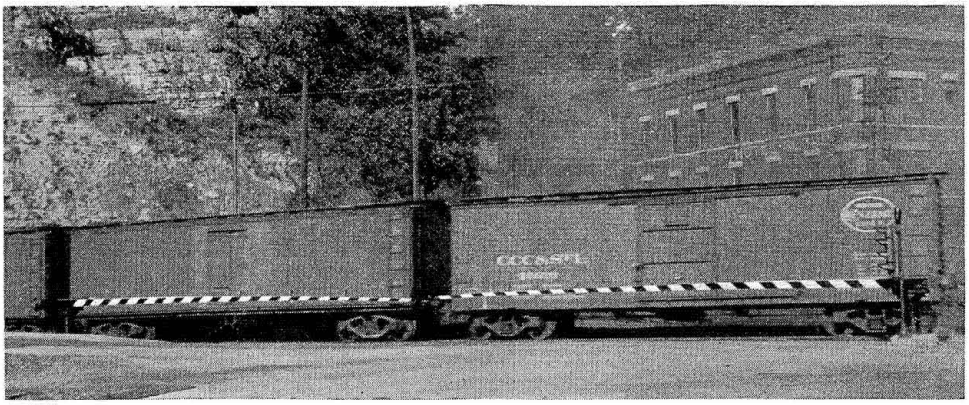
Railway Signaling

Automatic Crossing Gates on Illinois Central

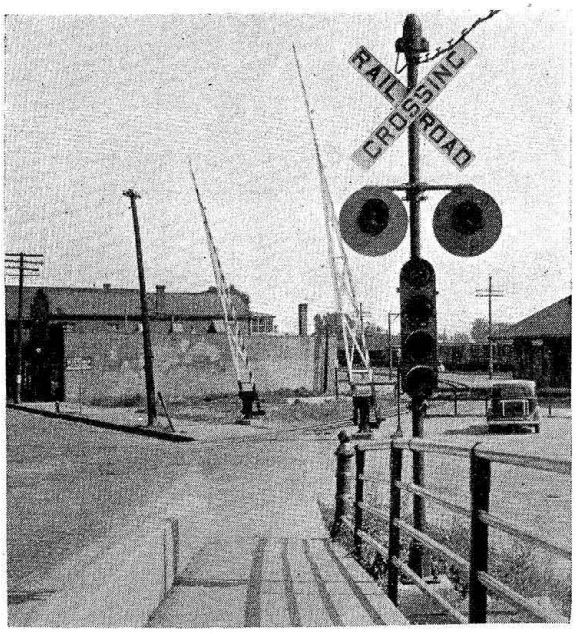


The gates at East Dubuque span a distance of 77 ft.

Manually-operated gates or flagmen replaced — Savings range from 40 to 45 per cent—Special controls on passing track

AT two heavily-traveled street crossings the Illinois Central has installed electrically-operated gates, which include several new features and are controlled automatically by track circuits. At East Dubuque, Ill., the new equipment replaces manually-operated gates, while at Rockford, Ill., flagmen were employed at the crossing now equipped with the new gates.

At East Dubuque, the main street, which also carries through highway traffic, crosses the single-track main line just west of the station. Several factors contribute to make this a hazardous crossing. The highway traffic is very heavy, especially during the summer months as this is the main route leading to a bridge over the Mississippi river. The view of approaching trains is cut off from the east by buildings, while from the west the track approaches the crossing through a tunnel, the end of the tunnel being about 50 ft. from the crossing. The daily traffic over this line includes 6 passenger trains and 17 freight trains of the Illinois Central, 4 passenger trains and 12 freight trains of the Chicago Great Western, and about 6 switch runs of the Chicago, Burlington & Quincy making a total of about 45 train movements daily in addition to several switching movements by the I. C.



