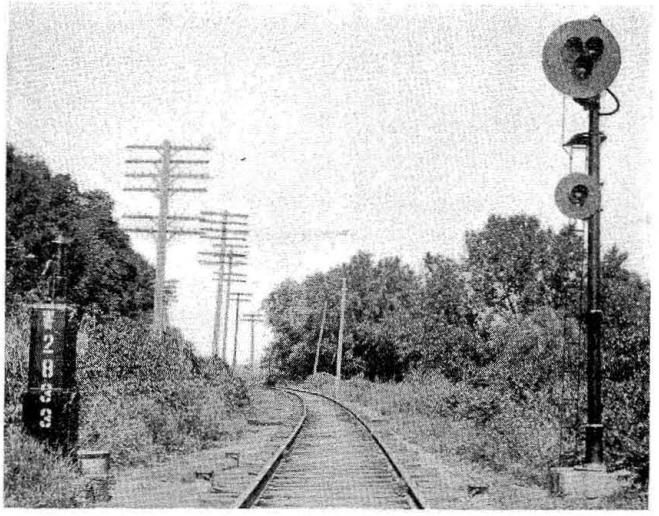
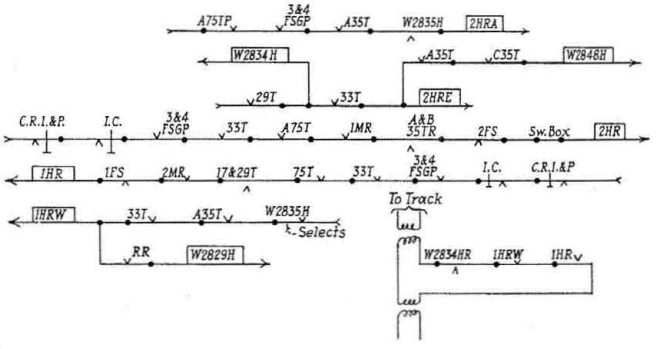
Automatic Interlocking in Train-Control Territory

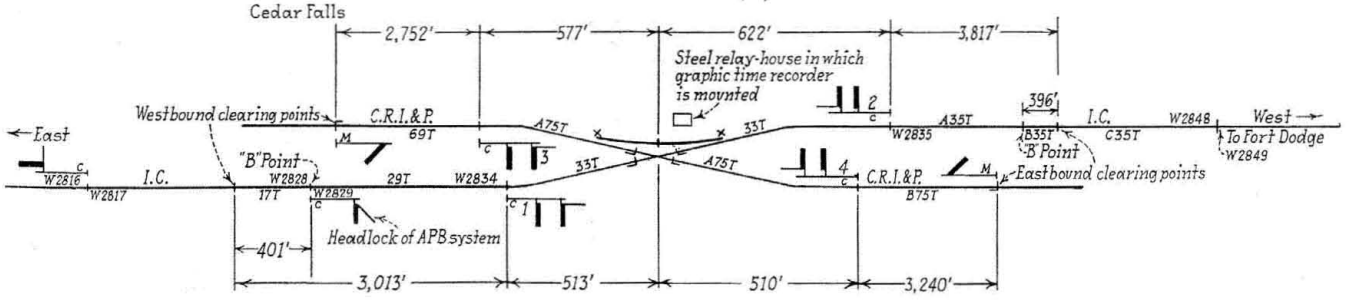
New plant has singular features . . . Cab signals take place of wayside distant signals on the Illinois Central . . . Mechanical interlocking removed . . . Graphic time recorder used

THE first automatic interlocking plant known to have been installed in automatic train control territory was placed in service by the Illinois Central last July at a grade crossing with the single-track line of the Chicago, Rock Island & Pacific, at Cedar Falls, Iowa. This crossing is located on the 97-mile single-track line of the Illinois Central between Waterloo and Fort Dodge, upon which the Union Switch & Signal Company's continuous induction-type automatic-train-stop system, with two-indication cab signals, was installed in 1926, in compliance with the second order of the Interstate Commerce Commission. (See *Railway Signaling*, August, 1926.) This train-stop installation is characterized by the absence of permissive wayside signals, although absolute two-indication color-light wayside signals are provided at the leaving ends of passing sidings and movements through interlocking plants are governed by wayside home signals of the two-position semaphore type. The circuits are arranged on the A. P. B. principle and trains are operated by time-table and train-orders, the engineman being required to govern the speed of his train in accordance with the indication of the cab signal.



