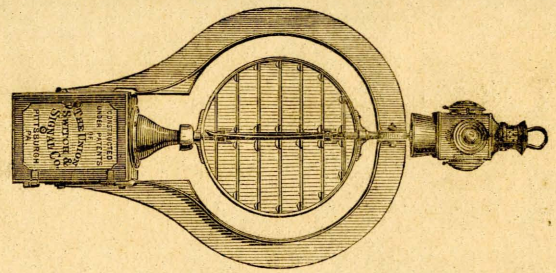
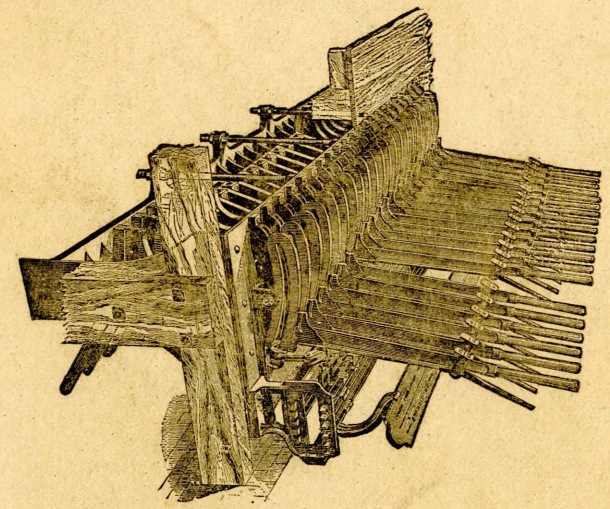


THE UNION SWITCH AND SIGNAL COMPANY.

CATALOGUE OF

Automatic Rail Circuit Block, Draw-bridge, Crossing and Station Signaling.



THE UNION

SWITCH AND SIGNAL CO.

MANUFACTURERS OF

RAILROAD SIGNALING APPLIANCES

OF ALL DESCRIPTIONS,

FROGS, CROSSING, SWITCHES AND SWITCH STANDS.

OFFICE AND WORKS:

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PITTSBURGH, PENNA.

May 1st, 1883.

Press of
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Automatic Electric Rail Circuit Block Signaling.

Fundamental Principles.

The Automatic Electric Signals introduced by The Union Switch and Signal Company depend upon the passage of a current of electricity along the *rails of the railway track.* Any interruption of the current causes the signal to turn to "danger," and it is only when the track is intact and unoccupied that the signals indicate "safety."

An eminent authority, writing upon the application of electricity to railway working, claims that any automatic system should be based upon the following principles:

1st. The normal condition of the signal should be "danger," *i. e.* any failure of the apparatus, or interruptions of the circuit, should result in producing the "danger" signal.

2d. The agency by which the signal is placed at "safety" should be active *during the existence of such signal.*

3d. The apparatus employed should be perfectly free from atmospheric influences.

4th. The apparatus should be simple, strong, and not easily deranged.

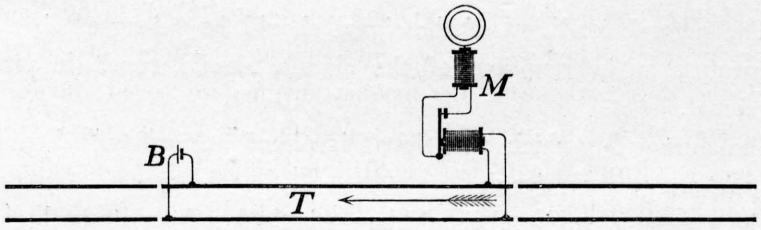
The Union Switch and Signal Company's automatic rail circuit system is the only one that fully meets all of these requirements, and is adapted to all the various necessities of railway signal service.

It affords a more perfect protection than is possible with any other block system, as every part of the track, as well as dangerous sidings and crossings, are protected, not by human agency, but by mechanism, which is so constructed that failure in any part can result only in giving the "danger" signal.

The most valuable features of our system are, the use of the track as part of the circuit; the use of a secondary or tell-tale signal; the use of the constantly closed circuit; the electric locking of switches; and the circuit-breaker for switches. These combined give the most complete and reliable system of electric railway signals in use.

It is the only system by which it is *impossible* to display a safety signal when danger exists.

Figure 1.



The electric circuit will be readily understood from the figure and description. In the diagram, Figure 1, "T" represents a section of railroad track, a mile or less in length, which is insulated at the ends of the section from the adjacent rails. At one end of the section the battery "B," consisting of a single cell, is placed, one pole attached to each rail, while at the other end of the same section is placed the electro-magnet "M," with one wire attached to each rail. Thus a complete metallic circuit is established from the battery, through the rails and magnet, back to the battery again.

