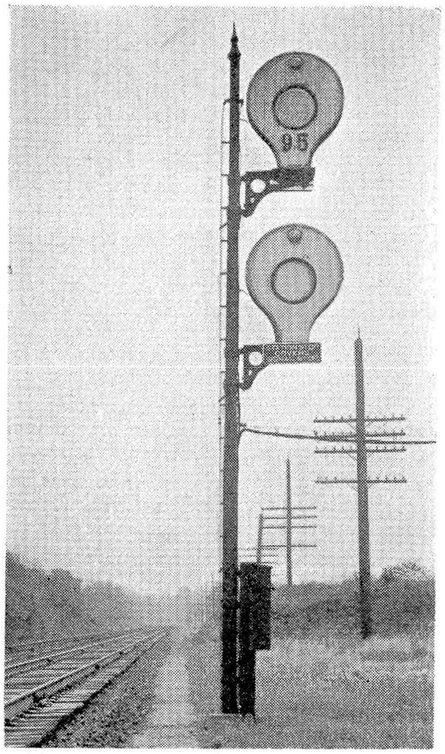


An enclosed disk automatic signal

Light-Type Signals

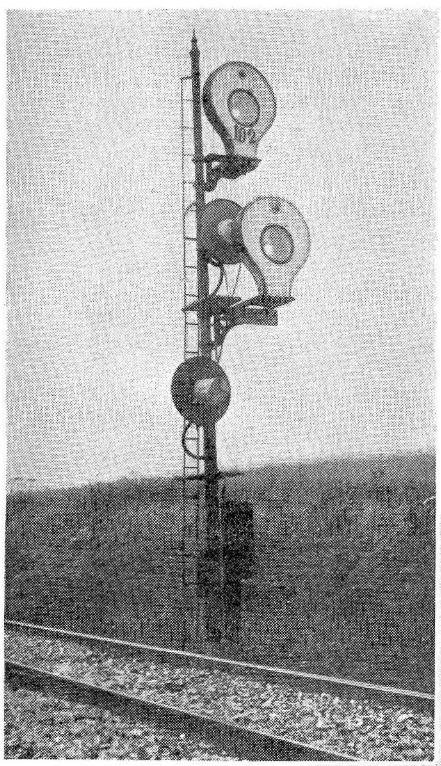
On the Reading, the replacement of enclosed-disk type home and distant signals with modern color-light type, including respacing of signals to provide a liberal margin of safety in stopping distances between signals, together with the installation of "SS" protection and substitution of light signals for wire-pulled semaphores at interlockings, as a part of an extensive modernization program started in 1941, has introduced a number of interesting features. The territory involved includes the two and four main track branch connecting with the Baltimore & Ohio at Park Junction and extending to Wayne Junction, where connection is made to the Reading's New York Branch, and the territory between Woodlane in the Philadelphia area and Reading, Pa., on what is known as the Main Line.

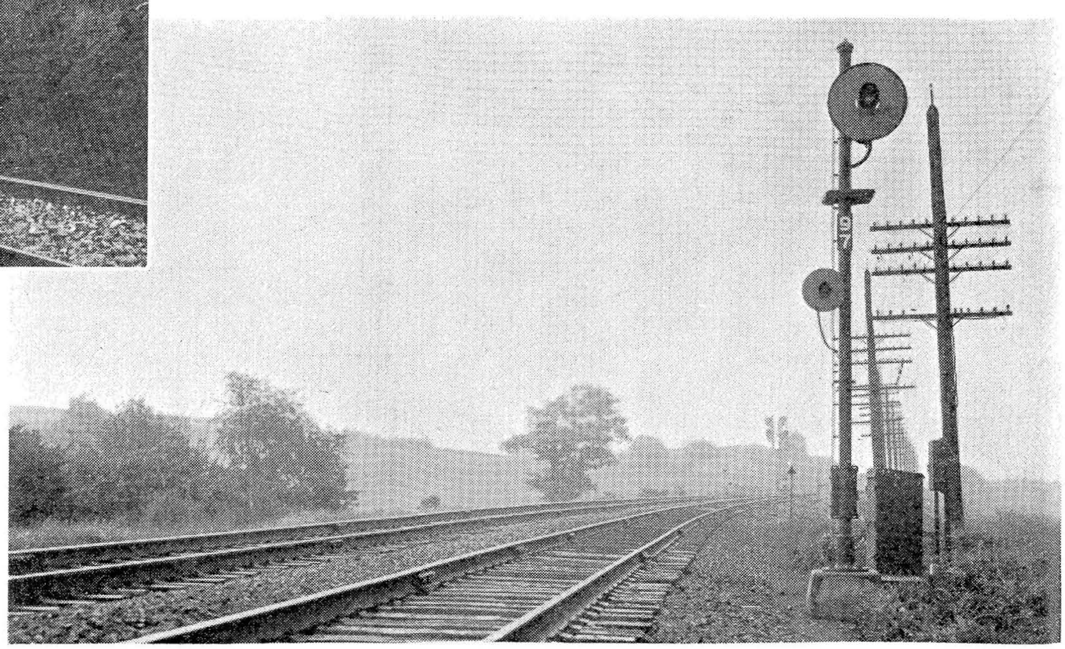
The enclosed-disk home and distant signals, originally furnished by the Hall Switch & Signal Company, were installed around 1900, and, at interlockings, wire-pulled or pipe-connected semaphore route arms, together with home and disk automatic signals located on the same mast, made up an early form of semi-automatic home signal. Practically all of the semaphore and enclosed-disk signals were oil lighted. Except where new signaling in the form of extensions to existing signaling and additional interlockings were installed, using power-operated semaphore or light-type signals, the original enclosed-disk type of signal remained in service until the replacement herein described.

