

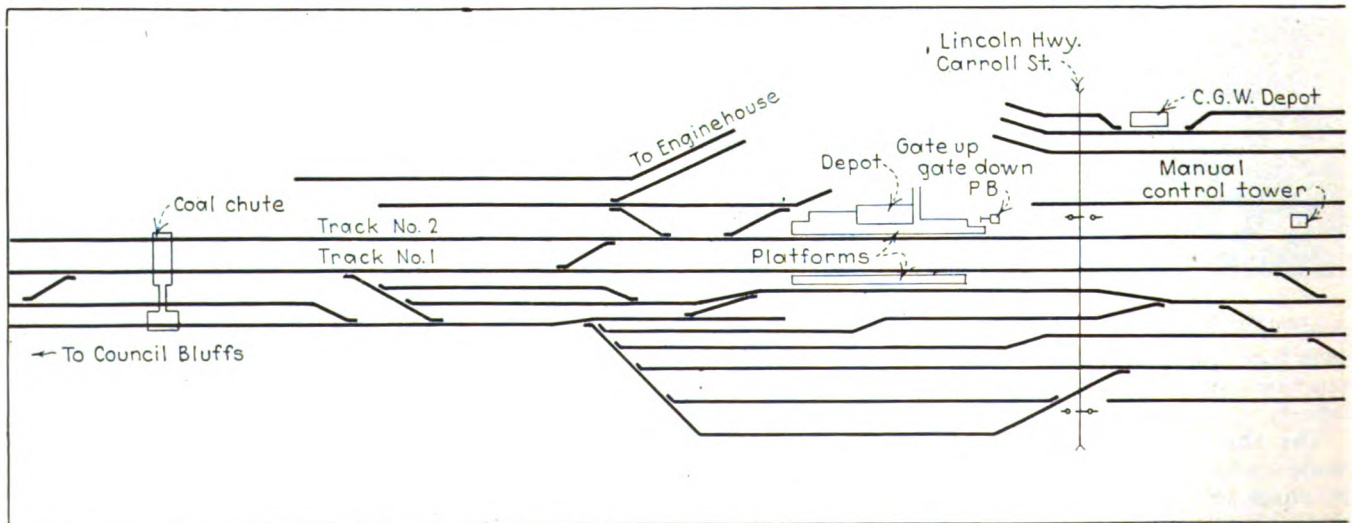
Pedestrian gate extends across sidewalk and street gate across right-hand half of pavement

