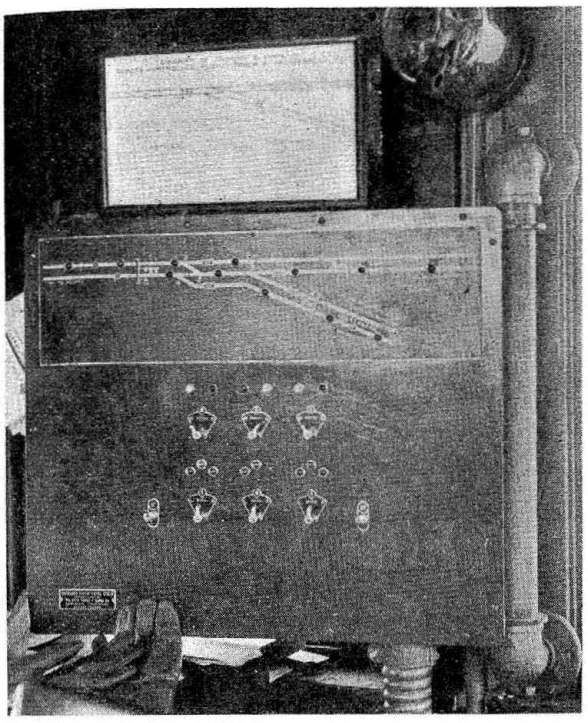


Consolidated Interlockings

Save the C. M. St. P. & P. $10,730 Net Annually on an Investment of $27,185

Junction plants, formerly electro-mechanical, now entirely power-operated and controlled from distant towers. . . . An attractive self-liquidating project

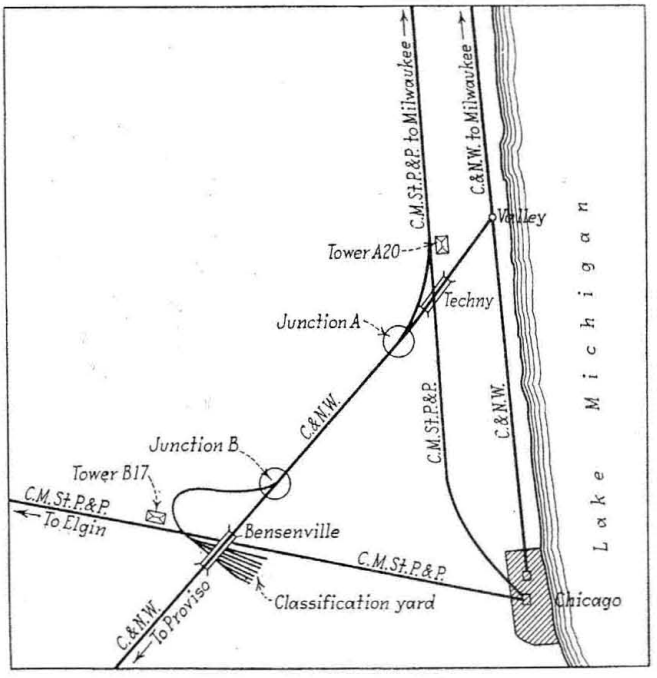
TWO remote-control interlockings, together effecting an immediate payroll saving of $10,348 in operating expenses annually, were recently installed by the signal department forces of the Chicago, Milwaukee, St. Paul & Pacific, near Chicago. These two plants, although separated by 10 miles of line, and, from an interlocking standpoint, in no way combined, are closely related in that they are both involved in the operation of an important cut-off connection on the Milwaukee. What the problem was, and how it was solved, will be seen in the following paragraphs.

The Milwaukee has a north-and-south double-track line between Chicago and Milwaukee, and another line from Chicago, west, through Elgin. At Techny, 20.6 miles north of Chicago on the former line, and at Bensenville, 17.4 miles west of Chicago on the latter line, a double-track line, owned by the Chicago & North Western, crosses over these two radial lines owned by the Milwaukee. During the World War period of government control of the railroads, the Milwaukee was given permission to run its trains over the North Western line between Techny and Bensenville, thus affording a direct connection between the Milwaukee's principal classification yard at Bensenville and its Chicago-Milwaukee main line.

