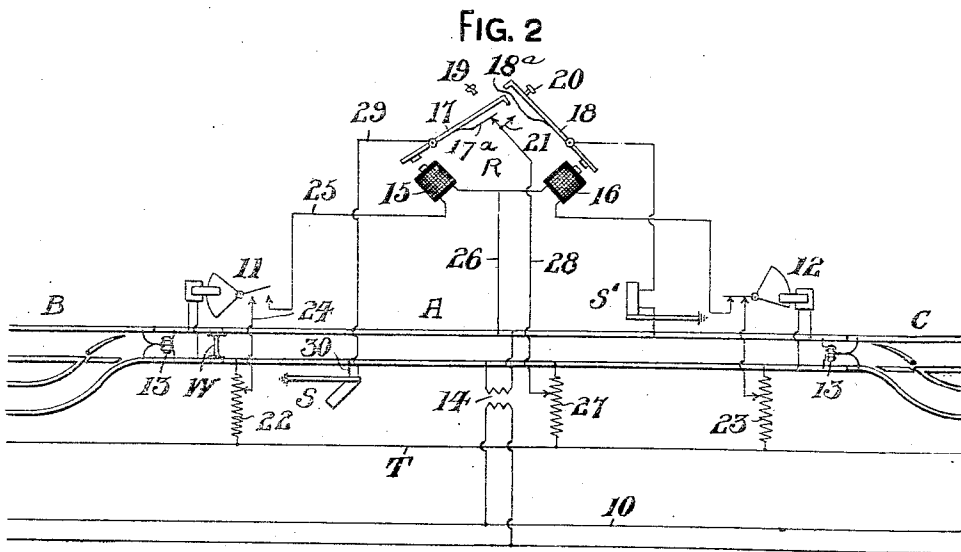
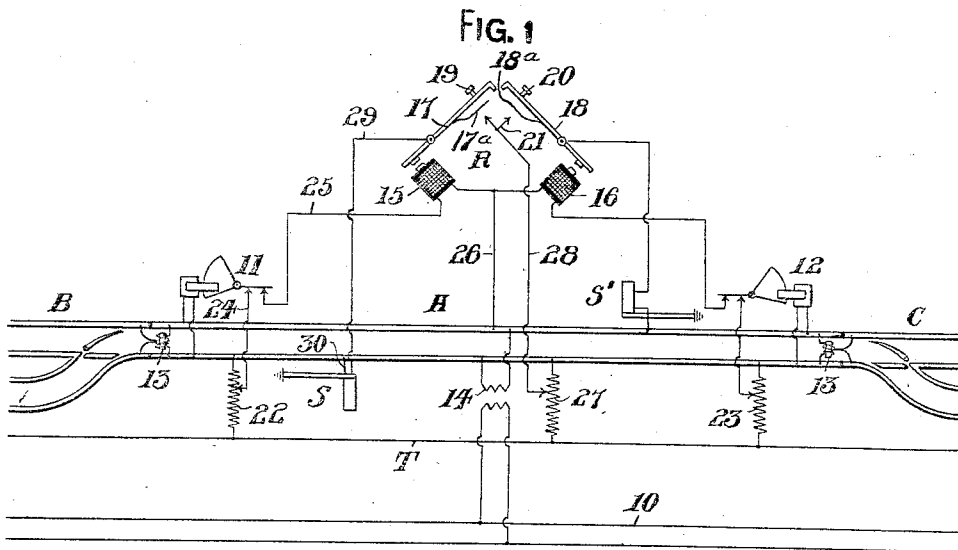


J. B. STRUBLE.
RAILWAY SIGNALING.
APPLICATION FILED FEB. 28, 1912.

1,055,683.

Patented Mar. 11, 1913.