Special Protection Problems

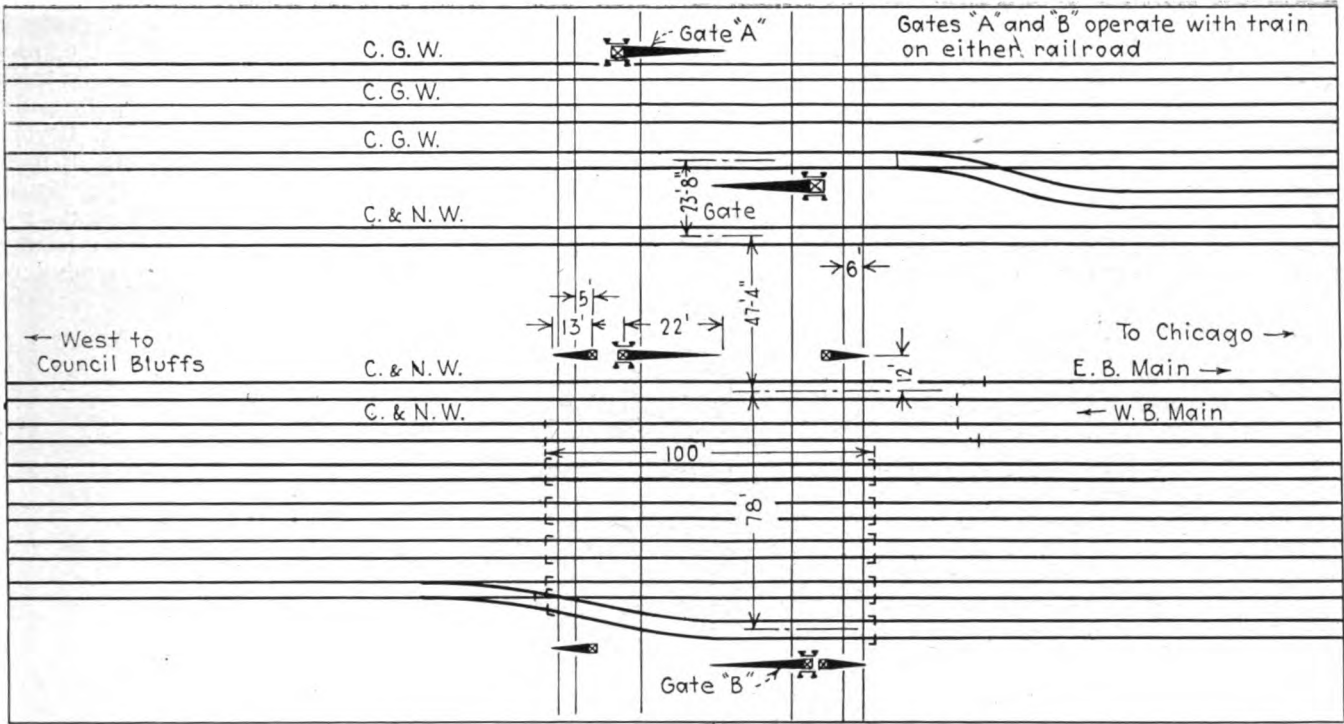
Solved by Gates and Flashers

Multiple-track crossings, involving two railroads through Carroll, Ia., are now equipped with standard types of protection in service 24 hours every day, thus improving safety to public as compared with former protection by part-time flagmen

THE Chicago & North Western and the Chicago Great Western have recently completed an installation of protection at three crossings at Carroll, Ia., that includes numerous ingenious practices to solve local problems, and, therefore, improve protection at these crossings. Carroll is 393 miles west of Chicago on the C. & N. W. route to Omaha and



Plan of tracks, streets and crossing protection on the



Details of layout at Main street crossing

on the Chicago Great Western, 422 miles from Chicago, on the route to Omaha via Oelwein, Ia. Through this territory the C. & N. W. has two main tracks and the C. G. W. one main track.

Carroll street, which is Lincoln highway, crosses the tracks 500 ft. east of the east end of the C. & N. W. passenger depot. This street crosses the two main tracks and six side tracks of the C. & N. W. Formerly, this Carroll street crossing was protected by a flagman continuously. Main street, which is 830 ft. east of Carroll street, crosses the two main tracks and six side tracks of the C. & N. W., and one main

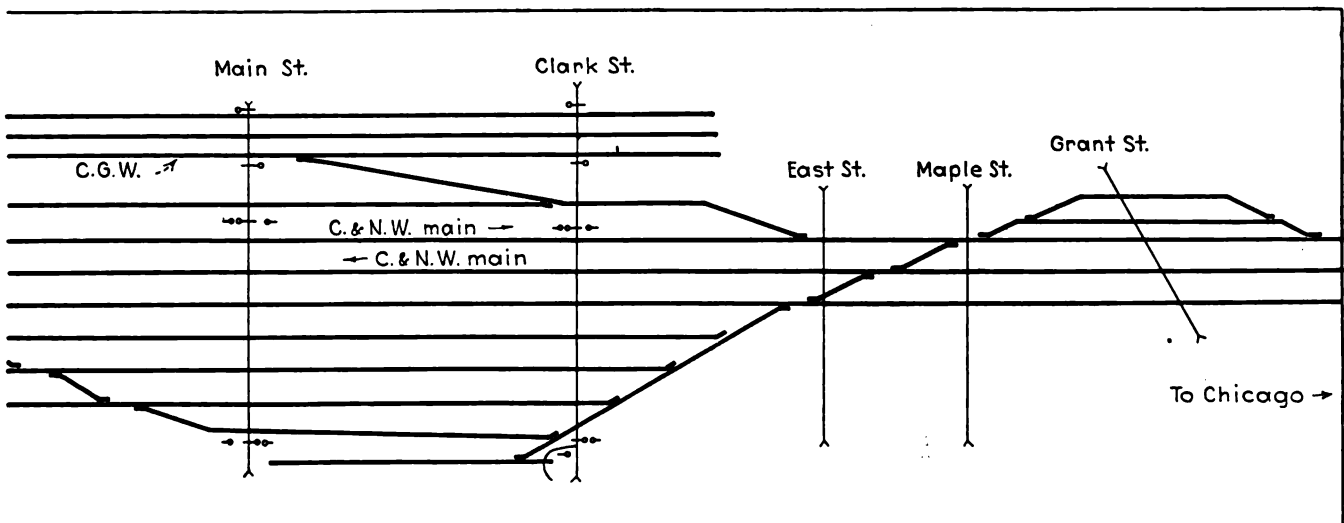
track and two side tracks of the C. G. W. This crossing was previously protected by flagmen for the C. & N. W. two tricks and for the C. G. W. one trick daily. Clark street, 820 ft. east of Main street, crosses the same number of tracks as Main street. This Clark street crossing was previously protected by a flagman for the C. & N. W. one trick daily.

