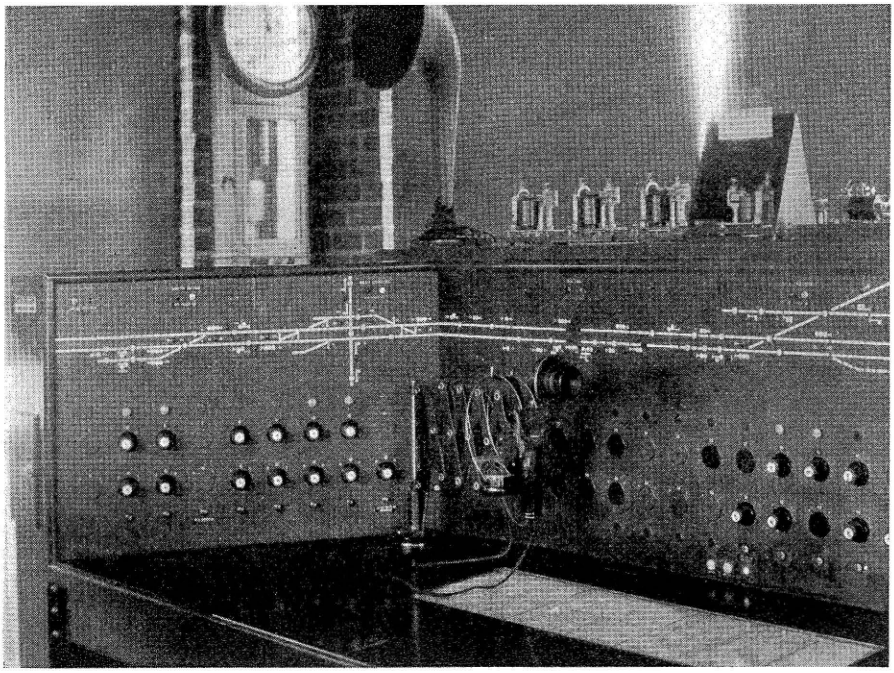


A new section was added to the left of the control machine at Waltham

New Signaling on the *Boston & Maine*

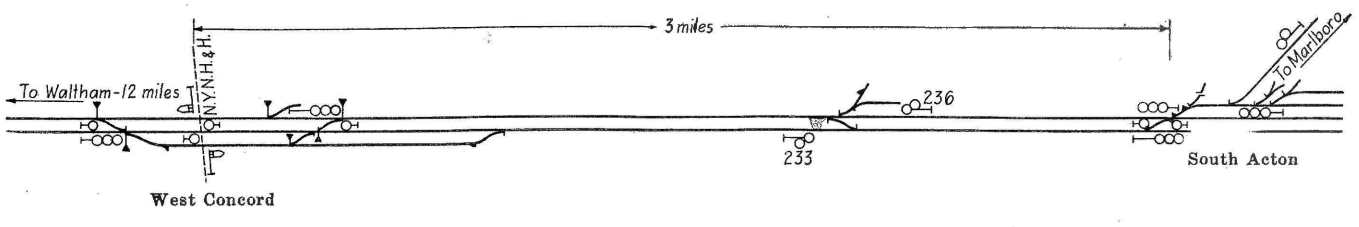
C.T.C. installation at Waltham, Mass., extended 12 miles west to include control of two layouts formerly requiring mechanical interlockings— Old automatics replaced on 53.2 miles of line

CODED-TYPE centralized traffic control apparatus has been installed, by the Boston & Maine, to control what was formerly two mechanical interlockings. In this new arrangement, the switches and signals in these two outlying interlockings are controlled from a new panel added to an existing C.T.C. machine at Waltham, which is 9.9 miles west of Boston. In the first interlocking layout in this project, at West Concord, 12 miles west of Waltham, a single-track line of the New Haven crosses the B. & M. The 32-lever mechanical interlocking at this crossing was replaced by new power-interlocked signals, which are controlled from Waltham. The hand-throw switches for three crossovers and two turnouts on the B. & M. in this layout, which were formerly equipped with bolt-locks operated from the mechanical machine, are now equipped with electric locks controlled from Waltham. New search-light-type signals were installed on the B. & M. at this plant, power semaphore signals being used on the New Haven.

