One mechanism operates street arm and sidewalk arm

Gates at Three Crossings

Chicago & North Western solves local problem by combination of automatic and manual controls, with selective speed control, switching cut-outs, and key controllers

BY DESIGNING a combined automatic track circuit control, in combination with supervisory manual control, the Chicago & North Western solved the problem of installing gates and flashing-light signals at three crossings in Crystal Lake, Ill., which were formerly protected by watchmen. Crystal Lake is 43 mi. from Chicago on the C&NW line through Janesville, Wis., to Madison, Wis., and St. Paul, Minn. The traffic includes about 30 trains daily. Some suburban passenger trains terminate and originate at Crystal Lake, thus requiring extra switching moves when crossing from one main track to the other, as well as in and out of the siding used to hold these trains between runs. A local freight makes various moves while serving industries. Thus, a total of 45 to 50 switching moves are made over these three crossings daily.

The street traffic over these crossings is heavy. For example, a 48-hr. count at Main street included 541 pedestrians, 3 teams, 3,550 automobiles and trucks, 8 buses and 144 bicycles. Previously, these crossings were protected by flagmen, on duty 16 hr. at Walk-up street, and 24 hr. at Main and Grant streets. In order to provide more complete protection, in service continuously, a decision was made to install electric gates with flashing-light signals and bells at all three crossings. Also "No-Right-Turn" controlled signs were installed to protect driveways which enter Grant street near the crossing.

The passenger station is on the south side of the tracks between Grant and Main streets, and platforms extend between these streets on both the north and the south sides of the main tracks. At the station, a sidewalk extends across the main tracks from one platform to the other. The north platform is used by passengers, when going to and coming from not only eastward main line trains but also the suburban trains which depart from the siding on the north side of the north platform. To give warning of approaching trains, for the protection of people using this crosswalk, a special flashing-light signal and bell, known as a pedestrian signal, was installed between the main tracks, alongside this sidewalk.

This project includes track circuits which are arranged to control the gates, signals and bells in the conventional manner, when trains approach and pass on through without stopping. In addition, a supervisory manual control was installed so that, during switching moves, the towerman can exercise manual control, and thereby reduce needless delay to street traffic.

Manual Control Machine

The manual control machine is in an elevated cabin on the north side of the track at the west edge of Grant street. The panel of this machine slopes at an angle. On this panel, the tracks are represented by heavy lines, each track circuit being repeated by a lamp which is lighted

when the corresponding track circuit is occupied. The ordinary approach track circuits are represented by white lamps. At each crossing, there is, on each main and side track, a short track circuit which extends for the width of the street. Each of these special track circuits is represented on the illuminated track diagram by a red lamp.

On this diagram, light-weight lines show the outlines of the locations of streets. On the panel, below the location representing each street, there is a telephone-type key, which is normally in the raised position. If an insulated motor car is approaching a crossing, the towerman throws the key for that crossing to the lower position, which causes the flashinglight signals to operate and the gates to be lowered. After the motor car passes, he restores the key to the normal position, thus raising the gates and cutting out the signals. A fourth telephone-type key, in this same row, is used to manually control the pedestrian signal. This means of control, known as "Manual Control" is used also to protect a crossing on the siding when a switching move is being made.

Manual Supervision

"Manual supervision" is a term applied to control used by the towerman, in combination with automatic control by train occupancy of track circuits. Below the words "Manual Supervision," as shown in the picture, there is a group of four red buttons (shown grey in the picture). Below the four red buttons is one black button.

