The Union's Signaling Exhibition Room

The Model Equipment, Showing the Application of the Various Devices Used by Signal Departments.

The Union Switch & Signal Company has fitted up in the power house at Swissvale an exhibition room in which the operation of the various devices made by the company can be demonstrated for the benefit of visitors. In the center of the room is a raised platform, on which is laid a miniature railway track. A diagram of this appears in Fig. 5. This track is divided into sections by insulated joints and each section constitutes a track circuit fed by direct current through a resistance from storage cells. Full size signals are erected in the position shown. These consist of five automatic block signals as follows:

One Style "T-2," A. C., 60 cycles, single phase, 110 volts; one Style "T," D. C., 12 volts; one Style "S," D. C., 12 volts; one Style "B," D. C., 12 volts; one Style "B," A. C., 25 cycles, single phase, 110 volts.

Six semi-automatic power operated high interlocking signals as follows: One double-arm Style "S," D. C., 110 volts, both arms working; one single-arm Style "T," D. C., 110 volts; one single-arm Style "E," D. C., 12 volts; one single-arm Style "T-2," D. C., 12 volts; one double-arm electro-pneumatic, D. C., 12 volts, rack and pinion type, lower arm fixed, and one single-arm electro-pneumatic, D. C., 12 volts, top mast.

Seven dwarf signals, power operated, as follows: One electro-pneumatic, D. C., 12 volts; one electro-pneumatic, D. C., 12 volts, low type one Style "T," D. C., 110 volts; one solenoid, D. C., 110 volts; one Style "T," D. C., 12 volts, and one slot-arm type, D. C., 12 volts, all of which are two-position signals.

One electro-pneumatic, D. C., 12 volts, three-position, semi-automatic, and six miniature dwarf signals between tracks.

The high signals, with the exception of the lower arm of the double-arm Style "S," are three-position. This lower arm works in two positions only. All signals work in the upper quadrant, and are shown by their proper symbols and marked as to type on the diagram.

