

# Interlocking Controlled Remotely

*Burlington replaces mechanical plant at railroad crossing with electrical equipment controlled from centralized machine 1.5 miles away*

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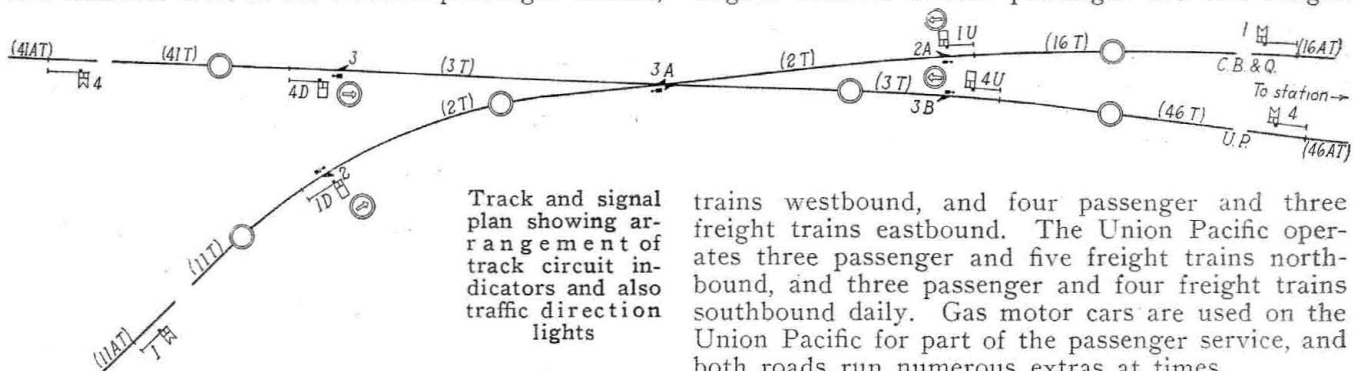


*Tower building and all mechanical fittings will be removed shortly—New remote control facilities in wooden shelter at right*

THE first application of the centralized dispatcher system for the remote control of an entire interlocking plant was placed in service February 14, 1929, by the Chicago, Burlington & Quincy at Lincoln, Neb., where a mechanical interlocking, known as the Sherman plant at the crossing of two single-track lines, was replaced by an all-electric low-voltage plant, the control machine being located in the tower of another interlocking at Hall street, about 1.5 mi. away. This new arrangement further completes the program of the consolidation of control facilities west of the Lincoln passenger station,

Kansas City, Mo., and the single-track main line of the Union Pacific between Valley, Neb., and Manhattan, Kan. The Burlington grade is 0.2 per cent eastbound and the Union Pacific is approximately the same. The two lines cross at an angle of 8 deg. 10 min., which requires crossing frogs with movable points to be included in the interlocking. Complete derail protection is provided, the Burlington using the Wharton lift type, and the Union Pacific the split-point type, all for 90-lb. rail.

The daily traffic through this plant on the Burlington consists of four passenger and two freight



as the Hall tower also controls the Cobb Junction layout located 7 mi. west on the main line to Denver, Colo.

The Sherman plant on the Lincoln division protects the crossing of the single-track main line of the Burlington running from Billings, Mont., to

trains westbound, and four passenger and three freight trains eastbound. The Union Pacific operates three passenger and five freight trains northbound, and three passenger and four freight trains southbound daily. Gas motor cars are used on the Union Pacific for part of the passenger service, and both roads run numerous extras at times.

## Economy Derived by New Installation

The mechanical plant, constructed in 1911, was of the Saxby & Farmer type, equipped with electric route locking. The operation of this plant required a force of three levermen, one for each trick. The

new remotely-controlled electric plant was installed to permit the saving of wages of levermen as shown in detail in the table:

COST OF MAINTENANCE AND OPERATION—OLD PLANT		
Three levermen at 55 cents per hour.....	\$4,818.00	
Maintenance and material.....	125.00	
Operating material and supplies.....	60.00	
Maintenance labor.....	225.00	
Int. depr. taxes, etc., at 10 per cent on \$14,200 .....	1,420.00	\$6,648.00

COST OF MAINTENANCE AND OPERATION—NEW PLANT		
Maintenance material .....	\$ 200.00	
Operating supplies and electric current.....	60.00	
Maintenance labor .....	225.00	
Int. depr. taxes, etc., at 10 per cent on \$17,664 .....	1,766.45	\$2,251.45
Total Net Annual Saving .....		\$4,396.55

### Field Apparatus

The apparatus used in this installation is in accordance with C. B. & Q. specifications. The General Railway Signal Company furnished the major

Balkite rectifiers. The battery is housed in a concrete well outside of the equipment house. A 220-volt, 60-cycle, single phase circuit is used for battery charging, the power being obtained at the crossing and distributed from that point. Standard d-c. track circuits are used with short trap circuits through the movable point crossing. Two Copperweld bond wires are installed to a joint, using Duplex channel pins.