5 SHEETS—SHEET 1.



WITNESSES

J. P. Hoffman,
A. L. Vercell

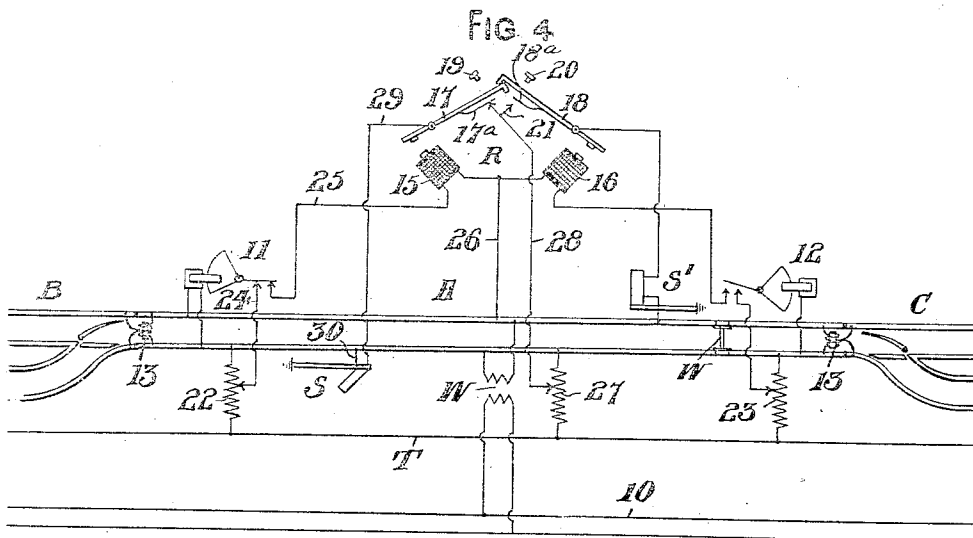
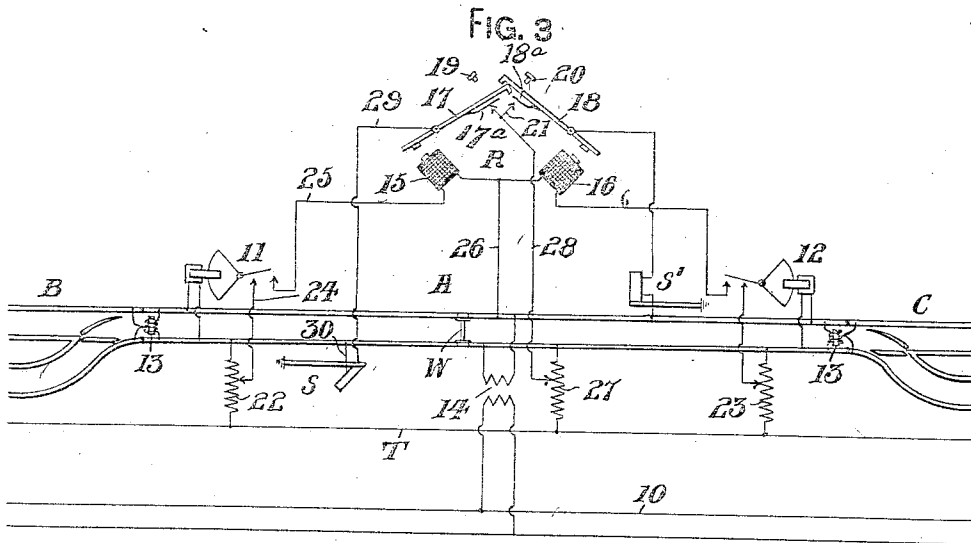
INVENTOR

Jacob B. Struble
BY *Geo. E. Crum*
ATTORNEY

J. B. STRUBLE.
RAILWAY SIGNALING.
APPLICATION FILED FEB. 28, 1912.

1,055,683.

Patented Mar. 11, 1913.
5 SHEETS—SHEET 2.