In normal times, the Milwaukee sends 12 to 15 freight trains daily over this cut-off to Bensenville, while the North Western uses this line as a principal one of several entrances to its important car-retarder classification yard at Proviso, a few miles south of Bensenville, the North Western's traffic over this line consisting normally of approximately 25 trains daily.

Formerly Four Mechanical Plants

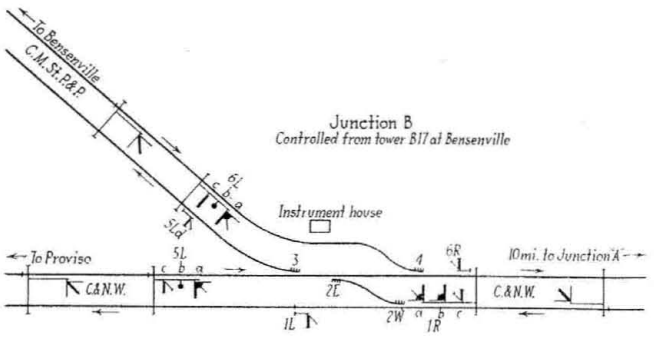
In order to tie in with the North Western at the two points mentioned, the Milwaukee constructed the connecting tracks shown in the single-line diagram. Because of the heavy volume of traffic prevailing at that time, 1918, and because of the necessarily great length of each of these connecting tracks, a mechanical interlocking was at that time installed at each of the four junction points. Thus, at Techny one such plant, designated as A-20, was required for the junction of the double-track connecting line with the double-track main line of the Milwaukee; and at the other end of this same connecting track a mechanical plant known as Tower A, was installed for the junction with the North Western's line. Similarly, at Bensenville, two mechanical interlocking plants were required. In order to permit trains to pull in and out of the Bensenville yard, the main-line end of the connecting track was curved to form a re-



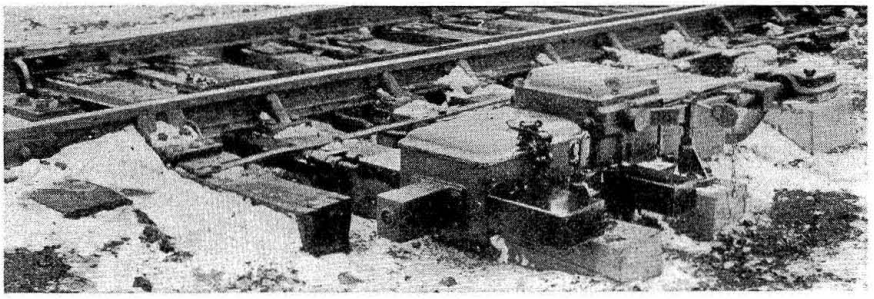
Single-line diagram showing the location of the new remote-control interlockings, as well as the old mechanical plants at the two junctions of the Milwaukee with the North Western. . . . Above—The control machines are of the CTC type

versing loop, rather than to use a wye connection.

In 1928 the interlocking tower at Junction B, the northerly junction at Bensenville, burned, and from that time to the date of the installation of the present remote-control interlocking, this junction was operated manually by three switchmen, one on each trick. Naturally, this method of handling the junction switches was undesirable from the standpoint of economy and safety.



Above—The track-and-signal arrangement of Junction B



One of the dual-control switch machines

The semaphore signals previously used were left in place

Changed to Remote-Control

Taking advantage of modern developments in centralized traffic control and remote-control interlocking, the Milwaukee decided to control Junction B from the existing Tower B17, and to control Junction A from the existing tower at Techny, thus eliminating entirely the necessity of employing switch tenders at Junction B, and eliminating the electro-mechanical plant and its attendants at Tower A.

Thus, the services of three switchmen were dispensed with at Bensenville, with a labor-saving of $5,113 annually, and in their place a remote-control interlocking was installed at a cost of $14,121. Allowing for operating and maintenance expenses, and depreciation, the net annual return on the Bensenville layout is 33 per cent.

At Techny, where, as stated, the new remote-control system replaced an electro-mechanical plant, $5,234 annually was saved in operators' wages, and the cost of the new interlocking was $13,272. The rate of saving here, after allowing for operating and maintenance expenses, and depreciation, and with proper accounting of the retirement of the equipment in the former plant, is 46 per cent annually.

