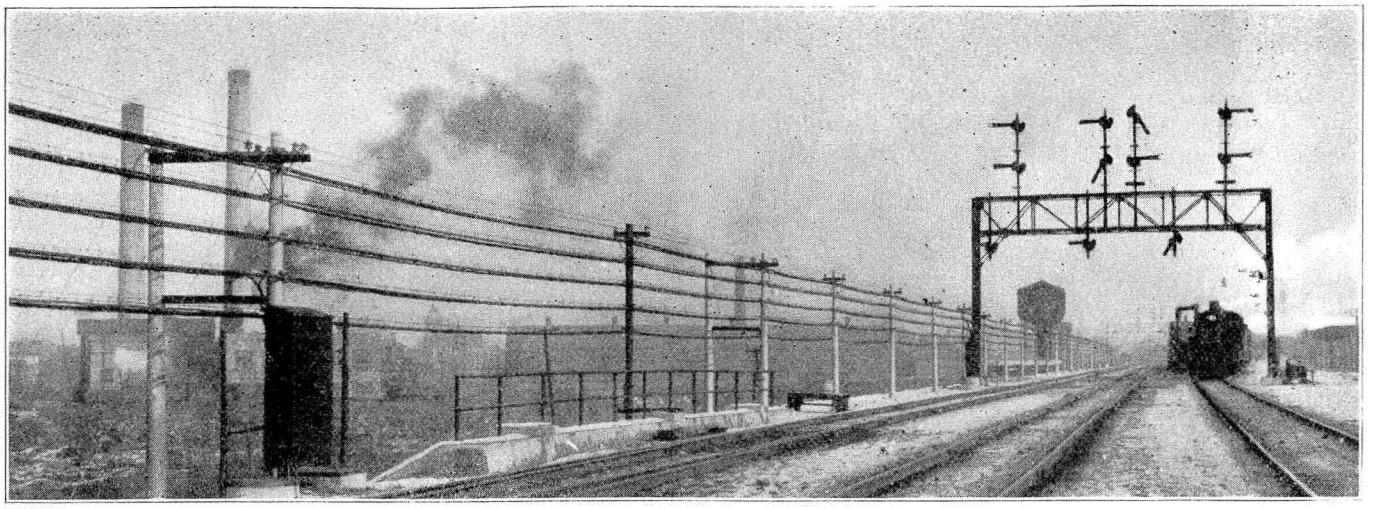


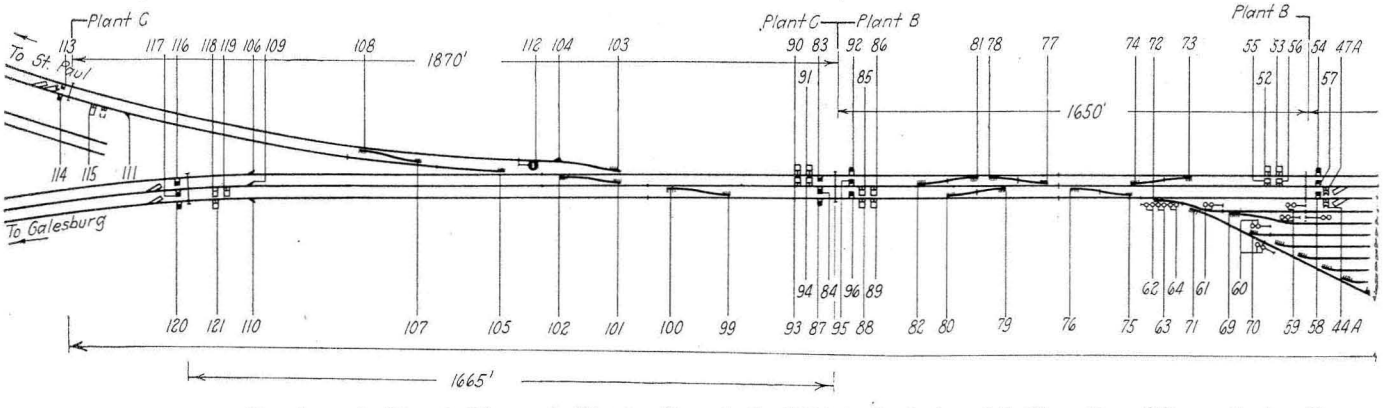
Concrete Pole Line and Aerial Cable, Looking East Through Plant "A", Westbound Denver Limited at Station

C. B. & Q. Plant Has Novel Features

Aerial Cables on Concrete Poles and Parkway Cable Underground Eliminates Trunking, Special Switching for Battery Charging

THE Chicago, Burlington & Quincy placed a new electric interlocking plant in service at Aurora, Ill., on December 4, 1924. This new plant combines the functions of three layouts in a single machine frame, the corresponding levers for each of the three sections of the plants are grouped separately. With three towermen, one for each trick, this plant replaces the services of three towermen that were formerly required to handle the old mechanical plant and the eight switch tenders that handled the many additional hand switches for yard and station movements. The new interlocking shows a saving of over $10,000 a year, about 7.7 per cent on a total investment approximately $130,000. However, the traffic conditions at this junction point were such that it was an operating necessity rather than an economy that governed the authority for this plant.

