



Yardmaster is able to talk to men in yard via 48 talk-back and 21 paging loudspeakers

Loudspeakers and Interlockings Improve Yard Operation

Yardmaster better able to coordinate yard operations through use of talk-back speaker system. Also have walkie-talkie radio for car checking operations. New interlockings expedite arrival and departure of trains.

AT GRAND RAPIDS, MICH., the Pere Marquette district of the Chesapeake and Ohio has installed two modern systems of communications in its Wyoming yard. One system includes 48 talk-back speakers and 21 paging speakers, and the other system includes a base radio station

which picks up calls made by car checkers using walkie-talkies to read the numbers on cars in the yard. Also, two new interlockings were installed at the east end of the yard. Grand Rapids, with a population of 175,647, is a manufacturing center noted principally for furniture; it

also produces food products, chemicals, gypsum and paper products. Many of these industries are serviced by the PM district of the C&O, and are now being provided with still better service since the new signaling and communications facilities were installed in Wyoming yard. Daily traffic in and out of the city is 10 passenger trains and 26 regular freight trains, plus extra freights as traffic demands.

The "nerve center" of the new signaling and communications facilities is a five-story control tower at Plaster Creek. The new brick tower contains on the ground floor the

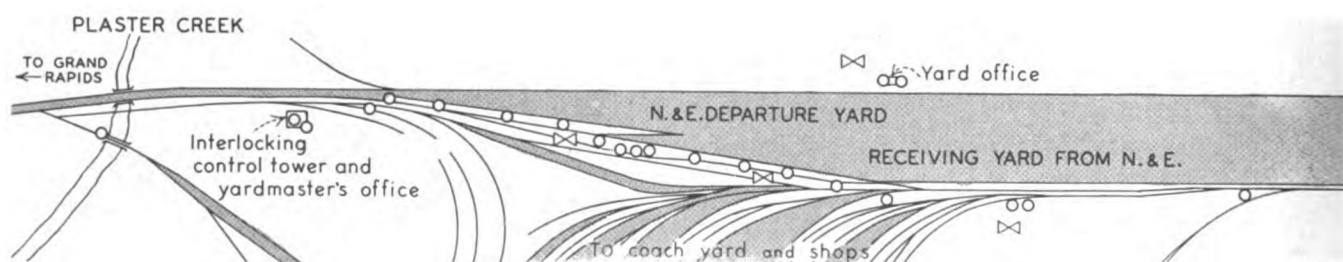


Fig. 1 Plan of Wyoming yard at Grand Rapids, Mich. showing talk-back and paging

heating plant and the diesel-driven generator; on the second floor—the terminal board and d.c. power supply for the signal system, as well as standby batteries; on the third floor—control machine and operator for Plaster Creek and Sunnyside interlockings; on the fourth floor—the rest room and lockers; and on the fifth floor—yardmaster's office with yard loudspeaker control console and Teletype. The yard loudspeaker control console has circuits to all talk-back and paging speakers, as well as telephone circuits to the engine house, car shops and other locations.

Talks to Operator

The interlocking operator has a communications sub-station on his desk which is tied in with the yardmaster's console, thus providing instantaneous two-way communications between them. Often, the yardmaster will call down to the operator, informing him that a switch engine, with some cars, wants to go down the yard lead past the yard entrance and return to the yard on the main track. Thus the operator can set up the route, and the train crew will be able to move out without any delay. This intercom arrangement has worked to the benefit of the entire yard operation, because each person can keep the other fully informed concerning train and engine moves.

