(No Model.) 3 Sheets—Sheet 1.

E. M. HEWLETT.

AUTOMATIC SWITCH FOR SURFACE CONTACT RAILWAYS.

No. 589,893. Patented Sept. 14, 1897.

FIG. 1.

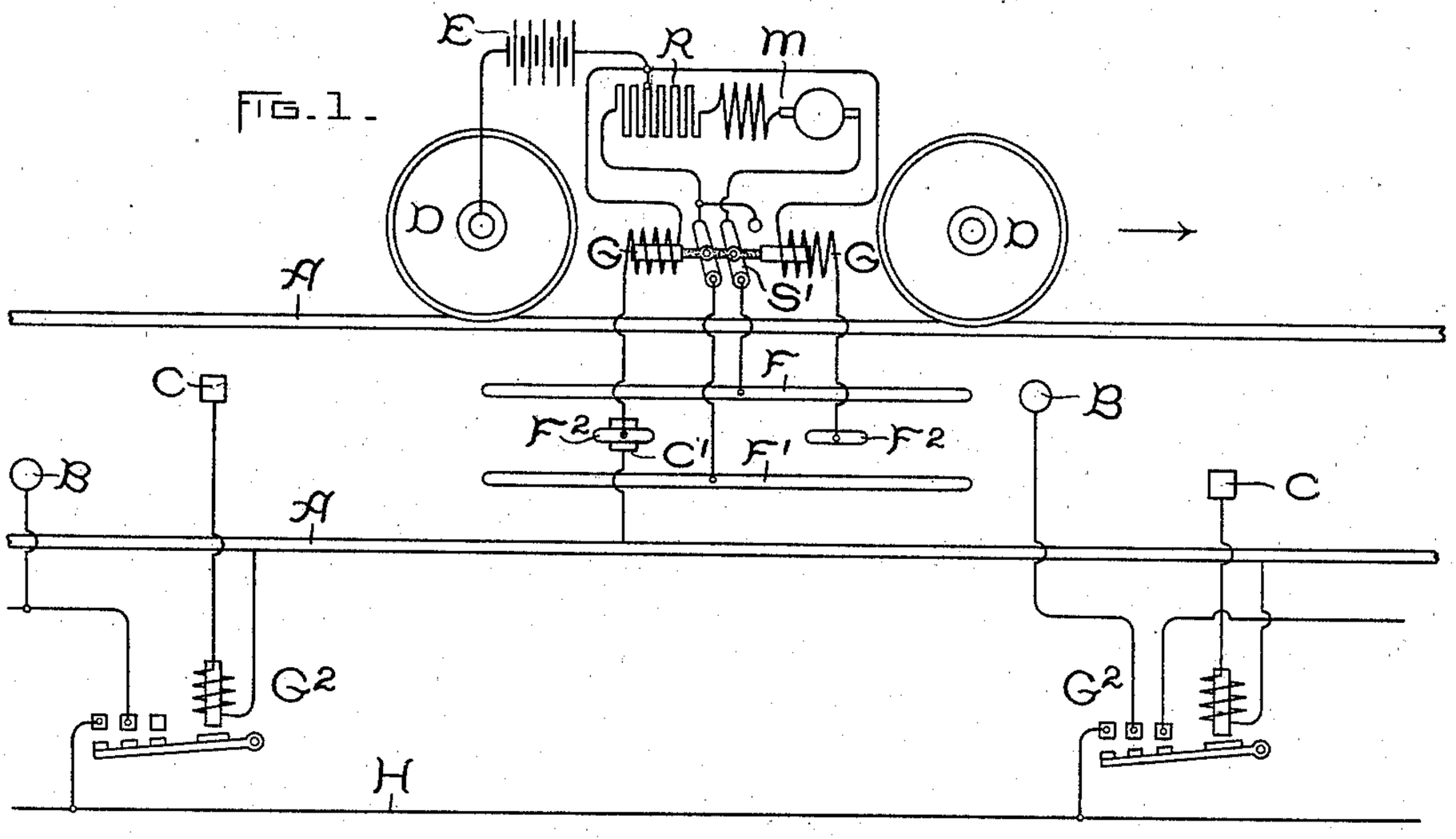
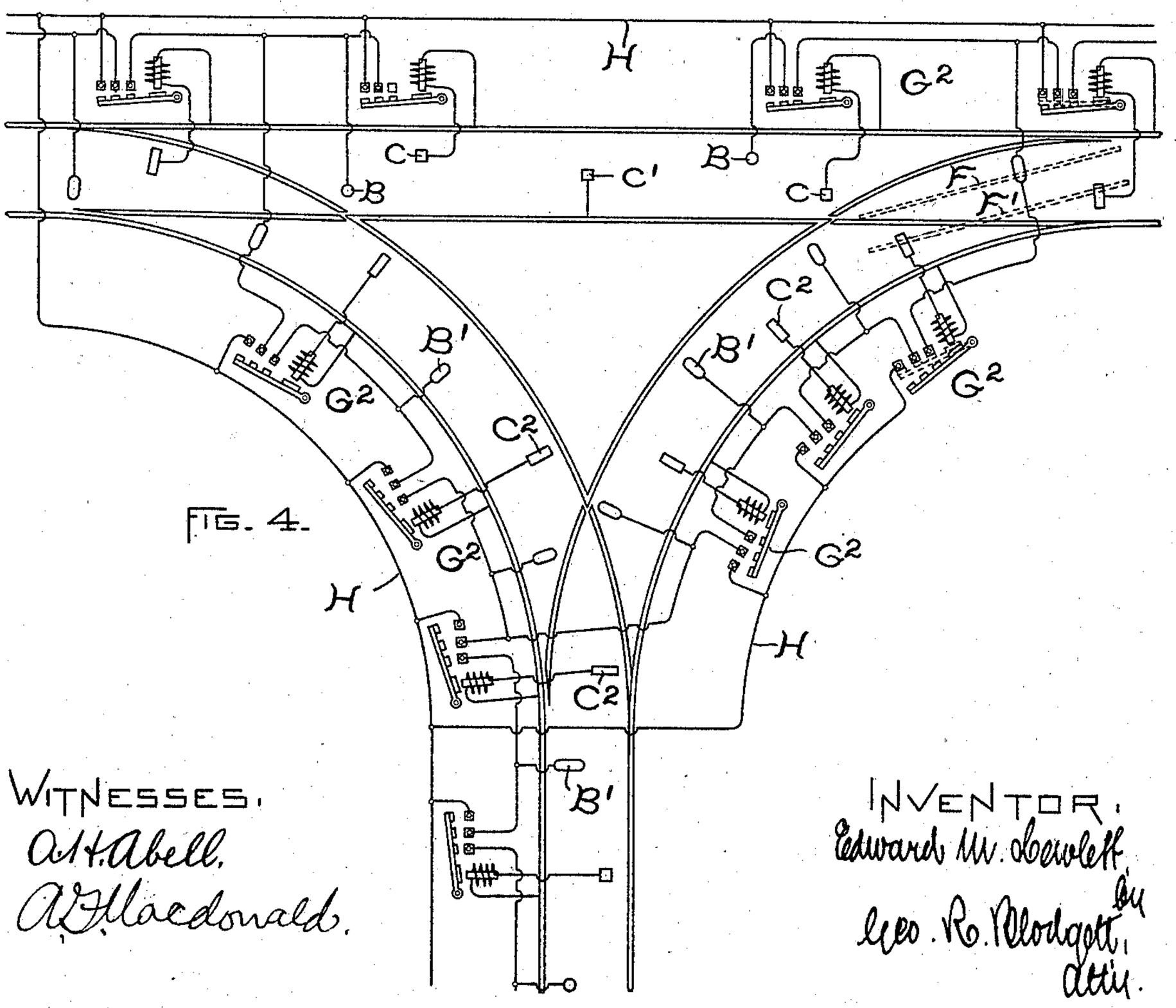


