

(No Model.)

2 Sheets—Sheet 1.

F. E. KINSMAN.

ELECTRIC CIRCUIT FOR CONTROLLING TRAINS.

No. 504,042.

Patented Aug. 29, 1893.

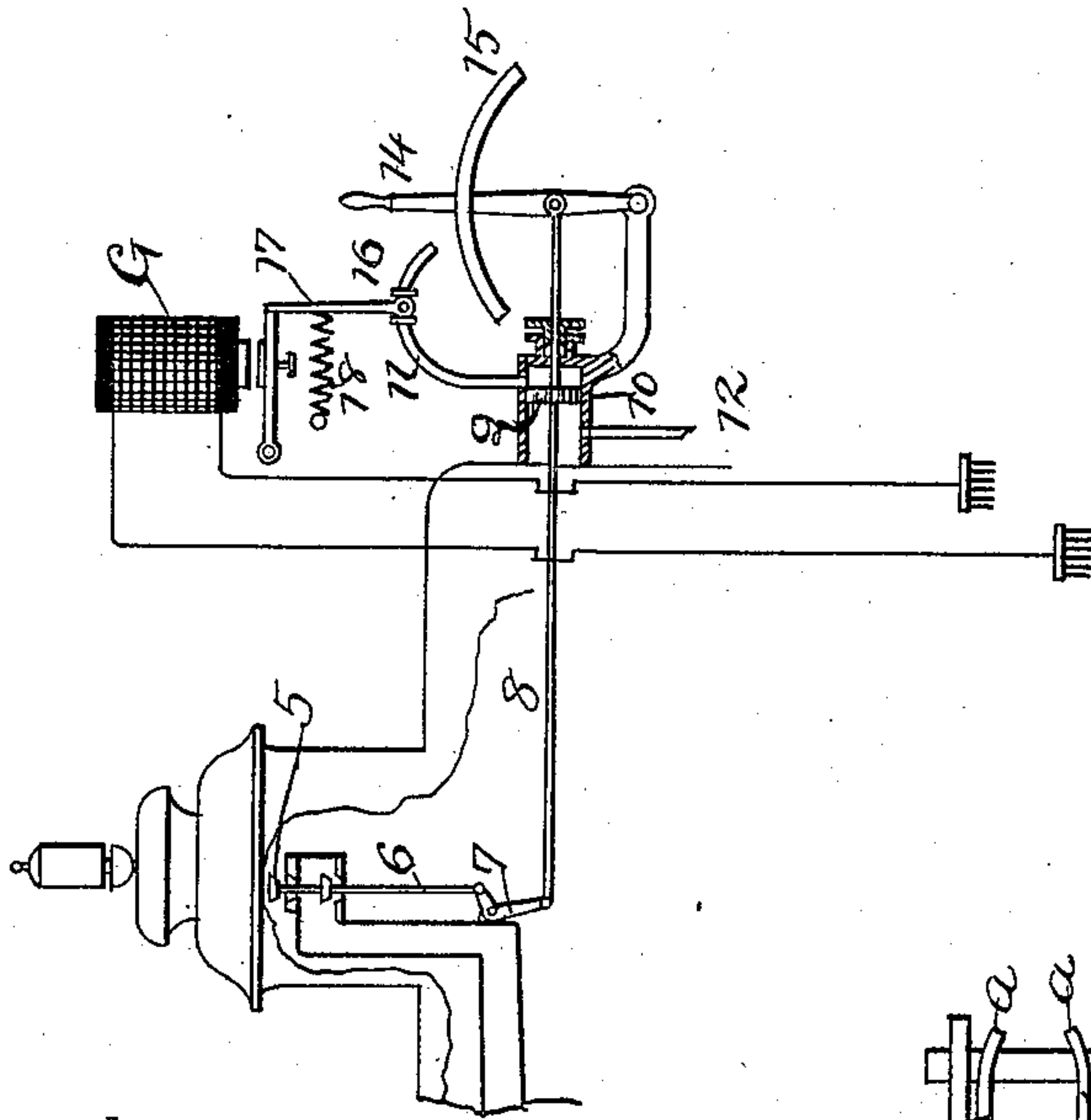


Fig. 1.

