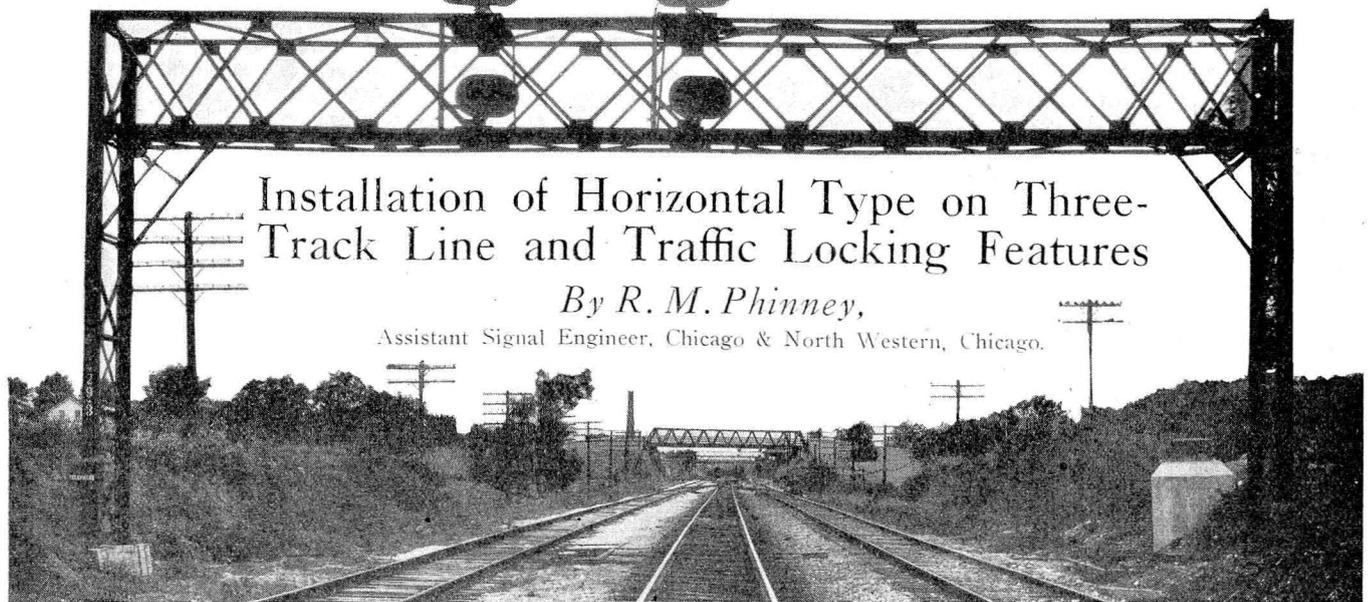


# Color-Light Signals on C. & N. W.



## Installation of Horizontal Type on Three-Track Line and Traffic Locking Features

By R. M. Phinney,

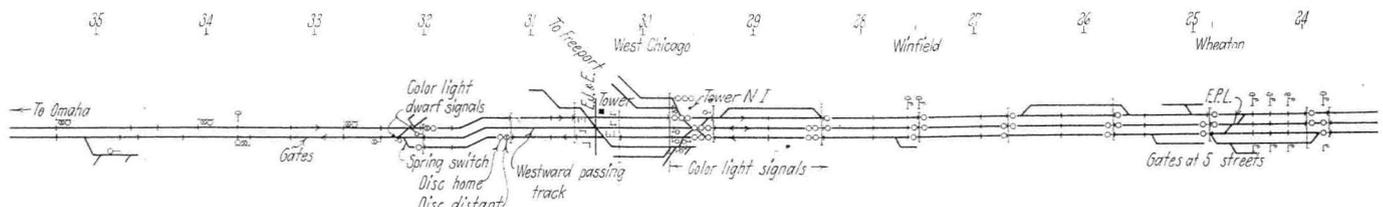
Assistant Signal Engineer, Chicago & North Western, Chicago.

Westward Home Signal Bridge at West Chicago, Ill.

ON account of the increase in traffic on the line from Chicago to Omaha, of the Chicago & North Western, a program has been developed for increasing the track capacity. As the first step, 14 miles of third track was built between Elmhurst (16 miles from Chicago) and West Chicago (30 miles from Chicago). This extra track permits freight trains to leave Proviso Yard, just east of Elmhurst, during the evening rush hours and to enter during the morning rush hours. Before this track was built, a freight train could not leave between 6 and 10 p. m. and could not arrive between 6 and 10 a. m. The center track is used westward from 10 a. m. until 2 a. m. and eastward the remainder of the time. At the same time, a new double track line was built between Melrose Park (11 miles from Chicago) and Elmhurst. This line was built so that it skirts Proviso Yard on the south. The object of this line was to remove the passenger tracks from the center of the yard, and to provide greater facility in the operation of the yard. Previously, there was no chance to cross from one yard to the other without going to either Melrose Park or Elmhurst. After the change, several cross connections are available be-

type, it was decided to remove the signals for use elsewhere and install color-light signals.

