(No Model.) 2 Sheets—Sheet 1.

E. LANGEN.

BLOCK SYSTEM AND APPARATUS ON ELECTRIC RAILWAYS.

No. 538,590. Patented Apr. 30, 1895.

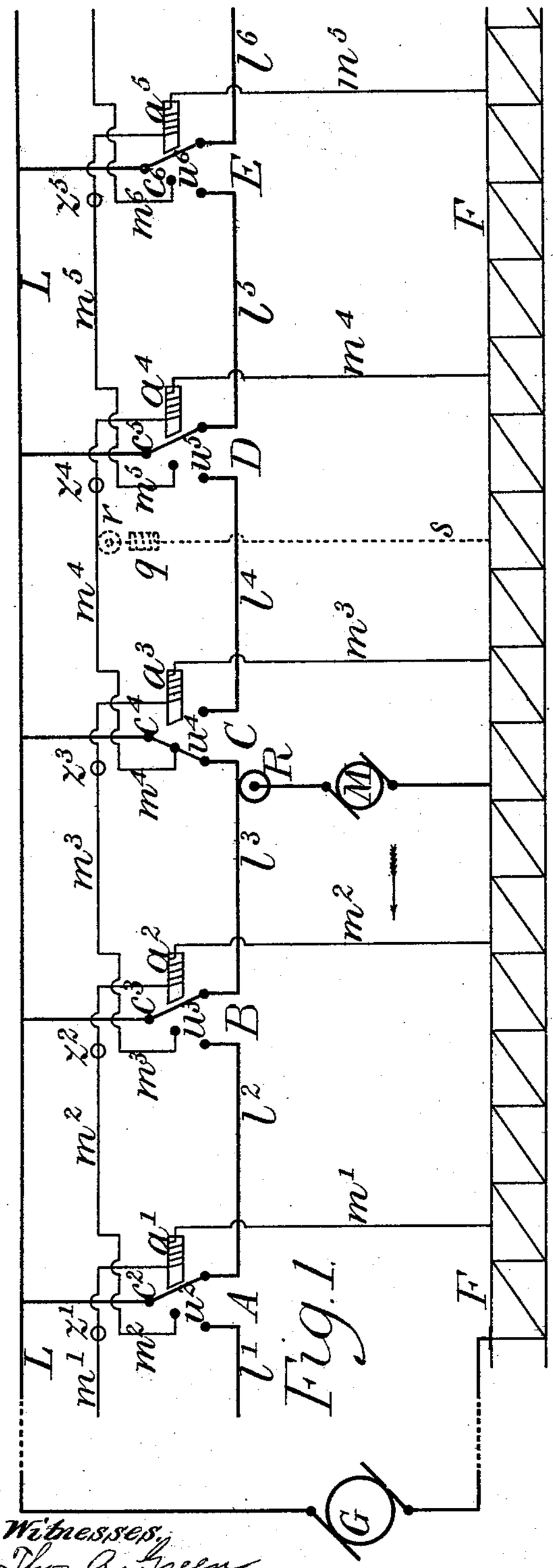

Fig. 1.

