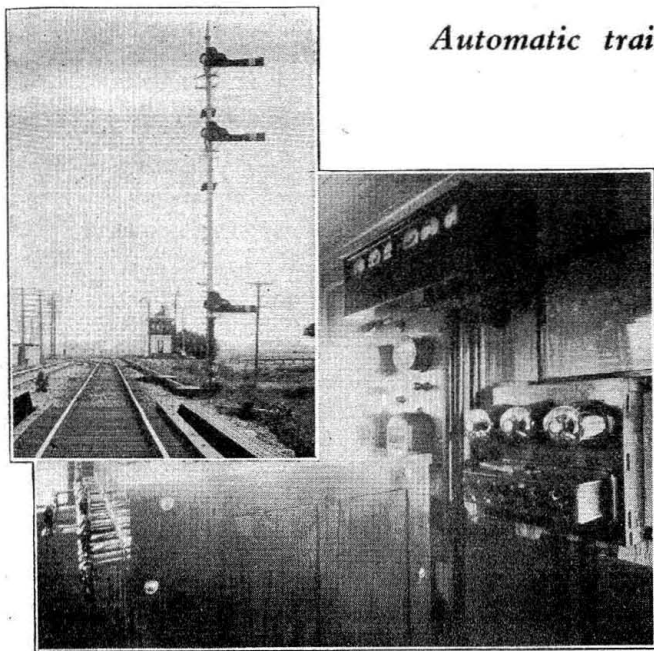


C. & A. Modernizes Signaling Facilities

Automatic train control installed in connection with reconstruction program



Model-2A power home signals replaced an obsolete type—Circuit controllers, electric locks and a new mechanical locking bed were added to the machine in the tower

AS a part of its automatic train control installation work recently completed, between Bloomington, Ill., and Chicago, the Chicago & Alton has modernized its automatic signal installation and also its mechanical and electrical interlocking plants in this territory. The signal reconstruction involved the replacing of Hall Style-D, two-position, lower-quadrant, normal-stop signals with General Railway Signal Type-D, two-indication, color-light signals. The interlocking work at the mechanical plants involved the installation of approach and detector locking circuits, the removal of detector bars, and the installation of power-operated signals. At an electric interlocking plant in this same territory, the C. & A. carried out, in addition to the aforementioned changes, other improvements which will be described in detail in this article.

Automatic Signal Work

The most recent section of signaling which the Alton has converted is that on its 25-mile single-track main line between South Joliet, Ill., and Mazonia. A feature of this installation is the use of two-indication (red and green) color-light signals, with a standard overlap of one block beyond the next signal. This section of line is used almost exclusively for passenger trains, there being 18 such trains and also two way-freights each day. The Alton has an alternate freight line between Mazonia and South Joliet via Pequot, Ill., over which the tonnage freight trains are operated.

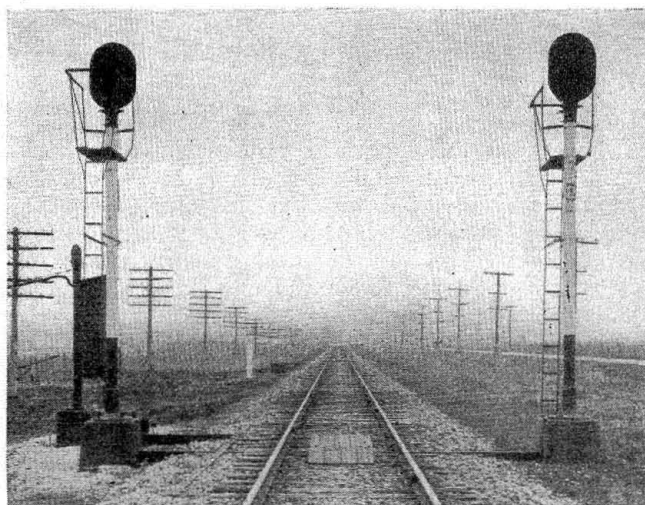
None of the old signaling remains, not even the foundations. The new Type-D color-light signals are mounted at a height of 16 ft. The signals display only two indications with an exception, however, at Wilmington, where three-indication entrance signals are used at each end of the passing track, and a three-indication approach signal is used in advance

of the entrance signal. These three-position signals were used to avoid the necessity of making two passenger train stops when meeting trains at Wilmington. In this connection, the circuits are so arranged that the usual "double distant" control of an entrance signal and approach signal thereto is not employed. Owing to the relatively light traffic on this line, it was found that two indication signals would answer the purpose. Proper braking distances are obtained by overlapping the stop signal control one block beyond the next signal in practically every instance.