FIG. 4.



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(No Model.) 3 Sheets—Sheet 2.

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AUTOMATIC SWITCH FOR SURFACE CONTACT RAILWAYS.

No. 589,893. Patented Sept. 14, 1897.

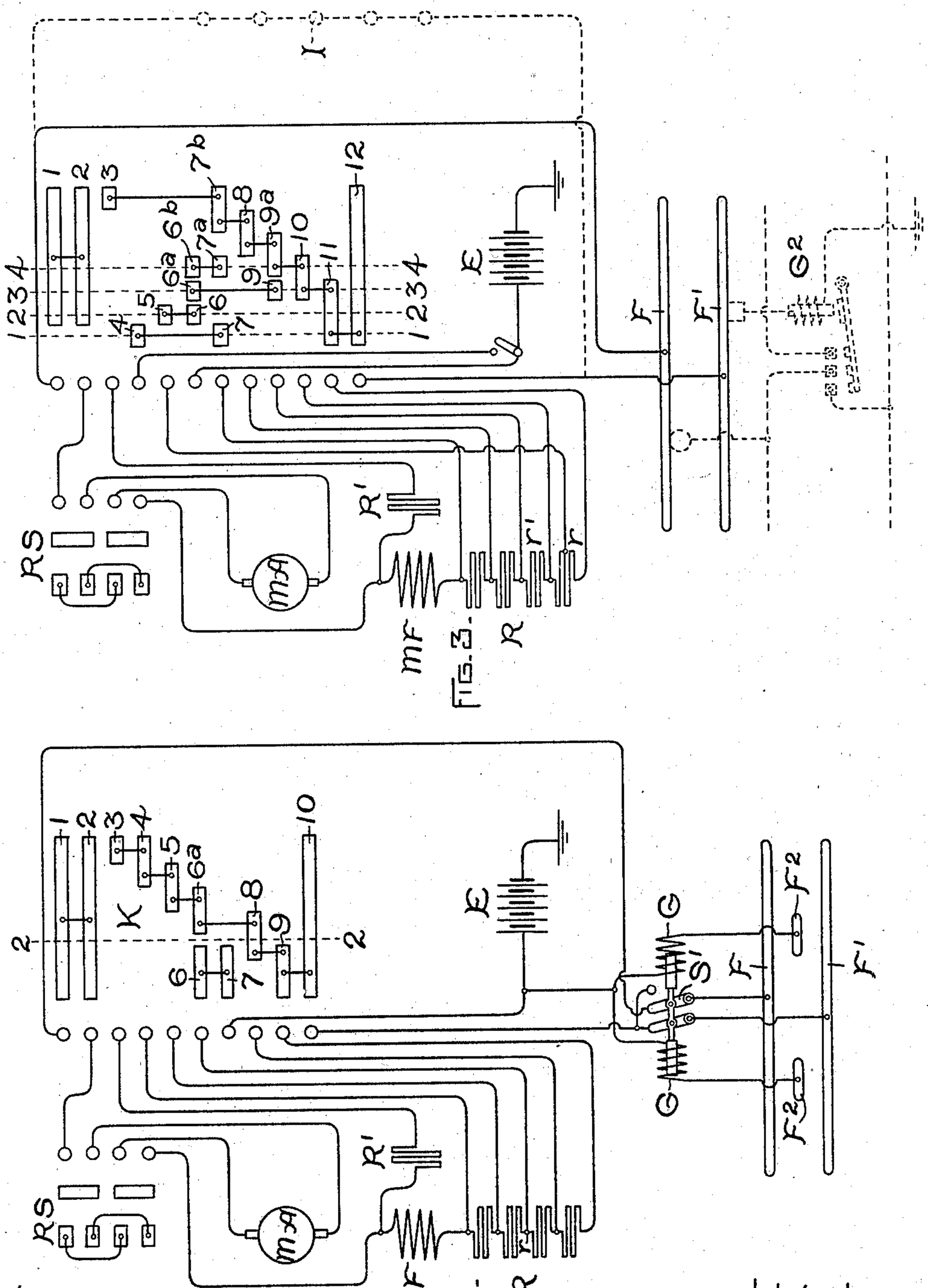

FIG. 3.

