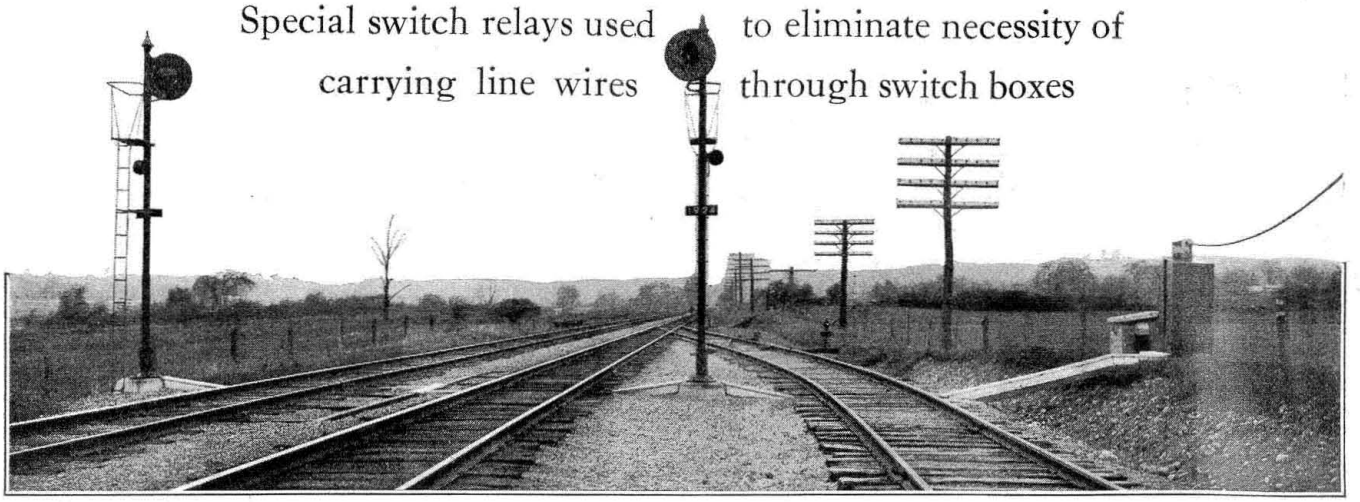
Color-Light Automatic Block Signals Installed on the New York Central

Line control employed with center-fed track circuits—Special switch relays used to eliminate necessity of carrying line wires through switch boxes



Typical double location on West Shore

DURING the last few years the New York Central (Buffalo and East) has carried on an active signal construction program to equip the West Shore line with color-light automatic block signals, especially on the section of the West Shore from Selkirk, N. Y., to Utica and from Syracuse west to Buffalo. This line is used as a through double-track freight line to relieve congestion on the New York Central main line.

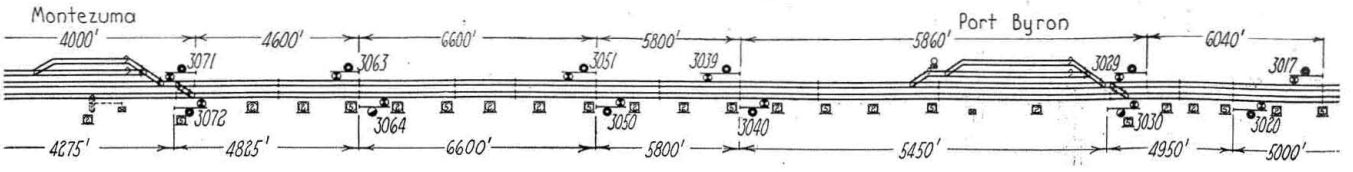
Light Signal Symbols				
Color	Non Automatic	Semi Automatic	Automatic	Fixed
Red and Yellow	●	◒	◔	
Red and Green		◑	◕	
Red, Yellow and Green		◓	◙	
Red				○

Chart of aspects for searchlight type color-light signal

As this is a comparatively low grade line, the major portion of which is equipped with 105-lb. rail with good ties and stone ballast; tonnage freight trains of about 100 cars operate in high speed through runs without interference from passenger trains, so that except in case of emergency the freights keep moving without entering the passing tracks. As traffic on this line became heavier it was decided that automatic signals should be provided as the best means of reducing the spacing between trains with safety. The signaling program was, therefore, started in 1924, in which year signals were installed from Rotterdam Jct., N. Y., to Harbor, 66.7 miles, and from Amboy to Lyons, 39 miles, while in 1925 and 1926 the installation from Lyons to Buffalo, 130 miles, was completed.

