(No Model.)

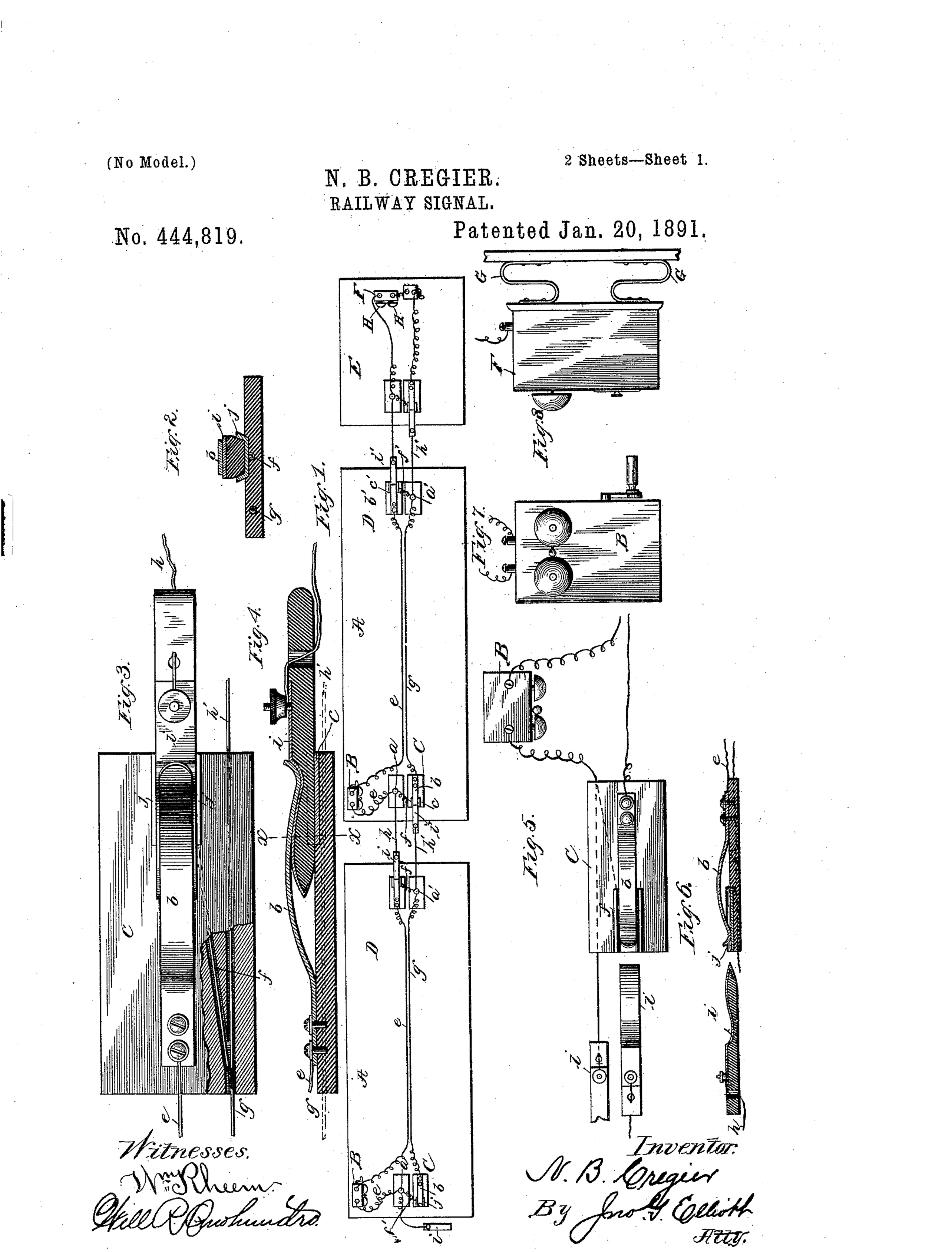
2 Sheets—Sheet 1.

N. B. CREGIER.

RAILWAY SIGNAL.