FIG. 2.

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(No Model.) 3 Sheets—Sheet 3.

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AUTOMATIC SWITCH FOR SURFACE CONTACT RAILWAYS.

No. 589,893. Patented Sept. 14, 1897.

FIG. 5.

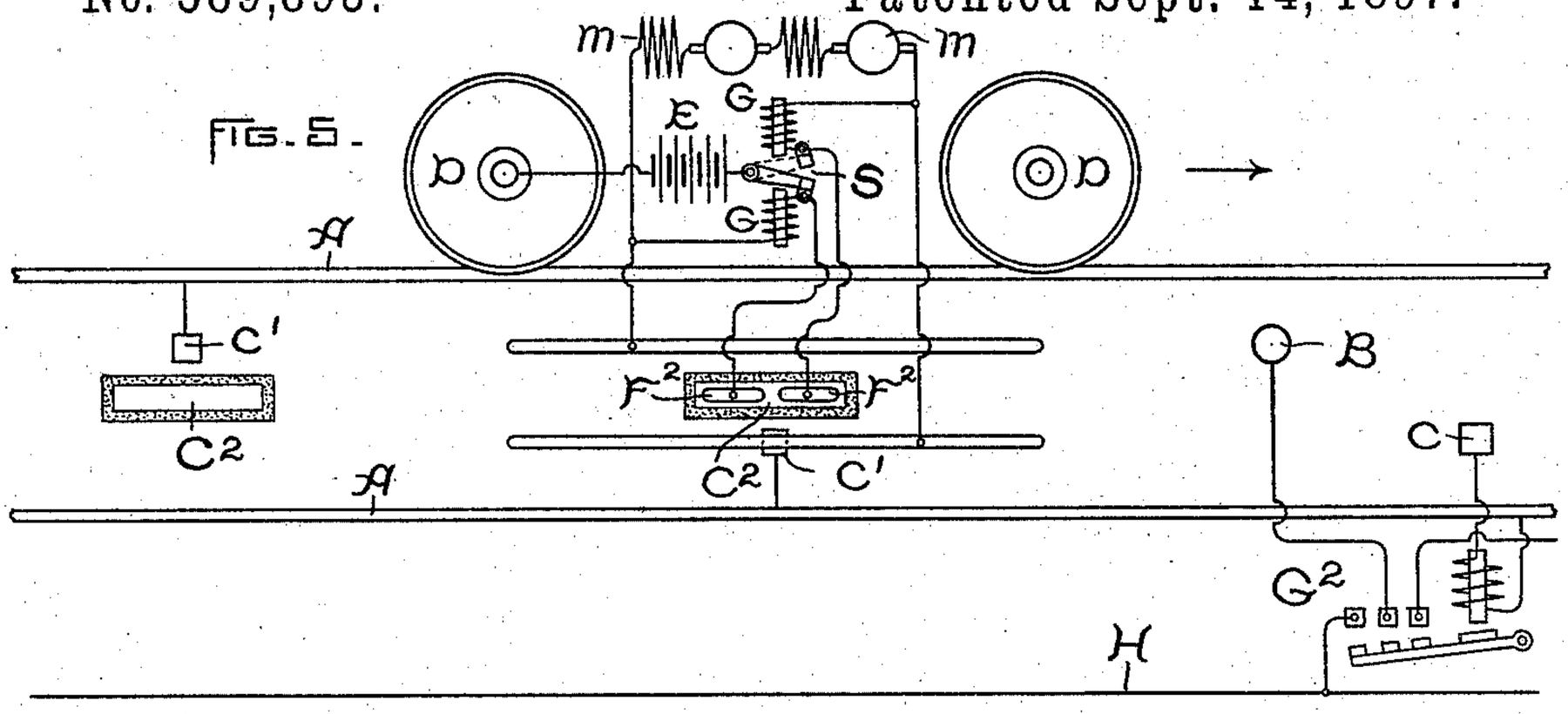


FIG. 6.