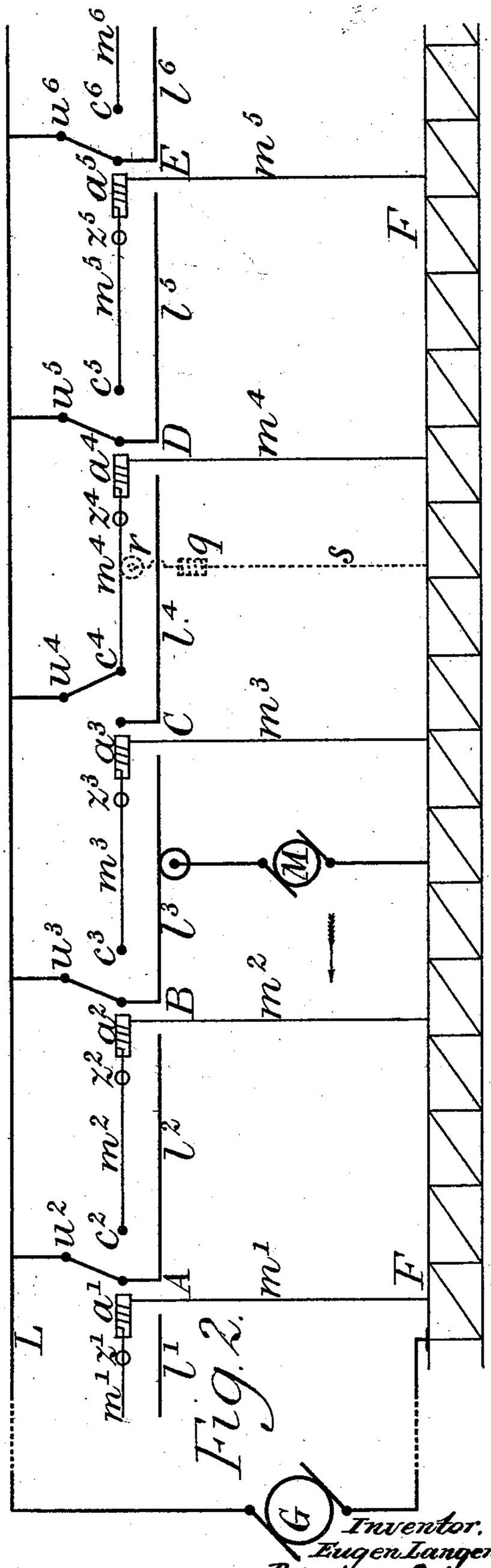

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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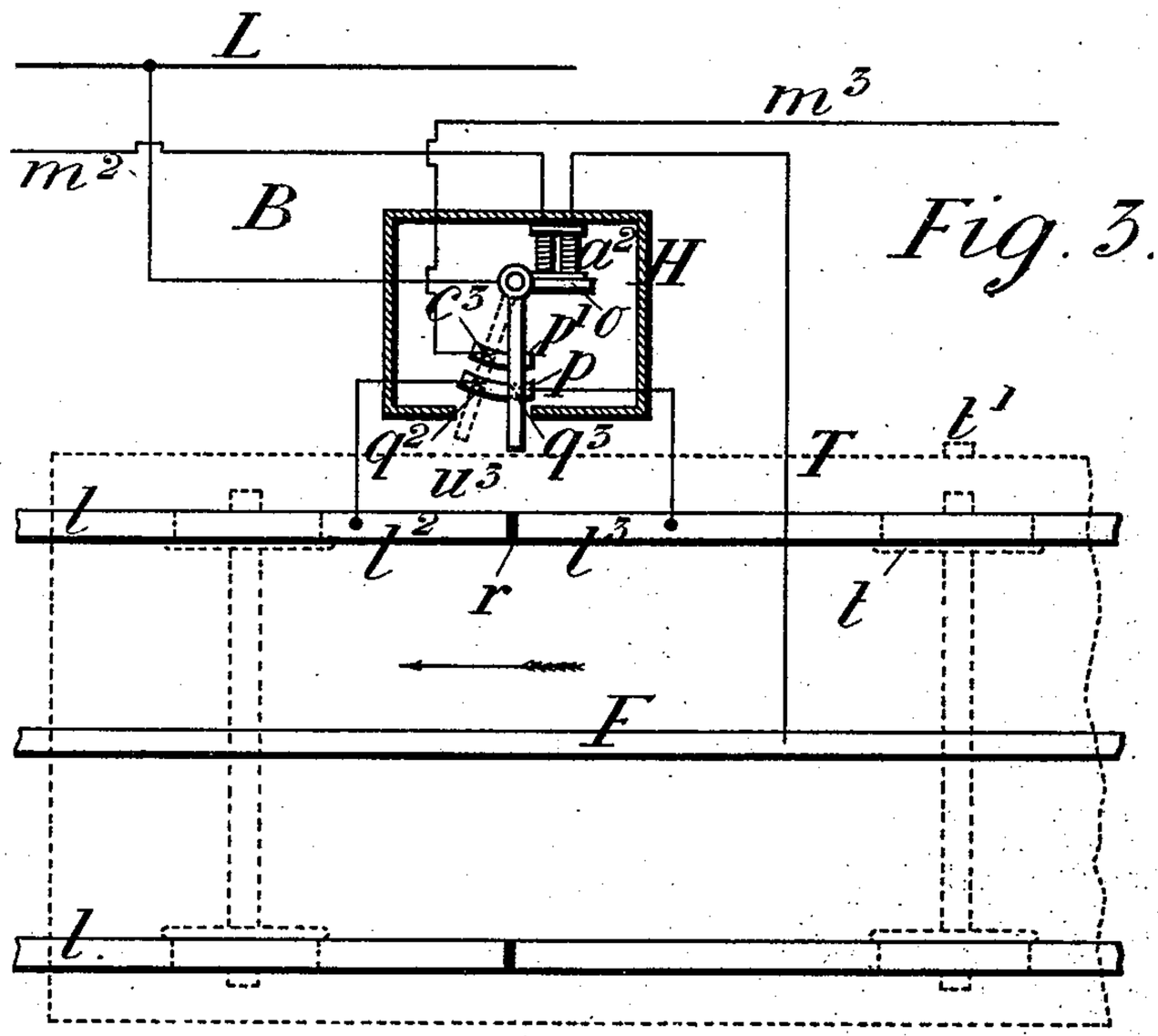

