

C. & N.W. Employs

Centralized Control

To Speed Up Trains

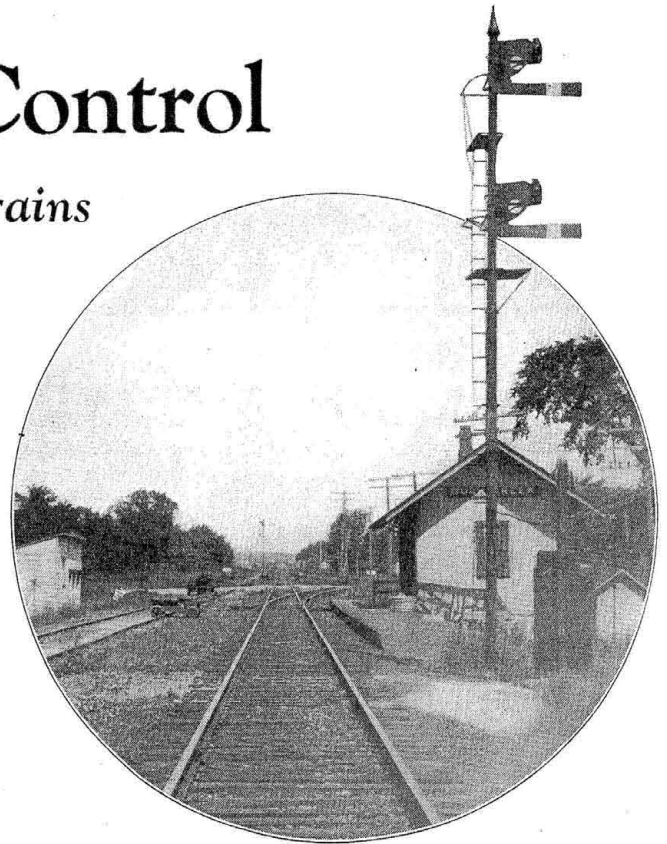
*Dispatcher at Green Bay controls
junction switch, yard lead and
a crossover remotely*

A NOTICEABLE improvement in train operation has resulted from a dispatcher-control installation on the Chicago & North Western between Green Bay, Wis., and Duck Creek, approximately four miles. At the latter location, where the Lake Shore and the Peninsula divisions diverge, there was formerly a four-lever mechanical interlocking plant, employing one combination leverman and operator on each trick. These men have been released and in addition the train dispatcher estimates that there has been a saving in running time of at least 15 min. per freight train between Duck Creek and Green Bay, by reason of the elimination of stops in entering and leaving the North Green Bay freight yard. In addition, there has been a large but undetermined saving in train time, because of the elimination, within these limits, of the superiority of trains according to class and direction, and the movement of all trains entirely by signal indication.

The traffic approximates 32 trains daily, including 9 passenger trains and 6 freight trains scheduled regularly in each direction, in addition to one or two extra freight trains daily. It is evident, therefore, that this short section of single-track railroad is a particularly busy line. All of the switch machines, signals, control relays and the control machine on this installation were furnished by the General Railway Signal Company.

Power Switches

The four switches are operated by power switch machines equipped with dual-control selectors. No derails are required in this layout. The motors are wound for 20-volt operation, and will effect a complete movement of the switch from normal to reverse or vice versa in 15 sec. A feature of the switch construction is the use of Morden adjustable rail braces, there being five of these braces on each rail, one on the inside and four on the



North bound home signal at the junction switch at Duck Creek

outside of the rail. The dual-control mechanism permits the train crew to throw the switch manually in case of a failure of the switch machine or when switching, provided permission is obtained from the dispatcher. If the dispatcher should mistake the identity of a train, line up the wrong route for it, and display clear signals; the electric locking can be released so that the route can be changed by instructing a trainman to operate the dual-selector lever to the vertical or mid position, and return it to its normal position.

Each switch machine is operated from a 10-cell Exide storage battery Type-KXCS-9, which is charged by a Fansteel electrolytic rectifier through a G-R-S step-down transformer. The storage battery and rectifier are housed in a concrete battery well, adjoining the relay case at the switch location.

