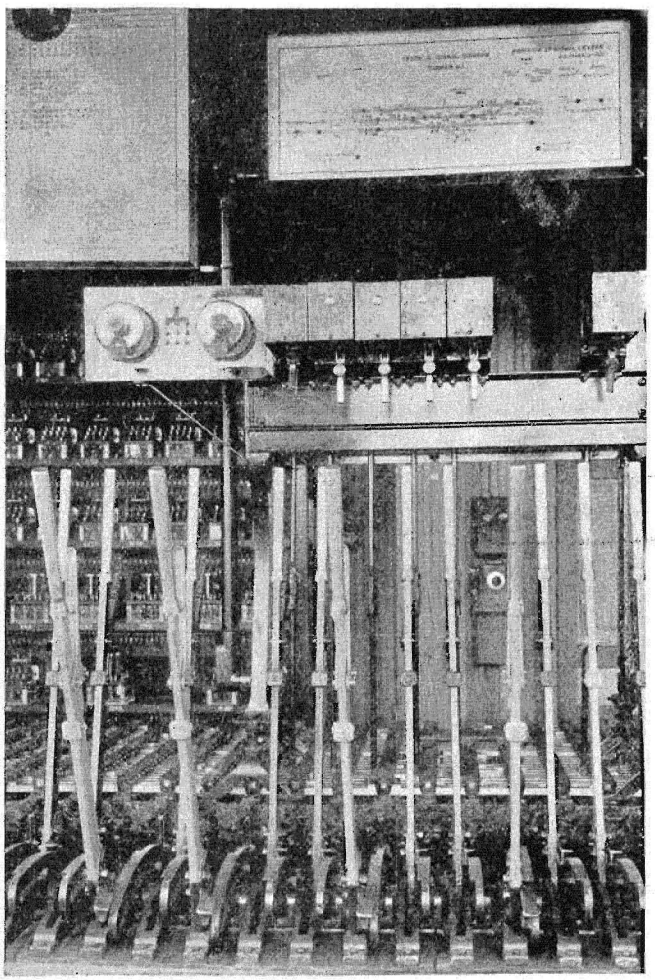
If a following train is to use the middle track and the leading train has passed the first automatic block signal No. 2-496, the leverman calls the Manteno interlocker asking for a "permissive" at the same time holding his own "permissive to Manteno" button in. As soon as the Manteno towerman pushes his button marked "permissive from Tucker," the traffic direction signal A governing the entrance to the middle track will again be cleared automatically. For train movements southbound over the middle track, a separate set of buttons performing similar functions are used.

It should be understood that the only possible opposing train movement onto this middle track must be made from the next interlocking. As the lock circuit between the two towers, controlling the operation of the levers, is broken through all the intervening track relays, a signal indication permitting a reverse move cannot be given until the middle track between the two plants is entirely unoccupied.

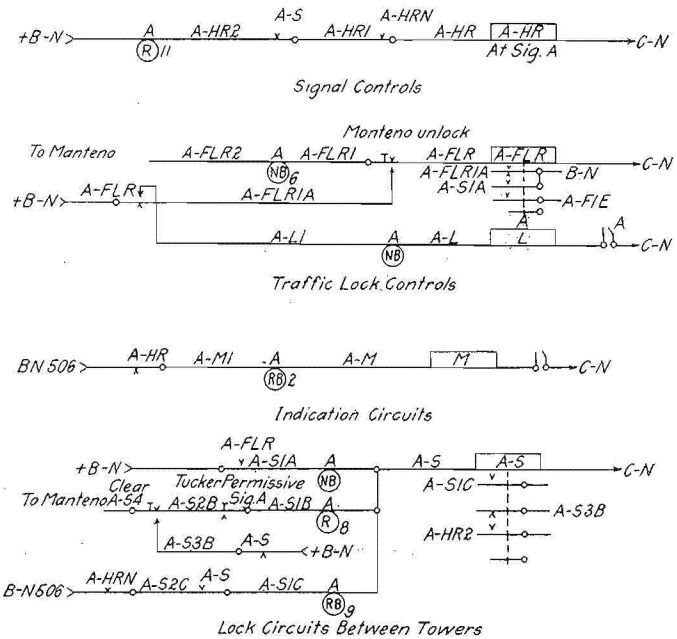
The towermen are required to set down on a record sheet the time each train passed and the time of its arrival at the next tower, also indicating which track the train used. A separate telephone line of two No. 9, copper wires was placed on the signal pole line with telephones in each of the five towers, this circuit being used primarily for direct communication between towers. Aside from this line there is a telephone in each tower connected to the regular telephone dispatching circuit.