The color-light signal gives better results if it is not too high above the eye of the engineman and inasmuch as practically all of the lately installed signals of the North Western are on signal bridges, it was very desirable to reduce the height of the signal as much as possible. This is particularly true where signals are installed through a track depression, where the overhead street bridges are only 18 ft. above the tracks. The General Railway Signal Company, therefore, designed a signal with the lights in a horizontal row. The signal is made up of unit lamp boxes, one to four being used as required. The light units are assembled on one adjustment and the whole arranged to mount on a 5 in. pipe. When mounted on either deck of the bridge a base having a 5 in. horn is used. When three arms are required the top arm is mounted on top of a pole and the other two on the two decks of the bridge. Where one arm is required it is mounted on the lower deck. Two ground signals are used one of which is shown in an accompanying illustration.



Track and Signal Plan of New Color-Light Signaling on the C. & N. W. Between

tween yards. The savings amount to about 10 per cent on the investment over and above fixed charges.

### New Type Horizontal Light Signal Developed

The two former tracks between Elmhurst and West Chicago, were signaled with three position upper quadrant signals. As the center track was to be signaled in both directions, the number of signals to be added was equal to those in service and as these were the only signals of this type on this line, the rest being of the disc

No markers for automatic signals are used as with the reserve light system developed by J. A. Peabody, signal engineer, it was felt that there would be practically no failures due to lamps burning out. To date there has not been a train stopped due to a lamp failure. This result is accomplished as follows:

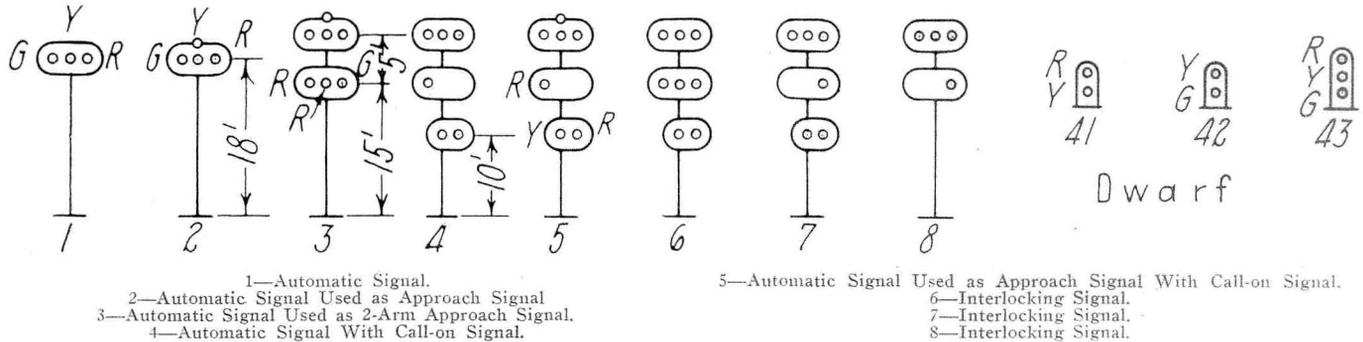
In series with the lamp on each unit, which is burning practically all the time, there is a relay. If the light which is burning all the time is the green and it burns out, the yellow light immediately appears. The trains

are, therefore, kept moving and the maintainer will soon notice what has happened and put in a new bulb. If the yellow light is the one which is burning practically all the time, and it burns out, the relay in series with it lights a reserve yellow light. This reserve unit is mounted over the center unit, but is not shown in any of the illustrations. No reserve is furnished for the red lights at interlocking plants as there are in all cases three red lights and it was felt that they would not all burn out at the same time and, therefore, there would be sufficient number of red lights showing to stop a train.

Reserve red lights, however, are in use in the lower

series with the lamps wherever the sighting range will permit the lowering of the voltage with consequent increase in the life of the lamps. Eight volt, 10-watt double-filament lamps are used in the dwarf signals. We are now negotiating for a 10-volt, 10-watt single filament lamp for use in dwarf signals and short range high signals. Lamps are not removed until they burn out.

The dwarf signals are of unit construction, similar to the high signals but smaller, and mounted vertically, with red at the top and yellow at the bottom. This arrangement was made because the bottom light is more apt to be covered up by obstructions. At Melrose Park there



1—Automatic Signal.  
2—Automatic Signal Used as Approach Signal  
3—Automatic Signal Used as 2-Arm Approach Signal.  
4—Automatic Signal With Call-on Signal.

5—Automatic Signal Used as Approach Signal With Call-on Signal.  
6—Interlocking Signal.  
7—Interlocking Signal.  
8—Interlocking Signal.

Signal Aspects Available With Horizontal Color-Light Signals as Installed on the C. & N. W.

arm of the approach signals. The red lights are arranged in a vertical staggered position to denote a stop and proceed signal. At the interlocking plants the red lights are in vertical lines to denote stop and stay signals. Inasmuch as the installation is operated on the floating battery system, the relays in series with the signal lamps are designed to operate on either a.c. or d.c. The relays are mounted in the relay boxes with the other relays, although they could have been mounted in the signal units without any additional wiring. To compensate for the voltage drop through the relay, an impedance is connected in the common of all other lights on the same signal arm. This impedance has the same characteristics as the relay on both a.c. and d.c.

