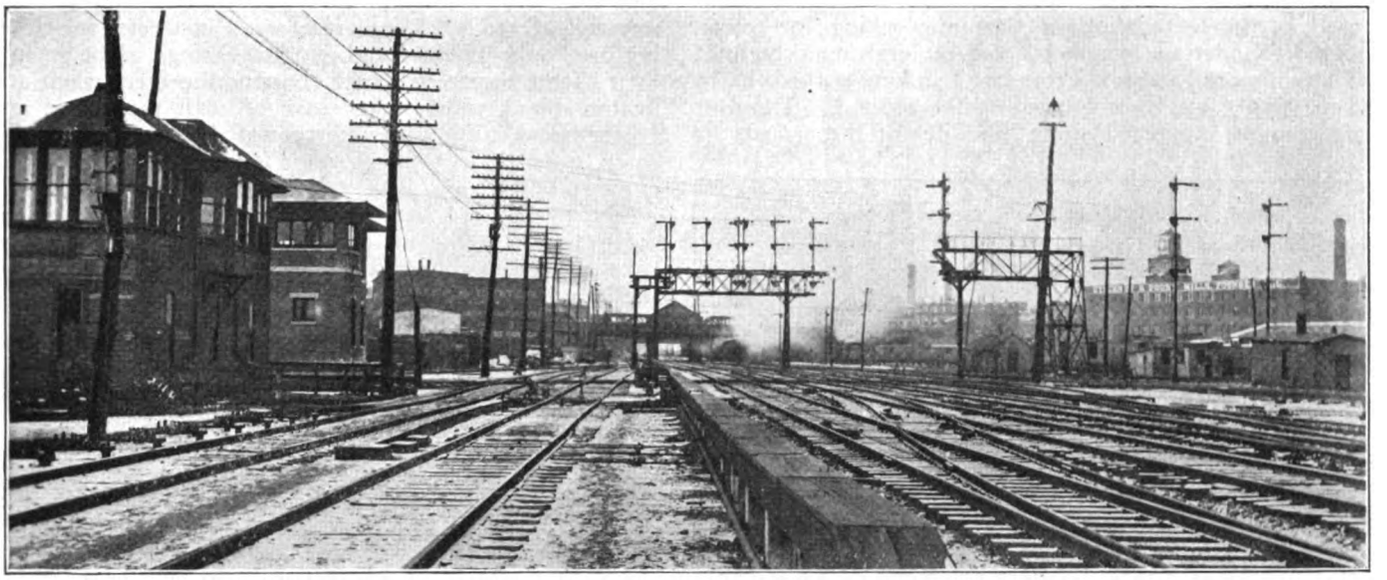


*General View Showing Old and New Towers, Signal Bridges Nos. 18 and 19, Also Portion of Main Trunking and Air Line*

# East Somerville Electro-Pneumatic Plant

## *Boston & Maine Replaces Mechanical With Up-to-Date Power Plant at Important Junction, Increasing Efficiency of Operation*

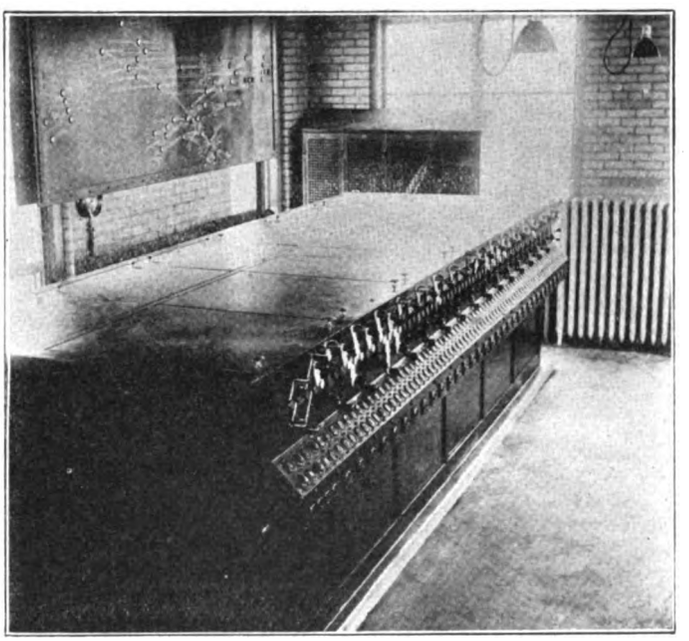
By CARL T. SMITH,
Signal Department, Boston & Maine, West Medford, Mass.

