

Chicago Great Western

Saves \$7,000 Annually

by Remote Control of Tunnel Interlockings

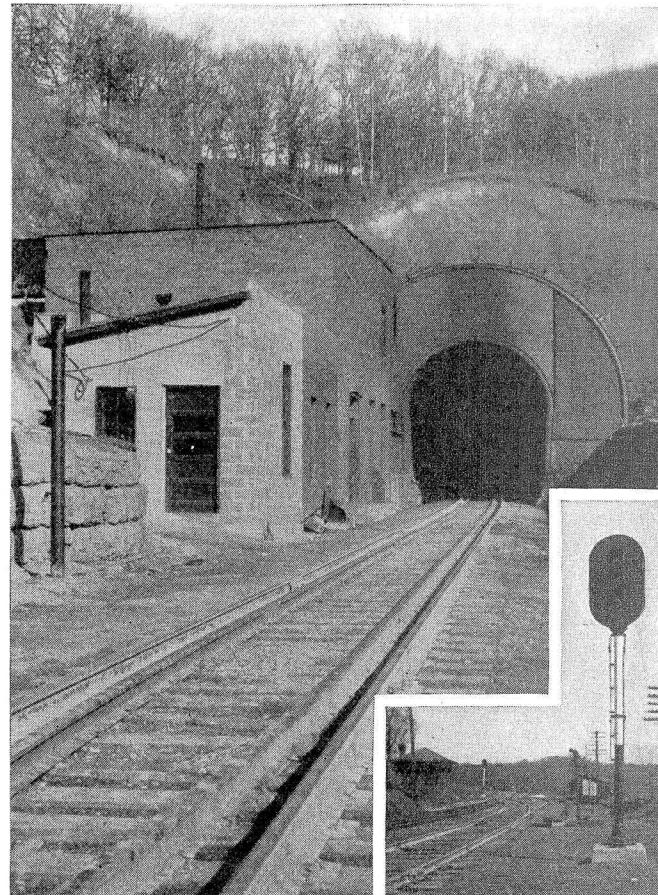
End-of-double-track on either side of tunnel controlled by CTC-type machine in fan house at west portal, with polarized line control circuits—Increased safety and flexibility of operation under new system have amply warranted the expenditure of \$18,000

West portal of tunnel. Inset—End of double track at Rice

A STRIKING example of the indispensable part played by the signal department in the reduction of operating expenses may be seen in a remote control installation on the Chicago Great Western at Rice, Ill., and Winston, 18 miles east of Dubuque, Iowa. Here the double track converges to single track where it passes through a 2,460-ft. tunnel located between these two stations, which are 1.6 miles apart. Until recently there was a mechanical interlocking plant at the end-of-double-track at Rice, and another at Winston, to control the switches and signals; and a staff system further safeguarded the passage of trains through the tunnel.

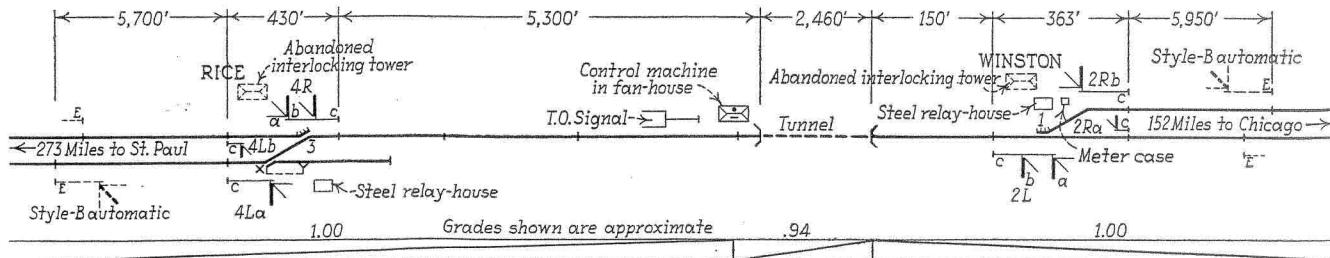
Because of the one per cent grade which eastbound trains must ascend through the tunnel, a fan, located at the west portal and controlled by an operator, blows the smoke out of the east portal ahead of eastbound trains. The freight lading consists mostly of live stock and general merchandise, including fruits and meat. In addition to the 20 freight trains daily, there are 4 passenger trains.

