

J. C. IRWIN.  
1911.

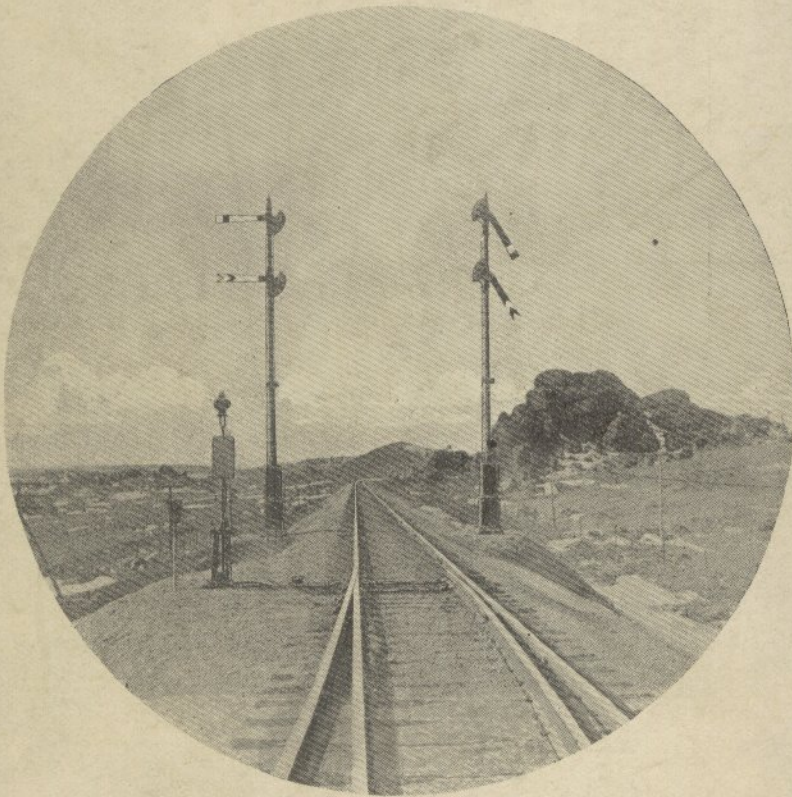
# The Union Switch & Signal Co. Swissvale, Pa.

GENERAL OFFICE AND WORKS, SWISSVALE, PA.

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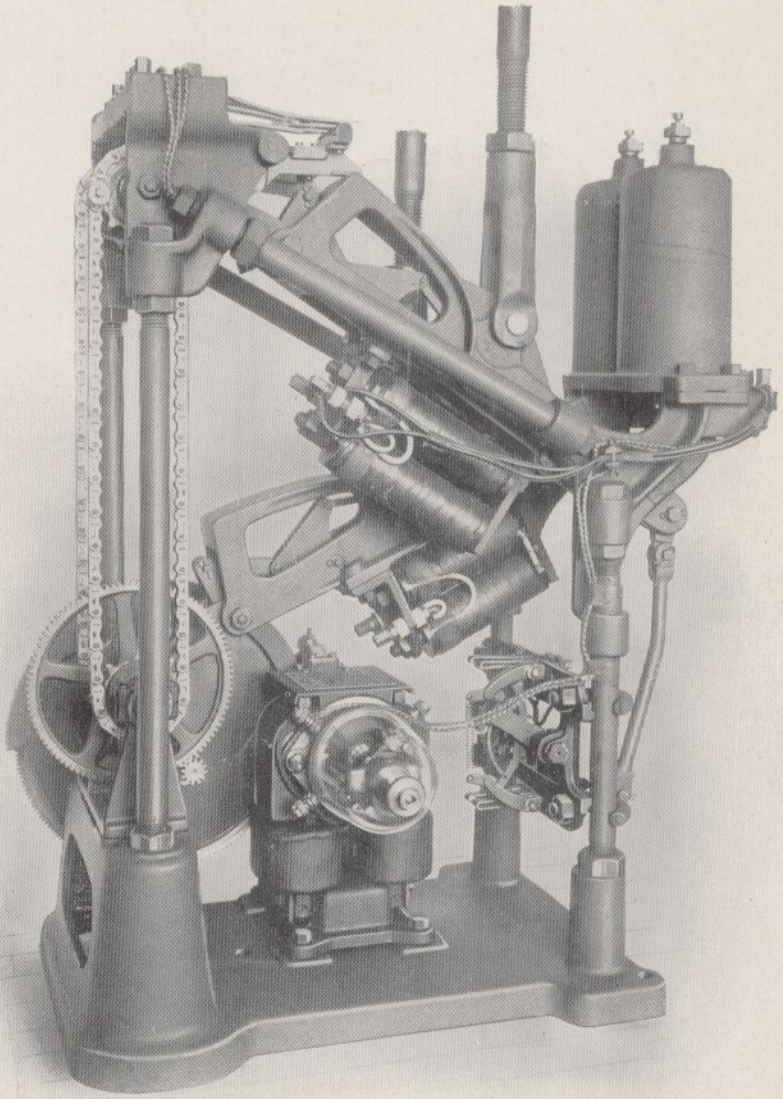
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## A System of Automatic Block Signaling for Single Track Operation