Outlying Junction Control

At South Acton, 15.2 miles west of Waltham and 3.2 miles west of West Concord, a single-track line branches off of the main B. & M. route and extends to Marlboro. A mechanical interlocking at this junction had been out of service for some time, the switches being hand thrown. The track layout at this point includes a main-line crossover and a junction switch, as well as the signals as shown on the plan. In view of the fact that the junction is used by about 10 branch-line trains daily, the delay to these trains, as well as to main-line trains, when branch-line trains were in the vicinity, made it desirable to have the junction layout interlocked and, therefore, power switches and signals were installed, and are controlled from the C.T.C. machine at Waltham.

The territory from Waltham westward through West Concord and South Acton is double track, using right-hand running. Train orders are in effect on this territory. Therefore, the new power layouts at West Concord and South Acton are properly designated as remote control rather than C.T.C., although these improved power layouts, controlled by code equipment, are in fact controlled from the C.T.C. type machine at Waltham, which is used also to control two remote-control interlockings on the 8.6-mile multiple-track territory from



Typical three-aspect automatic block signal with grade marker

Waltham east to Tower-H, Somerville, as explained in an article in the July issue of *Railway Signaling* for 1933.

The Control Machine at Waltham

At the time the C.T.C. machine was installed at Waltham in 1932, a blank section was inserted to provide spare space for a future panel to control the layouts at West Concord and South Acton. This panel is 26 in. long and 18 in. high, and is set at an angle with the older section so that the operator can reach all of the levers without leaving his chair. The additional panel, as shown at the left in the illustration, consists of the illuminated track plan at the top, below which are the six signal levers and the seven switch levers. The levers are of the rotating type, the signal levers, operating to the left or right, being normally on center, while the switch levers operate to two positions. The signal indications are repeated by lamps representing the signals on the track diagram, and the switch indications are shown on the face of the switch levers. Separate sets of "power-off" or "power-on" indication lamps are included at the top of the panel to show whether a-c. power is feeding locally at West Concord and at South Acton. In addition to the lamp indications, a bell rings when power is cut off at either of the outlying remotely controlled interlockings.

The control of the functions in the field is effected by the code system, using the General Railway Signal Company four-wire system, in which control codes can be sent out at the same time that indication codes are being returned to the office. These control wires are included as two twisted pairs with an additional twisted pair as spare in the aerial line cable, which handles all signal and interlocking line control circuits in this territory.

Automatic Signaling Modernized

The territory from Waltham westward through West Concord, South Acton and on westward to East Fitchburg, 36.7 miles, was formerly equipped with two-arm, two-position, lower-quadrant, d-c. semaphore automatic block signaling, installed in 1907. These signals were not properly spaced nor did they afford adequate aspects for modern train operating conditions on this high-speed heavy-traffic division. The traffic on this territory, under present conditions, includes 40 passenger and about 35 freight trains daily. Therefore, as a part of the signal improvement program, the old semaphore signaling was entirely replaced by modern searchlight-type signals, spaced properly and providing multiple aspects as needed to handle trains safely and efficiently under modern operating requirements.

