F. LACROIX.

ELECTRIC SIGNALING SYSTEM FOR RAILWAYS.

APPLICATION FILED JAN. 24, 1907. RENEWED NOV. 6, 1908.

925,353. **Patented June 15, 1909.**

Fig. 2.

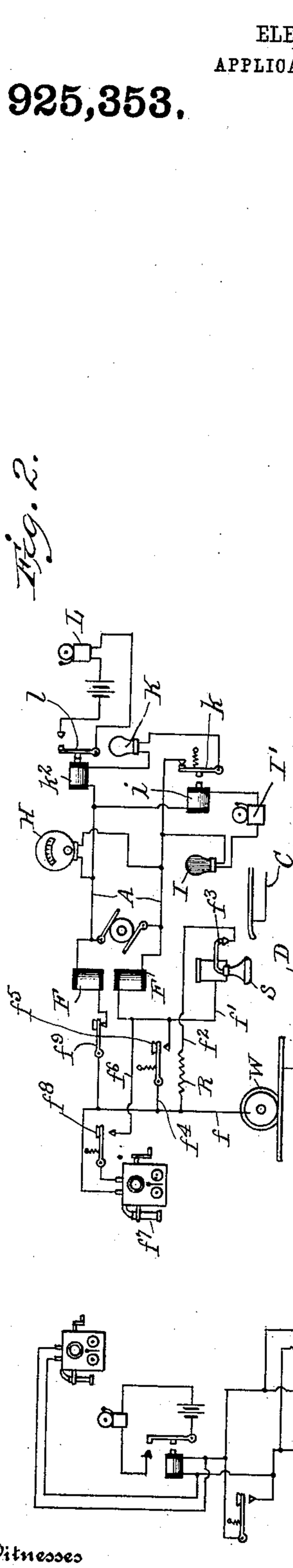
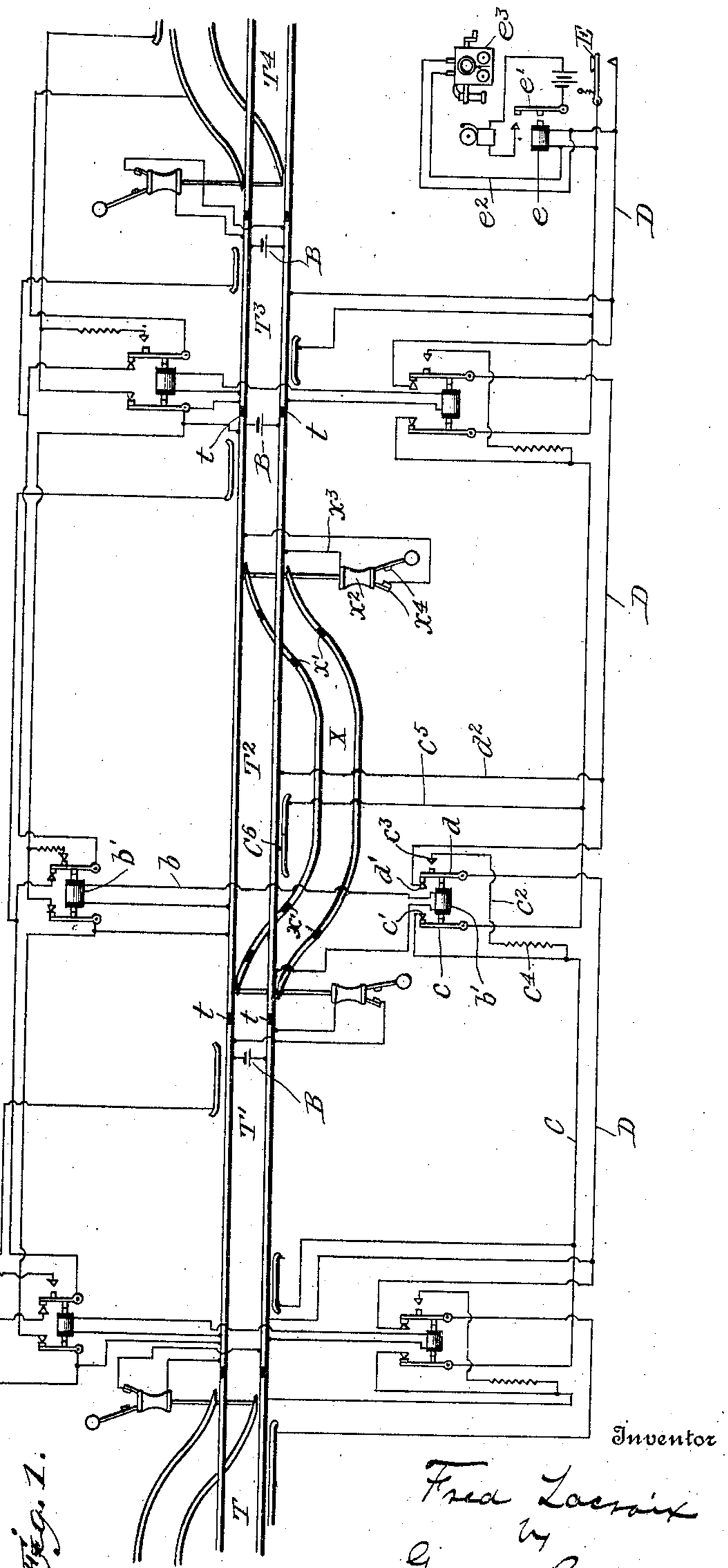


