No. 882,523. PATENTED MAR. 17, 1908.

F. E. KINSMAN.

BLOCK SIGNAL SYSTEM.

APPLICATION FILED NOV. 29, 1904.

FIG. 1.

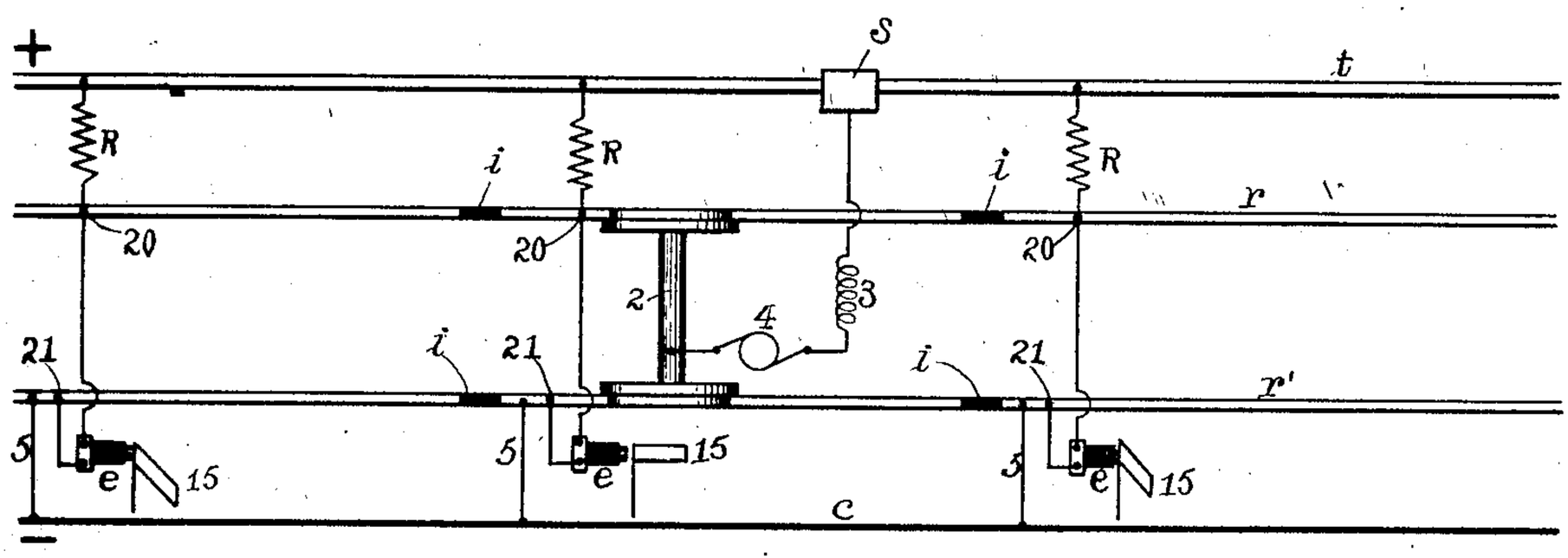
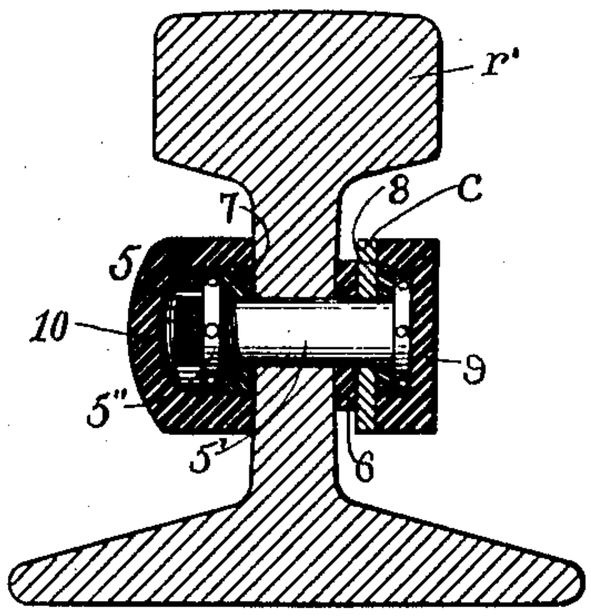


FIG. 2.



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BLOCK-SIGNAL SYSTEM.

No. 882,523. Specification of Letters Patent. Patented March 17, 1908.

Original application filed December 8, 1903, Serial No. 184,268. Divided and this application filed November 29, 1904. Serial No. 234,731.