AFTER 25 years of continuous service, an 84-lever mechanical interlocking plant which was installed by the Johnson Signal Company at East Somerville, Mass., was replaced on December 14, 1919, by a modern up-to-date 71-lever model No. 14, electro-pneumatic interlocking machine. This plant, which is known as tower "C," is at the intersection of a branch freight line of the Boston & Albany, connecting Cottage Farm, Mass., with East Boston, and the main lines of the Boston & Maine, Portland division. The construction work of the new plant was done by railroad signal department forces, except the interlocking buildings, which were built under contract.

The new interlocking machine was furnished by the Union Switch & Signal Company, Swissvale, Pa., with safety features of the latest design. This plant with its a.c. track circuits, double element relays, lever lights, illuminated track model and other features, ranks with some of the most recent up-to-date plants on other roads.

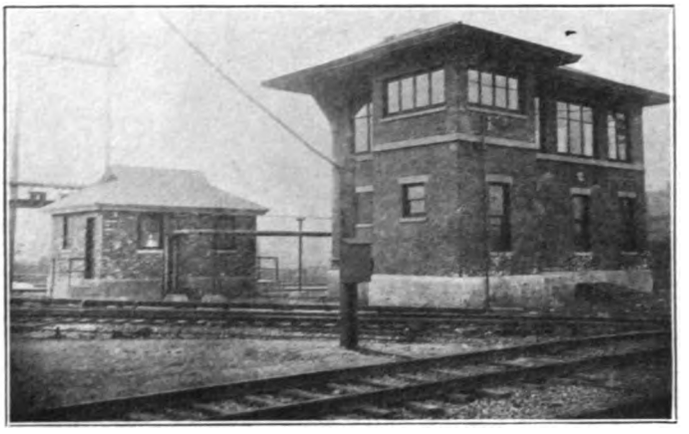
The track changes for the new layout included a new entrance on the north into engine house No. 5, replacing the old entrance on the west. A new crossover was installed between tracks three and four and a new lead from track four to the Valley yard. Tracks three and four were straightened and the old double slip switches with movable point frogs were replaced with a larger size, thus changing the angle at which the ladder crosses the four main line tracks; this necessitated relocating a crossover between tracks four and five, further north and controlling it from tower "D" instead of from tower "C." All tracks within the limits of tower "C" were raised six inches, rock ballasted and relaid with new 85-lb. rail. A certain amount of temporary signaling was necessary because of these changes prior to placing the new plant in service.

The installation consists of two signal bridges, No. 17 and 19, each equipped with six standard three-arm bridge signals, the lower arms of which are suspended; one cantilever bridge, No. 18, supporting one three-arm signal L 50; two single cantilever bracket poles and one double, all fitted with the same type of signals as used on the bridges. Besides the above there are 27 one-arm dwarf signals, 9 standard three-arm, ground signals, 17 single switches, 3 Hayes derails, 4 sets of movable point frogs only and 3 sets of double slip switches with movable point frogs.