Aurora, Ill., about 38 miles southwest of Chicago, is an important junction point on the Burlington. All traffic to and from Chicago from points west of Aurora is handled over a three-track line east from Aurora, the middle track of which is signaled for both directions all the way to Chicago. The line to St. Paul and Minneapolis, which carries the through transcontinental traffic for the Great Northern and Northern Pacific, joins the main line at the west end of the Aurora interlocking. The main line on west through Galesburg, Ill., carries the traffic for Denver, Colo., and intermediate points. Two daily passenger trains each way are split and combined at Aurora which necessitates considerable switching work within the station limits. In addition to handling a heavy through traffic at this point, Aurora is also the western terminal for many of the Chicago suburban trains. All the switching movements during the morning and evening rush hours, in making up the suburban trains, are handled within the interlocking and are directed by signal indications.

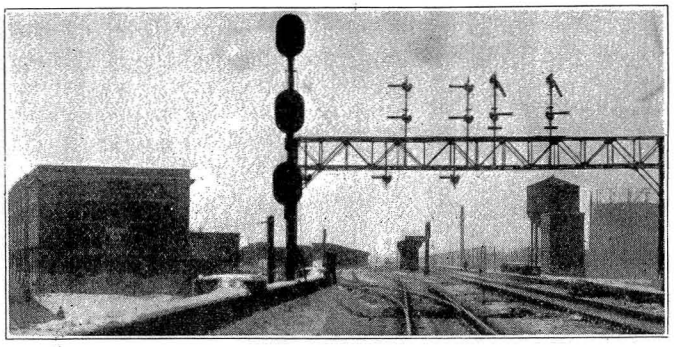


Track and Signal Plan of Plants B and C, Which Includes All Signaling West of the Tower

Before the tracks were elevated through Aurora all passenger and freight trains were compelled to observe a permanent slow-order, which in addition to a lack of sufficient switching facilities delayed many of the freight trains twenty to thirty minutes, in most cases just enough to prevent making their runs under the sixteen-hour law. To secure the full benefit of improved operation brought about by the track elevation

it was essential that a modern interlocking be installed.

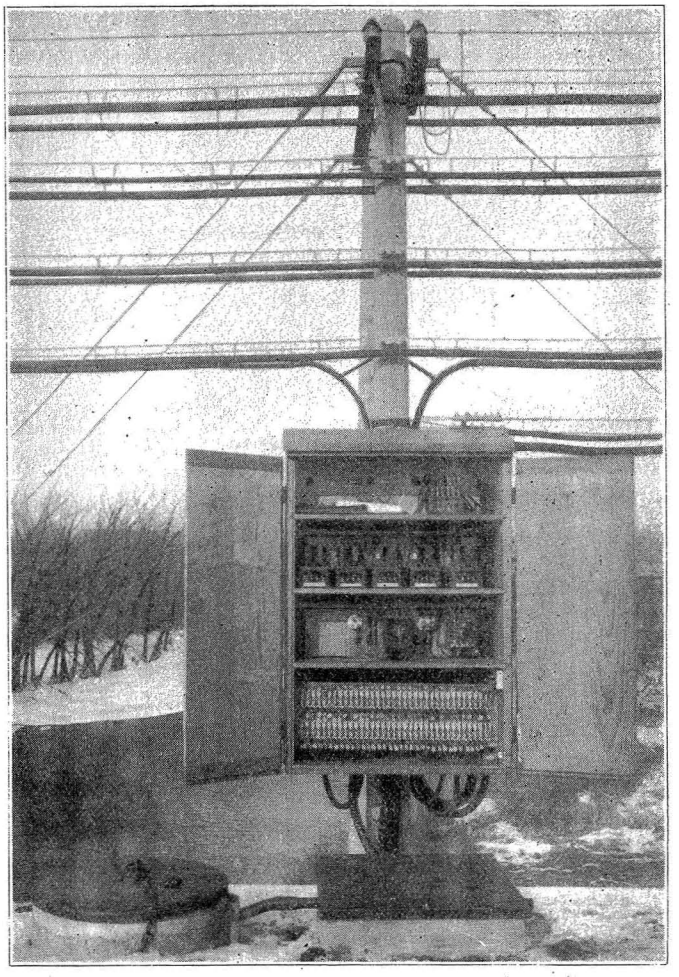
Reference to the track layout, will show the sections that form the three plants of this installation. The plant is quite extended it being 7,245 ft. from the east home signal to the west home signal. Plant *A* comprises the station platform tracks, also the switches and signals at the east end of the suburban coach yard and extends to the distant signal bridge at the east end of the interlocking. Plant *B* includes the crossovers and signaling at the west end of the sub-



