(No Model.)

E. T. GILLILAND.

RAILROAD TRAIN ELECTRIC SIGNALING APPARATUS.

No. 266,806. Patented Oct. 31, 1882.

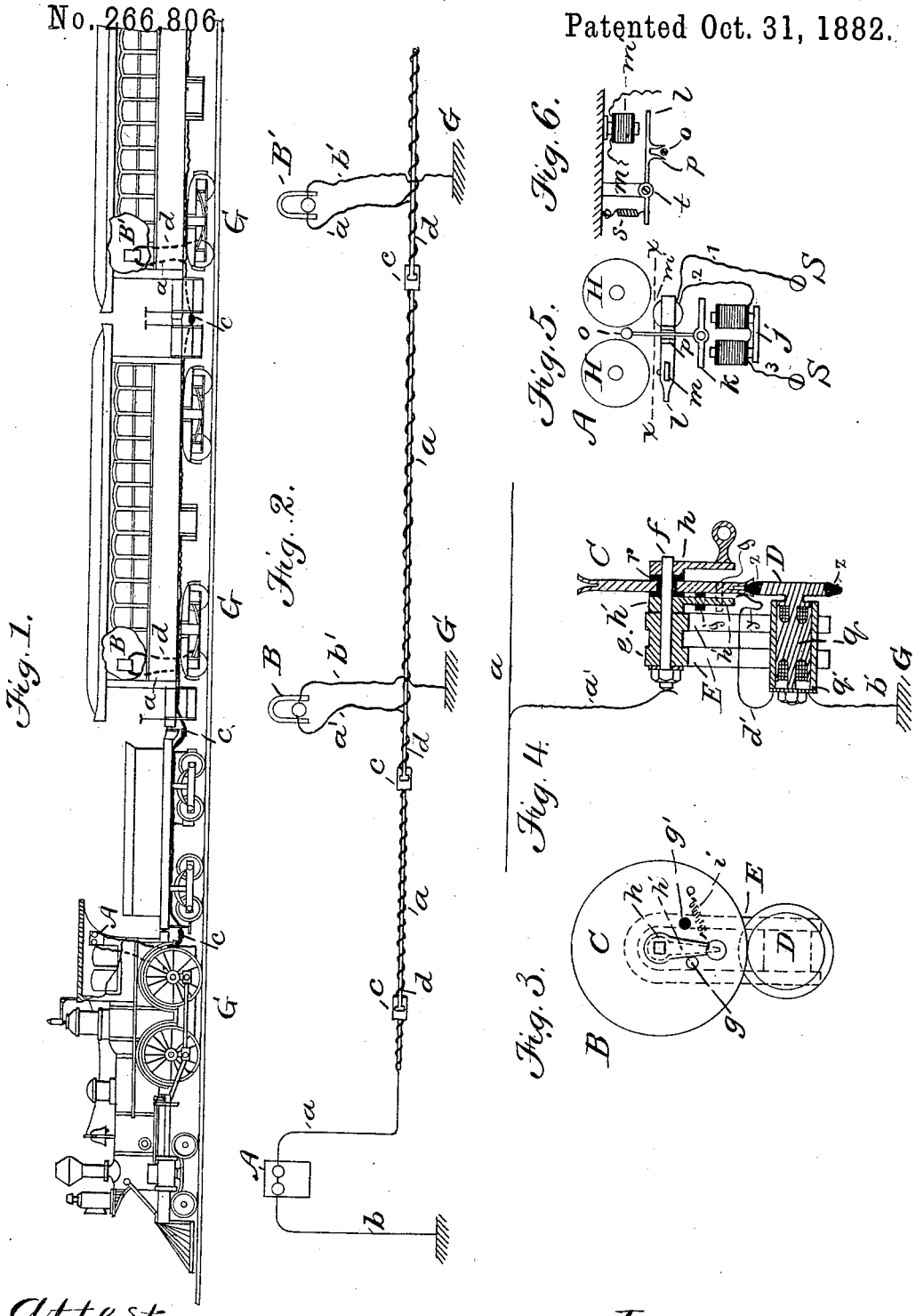

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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RAILROAD-TRAIN ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 266,806, dated October 31, 1882.

Application filed June 15, 1882. (No model.)

To all whom it may concern:

Be it known that I, EZRA T. GILLILAND, of Indianapolis, in the county of Marion and State of Indiana, have invented certain Improvements in Railroad-Train Electric Signaling, of which the following is a specification.

My invention relates to and is an improvement in the art of electrical signaling between the different cars and the locomotive of a railroad-train, and in the apparatus and organizations of circuits by which such signaling is accomplished.