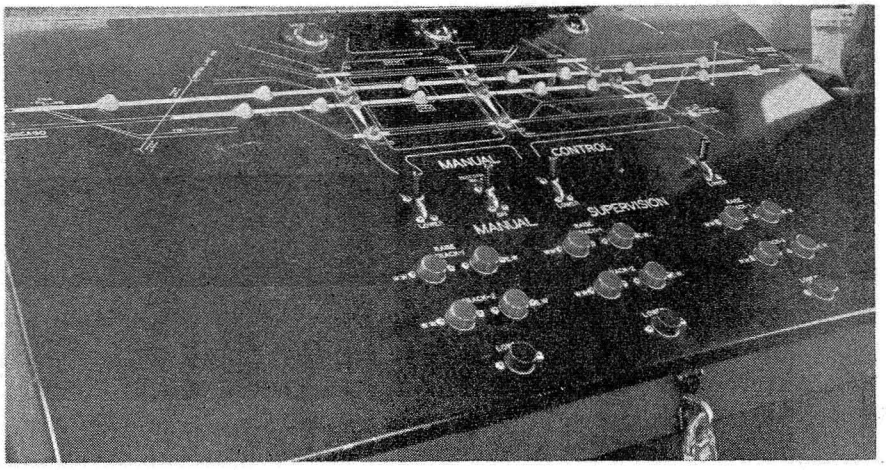
For example, the local freight train, approaching on the westward main track, No. 1, sets the signals in operation and lowers the gates at Main street, and then stops short of the crossing to make a switching move. Then the towerman pushes the left red button for track No. 1 for Main street. This cuts out the protection and raises the gates at Main street, so that street traffic can cross without further delay. At the time the button is pushed, a 1-in. red lens, above the track symbol for the Main street on the panel, is lighted as a special reminder to the towerman that he has cut out the protection, and, therefore, he is responsible for watching the switching. When he ses that a move is to be made toward the crossing, he then pushes the black button, below the red ones. This causes the protection to be set in operation and the gates are lowered.

In the discussion above, when the towerman pushed the red button, a circuit was closed to pick up a stick relay which sticks up through a back contact of the relay for the approach section then occupied by the switching move. The stick relay cuts that approach section out of the controls, so that the gates are raised, but in no case can it cut out the protection if the crossing itself is occupied.

Thus, this one red button and corresponding stick relay, are associated only with the westward approach section to Main street on the westward track. The other button for the westward track at Main street, and its stick relay, are associated only with eastward approach sections to Main street on the same westward track. The reason for these separate buttons and stick relays, is to isolate these special controls to the switching move being watched by the towerman. In the meantime, if some other train approaches in the opposite direction on the same track, or in either direction on the other track, the signals will flash and the gates will automatically go down at Main street, regardless of the special control then in effect.

Relays in Control Machine

The picture of the control machine with the lid raised shows the indication lamp sockets on the rear of the cover, and the 37 telephone-type relays, which are used in non-vital information circuits. Twelve of these are the stick relays mentioned above; one for each red button. When the button is pushed, a contact is closed in a circuit which includes battery to feed through back contact of crossing approach relay for approach section then occupied, then through the coil of telephone relay to pick it up. The principal purpose for this is to light the special 1-in. red lamp that warns the towerman that he is responsible for having raised the gates. Twenty-four of the remaining 25 telephone relays are for the control of track-occupancy indication lamps on the control panel. Because of the distance from the tower to Walkup avenue, an additional relay, energized through gate circuit controller contacts, was installed to illuminate a red "Gate Down" light, below track-occupancy lights for Walkup ave.