Bulletin No. 45



**Union Electric Semaphore Mechanism.**

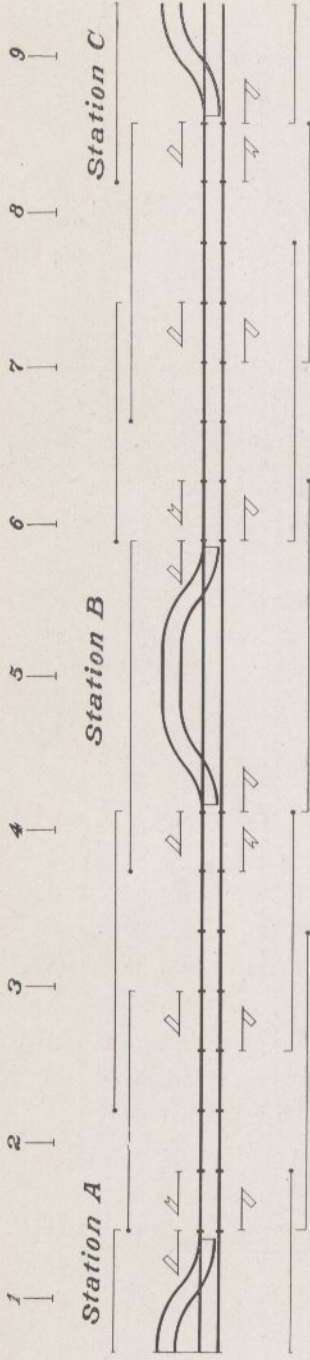
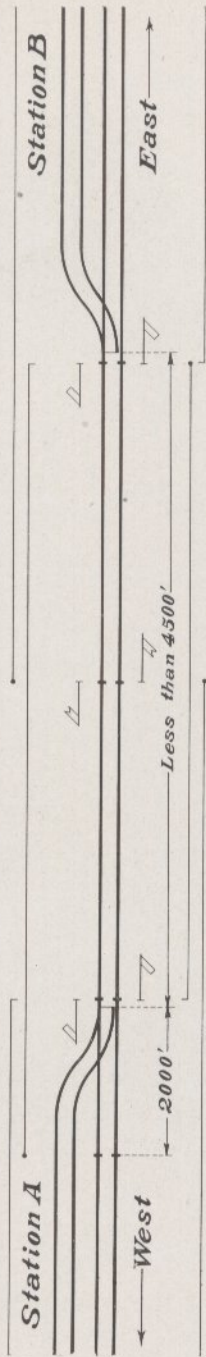


Fig. 1



Note:- This layout is used when the distance between two nearest headblocks is less than 4500'

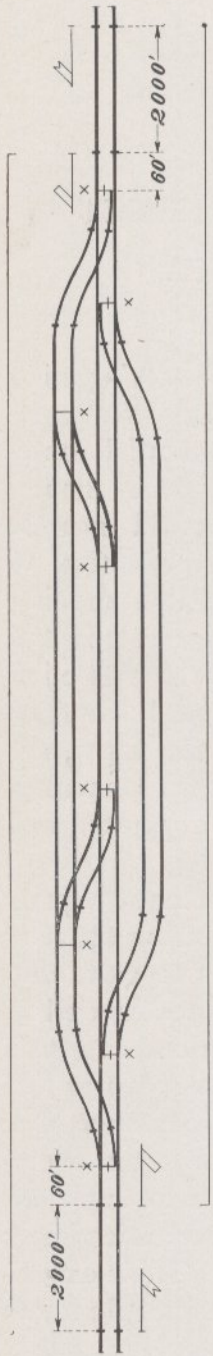
Fig. 2

## A SYSTEM OF AUTOMATIC BLOCK SIGNALING FOR SINGLE TRACK OPERATION.

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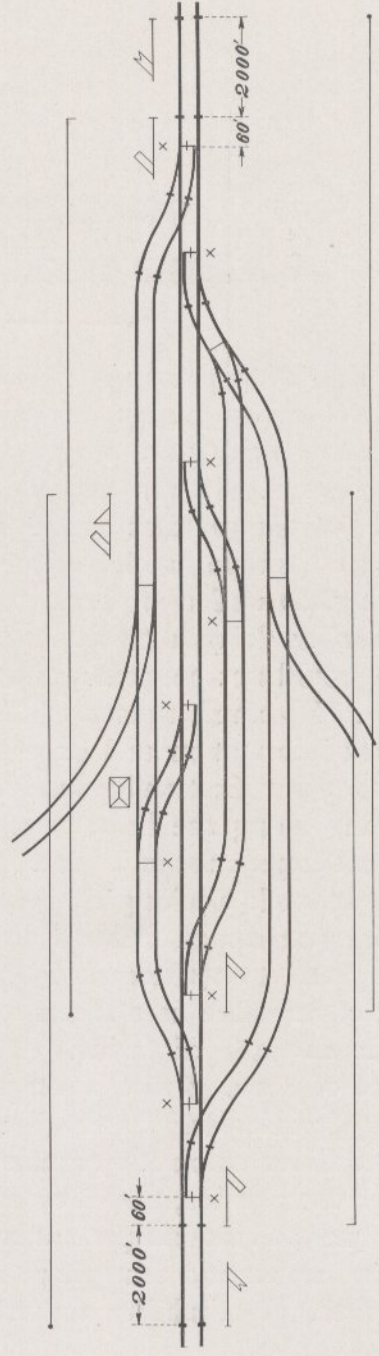
UNTIL a few years ago, the almost universal opinion among operating officials of railroads was unfavorable to equipping single track lines with automatic signals. It was also the general belief among signal engineers that such signals could not be located on single track lines to afford protection to opposing, as well as following trains, without causing such serious delay to traffic that the expense for installation would not be commensurate with the protection offered. However, almost all ideas, although based on the best information and experience of the times, are subject to modification because conditions are constantly changing along the lines of improved apparatus and practical experience in its use.

Single track blocking by means of automatic signals has been developed to such an extent during the past three years, that there no longer seems to exist any doubt of its value as a factor for the safety, as well as for the dispatch of trains. The experience in this respect of some of the most prominent roads in the country, particularly in the West, has been such that they consider automatic signals essential to the operation of their trains, and they are fast equipping their main lines and most important branches with electrically operated automatic semaphore signals. Their experience of the practicability and efficiency of single track