The signal aspects available are given in an accompanying diagram. At both Elmhurst and Tower "NI," West Chicago, there are high speed diverging routes. To facilitate movements the approach signals are double armed giving approach information for both arms of the home signals.

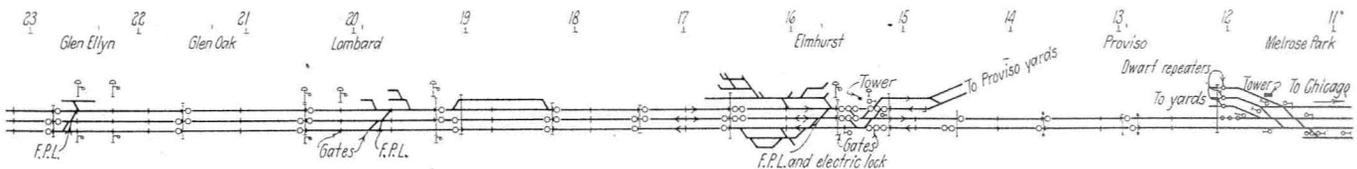
Ten-volt, 20-watt single filament lamps are used, in the high signals. Double filaments were rejected in favor of the light-out relay which provides a much more reliable reserve. With double filaments it is necessary to hold

are three dwarf signal repeaters located on the Indiana Harbor Belt overhead bridge to give trains leaving the yard advance information as to the position of the dwarf signals on the three tracks leading from the yard. These repeaters show yellow when the dwarfs ahead show red and show green when the dwarfs ahead show yellow.

Traffic Locking Between Towers

The center track is signaled in both directions, each direction being the same as on double track. Opposing protection is given by a traffic lock circuit between the Elmhurst tower and Tower "NI" and by time table rules. As the towers are about 15 miles apart, a single circuit for the traffic locks was out of the question; the circuit is, therefore, relayed. At each break in the signal common wire the traffic lock circuit is relayed which occurs at every opportunity and in any case not exceeding two miles. The accompanying circuit plan shows the circuit. The direction of traffic can only be reversed when the track is clear. The signals leading onto the center track are interlocked with the traffic levers.

There are four sets of crossovers for crossing to the center track from either of the outside tracks. These are principally for the use of the way freights but are avail-



West Chicago, Ill., and Melrose Park Installed in Connection With Recent Track Changes

the resistance, which is in series with the lamps, to a minimum because when one filament burns out the current is cut in two with a corresponding change in voltage drop and the voltage at the lamp increases. If this increase is sufficient to raise the voltage above the rated voltage the second filament will burn out also. This occurred in the preliminary tests. The use of single filament lamps permitted the use of No. 14 wire where with the double filament lamp No. 9 wire would have been required. It also permits the use of resistance in

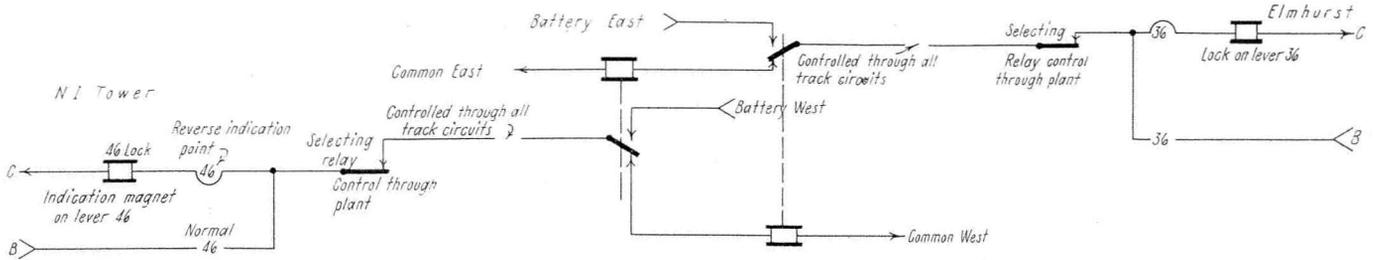
able for emergency moves onto or off from the center track. Complete sets of switch indicators are provided at the crossovers except at Elmhurst. In addition there is a telephone located in a concrete house opposite the center switches which are on an independent line extending from Elmhurst to Tower "NI," West Chicago. Before entering the center track, it is necessary for the trainman to get permission from the proper towerman.

Facing point locks are in use on all center track switches, which are all facing at some time. The two

facing point locks at each location are operated by one ground throw stand of the type used with slip switches. The facing point locks are equipped with contacts and the signals on the center track are controlled through them.