In keeping with the Great Western's program of rehabilitation and modernization, a study was begun, in



1929, to determine the most adequate and economically feasible plan of modernizing the train-operating facilities at this "bottle-neck." The cost of widening the tunnel or of cutting the hill away, to permit installing double track, prohibited these courses of action; too, it was doubtful if any probable increase in the volume of business would warrant such an expenditure. Because of the limited clearance in the tunnel, it was impossible even to gauntlet the track.

In the face of these difficulties, the signal department came forward with a plan that made possible the in-

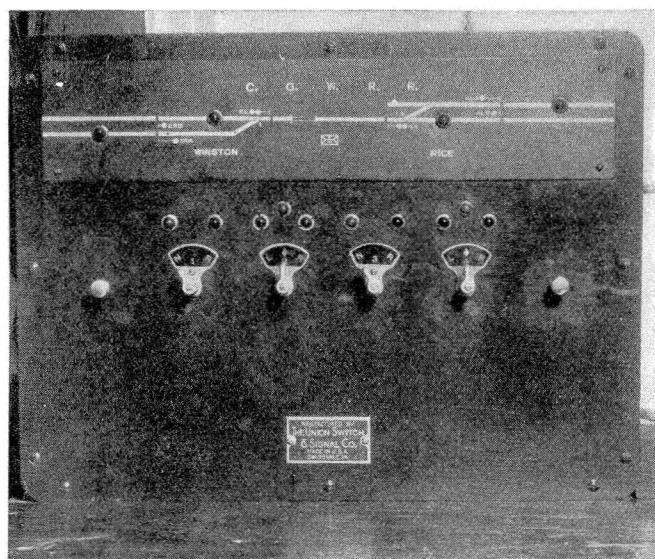


Track plan showing functions controlled from fan house

definite postponement of double-tracking, and at the same time effected a very tangible and appreciable saving in operating expenses. This plan was to treat each of the ends-of-double-track as a separate interlocking plant, but to control both plants from one remote point, by means of a system not unlike that employed in centralized traffic control installations. The proposal was approved and, on November 15, 1930, the field work was begun. On February 11, 1931, the new remote-control installation was placed in service.

Operation of the System

The control machine, which is located in the fan house at the west portal of the tunnel, approximately midway between the two ends-of-double-track, is supervised by



The control machine
Right—Smoke pouring out of east portal
ahead of freight train
Inset—Signals at east portal

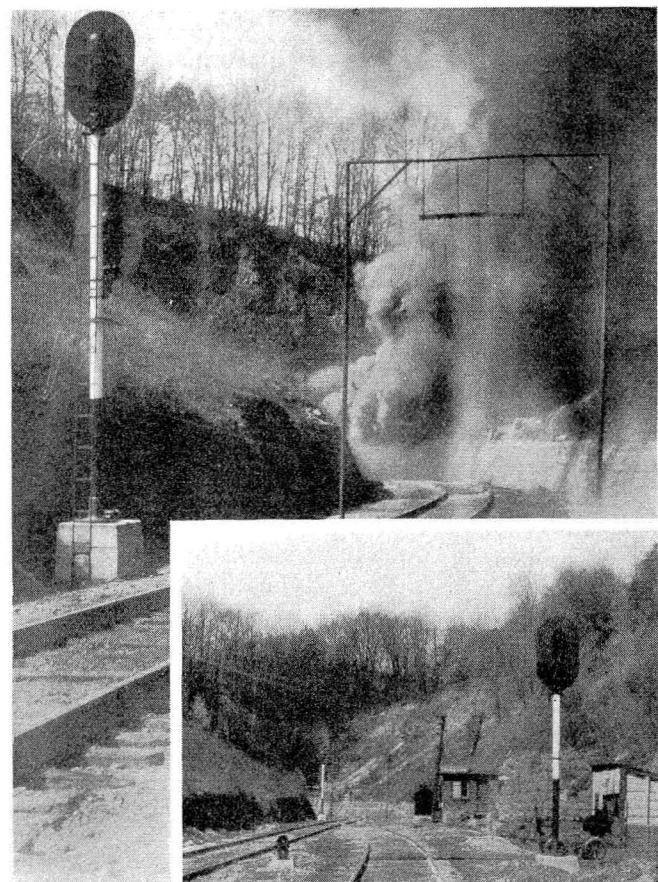
a telegraph operator who also starts and stops the fan, and makes minor repairs to the fan equipment. One such operator is employed on each of three tracks. These operators receive a somewhat higher wage rate than that received by regular interlocking operators. The six operators formerly employed at the mechanical plants have been released to other duties, or their services have been dispensed with. By reason of this reduction alone, an annual saving of \$7,000 has been effected, and still further economies are to be expected in the operation and maintenance of the new system, as compared with the old installation.