As additional protection all turnouts are equipped with pipe connected bolt-locked derails and all crossovers are provided with interlocked pipe-connected bolt locking, as will be described in detail later. Signal protection as shown in the location chart is provided at practically all crossovers and the automatic signals between crossover layouts are spaced about one mile apart, depending on curves, grades, etc.

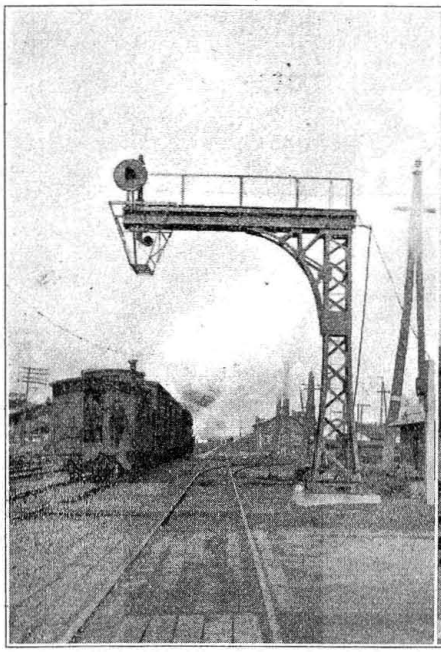
As this is primarily a freight line, special means were provided to prevent train stops at certain signals and yet insure adequate braking distance when stops were required. For example, it is especially desirable that trains are not stopped on grades where it would not be possible to start without pushing or doubling the train. At such locations a second signal unit is used as a slow-speed or grade signal. This slow-speed signal shows red in the same manner as a marker when the upper light displays yellow or green, but if the block is occupied and the top light is red, the lower light may be yellow, displaying a slow-speed indication and indicating that following trains may proceed into the block at slow speed without stopping, prepared to stop short of a train or obstruction. The display of a yellow light



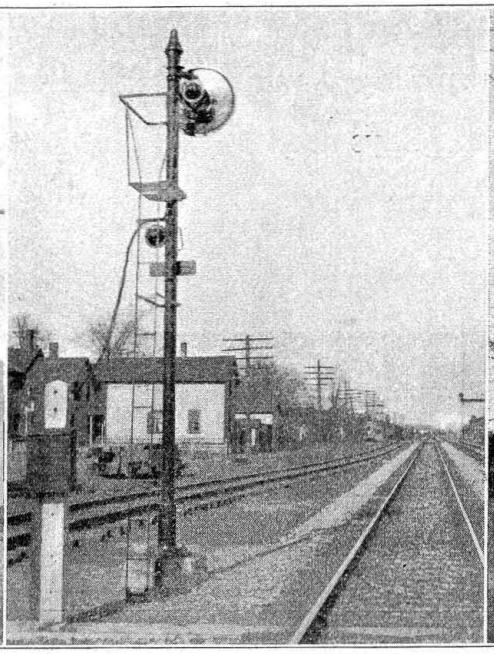
Track and signal plan showing typical location of signals

on the grade signal is controlled through a local circuit carried through a contact on the top mechanism only, when the latter is indicating red.

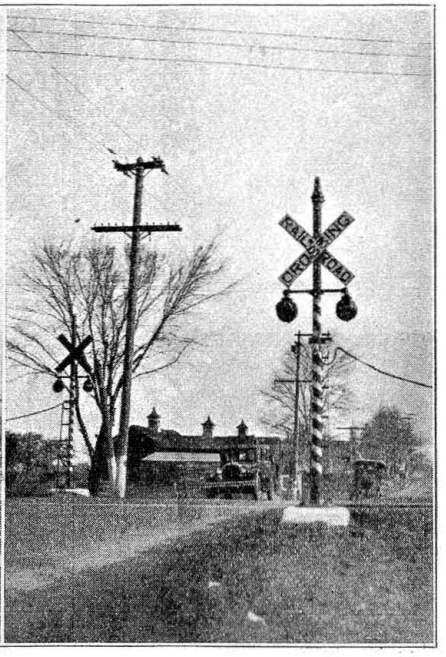
At certain special locations through towns or other unusual places the blocks may be too short for proper braking distance or in some cases it may be desirable to use short blocks to reduce the spacing near junctions or terminals; and in such cases the lower light in connection with the upper light gives an approach restricting indication. The upper light is known as signal A and the lower light as signal B. With the immediate block occupied both signals indicate red, with the immediate block ahead clear and second block occupied the signal A is yellow and signal B red. With first and second blocks clear and third block occupied signal A is yellow and the signal B green, and when there are three blocks clear the indication for an approaching train is signal A green and signal B red, which is just the same as the regular automatic signal with a marker.