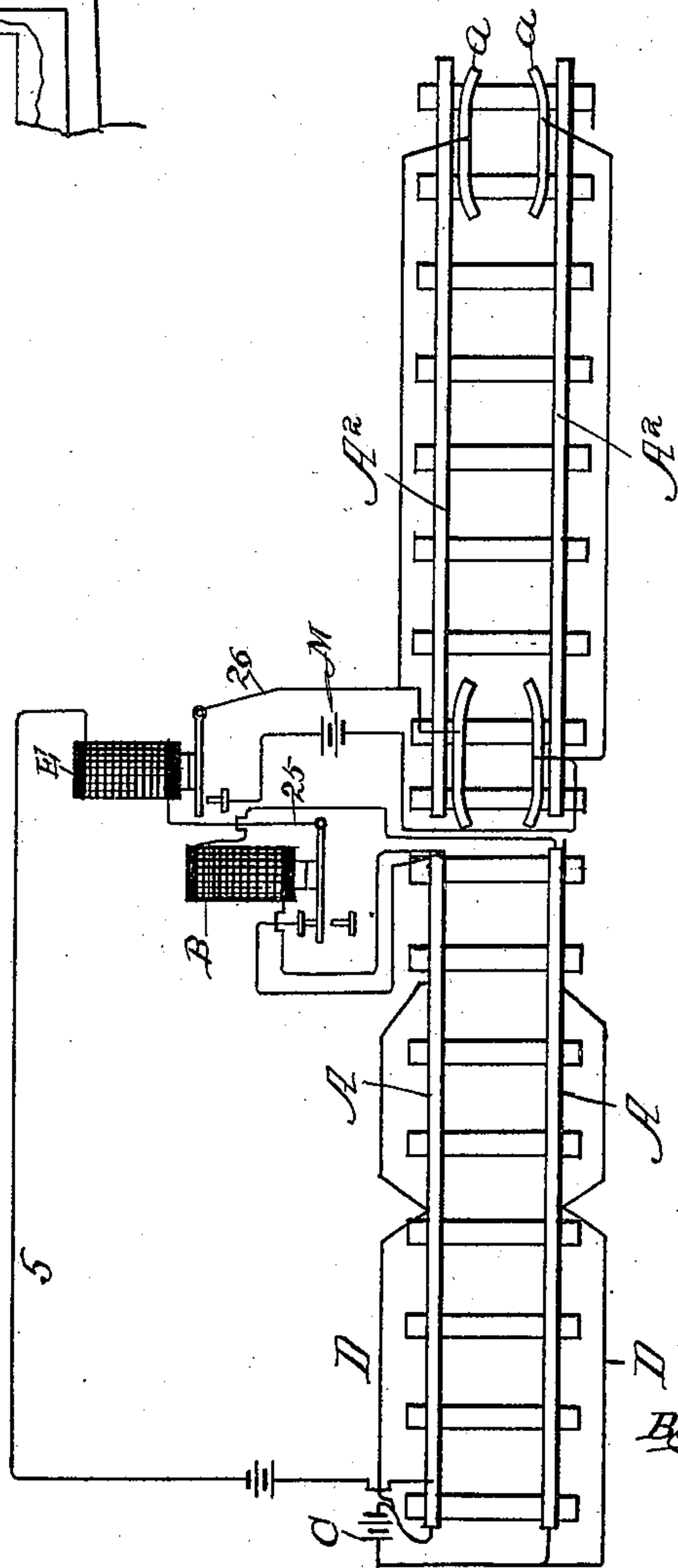
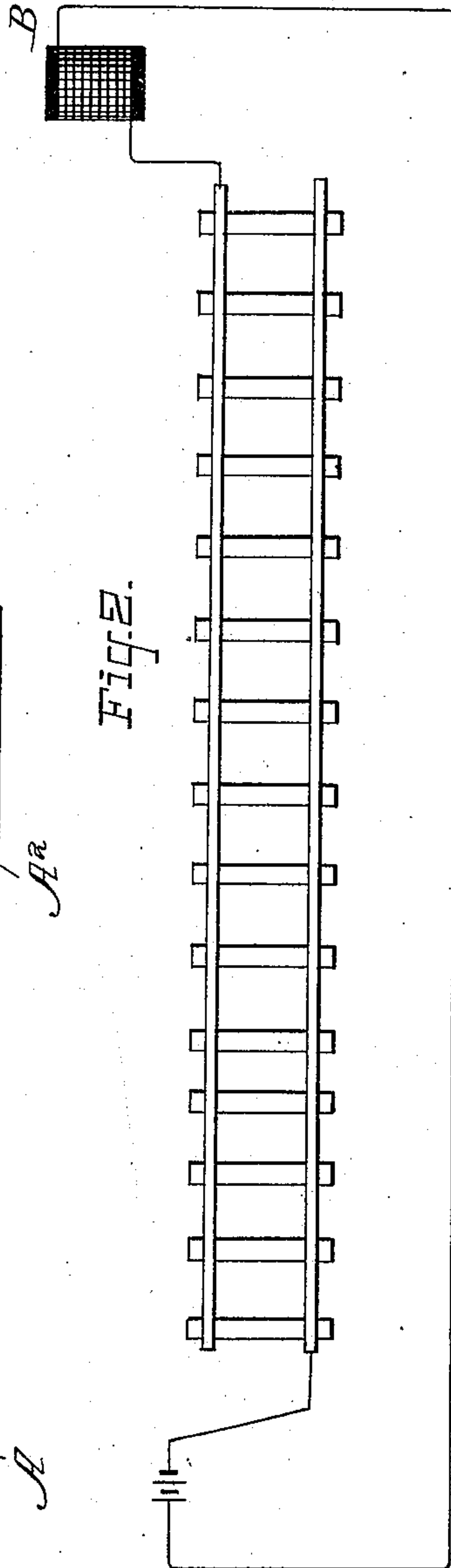