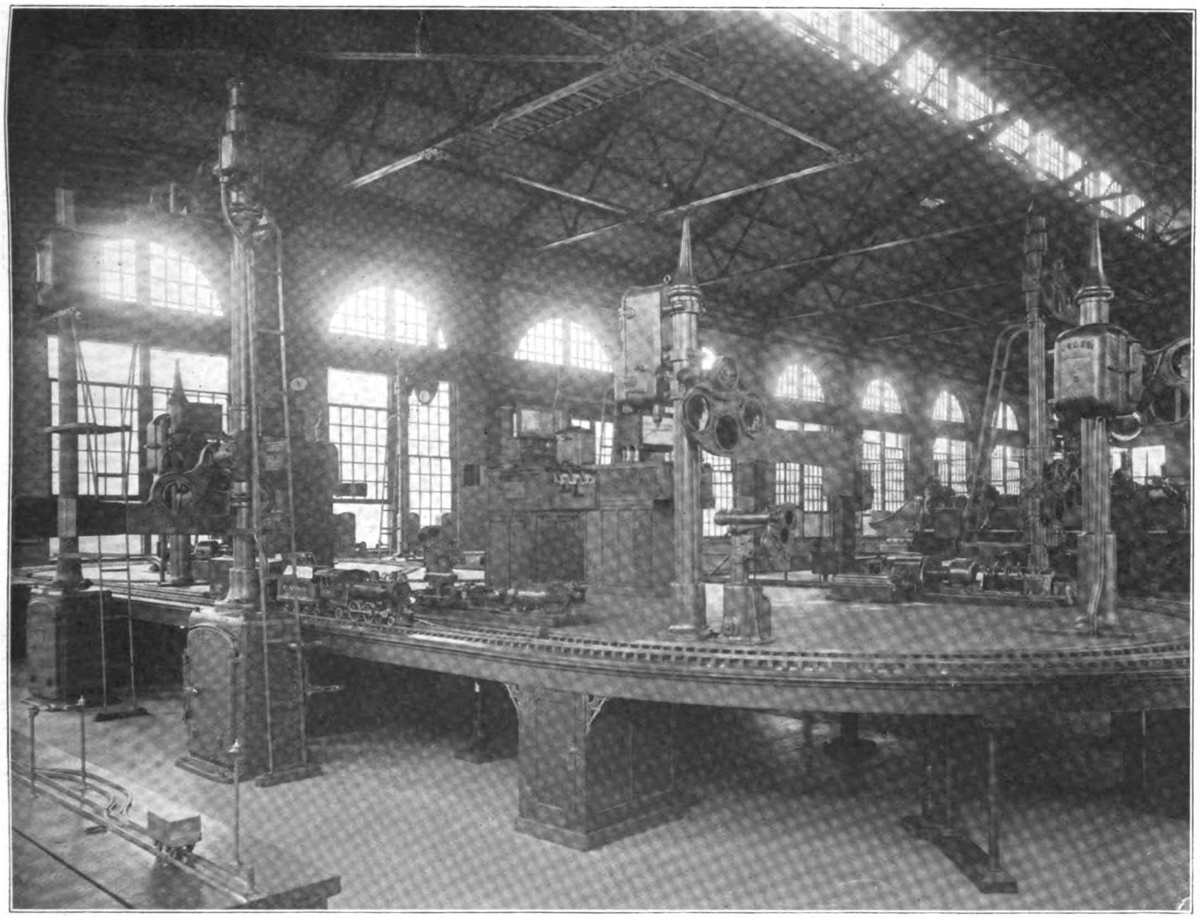
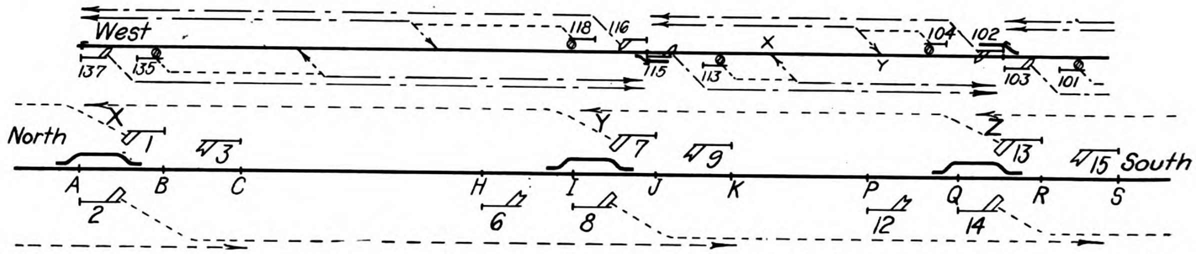


Fig. 1. A General View of the Exhibition Room.

The dwarf signals between tracks are of a special miniature design and are operated by magnets. At each signal is a miniature automatic train stop which works in connection with its signal. The switches and interlocking signals are operated by full-size interlocking machines. For this purpose there are erected on the platform one electro-pneumatic, one Type "F" electric, one Type "S-7" electro-mechanical, and one Type "P-3" electro-mechanical interlocking machine. The switch movements, however, are of a special miniature design, but there are a Style "B" electric and an electro-pneumatic switch and lock movement on the platform which can be operated from their respective machines.



Figs. 2 and 3. Showing the Arrangement of Signals Representing the practice of the Washington, Baltimore & Annapolis and the Illinois Traction System.

On the track a miniature locomotive and train runs, propelled by a Style "B" signal motor in the tank. This is supplied with current from a 10-volt storage battery in the freight car. This train can be made to run over the track in perfect obedience to the signal indications; for should a signal be at stop, the automatic train stop would bring the train to a stand. Clearing the signal releases the stop, which permits the train to proceed. The stops are operative for the proper running direction only.