Flashing-light signals and illuminated STOP signal with gates in the background

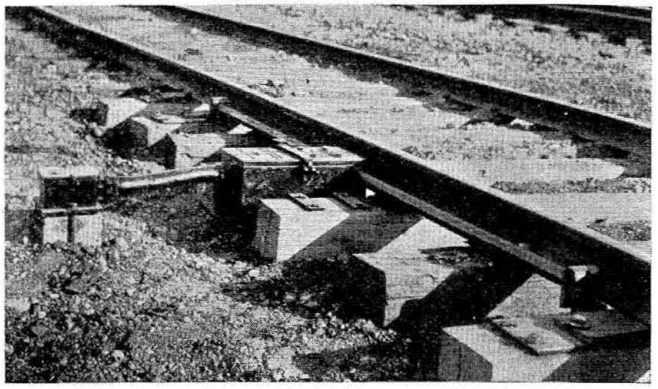
Under the previous arrangement this crossing was protected by manually-operated pneumatic gates, one man being on duty each trick. As these gates were in need of replacement, it was decided to install electrically-operated gates, controlled automatically by track circuits, thus making it possible to effect an annual saving in operating expenses which represents about 49 per cent of the gross expenditure for the new gate installation.

Features of Gate Operation

On account of the tracks crossing the street at an angle and because of the side street coming in on the crossing, the gates span an opening of 77 ft. on one side and 70 ft. on the other. The gate arms are of different lengths from 35 ft. to 40 ft. Spaced about 6 ft. apart along the top of each gate arm are three lamp units each consisting of a 50-watt, 110-volt red lamp with a sheet metal shield over the top. These lamps are lighted constantly at night and, when the gates are lowered, form a row of red lights across the highway. The lamp bulbs are made of red glass and the filament is of a special type designed to withstand rough service.

As train speeds are limited through East Dubuque, the westbound approach track circuit is 967 ft. long and the eastbound circuit is 1,021 ft. long. A separate track circuit 112 ft. long extends over the crossing. The two

ends of an interlocking relay are each controlled by one of the approach circuits, the control in each instance being taken through a front contact of the track relay on the short track circuit on the crossing. In this way the gates cannot clear until the short circuit over the crossing is unoccupied, and yet the gates will clear as soon as the rear of a train leaves this short track circuit.



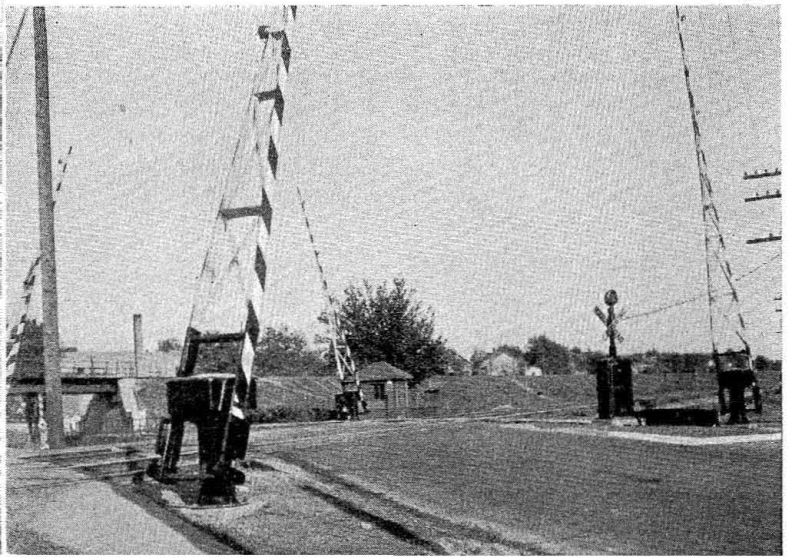
A Fusticlo instrument is used on the passing track

In case a train or cars are to be left standing on one of the approach circuits for some time the gates can be controlled by push buttons, one set of buttons being located on the operator's desk in the station window, located about 200 ft. from the crossing, and the other set of buttons is mounted on the outside wall of the station building.

Slow Downward Movement and Rapid Upward Operation of Gates

When a train enters a track circuit, about 3 seconds elapse before the gate starts, and then it is lowered to the down position in about 13 seconds, thus totaling about 16 seconds from the time the operation starts until the gates close the highway. An interesting feature is that the two gates on the side approaching the crossing start down about four seconds before those on the leaving side. The purpose of this arrangement of the control is to give time for an automobile or truck to get off the crossing in case it passes just as the gates are being lowered.

