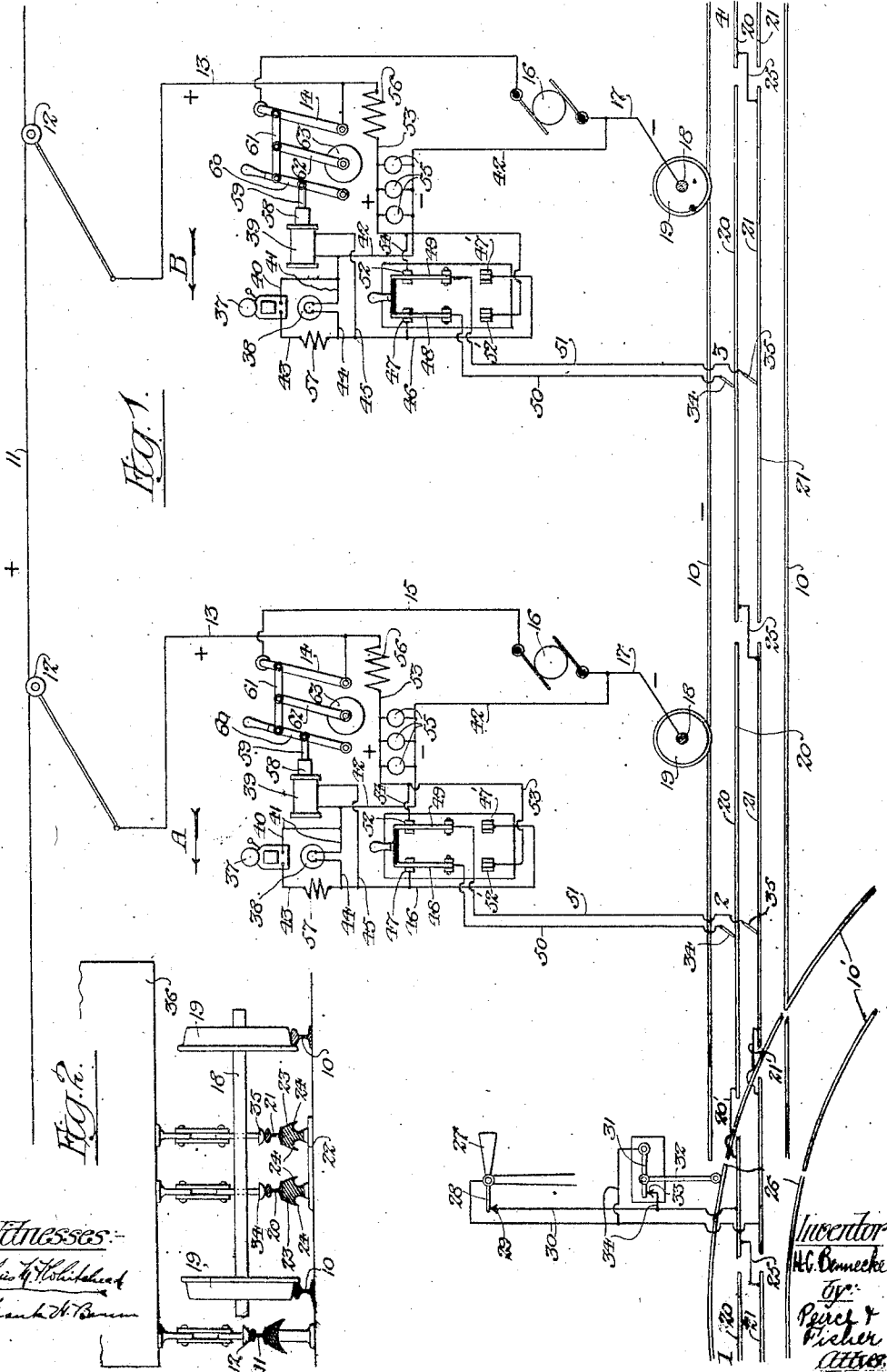


H. C. BENNECKE.
 RAILWAY SIGNALING SYSTEM.
 APPLICATION FILED MAY 13, 1909.

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Witnesses:
 Frank H. Wolschke
 Frank H. Berman

Inventor
 H. C. Bennecke
 by
 Peter F. Fischer
 Attorney

UNITED STATES PATENT OFFICE.

