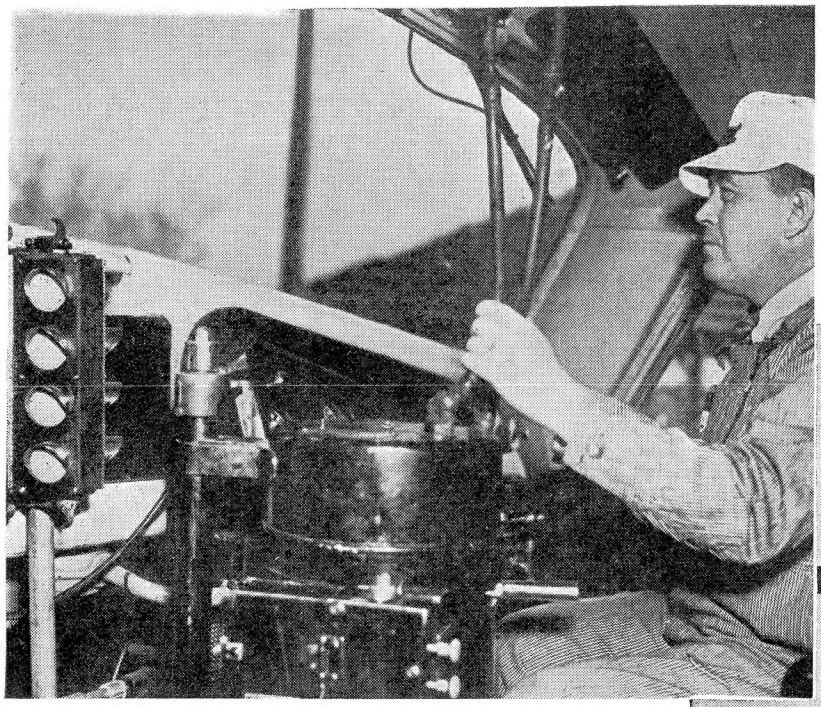
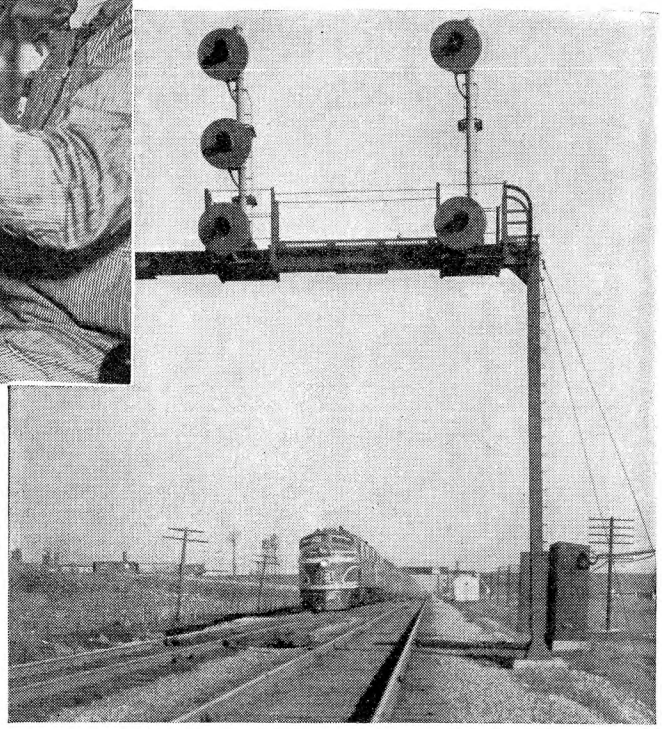
# Rock Island





Above—In a Rocket locomotive the cab signal faces two ways. Right—A westbound train passing the west end of Rockdale

**Old signaling and train control replaced on entire 165 road miles of double track, and C.T.C. for either-direction operation was added on 85 road miles**

THE Chicago, Rock Island & Pacific has recently completed a signaling replacement and expansion program on 165 miles of double-track main line between Blue Island, Ill. (Chicago), and Rock Island, Ill. The purpose of this program was to replace obsolete systems of signaling with the most modern systems as a means for increasing track capacity and reducing train relays.

In 1907, this territory was equipped with single-direction, right-hand running, automatic block signaling, using three-position lower-quadrant semaphore signals, which were controlled by conventional d-c. track circuits and polarized d-c. line circuits. The signals were spaced for blocks about one mile in length. In 1923, the Regan Company intermittant ramp-type automatic train control was installed in connection with the wayside signals on this territory. In 1927, the westward main track between Blue Island and Joliet, 24.7 miles, was rearranged for two-direction running. That project included a new set of crossovers at Mokena which were included in an interlocking. On this section of track, intermediate signals were respaced for 9,000-ft. blocks; absolute permissive block circuits were installed with traffic-direction locking under the joint control of the towermen at the three points mentioned above, so that train movements were authorized by signal indication in both directions on the westward main.

### Why Signaling Changes Were Required

Several considerations prompted the recently completed changes in signaling. The old semaphore signals and train control equipment were worn to the extent that major replacements would have been required at an early date. Except on the westward track between Blue Island and Joliet, as previously explained, the spacing of the automatic signals was inadequate for the present-day train speeds and tonnage. A study of the causes for serious train delays on various occasions led to the conclusion that there was a demand for more intensive utilization of the existing track facilities in this territory. A proposal was to provide signaling to authorize train movements in both directions on both tracks throughout certain sections where train delays were most prevalent. With this arrangement, when the preponderance of traffic is in one direction, both tracks can be used by trains of the same direction, thus allowing the faster trains to run around slower ones, and thereby more trains are kept moving at normal speed rather than holding some trains on sidings. Whereas previously, two-direction train operation by signal indication had been in service on only that portion of normally westward track between Blue Island and Joliet, this system of two-direction train operation by signal indication under centralized traffic control is now in service on both tracks of 85 road miles; Blue Island to Morris, 47.8 miles; Spring Valley to Bureau, 12.8 miles; and Atkinson to Silvis, 24.2 miles.

As a part of the program, color-light signals were installed to replace

# Installs Cab Signaling and Centralized Traffic Control

semaphores, the automatic blocks being lengthened in accordance with the requirements for train stopping distances. The intermittent ramp-type train control system was removed, and the new construction included continuously controlled four-aspect cab signaling. Especially during stormy weather, the cab signals permit trains to continue at normal speeds when otherwise the speed might have to be reduced to permit enginemen to see wayside signals. In circumstances where a train ahead is just getting in the clear on another track or a siding, a less restrictive aspect is displayed at once in the locomotive of a second train, thus permitting the train to accelerate at that time rather than waiting until the next wayside signal is passed.

### Coded Track Circuits

A feaure of the new signaling is that the track circuits are of the coded type, by means of which wayside signals and cab signals are controlled by different codes to display the various aspects, without the use of line control wires. For this reason, no additional crossarm was required on the pole line, thereby obviating the rebuilding of the pole line to provide vertical clearance.

