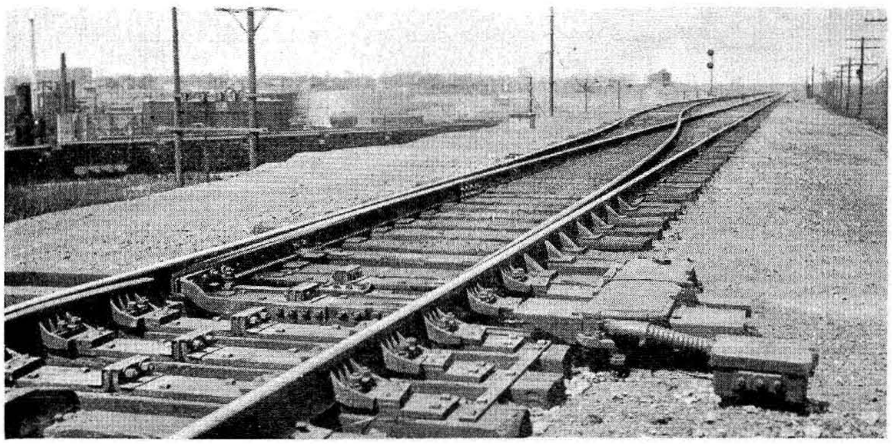
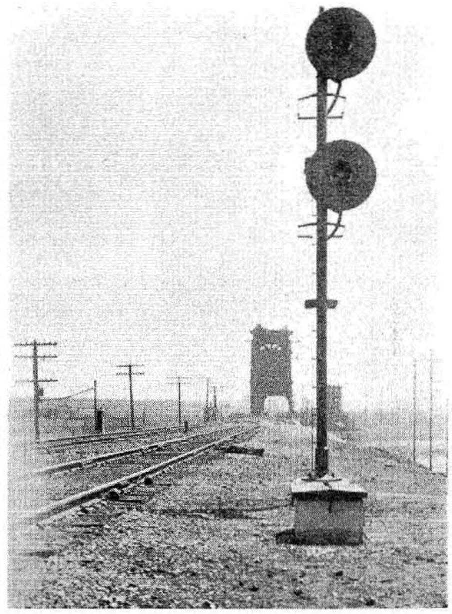
Railway Signaling

# Elgin, Joliet & Eastern Installs Electric Interlocking at Drawbridge



Interlocked switch at end-of-double-track location



Searchlight type signals are used

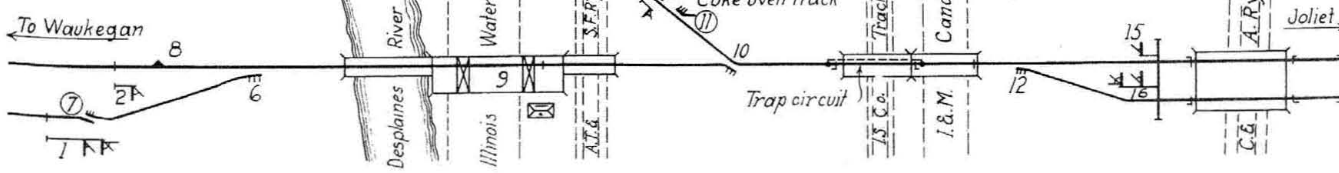
THE Elgin, Joliet & Eastern has constructed a lift-type drawbridge over the new Illinois waterway at Joliet, Ill. For the protection of trains using the bridge, as well as for the operation of the end-of-double-track switches situated near each end of the bridge, a 16-lever electric interlocker was installed. The new bridge was built to accommodate two tracks. However, only a single track is in service because the four other bridges in the immediate vicinity, as shown in the diagram, are for single track. Until such time as these other bridges are replaced, trains will be operated over the one track between the two end-of-double-track switches located approximately 600 ft. from each end of the bridge.

### The Signal Tower

The tower is a 20 ft. by 26 ft. steel and load-bearing tile structure built at the edge of the waterway near the end of the lift span. This location affords a view of both the river and railroad traffic. The main floor houses the interlocking machine, the illuminated track diagram and all of the bridge control equipment, including the main controller, level indicators, ammeters and voltmeters, and the automatic switchboard for the bridge operating motors. The towerman operates both the interlocker and the bridge. The lower floor houses the battery, charging equipment, and the relay cabinet, and affords space for the maintainer's quarters.