HENRY C. BENNECKE, OF CHICAGO, ILLINOIS.

RAILWAY SIGNALING SYSTEM.

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To all whom it may concern:

Be it known that I, HENRY C. BENNECKE, a citizen of the United States, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Railway Signaling Systems, of which the following is a specification.

The invention relates to signaling systems for railways and more particularly for electrically operated railways, and seeks to provide a simple and effective system by which the operator of each car or train will be notified when the line ahead of him is not clear, either by reason of a misplaced switch, another car or train or for other cause.

The present improvement is more particularly designed for use in railway systems in which all of the cars or trains on the same track run in the same direction.

The invention consists in the features of improvement hereinafter set forth, illustrated in the accompanying drawing and more particularly pointed out in the appended claims.

Figure 1 is a diagrammatic view of the improved system, the equipment for two separate cars or trains being represented. Fig. 2 is a diagrammatic section of the railway line.

As stated, the invention is particularly applicable for use in connection with electrically operated railways. The tracks 10 form continuous main conductors for one side, usually the negative side, of the operating circuit for the car motors. A trolley rail or wire 11 forms a continuous conductor for the opposite or positive side of the power circuit. The conductor for the positive side of the power circuit shown in Fig. 2, is in the form of an insulated third rail 11 arranged in usual manner at one side of the track. Each car or train is provided with a suitable trolley or shoe 12 which is connected by a conductor 13, circuit breaking switch 14 and a conductor 15 to one pole of the motor 16 which is arranged in any suitable or usual manner to propel the car. The opposite side or pole of the motor 16 is connected to the tracks or negative conductors for the power circuit by a conductor 17, wheel axle 18 and car wheels 19 that run on the track. The motor circuit is provided with any suitable form of controlling switch (not shown).

In accordance with the present invention

a pair of supplemental or signaling conductors 20 and 21 extend along the railway line. These conductors are insulated and may be of any suitable construction. In the form illustrated in Fig. 2, these conductors comprise supplemental rails arranged between the main rails 10 and are mounted on plates 22 fixed to the ties or other foundation structure. The rails are insulated from the plates 22 by wooden supports or rails 23. These wooden insulating supports are provided with projecting side flanges 24 having inclined outer faces and recessed lower faces, as shown in Fig. 2, to prevent the short circuiting of the supplemental rails or conductors 20 and 21 by moisture.

The supplemental conductors 20 and 21 are divided into sections or blocks is indicated in Fig. 1, and each section of the conductor 20 is connected to the section of the conductor 21 in the next adjacent blocks by cross conductors 25. At all danger points along the railway line, such as switches, crossings and the like, a normally open switch is interposed between the supplemental conductors 20 and 21 and is arranged to be shifted to closed position when the line at that point is not clear. In Fig. 1 the rails 10' of a side track are indicated and the switch rails 26 are shown in line with the rails 10' of the side track, so that the main line is not clear at this point. The semaphore signal 27 at this point is arranged to shift a normally open switch 28. This switch and its contact 29 are connected by conductors 30 to the signaling conductors or rails 20 and 21. The switch rails 26 are also arranged to operate a normally open switch 31 by means of a suitable connection 32, and this switch at its contact 33 is connected by conductors 34 and 30 to the signaling rails or conductors 20 and 21.

Besides the main traveling contacts 12 and 19 which engage the main conductors 11 and 10 of the power circuit, each car or train is provided with a pair of supplemental traveling contacts 34 and 35 which are in the form of suitable brushes or shoes and which are suitably supported from the car body 36 in position to engage the supplemental conductors or rails 20 and 21.

