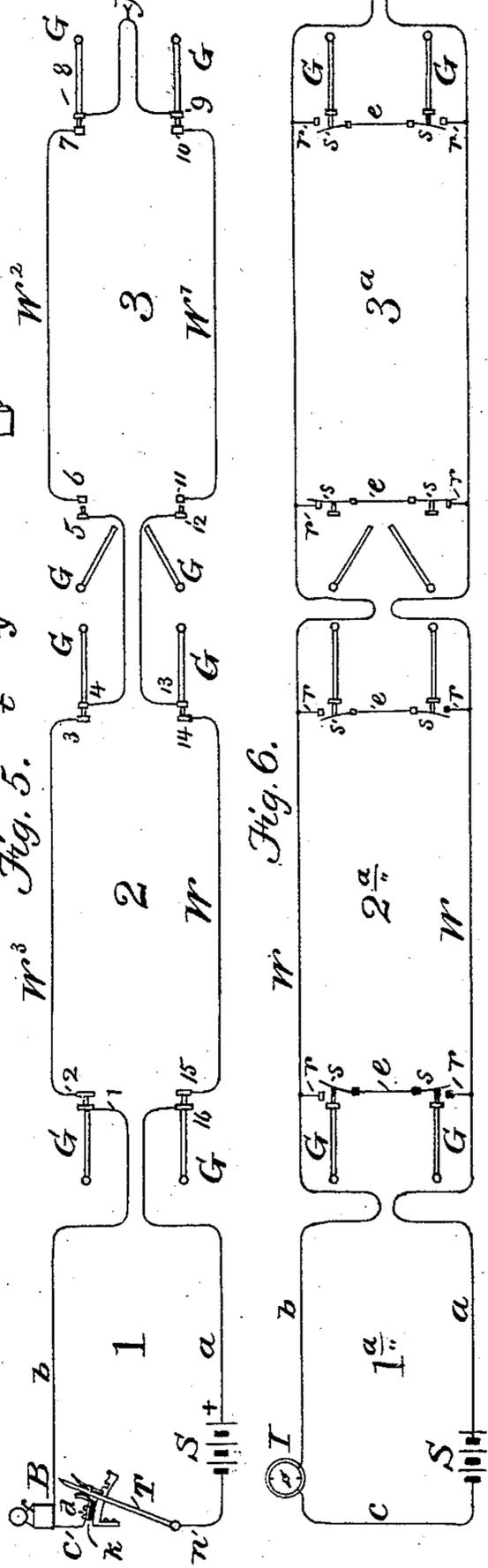
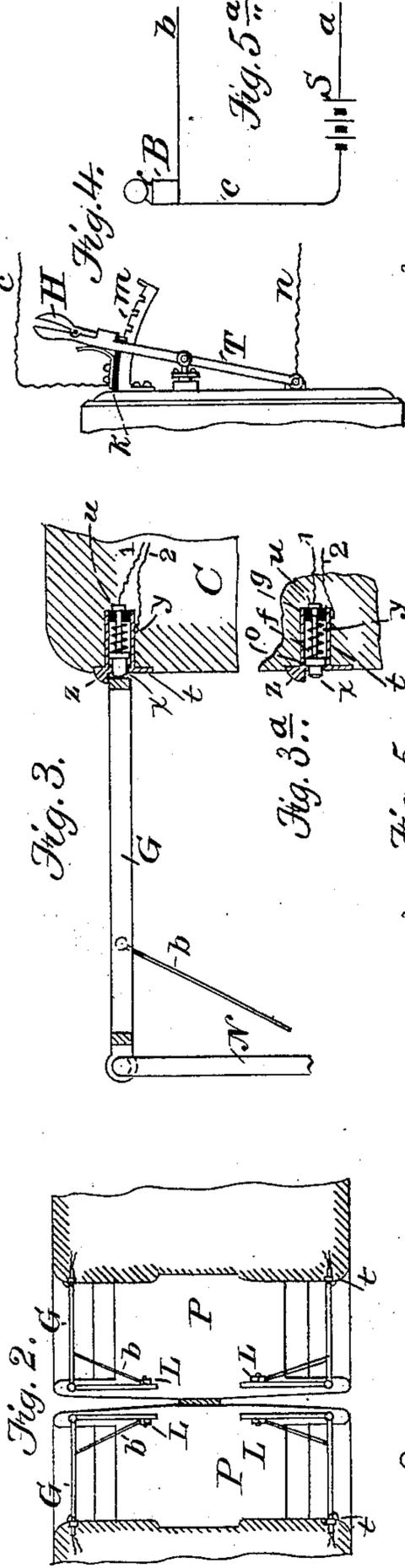
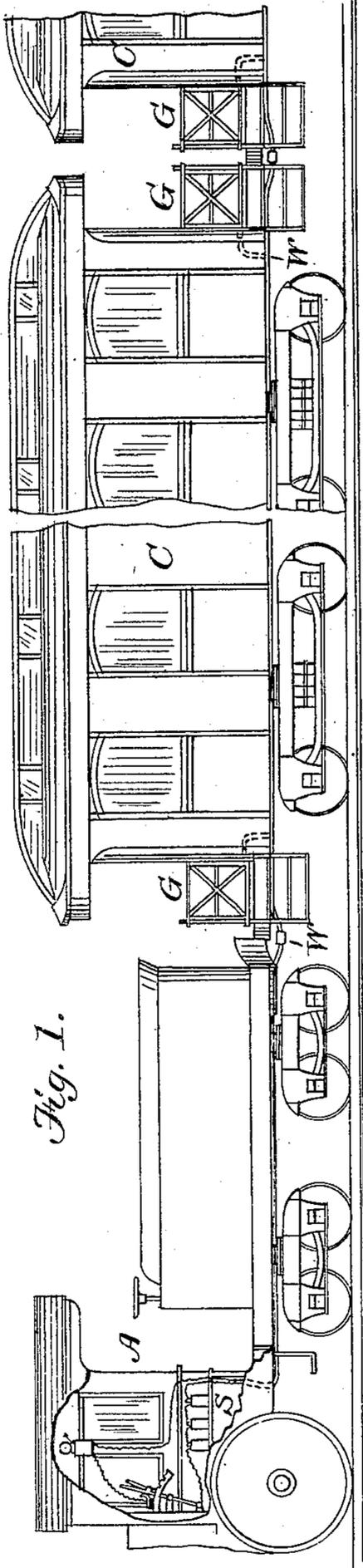