Note:-X-Switchboxes

Fig. 3



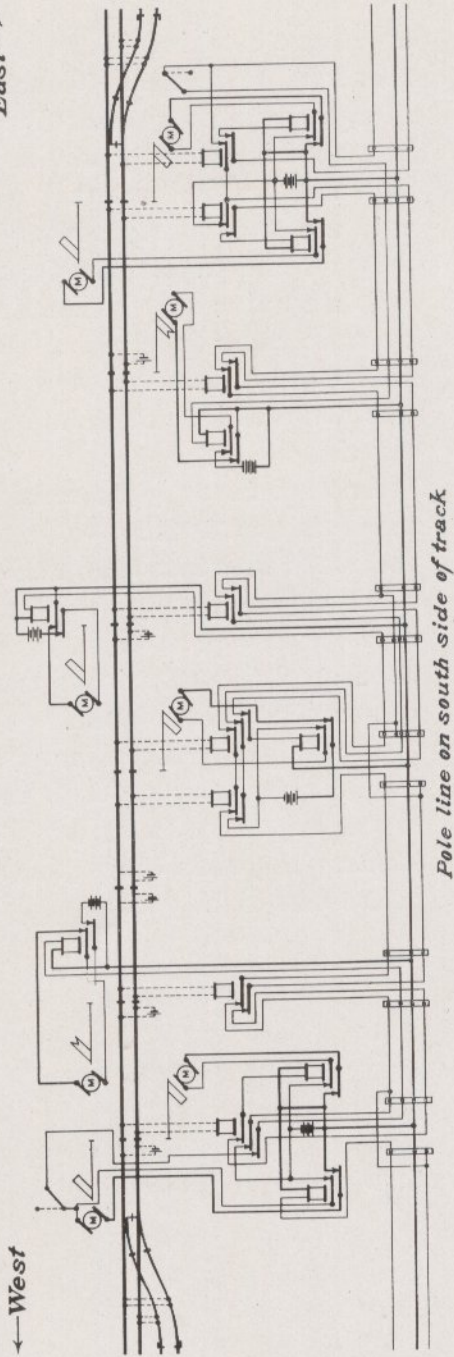
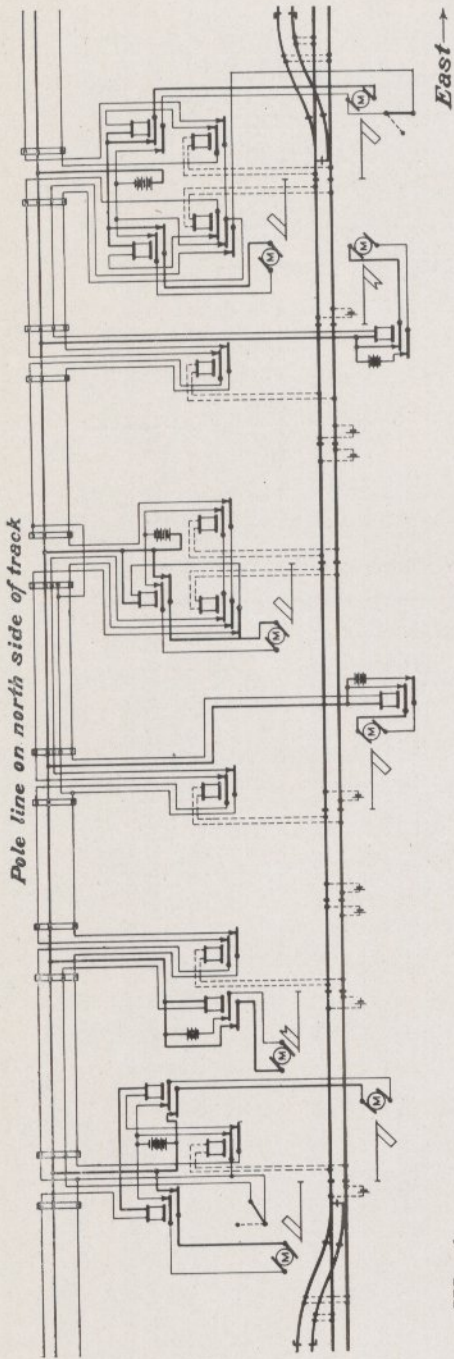
Note:-X-Switchboxes

Fig. 4

automatic blocking, should convince the most skeptical that it is advisable as an economical measure. As an illustration of the greater dispatch with which trains can be moved in territory provided with automatic signals, it is a well known fact that many division superintendents are strenuously advocating their installation, not only for the protection afforded, but in order that extra and late trains may be handled by the issuing of Form 19 train order in place of Form 31. This, many railroad officers claim to be entirely practicable, and it is common practice on lines fully equipped with automatic signals.

Another factor to be considered is that the traveling public is commencing to "sit up and take notice," and the roads that install and advertise complete automatic block signal protection of an up-to-date and approved type for the protection of their trains, are realizing handsomely on their investment by the increase in their passenger earnings alone.

The following table, compiled from a list published in the *Railroad Gazette* of January 11th, 1901, and from the report of the Interstate Commerce Commission of January 1st, 1909, shows the growth of block signaling in the past eight years:



*Fig. 5*

## Manual and Controlled Manual Systems

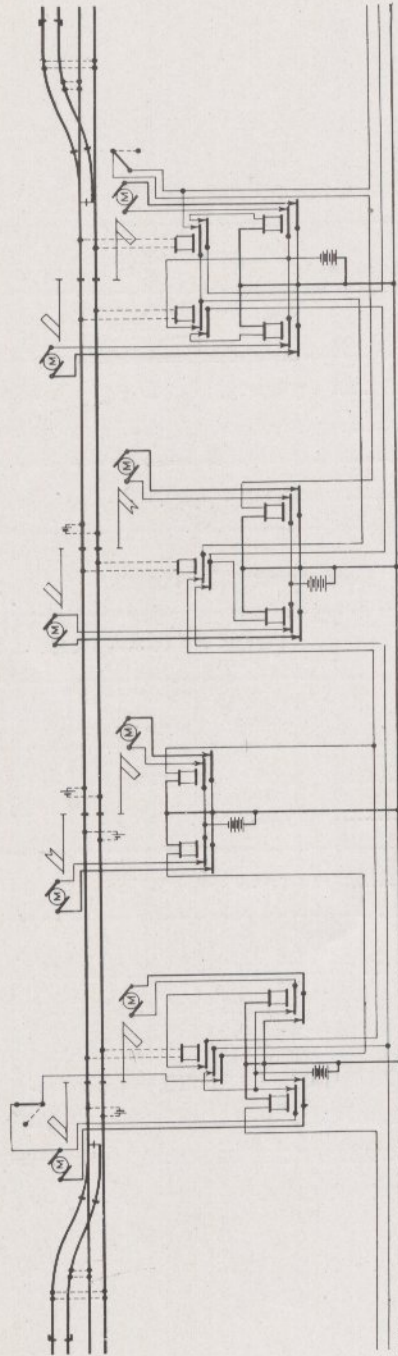
DATE	MILES OF ROAD PROTECTED		
	SINGLE TRACK	TWO, THREE AND FOUR TRACK	TOTAL
January, 1909.....	38,407.4	8,950.7	47,358.1
January, 1901.....	18,144.0	5,868.9	24,012.9
Total Increase.....	20,263.4	3,081.8	23,345.2