Track and Signaling Diagram of the Interlocking Plant at Tucker, Ill.



Electro-Mechanical Machine at Tucker



Written Circuits of Important Controls

All Signals Are the Light Indication Type

The automatic block signals on this installation are the three-color-light indication type of the Union Switch & Signal Company, Type R. The "red" light on the bottom indicates "stop," the immediate block is occupied, the middle light, which is yellow, indicates caution, that the second block is occupied, and the top light is green, indicating "clear," meaning that two or more blocks are unoccupied. Only one of these lights can be illuminated at once. However, the flash over from one indication to the other is so quick that the signal is not dark for a perceptible time. These signals are designed for long range daylight or night indication; even under adverse conditions of the sun shining into the lens a minimum range of 4,000 ft. is assured, while at night the indication can be seen readily for miles. At the same time, on account

of the signal being mounted so low, an engineman in a locomotive cab can see the indication plainly up to the time he is within 75 ft. of the signal.

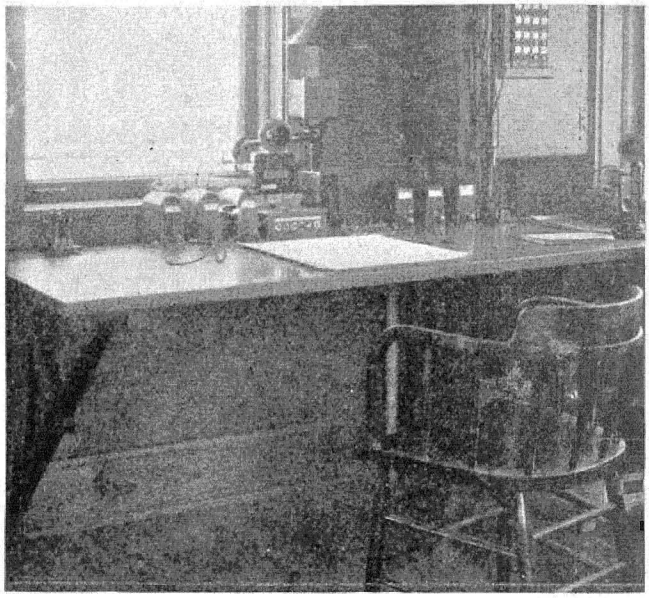
The three units of this light signal are mounted in a rectangular cast iron case with separate compartments for each unit. Each light signal is arranged to receive a special sighting telescope with a bracket, the use of which enables the signalman to align the entire signal correctly in a short time. The colored lenses are 8⅜-in. in diameter, the 30-watt, 10-volt double filament lamp giving the indication being mounted at the focus of the lens. These lamps are rebased at the factory of the signal company to ensure a proper focus without adjustment or realignment when renewing a lamp. A hood extends out from the face of the signal over each lens to exclude the sun's rays and to prevent snow and sleet from covering the lenses. A sheet iron background increases the distinctness of the indication. All light signals are mounted on 3-in. pipe supported on plates extending from top and bottom chords of the signal bridge. Provision was made in the design of signal bridges and in the conduit arrangement on the bridges to eliminate the necessity of moving but one signal should a fourth track be installed.

In contrast to the automatic block signals, the home signals at the interlocking plants are the single unit, three-indication, search light signals, made by the Hall Switch & Signal Company. In this signal but one electric lamp is usd, the three-color indication being secured by 1-in. colored roundels mounted in a movable vane at the focus of the lens and operating in a plane parallel to the lens. The lens of this signal is 10-in. in diameter surrounded by a shield disk 3-ft. in diameter.

