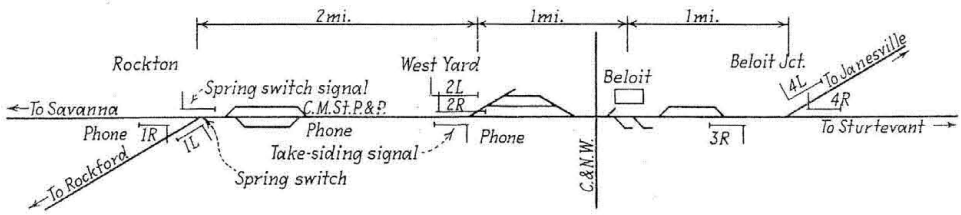
C. T. C. Replaces Staff on Milwaukee



Train movements are expedited and operating expenses are reduced

THE Chicago, Milwaukee, St. Paul & Pacific has recently installed a centralized traffic control system, including a spring switch, to replace a staff system on three miles of single track between Beloit, Wis., and Rockton, Ill., and the C. T. C. system also extends one mile eastward from Beloit to include the operation of the signals at Beloit Junction. The main line of the second district of the Milwaukee division extends from Sturtevant, Wis., through Beloit Junction, Beloit, Rockton and on west to Savanna, Ill. At Rockton a line branches off to Rockford, Ill., and extends to Davis Junction, Ill., where it connects with the Chicago-Savanna main line. At Beloit Junction a line branches to Janesville, Wis., to connect with the Chicago-Madison main line. With this layout of lines, the four-mile section of single track between Beloit Junction and Rockton handles not only the Milwaukee division main-line traffic but also the branch-line trains, the total traffic daily including eight passenger trains, eight freight trains and one or more extra trains.

Previous Operating Arrangement

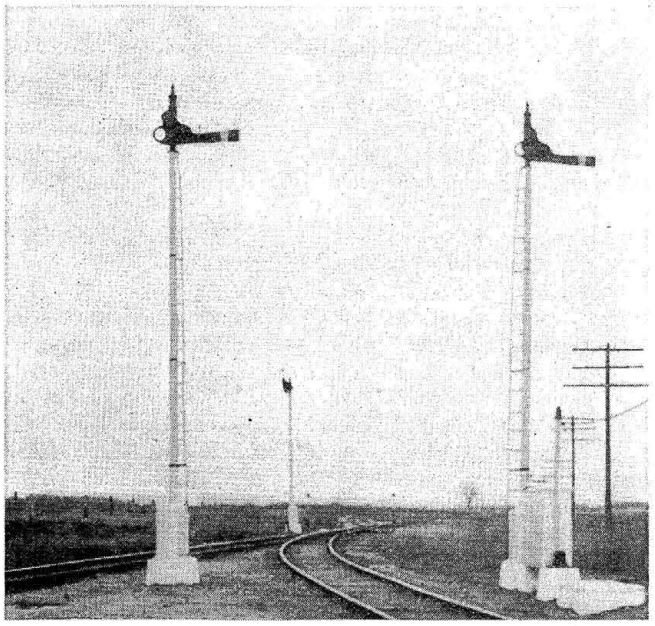
Under the previous method of operation, an electrically-controlled train-staff system was in service to maintain an absolute manual block between Beloit and Rockton. The dispatcher's office is located at Beloit and one operator was on duty at Rockton each trick. No operators were on duty at Beloit Junction, train movements to and from the branch line being directed by electric signals which were controlled by small switches on the dispatcher's desk. Prior to the installation of these signals a few years ago, trains had been required to stop at Beloit Junction to check the register.

The staff system of operation had certain limitations because it was not possible to make following train movements; furthermore, the handling of the staff introduced further delays at each end of the section. Therefore, in order to expedite train movements and to reduce operating expenses, it was decided to replace the staff system with centralized traffic control, with the control machine located on the dispatcher's desk at Beloit. Levers were provided in the machine for the control of the signals at Beloit Junction, thus making the system complete for the direction of train movements by signal indication.

As the enginehouse, freight yard and coal chute are located at West Yard, one mile west of Beloit, there are numerous switching movements in this area. Additional complications are introduced by the crossing of the Chicago & North Western line, which is protected by gates, operated by a watchman, which control dwarf signals for directing trains over this crossing. In view of all these factors, it was decided to locate signals *1R* and *1L*, for directing westbound trains, at the west end of Beloit yard, as shown in the diagram. A westbound train leaving Beloit is running within yard limits until it arrives at signal *2R* and if this signal is at clear, it gives the engineman authority to proceed to Rockton. Signal *2L* is used to direct westbound freight trains to pull out of the yard and proceed to Rockton.

The two signals *1R* and *1L* at Rockton are used to give a train authority to move from Rockton to Beloit Yard, where they enter the yard limit territory and proceed accordingly to Beloit station or into the yard or siding, as the case may be.

If the dispatcher wants to put an eastbound train in the siding at West Yard, he throws a lever which causes



Signals IR and IL direct eastbound trains at Rockton

the "Siding Signal" to be displayed. The illuminated track diagram on the control machine indicates to the dispatcher the location of the train when approaching Rockton or while proceeding between Rockton and West Yard.