## Automatic System

DATE	MILES OF ROAD PROTECTED		
	SINGLE TRACK	TWO, THREE AND FOUR TRACK	TOTAL
January, 1909.....	5,126.0	7,064.6	12,190.6
January, 1901.....	405.5	1,889.2	2,294.7
Total Increase.....	4,720.5	5,175.4	9,895.9

From this table it is apparent that while the miles of railroad protected by all manual systems have not quite doubled in eight years, the total mileage protected by automatic signals has more than quadrupled. The most significant fact, however, is that the amount of single track on which automatic signals are installed has increased over *twelve* times.

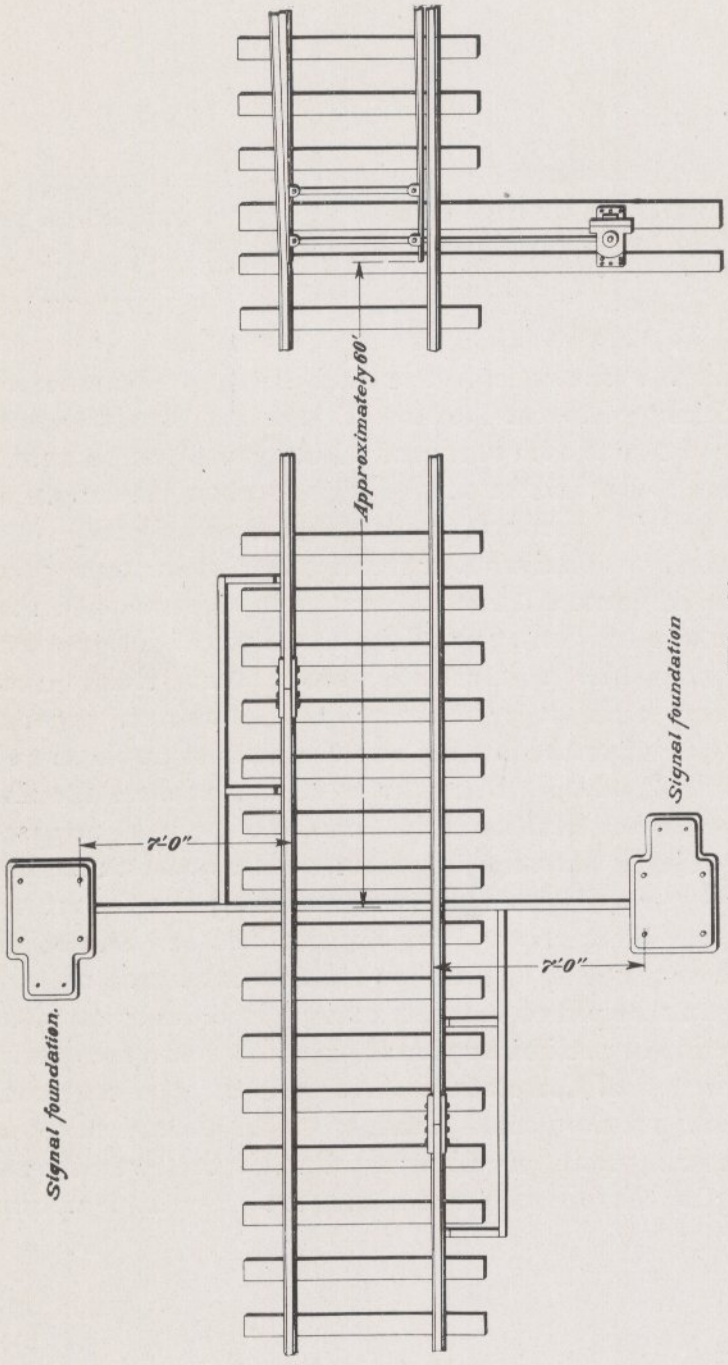




*Fig. 6*

So important has this branch of the signaling art become, that we have decided to issue a bulletin on the subject, with descriptive track diagrams and circuits showing single track blocking in practical service today, on some of our longest roads.

Fig. 1 shows complete and continuous automatic blocking with the location of home and distant signals in relation to each other and to stations. The horizontal lines above and below the signals show the length of track with overlaps, controlling each signal. The plan shows stations four miles apart; if in actual practice they exceed that distance, it is recommended that one or more extra sets of signals be placed intermediate between the stations, in order that trains may follow each other closely; this, however, depends largely upon the density and character of traffic as well as the grades, it being understood that after the first installation additional intermediate signals may be installed to accommodate increased traffic, at a comparatively small cost and without interfering with the general plan. Even though the distance between stations is not very great, it is important that intermediate home signals be placed between stations in order to avoid an overlap or preliminary track circuit between the outside switches of the station, since it is obvious that such track circuits would cause possible detention to an incoming train, providing a train that they were intending to meet occupied the main track. It will be noticed



*Signal foundation*  
**Fig. 7**

by reference to Fig. 1, that eight signals are used to protect traffic, six between stations, and two within station limits. This number of signals is necessary to adequately protect all traffic and at the same time insure proper flexibility, since with this arrangement trains can move up to the station limits under full protection from both directions, even though the main line may be occupied within these limits. This is because a train in the station does not affect approaching traffic on either side of it except the entrance signals themselves, and a train on one side of a station has no influence on traffic on the opposite side. This advantage can easily be seen in the case of Fig. 2 in which a train, standing at station A and waiting for a west-bound train to pass, would prevent the latter train from leaving station B. Therefore, on single track, the locations of automatic block signals and their controlling limits should be so arranged that a train occupying the main line at a station siding will allow movements up to the siding switches under clear signals. If the distance is less than one mile, or it is not desired to place home signals between stations, signals may be located as shown on Fig. 2, the preliminary circuit inside station limit being in the direction favorable to a superior train which has the right to hold the main track and which is to meet an inferior train. That is, if the train rules give west-bound trains the right of track over east-bound trains, then the preliminary circuit should be at the

