Derail Location and Tower

New Interlockers on the Flint Belt Line

One Electric Plant Handles Two Separate Crossings That Are 3,450 Feet Apart; Trunking Superseded by Suspended Cables; Tower Has Three Floors

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THE Flint Belt Railroad, a subsidiary company of the Pere Marquette, started train operation on June 4, 1923. This road is a new freight belt line which leaves the Toledo-Ludington division of the Pere Marquette approximately two miles south of the station at Flint, Mich., and again enters this line approximately four miles north of Flint, forming a belt line, through the eastern portion of the city. This road was built to divert freight traffic away from the downtown district and also to provide facilities for a new industrial section.

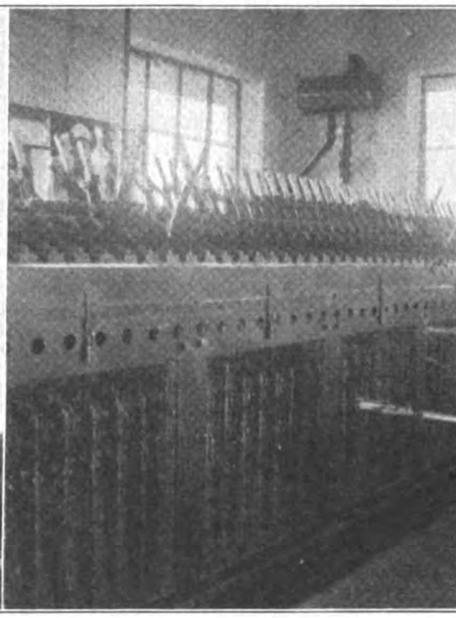
At the same time this road was opened for traffic two electric interlockings were placed in service, one at the crossing of the Detroit United Railway and the other at two crossings of the Grand Trunk.

One Plant Handles the Two Crossings 3,450 Ft. Apart

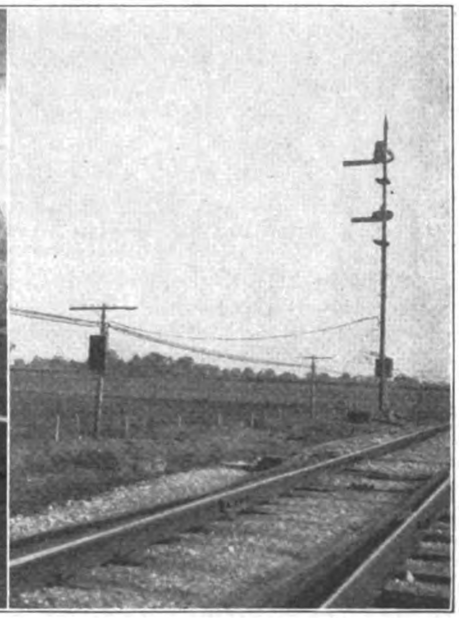
The interlocking at the Detroit United Railway consists of four derails and four signals, two of each on each road, both of which are single track at the present time. The functions are controlled from a 16-lever Federal Signal Company, Type 341 d.c. electric interlocking machine with d.c. indication. The machine is provided with 8 spare levers for future extensions.

The interlocking at the Grand Trunk crossings consists of 17 derails, 1 switch and 20 signals. At this interlocking the Flint Belt Railroad crosses both the main line of the Grand Trunk, and the freight or diverted line of the Grand Trunk, the two lines being 3,450 ft. apart. The main line of the Grand Trunk consists of three tracks and the Flint Belt consists of two tracks at this crossing. The Grand Trunk freight line consists of two tracks and the Flint Belt is single track at the other crossing. The functions are controlled from a 48-lever, Federal Signal Company, Type 341, d.c. electric interlocking machine with d.c. indication. The machine is provided with 8 spare levers for future extensions. The tower is located at the Grand Trunk main line crossing.