WITNESSES
J. P. Appleman,
A. H. Verrill

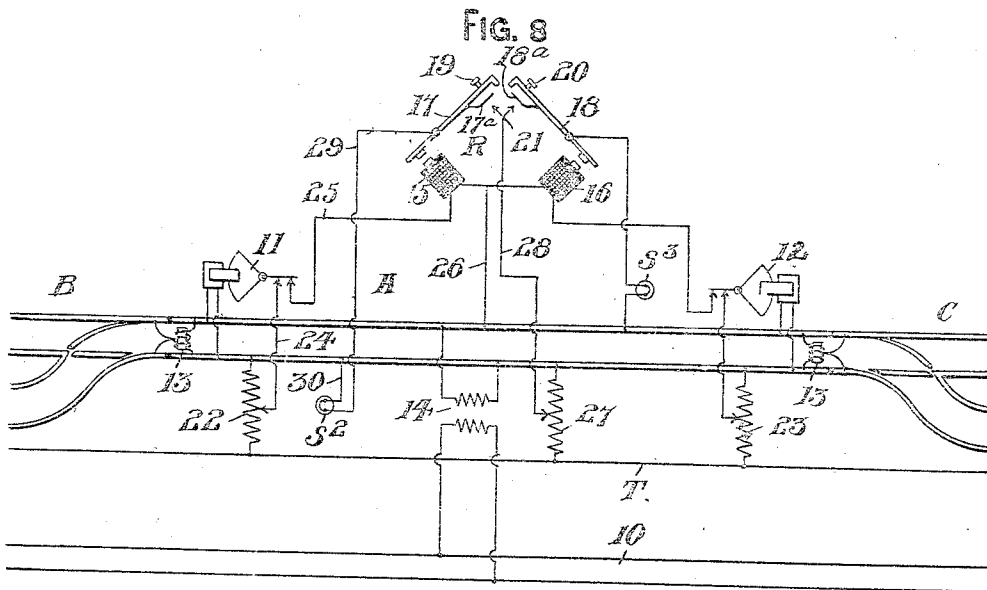
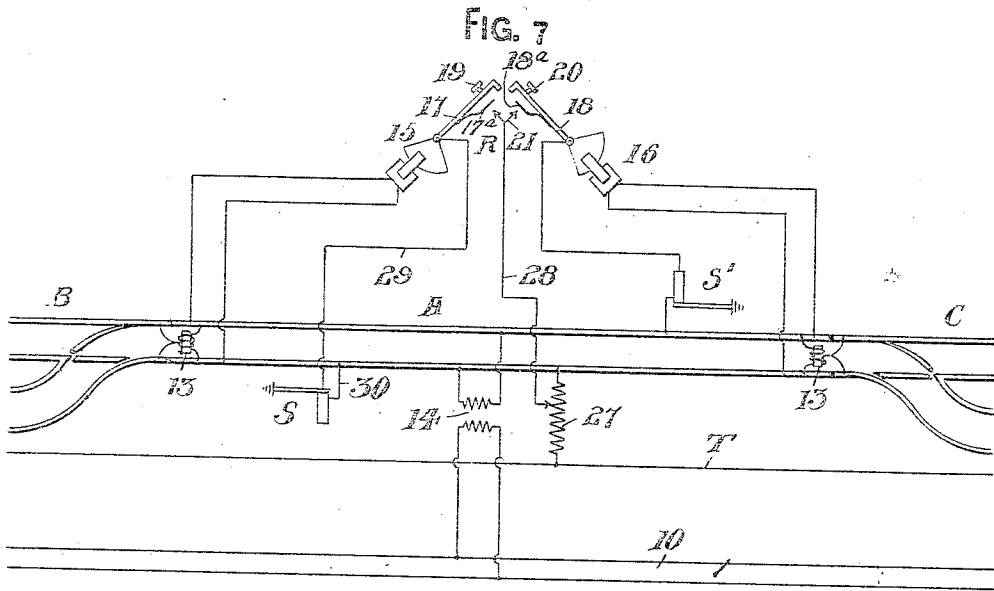
INVENTOR
Jacob B. Struble
BY *F. E. Crane*
ATTORNEY

J. B. STRUBLE.
RAILWAY SIGNALING.
APPLICATION FILED FEB. 28, 1912.

1,055,683.