Its objects are as follows: to dispense with the present inconvenient and cumbrous mode of communication in which a cord passing from car to car is forcibly pulled to operate a mechanical bell affixed to the engine-cab; to substitute for the said cords and bell an electric bell upon the engine, and an effective and convenient generator of electricity in each car; to accomplish the same without introducing a galvanic battery, which would be an objectionable feature upon railroad-trains; to provide means whereby the engine-bell may be prevented from giving false signals; and, also, to arrange the electrical circuits in such a manner that no additional work is necessitated in making up trains—such as the coupling or jointing of wires or binding-screws—while at the same time should the cars of the train, from causes, accidental or otherwise, be detached from one another, the apparatus or the cars still attached to the engine shall retain their effectiveness unimpaired.

For the attainment of these objects my invention consists in the combination of a suitable electric bell placed on the engine with a magneto-electric generator conveniently disposed in each car of the train, and with circuit-wires so arranged relatively to the air-tubes appertaining to the brake apparatus that the coupling of the air-tube joints shall also couple the said circuit-wires, so as to form a continuous conductor extending the length of the train, and provided at each car with a branch wire to the generator of such car, said branch wires being normally open, but adapted to make contact through the generator-coil with the earth when the said coil is rotated for the purpose of transmitting a signal.

It further consists in means whereby the main circuit may be closed at any of the generators, and the generating-coil introduced into the said closed circuit by the act of sending a signal, the said generating-coils, when quiescent, being maintained without any electrical connection with the main circuit whatsoever.

It also consists in means whereby the hammer and armature of the engine-bell are mechanically controlled and prevented from chattering, and thus giving false signals, when the generators are at rest, while their release is permitted whenever the generators are operated and by the first signal transmitted.

It consists, also, in the utilization of the air-tubes of the brake apparatus as a support for the continuous conductor, and of the metal joints of the said air-tubes as electrical conductors between the different sections of conductor, thus dispensing with additional and complicated adjuncts in the process of train-coupling.

It further consists in the combination of a ground or return wire with each generator-coil, one terminal of the coil being permanently connected with the said ground or return wire, and the other terminal being maintained normally open, but adapted to connect electrically with the branch wire extending from each generator to the main circuit, and thus close the said main circuit and include the generator-coil therein.

In the drawings accompanying this specification, Figure 1 is an outline view of a train fitted with my improved apparatus, having a portion of the side of the engine and of the cars broken away to show the locations of the bell and generators. Fig. 2 is a diagram of the completed main circuit, its several branches, and ground or return wires, showing the conductor spirally disposed round the air-tube, and its several sections united by the joints thereof. Fig. 3 is a side view of the generating-machine, showing a portion of the interior mechanism by dotted lines. Fig. 4 is a vertical section of the generating apparatus. Fig. 5 is a front view of the engine-bell, and Fig. 6 is a horizontal section of the same on the line *x x* of Fig. 5.

In Figs. 1 and 2, A is an electric bell conveniently placed in the engine-cab, and B B′ are magneto-electric generators located and suitably fixed in the several cars of the train.

The bell A may be of any desired construction, although its form is necessarily dependent upon the character of the generator employed. If I elect, for example, to attach a commutator to the generator, which will have the effect of straightening the alternating currents ordinarily supplied by the machine, an ordinary circuit-breaking bell will answer every requirement. If I dispense with a commutator and permit the alternating currents, when generated, to traverse the conducting-wire and reach the bell unmodified, it becomes necessary to provide what is generally known as a "polarized" bell, and this latter form I prefer. Irrespective, however, of the description of bell used, the controlling device hereinafter described, and shown in Figs. 5 and 6 is applicable, and becomes an important element in my invention. The electro-magnet coils of the bell A are attached in a manner well understood to binding-screws S, Fig. 5. A wire *b* is led from one of these binding-screws to any part of the metal frame-work of the engine with which it is electrically connected, thus forming a practical ground or return circuit through the rails. To the other binding-screw is attached the insulated wire *a*, leading to the nearest coupling *c* of the air-tube *d* of the brake apparatus. Each integral portion of the train—as the tender and the several cars—is of course provided with its separate section of air-tubing *d*, furnished at each end with a screw-coupling *c*, whereby the respective sections attached to the several cars may, when the train is made up, be united to form a continuous tube. An insulated wire, *a*, is wound spirally about each tube-section, and at both ends is terminated by soldering or otherwise attaching it to the metal coupling *c*. Each car-section of the air-tube is thus made to act as a support for a corresponding section of electrical conductor, the couplings serving the double purpose of tube-couplings and wire-connectors; and when, by coupling the air-tubes *d*, a continuous tube is formed, extending the entire length of the train, a continuous electrical conductor of corresponding length is simultaneously and by the same operation produced. Branch wires *a'* are permanently attached to the main conductor *a* and led up through the floor of each car to the magneto-generators B B'. These wires are so connected with the mechanism of the generators that when the said mechanism is at rest, or is not being operated, they are free from any contact with the generator-coils, and remain open or in an insulated condition. Normally, therefore, they have no effect upon the main conductor *a* or the signal-bell A. A second wire, *b'*, is led from the generator-coil to the metallic frame-work of the truck of the car and electrically attached thereto, forming, through the said truck and the wheels, a connection with the rails, and thereby serving as a ground or return conductor. The two wires *a'*, entering the generator mechanism from the main conductor *a*, and *b'*, entering the coils from the metal truck frame-work and ground, have normally no connection or contact with one another, as will be seen from the following description:

