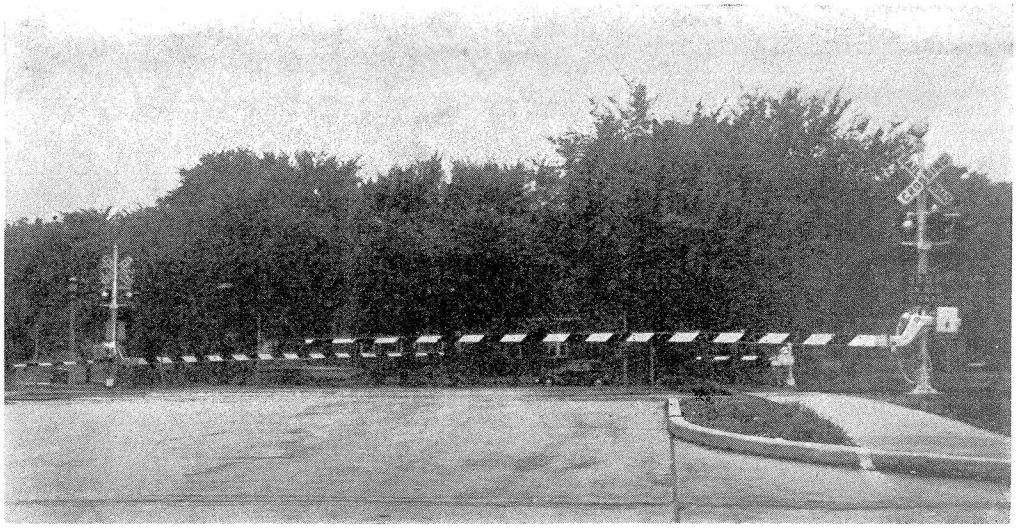


Each gate, when lowered, reaches more than half way across the paved part of a street

Gates at Three Crossings on C. & N. W.

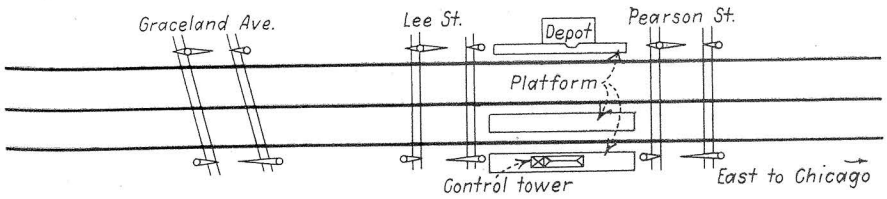
Combined automatic and manual control solves operating problem involving operations of suburban trains and through trains at Des Plaines, Ill.

IN ORDER to provide an improved form of protection, in service 24 hours every day, the Chicago & North Western has installed flashing-light signals and gates to replace watchman service at three street crossings in Des Plaines, Ill. This suburban town, located on the Chicago-Madison-St. Paul line of the C. & N.W., is 16.6 miles from the passenger terminal in Chicago. On the line through Des Plaines, there are three main tracks, the two outside tracks being signaled for single-direction operation and the center track for train operation in either direction. During the morning hours, this center track is used for trains inbound to Chicago, and in the evening it is used for outbound trains.

Including through passenger trains and suburban passenger trains, an average total of about 76 movements are made daily through Des Plaines. Through trains are not scheduled to stop at this station, but are required to reduce speed to 50 m.p.h. when passing through this town. Most suburban passenger trains stop at Des Plaines. The freight yards are on another line so that no through freight trains are operated through this town.

Pearson street crosses the tracks just east of the east end of the station platforms, and Lee street crosses just west of the west end of the platforms. Graceland Street crossing is 470 ft. west of Lee street. The streets are paved, and sidewalks are provided. All of these streets carry heavy local as well as through traffic, Lee street being U. S. highway No. 12 and 45 and also SBI 46. Pedestrian traffic is heavy on Pearson and Lee streets.

For years, these crossings have been protected by a watchman, on duty at each crossing on each of the three tricks daily. In order to provide more complete protection, the gates and flashing-light signals with bells were installed.

