No. 745,436. PATENTED DEC. 1, 1903.

F. W. HILD.

ELECTRIC RAILWAY SYSTEM.

APPLICATION FILED APR. 28, 1900.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

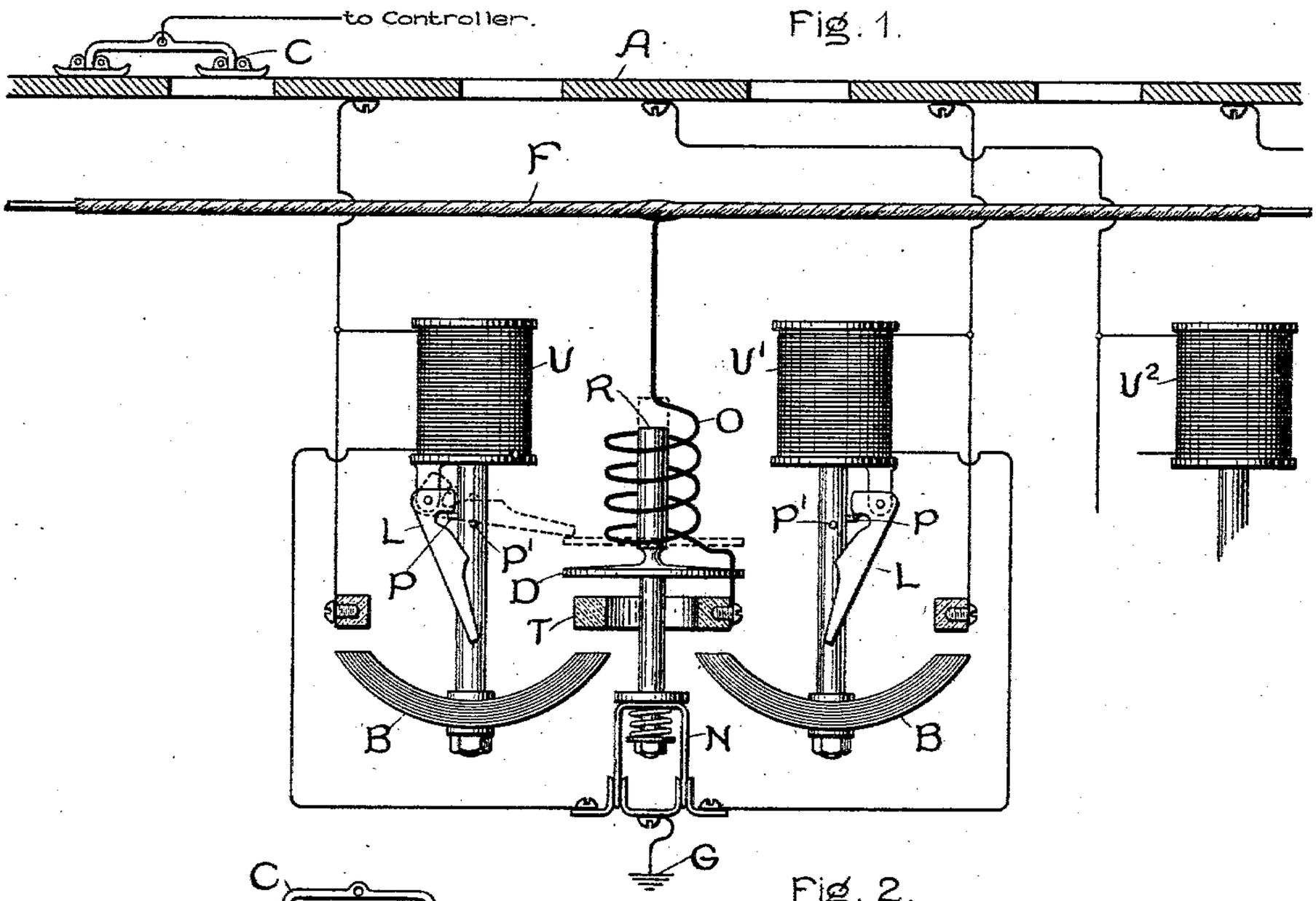
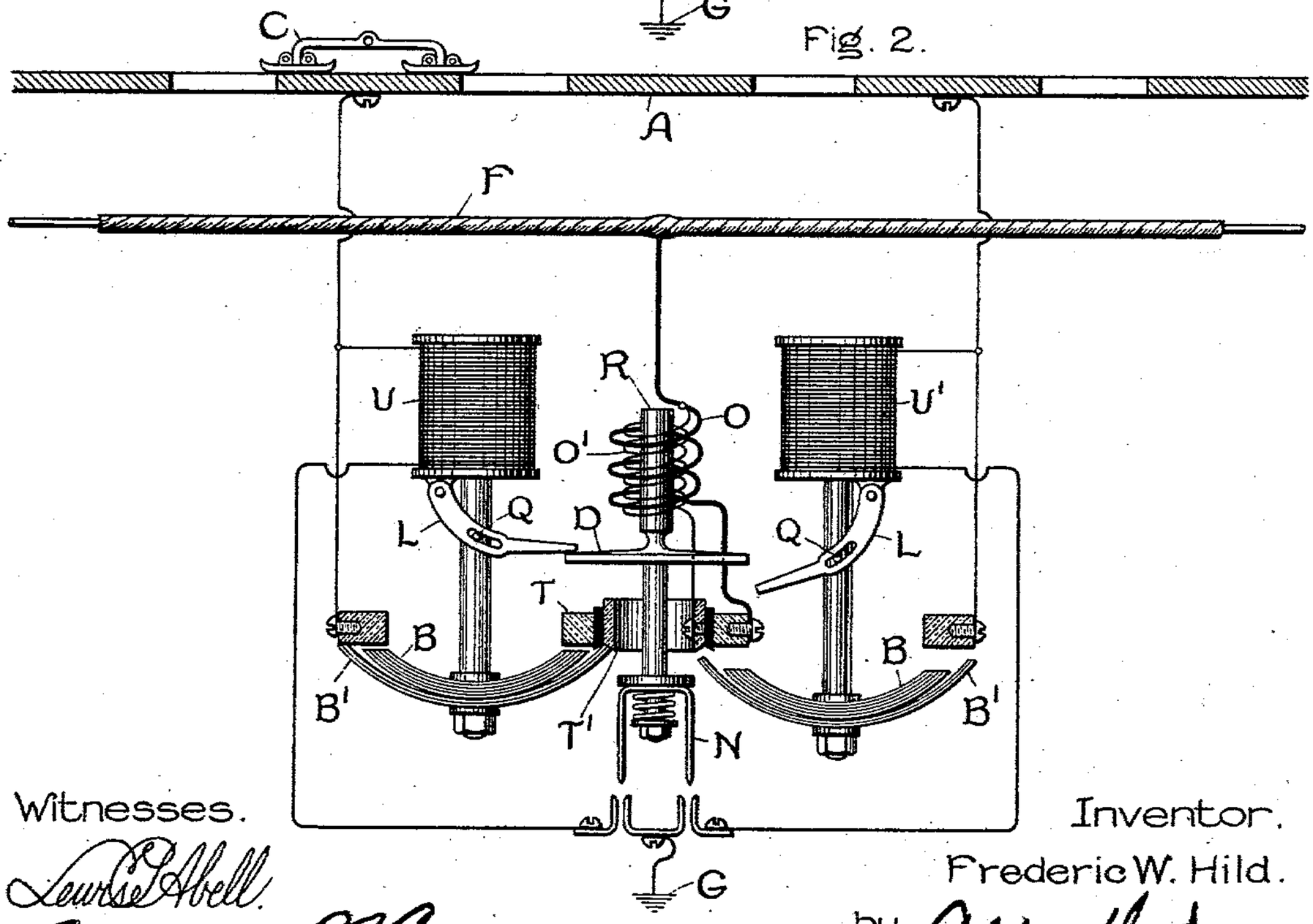