Patented Mar. 11, 1913

5 SHEETS—SHEET 4.



WITNESSES

J. R. Hoffmann,
A. L. Verrill

INVENTOR

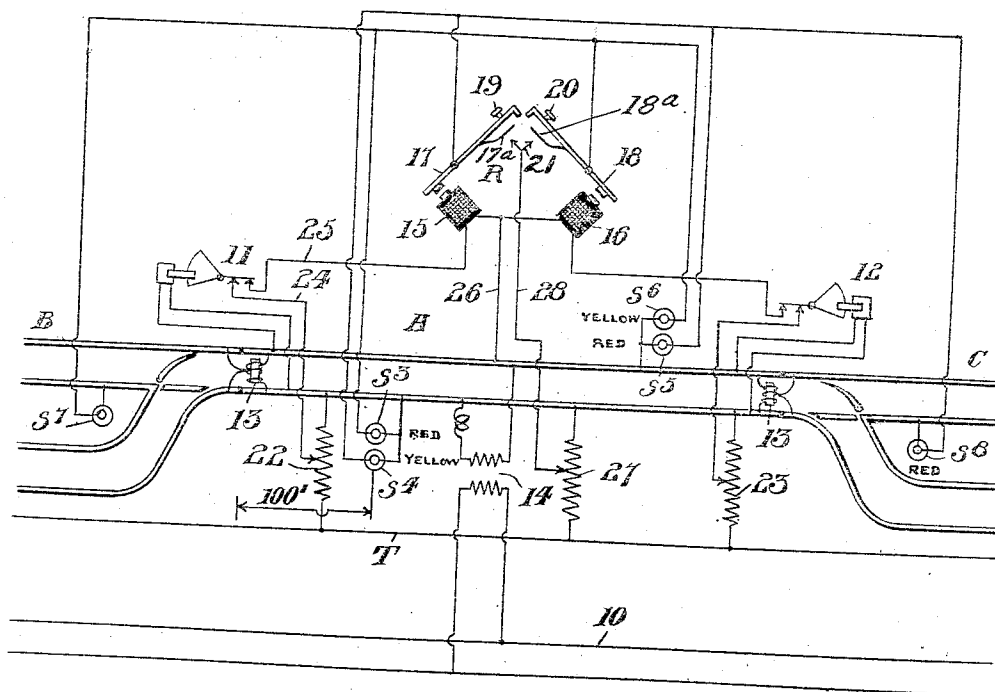
Jacob B. Struble.
BY *W. E. Crum*
His ATTORNEY

J. B. STRUBLE.
RAILWAY SIGNALING
APPLICATION FILED FEB. 28, 1912.

1,055,683.

Patented Mar. 11, 1913.
5 SHEETS—SHEET 5.

FIG. 9



WITNESSES

J. P. Appelman,
A. L. Verrill

INVENTOR

Jacob B. Struble
BY *W. E. Green*
ATTORNEY

UNITED STATES PATENT OFFICE.

JACOB B. STRUBLE, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

RAILWAY SIGNALING.

1,055,683.

Specification of Letters Patent.

Patented Mar. 11, 1913.

Application filed February 28, 1912. Serial No. 680,417.

To all whom it may concern:

Be it known that I, JACOB B. STRUBLE, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Railway Signaling, of which the following is a specification.

My invention relates particularly to automatic signaling systems, that is systems in which the railway signals are controlled automatically by the passage of a car or train, for portion of single track over which traffic moves in both directions; such for example as for stretches of track between passing sidings.

I will describe several forms of automatic signaling system embodying my invention, and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a diagrammatic view of one form of automatic signaling system embodying my invention, showing the usual condition of circuits and apparatus with no car or train present. Figs. 2, 3 and 4 are views similar to Fig. 1 but showing the conditions of circuits and apparatus of the system during the passage of a car or train. Figs. 5, 6, 7, 8 and 9 are views of modifications of the form of system shown in Figs. 1 to 4.

Similar reference characters refer to similar parts throughout the several views.