Home signal on the Illinois Central. . . . . Below—Typical circuits for signals on the I. C. . . . . Track-and-signal plan showing the location of two of the "B" points referred to in the description of the cab-signal operation



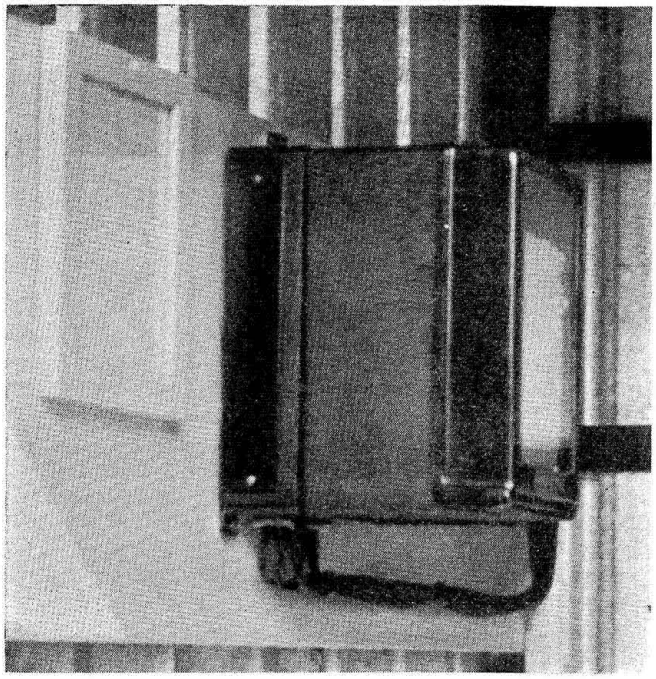


The automatic interlocking at Cedar Falls, which was installed by the signal forces of the Illinois Central, replaced a 15-lever mechanical plant for the operation of which one man was required on each of three tracks. A Union triangular color-light signal, with the yellow unit blanked out and with an additional red marker light attached, was substituted for each home signal on both roads. Fixed approach signals of the semaphore type are provided on the Rock Island, but the approach indications on the Illinois Central are given by cab signals only.

There is a 3-deg. curvature in the Illinois Central track approaching the crossing from either direction, with a descending grade of 0.4 per cent to 0.5 per cent eastbound and an ascending grade of 0.2 per cent to 0.35 per cent westbound. A time-table speed restriction of 20 m.p.h. has been placed on train movements over the crossing by both railroads.

Cab-Signal Operation

A westbound I. C. train will receive a red cab-signal indication at a "B" point located 8,963 ft. from the home signal if the I. C. home-signal slotting track-section is



	Pen No.	Circuit Selection	Information Given
C. R. I. & P	1	*B75TP* down	Occupancy of approach track section *B75T*
	2	*4HR* up	Position of signal No. 4
	3	*A75TP* down	Occupancy of detector track section *A75T*
	4	*3HR* up	Position of signal No. 3
	5	*69TP* down	Occupancy of approach track section *69T*
I. C.	6	*A&T35BP* down	Occupancy of approach track sections *A35T* and *B35T*
	7	*2MR* down	Position of signal No. 2
	8	*33TP* down	Occupancy of detector track section *33T*
	9	*1MR* down	Position of signal No. 1
	10	*17&29TP* down	Occupancy of approach track sections *17T* and *29T*

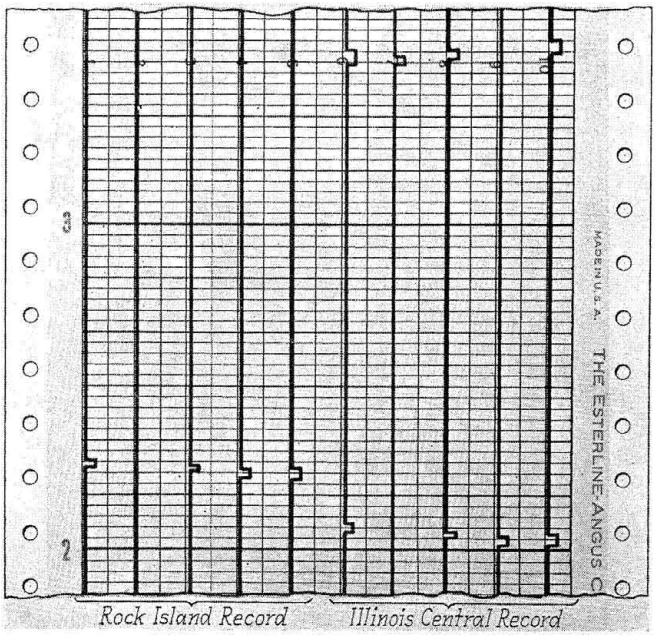
occupied. If the home-signal slotting track-section is not occupied, a red cab-signal indication will be received at a "B" point located 2,612 ft. from the home signal in case the home signal is held at stop by reason of the occupancy of the C. R. I. & P. crossing or approach sections. The clearing point is located 401 ft. out beyond the nearer "B" point to insure clearing of the signal before the "B" point is reached.