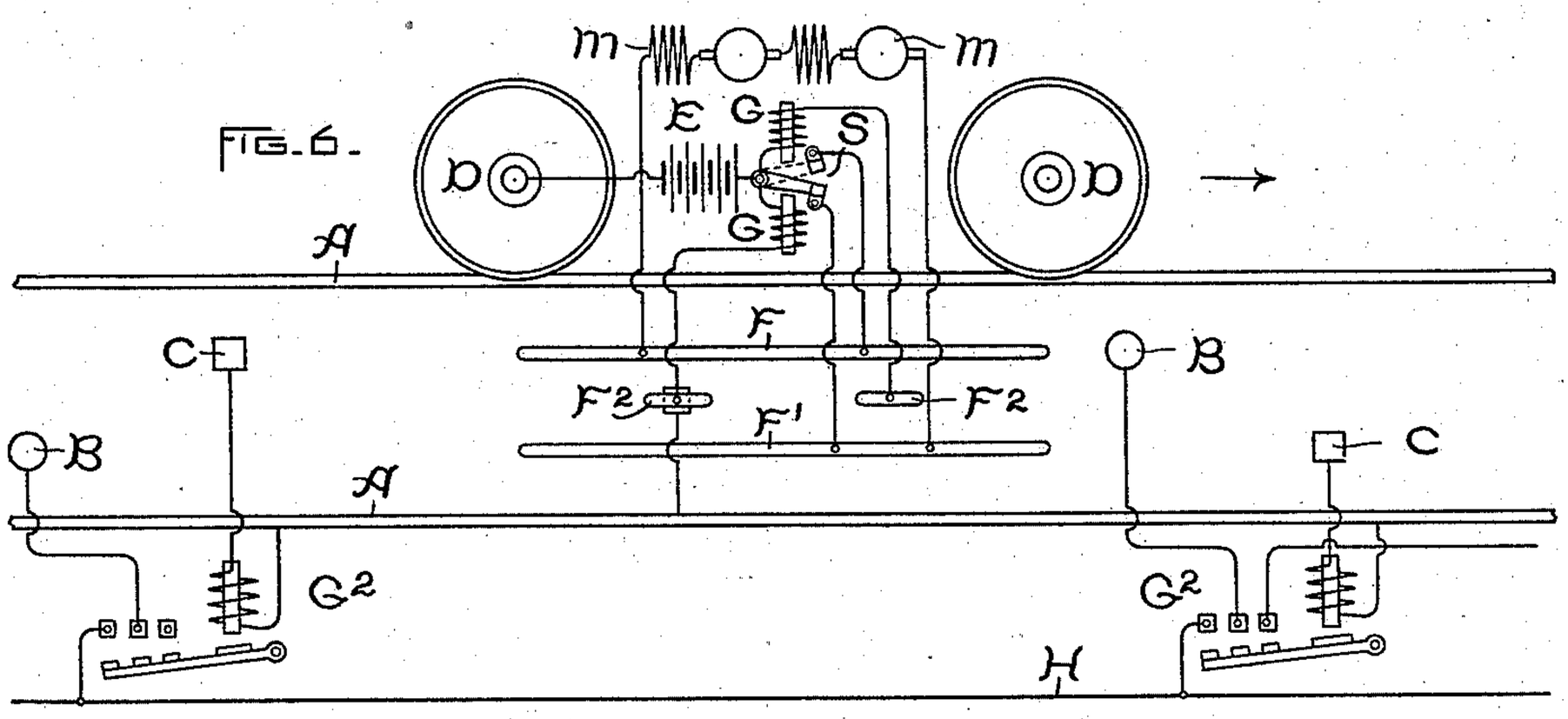
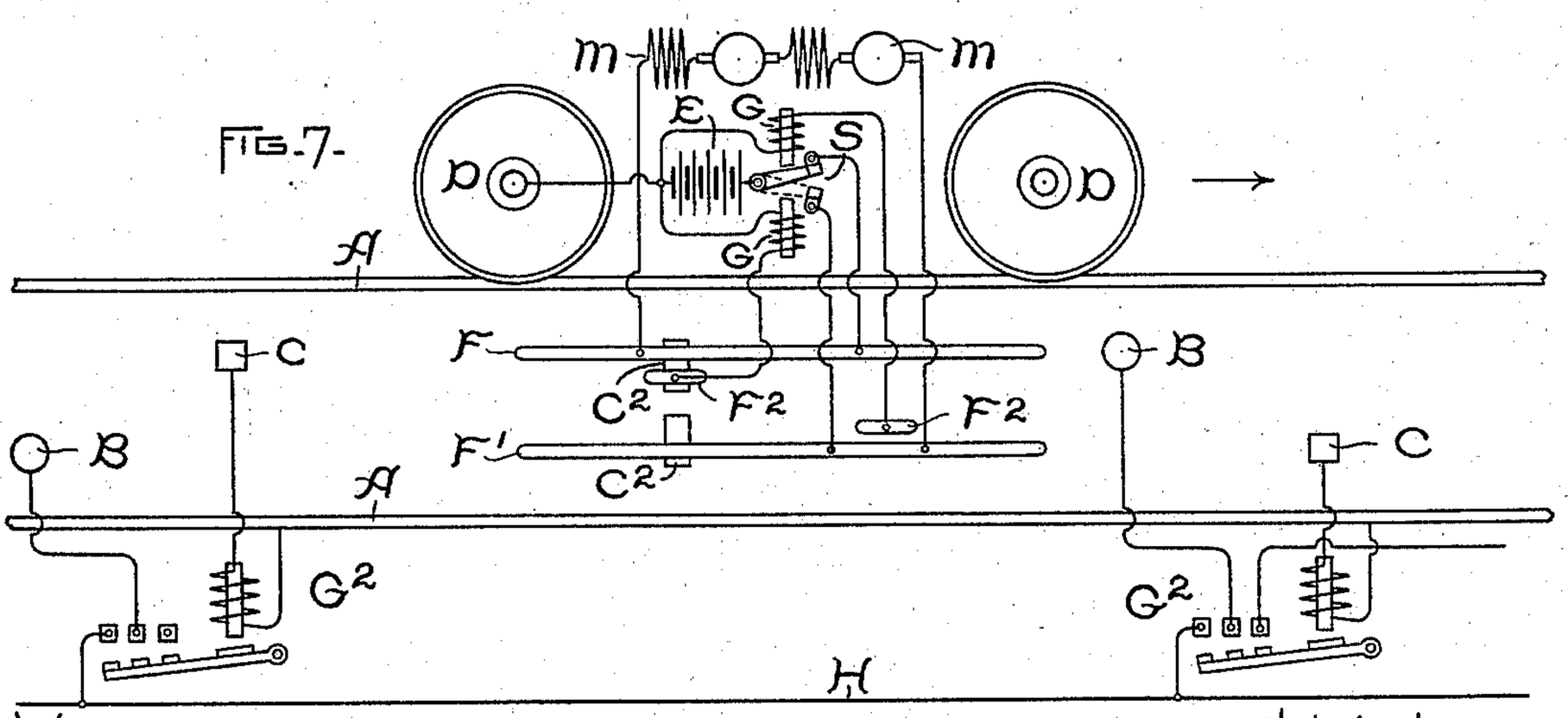