Fig. 2.



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ELECTRIC RAILWAY SYSTEM.

APPLICATION FILED APR. 28, 1900.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

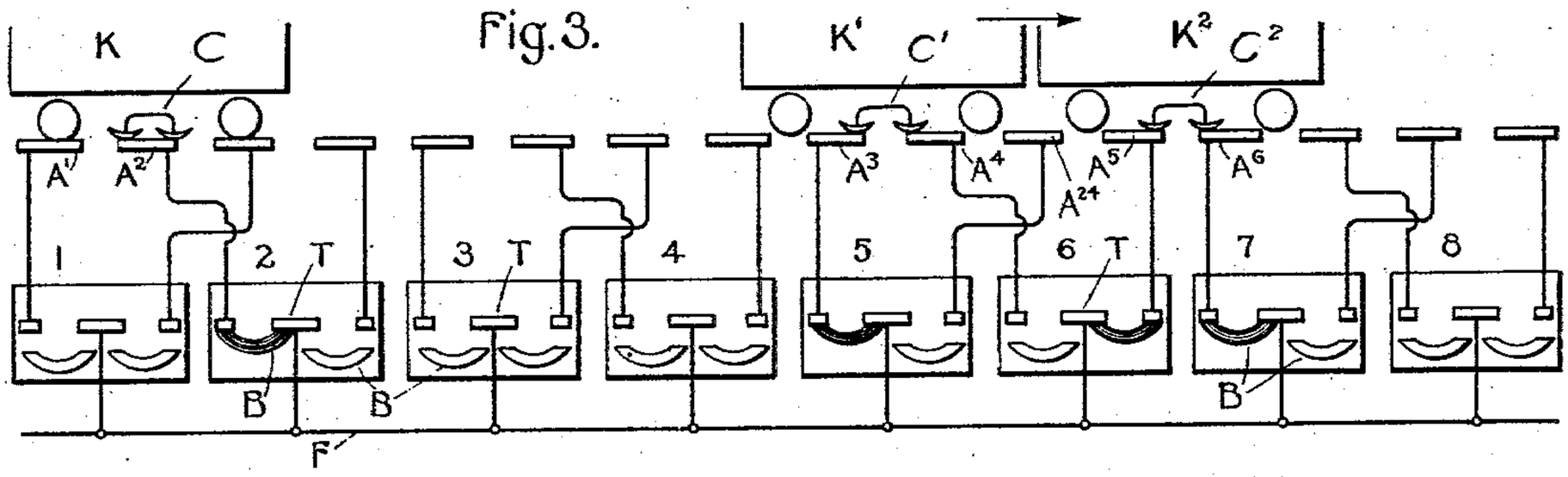


Fig. 4.