After a train passes off of the crossing, about three seconds elapse before the gates start to move after which they are raised in 5.5 seconds. This difference in time required to lower and raise the gate is an advantage in two ways. By lowering the gate slowly a warning is given to approaching cars so as to give the drivers a chance to stop. On the other hand, when the train has cleared the crossing, it is an advantage to raise the gates quickly so as to clear the crossing for vehicular traffic as soon as possible.



The single-track main line as well as a passing track are involved in the crossing at Rockford

Auxiliary Signal Protection

As the highway approaching this crossing from the west is on a descending grade and at an angle, the situation is especially hazardous. Therefore, in order to give an approach warning, a standard American Railway Association flashing-light signal is mounted at the right of the highway. This signal is controlled by the approach track circuits and starts to operate about three seconds before the gates start to lower. Also attached to this signal mast is a STOP sign which is normally dark and is illuminated when the signal operates. A similar STOP sign is located at the right of the approach to the crossing from the other side, as well as at the right of the side street approaching the crossing from the station platform. As further protection, a crossing bell is mounted on the signal at the right of the crossing approaching from the east and this bell rings from the time a train hits an approach circuit until the gates are down.

Installation at Rockford

In Rockford, Ill., Broadway street carries a heavy local as well as a through highway traffic. Approaching this crossing from the south the view of approaching trains is obstructed by the grade of the Chicago & North Western, the street going under the North Western track about 200 ft. from the I. C. crossing. Likewise, the view approaching the crossing from the north is cut off by factory buildings. The daily traffic on this line includes 8 passenger trains and 20 freight trains, as well as numerous switching movements. On account of these circumstances, this crossing has been considered hazardous and a watchman has been on duty at this crossing each trick daily for years. In order to provide better protection at this crossing, it was decided to install electric gates controlled automatically by track circuits. Incidentally the annual saving in operating expenses represents about 45 per cent on the gross expenditure for the new gates.

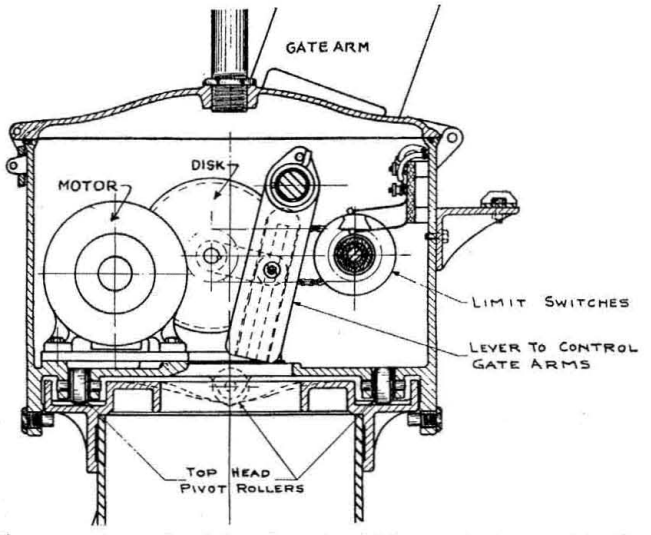
The control of the gates at this crossing includes some special features. As the train speed in this territory is about 25 m.p.h. the track circuit for the eastbound approach on the main line is 1,593 ft. and for the westbound 1,547 ft. On the passing track, the eastbound approach circuit is 922 ft. and the westbound 1,301 ft. In order to handle operation of the gates when a train is standing on the passing track or when switching movements are being made on this track, a special arrangement has been provided. If one of the approach circuits on the passing track is occupied more than 50 seconds and the train has not approached closer than 200 ft. from the crossing, the gates will be raised to clear the crossing for street traffic. However, when the train starts to approach the crossing and passes a Fusticlo controller, located 200 ft. from the crossing, the gates will again be lowered. A train waiting on the passing track must be cut to provide a space of 400 ft. when cutting for the crossing. The passing track control of the gates is separate from that for the main line so that a

train approaching on the main line will cause the gates to be lowered regardless of the set-up established on the passing track. At this street the gate arms are 25 ft. long which is sufficient to span the opening of about 57 ft.

