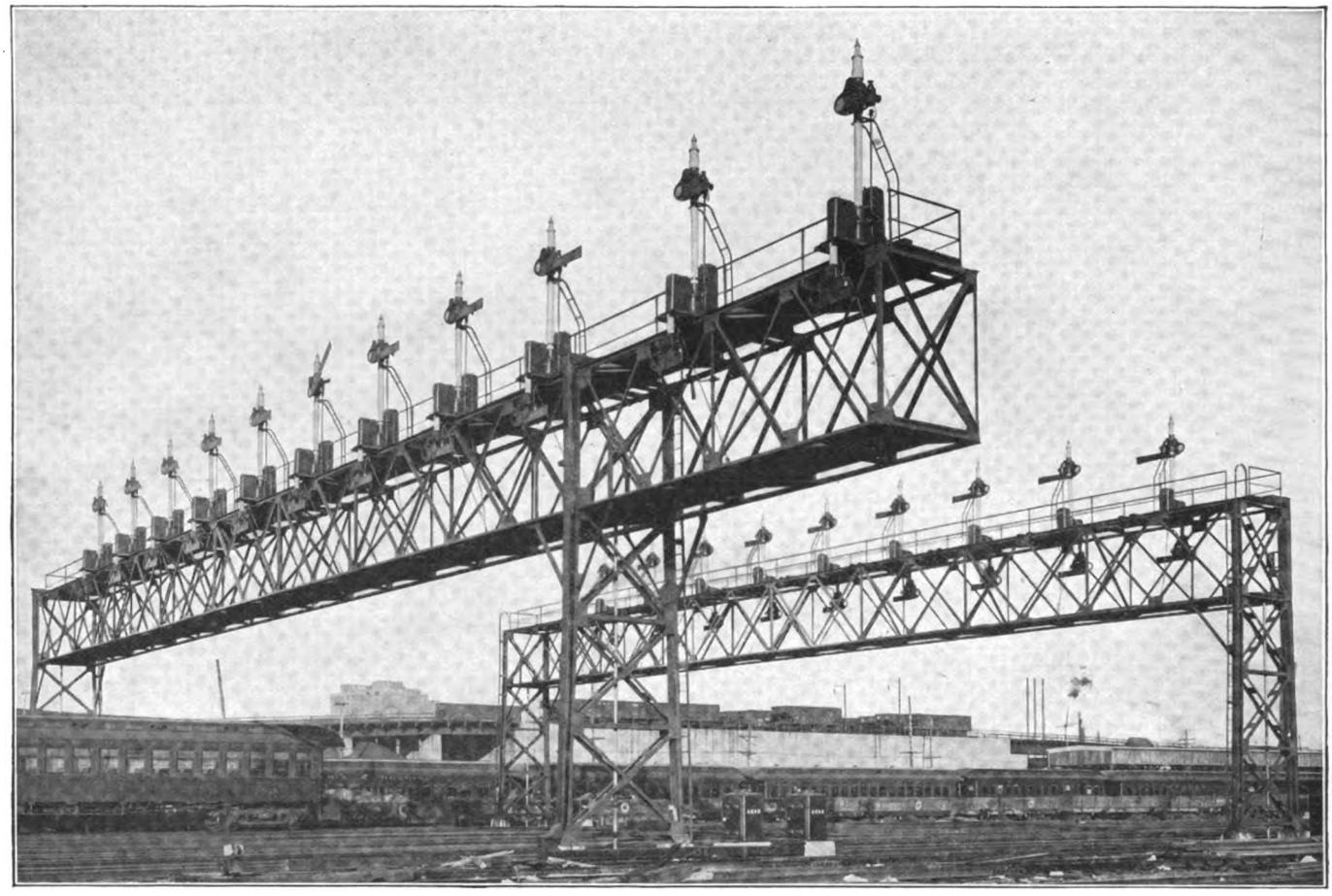
Jersey City Terminal Interlocking

C. R. R. of N. J. Is Installing Three Large Electro-Pneumatic Plants at Entrance to Station and Yards

As a part of the reconstruction and rearrangement of the main line tracks and the yards adjacent to its passenger terminal at Jersey City, N. J., the Central Railroad of New Jersey has installed a new electro-pneumatic interlocking plant with 592 operated units, and changed certain features of another plant with 233 operated units to conform with the new standards. The terminal interlocking consists of three plants. Tower A, the new one, governs the entrance to the new 20-track train shed, the 9-track throat, and the leads to the coach yards, etc. Tower B, which was built in connection with the work on the new engine terminal, controls the entrance to that terminal which is located south of the main line about one mile west of the station. Tower C, which has been altered, controls the junction of the main line with the Newark branch, about one-half mile further west.



Two of the Long Signal Bridges in the Jersey Terminal. The One in the Foreground Spans Ten Tracks and Has a Two-Track Cantilever End.

TRAFFIC.