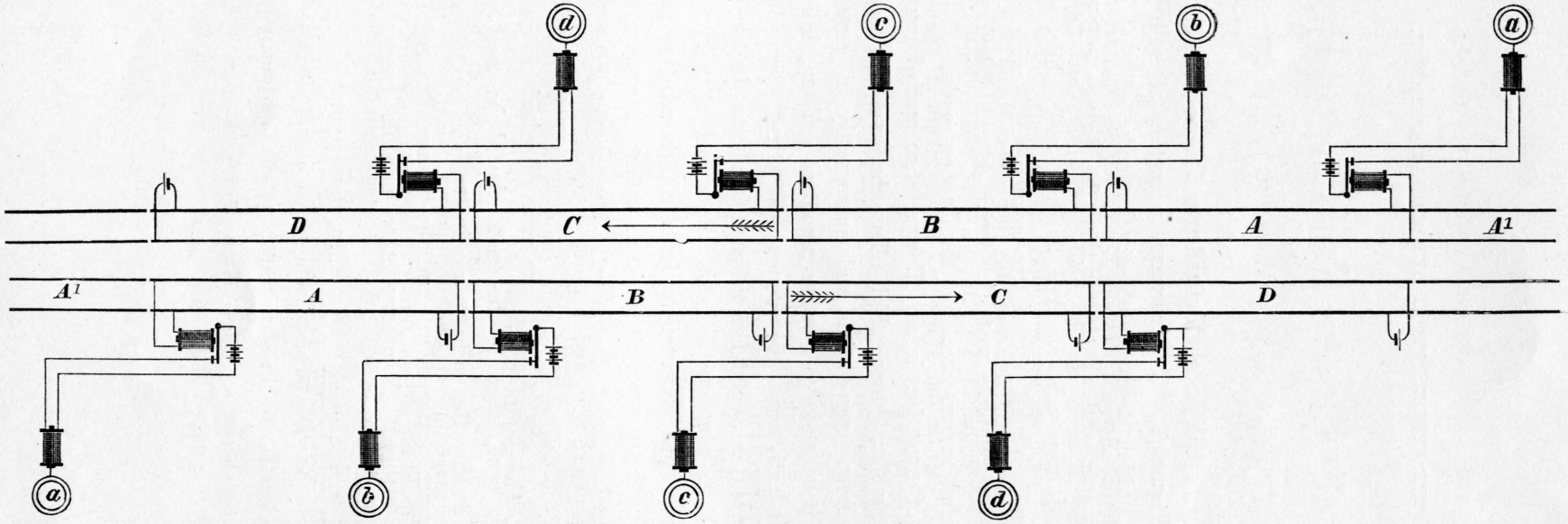
The principle of operation is as follows: when several courses are presented, electricity will follow that course which offers the least resistance, the rails being of metal, of very large cross-section, and consequently of great conductivity, are vastly superior as conductors to any surrounding medium, hence, the electricity adheres to the rails and keeps the magnet magnetized, even during the heaviest rain and snow storms, in preference to passing off to the earth.

The magnet while magnetized holds the signal at "safety." When, however, a train enters upon the section from either end, or from a siding, the wheels and axles instantly short-circuit the current, because they are better conductors than the small wire of the magnet. The magnet being thus demagnetized, releases the signal, which instantly turns to the danger position, and remains thus while the train, a car, or even one pair of wheels is on the section.

It will be observed, that if the track should be torn up, or a rail be broken, so as to destroy the metallic continuity, the electric current would be interrupted, the magnet demagnetized, and the "danger" signal displayed. Should the current be interrupted from any other possible cause, the signal would instantly show "danger."

Thus any error which may occur will be on the side of safety.

Figure 2.



The Automatic Electric Rail Circuit Block System, used for "Overlapping" the Signals of Adjacent Sections.

A very important advantage resulting from the use of a track circuit, is the ease with which a train can be made to actuate any number of signals.

In the simplest form of the automatic system one signal passes to "danger" as the train enters each section; but this has been found not to give sufficient protection, hence, a method of overlapping has been adopted, by which two or more signals, according to the situation, may be kept at "danger" in the preceding and succeeding sections.

This plan has proved to be eminently successful.

The Overlapping Block System, as Applied to Double Track Roads.

The following description, and Figures 2 and 3, will illustrate the application of the overlapping system to a double track road where but one signal is used in each section. The simplest form of overlapping signals for double track roads is illustrated in Figure 2. A train traveling in the direction indicated by the arrow, on arriving at the point "A," will set the signal "a" to danger; this signal being fifteen hundred feet, more or less, within the section "A^1." On arriving at the point "B," the first pair of wheels will set signal "b" in rear section to danger. We then have signals "a" and "b" protecting the train until the last pair of wheels passes off section "A" on to section "B," when signal "a" will turn to safety. In same manner signal "c" will be set to "danger" on the entrance of the train on to section "C," and signal "b" will turn to safety when the last pair of wheels has passed on to

Figure 3.