Fig. 1.



Witnesses

Edwin L. Jewell

Edwin F. Frey

Inventor

Fred Lacroix

by

Grant Burroughs

Attorney

UNITED STATES PATENT OFFICE.

FRED LACROIX, OF SAN ANTONIO, TEXAS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ELECTRICAL AUTOMATIC RAILROAD SAFETY SIGNAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRIC SIGNALING SYSTEM FOR RAILWAYS.

No. 925,353. Specification of Letters Patent. Patented June 15, 1909.

Application filed January 24, 1907, Serial No. 353,824. Renewed November 6, 1908. Serial No. 461,385.

To all whom it may concern:

Be it known that I, FRED LACROIX, a citizen of the United States, and resident of San Antonio, in the county of Bexar and State of Texas, have invented certain new and useful Improvements in Electric Signal Systems for Railways, of which the following is a specification.

In the accompanying drawings, in which similar reference characters designate corresponding parts, Figure 1 is a diagrammatic view of the track circuits and connections. Fig. 2 is a similar view of the cab circuits and connections.

My invention has for its object the provision of an electric signal system whereby the engineer in a locomotive can ascertain if the track ahead is clear; or, if there is a train ahead, an open switch, a broken rail, or other source of danger, he can locate the position of the obstruction.

It also has for its object the provision of means to enable the engineer in his cab to receive and to transmit signals from and to a distant point in the system.

Further, it has for its object other features which will be more particularly pointed out hereinafter.

This invention consists in the novel combination and arrangement of parts, such as will be hereinafter fully described and pointed out in the appended claims.

While the invention is particularly adapted to a single track road and will be described as so applied, yet it can be used where there are two or more tracks.

The wiring on one side of the track is the same as that on the other side, and the arrangement of the conductors and connections in one block is the same as in the other blocks. Consequently the description will be applied to one side of the track and to one block of the system.

Referring to Fig. 1 of the drawing, the track is divided into blocks T, T', T^2, and so on. The number and length of these blocks depend upon the nature of the road, the frequency of trains, and other determining conditions. It has been found that blocks of one mile in length meet the requirements quite well. The rails of each block are electrically continuous and are separated from the rails of the contiguous blocks by the insulating breaks *t*. Interposed between the rails and electrically connected with the same is the battery B or other source of electricity. The rails of each block are connected by the wire *b* which completes the circuit through the rails and the interposed battery. In this wire are the magnets *b'* on opposite sides of the track.

On each side of the track are the electric conductors C, D, extending parallel with the road. In each block the conductor C has a terminal in the switch *c* and a second terminal *c'* adjacent to said switch. Also in each block the conductor D has a terminal in the switch *d* and adjacent to the latter is a second terminal *d'*. Leading from the conductor C is the branch wire c^2 having a terminal c^3 adjacent to the switch *d* and in this wire is the resistance coil c^4. Another branch wire c^5 leads from the conductor C to the contact-rail c^6. A branch wire d^2 leads from the conductor D to the track rail adjacent to the contact-rail.

When each block is in its normal condition, that is when the circuit is complete through the track rails, the battery B and the magnet *b'*, the latter will hold the switches *c*, *d*, against the action of their springs. While so held the switch *c* makes contact with the terminal *c'* and the switch *d* makes contact with the terminal *d'*; at the same time the switch *d* is out of contact with the terminal c^3.