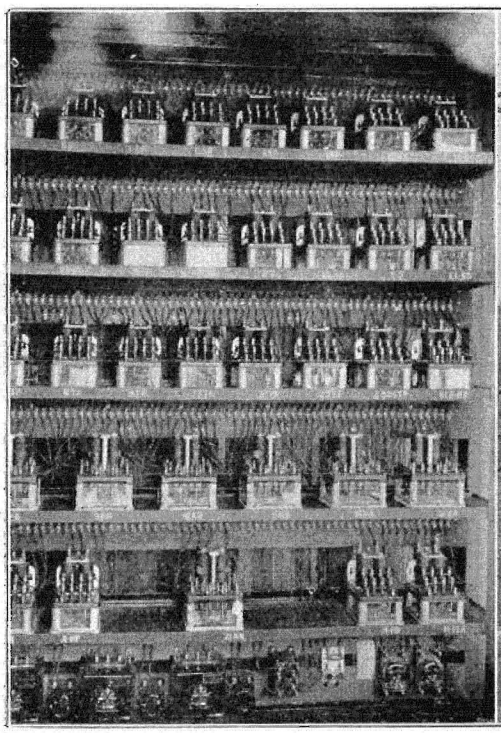
All signal lights are ordinarily illuminated by alternating current at 8 volts, which is fed from a special "NL" transformer. From the transformer this 8-volt circuit is fed through the front contacts of a U. S. & S. Co. 110-volt a.c. vane relay which is normally energized. However in case the a.c. supply should be cut off the vane relay drops and throws the lights on the 10-volt signal storage battery through the back points of the contacts to which the light circuit feed is connected. As soon as the line is again energized the lights are switched back to the a.c. feed automatically.

Local Control Circuits of Automatics

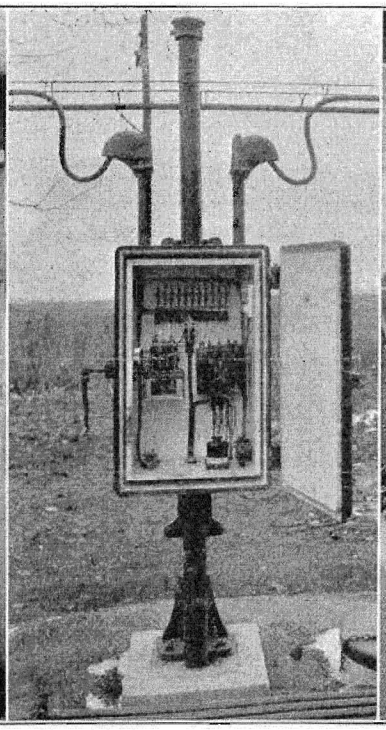
All signals on the installation are mounted on four track signal bridges; however, in order further to increase the contrast between the automatic signals and the home signals the three-color automatic signals are mounted on a line above the bottom girder of the bridges, while the home signals all consist of three of the search light signals mounted one above the other at 5-ft. spacing, the



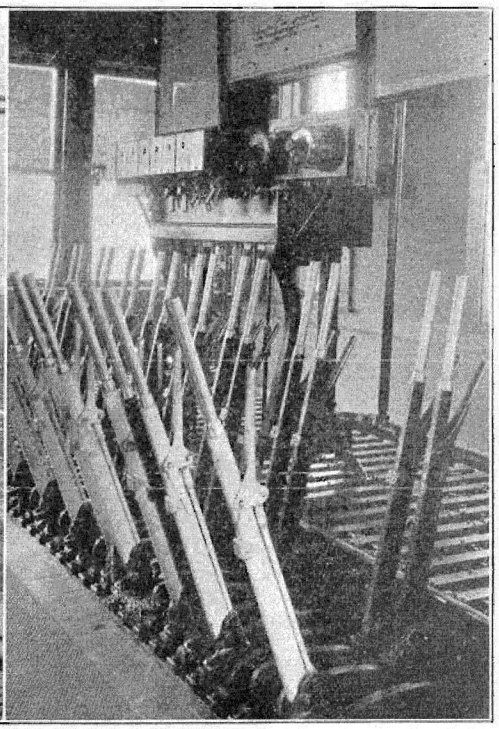
The Unlock and Permissive Buttons Are Placed on the Operator's Table