Gates of Simple Design

The electric gates used on both the Rockford and the East Dubuque installations are of the same type, manufactured by the Partition Machinery Company, Chicago. In details of construction the two installations are quite similar and, therefore, the explanation of details will be confined to the East Dubuque installation.

The operating mechanism and motor for each gate is housed in a cast-iron box mounted on top of a 12-in. pipe pedestal which is 3 ft. high, set in a cast-iron base and mounted on a concrete foundation. The mechanism box can be rotated horizontally, rollers 1 in. wide and 2 in. in diameter in the bottom of the box traveling on four inclined planes so arranged that the force of gravity holds the gate in normal position, or will return it to that



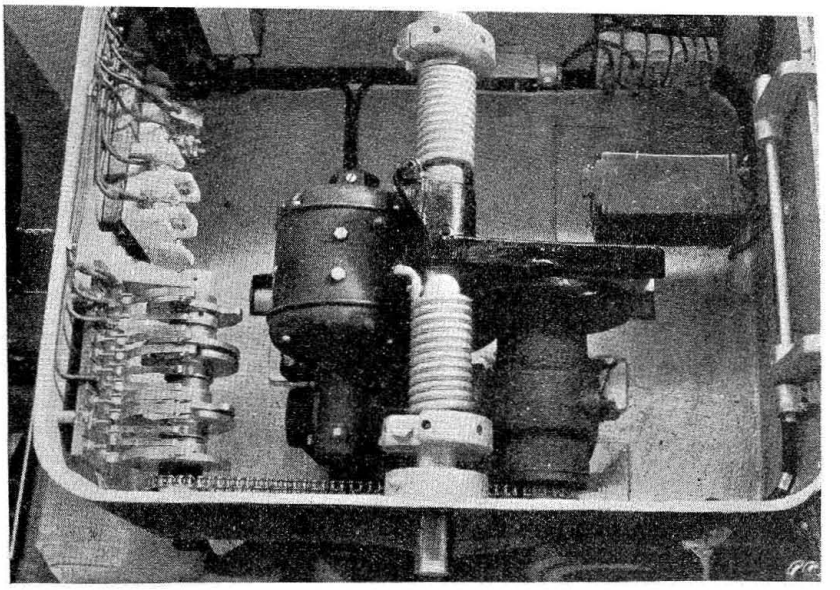
The motor drives the disk with a pin which operates in a slot in the cam arm

position if the gate is pushed around. This feature is provided to reduce the damage to the gate arm in case it is struck by an automobile or truck; and another advantage is that if the gates are lowered with an automobile on the tracks, the car can push the gates around and get out without damage to the car or to the gates.

Each gate is equipped with an electric motor, which, through a set of reduction gears drives a disk with a pin which fits in a slotted cam arm. From the horizontal down position the gate travels 70 deg. to the raised position. The disk and pin rotates 270 deg. to lower the gate and completes the revolution to raise the gate.

The crank arm is mounted on a 1½ in. shaft which extends through bearings at the side of the case, the gate-arm casting being mounted on the portions of this shaft on the outside of the box. The crank is fitted loose on the shaft and motion is transmitted to the shaft by coil springs fitted around the shaft and fixed to the crank and to collars which are pinned to the shaft. The purpose of these springs is to permit the gate arm to be stopped at any point without damage to the mechanism. For example, if the arm should come down on top of an automobile, it will be likely to bound back up without serious damage to the car or to the gate.