To all whom it may concern:

Be it known that I, FRANK E. KINSMAN, a citizen of the United States, and a resident of Plainfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Block-Signal Systems, of which the following is a specification.

This invention relates to a block-signal system for controlling the movements of electrically-propelled cars or trains on a line of way, and especially to a safety system for electric railways, such as third-rail systems, which are used chiefly in large cities and are a constant source of danger because of the exposed character of the working and return conductors. In such systems, as ordinarily installed, the third-rail is close to one of the track-rails, and any person walking on the track must exercise extreme care in order to avoid stepping on the third-rail or working conductor and the track-rail which constitutes a part of the return circuit and thereby receiving the full working current through the short-circuit formed by his body. Such third-rail systems are chiefly used on elevated structures, and are most dangerous at such times as the line of way may be temporarily blocked because of an accident or otherwise and the passengers may desire or be compelled to leave the car or train and make their way along the tracks to the nearest station. At such times especially, there is, so far as applicant is aware, no means now employed for preventing the short-circuiting of the working and return conductors by passengers unfamiliar with the operation of third-rail systems. The danger of accident is also present whenever an accident occurs not due directly to stepping on the working and return conductors, as is evidenced by the large number of fatalities in recent collisions and other accidents on elevated third-rail systems. In my system I reduce the danger factor to a minimum by so organizing the system as to make it impossible for a person to form a short-circuit by walking on the exposed working conductor or third-rail and the track-rail nearest thereto, and I accomplish this by providing a return path for the current at a point relatively remote from the working conductor or third-rail. This return path may be formed by any suitable conductor which will constitute with the other elements of the system a complete metallic circuit instead of a circuit having an earth return as in the systems now in use. I prefer, however, to provide a separate return feeder electrically connected with that track-rail which is most remote from the third-rail, this return feeder being unconnected with the track-rail adjacent to the third-rail. By so organizing the system it will be extremely difficult for any one, even intentionally, to form a short-circuit by stepping on the third-rail and a track-rail, as no such short-circuit will be formed by stepping on the third-rail and the track-rail adjacent thereto, and the distance between the third-rail and that track-rail which constitutes a part of the return circuit is so great as to preclude the spanning of the same by any person unless extra efforts to do so are made.

The use of a metallic return conductor for carrying the working current in an electric railway system renders it feasible to make use of a portion of this current as a means for controlling in an exceptionally favorable manner the operation of danger-indicating devices or signals, such, for example, as the signal devices of a block-signal system; and the principal feature of my present invention is the provision in connection with an electric railway system, of an electrically-controlled device which indicates a danger condition and is governed by the power circuit, this device being preferably in a branch of the power circuit having a metallic return and so organized that such branch will be short-circuited by the movement of a vehicle adjacent thereto on the line of way.

The present application is a division of my application, Serial No. 184,268, filed December 8, 1903.

Other features of my invention not hereinbefore referred to will be hereinafter described and pointed out in the appended claims and are illustrated in the accompanying drawings, in which

Figure 1 is a diagrammatic view of an electric railway system or third-rail system embodying my invention and having a metallic return conductor. Fig. 2 is a detail illustrating one mode of electrically connecting a return feeder to one of the track-rails.

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

In carrying my invention into effect it should be understood that I may apply it to any existing type of railway system, whether

