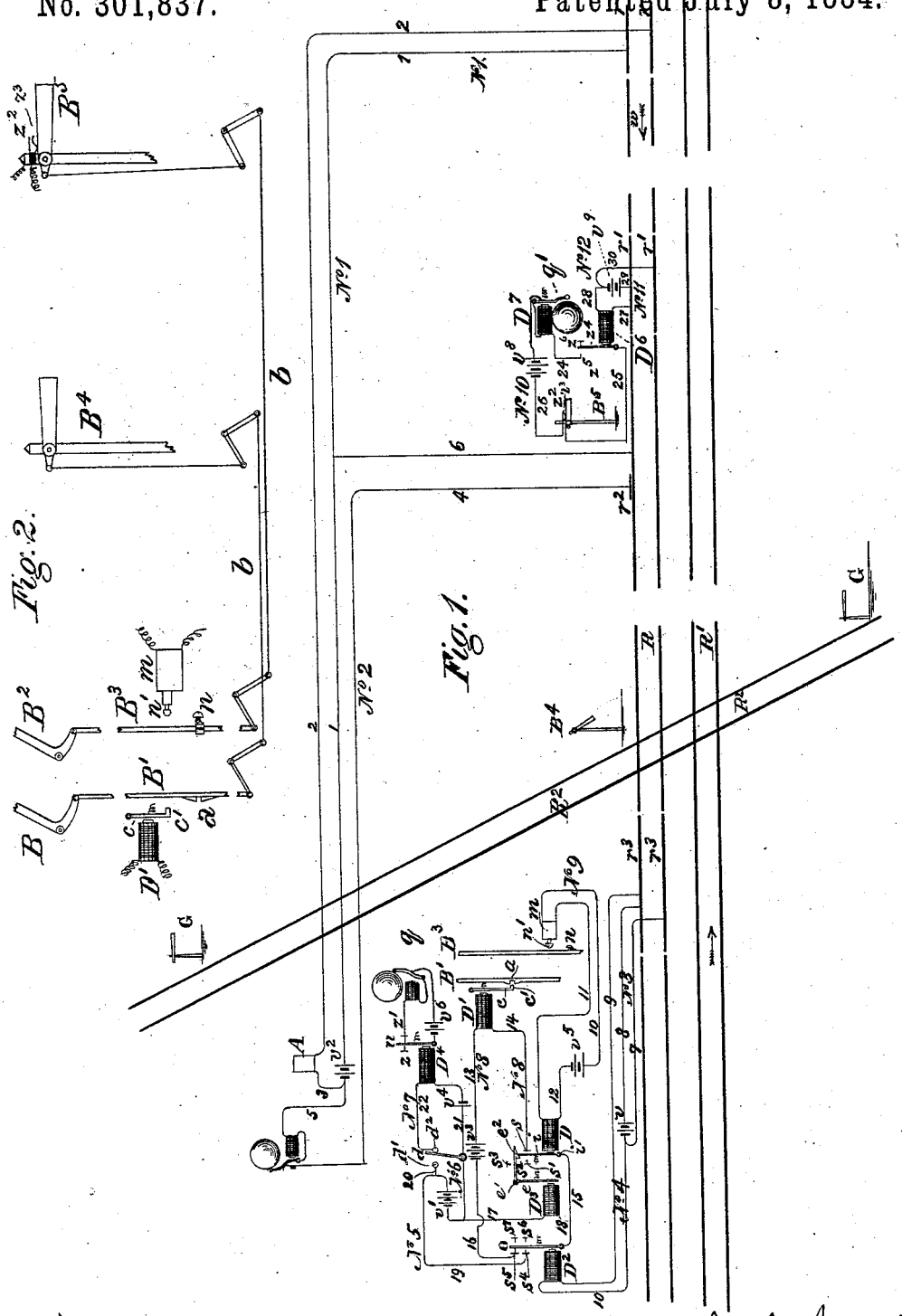
(No Model.) 2 Sheets—Sheet 1.