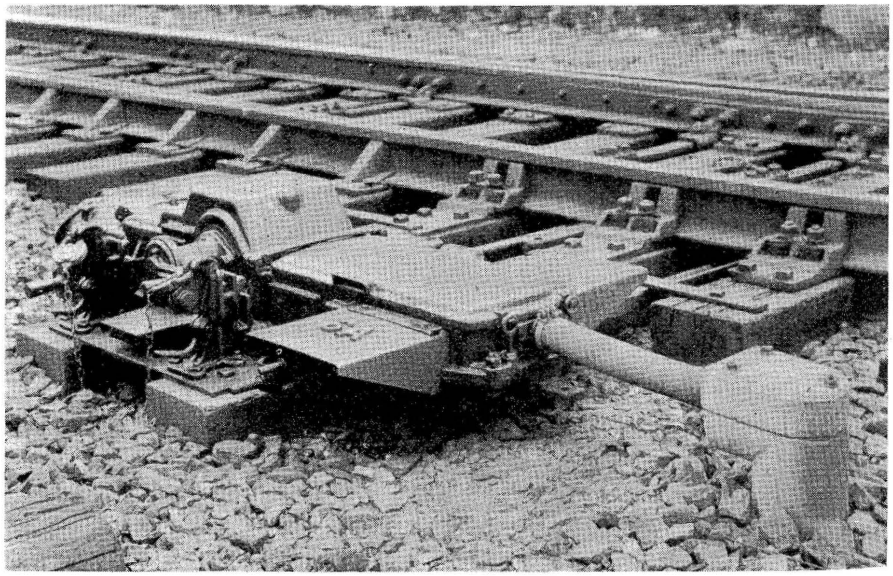
The old semaphores were spaced to provide blocks from 4,000 to 5,000 ft. long. As the train operation in this territory involves mostly high-speed through movements, using double-track right-hand running, the new automatic signals in open territory are spaced for blocks about 6,000 to 7,500 ft. long on ascending grades, and 8,000 to 9,000 ft. on descending grades using three-aspect signaling. At interlockings, as well as for the blocks approaching interlockings, multiple aspects, as explained in an article in the July issue of *Railway Signaling,* are used as required. Grade markers are used on some of the automatic signals which authorize trains to pass such signals, when indicating red, at restricted speed without stopping.

On account of the fact that the locations were so thoroughly rearranged and the old apparatus discarded, the improvement represented practically the same as an entirely new signaling system, the bonding of the track joints being the only part of the old system that was incorporated in the new; even the old line wires were replaced by aerial line cables.

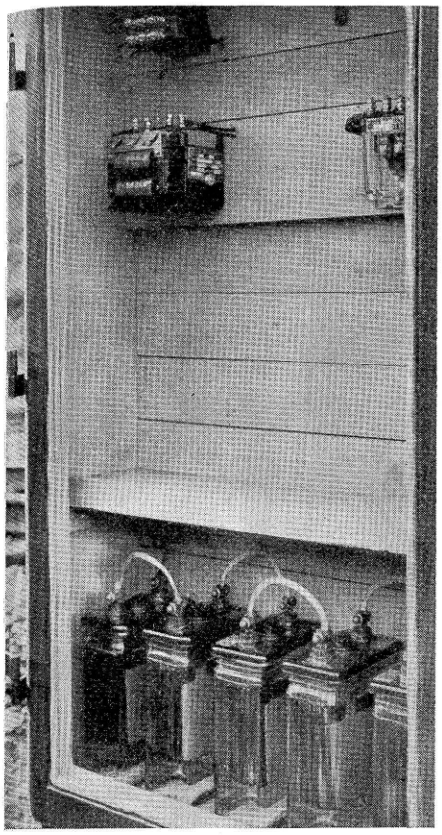
On a second section of 16.5 miles of double track on the same line, from Tyter, Mass., to Montague, a similar replacement of old semaphore automatic block signals with modern color-light signals was carried out as a part of this general signal program. This territory is located from 35 to 52 miles west of Fitchburg.