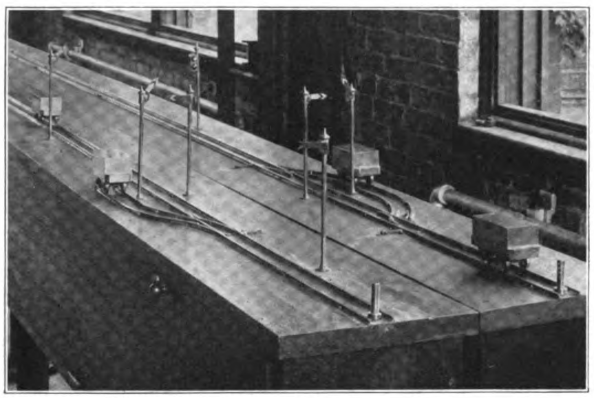


Fig. 4. A Miniature Electric Railway Signaling System.

As the train proceeds it shunts the various track circuits as it passes over them, thereby setting the signals and operating the electric locking on the levers of the machine, as well as causing the lever lights, annunciators, block indicators, etc., to display the proper indications in the same manner as would be the case on a railway in actual service operation. All wires, air pipes, relays, etc., are placed below the platform, as are also the operating magnets of the train stops, miniature signals and switch movements.

In addition to this platform with its full size apparatus, there are two small tables used in demonstrating the principles of interurban railway signaling. On one of these tables are two miniature railway tracks fitted with miniature signals, Fig. 4.

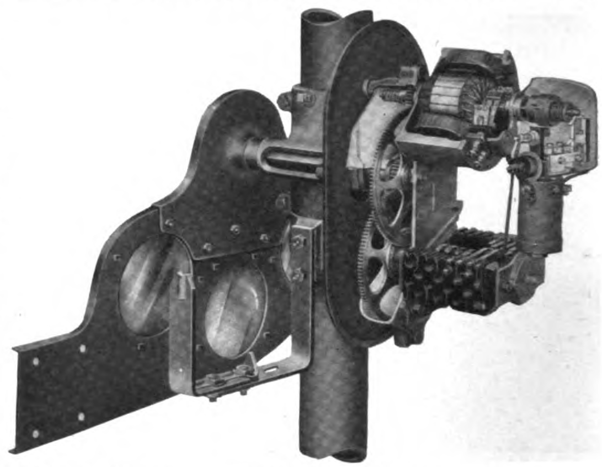


Fig. 6. Showing the Mechanism of the Style "T2" Signal.

One track is signaled in accordance with the standard practice of the Illinois Traction System. A diagram of this signaling is shown in Fig. 3. The other is signaled like the Washington, Baltimore & Annapolis, Fig. 2. There are miniature brass cars which can be run over the tracks to show the operation of the system as in actual service. On the second table is a small installation of automatic block signals illustrating curve

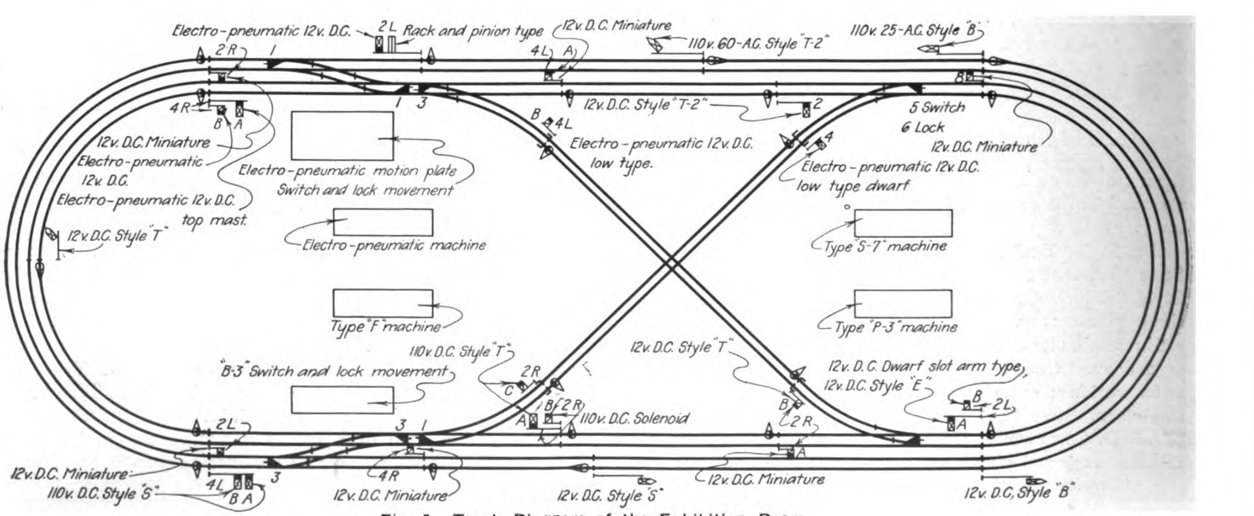


Fig. 5. Track Diagram of the Exhibition Room.