No. 444,819.

Patented Jan. 20, 1891.



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(No Model.) 2 Sheets—Sheet 2.

N. B. CREGIER

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Fig. 9.

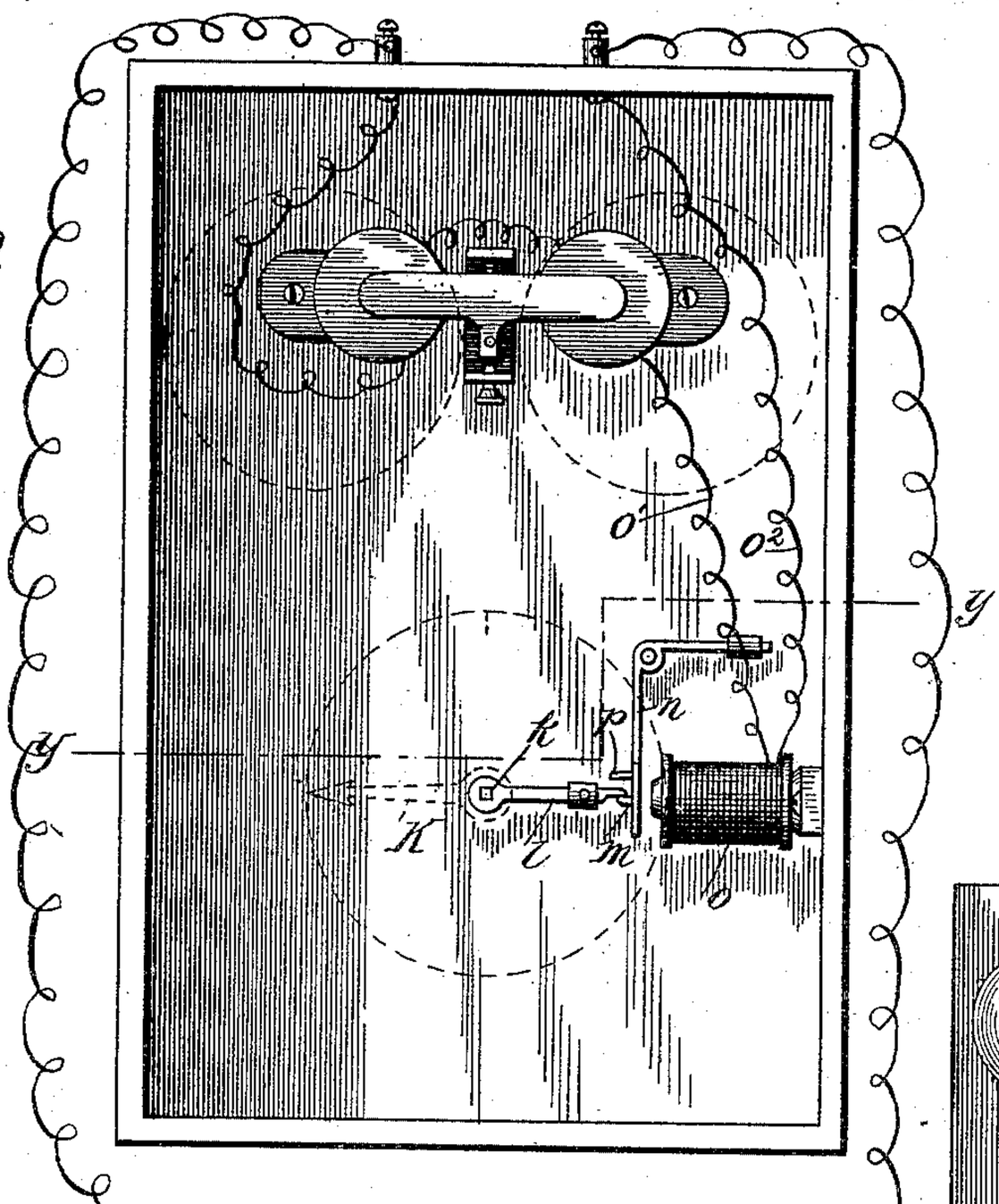


Fig. 12.