Referring now to Figs. 3 and 4, a metal shaft or arbor, *f*, is supported by any suitable bearings, *e*, within the arch of the horseshoe generating magnets E. It is fitted at its outside end with a crank or handle, *h*, by which it is rotated, and at its other end is provided with a screw and nut, whereby it is maintained in place. A ring or hub, *r*, of non-conducting material, is fixed to the center of the metal driving-wheel C, and is bored out so as to fit loosely upon the arbor *f*, and by its employment the said driving-wheel is insulated from the arbor, and thus from the entire metal parts of the generator. The driving-wheel C is grooved at its edge, so as to drive by frictional pressure a smaller wheel or friction-pinion, D, which is fixed upon the shaft of the Siemens armature *q*, this being adapted to rotate within the metal cylinder *q'* and between the poles of one or more of the permanent magnets E. The periphery of the small disk or friction-pinion D is wedge-shaped, so as to fit tightly within the groove of the driving-wheel C, and is shod with non-conducting material *z*. Consequently there is no metallic connection between the wheel C and the pinion D, or with any other part of the mechanism of the generator. The generator-coil *q* is at one of its terminals attached in any desired manner to the ground or return wire *b'*, and its other end is led by the wire *d'* to the spring *y*, which presses continually against the flat surface of the driving-wheel C, causing the said wheel C to become virtually the normal termination through the coil of the ground or return wire *b'*. An arm of metal, *h'*, is rigidly affixed to the arbor or shaft *f*, as shown in section in Fig. 4, and in the dotted lines, Fig. 3, and is normally maintained by the tension of the spiral spring *i* (also shown in dotted lines in Fig. 3) in contact with a non-conducting pin, *g'*, which is firmly inserted in the side of the driving-wheel C. A metal pin, *g*, is also inserted in the substance of the driving-wheel, and is constantly in electrical connection therewith. This pin is placed a short distance in advance of the non-conducting pin *g'* in the direction in which the crank is to be rotated, as shown in the end view, Fig. 3. The wire *a'*, branching from the main conductor *a* and leading to the generator, is permanently attached to any part of the mechanism or frame-work of the generator. I have shown it as a spring pressing against the end of the shaft *f*.

It will be readily understood by those skilled in the art of electro-mechanics that normally there can be no electrical connection between the wire *a'* thus attached to the arbor and the return-wire *b'*, which, after traversing the insulated wire of the armature-coil, is connected by the spring *y* with the driving-wheel C. Inasmuch as the said driving-wheel is insulated from the arbor by the non-conducting

ring *r*, and from its pinion D by the non-conducting rim thereof, the Siemens armature-helix of the generator is therefore normally on an open circuit; but when the crank is turned, as in the act of sending a signal, the arm *h'* is withdrawn from the insulated plug *g'*, against which it is held by the spiral spring, and forced against the metal pin *g*, with the double result of rotating the driving-wheel by the impelling action of the arm *h'* on the pin *g*, and of uniting the two wires *a'* and *b'*, and thus closing the circuit of the generating-coil *q* by the pressure of the said arm *h'* upon the pin *g*. The current generated by the rotation of the coil between the magnet-poles is thus enabled to traverse the completed circuit from the rails or ground G through the metal frame of the car-truck, and by wire *b'* to the generating coil *q* through the coil, thence by wire *d'* and spring *y* to driving-wheel C and metal pin *g*, thence by pressure-contact with the metal arm *h'* to arbor *f* and wire *a'*, continuing by means of the main conducting-wire *a* to the signal-bell A on the engine, producing the signal, finally returning by wire *b* to the metal frame of the engine, and thus through the wheels once more to the rails, which serve in practice as a return-conductor of low resistance in some cases and in others as an earth-plate.