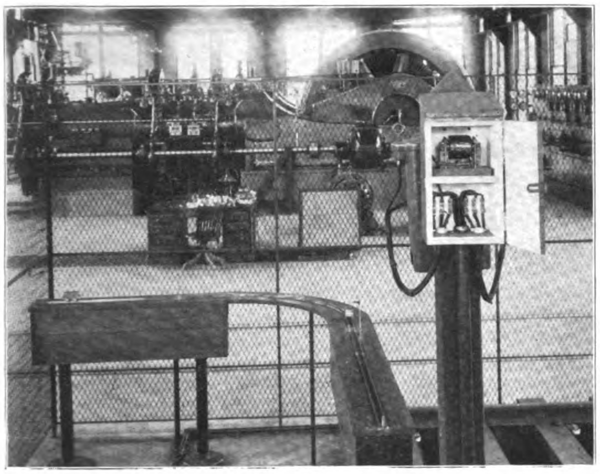


Fig. 7. Illustrating the Method of Curve Protection. and Showing the Transformer and Reactance Box on the Post.

Fig. 8. The Power House Wherein the Exhibition Room Is Located.

protection, Fig. 7. The track, cars, and signals are simiiar to those on the other table. The relays, magnets, wires, etc., for these three signal installations are carried in cupboards under the respective tables.

Electric power to operate the various pieces of apparatus is distributed from a switchboard located in the exhibition room; and 25 cycle, single phase, alternating current, at 110 volts is supplied from a motor-generator set, the motor of which is driven by 60-cycle, two-phase current at 110 volts from the power house mains. One phase of this 60-cycle current is used to operate the 60-cycle signal apparatus in the exhibition room. Direct current at 110 volts is obtained from the power house mains and is used to charge the 15-volt storage battery for track circuits and signal operation, the 10-volt storage battery on the