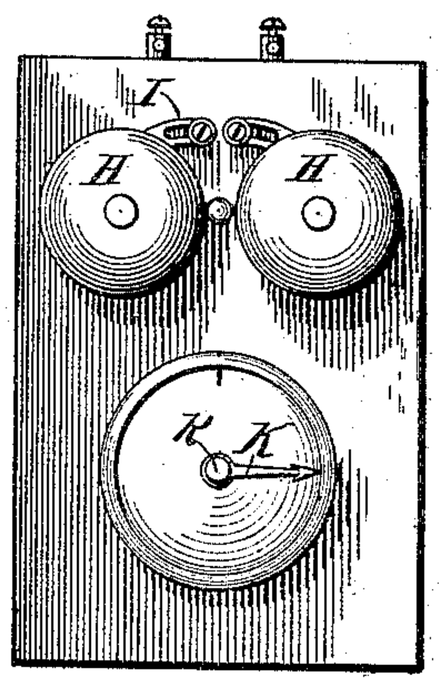


Fig. 10.

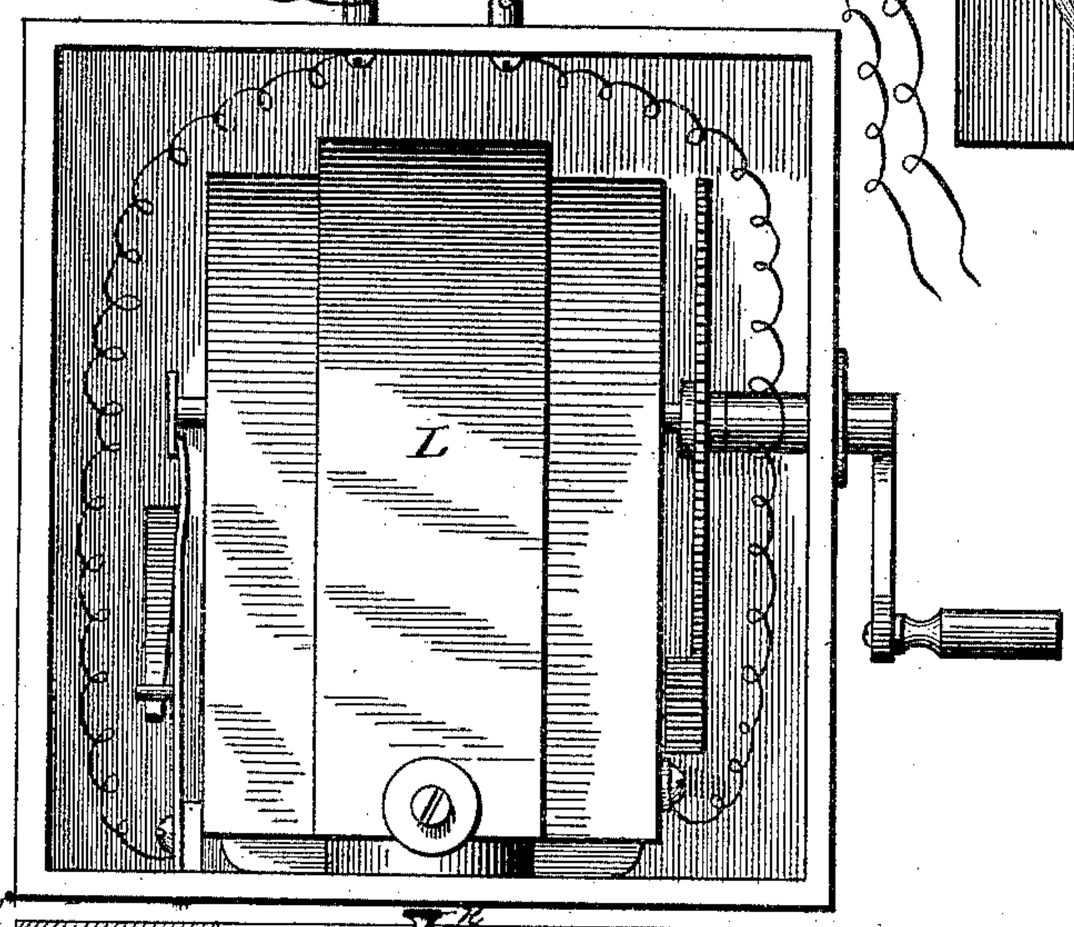
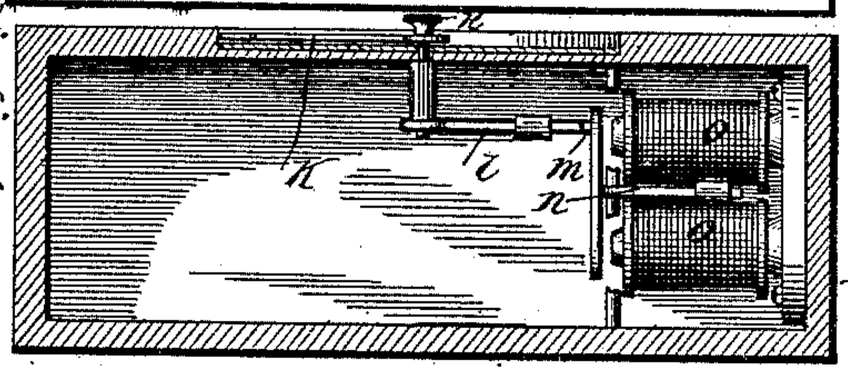