At the end of the conductors C, D, is the switch E, normally held open by a spring, for completing the circuit through the conductors at that point. Also in multiple connection with the conductors adjacent to the switch E is the magnet *e* controlling the switch *e'* in the circuit leading through a battery and an electric bell. The switch *e'* normally is in a position to break the circuit through the bell. When the magnet becomes energized through the completion of the circuit through the conductors and a current passing through the same the switch *e'* is moved to close the circuit and the bell is rung. Also in multiple connection with the ends of the conductors is the wire e^2 included in the circuit of the telephone e^3.

Referring to Fig. 2 of the drawing, in the cab of the locomotive is a shunt-wound dynamo driven in any suitable manner by power derived from the engine. The field coils F of the dynamo have a terminal *f* electrically connected with the wheel W of the

locomotive, and another terminal f' in the yielding shoe S mounted on the engine in a position to engage with the contact-rails c^6. A wire f^2 leads from the terminal wire f to the shoe S and has an electric contact as f^3 when said shoe is in a lowered position. In this wire f^2 is the resistance coil R. Inside of this wire f^2 is another wire f^4 having a multiple connection with the terminals of the field coils and in this wire is the switch f^5 for making and breaking the circuit through said wire. Inside of the wire f^4 is another wire f^6 also in multiple connection with the terminal wires of the field coils. Interposed in the wire f^6 is the telephone f^7 and also the switch f^8 for controlling the passage of the current through said wire. In the circuit of the field coils is the normally closed switch f^9 by means of which the said circuit can be interrupted.

In multiple connection with the armature coils A of the dynamo are the voltmeter H, the red lamp I, and the white lamp K. In series connection with the lamp I is the bell I'. The red lamp has a comparatively high resistance, and the white lamp has a comparatively low resistance. In the circuit of the lamp I is the magnet i for moving the switch k against the action of its spring to open the circuit through the lamp K. In the circuit of the lamp K is the magnet k^2 for holding the switch l against the action of its spring to open the circuit through the bell L.

The operation is as follows: The armature of the dynamo is constantly driven and the strength of the current generated by the armature of the dynamo and passing through the main circuit varies as the resistance in the circuit including the field coils varies. The resistance of the circuit including the field coils depends upon the length of the conductors C, D, included in such circuit. If the circuit through the field coils and the conductors should be completed by the engagement of the shoe S with a contact-rail c^6 and the conductors electrically connected at a considerable distance from the engine, then the resistance would be comparatively high; should the electrical connection between the conductors be made close to the engine, then the resistance would be comparatively low. As the electrical connections between the conductors are made by obstructions of the track, the location of an obstruction would be approximated by the resistance indicators. Should the indicators show a high resistance, then it could be concluded that the obstruction was at a considerable distance; if they should show a low resistance, then it would be inferred that the obstruction was close at hand.

When the shoe S is not in engagement with the contact-rail c^6 the wire f^2 normally completes the circuit through the field coils, but owing to the resistance R only a comparatively weak current flows through the field circuit. This comparatively weak current passing through the circuit of the white lamp K will cause the latter to glow with a very dull light, which will show to the engineer that his apparatus is in working order. The passage of this comparatively weak current will also energize the magnet k^2 sufficiently to hold the switch l open and thereby prevent the ringing of the bell L. This current, however, cannot pass through the red lamp I as the resistance of the latter is too great, consequently this lamp will not be lighted, nor will the bell I' be rung; and the magnet i will not be energized. The voltmeter H will indicate the passage of this comparatively weak current, which will also inform the engineer that his apparatus is in working order. If the lamp K should not glow and the voltmeter be inert the engineer would know that his apparatus was not in working order. To test all of his apparatus the engineer could complete the circuit through the wire f^4 by closing the switch f^5 and thereby cut out the resistance R. This would allow the full strength of the current to pass through the circuit of the field coils and there would be a corresponding increase of voltage through the circuit of the armature coils. This increase of current in the armature circuit would first cause the white lamp K to increase its glow to the maximum and the current would be sufficiently strong to pass through the red lamp I and the latter would also glow to its maximum. The current passing through the circuit of the lamp I would ring the bell I' and energize the magnet i and the latter would move the switch k to break the circuit through the lamp K. The interruption of this circuit would deënergize the magnet k^2 and the latter would release the switch l and the circuit through the bell L would be established and said bell would ring. The interruption of the circuit through the lamp K would also extinguish the light in the latter.