Cantilever bridge for signal



Rear view of a searchlight signal



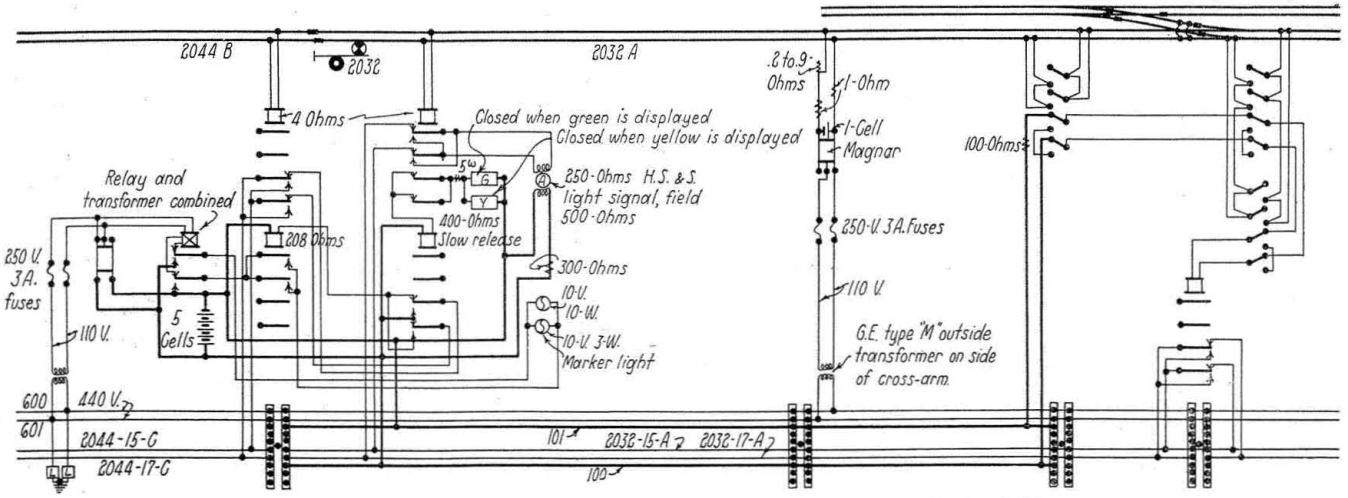
Flashing light crossing signals are used

Search Light Type Signals Used

Since 1922 the standard automatic signal for the New York Central (Buffalo and East) has been the so-called searchlight type of color-light signal using a single lens, reflector and lamp, the three indications being secured by the movement of a vane which brings a small, green, yellow or red roundel at the focal point of the reflector, thus giving the proper color indication when the light is projected through the large lens. The latter is protected by a long hood and provided with a sheet metal background. Several of these signals as manufactured by the Hall Switch & Signal Company and installed on the West Shore line are shown in the accompanying view.

A 21 c.p., single filament, 12 to 16-volt lamp with a single contact bayonet base is used in each signal. These lamps are similar to ordinary automobile headlight lamps, but are specially selected to insure precision of filament position. The normal a-c. supply is adjusted to about 11.5 volts during the time the approach control circuit is occupied. The lamps in the markers are of the same type, except that they are 3-watt lamps and require 0.25 amp.