In addition to the Central of New Jersey, this terminal is used by the Philadelphia & Reading, the Baltimore & Ohio, and the Lehigh Valley, the maximum number of trains in 24 hours amounting to about 200 each way. The Reading and the Baltimore & Ohio trains are operated by the Jersey Central in the same way as its own service, but the Lehigh Valley, with about 12 trains each way daily, operates separately, using the main line Jersey Central tracks for about 10 miles. As the Jersey Central suburban business is very heavy, the number of trains is much greater than normal during the morning and evening rush hours, and as all passengers use the ferry-boat service between the station and New York City, the schedules are arranged in many cases so that several trains will arrive or depart at a time that will allow close boat connections, thus further aggravating the tendency to congestion during certain parts of the rush hours. The maximum number of trains regularly handled into and out of the station in one hour is about 38. In addition to these scheduled trains, a large number of movements are necessary in making up trains from the coach yards, pulling out empty trains after their inbound runs, and in handling locomotives to and from the engine terminal. This terminal handles from 225 to 300 locomotives per day, including the freight engines, which also pass through the interlocking plant at tower B.

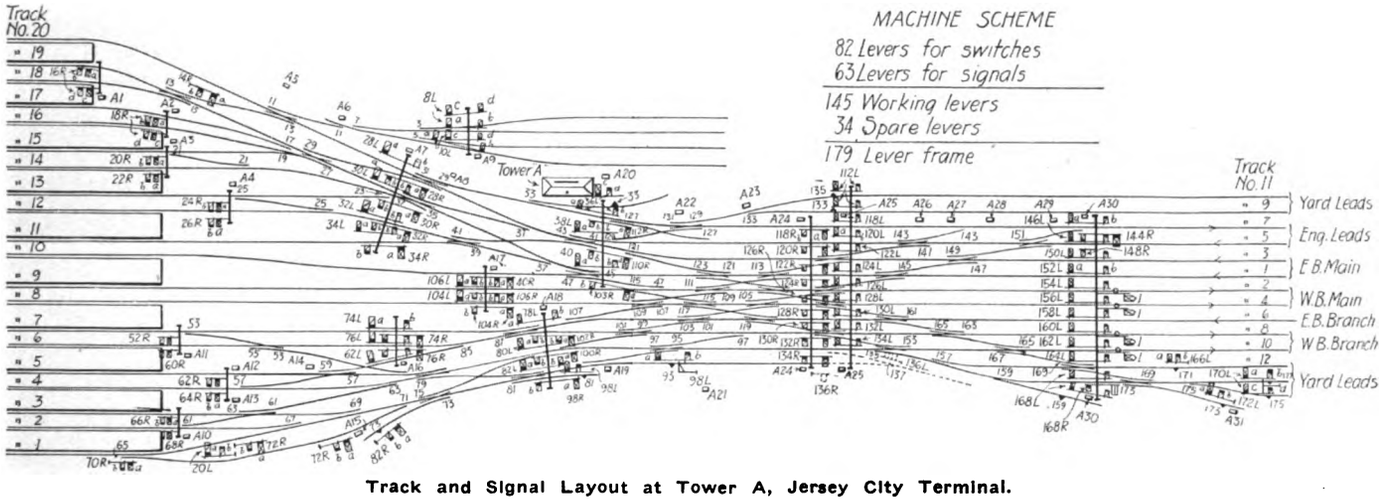
TRACK LAYOUT.

The layout at the three plants is shown in the accompanying plans. There are seven main tracks—two inbound and two outbound main line tracks and one inbound and two outbound for the Newark branch. There are also two engine leads and a running track to the coach yards paralleling these main tracks. The engine leads are normally operated left-handed between the station and Communipaw. The second outbound Newark branch track, extending as far as Communipaw, was added in order to allow a heavy through train, operating over the Newark branch, and a Newark suburban train, scheduled to leave at the same time, to pull out together and both keep moving. The lighter train can reach Communipaw and make the station stop while the other train is reaching that point and passing it a sufficient distance to allow both to proceed at a safe interval on

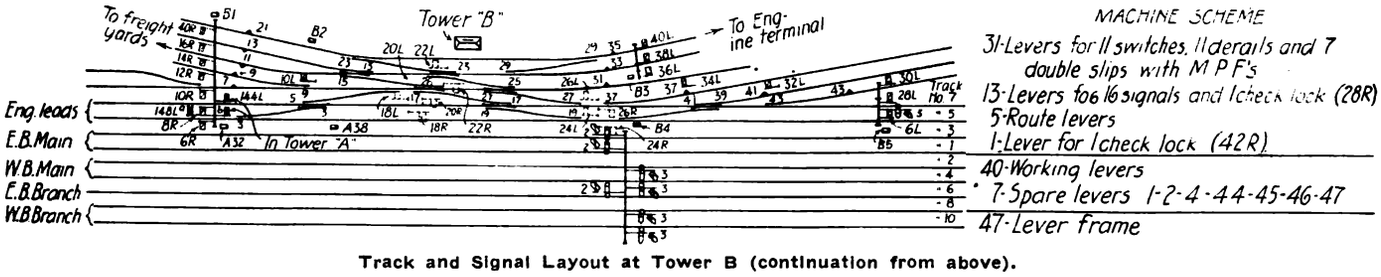
the same track. In addition to the Lehigh Valley and suburban trains, a few Jersey Central main line and Shore trains are operated over the branch connecting with the main line again at Elizabethport.