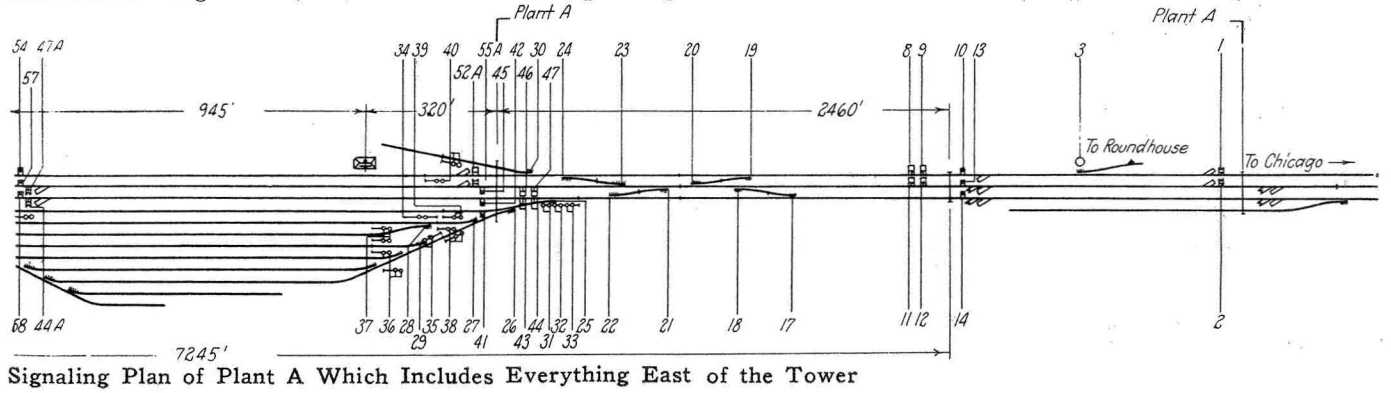
View Looking West Showing Passenger Station at the Left and Tower at the Right. Two-Indication Color Light Switching Signals 31, 32 and 33 in Center Foreground

urban coach yard, between the first and second signal bridges west of the tower. Plant *C* extends from the second signal bridge west of the tower to the home signal bridges on the main line and on the St. Paul line, including two junction switches and three crossovers. All of the levers for controlling the functions in each plant are grouped together in the machine in their relative position.

To facilitate switching movements at the end of the coach yard, left hand two-indication color-light signals have been placed at these points. For example, switching signals 31, 32, 33 are mounted on a mast set on the left side of the track over which they govern for the special benefit of the engineman in reverse switching movements. Signals 62, 63, 64 serve a corresponding



Relay Box with Track Battery Well and Parkway Junction Manhole



Signaling Plan of Plant A Which Includes Everything East of the Tower

purpose at the west end of the station layout. If these signals were not provided a great deal of unnecessary time would be spent in moving engines and cars all of the way to the signal bridge to receive the signal indications. Two-indication color-light dwarf signals and suspended semaphore type bridge signals function for reverse movements and for call-on moves. The east end home signal bridge is signaled for reverse operations on all three tracks.

Special Clearance for Switch Machines

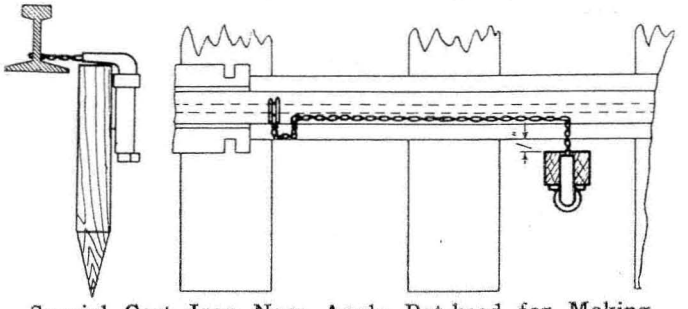
All the switches in this layout are operated by General Railway Signal Company Model-5 high-voltage switch machines and are mounted 4 ft. 7¾ in. from the gage of the rail and 1¼ in. higher than the standard practice for switch machine installations. The added rail clearance requires special C. B. & Q. switch rods that have an adjustment outside of the rail, instead of between the rails, and hence are more accessible. This extra rail clearance has been provided so that derailments will not wreck the switch machines but will only deform one or two of the switch rods. By mounting the switch machines higher than usual the rods are raised out of the snow and ice which accumulates between the ties.

Features of Wire Distribution

The control wires east of the signal tower are laid in vitrified clay lines encased in concrete and run to manholes where they terminate and connect with parkway cable leading to the relay boxes, the switch machines or bootleg connections. The duct lines,

which are carried in the parapet, were provided when the concrete structure of the elevated viaduct was built.