the working conductor be an exposed trolley wire, a third-rail, a working conductor contained in a conduit, or any other type of conductor for supplying current to a motor on a vehicle traveling on a line of way. I have, however, illustrated the invention in connection with a third-rail system for the reason that this is the most dangerous, so far as the short-circuiting of the same by an individual is concerned. The track-rails of a line of way are indicated in Fig. 1 by r and r', and the working conductor or third-rail is shown at t. This working conductor or third-rail will receive current in the usual manner from outgoing feeders (not shown) leading from a suitable source of supply, and from this third-rail current will be taken by a suitable current-collector, such as s, carried on the vehicle, one axle of which is indicated at 2. From the current-collector or shoe s the current for operating the vehicle will pass through the usual circuit on the vehicle and will leave the vehicle in the usual manner through the axles and wheels thereof. In these diagrams only the field-coils 3 and the armature 4 of the circuit on the vehicle are shown, all of the other elements ordinarily contained in such a circuit being omitted for the sake of simplicity and clearness. It should be understood, however, that this circuit from the current-collector or shoe to the axles and wheels of the vehicle or train may contain any or all of the devices ordinarily in use in electrically-propelled cars or trains. From the axles of the vehicle the circuit in my present system follows a somewhat different course, even through the wheels, than it does in the ordinary electric railway system. The reason for this is that only a single track-rail is connected in or forms part of the return path for the current as it leaves the vehicle. The track-rail which does form part of such return path is in this case the track-rail r' remote from the third-rail t, and the track-rail r does not form any part of such return path, whereas in the usual systems having an earth return the current passes to earth through both track-rails, and the system may be short-circuited by stepping on the third-rail and on the rail r. In my improved system, however, it will be seen that a short-circuit can not be established between the rails t and r and that the life of a passenger or employee will not be in danger unless he bridges the gap between the rails t and r'. These rails are so far apart that it is almost impossible to establish such a short-circuit by stepping on them. Hence a person walking on an elevated structure or any other embodying a third-rail system in which the third-rail is located outside the track-rails will run practically no risk from the high-tension current, in such systems. The metallic return circuit may be established through any suitable return conductor, connected at suitable intervals and by suitable conductors, such as 5, to the track-rail r' remote from the third-rail t. This return feeder c passes directly back to the source of energy or power-house and constitutes with the outgoing feeder (not shown), the third-rail t connected to such outgoing feeder, the traveling current-collector or shoe s, the circuit on the vehicle, and the axles, wheels, and track-rail of that side of the line of way remote from the third-rail t, a complete metallic circuit. Not only is such a system an exceptionally safe one, as compared with all other third-rail systems known to applicant, but it is also a much more economical system in operation, because of the greater conductivity of the metallic return circuit as compared with the ordinary earth return.

In Fig. 1 I have also illustrated how danger-indicating devices may be operated by current from the power circuit, and particularly how my improved safety electric railway system or third-rail system may be utilized or combined with a controlling system, such, for example, as a block-signal system. For this reason the track-rails r and r' are divided into blocks by suitable insulation, indicated at i, and the return conductor or feeder is connected to the track-rail r' most remote from the third-rail t by at least one connection 5 for each block.

Any suitable type of controlling circuit may be governed by the power circuit, but it will preferably be a controlling track-circuit fed by current from such power circuit. In this construction the controlling track-circuit is also a block-circuit and is adapted to be short-circuited by the entrance of a vehicle into the block of such block-circuit. The danger-indicating device or signal device, which may be a block-signal such as the semaphore 15, may also be governed by this controlling circuit in any desired manner, but will preferably be included directly in the controlling circuit, which is shown as a branch of the power circuit, this branch being connected from the working conductor or third-rail t to one or both of the track-rails, preferably to both, as shown herein. A suitable resistance may be interposed in this branch circuit at R, between the third-rail and the track-rail r', while the operating means for the signal or semaphore 15 is in that portion of the branch circuit between the two track-rails. The means for operating the signal device is shown as an electromagnet e and may have either a fixed or movable core. This electromagnet is normally in circuit with the resistance R and constitutes with said resistance and the track-rails and the conductor 5 a complete branch circuit from the third-rail to the return conductor, which branch circuit is obviously normally closed to energize the elec-

tromagnet and hold the signal in the position which indicates that there is no danger at that point, this condition being represented by the "clear" position of the semaphore.

Under ordinary conditions the power circuit has a traveling branch which is on the vehicle and supplies current to the motor which moves the vehicle, and it also has one or more fixed branches at the track, each normally energized and each serving when deënergized in any manner, either by the interruption of such branch circuit or the short-circuiting thereof, to indicate danger. Each of these fixed branches is located at the beginning of a block, and when an axle of a car or train entering a block is on the rails of the block section including such branch circuit the branch circuit is short-circuited between the points of connection 20 and 21 with the track-rails and remains short-circuited until the last axle of the train leaves such block, the resistance of the signal-controlling portion of the branch circuit between the points 20 and 21 being so adjusted as to be greater than the resistance of the short-circuit through the track-rails of the block and the axles and wheels bridging the same. Immediately on the short-circuiting of a signal device 15 the signal moves to the danger position shown in the second block in Fig. 1.