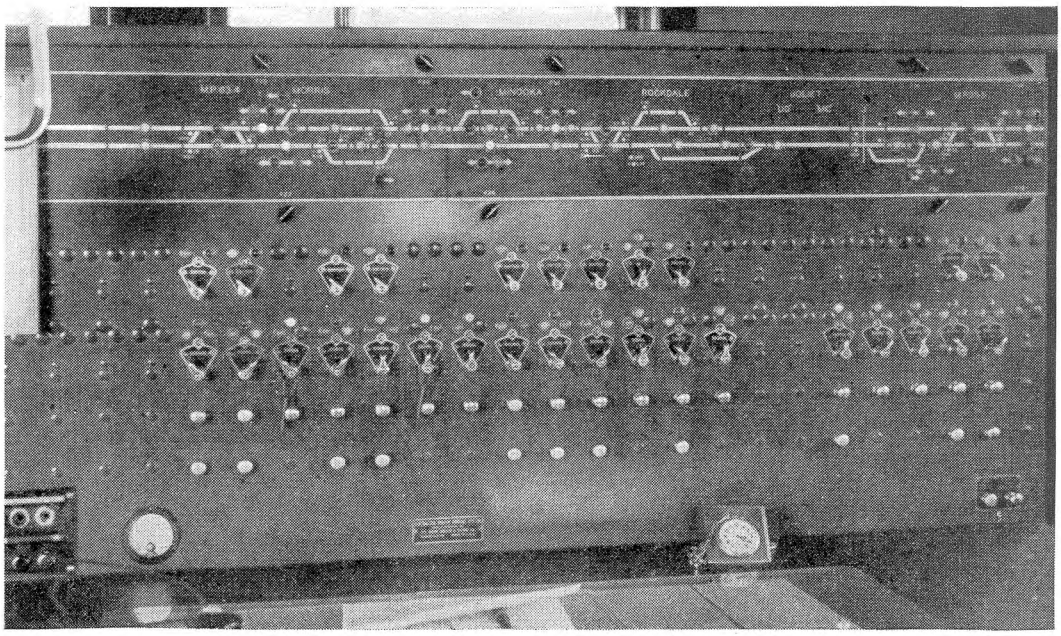
As measured by the amount of signaling apparatus, wiring, etc., this is said to be the largest single signaling project installed on any railroad during the past several years. The necessity to keep the old automatic signaling and train control service until the new wayside signals and cab signaling was cut into service caused much extra work.

### The Trunk of the Tree

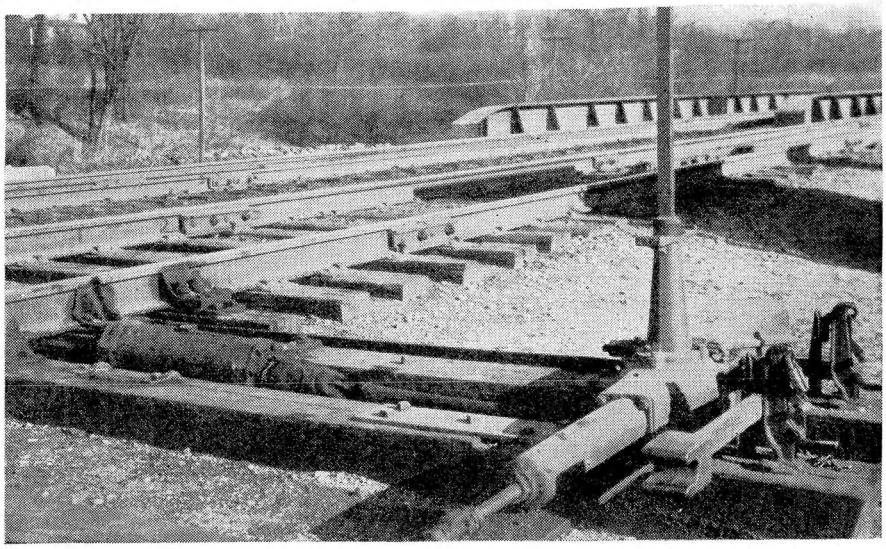
If the general layout of the 7,770 road miles of the Rock Island System is compared to a tree, the 165 miles between Chicago and Rock Island would be the trunk of the tree, with Chicago at the base. The main limbs of the tree would be the principal lines, one of which extends from Bureau, Ill. to Peoria, Ill., and four "limbs" extend from Rock Island, one through Kansas City to El Paso, Tex., as well as to Dallas and Ft. Worth, one through Des Moines, Iowa, and Omaha, Neb., to Colorado Springs, Colo., and Denver, one through Cedar Rapids, Iowa, to St. Paul, Minn., and Minneapolis, Minn., and one through Iowa Falls, Iowa, to Sioux Falls, S. D. The traffic of all these lines to and from Chicago must be handled over the Chicago-Blue Island-Bureau-Rock Island territory.

In the Chicago terminal area between La Salle Street station and Blue Island, 15.7 miles, the C.R.I.&P. has four or more main tracks. Road freight trains arrive at and depart from the Burr Oak yard located just north of the station at Blue Island. The signaling program starts at Blue Island and extends west to Rock Island.

Ten passenger trains, including the Rocky Mountain Rocket and the Des Moines Rocket, are operated each way daily between Chicago and Rock Island. Two Rockets, operated each way daily between Chicago and Peoria, use the main line between Chicago and Bureau, 114 miles. Twelve local suburban passenger trains are operated each direction daily between Chicago and Joliet, 40 miles. These 24 trains, added to the four Peoria Rockets and the 20 through trains,



The C.T.C. machine at the M.C. tower in Joliet with traffic levers shown above and below diagram



Spring switch with facing-point lock

make a total of 48 passenger trains on the Chicago-Joliet section.

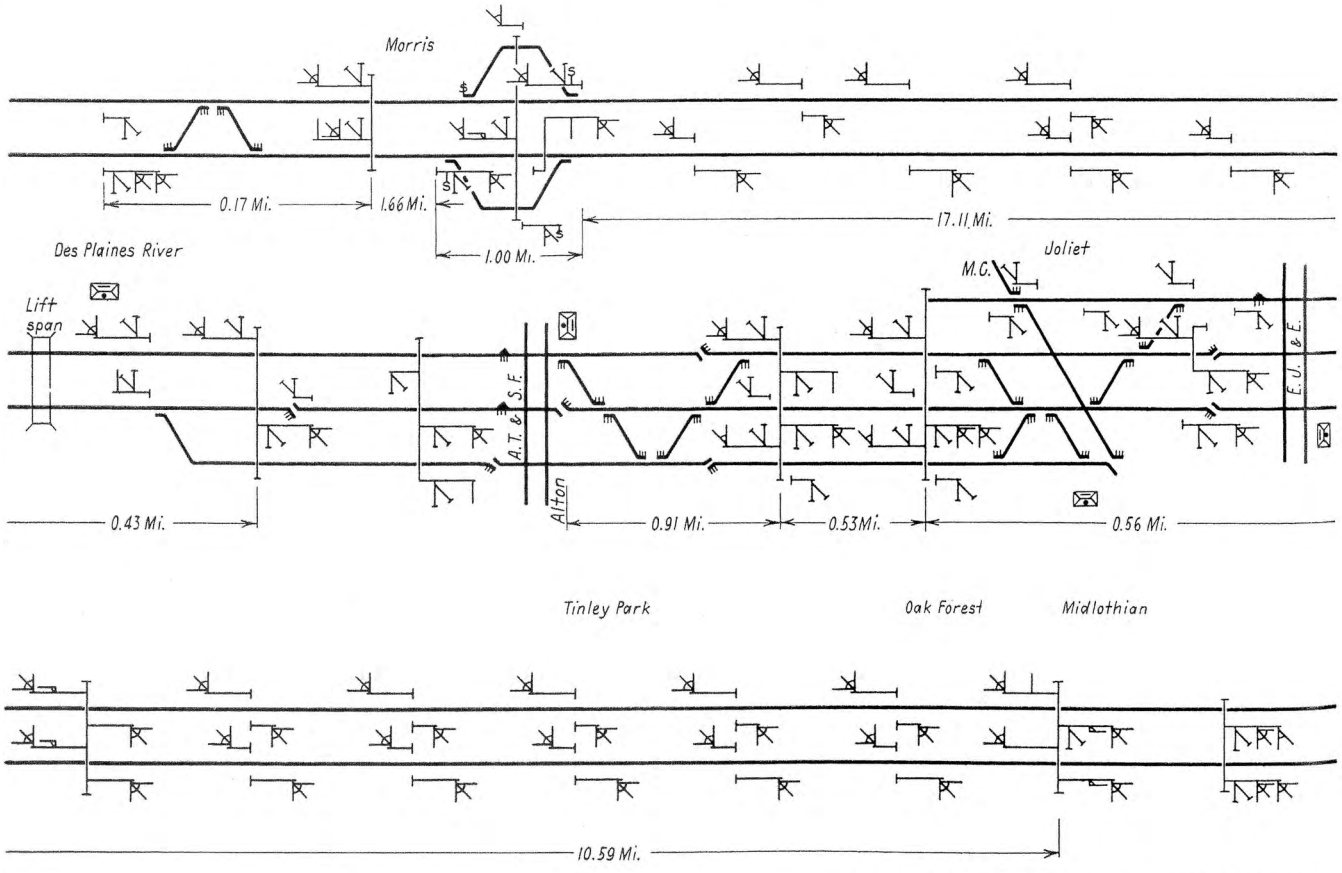
The schedules include an average of 10 through freight trains each direction daily, and a local freight train each direction daily except Sunday. Extra "switch runs" are operated in certain industrial areas such as Joliet, La Salle, Ottawa, Seneca and Peru. Extra passenger and freight trains are operated as required to handle the traffic. On the average, a total of about 95 to 100 trains are handled daily between Blue Island and Joliet, about 50 trains on the section between Joliet and Bureau, and about 45 on the section between Bureau and Rock Island.