My invention relates to that class of automatic signaling systems in which a stretch of track is protected adjacent both ends by a signal or signals which govern traffic from opposite directions through the stretch; the signal control being so arranged that as a car or train enters the stretch of track the signal at the entering end is caused to indicate "caution," that is, it is caused to give an indication for succeeding cars or trains to follow through the stretch; and the signal at the other end is caused to indicate "danger" or "stop" or is not affected if it already indicates danger or stop; and the control being so arranged that as the car or train proceeds through the stretch of track the said indications of the signals are maintained. With the signals giving the indications stated, a succeeding car or train or any number of succeeding cars or trains may follow through the stretch of track under the protection of the "caution" indication,

which indication remains until all cars or trains have passed out of the stretch of track. Of course all train movements in the opposing direction are prevented by reason of the "stop" or "danger" signal at the other end of the stretch of track.

I prefer that the railway signals at the two ends of the stretch of track should usually give what is known as their "stop" or "danger" indication, but I do not wish to be limited to this arrangement.

In the practice of my invention I provide at least two track relays for the stretch of track, one of which relays is opened when a car or train enters the stretch of track to cause the signal at such entering end to indicate caution, the signal at the other end continuing to indicate stop, while the other of the track relays as the car or train proceeds farther is opened to maintain the same condition of the signals. These two track relays may be energized from a single track circuit, in which case the source of signaling current will be located between them, or they may be energized from two or more track circuits. I also provide an interlocking relay device comprising two relays each for the control of the signal at one end of the stretch of track, which relays are controlled by the track relays.

Although a signaling system embodying my invention is equally well adapted for use on a railway on which any form of propulsion power is employed, I have for the sake of illustration herein shown it applied to a railway using electric propulsion. In each of the views, T designates a trolley or third rail extending along the railway. Since the track rails of the railway are included in the circuit for the propulsion current and are also to contain insulated joints to form track circuits, I provide means for conducting the propulsion current around the insulated joints from one track section to the adjacent section. As here shown, this means comprises inductive bonds 13, each of which is of such construction and arrangement as to afford a path of low ohmic resistance to the propulsion current from the rails of one section to the rails of an adjacent section, and to offer a high impedance to the passage of alternating signaling current between the opposite rails of a track section. A form of bond which I preferably employ is shown and described

in United States Letters Patent No. 838,916 granted to Louis H. Thullen on December 18, 1906.

Referring now to each of the views, A designates a stretch of track, here shown as being a portion of single track between two passing sidings B and C. Traffic through the stretch A in opposite directions is governed by signals S and S'. As here shown, these signals are each located a short distance in advance of the end of the stretch—one hundred feet for example—for reasons which will be hereinafter explained. These signals may be of any desired type—for example, they may be of the semaphore type, or they may be of a type giving their indications solely by the colors of lights.

In Figs. 1 to 7 inclusive I have shown signals of the semaphore type, and in Figs. 8 and 9 I have shown signals of the light type; it is understood however that these types of signals may be interchanged as desired. As pointed out hereinafter, the light signals are in many cases preferable to the semaphore type, for day indications as well as night.

Referring now particularly to Figs. 1 to 4 inclusive, the stretch of track A is as here shown provided with one track circuit extending throughout the entire stretch. 10 designates signaling mains which are connected with a suitable source of alternating signaling current (not shown) and from which current is supplied to the track rails at substantially the middle point of the stretch A through a transformer 14. Adjacent each end of the stretch A are track relays 11 and 12, these relays being of a type which will respond to the alternating signaling current and not to the propulsion current; as here shown they are of the well known "vane" type. As is well understood, with a track circuit arranged as just described, a car or train entering the track circuit at one end immediately opens the track relay at that end, but will not open the track relay at the opposite or leaving end until the car or train has proceeded some distance in the stretch; and the relay at the entering end will again close while the car or train is still in the stretch but not until after the relay at the leaving end has opened. This action of the track relays is due to the impedance offered by the track rails to the flow of the alternating signaling current.