On account of the descending grade, the eastbound "B" points and the eastbound clearing point are located farther out. An eastbound I. C. train will receive a red cab signal at a "B" point located 15,389 ft. from the home signal if the home-signal slotting track-section is occupied. With the home-signal slotting track-section unoccupied and the home signal at stop, the engineman will receive a red cab signal at a "B" point 7,015 ft. from the home signal when either of the C. R. I. & P. home signals is clear or the C. R. I. & P. crossing track-section is occupied. If the home signal failed to clear, due to circuit trouble, and the other home signals are at stop and the track sections are unoccupied, a red cab signal would be received at a "B" point 3,421 ft. from the home signal. To avoid a red cab signal under normal conditions, the eastbound clearing point is located 396 ft. out beyond the nearest "B" point or 3,817 ft. from the home signal.

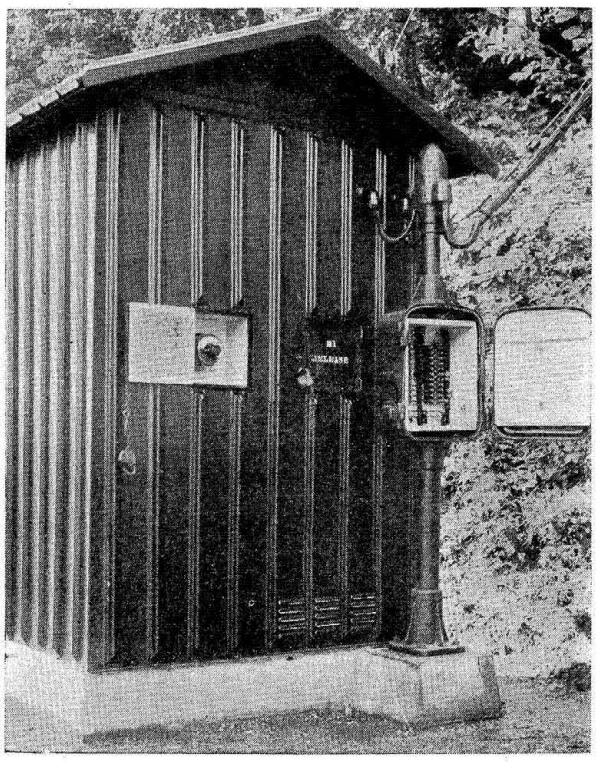
As a means of enforcing obedience to the home signals and to the rule which limits the speed of all trains to 20 m.p.h. over the crossing, an Esterline-Angus graphic time recorder was installed in the steel relay house at the intersection (illustrated), the instrument being mounted on the wall farthest from the track, in order to minimize the possibility of its record being destroyed in the event of a collision or derailment.

Graphic Recorder

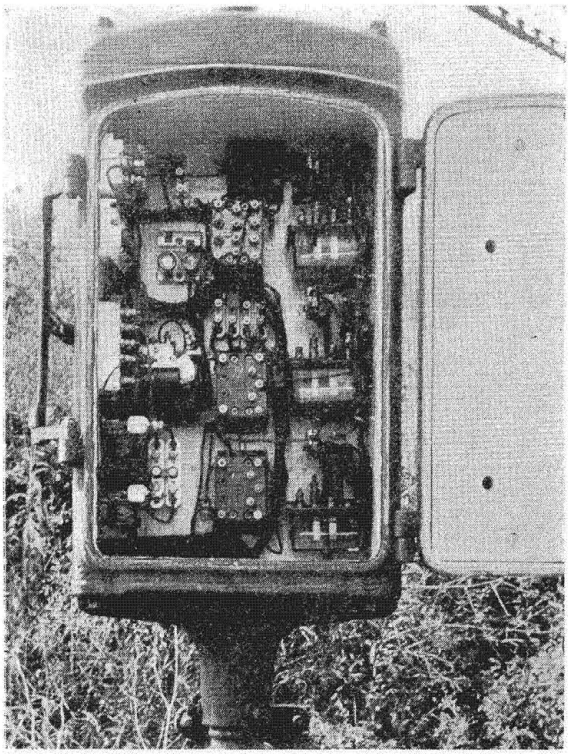
The graphic time recorder is composed of three essential parts; the containing case, the spring-wound clockwork chart-driving mechanism, and the writing elements. The case has two separate compartments. In the front