The difficulties of handling the trains is increased due to the fact that the trains are bunched. For example, many of the important eastbound through passenger and freight trains, as well as the suburban trains originating at Joliet, must be handled into Chicago during the early morning hours. On some days as many as 11 trains are moved eastward between Joliet and Blue Island from 6 a.m. to 8 a.m.

## Physical Characteristics of Line

Between Blue Island and Mokena, 14 miles, the grade ascends westward at varying rates between 0.3 per cent and 0.5 per cent. Likewise, between Joliet and Mokena, 10 miles, the grade ascends eastward at varying rates, the maximum on each of two sections, each about ½ mile long, being 0.62 per cent. This section between Joliet and Mokena is the ruling grade eastward. Between Joliet and Bureau the line follows along the north side of the Illinois river at river grade.

Between Bureau, Ill., and Rock Island the line passes over a rolling prairie country with several short rolling grades but no long heavy grades. In the vicinity of La Salle there are three curves ranging from 2 deg. 28 min. to 3 deg. 30 min., and at Wyanet there is one 2 deg. curve. Otherwise the curvature on this line is very light. The track, which includes 130-lb. rail, is in good condition. As a whole, therefore, this is a highspeed section of line, the maximum permissible train speeds being 50 m.p.h. for freight trains, 70 m.p.h. for passen-




Track and signal diagram of centralized traffic

ger trains using steam locomotives, and 90 m.p.h. for passenger trains with Diesel locomotives.

### Special Features of the C.T.C. Machines

The C.T.C. control machines have the conventional arrangement of levers, buttons and lamps for the control and indication of signals and switches. In addition, immediately above and below the track diagram panel, there are traffic levers of the push turn type each of which is used to establish the direction of traffic in its corresponding traffic section. The traffic levers above the diagram apply to the normally westward track, and the levers below apply to the normally eastward track.

Corresponding with each traffic lever there is a set of arrows and two blue lamps, which are located on the track diagram alongside the portion of the "track" representing the section of track over which the traffic lever governs. If traffic is set up eastward, the blue lamp on the east half of the double arrow is lighted, or the west lamp is lighted when traffic direction is west. On the line representing the track within the limits of a traffic section there is an amber lamp which is lighted when a semi-automatic signal is cleared for a train to enter that section, and this amber lamp stays lighted as long as the corresponding traffic section is occupied.

In addition to the amber lamps which indicate occupancy of a station-to-station block as a whole, there are also white lamps which indicate occupancy of approach sections. A red lamp indicates occupancy of a switch detector track section at each power switch.

### C.T.C. Territories

The accompanying map indicates the three different sections on which C.T.C. was installed for two-direction train operation on each of both main tracks.

The first section extends between Blue Island and Morris, 45 miles.

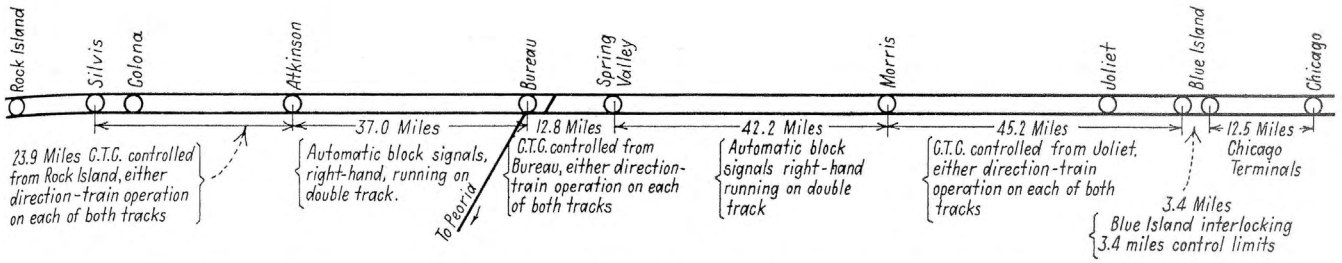
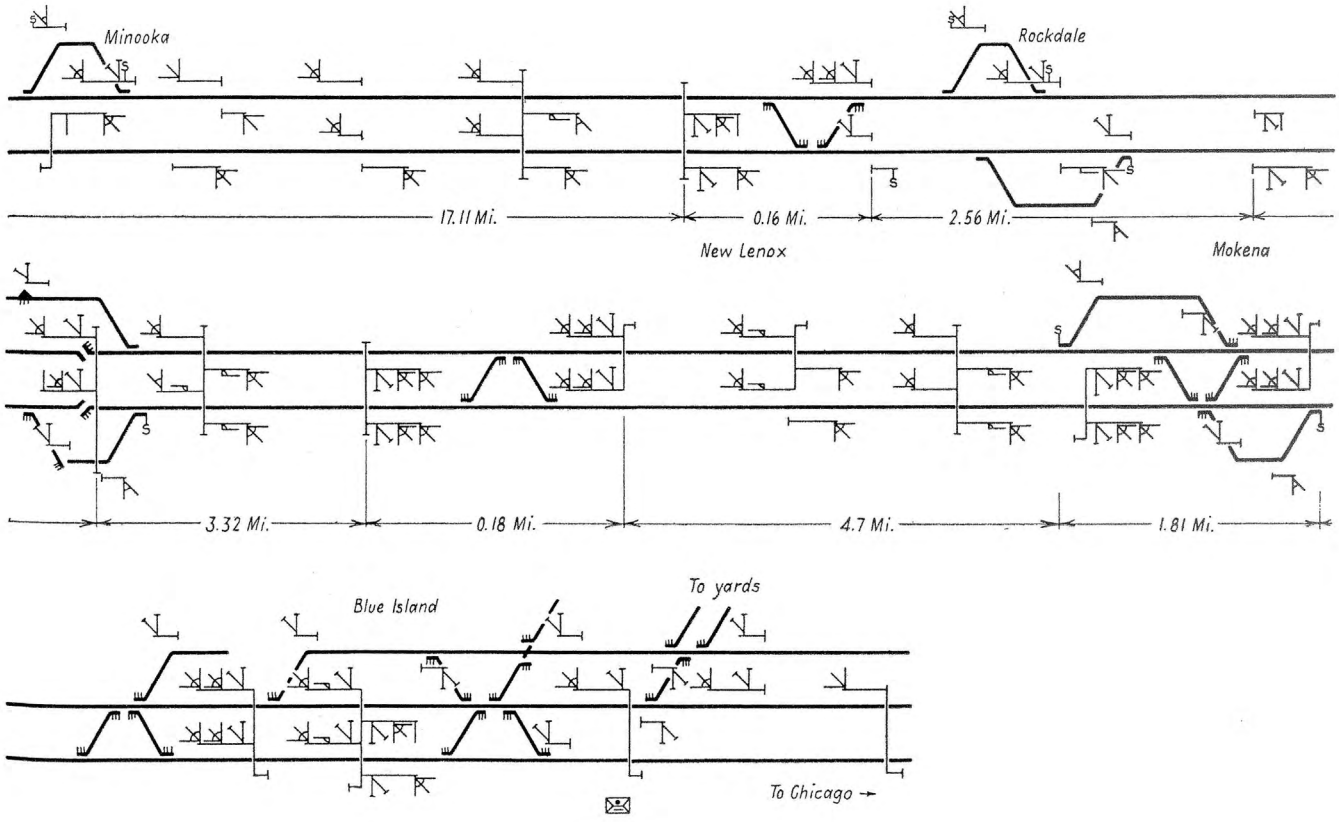