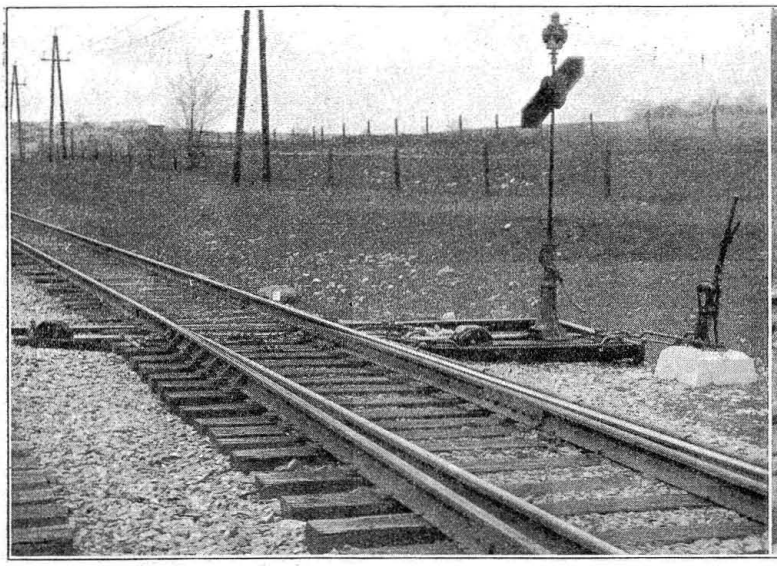
As shown, the signals are mounted on brackets fastened to 6-in. pipe poles 19 ft. high set in cast iron bases on concrete foundations so as to bring the center of the signal 17 ft. above the base of the rail



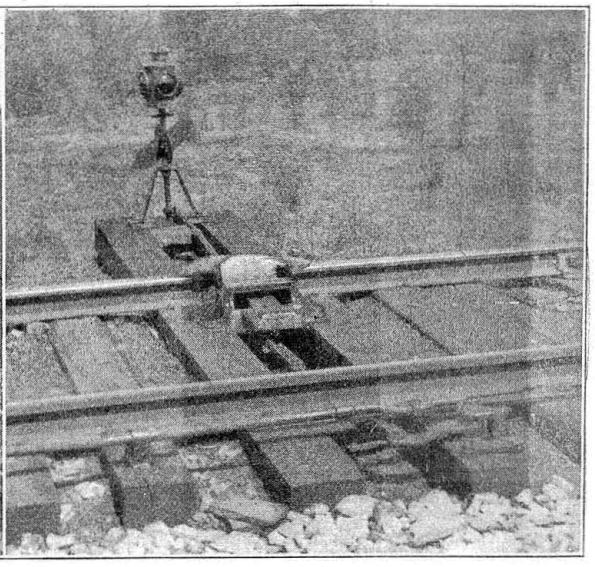
Typical diagram showing circuits for

and to the left of the pole. Where short blocks or other special conditions make it desirable, a second signal unit is mounted to the right of the pole 5 ft. 6 in. below the top signal, the second signal being used for the grade or approach restricting indication as described in the indication chart. Unless a second signal unit is used, a marker lamp is provided for each signal as shown, which shows red simultaneously with each of the three indications of the automatic signal. In case of the absence or burn-out of a lamp, the signal is to be regarded as giving its most restrictive indication. Telephones are located at all signals that may display a "stop" indication.

At each signal or track feed a General Electric Type-M air-cooled transformer attached to the cross-arm is provided to reduce the voltage to 110 volts. Two plug type cut-out fuses are attached to the cross-arm and connected between the power line and the transformer. General Electric power line arresters are also mounted on the cross-arm. From this line transformer the 110-volt power circuit is carried in a two-conductor No. 12 insulated wire cable to the box containing the rectifiers and combination cut-over relay and lighting transformer, as shown in one of the illustrations. These last mentioned units are mounted in a separate case whenever there is no room in the relay box.