Fig. 11.



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UNITED STATES PATENT OFFICE.

NATHANIEL B. CREGIER, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO DE WITT C. CREGIER, OF SAME PLACE.

RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 444,819, dated January 20, 1891.

Application filed October 25, 1887. Serial No. 253,283. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL B. CREGIER, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Signals for Railway-Trains, of which the following is a specification.

This invention relates to improvements in electrical signaling systems for railway-trains, all of which prior to my invention have been operated upon open circuits.

The prime object of my invention is a train-signaling system by which a signal sent from any one car of a train to the engine or from the engine will be automatically repeated in every car of the train.

Another object is a train-signaling system of such a character that whenever a train is broken in sections a signal sent from any car in the forward section will be automatically repeated in every car of that section and the engine, and one sent from the engine will be automatically repeated in every car of that forward section, and also that when a signal is made in any one or more cars of the rear section said signal will be automatically repeated in every car of that section.

A further object is a train-signaling system in which, after the circuit is once made between the several cars and engine of a train, there is not only no manipulation of switches or other circuit-closers required to make a signal, but in which during the running of a train no break in the circuit can or does occur except by the accidental parting of the train, whereby the circuit is always closed both when in and out of operation, and is therefore ever ready to operate.

Further objects are a train-signaling system in which batteries not only are not but cannot be used, in which no more skill, practice, or thought is involved in making a signal than is required in the turning of the crank-arm of a grindstone or a coffee-mill, and in which the switch connections between the several cars and the engine are of such a character that practically the parting of the train, although dividing the circuit, does not open the circuit, but results in a closed circuit on both train-sections at the instant of parting, and finally to avoid any and all of the objections hereinafter pointed out as to the open-circuit systems, and to accomplish certain other objects, as hereinafter described, embodied in the claims, and illustrated in the accompanying drawings, in which—

Figure 1 represents in plan view a diagram showing the application to an engine and train of cars of an electrical signaling device embodying my invention; Fig. 2, a transverse section through the switch on the line *x x* of Fig. 4; Fig. 3, a plan view of the switch, partly in section; Fig. 4, a central longitudinal section through the switch; Fig. 5, a plan view of the switch and a signal-bell, showing their electric connection; Fig. 6, a longitudinal section of the switch and its plug detached from each other; Fig. 7, a front elevation of a box containing the electro-magnetic machine for the cars; Fig. 8, a side elevation of the engine signal-bell and box therefor; Fig. 9, an enlarged rear elevation of the electrical devices for operating the engine signal-bell; Fig. 10, a similar view of the generator upon the engine, shown in electrical connection with the engine signal-bell; Fig. 11, a transverse section on the line *y y*, Fig. 9, showing the electrical and mechanical connections for actuating the indicator-hand on the engine signal-bell box; Fig. 12, a front elevation of the engine, signal-bell box, and the signal-bells and indicator thereon.