Aerial Cables Entering Tower



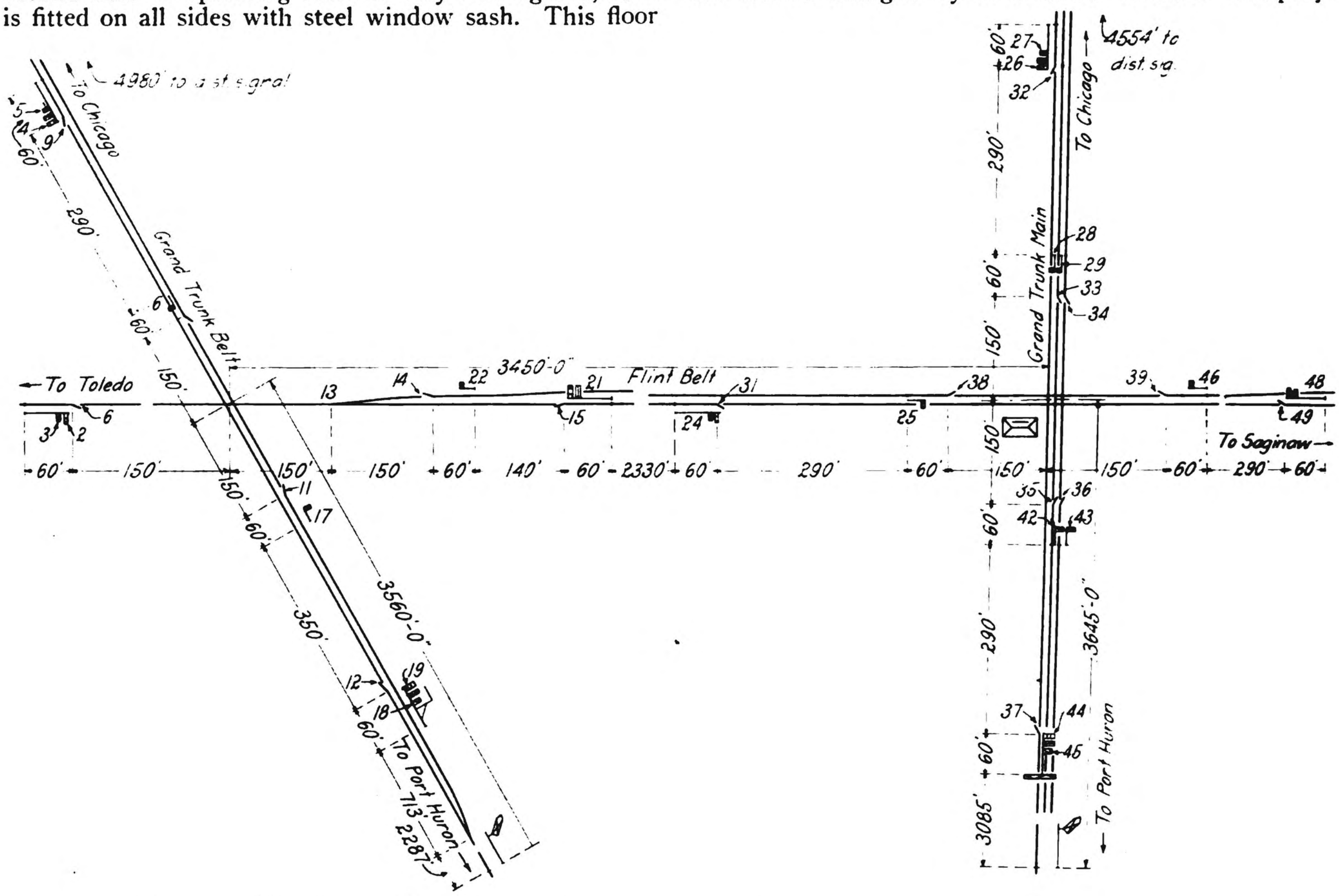
Federal Interlocking Machine



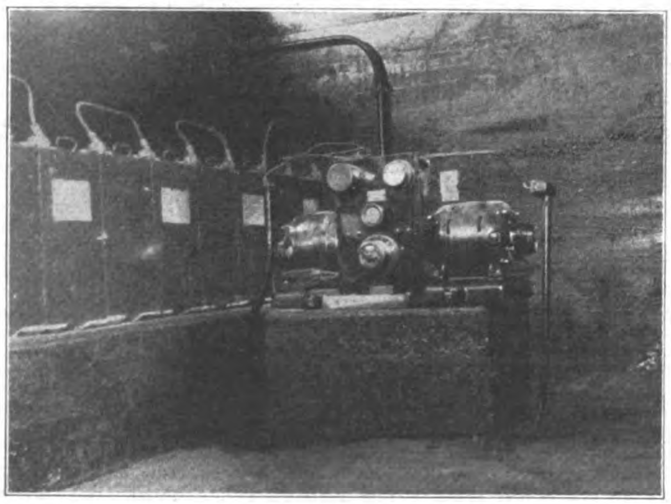
Cables Terminate in Junction Box

Unusual Construction of Towers

Both tower buildings are of fireproof construction, being built of brick with concrete floors and foundations. The roof is of composition shingles and the window frames of steel. The building at the Grand Trunk crossing is arranged in three floors. The basement has an extension at one end for coal storage. The main basement consists of two rooms separated by a concrete partition. One room contains the hot water heater and the other room the motor-generator set and storage battery. The first floor contains the relay rack and a work bench, also a storage cupboard over the basement stairway. The second floor or operating room is very well lighted, as it is fitted on all sides with steel window sash. This floor is reached by an outside steel stairway. The building at the crossing of the Detroit United Railway is arranged in two floors, the first floor being divided into two rooms, one room containing the hot air heater and a work bench, while the motor-generator, storage battery and relay cupboard are located in the other room. The second floor is the operating room.



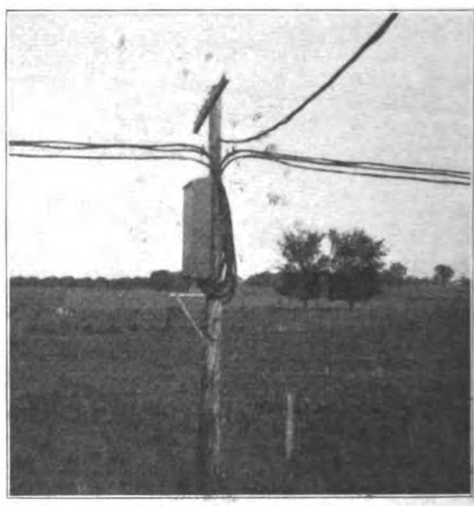
Track and Signal Plan Showing Functions of the Two Crossings Controlled by One Interlocking



Enclosed Type Storage Battery and Motor Generator

Special Electrical Units of Interest

The power plants at both the interlockings are the same, consisting of 60 cells of Electric Storage Battery Company's 120 a.h. "Ironclad" Type M-V-S-9 storage battery arranged in five cells to each tray. The batteries are trickle charged by a General Electric Company's motor-generator set. As little trunking as possible was used, cable of various sizes, in continuous lengths, of Okonite manufacture being used for all main wire leads.