Fig. 2.



ATTEST.  
*J. M. Mudd*  
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Attorney

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2 Sheets—Sheet 2.

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Fig. 3.

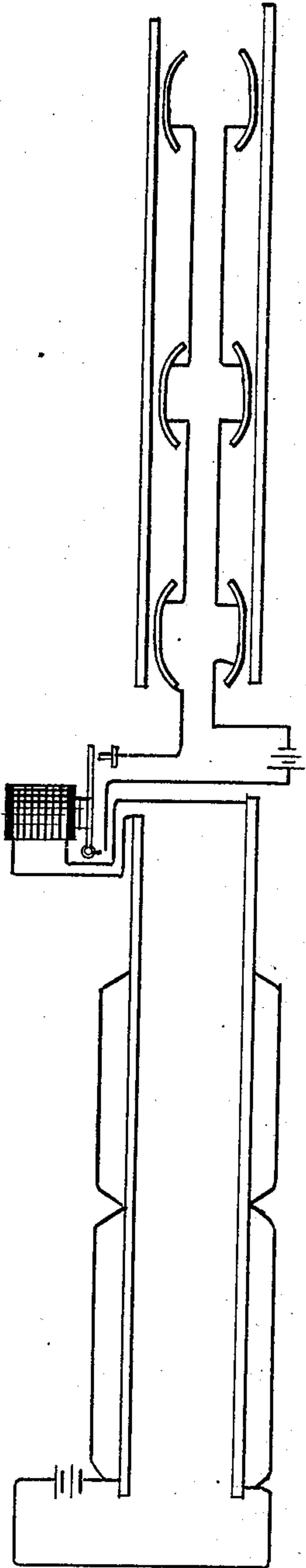
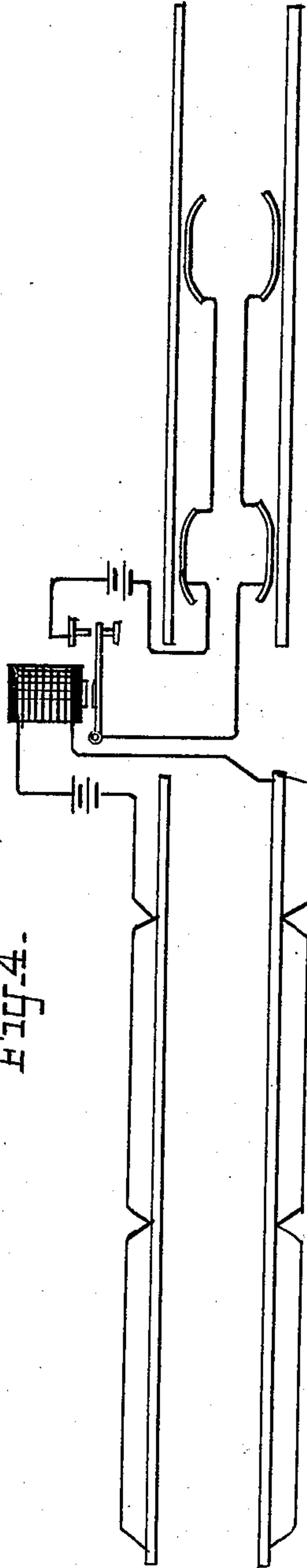