Extending west from the tower all control wires are carried in aerial cable supported on a concrete pole line paralleling the north track. A two-pin top cross-arm carries the 110-volt a. c. charging line for the operation of the rectifiers for charging the storage

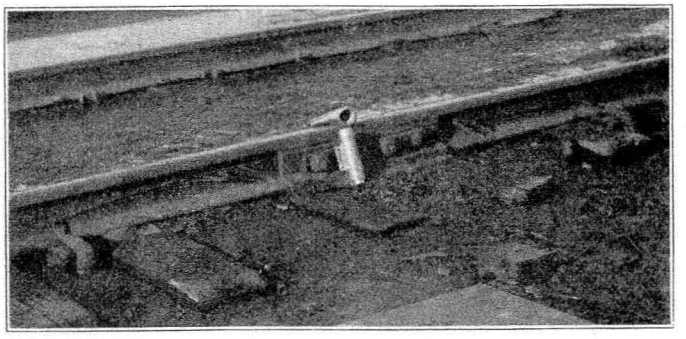


Special Cast Iron Nose Angle Pot-head for Making Parkway Connections to Bootlegs

cells for the track battery. The aerial cable was all made according to the railroad company's specifications from rubber covered wire having a 3/64 in. wall of insulation, each strand having a single braid cover impregnated. The cable was formed up with a braided and coating covering. Going west from the tower there are 9 cables totaling 328 wires. The conductor lists for each cable are as follows: Cable-A 23 No. 6 wires; Cable-B 37 No. 14 wires; Cable-C 26 No. 8 wires; Cable-D 30 No. 14 wires; Cable-E 30 No. 14 wires; Cable-F 30 No. 10 wires; Cable-G 30 No. 12 wires; Cable-H 61 No. 14 wires. The cables are supported in Blackburn cable rings from ⅜ in. stranded galvanized messenger. The poles are hollow spun, reinforced concrete manufactured by the Massey Concrete Products Company. The pole line is braced rigidly with ⅜ in. anchor guys and is reinforced at intervals with a special H-fixture, as illustrated in an accompanying photograph, that not only strengthens the line against end stresses, but increases the strength of the line for side stresses as well.

Sealed Junctions For Parkway

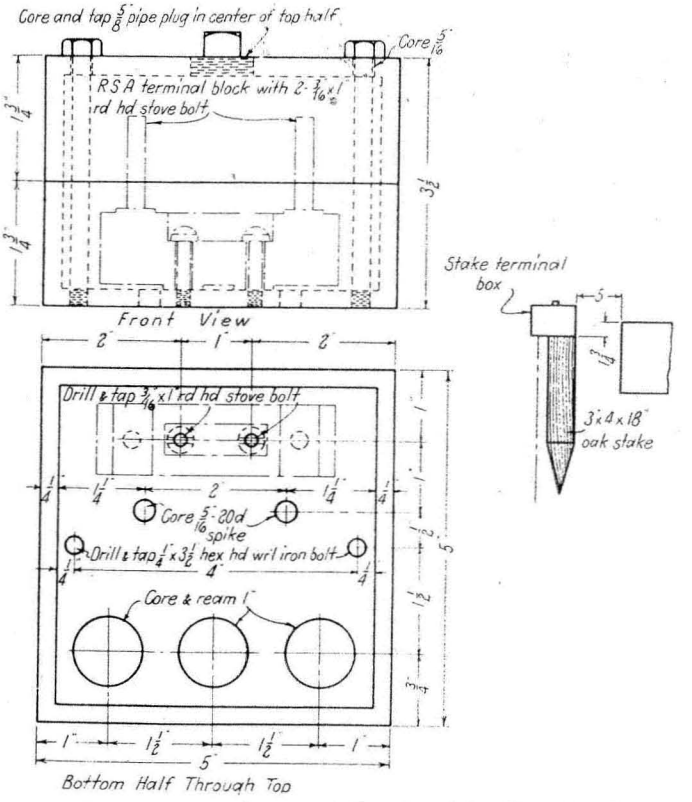
Parkway cable is used exclusively for all connections between manholes and operated functions, rail connec-



Parkway Junction Boxes Installed at an Insulated Rail Joint, Also View of Sleeve Casting and Nose Angle Fitting

tions and relay boxes. No trunking is used anywhere in the plant. The parkway cable terminates in a square cast-iron pothead adjacent to the switch machine. Each terminal box is mounted on top of an oak stake, with one end projecting over to permit the cable leads to enter the bottom of the box. A squeeze connection holds the end of the cable as it enters the box. The wires are terminated on standard R. S. A. porcelain mounted terminal blocks and from these terminals other wires are carried out through a hole in the side of the box through a flexible conduit to the switch machine. After all connections are made, the box is filled with sealing compound.

