(No Model.) 3 Sheets—Sheet 1.

L. C. WERNER.

ELECTRIC SIGNAL SYSTEM.

No. 603,390. Patented May 3, 1898.

Fig. 1.

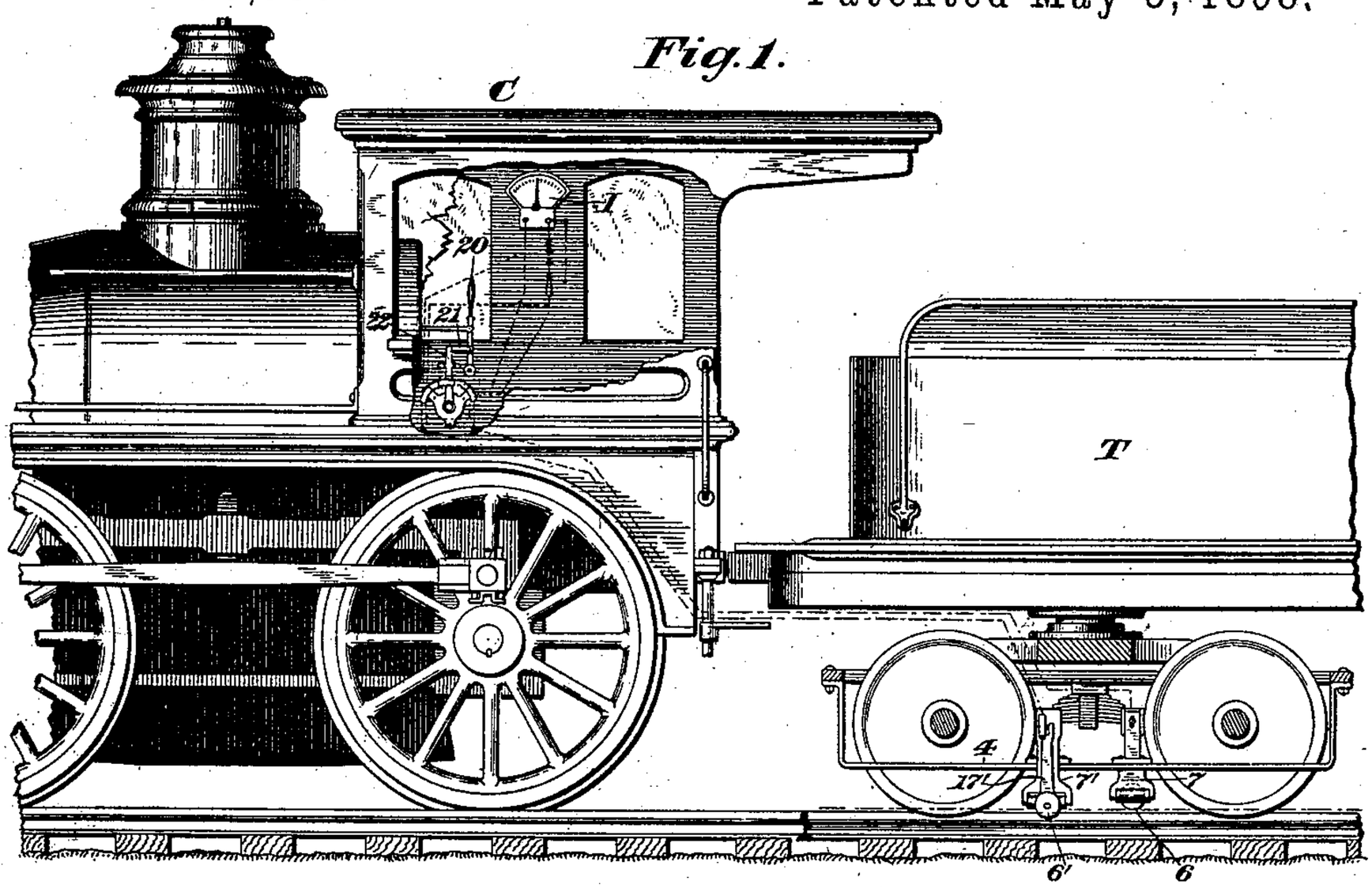


Fig. 2.

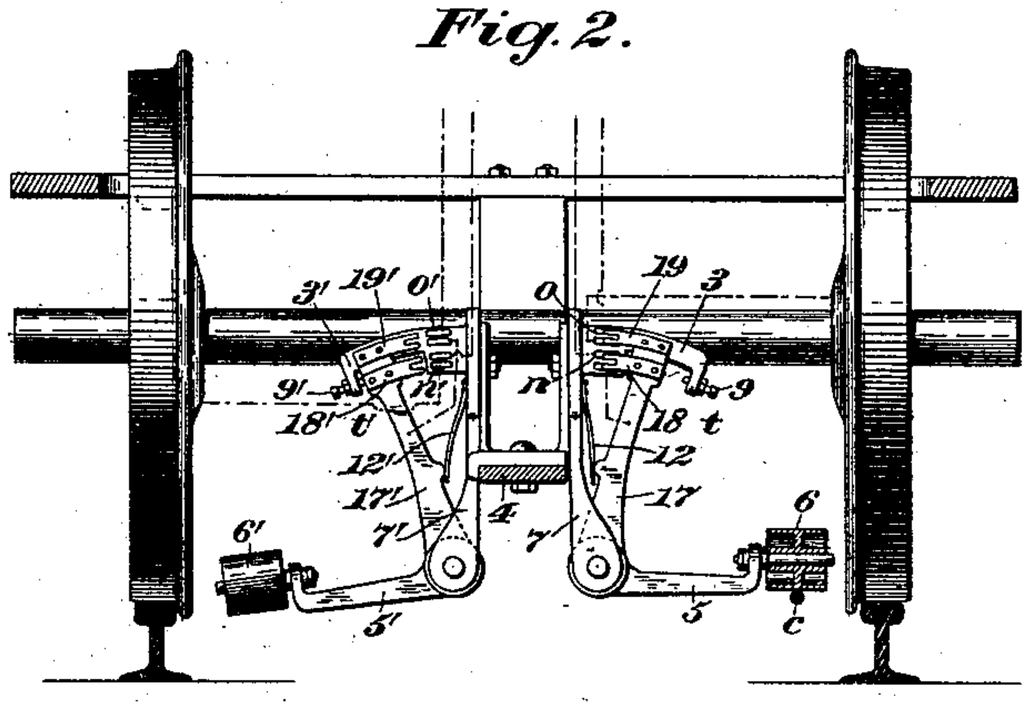
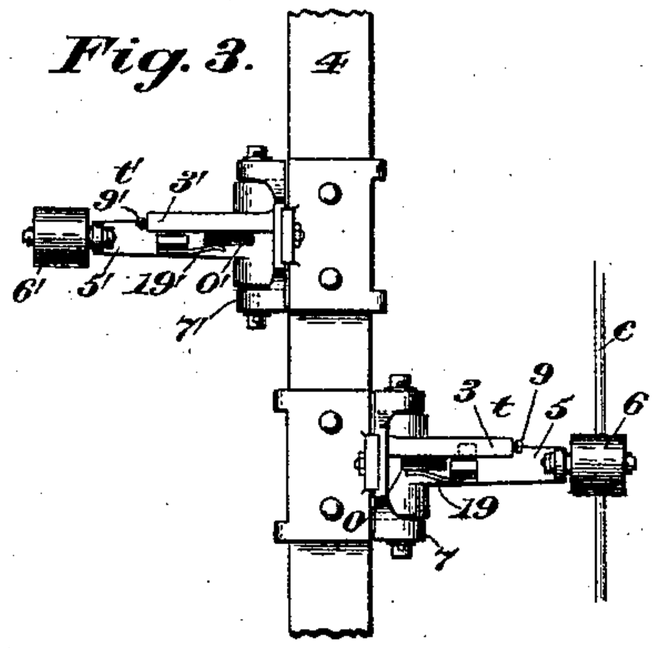


