

Signal in "Clear" position

IN DUBUQUE, Iowa, the main streets of the manufacturing, wholesale and water front district are crossed at grade by a network of tracks of four railroads, namely, the Illinois Central, the Chicago Great Western, the Chicago, Milwaukee, St. Paul & Pacific, and the Chicago, Burlington & Quincy, as shown in the track plan. An improvement program, involving the installation of crossing signals at 26 crossings, has recently been made to replace various forms of protection, including bells, watchmen, and gates, some of which were in service part time, while at some of the crossings no protection, other than fixed crossbuck signs, had been in service.

Signals Installed at 26 Crossings in Dubuque, Ia.

Four railroads involved in project to provide 24-hour uniform signal protection instead of gates or watchmen

10 hours at 1 crossing, and full time at 2 crossings. An automatic bell protected one other crossing and flashing light signals were in service at one of the crossings where gates were also in service 10 hours. All of these crossings are now protected by modern signals.

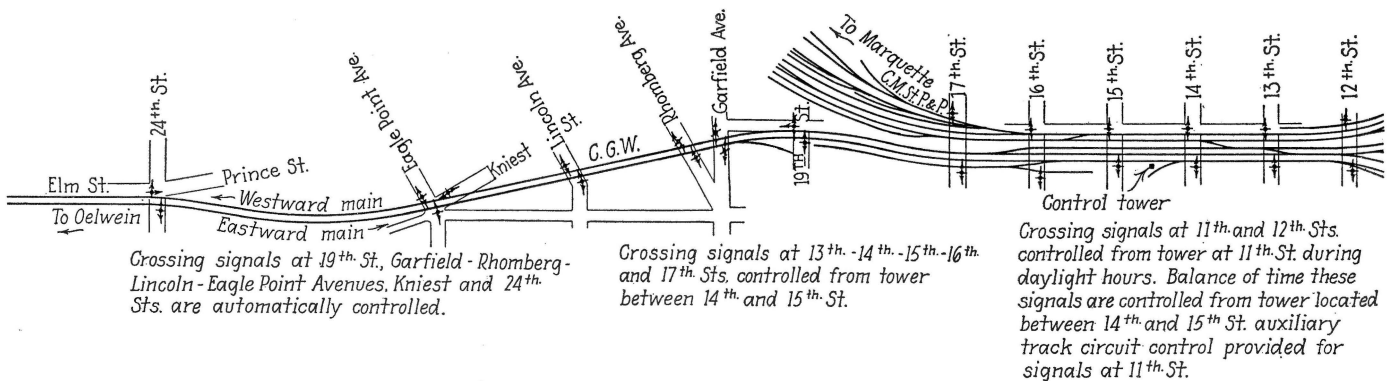
The 4th street crossing just north of the Milwaukee station involves nine tracks, including a single track main line of the Milwaukee, the Illinois Central and the Burlington, this street handling a heavy movement of local and through highway traffic. This was one of the crossings previously protected by gates in service full time. Rhomberg, Eagle Point and 24th streets also handle heavy local and through highway traffic and were protected by gates in service 24 hours.

At the Jones street crossing, just north of the Illinois Central station,

On the remainder of the streets crossed by the tracks, the traffic consists primarily of local movements to and from the various industries on the waterfront, most of this traffic being during the day time. The recently completed improvement program consisted of the installation of signals at all of these crossings.

This improvement program was made according to an order of the City Council of Dubuque and approved by the Iowa Railroad Commission and involved an expenditure of \$30,000 on the part of the railroads. In addition to the advantages of providing a uniform type of crossing protection in service the full 24-hour period, thus greatly improving the safety conditions, the project results in a substantial annual saving in operating expenses.

The new signals on all of the joint territory between 17th street and



The protection previously in service involved gates operating 24 hours a day at 5 crossings, 11 hours at 2 crossings, 10 hours at 3 crossings and 12 hours at 4 crossings; flagman on duty 16 hours at one crossing, 12 hours at 3 crossings, 11 hours at 2 crossings,

a flagman was on duty 12 hours during the day at the Milwaukee tracks and another was on duty the same hours at the I.C. tracks, but during the remainder of the 24-hour period one flagman protected both of the crossings.