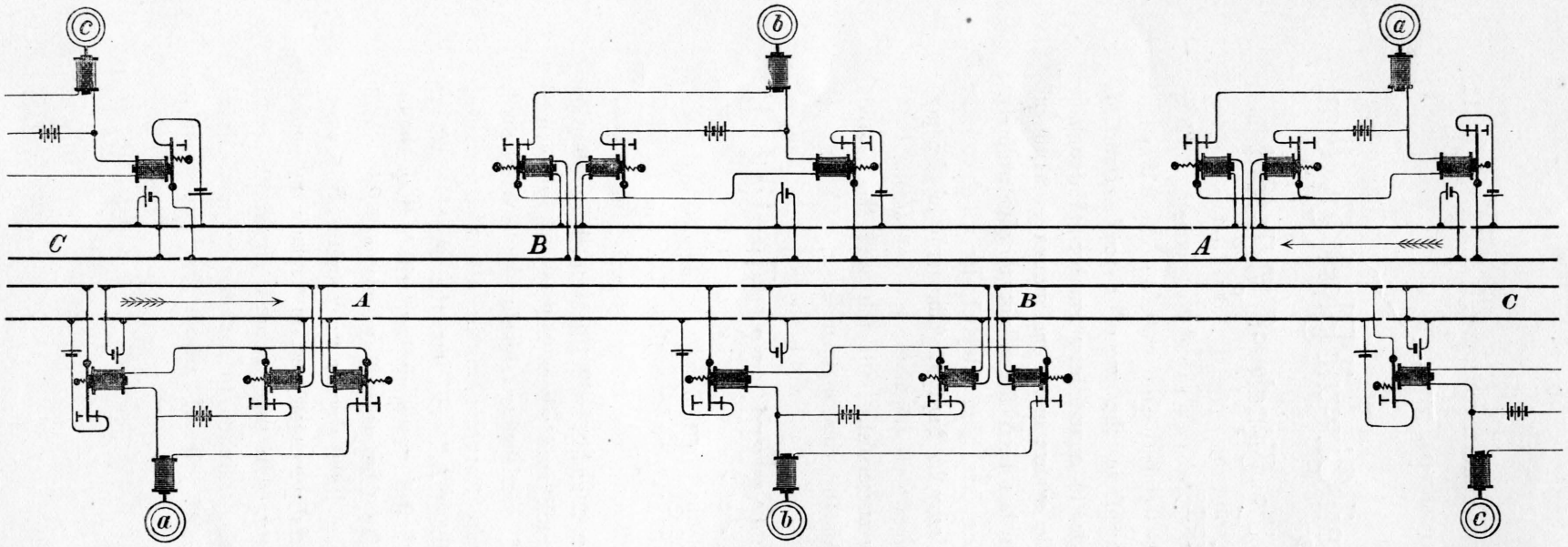
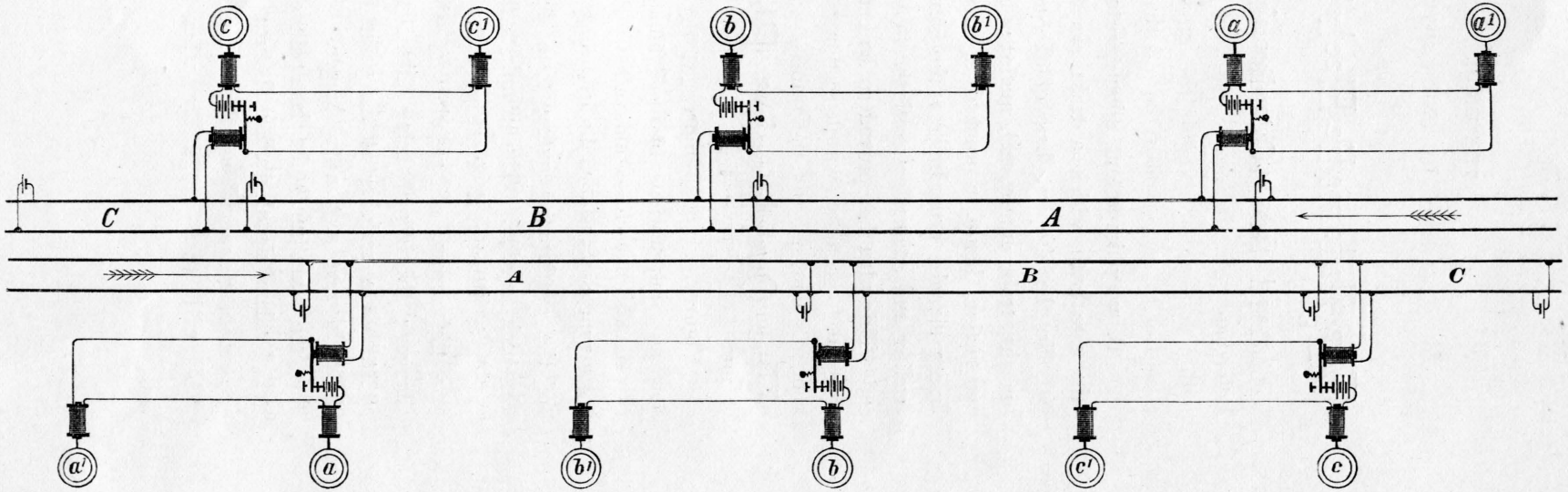


Figure 4.



section "C." In Figure 3 each signal is so connected with the one of the section immediately in the rear that until the train has passed 1,000 feet, or more, within any section it holds the signal of the one just passed to "danger." Thus there can by no possibility be less than 1,000 feet between a train and one following. The signals are placed some distance from the beginning of the section, in order that the approaching engineer may not only see the position of the signal, but may note the change from "safety" to "danger" by the automatic action of his own train on the rail, and thus be assured that the signal is working properly and that his train is protected.