The particular construction and mode of connecting the metallic return conductor or feeder *c* may be varied within wide limits, but I have shown the return feeder in Fig. 2 as a copper bar mounted directly on the track-rail *r'* and connected thereto at suitable intervals by a conductive connection, designated generally by 5, the main element of which may be a screw-bolt 5' preferably having a round head and held in place by a clamp-nut or check-nut (or both) such as 5'', also preferably round, the round head of the bolt and the round nut or nuts having peripheral openings or recesses for receiving a pin to turn the same. This conductive connection 5 is preferably insulated at all points where it is not in contact with the feeder *c* or with the track-rail *r'*, the insulating material being so disposed as to constitute an air-tight, and especially a water-tight, casing or seal for preventing electrolysis between the copper and iron or steel elements so connected. This I regard as an important feature of my invention, and I have shown at 6, 7 and 8 respectively an insulating washer between the feeder and the track-rail, an insulating washer between the track-rail and the nut 5'', another insulating washer between the feeder and the head of the connecting bolt 5', an insulating cap 9 covering the head of the bolt, and an insulating cap 10 inclosing the threaded end of the bolt and the nut or nuts thereof, the two caps 9 and 10 being preferably threaded over and into engagement with the washers 7 and 8. Any other suitable means may be employed, however, for conductively connecting the track-rail with the return-feeder and surrounding with an air-tight and water-tight casing the contacting iron and copper surfaces.

My improved electric railway controlling system may be applied in various ways for governing different kinds of danger conditions and for indicating such danger conditions in various ways to an approaching car or train. One important application of it is to the automatic stopping of a car or train when it reaches a point at which a danger condition is indicated, but this application of my invention constitutes the subject matter of a separate application filed by me December 1, 1903, Serial No. 183,387, and is not claimed herein.

What I claim is:

1. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically controlled device for indicating a danger condition on the line of way, a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and a controlling circuit fed by current from the power circuit and governing the electrically-controlled device.

2. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically-controlled device for indicating a danger condition on the line of way, a power circuit governing the movement of said vehicle, and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and a controlling circuit fed by current from the power circuit, and governing the electrically-controlled device and adapted to be short-circuited by said vehicle.

3. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of a signal device on the line of way, a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and a signal-controlling circuit fed by current from the power circuit.

4. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of a signal device on the line

of way, a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and a normally closed signal-controlling circuit fed by current from the power circuit.

5. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of a signal device on the line of way, a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and a normally closed signal-controlling circuit fed by current from the power circuit and including a track rail.

6. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of a signal device on the line of way, a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit and a normally closed signal-controlling circuit fed by current from the power circuit and including both track rails.

7. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically-controlled device for indicating a danger condition on the line of way, and a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit and having a controlling branch governing said electrically-controlled device.

8. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically-controlled device for indicating a danger condition on the line of way, and a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit and having a controlling branch located wholly on the line of way and governing said electrically-controlled device.

9. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically-controlled device for indicating a danger condition on the line of way, and a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and having a controlling branch adapted to be short-circuited by said vehicle and governing said electrically-controlled device.

10. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically-controlled device for indicating a danger condition on the line of way, and a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current reducing device for supplying controlling current to a controlling circuit and having a controlling branch including a track-rail and governing said electrically-controlled device.

11. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically-controlled device for indicating a danger condition on the line of way, and a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit and having a controlling branch connected at two points to opposite track-rails and governing said electrically-controlled device and adapted to be short-circuited between said points.

12. In an electric railway system embodying track-rails, the combination with an electrically-propelled vehicle movable along said track-rails, of an electrically-controlled device for indicating a danger condition on the line of way, and a power circuit including a metallic return conductor governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit and also governing said electrically-controlled device.

13. The combination with the track-rails of a line of way and with an electrically-propelled vehicle movable therealong, of an

electrically-controlled device for indicating a danger condition on the line of way, and a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit and also governing said electrically-controlled device and including a metallic return feeder connected with one of said track-rails.

14. In an electric railway system embodying track-rails, the combination with an electrically-propelled vehicle movable along said track-rails, of block-signal devices, and a power circuit including a metallic return conductor and governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit and having branches constituting block-signal circuits.

15. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of an electrically-controlled device for indicating a danger condition on the line of way, a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and a controlling circuit fed by current from the power circuit and constantly in circuit with both sides of the power circuit and governing the electrically-controlled device.

16. The combination with a line of way and with an electrically-propelled vehicle movable therealong, of a signal device on the line of way, a power circuit governing the movement of said vehicle and embodying a continuous working conductor through which working current normally flows continuously and which is permanently connected with a track-rail through a current-reducing device for supplying controlling current to a controlling circuit, and a signal-controlling circuit fed by current from the power circuit and constantly in circuit with both sides of the power circuit.

Signed at New York, in the county of New York, and State of New York, this 28th day of November A. D. 1904.

FRANK E. KINSMAN.

Witnesses:

EDGAR A. FELLOWS,

C. S. CHAMPION.