Jones street, involving 16 streets with 19 crossings, are of the rotating disk type with flashing lights. When indicating stop to street traffic the disk is turned to display the word "STOP", and the lights flash alternately. The word STOP is painted

in black letters on a standard octagonal yellow sign. The word stop and the outer edge of the disk are outlined with crystal, button type reflectors which stand out prominently at night under the glare of motor vehicle headlamps. When the signal is being cleared, a motor driven mechanism revolves the shaft to turn the disk 90 degrees so that the edge of the disk is turned toward approaching

motor vehicles. The force of gravity is used to turn the disk from the clear to the stop position.

Each of the signals is equipped with a set of flasher lamps directed each way, back to back, thus involving four lamps for each signal. Each lamp unit has a $8\frac{3}{8}$ -in. red lens and reflector, with a 50-watt 110-volt lamp, which gives a strong indication even under adverse conditions of sunlight. Mounted on the mast just above the flashers, is a button-type reflector sign indicating the number of tracks at the crossing and the standard "Railroad Crossing" crossbuck sign is mounted at the top of the mast. At some of the crossings, where pedestrians or vehicles approach at angles, standard crossing bells are provided as additional warning.

The flashing-light signal, together with the number of tracks and crossbuck sign, are according to the A.A.R. standards. The Iowa Railroad Commission has approved the flashing-light signal for use either with the reflector-type "Stop on Red" sign or with the rotating disk STOP sign, the use of this latter type of signal on this installation being at the request of the authorities of the City of Dubuque.

Manual Control System Used

On account of the variations in main line train speeds and stops at the railroad crossings and stations, as well as the complexity of switching movements, it was impracticable to use track circuits for the automatic control of these crossing signals in the area from 17th street to Jones street. Therefore, a system of manual control was devised, the crossings being divided into five groups with the signals in each group controlled by a small lever machine operated by a towerman in a small shanty. Four

of these shanties are elevated to afford a better view of approaching trains. Each control cabinet is made of sheet metal, 8 in. high and 8 in. deep and of a length required for the levers needed at each tower. The face of the cabinet is made of $\frac{1}{2}$ -in. bakelite insulating board. The signals at each crossing are controlled by a toggle type switch mounted flush with the face of the panel, the two-position operating handle or lever being arranged to operate in the vertical plane. Normally the lever is in the "up" position, being thrown to the "down" position to operate the signals. Above each lever is a small indication lamp with a green lens which is flashed in unison with the flashing of the signal lamps to indicate to the towerman that the signals are operating.

Some of the signals are located where no curb lines are established, and these signals are equipped with base lamps to illuminate the base of

TYPE OF PROTECTION PREVIOUSLY IN SERVICE

Jones Street: Flagman, 12 hours daily at Milwaukee crossing and 12 hours at I.C. crossing, one man on duty the remaining 12 hours for both crossings.

First Street: Flagman, on duty 12 hours, I.C.

Iowa Street: Flagman, on duty 11 hours, C.M. & St. P.

Second Street: Gates, in service 11 hours.

Third Street: Gates, in service 11 hours.

Fourth Street: Gates, in service 24 hours.

Seventh Street: Flagman, at C.G.W. crossing 10 hours. Flagman, at C.M. & St. P. & P. crossing 16 hours.

Eighth Street: Flagman, on duty 24 hours, also operated railroad crossing gates.

Eleventh Street: Gates, in service 10 hours.

Twelfth Street: Gates, in service 10 hours.

Thirteenth Street: Flagman, on duty 11 hours.

Fourteenth Street: Gates, in service 12 hours.

Fifteenth Street: Gates, in service 12 hours.

Sixteenth Street: Gates, in service 12 hours.

Seventeenth Street: Gates, in service 12 hours.

Nineteenth Street: Automatic crossing bell.