Protection for Each Railroad

The C. G. W. tracks are north of and parallel to the C. & N. W. tracks. The distance between the center lines of the C. G. W. main track and the C. & N. W. eastward track is 71

ft. at Main street and 73 ft. at Clark street. Each of these streets has pavements 30 to 48 ft. wide, parkways 10 to 19 ft. wide and sidewalks approximately 6 ft. wide.

At Main street and Clark street, each railroad has its own separate installation of gates, flashing-light signals and bells. When the signals are set in operation and gates are lowered on the C. & N. W., for example, highway vehicles stopping in approach to the southward C. & N. W. gate would be on the C. G. W. tracks. For this reason, the controls are especially arranged so that the same control that sets flashing-light signals in operation and lowers the



Chicago & North Western and Chicago Great Western at Carroll, Iowa

gates on the C. & N. W. also sets the southward flashing-light signal in operation and lowers the southward gate on the C.G.W. Similarly, when a C.G.W. train approaches, the two C. G. W. gates and the northward C. & N. W. gate go down. The C. G. W. track is not involved in the new protection at Carroll street, therefore, the C. & N. W. flashing-light signals and gates at this crossing are operated only by C. & N. W. controls.

On the C. & N. W. the traffic through Carroll includes 20 scheduled passenger trains and approximately 20 freight trains daily. Also, numerous switching moves are made over the crossing. Six of the 20 passenger trains are scheduled to stop at Carroll. The Chicago Great Western operates two local passenger trains, the eastbound being due at Carroll at 11 p.m. and the westbound at 4:16 a.m. One through freight operates each way daily. A local freight goes east one day and back the next, excluding Sunday.

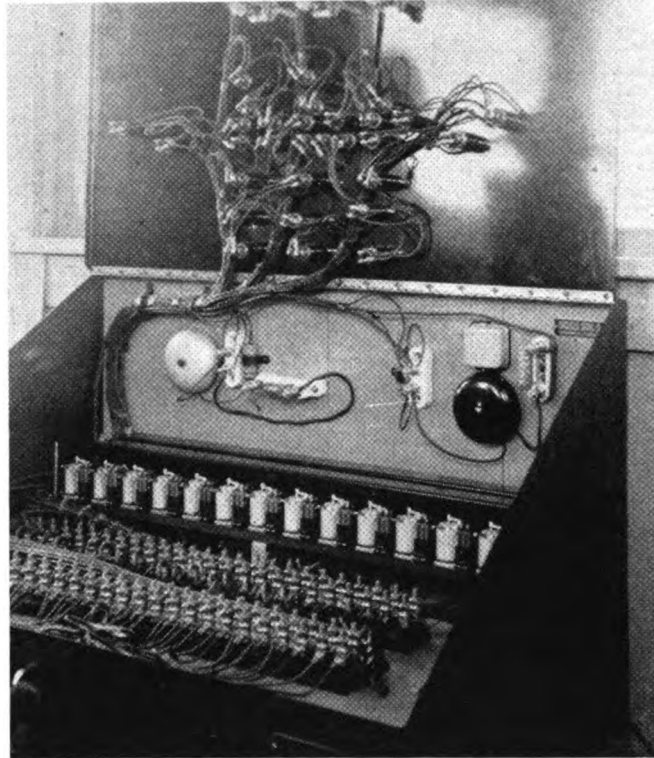
Superimposed Manual Control

Ordinarily, the flashing-light signals and gates are controlled automatically by trains on track circuits in the usual manner. In addition, on the C. & N. W., a superimposed manual control by a man at a control machine in an elevated cabin is in service 16 hours daily, which includes the hours when the local freight is switching in Carroll and eastward passenger trains are stopping at the depot.