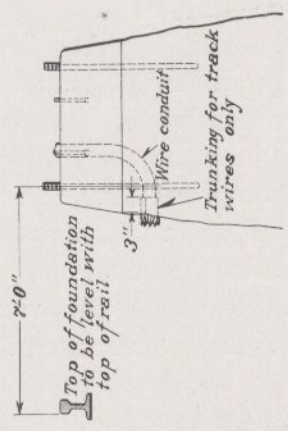
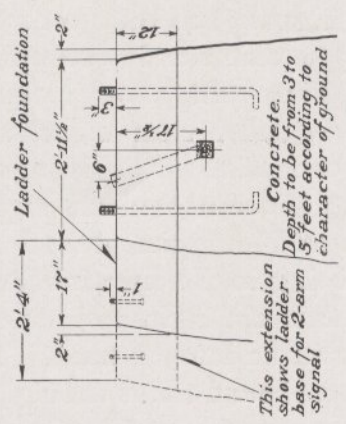
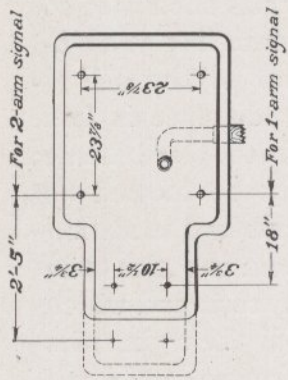


Fig. 8

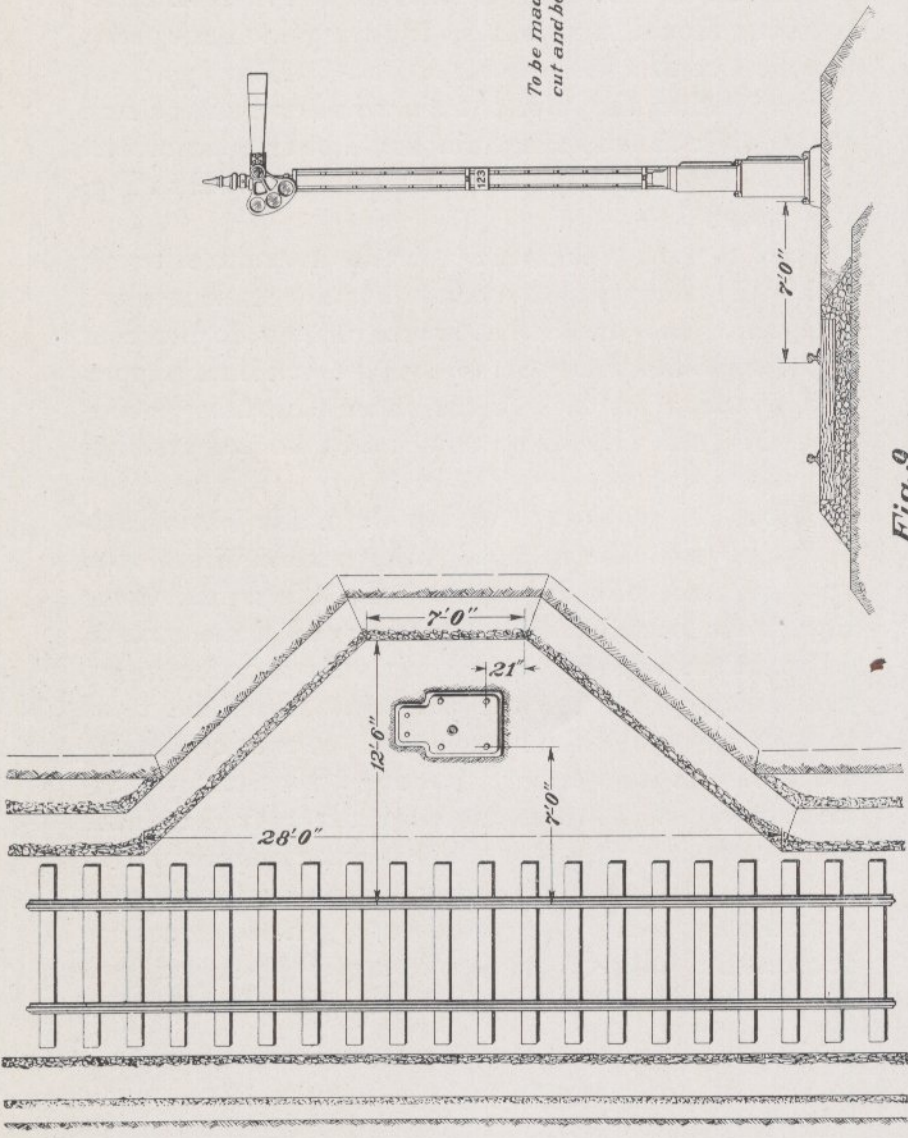
west station, as indicated on Fig. 2. Under ordinary conditions, in arranging circuits on single track a preliminary should favor a train traveling in the superior direction, so that in the event of the two trains approaching each other, the inferior train would encounter a stop signal while the superior train would be free to proceed.

The general scheme of signaling as outlined in Fig. 1 is intended,—

First, to provide complete protection to trains entering and while occupying the main track at stations, since experience has shown that approximately 80 per cent of the accidents that occur on single track lines happen within station limits. This is accomplished by placing a home signal with distant indication at each arriving end of the station.

Second, to provide protection for trains leaving stations and while between adjoining stations from both opposing and following trains. To effect this, home signals are located at each departing end of the station, with intermediate signals approximately 2000 feet apart, and half way between the stations. It will be noted that the position of the home signals at ends of stations are fixed. It is customary, however, to locate the intermediate signal so that an engineer may have the longest possible view of it while approaching it at speed.