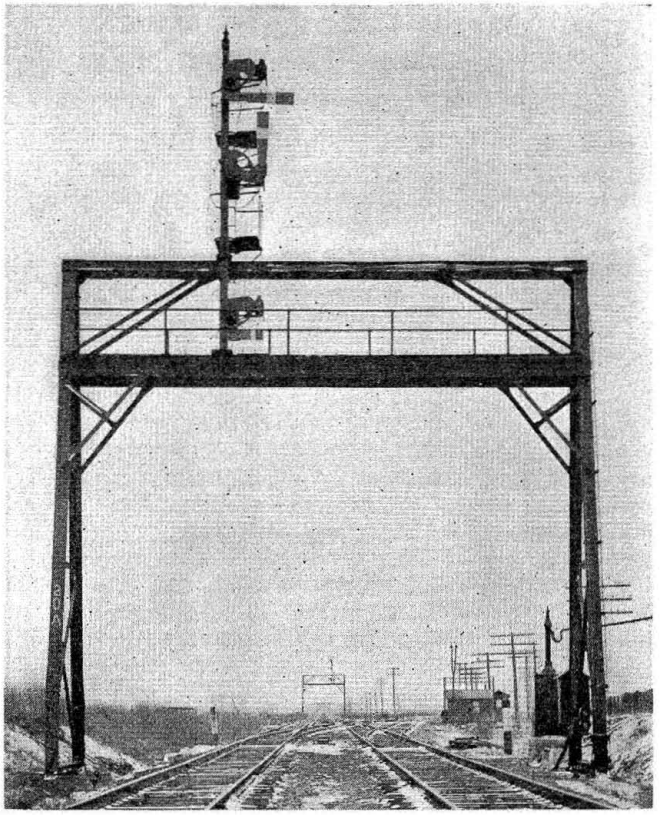
From a design standpoint, the two remote-control interlockings are almost identical, for each layout consists of a junction of two double-track lines. Therefore, the following description of the interlocking system employed will be confined to one of the interlockings—that at Junction B, Bensenville.

Dual-Control Switch Machines

The two crossover switches and the two turnout switches are operated by Union Switch & Signal Company Type-M22 20-volt d-c. 16-sec. dual-control switch machines. The semaphore signals which were a part of the former plant, were left in position on the signal bridges and are used in the present interlocking, but new color-light dwarf signals were installed for governing the back-up moves, those on the Milwaukee being of the searchlight type, and those on the North Western of the unit type. It will be noted that the high signals in each case are for the left-hand track (although located a little to the right thereof), the reason being that the North Western follows the English custom of running left-handed. The lower unit of each of the high signals is a call-on signal; for the North Western only, this arm clears in case of a failure of the top arm. The distant signals, which were used in the former plant, were left unchanged, except, of course, for slightly revising the circuits.

Control Machine of C. T. C. Type

All of these functions are controlled through a Union Type-B30 control panel mounted at the end of the operator's desk in Tower B17 at Bensenville. As the illustration shows, this panel is of the type used in C. T. C. installations. Its mounting is unique; it is supported from a vertical piece of 2-in. pipe in such a way that it can be swung through an angle of nearly 180 deg., a feature which facilitates inspection and cleaning, as well as other maintenance. A flexible conduit carries the control wires from the control panel to a 2½-in. conduit which extends to the sheet-metal relay case. The



18 relays required in Tower B17 are housed in a sheet-metal cabinet in the operating room near the control machine.

The control panel is completely equipped with a track diagram, track-occupancy indication lights and switch and signal repeater lights. A clockwork time release, mounted on the wall, above the control panel, is used for route releasing and for emergency operation.

The control scheme is of the direct-wire type, the 18 wires between Tower B17 and the central instrument house at Junction B 2½ miles distant, being carried on an open line. Weatherproof copper line wire strung on porcelain insulators, is used for this purpose. The pole line between these points was rebuilt with Class B poles.

An interesting construction feature is found here in the use of Kearney connectors instead of the usual soldered joints for all connections to the pole line. This connector, which can readily be screwed apart, is said to be fully as substantial as a soldered joint, while at the same time it is much more easily installed and greatly expedites test work.