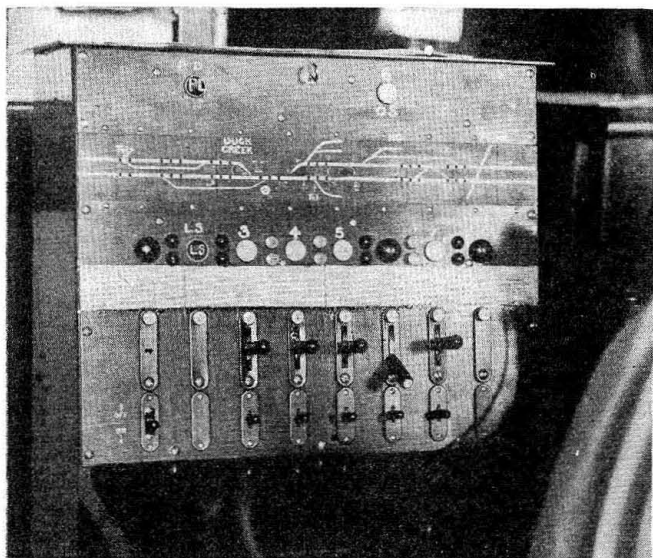
The signals are Model-2A semaphore type, the south-bound signals at Duck Creek operating from 0 to 90 deg. in the upper quadrant. The northbound home



The junction switch at Duck Creek is power operated by means of a Model-5A machine equipped with dual-control selector

signal at Duck Creek, however, operates only from 0 to 45 deg., because there are no automatic signals northbound after leaving Duck Creek. It was not necessary to change the southbound home signals at Duck Creek, because these were formerly power-operated signals, controlled from tail levers in the mechanical machine. It was, however, necessary to replace the northbound home signal, which was a mechanically operated signal.

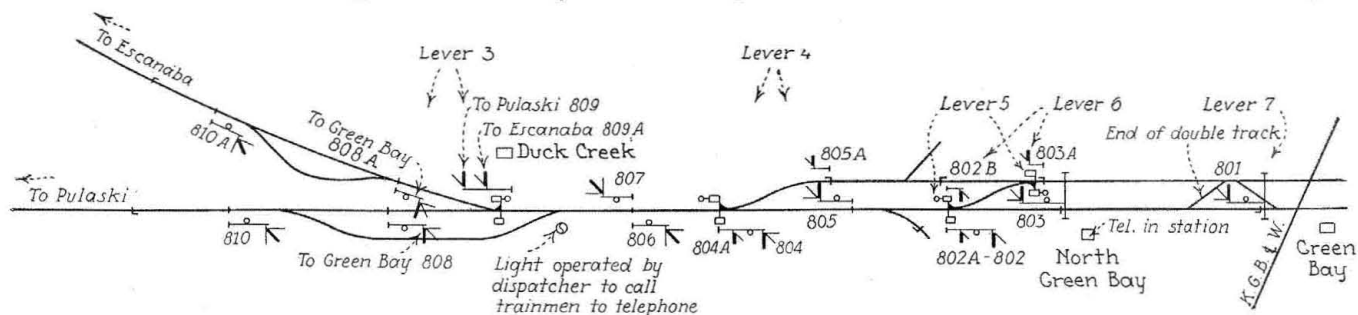
The home signals, 804 and 802, for southbound trains, which are located to the west of the yard connections, govern movements on the main track by display of the



Close-up of the control machine in the dispatcher's office

top arm, and movements to the yard by display of the low-speed arm for the diverging movement to a secondary track, which can only be made at slow speed.

It should also be noted from the track plan that signals 805 and 803, governing westbound movements on the main line, are located 500 ft. east of the switches, this arrangement being made so as to enable the dispatcher to advance westbound trains on the main line to one of these signals, thus permitting a simultaneous eastward movement of a freight train into the yard lead.



Track and signaling plan of centralized-control territory from Green Bay to Duck Creek

This arrangement of signaling has been found to save much time. If the dispatcher should desire to move a westbound freight train out of the yard lead at the crossover switch at North Green Bay, he clears the dwarf signal 803A, and as eastbound freight trains normally enter the yard at the switch about one mile west of North Green Bay it is thus possible for a westward train to pull out of the yard at the same time that an eastward train is entering the yard lead. Signals 803A and 805A are controlled by the regular A. P. B. single-track circuits in the same manner as the high signals.

All of the signals, with the exception of Signal 801 which is the westbound entering signal to the dispatcher-controlled territory, are controlled automatically by the position of the switch and the direction of traffic. Signal 801, however, is controlled by a separate lever in the dispatcher's machine. This signal is located on the signal bridge at the west end of the short double-track section running through the city of Green Bay. It permits the dispatcher to advance trains as far as the crossover at Signal 803, thereby clearing the K. G. B. & W. crossing just east of Signal 801. The track section between these two signals serves to control the "OS" lamp mounted above Lever 7, which is the lever controlling the entrance Signal 801.