A single lever stand at one end of a cross-over for bolt locking



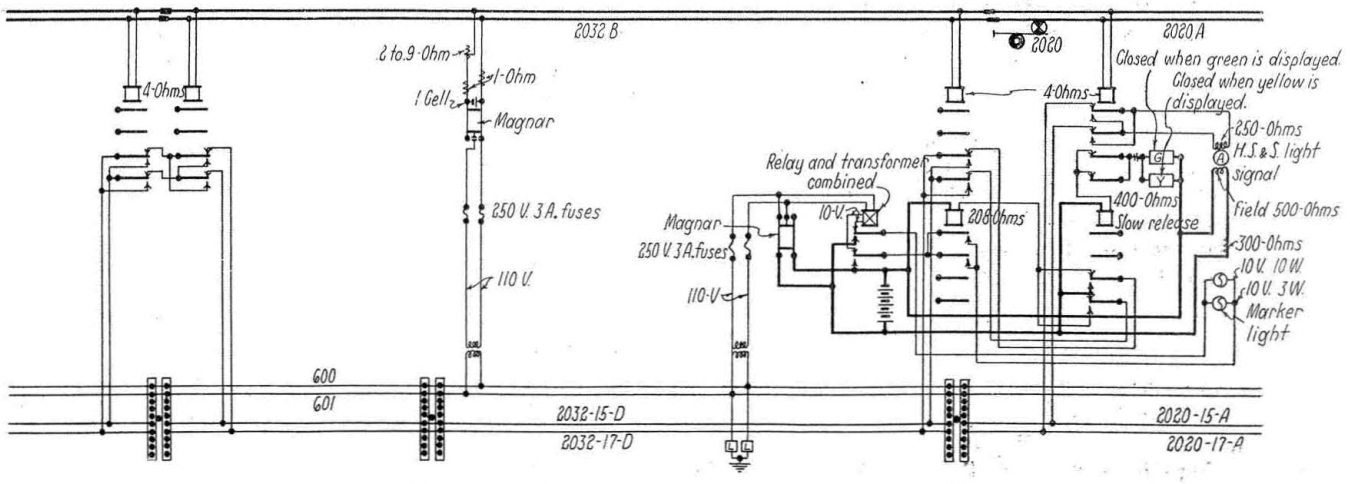
Pipe connected derail on siding

The A-C. Floating Power Supply System

The a-c. floating battery power supply system is used on this installation, the power being purchased locally at points 10 or 15 miles apart and distributed to the signal locations at 440 volts on two No. 6 A.W.G. hard-drawn copper wires with triple-braid weather-proof insulation strung on the two field side pins on the bottom of the signal cross-arm which was added to the existing Western Union pole line. These power wires are transposed approximately eight times a mile, a special pin being used to bring one wire across and under the cross-arm and the other across and over the cross-arm.

Five cells of lead type storage battery are used for each signal location and one cell for each track circuit. Both General Electric, Magnar rectifiers and Balkite rectifiers are used. The battery is housed in a reinforced concrete box made according to A.R.A. specifications, the bottom of the box being covered with an inch of clean dry sand on which the storage batteries are placed.

Wood relay boxes attached by bolts to concrete posts are used as standard as shown. The relays are the Hall Switch and Signal Co. wall type, the solid wires from the signals, track, lighting arresters, etc., running directly to the relay terminal posts. All



one track only on double track

relays with operating back contacts are equipped with spring suspensions to reduce the vibration of the relay when trains are passing.

Standards for Wire Sizes

The 440-volt power line wires are No. 6 A.W.G. hard-drawn solid copper with triple-braid weather-proof insulation, while the line control signal circuits are No. 8 A.W.G. hard-drawn copperweld of 30 per cent conductivity with double-braid weather-proof insulation.

The insulated wires between the signal mechanism and the relay case are No. 12 copper and between the rectifier and transformer are also No. 12. From the signal battery and the bus connection case No. 6 wire is used. The signal light feed wires are No. 10. For track connections No. 10 wire is used for battery leads while No. 8 is employed for relay leads.