The panel of this control machine is 2 ft. by 3 ft. 6 in. At the top is an illuminated diagram of the tracks and street crossings. When a train approaches, an annunciator bell rings and a white lamp is lighted in the corresponding track section. The

towerman pushes a button in the "track line" to shut off the annunciator bell. Just below the track diagram are three toggle levers, one for each crossing. These levers are for the direct manual control of signals and gates, entirely independent of track circuit control. Normally, these levers are in the "up" position. When a lever, as for example, the one for Main street, is lowered, the

would be consumed by stopping to permit trainmen to protect the crossing by flagging. On each side track, there is a track circuit for the width of the street and 10 to 15 ft. beyond the street line. Occupancy of these track circuits operates the signals and lower the gates independent of manual control. A red lamp, located adjacent to each street symbol on the diagram, when lighted, indicates

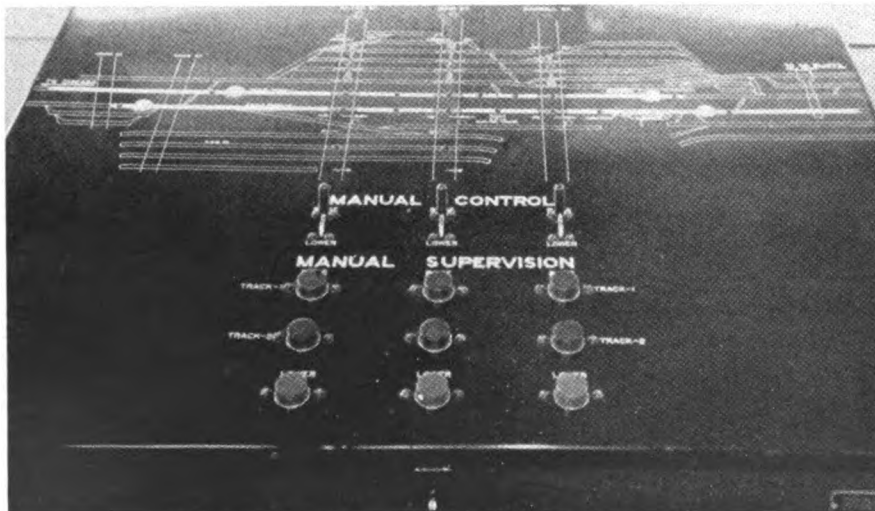


Lid of control machine raised to show rear of panel, wiring, and the relays

signals operate and gates go down at that crossing. This form of control is used, for instance, to protect a crossing when the local freight train is approaching that crossing on one of the six side tracks or yard tracks. This control of the protection saves the time which otherwise

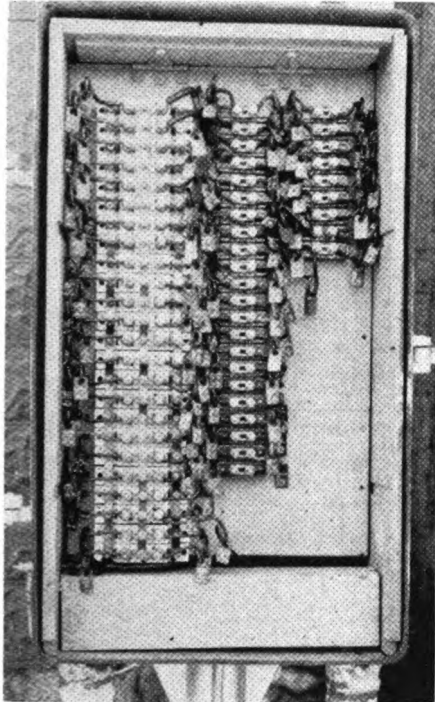
that both C. & N. W. traffic gates at that crossing are in the full lowered position. This is especially valuable to the attendant during periods of poor visibility.