Fig. 3.

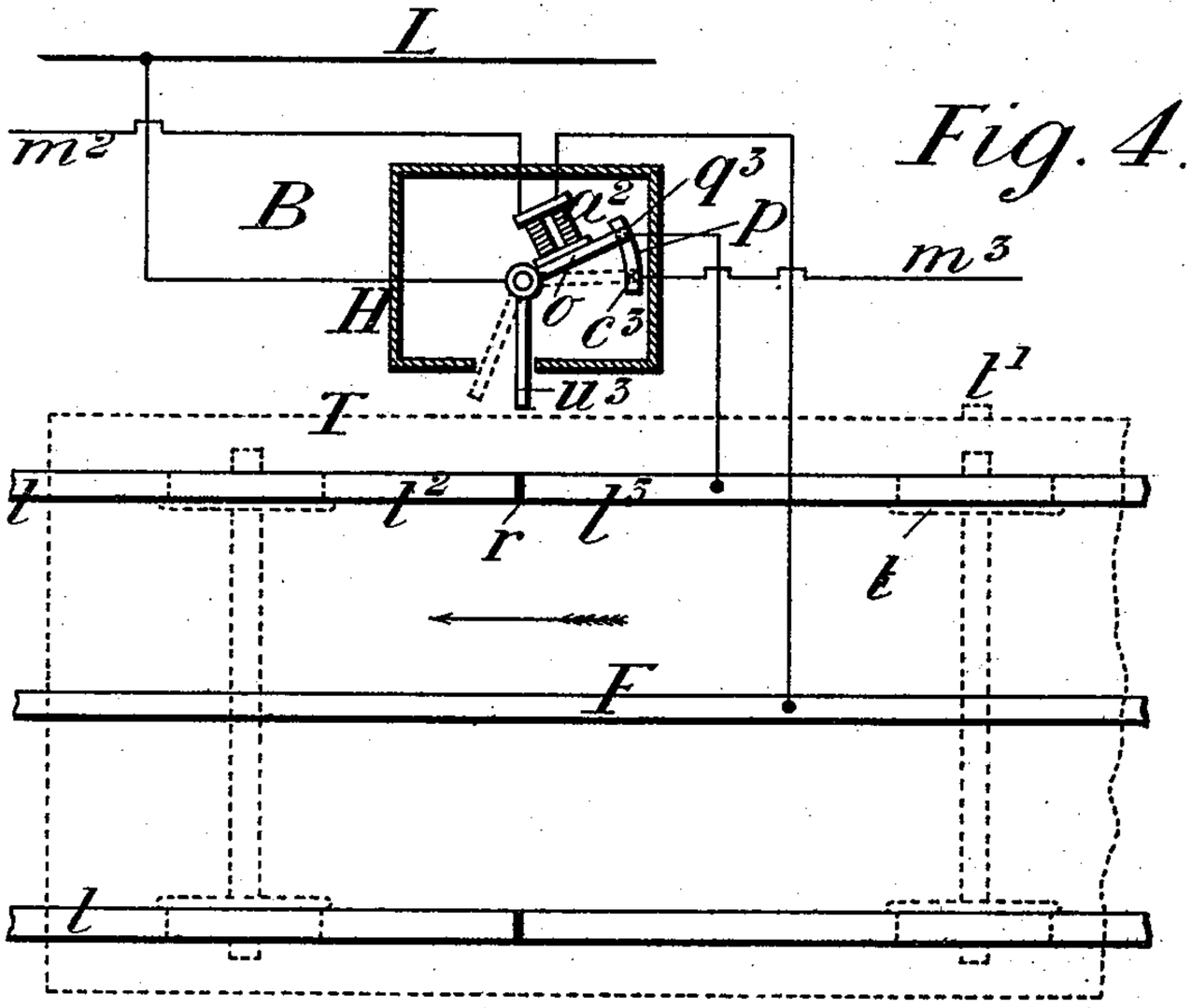

Fig. 4.

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UNITED STATES PATENT OFFICE.

EUGEN LANGEN, OF COLOGNE, GERMANY.

BLOCK SYSTEM AND APPARATUS ON ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 538,590, dated April 30, 1895.

Application filed July 16, 1894. Serial No. 517,720. (No model.) Patented in France June 28, 1894, No. 239,654; in Belgium June 29, 1894, No. 110,746; in Switzerland July 2, 1894, No. 8,632; in Turkey October 29, 1894, No. 423, and in Italy November 10, 1894, LXXIII, 306.

To all whom it may concern:

Be it known that I, EUGEN LANGEN, a citizen of Prussia, residing at Cologne, in the Empire of Germany, have invented a new and useful Improved Block System on Electric Railways and Apparatus Therefor, (for which I have obtained Letters Patent in France, dated June 28, 1894, No. 239,654; in Belgium, dated June 29, 1894, No. 110,746; in Switzerland, dated July 2, 1894, No. 8,632; in Turkey, dated October 29, 1894, No. 423, and in Italy, dated November 10, 1894, LXXIII, 306,) of which the following is a specification.

My invention relates to an improved block system on electric railways and apparatus therefor, which consists mainly in providing along the line a contact conductor divided into block sections which are connected to the main conductor for supplying current to the vehicles through switches that are automatically actuated by a vehicle on a section in such manner that the preceding section which the vehicle has just left is thereby thrown out of circuit, so that any vehicle entering such section will not receive current and will consequently remain stationary, while when the first named vehicle leaves its section, it automatically puts the preceding section in circuit again so that the vehicle thereon can proceed. There is furthermore provided an auxiliary conductor divided into sections corresponding to those of the contact conductor and so arranged in combination with switches that when a section of the contact conductor is thrown out of circuit, the corresponding section of the auxiliary conductor is put in circuit and is thereby made to excite an electro-magnetic device that brings the switch of the preceding section back into its original position.

In Figures 1 and 2 of the accompanying drawings are shown, diagrammatically, two arrangements for carrying out my said invention; and Figs. 3 and 4 are sectional plan views showing examples of reversing switches for carrying out the methods described with reference to Figs. 1 and 2.

In the figures L indicates the main conductor of the line for supplying electrical energy from the generator G to the motors on the trains.

F is the iron structure or rails of the line and l' l^2 l^3, &c., the separate electrical contact conductors of the several block sections A—B, B—C, C—D, &c. The contact conductors are not permanently connected to the main conductor, but they are put in conducting connection therewith in Fig. 1 by means of reversing switches u^2 u^3 u^4, &c., and in Fig. 2 by means of cutting out switches u^2 u^3 u^4, &c.