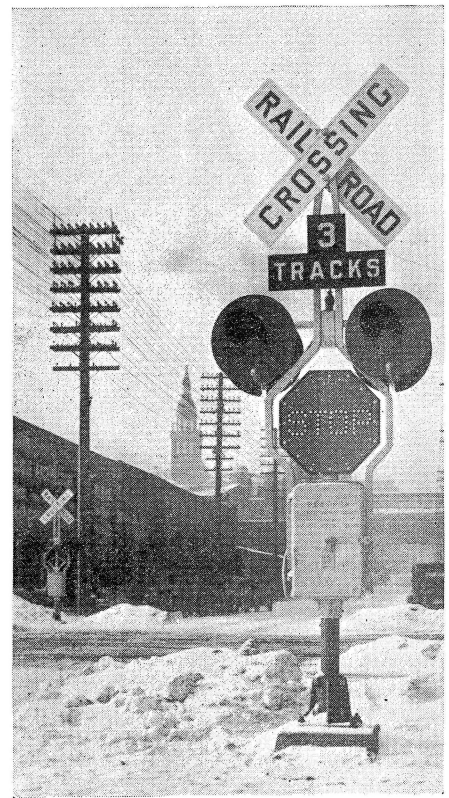
Garfield Street: Gates, in service 24 hours.

Rhomberg Street: Gates, in service 24 hours.

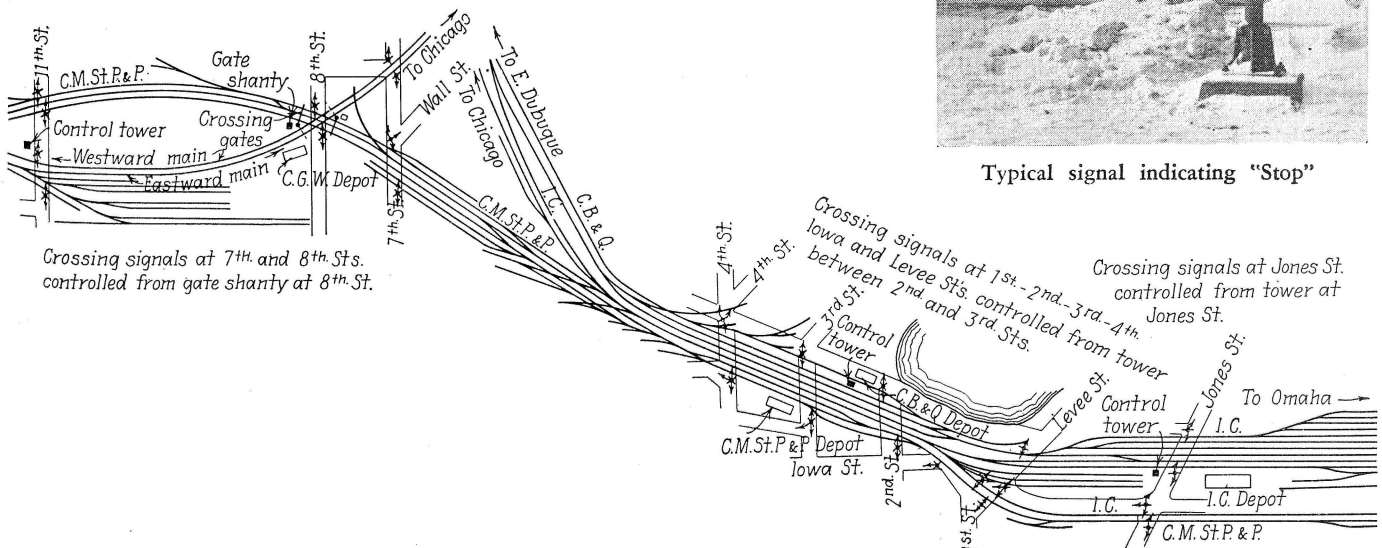
Kniest Street: Gates, in service 24 hours.

Twenty-Second Street: Gates, in service 24 hours.