The nine-track throat of the yard is crossed by four ladder tracks, two in each direction. At the west end, two of these tracks are extended to the north to include four yard receiving tracks. At the east end, the layout is expanded to embrace the 20 train shed tracks, the four main ladders being supplemented by five additional ladder tracks, two on the north side, and three on the south. The layout provides for connection between old plant used two-position, lower-quadrant signaling, while in the new installation three-position, upper-quadrant speed signaling, conforming to the R. S. A. recommendations, was adopted. Since all movements within the limits of this plant are at moderate speed, the high speed blade was omitted. The upper of the two arms governs in all cases over all routes fully equipped with track circuits, and the lower arm, those not fully equipped. The aspects and indications are shown in the accompanying diagram.

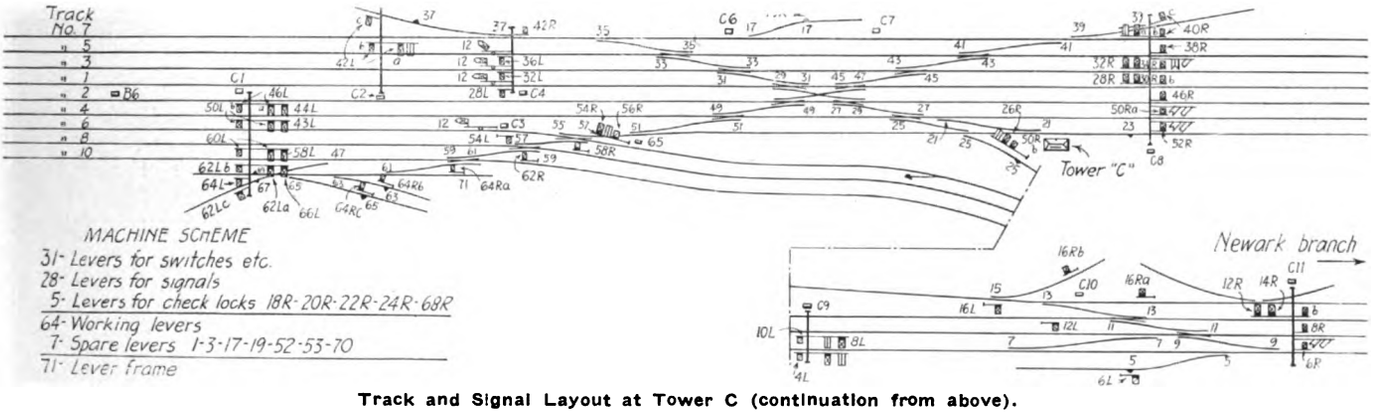
The new plant was put in service in six stages. The first step was coincident with the opening of the new engine terminal last



Track and Signal Layout at Tower A, Jersey City Terminal.



Track and Signal Layout at Tower B (continuation from above).



Track and Signal Layout at Tower C (continuation from above).

the seven northerly tracks and the north yard, and between the ten southerly tracks and the south yard, outside of the limits of the main throat. It is also possible to make six simultaneous moves between the train shed tracks and the coach yard, and at the same time, make four moves between the main line and the central train shed tracks. The layout consists of No. 9 slip switches and turnouts with three exceptions where larger number turnouts are used.

INSTALLATION OF TOWER A.

The plant at tower A replaces two old mechanical plants, one of which had been enlarged by the installation of a 29-lever, electro-pneumatic machine to handle the additional tracks put in service as the work on the new train shed progressed. The May, when temporary work became necessary at the old tower 2, to get the engines in and out. In many cases it was necessary for an engine to run to Communipaw and back, as it was impossible to reach the northerly five station tracks without a reverse movement. The second step consisted of about 40 per cent of the plant, including as much of the throat of the yard as could be completed at that time. The control of these functions was transferred to the new machine on November 15, allowing engines to move directly to and from the engine terminal. In the third move, the new ladders were connected to the west coach yard, putting the old tower 2 entirely out of service. The fourth move was to connect up the five northerly house tracks with the new plant, and the fifth move included the leads to the south side. The last step, which was to connect up the middle