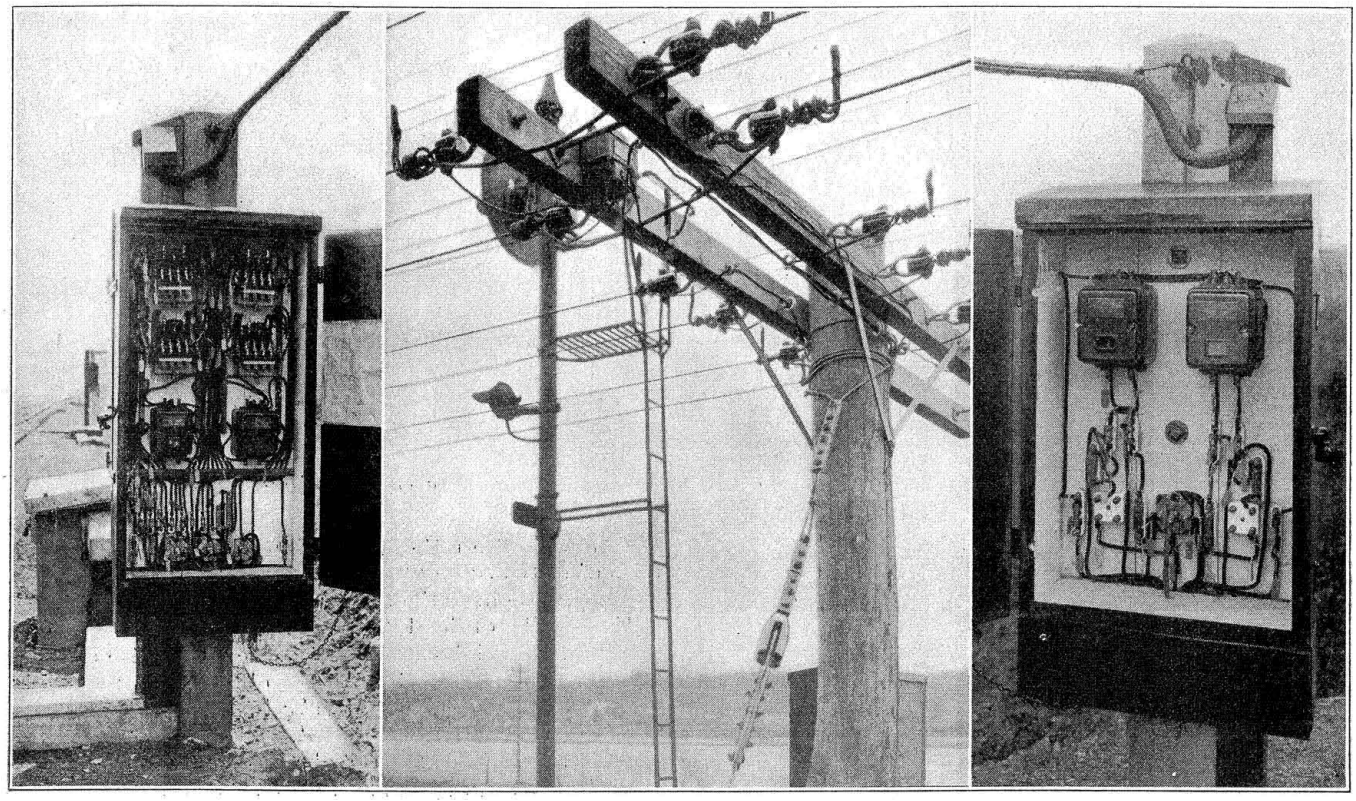
Concrete trunking is used for the main leads under the tracks, such as between the two cable posts at signals on opposite sides of the track, but wood trunking is used for side runs to the rail connections. No wires are run up through the signal poles, the wires being carried in a cable from the cable post directly to the signals. The rail is bonded with duplex copperweld bonds made of two No. 6 bond wires twisted together and bonded with duplex channel pins. The bond wires are on the gage side of the rail outside of the angle bar and are held in place by one P. & M. bond wire protector.

Control Circuit Features

The blocks are about one mile long and divided into two center-feed track circuits with a relay at each end of each circuit. The center-feed circuits are used to secure adequate broken rail protection and to prevent foreign current trouble as well as to insure reliable track circuit operation under bad conditions of weather. Each track circuit feed is approximately 1,250 ft. long and if a rail is broken on either side of a feed point, the train occupying the other end of the circuit would prevent a false clear signal for a following train, in case foreign current did pick up the other relay.

The signals are controlled by two-wire line circuits, both wires of which are carried through contacts of each track relay and to the pole changing relay at the signal in advance; this circuit for the relay being taken through a contact closed when the second block is clear; that is, when the signal is yellow or green.

The circuits for the display of an approach restricting indication are so arranged by means of a separate two-wire line control circuit that signal B may display a green light under the yellow light of signal A only when the contact on the next signal in advance is closed by that signal as when displaying a yellow or approach indication.



Rectifiers in relay case — Air cooled transformer on crossarm — Rectifiers in separate box

Special Switch Protection

At each main line turnout a line relay is provided, the positive and negative connections of the 10-volt battery being carried from the nearest signal. This relay is controlled through the switch circuit controller which not only shunts the track but also breaks the control wires of this switch relay and also shunts the relay coils. The line control wires for the signal control circuits are carried through contacts on this switch relay.