(No Model.)

E. T. GILLILAND.
ELECTRIC TRAIN SIGNALING.

No. 318,102.

Patented May 19, 1885.



Witnesses.

Thos Lockwood
Geo Willis Pierce

Inventor:
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By his Attorney,
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UNITED STATES PATENT OFFICE.

EZRA T. GILLILAND, OF BOSTON, MASSACHUSETTS.

ELECTRIC TRAIN-SIGNALING.

SPECIFICATION forming part of Letters Patent No. 318,102, dated May 19, 1885.

Application filed February 24, 1885. (No model.)

To all whom it may concern:

Be it known that I, EZRA T. GILLILAND, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented
5 certain Improvements in Automatic Electric Train-Signaling, of which the following is a specification.

My present invention is an improved system of electric signaling, and relates specially to
10 that class of signals in which the operation of the indicating-instrument is effectuated only when all of a number of circuit-controllers co-operate simultaneously to that end.

The object of my invention is to furnish at
15 a definite point an indication having a predetermined meaning by means of a signaling-instrument located at that point, and by means of the combined operation of mechanisms of like character to one another located at any
20 number of other points, so that the condition of such other points with respect to their function and their readiness to perform that function may be made known, and the action of the signal-receiving point predicated there-
25 upon.

The principal application of my invention which I at present contemplate is to the various cars and the locomotive of a railroad, and specially of such railroads as the elevated
30 roads in use in the city of New York, where the official in charge of the two approximating ends of adjoining cars has charge of gates controlling access to the platforms of the cars, the said gates of the two cars being opened by
35 the action of a lever actuated by the attendant when the train stops at a station to receive and discharge passengers, and closed by the reverse action of the said lever when the passengers are disposed of. So far as I am aware,
40 in the actual operation of such roads, each attendant, as he closes the two gates of his cars, gives a pull to the signal-bell rope leading to a mechanical alarm placed in the engine-cab, and thus successive strokes of the bell are
45 given in the hearing of the engine-man, and only after the requisite number of strokes have been delivered, indicating that the gates at every platform are closed, is the engine-man authorized to start the engine. It follows that
50 he must count the signals, which implies a