Changes in Masts

Where no change was to be made in the location of signals, old masts were continued in service by temporarily moving the lower Hall head to an extended platform and installing the new light units on the existing masts. An accompanying picture of automatic signal 102, during the construction period, illustrates how the light units were installed at a lower elevation than the original enclosed-disk signals. The Reading Company standard is to place the automatic signal unit with the red lens 17 ft. above the top of the rail and the marker, or the lower signal unit, 10 ft. above the rail.

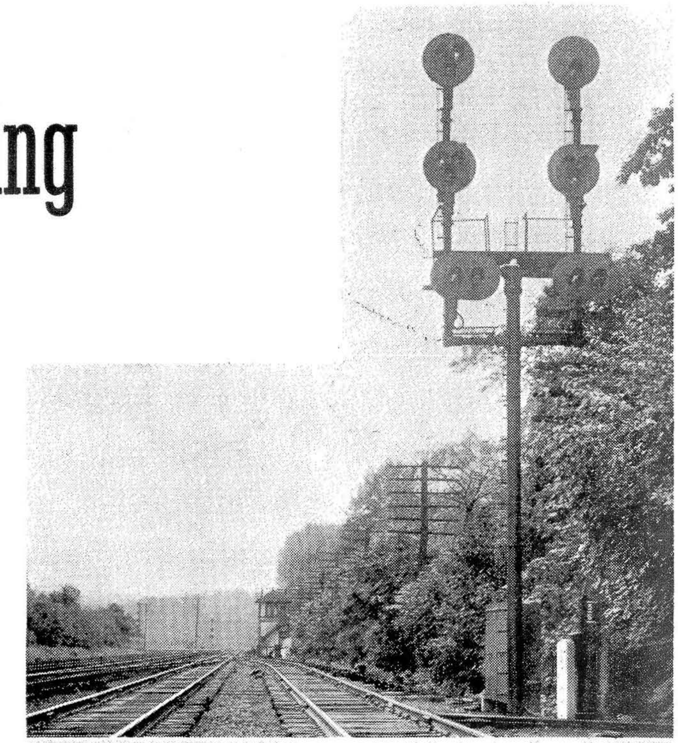
Where respacing of signals required an installation at a new location, the mast, which had been originally set in concrete foundation poured in the field, was cut off at the top of foundation with a burning torch. Then this old mast was re-





Above — Lower disk unit on a special platform while the light signals are being installed
Right—An automatic block using search-signal and marker

Installed on the Reading



Extensive program of replacing disk and semaphore signals with search-light signals includes numerous features such as plastic weatherproof insulation on the new signal line wires