Relay Rack in Tucker Tower Rectifier and Lamp Relays at the Bottom



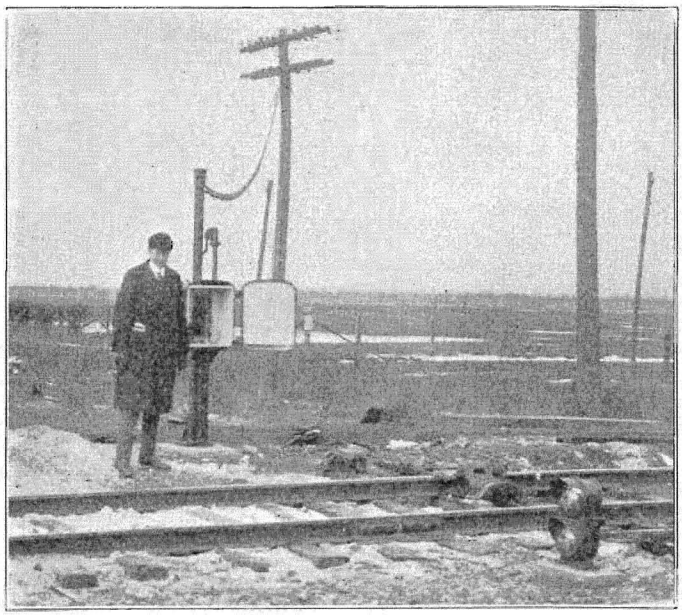
Track Relay Location at an Interlocker



Electro-Mechanical Interlocking Machine at Peotone, Ill., Showing the Time Releases

bottom one being on a line with the bottom girder of the signal bridge.

The track circuits extend from signal to signal, the maximum length being 5,500 ft. The red light for the danger indication is energized through a back contact of the 2-ohm track relay, when released due to a train in the block. When the train passes out of the immediate



Dwarf Signal Location on Industry Track, Showing Hayes Derail

block this relay is picked up, thus breaking the back contact which extinguishes the red light and then making a front contact which illuminates the yellow light giving the caution indication. This circuit is fed through a back contact of the 640-ohm line relay; therefore, as soon as the train passes out of the second block, the line relay picks up, the yellow light is extinguished and the green light is illuminated, giving the "clear" indication. These controlling features are the same not only for the two outside tracks but also for the signaling in both directions on the middle track. Thus a train on the middle track has protection to the rear for two blocks the same as furnished on the outside tracks. The automatic signal indications for the reversed direction of traffic are not affected by a train move except as the train enters the track circuits; this places the signals in advance first to caution and danger as the blocks are entered, the same as in the case of a train moving against traffic on a double track road.

Excepting where necessary for controlling crossing bells, the track circuits are not cut but extend from signal to signal, the longest circuits being 5,500 ft. The rails are bonded with two 48-in. galvanized iron bond wires using R. S. A. 9-32-in. channel pins. The 2-ohm d.c. track relays are rated to pick up at 64 m. a. and drop away at 32 m. a. The 2-ohm track relays and also the 640-ohm relays are the Universal type 9 form E of the General Railway Signal Company. A Hystatic shunt is placed across the terminals of all relay coils in addition to lightning arresters on controls from pole lines. The switch circuit controllers are the Union Switch & Signal Company's universal type.