The signaling and safety equipment of each car or train comprises an electric bell 37, an incandescent lamp 38 and an electromagnet 39. The operating circuit for these parts, in the preferred arrangement, de-

rives current from the motor circuit and comprises a pair of branch conductors on each car connected respectively to the two main contacts of the car and connected to the two supplemental contacts of the car by a pole-changing switch and a second pair of branch conductors. As shown, the bell, lamp and magnet are arranged in multiple in the signaling circuit. One pole of each of these parts is connected to the negative conductor 17 of the motor circuit by the conductors 40, 41 and 42. The other poles of the bell, lamp and magnet are connected by the conductors 43, 44 and 45 to a conductor 46 that is connected to two diagonally opposite poles 47 and 47' of a double pole, double throw, pole-changing switch. The blades 48 and 49 of this switch are connected by conductors 50 and 51 to the supplemental contacts or brushes 34 and 35 which engage the signaling conductors or rails 20 and 21. The two diagonally opposite poles 52 and 52' of the switch are connected by conductors 53 and 54 to the positive conductor 13 of the motor circuit.

The conductors 42 and 53 are arranged in the manner usually employed to form an electric lighting circuit by which the car or train is illuminated. As shown, a series of incandescent lamps 55 are interposed between the conductors 42 and 53 and a resistance 56, interposed in the conductor 53, properly cuts down the amount of current supplied to the supplemental lighting or signaling circuit. The present improved signaling equipment for a car or train is thus adapted to be connected direct to the electric lighting circuit now in common use.

A resistance 57 is preferably interposed in the conductor 43 leading to the bell 37, since less current is required to operate the bell than to operate the lamp 38 or the magnet 39. The electromagnet 39 is preferably in the form of a solenoid and its core 58 is connected by a link 59 to a pivoted lever 60. This lever is connected by a link 61 to the circuit opening switch 14 and to an arm 62 which operates the controlling valve 63 of the air-brake system on the car or train.

In the diagram Fig. 1, the blocks formed by the rail sections 20 and 21 are numbered 1, 2, 3 and 4. The equipment for two cars or trains A and B are represented as running on the same track formed by the rails 10. The blades of the pole changing switch of each equipment are engaged either with the poles 47 and 52 or with the poles 47' and 52', in accordance with the direction in which the car or train is moving. If it be assumed that the cars or trains A and B are moving in the direction indicated by the arrows, the pole changing switch on each car will be in engagement with the poles 47 and 52, as shown. As represented, the car or train A is in block No. 2 and car

or train B is in the next adjacent block No. 3. Under such circumstances current will flow from the positive power conductor 11 through the trolley 12 and conductor 13 of car A, through resistance 56, conductors 53 and 54 to the terminal 52 of the switch; thence by switch blade 49, conductor 51 to the brush 35 and rail 21 of block No. 2, thence by the cross connection 25 to the conductor 20 of block No. 3. If the next following train is in block No. 4 the circuit will be broken at the gap between the rails 20 of blocks Nos. 3 and 4, but if the car or train is in block No. 3, as shown, the circuit will be completed as follows:—from rail 20 to brush 34 and conductor 50 of car B to the switch blade 48 and terminal 47 and by conductors 46, 43, 44 and 45 to the bell 37, lamp 38 and magnet 39, and from these parts by the conductors 40, 41, 42 and 17 to the wheel axle 18, wheels 19 and tracks 10 which form the negative conductor of the power circuit. The completion of this circuit will thus by the audible and visual signals 37 and 38 indicate danger ahead to the engineer or motorman of the car or train B. At the same time the solenoid 39 in car or train B will be energized and the switch 14 shifted to open position, so that the power is cut off from the motor 16 of the car. The brake lever 62 will also be shifted automatically to apply the brakes to the car or train. As soon as the car or train A advances into block No. 1 the signaling circuit will be broken at the gap between the rail sections 20 of blocks Nos. 2 and 3 and the circuit through the bell 37, lamp 38 and magnet 39 of car or train B will be opened and the engineer or motorman of this car or train will be notified that he may safely proceed. If the trains A and B were traveling in the direction the reverse of that indicated by the arrows and occupied similar positions the bell, lamp and magnet of train A would be operated in a similar manner. The signaling and safety devices in any car or train are thus operated whenever there is another car or train in the next adjacent block ahead, but the signaling and safety devices in the leading car or train are not affected.