All turnouts are equipped with Hayes derails. For trailing lead-outs the derail is pipe-connected to the switch. For facing point switches a single-lever stand is provided to operate the derail and to bolt-lock the switch. Connected to the bolt lock is a separate switch circuit controller that also controls the switch relay. For crossovers the lever stand operates bolt locks for both switches. This protection insures that both switches are properly lined up and locked before the signals are clear.

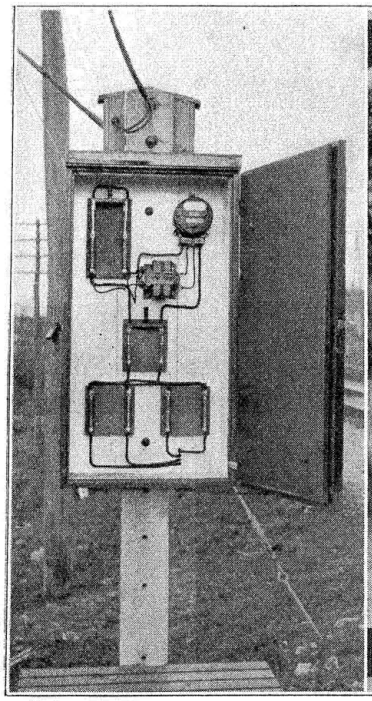
Signal Maintenance Organization

The average leading signal maintainer has a territory of about 30 miles of double-track signaling on the West Shore, and he is assisted by a maintainer and two helpers, the leading maintainer and one helper being located near one end of a section and the maintainer and the other helper about 15 miles away. Two Adams motor cars are provided for each section.

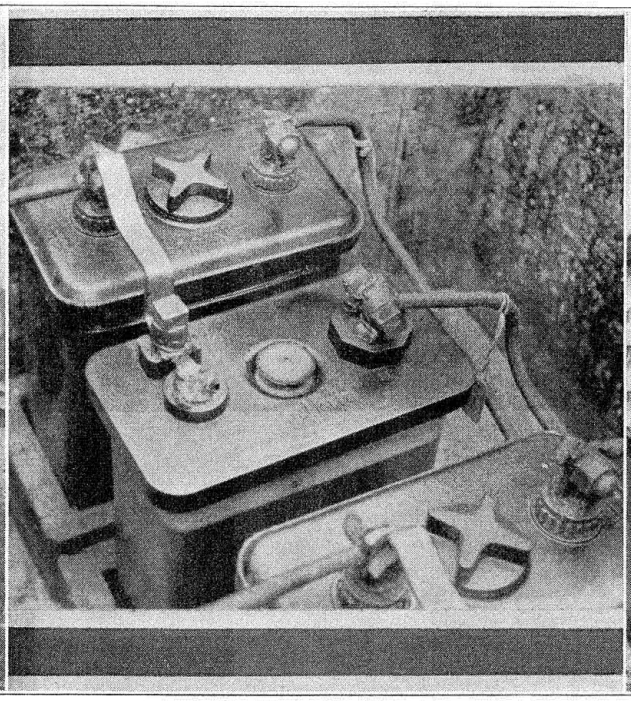
The leading maintainer is responsible for proper signal performance, being required to direct the work of the other three men, and personally to make such inspections and tests as required. The motor cars are equipped with rail contacts operated by levers to shunt the track when the maintainer desires to light up the signal, when on the approach section. This check is made on each signal every day.

When operating on 11.5 volts each bulb is supposed to have a life of 4,000 hours. Depending upon local conditions and density of traffic, the maintainers lay out a schedule for the time limit for each lamp, and at the end of this time the lamp is replaced.