From the separate contact conductors, for example from the conductor l^3, the electric current passes through the contact roller R to the carriage motor M, from which it passes to the rails F and thence back to the current generator. The usual position of the switches is that shown at A B D and E. When the carriage enters a block section, for instance C—B, it throws by means of a suitable mechanical device the reversing switch u^4 of Fig. 1 to the left hand or u^4 of Fig. 2 to the right hand. According to the arrangement of Fig. 1 the contact conductor l^3 now receives current through the two switches u^3 and u^4, while in Fig. 2 the current to the contact conductor l^3 still only flows through the switch u^3. This is the only difference between the two arrangements of Figs. 1 and 2. By the throwing over of the switch u^4 not only is the contact conductor l^4 thrown out of circuit, but a contact is simultaneously made at c^4 Figs. 1 and 2 so that the auxiliary conductor m^4 is now supplied with current. By this means the electro magnetic device a^4 is actuated whereby the switch u^5 which was previously in the position shown at u^4 is drawn back into its original position. The contact conductor l^4 is now, in both arrangements, without current while auxiliary conductor m^4 receives current. This condition remains until the carriage has passed the block station B and throws over the switch u^3. The above described action is now repeated. The contact c^3 is made, the conductor m^3 receives current, the switch u^4 is drawn back again, the contact conductor l^4 is put in circuit again and the two conductors l^3 and m^4 are cut out. Each contact conductor (for example l^4) therefore remains without cur-

rent so long as the following block section (B—C) is occupied by a carriage. During the same time the corresponding auxiliary conductor m^4, which is usually without current, receives current.

The construction of the switches u in Fig. 1 is such that the mechanical reversal of the same by a passing train can only be effected when the corresponding electro-magnetic device a is without current. If now, while section B—C is still occupied by a carriage, a second carriage passes beyond block station D on to the section C—D, it will not receive any current, and consequently, if the section is of sufficient length and has suitable conditions of levels, it will come to a standstill, and can only start again after the carriage in front has passed beyond the block station B, so that the occurrence of a collision is impossible.

Assuming that a carriage is leaving section D—C and passing on to section C—B, it moves switch u^4 from the position shown at D into the position shown at C, whereby the conductor section l^4 is put out of connection with the main conductor L, while contact is made at c^4, whereby the electro-magnet conductor section m^4 is put in connection with L, thereby exciting electro-magnet a^4 and causing it to bring switch u^5 over from contact c^5 to the position shown in which it puts the conductor section l^5 in connection with the main conductor L again. If now while the carriage is running on section C—B, a carriage should pass beyond station D on to section D—C, it will not receive any current from l^4 and consequently it will come to a stand still. As soon as the carriage on section C—B arrives at B, and passes on to section B—A, it effects the reversal of switch u^3, thereby disconnecting l^3 from L and connecting m^3 with L. Electro-magnet a^3 will now effect the reversal of switch u^4 again, thereby putting conductor section l^4 in circuit again, so that the carriage on section C—D can now proceed again.

Figs. 3 and 4 show, by way of example, in plan, constructions of reversing switches for carrying out the methods of working described with reference to Figs. 1 and 2. These figures illustrate the switch apparatus at station B in each case.