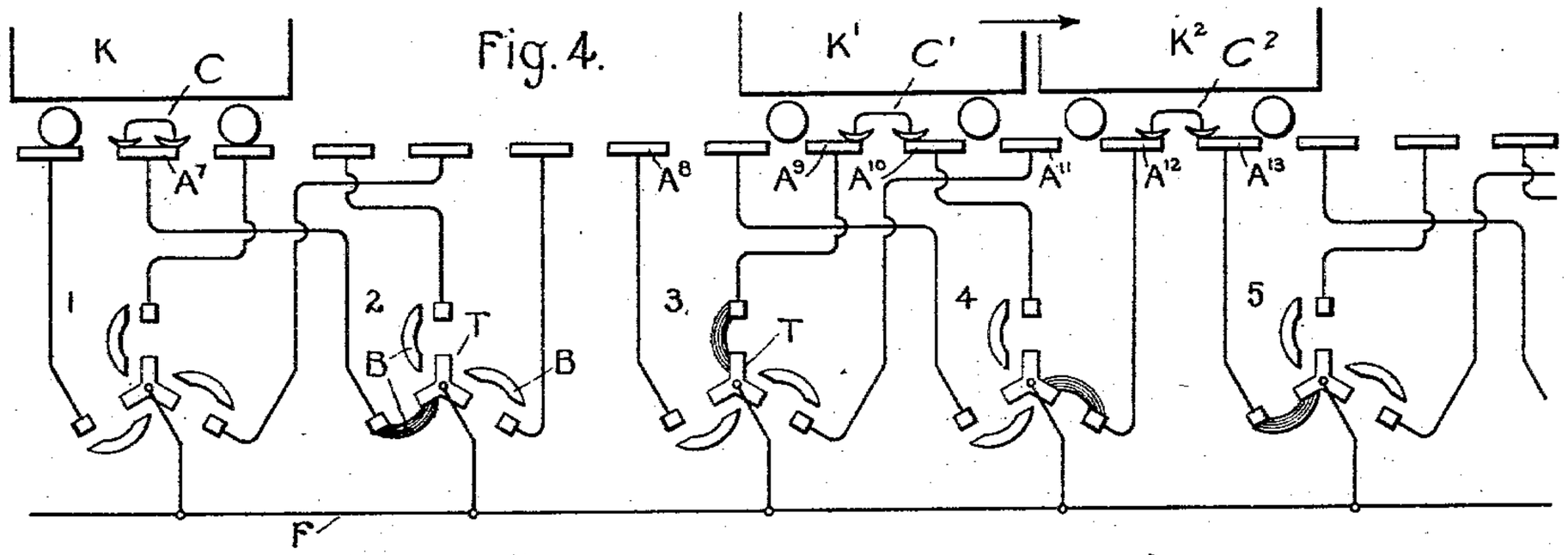
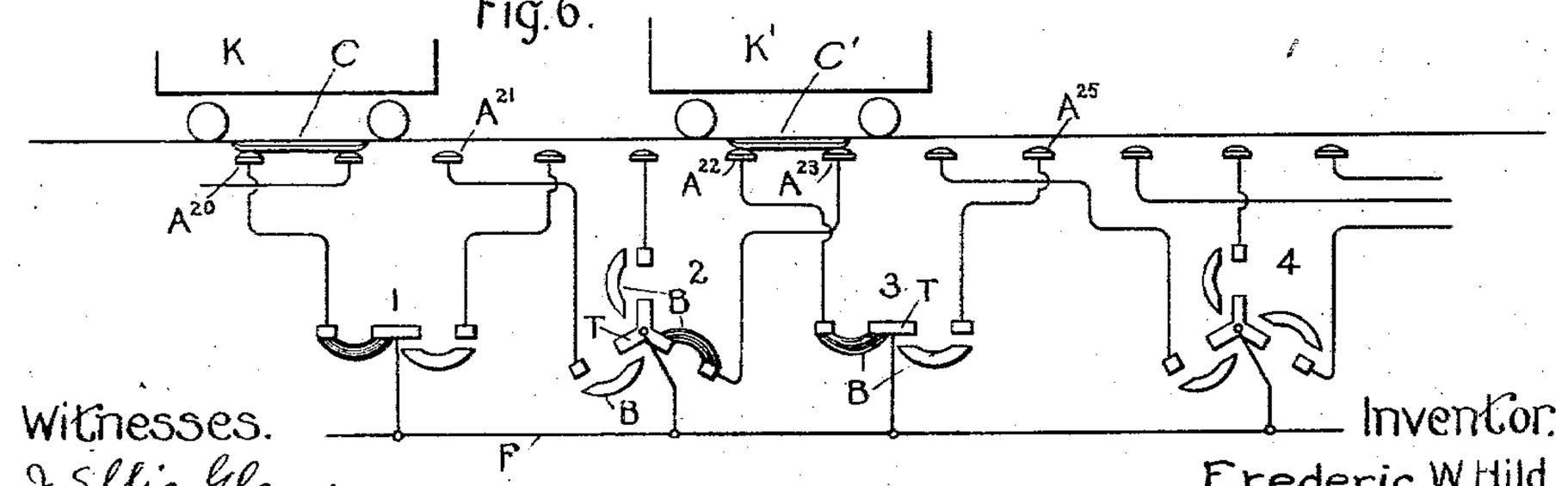


Fig. 5

Fig. 6.



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UNITED STATES PATENT OFFICE.

FREDERIC W. HILD, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 745,436, dated December 1, 1903.

Application filed April 28, 1900. Serial No. 14,649. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC W. HILD, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric-Railway Systems, of which the following is a specification.

This invention relates to improvements in electric-railway systems and switches adapted for use therein.

Of the drawings, Figure 1 is a diagrammatic illustration of the invention. Fig. 2 is a similar illustration with additional improvements; and Figs. 3 to 6, inclusive, are diagrams of sectional conductor and surface-contact railway systems embodying my invention.

In Fig. 1, U and U′ represent the coils of two electromagnetic switches, which are grouped together in a set, each of said coils being connected between a section of working conductor A and ground G. The switch-brushes B are adapted to connect each conductor-section with the feeder through the series coil O. The collector C is carried by the car and connected to the motor-controller thereon and is of sufficient length to bridge two consecutive conductor-sections. The series coil O is connected with the contact T, which serves for both the switches in the set, and when the switch B is closed by the engagement of the collector C with the corresponding conductor-section the coil O is energized to raise the core R. This core R carries contacts N, which normally connect both of the shunt-coils U and U′ to ground; but when the coil is actuated the contacts N are raised, so that both shunt-coils are open-circuited. A pivoted lever L is raised when the switch B closes by the pin P, carried by the switch, to a position above the disk D, which is carried by the core R, so that when the switch B is closed and the coil O energized the disk D engages with the lever L, which engages beneath the pin P′ to hold the switch B closed, although the coil U has been open-circuited by the raising of the contact N. The group of shunt-coils U and U′ are not connected with two consecutive conductor-sections; but a shunt-coil of another group is actuated between the times that the shunt-coils of the first group are actuated.