The two-way parkway cable for the track connections at an insulated rail joint is carried to a similar but smaller box also mounted on an oak stake. This box has three holes in the bottom, one for the incoming two-way cable and two for the outgoing single conductor cables, no outlet being furnished on the side of these boxes. The single conductor cable is carried through the ballast and up alongside another oak stake set adjacent to the rail. The pot-head for this rail connection between the parkway and the bond wire is a special feature. The end of the cable is brought up through a



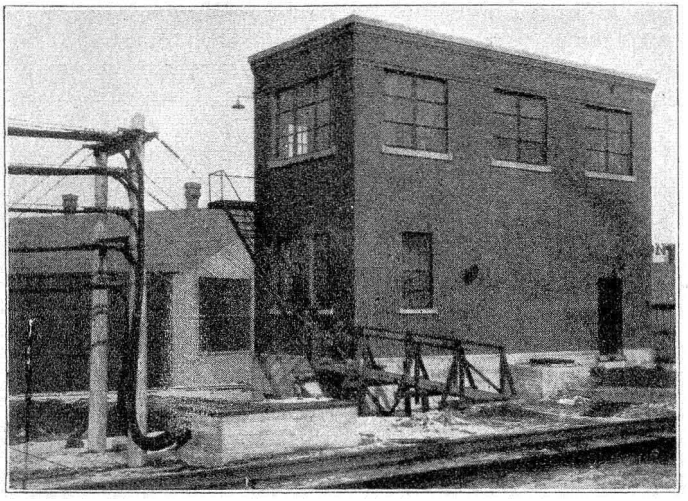
Details of Square Cast Iron Pot-head for Terminating Parkway Cable

sleeve casting which is nailed to the side of the stake. After the connection is made between the parkway and the bond wire, the joint is pulled back into this sleeve and the squeeze connection at the bottom is tightened. The sleeve is then filled with sealing compound. A special nose angle fitting is then slipped on over the bonding wire. This fitting sets down over, and is held by set screws, to the top of the sleeve casting. As an added feature a pipe strap may be placed over the nose casting to hold it to the top of the oak stake.

Tower Equipment

The tower, built of brick and concrete, has two stories and a basement, with the machine on the top floor, relays, terminal boards and charging panels on the ground floor and the storage batteries in the basement. The machine is a G. R. S. unit type with 128 levers and mounted above it is an illuminated track diagram with an L. S. Brach direct reading ground detector and an ammeter. The time releases and fuses are mounted on top of the machine within reach of the towerman.

A loud speaking telephone is mounted at one end of the machine and the leverman carries an operator's type transmitter with him and can plug in for telephone purposes at any one of three jacks that are mounted on the machine above the levers. The loud speaker is connected to the telephone system that connects with the dispatcher's office and with the telephones located at the signal bridges



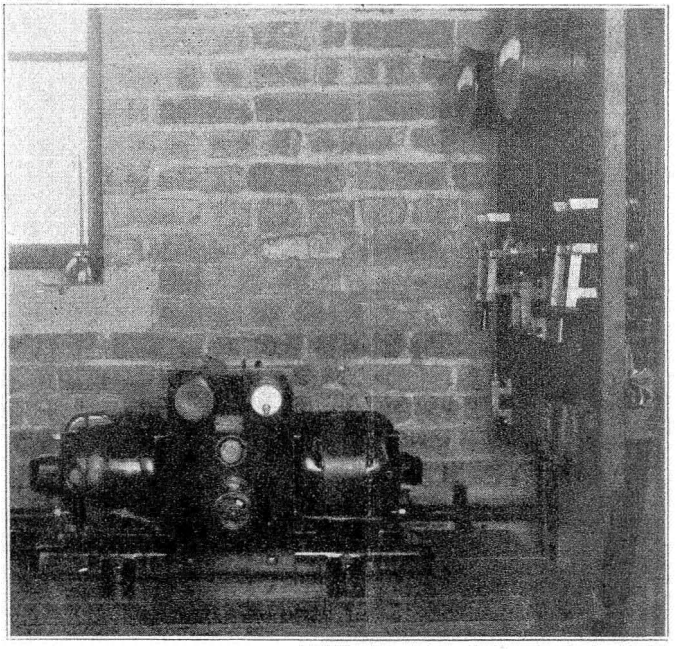
East End of Aerial Cable Line Which Enters Manhole and Runs to Tower in a Concrete Duct Line, South View of Tower with Grading Not Yet Finished

and coach yard, whereby trainmen and maintainers can get in touch with the towerman without taking him away from the machine. Taps for the telephone circuit are carried into all the important relay boxes over the plant and the maintainer has a portable pocket type telephone set that he can connect in to get in touch with the towerman at almost any point on the plant. This is a decided advantage during certain periods of the day when the leverman is too busy pulling levers to go over to his desk to answer the telephone.

The main tower manhole is built into the basement of the tower and carries all wires to the main terminal rack on the south wall of the ground floor. From this rack the wires are distributed to the machine on the floor above, to the relay rack on the ground floor, and to the storage battery in the basement. The relays are mounted on two sets of shelves running parallel to each other and with a passageway between them for getting at the terminals at the back of the shelves.