At the bottom of the panel are three large pushbuttons for each crossing, which constitute the "Supervisory controls". For example, the local freight train, approaching on the westward main track No. 1, operates the protection at Main street by ordinary approach control, and then stops short of the crossing to make a switching move. The towerman pushes the black button for track No. 1 in the row for Main street. This cuts out the flashing-light signals and raises the gates at Main street, and, at the same time, a red lamp is lighted in the diagram at the symbol for Main street. This lamp is a reminder to the towerman that he has raised the gates, and that he must watch the train. When the train is ready to move toward the crossing, he pushes the red button for Main street crossing which

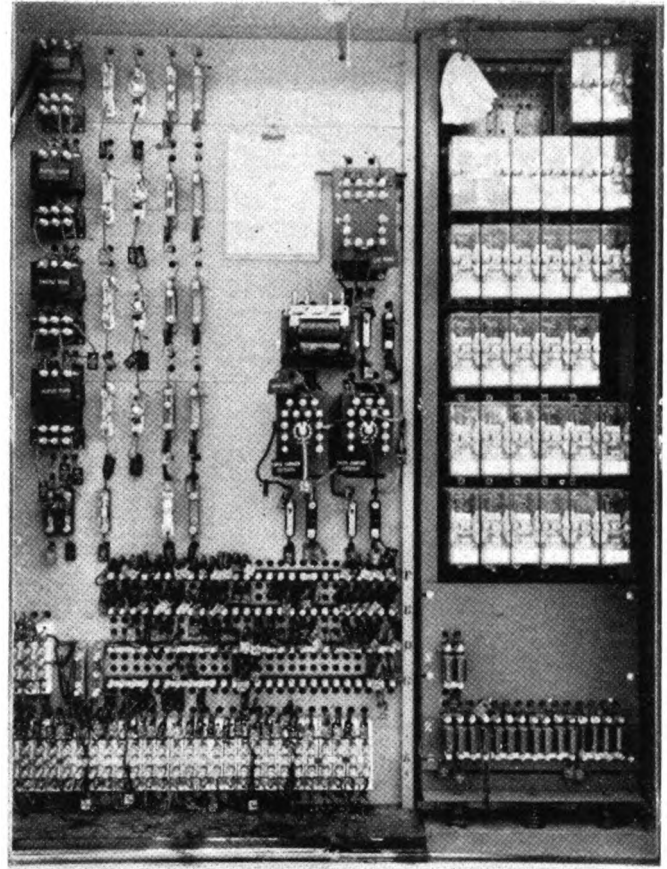


Panel of control machine in elevated tower

causes the signals to be operated and gates lowered at Main street. Should the towerman fail to place the crossing signals in operation for such a movement, the engineman is required to approach the crossing slowly and stop short of the crossing to permit trainmen to flag the



Left - This terminal board is hinged at the top to swing up. At right - Inside of C.&N.W. case showing plug-in type of relays.



crossing, or stop with leading truck wheels on the short track circuit over the crossing, setting the protection in operation. Thus, for the most part, the manual controls used by the man in the tower are for the purpose of improving protection for switching moves and raising the gates for street traffic to move when movements on the main line are stopped short of crossings.

Main-Line Approach Speed Sections

As preliminary warning, the flashing-light signals and bells at each crossing are operated about 5 seconds before the gates are released, and the gates are lowered in about 10 seconds. In all instances the controls are arranged so that the preliminary warning starts not less than 20 seconds before the arrival of a train at that crossing. The fast

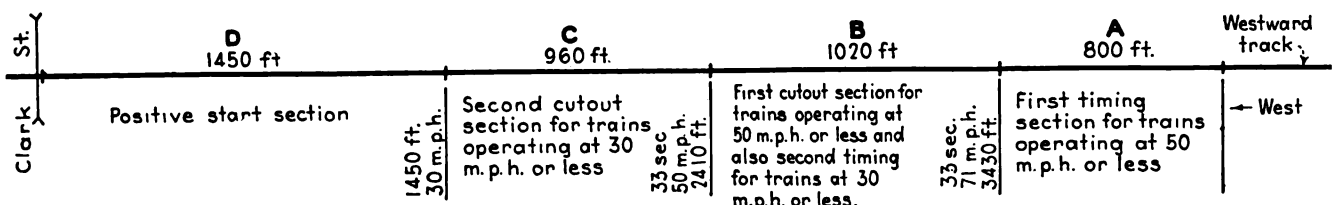
through passenger trains approach at about 90 m.p.h., and reduce speed to pass through the main part of Carroll at about 50 m.p.h. The through freight trains, operated by diesel locomotives, maintain a constant speed of about 50 m.p.h. through this territory. Freight trains pulled by steam locomotives usually stop for coal and water at the coal chutes west of the station. Passenger trains which stop at Carroll, may approach at speeds up to 65 m.p.h. and gradually reduce speed to a stop at the station. Therefore, if the automatic approach controls had been laid out for only the maximum train speeds, the gates would have been down an excessive length of time, thus unnecessarily delaying street traffic when slower trains approached. In order to minimize delays to street traffic, the C. & N. W. installed selective approach speed control, so that, for slower trains, the approach sections

are shorter, and thus the protection does not operate until these slower trains are closer to the crossing. In all instances, however, the protection is in operation a minimum of 20 seconds.