C. A. SCOTT.

RAILROAD ELECTRIC SIGNAL APPARATUS.

No. 301,837. Patented July 8, 1884.



Witnesses.
J. Snowden Bell.
E. M. Clarke

Inventor. Charles A. Scott,
By Attorney. George H. Christy

(No Model.) 2 Sheets—Sheet 2.

C. A. SCOTT.

RAILROAD ELECTRIC SIGNAL APPARATUS.

No. 301,837. Patented July 8, 1884.

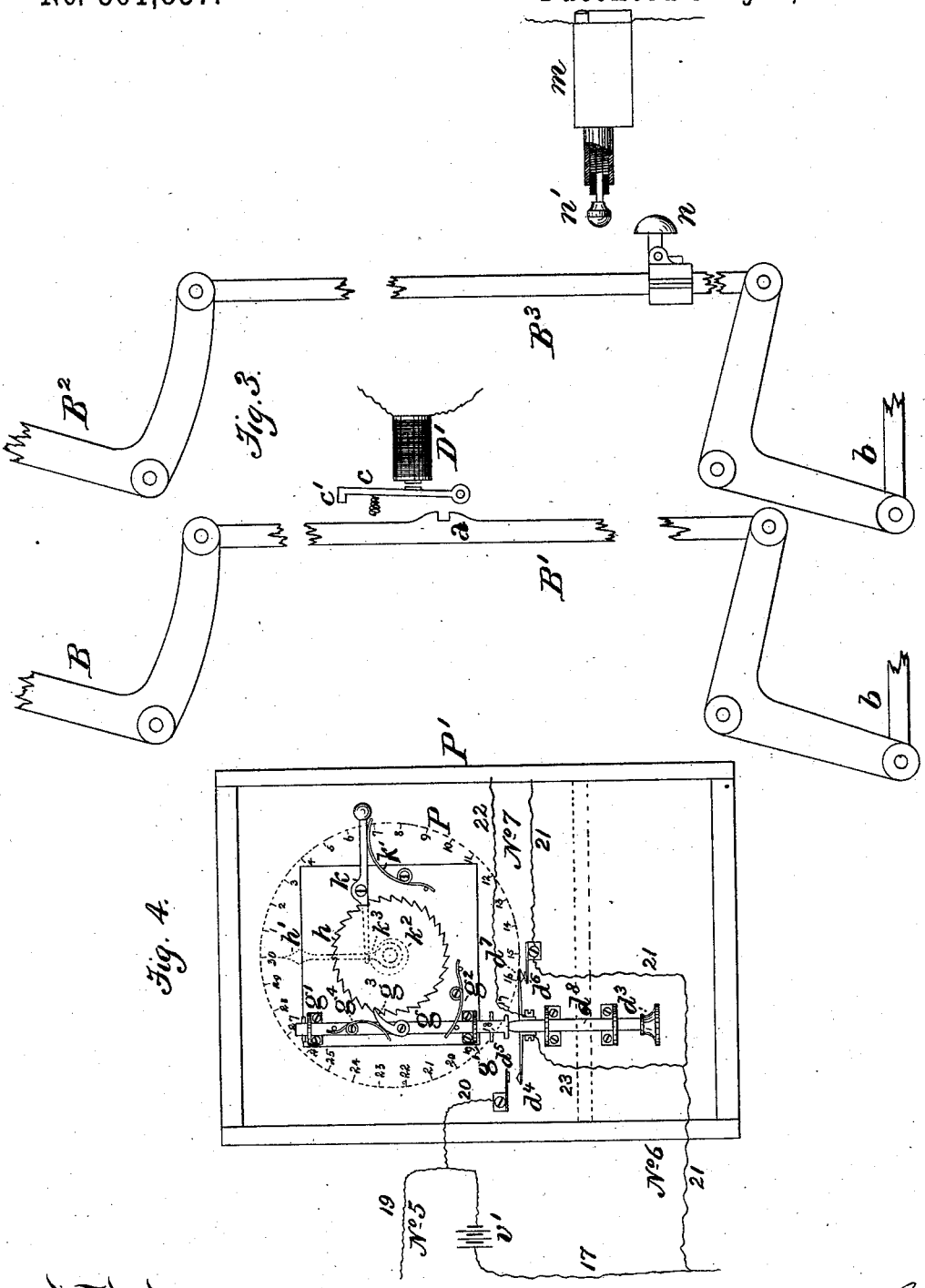


Fig. 3.