Within a closed box H, Fig. 3, is the pivoted insulated reversing switch u^3 connected at its point by a wire to the main conductor L, suitably mounted in an insulated manner underground. The switch u^3 has a tail o carrying the armature of an electro-magnet a^2 also fixed in the box H, and having one end of its winding connected to the return conductor F mounted in an insulated manner between the rails l of the railway, while the other end of the winding is connected by a wire m^2 to the contact c^2 of the next station (A, Fig. 1). The switch u^3, in turning on its pivot, slides upon two bars p, p' of insulating material fixed in the box H, the bar p having two contact plates q^2, q^3, connected by wires respectively with the rail sections l^2, l^3 of the line, these rail sections being insulated from each other at r, and carried in an insulated manner on the permanent way, so that they serve as the sectional contact conductors l, Fig. 1, with which the wheel t of the vehicle T (shown in dotted lines) makes contact so as to convey the current in any suitable known manner to the motor on the vehicle, the return conductor from which makes contact in any suitable manner with the main return conductor F. The bar p' carries a contact plate c^3 which is connected by a wire m^3 with the one end of the winding of the electro-magnet a^3 of the station C, Fig. 1. The reversing switch u^3 projects through a slot in the box H at such a level as to be about level with the rails, and the carriage has a downward projecting arm t', which, when the wheel t arrives at the end of the rail l^3, comes in contact with the end of the reversing switch, and moves it over from the position shown in full lines, in which it establishes the connection between the main conductor L and the rail section l^3, into the position shown in dotted lines in which it breaks the connection between L and l^3, establishes the connection between L and l^2, and also establishes the connection between L and the contact c^3 and m^3 leading to the winding of electro-magnet a^3 of station C, so as to cause this to attract the armature of switch u^4 at that station, and thus put the rail section l^4 in connection with L again. In like manner, when the carriage actuates the reversing switch u^2 of station A, the electro-magnet a^2 is put in action so as to attract the tail o of switch u^3, and thereby bring this back into the position making contact with q^3 and l^3.

The construction shown at Fig. 4 is substantially the same as that above described, the only difference being that there is only one bar p of insulating material having the two contacts q^3 connected with rail section l^3 and c^3 connected by wire m^3 with electro-magnet a^3 of station C, also, instead of the arm u^3 being the contact switch, its tail o constitutes the same, so that when in the position shown in full lines the switch makes contact between L and the rail section l^3, while when moved over to the dotted position by the arm t' of the carriage T, it breaks that connection, and connects the electro-magnet a^3 with the main conductor L, the action being as already described with reference to Fig. 2.

If the length or condition of levels of the several block sections are not such as to insure that a carriage entering the same with a certain impetus must come to a standstill upon it, there must be provided on the carriage, in addition to the roller R running on the conductor l, a second contact roller r which runs on the conductor m. By means of this contact roller, the carriage only receives current if it is upon a section the next section in advance of which is occupied by a carriage. If now the contact roller r be combined with an alarm signal and an automatic

brake *q* with return connection *s* to the rails, the carriage can be effectually brought to a standstill even on an incline, in the event of its entering with a certain momentum a block section which is cut out of circuit.

The auxiliary conductors *m* can, in addition, be provided with signaling devices Z situated at the several block stations and serving to convey to the guard or driver of a carriage signals for stopping or starting.

With electric railways in towns in which the stations may occur at short intervals, the division of the block sections can be so arranged that a carriage waiting at a station remains without current and is thus prevented from starting so long as the preceding carriage is still on the next section or station, so that even without the automatic brake appliance, and with any conditions of level, there would always be perfect security against collisions.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. In electric railways, a contact conductor divided into block sections, an auxiliary contact conductor divided into corresponding block sections, a switch on each contact conductor section adapted to be moved by a passing vehicle so as to cut such section out of circuit and to put the corresponding auxiliary conductor section in circuit, and an electromagnet on each auxiliary conductor section adapted to move the switch of the preceding section so as to put this into circuit again, when the said auxiliary conductor section receives current, substantially as described.

2. In an electric railway operated by a contact conductor *l* and an auxiliary contact conductor *m*, both divided into separate block sections, a vehicle having an electrically operated brake and signal apparatus, and a contact device connected with such brake and signal device and making contact with the auxiliary conductor section, so that when such conductor section receives current the electric brake and the signal of the vehicle will be operated, substantially as described.

3. In an electric railway, a contact conductor supplying current to the vehicles and an auxiliary contact conductor, both being divided into block sections and a switch device adapted by its movement in one direction to throw a main contact conductor section out of circuit and an auxiliary conductor section into circuit, and by its movement in the other direction to put a main contact conductor section into circuit and an auxiliary conudctor section out of circuit, substantially as and for the purposes described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 30th day of June, A. D. 1894.

EUGEN LANGEN.

Witnesses:
FRITZ SCHROEDER,
SOPHIE NAGEL.