Construction Methods and Equipment Used

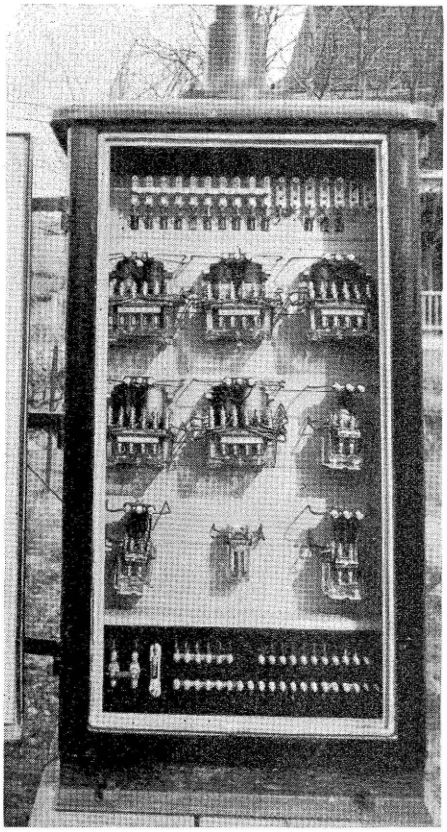
The installation of the remote control at West Concord and South Acton, as well as the new automatic signaling from Waltham to East Fitchburg, was a part of an extensive signaling program involving 19 projects, the construction of which was explained in detail in an article in the August issue. However, the equipment used on the installations referred to above will be explained in the following discussion.



Switch layout showing method of extending wires to the machine



Field side of instrument case



Track side of instrument case

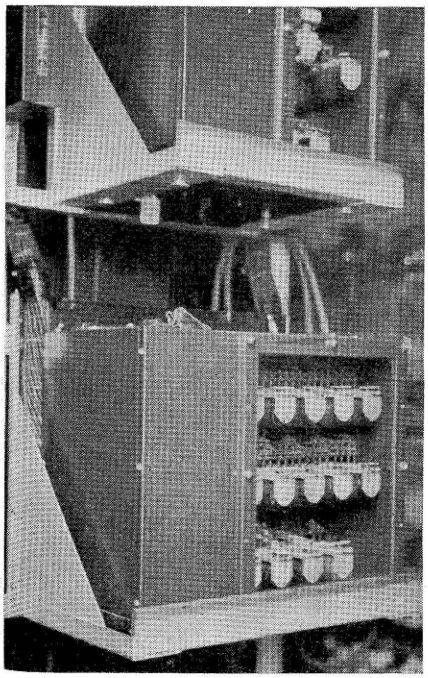
At West Concord and at South Acton, the old mechanical interlockings were dismantled completely, the towers being removed. At each of these locations large-size welded sheet-metal houses were provided to house the battery, relays and other instruments. These houses are set on a foundation consisting of a wall of concrete 1½-ft. thick and 4-ft. deep, across each end, with three old rail sections extending lengthwise of the house as supports for the entire floor area. The wall-type instruments are mounted on sheets of ⅝-in. transite asbestos, which are bolted to angle-iron uprights set so as to leave about 4½-in. wire space behind the board. The wall-type, spring-mounted, instruments are attached to a section of transite board 11-in. wide, extending the length of the panel horizontally, leaving an opening below 6-in. wide, which is covered with transite board after all of the wiring is in place.

Terminal Board

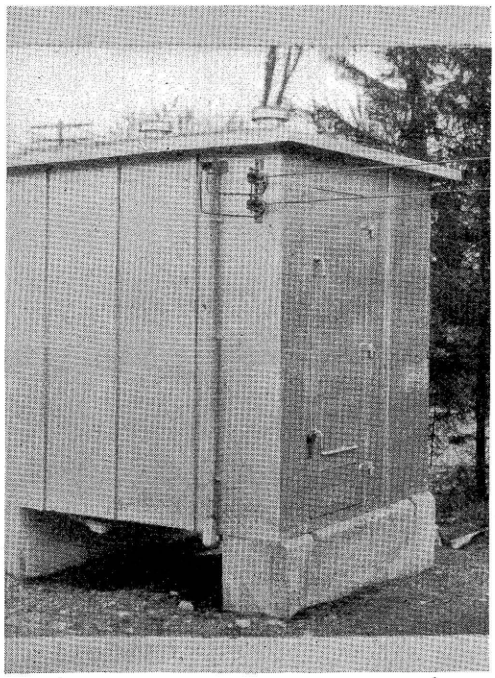
The wires of all the incoming cables are terminated on a standard terminal board located on the rear wall of the house. Each section of this terminal panel is made of ½-in. ebony-asbestos wood material 8 in. wide and 2 ft. 9 in. long, set vertically. The board was furnished drilled for two rows of ¼-in. holes in which A.A.R. 107,010 terminal posts are set as needed. A ¼-in. hole on each side of each terminal is drilled so as to bring in the wires to the post. Tags are slipped over the wire and glued flat against the face of the board. The lightning arresters are also assembled on this board, Turret-type arresters being used for all circuits excepting the code control line on which General Electric No. 9LA4A2 arresters are used.