Similar letters of reference indicate the same parts in the several figures of the drawings.

In carrying out my invention I employ on each car A A of a train (see Fig. 1) what is generally known as an "electro-magnetic machine" B, principally consisting of a generator, signal-bells, and electro-magnets electrically connected together and contained in a small wooden case or box, which magnets may be of the ordinary and well-known construction and arranged in any convenient position in the car within easy reach and manipulation by the train attendants, but preferably near one end of said car. At each end of the car are switch-boards C and D precisely alike in construction, and respectively provided with

binding-posts *a a'*, plug-holding jaws *b b'*, and contact-plates *c c'* of the peculiar construction hereinafter described.

The electro-magnetic machine of each individual car is electrically connected with these switch-boards, so as to form a closed circuit on that car by a wire *e*, passing from the magnets to the spring-jaw of the switch-board D, also from said electro-magnetic machine to binding-post *a* of switch-board C, short wire connections *f f'* between the contact-plates and binding-posts of each switch, and a return-wire *g* from the binding-post *a'* to the spring-jaw *b* of the switch-board C.

The switch-boards are preferably secured under the hoods at each end of the car, so as to be in convenient reach, and from their respective binding-posts extend short wires *h h'*, to the ends of which are secured plugs *i i'*, the wires *h h'* being of such a length that the plug may be inserted in the opposing switch-board on the adjacent car, and the plug of that car be likewise inserted in the switch of the car just mentioned, whereby a closed circuit between two or more cars is formed.

In order that the plugs may not be accidentally withdrawn from their respective switches, and yet be pulled out of the switches when from any cause the cars are uncoupled and separated, each plug is concaved upon its upper and conductive face, so that the spring-jaw will firmly hold it against accidental detachment, the lateral play of the plug while in the jaw being prevented by risers or flanges *j* on each side of the contact-plate. As usual, the main body of the plug and that portion of it next the contact-plate is of gutta-percha or other non-conducting substance, while that portion of it next the spring-jaw is faced with metal, so as to electrically connect the spring-jaw with the line-wire connected to the plug.

When one or more cars are to be detached from a train, it is desirable that the plugs *i* should be first withdrawn by hand; but if in case of accident or neglect this is not done, the construction and arrangement are such that said plugs are withdrawn automatically without injury to any of the parts of the device, leaving the circuits closed and operative on each and every section or car which may become respectively detached from a train.

In making up a train or reconnecting the cars thereof all the plugs must be inserted in their proper places in order to put all the cars of the train in circuit—that is, except the plug on the rear end of the last car, which is left hanging idle, the circuit at this end being completed by means of one of the short wires *f* or *f'*, which, as before described, connects the binding-post and contact-plate, and with the latter the spring-jaw corresponding thereto comes into contact, so as to complete the circuit, whenever a plug is withdrawn or not inserted. The return of the circuit is effected by the short "jump" or connecting-wire *f* or *f'*, as the case may be, which connects the binding-post and contact-plate of the switch-board at that end of the car, thus enabling the current to cross over and enter the return-wire through the medium of the spring-jaw, which bears upon the contact-plate at all times when the plug is not inserted.

It frequently occurs in practice that the plugs are inserted upside down, either as a result of ignorance or inadvertence, resulting, of course, in a broken circuit and rendering all the signal devices useless for the time being, and to avoid such a possibility I have herein provided the contact-plates *c c'* with the diverging flanges *j*, before mentioned, between which is inserted the plug whose side edges are beveled to correspond, and it is evident that with such a construction the plugs could not be inserted in position at all if attempted while they are upside down.