Diagram showing C.T.C. and automatic block sections between Chicago and Rock Island

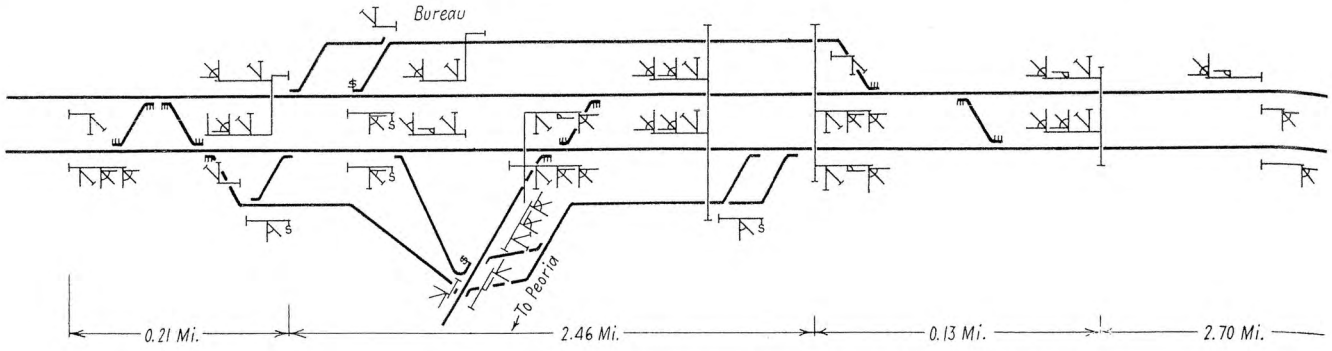



control territory between Blue Island and Morris

A C.T.C. control machine located in the interlocking tower at MC in Joliet, controls the C.T.C. layouts at New Lenox and from Rockdale to Morris inclusive. Previously existing interlockings at Blue Island and Mokena are operated in co-ordination with the remainder of the sys-

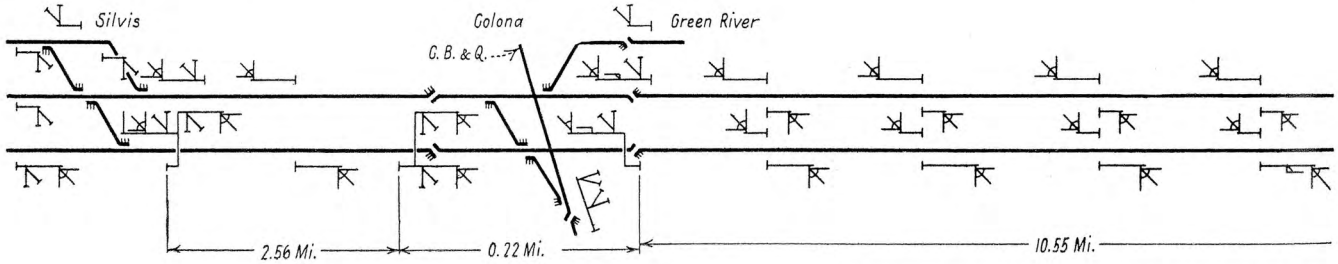
tem of authorizing train movements by signal indication, traffic locking being in effect between Blue Island and Mokena, and between Mokena and New Lenox.

The second C.T.C. section, extending between Spring Valley and Bureau, 12.7 miles, is controlled from a C.T.C. machine at Bureau.




Track and signal plan of centralized traffic control territory

The third section between Atkinson and the east end switches of the freight yard at Silvis, 24.4 miles, is controlled from a machine in the dispatcher's office at Rock Island, which is about 8 miles west of the end of the C.T.C. section. Switches and signals are controlled by the Union Switch & Signal Company




Track and signal plan of the centralized traffic

Type-L, Form-506 time-code system using two line wires from the control office to the ends of the territory controlled for each machine. Two new No. 9 Copperweld line wires were installed for this C.T.C. code line circuit, and a telephone circuit is superimposed on these wires.

On the 39 miles between Morris and Spring Valley and on the 33 miles between Bureau and Atkinson, trains are operated right-hand running under rules applying to double track with automatic block signal protection. The timetable applies, and train orders are issued to authorize variations from the timetable.

When planning to use both tracks for trains for the same direction, the first consideration is to provide crossovers between the main tracks at spacing so that trains can make run-around moves. The crossovers should be designed to permit trains to make diverging moves at the highest speed practicable thereby minimizing the train time lost, and furthermore, sufficient signal aspects should be provided to permit trains to be brought up to and through these high-speed crossovers at the speeds for which these track facilities are designed. On this basis, the project included three additional sets of two No. 20 crossovers, at New Lenox, at Rockdale, and at Morris. The C.T.C. section controlled from Bureau includes three sets of No. 20 crossovers, one at Spring Valley, one east of Bureau station and one west of the coal chutes. The C.T.C. section on the west end includes a pair of No. 20 crossovers at Atkinson and a single crossover at the east end of Silvis yard. All of these crossovers, as well as the semi-automatic signals at these locations for authorizing train movements, are controlled by the C.T.C. system.

The two No. 15 crossovers at Mokena, 10 miles west of Blue Island, are operated by a mechanical interlocking. As soon as practicable, these crossovers are to be replaced with No. 20's and the new crossovers and signals will be included in the C.T.C. system.