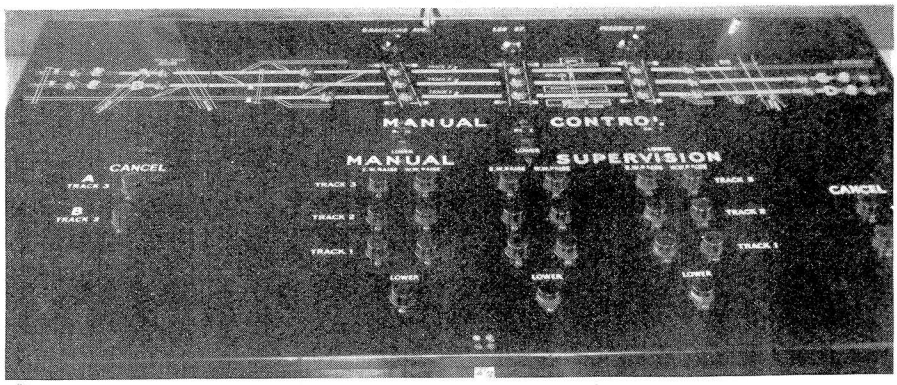


Track and signal arrangement of crossing protection

Form of Protection

At each of the three crossings, a gate was installed at the right-hand side of the street, as viewed when approaching the crossing from each side. Each gate arm is long enough to reach more than half way across the street, thus obstructing vehicles in the normal right-hand lane from entering upon the track, but the arms do not obstruct vehicles on the tracks from departing. The arms vary in length from 28 ft. to 38 ft., depending on the widths of the pavement and whether space was available to locate the masts between the sidewalks and the pavement.

At all four sidewalk approaches to the tracks at each crossing, gates obstruct the entire width of each side-



The illuminated track diagram and push-buttons are arranged on a sloping panel

walk. In some instances the main gate masts were set beyond the sidewalks so that the street arm served also to obstruct the sidewalk. Where the masts are between the walk and the curb, a separate sidewalk arm on the main mast is crank connected and operated by the mechanism, which also operates the street arms. At the locations where no street gates are used, separate masts with short arms were provided as side-walk gates.

Flashing-light signals are mounted on the gate masts for the street gates. In view of the fact that street traffic may approach the crossing from various angles, extra sets of flashers are provided as required to protect for each possible approach. As additional protection, especially for pedestrian traffic, a bell is provided at each of the three crossings.

Difficulties of Controls

The practice of controlling the gates and signals automatically by track circuits exclusively was not practicable because the gates would be down, thus obstructing traffic for extended periods while the suburban trains were making the station stop, and while the switch engine was serving the various house tracks. The problem was solved by installing automatic track circuit control in combination with manual control.

The maximum permissible train speed through this town is 50 m.p.h. Track circuit controls for the crossing protection are arranged to give adequate warning time for train speeds up to 70 m.p.h., and the controls are arranged for either-direction train operation on each of the three tracks. This track circuit control is normally in effect to set the crossing protection in operation as a train approaches and to cut out the operation after a train passes.

When protection is to be provided, the flashing-light signals and bells are set in operation, and, after a five-second delay interval as a pre-warning that the gates are to be lowered, the gates are released, a period of about eight seconds being required for the gates to arrive at their lowered position. After a train clears the crossing, the gates are raised in about eight seconds, and then the flashing-light signals and bell are cut out.

The manual control, which is superimposed on the automatic control, includes a control machine with illuminated track diagram, furnished by the Griswold Signal Company and located in an elevated cabin on the south side of the tracks and midway between Pearson and Lee streets. As a through train approaches and passes, the automatic track circuit controls are effective to control the operation of the gates and signals without any action on the part of the towerman.