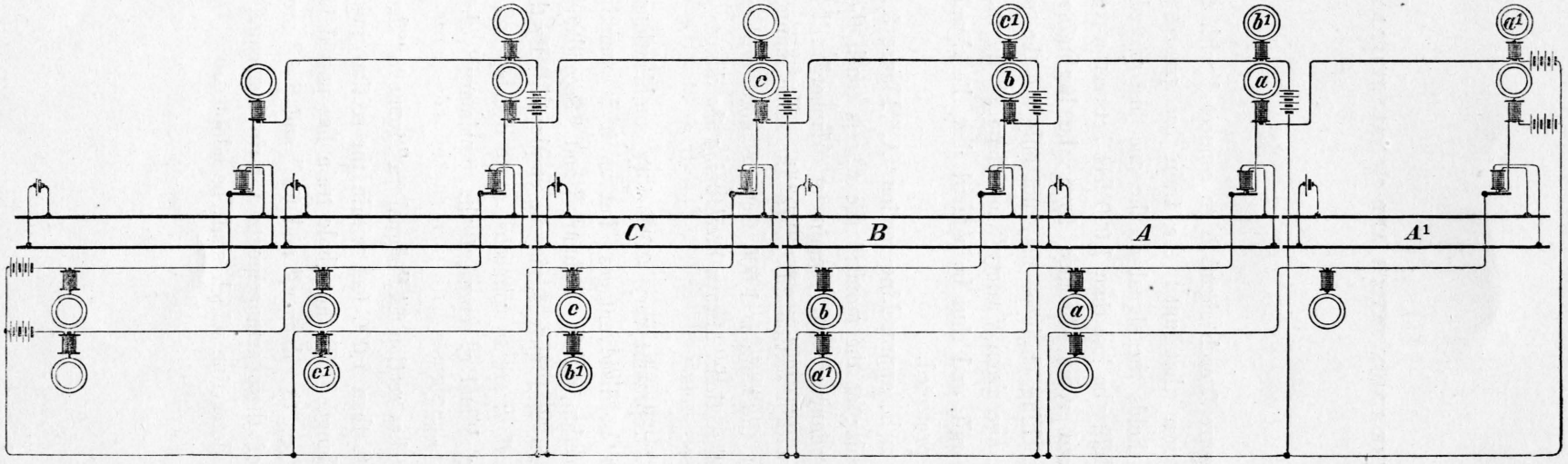
Suppose a train to be approaching section "A," Figure 3, and signal "a" being at "safety," it proceeds; at the moment the wheels touch the rails of section "A" signal "a" turns to "danger" and remains at "danger" till the train has passed 1,000 feet, or more, within section "B." In the same manner signal "b" will be kept at "danger" till the train is 1,000 feet, or more, within section "C," and so on for any number of sections, always *overlapping the danger signals* for 1,000 feet, or more, of every section.

Figures 2 and 3 represent very satisfactory combinations of signals, and present no complications or disadvantages; but as it is sometimes desirable to have two signals in each section, called "Primary" and "Secondary" signals, the following arrangement, shown in Figure 4, may be employed. By this method the signals of *adjacent ends of sections* are so connected as to overlap and operate in unison.

In the figure *a*, *b* and *c*, represent the "primary" signals, and a^1, b^1 and c^1, the "secondary" signals.

When a train reaches section "A," signal "a" turns to "danger," and also signal "a^1," which is not less than 1,000 feet within the section just passed. Both these signals are held to "danger" till the whole train has passed into section "B," when signals "b" and "b^1" go to "danger," and "a" and "a^1" are released. It is evident that by either of these arrangements a train has equal protection, and only local exigencies must determine which shall be adopted.

Figure 5.



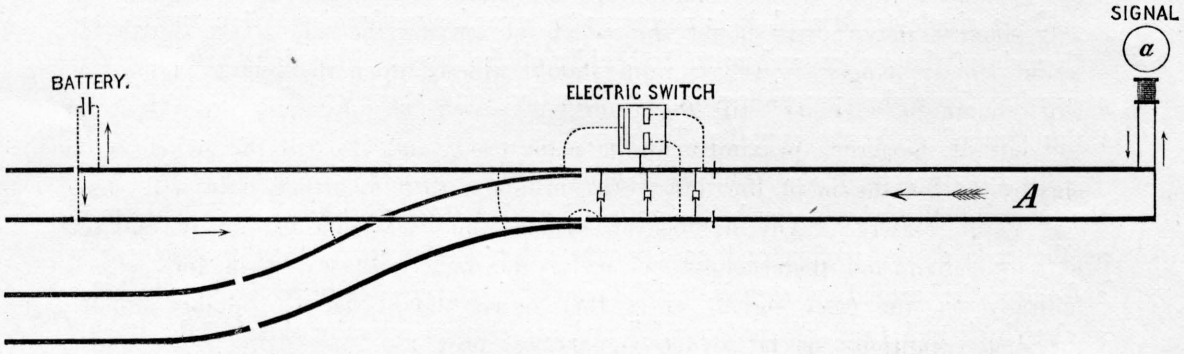
The Overlapping Block System, as Applied to Single Track Roads.