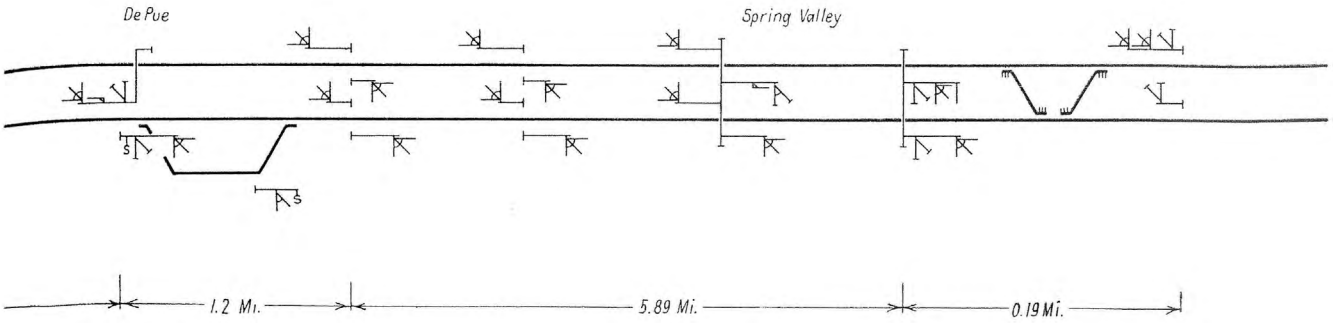
## Passing Tracks for Emergencies

On the C.T.C. sections, ideal operation is to use the crossovers to make run around moves thus keeping all trains moving, rather than holding some trains on sidings to permit others to pass. This ideal, however, is not always attainable and, therefore, some passing tracks must be available.

The Mokena layout includes two passing tracks one for eastward and one for westward trains, the entering switches being operated by the interlocking and the departure switches being equipped with spring buffer mechanisms including mechanical facing-point locks. Similarly the eastward siding at E. J. & E. crossing near Joliet and the westward siding at Bureau have a power-operated entering switch and a spring switch at the departure end. Train movements into and out of these sidings are made without the trains stopping and in accordance with aspects displayed by semi-automatic controlled signals.

Other previously existing sidings, for example, at Rockdale, Minnoka, Morris and Geneso, are retained in service but are not used ordinarily. When a train is to be directed to stop and enter a passing track at a hand-throw switch, such as at the westward siding at Rockdale, the signal is controlled to display an aspect of red-over-red over an illuminated letter "S," as shown in one of the illustrations. After the train has stopped and the switch is reversed, the aspect changes to red-over-yellow. When the train is to be directed to leave at the west end of this Rockdale siding, the leave-

siding signal displays an illuminated letter "S" over a red, to direct that the switch be thrown, and then the aspect changes to yellow to authorize the train to pull out onto the main line, after which the switch must be placed normal before the train departs. At other locations such as the sidings at Morris and Geneseo, signals and for interlocking home signal units. The automatic block intermediate signals for right-hand running are high signals on masts and are color-light type with the three color lenses of each head arranged in a triangle. The automatic block intermediate signals for left-hand running are searchlight-type of the war program, the engineering department developed a special design for these signal bridges. For a double-track bridge, the two uprights are 8 in. by 14 in. wide-flange beams at 48 lb. per ft., and the horizontal member across the tracks is 14 in. by 14 in. wide-flange beam at 87 lb. per ft. Larger sized steel sec-




between Bureau and Spring Valley

spring switch mechanisms are provided at the leaving end of the sidings so that trains can depart without stopping.

The spring switch mechanisms are the Mechanical Switchman type made by the Pettibone Mulliken Corporation, a total of 13 switches being so equipped on the entire territory between Blue Island and Rock Island. In the C.T.C. territory where trains are operated in either direction on both tracks, each spring switch layout is equipped with a Union Switch & Signal Company mechanical facing-point lock. On the straight automatic block territories between Morris and Spring Valley, as well as between Bureau and Atkinson, trains operate right-hand running only, and the spring switches are for trailing main line moves; therefore, no facing-point locks were installed. In all instances, however, signals are provided facing-point protection.

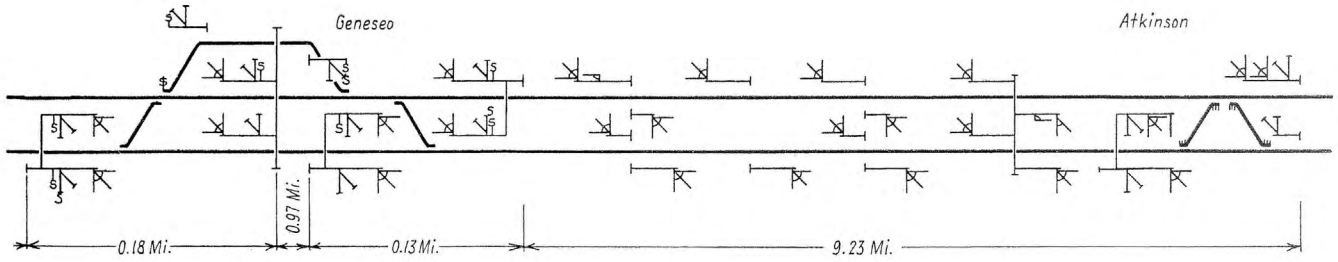
## Types of Signals and Mountings

The new installation includes searchlight-type signal units for all the semi-automatic C.T.C. controlled dwarfs, located between the main tracks.

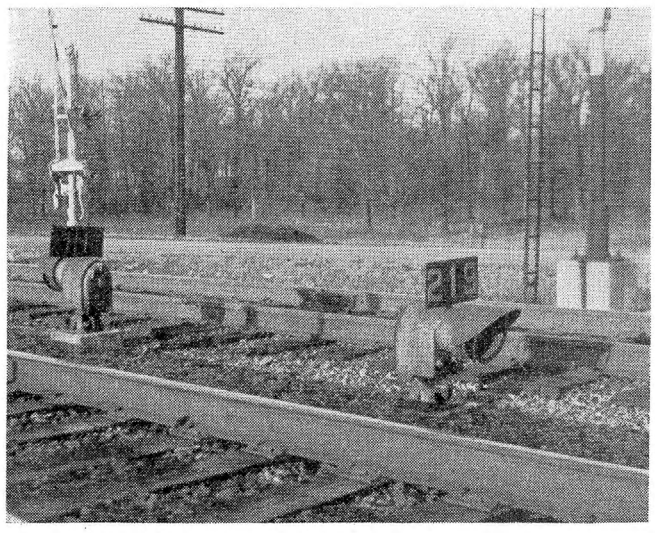
In the sections which are signaled for two-direction train operation on both tracks, overhead signal bridges were provided for the interlocking home and approach signals and the C.T.C. controlled home signals at crossover layouts such, as for example, at New Lenox, Ill., and Rockdale, Ill.

In order to conserve steel as a part of the war program, the engineering department developed a special design for these signal bridges. For a double-track bridge, the two uprights are 8 in. by 14 in. wide-flange beams at 48 lb. per ft., and the horizontal member across the tracks is 14 in. by 14 in. wide-flange beam at 87 lb. per ft. Larger sized steel sections are used for bridges which span more than two tracks. For example, at Morris the bridge spans four tracks and the cross member is a 27 in. by 14 in. wide-flange beam at 154 lb. per ft.

On account of the comparatively light construction of these bridges, guys are provided to prevent the bridges from swaying during wind storms. At each end of each bridge two ⅝-in. stranded Copperweld guys




control territory between Atkinson and Silvis



Searchlight dwarf signals as reverse running automatic signals are located between tracks

extend at 45 deg. to the vertical columns, and are tied to concrete pedestals acting as anchors.

### Signal Aspects

The intermediate automatic block signals display the three conventional aspects, red for Stop-and-Proceed; yellow for Permissive; and green for Clear. A number plate on the mast designates each of these signals as an automatic signal and denotes that the most restrictive indication is Stop-and-Proceed.