Speed Selection

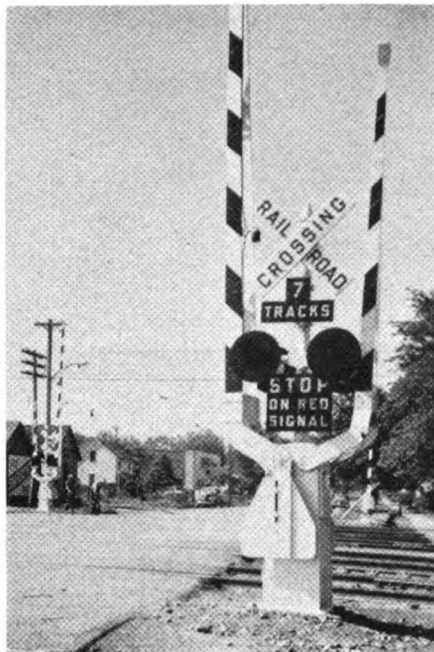
Each selective speed control includes several track circuits, as for example, track circuits A, B, C and D approaching westward to the Clark street crossing, as shown in the diagram. Release of track relay A starts a timing relay, thus measuring the speed of a train from the time the front wheels enter track circuit A, until they enter track circuit B. If the speed thus measured is more than 50 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 50 m.p.h., the control of the crossing protection is not af-



Selective speed control on westward track for protection at Clark street

fect. While the front wheels pass through track circuit B the time is measured, and, if speed is less than 30 m.p.h., the crossing protection is not set in operation when front wheels enter track circuit C.



Street arm and sidewalk arm

However, even with speed below 30 m.p.h., the crossing protection is set in operation when the front wheels of the train enter track circuit D which is known as the "positive start".

For eastward trains, the selective speed controls are somewhat more extensive. Timing sections and controls are arranged to provide for train speeds of 90, 70, 50 and 30 m.p.h. For example, if an eastward freight train reduces speed and stops to take coal at the coal chutes 2,770 ft. west of Carroll street, the gates at Carroll street will not go down until the train takes coal, then gets under way and approaches the crossing.

The approach control and speed selective sections are separate for each of the three crossings, which require several track circuits, some of which are, of course, common to the controls for two or more streets. Track circuits about 800 ft. long are normally used for speed measuring. The KB type motor-driven time relays on project are made to measure up to 64 seconds. At 50 m.p.h., the front wheels of a train travel 73.3 ft. per second so that at that speed the time cutout on an 800-ft. section would be set for 11 seconds, and, if a train movement was longer

than 11 seconds in the time-measuring section, a section of the approach control would be cut out.

Switch Stick Controls

Local trains which operate on the C. & N. W. line extending from Carroll to Sioux City, Ia., terminate at Carroll. The enginehouse used by the locomotives on this line is north of the tracks, west of the depot, and the yard is south of the main tracks. Locomotives coming from the enginehouse, enter track No. 2, use a crossover to move to track No. 1, and then use a turnout to the yard—all within the eastward approach control track circuits for the crossing protection at Carroll street. Circuits through contacts in switch circuit controllers on the crossover and turnout switches are



Key controller on C.G.W.

arranged to cut these track circuits out of the crossing protection controls, so that protection does not operate to delay street traffic.

Relays and Case Wiring

Plug-in type relays, mounted in a relay case, are used at each crossing location to reduce the size of the housings required in the vicinity of the crossings, thus creating the least obstruction to vision.

The C. & N. W. manual control tower is on the north side of the tracks and the signal pole line is on the south side. An underground cable extends under the tracks from the manual control tower to a terminal board in a cast-iron box on the south side of the track. The terminal board in this box is hinged at the top so that the board can be swung up and held in this position by a brace. This facilitated the installation of the incoming wires which enter the rear of the board and then pass through individual holes to terminals on the face of the board.