fixed attention on his part, and, moreover, a possibility of two signals coming in at once, whereby a delay is or may be caused. To prevent the occurrence of any such contingency, I have devised the invention which I
55 am about to describe. I place an electric signaling-instrument of any desired character (either audible or visual, for example,) in the cab of a locomotive, and arrange a voltaic battery or some equivalent source of electric
60 energy in circuit therewith. I further extend wires constituting the said circuit or an extension thereof along each side of the train of cars, and provide circuit-controllers, one at
65 each gate, whereby the position of the gates determines the condition of the circuit, and as a consequence the condition of the signaling-instrument placed in the engine-cab. The
70 said circuit may be either normally open or normally closed; but the arrangement of the wires and circuit-controllers is not entirely alike in both cases. If the closed circuit is elected, the
75 said circuit passes through the several gates on both sides of the train successively and must be permanently closed at the rear. When the several gates on either side are open for the
80 ingress and egress of passengers, the circuit-controller at each of the open gates is also open, and the instrument in the cab is therefore quiescent. Moreover, if any number of
85 the gates short of the total number be closed, the circuit is still open and no signal can be given; but when all the gates are closed all of the circuit-controllers are, as a result, made
90 operative, the signal is instantly given, and the train is put in motion. I may also allow the signal to be continuously given during the period of time while the train is moving; or I may provide mechanism whereby the starting of the train automatically stops the signal.
95 Should the open-circuit system be adopted the connections between the cars are necessarily reversed. Instead of leading the wires of the circuit successively through the various circuit-changers, I lead them, as before, from
100 one end of the train to the other, but leave them open or disconnected from one another at the rear, and I extend branches inward at each gate on both sides, arranging the circuit-controllers so that the circuit is closed and the

signal given when any or all of the gates are open, and opened only when all the gates are closed, so that the cessation of the signal conveys to the engine-man the knowledge that all is ready for a start. It will of course be understood that my invention is not exclusively applicable to trains having gates such as I have referred to. It may be applied with equal facility to any arrangement where the operation at a central point depends upon the condition of affairs at a number of other points. It may, for example, be applied to ferry-boats, to surface railroads, or to street-car routes where the cars are run in trains, or where driving engines or cables are employed as motive power.

In the drawings which illustrate this specification, Figure 1 is a view of a train of cars furnished with gates as above, and showing the battery and signaling-instrument on the engine-cab. Fig. 2 is a plan view of the two platforms of adjoining cars and illustrates the arrangement of the gates. Fig. 3 shows the circuit-changer in section and the manner in which it is acted upon by the gate when closed; and Fig. 3^a is a section of the same circuit-changer, holding the circuit open. Fig. 4 is an enlarged detail exhibiting the plan by which the stopping and starting of the engine controls the circuit, so that when stopped the bell is in position to be operated by the action of the gate-circuit changers, and so that when the train is in motion it is not in such position. Fig. 5 is a diagram representing the arrangement of the closed-circuit system in accordance with my invention. Fig. 5^a is a portion of the circuit, showing the arrangement when the throttle attachment is omitted; and Fig. 6 is a diagram exemplifying the application of an open circuit thereto.

In the drawings, A is the cab of a locomotive-engine drawing a train of cars, C, connected with one another in the usual way. The platforms of these cars are inclosed at the sides by gates G, which are uniformly closed while the train is running, and which are of course opened by a brakeman or other attendant standing upon the platform upon the arrival of the train at a station. The said attendant, by means of a lever and a system of connecting-rods, (forming no part of my invention, and consequently being merely indicated here,) throws the gates of the two adjoining cars open.

The letter L indicates the lever, which, by means of the rod *b*, pulls the gate G inwardly, so that while, when the train is running, the gate G stands across the platform and at right angles to the standard N, on which it is hung, as shown in Fig. 3, when the train is stopping at a station, the gate being open is swung back on its hinges, and stands parallel to the said standard N. The gates are of course placed on both sides of the train, so as to afford facilities for running in either direction. An electric circuit runs from the engine to the rear end of the train. One of the wires of the said

circuit may be run on one side of the train and one on the other; or both may be run on one side, as may in practice be found more convenient.