Dispatcher's Control Machine

The G-R-S dispatcher-control machine has five working levers and is located in the dispatcher's office in the Green Bay station. The machine is within easy reach of the dispatcher when he is seated at his desk handling train movements by telegraph on other parts of the division. Levers 3, 4 and 5 control the four power-operated switches, Lever 3 controlling the junction switch at Duck Creek, Lever 4 the west lead to the yard, and Lever 5, both ends of the crossover. Lever 6 controls the two dwarf signals on the yard track at the crossover, one dwarf (803A) being for westbound movements over the switch, and the other dwarf (802B) for eastbound trains on the yard lead. It was necessary to have a separate signal control lever for these two dwarf signals in order to permit uninterrupted switching movements over the yard end of the crossover switch. Lever 7 controls the northbound Signal 801.

A white switchboard lamp or bull's eye, located above each switch control lever, provides two indications. Whenever a train occupies the track section in which the switch is located, this lamp is lighted. Also, whenever the switch is operated from normal to reverse, or vice versa, two distinct flashes of the lamp occur, one flash at the moment that the switch starts to operate, and the second flash at the instant when the switch movement is completed. The flashing of the lamp is accompanied by an audible bell signal to attract the dispatcher's attention. The small traffic direction lights

have arrows pointing in the direction in which routes are established for trains to operate.

There are two approach annunciator lamps for eastbound trains on the control panel, one for the Peninsula division and the other the Lake Shore division. Westbound movements for the yard are announced by telephone while westbound movements on the main track are scheduled movements arranged for by the dispatcher. A feature of the dispatcher's machine is the special annunciator relay located on the relay panel at the base of the machine. This special polarized relay

is controlled by a single wire from Duck Creek, and provides an indication of an approaching train on either the Peninsula or Lake Shore divisions. This relay controls the two eastbound annunciator lamps on the panel. About four miles of line wire was saved by its use.

Beneath each major control lever of the machine is a small telephone type key which can be moved up or down. When one of these keys below a switch lever is thrown upward, the signals at that location are stick controlled; that is to say the home signal will remain at stop after the train passes through the dispatcher-controlled territory. Also the "OSing" feature of the lamp is continued indefinitely until the dispatcher releases the key, this feature being used whenever the dispatcher is called away from his desk, and serving to remind him of what has taken place during his absence. When one of these keys is thrown down, the audible bell signal is cut out. This is desirable whenever the maintainer is making a test, because the operation of the bell under these conditions is objectionable.

Telephone Call Signal

At each switch location, a magneto telephone is provided so that train crews can communicate with the dispatcher. These telephones are all on a multiple circuit, and in order to improve the quality of the telephone service, a special cut-out switch is incorporated in each telephone cabinet, such that, when the door is closed, the telephone is disconnected from the line.

It will be noted on the track plan that a special light signal, operated by the dispatcher, is located at the east end of the Duck Creek passing track. This signal comprises a Railroad Supply Company Type-LUR highway crossing lamp mounted on a bracket arm and a cable post. This signal has a 10-volt, 10-watt lamp with a red lens and burns continuously whenever the train dispatcher operates the key at the lower left corner of the control panel. When this signal is displayed, it indicates to a freight train on the passing siding, or to any eastbound train approaching the junction, that the dispatcher wishes to communicate with the train crew by telephone. In other words, it calls the train crew to the telephone, so that the dispatcher can secure any information he may desire and it gives him just as much contact with the train crew as when the telegraph operator was stationed at Duck Creek.

