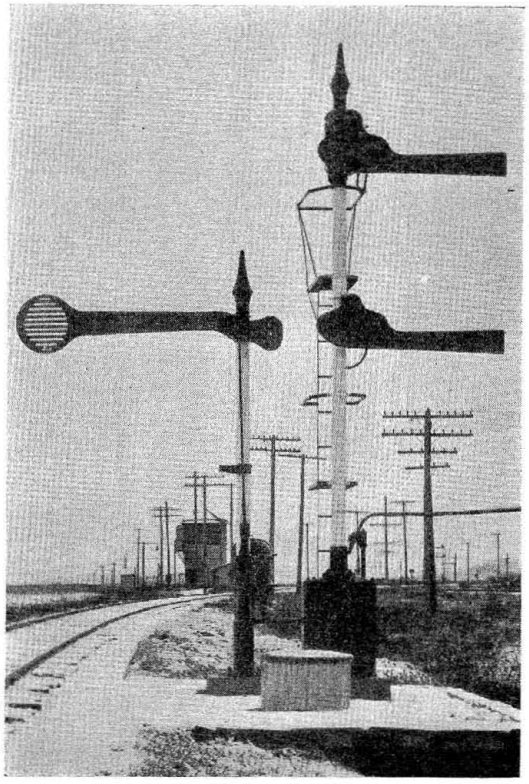
Railway Signaling

Automatic Interlocking Replaces Mechanical Plant

Chicago Great Western and Chicago & North Western effect total net return of 23 per cent on investment of $10,500 —Smash-boards required—Circuits utilize interlocking relays for directional control



Home signal on the Great Western

AUTOMATIC interlocking at a grade crossing of the Chicago Great Western and the Chicago & North Western, near Rochester, Minn., is saving the Great Western $1,400, and the North Western $1,000, net, annually, which represents a return of approximately 23 per cent on the investment, for both roads. The requirement of the Minnesota Railroad & Warehouse Commission that smash-boards be installed as part of the automatic interlocking accounts for approximately 30 per cent of the cost of the installation. The automatic plant, which was installed in July, 1931, replaced a mechanical interlocking which had been in service 28 years.

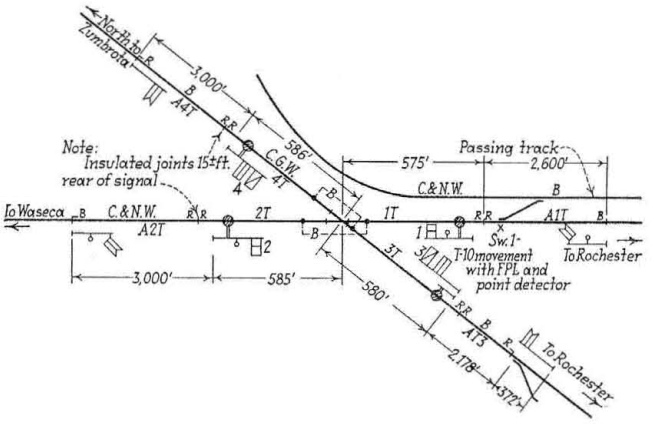
Traffic Conditions

The crossing here described is on a branch line of the Minnesota division of the Great Western, which extends from Randolph, Minn., to McIntire. About 1½ miles north of Rochester, Minn., this line crosses at grade a branch line of the Chicago & North Western. The traffic on the Great Western at this point normally consists of two freight and four passenger trains daily, while that on the North Western consists of four freight and four passenger trains. Ladings are chiefly farm products and general merchandise.

Since the speed over the crossing is limited by bulletin to 20 m.p.h., operative distant signals were not required. The home signals on the Great Western operate to two positions, Stop and Caution, and are designated as such by an auxiliary blade fixed in the Stop position. On the North Western the home signals operate to two positions, Stop and Clear, and carry lunar white marker lights. The distant signals on the latter road carry yellow marker lights. Home signals are located approximately 580 ft. from the crossing, with the distant signals 2,550 to 3,000 ft. in the approach to the home signals.