Fig. 3 is a layout of signals for the protection of a station only, that is to say without signals intermediate between the stations, and to take care of the 80 per cent. hazard of accident above mentioned. On main or branch



To be made from old boiler tube  
cut and bent as shown.



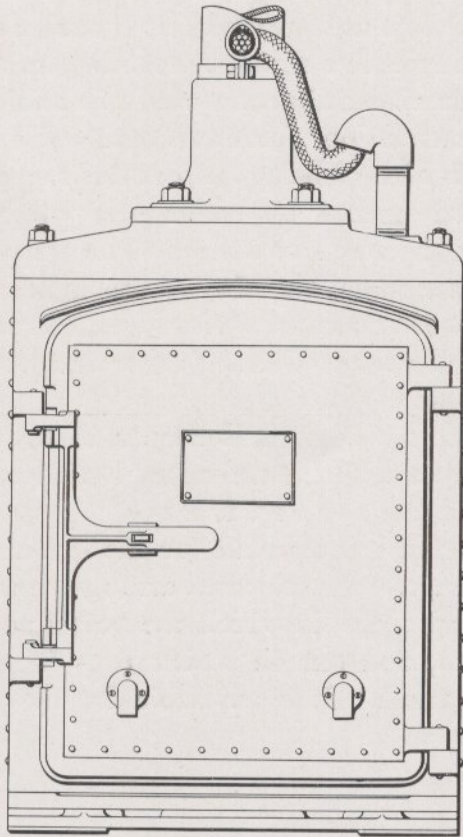
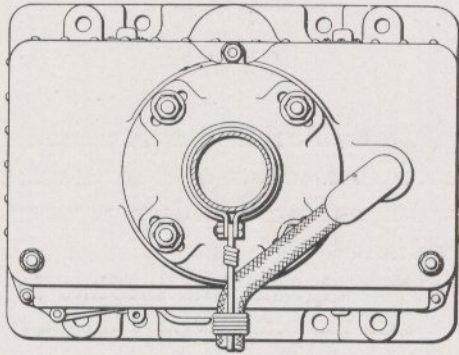
lines having little traffic this plan may be adopted preliminary to the later installation of complete and continuous signal protection, as shown on Fig. 1, when justified by increased traffic.

Fig. 4 shows signals intermediate in a large terminal yard. The plan shows only one set of such signals; two or more sets may be installed according to track conditions, which is determined by the length of yard, the number of switch engines in service at one time, and the layout of tracks. It is obvious that without these intermediate signals, incoming trains entering the yard from either direction would be subject to more or less detention on account of the signals at the extreme ends of yard being held at the stop position by switching movements, by trains occupying the main track, or by reversed switches. The purpose of the intermediate signals, therefore, is to make the blocks within yard limits as short as possible, and thereby reduce the detentions of passenger trains at such points to a minimum.

The installing of signals as per Figs. 3 and 4 is directly in line with the ultimate plan of complete signaling as indicated by Fig. 1.

Fig. 5 is the wiring plan for the layout of signals shown in Fig. 1. Two separate arrangements of wiring are shown, viz; one in which the pole line is located on the north, and one in which it is located on the south of the track. It is advisable for the purposes of