The connections to be used between each two cars may be of any preferred character, and a good plan is that shown and described in Letters Patent issued to me October 31, 1882, No. 266,806, wherein the circuit-wires W are supported by the air-brake pipe, and wherein the couplings of the said pipe are utilized also as the splices or joints of the electric circuit. Included in this electric circuit and placed in the engine-cab are a voltaic battery or equivalent constant source of electrical energy, S, and an electric signaling-instrument, which I have variously shown as an electro-magnetic bell, B, and an indicating-needle, I, since either form, or, in fact, any of the well-known forms, may be used without departing from the spirit of my invention. The latter instrumentality is so placed as to be continuously under the immediate cognizance of the engineer, so that he may be at all times governed by its operations or movements. It should here be noted that it is not absolutely essential that a battery shall be employed, since it is possible to operate locomotives by means of dynamic electricity, in which case it would be preferable to tap the main conductor conveying such electricity by means of branch circuits in a manner well understood by skilled electricians, and to utilize the electricity so obtained in lieu of employing a special battery for that purpose. Circuit-controlling springs are let in suitable points on the corners of the car frame-work. These may be of any of the well-known forms used in burglar-alarms and like electrical systems.

Figs. 3 and 3^a show in section one form, which may readily be adapted to this purpose. Each circuit-controller consists of a socket, *t*, having externally an abutment, *z*, against which the edge of the gate G, when closed, abuts. Within this socket is a longitudinally-sliding rod, *y*, which, when uncontrolled, is pressed outwardly by a spiral spring, *f*, but which is prevented from moving too far in its outward direction by the collar *e*, which surrounds it. A nipple, *x*, constitutes the end of this rod, and projects normally beyond the surface of the socket *t*. One of the circuit-wires, 2, is connected with the sliding rod through the metal frame of the socket, or otherwise, and the other wire, 1, is united to a metal contact-pin, *u*, which projects through an insulating-plug, *g*, into the bottom of the socket to meet the movable end of the rod *y*. It will be readily observed that when the gate G is closed its edge presses the end *x* of the rod *y* against the force of the spring *f*, and the rod being thus pushed in makes contact, as shown in Fig. 3, completing the circuit at that point. On the contrary, when the gate is opened the rod springs outward, opening the circuit, as shown in Fig. 3^a. The entire cir-

5 cuit, as indicated by the diagrams, Fig. 5,
 leaving one pole of the electrical source S,
 is through the wire *a* to the circuit-controlling
 springs at the first car-junction, 16 and
 10 15, then by wire W and the successive circuit-springs
 14 and 13, 12 and 11, wire W', springs 10 and 9
 to the rear end of the train, where it is formed
 in a snap-coupling, *j*, which may, as desired,
 form a connection with the wires of another car,
 or which may act as a terminal. Returning from
 the couplings *j*, it passes the several springs,
 8 and 9, 6 and 5, 4 and 3, 2 and 1, and the
 wires W², W³, and *b* to the signal-instrument
 B, thence by wire *c* to a contact-spring, *d*,
 15 placed on a non-conducting block, *k*, so that
 the throttle-lever T may come in contact therewith
 when the throttle is closed, but is severed therefrom
 when the throttle is open. The throttle-handle
 20 itself by wire *n* connects with the other pole of
 the original source of electricity, so that when
 the throttle-lever is pushed forward and the gates
 are all closed the circuit is also closed, and
 the signal consequently in operation; but when
 25 the circuit is open at but one of these points—
 that is to say, when any of the platform-gates
 are open or when the throttle is open—the signal-
 instrument is inert. In the diagram it is assumed
 that the throttle and all of the gates except those
 30 controlling the springs 5 and 6 and 12 and 13
 are closed. These gates being open, the signal
 cannot be given. It is of course understood that
 although the diagram implies that the wires run
 35 both sides of the train, such would rarely be
 the case in actual practice. The preferable plan
 would be to use a cable in which both wires,
 insulated from one another and from external
 objects, are comprised.