On a single track road it is necessary to have the *overlapping system* applied to both ends of the section and upon both sides of the track. The right hand signals answering for trains proceeding in one direction, and those on the left hand for trains proceeding in the opposite direction.

In Figure 5, suppose a train to be entering upon section "A" from section "A^1," the moment the wheels touch the rails of section "A" the signals "a" and "a," at the ends of the section and on opposite sides of the track, turn to "danger," and also the secondary signals "a^1" and "a^1," which are respectively a whole section back and front of section "A," and are also on opposite sides of the track. Thus the train is not only protected while fully within a section, but also while entering and leaving, as no other train can be nearer than the length of a section.

Should a train be traveling in the opposite direction, for instance, from section "C" to section "B," the signals will turn in the same order, *i. e.* "b" and "b" at the ends and opposite sides of section "B," and "b^1" and "b^1" of sections "C" and "A."

Figure 6.



Electric Locking of Switches.

When the electric lock for switches is used, Figure 6, a train having entered a section with the signal at "safety" is entirely secure, since it will be impossible to throw the switch in front of the train.

Should a train enter section "A," the main line being clear, signal "a" will show "safety"; but should the switch be set for the side track, signal "a" would show "danger." If the train should proceed upon the switch, signal "a" will remain at "danger" till the train has passed entirely upon the side track and out of dangerous proximity to the main track, and also till the switch is not only re-set for the main line but *locked* in place, then and then only will signal "a" go to "safety." Any number of switches may be connected in like manner with a section, and their connection or disconnection with the main line will be indicated by the *block* signal, unless that signal should not be suitably situated, for such conditions special switch signals are provided.

As a necessary precaution against the turning of a switch through mischief or ignorance, the lock is so constructed and connected with the electric circuits that it cannot be unlocked except by means of the proper key, which is in the hands of the trainman. In certain cases signals are so electrically locked with the switches that the switch lever cannot be moved until after the signal is turned to "danger," and conversely the signal can be put to "safety" only by locking the switch in its place.

Draw-bridge Signals.

What has been said about the locking of switches and signals is equally applicable to the locking of draw-bridges and their signals. Draw-bridges are always provided with locking-bolts, which, when connected with circuit instruments, will set the signals to "safety" or "danger," as the draw is locked or unlocked. The signals may be placed at any distance from the bridge that may be considered best for the protection of the train. It is always desirable that the *bridge-tender* should know the position of the signals, and if the latter are placed at a great distance, or obstructions prevent him from seeing them, a miniature repeating signal which indicates the position of the out-door signal is placed in his house. Any change of position of the signal is accompanied by a stroke on a bell to call his attention. After a train has passed the signal which indicates safety, it is impossible to open the draw until the train has passed entirely over it; this is accomplished by the automatic locking of the locking-bolt of the draw by the train as soon as it has reached the signal. This locking of the draw may be effected by the presence of the train on the line at any desired distance from the bridge, even before the signal is reached. See, also, Catalogue of Interlocking.

Grade Crossings and Junctions.

Where two or more railroad tracks cross each other at grade, "primary" and "secondary" signals are located at proper distances from the crossing, in all directions, and so arranged, that when a train approaches from any direction, it will operate such signals as may be necessary to guard the crossing from the approach of another train.

At junctions, trains approaching on the main line expose a "danger" signal on the branch track, and trains approaching on the branch expose "danger" signals in both directions on the main line. Grade crossings and junctions are more perfectly protected by the "derailing" switches. See Catalogue of *Interlocking.*

Highway Crossings.

The automatic system provides for the thorough protection of highway crossings.

Highway crossings where gatemen are not employed, are protected by bells, either in addition to, or independent of, visual signals.

Highway crossing signals are operated in the most simple and effectual manner, both on single and double track roads, and by trains moving in either direction. On single track roads the bell begins ringing when the train approaching the crossing is half a mile or more distant, and ceases to ring as soon as the train has passed the crossing.

Station Approach Signals.

Bells and other signals are located at stations, and operated in connection with, or independently of, the block signals, to announce to station-agents and passengers the approach of trains to the stations, and indicate from which direction they are coming.

Repeating Signals.