As stated, normally open switches, such as the switches 28 and 31, are arranged at danger points along the line and are closed when the line is not clear. These switches are interposed between the block conductors 20 and 21. If any car or train enters a block in which one of these switches is closed the signaling and safety devices thereof are operated. For example, in the diagram car A is represented as being in the same block with the switches 28 and 31 which are in their closed or danger positions. Under such circumstances current will flow as follows: from the positive

power conductor 11 through the trolley 12 and conductor 13 of car A and, as before, through the resistance 56, conductors 53 and 54, switch terminal 52, switch blade 49, conductor 51 and brush 35 to the rail 21, thence by the conductors 30 and 34 to one or both of the switches 28 and 31 to the conductor rail 20, thence by the brush 34, conductor 50, switch blade 48, conductors 46, 43, 44 and 45, through the bell 37, lamp 38 and magnet 39 and thence, as before, through conductors 40, 41, 42 and 17 to the traveling contact wheel 19 and the negative power conductor or track 10. The power circuit to the motor 16 of car A will then be opened by the circuit breaking switch 14, the brake-controlling valve 63 will be operated, and the signals 37 and 38 indicating danger ahead to the motorman or engineer of car or train A. These signals will remain at danger until the line is clear and the switches 28 and 31 restored to their normal open position.

While the preferred arrangement is set forth and illustrated it will be understood that the details can be varied without departure from the essentials of the invention as defined in the claims.

I claim as my invention:—

1. In electric railways, the combination with main power conductors, of supplemental line conductors divided into blocks with one conductor of each block connected to the opposite conductor of a different block, and a car equipment comprising a motor for propelling the car, an operating circuit therefor connected to said main power conductors, and two pairs of branch conductors on the car electrically connected respectively to said main power conductors and said supplemental conductors, a pole-changing switch for connecting said pairs of branch conductors, and a signal interposed in one of said branch conductors, substantially as described.

2. In electric railways, the combination with main power conductors and supplemental line conductors, said supplemental line conductors being divided into blocks with one conductor of each block connected to the opposite conductor of the next adjacent block, of a car equipment comprising a motor for propelling the car, an operating circuit therefor interposed between said power conductors, two pairs of branch conductors on the car electrically connected respectively to said main power conductors and said supplemental line conductors, a double pole, double throw, pole-changing switch connecting said pairs of branch conductors, and a signal interposed in one of said branch conductors, substantially as described.

3. In railways, the combination with main power conductors and parallel supple-

mental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor of each block connected to the opposite conductor of the next adjacent block, of a car equipment comprising main and supplemental traveling contacts respectively engaging said main and supplemental conductors, two pairs of branch conductors on the car connected, one pair to said main contacts and the other pair to said supplemental contacts, a double pole, double throw, pole-changing switch connecting said pairs of branch conductors, and a signal interposed in one of said branch conductors, substantially as described.

4. In railways, the combination with main power conductors and parallel supplemental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor of each block connected to the opposite conductor of the next adjacent block, of a car equipment comprising main and supplemental traveling contacts respectively engaging said main and supplemental conductors, two pairs of branch conductors on the car connected, one pair to said main contacts and the other pair to said supplemental contacts, a pole-changing switch connecting said pairs of branch conductors, an electromagnet interposed in one of said branch conductors, and a brake controlling device operated by said magnet, substantially as described.