Fig. 4.

Witnesses.
J. Snowden Bell.
C. M. Clarke.

Inventor Charles A. Scott,
By Attorney George H. Christy

UNITED STATES PATENT OFFICE.

CHARLES A. SCOTT, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF PITTSBURG, PENNSYLVANIA.

RAILROAD ELECTRIC SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 301,837, dated July 8, 1884.

Application filed November 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. SCOTT, a citizen of the United States, residing at Boston, in the county of Suffolk, State of Massachusetts, have invented or discovered a new and useful Improvement in Railway Electric Signaling Apparatus; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a diagrammatic plan of a railway-crossing, showing the arrangement of the present apparatus, and illustrating the manner of applying it in governing train movements. Fig. 2, by outline view, illustrates the lever and signal movements. Fig. 3, Sheet 2, shows, to an enlarged scale, so much of the levers and their connections and co-operating appliances as further to illustrate the operation of the present system of apparatus; and Fig. 4 is a detached view of a recording apparatus, to an enlarged scale, intended for use in connection with the apparatus of Fig. 1, in the manner presently to be described.

My present system of apparatus relates in a general way to the governing of train movements with reference to safety at street or grade crossings, or at draw-bridges, or at other points where such special protection is desired. In it I use mechanically-actuated signals, combined with electric locks and with alarm-bells and recording mechanism, substantially as hereinafter described and claimed.

R and R′ may represent two parallel tracks, and R^2 a track-crossing at grade, and for present purposes it will suffice to show and describe the apparatus as arranged for governing the movement of trains approaching from the right on the track R, or moving in the direction indicated by the arrow *w*. At the usual or any desired distance from the crossing I arrange the home signal B^4, and at a distance therefrom—say one thousand eight hundred feet, more or less—a distant signal, B^5. These signals may be of any desired construction, such as are adapted to be operated by suitable hand-levers, B B^2, from the switchman's stand or cabin, through the usual or any desired connections, *b*. At a considerable distance out on the track—say one-half mile or more—I make a short insulated section of track, *r r*, and connect the opposite rails thereof by wires 1 2 3, through battery v^2, with an annunciator, A, of any desired construction. This gives a normally-open circuit, which I call "circuit No. 1." Just inside the distant signal B^5, I arrange the terminals of circuit No. 2, which circuit may consist of wires 4, 5, 1, and 6, of which the terminal wire 6 is connected to the track-rail, and the terminal wire 4 is connected with a track-instrument, r^2, which, as shown, consists of a bar in suitable position to be engaged by the wheel while running on the rail. This is a normally-open circuit, and is intended, when closed, to operate a bell-ringer, A′, by an electro-magnet included in the circuit, as shown. On the other side of the crossing is an insulated track-circuit, r^3 r^3, to opposite rails of which the circuit-wires 7 and 8 are connected. These wires lead through a battery, *v*, and constitute circuit No. 3. A wire 9, leads from one of the rails r^3 to and through electro-magnet D^2, and back by wire 10 to one pole of battery *v*, so as, in connection with wire 8, to constitute circuit No. 4. Circuit No. 3 is normally open and circuit No. 4 is normally closed. Circuit No. 9 extends from battery v^5 by wire 10 through circuit make-and-break mechanism *m*, by wire 11 through electro-magnet D, and by wire 12 back to the battery. It is normally closed. Circuit No. 8 goes from battery v^3 by wire 13 to and through electro-magnet D′, by wire 14 to contact-stop *s*, thence by armature-lever *i* and wire 15 to armature-lever *o*, thence by contact-stop s^5 and wire 16 to battery. It is normally closed. Circuit No. 5 goes from battery *v*′ by wire 17 through electro-magnet D^3, thence by wires 18 and 15 to armature-lever *o*, thence by contact-stop s^4 and wire 19 back to the battery. It is normally closed. Circuit No. 6 goes from the same battery, *v*′, by wires 19 and 20 to contact *d*′, thence by switch *d* and wires 21 and 17 back to battery. It is normally an open circuit. Circuit No. 7 goes from battery v^4 by wire 21 through electro-magnet D^4, thence by wire 22 to contact d^2, thence by switch *d* and wire 21 back to the battery. The circuit-changer *m* is of any suit-