Twenty-Fourth Street: Gates, in service 10 hours, with flashing light signals in service 24 hours.



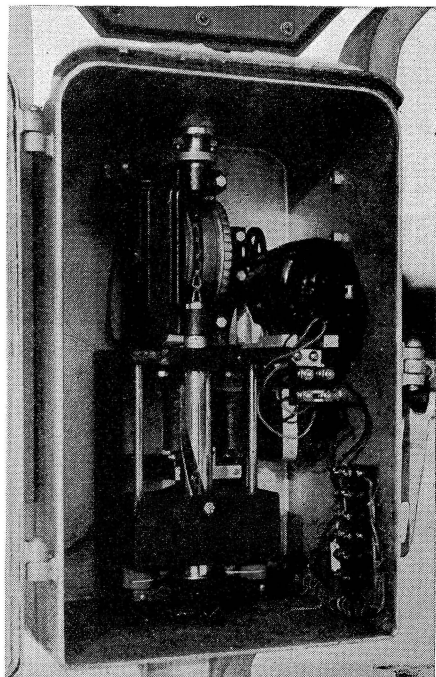
Typical signal indicating "Stop"



the signal and the foundation at night, so that vehicles can be steered clear of them. The small toggle switch shown in the view of the typical control machine is for the control of these base lamps, the switch being thrown to the "on" position at sundown and left there until daylight each day. In addition to these facilities some of the towers are equipped with annunciators to indicate the approach of trains.

A.-C. Power Supply and Operation

In view of the fact that reliable alternating current power supply was available, and further, that the tower-men were to be on duty constantly to detect immediately any failure of power, it was considered practicable to operate the signals from the a-c. source of power with no battery standby. In order to limit the extent of any local failures, a separate con-



Mechanism for operating "stop" sign

nection to the commercial a-c. lines was made at each of the five towers.

Each signal is operated by a 1/75-hp. capacitor start capacitor run 110-volt a-c motor operating at 1,725 r.p.m., and the holding coil is rated at 7.5 watts, 110 volts. Likewise, each of the four lamp units on each signal is equipped with a 50-watt, 110-volt lamp. When a lever is operated to the "on" position, the current, which normally holds the STOP sign clear, is opened, thus permitting the sign to revolve by force of gravity to the stop position, while another circuit controlled by the lever starts the flasher relay and completes the circuit to

feed the lamp in the flasher signals.

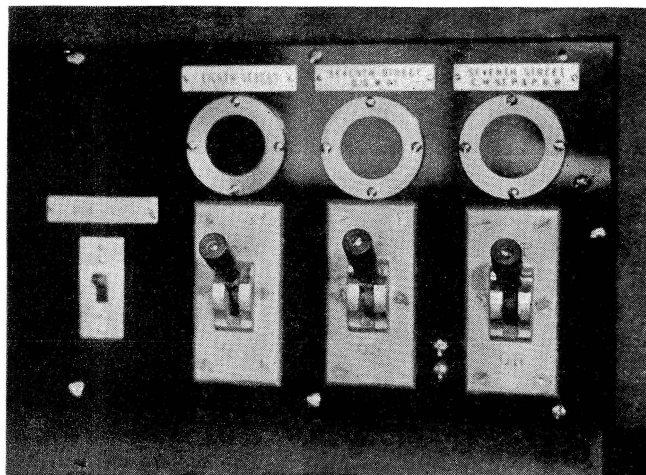
One 110-volt flasher relay, of the synchronous motor type, can serve one or more crossings, depending on the grouping. An underground cable, including from five to eight wires with non-metallic mummy-type protective covering, extends from the control machine to each signal.