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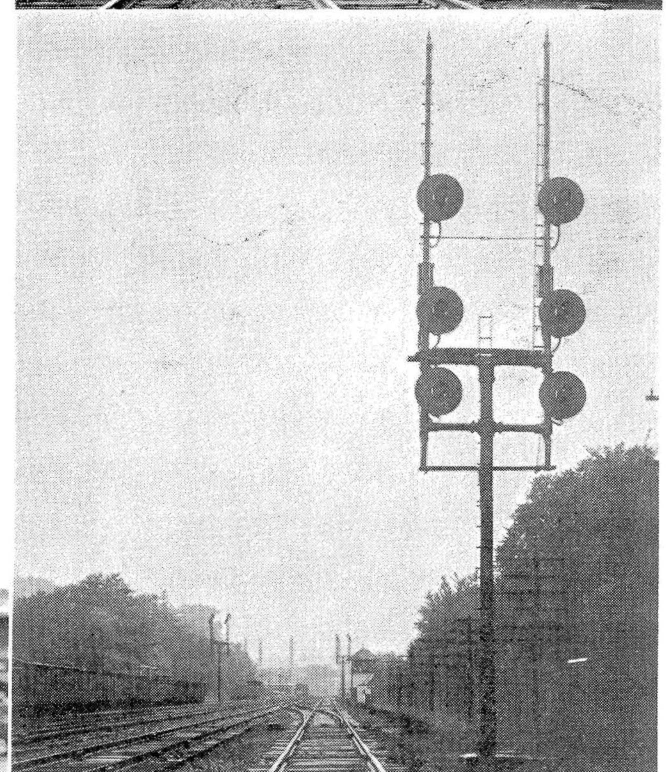
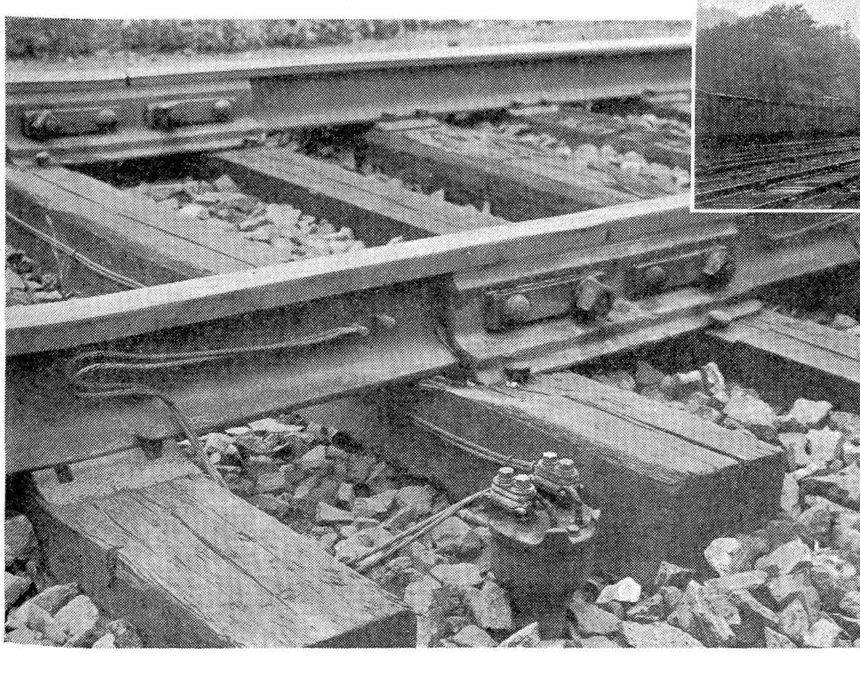
used in a new A.A.R. base casting. After the same manner, bracket poles were retained in service or relocated by applying new bases. Tops of dolls were cut off due to the lower over-all height required by light-type signals. Automatic signal 97, after new light units had been placed in service, is shown in one of the illustrations.

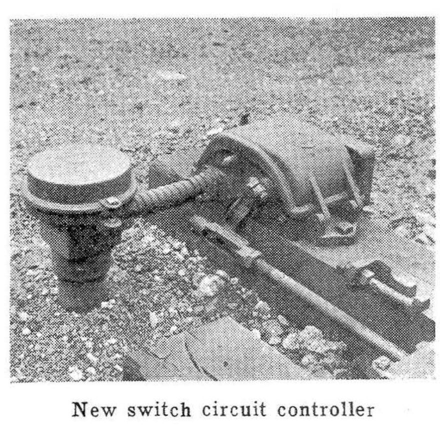
Track Connections and Switch Circuit Controllers

Connections to rails were made by installing two-way boot-legs on the side of track adjacent to relay housing, and then installing long track