Control Relays of Interlocking Type

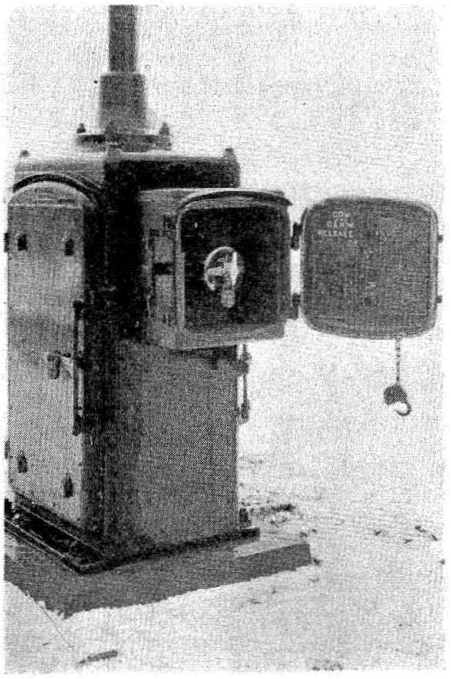
The circuits are patterned after the Chicago & North Western's standard plan for automatic grade-crossing interlocking, a feature of which is the use of interlocking relays to secure the desired directional control. A Great Western train approaching signal *3* will, on entering track circuit *A3T,* cause signal *3* to clear, provided there is no train between signals *3* and *4,* or between signals *1* and *2,* and that there is no train approaching a clear home signal on the North Western. As the train in question passes signal *3* this signal assumes the Stop position and cannot again be cleared until the train has passed signal *4.*



Meets can be made at the passing-track without operating the emergency release

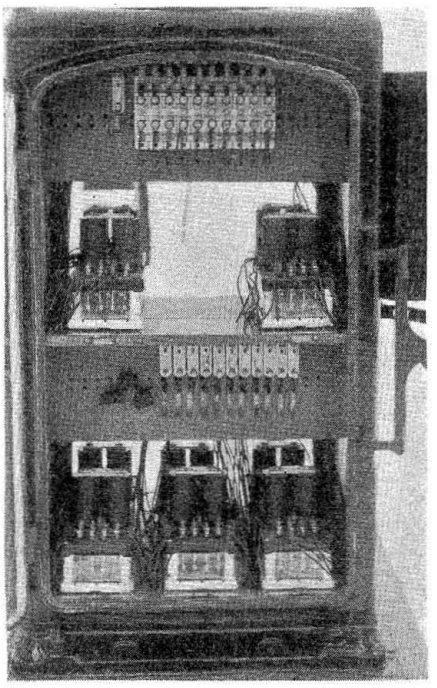
After a signal—for example, signal *3*—has been cleared, in normal operation neither home signal on the North Western can be cleared until the train which has caused signal *3* to clear has passed signal *4*. In connection with this, however, it is interesting to note that it is possible for signals *3* and *4* (or *1* and *2*) to be clear at the same time, since, for example, the control for signal *3* extends only to signal *4* and is not selected through the latter signal in the Stop position. Although this at first seems contrary to basic precepts of interlocking practice, the reason for using this type of control circuit is that the function of an interlocking of this kind is, not to protect opposing moves on any one line, but to protect conflicting moves on both lines. The probability of two opposing trains on, say, the Great Western entering this section of single-track as a result of any kind of error is exceedingly remote, and even if this did happen, the likelihood of such trains colliding within the interlocking limits is considered much too improbable to warrant the additional expense incidental to designing the circuits so as to preclude the possibility of opposing signals being clear at the same time.

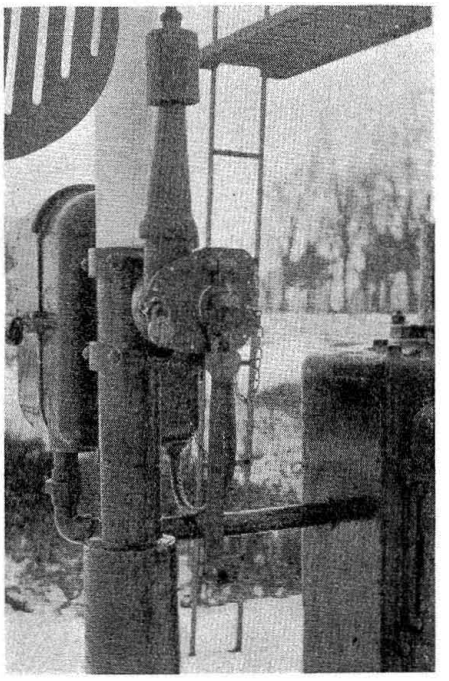
If it is desired to clear signal *1* or *2* while the train which has caused signal *3* to clear is standing in section *A3T*, a trainman may operate the clockwork time release at the crossing, thereby restoring signal *3* to the Stop position and clearing signal *1* or *2*, depending upon which approach section is occupied. One time-release, which serves both roads, is locked in a case attached to the center relay case at the crossing, by a special hasp-and-padlock arrangement permitting a trainman of either road to unlock the case.