Under the previous method of operation, the operator at Rockton handled the junction switch for heavy

trains. As gas-electric cars are used for passenger service on the Rockton-Rockford line, no great delay is occasioned by requiring these trains to stop to handle the switch. However, on account of grade conditions, some difficulty would be occasioned by requiring a freight train, en route from Rockford to Beloit, to be stopped at Rockton to throw the junction switch. Therefore, an oil-buffer type of spring switch was installed at this junction switch. The switch is normally lined up for the main line and trains en route from Rockford to Beloit

Relays and battery in station at Beloit

trail through the spring switch without stopping. However, trains en route from Beloit to Rockford are required to stop to throw the switch. A signal (marked "Spring switch protection signal" on the plan) is located 12 ft. in the approach to the facing point of this switch and is controlled through contacts, in the switch-circuit-controller, which are open when the normally-closed point is open more than $\frac{3}{16}$ in.

The Control Machine

The control machine, located in the dispatcher's office, has four control levers which control the seven signals. When the levers are on center, the signals are at "stop" and each lever operates to the right or left to clear the corresponding signal. The indication of each signal is repeated by small lamps mounted above each lever. The take-siding signal at West Yard is controlled by a small toggle switch mounted below and between levers No. 3 and No. 4. Four separate snap switches marked O1LT, etc., are provided to cut out the annunciator bells for different approaches. The illuminated track diagram, located on the machine above the levers, reproduces the entire track and signal layout, and small lamps, located in the line representing the track, repeat the track occupancy of the different sections, so that the dispatcher knows the location of trains.

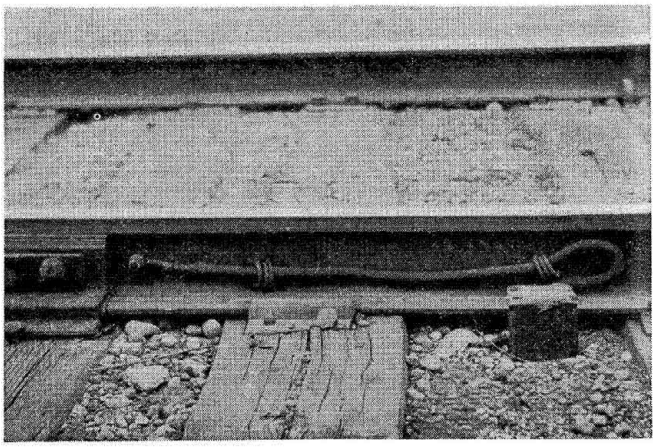
The new installation not only affords safety for train movements equal to that of the previous staff system, but, furthermore, facilitates train operation by permitting following movements, and eliminates the time previously lost in handling the staff. The three operators at Rockton are no longer required, the station work being handled by one agent on the day trick. The new signaling cost approximately $6,000 and effects an annual saving in operating expenses of approximately $3,000.

Field Equipment

The signals on this installation are Style-B semaphores, equipped with 10-volt d-c. motors. The take-siding signal at West Yard consists of a single red light unit mounted on a 4-in. cable post 10 ft. high, and uses one 50-watt 230-volt lamp, fed from the a-c. line when the signal is operated to display a take-siding indication. The control and track relays, etc., all operate on direct current, the a-c. primary system of power supply being used. One set of 18 cells of 500-a.h. primary battery is located at Rockton, at the west end of West Yard, at Beloit Junction, and at the dispatcher's office.

Normally, the only discharge from these primary batteries is that required by a 500-ohm line relay, the idea being to draw just enough current from the battery to keep it alive. The remainder of the load, including control relays and signal operating relays and lamps, is normally carried by a Union RT-22 rectifier, capable of delivering up to 5 amp. at 10 volts. In case of an a-c. power outage, the power-off relay switches the load to the 18-cell primary battery.

Each semaphore is equipped with a Union Style-D lamp body using a 10-volt 18-watt lamp, thus giving a good daylight indication, which is required on account of the poor backgrounds for some of the signals. These lamps are normally fed from the rectifier, and, in case of an a-c. outage, the lamp feed is switched to the primary battery, but the circuit includes a 5-ohm resistance which reduces the voltage on the lamp. This has two advantages. First, it conserves the primary battery, and second, the reduced brilliancy is at once noticed by the engineman and is reported to the dispatcher, who calls the maintainer, thus giving a quick check on a power failure, or blown fuse, etc.



The parkway cable is extended to a connector plugged in the rail

The a-c. power supply for the operation of the rectifiers and for the electric lighting of the signals is obtained from the main a-c. connection furnishing power for the operation of the coal hoist at West Yard, thus resulting in a minimum cost for energy consumed. This arrangement also made it possible to supply, from the charging line, energy for the lights in the station and on the platform at Rockton, thus resulting in additional savings.

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been our experience that it is much more economical to use some method of spraying the paint than by using paint brushes.

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Defective Track Insulation

"How do you locate track-circuit trouble caused by defective insulated rail joints, or by defective insulation in switch rods?"