Constant Lighting Employed

These signals are lighted normally by power from the alternating current line, using 8-volt, 18-watt lamps which burn constantly. In the event of a power failure, the signal feed circuit is connected to a reserve storage battery by means of a G-R-S Type-H power-off relay. The lighting transformer also furnishes energy to the Balkite Model-C1 rectifier for charging the storage battery. The latter is a four-cell Exide Type-KXHS 125-a.h. battery and is located in a concrete battery box adjoining the signal. The necessity for the 125-a.h. storage battery arises from the fact that the wayside train stop inductor which is energized from this four-cell battery, requires a current of two amperes to energize its winding.

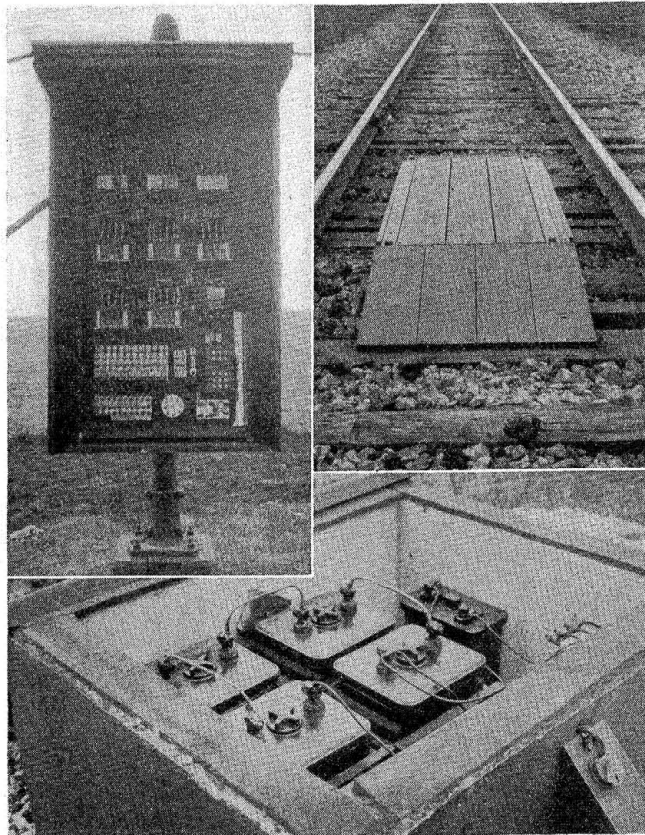
The wayside inductor of the National Safety Appliance Company's train control system, as shown in one of the illustrations, is located in the center of the track and in line with the signal. A short energizing track section, about 250 ft. long, is provided at each signal. At a double location, there are two energizing sections, one in each direction from the signal location. An approaching train, when within 250 ft. of the signal, drops a quick-acting track relay in the short track section and this energizes the wind-



Two-indication (red and green) color-light signals are used on major portion of recent 25-mile signal construction

ing of the wayside inductor. When thus energized, the inductor's magnetic field is neutralized. This is provided the signal indicates clear, in which case the locomotive passes over the inductor without receiving the stop application. A failure of current will give a stop application, because of the permanent magnet located within the inductor.

The concrete foundations and the concrete battery boxes were made in the field. A portable concrete



Relay case at signal location—Wayside train stop inductor
—Four-cell storage battery of 125 a.h. capacity is used

mixer, gasoline engine driven, mounted on a motor car trailer, was used for this purpose.

The charging line for the a-c. floating system comprises two No. 6 weatherproof covered copper wires carried on two field pins of the bottom crossarm of the Western Union pole line. Owing to the large number of power sources along the railroad, the maximum length of feed section is approximately five miles.

Center-Fed Track Circuits

The longer track circuits (those exceeding 6,000 ft.) are of the center-fed type, using six 500-a.h. Edison primary cells connected in multiple. This method of operation gives an average battery life of six months. The shorter track circuits are of the end-fed type, using three 500-a.h. cells in multiple, with an average life of eight months. Four-ohm track relays are used for both the standard track sections and the short energizing track circuits immediately in approach of the signal location.