It is obvious that the currents generated will take the desired direction through the engine-bell, since the circuit is permanently closed in the direction of the bell only, for the main conductor being uniformly open in the rear direction, except when a signal is actually being transmitted, no facilities are offered to the currents to traverse the conductor in that direction. It is therefore advantageous to employ a generator such as I have described, whereby the line is maintained normally open, and whereby any generator, when operated, is enabled to concentrate its entire energy in the direction of the bell to be rung.

I prefer to construct the crank end of the arbor *f* of some special conformation. For example, I have shown it as being squared, and by such a construction and by the provision of handles or keys which may readily and conveniently be slid on or off the end of the arbors I propose to prevent the unauthorized or unnecessary use of the generating-machine and the irregular signals which would result therefrom. By the adoption of such a method it is evident that each official may carry the requisite key or crank with him, only to be used when absolutely necessary and by the proper persons.

Experience has demonstrated that the violent and continued jarring of locomotive-engines frequently causes the delicately-suspended armature of an electric bell to be mechanically shaken or vibrated, thus bringing the hammer into forcible contact with the bell and producing false signals. To provide for such a contingency and prevent all such unintentional signals, I have devised the means shown in Figs. 5 and 6, in which *j* is the regular bell-magnet, provided, as usual, with a polarized armature, *k*, pivoted at its center and adapted to vibrate from side to side when influenced by electrical pulsations of alternating direction. The bell-hammer *o* extends from the center of the armature, and when in operation strikes alternately the two bells H H. Upon the vertical base of the apparatus I place a second electro-magnet, *m'*, in the main circuit of the bell-magnet *j*, arranging the circuit-wires as shown in Fig. 5. Entering the bell apparatus at the binding-screw S, the circuit is through the auxiliary magnet-helix *m'* by wire 1. Passing through the said helix, it proceeds *via* wire 2 to the bell-magnet *j*, and thence by wire 3 to the second binding-screw S, and out. A soft-iron or neutral armature and lever, *l*, fulcrumed at the point *t* upon a standard, *m*, is normally retracted from the core of the auxiliary magnet *m'* by a spiral spring, *s*. It is provided with a jaw, *p*, which, when the said armature is quiescent, clasps or embraces the bell-hammer *o*, thereby preventing any lateral movement thereof, and keeping it from striking the bells H when such striking is not designed. Being of soft iron, the armature *l* is capable of responding to electric pulsations irrespective of the direction of such pulsations, and therefore when the generators in any of the cars are operated the first electric impulse transmitted vitalizes the auxiliary magnet *m'*, the armature *l* is attracted and releases the bell-hammer *o* from the jaw *p*, and when thus liberated the armature *k* is of course susceptible of free vibration by the rapidly-changing magnetism of the magnet *j*, and the bell is rung.

To cause my invention to become operative it is only necessary to fit the crank or handle of the desired generator to the end of the arbor or shaft and to rotate the same manually. The act of rotation first brings the generating-coil terminal into contact with the main conductor, and, second, produces a strong current of electricity within that conductor, which, passing through it, releases the bell-armature and oscillates or vibrates the same, producing the signal.

It is obvious that when the generating apparatus for each car is, as I have described, located in a severed derived circuit of the main conductor, one or more cars may be broken or detached from the train without in any way interfering with the proper action of the apparatus in the remaining portion of the train attached to the engine.

Although I have stated herein that the insulated conductor is supported upon the air-tube, it is evident that in many cases I may, without departing from the essence of my invention, utilize gas or steam conveying tubes, if such tubes be employed in sections, and adapted to be coupled, and thereby made continuous. In the event of such tubes being me-

tallic throughout, I may use their substance as the return-conductor of the signaling-circuit.

Having now fully described my invention and its application, I claim—

1. A system of electrical train-signaling circuits and apparatus comprising the following elements: a magneto-electric generator in the several cars, an electric alarm-bell upon the locomotive, a main conductor attached at one extremity thereof to the metal frame of the locomotive, having the helix of said alarm-bell included in its circuit and extending throughout the length of the train and in normally-open branches to each generator, a return-wire for each generator, including the generating-helix in its circuit, and connected on one side of the said helix with the metal of the car-truck and extending on the other side of the helix to a normally-open termination, and means adapted to effect a contact between the normally-open return-circuit, including the generating-helix, and the branch of the main conductor adjacent thereto, and immediately thereafter to transmit signals over the signaling-circuit thus completed, substantially as described.