able construction, adapted, when the head n' is forced in by a knob, n, as presently to be described, to break circuit No. 9, and such that by a spring the circuit will be reclosed after the knob n has passed, the knob n turning on a pivot as it moves downward on its reverse motion, so as not then to break the circuit. This construction (shown more particularly in Fig. 3) is included in the subject-matter of Letters Patent No. 282,230, issued to me July 31, 1883.

The arrangement of armature-levers i, e, and o will be understood from the description of their operation presently to be given.

In the hand mechanism employed in this apparatus I prefer the use of the Saxby and Farmer levers, of which I have shown two, B B^2, of which the first one, B, is intended to operate the home signal B^4, and the other, B^2, is to operate the distant signal B^5. The connecting-rod B′ of lever B has a notch, recess, or shoulder, a, adapted and in suitable position so that when the signal B^4 is at "safety" it may be engaged by a hook or catch, c', of an armature-lever, c, the electro-magnet D′ of which is included in circuit No. 8. The connecting-rod B^3 of the other lever, B^2, carries a swinging knob, n, which, when the lever B^2 is moved to move the rod B^3 upward, and so set signal B^5 to "safety," engages the head n' of the circuit-changer m and breaks circuit No. 9, but, as already stated, does not break such circuit at its return motion. Additional levers are to be provided for working signals, say, at G G′ on the crossing track R^2, at suitable distance from the crossing, and all these levers are provided with mechanical interlocking devices, such that safety-signals can be displayed on only one line at a time, and setting the proper signals to "safety" will lock all conflicting signals at "danger;" or the apparatus herein represented or other like apparatus may be added for such conflicting line.

Near the distant signal B^5, I arrange another series of electric circuits. The first, No. 10, starting from battery v^8, goes through a bell-ringing magnet D^7 and wire 24 to contact-stop z^3, thence by armature-lever z^4 and wire 25 to one, z^3, of two terminals, from the other, z^2, of which wire 26 goes back to the battery. Circuit No. 11 includes battery v^9, wires 27, 28, and 29, and a part of one track, r'. Circuit No. 12 (normally open) is composed of the same battery, v^9, and of wires 29 and 30, which lead to the opposite track-rails, the closing of this circuit being done by the wheels and axle, which then form a part thereof.