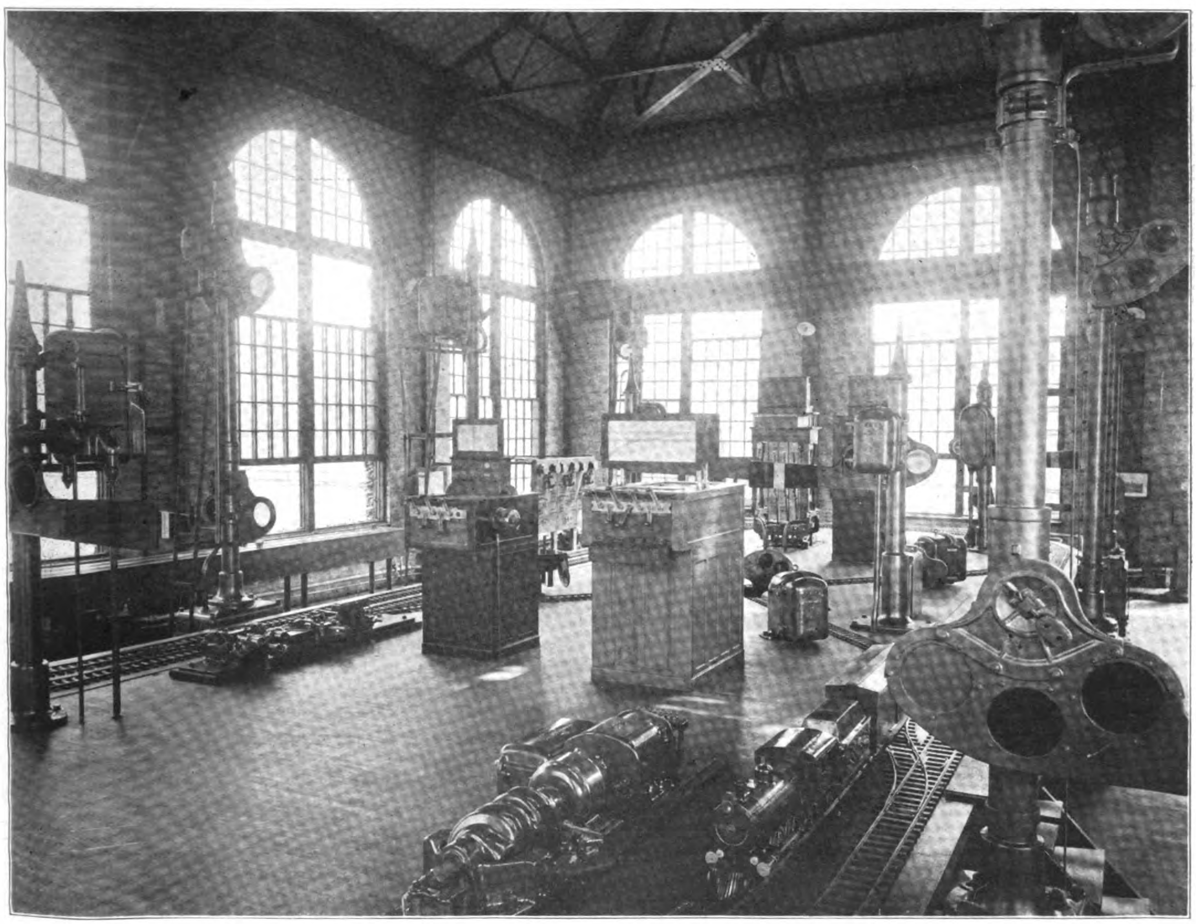


Fig. 9. Showing the Power Interlocking Machines.

train and to operate the 110-volt direct current signal apparatus. The track circuits are supplied from the 15-volt battery through resistances.

At one side of the room are two sets of electric train staff instruments. One set is the standard design used on steam roads and is equipped with an electric lever lock attachment. The other set is designed to be operated by the train crew where there are no station attendants. Both sets of instruments are connected up and in working order. Current is supplied from dry battery. In another part of the room there is a typical installation of a light signal together with a complete equipment for a cut section of an A. C. track circuit on an electric road. This includes a set of impedance bonds, two transformers, a relay box containing one vane relay, and one galvanometer relay, and two terminal boxes at the transformers containing track reactances, all connected to a short section of standard gauge track. The relay box is mounted on a cable post. There is also a Style "T-2" D. C. signal, in which various portions have been cut away to afford a clear view of the method of operation. Fig. 6 shows the mechanism of this signal. In addition to the above-mentioned apparatus, there are on exhibition, one three-position galvanometer relay, 60 cycles; one two-position relay of the same class; one two-position radial polyphase relay, 60 cycles; one of same type used as a frequency relay; one "Z" armature relay, single-phase, 60 cycles; one single-phase vane track relay; one Model 12 polyphase relay; and one vane track frequency relay. All these instruments are connected up and may be operated by throwing hand switches.

Figs. 1 and 9 are general views of the exhibition room, and Fig. 8 shows the power house.

THE HOUSING OF UNDERGROUND SIGNAL WIRES AND BATTERIES

BY HUGH T. WREAKS.

The successful operation of a railway signal system may be described as a matter of dollars and cents properly applied. But this proper application is not always easy. There is probably no other signaling system which compares with that of the railway in first cost, except signaling used for submarine work. Incidentally, the maintenance cost of each is proportionately large. A large amount of trouble caused in railway signaling may be traced to the wires transmitting the electrical current, although lightning, mechanical injury, battery trouble, malicious interference and other causes all play their part. In a way, battery trouble and wire trouble, especially those wires which are laid underground, group together in that the manner in which they are housed, inspected and maintained or repaired, will determine the amount of trouble they are likely to give.