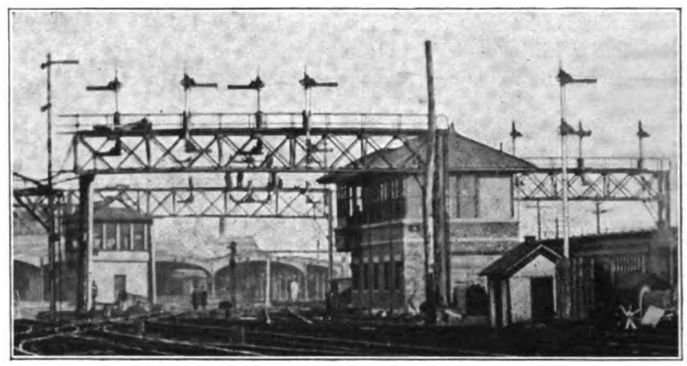
seven tracks in the shed, was completed on March 20, thereby placing the entire plant in service.

The new tower A is located about 750 ft. west of the end of the train shed and south of the main tracks. It is a steel frame structure with brick walls supported on piles driven about 65 ft. to rock, cut off at low water level, and capped by reinforced concrete beams. The floors are of concrete, the upper one being finished with Taylorite surface and wainscoting. The roof is of slate with copper cornice, and Lupton steel sash are provided for all windows, making the building fireproof throughout, with the exception of the wooden relay rack.

INTERLOCKING MACHINE.

The interlocking machine is the Union Switch & Signal Company's electro-pneumatic type, having a number of improved features. It has a 179-lever frame, 34 of the levers being spare. The working levers control 41 single switches, 11 derails, 38 double-slip switches with movable-point frogs, 3 single-slip switches with movable-point frogs, 204 signals, blades having 292 positions, and 9 locks between towers. The machine has an enameled steel case and the track diagram will be suspended from the ceiling over the machine, in a steel case matching that of the machine. Lever-light indicators are provided for all switch and signal levers to show the condition of track circuits and switches. These lights, directly under the levers, give the levermen the information needed without the use of an illuminated track diagram. A pushbutton is also provided below each signal lever, which, with this lever reversed, operates the lower arm as a calling-on signal for slow speed movements when the route governed by the top arm is occupied. This pushbutton, when depressed, remains in that position, eliminating stick relays. The levers are improved by the application of a latch depressor which insures that in throwing them time will be allowed for the latch to drop during each stroke.

Probably the most important change in design in this machine is the system by which a roller which is not long enough to carry all the necessary contacts can be connected by a link arrangement at its lower end to some other roller with spare space. This utilization of the otherwise unused space makes it possible to put all the contacts needed for a plant of this size on two combination plates, and avoids the necessity of increasing the height of the machine with the consequent changes in the tower. A change has also been made in the design of the electric lock on the lever, making it possible to equip adjoining



New Tower A, at the Right, and Old Tower 1, at the Left, Showing Temporary Signal Bridges.

levers with three locks each. The third lock is sometimes desirable for a traffic lock, for example.

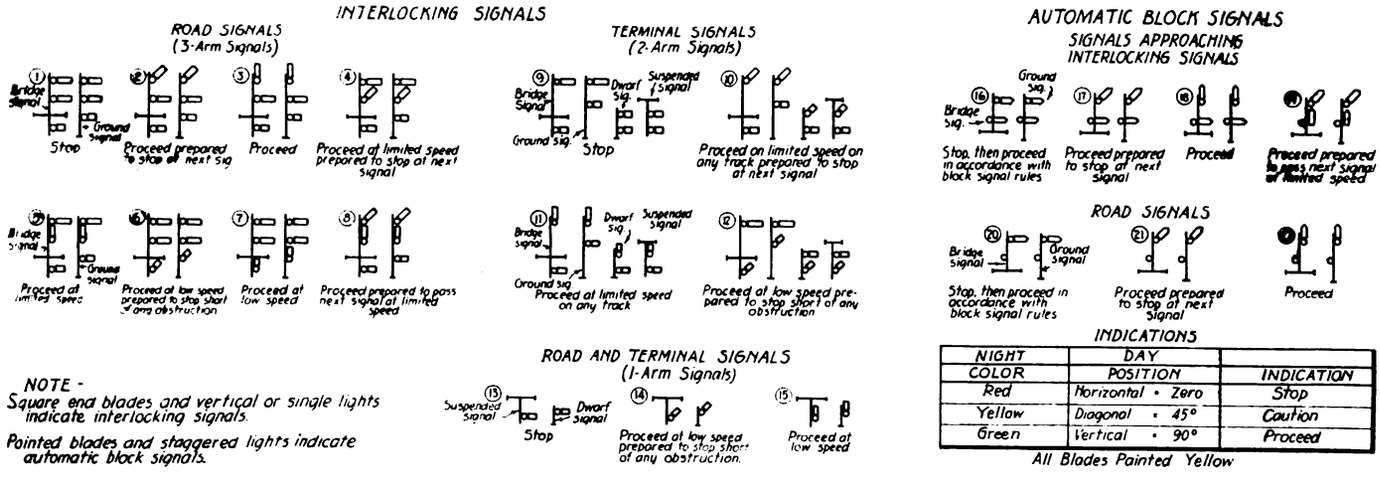
LOCK AND INDICATOR CIRCUITS.