Fig. 4.



ATTEST:

*J. Mundy*  
*D. F. Conkey*

INVENTOR:

*Frank E. Kinsman*

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# UNITED STATES PATENT OFFICE.

FRANK E. KINSMAN, OF PLAINFIELD, NEW JERSEY.

## ELECTRIC CIRCUIT FOR CONTROLLING TRAINS.

SPECIFICATION forming part of Letters Patent No. 504,042, dated August 29, 1893.

Application filed January 11, 1892. Serial No. 417,620. (No model.)

*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 Electric Circuits for Controlling Trains, of which the following is a specification.

My invention relates, generally speaking, to apparatus for controlling the movement of vehicles running upon rails which may form the circuit of the controlling magnet.

My invention is designed, among other things, as an improvement upon that class of circuits wherein the rails of a section of track are employed in conjunction with an electro-magnet and a battery or other generator of electricity, and the connection is closed from one rail to the other by any means as, for instance, by the wheels and axles of a vehicle moving on said line of rails for the purpose of changing the power or condition of the electro-magnet so as to call into operation the agency or the devices whereby the movement of the train is controlled as, for instance, a semaphore or signal, a means for automatically stopping the train as by applying the brakes or cutting off the steam, or means for throwing a switch, or other means by which the movement of the train may be controlled automatically or otherwise in the manner required.

The invention is applicable especially to those systems wherein the circuit of the battery or other generator of electricity is normally closed through the rails and the controlling or actuating magnet and the action of the devices closing the circuit from one rail to the other is to shunt current from said magnet, but it is also applicable to those cases wherein the rail circuit is a normally open circuit and the circuit of the magnet is closed through the presence of one or more pairs of wheels and axles on the rails.

One of the objects of my invention is to provide means whereby the difficulties at present experienced owing to the large resistance of the rails may be effectually overcome and to increase the quantity of current that shall flow in the coils of the electro magnet.

A further object of my invention is to obtain as far as possible a uniformity of action

in the apparatus for all positions of the circuit closing axle and wheels upon the section of track in question.

With the present systems where there is a considerable resistance in a line of rails either owing to the resistance of the rail joints or to the length of section which it is desired to employ, it will be found in for instance the normally closed circuit system that much less current will be subtracted by short circuiting from the magnet, when the wheels and axles for forming the short circuiting action or operation are near the end of the section to which the battery is connected, than when they are near the end which is connected to the battery. My invention not only tends to obviate this difficulty of want of uniformity in the operation, but also increases the length of section that may be operated by a battery of the ordinary size. The same want of uniformity in action would also exist in the case of a normally open circuit, that is to say, a system wherein the presence of a pair of wheels and axles on the line of rails is required in order to close the circuit of the battery or other generator of electricity connected to the said line of rails.

To this end my invention consists in the combination with the track circuit, the electro-magnet and the battery or other generator arranged in the ordinary way, of a supplemental conductor or conductors connected to the battery and adapted to form a path for the current wholly or partially independent of the rails themselves. A supplemental conductor may be used for each pole of the generator, or for each line of rails, and may be extended to a greater or less distance as desired along the line of rails attached directly to the terminals of the electro-magnet or to the end of the rail section.