Battery and Relay Housing

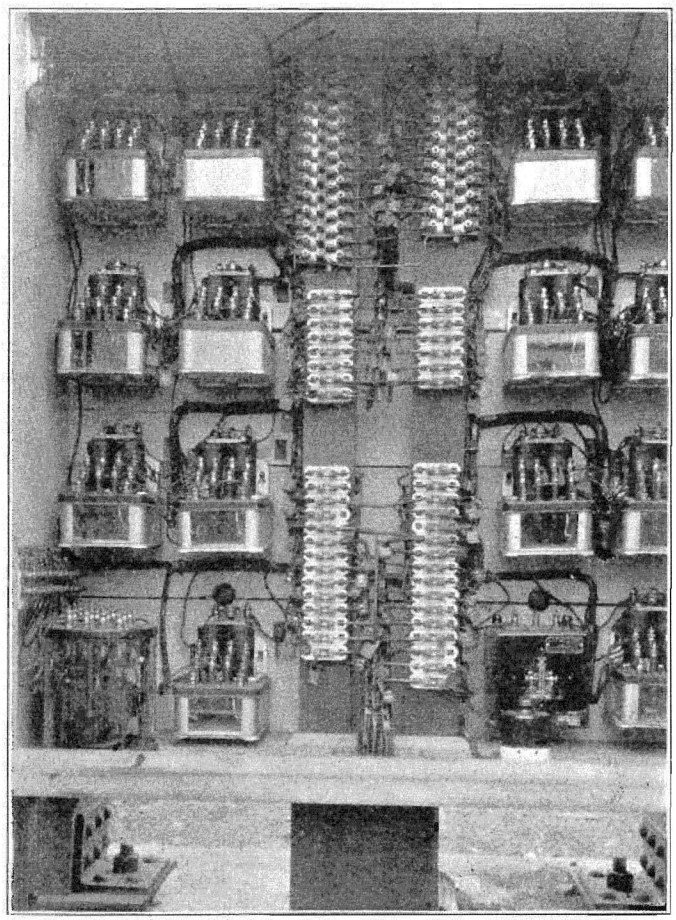
Two cells of 84 a. h. Exide battery connected in multiple are used for each track battery. All the light signals and the line circuits at a signal bridge location are operated from a battery of two sets of 5 cells of the 84 a. h. storage cells connected in multiple. Track battery and signal battery are kept under floating charge by the use of Leich non-tune double wave type rectifiers with adjustable external rheostats for each separate rectifier. Connected in the 110-volt feed to each rectifier is a double-pole switch and two 3-amp. plug type fuses, which facilitates the inspection and secures adequate protection.

All of the battery at a signal location is housed in a 24-cell capacity R. S. A. type concrete battery box furnished by the O. S. Flath Co. These boxes are equipped with screened ventilators covered by cast iron hoods. The boxes are set in the ground only far enough to give a good foundation, as is shown in the illustration.

A single compartment wood relay box, 4 ft. by 4 ft. by 18 in. deep, is attached to the signal bridge on the pole line side. This box is made of 1¼-in. pine and covered all over with galvanized iron and is equipped with double doors. As may be seen from the picture, the terminals and arresters are located in the center with the wall type relays on each side, the rectifiers and resistance units being at the bottom. All relay boxes were wired up complete at the signal shop at Peotone, Ill., where conditions are favorable for obtaining first class, uniform results.

The Pole Line and A. C. Feed

The signal pole line in this territory was rebuilt and an additional cross-arm added. All line circuits are No.



Portion of Relay Box at an Automatic Signal Location

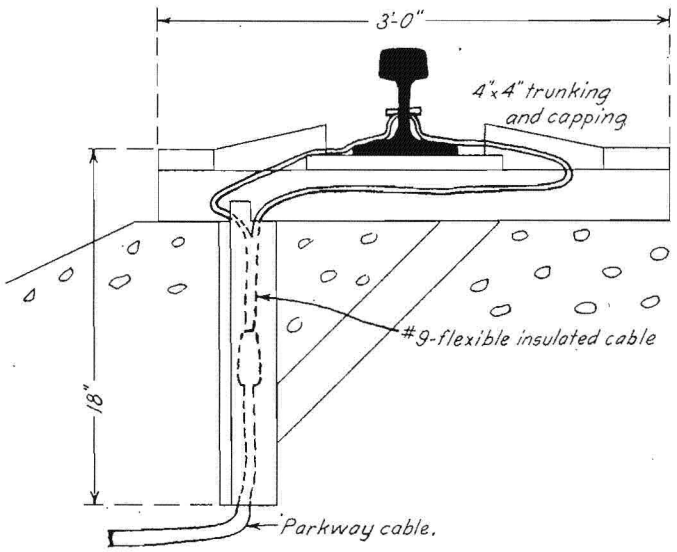
12, weatherproof copper clad. The R. S. A. standard dead end construction, using strain insulators, was used at all signal locations. No. 14 insulated solid copper wire