The plant is equipped with switch detector circuits with advance route locking, and approach locking with clockwork time releases set at one minute is provided for locking all signal levers controlling signals governing in the direction of traffic entering the plant. Approach indicator lights and bells with a different tone for each track warn the train director of the approach of a train, the lights being extinguished and the bell stopped by depressing a button under the lever of the home signal for that block. Train-describing instruments are also used for apprising the train director at the next tower of the class of train that is approaching. Another indicator shows whether or not the two receiving tracks alongside the coach yards are occupied. An electro-pneumatic whistle is provided with which the movements of trains in emergencies can be controlled by signal, this whistle also being used to call the maintainers to the tower. Telephones are provided at all signal bridges, work shops, etc., to allow the maintainers to keep in touch with the tower at all times.

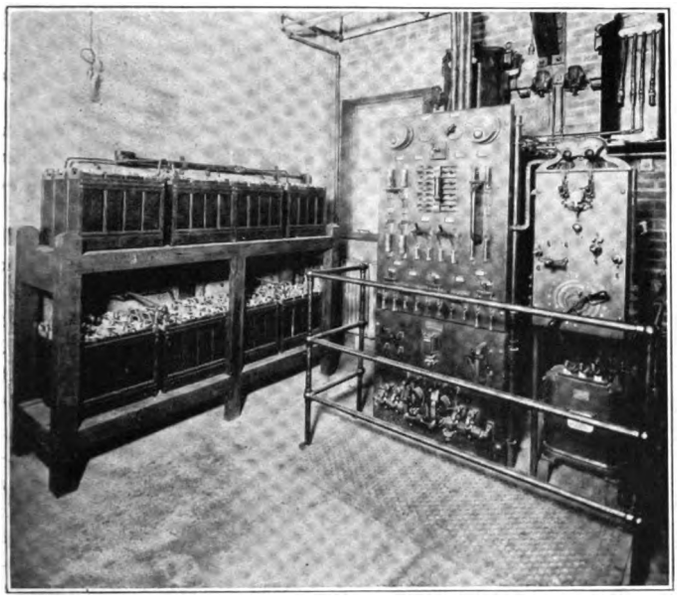
TRAIN-STARTING SYSTEM.

A train-starting system provides for intercommunication between the ferry-master, gatemen, train conductors and towermen. Light-indicator cabinets with a unit for each of the 20 station tracks are located in the ferry-master's office and in the tower; a three-way light indicator with one red, one green and one yellow lens is located at each gate and key switches are provided on each platform of the train shed and at each gate.

On the arrival of the last ferry boat carrying passengers for any particular train, the ferry-master pushes a button in his cabinet, which is numbered to correspond to the track on which the particular train is loading. The pushing of this button lights one of the indicators in the tower cabinet corresponding to this track, and at the same time lights the red light in the indicator at the gate. This signal notifies the towerman, gateman and conductor that the last boat has arrived. When the train is made up, with the engine attached, air tested, etc., the conductor operates the key switch on one of the columns along the platform, thereby lighting the green light in the gateman's indicator



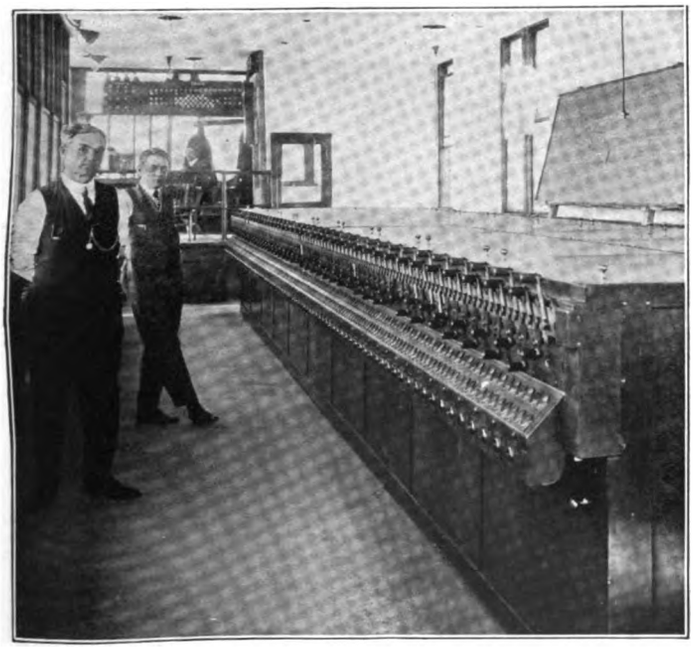
Signal Aspects and Indications, Jersey City Terminal.