Signals which protect junctions, draw-bridges, or an entrance to a depot, are, when necessary, connected with miniature repeating signals which are placed in the switchman's or bridge-tender's houses, or in the stations. They faithfully repeat the position of the out-door signals, and enable the switchman or the station-agent to keep a constant control over the out-door signals, if desirable. In addition to the miniature signal, a bell is made to ring a stroke when a change in the position of the signal takes place.

A repeating-signal is, moreover, a timely detective of any derangement of the electric current or breaking of a rail in the track.

On railroads where the "telegraphic block system" is in use, the "block towers" being several miles apart, the automatic block signals are used to divide the blocks into sub-sections, and repeating signals placed in the "block towers," whereby the operators are continually notified of the location of the trains as they proceed along or stop within their "block."

Figure 7.

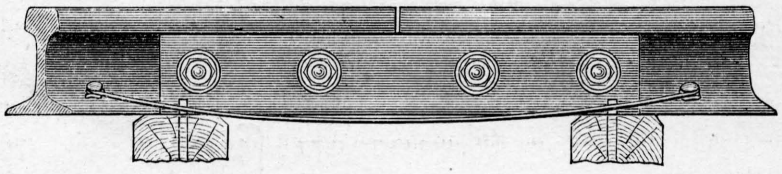
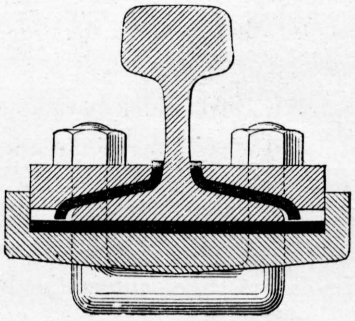


Figure 8.



Metallic Continuity of Rail Sections.

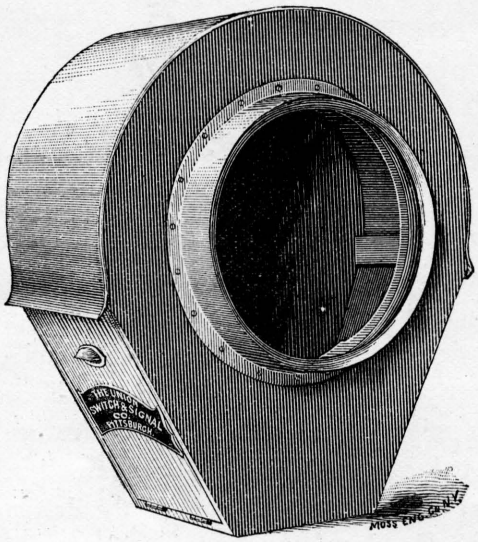
For the proper working of our system it is necessary to have reliable metallic continuity throughout the whole length of the signal section. The fish-joints ordinarily make electrical connection between adjacent rails, but this connection cannot be relied upon; sometimes the splice will be loose, and often the rust and dust between the rails and splice-bar will interfere with a continuous circuit. To make the circuit entirely reliable, therefore, at the rail-joints we connect adjacent rails in the manner shown in Figure 7, in which, as will be seen, the rails are connected by a wire. The ends of this wire are wrapped around the heads of stout rivets and soldered thereto; holes are then drilled in the flanges of the adjacent rails, and the rivets are firmly driven into the holes, thus making an entirely reliable electrical connection from rail to rail.

Insulation of Joints.

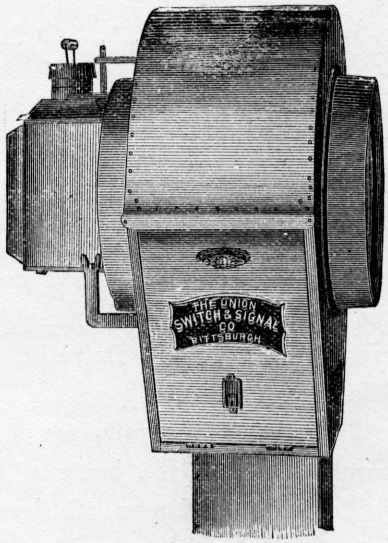
The insulation of a track section is accomplished in several ways; in one, the Fisher & Norris joint is used for the purpose, and the arrangement is shown in cross-section in Figure 8.

Plates of fibre, about one-eighth inch thick, are placed between the bottom of the rail and the chair, and between the forelocks and the rail, as shown in the engraving. Also a piece of the same material, and of the shape of the rail section, is placed between the ends of the connecting-rails, to prevent an electric contact being made by the creeping or expansion of the rails.

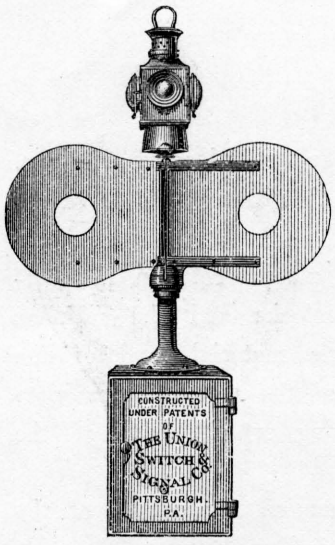
The rails are insulated by using a wooden splice-bar on the outside of the rails, a divided fish-bar on the inside, and a piece of fibre between the ends of the rails; this is very simple, effective and durable.