Voltmeter Used

R. A. Davis
Signal Maintainer, Chicago, Burlington & Quincy, Burlington, Iowa

A quick and easy way to locate defective track insulation in switch rods and gage plates, is to proceed as follows: Leave the track battery connected to the rails, then connect the positive lead of a voltmeter to the positive rail, then brighten a place on the plate or rod next to the positive rail; then connect the negative lead of the voltmeter on the rod or plate, and, if the insulation is defective, a small reading will show on the meter. Defective insulated joints can be located this way by disconnecting the track battery in the adjoining track circuit. This test should be made in dry weather.

(For other articles on this subject see page 46 of the January issue).

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C. T. C. on the Milwaukee

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On each track circuit there is a set of three cells of 500-a.h. primary battery, in parallel with an RT-5 rectifier which is adjusted so that the normal discharge from the battery is from 3 to 10 m.a. Edison primary battery is used throughout this installation.

No Soldered Joints in Wiring

An interesting feature of this installation is that no soldered joints are used. The two line wires for the 220-volt distribution are No. 8 bare copper, and the line control circuits are No. 10 copper with weather-proof covering. Kearney connectors are used to connect the cable wires to the line wires. The cables are made up of No. 9 insulated wire for the common and No. 14 for other circuits, stranded Copperweld being used as messenger wire. The circuits running underground to signals are in Parkway cable made up with two wraps of steel tape, but no lead. The connections to rail are in No. 9 single-conductor cable made up without steel tape or lead, the insulation being 5/64 in. thick with two wraps of jute. At the rail, the conductor is brought up through a trunking riser, 18 in. long, made of Elastite. The conductor extends out through a hole in the side of the riser and to a Saco rail terminal plugged into the rail as shown in one of the illustrations. The cable is supported along the rail by two rings made of No. 9 insulated wire plugged into the rail with 9/32-in. pins. The riser is then filled with compound. All of the insulated wire and cable were furnished by Kerite.

Western Pacific

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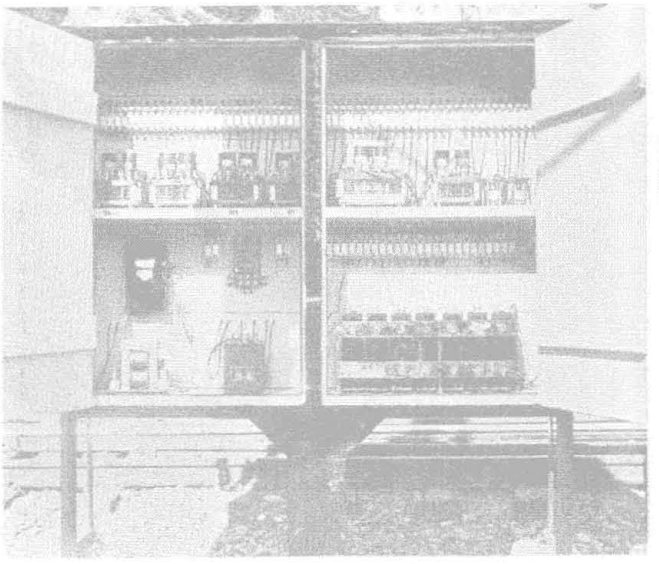
mal position, an amber indication light is shown. If the switch fails to make a complete movement or fails to lock up, no lever light is given.

The miniature track-and-signal diagram mounted on the machine over the levers, shows all the interlocked signals and switches in their normal position, and there are 11 track lights, each of which is lighted when the corresponding track section is occupied. When a train enters or leaves an approach section in either direction, a bell on the control panel rings, push-buttons being provided for each approach so that the operator can cut out the bell.



Battery and relay case near east portal of tunnel No. 32

Route locking is provided so that a lineup may be changed to a diverging route for a following train. The time-releases are set for four minutes. A total of 75 relays are in use on the plant. The polar relays are the DP-14 type, and all of them are equipped with silver impregnated front contacts. Double-wire double-break circuits are used throughout.

Each track circuit is operated by three cells of Edison 500-a.h. primary battery. Storage batteries, on trickle charge through Union rectifiers, are used for the operation of the other circuits. At each switch there is a set of 18 Edison B4H-75 a. h. storage cells, and at each signal there is a set of 7 such cells. The charging line is on two No. 10 wires carrying 220 volts a-c., and, although this circuit is in the same cable with the telephone circuit, there has been no interference with the telephone service. All apparatus is protected by General Electric Model GLA4A2 signal lightning arresters.

The copper wire and cable on this installation was furnished by the Kerite Insulated Wire & Cable Co. and included 9,000 ft. of 12-conductor cable made up of 10 No. 14 and 2 No. 10 wires; 13,000 ft. of 21-conductor cable made up of 19 No. 14 and 2 No. 10 wires; and 25,000 ft. of single-conductor No. 14 and 11,000 ft. of stranded No. 14 wire.

The signaling equipment on this installation, including the control machine, signals, relays, rectifiers, switch machines, etc., was furnished by the Union Switch & Signal Company. The construction was handled by the Western Pacific forces.