Aerial Cables Terminate in Junction Boxes on Pole Line

The cable was installed on the poles with junction boxes at the signals. All signals are electric lighted, the home and dwarf signal lights being controlled by transposition switches on the tower switchboard and the distant signals are lighted by the low-voltage approach lighting scheme. Each plant has an illuminated spotlight track diagram for all track sections. The energy for track circuits at the Grand Trunk crossings is furnished by Edison 500 a.h. primary battery, while the track circuits at the Detroit United Railway crossing are alternating current.

Switch Locking

The derails and switches are protected by electric switch locking circuits, the locking being effective upon the reversing of a home signal lever which breaks down a stick relay. The stick relay is picked up by the shunting of the track circuit in which the switch or derail is located and this track circuit locks the function directly. Hand release of a route is accomplished by a clock-work device; also by an emergency knife switch. Four-ohm relays are used for the track circuits, and 500-ohm relays, operating on 110 volts with resistance inserted at relay coils, are used in the line circuits. Each interlocking machine is furnished with one 15-amp. scale ammeter for readings on signal circuits and a 60-amp. scale ammeter for readings on switch circuits. Telephone communication has been provided between the tower at the Grand Trunk main line crossing and the Grand Trunk freight line crossing. The materials for both interlockings was furnished by the Federal Signal Company forces, which company also installed the plants complete.