The advantages of my invention are realized in part by using but one conductor from one side of the circuit, but I prefer to use a conductor for both sides, and I also prefer to connect the said supplemental or auxiliary conductor to the rails at intervals, greater or less in extent as circumstances may require. The said supplemental conductors may be connected as often as once in a thousand feet where the electric circuit is of considerable resistance. By this means a uniformity of electric



condition over the whole section of track is obtained, especially where the said supplemental conductors are made of small resistance. In the case of a closed circuit system, I may, therefore, by this means, approach the ideal condition of no resistance in the track connection between the generator and the electro-magnet so that the latter will be operated or affected to practically the same extent for all positions of the controlling axle and wheels.

I have herein shown my invention as carried out in connection with an organization of apparatus designed to operate both the throttle valve or other motive power controlling device and the air brake cock or other brake controlling device at or about the same time by the operation of an electro-magnet or magnets which are included in a circuit on the car or locomotive and are connected with devices by which they may be put in electrical connection with devices on the road-bed so as to be energized at the proper time or by devices by which they may be energized in any other desired manner at the proper time as the car or locomotive passes a certain spot.

In carrying out my invention the electro-magnet which is connected to a section of track may be used in any desired manner to control the movement of a train or locomotive, as now well understood in the art, either by a semaphore directly or by relaying a semaphore circuit. Said electro-magnet might operate through any other apparatus suitable for controlling the movement of the train as, for instance, upon a circuit which may be used for operating the brake or the throttle valve, or for throwing the switch to throw the train onto a siding, or for giving an audible signal to the engineer, or for bringing into operation any other device which shall be effective in bringing the train to rest on the occurrence of the danger condition or switching it from danger.

My invention consists further in the special combinations of circuits hereinafter more particularly described and claimed.

In the accompanying drawings, Figure 1, I have shown my invention diagrammatically, the devices on the locomotive being shown in outline in side elevation. Fig. 2, illustrates a modification in the circuits. Figs. 3 and 4, illustrate other modifications.

In Fig. 1, *a, a*, indicate the two opposite rails of a section of track which are connected with the coils of an electro-magnet B, in the ordinary and well known manner, while the rails are connected to the generator of electricity C, such as a galvanic battery the circuit of which is normally completed over the rails and through the electro-magnet so that the same will be energized when no vehicle is upon the said section of track. When, however, the rails are bridged by an axle and wheels then the current of the battery is short circuited and the electro-magnet loses its power so that its armature will be caused to

move by the influence of a retractor and bring into operation the desired safety devices or circuits. In connection with said battery I employ the supplemental conductors *d, d*, as indicated, which are preferably of very low resistance, and which lead from said battery along the said section of track. They are preferably connected as shown at intervals to the said section, though it would be possible to omit the intermediate connections and even to attach the ends directly to the wires which connect the magnet with the rails. It would also be possible to omit one of the said supplemental conductors. By means of these conductors the current of the battery may flow without encountering the rail resistance to the electro-magnet and charge the same to full power, but as will be obvious the presence of any train or pair of wheels and axles on the said section of track will effectually short circuit the current from the electro-magnet B.

Fig. 4, illustrates the application of the invention to the case of a normally open rail circuit of the character well understood in the art of railway signaling. In this case the presence of a pair of wheels and axles or other means for closing the circuit from one rail to the other is required in order that the magnet may be energized.

I have shown in the diagram Fig. 2, a modification of the invention in which the battery is connected by a supplemental conductor directly to one pole of the electro-magnet and the connection of the electro-magnet or of said conductor to the section of track at the end opposite the battery is omitted.

By the use of my invention it will be obvious that longer sections of track can be efficiently operated and with a uniformity of result in the action of the magnet during the movement of the train or vehicle over the whole section. In other words there will be practically the same margin of power or ratio of charge in the power of the magnet for all positions of the short circuiting wheels and axles.

The electro-magnet B, may be employed for any of the purposes usual for controlling the movement of trains and in any other desired way for controlling such movement, as by throwing a switch, setting a signal, &c. It may be employed in connection with other devices and circuits as shown in the diagram, Fig. 1. In this case the armature of the electro-magnet is normally held against a back stop through which a circuit indicated by the numeral 25, is completed. This circuit I term a detector circuit as it is completed through the rails of one side of a section of track which may be either the same section as that to which the electro-magnet B, is connected, or any other section. By this arrangement it is obvious that the said circuit 25, will be interrupted not only when the electro-magnet B, loses its power, but in case there should be any interruption of the continuity of the rails