Fig. 3.



Witnesses:
F. L. Edwards Jr.
Fred. J. Dole.

Inventor:
Louis C. Werner.
By his Attorney,
F. A. Richards.

(No Model.) 3 Sheets—Sheet 2.

L. C. WERNER.

ELECTRIC SIGNAL SYSTEM.

No. 603,390. Patented May 3, 1898.

Fig. 4.

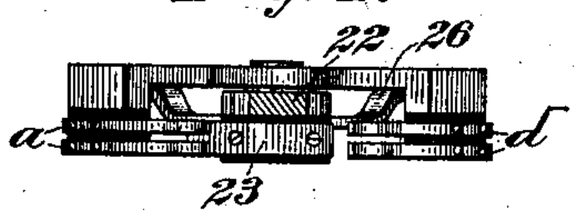


Fig. 5.

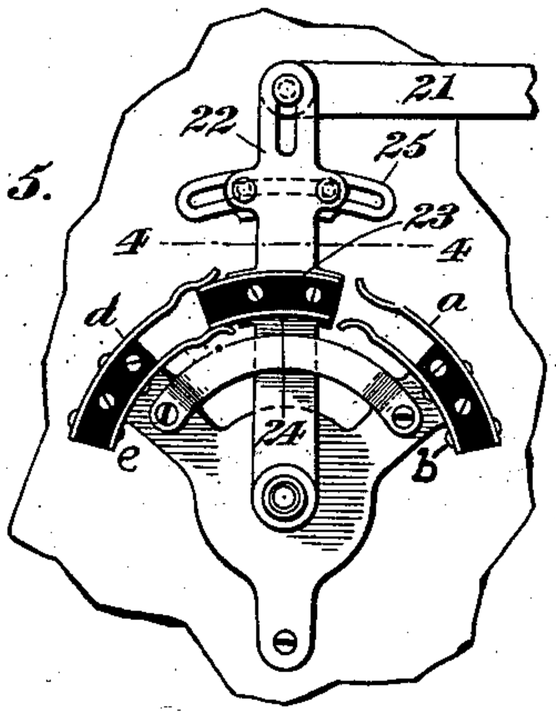


Fig. 6.

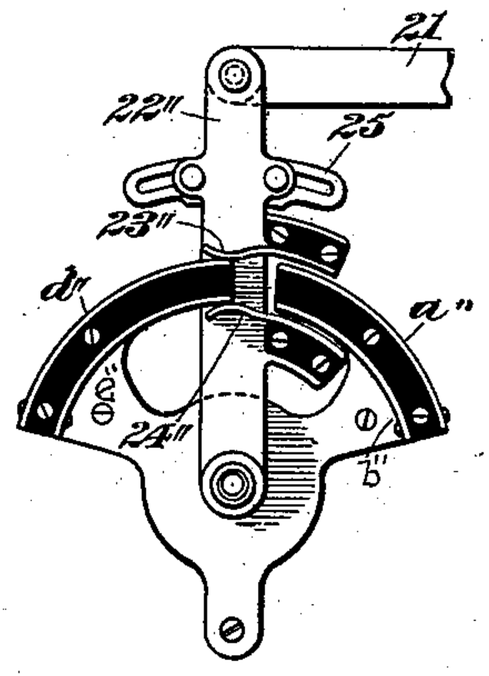


Fig. 7.