The C.T.C. controlled semi-automatic signals governing train movements at the high-speed crossover layouts are each equipped with two or three searchlight signal heads in a vertical row. For a through move on straight track, the aspects are red-red-red for Stop, yellow-over-red-red for Permissive, and green-over-red-red for Clear. With a No. 20 crossover reversed for a diverging move from one main track to the other, the aspects are red-over-green-over-red for Clear-Restricting with two or more automatic blocks ahead unoccupied, and red-over-yellow-over-red for Approach-Restricting with only one automatic block unoccupied. With either the Clear-Restricting or Approach-Restricting aspect displayed by the home signal, the distant signal displays the Approach-Permissive aspect yellow-over-green. Thus an engineman can bring his train up to and through one of these crossovers at approximately 40 m.p.h., whereas if only the Approach aspect were available on the distant signal, he would be obliged to reduce to half authorized speed at that signal and approach the home signal prepared to stop.

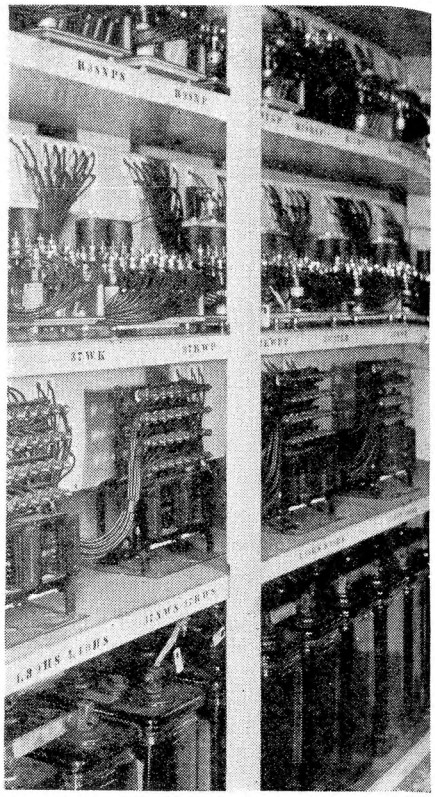
On these distant signals capable of displaying the Approach-Medium aspect, the top "arm" is a color-light head to display either red, yellow or green, and the lower "arm" is a single unit capable of displaying green only, in combination with yellow in the top "arm." If the lamp in the bottom "arm" burns out, the single yellow in the top is more restrictive than yellow over green. If the filament in the yellow lamp in the top unit fails, a relay in series is opened to prevent the illumination of the lower "arm" lamp.

The third, i.e., the bottom arm on a C.T.C. home signal crossover layout can be controlled to complete a Restricting aspect, red-over-red-over-yellow. This is a call-on aspect, the control of which does not include the track circuits.

### Aspects of Cab Signals

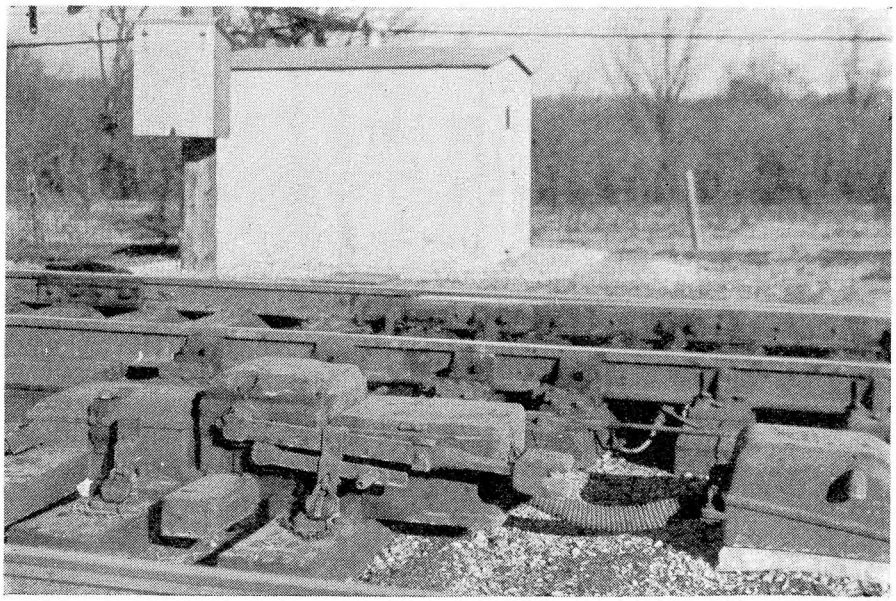
Each cab signal has four circular lens openings 1½ in. in diameter in a vertical row. Only one of the four can be illuminated at any one time. The glass in the top opening is green. In the second opening the upper half of the glass is yellow and the lower half green, so that when lighted, it displays the yellow-over-green Approach-Medium aspect. The third opening has a yellow glass. In the fourth opening the upper half of the glass is red and the lower half yellow, so that when lighted it displays the red-over-yellow Restricted Speed aspect. Each time the aspect of a cab signal changes to a more restrictive aspect, a whistle or whistles in the locomotive cab are sounded until the engineman operates an acknowledging lever.

The aspect displayed by the cab signal is the same as that of the wayside signal which the locomotive has just passed. And any change in the condition in the blocks ahead is immediately reflected by the cab signal. Thus, if a train ahead clears the main track, the cab signal displays less restrictive aspects, enabling the engineman to at once accelerate his train rather than waiting until the next wayside signal is passed. By this means train delays are reduced or minimized.



Relays and battery in concrete house

During stormy or foggy weather when the range of the wayside is reduced, the aspects of the cab signals permit trains to be operated safely at normal speeds, otherwise it might be necessary at various locations to reduce speed so that enginemen could see the aspects displayed by the wayside signals.



Dual-control low voltage electric switch machine

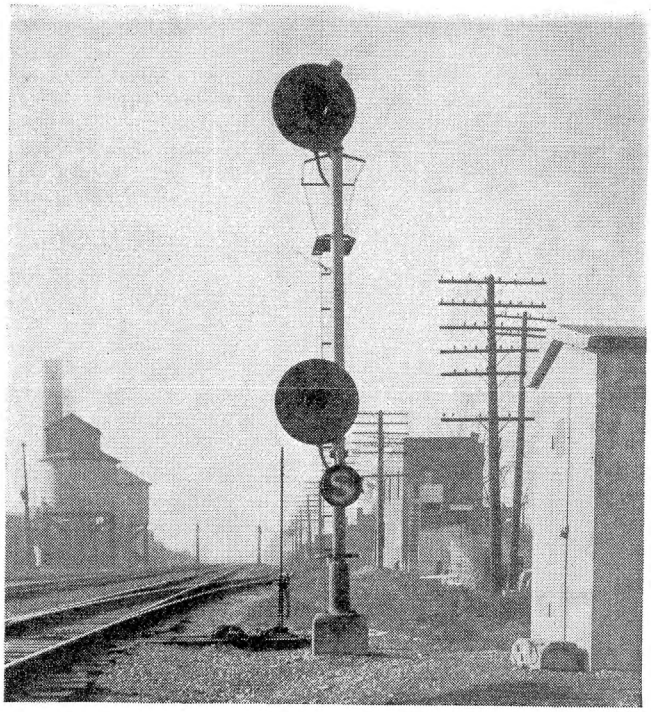
### Types of Track Circuits

Conventional normally-energized neutral d-c. track circuits, with 4-ohm relays are used within control limits for highway crossing protection, within interlocking home signal limits and within C.T.C. home signal limits at crossover layouts such as at Spring Valley. Outside these limits the track circuits are of the coded type having a maximum length of 7,000 ft.