Novel Charging Panel For Low-Voltage Batteries

The high-voltage battery is charged by means of two General Electric unit-type motor-generator sets rated at 125 volts, 6 amperes output. One machine is held

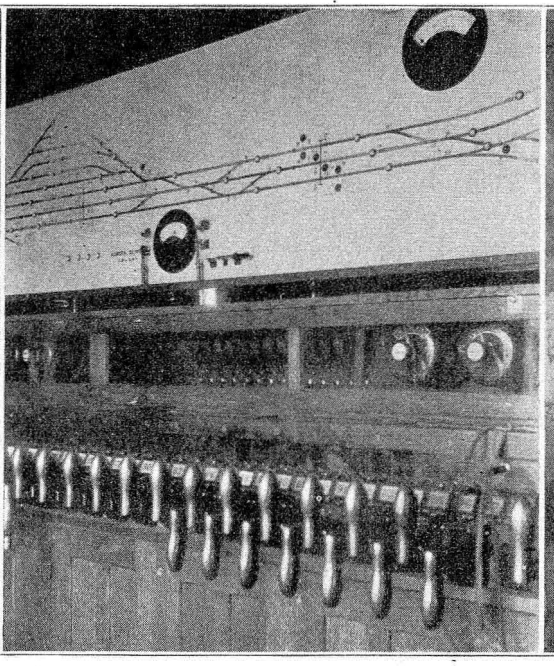


Charging Panel and One of the Motor-Generator Sets for the High-Voltage Battery

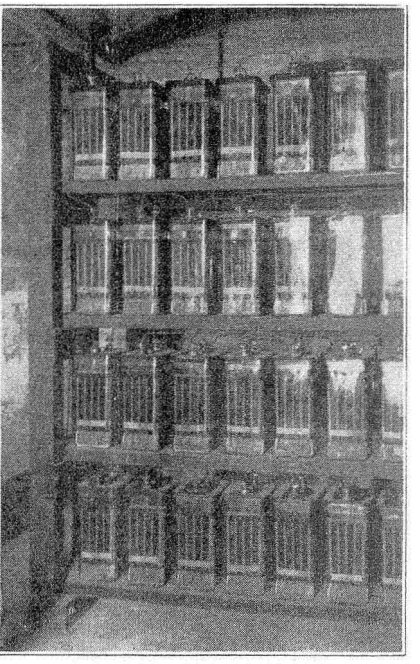
in reserve while the other is floated across the battery. These two machines are mounted on a heavy oak table.

A novel emergency switching scheme for cutting rectifiers and batteries in and out of circuit has been worked out in conjunction with the low-voltage charg-

Relay Rack on First Floor of Tower, Note Absence of Wires

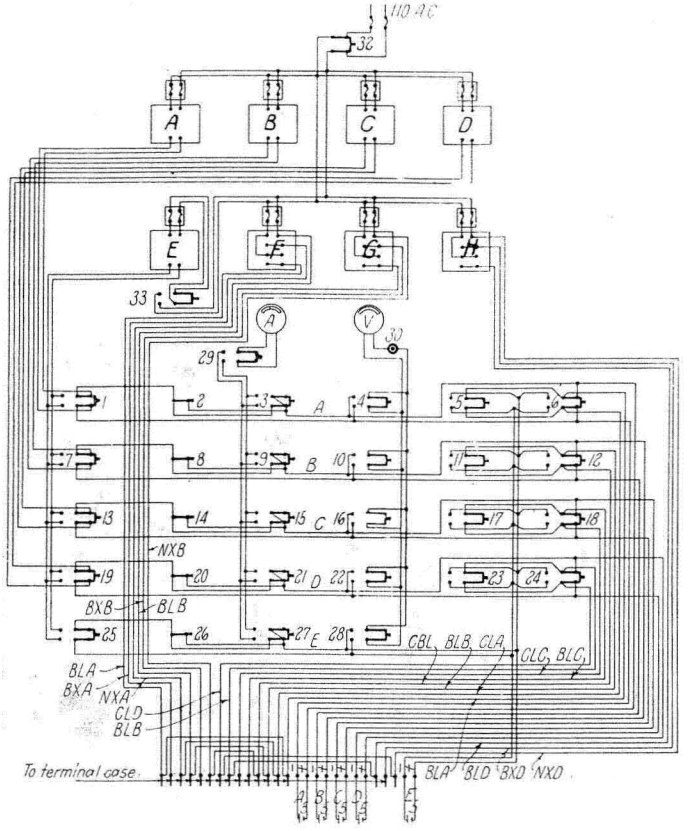


Interlocking Machine, Note Telephone Plug at Right



Sealed Glass Cover Type Jars Used for Storage Batteries

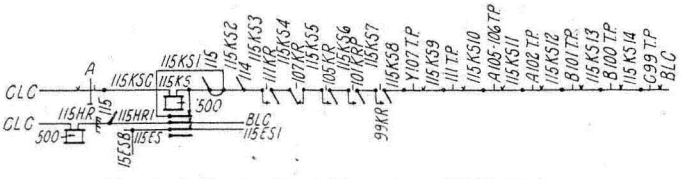
ing panel located adjacent to the main terminal rack. The arrangement of switches, meters and rectifiers is shown in the drawing herewith. Mounted at the top of the panel are five Non-tune rectifiers, three light relays, a voltmeter and an ammeter. The *A*, *B* and *C* rectifiers are for charging the three 5-cell batteries, the *D* rectifier is for the 5-cell tower control battery