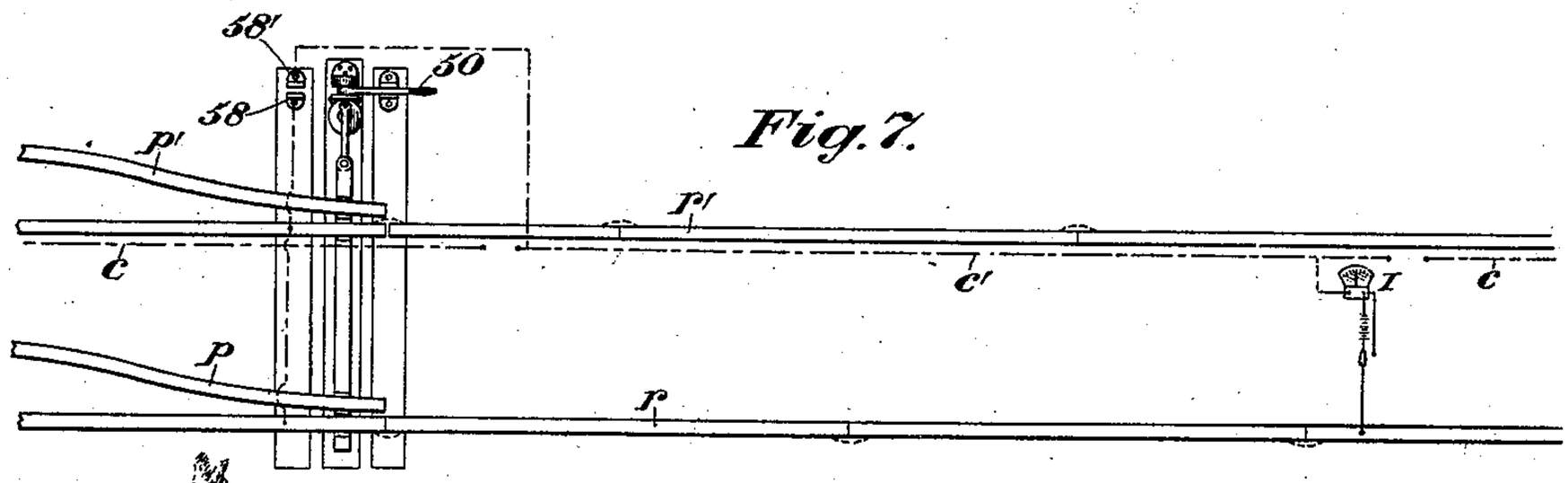


Fig. 8.

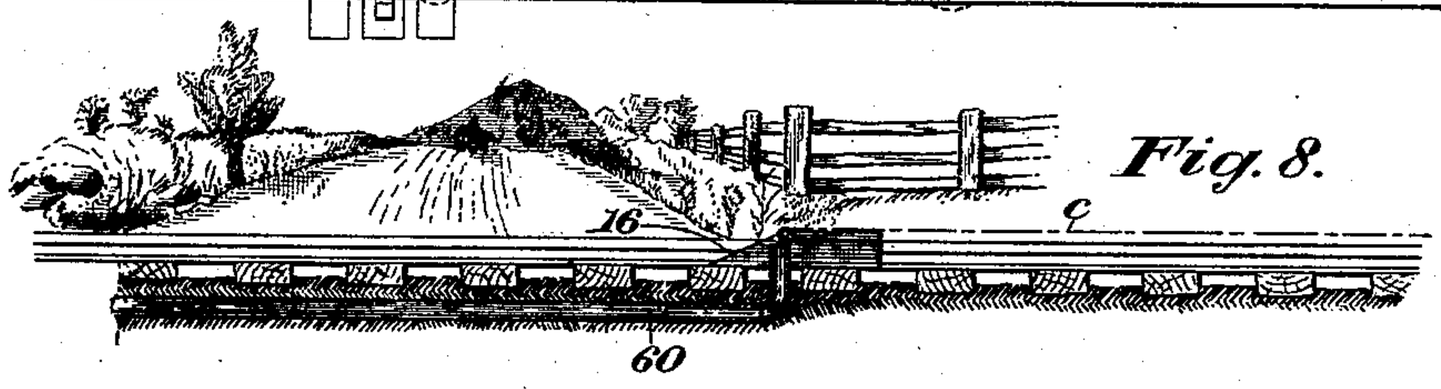
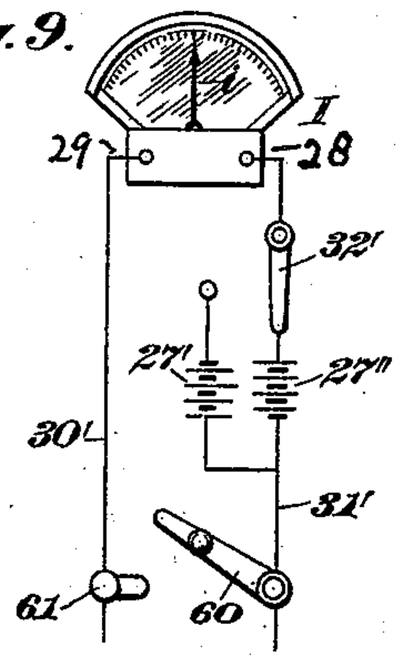


Fig. 9.



Witnesses;
C. W. Smith
Fred. J. Dole

Inventor:
Louis C. Werner
By his Attorney,
F. A. Richards.

(No Model.) 3 Sheets—Sheet 3.

L. C. WERNER.

ELECTRIC SIGNAL SYSTEM.

No. 603,390. Patented May 3, 1898.

Fig. 10.

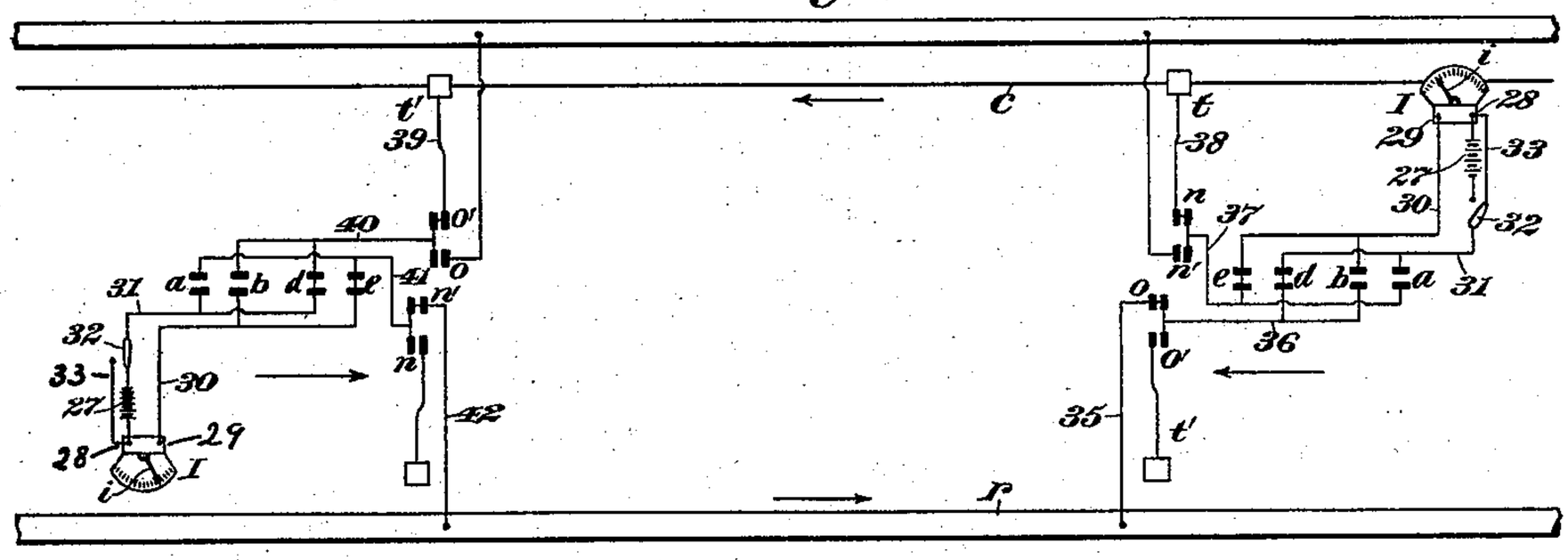


Fig. 11.