On the engine E or its cab is a switch-board precisely like those on the cars and with the same plug connection, so that any accidental disconnection of the engine from the cars will result in there remaining a closed circuit on the detached car and also on the engine, though, of course, as will hereinafter be understood, there is no object in having a closed circuit on the engine alone. In this connection it should be observed that the binding-posts *a a'* may be dispensed with, and, as shown in Fig. 3, the wires *f g h'* be spliced or joined together upon or within the board, as shown.

Owing to the violent jarring of an engine the ordinary form of magnets cannot be used thereon without a liability of false signals being given, and this liability, as demonstrated by practice, cannot be avoided without separating the signal-bells from the generator and then supporting them so as not to be subject to the engine jars. To this end the signal-bells, with the actuating electro-magnets, are boxed separately from the generator of an electro-magnetic machine, as shown in Figs. 9 and 10, and their box F, (see Fig. 8,) mounted upon any suitable form of springs G G, in turn secured to any desired portion of the engine-cab. Furthermore, it is desirable that the signal bell or bells H, as the case may be, (see Fig. 12,) should be adjusted toward and away from the vibratory hammer thereof, so as to insure a clear ringing of the bells, and to this end the usual bracket-support of the bells is provided with a slotted arm I, through which is passed a retaining-screw, securing the bracket to the box. Again, it is desirable to guard against the engineer mistaking other sounds incident to moving trains for a signal of his bell, and also to furnish him with a means for verifying by sight the correctness of his hearing, and, in fact, to enable him to substitute the sense of sight for that of hearing when the noise of a whistle, bell, or of a passing train is so great as to render it impossible for him to distinguish the

sound of the signal-bell, and I have therefore provided an electrically-actuated pointer K, working on the face of a dial secured to the bell-box just below the bells, by means of a change in the position of which is indicated the ringing of the bell. This pointer K is pivoted in the ordinary manner at *k* and has a weighted arm *l*, the free end of which arm, or a suitable projection thereon, is adapted to engage and be held up by a stop or lug *m* on a bell-crank lever *n*, weighted at its other and free end and constituting an armature-lever opposed at its lower end by electro-magnets *o*, electrically connected by wires *o'* o^2 with the electrical devices of the bell and the main circuit, or, in other words, the said electro-magnets are in circuit with the bells, the generator, and the magnets of the cars, as shown in Figs. 9 and 10.

The stop-connection between the indicator-hand and the armature-lever is of such a character that when a signal is made to the engineer the electro-magnets *o* attract the armature-lever so as to draw it away from and release the indicator-lever, which, owing to its weighted end, swings from a horizontal to a vertical position, in which latter position it indicates to the eye of the engineer that he has been signaled from some portion of the train. If the engineer fails to understand the character of the signal, he may, by turning the crank of his generator, and thereby putting in operation the car signal-bells, request the signal to be repeated, after which the dial-hand is turned back to a horizontal position until it again catches upon the stop *m* on the armature-lever, which armature, owing to its weighted end, swings away from its electro-magnets the moment they are demagnetized.

As a convenient means for preventing the engineer from turning the indicator an unnecessary distance beyond the armature-lever, said lever is provided with a projection *p* above the stop; but a projection from the box will answer the same purpose.

By having the bell and indicator therefor separate from the generator L, as shown in Figs. 9 and 10, the combined bell and indicator may be placed directly in front of the engineer as he stands in position to operate his throttle-lever and where he can hear and see it without changing his position, while, on the other hand, the generator can be located at some other point where, while standing in the same position, he may conveniently actuate it by turning its crank without moving his other hand from the throttle-lever or materially changing his position. This separating of the signal-bells from the generator also enables the fixing of said bells at a point in the cab where they are least liable to jars, and at the same time locate the generator within convenient reach of the engineer and without regard to those jars.