Only 20 in. long, 15 in. high, and 6 in. deep, the control machine consists of a track and signal diagram, under which two switch levers, two signal levers, and various approach and section annunciations are mounted. To set up any desired route, the operator merely turns the button-type levers to correspond with the required position of the switches and signals, and watches the indicator lights, in order to satisfy himself that the switches and signals have responded properly.

For example, referring to the illustration of the control machine, if the operator has received orders to line up the route for the passage of a train from Winston to Rice, with the current of traffic, he will put lever No. 1 reverse, No. 2 right, No. 3 reverse, and No. 4 right, thereby alining the switches and causing the desired

color-light signals to assume the clear position. When the train in question enters the track section in the rear of signal 2RA, the red indicator light mounted in the corresponding track section on the control machine will be extinguished and a buzzer, mounted inside the control machine, will sound until the operator acknowledges the approach of the train by pressing the push-button directly under this light. Similarly, when the train enters either of the detector track sections in which the switch machines are located, the corresponding red light in the track diagram is extinguished.

Above each switch lever there are two switch-repeater lights: Green for the normal position, and amber for the reverse position. When a switch is in transit from, say, the normal to the reverse position, the corresponding detector track-section repeater light and the green switch-repeater light are extinguished and remain so until the switch has completed its movement, at which time the detector light is again displayed and the amber light is



displayed to indicate that the switch is in the reverse position.

Each signal lever has three indicator lights mounted above it, the two green lights on the outside repeating the caution or clear position of the corresponding signal, while the middle, red, light is displayed at all other times.

Color-Light Signals and Dual-Control Switch Machines

Since nothing was to be gained by tearing down the old one-story brick towers, these are still used as telephone booths, in each of which there are three telephones—local, dispatcher and message. If a train is stopped at a home signal, the engineman calls the operator on the telephone for instructions.

As this territory had been equipped with Style-B upper-quadrant semaphore automatic-block signals for

many years, the only new signals required were those at the ends-of-double-track. These are the Union Switch & Signal Company's Style-P2 color-light type, the high signals being three-indication, and the dwarf and diverging-route signals two-indication—red for stop and yellow for proceed. The signal lamps are 10-volt 10-watt, continuously lighted, normally by alternating current at 8 volts, and, when the a-c. power fails, by an 8-volt tap on the Edison switch-operating battery.

A 16-sec. 24-volt dual-control switch movement, the Union Switch & Signal Company's Type M22, is used with a point detector. A unique feature of this machine is the thermal cutout and stick-relay circuit that opens the switch-operating circuit if an obstruction prevents the switch from completing its movement, and holds the circuit open until the operator acknowledges the fact by restoring the switch lever to its previous position and again manipulating the lever to the desired position. Thus, two advantages are secured: There is no wasteful consumption of the battery energy, and the operator is forced to be on the alert for any defect in the operation of the switches.

Extra precautions have been taken in reinforcing the switch layouts to eliminate creepage and other faults. There are five tie-rods; and the ties between the heel and the point are securely strapped on the outside of the rails, and those on the far side of the heel are similarly strapped on the inside.

Polarized Line Control Circuits

Contrasting this installation with any similar portion of a centralized traffic control installation, it might be observed that the only essential difference is that the switch and signal functions in this remote-control installation are not code controlled. Instead, a scheme of direct control is used, in which two line wires are used between the control point and the remote locations, together with a common return wire. These conductors are for the purpose of switch and signal control and indication. Each conductor is used in a dual capacity for both switch and signal units, being used for control purposes under certain conditions and for indication purposes under other conditions.

Two separate approach indications are obtained over one approach annunciator wire, the common wire being used as a return. Polarized circuits are employed for the control of the switches and signals, and for signal indication. The switch indication circuits are of the neutral type.

All safety features are incorporated in the local control of switches and signals in the remote layouts. Complete switch locking is provided, including, in addition to detector locking, two-minute approach locking for all main line moves and time locking for movements from the sidings. The approach-locking time interval is imposed by Union DT-10 time-element relays. The control relays are the Union DN-11, DP-14 and related types.