The theory on which most of the underground wire is laid is apparently that railroad conditions call for so much exposure of the wire to likelihood of mechanical injury, corrosive or destructive action from soil, deterioration due to contact with moisture containing sulphur, acids, or alkalies, frost action in the ground, together with shifting of rail joints and consequent frequent temporary connections that no form of housing or protection would prevent, that it is felt necessary to buy wire strong and durable enough to withstand conditions mentioned, in a large measure independent of any protection afforded by housing, conduit or ducts; and to this extent, the value and importance of such housing has, in a large measure, been lost sight of.

To-day changing conditions and public opinion are calling continually for more and more efficiency from railway signal systems, which would seem to indicate the necessity of more special consideration of the question of housing for underground wires for signals, and also the treating of this housing from a point of view of permanency so that best results may be accomplished.

Turning to the experience of those outside of the railway signaling field who use underground wire, we find the following facts:

(1) That the wooden or pump log duct for underground work has been abandoned in most cases and severely criticized as inefficient and unserviceable, owing to decay and short life;

(2) that iron pipe gives good service in electric light distribution for underground feeders;

(3) that tile and fiber pipe laid in concrete are very serviceable for electric light and power mains; and

(4) That concrete ducts formed over molds are equally serviceable for light and power mains.

Turning now to the railroads, there is apparently no accepted standard covering these various classes of conduit enumerated. There are a good many wooden or so-called pump log ducts used; there is some tile and fiber pipe used, and some iron pipe construction. The wooden ducts have an apparently limited life, owing to corrosive action of the soil, and also allow for various mechanical injuries, accumulation of moisture, and, I believe, even the nesting of field mice, to the consequent destruction of rubber-covered wire in the ducts. Tile would seem to offer no special advantage, being brittle, difficult to handle as regards right-angle turns and joints, and not particularly strong for the service unless protected by concrete. Similar comments can properly be made on fiber conduit, which, although less brittle than tile, would be much more liable to be crushed. Concrete ducts would seem to be entirely impracticable, as they are expensive for signal wires and present other features which would hardly make them attractive for railroad use.

Criticisms have also been made concerning iron pipe, in that it is affected by soil corrosion, and would fail to show up those results which would warrant its universal use or large adoption. It would seem, however, from a study of the facts, that iron pipe, properly protected, or coated against soil corrosion, is the solution of the housing problem for underground signal wire.

The essentials would seem to be as follows:

(a) Exclusion of moisture from within the pipe, and protection against corrosion on the inside;

(b) protection against soil corrosion combined with mechanical abrasion from the outside, and

(c) installing at a depth sufficient to be safe from the laborers' picks and changing conditions of roadbed.

The exclusion of moisture from the inside can be accomplished by making the joints tight and using proper outlets and with proper enameling or coating on the inside.

The protection against corrosion of soil combined with mechanical injury is more of a problem, and yet, taking experience gained to date by various authorities, this, too, is capable of solution.

Experiments and experience to date show that a well Sherardized, galvanized or enameled iron pipe, which has not been damaged mechanically between time of process and using, so that the coating is still intact, will give excellent resisting results against soil corrosion. Unfortunately, this mechanical injury can with difficulty be guarded against, but results of such injury can be overcome in two ways:

(d) By recoating the pipe after it is made up with the elbows and couplings, this coating consisting of a quick drying enamel applied on the outside, and the pipe then receiving no further handling except to lay and replace the soil on the roadbed; and

(e) by similarly coating the pipe on the outside with hot pitch and wrapping with asbestos, tar paper or friction tape.

Of these two processes, the latter is slightly more expensive as regards labor, although not greatly so if enough pipe is coated and work properly systematized. Of course, this method would cost a little more in material and quite appreciably more in labor than the use of wooden ducts or pipe less carefully protected, and this fact will doubtless bring forth some objection, especially on track circuit work, on the ground that so much of this work is temporary and the process of coating as specified in (d) or (e), or even the use of iron conduit at all with the necessary unions and elbows and fitting lengths of pipe would mean so much extra work on the maintainers as either to detract from their other work and general supervision.