5. In an electric railway, the combination with main power conductors and parallel supplemental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor of each block connected to an opposite conductor of a different block, of a car equipment comprising a motor for propelling the car, an operating circuit therefor interposed between said main conductors, two pairs of branch conductors on the car electrically connected respectively one pair to said main conductors and the other pair to said supplemental conductors, a pole-changing switch for connecting said pairs of branch conductors, an electromagnet interposed in one of said branch conductors, and a circuit breaking switch for said motor circuit controlled by said magnet, substantially as described.

6. In an electric railway, the combination with main power conductors and parallel supplemental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor of each block connected to the opposite conductor of the next adjacent block, of a car equipment comprising main and supplemental traveling contacts engaging said main and supplemental conductors,

a motor for propelling the car, an operating circuit therefor connected to said main contacts, two pairs of branch conductors on the car, one pair connected to said main contacts and the other pair to said supplemental contacts, a double pole, double throw, pole-changing switch connecting said pairs of branch conductors, a signal interposed in one of said branch conductors, a magnet interposed in one of said branch conductors, and a circuit breaking switch for said motor circuit controlled by said magnet, substantially as described.

7. In an electric railway, the combination with main power conductors and parallel supplemental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor of each block connected to the opposite conductor of the next adjacent block, of a car equipment comprising main and supplemental traveling contacts engaging said main and supplemental conductors, a motor for propelling the car, an operating circuit therefor connected to said main contacts, two pairs of branch conductors on the car, one pair connected to said main contacts and the other pair to said supplemental contacts, a double pole, double throw, pole-changing switch connecting said pairs of branch conductors, a magnet interposed in one of said branch conductors, and a brake controlling device and a circuit breaking switch for said motor circuit operated by said magnet, substantially as described.

8. In a railway, the combination with main power conductors and parallel supplemental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor of each block connected to the opposite conductor of a different block, of normally open switches at danger points interposed between said supplemental conductors and arranged to be shifted to closed position when the line is not clear, and a car equipment comprising main and supplemental traveling contacts arranged to engage said main and supplemental conductors respectively, two pairs of branch conductors on the car, one pair connected to said main contacts and the other pair to said supplemental contacts, a pole-changing switch for connecting said pairs of branch conductors, and an electric signal interposed in one of said branch conductors, substantially as described.

9. In a railway, the combination with main power conductors and parallel supplemental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor of each block connected to the opposite conductor of a different block, of normally open switches at danger points interposed between said supplemental conductors and arranged to be

shifted to closed position when the line is not clear, and a car equipment comprising main and supplemental traveling contacts arranged to engage said main and supplemental conductors respectively, two pairs of branch conductors on the car, one pair connected to said main contacts and the other pair to said supplemental contacts, a pole-changing switch for connecting said pairs of branch conductors, a signal and a magnet interposed in one of said branch conductors, and a brake controlling device operated by said magnet, substantially as described.

10. In an electric railway, the combination with a track and a main trolley conductor, of a pair of supplemental conductors extending along the railway line and divided into blocks with one conductor of each block connected to an opposite conductor of a different block, of a car equipment comprising a trolley engaging said trolley conductor, a pair of brushes engaging said supplemental conductors, a motor for propelling the car, an operating circuit therefor connected to said trolley and to the car wheels, two pairs of branch conductors on the car, one pair connected to the opposite sides of said motor operating circuit and the other pair to said brushes, a double pole, double throw, pole-changing switch for connecting said pairs of branch conductors, and a signal interposed in one of said branch conductors, substantially as described.

11. In an electric railway, the combination with main conductors and parallel supplemental conductors extending along the railway line, said supplemental conductors being divided into blocks with one conductor on each block connected to an opposite conductor of a different block, of normally open switches at danger points interposed between said supplemental conductors and arranged to be shifted to closed position when the line is not clear, and a car equipment comprising main and supplemental traveling contacts arranged to engage said main and supplemental conductors respectively, a motor for propelling the car, an operating circuit therefor connected to said main contacts, two pairs of branch conductors on the car, one pair connected to said main contacts and the other pair to said supplemental contacts, a pole-changing switch for connecting said pairs of branch conductors, an electromagnet interposed in one of said branch conductors, and a circuit breaking switch for said motor operating circuit controlled by said magnet, substantially as described.