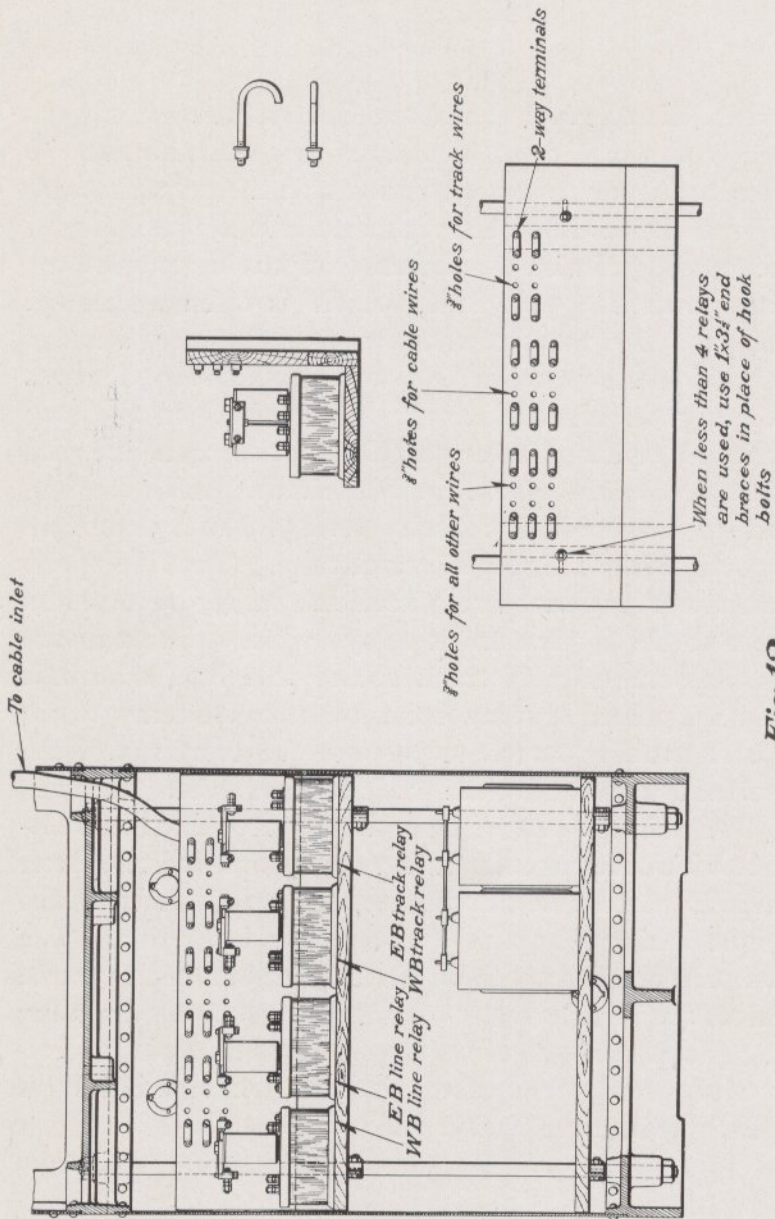




*Fig. 11*

inspection and repairs, that the line wires should always occupy the same relative position to each other, on the cross arms, no matter on which side the pole line may be located. This avoids confusion and a possibility of the crossing of wires in the event of having to cross the track with the pole line, which is often necessary. Also, the line wires are so placed on the cross arms as to avoid the least possibility of a cross between the wires affecting the signals except to put them in the stop position. This plan contemplates using iron line wire with 500 ohm relays on the line circuits, and with an 8 volt 50 ampere hour capacity storage battery common for both line and signal motor circuits. The line relays and motor batteries are placed in the signal cases as are also the 4 ohm track relays when the signals are on the same side of track as the pole line, otherwise they are placed in relay boxes on separate relay posts; this to avoid as much as possible the carrying of the overhead wires under the track to the signal.

The maintenance of line circuits free from interference with other circuits such as telegraph and telephone lines is of extreme importance, since such interference might easily result in a false clear indication. The maintenance force can do little to prevent such trouble unless the initial construction is such as to guard against it. A separate pole line for signal wires and the erection of guard wires at the intersection of other lines greatly reduce the liability of trouble.



*Fig.12*

The arrangement for overhead wires and for wiring of signals, as illustrated in Fig. 5, has been in service on some of the single track western lines for a number of years, covering several thousand miles of automatic block signals, and is said to be entirely successful and satisfactory from an operating as well as an economic standpoint.

Fig. 6 shows a wiring plan where intermediate signals come opposite distant signals. This frequently occurs in continuous blocking when stations are not over  $2\frac{1}{2}$  miles or 3 miles apart.

Fig. 7 shows the location of the two home signals with reference to the outside switches at ends of passing tracks. Fig. 8 is detail of concrete foundation with ladder extension for either 1 or 2 arm signal. Fig. 9 is an embankment built up of dirt or other material that may be most convenient. This kind of work is ordinarily done by section hands or a special gang of cheap labor after the signal forces have completed their work. Fig. 10 is a boiler tube conduit built in with the concrete to carry wires from underground connections into the bottom of the signal case. Fig. 11 is a special pipe attachment for leading overhead wires from the signal pole line into the top of signal case by means of a cable. When the signal is on the opposite side of the track from the pole line, the end of cable is secured to a combined cable and relay post from which underground connections lead to the signal across the track.

Figs. 12 and 13 show wire connections inside the signal case. The cables in entering either at the bottom or top of signal case lead to terminal boards to which are attached the internal wires connecting to relays, to

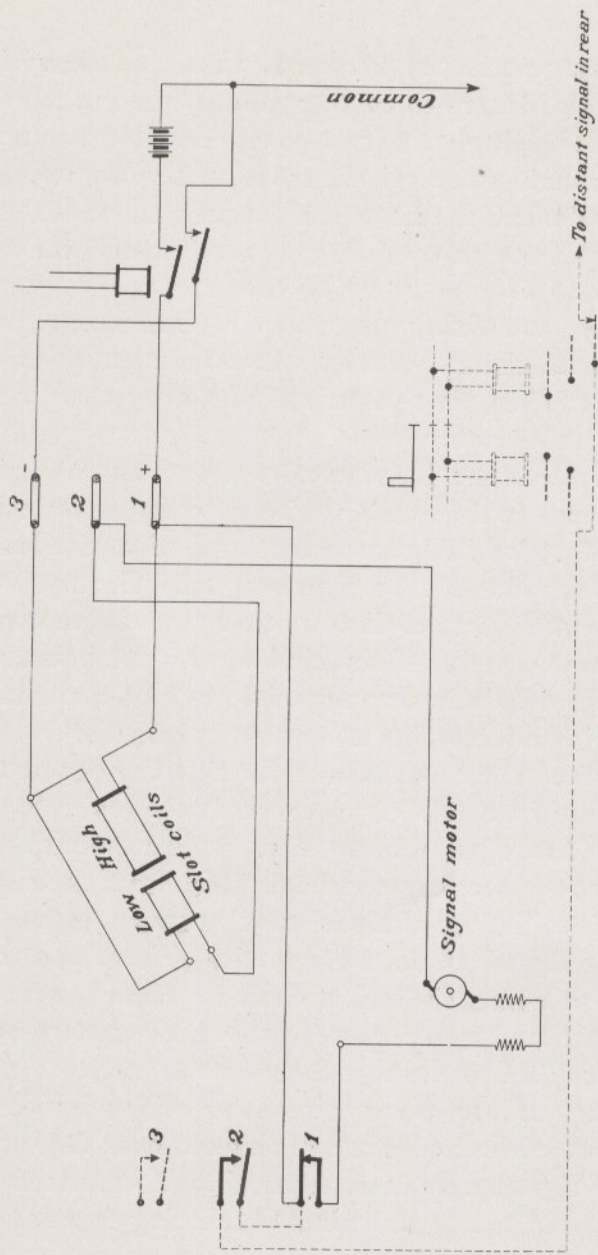


Fig. 13

slot coils, to circuit controllers, to signal motor, and to battery. This arrangement of wiring signals practically eliminates all possibilities of troubles caused by outside influences such as grounds, shorts, or foreign current. Some form of lightning arresters may be used in place of the terminal board, but it is usually better practice to locate lightning arresters on the pole line at the terminal of the branch cable.

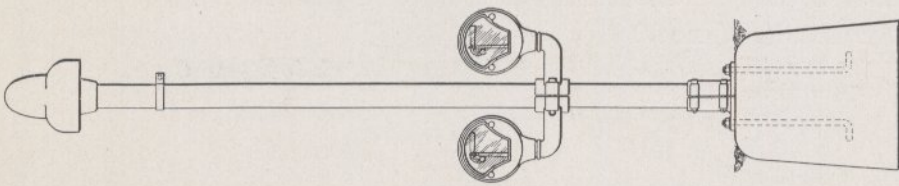
Figs. 14, 15, and 16 illustrate several designs of combined cable, relay box and switch indicator posts. Line wires are carried on a messenger wire direct from the pole line to the holding clamps near the top of the post, thence under the drip cap to the interior of the post, and to the instrument terminals. Underground wires in conduit enter the post through the base.