In the upper left-hand corner is a view of the graphic time recorder and, at its left, the chart which shows the function of each of the 10 pens. These functions are described in the table at the left. . . . . Above—Section of a typical record. . . . . Below . . . . . The steel relay-house in which the recorder is mounted



space is placed the clock mechanism which drives the chart. The front cover, which encloses this compartment, and which can be opened downward, has a large glass window, through which the record and the operation of the instrument can be observed. This construction has



Equipment case near "B" point in approach to signal No. 2 on the I. C.

the advantage that such parts as the clock, ink-well and chart, which require periodical attention, are accessible, while the electrical elements are fully enclosed and therefore not exposed to dust or danger of injury.

The recording mechanism consists of a series of 10 writing pens, each of which is operated by a small electro-magnet. When one of these magnets is energized, it moves its corresponding pen so that it draws a short line transversely on the chart. (A typical record is illustrated.) The magnets are operated on the 12-volt d-c. signal supply, each magnet circuit being selected through relay contacts as described in the accompanying table. The information recorded on the chart is as follows: The time each train enters and leaves the approach section, the time the home signal clears and the time it is restored to the Stop indication, and the time the train enters and leaves the track circuit between the home signals. With this information, the speed of the train can be calculated. The chart is 6 in. wide, and 90 ft. long and operates at a speed of three inches an hour. At this speed, it is said to be possible to measure time values accurately to within 5 seconds. The only maintenance required by the recorder is to renew the chart roll every 14 days, to wind the clock-work driving mechanism every 8 days, and to fill the ink-well, which holds approximately 1 fluid oz., every 3 months.

With the exceptions noted, the plant is similar to others of its type. Time releases are provided for emergency operation. The a-c. floating power system, with Exide batteries, is used for the operation of the long track circuits on the I. C. and for some of the line circuits. The other track circuits are fed by Edison primary batteries. Edison primary batteries are used for some of the line circuits, and at one location the rectifier-primary system is in use, the primary battery being floated across a Balkite rectifier. Union bootleg outlets are used. Most of the relays were furnished by the Union Switch & Signal Company and are spring-mounted. The steel relay house, located at the intersection, was built by the Butler Manufacturing Company. The rail bonds on the I. C. are the stranded duplex Copperweld plug type; those on the Rock Island are the galvanized-iron type with single channel pins. The switch boxes are wired to shunt the track and open the line circuit. Westinghouse auto-valve arresters are used.

Cab Signals Authorized on the Pennsylvania

AS THE RESULT of a decision of the Interstate Commerce Commission, reached by Commissioner McManamy on December 12, the Pennsylvania is now free to operate locomotives with automatic cab signals in place of automatic train control, throughout its lines equipped with A. T. C. This means that the company can now use cab signals exclusively throughout its lines which are equipped for automatic train control and/or cab signaling.

No hearing was held on this petition, the commission deciding that its records in this field are already sufficiently complete. The report gives a condensed history of the experiments which have been made in automatic train control by the Pennsylvania since 1922, observing incidentally that occasional experiments have been made on this road since the year 1880.

The decision covers locomotives used on sections of the Central of New Jersey and the New York & Long Branch, over which Pennsylvania trains are operated. The orders of the commission of June 13, 1922, and January 14, 1924, are abrogated so far as they apply to any and all lines in the Pennsylvania system.

History

The first experiment with the Union three-speed continuous inductive apparatus developed by the Union Switch & Signal Company, was made (voluntarily) on the line between Lewistown, Pa., and Sunbury, Pa., 47 miles, and was put in operation on July 11, 1923. This was continuously operated until January 17, 1926, and as a result of the performance here the road installed a similar system between Baltimore and Harrisburg, this as a compliance with the first order of the commission. This installation was placed in service on July 17, 1926. The locomotive apparatus here include three-indication cab signals, though not required by the government, but cab signals had proved so valuable on the Lewistown-Sunbury line that all subsequent A. T. C. installations on the Pennsylvania included the cab signal equipment.

Further development resulted in the introduction of the coder system (interrupted rail currents) and this has been adopted as standard for all installations on the Pennsylvania, the Baltimore-Harrisburg line being changed so as to operate under this system. Next, the company developed a system of four-indication cab signals with whistle and acknowledger, without train control apparatus; and this was installed on certain sections beyond the requirements of the government. Granting the petition of the company, the commission on February 6, 1931, authorized the operation of locomotives having this cab signal equipment in inter-divisional runs over sections where A. T. C. was required.

(Continued on page 24)