themselves through or over which the circuit 25 is completed. Included in said circuit is a second electro-magnet E, which electro-magnet is normally excited by means of a battery or other generator of electricity in the detector circuit and normally holds up its armature lever so that the circuit 26, connected to the armature lever and back contact stop will be normally interrupted. It will, therefore, be obvious, that by this arrangement the circuit 26, will be closed when the electro-magnet B, is short circuited, because in this case the armature lever of B, will drop back and open the circuit 25, and allow the armature of electro-magnet E, to drop back and close circuit 26. The said circuit 26, will be similarly closed in case there should be an interruption of the line of rails through which the detector circuit 25, is connected because, although said circuit should be kept intact at the contacts of relay B, the electro-magnet E, would nevertheless lose its power and the armature thereof would drop back and close circuit 26.

Circuit 26, may be used for controlling the movement of the train on an adjoining or any other section of track, as, for instance, on sections  $a^2$ ,  $a^2$ , by any desired means, but preferably, by simultaneously applying the brakes and shutting off the steam or other driving power. For this purpose the circuit 26, is carried on to the locomotive when it comes onto section  $a^2$ , by means of the contact rails  $a^3$ ,  $a^3$ , placed on the road bed as described in my prior patent No. 405,964.

Pairs of rails  $a$ , may be placed at any desired intervals and arranged to be engaged by arms or brushes F, which are carried by the locomotive and are insulated from one another and connected to the terminals of a circuit thereon which circuit includes an electro-magnet or magnets G. The said magnet or magnets G, control the operation of the throttle valve or other controlling device for shutting off the motive power and also an air brake or other arm or lever or other device or mechanism whereby the brakes may be conveniently applied.

Two magnets G, might be used each of which would have its armature lever arranged to operate as a trigger or detent to release a lever or arm of the controlling mechanism. This mechanism might be constructed as follows:—5, is any suitable throttle valve in the dome of the boiler, which valve is connected by a link 6, with a bell-crank lever 7, that in turn connects with a piston rod 8, the piston 9, of which works in a cylinder 10. The cylinder 10, has a port near its rear end to which is connected a pipe 11, leading to some part of the air brake equipment wherein a relief or other change of the air pressure will cause the brakes to be set in obvious manner. At another point in the cylinder 10, is a port which connects with an exhaust pipe 12. The latter port is in such position as to be uncovered by the piston 9, when the latter

is moved through the pressure of air allowed to pass into the cylinder 10, through pipe 11. The piston 9, may be also connected with an ordinary hand lever 14, which will be used to shut off the steam and simultaneously apply the brakes in the usual manner and which said lever works in connection with a quadrant 15, and automatic catch, in the ordinary and well known way. In the pipe 11, is a cock 16, to which is attached an arm 17. Applied to the arm is a spring 18, or other actuating power which is normally restrained by a detent carried by the armature lever of the electro-magnet T. This detent may be the end of the armature lever which normally is in position to be engaged by the end of the arm 17. When the magnet is excited the arm is released and the cock 16, turning, opens communication from the pipe 11, so that the air may pass through said pipe and acting on piston 9, may move the same in a direction to cut off the steam. Immediately after the cutting off of the steam or simultaneously therewith, the port connecting with the exhaust 12, is opened so that the air may be allowed to escape freely from pipe 11, and thereby cause the relief or other change of pressure which will apply the brakes. I contemplate also taking off steam from the boiler or other source for the purpose of operating the piston of cylinder 10. I do not claim such modification specifically in this application as the same will be made the subject of another application for patent. This mechanism for simultaneously applying the brakes and cutting off the steam is constructed in the manner shown and claimed in another prior application for patent filed by me and is therefore not herein specifically claimed.

Any other arrangement of apparatus controlled by the electro-magnet or magnets might be employed for producing the same effect of cutting off the steam or other driving power and at the same time applying the brakes. On the closure of the circuit 26, which is charged by a battery or other generator of electricity, indicated at M, through the interruption of the circuit thereof through the coils B, any train coming upon section  $a^2$  would have its driving power cut off and its brakes simultaneously applied in obvious manner, thus insuring the stoppage of the train. With the arrangement of circuits herein shown it is obvious that this stoppage of the train would be effected whenever the section  $a$ , of the track is occupied at any point by a vehicle. In the same manner the train would be stopped in case the detector circuit 25, should be interrupted by the breakage of a rail in the section  $a$ , or in the particular section through the rails of which the circuit 25, is completed.