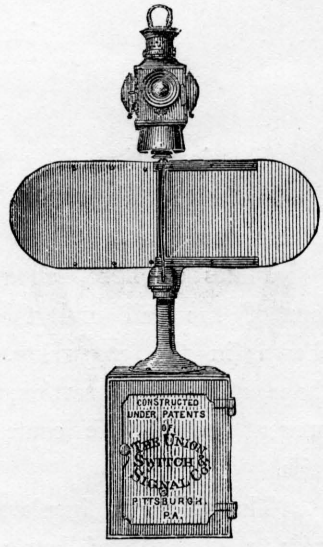
"A" SIGNAL.
Front view, showing Disc.



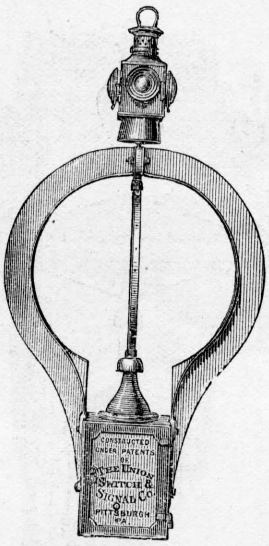
"A" SIGNAL.
Side view, showing manner of hanging the Lamp.



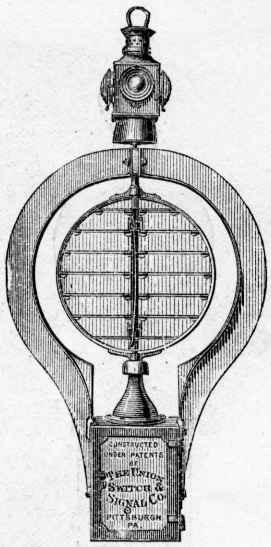
"B" SIGNAL.
At Danger.



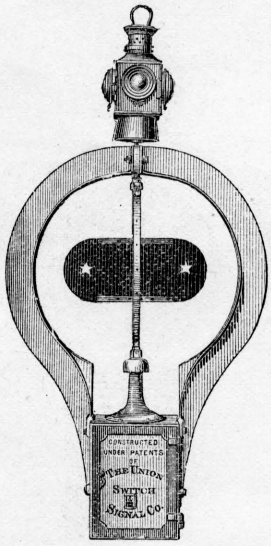
"B" SIGNAL.
At Safety.



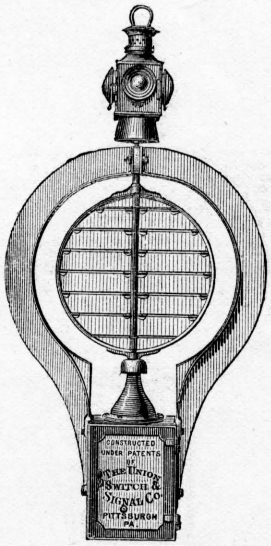
"C" SIGNAL.
Open.



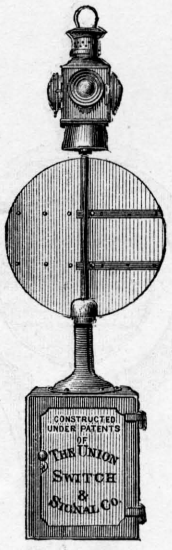
"C" SIGNAL.
Closed.



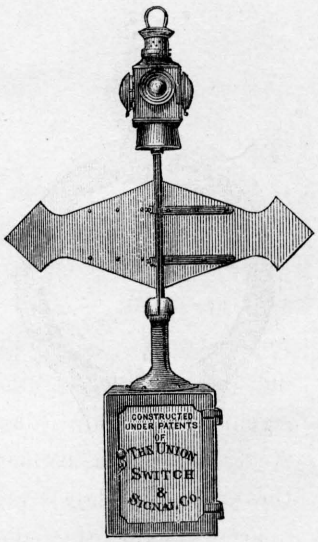
"D" SIGNAL.
Open.



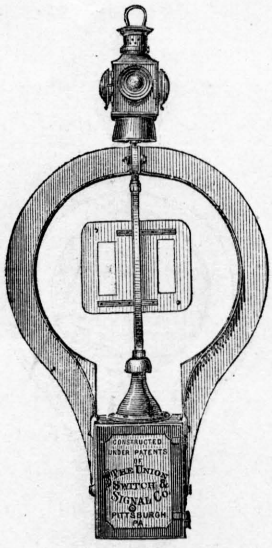
"D" SIGNAL.
Closed.



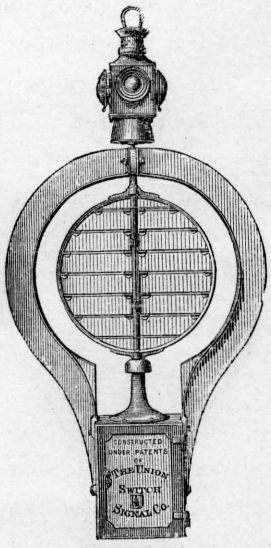
"E" SIGNAL.
At Safety.