2. The combination, in a system of electrical train-signaling between the cars and locomotive of a railroad-train, of a main conductor extending the length of the train and composed of sections—one for each car—the said sections being supported by the air-tubes of the brake apparatus and permanently at each end with the metal couplings thereof, an alarm-bell connected in the circuit of the said main conductor, normally-open branch wires extending from the said conductor to each car, a normally-open ground or return conducting-wire extending from the metal truck-frame into each car, and a series of magneto-electric generators—one for each car—placed between the branch and ground wires, and adapted, when operated, to make contact between the said branch and ground wires, whereby a signaling-circuit including a generating-coil is completed and signals transmitted.

3. The combination of a normally-open signaling-circuit and branches thereof, and an electric bell included in the said circuit, with a series of normally-open return-wires and a series of magneto-electric generators interposed between the branches of the main-signaling circuit and the return-wires, each of the series being adapted to close the main signaling-circuit through the alarm-bell and through its own helix by means of its own return-wire, and to transmit signals over the completed circuit, substantially as described.

4. The combination of a normally-open signaling-circuit, and an alarm-bell included therein, with a magneto-electric generator and a normally-open ground or return line attached to the armature-helix thereof, and circuit-closing devices, as indicated, whereby when the generator-helix is rotated the said signaling-circuit is automatically closed and the generating-helix included therein for the purpose of sending signals, and automatically reopened at the cessation of such rotation, substantially as described.

5. At any station on a normally-open signaling-circuit and on a derived line of the same, the combination of the said derived line with a magneto-generator the armature-circuit of which is normally open or discontinuous, a normally-open ground or return line, driving mechanism for the generating-helix, and a circuit-closer actuated by the said driving mechanism, whereby when the armature-helix is rotated by the said driving mechanism the derived circuit is united with the ground-wire and the armature-helix included in the completed circuit, substantially as specified.

6. The combination, substantially as hereinbefore described, in a system of electric signaling between the cars and the locomotive of a railroad-train, of a series of magneto-electric generators and operating devices therefor, an electric alarm-bell in the engine-cab, a normally-open main circuit connected by means of the engine-frame with the earth, having the bell-helix permanently included therein and extending the length of the train, supported by means of the air tubes of the brake apparatus, or by means of a system of tubing arranged for the conveyance of gas or steam between the several cars, and made continuous by the couplings thereof, a series of branch wires permanently united with the main circuit and extending to each magneto-generator, these being normally open, a series of return or ground wires, one for each generator, permanently including the helix of the said generator-armature in the circuit thereof, and leading therefrom by means of the metal car-frames to earth, and a circuit-closer adapted to become operative when the generator is rotated, and to complete the main circuit by means of the return-wire and generating-helix, for the purposes specified.

7. A magneto-electric machine having its armature-helix in a normally-open or discontinuous circuit, the said circuit being adapted to close or become continuous only during the rotation of the armature, as described.

8. In a magneto-electrical apparatus, the combination, substantially as hereinbefore described, of a normally-discontinuous derived circuit from a main line, a ground or return wire, a generating-coil having one of its terminals permanently connected with the said ground or return wire, and the other terminal being maintained normally open, but adapted to make electrical connection with the derived main-line circuit by the act of transmitting a signal, whereby the said main circuit may be completed and the generating-coil included therein, for the purposes set forth.

9. In a magneto-electric apparatus, the combination, substantially as hereinbefore set forth, of a generating-coil or armature-helix, a ground or return wire having the said helix

included in its circuit, driving mechanism whereby the said helix may be rotated, a branch line attached thereto and extending outwardly therefrom for connection with a main-line conductor, the said branch line and return-wire both being normally open and insulated from one another, and a circuit-closer adapted to be actuated by the driving mechanism to connect the said coil and return-wire with the branch line, whereby the circuit of the coil may be closed and electrical pulsations transmitted over the main line, substantially as described.

10. The combination, with the hammer of an electric bell, of an automatic guard therefor, consisting of an auxiliary electro-magnet, an armature, a retracting-spring, an armature-lever, and a jaw fixed thereon, the said jaw being adapted to clasp the bell-hammer when retracted by the spring, and to release the same when the electro-magnet is energized, substantially as set forth.

11. In an electrical alarm-bell apparatus, the combination of an electro-magnet, an armature therefor, and a bell-hammer attached to the said armature, with an auxiliary electro-magnet in circuit with the bell-hammer magnet, provided with an armature and armature-lever, and a mechanical guard consisting of a jaw affixed to the armature-lever and normally actuated by a retracting-spring to clasp the bell-hammer, but adapted to release the same when the armature of the auxiliary magnet is attracted by the influence of a passing current, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 5th day of June, 1882.

EZRA T. GILLILAND.

Witnesses:
JAMES F. GILLILAND,
C. W. CRANDALL.