More Efficient Operation

Some savings in time have resulted from the use of the new communications and interlocking facilities installed at Wyoming yard. Outstanding results include: (1) Almost instant availability of switch crews because of the communications now available; (2) speedier handling of arriving and departing trains; (3) a reduction in time required for handling cars, with the result that cars spend less time in the yard than previously; (4) safer and faster operation due to the interlocking; (5) daily operations are made easier and more efficient; (6) constant supervision by the yardmaster; and (7)



Paging speakers mounted high above ground to provide coverage over several tracks



Remote control radio set in yard office enables clerk to talk to car checker

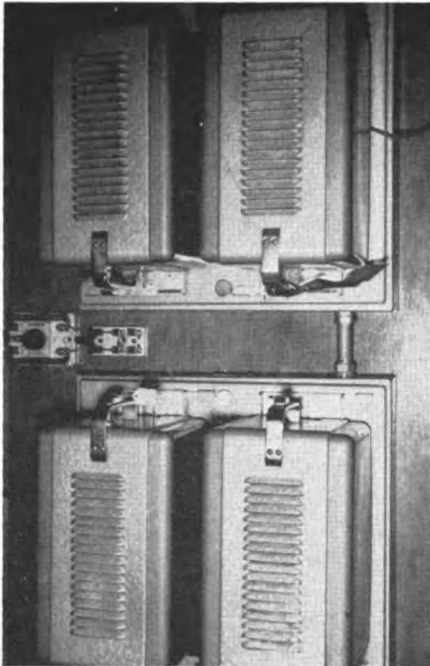
better service to shippers.

Centralized control of yard operations has been accomplished because the yardmaster is located in an office where he can be reached at all times

and two-way communication is provided between personnel working in the yard and the yardmaster. Now he has "everything at his fingertips." He can talk to men in a matter of a



Speaker locations. New interlocking is at yard entrance near Plaster Creek



Base radio equipment for car checking



Typical talk-back loudspeaker mounting

few minutes. Previously, the yardmaster was a "legman" who was either the "hunter" or the "hunted" in the yard.

Recently a switching crew, about to pull a cut of cars, found that rain had washed the chalk marks off several cars. To be sure they had the right cars, the foreman went to a talk-back speaker and called the yardmaster for a check. The yardmaster informed the crew that they had the right cars, so they pulled them. A simple request answered in a matter of minutes. Why? Because the foreman could talk to the yardmaster now, not 10 or 15 minutes later when he found a telephone. Another example of time saving is in the pulling of bad order cars from a train. Previously as much as 20-35 min. would elapse between the time an inspector found a bad order car and it was pulled from the train. Now the time has been reduced to 15 min. because of two-way communication between the car inspectors, the yardmaster and switching crews.

Talk-Backs Speed Operations

The loudspeaker system has expedited the setting out of cars destined for downtown Grand Rapids. For example, when No. 42, a train of perishables from Chicago, enters Wyoming yard, a switch engine is ready to pull the Grand Rapids cars and take them downtown to be spotted. The yardmaster is able to call a switch engine crew upon No. 42's arrival without delay because he

can quickly contact them via the loudspeaker system.

The Teletype system between the freight office and the yard office is another time saver. Under the old system, if there was no waybill for a particular freight car, the car was sent to the hold track until the waybill arrived at the yard office. Then after the yard office had the waybill, they would have the car pulled from the hold track. Now the yard office checks with the freight office via Teletype, and is able to get the proper information so the car can be put into a train, rather than wait on the hold track until the waybill arrives at the yard office.

Walkie-talkies Speed Car Checking

Car checkers have saved time and steps by using walkie-talkies. Previously, the car checker would walk the length of the train, noting the car initials and numbers, and then return to the yard office where the waybills would be pulled and a consist manifest report made up for the train. Now, as the checker walks along the train, he reads the information into his walkie-talkie microphone, and a clerk in the office takes down the information on cards. The transmitted signal from the walkie-talkie is picked up by a base radio station located near the center of the yard, the antenna of which is mounted atop a 100-ft. light tower. The received signal is relayed over a telephone pair to the yard office into a remote control unit over which the clerk hears the checker's voice.

After the clerk finishes with a card, he passes it along to another clerk who pulls the way-bills, and lines them up ready for typing the CM report. Ten minutes or so after the checker has read the last number, the CM report is ready for the conductor. A copy of the CM report is also Teletyped to the next yard where the train is to set out or pick up cars. The checker can now check two trains on one round-trip from the yard office, whereas previously he took one round-trip to check just one train. The yardmaster also has a remote control unit so that he can talk to a car checker if he desires. These remote control units also provide an additional intercom circuit between the control tower and the yard office.