A chain, at one side, drives a circuit controller at the

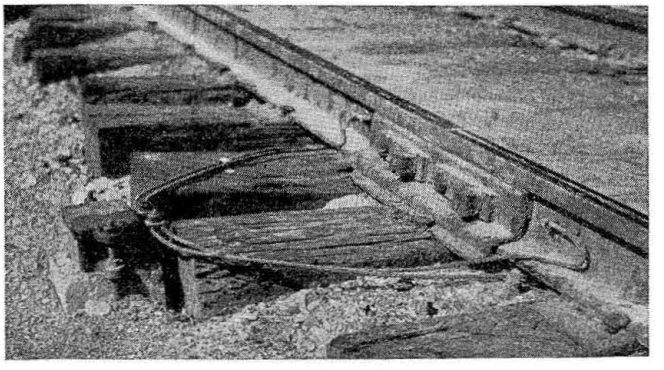


View of interior of gate mechanism case with cover removed

end of the case, this controller being used to stop the motor, control the gate lights, bell, etc. The motor is rated at 1/3 h.p. 1,725 r.p.m. and at 20 volts d-c. consumes 17.5 amp. The motor circuit is made and broken through a mercury-contact relay in the small black box mounted at the right end of the mechanism case, as shown in the illustration. This relay in turn is controlled by the controller contacts and a telephone-type relay in the small white box at the upper left corner. The telephone-type relay is controlled through the interlocking relay which is controlled by track circuits in the usual manner. Each gate is controlled and operated as an independent unit so that trouble on one gate will not affect the operation of the other three.

Details of Construction

The battery for operating the motors and as a standby for the flashing-light signals, consists of 17 cells of Edison storage battery located in a concrete well. This battery is on floating charge of 1.3 amp. through a Union RT-42 rectifier. This rate of charge can be adjusted to meet requirements. The track circuits are each operated by three cells of Edison primary battery. The lights on the gates are operated on 110-volts a-c. and, as there is



One bootleg serves both rail connections

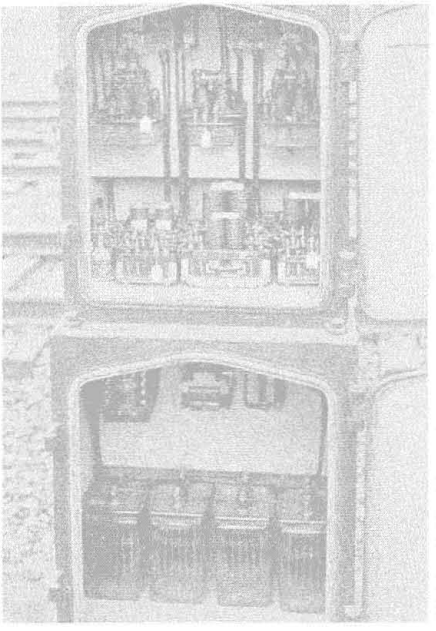
no need for these lights to be illuminated during daylight hours, a Sangamo electric time clock is used to control the feed for this circuit; at the present time the clock is set to turn on the feed at 7 p. m. and cut it off at 6 a. m., the lights being lighted continuously during this period.

A large wooden relay case is used to house the track,

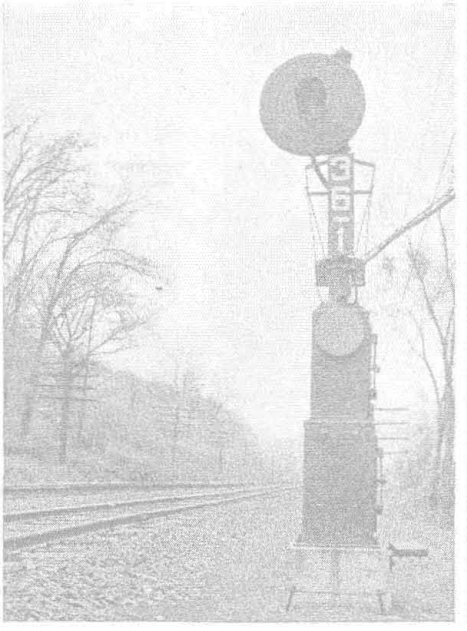
(Continued on page 346)

are 50-ohm Hall type, in series with the DP-21 relay or in some cases with the searchlight signal.