In Fig. 2 is shown the coil O, connected to contact T, as in Fig. 1. In addition a second series coil O′ is connected to a second contact T′, insulated from the contact T. The coil O′ has a greater number of turns than the coil O, the latter being shown of thick wire in order to distinguish from the coil O′; but in practice the material of the coil O will preferably be of the same size as that of the coil O′. The brush B is provided with an extra portion B′, which is adapted to engage with the second contact T′. The two coils are normally connected in parallel with one or both of the brushes; but as the coil O′ has a greater number of turns, and hence a greater length of wire and resistance, most of the current is shunted through the coil O, so that the lifting power of the coil O′ is very small. When for any reason the current flowing from the feeder to the car through the coil O is not sufficient to maintain the switch B in its closed position, the switch tends to drop, whereat all the current flows through the coil O′, which has a greater number of turns than O and holds the switch portion B′ closed against the contact T′. The lifting power of the coil O′ is greatly increased, although a smaller current is flowing from the line, because this entire smaller current flows through it, whereas when the coil O was in circuit only a small portion of the greater current flowed through the coil O′. A bad contact of the brush B with the contact T may introduce sufficient resistance into the circuit of the coil O so that sufficient current will be shunted through the coil O′ to keep the switch closed. The lever L shown in Fig. 2 has the same function as that shown in Fig. 1, but a slot and pin are employed instead of the two pins. Coils U and U′ should generally pull the switches up with sufficient force to cause the brush B to engage with the contact T; but in case the condition should be such that one of these coils should not do this, but only pull the brush B′ into contact with the contact T′, the coil O′ would be adapted to raise the core R.

This system embodies features which may,

if desired, be advantageously employed in a block or safety system, as it is clear that the shunt-coils U and U′ of the electromagnetic switches may be connected with any desired conductor-sections in any desired manner, and when one of the shunt-coils of a group of switches is energized all the other shunt-coils of the group are open-circuited through the contacts N, and the conductor-sections connected with the last-mentioned coils are deënergized and a car moving onto one of said sections is deprived of current. It is also clear that any desired number of electromagnetic switches may be grouped together and controlled by a single plate D, operated by the series coil or coils of said group.

Figs. 3 to 6, inclusive, are diagrammatic illustrations of railway systems embodying various modifications of my invention. For the sake of clearness and in order not to complicate the drawings unnecessarily I have omitted from these figures the switch-actuating coils U and U′, the series coils O and O′, the contact-plates D, and the contacts N. (Shown in Figs. 1 and 2.) The system shown in Fig. 3 corresponds to that shown in Figs. 1 and 2, in which but two switches are used in a single group, while in the systems shown in Figs. 4 and 5 three switches are used in each group. Fig. 6 represents a system made up of alternate groups containing two and three switches, respectively. In the systems herein shown the energization of the section of sectional conductor next in advance of the car does not prevent the deënergization of the conductor-section which the collector-shoe has just left. Neither does the energization of one section prevent the simultaneous energization of the section next in advance, since these two adjacent sections are connected to switches in different groups. A single row of conductor-sections is used and the cars may travel in either direction on the track. The switches which are closed are shown shaded and those which are open are shown in outline.

Referring now to Fig. 3, K represents a car carrying a collector C, which is connected to the motors carried by said car. (Motors not shown.) K′ and K^2 represent cars of a train, the said cars carrying collectors C′ and C^2, which are connected with the motors carried by said cars. (Said motors not shown.) A′, A^2, A^3, A^4, A^5, A^6, and A^{24} are sections of the working conductor and are connected to the feeder F by means of the electromagnetically-actuated switches B. As before, T represents the contact, which is common to each of the switches in a single group and is directly connected to the feeder F. The several groups of the system are represented by 1 to 8, inclusive. The car K is taking current from the feeder F through the shaded switch B of group 2 and section A^2 of the sectional working conductor. As the said car moves forward onto the succeeding sections the switches which control the said sections are operated, as will be readily seen from the diagram. The car K′ is receiving current from the feeder F through the shaded switch of the group 5 and the section A^3 of the sectional conductor. The car K^2 is receiving current through the shaded switches of groups 6 and 7 and the sections A^5 and A^6 of the sectional conductor.