**Electro-Pneumatic Machine and Illuminated Track Model**

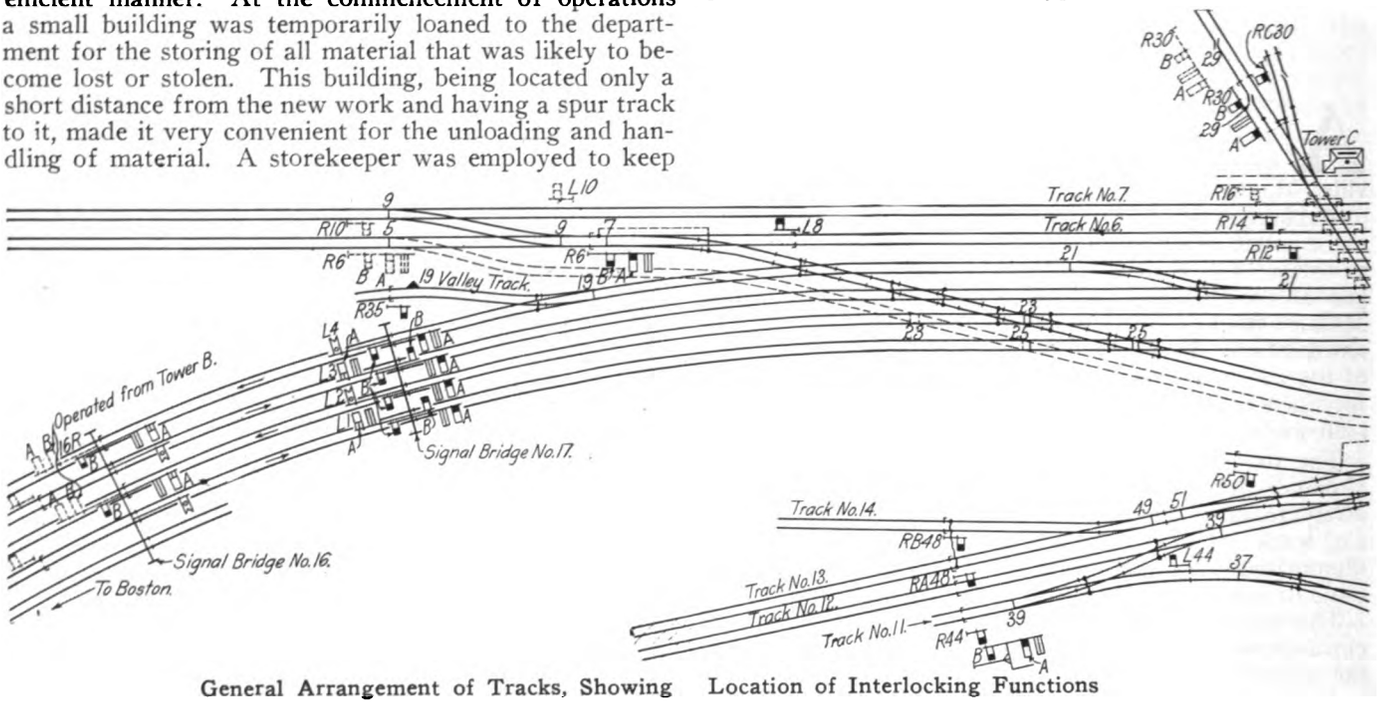
It may be of interest to note that 30 tons of cement was used in the installation of this interlocking for tower, signal foundations, manholes and underground conduits. Three hundred and sixty concrete trunking posts, 6 in. by 8 in. by 4½ in., were formed on the ground. The 3-in. air main is supported along the sides of these posts by



**New Power House and Interlocking Tower**

hook bolts which extend through the post with a check nut on the opposite side. Two hundred and fifty of the 360 concrete posts are set 7 ft. apart in one line south of the tower. This in itself is a feature of the job.

During construction all material was handled in a very efficient manner. At the commencement of operations a small building was temporarily loaned to the department for the storing of all material that was likely to become lost or stolen. This building, being located only a short distance from the new work and having a spur track to it, made it very convenient for the unloading and handling of material. A storekeeper was employed to keep




General Arrangement of Tracks, Showing Location of Interlocking Functions

strict account of all material received and used. He was especially assigned to the installation and by this method a large saving was accomplished, both in material and time of the men.