R designates an interlocking relay device of a usual and well known type. This device comprises two relays 15 and 16 each of which is provided with an armature 17 or 18. Each armature is provided with a back contact 17^a, 18^a which, when the armature is open, engages a contact 21. It is understood that these armatures are each biased by gravity or otherwise to the "open" position, that is, to such position that their back contacts are in engagement with contact 21;

and that when their magnets are energized the armatures are attracted into such position that the back contacts do not engage with contact 21, that is, the armatures are then drawn into engagement with stops 19 and 20 respectively. These armatures are interlocked in any suitable manner (as here shown by means of a hook carried by each armature) so that when one relay has been deenergized and its armature has opened, and the other relay then becomes deenergized, the second armature cannot open far enough to allow its back contact to engage with contact 21; and that when the first relay is then again energized, its armature is held so that its back contact remains in engagement with contact 21 until it is released by the second magnet becoming again energized and attracting its armature.

Each relay of the interlocking relay device is as here shown provided with a circuit which includes a source of current and a front armature contact of one of the track relays. As here shown, the source of current for each of these circuits is the propulsion current, the voltage being reduced to a suitable value by connecting resistances 22 and 23 between the trolley wire or third rail T and the track rails, and tapping these resistances at the desired points. For example the circuit of magnet 15 is from resistance 22 through wire 24 armature of track relay 11, wire 25, relay 15, wire 26 to track rail and resistance 22. It will be seen that each of the relays of the interlocking relay device is energized when the corresponding track relay is closed.

Each of the signals S and S' is provided with a controlling circuit, and each of these circuits is controlled by the back contact of one of the armatures of the interlocking relay device. These circuits are supplied with current from a resistance 27 connected between the trolley wire and a track rail. The circuit for signal S is from resistance 27 through wire 28, contact 21, back contact of armature 17, wire 29, signal S, wire 30 to a track rail and resistance 27. The circuit for signal S' is similar. It will be seen that when both of the relays of the interlocking relay device are energized, the circuit for each signal will be open and both signals will indicate "stop"; but when either relay is deenergized, the circuit for the corresponding signal will be closed and that signal will change to the "proceed" indication.

The operation of the system shown in Figs. 1 to 4 is as follows: When no car or train is present in the stretch of track A, the circuits and apparatus will be in the conditions indicated in Fig. 1. Assume now that a car or train represented by the wheels and axle W (see Fig. 2) enters the stretch A from the siding B. As this car or train comes upon the rails of the track circuit it

opens track relay 11, which in turn deenergizes relay 15 and allows armature 17 to close the controlling circuit for signal S, which then changes to its "proceed" indication. This signal, is, as hereinbefore stated located a short distance in advance of the beginning of the stretch A—for example about one hundred feet—the distance being such that just before the car or train reaches the stretch A the driver is able to see the indication of the signal; and when the vehicle bridges the rails of the track circuit if the signal changes to the proceed indication, the driver is able to see the signal make the change. Having observed this change of indication, the driver of the car or train knows that the stretch A is unoccupied and that he may proceed at full speed through the entire stretch. Referring now to Fig. 3, when the car or train W reaches a point near the connection of the source of signaling current with the track rails, track relay 12 opens, thereby opening the circuit of relay 16. But the armature of this relay cannot engage with contact 21 for the reason that its full stroke is prevented by armature 17. The circuit of signal S' is therefore not closed, and this signal continues to indicate stop. As the car or train proceeds past the point of connection of the source of current, track relay 11 closes, and the circuits and apparatus are then as indicated in Fig. 4. Although relay 15 is energized, its armature 17 is held in engagement with contact 21 by the hook of armature 18, and the signal S therefore continues to indicate proceed. When the car or train passes off of the stretch A, track relay 12 closes thereby closing the circuit of relay 16 which then attracts its armature, releasing armature 17 from contact 21. Signal S then changes to stop indication, and the circuits and apparatus are again as indicated in Fig. 1. Assume now that a car or train has entered the stretch A from siding B, as just described, and that while this car or train still occupies the stretch A a following car or train approaches the stretch from the same siding. The driver of this following car or train observing that signal S indicates proceed before his car or train enters the stretch knows the stretch is already occupied by a car or train moving in the same direction, and the second car or train and similarly any number of following cars or trains may therefore proceed through the stretch with caution, expecting to find the car or train in advance at any point in the stretch A. Assuming now that while the stretch A is occupied by a car or train which has entered from siding B, another car or train enters the stretch A from siding C. Signal S' will not change to proceed indication because armature 18 is prevented from moving into engagement with contact