Power Switchboards and Storage Battery Installation.

and a corresponding light in the tower, thus informing both the gateman and the towerman that the train is ready to leave. The gateman, after the last passenger has entered, operates his key switch, lighting the yellow light in the three-way indicator and the third indicator for that particular track in the tower. The towerman is thus advised that it is time to set up the route and clear the signal. The conductor, also observing the yellow indication in the gate light indicator, knows that he may start the train as soon as the last passenger has boarded it.

The gate light indicators are arranged so that the red, green and yellow lights are easily observed by the train conductor on the platform. Frosted lenses are provided back of these three colored lights so that the gatemen observe the indicator from the rear, differentiating between the ferry-master's and the conductor's signal by the position of the lights. The station-master on duty in the concourse can also observe the lights in the gateman's indicator and keep informed as to the preparations being made for the departure of any particular train. On the departure of the train, the gateman extinguishes all lights by releasing the key switch at the gate. The system is operated by



Interlocking Machine in Tower A. Note Indicators Above Train Director's Desk.

110-volt, 60-cycle, alternating current, all wires being carried through duct lines in multiple cables.

SIGNALS AND SWITCHES.

With the exception of 10 ground and 2 bracket signals, all signals are mounted on bridges, of which 16 were required. Three of these are of notable length, one spanning 10 tracks, another 11 tracks, and a third 10, with an additional two-track cantilever end. The seven bridges, located near the end of the train shed, are made as low as possible to enable the indications to be read by the trainmen in the shed. The bridges are supported on spread footings, consisting of heavy concrete slabs carried down about 4 ft. below the finished grade. In many cases temporary expedients had to be adopted in the construction of the bridges, relay boxes, etc., where the foundations

Looking West Through the Throat of the Yard, Showing Double Crossed Ladder Leads.

interfered with the old pipe runs. In some of these locations the forms that were to be used later for the concrete foundations were used as a temporary support, and in others, temporary cribs had to be built.

The signals are the U. S. & S. three-position, upper-quadrant, electro-pneumatic type, employing tandem cylinders. The lower blades are suspended below the top chords in all bridge-mounted signals. The upper blades are semi-automatic and the lower are not. The signals are electric-lighted, using Dressel lamps. These lamps are equipped with Signal Accessories Company automatic cut-in-relays, with which only one bulb is normally burning, a reserve bulb being automatically lighted when the normally burning bulb fails. All blades are of the "Saco" enameled steel type. The No. 14, U. S. & S. switch-and-lock movement is used for all switches and is provided with a new type of cutoff valve, mounted directly on the cylinders. The Bossert snowproof switch adjusters are used throughout.

POWER SUPPLY AND DISTRIBUTION.

Power for operating the plant is secured normally from the company's powerhouse at Communipaw. Single-phase, 60-cycle alternating current is received at 550 volts and compressed air at 100 lb. at the compressor. An alternate source of electric power is furnished by connection with the Public Service Company's 2,200-volt line through a transformer which reduces this

Relay Rack on First Floor of Tower A.

voltage to 550, and the compressed air can also be supplied from the service building north of the station. An automatic switch on the main board on the first floor of the tower cuts in the Public Service circuit immediately if the company line is de-energized; and when power returns to this line, the switch immediately connects the plant to it again.

Duplicate installations of four sets of 12 cells each of Edison Storage Battery supply direct current for the operation of switch and signal circuits. These batteries are charged by a mercury-arc rectifier, the cells being arranged to charge in series and discharge in multiple.

The 550-volt current is stepped down in the tower to 110 volts by oil-cooled transformers, and distributed at that voltage for operating track circuits and for tower and signal lighting. Each track circuit is fed by an individual air-cooled transformer of the reactive type, mounted in an iron housing, thus eliminating all resistance or reactance coils. Two lighting circuits with separate control feed the lines east and west of the tower. The 110-volt current is stepped down to 12 volts for signal lighting by a small air-cooled transformer at each bridge or signal location. This arrangement permits the use of 12-volt, 2½-watt lamps in the signals. The direct current supply is distributed throughout the plant to terminal boards.