The conductors, from these terminals and arresters to the various instruments, are No. 14 flexible insulated wires, which are run around behind the boards and out through individual holes to the terminals on the instruments. With this arrangement, the wiring is all enclosed, but at the same time is readily accessible by removing the sections of panels. No lacing or tying is used. Therefore, the wires can be readily traced out in case of trouble, or changes can be made without spoiling appearances.

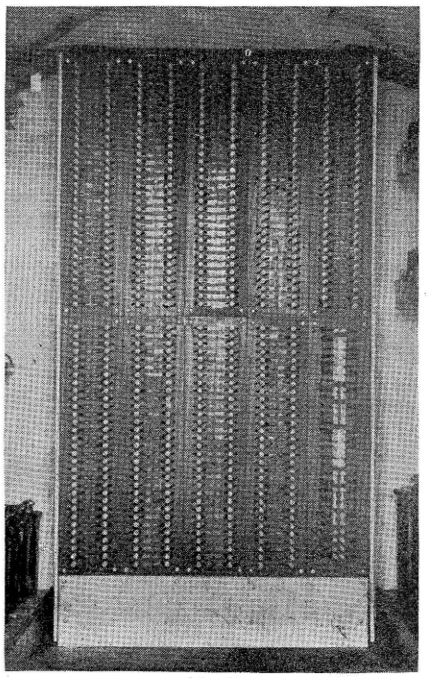
The code-control field instruments are mounted on shelves as shown in the illustration, plenty of space being



Coding equipment at a field station



Sheet-metal house at field location

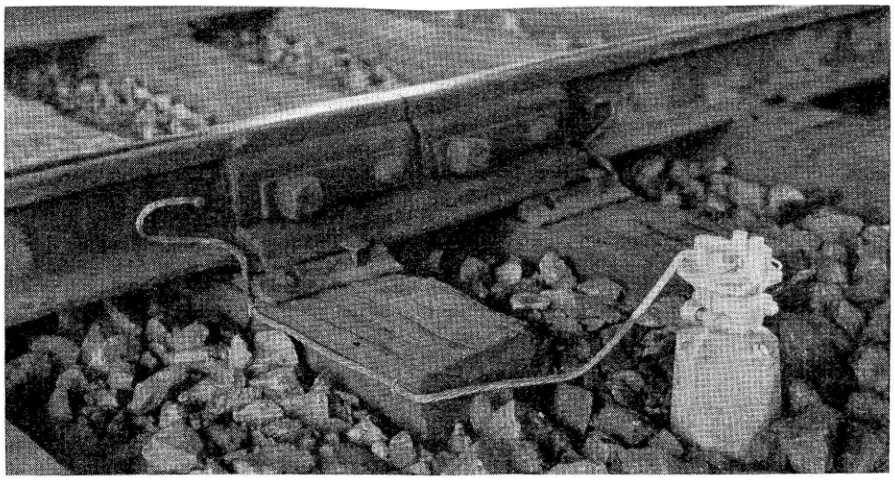


Terminal board in instrument house

allowed for inspection and changes. The storage battery is arranged in rows on the bottom shelves. A ribbed rubber mat is furnished for the floor.

attached to the switch machine so as to permit no lost motion between the position of the rail and the machine.