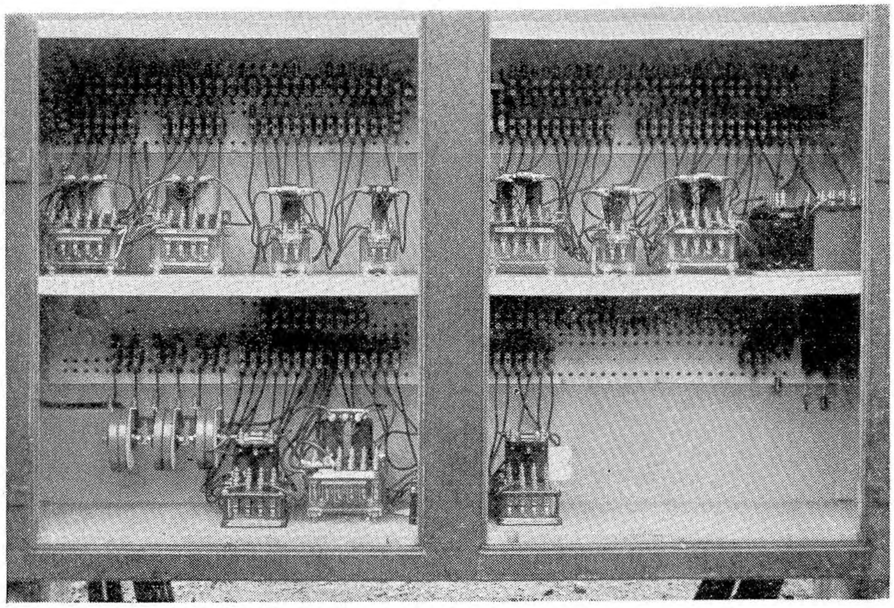


Upper view — Color-light home signals Right — A view made before high masts for old semaphores were taken down Below—Double boot-leg with connection to far rail attached to side of tie