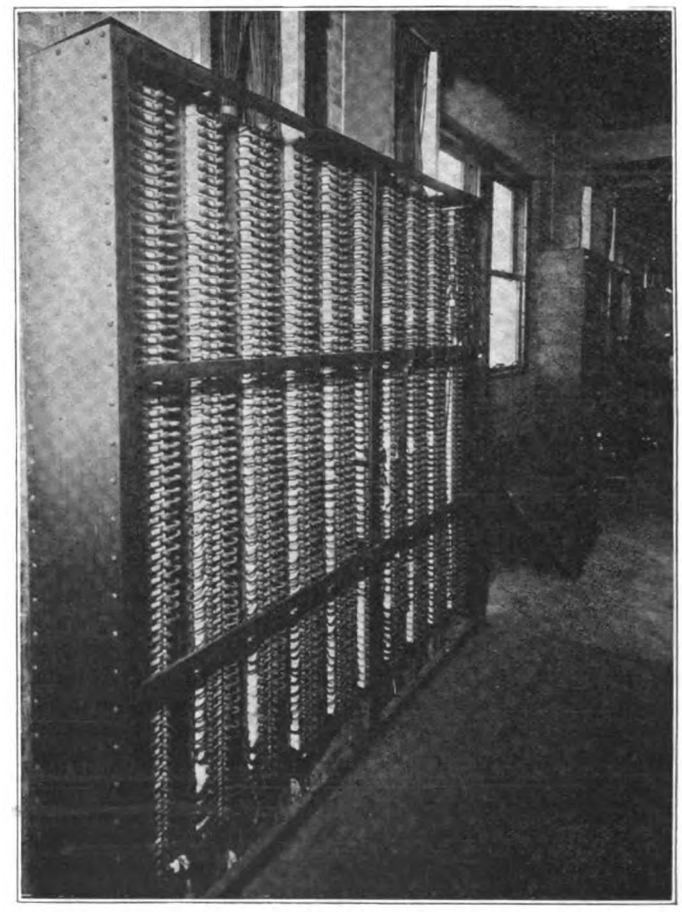
The compressed air is distributed in a 2½-in. main laid along each side of the yard and connected over each signal bridge with proper valves in the line to allow either main to supply all signals. The connection to all switch machines is made by ¾-in. pipe, also connected to both mains. All cables for the control of functions are Okonite, lead-covered. All conduits are made up of creosoted, yellow pine lumber, 2 in. by 8 in., and 2 in. by 12 in., with the top of the conduit at least 12 in. below the tie. In laying this conduit, three sides were built and a layer of clay was placed in the bottom and along the sides before the cable was placed. This was later covered by clay to a depth of 3 in., before the top of the conduit was laid, in order to keep out rats.

Concrete bootlegs of the Jersey Central standard design were used throughout. The track circuit control wires are carried in two conductor cables to these bootlegs; one conductor is attached to the near rail and the other is passed down through the bootleg again, and under the track to the connection with the other rail. This arrangement eliminates the inductive effect of the alternating current.

All wires are brought into the tower in a gallery under the first floor, from which they are carried up to three terminal boards, one for the train-starting system, one for the east half of the yard and one for the west. The R. S. A. written circuits and wire numbering are used throughout. The terminal boards carry standard R. S. A. tagged terminals, mounted on composition insulating strips, drilled to hold the wires separate so they cannot be displaced. All conduits in the tower are lined with asbestos. The relay rack, of standard wooden construction, which occupies a large part of the first floor of the tower, contains 404 relays. The U. S. & S. vane-type relay is used for all track circuits on account of its quick release.

TOWERS B AND C AND THE AUTOMATICS.

The details of the installations at towers B and C are similar to those described for tower A. At tower B, all signals are of the three-position, upper-quadrant type, and all track circuits



One of the Three Terminal Boards in Tower A.

are alternating current. The machine has a 47-lever frame with 7 spare levers and controls 10 single switches, 11 derails, 6 double-slip switches with movable-point frogs, 16 signals and 4 locking circuits between towers. The signals at this plant have only one blade, as no high speed movements are made.

At tower C, where high speed main line movements are allowed, three-arm signals were installed and the 71-lever machine rebuilt. This machine controls 17 single switches, 10 derails, 15

double-slip switches with movable-point frogs, 80 signal blades with 113 positions, and 9 traffic locks. There are 150 relays required.

The main tracks between towers A and C are protected by 22 automatic signals with 19 track circuits. The track circuits are polarized and equipped with U. S. & S. model 12, three-position, polyphase track relays.

The contract for the interlocking was let to the Union Switch & Signal Company, Swissvale, Pa.; the tower was built by John W. Ferguson & Co., Paterson, N. J., the conduit by Westinghouse, Church, Kerr & Co., Boston, Mass., and the track work was handled by company forces. The entire improvement was carried out under the general direction of W. G. Besler, president and general manager, and J. W. Meredith, general superintendent; and under the personal supervision of J. O. Osgood, chief engineer, and W. H. Higgins, signal engineer.

HIGHWAY CROSSING PROTECTION ON ELECTRIC RAILWAYS*

The methods that may be followed in making a crossing safer for the passage of trains and highway traffic involve the improvement of physical conditions surrounding the crossing, or the installation of protective apparatus. The first may be accomplished by grade separation; re-alinement of highway to give better vision; reduction of time vehicles are on crossing; removal of obstructions to the view of approaching trains, such as hedges, brush, trees, buildings, fences, show boards and embankments; and improvement of the highway profile. Under the second, barriers, i. e., gates and watchmen, may be installed; or signals, including signs and alarms, may be used.