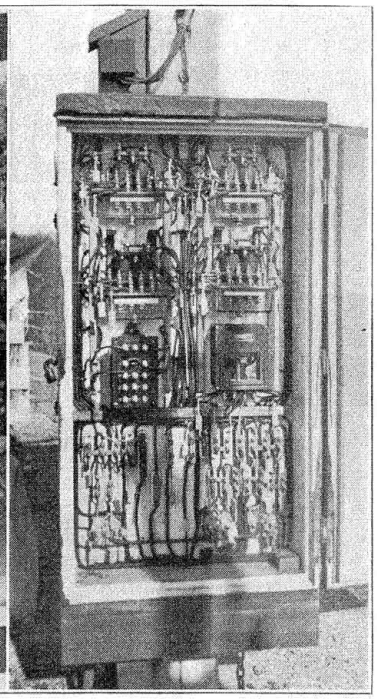
The storage batteries are tested once a week, the voltage being held between 2.1 and 2.2 volts with the rectifier in operation, the specific gravity being 1210.



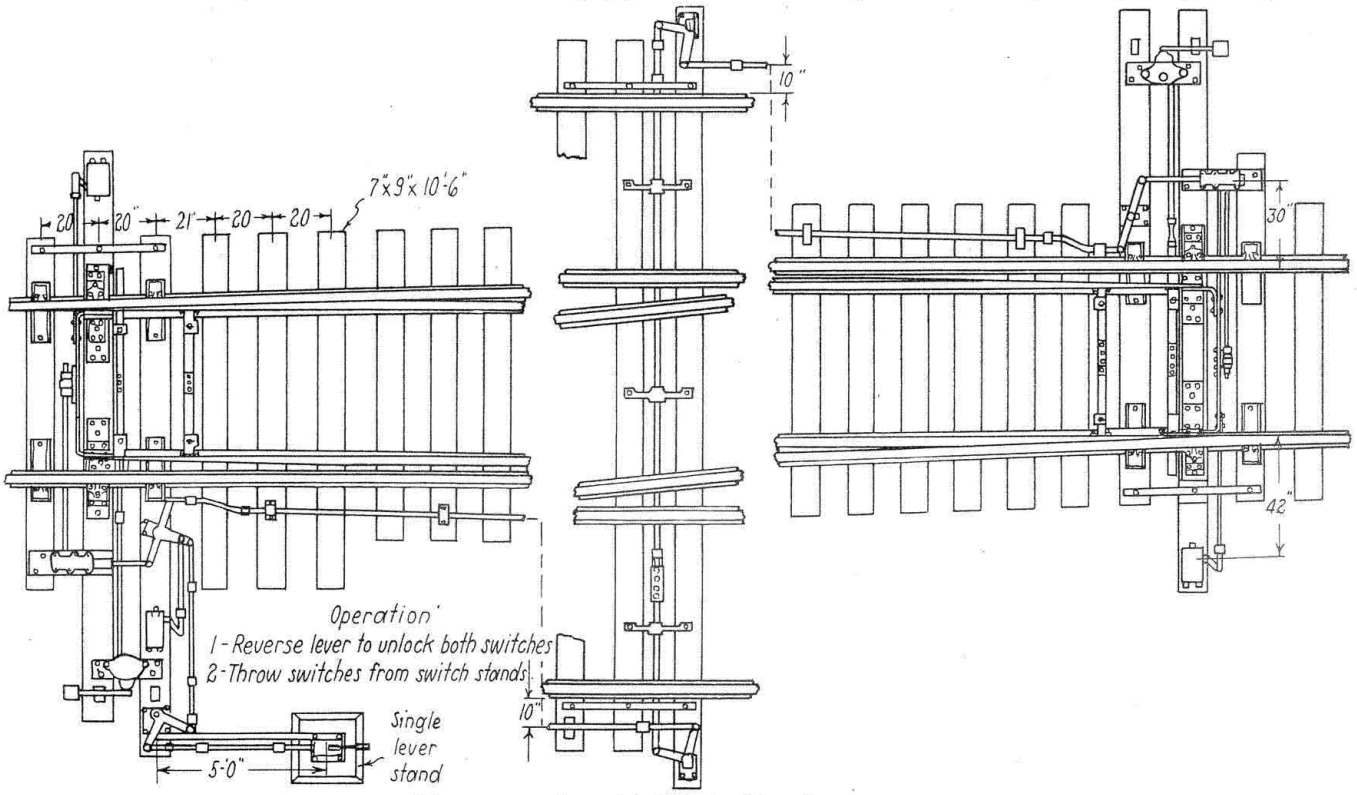
Power distribution switch-box



Balkite rectifier cell and storage battery



Wall type relays are used



Pipe connections for bolt locking for crossover