Joint Great Western and Milwaukee Groups

The double-track main line of the Great Western crosses the single-track main line and two sidings of the Milwaukee at 8th street, and these roads run more or less parallel northward to 17th street, the crossing protection in this area being joint between the two roads. Under the previous arrangement flagmen were on duty 10 hours daily at 7th street, 24 hours daily at 8th street, gates were in service 10 hours daily at 11th and 12th streets, flagmen were on duty 11 hours daily at 13th street, and gates were in service 12 hours daily at 14th, 15th, 16th and 17th streets. The annual operating expense for the protection at these locations, together with coal and supplies, totaled \$8,963 annually. The new manually controlled signal protection in this area involved nine streets, including two separate signals at each of the 11 crossings, entails an annual operating expense of \$5,292, including interest on the investment, thus representing an annual saving of \$2,671.

The railroad crossing of the Great Western and the Milwaukee at 8th street is protected by crossing gates operated by a gateman on duty 24 hours, and this gateman now also controls the new signals at 8th street as well as at the two crossings on 7th street.

Eleventh and 12th streets serve factories and industries so that most of



Typical manual-control panel

the street traffic is during daylight hours. It was, therefore, arranged that the signals at these two streets be controlled, between the hours of 7 a.m. to 5 p.m., by a towerman located at 12th street. During the remainder of the 24-hour period, the signals at these crossings are controlled from the machine in the tower at 15th street, which also controls the signals at 13th to 17th street, inclusive, throughout the 24-hour period. To assist in the operation of the signals at 11th street, especially at night, track circuits were provided to effect automatic control of the signals for switching moves. These track circuits, as well as main-line approach track circuits, control indicators which assist the towerman in the control of the signals.

Joint I.C. and C.M.St.P. & P. Territory

In the territory from 4th street south to Jones street, the single track main lines of the Illinois Central and the Milwaukee run parallel, together with several sidings and yard tracks. Likewise, the Burlington has one track crossing 2nd, 3rd and 4th streets.

In this territory the protection previously provided included gates in service full-time at 4th street, gates in service 11 hours daily at 2nd and 3rd streets, a watchman on duty 12 hours daily at the Jones street crossing of the Milwaukee and another at the I.C. crossing the same period, with one watchman for both crossings the remainder of the 24 hours, while at the Iowa 1st street combined crossing, the Milwaukee and the I.C. each had one watchman on duty 12 hours daily. The total annual expenditure for this protection was \$8,468, including fuel and supplies. With the new signaling protection the total annual expense, including inter-

est on investment, is \$4,861, representing a saving of \$3,607 annually.

The manual control of the signals in this area is arranged in two groups; the leverman in the tower near the C. B. & Q. station controls the signals at 2nd, 3rd and 4th Levee and Iowa streets, while the towerman at Jones street controls the signals at Jones street.

The installation in the entire area from Jones street to 19th street, inclusive, was placed in service on January 30, and has given satisfactory service, having been approved by the authorities of the City of Dubuque and the Iowa Railroad Commission. The installation was made under contract by the Western Railroad Supply Company, Chicago, which furnished the signals, control machines, etc., the insulated wire and cable being furnished by the Kerite Insulated Wire & Cable Company.

Exclusive Great Western Project

On the territory from 19th street north, the Chicago Great Western alone was involved. Under the previous arrangement gates were in service 24 hours daily at Garfield, 20th, 21st, Kniest and 22nd streets, gates were in service 10 hours daily and flashlight signals were in service 24 hours daily at 24th street, while an automatically controlled crossing bell was in service at 19th street. The total annual operating expense for this protection was \$5,732, as compared with the present

expense for maintenance, operation and interest on investment for the crossing signals of \$940 annually, thus effecting an annual saving of \$4,792.

The signals at six of these crossings are of the rotating disk type with flashing lights, similar to those explained previously as being used at the joint territory; however, at 19th street, which handles comparatively light traffic, flasher lights only were installed. A crossing bell, as auxiliary warning, was provided on one of the signals at each crossing.

In view of the fact that there is not much switching in this area north of 19th street, practically all of the traffic being through train movements on the two main tracks of the Great Western, it was practicable to use track circuits for the automatic control of the crossing signals, the controls being arranged for train operation in either direction on each track. As these signals are not under constant observation of any railroad employee, and to connect in with the automatic block signal system, it was considered necessary to provide for ordinary direct current operation with battery as the source of power, storage battery on floating charge from the a-c. supply being used.