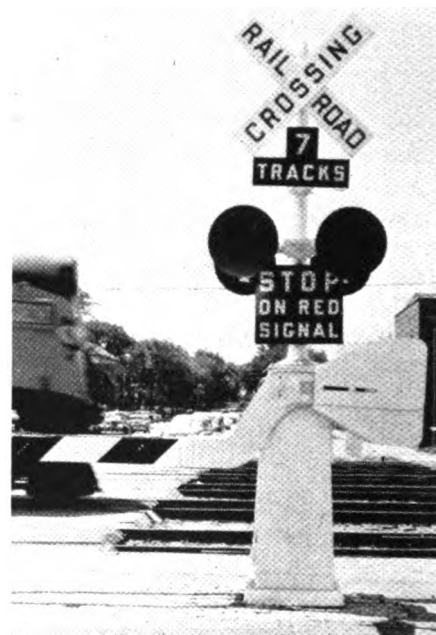
On the C. & N. W., telephones are located at each crossing, in the ticket

office at the passenger depot and in the elevated manual control tower. These phones are connected to a local phone circuit and are used primarily for inter-communication concerning train movements, switching moves, report by attendant in event of trouble, etc., with respect to protection of the crossings.

Also, at each of the three C. & N. W. crossings there is a box with a special control mounted on the instrument housing, by means of which the maintainer can test the operation of the flashing-light signals and gates. A record of each test is made on a record form, and, when the card is full, it is mailed to division headquarters for filing.

Push-Button Cut-Out

When an eastward C. & N. W. passenger train approaches, the gates at Carroll street are lowered by automatic track circuit control in the usual manner. The passenger trains that stop at Carroll, stop



Signal with street arm

with the locomotive at the water column, which is located approximately 100 ft. east of the station, and in this location the locomotive is west of insulated joints at the west end of the track circuit extending eastward to Carroll street crossing.

If the train is to be stopped for five to ten minutes to load express, a trainman can go to a special box on the north side of the track at the end of the platform, and, by pushing the "raise" button, the gates at Carroll street will be raised so that

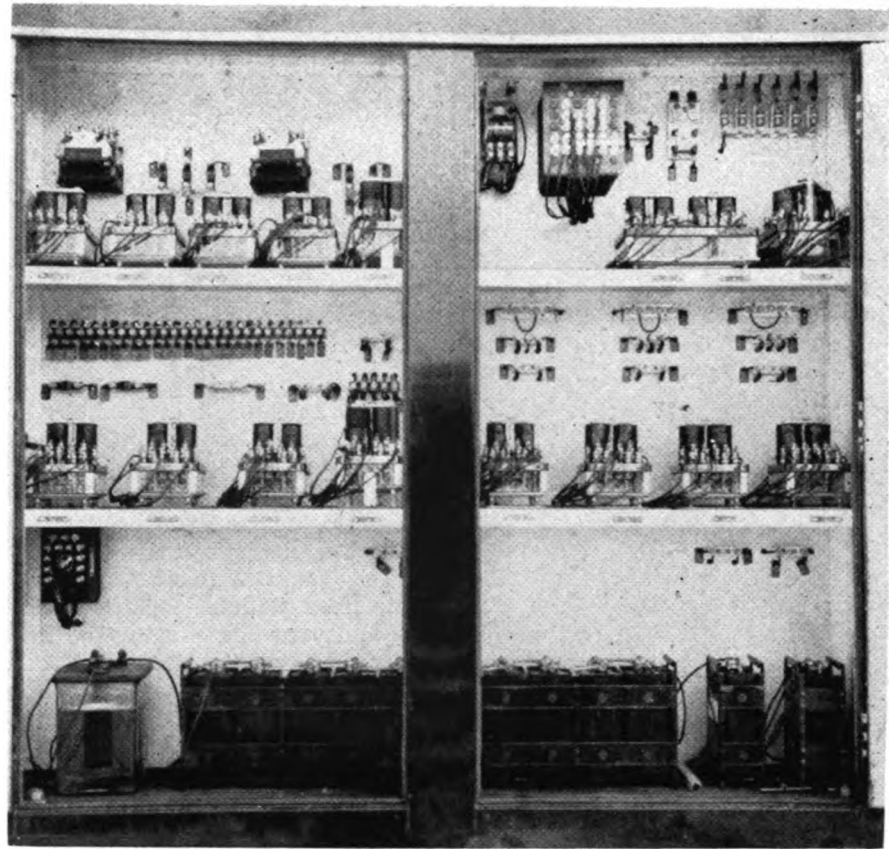
street traffic can pass. When the train is ready to go, the "lower" button is pushed and the protection operates. If the "lower" button is not pushed, the protection will operate when the front wheels of the locomotive pass into track circuit, which is 136 ft. long, and instructions prohibit engine moving onto the crossing until the gates are in the fully lowered position.