Detail Wiring Plan of Low-Voltage Charging Panel

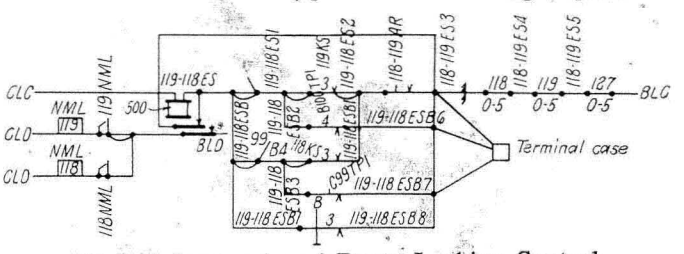
which feeds the lever locks, the manipulation chart, etc., and the *E* rectifier is for charging the emergency *E* battery. All the rectifiers are the Universal Leich 10-volt type. The left hand row of knife switches are arranged to allow switching the emergency *E* rectifier in circuit with any one of the five sets of 10-volt battery by simply reversing the proper switch.

The second row of single-pole knife switches and also the third row of double-pole knife switches are connected to permit the ammeter to be placed into any one of the five charging circuits. To take a current reading the double-pole knife switch is first reversed



Typical Control of Signal or "KS" Relays

and then the single pole switch, which forms a shunt around the throw-over switch, is opened. By providing this shunt switch, there is no break in the charging circuit while cutting the ammeter in and out. In a similar manner voltage readings of each battery can be taken by using the push button and reversing the proper knife switch in the fourth row. Reversing any one of the fifth row of switches will connect the emergency *E* battery in parallel with any one of the other control batteries. Similarly, reversing any one of the knife switches in the sixth or right-hand row will replace any battery with the *E* battery. By providing two sets of switches, the transfer can be made quickly without de-energizing any of the control circuits, because the emergency battery can first be switched in parallel with the other battery before the battery is removed from the circuit. The rectifiers and switches are mounted on a heavy oak panel, making a neat appearing control board. The high-voltage battery consists of a set of 58 cells of 160 ampere-hour Exide chloride accumulator Type EMG-9 having 4 positive



Typical Approach and Route Locking Control

plates. The low-voltage sets each have 5 cells of 120 ampere-hour battery of the KXH-11 type. All jars have the sealed glass covers.

Other Circuit Features

The signal control circuits are arranged so that the *H* relay control wire leaves the tower and runs direct to the *H* relay without any circuit breaks. The control is accomplished by breaking the *H* relay circuit through a special stick *KS* relay. An accompanying drawing shows the control of one of these stick relays which really check the track sections and switch positions in place of the *H* relay circuit doing so.

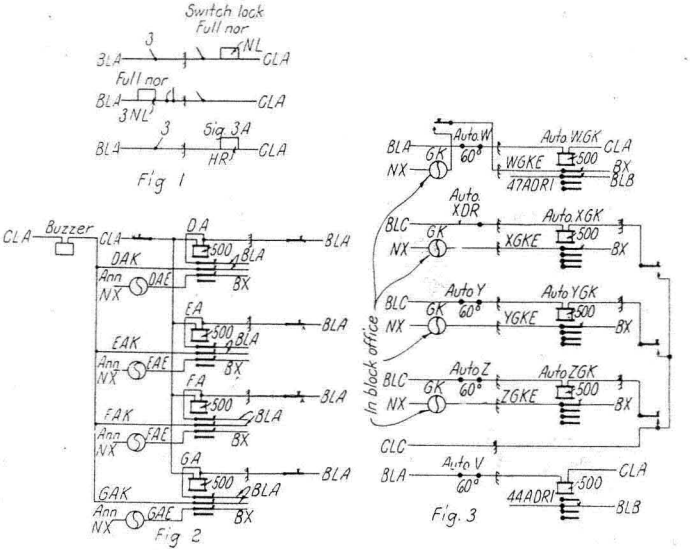


Fig. 1—Electric Lock on No. 3 Outlying Switch
Fig. 2—Train Starting Annunciator Circuits
Fig. 3—Dispatcher's Push Button Operated Light Indicators

The switch indicating relays, known as the *KR* relays, are the G. R. S. three-position motor type. Many of the other control relays were made from standard materials at the railroad company's relay shop at Aurora.

Approach and route locking circuits, in straight line form, for two of the eastbound home signals are shown herewith. The control for the normal locks on these two signals levers is taken through front contacts on

the stick locking relay. This is in effect sectional route locking, as the signal lever under certain conditions can be moved full normal before the train has cleared the route, without operating the time release.

There is an electric switch-lock on the hand-operated junction switch leading to the roundhouse. The control circuits for the lock, also the normal indication circuits of the switch and the *H* relay control for the switch signal are shown herewith.