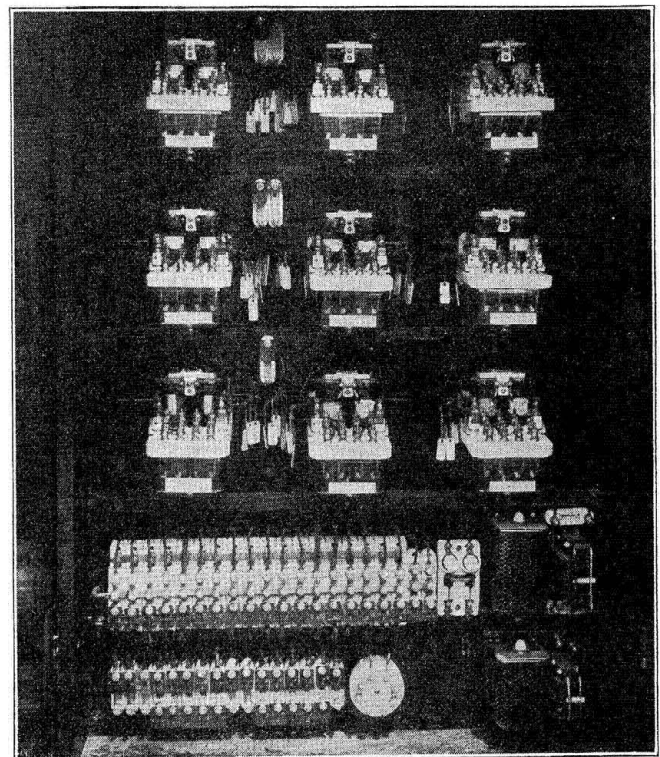
At double locations, the wires are carried between signals in wooden trunking placed at the surface of the ballast. This trunking passes under the wayside inductor, and the two wires for the inductor enter the latter at the bottom so that none of the wiring is exposed. Both parkway cable and wooden trunk-

ing are employed for track circuit connections, the parkway cable being used particularly at single locations. Cable is employed also for the connections running to the ends of the track circuits adjoining the short energizing sections at the signal locations. In other words, the track relay for the standard track circuit, instead of being located 250 ft. from the signal, or at the end of the track circuit, is brought into the instrument case at the signal, the connections being arranged with parkway cable. This has resulted in a substantial saving for relay housings.

Changes Made at Electric Interlocker

A description of the reconstruction work which the Alton has carried out at one of its electric interlocking plants in this territory will illustrate the character of the interlocking modernization program which has been carried out as part of the general signaling and train control program. The interlocker referred to is the C. & A. electric plant at Mazonia, Ill., which is a junction of its single-track main line to Joliet with its double-track line to Pequot (the alternate line to Joliet). There is also a crossing with the single-track line of the Elgin, Joliet & Eastern, this latter railroad running south to Coster, Ill.

The modernization program carried out at this interlocker consisted essentially of the addition of forced drop electric locks, lever circuit controllers,



Ziegler relays are used at Mazonia electric interlocker

time contactors (on signal levers), indication selectors, a complete set of polarized relays, a new terminal board and oak cabinet. At the same time that the G-R-S Model-2 machine was rebuilt, a new power or operating board was added in the control room in the tower. This is the standard G-R-S board and contains an individual circuit breaker for the signals and another for the switches. Other facilities added in the tower, during the rebuilding work, include four additional annunciators, three clock-work time releases for effecting changes of routes, four emergency

push switches for track circuit failures, and a track plan and manipulation chart.

The original Model-2 electric machine frame and working levers were retained in service. This control facility has a 28-lever frame and at present 22 working levers, 3 less than formerly. To effect the circuit changes, it was necessary to add three circuit controllers to the machine as well as an entirely new mechanical locking bed. The seven G-R-S electric locks were distributed as follows: three were installed on home signal levers for the C. & A., while the other four were fitted to master levers which function as route locking levers. These last mentioned levers must be reversed before the home signal can be cleared for any given route. The five clock-work time contactors on the machine are set for 30-sec. delay. Two of them are applied to dwarf signal levers, while the other three are connected to call-on signal levers for the C. & A. Some of the indication selectors at the rear of the machine were replaced.

Old Signals Replaced

Nine G-R-S Model-2A power home signals were installed to replace old Taylor signals. The northbound home signal on the C. & A. is a three-arm signal as shown in the illustration. There are two southbound double-arm home signals on the two lines of the C. & A. and two single-arm signals on the E. J. & E. In addition to the high signals, there are two dwarf signals on the C. & A. for reverse traffic movements and these are also of the Model-2A type.