At Elmhurst the crossovers are used regularly by suburban train crews in starting their trains back toward

power. The others are equipped with taps normally arranged for charging 1, 3 or 5 cells of battery. This permits the use of one rectifier for all purposes as this unit is capable of charging 1, 2, 3, 4, 5 and 6 cells of battery. It is always possible to charge with a rectifier one cell more than rating at about three-quarters capacity which is usually more than is required. The storage battery is the



Schematic Diagram of Traffic Lock Circuit for Center Track Operation

Chicago. As these crossovers are within the blocks of the westward home signals of the plant, an electric lock is installed on the facing joint lock lever locking the center track switches. This lock is released by the leverman on request of the trainmen. The leverman is given sufficient advance information by annunciators to protect the move properly.

**Power Supply Systems**

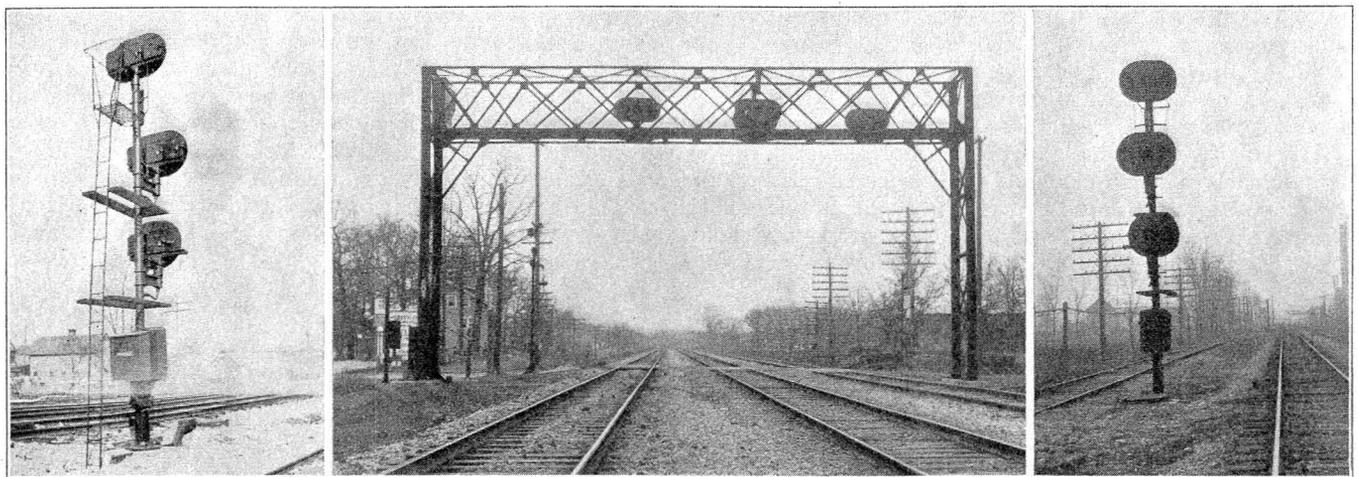
The signals are operated on the floating battery system with the transmission voltage at 440. Power is obtained from commercial sources at Melrose Park interlocking plant, Elmhurst interlocking plant, Lombard, Wheaton, Winfield, and from the company power plant at Proviso Yard. Power is fed from each source to points midway between, except that the line is not broken between Elmhurst and Proviso and between Proviso and Melrose Park. In case of emergency the lines can be connected by switches so that any section can be fed from each of two or more sources. Number 5, bare copper-clad wire of 40 per cent conductivity is used, located on the first two track pins on the top arm. The 440-volt circuit is carried in to the rectifier housing by No. 14 copper

Exide-KXH type, 19 plates used for signal reserve, 9 plates for track circuits and wig-wags and 5 plates for line circuits.

**Relay and Battery Housings**

At the signal bridges the 15-way relay boxes formerly in use were continued. However, in some cases it was necessary to use a four-way box in addition. The track relays are regularly located at the signal bridges with the track battery located between. There are, therefore, six track relays, four H relays (45 deg. control), four D relays (90 deg. control), and four light-out relays at a signal bridge. In addition there are the one point relays on the traffic lock circuit always in pairs and sometimes highway crossing protection relays (interlocked on the center track). The maximum number of relays at any location is 24.

At the signal bridges the battery and rectifiers are housed in wooden boxes mounted on the leg of the bridge as shown in an illustration herewith. At locations other than at signal bridges, concrete houses are used. These houses, manufactured by the Gerald Company, Chicago, have several novel features. They are received in two