21 by armature 17 which is already in engagement with contact 21. The driver of the second car or train observing that signal S' continues to indicate stop, will know that the stretch is already occupied by a car or train moving toward his end of the stretch, and he will therefore back his car or train into siding C. Referring now to Fig. 5, in this modification the stretch of track A is divided by insulation into two track circuits, each of which is supplied adjacent one end with signaling current from the mains 10, and each of which is provided with a track relay adjacent the other end. In this system a car or train passing through the stretch in either direction will bridge the rails of the second track circuit before it leaves the rails of the first, so that the second track relay will be opened before the first is closed. This sequence gives the desired operation of the interlocking relay device R, and the operation of the system is therefore the same as that of the system shown in Figs. 1 to 4.

In the modification of my invention shown in Fig. 6, the stretch of track A is divided into two track circuits each of which is provided with a relay at each end and a source of signaling current adjacent the middle. In this modification, the armature contacts of both track relays for one track circuit are included in the circuit of one of the relays of the interlocking relay device, and the armature contacts of both track relays of the other track circuit are included in the circuit of the other relay of the interlocking relay device. It is clear that the operation of this modification of my invention is similar to that of the systems hereinbefore explained, hence no detailed explanation is necessary.

Referring now to Fig. 7, the system here shown is similar to that shown in Figs. 1 to 4, except that the two relays 15 and 16 of the interlocking relay device R are connected directly with the track circuit at opposite ends of the stretch A. These relays are therefore of a type which will respond only to alternating signaling current, and as here shown they are of the vane type. The armatures 17 and 18 of these relays are provided with hooks which interlock in the same manner as in the preceding views. The operation of this modification will be obvious from the explanation of the system shown in Figs. 1 to 4.

The system shown in Fig. 8 is similar to that of Figs. 1 to 4 except that I have substituted electric lamps S² and S³ for the semaphore signals. It will be seen that when the stretch A is unoccupied, both lamps S² and S³ are extinguished. If, when the stretch is unoccupied, a car or train enters from either end, the driver will see the lamp at that end illuminate indicating that

the stretch is free and that he may proceed at full speed. A following car or train, and similarly any number of following cars or trains, will find the lamp illuminated and their drivers will know that they may proceed at caution expecting to find the preceding car or train at any point in the stretch. After a car or train has entered the stretch from one end, if a second car or train enters from the opposite end the lamp at the latter end will remain extinguished, indicating "stop" to the driver of the latter car or train. The use of lamps in this manner is simple and more economical than the semaphore signals shown in the preceding views, and the lamps are therefore preferable in many cases to the semaphore signals.

In Fig. 9 I have shown a modification of the lamp indication system of Fig. 8. In this view I provide two lamps giving different colored indications at each signal location; as here shown there is one red and one yellow lamp at each location. The red lamp S^3 at one end of the stretch is connected in parallel with the yellow lamp S^6 at the opposite end, and similarly red lamp S^5 is connected in parallel with yellow lamp S^4 . It will readily be seen that all lamps are extinguished when the stretch is unoccupied; and that when the stretch is occupied by a car or train the yellow lamp behind the car or train and the red lamp at the opposite end are illuminated, indicating caution to a following car or train and stop to a car or train attempting to enter the stretch from the end opposite to that at which the first car or train entered. In this view I have also shown two additional red lamps S^7 and S^8 located adjacent the passing sidings B and C. These lamps are connected respectively in parallel with red lamps S^3 and S^5 and serve as repeating signals for the latter lamps. When one of these additional lamps is illuminated it indicates to the driver of a car or train on the corresponding siding that stretch A is occupied by a car or train approaching that siding, and it is therefore unnecessary for the car or train on the siding to enter the stretch A and then to back into the siding again after discovering that the red lamp S^3 or S^5 is illuminated. These additional lamps are particularly useful in case of fog or when for other reason the main signals are not visible to the driver of the car or train before the car or train has entered stretch before the car or train has entered stretch A.