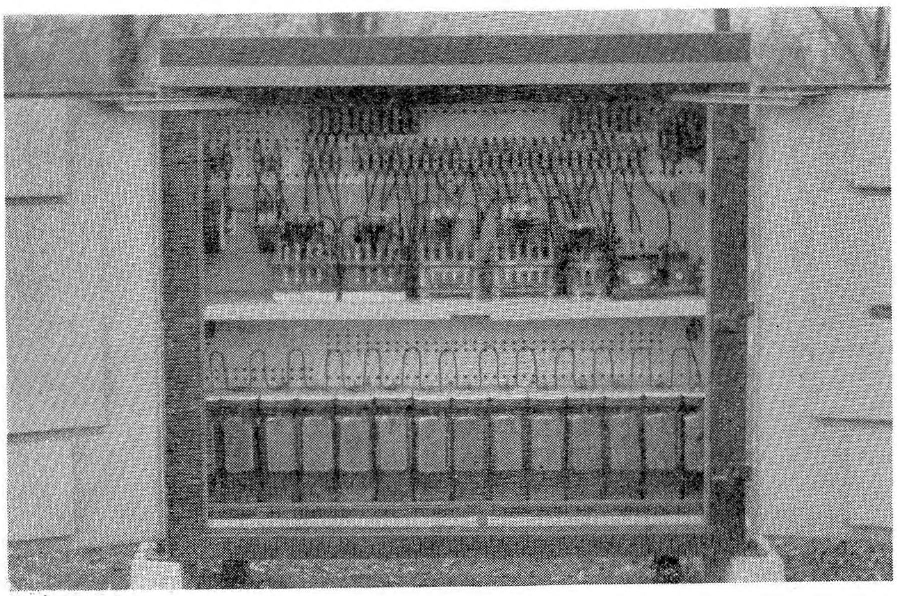


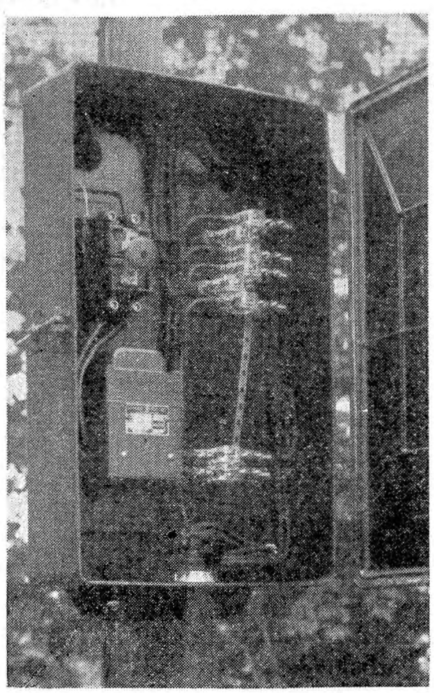


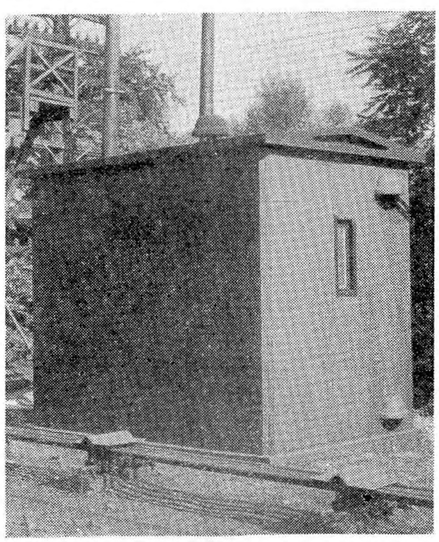
New switch circuit controller



Above—Discharge resistors connected across rails
Below — Typical case in a-c. primary territory







Left—Line terminal box. Above — Sectional concrete house

circuit connectors stapled to the side of tie and extending to the far rail.

Each turnout switch and derail, connecting to main track in automatic territory, is equipped with a new switch circuit controller with a self-centering device which will cause the controller arm to move to the center position in the event of a break in the operating rod or connection to the switch point. The controller end of the operating rod is fitted with a ball-and-socket spring connection which automatically compensates for wear, a gooseneck connection being employed to connect the other end of operating rod to the switch point lug. Underground cables to circuit controllers are terminated in a riser-box from which individual wires extend to the controller through the flexible steel conduit.

Instrument Cases

Sheet-metal instrument cases at automatic signals and interlockings are the Reading standard design and are mounted on pre-cast foundation pedestals. These pedestals, which are 3 ft. by 26 in. by 5 in. top, and 8 in. at the base, are installed with approximately 1 ft. of the pedestal extending above the level of the ground and are tied together mechanically by a pre-cast concrete strut located just below the ground level. The relays are set on shock-absorber bases. The Thyrite discharge resistors, shown on the extreme left of lower shelf, are bridged across rails at each end of all track circuits and are used in lieu of arresters. The mid point of each Thyrite resistor is tied in with ground network, including a driven earth ground which is connected to special lug on the side of the metal relay housing. One of the illustrations shows a typical relay case at an automatic signal in a-c. primary territory where the control circuits are energized from rectifiers connecting to a 60-cycle, a-c. power supply, and the signals are approach lighted from this same supply, the primary battery acting as a reserve.

Power Supply

Prior to the installation of light-type signals, the disk signals were energized from a 66-volt d-c. discharge line, which connected to storage cells located at various points along line, each bank of cells operating approximately 10 miles of double, three and four-track signaling. In the interest of conserving line wire, new signals were operated on the local storage or primary battery until the d-c. storage line circuit could be converted to 440-volt, 60-cycle a-c. distribution line. A typical line terminal box houses a plug-type 440-volt switch, a 440 to 110-volt dry-type transformer and low-voltage arresters across the 110-volt bus.

Lightning protection for the 440-volt distribution line is provided by the installation of Pellet-type arresters, mounted on the crossarms. The ground connection to these arresters is tied in to the metal transformer housing, low-voltage arresters within this housing, and to the steel messenger used to support the line drops from open aerial line wires to the relay housing. By tying all grounded apparatus and earth grounds together at a given location, the lightning potentials are equalized. In addition to the lightning protection previously referred to, all low-voltage line-controlled circuits are protected by arresters located in terminal and instrument cases, and the lighting circuits by a special rare-gas type arrester connected across the lighting bus.