is tapped to the line wire pig tails and is carried in a madeup cable to L. S. Brach type No. 20 carbon block arresters, on the board mounted in the center of he relay box.

The 440-volt a. c. feed for the floating battery charge is carried on the two No. 6, copper wires on the top arm on the field side. Alternating current at 2,300 volts is purchased from the power company at Matteson, Monee, Bradley and Tucker. This voltage is cut down to 440 volts by a transformer, as shown on the pole in one of the illustrations. At each signal location is a small 120-v. a. Type M, air cooled, outdoor type transformer to reduce the voltage to 110-volts for the operation of the rectifiers and lighting transformers. Sectionalizing switches are placed at each power feed so that the line can be cut off, cut through or fed from either end.

Four Electro-Mechanical Interlockers Installed

Electro-mechanical interlocking plants were installed at Tucker, Manteno, Peotone and Monee to handle the crossovers, and passing track and industry switches. These machines are all of the same size, viz.: 36-lever mechanical and 8-lever electrical units. The three tracks continue straight through each of these plants with a crossover for each direction between both the north-



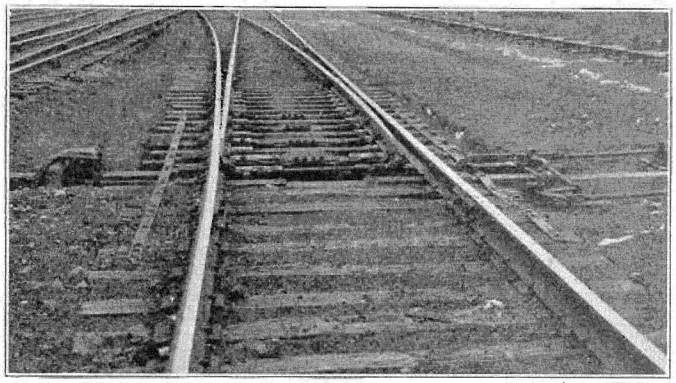
Construction of Trunking for Bootleg Rail Connection for Parkway Cable

bound track and the middle track and also between the southbound track and the middle track, as is shown in the layout of the Tucker plant. The layout of the crossover permits parallel simultaneous movements to or from the middle track and outside tracks. The main line crossovers are 378 ft. long, using No. 18 frogs, which permit of train movements at a comparatively high speed.

At Monee on the north, the four tracks from the north converge to three tracks. At Kankakee junction on the south end of the three track additional levers were added to the existing electrical General Railway Signal Company, Model 2, plant to provide for the three track to two track junction. With the installation of these interlockers all main line switches entering the middle track in this three track territory are operated by the towerman, with the exception of two sets of crossovers near Kankakee junction which are locked with electric switch locks controlled by the Kankakee junction towerman.