Time release at the crossing

Relay case at the crossing





Special hasp-and-padlock arrangement for smash-board emergency crank

Provision for Special Moves

The use of interlocking relays introduced some difficulty in designing the circuits to permit a westbound train to wait on track-section *A1T* for an eastbound train, and, after the latter has headed in at switch *1*, to receive a Proceed indication on signal *1*. *It* will be seen that the eastbound train, under these circumstances, causes track-relay *A1T* to drop only half-way to its back contacts, since its armature is mechanically interlocked by track-relay *1T*. (These are the component relays of one of the four interlocking relays used in the crossing circuits.) To overcome this effect, switch *1* is equipped with a switch-circuit-controller having a set of contacts that make only when the switch is in the intermediate position. The circuit for track-relay *A1T* is controlled through this switch-circuit-controller in such a manner that when the crew of the eastbound train closes switch *1* after that train has cleared the main, track relay *A1T* will be momentarily energized, thus annuling the interlocking feature and permitting *A1T* to drop to its back contacts. Signal *1* will then clear for the westbound train waiting on the main track. Switch *1* is equipped for manual operation, with a Union Switch & Signal Company T-10 hand-operated switch mechanism.

Signals and Smash-Boards

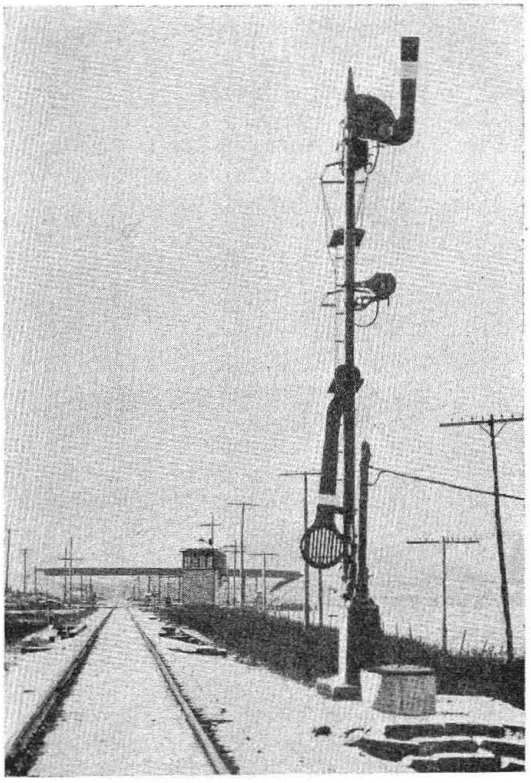
The smash-board mechanisms are the Union Type-T2 and are power-operated in both directions. They are so designed that they will not "drift" when in either the reverse or the normal position, and, since they are not held electrically, they will not move in case of a power failure. The insulated joints at each home-signal location are located approximately 15 ft. to the rear of the signal mast, to prevent an undesirable operation of the smash-board if and when the rear truck in the rear end of a receding train clears the center track-circuit but has not passed far enough beyond the signal mast to cause the overhanging rear platform to clear the smash-board.

The emergency crank for this smash-board mechanism is locked in a case (illustrated) with a switch padlock of the corresponding road's type, and the crank is chained to the smash-board mast to prevent it from being lost, mislaid or forgotten after it has been used in an emergency operation.

All of the operative signals are of the Union T2 semaphone type and are approach electric lighted. Two of the distant signals are electrically lighted at night, through

the control of Edison sun relays, while the other two are lighted by oil lamps.

Both of the center, or crossing, track-circuits and all of the track-circuits on the Great Western, are center-fed. This arrangement of the center track-circuit relays is a requisite of the interlocking-relay control scheme used at this crossing, if track-repeaters are to be avoided. Track-circuits *A4T* and *A3T*, on the Great Western, are of the center-fed type in order to overcome trouble resulting from the failure of rail motor trains to hold the shunt.