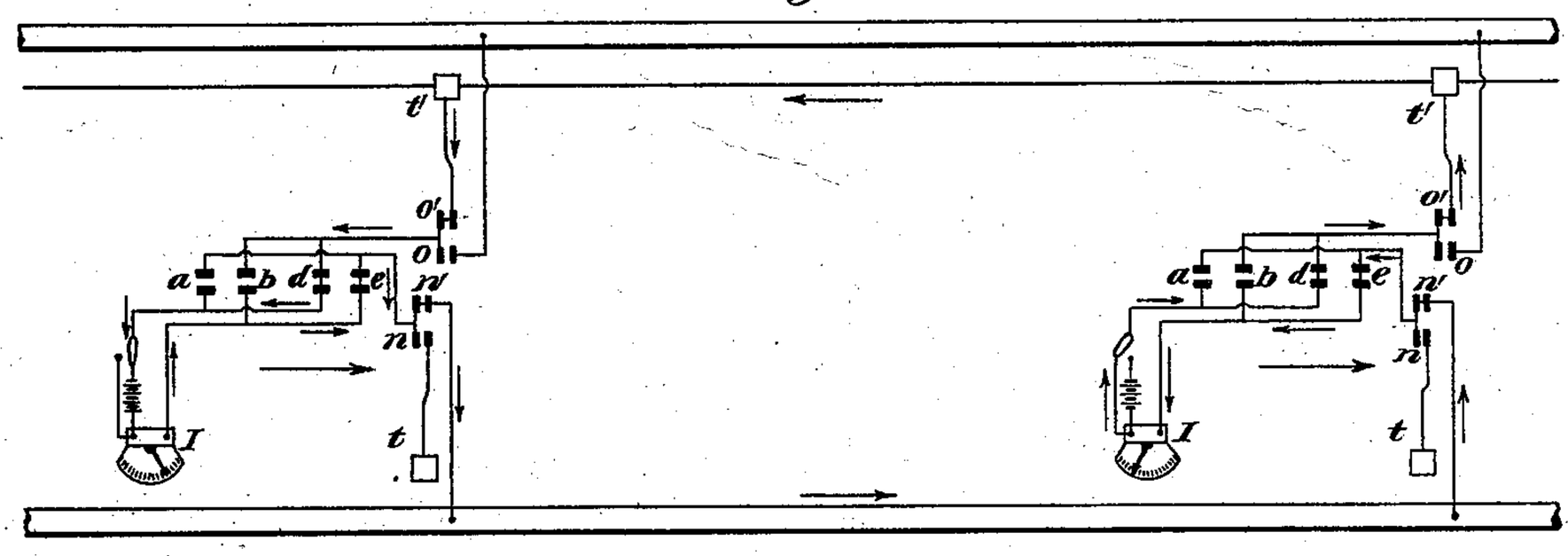
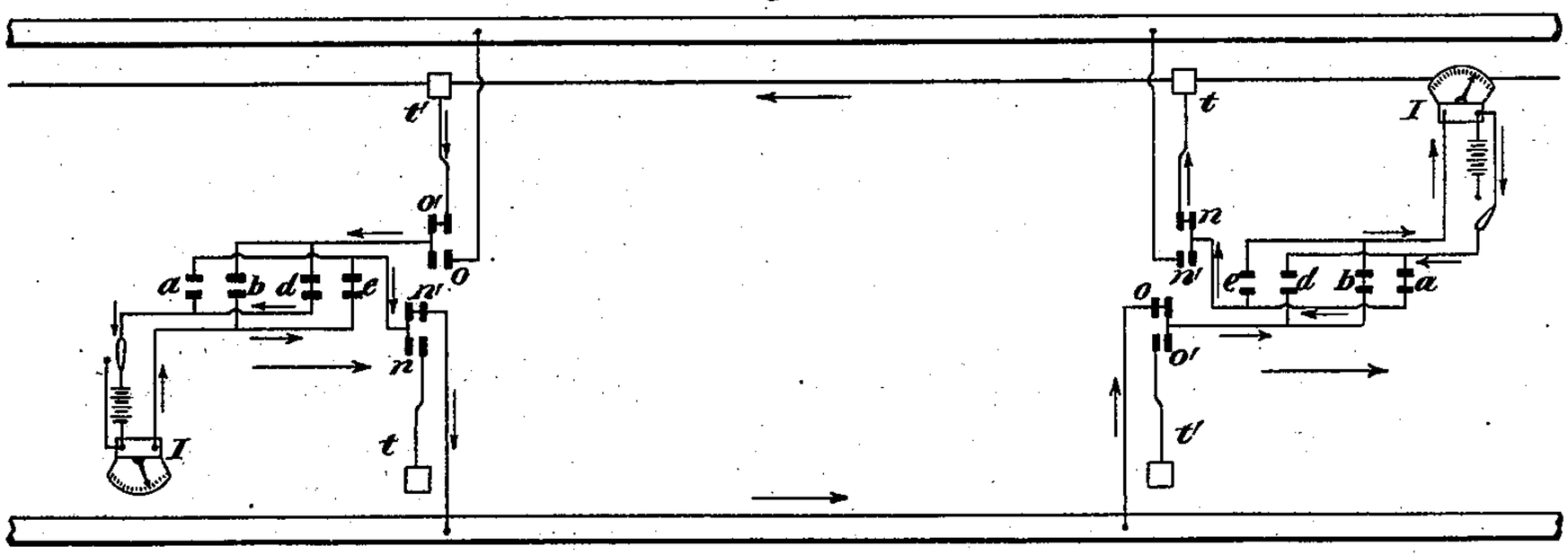


Fig. 12.