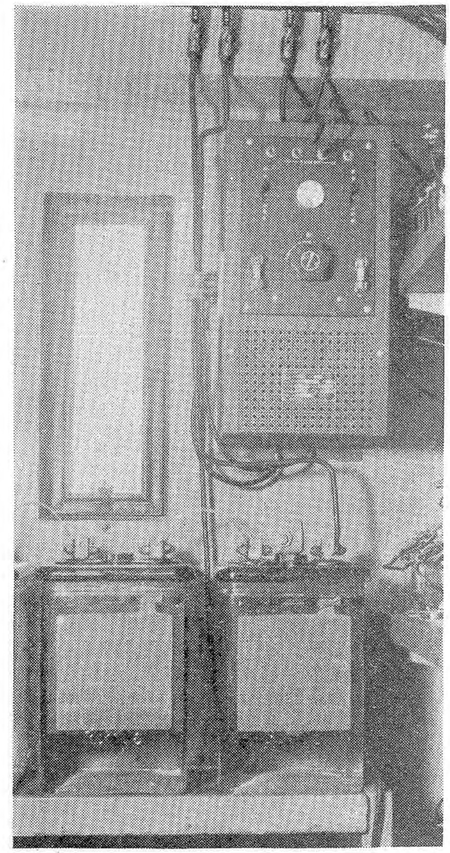
Plastic Weatherproof Insulation

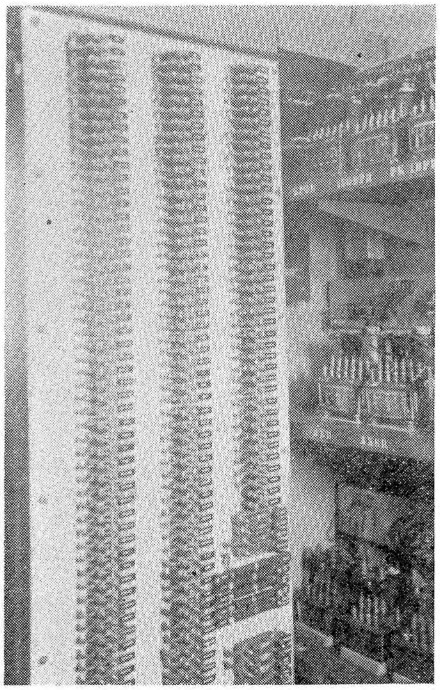
The low-voltage signal line control circuits on a large portion of the territory are on conventional weatherproof No. 10 and No. 12 hard-drawn copper line wires. Where this old line wire was in poor condition, it was replaced in 1941 with No. 10 Copperweld steel, 40 per cent conductivity wire, processed with Formex. The use of Formex as a protection and insulation on low-voltage aerial signal control wires is entirely new. Previous to this installation, the use of Formex, which is a plastic, was limited to motor and apparatus coils. This plastic, which is a compound of inert mineral materials, is expected to be impervious to weathering, and, as it has a dielectric of approximately 4400 volts, its insulation value is superior to weatherproofing. The use of Formex insulated wire reduces the overall circumference of the wire, and thereby the ice loading, all of which has proved advantageous during winter ice storms. This new type of wire is tied to standard glass low-voltage crossarm insulators with No. 10 copper, processed with the same insulating material. The line connections are made with an improved mechanical type of connector.

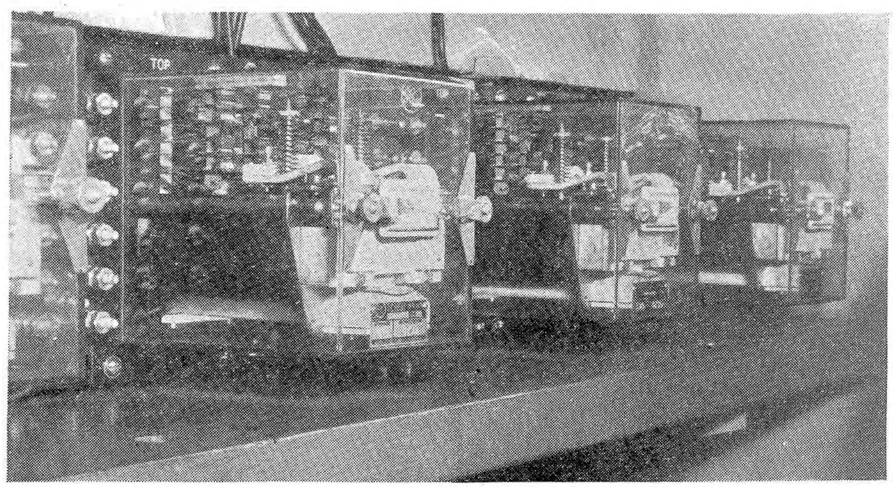
Changes at Interlockings

Most of the smaller interlockings, within the territory where the signals were respaced and modernized,