### Line Construction

Through the elimination of mechanical locking on the machine and the placing of the locking in the field, it was possible to reduce the number of wires so as to use a 7-conductor No. 16 gage assembled aerial braided cable made according to the C. B. & Q. specification. This cable is suspended on a 4,000-lb. messenger wire in cable rings spaced approximately 2 in., and extends continuously from Hall tower to the equipment house at the Sherman crossing, from which point the circuits are distributed, the



Crossing frogs with movable points are operated by a Model-5A switch machine equipped with a dual-selector mechanism

portion of the new equipment such as five Model-5A low-voltage switch machines, five independent dual-control machines, the necessary polarized interlocking and Type-R relays, the thermal relays and thermal cut-out units, as well as other material necessary to install and operate the latest type of dispatching directional control circuits. The neutral 4-ohm and 500-ohm relays are of C. B. & Q. construction, having been made in the signal shop at Aurora, Ill. Lightning protection is accomplished by the use of L. S. Brach lightning arresters, the No. 25 being used for the 220-volt charging line and the No. 20 for the low-voltage circuits. The signals are of the lower-quadrant semaphore type, using Model-4 top-post Federal mechanisms.

The old brick interlocking tower and train order signal, as shown on the left in the view at the heading of this article, are to be removed. The small building on the right is the equipment house which contains the apparatus for the control of the new plant and in reality becomes the interlocking tower. In this equipment house the apparatus has been separated and grouped according to the work each group performs. A telephone, mounted on the right-hand side, connects with the loud speaker in the Hall street tower, where the control board is located. Electric lights are provided for this house.

Power for the plant is supplied from an Exide KXH-11 storage battery charged by Union and

line circuits running in additional cable to the functions. The track wires are of No. 8 gage, assembled in standard parkway cable with lead and steel armor as manufactured by the Okonite Company. The motor circuits extend from the central location to the several switch machines in parkway cable, No. 6 conductors being used so as to eliminate unnecessary drop in voltage.

### Control Machine Located in Hall Tower

The control machine, located in the Hall tower, is the General Railway Signal Company dispatcher type, revamped somewhat to fit interlocking conditions. This machine includes four levers numbered from left to right. Lever 1 controls the signals on the Burlington track. When the lever is up the westbound indication is displayed and when the lever is down the eastbound indication is given. Lever 2 controls the Burlington derails. The lever up places the derails on the track, and the lever down removes the derails. Lever 3 handles the Union Pacific derails and the movable-point crossing frogs. With this lever up, the derails are placed in the derailing position on the Union Pacific track and the movable crossing frogs are lined for the Burlington track. When this lever is down, the Union Pacific derails are placed in the non-derailing position and the crossing frogs are lined up for the Union Pacific. Lever 4 controls the Union Pacific



signals. With the lever in the up-position, a north-bound indication is given, while with the lever down a southbound indication is displayed.

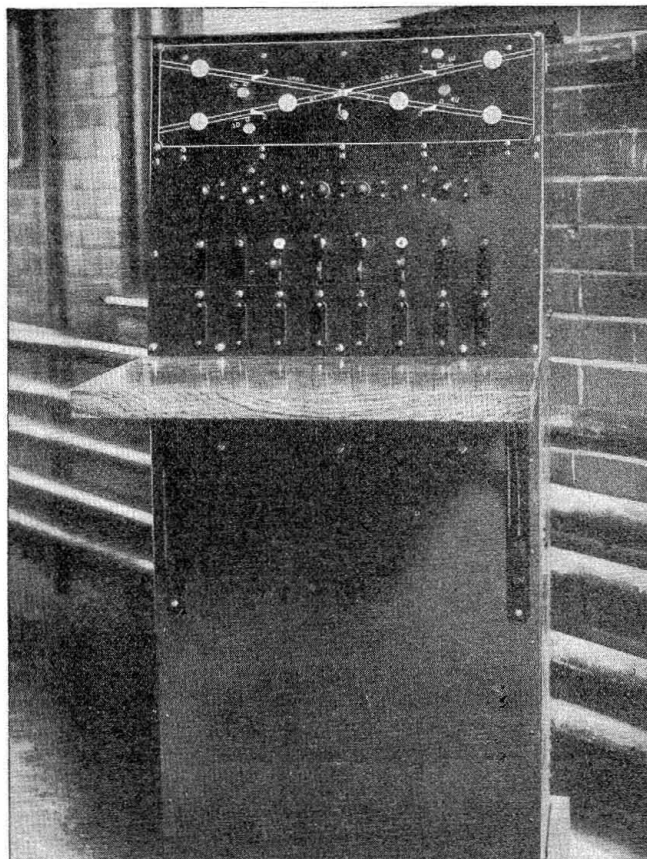
The unique feature about this installation is the fact that the entire interlocking is accomplished between functions in the field rather than through the agency of the control levers in the machine. The signal levers are operated to three positions, the center position causing all signals controlled by that lever to show their most restrictive indication. The distant signals are controlled by the home signals.