Westward Home Signal Melrose Park, Rear View

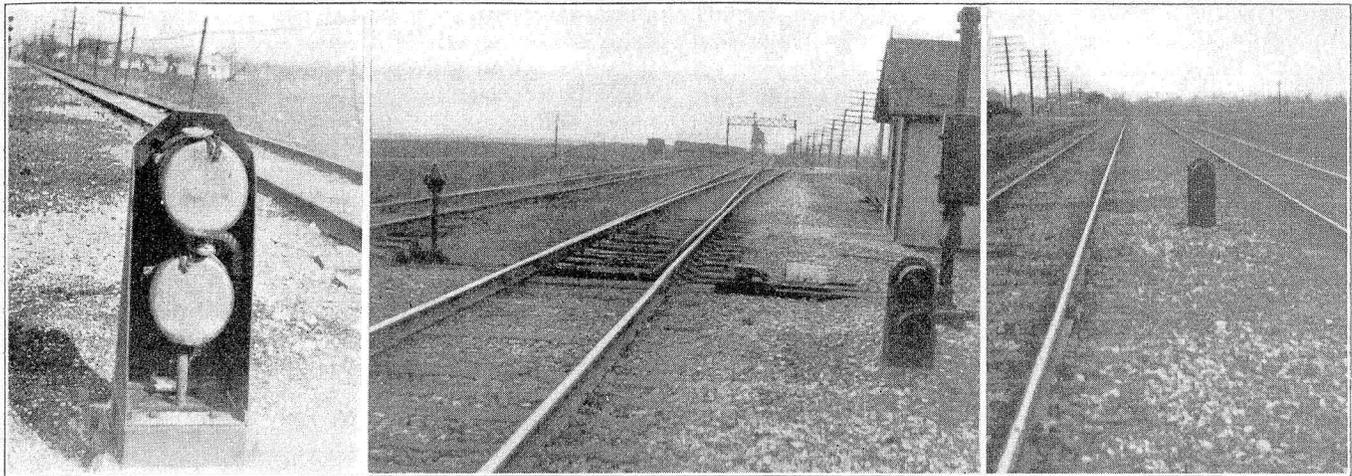
Signal Bridge at Finley Rd., Lombard, Showing Two Wig-Wags and Power Service Box

Front View of Westward Home Signal at Melrose Park

twisted pair wires without messenger wires. A small air-cooled transformer of 100-watt capacity is used at each location to step the voltage down to 110 volts.

The rectifiers are "Non-Tune" of two types. One type is used for charging the reserve battery for the signals and these are equipped with power off relays for transferring the lights from a.c. to d.c. in case of failure of the

parts; one, the top, is cast concrete, the other, the house proper, is built up on steel re-inforcing by a cement gun. The house is a cylinder with no projections so that it can be rolled. It is placed three feet in the ground, thus forming an anchor to prevent its tipping over. There is no bottom but there is a step projection on the inside to give proper footing. Dirt can be placed in the inside if



Rear View of Hall Dwarf Signal

Spring Switch at End of Westward Passing Track Which Terminates Three-Track at West End

Dwarf Signal Leading Out of Passing Track

desirable or the space can be used for battery. Openings are provided at the ground level for trunking, below ground for parkway cable and near the top for the cables from the pole line. After the house is erected, which can be done without the use of a derrick, the space between the top and the house proper is filled with cement grout. The arrangement of shelves and racks suits the most probable requirements but is so constructed that changes can be made if found necessary. The shelves are intended to accommodate shelf-type relays and battery. The shelves are supported by two racks made like ladders. The rungs of these ladders can be removed and placed at any height desired. The racks above are intended to hold the lightning arresters, terminals, rectifiers, resistances, transformers, switches and wall relays. One of the views shows a location where there are only six track batteries. The line transformer can be seen in the center above the rectifiers. The service switch is at the right and is the fused type of enclosed switch. These houses answer the needs formerly requiring battery wells, relay boxes, cable posts, and foundations.