The coded track circuits for the control of the wayside signals are of the d-c. type. Absence of code causes

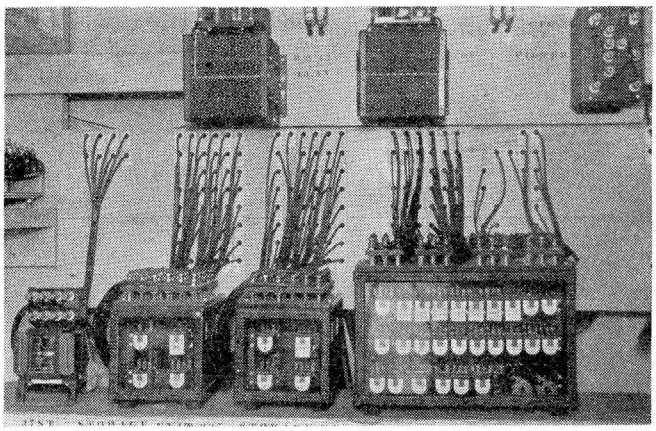
the signal for that block to display its most restrictive aspect. Code at 75 times each minute controls the Permissive aspect, and at 180 the Clear aspect. On automatic signals in approach to home signals, the Approach-Medium aspect is displayed when 120 code is in effect in the track circuits of that block.

The locomotive cab signal equipment includes a set of receiver coils mounted above each rail at the front of the locomotive just behind the pilot. These coils will not pick up the d-c. code on the rails used for the control of wayside signals, but these coils will pick up a-c. code which is superimposed on all track circuits for the control of cab signals. Absence of a-c. track circuit code causes the cab signal on a locomotive to display the Restrictive aspect; 75 code the Permissive aspect, 120 code the Approach-Medium aspect and 180 code the Clear aspect.



Signal at hand-throw switch at east end of Rockdale with "S" lamp light to indicate Stop, throw switch, and take siding

The cab signaling on the locomotives is operated only by a-c. codes. On some projects, the same a-c. codes for feeding cab signaling are used also to control wayside signals. On this Rock Island installation, however, the supply of a-c. is from commercial source, without automatic switching for standby, and, for this reason, d-c. track circuits operated from battery were used to control the wayside signals. With this arrangement, if the a-c. power fails on any short section, the trains can continue to move by wayside signals, under special rules, although the cab signaling will be out of service.



The line coding apparatus in the house at Rockdale

### Track Circuit Feeds

On the territory equipped for single-direction train operation, the d-c. code in each track circuit is fed in the direction toward an approaching train, and a reverse code is fed in the opposite direction during the off periods of the normal code. This reverse code controls a relay for the approach control of the signal lamps and for the approach control of the a-c. cab signal feed to that track section, this a-c. feed being in the direction toward an approaching train. Thus, under normal conditions in single-direction territory and with no train in the blocks involved, 180 d-c. wayside signal code is being fed to the track circuits of the block, but no a-c. code is being fed. The 75-code transmitter is normally not in operation, being started on approach control.

In the two-direction territories, the direction of traffic over a section of track between two stations is established by C.T.C. control, and the direction last used remains in effect until changed. Normally the track circuits are fed steadily-flowing energy in the direction of traffic. This use of steadily energized track controls serves several purposes: (1) to extinguish the lamps in the automatic signals normally; (2) cut off coded a-c. cab signal feed to the track circuits normally; (3) the steady energy, when feeding throughout the length of a station-to-station traffic section, causes information to be transmitted to the C.T.C. machine to indicate that that section is unoccupied and that the traffic direction is released.

When a C.T.C. controlled semi-automatic entrance signal for a traffic section is cleared, or if a train enters such a section, then the steadily-flowing energy in the track circuits ceases, and each track circuit is fed d-c. code to control the wayside signals and a-c. code to control the cab signals, these codes being fed in the direction opposite to the direction of traffic. Simultaneously the lamps in the intermediate automatic block signals are lighted. In this arrangement there is no reverse code.

### Power Supply

The improvement program included the installation of a single-phase 550-volt a-c. power distribution circuit on two No. 6 hard-drawn copper wires. At stations about 15 miles apart this line is fed in each direction. Normally these sections are not connected, but if the feed at a certain station fails, switches can be closed to end-feed from either side of the failure.

At each location there is a 550/110-volt line transformer to feed low-voltage transformers for various purposes such as feeding the signal lamps normally, feeding rectifiers for charging batteries, and feed-

ing the a-c. cab signal track circuit code.

Wherever practicable the signal locations on the two tracks are opposite so that the power supply, code transmitters, etc., could be used in common. At such a location, a set of five cells of 120-a.h. Exide storage battery, on floating charge, feeds the local relays, the decoding transformers and code transmitters, as well as acting as a standby for the signal lamps in case of an a-c. power failure.

In single-direction train operation territory, the normal direction track circuit feed is from a set of nine cells of 500-a.h. primary battery arranged three cells series multiple, with a rectifier connected to carry most of the normal discharge. The reverse track circuit code is fed from four cells of 500-a.h. primary battery connected two cells in series multiple, with a rectifier across the battery. The primary batteries are of both the Edison and the Waterbury manufacture.

In two-direction train operation territory, the track circuits are reversible, a single cell of 120-a.h. Exide storage battery being provided at each end of every track circuit.

In single-direction territory, there is a track transformer at the feed end of each track circuit to feed the a-c. cab signal code, and on two-direction territory such a transformer is provided at each end of every track circuit.

At each power switch location, a set of 13 cells of Exide 160-a.h. storage batteries are used to feed the switch machine and also certain line circuits and coding equipment.

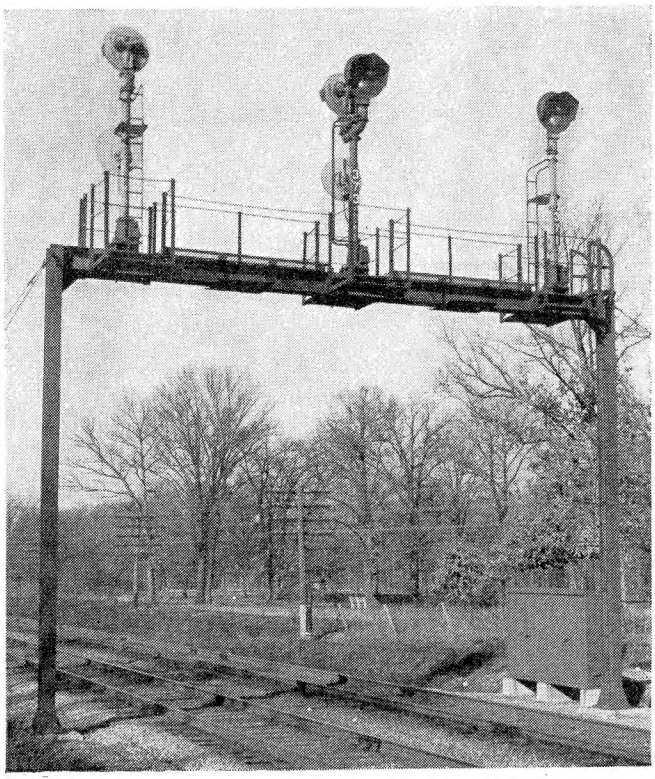
At C.T.C. power switch locations, the batteries, code equipment and relays are in concrete houses, and at intermediate signal locations sheet-metal cases are used. These houses and cases were wired complete with instrument in place at a temporary signal shop in Chicago.

W. E. Cannon, leading signal maintainer, inspecting equipment

## Cab Signals on the Locomotives

As a necessary part of the project cab signaling equipment was installed on all locomotives regularly assigned for operation over this territory, including 91 steam and 9 Diesel-electric locomotives.

Two receiver coils, each 24 in. long, were applied at the front end of each locomotive at a height of 6½ in. to 9½ in. above each rail. On the steam locomotives the center of the receivers are over the rails but, on account of structural features behind the pilots on the Diesels, the receivers were mounted so that the center of each receiver is about 3 in. off center to the gage side of the rail.