Witnesses;
J. L. Edwards Jr.
Fred. J. Dole

Inventor:
Louis C. Werner,
By his Attorney,
F. H. Richards.

UNITED STATES PATENT OFFICE.

LOUIS C. WERNER, OF BROAD BROOK, CONNECTICUT.

ELECTRIC SIGNAL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 603,390, dated May 3, 1898.

Application filed June 17, 1897. Serial No. 641,172. (No model.)

To all whom it may concern:

Be it known that I, LOUIS C. WERNER, a citizen of the United States, residing in Broad Brook, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Electric Signal Systems, of which the following is a specification.

This invention relates to electric signal systems, and more particularly to a system for indicating to a vehicle or train moving along a line of way its position relatively to a distant point on the same track, and especially the distance between it and the nearest vehicle on such track.

Ordinarily the several component parts of the system will be so organized as to show by means of indicators on adjacent vehicles or trains the positions of those vehicles relatively to each other by indicating to each variations in the resistance of a circuit therebetween, which variations will be due to the increase or decrease of the distance between the vehicles as they move in opposite directions or in the same direction toward or following each other on the same track.

My present invention is in the nature of an improvement upon that shown and described in my application, Serial No. 640,436, filed June 12, 1897, to which reference is hereby made, and in this case, as well as in said other application, I have illustrated a safety system by means of which the presence and position of another train on the same track may be signaled to the engineer in the cab of the nearest train.

As is well known, the current flowing through an electrical conductor is proportional not only to the cross-section but also to the length of such conductor, and hence if two vehicles be equipped to make traveling contact with a conductor extending along the line of way over which the vehicles are running and these vehicles are furnished with devices which may make a complete circuit from one train to the other the resistance of said circuit will be varied in accordance with variations in the length of that portion of the conductor which is between the two trains as the latter move toward and from each other. Moreover, if suitable devices be included in the circuit on each train variations in the strength of the current flowing through the circuit may be noted and these variations may be made to serve as a means for correspondingly operating an indicator located at a proper point on each such train or vehicle. Thus by means of suitable signaling devices, preferably visual indicators, such as galvanometers, every change in the positions of two trains may be indicated by reason of the corresponding change in the resistance of the conductor extending along the line of the track. The distance between the train and a switch or other danger-point may be indicated in a corresponding manner.

In my application hereinbefore referred to I have illustrated pole-changing switches by means of which the direction of travel of the current through any indicator may be reversed when the direction of travel of the vehicle on which such indicator is carried is changed, and one of the main features of my present improvements is the provision of such a switch controlled by the reversing-lever on a locomotive-engine, so that the shifting of such reversing-lever by the engineer will at the same time cause a corresponding movement of the electrical pole-changing switch.

Other features of importance and modifications of the apparatus shown and described in my other application, to which reference has been made, which features add materially to the simplicity and effectiveness of the system as a whole, will be described hereinafter.

In the drawings accompanying and forming part of this specification, Figure 1 is a sectional side elevation of a portion of an engine and tender movable along a track and equipped with an indicator and pole-changing switch constructed in accordance with my improvements and adapted to make traveling contact by means of a suitable current-collector with a conductor extending along the line of way. Fig. 2 is an enlarged detail end elevation of a portion of one of the trucks of the train, carrying a pair of current-collectors for making traveling contact with the conductor. Fig. 3 is a plan of a portion of the same. Fig. 4 is a sectional plan, taken in line 4 4, Fig. 5, of an electrical pole-changing switch adapted to be operated by the reversing-lever of a locomotive-engine. Fig. 5 is a side elevation of said switch. Fig. 6 is a simi-

lar view illustrating a modification of the pole-changing switch controlled by the reversing-lever. Fig. 7 is a diagrammatic plan of a portion of a road-bed, illustrating the main line and a closed switch in connection with my system, this feature showing the manner in which a circuit may be made to an approaching train from a disconnected portion or section of the main conductor in advance of the switch. Fig. 8 is a view illustrating a modification of my invention and shows the manner in which the conductor is carried under a crossing. Fig. 9 is a side elevation of a modified form of indicator, showing its connections, with suitable batteries for operating the same. Figs. 10, 11, and 12 are diagrammatic views illustrating a section of railway equipped with my improved safety system and showing the manner in which the indicators on two adjacent trains operate under different conditions.

Similar characters designate like parts in all the figures of the drawings.

Reference will be first made to Figs. 1 to 5, inclusive, in which I have illustrated the preferred form of apparatus for making contact between a traveling vehicle and a conductor extending along the line of track and the preferred form of pole-changing switch controlled by the reversing-lever on the locomotive of the train.

In Fig. 1, C designates in a general way the cab of a vehicle or train in which a signaling device or indicator is stationed, this indicator being suitably connected with a pair of current-collectors supported on the trucks of the train—as, for example, beneath the tender T, coupled to the engine. I provide duplicate current-collectors on each train, one adjacent to each rail of the track, and hence at opposite sides of the tender, owing to the fact that the conductor will usually be supported in such a position as to lie between one of the rails and the center of the track.

The current-collectors are designated in a general way by *t* and *t'* and, as before stated, are carried by the trucks of the tender, and each embodies a carrier-arm pivotally connected with a suitable carrier on the truck and a contact-maker, such as a trolley-wheel, pivoted to the carrier-arm. As the two current-collectors on each train are substantially similar in construction and operation a description of one will suffice for both, appropriate prime-marks being employed to designate those corresponding parts of the second or duplicate current-collector not referred to particularly herein. The current-collector *t* is in this instance in the form of an angle-arm pivoted on a carrier 7, secured to one of the members or beams 4 of the truck, the lower arm or carrier-arm 5 supporting a suitable contact-maker 6, which may be a rolling member or trolley-wheel. The other member of the angle-arm, which is designated by 17, is intended to serve also as a circuit-controller or circuit-breaker for breaking circuit to the indicator from the trolley-wheel 6 when the latter is out of contact with the conductor and in its inoperative position. This arm 17 is limited in its movement in one direction toward its idle position by a suitable stop on the arm 3, projecting laterally from the carrier 7. This stop may be adjustable, it being shown in this case as an adjusting-screw 9, the inner end of which may be moved nearer to or farther away from the coöperating portion of the arm 17, the movement of which it is intended to limit.