Half-Watt Walkie-Talkies

The walkie-talkies are Hallcrafters' Littlefones, having an output of $\frac{1}{2}$ watt and are powered by wet batteries. The C&O has four of them at Wyoming yard. These walkie-talkies and the base station operate on 160.41 mc. The base radio station equipment consists of plug-in type units; transmitter, receiver, power supply and local control unit, all of which are located in a small frame building at the base of a light tower, on which the antenna is mounted. The antenna is the half-wave colinear type with all elements grounded for lightning protection. The antenna lead is RG-17/U, 52-ohm coaxial cable. Telephone pair is run aerially from the base station to the yard office and to the yardmaster's office. For maintenance and checking of the operations of the walkie-talkies and base stations, a handset and hanger have been installed at the base station, by which the radio maintainer can operate the station locally. The remote control units contain a line amplifier and speaker for receiving calls, and the control circuits for keying the base station transmitter. When the push-to-talk button on the handset is not pressed, intercom calls can be made over the telephone twisted pair between control units, without keying the transmitter. The base radio station equipment was furnished by the Federal-Farnsworth Division of the Federal Telephone and Radio Corporation.

Loudspeaker System

The yardmaster has a console desk, Type C-100, on which are the conventional two-position type keys; one key for each circuit to a talk-back speaker location and for each paging

speaker location. The keys are normally on center position and when depressed, put the yardmaster's console on the line. These keys have a spring return so that they must be held down to keep the console on the line. Above each key is an indication lamp which lights when someone at a talk-back location presses a button to signal the yardmaster. A buzzer is also provided to operate at the same time that the button is pressed. However, the buzzer can be cut out at the discretion of the yardmaster.

Control of Paging

The yardmaster's console has separate keys for the paging system, i.e. each key connects the console to a pair of paging speakers, which are mounted on telephone poles or light towers. Also, paging can be done over groups of talk-back speakers. There are separate keys for this operation, each connecting five talk-backs in a group. Generally, the yardmaster uses the group talk-backs for paging. In an emergency, or for a general announcement which he desires all personnel to hear, he uses the general paging system.

The yard was formerly equipped with a low-level intercom system with a few microphones spotted about the yard to permit trainmen to talk with the yardmaster. The old system had paging speakers in four locations. At that time the yardmaster was located in the yard office near the center and on the south side of the yard. The new system is a two-way high level communications network. Separate amplifiers are used for transmission to, and reception from, the talk-back speakers. When a talk-back circuit key is depressed, the line is normally connected to the input of the receiving amplifier, and the output of the transmitting amplifier is shorted out to prevent any feed back. When the yardmaster steps on his foot switch, this short is removed, the line is transferred to the output of the transmitting line amplifier, and the output of the receiving amplifier is shorted. At the same time, a short circuit is removed from the microphone input circuit. A preamplifier brings the microphone signal up to the proper input level for the transmitting or line amplifier and paging amplifiers. The talk-back line amplifier has an output of 25 watts. A separate 25-watt amplifier is used for group paging, and the general paging speakers are operated by a 60-watt amplifier. All amplifiers and

relay power supplies are in duplicate, to provide uninterrupted service in case an operating unit becomes defective.

The talk-back speakers in the yard are Jensen 15-watt speakers in weatherproof housings, mounted in pairs back to back on a three-inch pipe mast. Signaling is accomplished by depressing a heavy-duty weatherproof switch in a Crouse-Hinds conduit which closes a simplex circuit on the speaker line. This causes a telephone-type relay in the console to pickup, thereby causing the indication lamp for that circuit to light. Talkbacks are spotted along yard ladders near switches, as well as at the yard office, switchmen's ready room, and a lunch and locker room for yard crews.