Suburban Train Operation

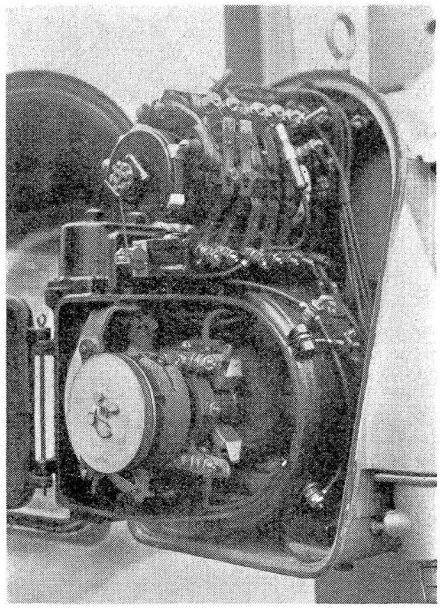
When a suburban train is approaching at slow speed preparing to stop at the station, the towerman, by pressing a button, can cut out the effectiveness of one approach control track circuit so that the crossing protection is not placed in operation until the train enters a second track circuit, which is sufficiently long, for a train at the given speed, to provide the standard period for the warning and the lowering of the gates before the train arrives.

As a general rule, the westbound suburban trains stop with the locomotive short of Lee street, but just in case the train might overrun, the gates at Lee street are allowed to be lowered by automatic control. On the other hand, the towerman takes action to prevent operation of the protection at Graceland avenue when a westbound suburban train is approaching, because he knows that the train will stop short of that crossing.

As soon as the train stops, and if the locomotive is short of Lee street, the towerman pushes a button which cuts out the signals and raises the gates at that crossing, thus permitting street traffic to use the crossing. When the train is ready to depart, the towerman pushes another button which sets the signals in operation and lowers the gates at Lee street. Another button effects the same controls at Graceland avenue.

A separate set of buttons is provided for manual supervision in connection with each of the three tracks for each direction and for the gates at each of the three crossings, thus a total of 21 buttons are provided for this local control. The buttons, which are mounted in the face of a sheet-metal panel, are spring operated to restore them to the normal position.

The cut-out circuits include stick features so that a cut out is cancelled automatically when a train departs.



A governor for lowering operation

For this reason, no matter what action the towerman takes, he cannot leave any cut outs in effect for other than the train for which the cut out was established.

If the towerman establishes a cut out for a suburban train standing at the station, and a through train approaches on another track, the automatic control established by the through train takes precedence over the cut out, and the signals are set in operation and the gates lowered.

Whenever the towerman takes action to counteract the automatic track circuit control, a red lamp is lighted on this panel above the symbol for the corresponding crossing, and this lamp stays lighted until the manual cut out is no longer effective. This red lamp serves as a warning to the towerman that he has placed a control in effect, and that he must concentrate his attention on the movement of the train and

the control of the crossing protection at the streets yet to be crossed by the train.

Direct Manual Control

In addition to the push-button manual control for operation in conjunction with the track circuit control, the towerman can lower the gates at each crossing independent of the track circuit control. For example, if a track motor car approaches, the towerman, by operating the toggle handle of a snap-switch on his panel, can set the signals in operation and lower the gates at the corresponding crossing. After the car passes, he places the switch normal, thus raising the gates to normal. If he left one of the toggle switches in the wrong position, the gates at the corresponding crossing would stay down regardless of other controls, but failure to operate these toggle switches as intended cannot result in a circumstance in which the gates will not be down and the signals operating when a train approaches a crossing.

On each track over each crossing there is a separate track circuit the width of the street, and the signals continue to operate and the gates stay down as long as such a track circuit is occupied, there being no cut-out for this section.

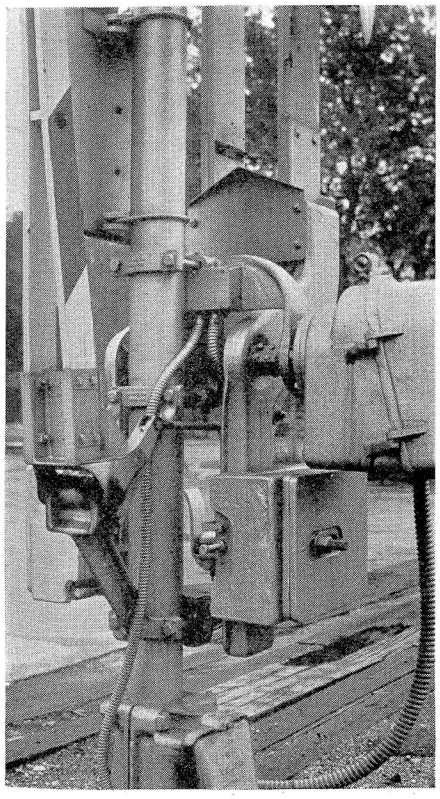
Between 10 p.m. and 6 a.m. very few suburban trains are operated; therefore, no towerman is on duty. During this period the track circuit automatic control of only the signals and gates is in effect.