Although I have herein shown and described only a few forms of signaling system embodying my invention it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:—

1. In combination, a stretch of railway track between two passing sidings, track relays connected with said stretch, two signal relays each including a back contact, two circuits one for each signal relay the said circuits being controlled by the track relays so that during the passage of a car or train through the stretch one of the signal relays is opened then the other signal relay is opened and then the first signal relay is again energized; mechanical interlocking means between the armatures of the signal relays for holding closed the back contact of the first signal relay until the armature of the second signal relay again closes, signals adjacent the ends of the stretch for governing the passage of cars or trains through the stretch the signals being located a short distance in advance of the ends but each within view from its end of the stretch, a controlling circuit for each signal each circuit including the back contact of one of the signal relays whereby both signals indicate stop when the said stretch of track is free from cars or trains and whereby when a car or train enters either end of the stretch the circuit for the signal adjacent that end is closed and that signal changes to proceed indication before it is reached by the car or train, and whereby as the car or train passes through the entire stretch the said indication is maintained and the signal at the other end of the stretch continues to indicate stop.

2. In combination, a stretch of railway track, two signals governing traffic through the stretch in opposite directions, two signal relays each normally energized and each having a back armature contact, means controlled by the passage of a car or train through the stretch for successively deenergizing said relays, the relay first deenergized remaining deenergized until after the second relay has been deenergized, interlocking means included in the armatures of said relays for holding closed the back contact of the first relay until the second relay has again become energized, and a circuit for each signal each circuit including the back armature contact of one of the relays.

3. In combination, a stretch of railway track, two relays each normally energized and each comprising a back contact, means controlled by the passage of a car or train through the stretch for successively deenergizing said relays, the relay first deenergized remaining deenergized until after the second relay has become deenergized, interlocking means controlled by the armatures of said relays for holding closed the back contact of the first relay until the second relay becomes again energized; a signal device adjacent each end of the stretch each

for governing traffic through the stretch, and a circuit for each signal device each circuit including the back contact of the relay first deenergized by a car or train entering the stretch from the end adjacent the corresponding signal.

4. In combination, a stretch of railway track, two relays each normally energized and each comprising a back contact, means controlled by the passage of a car or train through the stretch for successively deenergizing said relays, the relay first deenergized remaining deenergized until after the second relay has become deenergized, interlocking means controlled by the armatures of said relays for holding closed the back contact of the first relay until the second relay becomes again energized; a signaling device adjacent each end of the stretch, each device comprising a caution signal and a stop signal; a signal circuit for the caution signal at one end and the stop signal at the other end which circuit is controlled by the back contact of the relay first deenergized by a car or train entering the end of the stretch adjacent the last-mentioned caution signal; and a second signal circuit for the remaining caution and stop signals which circuit is

controlled by the back contact of the other relay.

5. In combination, a stretch of railway track, a signal located adjacent each end of the stretch for governing the passage of cars or trains through the stretch in opposite directions, two track relays one connected with the track rails adjacent each end of the stretch, a source of signaling current connected with the track rails adjacent the middle of the stretch, an interlocking relay having back contact points, two control circuits for said interlocking relay each of which includes an armature and front contact point of one of the track relays and an energizing coil of the interlocking relay, and a signal circuit for each signal each of which includes the back contact point and armature of the interlocking relay which are controlled by the track relay at the same end of the stretch as the signal.

In testimony whereof I affix my signature in presence of two witnesses.

JACOB B. STRUBLE.

Witnesses:

A. F. PETERSON,
J. S. HOBSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."