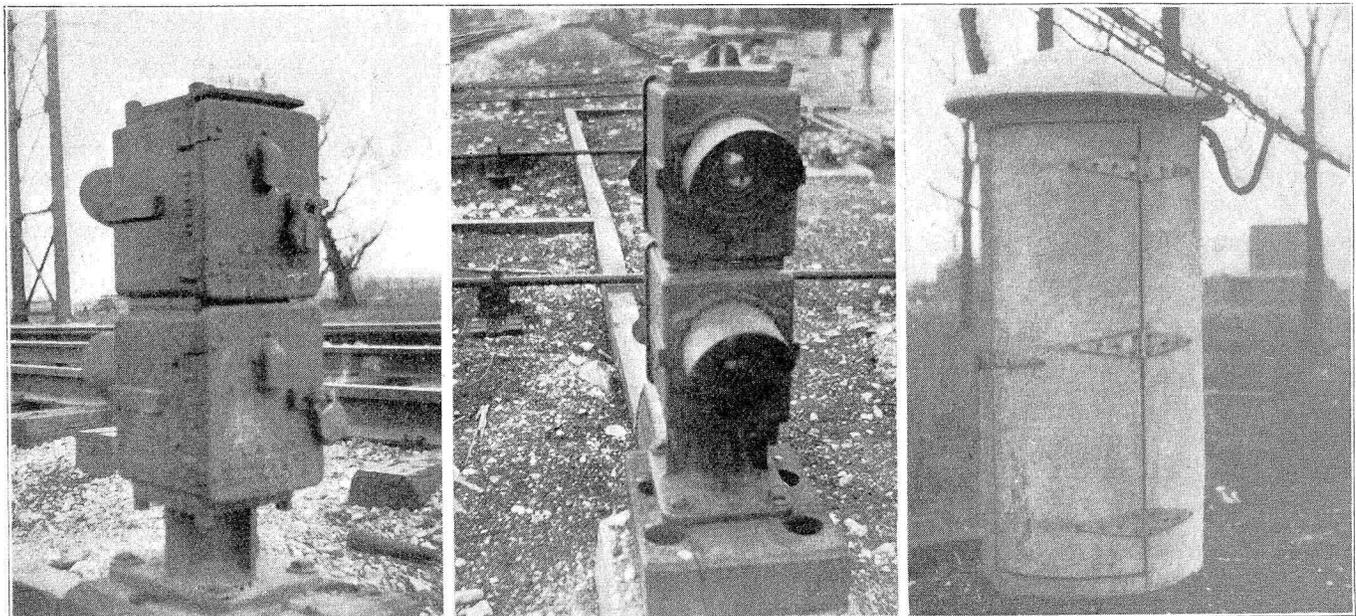
**Cable Terminals and Wiring**

Parkway cable is used on all of the new track connections. Four No. 14 wire cables are used throughout. All

ends are protected by "Aldoseals" manufactured by the Aldobuilt Company, Chicago, placed directly opposite the rail joints on concrete foundations furnished with the "Aldoseal" outside the ties so that tamping is not interfered with. From the terminals in the "Aldoseals," copper-clad bond wires are run to the rails stapled to the ties. At the signal bridges the cables end in similar pot-heads located near the foundation of the bridge, one "Aldoseal" accommodating two cables. The wires are in trunking from there to the relay boxes. At the concrete houses the pot-heads are placed inside above the floor. One cable is run for each track running first to the pot-head at the nearest joint with all four wires working. From this point another piece of cable is run to the pot-head at the other joint. In this cable, there being only two circuits, the wires are multiplied. A view of this type of construction is shown herewith.

On top of the signal bridge the wires are run in open cable suspended from the top chord of the bridge and drop down to the wire entrances in the ends of the signals. No wires enter the bases of the signals. This construction is shown in one of the illustrations. Standard four-way iron relay boxes are installed for power service at the point where power is purchased.

West of interlocking plant "NI" at West Chicago, the

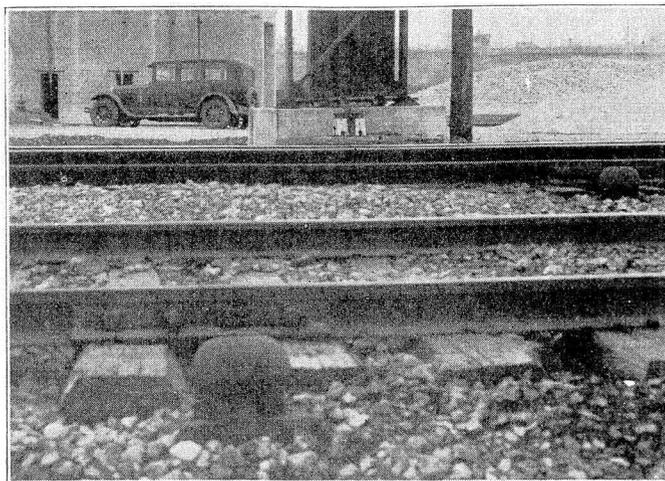


Rear View of G. R. S. Dwarf Signal at Elmhurst

Front View of G. R. S. Dwarf Signal

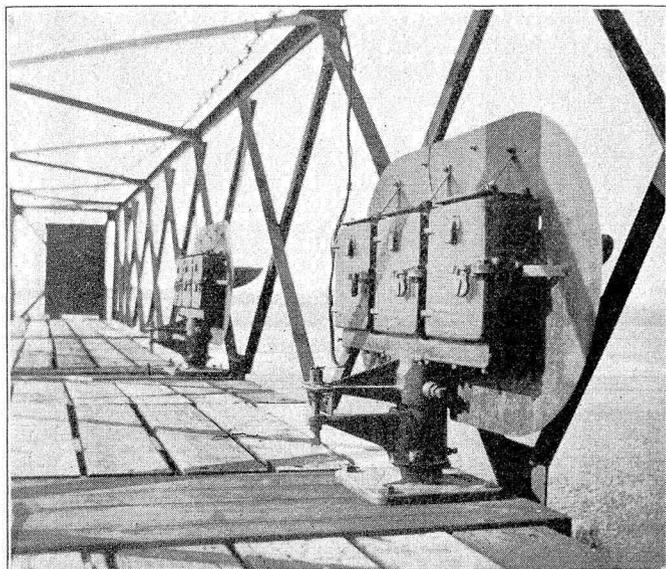
Concrete Housing Showing Cable Tap

center track is a westward passing track without signals. Practically all westward freight trains take water and coal near the west end of this track. A spring switch, set for the main track, is used at the west end. Trains leaving the passing track without stopping, force the switch points open. A spring forces the switch points back to



"Aldoseals" at Track Connections, Also Note Two "Aldoseals" on Ties Below Relay Box on Farther Bridge Base

normal position as soon as the wheels have passed. To reduce the shock, and consequently the wear and tear on the switch points, an oil buffer is used. This oil buffer which can be seen to the right of the switch box in the illustration, uses a mixture of kerosene and black oil. There is a large valve in the piston which allows the oil to pass freely in one direction but the oil must return through a by-pass pipe. The spring switch can be thrown by the regular switch stand when desired. The spring switch is specially re-inforced for the purpose and was made by the Pettibone-Mulliken Company of Chicago. Three switch tenders were removed by the installation of the spring switch.