Keys for manual control, and buttons for supervision

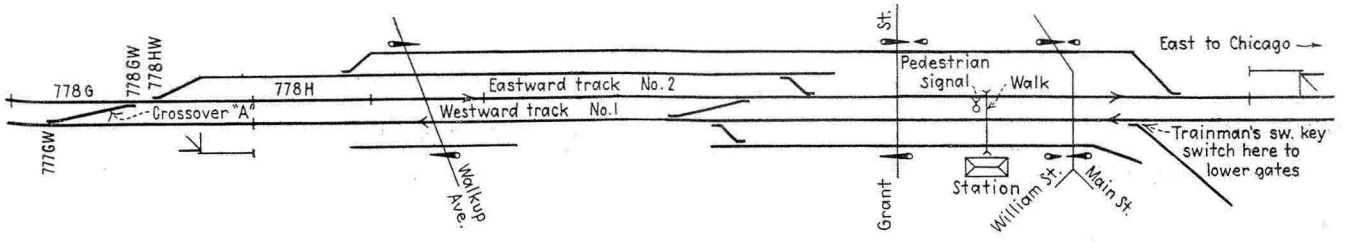
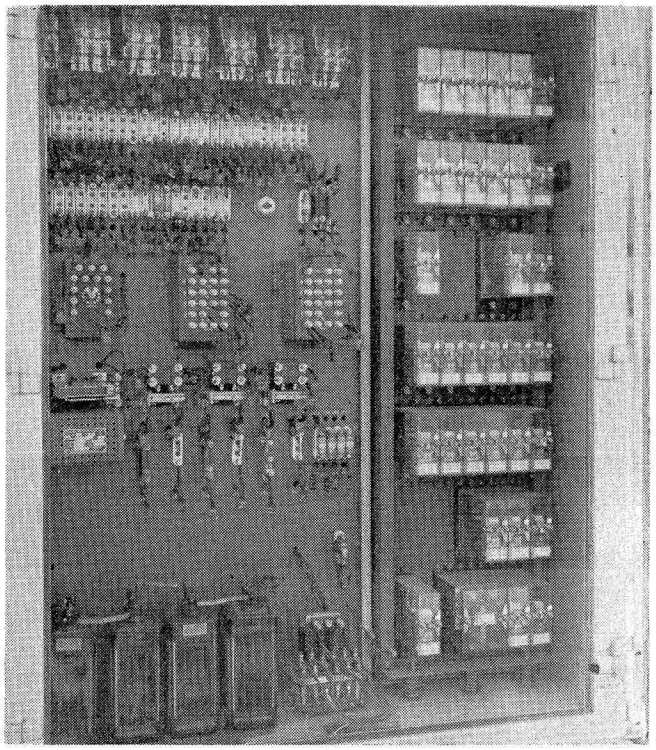
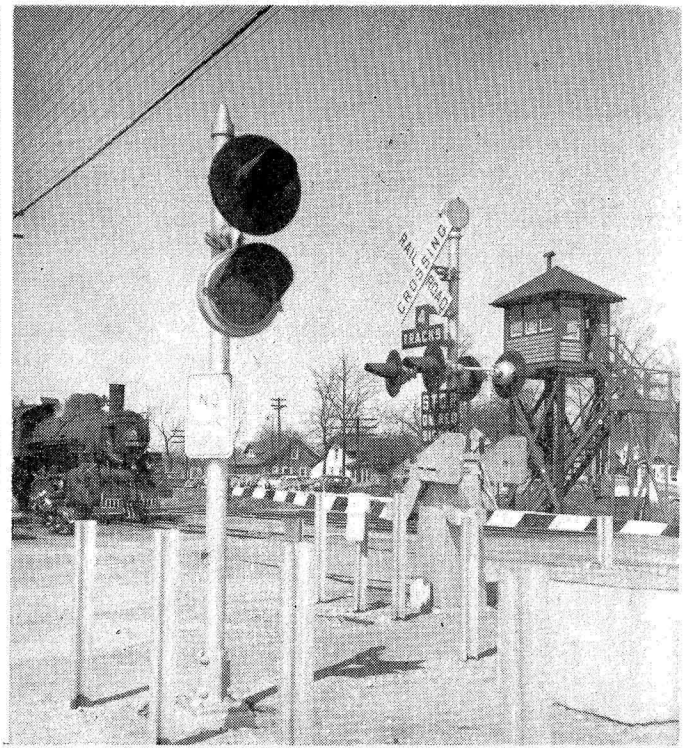


Fig. 1—Plan of tracks, streets and crossing protection



Relays are plug-in type



"No-Right-Turn" sign

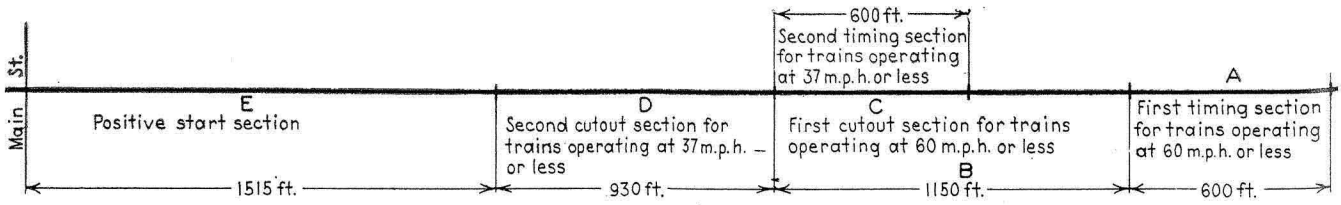
At each crossing, there is a cast-iron box (locked with a signal department lock) which contains a three-position switch. If a broken wire or a track circuit outage causes the gates at the crossing to go down and stay down, the maintainer is called as soon as possible. In such instances, the maintainer, or some other railroad man, under the direction of the maintainer, can use the special switch, in the box, to control the gates and flashing-light signals directly. By moving the switch handle to the right, the gates are raised by direct application of battery to the control relay, cutting around all other relay selections. When a train approaches, the switch handle is moved to the left, to lower the gates and operate the flashing-light signals. In the meantime, the maintainer can make tests to locate and correct the trouble. Then the switch is returned to its normal center position. The switch must be in this position in order to close the cover, because a hole in the wood block, on the inside of the cover, fits over the handle of the switch. Experience on the North Western is that this special local manual control is an important aid in reducing delays to street traffic, when circuit failures cause the gates to stay down.