I do not limit myself to any particular form or construction of electro-magnet or of the intermediate mechanism whereby the brakes may be applied and the steam cut off, nor do I limit myself to any particular way of



causing current to flow on the locomotive, as any suitable means may be employed whereby the current flowing on the circuit 26, may cause the electro-magnets on the locomotive to be energized.

While I have described my invention as carried out by the use of an air brake, it is obvious that it might be practiced by using any other form of brake apparatus the actuating or operating power of which can be controlled in a similar way by the movement of an arm or lever. So also while I have described the use of steam as the driving power it is obvious that a throttle valve or cut off adapted for controlling any other motive power agency might be operated in place of the steam throttle valve in a similar way.

Fig. 3, illustrates a simple arrangement of the circuits wherein the magnet B, when de-energized is caused to close the circuit to the track devices directly instead of through an intermediate magnet. In this instance the armature of the electro-magnet is shown arranged to close such circuit upon its back stop, circuit being normally kept open by the power of such magnet. In the case of the normally open track circuit it would obviously be only necessary to invert the contact through which the circuit to the track devices is closed.

The combination of apparatus whereby the throttle and the brake may be brought into action together by the direct operation of an electro-magnet as hereinbefore described, is not herein claimed but is broadly claimed in another application for patent filed by me February 24, 1892, Serial No. 422,631.

What I claim as my invention is—

1. In an apparatus for controlling the movement of railway vehicles, the combination with an electro-magnet connected to the opposite rails of a section of track, of a battery or other generator of electricity connected to the opposite rails of the said section, and an auxiliary independent conductor extending from said generator along said section and forming a circuit closed through wheels and axles of a vehicle on said section and independent to a greater or less extent of the rails for a greater or less portion of the section.

2. The combination of an apparatus for controlling the movement of railway trains or vehicles, of a magnet connected to the opposite rails of a section of track, a generator of electricity connected to the same section, and two supplementary auxiliary conductors leading from said generator and forming a path for the current flowing to the said magnet independent to a greater or less extent of the rails themselves over a greater or less portion of the section.

3. The combination substantially as described, in an apparatus for controlling the

movement of railway trains or vehicles, of the electro-magnet connected to the opposite rails of a section of track, a battery or other generator of electricity connected to the said rails at another point, and a supplemental conductor or conductors leading from the battery or other generator along the section of track and connected to the track at one or more points.

4. The combination in an apparatus for controlling the movement of railway vehicles, a relay connected to a section of track, a battery or generator of electricity connected to the section, a detector circuit formed over the rails of the said section of track and normally kept closed by the action of said relay, a second electro-magnet in said relayed detector circuit, and a third circuit controlled by the latter relay, as and for the purpose described.

5. The combination, substantially as described, with the rails of a section of track, of an electro-magnet connected to one end thereof, a battery connected to the opposite end, a detector circuit formed over the rails and through the front contact of the armature for said magnet, an electro-magnet in said detector circuit, and a relayed circuit normally kept open by the latter magnet and connected to circuit closers on the road bed of another section of track.

6. The combination in an apparatus for controlling the movement of railway vehicles, of a vehicle having a brake controlling device and a motive power controller, an electro-magnet or magnets for bringing the same into operation together, a circuit for said magnets on the vehicle, devices on the road bed of a section of track, an electro-magnet connected to or with the rails of another section of track, and relay devices governed by said magnet for controlling the connections to the devices on the road-bed of the first named section.

7. The combination substantially as described, with a section of railway track, of an electro-magnet whose opposite terminals are connected respectively to the opposite rails, a generator of electricity having its opposite poles connected to the opposite rails of said section at another point, a supplemental conductor extending from the said generator connected to the rails at one or more points, and a detector circuit formed through the rails and independent of the circuit formed by the said magnet, battery and supplemental conductor.

Signed at New York, in the county of New York and State of New York, this 9th day of January, A. D. 1891.

FRANK E. KINSMAN.

Witnesses:

WM. H. CAPEL,  
T. F. CONREY.