12. In an electric railway, the combination with a track and a main trolley conductor, of a pair of supplemental conductor rails extending along the railway line and divided into blocks, one rail of each block being connected to the opposite rail of the

next adjacent block, of normally open switches at danger points interposed between said supplemental conductors arranged to be shifted to closed position when the line is not clear, and a car equipment comprising a trolley engaging said trolley conductor, a pair of brushes engaging said supplemental rails, a motor for propelling the car, an operating circuit therefor connected to said trolley and to the car wheel, two pairs of branch conductors on the car, one pair connected to the opposite sides of said motor operating circuit and the other pair connected to said brushes, a double pole, double throw, pole-changing switch connecting said pairs of branch conductors, a signal interposed in one of said branch conductors, a magnet interposed in one of said branch conductors, and a circuit breaking switch for said motor operating circuit controlled by said magnet, substantially as described.

13. In an electric railway, the combination with a track and a main trolley conductor, of a pair of supplemental conductor rails extending along the railway line and divided into blocks with one rail on each block connected to an opposite rail of a different block, of a car equipment comprising a trolley engaging said trolley conductor, a pair of brushes engaging said supplemental rails, a motor for propelling the car, an operating circuit therefor connected to said trolley and to the car wheel, a pair of branch conductors on the car connected to the opposite sides of said motor operating circuit and forming an electric lighting circuit, an electric signal interposed in one of said branch conductors, a second pair of branch conductors on the car connected to said brushes, and a double pole, double throw, pole-changing switch connecting said pairs of branch conductors, substantially as described.

14. In a railway, the combination of a pair of conductors divided into blocks and a continuous conductor extending along the railway line, one of the divided conductors of each block being connected to the opposite conductor of a different block, of a car equipment comprising traveling contacts engaging said continuous conductor and said divided conductors, an electric motor for propelling the car, an operating circuit for said motor connected on one side to said continuous conductor contact, two pairs of

branch conductors on the car, one pair connected to the opposite sides of said motor operating circuit and the other pair to said divided conductor contacts, a pole-changing switch for connecting said pairs of branch conductors and a signal interposed in one of said branch conductors, substantially as described.

15. In a railway, the combination with the track, of a pair of parallel conductors extending along the railway line and divided into blocks with one conductor of each block connected to an opposite conductor of a different block, of a car equipment comprising a pair of brushes engaging said divided conductors, an electric motor for propelling the car, an operating circuit for said motor connected on one side to the car wheels, two pairs of branch conductors on the car, one pair connected to the opposite sides of said motor operating circuit and the other pair to said brushes, a double pole, double throw, pole-changing switch for connecting said pairs of branch conductors, an electromagnet in one of said branch conductors, and a safety device controlled by said electromagnet, substantially as described.

16. In a railway, the combination of a pair of parallel conductors divided into blocks and a continuous conductor extending along the railway line, one of the divided conductors of each block being connected to the opposite conductor of a different block, normally open switches at danger points interposed between said divided conductors and arranged to be shifted to closed position when the line is not clear, and a car equipment comprising traveling contacts engaging said continuous and said divided conductors, an electric motor for propelling the car, an operating circuit connected on one side to said continuous conductor contact, two pairs of branch conductors on the car, one pair connected to the opposite sides of said motor operating circuit and the other pair to said divided conductor contacts, a pole-changing switch for connecting said pairs of branch conductors, a magnet interposed in one of said branch conductors and a safety device controlled by said magnet, substantially as described.

HENRY C. BENNECKE.

Witnesses:

HARRY L. CLAPP,
CLARA A. NORTON.