In order to break the circuit to the indicator when the trolley 6 passes off from the conductor, I make use of a suitable spring, such as 12, between the arm 17 and the carrier 7 and located in such a position that it normally tends to hold the trolley-wheel firmly against the conductor and will also operate the arm 17 to break the circuit to the indicator when the trolley-wheel leaves such conductor.

As before stated, the electrical circuit-breakers which I employ for controlling the circuit to the indicator from the respective current-collectors are preferably carried by the latter, the contact points or terminals, which are controlled by the circuit-breakers, being usually located on the arms 3 and 3', projecting from the carrier on the truck. The swinging arm 17 has a pair of resilient contact-arms 18 and 19, insulated from each other and coöperative, respectively, with the pairs of contacts or terminals *n* and *o* on the arm 3. The manner in which these contact-points are connected to the current-collector, the indicator, and the return-circuit through the wheels and track-rails will be apparent by reference to Figs. 1 and 2, and it will be obvious that the circuit at these contacts will be automatically broken by the spring-pressed circuit-breaker when the current-collector is not in contact with the conductor *c*.

The conductor *c*, with which the current-collector is intended to travel in contact, will usually be a wire of uniform cross-section extending along the track, and it may be mounted in any suitable manner, preferably between the rails of the track and adjacent to one of them, as shown in Fig. 2.

It will be noticed that the conductor is elevated above the tread of the rails, this being done to allow the current-collectors to clear crossings, as at switches, &c.

I have made reference in the preceding description to the use of pole-changing switches for reversing the direction of the current traveling through the indicators, (which latter will be described hereinafter in detail,) and these switches are in this case intended to be operated by the reversing-lever in the cab of the engine in order that the engineer may control the reversal of the movement of the train and the reversal of the direction of flow of the current through the indicator by a single operation. The preferred form of pole-changing switch is illustrated in Figs. 4 and 5, and the manner in

which it is operated by the reversing-lever of the engine is indicated in Fig. 1. In this latter view the reversing-lever is indicated by 20, and is connected by means of a link 21 with a pole-changing switch-arm 22 in such a manner that the movements of the latter correspond with those of the former—that is to say, if the reversing-lever is thrown forward in order that the train may move in that direction the switch-arm 22 will be moved in the same direction, while if the reversing-lever is thrown to the rear the pole-changing switch will also be carried to the rear. The movable switch-arm 22 may be pivotally mounted within the cab, preferably at one side of the latter, and will usually have a pair of contact-strips 23 and 24, insulated from each other and projecting laterally from the switch-arm, so as to avoid interference of the latter with the contacts with which such arm coöperates. These contacts are disposed in pairs, and the pairs are indicated herein by *a*, *b*, *d*, and *e*, respectively. All of these contacts are, in the construction illustrated in Figs. 4 and 5, in the form of yielding or resilient arms, disposed so as to be substantially concentric with the axis of movement of the switch-arm 22. The arms of each pair are insulated from each other, and each pair is insulated from every other pair, as will be evident by reference to said figures. Hence when the switch-arm is thrown to the left, as seen in Fig. 5, when the vehicle is moving forward the contacts *d* will be bridged by the contact-strip 23 and the contacts *e* will be bridged by the other contact-strip 24, so as to close the circuit to the indicator to cause the flow of the current therethrough in a direction corresponding to that in which the train is moving. Moreover, this contact may be made, as shown in Figs. 1, 4, 5, and 6, when the train is standing still and the reversing-lever is in its idle position in order to complete the circuit and prevent accidents if another or other trains are moving on the same track. In the present instance the contacts *d e* are normally always bridged when the train is standing still. Suitable guides, such as those shown at 25 and 26, may be employed for positively positioning the switch-arm in lateral direction.

In Fig. 6 I have illustrated a modification of the pole-changing switch in which the fixed contact members are carried by a fixed portion of the device, while the yielding contact-arms are secured to the switch-arm 22″. The pairs of fixed contact-strips are indicated in this view by *a*″, *b*″, *d*″, and *e*″, respectively, and the yielding contact-arms on the switch-arm 22″, which are designated, respectively, by 23″ and 24″, are insulated from each other, as is the case with the contact-strips 23 and 24, Fig. 5.

It will be noticed that in both of the forms of pole-changing switch shown herein the switch-arm has a considerable range of movement corresponding to that of the reversing-lever in the cab of the locomotive. In order to avoid confusion, the manner in which the contacts of the pole-changing switch are wired up and connected with the circuit-breaker at each current-collector is not illustrated in the detail views, but is shown clearly in the diagrammatic views, Figs. 10, 11, and 12, from which the wiring will be obvious.

As before stated, the indicator which I employ is preferably a visual one, operative substantially on the principle of a galvanometer, and the type of instrument which I prefer to employ is illustrated in these diagrammatic views and in Fig. 1, together with the connections thereto and a source of energy therefor. This indicator is designated in a general way by I, and as the construction of a galvanometer is well understood these signaling devices will not be described in detail. Indications are made by means of the usual pointer or index-finger *i*, this being controlled by the direction and strength of the current traversing the coils of the galvanometer. The current by means of which the indicator is operated may be taken from any suitable source of energy, preferably from a battery on the engine, this battery, which is indicated by 27, being connected to one terminal 28 of the coil at the indicator, while the other terminal 29 is connected to the return-conductor 30. The conductor 31, through which the circuit will usually be made to the battery, is controlled by a switch 32, by means of which the circuit may be made either through the battery 27 or through a branch conductor 33, also connected to the terminal 28. The conductors 30 and 31 are connected to the pole-changing switches in such a manner that the direction of flow of the current through the indicator will be reversed on the reversal of the position of the pole-changing switch-arm, and the wiring for this purpose will clearly be understood by reference to the diagrammatic views, Figs. 10, 11, and 12.