FIG. 7.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC SWITCH FOR SURFACE-CONTACT RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 589,893, dated September 14, 1897.

Application filed January 25, 1897. Serial No. 620,577. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Automatic Switches for Surface-Contact Railways, (Case No. 493,) of which the following is a specification.

My invention relates to surface-contact railway systems; and has particular reference to those systems which have occasion to reverse the car at the ends of the road, so that the car may always run with the same end in front. It is most useful in roads in which a Y is provided by means of which the car is turned. In the Y a dead space (having no contacts supplying current) is left, across which the car drifts. While passing this dead space the connections of the moving contacts on the car are to be changed, so that what was before the positive sliding contact becomes the negative, and vice versa. Thus the two shoes or contacts coöperate with the proper sets of surface contacts in the roadway to operate the car and the usual electromagnetic switches. The latter being operated by a storage battery, under some circumstances it becomes also necessary to change the connections of the battery so that current may pass through it in the proper direction to energize the switches.

To accomplish the objects of this part of my invention, I provide, in addition to the ordinary shoes or sliding contacts, auxiliary contacts carried upon and moving with the car and so arranged that contact with a part of the road structure will act automatically to shift the connections of the shoes and of the battery. This may be done in many ways, some of which I have illustrated in the drawings attached. It may be done by momentarily connecting two shoes by a metallic piece in the roadway, by utilizing one of the main shoes as one part of the circuit, by completing a grounded circuit by contact between one of the shoes and ground, or in other ways, which will readily occur to engineers from an inspection of this specification. In circuit with the shoes I arrange coils and suitable connections operating the switch to accomplish the purposes which I have named.

Another part of my invention relates to the storage battery and its connections commonly provided in systems of the general type described. It is desirable for many reasons to use a low-potential battery, and it is also ordinarily desirable that this battery should be charged by the line-current. It becomes necessary, therefore, to provide a resistance in circuit with the battery, so that the proper potential may be used in charging it. For this purpose I prefer to use a portion of the ordinary working resistance of the car which is used in regulating the speed of the motors. Ordinarily in starting or getting up speed a very large current flows, it being necessary to waste a portion of the energy in the resistance. I so arrange the controlling apparatus that at the moment of starting the storage battery is in series with the motors and in multiple with a portion of the motor resistance, adjusted to the proper amount to permit current to flow through the battery at a suitable charging potential. As the car acquires speed, however, the large current is cut down by the motors. At this time I arrange to cut out the storage battery, so that it ceases to take current from the line.