The parkway cable going to a flange connection on the switch machine. When the wires are all in place, the concrete cap is placed on the riser. This arrangement allows flex-



Stranded cable extends from the boot-leg outlet to the rail

A set of 16 Exide DMGO-5 lead storage cells is provided at South Acton for the operation of the switch machines. These batteries are on floating charge.

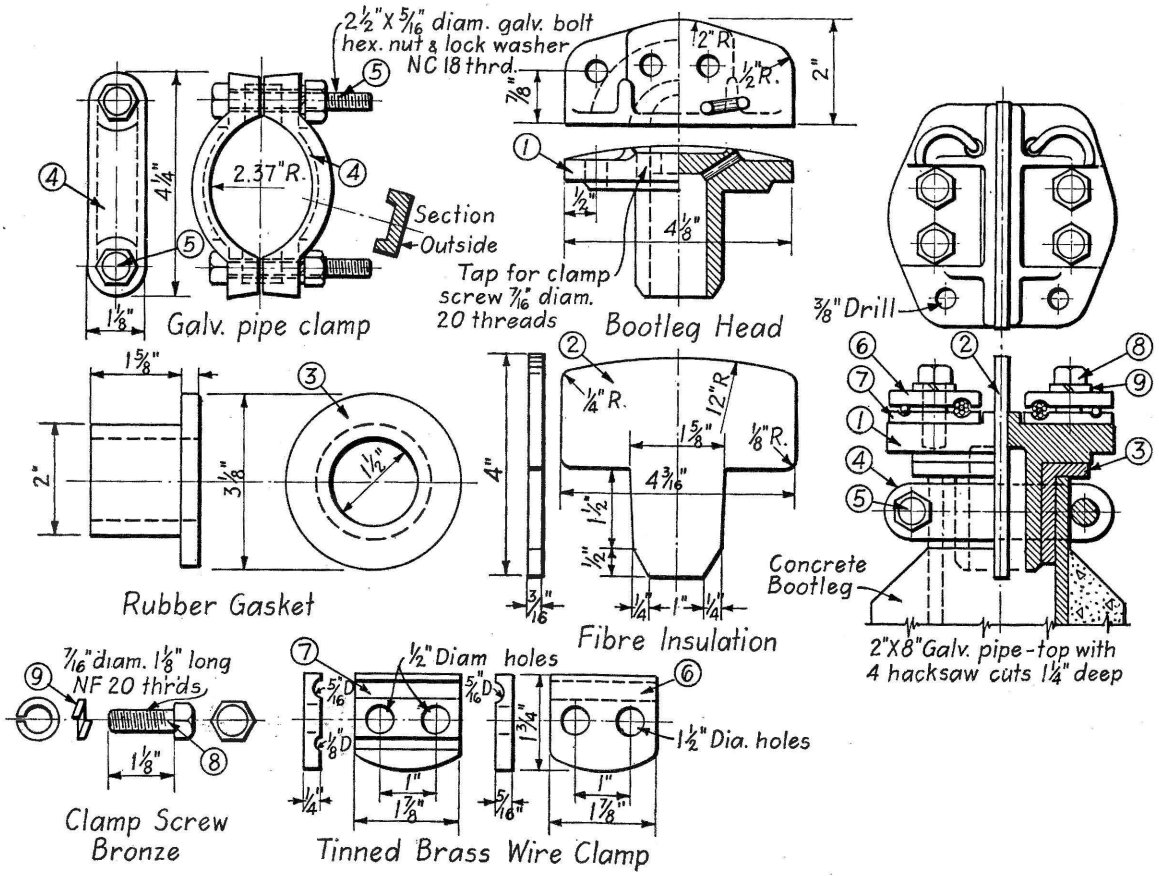
The switch machines are the Model-5D, with selectors, and are equipped for operation on 32 volts direct current. Tie plates 1-in. thick and 7-in. wide, together with adjustable rail braces, are used on three ties including the one ahead of the points. On two ties the plates extend and are