Inasmuch as this plant is located in the automatic train stop territory of the C. & A., wayside inductors were provided at the northbound home and distant signals on the C. & A., at the southbound home and distant signals on the C. & A. main line, and at braking distance from the southbound home signal on the Pequot line. These inductors are of the National Safety Appliance Company type.

Detector bars had been in service at this point since its installation in 1902. These, of course, were removed and replaced with electric detector locking. Approach and route locking was also provided. To make the necessary circuit changes, many relays were required; these are mainly National Railway Signal Company Type-F, the remainder being of General Railway Signal Company manufacture. All of the wiring, both inside and outside of the tower, was replaced with Okonite wire and entirely new trunking runs as well as concrete junction and battery boxes, were provided. Most of the trunking is carried on concrete stakes painted to harmonize with the trunking.

Power Supply

In addition to the existing 110-volt storage battery for operation of the functions in the plant, a five-cell Exide Type-KXHS7 battery was installed for the electric locking circuits. This battery is charged by a Balkite rectifier on the a-c. floating system. The home and dwarf signals are electrically lighted with 110-volt, 10-watt lamps. They are controlled by a knife switch on the power board in the tower and, while normally operated from alternating current, are arranged to be cut over to the 110-volt storage battery in the event of an a-c. power failure.

At each home signal location on the C. & A. a five-cell Exide Type-KXHS7, 120 a. h. storage battery is provided for energizing the train stop inductors.

N. P. Carries Out Many A. P. B. Circuit Refinements

By I. S. Jones

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THE only single-track overlap signaling installed on the Northern Pacific went into service in November, 1910. This was a 100-mile section between Laurel, Mont., and Livingston. The next single track work was of the A. P. B. type (absolute permissive block) and consisted of three short stretches which went into service in the following order: Marshall, Wash., to Cheney, 9.4 miles, August, 1912; Sand Point, Idaho, to Athol, 31.5 miles; and Hauser, Idaho to Velox, Wash., 10.1 miles in March, 1913. The records of these installations show that more apparatus was installed, particularly relays, than in the subsequent work, and that slightly less flexibility was secured.

Profiting by experience gained in these installations, some changes were made in the circuits. The number of relays was reduced and multiple circuits through circuit controllers were added on certain signals to prevent

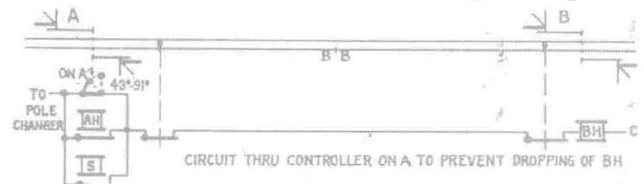


Fig. 1—Multiple connection of H relay control to prevent consecutive dropping of signals on a stretch of single-track

the "knocking down" of a long stretch of them through a change in polarity of the line circuits. We have not been able to reduce the number of relays since that time.

Signaling installed under this arrangement included that from: Lester, Wash., to Auburn, 43.3 miles, in service September, 1913; Sunnyside Jct., Wash., to Cle Elum, 85.6 miles, in service October, 1913; Duluth, Minn., to White Bear, 135.5 miles, in service November, 1913; and Superior, Wis., to Carlton, Minn., 15.6 miles, in service December, 1913.

Open Switch Protection

Up to this time the line circuits had been broken through all of the switches. The next change in circuits was to have the connections at all switches shunt the track relay and break the track circuit unless this action would pick up a stick relay. This improvement has helped materially in keeping the line free from grounds. All of the improvements up to this point have been embodied in the older work. The use of a single insulated joint at a switch located near the center of a track

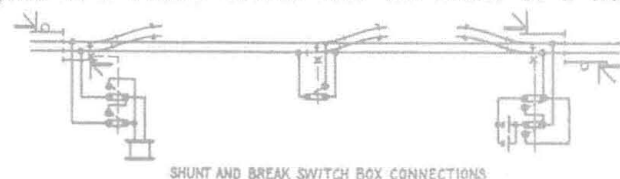


Fig. 2—Method of providing safe switch protection at locations near either end of the track circuit and near the center, or too far from either end to employ the scheme shown therefor

circuit is a unique practice. This scheme was followed in the installations made between: Sand Point, Idaho, and Hauser, 11.6 miles, in service October, 1914; Pasco, Wash., and Sunnyside Jct., 65.1 miles, in service No-