### Interlocking Buildings

The location of the new tower is approximately seventy feet north of the old one and across the Southern division, Mystic branch track. This location provides practically the same view as the old one. The new arrangement required the erection of two buildings, one for the interlocking machine and the other for the power control apparatus. The type and general design of these buildings are clearly shown in the illustrations. Both are constructed of red brick and reinforced concrete, wood being used only for door and window casings. The ground floor of the tower structure contains the relay room and heating plant which takes care of both the tower and power house. The upper portion of the tower, or second story, consists of a single room for the interlocking machine and director's table.

The power and battery house is adjacent to but not connected with the main building and contains all apparatus used in connection with the supply of energy for the interlocking plant. This building is only a one-story structure divided into two rooms, one for switchboards, rectifier and motor-generator set and the other for storage and primary batteries. In this room a heavy frame of hardwood, bolted together and arranged with three shelves, constitutes the rack for all batteries.

### Power Supply

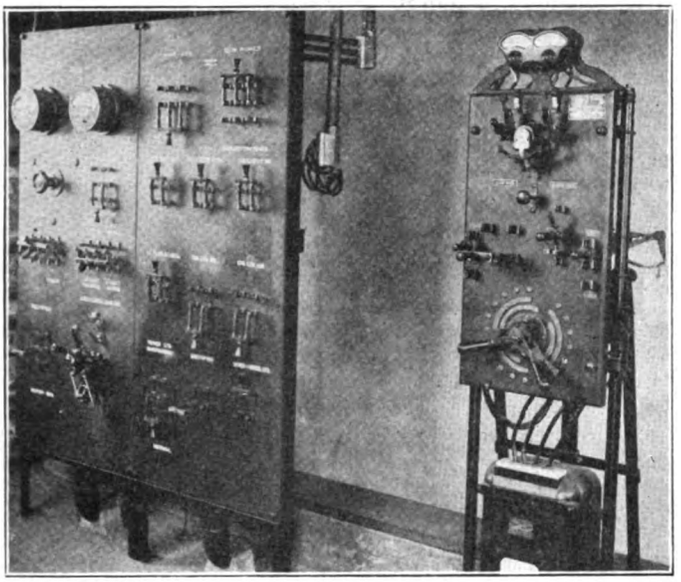
Electrical energy is obtained from two sources; ordinarily the railroad power plant located at the North Terminal passenger station, Boston, Mass., furnishes the power. But in emergency cases energy may be obtained from the Charlestown Gas & Electric Company, Charlestown, Mass. The service in either case is supplied to the interlocking plant at 110 volts, 3 phase, 60 cycles. A General Electric mercury arc rectifier "type M 3," equipped with a 110-volt, 40-ampere tube, is used for storage battery purposes.

The storage battery, which has a capacity of 240 ampere hours, consists of 14 "type E 13" chloride accumulator cells. This battery, which was furnished by the Electric Storage Battery Company, Philadelphia, Pa., is divided into two sets of 7 cells each. The arrangement permits one set on charge or held in reserve, while the other set is in service. As a precaution against any failure of the mercury arc rectifier a ½ k.w. General Electric Company shunt wound motor-generator set may be used to charge the storage batteries.