switch machine is brought up through a concrete riser, as shown in one of the illustrations. The outer protective coverings are removed on a section sufficient to allow the single conductors to extend into the machine. The ends of the outer coverings are then tied and taped and painted with insulating compound. The riser is then filled with sand. The single conductors are run through a 17-in. section of 2⅜-in. reinforced rubber conduit which extends from the riser to a

ibility to compensate for the vibration of the switch machine.

The signals are of the SA searchlight type equipped for operation on 10-volts d-c. In the three-aspect two-block territory, one signal unit is used on each mast, but for signals approaching interlocking or for interlocking home signals the necessary number of units is used to provide the aspects required, as explained in an article in the July issue.

Each signal unit is equipped with



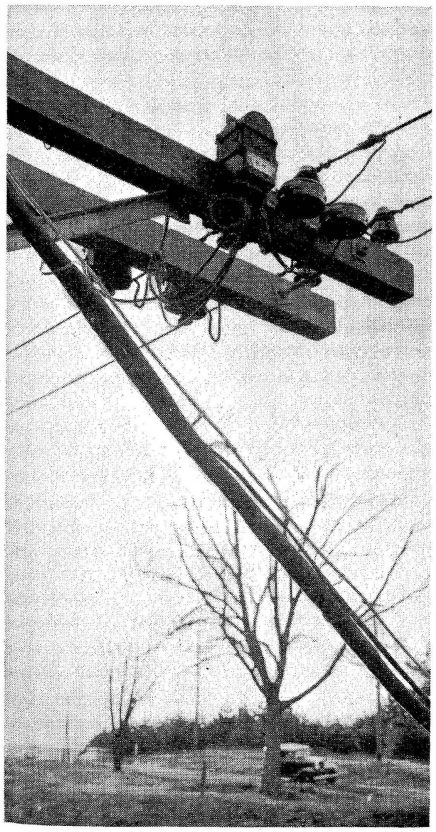
Detail construction of boot-leg head

an 11-volt, 11-watt single-filament lamp, which is normally fed from the a-c. service, the voltage being adjusted to about 10-volts at the lamp. The automatic signals, as well as the interlocking signals, are controlled for approach lighting, except that dwarf interlocking signals, having no track circuit in the rear, are continuously lighted.

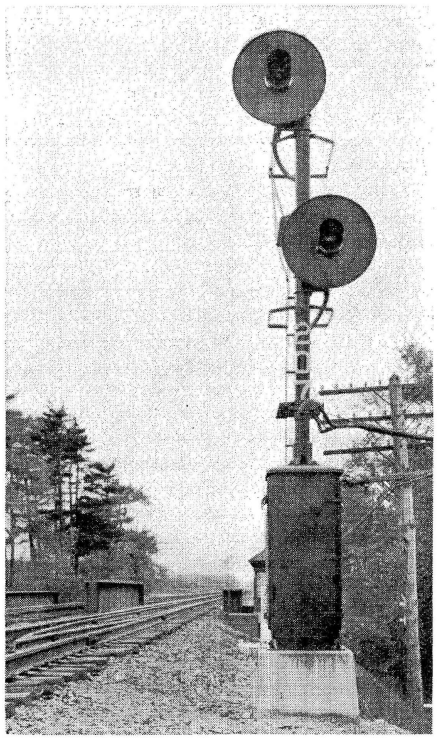
At each signal location a large sheet-metal case, with a door on the track and one on the field side, is provided to house the battery and the instruments. Each of these cases has a partition dividing the case into two compartments, the one on the track side being used for relays, while the one on the field side is used for transformers, rectifiers and storage battery. The terminals and arresters for underground cables are located at the bottom of the partition, while the terminals for line cables are at the top. Jumper wires from these terminals run in back of the board, up and out through individual holes to the instruments.