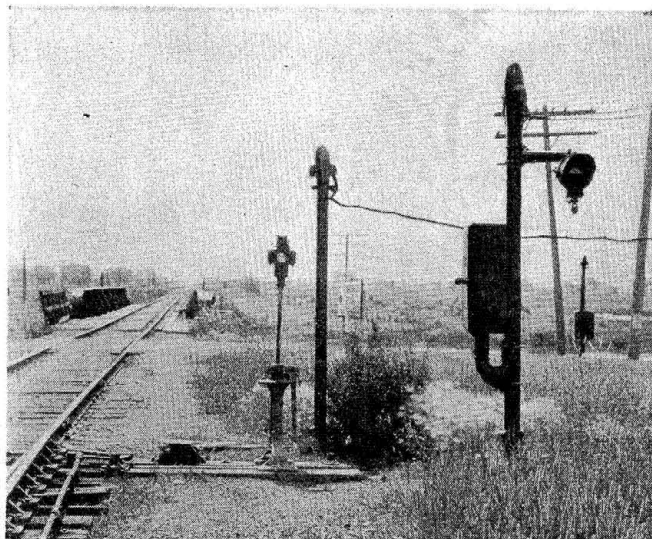
The control of this "phone" signal is rather ingenious. A Western Electric polarized telephone relay of 2,500-ohms resistance, in series with two additional 2,500-ohm resistance units, is connected across the telephone wires. A 90-volt radio B battery is connected to the telephone wires through normally open polarized contacts of the control key on the machine. Operation of the control key impresses 90 volts across the telephone wires momentarily to kick over the polarized telephone relay from the "off" to the "on" position or vice versa. The extremely high resistance is necessary in order to prevent the operation of this relay whenever a telephone magneto is operated at any of the telephones because these magnetos are in multiple with this control circuit. A small step-down transformer without a storage battery reserve supplies the 10-volt lamp for the signal.

Control Relays and Circuits

The control relays are housed in steel cases and are suspended by wall brackets to reduce vibration. Relays are all of the G-R-S type and were wired in the cases at the factory. The polarized line control relays are the Type-K. Each switch machine is protected with a thermal relay (G-R-S—53174—GR1) and these func-

tion to disconnect the motor from the battery, if an obstruction becomes permanently lodged between the switch points. The delay period is about two minutes. A small thermal relay (GR-S 53610) is also provided for the purpose of enforcing a 15-sec. time delay on the approach stick locking circuits. This relay is operated whenever the route is changed and no train is approaching.

The line control wires are carried on a separate signal department pole line, there being a separate common wire for the dispatcher control circuits. There is also



Special signal for getting train crews to call the dispatcher on the telephone

one control wire for each switch location. The only other wires are the annunciator wires and the usual A. P. B. signal controls. The dispatcher control wires are No. 8 weatherproof copperweld carried on porcelain insulators. The cable drops are made up of a No. 6 galvanized steel messenger wire and the individual insulated copper conductors tied together with marlin. Lightning arresters are Railroad Supply Company Premier No. 3, with a neon tube in multiple on dispatcher control circuits.

The track circuits are fed by three cells of Edison 500-a.h. primary battery, the relays being four ohms. Rail joints on new rail are bonded with Ohio Brass gas-welded bonds. The old rail, which will later be replaced with heavier rail, is at present bonded with galvanized iron wires and channel pins. All track circuit wires and control wires to the switch machines are run in wood trunking buried on a level with the ballast.

Operating Instructions

The superintendent issued instructions to train service employees covering the operation of trains in the dispatcher-control territory, at the time this installation was placed in service. These instructions follow:

"1. Signals 801 to 809 inclusive, and signals 808-808A to 802 inclusive, except signals 806 and 807, are controlled by the train dispatcher. Signals 806 and 807 are automatic stop-and-proceed signals. Signal 809 governs over the junction switch at Duck Creek. Dwarf signals 803A and 805A govern westward movements from North Green Bay yard to the main track.

"2. Telephones for communication with the train dispatcher are located as follows:

At all signals except signals 806 and 807.

At west switch at Saranac on Peninsula division.

At industry track switch west of signal 802.

At yard office North Green Bay.

"3. Power-operated dual-control switch machines are in service on switches controlled by the train dispatcher as follows:

Both crossover switches just west of North Green Bay yard office.

Switch connecting extreme west end of yard lead with main line.

Junction switch at Duck Creek.

"4. When a red light is visible on a pole located on the west side of main track and near the east switch of Lake Shore division passing track at Duck Creek, trainmen of either division will immediately call the train dispatcher on the telephone and ask for instructions.

"5. Trains can enter the Duck Creek passing track at the west end without interfering with the centralized control system, but no train, engine or car will enter the main track from the east end of this passing track without permission from the train dispatcher.

"6. In centralized control signal system districts, conflicting rules are hereby modified and train or engine movements will be made by, and upon the authority of, signal indications, only, or upon receiving oral permission of the train dispatcher.