The paging speakers are also Jensen speakers rated at 25 watts. They are mounted back to back in pairs about 50 ft. above the ground on telephone poles. The major items of

equipment for the talk-back speaker and paging speaker system were furnished by R. W. Neill Company.

Both underground and aerial cable is used between the tower and junction boxes, strategically spotted throughout the yard. This cable is Ankoseal multi-conductor with aluminum armor wrap and vinyl jacket made by the Ansonia Wire & Cable Co. From the junction boxes, U.S. Rubber No. 14 AWG twisted pair, direct burial wire was run to the speakers. Carbon arresters are used to protect both aerial and underground cables from damage by lightning.

Power for the loudspeaker system is 110 volts a.c., from commercial sources. In the basement of the tower an R. H. Sheppard Co. 3½-hp., 1800-r.p.m., 4-cycle diesel engine drives an Electric Machinery Mfg. Co. 2-KW. synchronous generator, for use as standby power in case the commercial current fails.

New Interlockings

One remote control plant includes power switch machines formerly hand operated, and a second remote control plant includes crossing with another railroad

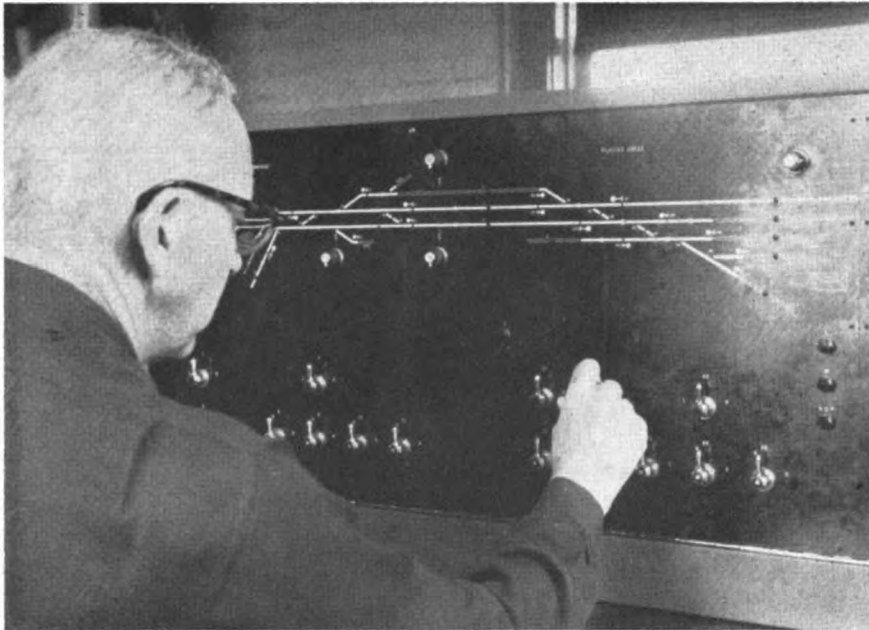
Installation of two new interlockings has completed a program of providing modern signaling from Porter to Grand Rapids. By 1949, the C&O had completed a program of installing centralized traffic control from Porter, Ind., to Lamar, Mich., the latter point being at the west end of Grand Rapids Wyoming yard.

Time Is Saved

Now, with the new remote control interlockings at the east end of the yard, through freight trains and passenger trains between Chicago and Grand Rapids are routed without delay. The interlocking located nearest the tower is known as Plaster Creek interlocking. Formerly, the switches at Plaster Creek were hand-thrown operated by switch tenders. Main line train movements were governed by electric semaphore signals and yard switching movements were governed by hand signals from switch tenders.

This interlocking now consists of two power crossovers, three power switches, 7 searchlight dwarf signals and 2 searchlight high signals, one of the high signals being mounted on a cantilever bracket so as to put the signal over the track governed. Now through Plaster Creek, the main track is on the south and all other tracks are yard leads.