Ordinarily at a signal location, a set of five KXHS-7 lead storage cells is provided for the signal operation and for line circuits. One cell of the same type is used to feed each track circuit. Type-K rectifiers of various ratings are used to charge these batteries.

The track connection wiring is in underground parkway cable which has



Line transformer and protective devices mounted on crossarm



Two-unit multiple-aspect signal in approach to interlocking home signal

outer covering of a non-metallic combination. A two-conductor No. 9 solid-wire cable extends from the instrument case out to a concrete riser set opposite each insulated rail joint. Each of these risers, as shown in the detail plan, has a section of 2 in. pipe 8 in. long set in the top of the foundation so that about 1¼ in. extends above the top of the foundation. A bootleg head is clamped to the section of pipe extending out of the top of the foundation. The details of the construction of this bootleg head are shown in one of the illustrations; in brief, the feature of this device is that it consists of two separate terminals, insulated from each other and from the pipe. Each of the two cable wires extends to one half of the bootleg head and a 5/16-in. stranded galvanized iron bond 4 ft. 2 in. long is clamped to the head and extends to a ⅜-in. plug driven into the rail. As shown in one of the illustrations, the bootleg outlet is set beyond the ends of the ties and the cable from the head is run across the end and along the edge of each tie, being held in place by Copperweld staples. The parkway bootlegs for both rails of a track are located on the field side, and at the location of the insulated joint on the far rail, stranded connections 10 ft. 4 in. long are used, being stapled to the side of each tie 1 in. below the top edge.

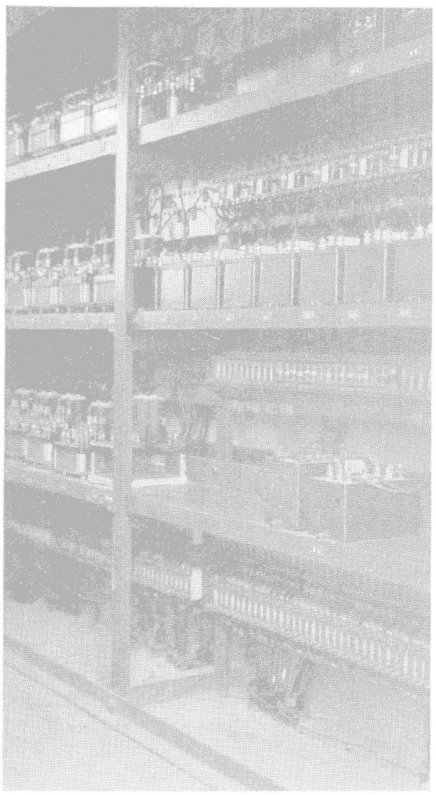
These installations were planned and constructed by signal forces of the Boston & Maine, the signal equipment being furnished by the General Railway Signal Company.

Santa Fe Automatic Interlocking

(Continued from page 474)

to which they connect and are tagged with fibre tags. Each hole is similarly tagged.

The signals on this installation are the Union Switch & Signal Company's searchlight type, and this company also furnished the relays. The power-off relays are of the ANL type. Neutral track and line relays are the DN-11 type, while the polars are the DP-14, and the time relays the DT-10 type. Fansteel electrolytic



Interior of instrument house

rectifiers and transformers are used for charging the storage batteries, the lighting transformers being the Union type W-10.

The spring-switch mechanisms are the Pettibone-Mulliken Company's mechanical-switchman type. Each spring-switch layout is equipped with two switch circuit controllers, one connected to the point, and the other to the throw rod. The circuit for the KR relay is selected through both of these controllers, thus insuring that the points are in proper position and that they correspond in position with that of the switch stand.

The cost of power for the North Junction layout is averaging about $8 monthly and for the South Junction $7 monthly. The maintenance charges are nominal, amounting to approximately the same as for a new automatic installation of the same size.