After making up a train provided with my signaling devices the plugs between the several cars and the first car and the engine are inserted in their operative position in the switch-boards, thereby making a closed circuit throughout and between the train and the engine and without any manipulation of or attention to the switch-board on the rear end of the rear car. Communication is not only thereby established between all of the cars and the engine, but between the several cars, respectively, so that a signal to the engineer from any one car is repeated in all the other cars for the information of the train attendants in the various parts of the train, who, thus being notified, will act accordingly, and so, on the other hand, the engineer may signal the conductor on any part of the train or any particular train attendant by having a system of signals adapted for that purpose. Furthermore, should a portion of the train become accidentally detached, the plugs will be withdrawn from the switches adjacent the parted train-sections, thereby automatically closing the circuit on each section, so that the train attendant on either or both sections first making the discovery of this accidental parting may immediately signal every other attendant on his section and cause them without delay to act accordingly.

The advantages of my closed-circuit system over open-circuit systems heretofore exclusively employed in signaling systems for trains are not only very striking, but of the utmost importance in railway signaling systems. In this connection it is proper to observe that no train-signaling system is practical when it is at all uncertain in its operation, when it requires any particular skill or practice to operate or keep it in order, when it fails to deliver in every car and engine of a train signals given from any car to every other car and the engine and from the engine to every other car or that fails to signal when signals are simultaneously turned on in two or more of said cars. All this is obvious when it is remembered that the most important signals to be given are those intended to save life and limb, and which must not only be certain and to every train attendant as far as possible, but which must be made quickly and under great excitement, and frequently attempted simultaneously on two or more of the cars of the train and at a time when skill would certainly forsake the average attendant.

In open-circuit signaling systems for signaling from the cars of a train to the engine the circuit on the car from which the signal is made must be closed as a condition precedent to sending the signal, and as a result no signal can be made rearward of that car, and although it is true that a signal can be sent from and only from the rearmost car to every other car and the engine, it is equally true that a signal cannot be sent from the engine to any car. In other open-circuit systems it is also true that signals can be sent from a single and rear car only to the engine and from the engine to that car; but in such systems there must

be a battery on both the engine and said car and duplicate signaling devices on both car and engine, for the reason that on closing the circuit at the car no signaling device is actuated without using the engine-battery, and vice versa from the engine to that rear car. Both of these open-circuit systems require the use of a battery to the exclusion of a mechanical generator, because neither form of switch they employ is or can be adapted to actuate mechanical generators, no matter in what numbers employed or where placed. In other words, both of these systems require a generator that is charged and energized at all times and with which their switches can only have an electrical connection, and batteries are the only form of generator by which these two results can be accomplished in said systems. Batteries are wholly impractical of use in a closed-circuit system, for trains for the reason that every signaling device in that circuit will be continuously sounded, and therefore no signal can be sent by the train attendants. Furthermore, the use of batteries in open-circuit systems under the most favorable conditions is at best objectionable, because of evaporation, the renewals required, the valuable space they occupy, their liability to break and spill their contents from the usual jarring of a train starting in motion and in stopping, and above all no signal can be sent from the engine by the engineer to more than one car at a time or from any car to any rearward car.

In open-circuit systems in which mechanical generators are employed the generators are in each of the several cars and the signaling device on the engine alone, and the circuit is broken on the rear car, but may be bridged and a short circuit established at either generator and can only be so established by the generator-crank during the latter part of its forward and the fore part of its return swinging movement, actuating and energizing the generator. No signal is sounded in any car from any other car of the train or from the engine to any car, and even if signaling devices were permanent in the metallic circuit and a similar generator in the engine of that system the fact remains that no signal could then be sent from the engine to any of the cars for the reason that the entire circuit is normally open, and for the same reason no signal could be sent from a car to any of the cars rearward of it.