In the system shown in Fig. 4 the sections of the working conductor and switches are so arranged as to allow the use of shorter sections. As before, F represents the feeder; B, the electromagnetic switches; T, the common contact of each group; K, K′, and K^2, cars operated upon the track, and C, C′, and C^2 the collectors carried by said cars, respectively. In this system three switches are shown in each group, said switches being controlled by a single series coil. As shown, the car K is receiving current through the shaded switch B of group 2 and the section A^7 of the sectional conductor. The car K′ is receiving current from the feeder F through the shaded switch of group 3 and section A^9. The switches of group 3 control the sections A^8, A^{10}, and A^{11}. The car K^2 is receiving current from the feeder through the shaded switch of group 4 and conductor-section A^{12} and also through the shaded switch of group 5 and conductor-section A^{13}.

In the system shown in Fig. 5 the same grouping of switches as that used in Fig. 4 is used. The connections from the individual switches of a group, however, are different from the system described. For instance, the switches of group 3 control the sections A^{15}, A^{16}, and A^{17}. The car K receives current from the shaded switch of the group 2 and the section A^{14} of the sectional conductor. The car K′ receives current from the feeder through the shaded switches B of the groups 3 and 5 and sections A^{17} and A^{18} with which the collector C′ contacts. As shown, the car K^2 is receiving current through the shaded switch of the group 4 and the section A^{19} of the sectional conductor. The car-collector in this system may be made of collector-shoes spaced a short distance apart, such as C, or spaced a considerable distance apart, such as C′ and C^2.

In Fig. 6 a composite system is shown, the switches being connected to the contact-studs of a surface-contact system, groups 1 and 3 containing two switches and groups 2 and 4 containing three switches, respectively. The car K, carrying the collector C, receives its current from the feeder F through the shaded switch of the group 1 and the surface-contact stud A^{20}. The car K′, which carries the collector C′, receives its current from the feeder F through the shaded switches of groups 2 and 3 and the contact-studs A^{22} and A^{23}.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an electric-railway system, the combination with the feeder, of a sectional con-

ductor, collecting means carried by the car for bridging consecutive conductor-sections, electromagnetic switches which are adapted to connect the conductor-sections with the feeder, and a coil adapted to be connected in series between the feeder and any one of several conductor-sections, which coil is adapted to control any of several switches which are connected respectively with said several conductor-sections.

2. In an electric-railway system, the combination with the feeder, of a sectional conductor, collecting means carried by a car for bridging consecutive conductor-sections, electromagnetic switches which are adapted to connect the conductor-sections with the feeder, and a coil in series between the feeder and any one of several non-consecutive conductor-sections, which coil is adapted to control any of two or more switches constituting a set, the switches of which set are connected with said conductor-sections.

3. In an electric-railway system, the combination with the feeder, of a sectional conductor, collecting means carried by the car for bridging consecutive conductor-sections, switches which are adapted to connect the conductor-sections with the feeder, shunt-coils connected between the conductor-sections and ground for actuating said switches, and a coil adapted to be connected in series between the feeder and any one of several conductor-sections, said coil being adapted to control any of several switches which are connected respectively with said several conductor-sections.

4. In an electric-railway system, the combination with the feeder, of a sectional conductor, electromagnetic switches which are adapted to connect the conductor-sections with the feeder, which switches are arranged in groups or sets, and means whereby, when a switch is closed, its coil is open-circuited, and the switch is held closed independently of its coil.

5. The combination with a switch, of means for actuating said switch, an independent coil energized when said switch is in its closed position, and mechanical means operatively connected with said switch and moved into its operative position by said independent coil after said switch is closed for holding the switch in its closed position.

6. The combination with an electromagnetically-actuated switch, of an electromotive device which is operative while the switch is in one position and inoperative while the switch is in another position, mechanical means actuated by said electromotive device to hold the switch in the position in which the electromotive device is rendered operative, and means also operated by said electromotive device for open-circuiting the actuating-coil of said electromagnetically-actuated switch.

7. The combination with an electromagnetically-actuated switch, of an independent electromotive device which is operative while the switch is closed, mechanical means independent of the switch and actuated by said electromotive device whereby the switch is held in its closed position, and means also actuated by said electromotive device for open-circuiting the actuating-coil of said switch after the switch has been closed by said actuating-coil.