Sunnyside interlocking, one mile east of Plaster Creek, is the junction point of the C&O main line into Grand Rapids and the main line to Petoskey, Mich., as well as a crossing of a single track line of the Pennsylvania. This interlocking was formerly controlled by a low-voltage table lever machine in a tower located north of the C&O main line between the Petoskey line and the PRR. Sunnyside interlocking now consists of two power crossovers, three power switches, four dwarf searchlight signals, four searchlight high signals, one of them being on



Interlocking operator controls switches and signals at yard entrance

Signals R37 (dwarf) and R39 (cantilever) looking towards yard entrance

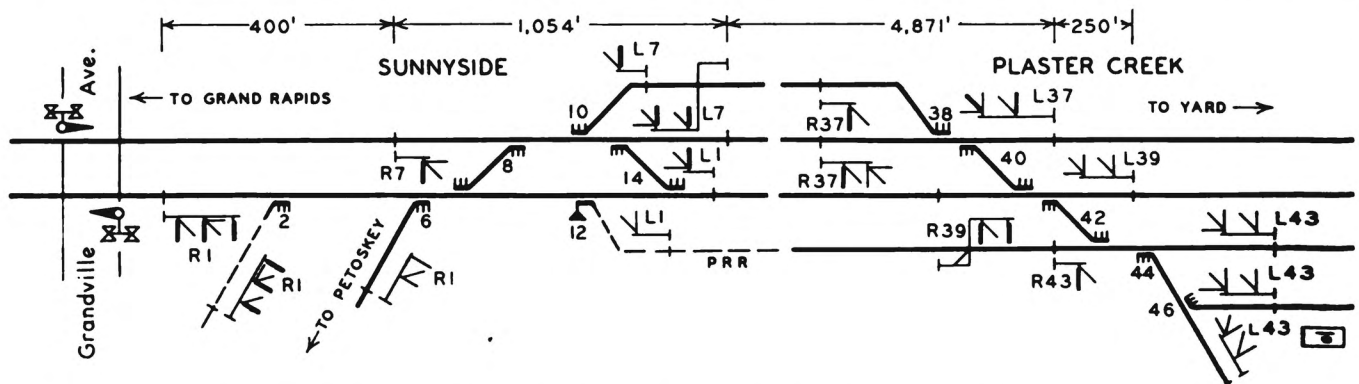


a cantilever bracket, and one electric lock on a hand-throw switch. The interlocking control machine on a PRR connection to the C&O is mounted on the operator's desk in main line. All signals for both inter-

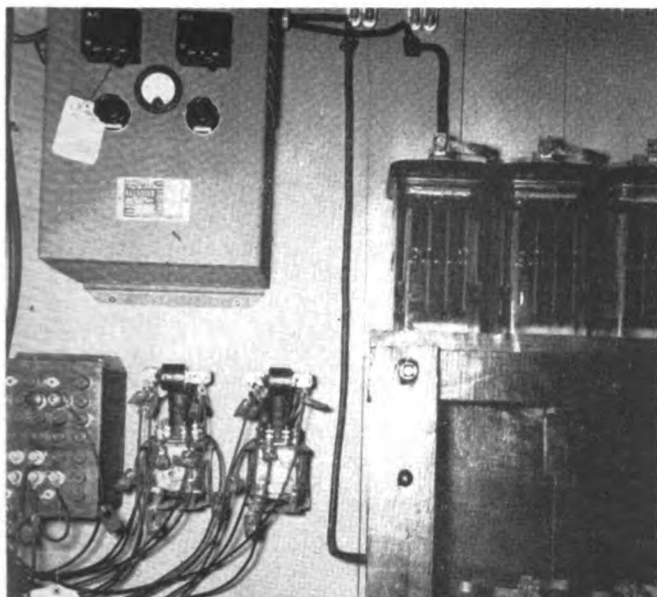
Creek tower. The machine contains the conventional track diagram with the tracks represented by a white line $\frac{1}{4}$ -in. wide with opal track-occupancy lights mounted in the line for OS detector sections and for approach track sections. Below the track diagram is a row of three-position signal levers. When a signal lever is vertical (standing on center position), the signal is controlled to Stop. The lever is turned 90 deg. to the right to clear the signal for traffic movement to the right, and turned 90 deg. to the left to clear the signal for traffic movement to the left. A green indication lamp is located in the center of the signal lever. After the signal clears, the indication lamp will light. Below the row of signal levers is a row of two-position switch levers that stand vertical for switch normal and 90-deg. to the right for switch reverse. An opal light in the center of the switch lever indicates when the switch is out of correspondence with the lever. Otherwise, the lamp is dark. The control machine is also equipped with an annunciator bell which rings when a train enters the approach sections to the interlocking.