From the foregoing it is now obvious that there are advantages of the utmost importance in train-signaling due to the use of my closed-circuit system, the entire absence of which is common to and their production impossible in open-circuit systems, and among those so absent and impossible in open-circuit systems, but resulting from my closed system, is the sending of a signal from any one car in a train of any number of cars to all other cars and the engine of that train and from the engine to all cars; the simultaneous turning on of signals from any two cars without destroying both signals; that every car in a train of any number of cars is always in a closed circuit and the generator and signaling devices operative in that car and from every other car in one and the same circuit; that every car is always in a closed circuit when there are other cars in a train not electrically connected with the others therein; that when once all of the cars of a train are in the same circuit that circuit and no other circuit that is made therefrom is ever open even at the instant of the accidental parting of the train, and that at the instant a train parts there is a closed circuit on both sections, the signaling devices in every car of each section may be used, and when used will transmit the signal given every car of that section. Furthermore, my closed-circuit system not only dispenses with but absolutely prevents the use therein of batteries with their objectionable features, and also of all switches for sending signals, and furthermore involves in the sending of a signal by a train attendant or engineer no more thought, skill, or practice than is required to turn a grindstone or a coffee-mill, and it is obvious that this is not true in the required manipulation of the crank-arms and switches of these open-circuit systems as a condition precedent to sending a signal therein.

Further advantages of my closed-circuit system over the open-circuit system are that no valuable space is occupied by the generator; that none of the devices employed are liable to get out of order from the jarring of the train or any other cause; that no portion of a forward movement of the crank-arms could be made (particularly under excitement) without giving a signal, and, in short, that every part of my system is where it is wanted when it is most wanted and out of the way when not wanted for use.

My invention, broadly and briefly stated, is a signaling system for railway-cars in which mechanical generators and signal devices are in a circuit always closed in each car or between every car and the engine electrically connected, whereby a signal made in any car of a train will be automatically repeated in every other car of the train and the engine electrically connected therewith, or, in other words, a signaling system for railway-cars in which a series of closed circuits, one for each car and the engine, including a generator and signaling device, are adapted to be united into a single closed circuit, whereby a signal from any car in the circuit will be repeated in every other car and the engine in that circuit.

In view of the fact that I am the first, so far as known, to employ a closed circuit of this character and producing these results my invention is not limited to the special devices described and illustrated as forming that circuit, nor to the special construction

and arrangement of mechanical generator, signal devices, and switches shown and described, for obviously any other form of closed circuit generators, signaling devices, and switches, when so arranged and combined as to produce these results, would be but the mechanical equivalents thereof and within the spirit of my invention.

The word "generator" herein refers (and particularly in the claims) to a mechanical generator as distinguished from a battery.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a signal system for railway-trains, the combination of a closed circuit for the electrical current and mechanical generators, signaling devices, and switches in and operating on said closed circuit, substantially as described.

2. In a signal system for railway-trains, the combination of a closed circuit for the electrical current and magneto-generators, signaling devices, and switches in and operating on said closed circuit, substantially as described.

3. In a signal system for railway-trains, the combination of a closed circuit for the electrical current and a mechanical generator and signaling devices located upon the engine and the several cars of the train in said circuit, switch-boards at both ends of the several cars, and plugs permanently secured at one end to the metallic circuit and electrically secured to the switch-boards, whereby a closed circuit is formed between the circuit of the adjacent cars, substantially as described.

4. In a signal system for railway-trains, the combination of a closed circuit for the electrical current, a spring-jaw and opposing contact-plate in said circuit, said plate being provided with parallel projecting inclined side flanges, and a switch-plug, also in said circuit and having inclined sides corresponding with said flanges for insertion between the jaws and plates, substantially as and for the purpose described.

5. In a signal system for railway-trains, the combination of a series of closed circuits, one for each car, signaling devices included in said circuits, and separable switch devices for uniting all of said independent circuits into a single circuit, whereby the separation of any number of cars from the train will cause the automatic closing of the circuit through each section of the train, substantially as described.

6. In a signal device for railway-trains, the combination of a series of closed metallic circuits, signaling device included in each of said circuits, and a separable switch device embracing a switch-board provided with a retaining-spring and a plate in said circuit, and a separable plug, which, when inserted between said spring and plate, closes the circuit with the spring and breaks the circuit between the spring and plate, substantially as and for the purpose described.

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