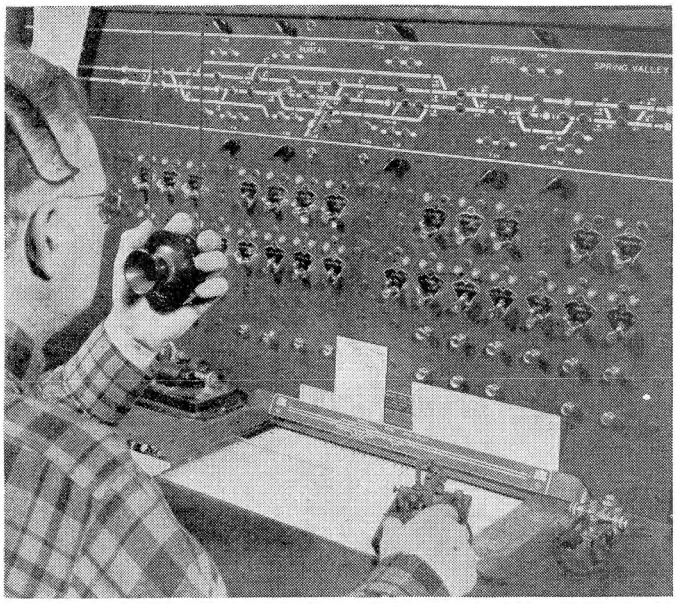
An intermediate automatic signal bridge showing the rear of one of the lower units

## Location of Apparatus

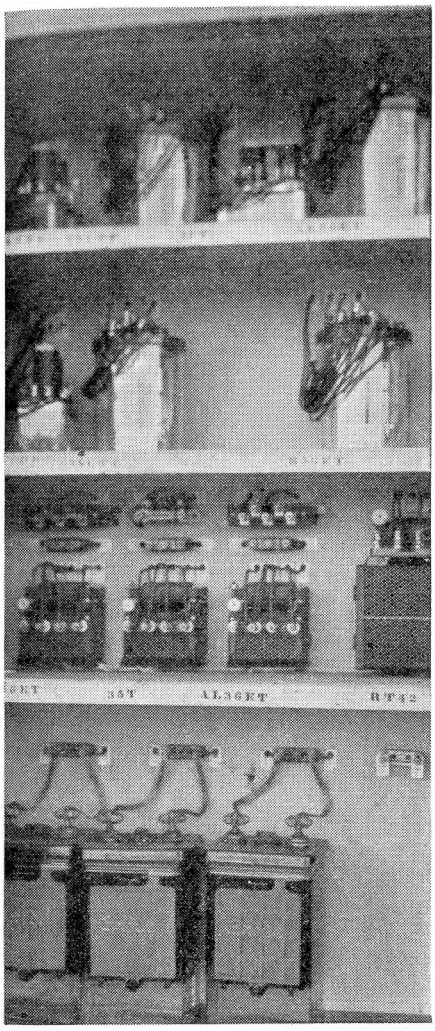
The amplifier equipment on each locomotive is in a specially constructed case located on the left side of the locomotive on top of the boiler. On some Diesel locomotives the equipment box is located inside while on others it was necessary to locate same in a protective box underneath the locomotive. The locomotive equipment on this project is a new development in that the amplifiers operate on a relatively low voltage of 32 volts d-c. as compared with higher voltages of about 350 volts d-c. required on previous cab signaling. This change eliminated the necessity for motor-generators on the locomotives to secure higher plate voltages. On steam locomotives, the 32-volt feed for the plates is taken from the turbo-generator used also for the head-light. On the Diesel locomotives, a special motor-generator was added to reduce the voltage from 64 volts to 32 volts. An advantage is that this motor-generator separates the signal circuits from the power wiring of the locomotive. The locomotive equipment operates on the so-called "low level" axle current of about 0.7 amp. 60 cycle.

Each steam locomotive is equipped with two four-aspect cab signals, one on the engineer's side of the cab and the other on the fireman's side, and there is an air whistle on the engineman's side. On the Diesel locomotives a double-faced cab signal near the instrument panel in the cab displays aspects toward the engineer and toward the fireman. A similar double-faced cab signal near the center of the engine room displays aspects to the front and to the rear. Also on a Diesel locomotive there are two whistles, one in the cab and the other in the engine room.

On each steam locomotive the acknowledging switch is below the cab window on the engineer's side, and on a Diesel locomotive the acknowledging switch is on the rear of the throttle to the left of the engineer.



The C. T. C. machine in the office at Bureau controls 12.8 miles of line

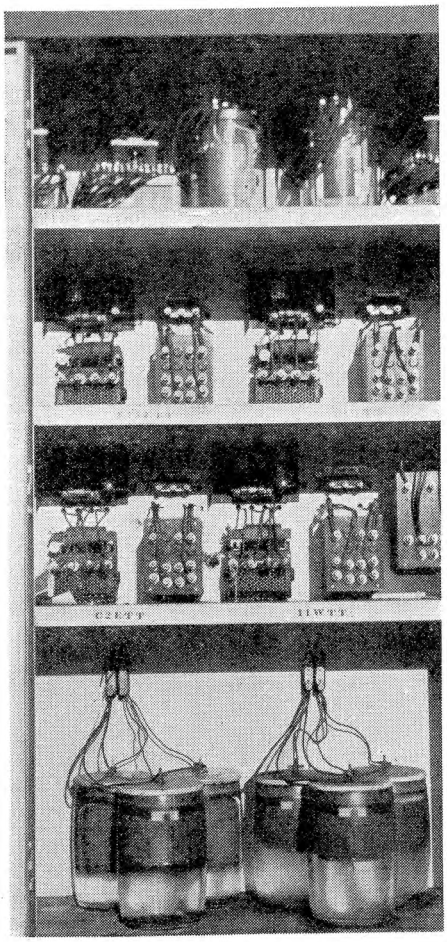


Case showing relays, rectifiers and storage batteries

## Cab Signal Tests

The arrangements installed at the locomotive terminals to test the cab signal apparatus includes several features of interest. A first item is that the track on the turntable is equipped so that the tests can be made while a locomotive is being turned, thus saving time. The loop test circuit is on parkway cable attached to but insulated from the rails on the turntable, thus the rails need not be insulated.

An old instrument case mounted on one end of the locomotive turntable, houses the control apparatus which includes code transmitters and a sequence timer driven by an a-c. synchronous motor. A signal, identical to a cab signal, is mounted on a 2-in. pipe at each end of the turntable.



Instrument case including primary battery on track

After a locomotive is on the table, the operator turns a control handle which starts the sequence time which causes 180 code, 120 code, 75 code and no code to be applied for four seconds each to the parkway loop attached to the rails on the turntable. The hostler in the cab of the locomotive watches to see that the signal in the cab repeats the same aspects as signals mounted on the turntable. The reason for the two signals, one at each end of the turntable, is that one or the other can be seen from the cab, regardless of which way the locomotive is headed on the table.

Each time the cab signal changes to a more restrictive aspect, the whistle in the cab is sounded until the acknowledger switch in the cab is operated.

The wayside portions of this project were planned and constructed by the signal department forces of the Rock Island under the direction of C. R. Swenson, signal engineer, who succeeded C. M. Duffy after the project was under way. The cab signal equipment on the locomotives was planned and installed by the mechanical department and forces under the direction of A. E. Ganzert, electrical engineer. The principal items of the signaling equipment, including the C.T.C. and cab signaling, were furnished by the Union Switch & Signal Company.

EDITOR'S NOTE—An article discussing typical circuits used on this installation will be published in the next issue.