### Interlocking Layout

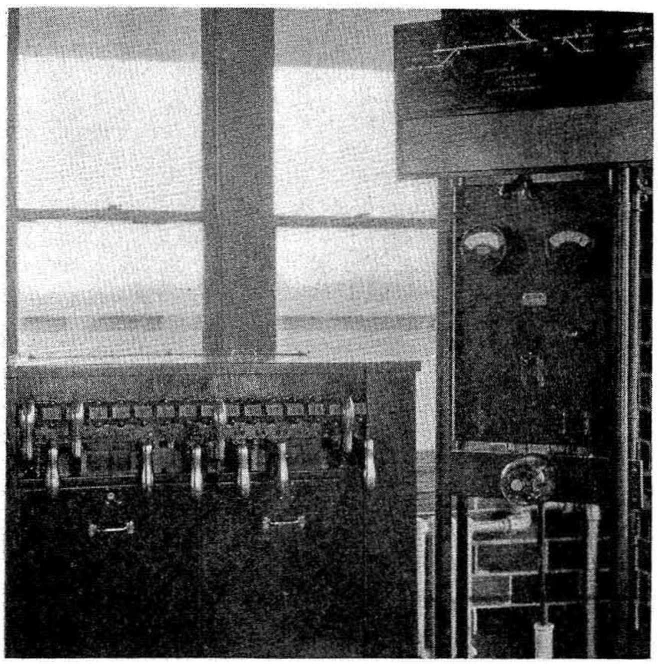
The interlocking is of the all-electric type, using a Model-2 unit lever type, General Railway Signal Company interlocking machine which has a 16-lever frame with 12 working levers. One lever, No. 9, is used as a master lock lever. In addition to the two end-of-double-track switches, the interlocking track layout includes a main-line switch located 422 ft. from the south end of the lift span, this track leading to a coke plant. This switch is normally lined for the coke plant, thus serving as a main line derail. The southward main line derail, No. 7, is of the Wharton type; the back-up derail, No. 8, is of the Hayes type and a split-point




derail, No. 11, is used on the coke-plant lead.

The interlocking circuits are the standard G. R. S. types with dynamic indication on the switch and derail control levers. As the signals are of the color-light type, a special repeater indicator circuit is used to flash the lever lights at each signal movement. The signal circuits are checked through switch repeater relays. The machine is equipped with forced-drop electric locks. A clockwork time release is used with the approach-locking circuits. All low-speed-signal levers are equipped with mechanical time locks.

Lever No. 9, the master locking lever, is kept in the reversed position for signal operation and in this position the interlocker may be operated in the usual way,



Illuminated diagram, meter panel, and the 16-lever machine

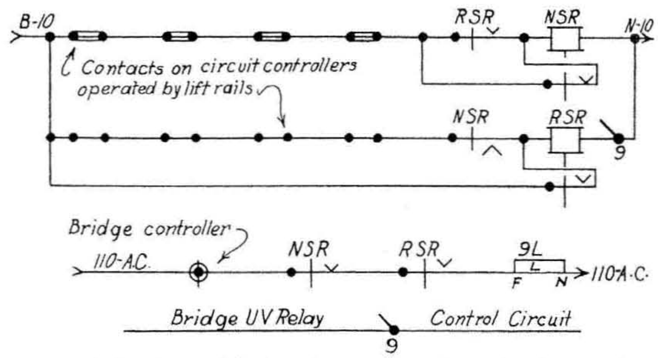
but the bridge "UV" relay, the master relay controlling all bridge operating circuits, is energized through a normal contact of lever No. 9; hence, with it reversed, the bridge cannot be moved. On the other hand, if the bridge is to be raised, the operator must first place all the levers normal, including the derails and the master lever, to energize the UV relay. Of course the master lever cannot be restored to the normal position with a signal line-up pending, or unless the derails are set, on account of the mechanical locking arrangement. Lever 9 having been once placed normal for bridge operation, the signal levers are mechanically locked. This lever has an electric lock which must be energized before it can be reversed again to restore signal operation.

The above operation of the master lever holds but with one exception. If the coke-plant switch, controlled by lever 10, is in its normal position, i. e. for moves not involving the bridge, the bridge and the interlocking involved in this situation may be operated simultaneously, in which case lever 9, for bridge operation, locks lever 10 against a removal of the derail protection afforded by this switch.

### Special Circuits

As previously mentioned, a normal lock must be energized before the master lever can be moved to its position for signal operation. Ingenious control circuits for this electric lock were designed, involving two stick relays. The description of these circuits, which appear in the illustration below, is as follows: The control of the normal stick relay, NSR, includes normal contacts of each of the four rail-end circuit controllers and a normally-open front contact of the second and reverse stick relay, RSR, all in series, the RSR contact being bridged by the stick circuit of NSR through one of its front contacts. The control of RSR includes reverse contacts of each of the rail-end circuit controllers and a normally open back contact of NSR, all in series, the entire group being bridged in parallel by the stick circuit of RSR through one of its front contacts. This entire circuit is in series with a normal contact of the master lever. A third circuit includes a front contact of both of the stick relays RSR and NSR and a normal contact on the bridge circuit controller in series, to energize the normal lock of the master lever.