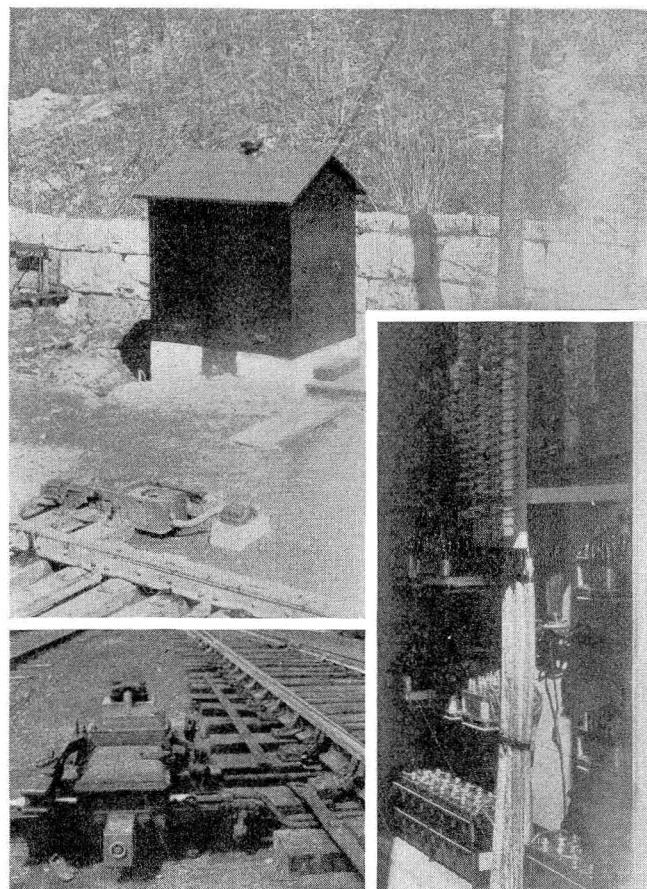
Because of the muddy condition of the ballast through the tunnel, considerable difficulty had been experienced with the track circuits prior to the installation of a concrete sub-flooring. The ballast outside of the tunnel is gravel, and, with the 100-lb. rails bonded by Copperweld plug-type 7-strand bonds, and the DN-11 relay in each track circuit fed by one Exide DMG07 cell, entirely satisfactory track-circuit operation has been obtained.

The complete absence of trunking is an important factor in the appearance of neatness that prevails. Okonite parkway cable is used throughout for all short runs between signals, relay housings and rails, at each

location. Cable outlet boxes were provided wherever their use made possible a saving in cable, or where testing would be facilitated thereby.

Steel Equipment Houses

A most effective centralization of relays and other control equipment has been obtained by the use of a Union steel relay house at each end-of-double track. Not only does the use of these houses result in a neater in-



The interior of the steel relay house (above) is shown in the right inset. Left inset—Dual-control switch machine

stallation, but it provides better shelter for the equipment, and simplifies the construction, testing and maintenance duties. These houses were wired in the factory at Swissvale, and were shipped completely assembled, excepting the batteries.

Open line wires carry the signal and a-c. power circuits, the field-made aerial cable drops being supported by Davidson cable hangers on a No. 8 weatherproof insulated Copperweld messenger wire. The signal control line wires are No. 10 3-braid Copperweld.

Power and Batteries

Power for the signal lighting and battery charging is taken from the local power company's 220-volt 60-cycle line at Winston, whence it is carried over two No. 6 copper wires to the fan house, and from the latter point to Rice over two No. 8 conductors. The electric meter is housed in a separate relay box adjacent to the steel relay-house at Winston, where, although it is available to the power company's meterman, as well as to the signal maintainer, it is read by the latter, from whose

readings the power company calculates the charges at the rural lighting rate.

Each switch machine is powered by a battery of 16 Edison B4H 80-a.h. cells, which is tapped at the mid-point to feed the 12-volt control circuits. At the fan house, a battery of 12 Exide DMG07 cells, tapped at the mid-point, energizes the polarized-control line circuits, as well as the local annunciator circuits. These batteries are on a-c. floating charge through Union copper-oxide rectifiers.