"7. When a train or engine has been stopped by a 'stop' signal in such district, the conductor or engineman must stop at once, communicate with the train dispatcher by telephone, and then be governed by the instructions received from him. The instructions must be repeated to insure correct understanding. When given oral instructions to pass a 'stop' signal, trainmen must examine the dual-control switch and know that it is in proper position for the train movement, or secure permission to operate it by means of the hand throw devices.

"8. Dual-control switches must not be operated except on instructions from, or by permission of, the train dispatcher. To operate such switch the selector lever must first be thrown to the reverse or hand throw position and then the switch can

be operated by means of the hand throw lever the same as an ordinary switch. After the movements have been completed, the switch must be set for main track unless otherwise instructed by the train dispatcher and the selector lever thrown to the normal or switch machine position, and selector lever locked in this position. The train dispatcher must immediately be notified and be given the location of the train or engine.

"9. If a trainman desires to use a dual-control switch, he must first call up the train dispatcher and get permission and the train dispatcher in giving his permission must state between what points on the main track, the train shall be allowed to operate. When permission is given by the train dispatcher to operate a dual-control switch by hand, no part of a train or engine must move beyond the point designated by the train dispatcher, and if movement beyond such designated point is necessary, further communication must be had with the train dispatcher to secure proper authority for such movement.

"10. Trains or engines entering passing tracks or sidings not equipped with signals will advise the train dispatcher when clear of main track and switches are closed, and will not again enter upon main track, nor open switches without first receiving authority from the train dispatcher.

"11. Enginemen and trainmen must not accept hand signals as against the fixed signals in making movements over a dual-control switch, unless they have been informed that the selector lever is in the reverse position.

"12. Signal, bridge and track men must not do any work on signals, bridges or track in centralized control districts that will, in any way, affect the signal indications, track circuits or operation of switches, without first calling the train dispatcher, telling him what work is to be done and securing his permission to do so before starting the work, and upon completion of such work they must immediately notify the train dispatcher to that effect.

"13. Employees operating track cars must stop and push cars over dual-control power-operated switches to avoid accident or injury."

I.C.C. Issues Form for A.T.C. Reports

THE Bureau of Safety has just issued, in co-operation with the automatic train control committee of the A.R.A., a form for reporting the performance of automatic train control. This was brought out in the hope that it would bring about a better understanding of what is being done and would also help to establish uniform definitions. Uniformity in reporting train control performance will make it possible to make comparisons between individual roads. Under the old method of reporting, this was not possible. The railroads have been requested to use the new forms in making their July reports, and it is understood that the new form will be given a six months' trial, during which period suggestions will be invited from the railroads.

Accompanying the new form, the commission issued an instruction and definition sheet which is reproduced below in abstract, because of the operating definitions which are included therein. Railroads equipped with cab signals, but without automatic train control, are requested to report the performance record on these same forms, using the definitions in so far as they apply.

(7) Where a number of false restrictive or false proceed operations result from the same cause, the report should show the number of causes and the number of operations produced by these causes.

(8) A detailed statement on Form ATC-2 should be filed with this report, setting forth the nature and cause of each false restrictive operation, false proceed operation, potential false proceed, and the cause of each cut-out. The number and

causes of improper operations occurring outside of train-control territory should be reported separately on Form ATC-2.

(9) If the train-control apparatus was in any manner involved in an accident occurring during the month, a statement should be filed with this report describing such accident.

(10) The initiation of a brake application which results when a restrictive condition corresponding with track conditions of the controlling section is imposed and which occurs because of failure to acknowledge, forestall, or suppress the brake application, or to control speed within prescribed limits, should be classed as a proper operation.

(11) *Operation*—The functioning of the automatic train-control device which results from the movement of an equipped locomotive over the track element or elements for each block with the automatic train-control device in service, or which results from the failure of some part of the device. This functioning may consist of either a change of condition or the continuance of existing condition of locomotive apparatus, which may occur at one or more contact, inductor, magnet, or other control points with an intermittent system or at any point in a block with a continuous system. An operation as thus defined which results from failure of some part of the device may occur at any point in the block with either type of device. The functioning of the device for the entire block is considered as one operation. The number of operations is the product of the number of blocks by the number of trips.

Definitions

Operations are classified as follows:

(12) *Proper operation*—The functioning of the device to create or continue a condition of the locomotive apparatus which corresponds with the condition of the track of the controlling section when the locomotive apparatus is in operative relation with the track elements of the device.