The arrangement of controller just indicated is sufficient under most circumstances to keep the battery at proper charge; but under some circumstances it may be desirable to increase the time during which the current would flow through the battery. This I accomplish by a modified form of the controller, in which the battery is thrown in multiple with a part of the main motor resistance at starting, and as the part of the resistance with which it is in multiple is cut out of the series connection the connections of the battery are shifted to another section of resistance, and so on until all of the resistance is cut out. It is manifest that this step may be repeated as often as desired, so that the battery will be in multiple with a portion of the resistance for so much time as is necessary to maintain its charge. The skill of the engineer will be sufficient to determine for how long a time this should be the case under the circumstances of each particular installation.

One part of my invention concerns the providing of a suitable device for keeping the lighting-circuit of the car alive during the

time that the motor-current is interrupted. For this I preferably employ the second form of controller which I have devised, though my invention is not limited in this regard. At the normal off position of the controller I provide contacts which complete the circuit of the storage battery, so that the switch (or one of the switches) over which the car happens to be will be held up by the battery-current, and thus sufficient line-current will pass to maintain the lighting-circuit, it being arranged, as in an ordinary trolley-car, as a shunt to the motor-circuit. While this arrangement might be employed, if desired, in daylight, at which time the switch of the lighting-circuit is ordinarily open, it is manifest that it would be unnecessary at such times as the car did not need current, the storage battery being relied on to pick up as its circuit is completed by the revolution of the controller. I therefore prefer to so arrange the switch that this part of my invention may be thrown out of action, if desired, and ordinarily the normal off position of the controller will interrupt all the circuits; but at night or at other times when the lighting-circuit may be desirable, as in underground work, the switch would be thrown to connect the storage battery in the way described.

The accompanying drawings show in diagram different ways of embodying my invention.

Figure 1 is a diagram of a railway system embodying the constructions outlined, Fig. 2 being a development of a cylindrical controller adapted for the purposes of the invention. Fig. 3 is a development of the second form of controller indicated in my statement of invention. Fig. 4 is a plan of a suitable Y for reversing the car, this, however, not being of my invention; and Figs. 5, 6, and 7 are other forms of the invention, all embracing the same general idea.

In Fig. 1, A A are the rails; B, the positive, or, as they are often called, the "high-potential" studs in the roadway. C is one of the low-potential studs. The portion of track illustrated is the dead part of the Y. The other parts not being necessary to an understanding of the invention are therefore not illustrated in this figure, being shown in Fig. 4. C′ is an auxiliary grounding contact, the office of which will be presently described. D D are the car-wheels. E is a storage battery; M, the motor; R, the motor resistance. S′ is a switch, and G G are coils which operate the switch. F F′ are the sliding contacts completing the motor-circuit, and F^2 F^2 are auxiliary contacts in circuit with the battery E and respectively with the coils G G of the automatic switch. The switch is one of the ordinary double-pole type and is so disposed as to reverse the connections of the battery as it is thrown, and at the same time to reverse the connections of the shoes F F′ with the motor, so that the resistance and the field of the motor are always on the ground side of the circuit, for reasons well known to engineers.

The operation of the parts shown is as follows: Assuming that the switch is in its dotted-line position and that the car is moving in the direction of the arrow when the first or right-hand one of the auxiliary shoes F^2 touches the grounding contact C′, the circuit is completed as follows: from the battery through the coil G to the shoe F^2 and contact-stud C′ to ground, and thence back to the battery, the other end of which is grounded. The coil G, being energized, has no effect upon the switch S′, it being already in its attracted position with reference to that coil. When, however, the second auxiliary shoe F^2 touches the contact C′, the other coil G is included in circuit, as in the illustrated position, and the switch is then thrown to its full-line position, reversing the connections of the battery E with reference to the shoes F and F′, and also throwing the resistance and the field of the motor upon the ground side of the system through the shoe F′. This is done so that the battery may conveniently work through the the resistance in charging and in operating the "pick-up" coils commonly employed. When the car is run in the opposite direction, as will be readily understood, the operation of the switch is reversed.

In Fig. 2 a controller adapted to my invention is shown. The controller-cylinder is lettered K, the reversing-switch RS, the resistances R R′, the motor-armature MA, and the motor-field MF. The current enters the controller from the shoe F, through the switch S′, passing to the contact-plate 1, thence to the contacts of the reversing-switch, (being first brought to the contact 2 by the cross connection,) then through the motor-armature back to the reversing-switch, through the resistance, to contact 9 of the controller, by the contact 10, through the other blade of the switch to the shoe F′ and to ground. In the first positions of the controller while the contacts 6 and 7 are in circuit another path is provided to ground through the battery E, which is thus thrown in series with the motors. This circuit starts from the point *r* in the resistance, passing to contact 6, to contact 7, through the battery to ground, a portion of the resistance being thus in multiple with the battery. The various steps of the controller act to cut out resistance from the motor-circuit in the usual way. When the dotted line 2 2 is reached, the battery-contacts are opened. When the last position of the controller is reached, the section of resistance R′ is thrown in multiple with the motor-field to obtain higher speed.