Just east of Main street, a switch leads to a spur that descends down a grade to a coal chute. When the switch engine has loaded cars to pull up out of this track, it must make a run for the grade. In such instances, the locomotive may approach Main street crossing faster than normal switching speed, and the trainman protecting the crossing might have difficulty in stopping street traffic. Therefore, a special arrangement, including a key controller, was installed. When a switching move is to come up out of the hole to the main track, a trainman inserts and turns his switch padlock key in a key hole in the controller, operating the signals and lowering the gates.

A suburban train, consisting of three Budd self-propelled cars, makes round trips daily between Crystal Lake and Chicago. After this train (going west) arrives at Crystal Lake and discharges its passengers, it pulls on down west of crossover A in Fig. 1. The trainman then reverses hand-throw switches 777GW and 778GW on the crossover and single switch 778HW so that the train then runs east through the crossover and switch to the holdover siding. Circuits through switch circuit controllers on the crossovers and 778HW, cut out track circuit 778G from the approach control for the protection at all three crossings. These same principles are used for controls applying to various other hand-throw switches which are involved in switching moves which occupy approach sections, but in which the crossing is not to be occupied.

As preliminary warning, the flashing-light signals, gate arm lamps and bells are operated about 5 sec. before the gates are released, and the gates are lowered in about 10 sec. In all instances, the controls are arranged so that the preliminary warning starts not less than 28 sec. before the arrival of a train.

The "Dakota 400" passenger train runs through Crystal Lake at a maximum of 79 m.p.h., and, therefore, the approach control track circuits are arranged on this time-speed basis. The through freight trains operate at a maximum of 50 m.p.h. Local trains operate at reduced speeds when approaching and stopping at

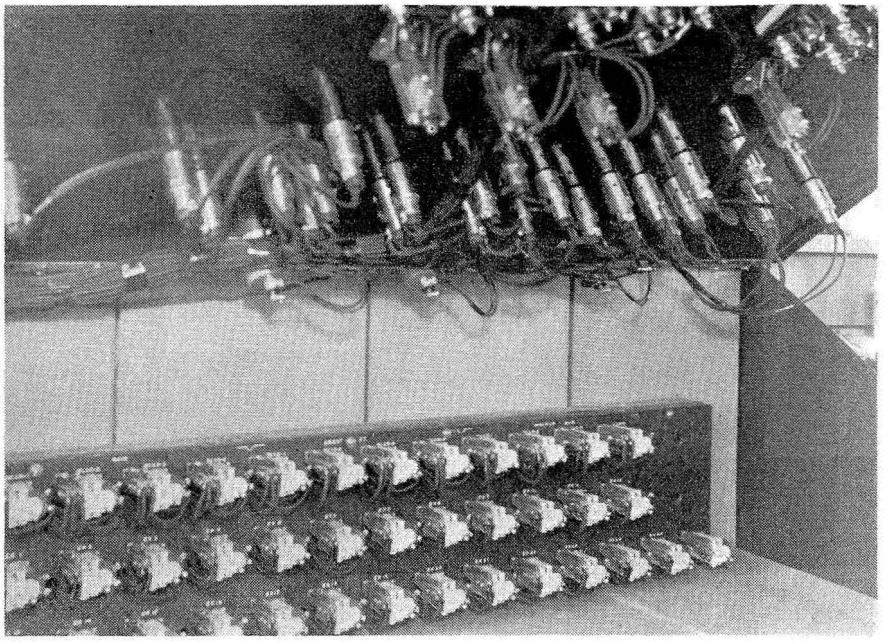


Crystal Lake passenger station.