The crossing signals, including the flashing-light signals and gate mechanisms, were furnished by the Western Railroad Supply Company, the complete assembly being known as the Model 10. The gate shafts operate in double bearings. The d-c. operating mechanisms are controlled to drive the gate arms when being lowered as well as when being raised. The gates are balanced to lower automatically by force of gravity, but the power drive, which is in effect during the first 45 deg. of the lowering motion, is an extra feature to overcome adverse wind. The special fly-ball type clutch and governor used in connection with the lowering operation is shown in one of the accompanying illustrations.

The gates at each crossing are operated from a set of 10 cells of Exide EM-9, 160-a.h. storage battery which is on floating charge from a rectifier. The lamps in the flashing-light signals, as well as on the gate arms, are rated at 10 volts, 18 watts. These lamps are normally fed from transformers, but in case of an a-c. power outage they are switched to feed from the storage battery. Each track circuit is fed by one cell of EMGO-9 storage battery.

In order to secure maximum shunting, the primary-secondary circuit arrangement is used on the short track circuits on each track over the street crossings. The Type K-8 relays are used as the secondary relays and the Type K-2 as the primary relays. All of the track and control relays were furnished by the General Railway Signal Company.

This crossing protection project was planned and installed by signal forces of the Chicago & North Western, under the direction of S. E. Noble, superintendent of telegraph and signals.



The double-mounting of gate arms

Accident on the Union Pacific

On August 20, a rea -end collision occurred at Moapa, Nev., on the Union Pacific. The following information concerning this accident was abstracted from a report by the Bureau of Safety, I. C. C.

In the vicinity of the point of accident this is a single-track line over which trains are operated by time table, train orders and an automatic block-signal system. At Moapa a siding 6,247.9 ft. in length parallels the main track on the south. The west switch of this siding is located 2,595.4 ft. west of the station and is equipped with dual-control mechanism, which, when it is operated by power, is under the control of the operator at Moapa. The accident occurred on the siding at a point 462.6 ft. east of the west siding-switch. As the point of accident is approached from the west on the main track there is a tangent 1.14 miles in length to the west siding-switch. On the siding there are, in succession, a No. 14 turnout to the right 131.76 ft. in length, a tangent 265.14 ft., and a 1-deg. curve to the left 65.7 ft. to the point of accident and 5,608.8 ft. beyond. In the vicinity of the point of accident the grade for east-bound trains is 1 per cent ascending.

Under either remote-control or automatic operation the control circuits are so arranged, that when the west siding-switch is lined for a train to enter the siding, signal 3818 will display Approach and signal 2L will display red-over-yellow.

The control machine, which is located in the station at Moapa, consists of a two-position switch lever mechanically interlocked with a three-position signal lever. The switch lever is provided with a semaphore indicator which indicates when the switch control relay at the west siding-switch is energized and when any controlled signal is cleared. The switch lever is also provided with an electric lock which prevents the movement of the lever when the indicator is de-energized. A semaphore indicator is also provided to indicate track occupancy of the track section between the remotely controlled signals. A master switch is provided so that the operator can change the operation of the remote-control switch and semi-automatic signals to automatic operation with the signals operating as automatic signals and the siding switch operated manually. The west siding-switch and protecting signals are arranged for normal operation by remote control by the operator. Time locking is provided to prevent the changing of the route after a signal has been cleared until after a pre-determined time interval of 1 minute 45 seconds has elapsed. In order to change from remote-control operation to automatic operation, the instructions require that