Fig. 3 shows the second form of controller which I have devised. In this the arrangement of contacts is similar to the first form, and the arrangement of the reversing-switch, resistance, and motor parts is the same. The contacts, however, are modified in the follow-

ing particulars: Contacts 4 and 7, which are cross-connected, are in the first or normal "off" position of the controller. To bring these contacts into action, it is necessary to throw the switch S^2, which is shown open. This would be the daylight off position. When, however, it is desired to hold up one of the switches of the road, (shown in dotted lines at G^2,) the switch S^2 is thrown, and then the circuit of the battery E will be completed, the current passing to the contact 4 from the battery over the switch S^2, then to contact 7, then through the resistance R to contact 11, to contact 12, to the shoe F', and through the switch G^2 to ground, returning to the battery, the other end of which is grounded. The switch G^2 is thus held up and the trolley-circuit is kept alive, as also is the lamp-circuit I. (Shown in dotted lines to the right of the diagram.) The particular form of the switch G^2 is also not of my invention.

The second form of controller shown in Fig. 3 also embraces the arrangement indicated in my statement of invention for charging the battery during a longer time than is the case with the controller illustrated in Fig. 2. In Fig. 3 the contacts 5 and 6, as will be seen, come into operation as soon as the trolley-circuit is completed upon contacts 1 and 2—that is, at position 2 of the controller. In this case the trolley-circuit is through the reversing-switch, the motor, and resistance to ground, the shoe F' being grounded through the various switches, as is well understood in the art. The lead starting at the point r in the resistance takes current to the contact 5, then to contact 6, to the battery E, acting to charge it. When the section of resistance nearest to ground is cut out by the contact 10 at the third position of the controller, contacts 5 and 6 are thrown out of action and contacts 6^a and 9 come in, current passing from the point r' of the resistance to contact 9, thence to the contact 6^a and to the battery. When the contact 9^a cuts out another section of resistance, the contact 6^b and 7^a again insert the storage battery, as will be readily seen. By this time the current flow will be so reduced as to make it undesirable to leave the battery in circuit and contacts 8 and 7^b simply act to cut out the remaining sections of resistance, the contact 3 inserting the resistance R' in shunt to the motor-field for obtaining higher speed.

Fig. 4 shows a Y with suitable contacts adapted to turn the car. The contacts C^2 C^2 and B' B' are, it will be observed, of greater extent laterally than the others to provide for the displacement of the shoes in making the turn. In this figure I also illustrate in some detail the connections of the system which I prefer. H is the feeder, the switches being marked, as in Fig. 3, G^2. The negative contacts C^2 pass the motor-current through a coil, serving to pick up the switch-lever, completing the connections to the motor-studs B'. On the right hand of the figure shoes F F' are shown in dotted lines. It will be seen that the shoe F' touches one of the contacts C^2 before it leaves the next adjacent one, thus picking up the switches in sequence.

The construction of the Y with the extended contacts and the connections used as an illustration of my invention I do not claim, as they are not of my invention. They form no essential feature of the invention set out in this application, as other connections or other means of turning the car might be substituted for them without affecting my claims.

With the arrangements just pointed out any accidental grounding of either one of the shoes F^2 might be followed by a shifting of the switch S'. To avoid this, the construction outlined in Fig. 5 may be employed, although it is not the preferred form of the invention, as the danger of accidental grounding referred to is comparatively small. In this case, as in the arrangements shown in Figs. 6 and 7, a single pole-switch S may be employed. The parts are lettered as before; but the two shoes F^2 are so arranged that the grounding of either one of them can have no effect, inasmuch as the connection must be made from one to the other before the switch S can be thrown. To effect the connection named, I locate in the roadway metal blocks C^2, surrounded by insulation c, the blocks forming a bridging contact between the two shoes. All of the parts of my invention are not illustrated in this figure, inasmuch as their application will be readily understood. Assuming that the car is moving in the direction of the arrow, when the shoes F^2 F^2 reach the block C^2, upon which they are illustrated as resting, current passes from the battery E through the switch S to one of the shoes F^2 by the bridging contact C^2 to the other shoe, thence through the upper coil G on the switch and to the ground by the shoe F' and the grounded contact C'. The coil G draws the switch-blade up to its dotted-line position, thus reversing the battery with reference to the shoes F F'. When the car is running in the other direction, as soon as the shoe F is grounded by the contact C' on the left of Fig. 3 and the two shoes F^2 are connected, the other coil G is energized and the switch is drawn to its illustrated position. With this arrangement it will be seen that the direction of current through the motors is reversed, but, as is well understood, this does not act to reverse the direction of motion, the motors being of the series type.

In Fig. 6 I show another modification, it being like Fig. 5 in that the direction of current through the motors is reversed. In this case when one of the shoes F^2 touches the grounded contact C' the circuit of the battery is completed through the coil G, connected to the shoe, and the switch is thrown, according to which coil draws it.