At each crossing a set of five cells of Exide DMGO-9 storage cells is used to feed the control circuits and to operate the motor and holding coil of the signals as well as to serve in case of an a-c. power failure as a



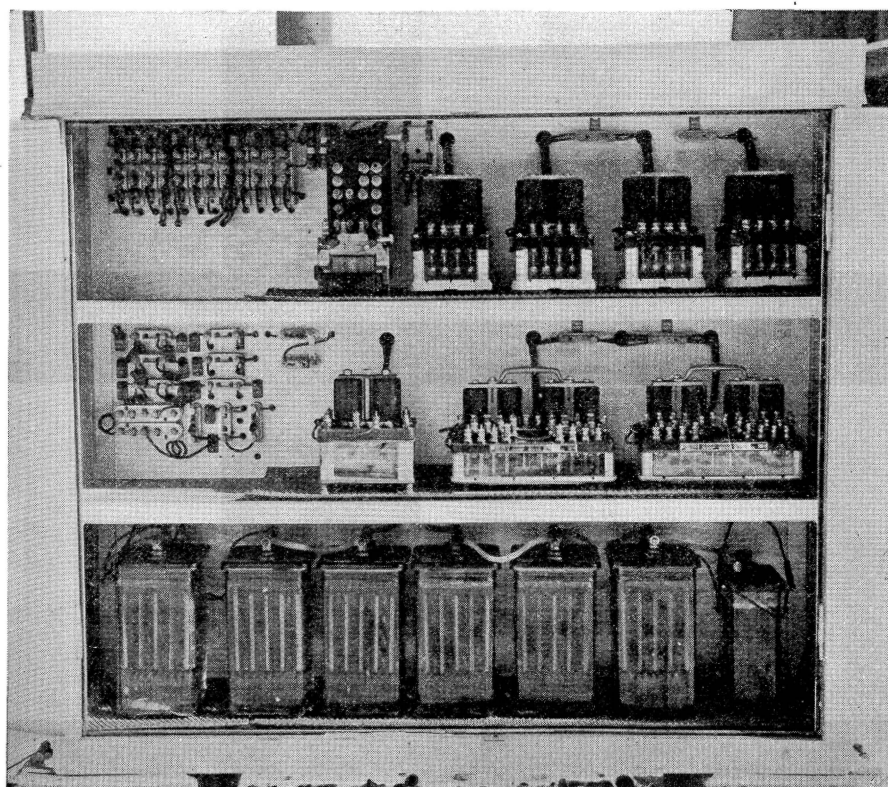
Signal on C.G.W. territory in "clear" position

stand-by supply for the flashing-lights which are normally fed from the a-c. supply. These signal lamps are rated at 10 volt, 10 watt. Each set of storage battery is on floating charge through a Balkite rectifier cell. The interlocking relays are the Union Model-DX-13, and the flasher relays are the Peerless Model C-1. The underground cables to the signals are Okonite with lead sheath and steel tape protection, while the track connection cables are of the non-metallic mummy-type finish.

At each crossing the control equipment and battery are housed in a large-sized welded case made of $\frac{1}{8}$ -in. copper bearing rust-resisting sheet metal. The case is 4 ft. 6 in. high, 5 ft. wide and 2 ft. deep. At the rear two removable panels give access to a wiring space $6\frac{1}{2}$ in. deep, which is partitioned off by panels of ply wood $\frac{3}{8}$ -in. thick, which forms the board on which terminals are mounted.

The case is mounted on two concrete foundations, one at either end, and a duct is formed in each of these foundations so that underground cables can be brought up into the wiring space at the rear of the case. Aerial cables are brought in through conduit fittings at the end of the case near the top. These cases provide adequate space for the equipment which is readily accessible for inspection. These cases were manufactured by the Union Switch & Signal Company, according to plans developed in cooperation with the C. G. W.

The signaling in this territory was designed and installed by the Chicago Great Western signal forces.



Sheet-metal instrument case on C.G.W.