The operation of these circuits is as follows: Suppose the bridge is down and the interlocker has been in operation. In this case relay NSR is energized through the normal rail-end controller contacts and its own front contact. Also relay RSR is de-energized, the master lever being reversed. A normal contact of each of these two relays is included in the signal control combination for train movements which involve the bridge. Suppose now, the leverman wishes to raise the bridge. If no trains are occupying the plant, he first places the master lever normal, locking the other levers. This energizes the bridge control relay. He now operates the bridge controller and the bridge begins to move. This breaks the control of NSR so that

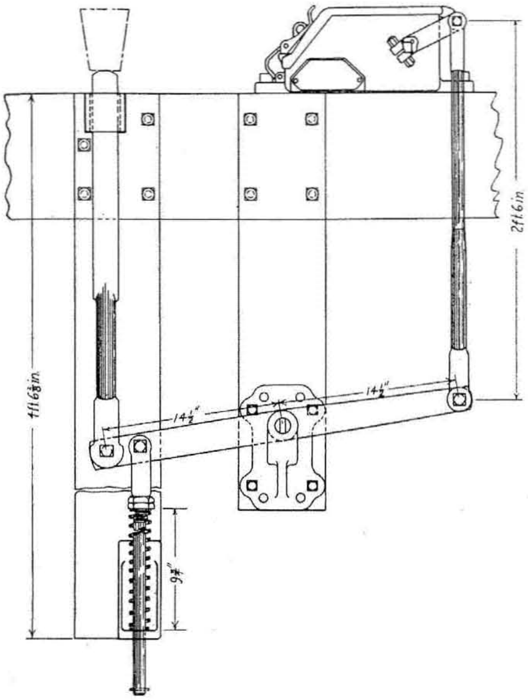



Stick relays and locking circuits for rail-end checking

it immediately drops and opens the signal control circuits; in addition, relay RSR is now energized through reverse rail-end controller contacts and a lever 9 normal contact, also breaking the signal control circuits.

After the bridge has been lowered into position, relay NSR again is energized, owing to the rail-end controllers becoming normal again. Now both stick relays being energized, the normal contact on the bridge controller allows the normal lock of the master lever to pick up, thus releasing the lever. The signals cannot be operated yet however, until the master lever is reversed, since both the mechanical locking and the signal circuits are not yet normal, relay RSR still sticking up through a normal contact on the master lever. If now lever 9 is reversed, the interlocker is ready for use again and the bridge cannot be moved. Thus, any interruption in the normal cycle of the bridge operation, repeated by the stick relays, which may be caused by failure of the signal apparatus or failure of the bridge in returning to its proper position, automatically precludes any signal clearing for movements over the bridge, and makes certain the derail setting against such moves. If such failure occurs the leverman may attempt to clear up the trouble by repeating the bridge cycle. The great advantage of these circuits lies in the fact that the operation of the bridge and protecting equipment must be perfect with rail ends matched and controls locked before a train movement can be made.

An additional feature of the signal circuits is a normal lever contact on each signal lever shunting the signal control relay to guard against the relay becoming energized from some foreign source. This precaution is warranted in view of the fact that the entire signal combination and control circuits, with the exception of the electric lock on lever 9, are operated by one 10-volt battery, the lock being operated with 110-volt a-c.



One circuit controller is operated by each rail-end of the lift span

energy. On account of the steel deck on the bridge over the Illinois Steel Company tracks, it was necessary to use a trap circuit which is repeated by an indicating light on the illuminated diagram in the tower.

### Contactor on Bridge Track Circuit

Each drawbridge signal installation presents a special problem regarding track-circuit continuity and rail-end checking. In the past much trouble has been experienced in such situations for the reason that the bridge span does not always come to rest in exactly the same position, owing to the natural expansion and contraction of the bridge steel and to wind conditions. Also some of the common track-circuit contactors were liable to fail when snow or dirt obstructs them. These possibilities have been effectively eliminated by the special track-circuit contactor shown in the accompanying illustration. This contactor was designed and furnished by the G. R. S. Company. It consists of a 30 in. by 3 in. spring, made up of six No. 14 gage rolled phosphor-bronze spring leaves with a 6 in. tip, bent at a 30-deg. angle, and a 6 in. by 10 in. brass plate contact surface. One contactor spring is mounted near each of the four rail ends on the lift span and the corresponding contact plates are on the fixed spans. Sufficient spring pressure is maintained by an adjusting screw to effect a wiping action on the plate, thus keeping it clean and making a reliable low-resistance contact. The contactor will operate over a comparatively wide variation of bridge settings owing to the large area of the contact plate, this being one of the main advantages. A hinged cover protects the contactor from rain, snow and sand; the only time the contact surface is exposed is while the bridge is up.