In Fig. 7 still another modification is shown, in which a bridging contact is used in the roadway, but one of the motor-shoes F F' is

utilized in the switch-circuit in conjunction with the auxiliary shoe F^2. The operation of the parts will be readily understood from the drawings, the current passing over the switches in the illustrated position to the shoe F, thence by the bridging contact C^2 to the shoe F^2, and back through the lower one of the coils G to the other end of the battery, the switch being drawn by the coil G to the dotted-line position. In this last construction the grounding of the battery is for the purpose of fulfilling its ordinary functions in "picking up" the switch-magnets in the roadway, as in many well-known surface-contact systems, the circuit of the switching device being independent of ground.

In each case it is preferred that the switch shall be located within reach of the motorman and shall be capable of manual operation in case of failure to act, being of course provided with a suitable handle of any convenient form.

I have not illustrated any particular type of switch, as my invention may utilize any well-known form.

So far as I am aware I am the first to devise an automatic switch for the purposes set out by which danger of accident to the car from improper connections is minimized, and I also believe myself to be the first to so arrange the controller that the battery may be charged from the line-circuit, although of low potential, only during such time as an excess of current is flowing, being cut out when the current is normal, and to these elements of novelty I wish to make broad claims.

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

1. In a surface-contact railway system, a car provided with a storage battery, means for turning the car, and an automatic switch for reversing the battery connections.

2. In a surface-contact railway system, a car provided with a storage battery, means for turning the car, and a switch mechanism automatically actuated to reverse the battery connections at the time of turning of the car.

3. In a surface-contact railway system, a car provided with a storage battery and an operating motor or motors, the battery being in series with the motors between the source of supply and ground, and an automatic switch for reversing the connections of the motors and the battery relative to the road-contacts.

4. In a surface-contact railway system, a car provided with a motor or motors, and a storage battery in series therewith between the source of supply and ground, means for turning the car, and an automatically-operated switch for reversing the connections of the motor and the battery relative to the road-contacts.

5. In a surface-contact railway system, a car carrying a motor or motors and a storage battery, the battery being in series with the motors between the source of supply and ground, and a common resistance for controlling the speed of the motors and the potential of the current supplied to the battery.

6. In a surface-contact railway system, a car carrying a motor or motors and a storage battery, the battery being in series with the motors between the source of supply and ground, and a common resistance for controlling the speed of the motors and the potential of the current supplied to the battery, the battery being in multiple with part of the resistance.

7. In a surface-contact railway system, the combination of a dead section of track, containing a contact a car provided with sliding contacts, and an automatic switch for reversing the connections of the sliding contacts, the contacts in the dead track coöperating with the sliding contacts on the car for actuating the automatic switch.

8. In a surface-contact railway system, the combination of a dead section of track, a car provided with sliding contacts, and a motor or motors, and an automatic switch for reversing the connections of the motor or motors acting to maintain the resistance always on the ground side of the system, with a contact or contacts in the roadway coöperating with the sliding contacts on the car for actuating the automatic switch.

9. In a surface-contact railway system, the combination with a dead section of track provided with suitable coöperating contacts, of a car having sliding contacts, a storage battery, and an automatic switch for reversing the connections of the storage battery, the switch actuated by a circuit including the sliding contacts on the car and the contacts in the roadway.

10. In a surface-contact railway system, the combination with a dead section of track provided with suitable contacts coöperating with the sliding contacts on the car, of a car provided with sliding contacts, a motor or motors and a storage battery in series with the motors between the source of supply and ground, and an automatic switch operated by the circuit including the sliding contacts and the coöperating road-contacts to reverse the connections of the battery and the motors.

11. In an electric car, the combination with a motor or motors and a storage battery, of a device including the battery in series with the motor or motors between the source of supply and ground at times when the current is of considerable volume, and cutting it out when the current diminishes.

12. In an electric car, the combination with a motor or motors and a storage battery, of a device for including the battery in series with the motors and in multiple with a resistance, thus reducing the potential of current supplied, the device so including the battery with the motors when the current is of considerable volume, and cutting it out when the current diminishes.

13. In an electric car, the combination with a motor or motors and a storage battery, of a

controlling device including the battery in series with the motors between the main source of supply and ground, and in multiple with a part of the main motor resistance at starting, and for cutting out the battery when the motor acquires speed sufficient to cut down the current.

14. A controlling device for an electric car provided with motors, a storage battery and a resistance, the controlling device provided with contacts and connections adapted to include the battery in series with the motors and a part of the main motor resistance, and in multiple with another part of the resistance while a large current flows, and afterward to cut out the battery.

15. A controlling device for an electric car, provided with motors, a storage battery and a resistance, the controlling device having contacts and connections adapted to include the battery at starting in series with the motors and one part of the resistance, and in multiple with another part of the resistance, and to cut it out as the speed of the motors is increased.

In witness whereof I have hereunto set my hand this 6th day of January, 1897.

EDWARD M. HEWLETT.

Witnesses:
B. B. HULL,
M. H. EMERSON.