As the engine moves along the shoe S successively engages the contact rails c^6 and by the signals transmitted the engineer can ascertain the condition of the track. For an instance, suppose the locomotive is leaving block T and is entering block T', the depressed shoe will engage the contact-rail c^6 on the right-hand side of the block T'. When this engagement takes place the terminal f of the field circuit will form an electric connection with the conductor D through the wheel W, the track on which the wheel rests, and the wire d^2. The other terminal f', will form an electric connection with the conductor C through the shoe S, the contact-rail c^6, and the wire c^5. If the road is in its normal condition, with the circuit through the conductors C, D incomplete, there will be no increase of current through the field coils,

and, consequently, no increase of the current through the armature circuit and the normal condition of the indicators in the armature circuit would remain unchanged, which would inform the engineer that the track was clear. If there should be a source of danger on the track ahead, say a train in block T^2, then the circuit through the conductors C, D would be completed. In block T^2 the circuit through the rails, the battery B, and the wire b would be short-circuited. This would de-energize the magnet b' and the switches c and d would be released and the circuit of the conductor C would be broken at the contact c' and the circuit of the conductor D would be broken at the contact d'. The circuit between the conductors would be established at the contact c^3 by the engagement of the switch d with said contact. This completion of the circuit through the conductors C, D at the block T^2 would also establish the circuit through the field coils of the dynamo and there would be a consequent increase in the strength of the current passing through said field coils. This increase of current in the field coils would cause a corresponding increase in the current passing through the armature circuit. The increase of the current in the armature circuit would cause the red lamp I to glow, the bells I' and L to ring, and the white lamp K to cease to glow. These several signals would indicate to the engineer that there was an obstruction on the track ahead. By referring to the voltmeter H he can ascertain the location of the obstruction.

By calibrating the coils c^4 the resistance of the conductors through the several blocks are regulated to gradually increase from one end of a section of road to the other. For each block there is a graduation mark on the scale plate of the voltmeter and as each block is a mile in length, for convenience, the graduations are marked "1 mile, 2 miles, 3 miles" and so on, according to the number of blocks in the section of road. The locomotive being in block T', the pointer of the voltmeter would stand at "1 mile", which would inform the engineer that the obstruction was in the next block, or in block T^2.

If the track should be clear and the shoe S on the contact-rail c^6 in any block a station agent at the end of the line could signal to the engineer by closing the switch E. By making and breaking the circuit at this point the lamps could be flashed in the cab and by using a predetermined code, messages could be transmitted. In the same way the engineer could communicate with the station agent by opening and closing the switch f^9 and thereby make and break the circuit through the bell controlled by the switch e'. Also, telephonic communication could be established by the engineer in his cab opening the switch f^9 to cut out the circuit of the field coils and by closing the switch f^8 to introduce the circuit of the telephone f^7. The telephone e^3 could be brought into the circuit by closing the switch E. The telephone is not operated by the current generated by the dynamo, but depends on a battery such as is ordinarily used for such purposes.

In Fig. 1 of the drawing a side track X is shown, which is insulated at x', x', from the main track. A train on the siding would be insulated from the main track and could not affect the circuit through the battery B. The switch x^2 for opening or closing the siding to the main track has two wires x^3 leading from the rails of the main track to the contacts x^4 on the switch. When the lever of the switch is thrown to open the siding to the main track the two contacts x^4 are moved into engagement and the circuit through the battery B is thereby short-circuited and the connections between the conductors would be made the same as if the circuit had been interrupted by a train on the main track. Likewise, should a rail be broken in any block or become displaced, the circuit through the battery B of that block would be interrupted and the signals would be operated.

It is obvious that instead of track circuits arranged to indicate in which of separate blocks having individual different resistances the obstruction is located, the track circuits can be arranged to show the condition of one or more blocks immediately in front of the train. For an instance, the rails being bonded and divided into blocks as shown in the diagram, the wire D instead of being connected in circuit through the relays continuously or with several separate blocks having different resistances is connected to run only to the relay in the next succeeding block, and all the blocks can have a uniform resistance.

While the dynamo and signals have been described as being mounted in the cab of a locomotive, yet they could be mounted on any other part of the train. They also could be mounted at a station on the ground alongside of the track. In the latter instance the field coils of the dynamo would have permanent connections with the conductors C, D, and the action of the signals would be the same as in the cab. In this way the location of a train or other obstruction on the track could be ascertained at the station.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an electric signal system for railways, a track divided into insulated blocks with each rail of each block electrically continuous, a source of electricity in each block, a circuit in each block including the rails

and source of electricity adapted to be short-circuited by an obstruction of the rails of the block, a magnet in said circuit, conductors extending along the track with each conductor having terminals in each block, a switch for the terminals of each conductor in each block normally held by the magnet in the block to close the terminals of their respective conductors, a branch wire in each block extending from one conductor to a terminal adjacent to the switch of the other conductor to contact with said switch when the latter is released by its magnet, a normally incomplete circuit, means for electrically connecting said normally incomplete circuit with said conductors, a source of electricity in said normally incomplete circuit, and resistance indicating mechanism included in said normally incomplete circuit.