During the morning rush hours, there are three suburban trains that make up and load on the platform tracks at the same time. In order to signal the towerman, the conductor of the first train that is ready to go pushes an annunciator button mounted on one of the platform columns. As shown in the accompanying circuit, this picks up a stick relay in the tower, thereby operating a buzzer and lighting an indicating lamp. The buzzer continues to ring until the towerman drops the stick relay by pushing an acknowledging button. This train starting system is a great help to the towerman, as he knows immediately which train is ready to go.

In all three directions leaving the plant are "Stop and Stay" signals of the A. P. B. signal system. Located before the dispatchers, who are in the station building, are light indicators operated by push button circuits to indicate the position of starting signals so that necessary orders may be delivered at the station to permit passing these signals in accordance with the rules provided for such purposes.

This plant was engineered and installed by the signal department forces of the Burlington.

Signaling of Paired Track Operation

Low-Voltage Interlockers Operated by Primary Batteries, Both Lines Equipped with Automatic Signals

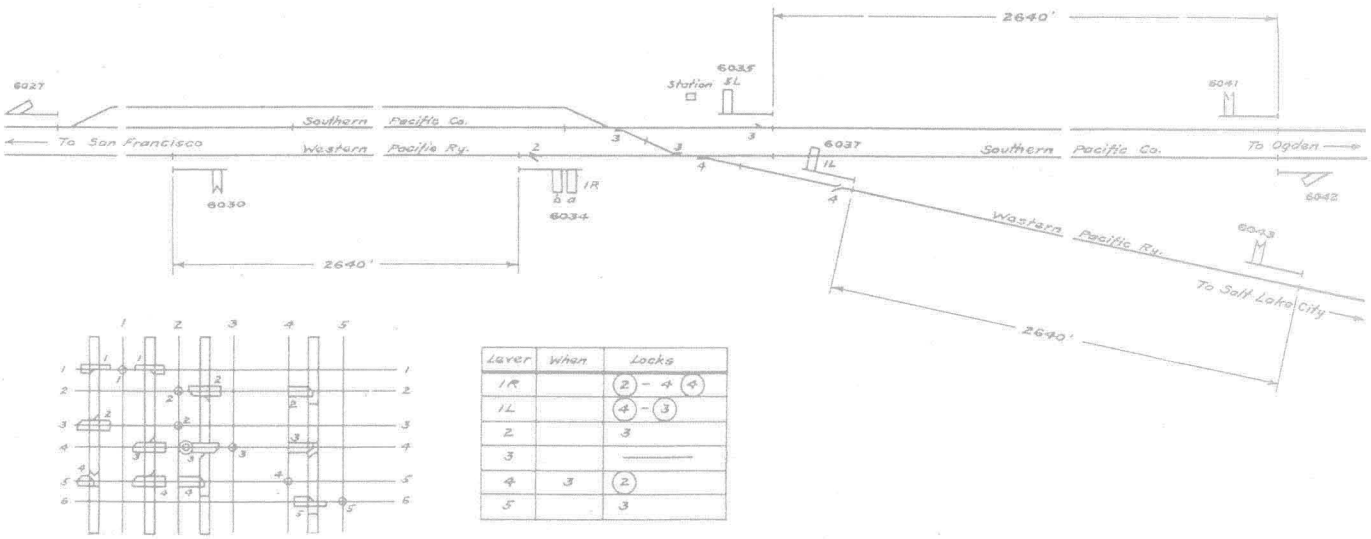
By R. D. Moore

Assistant Signal Engineer, Southern Pacific Co., San Francisco, Cal.

A RATHER interesting joint operating arrangement on the main lines of the Southern Pacific and Western Pacific in Nevada was inaugurated effective August 1, 1924. The two roads virtually parallel each other for a distance of 183 miles through the Humboldt river valley, the route of the early emigrants who crossed the plains to California in the "covered wagon" before the days of the "iron trail." A glance at the accompanying map will show the relative position of the two roads in this territory. The tracks are 200 ft. apart at Weso (near Winnemucca), and 13 ft. at Alazon (near Wells), the west and east ends, respectively, of the joint track. At intermediate points the distance varies up to 6 miles.

Heretofore the two roads have been operated independently as single track lines between these two points, but under the new arrangement all eastward trains of both the Southern Pacific and Western Pacific will use the Western Pacific track and westward trains the Southern Pacific track, thus giving both roads the equivalent of 183 miles of double track railroad. Of the 777 miles of Southern Pacific main line between Oakland, Calif., and Ogden, Utah, 324 miles were already double tracked, therefore, with the introduction of the joint track facilities, 507 miles of this line are now double tracked, or 65 per cent of the total distance.

The combined business over the joint tracks averages about 40 trains per day, with the number running considerably higher during the heavy fruit season. Each road maintains its own tracks and other facilities and trains operate under the jurisdiction of the dispatchers and subject to the rules of the company over whose tracks they are running. The Southern Pacific line is equipped with Union Switch & Signal Co. Style-B, automatic block signals and the Western Pacific is now installing automatic signals of the same type on their line, so that both tracks



Track and Signal Plan of Plant at Alazon on East End of Paired Track