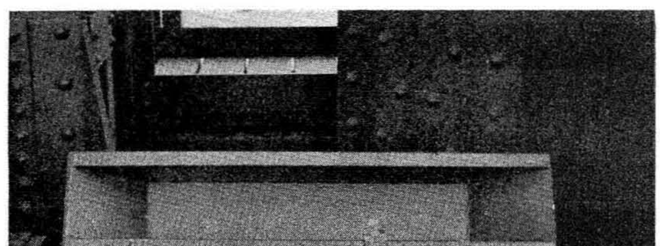
Switch-circuit controllers installed on the four fixed rail ends are adjusted to check the bridge position to ¼ in. Each of these controllers is actuated by a plunger which is moved by the carry-over rail as the bridge comes to its seating position through a lever and spring arrangement. The NSR and RSR relay circuits are cut through these controllers in series as explained above. A sketch of the operating mechanism appears herewith.

### Signals and Switch Machines

The signals are of the G. R. S. searchlight Type SA, designed to operate on 10 volts direct current and are equipped with 115-volt 25-watt lamps. The southward home signal, No. 1, and the northward home signal, No. 16, each have two units. The top unit of No. 1 operates to give two aspects, red and green. The top arm of No. 16 operates to give three aspects, red, yellow and green. The remainder of the signals give two aspects, red and yellow, and purple and green in the case of the dwarf signals. The machines for operating the switches and derails are the Model 5A, equipped for operation on 110 volt d-c.

### Special Boat Signal

When a boat is approaching, the bridge operator must signal to the boat, the ordinary method being to use a flag or a lantern. Ordinarily if no trains are approaching immediately and the operator can raise the bridge at once, he would use a white flag or a green lantern and raise and lower vertically, but if the plant is lined up for an approaching train or a train is passing he would use a red flag or a red lantern and swing it horizontally. Such a system of signaling is not satis-

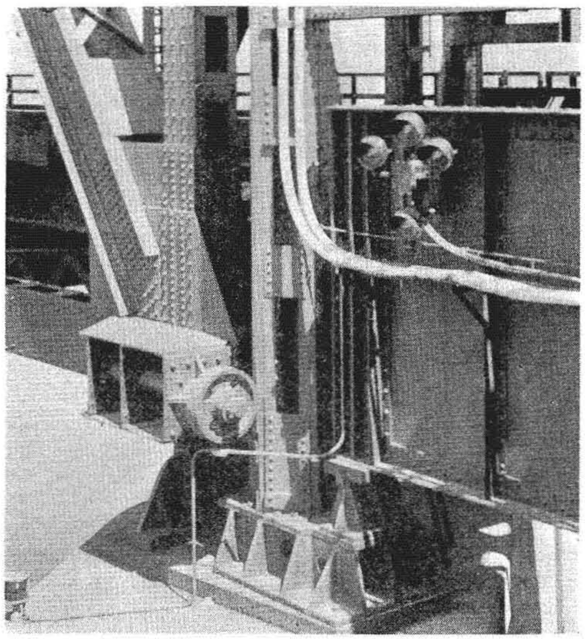


Track circuit contactor at the end of the lift span

factory from the safety standpoint and, therefore, the E. J. & E. prepared plans for a boat signal using electric light units mounted on each side of the bridge. These signals are made up of a group of four G. R. S. light units similar to those used for flashing-light highway crossing signals. Each unit has a 10-volt 18-watt lamp operated on a-c. Two units are mounted on 2½-ft. centers horizontally and the other two on 2½-ft. centers vertically. The red indication is given by the horizontal lights flashing and the green by the vertical lights, simulating a moving lantern. A single-pole double-throw knife switch is provided in the signal tower for the control of these lights. In addition, eight miniature colored repeater lamps are mounted on the control board. Each of these repeaters consists of a four-volt lamp in multiple with a suitable resistance which is connected in series with one bridge lamp. The d-c. flasher relay is operated indirectly from a-c. through a copper-oxide rectifier.