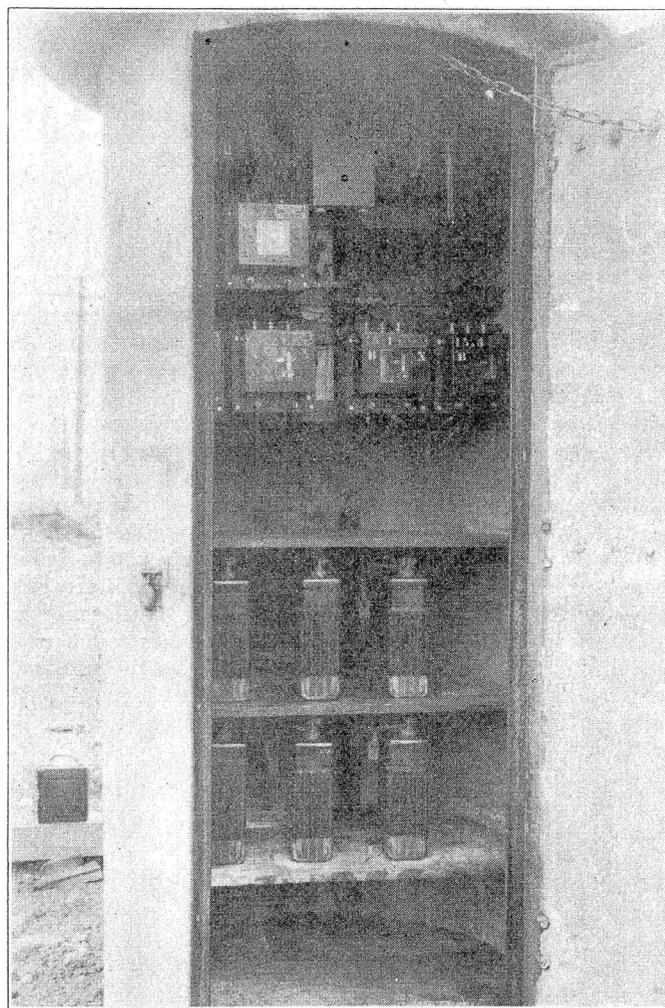


Color-Light Signals on Lower Chord of Bridge Showing Aerial Cable Construction

A dwarf signal was installed to govern trains out of the passing track. This signal is controlled by the switch indicator circuit and not by the block. In other words, if a train is approaching the switch on the main track, the signal will be red. If no train is approaching on the main

track, the signal will be yellow. There is an approach track section about 700 ft. long for lighting the signal on the approach of a train on the passing track.

To protect against a misplaced switch for a back-up move, a dwarf signal was placed just ahead of the switch. This signal is yellow when the switch points are in either closed position and red in all other positions. The yellow light circuit goes through the switch box in both normal and reverse positions. In series with the yellow light is one of the light out relays which will light the red light on its back point. In this way, the lights always change from one to the other without troublesome adjustment. The dwarf signals used at this point were furnished by the Hall Switch & Signal Company.



Interior View of Concrete Battery and Rectifier House

All gatemen and flagmen are provided with annunciators, the control being about three-quarters of a mile for gatemen and about one-half a mile for flagmen. The annunciators, manufactured by the Railroad Supply Company of Chicago, are of the train drop type which, on tripping, display a target showing that a train is approaching and at the same time a bell rings. The bell can be stopped by pulling a lever which also restores the indicator. In order that the gateman or flagman will still be able to tell that a train is coming, a lamp is added. This lamp is behind a ground glass window and appears at the time the bell starts ringing but stays lighted as long as a train is in the control section.

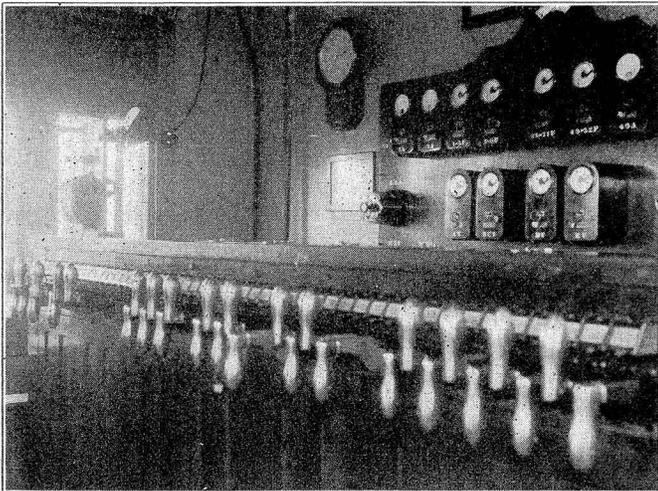
#### Interesting Features of Interlockings

The electric interlocking plant at West Chicago was installed by the General Railway Signal Company. The

signals being all of the light type, are controlled by line relays with individual return. The control and return are both carried through the lever and with the lever normal the control is connected to the return wire. Where necessary to control the signal through a switch-box between the lever and the relay, the switch-box when in the wrong position connects the control wire to the return wire. The signals are normally fed from a.c. but have a reserve battery for each group of signals which is automatically thrown on in case of failure of the a.c.