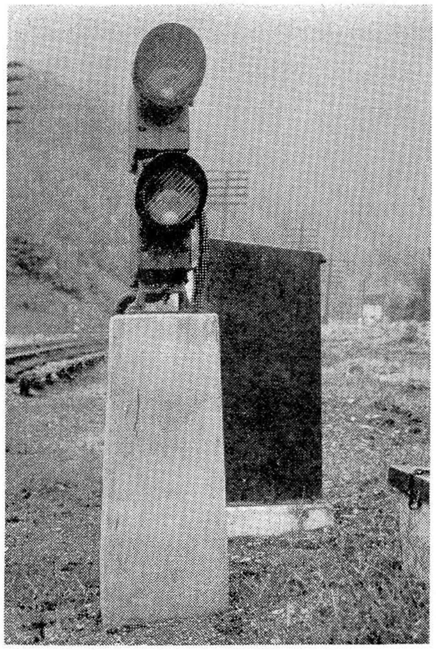
Right—Storage battery and rectifier at rear of house
Below—A terminal board and vertical wire chases







Above—Plug-in type polar switch-repeater relays
Below—Typical searchlight type home signals



Four-aspect dwarf

are mechanical plants. The modernization included the installation of forced-drop electric locks and approach locking, with a minimum number of time releases to effect an emergency release. To forestall an operator inadvertently clearing a signal for a route leading against current of traffic, an arrangement has been installed which places a requirement on the operator of operating an exit push button, in addition to the reversing signal lever, before a signal will clear with the route set against the current of traffic.

Another new feature is the use of pre-fabricated sectionalized relay housings at interlockings. These relay houses, built to Reading Company specifications, provide a fireproof structure for the housing of all control apparatus involved in the interlocking network, transformers, storage battery for the interlockings and rectifiers. These houses, which are a standard width of 6 ft., are available in any length in multiples of 2 ft., the vertical side sections being 2 ft. in width. All sections are cast concrete, water-proofed and agitated in the molds at the time of manufacture. The sections are cored for the purpose of limiting the weight. The wall sections are held together by means of steel insert plates and eccentric nuts and bolts to establish uniform spacing. Each section, including the sectional roof, is designed with a ship-lap joint arranged to permit the introduction of caulking compound which insures that structure will be weatherproof. The vertical side sections of the relay house are mounted on reinforced sills which are placed on sub-foundations placed in excavation 24 in. to 30 in. deep to provide a solid footing. The flooring consists of reinforced pre-cast slabs resting on the floor rail, which is an integral part of the base sill.

Each relay house is provided with shelves supported by metal brackets and attached to side walls by means of inserts. In addition, the shelf brackets provide support for an open-top type concrete wire chase with openings of sufficient size to accommodate all wiring without crowding. The wire chases thus provided, permit easy access to each shelf. All circuits entering the relay house are terminated on a main terminal board from which connections are run through inside wire chases using Flamenol insulated wire.

Plug-in-Relays

A special feature of the interlocking work is the use of a plug-in type of polarized switch-repeating relays, the plug-in panels being designed in individual relay units so as to permit installing the exact number, plus one spare, at any interlocking.

At each interlocking, wall-type indicators have been replaced by small model boards suspended over the interlocking machine whereon tracks are shown as a single line diagram. "OS" and receding track circuits are distinguished by color and by lights located within the track circuit, and signal indications are repeated by colored lights.

Four-Aspect Dwarfs

A typical three light interlocking home signal is shown in one of the accompanying illustrations. Where trains enter main track with current of traffic, a four-position dwarf-type signal, mounted on concrete pedestal, displays block indication. These signals are arranged to display "Stop," "Approach," "Clear Slow" or "Restricting."

Practically all of the materials required for the work described herein were ordered in 1941, and the construction work actually started in December of the same year. The work has been retarded by a shortage of trained signalmen. Plans for the entire project were developed by Reading's Signal Engineering organization, and construction work in the field was performed by the regularly assigned Signal Department Division maintenance organizations under the supervision of respective Division Supervisors, and W. L. Scott, representing the engineering office as Supervisor of Signal Construction.

West end of double passing track layout at Cima, Nev., in C.T.C. territory on the Union Pacific