8. The combination with a switch, of an electromotive device which is operative while the switch is closed, of a pivoted lever which is first moved by the closing of said switch, and is then moved by said device to hold said switch closed.

9. The combination with an electric circuit, including a series coil, of a switch in said circuit, a pivoted lever mechanically connected with said switch, and a member actuated by said series coil which engages with said lever to maintain the switch closed.

10. The combination with an electric circuit, including a series coil, of an electrically-operated switch for said circuit, a pivoted lever which engages with said switch, a member actuated by said series coil which open-circuits the coil of said switch and engages with said lever to maintain the switch closed.

11. The combination with a body which it is desired to maintain for a time in a certain position, of a magnet-coil having a certain number of turns, which coil maintains said body in its position while a certain current is passing through the coil, and a second magnet-coil having a greater number of turns than the first coil, through which second coil a current flows to maintain the body in position, when said current is insufficient to maintain said body in said position by flowing through said first coil.

12. The combination with an electric switch, of a magnet-coil having a certain number of turns, which coil maintains said switch in a certain position, while sufficient current is passing through the coil, and a second magnet-coil having a greater number of turns than the first coil, through which second coil a current flows to maintain the switch in its position when said current is insufficient to maintain the switch in position by flowing through the first coil.

13. The combination with an electric circuit, of a switch therefor, one contact of which is divided; a coil having a certain number of turns, in series in said circuit, connected with one part of said divided contact, and adapted to maintain said switch closed; and a second coil having a greater number of turns, in series with said circuit, in parallel with the first coil, connected with the other part of said divided contact, and adapted to maintain the said switch closed when the current flowing in the circuit is insufficient to maintain the switch closed by flowing through the first coil.

14. The combination with an electric circuit, of an electromagnetic switch therefor; of an independent coil having a certain num-

ber of turns, and in series with said circuit; a second independent coil having a greater number of turns, in series with said circuit, and in parallel with the first independent coil; each of which coils can open-circuit the coil of said switch when the switch is closed; and means whereby either of said coils can hold said switch closed after the coil of the switch has been open-circuited.

15. The combination, in an electric circuit, of a switch therefor, a coil having a certain number of turns, in series in said circuit, and adapted to maintain said switch closed, and a second coil having a greater number of turns, in series in said circuit and in parallel with the first coil, said second coil maintaining said switch closed when the current flowing in the circuit is insufficient to maintain the switch closed by flowing through the first coil.

16. In an electric-railway system, the combination with the feeder, of a sectional conductor, electromagnetic switches for connecting the conductor-sections with the feeder; an independent coil having a certain number of turns, in series in each circuit between the feeder and a conductor-section; a second independent coil having a greater number of turns, in series with said circuit, and in parallel with the first independent coil, each of which independent coils can open-circuit the coil of the corresponding electromagnetic switch when that switch is closed, and means whereby either of said independent coils can hold said switch closed after the coil of the electromagnetic switch has been open-circuited.

17. In an electric-railway system, the combination with the feeder, of a sectional conductor, groups or sets of electromagnetic switches, each switch being adapted to connect a certain section with the feeder; and means whereby, when one switch of a set is actuated, the coils of all the switches in the set are open-circuited, and the switch which has been actuated is held in the position to which it has been moved.

18. In an electric-railway system, the combination with the feeder, of a sectional conductor, groups or sets of electromagnetic switches, each switch being adapted to connect a conductor-section with the feeder, but no two switches of a group being adapted to connect consecutive sections with the feeder; and means whereby, when one switch of a set is actuated, the coils of all the switches of the set are open-circuited, and the switch which has been actuated is held in the position to which it has been moved.

19. In an electric-railway system, the combination with the feeder, of a sectional conductor; groups or sets of switches, each switch being adapted to connect a conductor-section with the feeder; and means whereby when one switch of a set is actuated, the coils of the other switches in the set are prevented from being energized.

20. In an electric-railway system, the combination with the feeder, of a sectional conductor, electromagnetic switches for connecting the conductor-sections with the feeder, an electromotive device operative when a switch is closed, and mechanism whereby said device holds the switch closed.

In witness whereof I have hereunto set my hand this 26th day of April, 1900.

FREDERIC W. HILD.

Witnesses:
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