As the main battery has only the load of the switches a comparatively small battery is required. A 60-a.h. Type-DMT Chloride battery in rubber jars assembled in wood cases is used. A cupboard only is required to house this battery. It is charged on the floating system by a 200-watt, Wotton motor-generator set manufactured by the Electric Products Company of Cleveland, Ohio. There are ten or twelve of these machines working on the system and two spare machines are kept on hand for emergency use. As they weigh only about 150 lb. they can be shipped by baggage without any difficulty.

Another novel feature is that all wires are carried in field made cables supported on the pole line about 8 ft. above the ground. The cables enter the tower from the rear just below the second floor, part of the wires going



Interior of Tower "NI" at West Chicago, Showing Electric Interlocking Machine and Part of Relay Board

directly to the interlocking machine and the remainder going directly to the terminal board back of the relays which are all of the indicator type and all are located on the board back of the machine. The battery and charging apparatus is the only electrical equipment on the first floor.

The mechanical interlocking plant at Elmhurst had to be completely rebuilt. The only things which were not moved were the eastward signal bridge and the tower, but even the tower had to be extended. It was found cheaper to extend the tower 10 ft. and extend the machine, which was Style-A, than to add the electric levers above it, making it an electro-mechanical machine. The rebuilding was carried out by the railway company's forces.

All crossovers and switches used by high-speed traffic have No. 20 frogs. The plant at Elmhurst operates the switches at the junction of the three tracks to the west with the two double-track lines to the east. One of the latter is the main passenger line and the other is the freight line into Proviso Yard. There is only one derail in the plant and it is interesting to note that it is located 1,200 ft. from the lever. It is of the Wharton type and is operated by a switch and lock movement.

The interlocking plant at Melrose Park operates the switches at the east end of Proviso yard. Provision is made for double track moves, in and out of the yard. Everything at this plant was moved except the tower. This plant is an electric plant originally installed in 1905 by the General Railway Signal Company. As at West Chicago, the wires are carried as overhead cables, made in the field, of individual wires. A Wotton generator is used here also. Lock levers are made use of for electrically locking the switches while a train is passing over a route. These lock levers use the standard low-voltage indication magnets and one is provided for each parallel route. Their circuits are selected through the routes.

## Preliminary Report on A. C. L. Train Control Installation

THE Interstate Commerce Commission has made public a letter written by E. H. De Groot, Jr., director of its Bureau of Signals and Train Control Devices, to Lyman Delano, executive vice-president of the Atlantic Coast Line, offering the following criticisms and comments as a result of the preliminary inspection of the installation of the intermittent inductive type of auto-manual train-stop device of the General Railway Signal Company on the 24-mile double track section of its line between Rocky Mount and Ruggles, N. C.:

1. The track inductor as located and fastened makes displacement or removal unlikely, and it is therefore believed that the employment of detectors is not required on this installation.
2. The closing of the inductor winding results in a clear operation of the device; hence a cross in the wires leading to this winding would result in a false clear condition of the inductor. It is, therefore, vital that the installation and maintenance of the track inductor circuit shall be such as to protect the integrity of this circuit.
3. With a signal in the clear position, the polarized track relay is picked up and the track inductor winding closed, so that, should a signal fail in the clear position with a train in the block, the stop inductor at the failing signal would constitute the only automatic protection afforded a following train, and the degree of protection would vary with the location of the train occupying the block.

It is suggested that this be given careful consideration with a view of possibly securing increased protection should these conditions arise.

4. The track inductors are located at the signals, and the stop operation for an occupied block is provided at the next signal in the rear of that at the entrance to such block. This requires an engineman to forestall at a caution signal in order to avoid an automatic application of the brakes, and should this block be too long and an engineman not be alert while running therein after forestalling, the train could approach the stop signal at such speed as to overrun this signal. This observation is not directed at the blocks of this installation but is offered on account of its basal importance.
5. Track inductors should be provided at braking distance from the signals governing entrance to train control territory.
6. It is suggested that the type of fouling protection employed at sidings and crossover switches be considered with a view of possibly securing increased protection.
7. It is suggested that the smaller actuator piston which operates the rotary valve to service position be checked to make sure that its area provides an ample margin of safety for overcoming any extreme rotary valve frictional resistance which might develop.
8. Since certain crosses in the locomotive circuits could result in false clear operations, it is obvious that the integrity of these circuits must be protected.
9. It is obvious that adequate means should be employed to reduce the number of undesired stop operations to a minimum.