Home signal on the C. & N. W.

All of the wiring between signal locations is carried on open line, No. 10 weatherproof wire being used for this purpose. Okonite underground cable is used for all local wiring. The interlocking track relays are Union DX13, while the line relays are Model 13. Two Copperweld bonds are used on each rail joint. Edison primary batteries are used throughout.

The maintenance force was not increased as a result of this installation. A traveling maintainer handles, not only this plant, but also several other interlockings, crossing bells and telegraph lines on this branch.

The plant was installed by Great Western forces under the direction of T. H. Kearton, superintendent of signals of that road. The installation cost, $10,500, was borne entirely by the Great Western, but the operating and maintenance costs are divided as they were for the former mechanical plant, one-third being charged to the North Western and two-thirds to the Great Western, the junior road at this crossing.

Collision in Signal Territory

ON NOVEMBER 21, a rear-end collision between a freight train and an empty coach train on the Chicago & North Western, at Barrington, Ill., resulted in the death of one person carried under contract, and the injury of two employees. The accident occurred on the Wisconsin division, which extends between Chicago, Ill., and Harvard. In the immediate vicinity of the point of the accident this is a double-track line over which trains are operated by time-table, train orders, and an automatic block-signal system.

The signal governing eastbound movements in the block in which the accident occurred is interlocking home signal No. 2. This is a three-panel color-light signal, located at a point 565 ft. west of a grade crossing with another railroad. The circuits are so arranged that when this block is occupied the bottom or call-on panel may show yellow with the two top panels displaying red lights, thus indicating "Proceed at restricted speed." The distant signal is located 3,359 ft. west of home signal No. 2. This signal will have the blade in the horizontal position, displaying red and green lights, indicating "Prepare to stop at next signal; train exceeding 20 m.p.h. must at once reduce to that speed," when the track in advance is occupied, or when the home signal displays stop indications on the two top panels with the call-on arm displaying either a red or a yellow aspect.

Eastbound second-class freight train No. 594 departed from Crystal Lake, 11.29 miles west of Barrington, at 11:43 p. m., arrived at Barrington at 12:13 a. m., where it set off five cars, and had just started eastward, and was traveling at a speed variously estimated to have been from 3 to 12 m.p.h., when its rear end was struck by train No. 698.

Conductor Vethe, of train No. 594, stated that he instructed the rear brakeman to ride on the head end of the train and assist the head brakeman in setting off cars at Barrington, and that he himself assumed the duties of flagman. Upon arrival at Barrington, Vethe got off with his flagging equipment and walked back a distance of four or five car-lengths, the rear end of his train having stopped at a point between the home signal and the interlocking tower. He stated that he was watching the brakemen when they gave the signal for their train to proceed after setting out the cars and he then returned to the caboose. At that time he saw train No. 698 approaching, but did not think that it would overtake his own train and did not leave torpedoes or a lighted fusee on the track. Just as his train started he got up on the rear platform and stepped inside the caboose to set his lantern down; then, upon looking back he saw that train No. 698 was getting closer and he reached inside the door, got a fusee, lighted it, and dropped it off, but too late to avert the collision.

Engineman McClosky, of train No. 698, stated that upon approaching Barrington he observed the approach signal for the interlocking plant displaying a caution indication, while the home signal was displaying a stop indication with a yellow light displayed by the calling-on unit; he stated that he called these indications to the fireman and the fireman repeated them. At some point between the approach and the home signals McClosky applied the air brakes, and reduced the speed to between 25 and 35 m.p.h. by the time he passed the home signal. As he approached the crossing it appeared to him that everything ahead was clear and he released the brakes, at which time the speed had been reduced to between 20 and 25 m.p.h. and the throttle was practically shut off, but just as he released the brakes he looked ahead again and saw some one with a white lantern, and immediately applied the air brakes in emergency.

According to the report of the I. C. C. Bureau of Safety, from which this description is abstracted, the accident was caused by the failure of Conductor Vethe to provide proper flag protection and by the failure of Engineman McClosky to reduce the speed of his train in accordance with indications displayed by interlocking approach and home signals.