40 In the operation of this invention let it be
 supposed that a train is standing at a station,
 all of the platform-gates being open to admit
 and discharge passengers. The locomotive-throttle
 is of course closed since the engine is at rest;
 45 hence the circuit is closed at that point, though
 open at several others. We may further assume
 the gates being successively closed between cars
 1 and 2, 2 and 3, and 3 and 4, each gate operating
 a single circuit-controlling spring. When, now,
 50 the last gate is closed, the circuit is also closed,
 the signal is given, and the train starts. The
 engine-man, however, is compelled to pull the
 throttle before he can move the train, and thus
 the circuit is once more opened and the signal
 55 ceases to operate as soon as the train starts.
 It is not, however, essential that the circuit
 shall be so controlled by a throttle attachment
 or by any automatic or manual attachment, as
 circumstances may arise in which it becomes
 60 desirable to allow the signal to remain operative
 during the entire period during which the train
 is in motion. In such a case the engine-circuit
 changer may be dispensed with, and the circuit
 65 will be continuous, so far as that part of it
 contained on the engine is concerned, as shown
 in Fig. 5^a. Furthermore, I do not con-

fine myself exclusively to the use of an electric
 bell as an indicating or signaling instrument,
 as in actual practice what is known technically
 70 as a "buzzer" would usually be preferred; but
 I have shown a bell simply as a type of any
 preferred instrument. It is perfectly evident
 that an open-circuit system may be adapted
 to my invention with equal facility, and I have
 75 in Fig. 6 shown such an arrangement. It will
 be observed that the only change made necessary
 by this modification is that the main-circuit
 wires, instead of passing through the circuit-
 controlling springs, pass direct to the rear
 80 of the train. Branch wires *r* are at each gate
 extended inward, and a bridge, *e*, of conducting
 material extends across from the other main-
 circuit wire, and terminates in a spring, *s*,
 which is actuated by the gate G, and which,
 85 when the gate is closed, is kept away from
 the stud at the end of the branch *r* at all
 points, so that while the gates are closed the
 circuit is open and the signal I is inoperative.
 Should any of the gates G be opened, as
 90 shown, in the front of the rear car, the circuit
 is at once closed at one point, between *s* and
r, and this of course operates the signal quite
 as well as if all of the said gates were open.
 Thus the signal must necessarily be in opera-
 95 tion as long as the train is stopped at any
 station, and conveys the indication to the
 engine-man by ceasing to operate when all is
 right. If a battery is used, any of the well-
 known forms in which the splashing of fluid
 100 is prevented by packing with sand or saw-
 dust may be employed; or I may use an her-
 metically-sealed battery.

In Fig. 6 I show a dial-indicator instead of
 an audible signal, as in some instances such
 105 an instrument would be preferable.

Where I have in this specification used the
 term "locomotive," it must be understood that
 a steam-locomotive is not necessarily implied,
 as my invention may be applied with equal
 110 propriety to an engine impelled by any other
 force.

I claim—

1. The combination, with a locomotive and
 a train of cars, of a series of platform-gates for
 115 the said cars, an electric circuit, a series of
 circuit-controllers included in the said circuit,
 and independent of but mechanically actuated
 by the said gates, and a signaling-instrument
 placed on the locomotive and
 120 adapted to give a signal in response to the
 united action of all of the circuit-controllers,
 substantially as and for the purpose specified.

2. The combination, with a locomotive and
 a train of cars attached thereto, and provided,
 125 as shown and described, with platform-gates,
 of an electric circuit extending from the engine
 to the several cars, an alarm-instrument
 included in the said circuit and placed on the
 engine, a series of circuit-changers in the said
 130 circuit, one for each platform-gate, automati-
 cally actuated by the opening and closing of
 said gates, and means, substantially as indi-
 cated, whereby the circuit may be automatic-

ally opened and closed when the engine is started and stopped, substantially as described.

3. The combination, with a locomotive and a train of cars provided, as hereinbefore described, with platform-gates, of an electric circuit including a signaling-instrument placed on the engine, and a battery or other equivalent source of electric energy, a series of circuit-changers included in and controlling the said circuit, each circuit-changer being adapted to be automatically operated by the opening and closing of one of the platform-gates, so that the concurrent action of all the circuit-closers is required to actuate the signaling-instrument, and an auxiliary circuit-changer also included in the same circuit but controlled by the throttle-lever of the locomotive so that the said lever when moved to start and stop the engine is enabled at the same time

to actuate the said auxiliary circuit-closer and open and close the circuit, substantially in the manner and for the purposes specified. 20

4. The combination of an electric circuit, a circuit closer or changer therefor, and a locomotive-engine throttle or regulator, whereby the circuit may be opened by the action of starting the engine and closed by the action of stopping the engine, or vice versa, as described. 25

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 14th day of February, 1885. 30

EZRA T. GILLILAND.

Witnesses:

GEO. WILLIS PIERCE,
THOS. D. LOCKWOOD.