### Signal Lighting

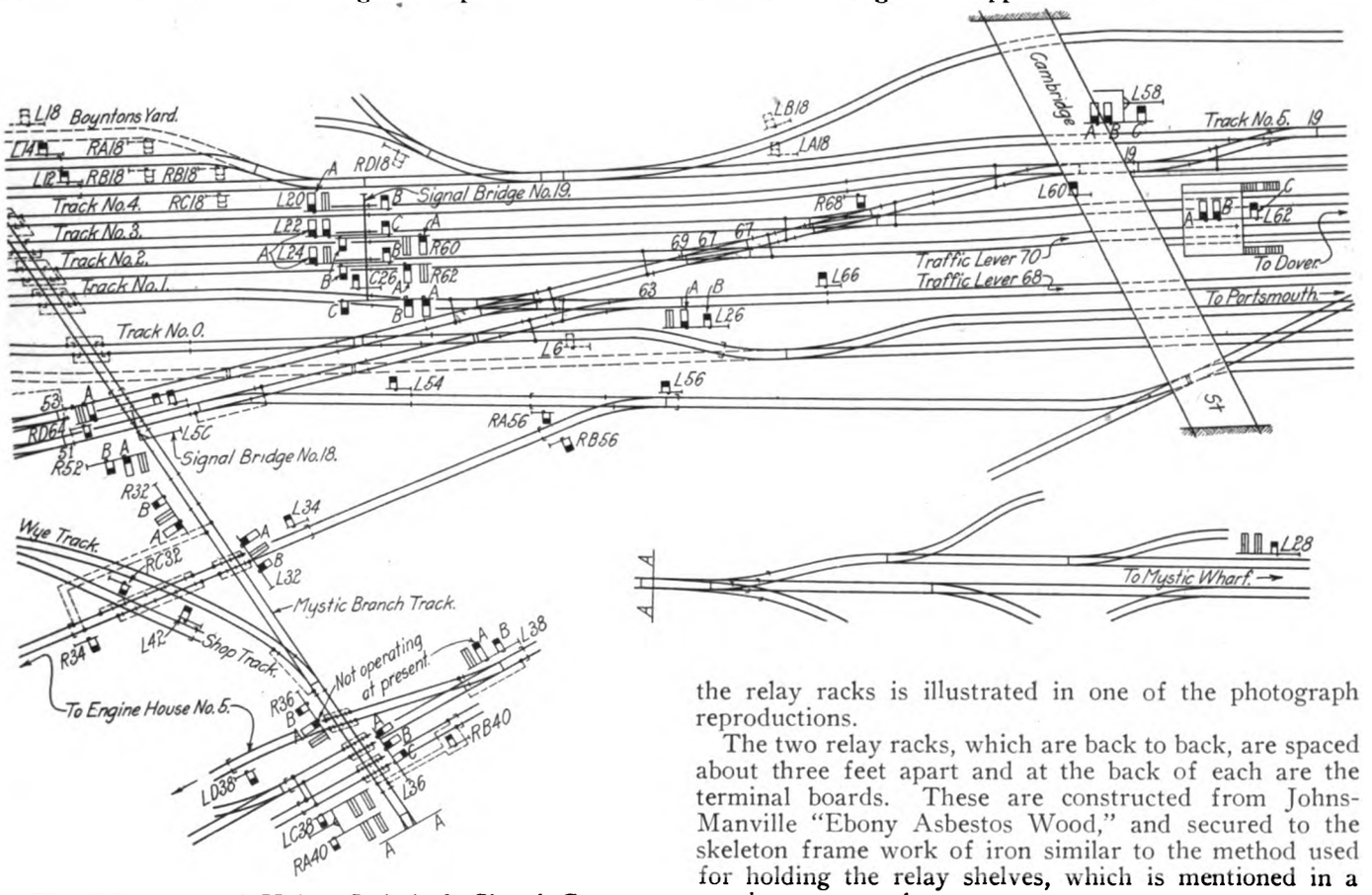
All signals are electrically lighted with Mazda 12-volt 2½-watt lamps. Transformers for this purpose are installed in the combination terminal and transformer cases, of which there are nine throughout the plant, thus allow-

ing one transformer to a location or practically 23 lights to a circuit. A separate pair of No. 9 B & S gage solid copper wires transmit the power at 110 volts for lighting, which is stepped down at each of the transformer loca-



**Power Board and Rectifier Set**

tions to 12 volts. All wires for lighting purposes, that emerge from main trunking, are carried in 1-in. pipe or flexible reinforced conduit. All conduits are painted with several coats of anti-corrosive galvanic paint.




Signal lanterns of Union Switch & Signal Company manufacture are provided with cut-in relays and two lamps to guard against light failures. These relays, which are of low resistance, are mounted on small wooden bases, to each of which is attached two lamp sockets. One of the two lamps is connected in series with the relay coils and when this lamp burns out the other one receives current through back contacts of the relay. These contacts close when the relay becomes deenergized due to a break in the series circuit when the first lamp burns out.