E. M. F. of Cells at Low Temperatures*

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THE practical importance of a knowledge of the electromotive behavior of dry cells and storage batteries at low temperatures has arisen from their use in the Arctic and at high altitudes. In June, 1921, the Department of Terrestial Magnetism of the Carnegie Institute, through Dr. S. J. Mauchly, requested the Bureau of Standards to furnish information in answer to the following questions: (1) What is the open circuit voltage of dry cells at approximately 0 degrees F and below? (2) Are dry cells fit for use after they have been frozen and thawed out again? Since there was no reliable information available on this subject, some experimental work was undertaken, which included observations on storage batteries also. In the first experiments the temperature range was extended to —72 degrees C, and as the open circuit voltage of the cells was not materially changed by cooling them to this temperature the work was extended to —170 degrees C because of the theoretical interest in the application of the Gibbs-Helmholtz and Nernst equations to these cells.

Two methods for cooling the cells were employed. For the range +25 to —72 degrees C, the cells were submerged in a gasoline bath to which small amounts of carbon dioxide snow were added gradually until the lowest temperature attainable was reached, when an excess of the snow was packed around the cells. For the range +20 to —170 degrees C liquid air was used for cooling. The dry cells were placed in a double-walled glass jacket similar to a Dewar vessel, but having air at atmospheric pressure between the walls. This was submerged in liquid air contained in a larger Dewar flask. The storage cell, contained in a glass test tube, was similarly arranged with the addition of a ground cork packing to protect it from breakage. By this means the cooling was gradual, about two hours being required for the cells to fall from room temperature to the lowest temperature available.

The temperatures were measured by a thermocouple of standardized constantan and copper wire. Since it was not practicable to inset the thermocouple in the dry cells of which the e. m. f. was measured, the thermocouple was placed at the center of a similar dry cell which was grouped symmetrically with the other cells. The temperature of the storage cell was measured by placing the thermocouple, protected by a thin-walled glass tube, in the electrolyte between the positive and negative plates of the cell. The electromotive forces of the thermocouples were read on a high-resistance potentiometer.

The dry cells were ¾ in. dia. by 2⅛ in. high and were taken from flashlight batteries of a well-known make. A few experiments on silver chloride dry cells were made also. The storage cells were made by cutting strips of suitable size from the pasted plates of an automobile starting and lighting battery. These were placed on test tubes 1 in. in dia., with perforated hard-rubber separators and a few glass beads. The electrolyte was adjusted to a specific gravity of 1,275 to 1,280 at the end of five days of continuous charging at 0.4 amp.

TABLE 1—Open Circuit Voltages of Cells

[For values below —70 degrees C, see Fig. 2]

Temperature (°C)	Temperature (°F)	Ordinary Dry Cell* Volts	Storage Cell* Volts	Silver Chloride Cell† Volts
20	68	1.540	2.116	1.06
10	50	1.537	2.113	1.05
0	32	1.533	2.111	1.04
—10	14	1.523	2.107	1.03
—20	— 4	1.512	2.103	1.02
—30	—22	1.508	2.100	1.01
—40	—40	1.530	2.096	1.00
—50	—62	1.540	2.092	.99
—60	—76	1.540	2.087	.98
—70	—94	1.526	2.081	.97

*Based on potentiometer readings.
†Interpolated values based on electrometer readings.

The voltage of the cells during tests was measured by three different methods, but the open circuit measurements at the lowest temperatures could be made only by an electrometer. The open circuit voltages were also measured on a 20,000 ohm potentiometer, which afforded a very sensitive method before the cells were frozen, although after this it was nearly useless. A voltmeter having a scale of 2.5 volts and a resistance of 25,000 ohms was used for some of the measurements.

Result

The results of experiments with dry cells of the ordinary type are shown in Table 1 and Fig. 1. Curves *A* and *B* represent the open circuit voltages as measured for two different cells by the electrometer and the potentiometer. Curves *C*, *D*, *E*, and *F* represent the terminal voltage when the cells were discharged through 25,000, 100, 25, and 4 ohms, respectively. The curves indicate the existence of a critical point at about —21 degrees C.

The open circuit voltage curves indicate that changes

*Abstract from paper on this subject prepared by the Bureau of Standards.