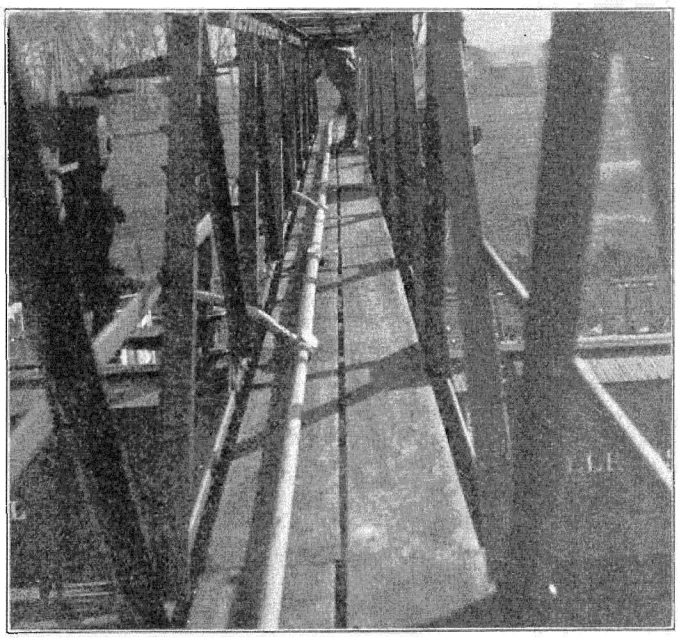
As all of the new plants are of the same general type and construction only the interlocking at Manteno will be described. All switches are handled by mechanical levers, pipe connected. No derails are used on the main tracks, but Hayes type derails are used on the industry tracks. No detector bars are used, as track circuit locking is carried out through all the plants. The electric levers are used for the signals, and as the switches are lined up for the several routes, selection is made to the proper signal. Thus a single electric lever may be used for several signals and in one case an electric lever operates five signals. This illustrates the economy of the electro-mechanical machine over the straight mechanical type, which would require a lever for each signal and in addition an electric lock for the home signal levers.

The interlocking machines are all the Union Switch & Signal Company electro-mechanical Type S-8, S. & F.



The Switches Are Operated Mechanically

locking. Illuminated track diagrams take the place of track indicators. The relays located in the first story of the tower are placed on a relay rack consisting of shelves supported on a framework of angle iron with wooden shelves. The corner angle iron is 3 in. by 3 in. by ¼ in. and the cross pieces are 1½ in. by 1½ in. by ⅛ in., all being bolted together with stove bolts. The



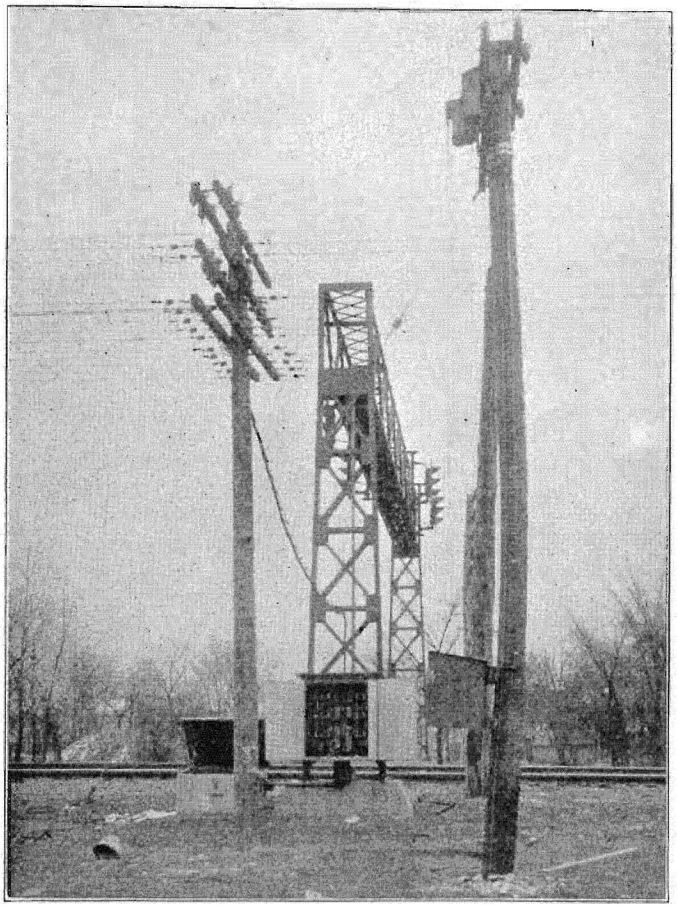
View Through Signal Bridge, Showing Head Room. Note the Conduit Used Instead of Trunking

top section is enclosed and used as a slack box. Wires are brought in to the tower in ready made aerial cables to terminals mounted on the rear of the relay rack and jumpers extend from these terminals to the relays on

the shelves. Rectifiers and resistance units are placed on the bottom shelves of these cases as shown in the picture. These shelves are not enclosed. The tower battery for the interlocking circuits is housed in a cupboard in the lower story of the tower.