Proposed Train-Order Signal

In order to eliminate the present necessity of west-bound trains running slower than necessary in order that the engineman may observe the indication of the train-order signal at the west portal, adjacent to the fan house, it is proposed to install a color-light repeater signal at Winston. This signal, which will probably be mounted on the steel relay house, will consist of a lunar white unit which will be (approach) lighted when the westbound train-order signal is clear and extinguished at all other times. Thus, the engineman will be able to determine,

before he enters the east portal of the tunnel, whether or not to expect to pick up train orders at the west portal.

Maintenance Force Not Increased

No additions to the regular maintenance force have been necessitated by the installation of this remote-control system; a signal maintainer and his helper maintain a 24-mile section of double-track automatic signals, including the new signals and switches. Therefore, the savings mentioned in the introduction represent a conservative estimate of the economy in operating expenses that has been effected by this installation. Add to this the greater flexibility and safety of train operation in the new system, and a compelling picture of the possibilities of remote- and centralized-traffic-control systems is presented.

The installation was designed by engineers of the Union Switch & Signal Company, which company also supplied the signal equipment. The field work was handled by the railroad company's regular signal construction forces, under the direction of T. H. Kearton, general signal inspector.

Report on Milwaukee-Omaha Collision

Engineman's failure to control speed responsible for accident on crossing at Camp Douglas, Wis.

ON February 28, 1931, there was a side collision between a passenger train of the Chicago, Milwaukee, St. Paul & Pacific and a passenger train of the Chicago, St. Paul, Minneapolis & Omaha at the crossing of the tracks of the two railroads at Camp Douglas, Wis., which resulted in the death of 1 employee and the injury of 17 passengers, 2 employees, 6 mail clerks and 1 Pullman employee. The following report on this collision has been abstracted from the report of the director of the Bureau of Safety of the Interstate Commerce Commission:

Location and Method of Operation

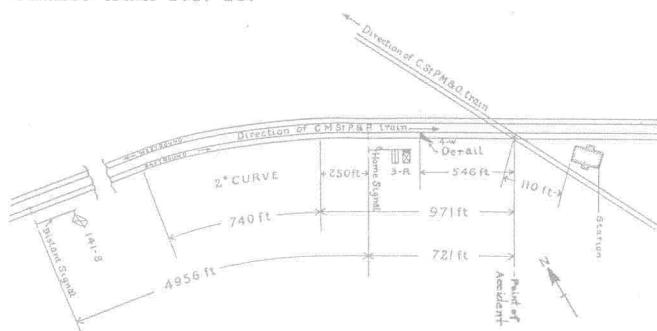
The Milwaukee is a double-track line over which trains are operated by time-table, train orders, an automatic block-signal system, and an automatic train-stop and cab-signal system of the continuous-inductive type. Train movements on the Omaha, which is a single-track line, are governed by time-table, train orders and an automatic block-signal system. The movements of the trains of both railroads over the crossing are controlled by means of an electric interlocking plant. The crossing is located at a point about 110 ft. west of the station, which is situated in the 27-deg. angle between the tracks of the two railroads.

Trains approaching the crossing on the Milwaukee eastbound main track are governed by interlocking distant signal 141-8, a one-arm signal which is also used as an automatic block signal and which is located 4,956 ft. west of home signal 3-R, which is a two-arm signal located 721-ft. west of the crossing. Except for the bottom arm of signal 3-R, which is fixed, these signals are of the 3-position, upper-quadrant type, displaying white, green, and red indications, for proceed, caution, and stop, respectively.

A split-point derail operated in conjunction with the

signals is located in the south rail of the Milwaukee eastbound track between the home signal and the crossing, the point of the derail being 546 ft. west of the crossing. The weather was cloudy at the time of the accident, which occurred about 3:47 a. m.

Westbound Omaha train No. 515 arrived at Camp Douglas at 3:43 a. m., three minutes ahead of its scheduled departing time, and was standing with the tender of the engine on the crossing when it was struck by Milwaukee train No. 16.



Track and signal plan of Camp Douglas layout

Eastbound Milwaukee train No. 16 passed Tomah, the last open office, 12.8 miles west of Camp Douglas, at 3:36 a. m., 16 min. late, passed distant signal 141-8 displaying a caution indication, passed home signal 3-R displaying a stop indication, passed over the open derail, and collided with train No. 515 while traveling at a speed estimated to have been from 30 to 40 m.p.h.

Summary of Evidence

Engineman Taylor, of Milwaukee train No. 16, stated that approaching distant signal 141-8 he could see the