In Fig. 10 two trains are supposed to be moving in opposite directions and approaching each other on the same track, and at the proper distance, which may be the length of one or more blocks of an ordinary railway, each indicator should show that there is another train on the same track ahead of it. In this view, since the trains are moving in opposite directions, the contacts *o′ n′*, controlled by the current-collector *t′* on the left-hand cab, are bridged, while the contacts *o n*, controlled by the current-collector *t* on the right-hand cab, are bridged, and since both trains are moving forward corresponding contacts *d e*, controlled by the pole-changing switch, are bridged. A current-collector on each vehicle makes traveling contact with the conductor *c*, and all of the parts are in position to indicate to each of the two trains the presence of the other. In order, however, that the same amount of current may traverse the circuit while signaling, one of the batteries should be thrown out by shifting the corre-

sponding switch 32 onto the terminal of the conductor 33, the battery at the right in Fig. 10 being preferably the one disconnected. Obviously one of the batteries must be thrown out while signaling or else the length of the conductor between the trains would not be the only variable factor in the circuit of the indicator. It will be noted, however, that whether the battery on one of the trains is cut out of the circuit or not both of the indicators are always in circuit and in condition to cöoperate with each other to show each to the other its own position on the track with respect to such other train.

Both of the switches 32 are normally in circuit with their respective batteries and will remain in that position until one of the engineers desires to know whether there is a train near him, whereupon he will shift his switch 32 to cut out his battery, and if he gets no indication he will return his switch quickly to its normal position to connect his battery in circuit again. Each engineer should repeat this several times and in somewhat close succession if he gets no indication the first time. In no case, however, should he leave his battery cut out, except momentarily, unless his indicator shows the presence of an adjacent train. It is immaterial which operator cuts out his battery in signaling, and if both should happen to cut out their batteries simultaneously the switches should be restored to their normal positions and the proper indication would be shown in the cab on the second or third shifting of the switch.

When two trains are approaching each other, as shown in Fig. 10, and the switch 32 on the train at the right in said view is shifted to the position shown therein, a circuit is closed from the rail *r*, through conductor 35, contacts *o*, conductor 36, contacts *d*, conductor 31, switch 32, and conductor 33, through the coil of the galvanometer, whereupon the indicator-finger *i* is thrown to the left by the current traversing such coil, and the current passes on through the conductor 30, contacts *e*, conductor 37, contacts *n*, conductor 38, current-collector *t*, and conductor *c*, whence it goes to the opposite current-collector *t'* on the train ahead of it, the circuit then being through conductor 39, contacts *o'*, conductor 40, contacts *d*, conductor 31, switch 32, and battery 27, through the other indicator, causing the deflection of the pointer toward the first-mentioned approaching train, the current then passing out by way of conductor 30, contacts *e*, conductor 41, contacts *n'*, and conductor 42, back to the rail *r*. Each engineer of these trains now knows that there is a train ahead and approaching, and hence will be warned by the indicator to stop his train in time to avoid a collision. Not only is this the case, but the amount of deflection of the needle of each indicator will also show to the engineer how far ahead of him the other train is, and the amount of such deflection will be controlled entirely by the length of that portion of the conductor *c* which is between the current-collectors *t* and *t'*, and hence by the interval between the trains themselves.

In Fig. 11 I have illustrated the operation of the system when two trains are moving in the same direction and following each other on the same track. As the circuit through the several devices of the system has been traced out with respect to Fig. 10 it is not thought necessary to follow it in detail in Fig. 9, but I have instead indicated the course of the current by arrows. In this view corresponding sets of contacts *d*, *e*, *o'*, and *n'* are bridged by the pole-changing switches and the current-collector-controlled switches on each train, this being due to the fact that the trains are traveling ahead and in the same direction on the same track, and hence making contact with the conductor *c* in the same manner. In this case, also, the engineer on the train at the right in said view shifts his switch 32, which points to the train in the rear, thus closing the circuit between his own train and that following him and indicating not only that there is a train behind him, but also the interval between the two trains. The amount of deflection of the indicating-fingers will show at all times just what the interval between the two trains is and will thus enable each engineer to gage the running of his train accordingly.

In Fig. 12 I have shown the operation of the indicators for two trains following each other on the same track, one of which has been reversed and is running backward. In this case, as the movement of the train indicated at the right in said figure is the reverse of that which it ordinarily would have, the pointer of the indicator is moved in a direction which is the opposite of that in which it would be deflected usually, and hence instead of pointing toward the train following it it, as well as the reversing-lever, points away from the train in advance of it and toward the rear of the train on which it is mounted, thus showing that there is a train following it. In this figure the collector-controlled contacts *n o* on the right-hand cab is bridged, while the contacts *n' o'* on the left-hand cab is bridged. Also, since one train is backing while the other train is moving ahead, the contacts *d e*, controlled by the pole-changing switch on the left-hand cab, is bridged, while the contacts *a b* on the right-hand cab is bridged. The direction of flow of the current through the circuit is indicated by arrows in Fig. 12. It will be noted here that the conditions are similar in most respects to those indicated in Fig. 10, except that the direction of movement of the train at the right in Fig. 12 is reversed, and hence different pairs of contacts are bridged on said train in Fig. 12 from those connected in Fig. 10. In Fig. 10 the circuit is closed through the pairs of contacts *d*, *e*, *n*, and *o*, whereas in

Fig. 12 the circuit is closed through contacts *a*, *b*, *n*, and *o*, there being an open circuit at *d* and *e*.

In all of these diagrammatic views the duplicate current-collector-controlled switches are properly connected with the respective indicators, but none of the pairs of contacts is bridged by these switches, and the current-collectors are freely suspended and out of contact with any conductor, and hence there is no circuit through these parts.

Although my invention is intended primarily as a means for preventing collisions between trains by signaling to two approaching trains their relative positions with respect to each other, yet it is adapted for operation for preventing any kind of accident which might be due to errors in the running of the trains, in the throwing of switches, &c.

It will be obvious that if the circuit be closed between the rails and the conductor at any point distant from a train approaching on the track a circuit through the indicator on the train will be closed, and the presence of such danger-point and its distance indicated on the approaching engine, whereupon the engineer will of course take the proper precautions to insure the safety of his train.