The roadway gate arms extend halfway across the width of the pavement, thus obstructing the right-hand lane approaching the tracks and at the same time leaving the left half open to permit roadway vehicles on the track to depart. On the C. & N. W. gates at Carroll street, the mechanism operates not only the street arm, but also an arm extending to the right across the sidewalk. At the other gate locations on the C. & N. W., due to the width of the parkway, separate mechanisms operate sidewalk gate arms at all four sidewalk approaches to each crossing.

On the Great Western

The control of the flashing-light signals and gates at the two crossings on the Chicago Great Western are automatic, except for the southward gate being lowered by the C. & N. W. manual control, as explained previously.

When an eastbound passenger train or local freight train on the



Sheet-metal case on Chicago Great Western

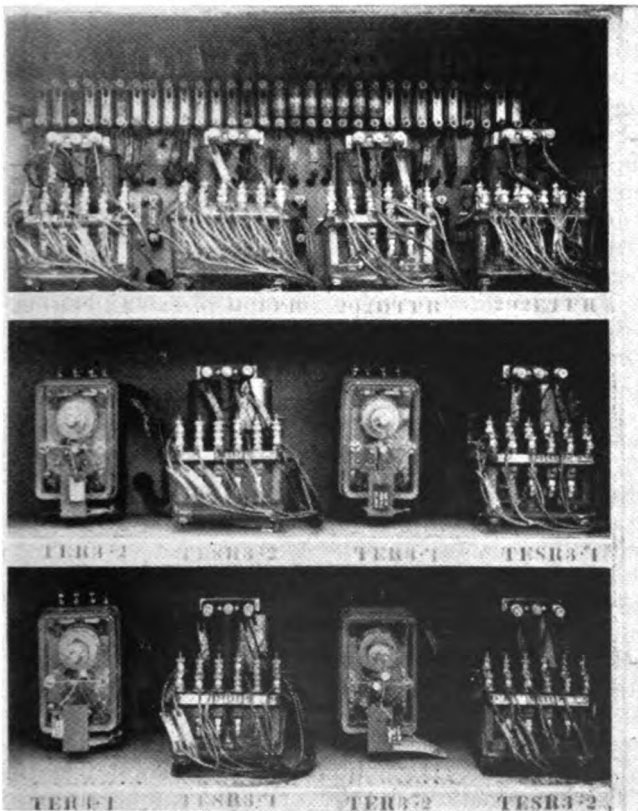
C. G. W. approaches, the protection is set in operation as usual. If the train stops at the station for more than 50 seconds, the gates are raised automatically to allow the street traffic to cross. Then, when the train

is ready to depart, it enters a track circuit 350 ft. long in approach to the crossing, which puts the protection in operation again before the train arrives at the crossing.

A switch-key controller is provided on the side of the instrument case at each of the crossings. In an emergency, the gates can be raised or lowered as the occasion demands, by inserting a switch key in the controller and turning.

If a switching move is being made on a side track, the key is inserted in the "down" keyhole, and, by turning the key, the protection is set in operation regardless of whether a track circuit is occupied. The man must turn his key back to normal in order to remove it, which causes the gates to be raised if a track circuit has not been occupied.

The gates, flashing-light signals and supervisory manual control machine on this project were made by the Griswold Signal Company. The relays, switch circuit controllers, etc., on the C. & N. W. were made by the General Railway Signal Company; and on the C. G. W. by the Union Switch & Signal Company. The batteries on the C. & N. W. are Exide lead storage, with the exception of the track batteries which are Edison primary. On the C. G. W. the batteries are Edison storage.



Selective speed control scheme includes these motor-driven timing relays