Complete indications are given on the control machine. A green light located just above each of the derail levers flashes when the derail starts to operate and again when it has completed its operation and is locked in either position. The illuminated diagram, as shown on the top of the machine, contains approach annunciator lights of opal color announcing the approach of a train from either direction on either railroad. Also located on each track between the derails is another opal light which shows the occupancy of the plant, these lights burning steadily while trains are on the track circuit. Located near each signal on this diagram is a white light in the shape of an arrow, which burns permanently when the signal is clear and also points in the direction of traffic for that signal.

The machine is also equipped with a single-stroke bell, which rings upon the approach of a train as well as when any of the indicating lights are lighted.

#### Operation of the Plant

Levers 1 and 4 are normally kept in the central positions. Levers 2 and 3 in the upward positions. This places all signals at stop and the derails in the derailing positions. As an example of the method of operating the plant, it is assumed that a train is



Control machine located in Hall street interlocker 1.5 miles away from Sherman crossing

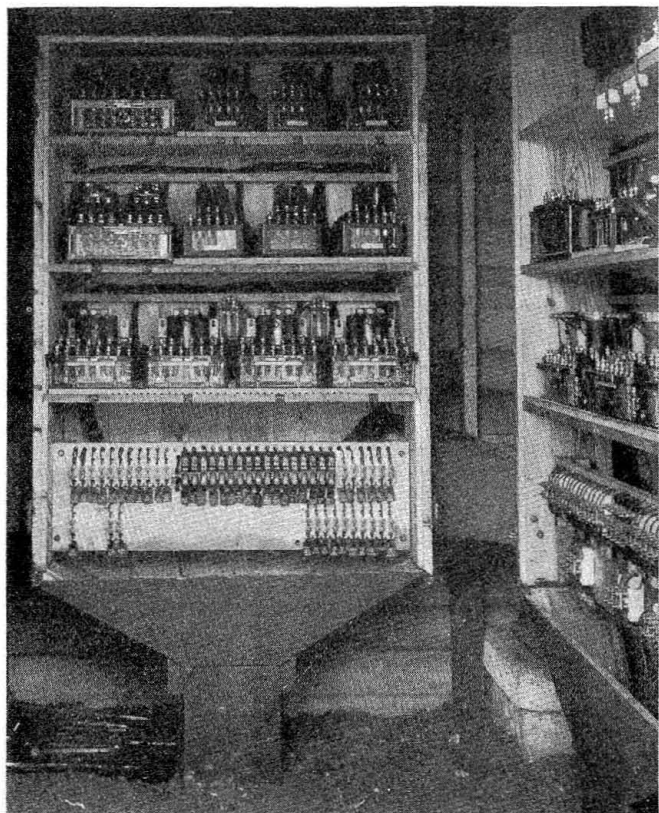
approaching toward Signal 1D on the C. B. & Q. This is indicated by the sounding of a gong and the illumination of the light indicator located on this section of track on the model board. The indicator is illuminated when the track section in the rear of distant signal becomes occupied and remains lighted until the rear end of the train passes home Signal 1D. To line up the route for the train approaching Signal 1D, the operator places Levers 1 and 2 in the downward positions, which clears Derails 2 and 2A, home Signal 1D and the distant signal on the C. B. & Q.

The light indicator above Lever 2 flashes and a gong sounds when the switch machines at the derails start to move and again when the movements are completed. When Signal 1D operates to its proceed position, the small light indicator, located near this signal on the track model, displays an illuminated arrow pointing in the direction of the train movement. When the train passes to track section 2T, which extends between home signals on the C. B. & Q., the gong sounds and the light indicator on the track model for this section is illuminated and remains lighted until the train passes off of this section.

#### Interlocking Features Accomplished Locally

For a train movement in the opposite direction on the C. B. & Q., the operator places Lever 2 downward and Lever 1 upward. This clears Derails 2 and 2A, Signal 1U and its distant signal. The derails, movable-point frog and signals on the U. P. are operated in the same manner by Levers 3 and 4.

All of the functions are interlocked electrically with each other so that none will respond to the lever



Relays and associated control apparatus in wooden shelter at the crossing

movement, unless conditions are proper for the operation of that function. The operator is free to manipulate the levers at any time and in any sequence that he chooses, but he cannot set up an unsafe condition.