Two inch up-and-down rods are used at the machine connections without pipe carriers, thus eliminating the pipe bending and lost motion at this point. Rocker shaft leadouts are used at all plants. One inch R. S. A. galvanized steel pipe is used throughout. The pipe lines and head rods are insulated with insulated screw jaws, as is shown in one of the views.

At the interlockers the signals used for back-up moves and train movements out of passing and industry tracks are the two-color-light dwarf type. The signal is



Automatic Signal Location, Showing Pole Line Construction, and Power Feed

mounted between tracks on a horizontal concrete foundation. The signal case is designed to incline 4 degrees from vertical, making it possible to receive a better close up indication.

No Trunking Used

It is noticeable that no wooden trunking was used except for bootleg connections to the rail on either the automatic signals or the interlockings. All wires from the tower to the relay boxes are carried in factory made cables of No. 14 copper insulated wire. Cables of 25, 19, 14 and 7 conductor were used. As seen in the pictures this cable is carried on messengers supported on 3-in. iron pipe cable posts. These posts are set at not more than 70 ft. apart. Where highways cross the tracks in the limits of an interlocking, the cables are carried over the highway, being supported on each side by a 25-ft. pole formerly used for the Model 5 signals. The 5-16-in. stranded messenger is stretched by means of a turn buckle adjustment at the ends. Bonita cable clips spaced 18 in. apart carry the cable. One 25-conductor cable is run straight through from the tower to the bridge, while the smaller size cables are cut through the several relay boxes and switch boxes for the control of polarized switch indicating relays and also at track cuts locations.

Parkway cable buried 18 in. below the base of the rail is used for all rail connections. Beneath the rail a vertical rise of trunking brings the wire up to the cross piece of trunking forming the bootleg from which the parkway cable connects to No. 9 stranded wire which connects to each side of the rail. When installing this parkway cable, measurement was made first and the cable was cut, the steel striped back and taped up. The soldered connection to the bond wire was made before any of the cable was installed. At the relay box the parkway cable enters the pipe through a slot left in the base of the concrete foundation.

The wiring on all signal bridges is carried in galvanized iron conduits, 2 in. being used for main runs and 1½ in. for leads to signals. Crouse-Hinds condulets are used at all turns and outlets. Flexible conduit connects the conduit with the signal mechanisms. In the towers all wiring is in conduit varying from 1½ in. to 3 in.

The installation of these interlocking plants and automatic signals was handled entirely by signal department forces of the Illinois Central.

I. C. C. Terminates Cooperation with Joint Train Control Committee

THE Interstate Commerce Commission has directed that the co-operation of its Bureau of Safety with the Joint Committee on Automatic Train Control of the American Railway Association in the investigation and tests of automatic train control apparatus be terminated. This information was conveyed in a letter from W. P. Borland, chief of the Bureau of Safety, to President Aishton of the American Railway Association, stating that "the period provided for intensive tests having expired on January 1, 1923, and the carriers now being required by the Commission's order to 'proceed without unnecessary delay to select and install the devices as specified,' it does not appear that any material advantage can result from the further close co-operation of the bureau with the A. R. A. Joint Committee on Automatic Train Control" and that the Commission has, therefore, directed that this portion of the work be concluded. It was further stated that field work in progress in connection with the joint tests would be discontinued on January 31 and that the records and reports would be completed as early as practicable. The letter pointed out that the period between the date of the train control order of June 13, 1922, directed to 49 roads, and January 1, 1923, was expressly for such tests as the carriers desired to make preparatory to making their selection and that the two-year period from January 1, 1923, to January 1, 1925, was provided in accordance with the law in which to make actual installation, which is to be completed then.