The foregoing matter describes the system of single track automatic block signaling which is most extensively in use on the railroads of this country to-day. In a later publication we shall treat of systems in which three-position signals are used and in which the polarized method of line control is introduced.

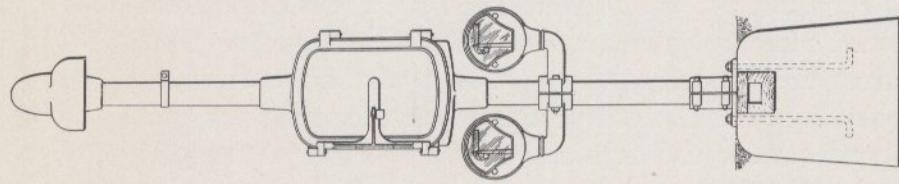
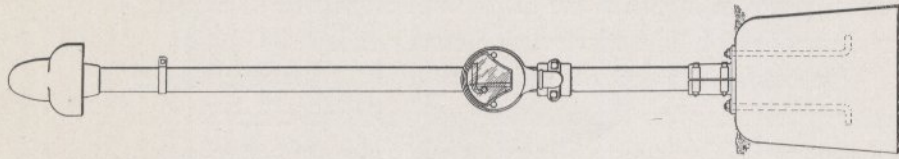
The main object of this bulletin, however, is an attempt to bring to the attention of railroad officials that single track block signaling is no longer an experiment, but a practicable, safe, and economic investment, which will enhance the value of a railroad as a public conveyor of freight and passengers, and also to offer some suggestions to them on this subject which may prove of interest and advantage when they contemplate the advisability of installing automatic block signals on single track lines.

PITTSBURGH, PA.

**The Union Switch & Signal Co.**

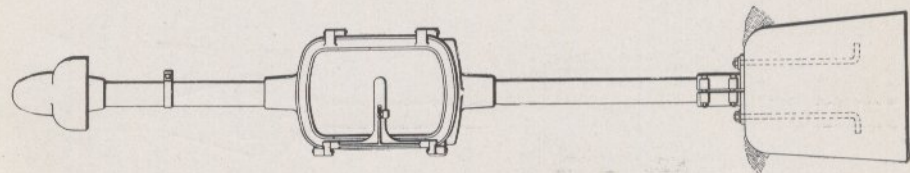


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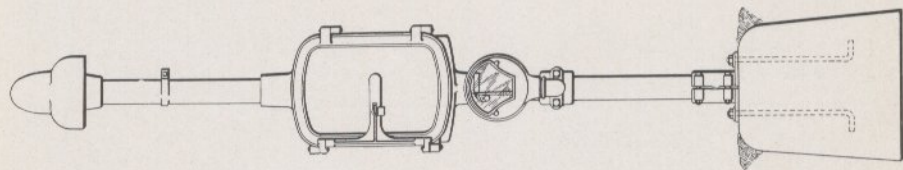


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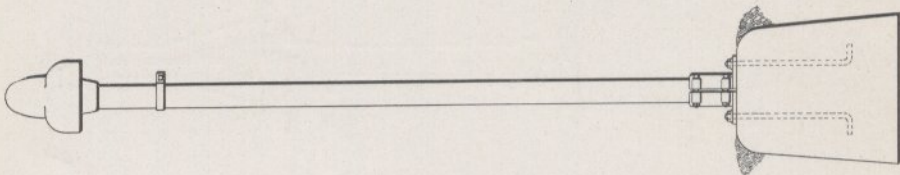
Switch Indicator and Relay Box Posts.



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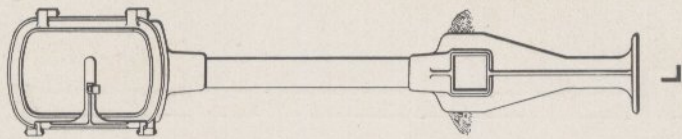
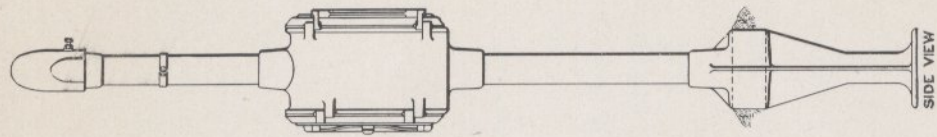
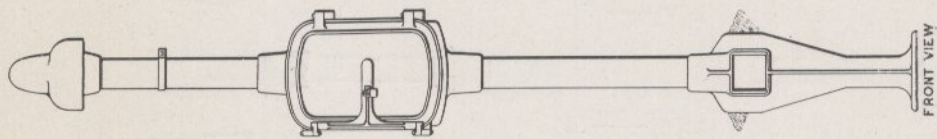
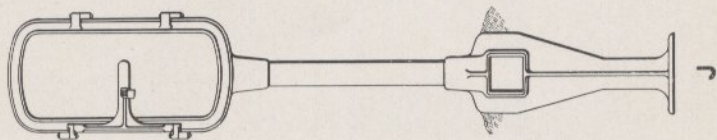
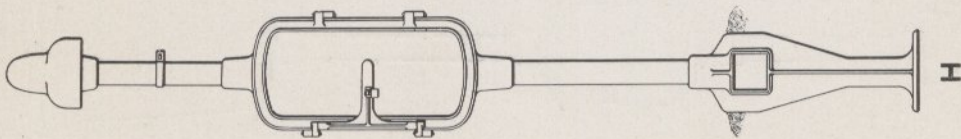
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G

Switch Indicator, Relay Box and Cable Terminal Posts.





Relay Box Posts.

THE UNION SWITCH & SIGNAL COMPANY'S  
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Swissvale, Pa.

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