Derails 2 and 2A on the C. B. & Q. cannot be operated unless all of the home signals are at stop, unless Derails 3 and 3B on the U. P. are in their derailing positions and unless movable-point frog 3A is in its normal position. Likewise, Derails 3 and 3B and movable-point frog 3A cannot be operated, unless all home signals are at stop and unless Derails 2 and 2A are in their derailing positions. Home signals are controlled through all four derails, movable-point frog, and the opposing signals. For example, before Signal 1D can be cleared, Derails 2 and 2A must be clear, movable-point frog 3A must be normal, Derails 3 and 3B must be in their derailing positions and opposing Signal 1U must be at stop.

### Locking Features

When a route has been lined up and a proceed signal displayed, the derails on this route cannot be operated after a train has entered the approach section to the distant signal, until the home signal has been placed at stop and has remained in that position for a period of two minutes. During this time interval the train will have stopped at the home signal or will have passed on to the detector circuit, which prevents operation of derails until the train has passed over the route. This is the same kind of approach and detector locking protection that is usually provided at interlocking plants, but it is secured directly through the circuits at the crossing, rather than through the control machine.

The economy of operating the protection at a crossing of this kind from a location where an operator is required for other duties is self-evident, there being no facilities or protection sacrificed that a regular interlocking plant affords, yet the cost of installation compares favorably with any type of electric plant handled directly by individual levermen. The maintenance should be no more costly than on any type of electrical equipment as it is planned to utilize the same maintenance force to maintain this plant that has been maintaining Hall tower and the old mechanical plant. This maintenance force consists of one maintainer and one assistant maintainer working eight hours a day and subject to night calls.

### Operating Advantages

An added advantage of this type of interlocking is the speed with which routes can be lined and traffic handled. The operation of the switch machine (timed on the ground) shows that the four movable points at the crossing can be operated in 14 sec. in spite of the fact that the points are short and of heavy rail, which operate rather stiffly. The derails operate in 11 sec., which is fast enough for this type of a plant.

This is a joint plant with the Union Pacific as is also the electric interlocker at Hall tower where the control board is located. As all trains operating on these lines of the Burlington and the Union Pacific pass through both plants, it is evident that one set of operators is ably adapted to handle both plants. Hence, it is expected that a greater efficiency and economy will result than what is shown by the elimination of the levermen at Sherman tower.

## Report on I. C. Derailment at Interlocking Plant

THE Bureau of Safety of the Interstate Commerce Commission has issued a report covering the derailment, on November 7, 1928, of a passenger train on the Illinois Central at Centralia, Ill., an abstract of which follows. This accident resulted in the death of two employees and the injury of three passengers, three employees and a Pullman porter. In the vicinity of the point of accident, this is a double-track line over which trains are operated by time-table, train orders and an automatic block signal system. The accident occurred within yard limits, at a lifting-type derail located 746 ft. south of a crossing at grade with the tracks of the Chicago, Burlington & Quincy.

The signals involved are Signals 1 and 2544, located 59 and 5,726 ft., respectively, south of the point of accident. Signal 1 is a one-arm, home interlocking signal of the two-position, lower-quadrant type, and Signal 2544 is a two-arm signal, also of the two-position, lower-quadrant type, the bottom arm giving a distant indication for Signal 1, which normally is in the stop position.

Northbound passenger train No. 8 departed from Carbondale, 55.7 miles from Centralia at 2:31 a. m., four minutes late, and was derailed by the derail south of the C. B. & Q. crossing, while traveling at a speed estimated to have been between 30 and 50 m.p.h.

### Conclusions

This accident was caused by failure properly to obey signal indications. The evidence indicated that home interlocking Signal 1 was in the stop position, with distant Signal 2544 in the caution position, and that these signals were displaying these indications because of the fact that the route through the interlocking plant was lined for the movement of a C. B. & Q. freight train, the caboose of which was just passing over the crossing when train No. 8 was derailed. It did not definitely appear that the usual whistle signals were sounded by the engineman of train No. 8 when approaching the interlocking plant, while the statements of the train crew indicated rather strongly that the accident occurred without any application of the brakes having been made, with the exception of a light service application made some distance away.

The Centralia district, on which this accident occurred, is on the main line of the Illinois Central extending between Chicago and New Orleans and other southern points. On this district there are 31 scheduled trains of all classes in addition to such extras as traffic conditions may require; 27 of the 31 scheduled trains are operated daily. The movements of these trains are protected by an automatic block-signal system, with interlocking plants at a few points. Extending northward from Branch Junction, 2.3 miles north of Centralia, to Champaign, a distance of 121.8 miles, there is an automatic train control installation in service; this automatic train control system is designed to prevent accidents such as that here under investigation. In view of this accident "it is believed the carrier should seriously consider whether the automatic train control system now in use should not be extended southward from Branch Junction."