In Fig. 7 I have indicated the manner in which the presence of an open switch ahead may be indicated to a train. In this view the track-rails, which are indicated by *r* and *r'*, may be connected to a switch-post 58 at the side of the track, and the corresponding post 58' will be connected to the conductor extending along the line. In order that the circuit may be broken after a train has been signaled and has passed by the switch, I prefer to interrupt the conductor in advance of the switch, a disconnected section *c'* of a length sufficient to permit the indicator on the approaching train to be operated and the engineer to stop his train if the switch is open being shown in this view. The circuit may be closed at the contacts 58 and 58' by means of a switch-lever 50 for operating the point-rails *p* and *p'*, the connections between the switch-lever and these rails being of any suitable type. It will be obvious that if the switch is open this fact will be indicated to the train as soon as its current-collector comes into contact with the disconnected section *c'* and also that the circuit to the indicator on the train will be broken as soon as the current-collector passes off from such section, thus causing the breaking of the circuit to the indicator as soon as the danger-point is passed.

In Fig. 8 I have illustrated one way in which the conductor *c* may be carried past a crossing without interfering with the passage of the vehicles crossing the tracks. In this view the wire is carried under the tracks and passes through a tube or conduit, such as 60, located beneath the road-bed. At the point where the conductor passes beneath the tracks there is located an inclined guide 16 for directing the trolley-wheel or contact member 6 onto the conductor after passing the crossing.

In Fig. 9 I have illustrated a modification of the operating connections for the indicator. In this view instead of employing a single battery in the main line connected with one terminal of the indicator I make use of two batteries, one in the main wire and the other in the branch conductor. One of these batteries is designated by 27' and the other by 27'', both being connected to the conductor 31' and both also being controlled by a switch 32', by means of which one or the other may be thrown into circuit with the coil of the indicator. By means of this construction I am enabled to keep a battery on each of two adjacent trains on the same track in circuit with the other, it being understood, of course, that all of the batteries should be of equal strength in order that the indicator-finger may be deflected to the proper extent by a definite variation in the resistance of that portion of the conductor between the trains. In connection with this form of indication I prefer to employ a short-circuiting switch, such as 60, adapted to span the conductors 31' and 30' for the purpose of testing the strength of the batteries. It will be evident that if the switch is thrown onto the terminal 61 a current may be passed through either of the batteries 27' and 27'' in accordance with the position of the switch 32', thus enabling the engineer to ascertain whether his batteries are of standard strength.

My improved signaling system may be divided, for convenience, into blocks similar to those employed for controlling the signals of a block system, and the engineers of trains on the same track, whether following, approaching, or receding from each other, may indicate their positions each to the other in accordance with a prescribed code of signals—as, for example, by shifting the switch 32 off from its contact-terminal a number of times corresponding to the number of the block on which his train may be at the time—or any other desired system of signaling may be employed. It will be obvious, however, that under whatever conditions the system may be operated the direction in which the current may travel through the indicator on each train, and, indeed, the making of the circuit to such indicator, will always be controlled by the reversing-lever of the engine, as if it is in its central or idle position there will be a circuit and if it is in either of its extreme positions the direction of travel of the current through the signal device will correspond to such position.

Having described my invention, I claim—

1. In an electric signal system, the combination, with a track of a line of way, of a conductor extending along the line of way and insulated from said track; a source of electric energy; a train movable along such track; a current-collector carried by said train and

adapted to make traveling contact with said conductor; means for closing the circuit between the conductor and the track at a point distant from the train; a visual electrical indicator carried by said train and in circuit with said current-collector and responsive to every variation in the length, and hence in the resistance, of the conductor between said vehicle and such distant point within the range of the indicator, and having an indicator-hand movable at either side of a normal, idle, central position in accordance with the direction of movement of the train, and adapted to indicate every variation in the distance between the train and such point; a reversing-lever carried by the locomotive of the train; and an electrical pole-changing switch controlled by said reversing-lever and adapted to send a current in either direction through the indicator.

2. In an electric signal system, the combination, with a track of a line of way, of a conductor extending along the line of way and insulated from said track; a source of electric energy; a train movable along such track; a current-collector carried by said train and adapted to make traveling contact with said conductor; means for closing the circuit between the conductor and the track at a point distant from the train; a visual electrical indicator carried by said train and in circuit with said current-collector and responsive to every variation in the length, and hence in the resistance, of the conductor between said train and such distant point within the range of the indicator, and having an indicator-hand movable at either side of a normal, idle, central position in accordance with the direction of movement of the train, and adapted to indicate every variation in the distance between the train and such point; a reversing-lever carried by the locomotive of the train; and an electrical pole-changing switch connected with, and controlled by, the operation of said reversing-lever and adapted to send current in either direction through the indicator.

3. In an electric signal system, the combination, with a track of a line of way, of a conductor extending along the line of way and insulated from said track; a source of electric energy; a train movable along such track; means for closing the circuit between the conductor and the track at a point distant from the train; a visual electrical indicator carried by said train and responsive to every variation in the length, and hence in the resistance, of the conductor between said train and such distant point within the range of the indicator, and having an indicator-hand movable at either side of a normal, idle, central position in accordance with the direction of movement of the train and adapted to indicate every variation in the distance between the train and such point; a traveling current-collector carried by said train and adapted to make contact with said conductor; a reversing-lever carried by the locomotive of the train; an electrical pole-changing switch controlled by said reversing-lever and adapted to send current in either direction through the indicator; and an automatic spring-released circuit-breaker controlled by the current-collector and controlling the circuit to the indicator.

4. In an electric signal system, the combination, with track-rails and switch-rails of a line of way, of a conductor extending along the line of way and insulated from said rails and having a relatively long section in advance of the switch disconnected from the main portion of the conductor; a source of electric energy; switch-operating means; circuit-closing means controlled by the opening of the switch and operative for closing the circuit between the rails at the switch and such disconnected section; a vehicle movable along the track; a traveling current-collector carried by said vehicle and adapted to make contact with said conductor; a visual electrical indicator carried by said vehicle and in circuit with said current-collector and responsive to every variation in the length, and hence in the resistance, of the conductor between said vehicle and such circuit-closing means within the range of the indicator, and having an indicator-hand movable at either side of a normal, idle, central position and adapted to indicate every variation in the distance between the vehicle and the switch on the approach of the former toward the latter; a reversing-lever carried by the vehicle; and an electrical pole-changing switch controlled by said reversing-lever and adapted to send current in either direction through the indicator.

LOUIS C. WERNER.

Witnesses:
FRED. J. DOLE,
C. W. SMITH.