2. In electric signal systems for railways, conductors extending along the track and divided into blocks of different electric resistances and forming an incomplete circuit, means actuated by an obstruction on the track to form an electric connection between the conductors in the adjacent block, a shunt-wound dynamo mounted on the carrier movable on the track, means for electrically connecting the circuit of the field coils of the dynamo with said conductors, and resistance indicating mechanism and signals included in the circuit of the armature coils of said dynamo.

3. In an electric signal system for railways, a track divided into insulated blocks with each rail of each block electrically continuous, a source of electricity in each block, a circuit in each block including the rails and source of electricity adapted to be short-circuited by an obstruction of the rails of the block, a magnet in said circuit, conductors extending along the track with each conductor having terminals in each block, a switch for the terminals of each conductor in each block normally held by the magnet in the block to close the terminals of their respective conductors, a branch wire in each block extending from one conductor to a terminal adjacent to the switch of the other conductor to contact with said switch when the latter is released by its magnet, a shunt-wound dynamo, means for electrically connecting the field coils of the dynamo with said conductors, and resistance indicating mechanism included in the circuit of the armature coils of said dynamo.

4. In electric signal systems for railways, a track divided into insulated blocks with each rail of each block electrically continuous, a source of electricity in each block, a circuit in each block including the rails and source of electricity and adapted to be interrupted by an obstruction on the rails of the block, conductors extending along the track, means in each block actuated by the short-circuiting of the rail circuit of the block for electrically connecting said conductors opposite the block, a shunt-wound dynamo mounted on a carrier movable on the track, means for electrically connecting the field coils of the dynamo with said conductors, and resistance indicating mechanism and signals included in the circuit of the armature coils of said dynamo.

5. In an electric signal system for railways, a track divided into insulated blocks with each rail of each block electrically continuous, a source of electricity in each block, a circuit in each block including the rails and source of electricity adapted to be short-circuited by an obstruction of the rails of the block, a magnet in said circuit, conductors extending along the track with each conductor having terminals in each block, a switch for the terminals of each conductor in each block normally held by the magnet in the block to close the terminals of their respective conductors, a branch wire in each block extending from one conductor to a terminal adjacent to the switch of the other conductor to contact with said switch when the latter is released by its magnet, a resistance coil in said branch wire, a contact-rail adjacent to the track of each block, a wire connecting said contact-rail with one of the conductors, a wire connecting one of the track-rails with the other conductor, a carrier movable on the track, a normally incomplete circuit on said carrier having an electric connection at one end with the wheel traveling on the track-rail connected with one of the conductors, a shoe on said carrier at the other end of said normally incomplete circuit operating to engage the contact-rail to complete the circuit through said normally incomplete circuit and said conductors, a source of electricity in said normally incomplete circuit, and resistance indicating mechanism included in said normally incomplete circuit.

6. In an electric signal system for railways, a track divided into insulated blocks with each rail of each block electrically continuous, a source of electricity in each block, a circuit in each block including the rails and source of electricity adapted to be short-circuited by an obstruction of the rails of the block, a magnet in said circuit, conductors extending along the track with each conductor having terminals in each block, a switch for the terminals of each conductor in each block normally held by the magnet in the block to close the terminals of their respective conductors, a branch wire in each block extending from one conductor to a terminal adjacent to the switch of the other conductor to contact with said switch when the latter is released by its magnet, a resistance coil in said branch wire, a contact-rail adjacent to the track of each block, a wire connecting said contact-rail with one of the conductors,

a wire connecting one of the track-rails with the other conductor, a carrier movable on the track, a shunt-wound dynamo on said carrier with its field coils provided with a terminal in the wheel traveling on the track-rail connected with one of the conductors, a shoe on said carrier at the other terminal of the field-coils operating to engage said contact-rail to complete the circuit through said field-coils and the conductors, a resistance coil interposed in the field-coils of the dynamo, and resistance indicating mechanism in the circuit of the armature coils of the dynamo.

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

FRED LACROIX.

Witnesses:

CHARLES ADKINS BAKER,

J. S. GOLDMANN.