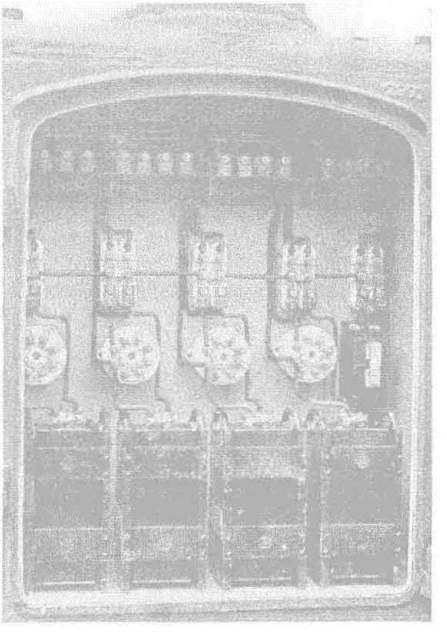
The instrument cases are wired with No. 9 single-conductor solid-copper (braid only no tape) insulated wire so that the wires stay in place and present a neat appearance as shown in the illustrations. The arresters are the Everett Raco type with a Raco high-static Type-B unit connected across each set of line arresters or track connections.



Solid wire is used in the instrument cases



Westward signal with grade marker



Track battery and rectifiers in case

Power Supply System

The a-c. floating system of power supply is used on this installation, the line distribution being at 110 volts run on two No. 6 hard-drawn copper wires with weather-proof covering. A 110-volt line is practical in this instance because connections to existing feeds were available at several stations. In order to distinguish the 110-volt wires, they are run on amber-colored Pyrex insulators.

One advantage of using 110-volt for the distribution is that the power wires can be brought in to the instrument case, and no line transformers are required. These two 110-volt wires terminate in the case in a Raco porcelain-enclosed type of fused disconnect switch which is so constructed that when the cover is removed, the circuit is broken and the fuses, which are attached to the cover, are readily accessible. The fuses used are rated at five amperes. The transformer relays are the Type ANL-40 and the rectifiers are the RT-10 type. At each signal location a set of four cells of Exide KXHS-11 storage cells are used for the line control circuits and as a standby for the signal lamps. One Edison Type-B6H storage cell is used on each track circuit and an Everett-RV5 resistance is used in series with each track feed. The maintainer reads the voltage on each cell of storage battery each week and the gravity reading is taken every three months.

The line wire for the control circuits is No. 10 hard-drawn copper, with weather-proof covering, run on glass insulators. The cables at signal locations are made up of single-conductor No. 14 insulated wires using Raco cable straps. Parkway cable is used for underground runs, the run to the rail being single conductor No. 9 parkway made up with two wraps of steel tape but with no lead. At the rail, this cable is brought up through a Raco bootleg outlet and is connected to a 32-strand copper cable which is clamped in the top of the bootleg and extends to a ⅜-in. plug in the rail. The rail joints on this installation are bonded with stranded steel bonds with copper core, applied by welding, both the Tiger-Weld and the OBalloy types being used.

The design and construction of this automatic signaling installation was handled by the signal department forces of the Erie Railroad, the signals, relays, etc., being furnished by the Union Switch & Signal Company.

Illinois Central Crossing Gates

(Continued from page 343)

interlocking, flasher and power-off relays, rectifiers and transformers. A four-conductor No. 9 parkway extends from this box to each gate pedestal, and three single-conductor No. 9 cables are run to each of the signals. Two single-conductor No. 9 parkway cables extend to each bootleg outlet at the rail. This cable is of Kerite manufacture made up with two wraps of steel but with no lead sheath.

At the rail the two parkway cables are terminated in a cast-iron bootleg outlet set on a concrete foundation. Each cable comes up through a hole in the foundation and the conductor is run around a ¾-in. threaded steel stud and held by nuts. The stud is insulated from the box and extends to the outside. Two ⅜-in. stranded Copperweld cables are bolted to each stud and extend to ⅜-in. plugs driven in the rail, one cable going to the outside and the other to the inside of the rail. The same arrangement applies for the end of the rail on the other side of the joint so that one outlet box serves for two rail-end connections. It will be noted that the bootleg is set at the end of a tie so that the space between all ties is left open to permit tamping.

These automatic gates were placed in service on May 22, and although traffic has been fairly heavy on the highway as well as the railroad, the gates have operated satisfactorily to protect the crossing. The project was planned and installed by the signal department forces of the Illinois Central, with the co-operation of the division operating officers.