### Interlocking Machine, Terminal Boards and Relay Racks

The interlocking machine is the Union Switch & Signal Company's model 14, electro-pneumatic type, modified to meet the specific requirements of this installation. The machine has 56 working levers and 15 spare levers, a portion of which were provided for use in connection with proposed additions. The levers are arranged so that they can be removed without interference with the other levers. Provision is made for lever light indicators and push buttons for supplementary signal control. All terminals are mounted on boards of approved insulating material. The machine is enclosed in a sheet steel case, which is securely locked, thus preventing unauthorized manipulation of operating parts.

The relay racks and terminal boards are arranged to correspond with the sectionalizing of the plant, which is divided into two parts, the north and south sections. One relay rack contains the north relays, indicators and terminals, while the south relays, etc., are similarly located on the south rack. The shelves for both the north and the south racks are made from Johns-Manville "Transite Asbestos Wood," ¾ in. thick. The outer edge of the shelves rest on a frame work made of 1½-in. by 2-in. angle iron. This arrangement forms a tray, thus reducing the possibility of relays being pushed from the shelves. The general appearance and construction of the relay racks is illustrated in one of the photograph reproductions.

The two relay racks, which are back to back, are spaced about three feet apart and at the back of each are the terminal boards. These are constructed from Johns-Manville "Ebony Asbestos Wood," and secured to the skeleton frame work of iron similar to the method used for holding the relay shelves, which is mentioned in a previous paragraph.

Approximately fourteen hundred standard R. S. A. terminal blocks with tag mounting are used throughout the installation; these are assembled on terminal boards to which all of the cables and wires are carried to make

the necessary local and inter-connections. Outside cables and wires entering the tower pass through a trough under the floor of the relay room into another trough which extends the entire length of the relay racks. This trough is made of hardwood lined with ½-in. asbestos board; extra space is provided for surplus wire and cable in case additonal wiring becomes necessary for any reason in the future.

### Illuminated Track Model, Lever Lights and Relays

An illuminated track model of the spot light type, and lever lights furnishes adequate indication of the occupancy of track and the functions operated. The track model is a reproduction of the entire interlocking layout with each function plainly marked; thus enabling the levermen to manipulate the plant at the maximum speed, especially when quick movements are necessary, such as in freight shifting. Each track section of the model contains a 1¼-watt 12-volt miniature base lamp, except on trap circuit sections, in which case two lamps are used. Alternating current is supplied to these lights from the same type of transformer as is used for signal lighting mentioned in a previous paragraph.

All relays used in connection with this installation are equipped with not less than four front and back contacts and are of the Union Switch & Signal Company manufacture. The relays used for switch indication circuits are d.c. model No. 12 three-position polar type of 1000-ohms resistance. Track relays are model No. 15 two-element two-position vane type, 60-cycle with 110-volt local winding. The relays used for approach and route locking are enclosed disc type d.c. indicators. Where repeaters for track relays are necessary because of an insufficient number of contacts on the track relay the same type of disc indicator is used.

### Signals and Switches

All signals are 60-degree right-hand lower quadrant, electro-pneumatic, with the exception of signal No. L 28, which is operated by primary battery. Its location is on a freight branch about nineteen hundred feet from the tower and the expense of installing a pneumatic line for only a single function was not warranted. The purpose of this signal is to hold long freight trains back of two grade crossings until the interlocking can handle them. All of the high signal masts are equipped with three arms, the lower arm of which is operated as a "calling on" signal.