Highway crossing signals perform either or both of two functions: They designate the locations of crossings and announce the approach of trains. The ordinary sign board designates the location of crossings, while the announcing of trains on electric railways may be accomplished by simple illuminated crossing signs, the intermittently illuminated sign giving repeated flashes of light, the signal with moving parts imitating the swinging of a red blade or flag or various combinations of these aspects. Combined with these visible indications, audible indications, such as bells, gongs and sirens, may be provided.

The prime requisite in a highway crossing signal is reliability. The signal should be so controlled that when the train passes certain limits or when it is in a certain section it will cause itself to be announced at the crossing. There are two forms of such control: intermittent and continuous. With the intermittent, the electrical signal release is actuated either by the passage of the car wheels or the trolley wheel at some setting device, or it may be accomplished by the movement of the rails opening or closing balanced contacts attached to the base or side of the rail. Continuous control is obtained through the track circuit.

Continuity of operation is necessary. For example, if more than one train should enter the ringing limits at one time, and later, one should pass out, or both stop for some time and then proceed across the highway, the signal must warn against the last as well as the first crossing. Car counting devices have been developed to give this result with the intermittent scheme of control. With trolley contact and mechanical rail control, continuity may be approached by placing extra contactors or restarters between the first starter and the crossing; then when trains do not immediately proceed over the crossing where time limit devices have been installed to stop the bell ringing after a predetermined time, an additional instrument or contact insures that a warning will be given when the train again proceeds.

The cost of installation, maintenance and operation of signals, as obtained by the committee, differed widely, due to varying local conditions. The average cost in installing a single-track warning signal, exclusive of the cost of the signal itself, was $110, the range being from $90 to $150.

The number of signals maintained by one man varied from 15 to 20, the average being about 44. The wide difference in costs is accounted for by the fact that some roads combine signal maintenance with other signal and telephone costs, while others stated the cost for bells alone. One road maintains 29 signals at a monthly cost of $0.65 per bell, this being the average for a year. Another road, with 64 signals, reported the cost as $2.86 per signal per month, while some roads reported as high as $7 per signal per month, but sufficient data were not at hand to reduce this cost to the basis of a single operation. The first road mentioned above, however, had somewhat fewer than one-third the number of operations of the road having the maintenance cost of $2.86. The average cost of maintenance from all replies obtained by this committee was $3.25 per bell per month, which appears to be higher than it should be.

There was a great difference in the frequency of required inspection. Two roads inspected daily, four weekly and one every two weeks. A request by the committee for suggestions for improvements resulted in frequent suggestions for an indicating light for the motormen. The bettering of the indication was suggested, as was also the need for a signal which would show a green light or other proceed indication to a motorman when no train was approaching and a stop or danger indication when the signal was out of order.

The committee pointed out that methods of protection for highway crossings are still in the development stage, and no recommendations were made for this reason. It was suggested, however, that close attention be given by the manufacturers to the development of more uniform aspects.

*An abstract of the report of the Block Signal Committee of the Illinois Electric Railways Association, presented at the annual meeting in Chicago, in January.

KANSAS CITY REGIONAL COMMITTEE

The first meeting of the Kansas City regional committee of the Railway Signal Association was held at Kansas City March 8. Four roads were represented, the Atchison, Topeka & Santa Fe, the Chicago, Rock Island & Pacific, the St. Louis & San Francisco and the Kansas City Terminal, 13 members being present. It was decided to hold future meetings on the second Monday of every other month. The next meeting will be held in the office of the signal engineer of the Kansas City Terminal, in the Union Station, at 10 a. m., Monday, May 8. The special subjects for discussion at this meeting will be Storage Battery and Insulated Joints. All signal men in the vicinity are invited to attend this meeting.

SIGNAL MAINTAINER INJURED

L. N. Carroll, signal maintainer on the Panama Railroad, Panama, C. Z., was seriously injured on the morning of March 18, being struck by a work train while endeavoring to remove his gasolene speeder from the track. He sustained a broken arm, a fractured ankle and numerous bruises and cuts. He was removed by the crew of the work train and taken to Ancon Hospital, where it is expected that he will recover within a period of six weeks, having been fortunate enough to escape internal injury. Mr. Carroll only recently entered the telephone and signal department, having been a conductor on the Panama Railroad for several years. He was at one time identified with signal construction and maintenance on the Illinois Central and the Chicago & North Western.

PROFITS IN PANTS.—The Frisco Railroad is engaged in a campaign to psychologically popularize upper berths in the Pullmans. The agents will cease assuming that every passenger is going to insist on a lower, and will recommend the low price, the spring mattress, the roominess, the conveniences for hanging clothes and the other advantages to be had by buying an upper; and then the prospective passenger will imagine himself swayed to sleep on a spring mattress in an ideal temperature, and with his pants hanging safely on the conveniences provided, and containing the 20 per cent difference in cost between the upper and the lower berth.—*St. Louis Republic.*