"E" SIGNAL.
At Danger.



"F" SIGNAL.
Open.



"F" SIGNAL.
Closed.

Forms of Signals.

We can supply any form of Signal, all of which are mounted on iron posts. Those shown in the illustrations being now in use. Preference is generally given to the "C" signal.

The "A" signal is an enclosed signal, and is used mostly at stations or under cover. It is provided with two round glass windows on opposite sides, on the outside of the back window a lamp is suspended, as shown. The signal disc within consists of red or green bunting stretched tightly over a wire ring, forming a banner or disc. When this signal disc is at right angles to the track, it shows red for *danger*, or green for *caution*, but when turned a quarter round, the edge only is seen, indicating all clear. At night, when the bunting disc is exposed in front of the white light, the light is changed to red or green; but when the signal is withdrawn, the light again becomes white. When it is desired to show a signal in both directions, two banners or discs are used, one being exposed at each window. In this case the lamp is placed within the box between the signals.

In many cases, two distinct signals, a red and a green, are placed on the same post. These are primary and secondary signals, representing danger and caution respectively, and work independently of each other.

The construction of the enclosed signal is very simple. Its motive power is a stiff, coiled spring, and is so constructed that neglect of winding will cause the signal to show "*danger*" or "*caution*," never "*safety*." The expansion of the unwound spring in the "A" signal will instantly throw the signal to "danger," and hold it there.

The "B," "C," "D," "E" and "F" signals are all out-door and open signals; the mechanism contained in the cast iron box below operating a revolving stem or shaft, to which are attached, in the case of the "B" and "E" signals, sheet iron vanes of different shapes placed at right angles to each other, and in the case of the "C," "D" and "F" signals, banners composed of slats hanging freely, thus avoiding wind pressure.

The targets of the "B" and "E" signals indicate safety or danger, as shown in the illustration. In the "C," "D" and "F" signals the banner when closed is at right angles to the track and indicates danger; when reversed it presents an edge view which indicates safety. In the "D" and "F" signals there are peculiar forms of banners shown in addition to the edge view. On top of the shaft of the "B," "C," "D," "E" and "F" signals is placed a lamp which at night presents a colored or white light as the signal changes from danger to safety.

All signals should be wound daily when the lights are lit, the winding being done from the outside without opening the box containing the mechanism, and are so constructed that neglect of winding will cause the signal to show danger, *never safety.*

Batteries.

Astonishing as it may seem, in practice it is found that a single cell of gravity battery will operate any of these signals through a mile section of track. Therefore, the simplest and most economical form of battery, with the least possible number of cells, is all that is required.

Correspondence respectfully solicited, and proposals will be made upon application for any or all kinds of signaling required in railway service; also, for frogs, crossings, switches and switch stands.

THE UNION SWITCH AND SIGNAL COMPANY,

PITTSBURGH, PENNA.

List of Railroads using the Union Switch and Signal Company's Automatic Electric Block Signal System and Highway Crossing Bells.

THE PROVIDENCE & WORCESTER R. R.
THE BOSTON & ALBANY R. R.
THE OLD COLONY R. R.
THE FITCHBURG R. R.
THE EASTERN R. R.
THE BOSTON & PROVIDENCE R. R.
THE BOSTON & MAINE R. R.
THE BOSTON & LOWELL R. R.
THE NEW YORK & NEW ENGLAND R. R.
THE NEW YORK CENTRAL & HUDSON RIVER R. R.
THE NEW YORK, LAKE ERIE & WESTERN R. R.
THE WEST JERSEY R. R.
THE BALTIMORE & POTOMAC R. R.
THE NORTHERN CENTRAL R. R.
THE PHILADELPHIA, WILMINGTON & BALTIMORE R. R.
THE PENNSYLVANIA R. R.
THE P., C. & ST. L. RY.
THE ALLEGHENY VALLEY R. R.
THE PITTSBURGH, FT. WAYNE & CHICAGO RY.

The Little Miami Ry.

The Chicago, St. Louis & Pittsburgh Ry.

The Jeffersonville, Madison & Indianapolis Ry.

The Louisville & Nashville R. R.

The Nashville, Chattanooga & St. Louis Ry.

The Chesapeake & Ohio Ry.

The Cincinnati, New Orleans & Texas Pacific Ry.

The Cleveland, Columbus, Cincinnati & Indianapolis Ry.

The New York, Chicago & St. Louis Ry.

The St. Louis Bridge Co. & Tunnel R. R.

The Missouri Pacific R. R.

The Michigan Central R. R.

The Detroit & Bay City R. R.

The St. Paul, Minneapolis & Manitoba R. R.

The Grand Trunk R. R.

The Brooklyn, Flatbush & Coney Island R. R.

The New York, Providence & Boston R. R.

The Naugatuck R. R.

The Connecticut River R. R.