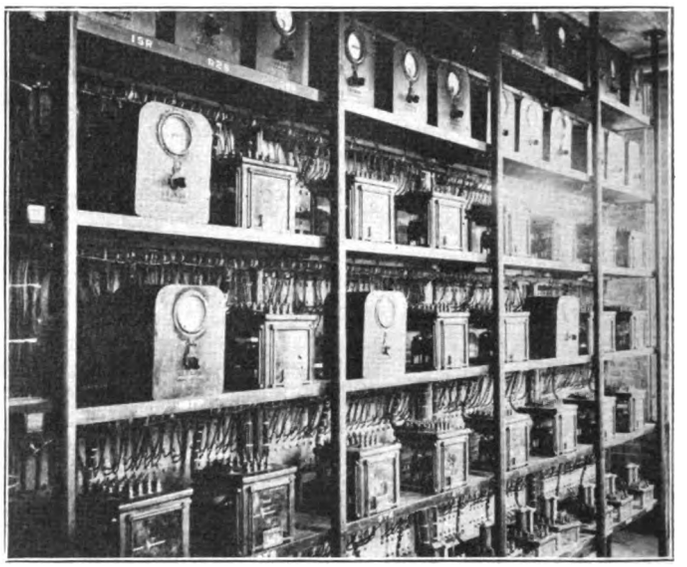
Switch movements are of the Union Switch & Signal Company type and are equipped with style "C" cut-off valve, thereby effecting considerable saving in air. All of the mechanical fittings are of the Boston & Maine standard type such as are used in connection with this kind of switch movement.

### Switch and Signal Indication Circuits

Normal and restricted speed signals are semi-automatic, while the dwarf and slow speed signals are not controlled by the track circuit. The position of each switch is repeated in the signal tower by use of Union Switch & Signal Company model 12 three-position 1000-ohm relays known as the "KR" relay. All selecting of signals is accomplished in the tower through these relays, which are controlled solely by the actual position of the switches. Complete approach, detector and sectional route locking is used. The route locking not only locks the route which may be set up, but gives sectional releasing for all switches. After a route has been lined up it can only be changed by restoring the signal lever to the normal position. If a train has entered the approach locking circuit a two-minute automatic time release must be operated before the lever can be placed normal, unless there is a train still in the track section just beyond the signal. Two traffic levers lock mechanical signal levers at tower "D" in order to provide for movements against traffic on tracks 1 and 2. Track circuits vary in length; only a few extend over 700 ft. These are track circuits 1T, 2T, 3T and 4T, which are about 2400 ft. long. The transformers located at signal bridge No. 16 feeding these track circuits are of a larger capacity than the ones used on all other track circuits and the secondary winding has 15, 12, 10, 7, 5 and 3 volt taps.

### Wiring

Rubber-covered wire, R. S. A. specifications, is used. Separate No. 14 conductors are used in each case from the nearest ground terminal case to signals. For the switches 5-conductor cables, with No. 16 solid wire B & S gage, are installed from the interlocking tower terminal boards direct to the switches, and in the case of crossovers 7 conductor cables are used between the ends of crossovers. No. 9 solid B & S wire is used for all track leads and for all mains and commons, except the No. 6 main, which furnishes energy to the track transformers on signal bridge No. 16. Relay leads from the outside ground terminal cases to the tower terminal boards for track relays in the tower are 5 and 7 conductor cables of No. 16 wire, except on the four 2400-ft. track sections,



**Relay Rack in Lower Portion of Tower**

for which 4-conductor No. 14 wire cables are used. All tower wiring is No. 16 B & S gage. All wires in cases and terminal locations are connected to standard R. S. A. terminal blocks, half hitched with waxed twine. Special care was exercised in this wire work not only to make a neater appearance, but also to reduce the pulling of wires for inspection. Ferrin spotted cables and Okonite wires are used throughout the entire installation.

### Trunking and Wire Protection

Black or red cypress trunking, Greenfield flexible steel conduit, Byers' galvanized conduit and Orangeburg fibre conduit furnish protection for the wires and cables. The cypress trunking is used for all main line leads, the flexible Greenfield for switch movements, the Byers conduit for signal lighting wires, etc., and the Orangeburg fibre, laid in concrete is used for all underground main leads across tracks with a concrete manhole at each end. The main line trunking was built on the ground in three sizes designed especially to suit the conditions. For small cross track leads or offshoots B & M standard sizes of trunking are in use.