### Power Supply

The switch machines are operated by a 57-cell lead storage battery of the Exide EMGO-7 type. This battery is housed on the first floor of the signal tower on wood shelving. A G. R. S. Type-BP rectifier, rated at 145 volts and 1.5 amps. maintains the battery on floating charge, the normal charging rate being 200 m. a. The 10-volt lock and signal-circuit battery is charged by a Type-BX G. R. S. rectifier rated at 13.5 volts and 1.2 amp. Each track circuit is operated by a battery of three Edison 500-a. h. primary cells.



Flashing lights for signaling to river boats

The a-c. supply consists of a 4,000 volt wye connected 3-phase transformer bank which furnishes 3-phase 220-volt energy for the bridge motors and controls, and single-phase 110-volt energy for the signal equipment and tower lighting.

### Wiring Distribution

The wiring distribution at this interlocking is all in cable. The main run from the tower across the bridge is a 35-conductor aerial cable, run in Copper-weld rings on a stranded Copperweld messenger, a ½-in. high strength messenger being used for the 320-ft. span across the waterway and ⅜-in. messenger beyond the open draw. This cable is terminated in boxes at each end of the draw so as to facilitate repairs and testing. At central points on the plant the cable is brought down into sheet metal terminal cases set on concrete foundations. From these cases parkway cable extends to the switches and signals. At each switch machine the cable terminates in a cast-iron outlet box and from these terminals single conductors are extended through flexible metal conduit to the switch machine.

Single-conductor No. 8 parkway is used for connections to the rail, the cable being brought up through an Aldobilt bootleg outlet to an R. S. A. porcelain terminal mounted in the head, from which point a flexible insulated conductor extends to a Saco rail tap plugged into the rail. The insulated wires and cable, as well as the Type-SI stranded plug rail bonds on this installation were furnished by the American Steel & Wire Company.

This interlocking was installed by the signal department of the Elgin, Joliet & Eastern Railway Company.

# Accidents in Iowa

A SUMMARY of highway grade crossing accidents for the year 1933 discloses the following table of statistics which was taken from the monthly reports of the various railroad companies operating in Iowa. These reports cover only reportable accidents and this necessarily eliminates a considerable number of accidents which might be otherwise reported.

Comparative accident totals and casualties per 10,000 vehicles registered.

| | *1933* | *1932* | *1931* | *1930* |
|---|---|---|---|---|
| (a) Total no. of accidents | 102 | 136 | 165 | 177 |
| (b) Total no. killed | 51 | 56 | 71 | 74 |
| (c) Total no. injured | 102 | 134 | 175 | 188 |

| *Year* | *Killed* | *Injured* | *Auto & Truck Reg.* |
|---|---|---|---|
| 1933 | .82 | 1.56 | 632,292 |
| 1932 | .82 | 1.95 | 687,135 |
| 1931 | .94 | 2.34 | 748,438 |
| 1930 | .94 | 2.39 | 785,344 |
| 1929 | 1.06 | 2.15 | 780,000 |
| 1928 | .98 | 2.56 | 733,000 |

Six of the 1933 total number of accidents involved pedestrians, thereby leaving 96 accidents as strictly involving vehicles; 93 of which were automobiles and trucks, one being a horse-drawn vehicle, one a road grader and one a bicycle. The six pedestrian accidents represent five killed and one injured which leaves 46 deaths and 50 injuries as being attributable to automobiles and trucks. Three of the accidents were reportable on account of property damage in excess of $300; one of these was at a protected crossing where a flashing-light signal was operating; the second was caused by a truck running into the side of a train and the third at a crossing where part-time protection was provided. The accident comparison for the year 1933 involves 34 less accidents than for 1932 with 5 less killed and 32 less injured.

The larger percentage of these accidents is unquestionably due to carelessness on the part of the traveler on the highway in not protecting himself at these dangerous intersections. There are very few accidents at railroad-highway crossings occurring to travelers from a distant vicinity. It is estimated that 90 per cent of all such accidents involves those living near the vicinity of the crossing or acquainted with the location and it has been especially noted that a number of accidents have occurred to persons using a particular crossing from one to perhaps five or more times per day. Particular attention should be directed to the fact that 40 accidents resulted from colliding with the side of a train, which does not represent any appreciable decrease from other years, even though all other forms of accidents do represent about a uniform decrease. There are a few of these accidents which may be excused for reasonable causes but in most instances they represent an entire disregard for the life of the driver or the lives of those entrusted to his care.

The grand total of grade crossings in Iowa is approximately 12,000, with less than 1,000 protected in an approved manner and an additional 950 crossings at which grades are separated. In 1919 there was one grade crossing for each six miles of primary road; and in 1933, one grade crossing for each 11.33 miles of primary road.