Therefore, if the approach controls had been laid out for only the maximum train speed, slower trains would cause excessive delays to street traffic. In order to minimize delays to street traffic, the C&NW installed selective approach speed control, so that, for slower trains, the approach sections are shorter, and thus the protection does not operate until the slower trains are closer to the crossing. In all instances, however, the protection is in operation a minimum of 28 sec. before a train reaches the crossing.

Each selective speed control includes several track circuits, as for example, track circuits A, B, C, D and E approaching westward to Main street, as shown in the diagram. Release of track circuit A, starts a timing relay, thus measuring the speed of the train from the time the front wheels enter track circuit A, until they enter track circuit B. If the speed thus measured is more than 60 m.p.h., the crossing protection is set in operation when the front wheels enter track circuit B. If the speed in track circuit A is less than 60 m.p.h., the crossing protection is not affected.

While the front wheels pass through track circuit C, the time is measured, and if it is 37 m.p.h., or less, the crossing protection is not set in operation when the front wheels enter track circuit D. However, even with speed below 37 m.p.h., the crossing protection is set in operation when the front wheels enter track circuit E, which is known as the "positive start section."



Lid raised to show rear of panel and telephone-type relays

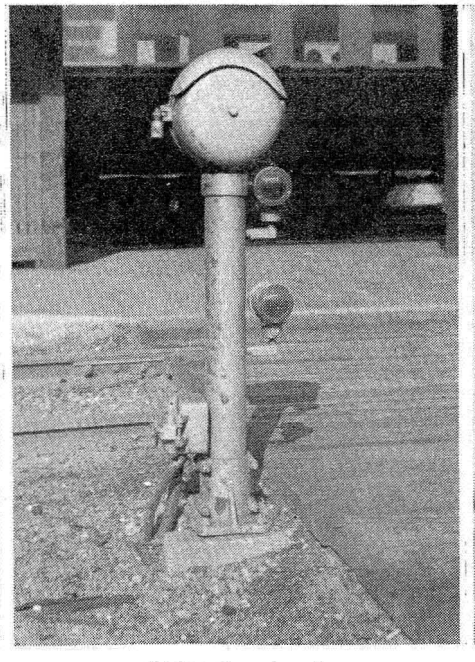
Approach control and speed selective sections are separate for each of the three crossings, which require several track circuits, some of which are common to the controls of two or more streets. Track circuits for measuring speed range from about 600 ft. to 1,000 ft. The KB-type, motor-driven time relays, used on this project, can measure up to 64 sec.

The gates, flashing-light signals and supervisory manual-control machine on this project were made by the Griswold Signal Company. The relays in sheet-metal cases at crossings are the plug-in type made by the General Railway Signal Company.

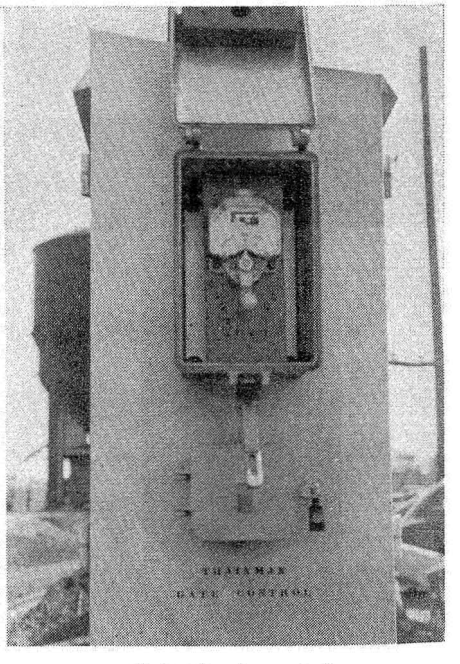
At each crossing, the gate motors are fed from a set of six Exide 160-a.h. storage cells. These batteries are charged by Balkite C-10 rectifiers. The lamps in the flashing-light signals and on the gate arms are fed from a.c. supply through front contacts of a power transfer relay, or from the gate operating battery in event of power failure. Each track circuit is fed by two Edison 500-a.h. primary cells.

This project was planned and constructed under the direction of H. T. Fleisher, signal engineer.

Trainman's key controller



Pedestrian signal



Maintainer's control