Most of the control equipment at the junction is concentrated in a centrally-located relay house of frame construction, with sheet-metal covering affording fire-proof protection. The use of concrete in the floor and foundation of this house eliminates chances of fire starting underneath. The 31 relays in this house were furnished by the Union Switch & Signal Company. Solid conductor insulated wire, very neatly installed, runs to porcelain-based terminals mounted on the wall above the relay, with flexible jumpers extending to the relay posts. The eyelets and tags are of Raco manufacture. Copperweld ground rods are used throughout. Parkway cable is used for runs between the instrument house and the cable terminal boxes at the switch machines, from which boxes single conductors extend to the switch machines, through flexible metal conduit. Parkway is also used for track wires, Signal Accessories Corporation rail connectors being used. All insulated wire and cables are of Kerite manufacture.

Ohio Brass Company steel-stranded welded bonds are used on the North Western rails, and American Steel & Wire Company 46-in. 7-strand cable bonds on the Milwaukee. Edison 500-a.h. primary batteries are used on the track circuits, and Exide storage batteries on the line and operating circuits. One set of 12 cells of DMGO-9 battery is used for the operation of the switch machines, and another set of 6 cells is used for the line control circuits. These batteries are on floating charge by Union rectifiers.

N. & W. To Use Cab Signals

THE Interstate Commerce Commission, on petition of the Norfolk & Western, has modified the requirements of its automatic train control orders of 1922 and 1924 to permit the operation on that road between Roanoke, Va., and Hagerstown, Md., of locomotives equipped with automatic cab signals in lieu of automatic train control. Commissioner Aitchison dissented.

This line is 239 miles long; the first part was equipped with automatic train control on February 15, 1925, and the second part on March 16, 1928. The number of locomotives equipped is 79, which includes four of the Chesapeake & Ohio, which road runs trains over a nine-mile section of the line.

The expenditures for these installations, including locomotive equipment, have amounted to $750,899. The locomotive equipment includes a speed-limit indicator. The cost of maintenance and operation is about $90,000 a year and with the discontinuance of the brake-setting apparatus the cost will be reduced by $9,800 yearly; and the change will put a stop to various other items of cost, especially those due to unnecessary stopping of trains because of undesired brake applications.

This is a single-track line through a thinly settled region. The traffic has suffered a great diminution, the average number of trains daily in July and August having been about 15 a day in both directions which is less than half the average number in the summer of 1924.

The use of the cab signal in lieu of automatic train control is approved on the addition of a second signal unit (for the fireman) and an audible signal or whistle, as called for in the specifications. A code of requirements is prescribed as in the case of the Union Pacific and other roads which have been granted similar authority to use cab signals instead of automatic train control. The following lists of definitions and specifications accompanied the Commission's order:

Definitions

For purposes of these specifications the following definitions will apply:

Automatic cab-signal system.—A system which provides for the automatic operation of the following: (a) *Cab signal,* a device located in the cab which, when locomotive and roadway apparatus are in operative relation, displays indications of conditions in advance, and (b) *cab indicator,* a device located in the cab which indicates a condition or a change of condition of one or more elements of the system.

Block.—A length of track of defined limits, the use of which by trains is governed by fixed signals or cab signals or both.

Cab.—The compartment occupied by engineman, fireman or motorman, of the engine, motor car or multiple-unit car from which the propelling power of the train is controlled.

Continuous control.—A type of control in which the locomotive apparatus is constantly in operative relation with the track elements and is immediately responsive to a change of conditions in the controlling section which affect train movement.

Controlling section.—A length of track of one or more track circuit sections by which the track elements governing approach to or movement within a block are controlled.

Locomotive.—A self-propelled unit of equipment used in train service.

Track element.—That portion of the roadway apparatus to which the locomotive apparatus is directly responsive.

Specifications

1. The purpose of these specifications is to prescribe essential features involved in the design, construction, installation, operation, and maintenance of automatic cab-signal systems of the continuously controlled type, without automatic train control.

2. The automatic cab-signal system shall function to display a cab-signal indication which constantly corresponds with conditions in advance in the controlling section.

3. The automatic cab-signal system shall be so arranged that a change of conditions affecting a train movement which occurs within braking distance in advance

(Continued on page 53)