Route Checking Lamps

One of the unique features, which the C&O has installed on the control machine, is a route checking circuit which consists of pushbuttons and small green indication lamps located at the entrance to the interlockings. When the operator has lined up a route, but prior to clearing the signal, he pushes the route checking button for that particular track, and the green indication lamps will light at the entrance and exit of the route. The purpose of the buttons and the green route indication lamps is to give the leverman this opportunity to check the track line-up before clearing the signal, because once the signal clears, the



Plan of Sunnyside and Plaster Creek interlockings both remotely controlled from yardmaster's tower at Plaster Creek



Rectifier charges storage battery for switch machine power



Plug-in relays used extensively at instrument housings

route is locked and cannot be changed until the signal is returned to the Stop aspect by lever control and the time release has operated. These route checking circuits are helpful to the maintainers to check the operation of the control machine, and are most beneficial to the operator in checking his lineups. Pressing the button lights the indication lamps, releasing the button extinguishes them. Separate route checking circuits with indication lamps are available for Plaster Creek and Sunnyside interlockings.

Switches and Wiring

The switch machines used in these interlockings are the Model 5C, 110-volt d.c. type with built-in master controllers and outboard shoe-type brakes. These machines are mounted on the No. 1 and No. 2 ties, which are dapped to take the machines, thus obviating offsets in the lock rod, point-detector rod and throw rod. Adjustable rail braces are used on the No. 0, No. 1, No. 2, No. 4, No. 6, No. 9 and No. 12 ties. Rail in this section is 115 lb., and No. 12 and No. 16 turnouts are used with 22-ft. and 30-ft. points, respectively. Swivel-type front rods are used on all interlocked switches. Multi-conductor cable runs underground from the field station bungalow to each switch location where, after it comes up through a 2-in. riser pipe into an iron terminal box, the wires terminate. From the terminal box, flexible wire is run through a 2-in. rubber hose to the switch machine. Use of the rubber hose between the terminal box and the switch machine minimizes wire breakage.



Signal L7 (cantilever) and L1 (dwarf) at Sunnyside, facing Grand Rapids

Both Plaster Creek and Sunnyside interlockings are unit wire controlled. Two 19-conductor Kerite aerial cables, with attached Copperweld messenger, carry the circuits between Plaster Creek and Sunnyside. Gould DP-7 60-a.h. storage battery, feeds the switch machines. The track circuits are the conventional d.c. type, using 4-ohm track relays, fed by Edison 1,000-a.h. primary battery.

Also included in this new signaling program was the "tying in" of the controls of the automatic short-arm gates and flashing-light signals at Grandville avenue, to the clearing of the home signals. Thus, if a train is approaching Grandville avenue from the west, the crossing protection will not begin operation until home signal L-7 or L-1 is

cleared. This control was added to prevent needless highway traffic tie-ups. If the train moves onto the Petoskey line, the crossing protection will not operate.

Track and other conventional type relays were supplied by the Union Switch and Signal-Division of Westinghouse Air Brake Company. Plug-in type relays, switch machines, signals, the control machine, and major items of signal equipment were furnished by the General Railway Signal Company.

The new signaling and communications facilities were planned and installed under the direction of M. F. Anderson, engineer communications and signals, Pere Marquette district, Chesapeake and Ohio. Installation work was carried out by railroad forces.