That the practical operation of the apparatus thus shown and described may be the better understood, I will assume that a train approaches the crossing on the track R, coming from the right, as indicated by arrow w. As soon as the train enters on the insulated section of track r, the cross connection made by wheels and axle from rail to rail closes circuit No. 1, so as to cause the annunciator A to indicate accordingly. If everything is clear and ready for the reception of such train—by which I mean in the present case the proper display of danger signal or signals G G′ on the crossing line R^2—the operator pulls lever B, (with which rod B′ is connected,) and by the usual rod, wire, rope, or gas-pipe connections sets the home signal B^4 at "safety." If interlocking levers be used, this motion locks at "danger" the signals G G′ of the line R^2, so as to guard against and prevent the approach of a train from one direction or the other, as may be required by the train arrangements of the road. This movement of lever B, with its rod B′, brings the latter to such position that the notch, stop, or recess a thereon stands opposite to and in position to be engaged by the hook or catch c' of armature-lever c, and also by the same movement lever B^2 is mechanically unlocked. The operator then pulls this lever B^2, (with which rod B^3 is connected,) so as by the usual mechanical connections to set distant signal B^5 at "safety." The rod B^3, in rising, by its knob n engaging the head n', breaks circuit No. 9, so that electro-magnet D is demagnetized, and the free end of its armature-lever i, under the influences of its retractile spring, leaves the contact-stop s, passes under and to a position back of the catch c' of armature-lever c, so as to be locked thereby, and engages dead-stop s'. This breaks at s the No. 8 circuit, so that electro-magnet D′ is demagnetized, and its armature-lever c moves under the influence of its retractile spring, so that its catch c' enters the notch a of lever-rod B′, and locking-lever B locks the home signal B^4 at "safety." When the approaching train reaches the track-instrument r^2, it closes circuit No. 2, so as to cause the bell-ringer and bell A′ to sound, and thereby inform the operator or signalman that the train has passed the distant signal B^5. He then reverses lever B^2 and rod B^3, so as to set distant signal B^5 to "danger," and thereby protect that train as against a following train; but as No. 8 circuit still remains broken, the lever-rod B′ remains locked, and with it the home-signal B^4 at "safety." The train, having passed over the crossing, enters on the insulated track-section r^3, and by making a cross-connection through wheels and axle it closes circuit No. 3 and diverts the current of battery v from the circuit No. 4, and so demagnetizes electro-magnet D^2, and its armature-lever o, under the influence of its retractile spring, leaves the contact-stops s^4 s^5 and goes to the dead-stops s^6 s^7. This breaks circuit No. 5, demagnetizes electro-magnet D^3, so that armature-lever e is, under the influence of its retractile spring, free to turn on its pivot e', so that its free end shall go to dead-stop s^3. As a result of this the catch e swings clear of and unlocks the free end of the armature-lever i, and the latter, being drawn over by its magnet D, which is now in a closed circuit, goes to the contact-stop s, and so closes the break at s in circuit No. 8; but

this circuit No. 8 is still broken at s^5, and will remain so until the rear end of the train leaves the insulated track-section r^3. As soon as this takes place circuit No. 3 is broken, and the current of battery v goes to circuit No. 4, so as to again excite magnet D^2, as a result of which armature-lever o is again brought to contact-stop s^5, and circuit No. 8 is completely restored. Its magnet D′, then being again excited, draws over the armature-lever c, and causes the hook or catch c' to clear the recess a on the lever-rod B′, so that the latter is then unlocked, and with it the home signal B^4. Should a train stop from any cause after getting a distant safety signal—say just before it passes the home signal B^4—and it becomes necessary or desirable to take the right of way from that train and give it to another, say, on the track R^2, the signalman can do so by working an electric button or hand-switch, d, which he throws onto the contact d', and by doing so diverts the current of battery v' onto the circuit No. 6, and demagnetizes the magnet D^3 of circuit No. 5, with the result of unlocking, in the manner already described, the armature-lever i and reclosing circuit No. 8 at s, and so, as before, unlocking the lever B′ and its signal B^4. The latter may be then set at "danger," so as to bar the further progress of the train on track R, after which the right of way may be given to the other train; also, this movement of the hand-switch d from its contact d^2 will break circuit No. 7, so as to demagnetize electro-magnet D^4, as a result of which its armature-lever u will go from dead-stop z to contact-stop z' and close a bell-ringing circuit through electro-magnet D^5 and battery v^6, and actuate a bell, q, so as effectually to call the attention of the signalman to what he is doing, and to remind him that he is using the apparatus in an exceptional manner. As this is an irregular and exceptional way of using the apparatus, I consider it better to add to the bell-ringer q, or substitute for it, as may be preferred, a recording-instrument, more fully shown in Fig. 4, where a push-button, d^3, takes the place of the hand-switch d of Fig. 1, as its mechanical equivalent. If this recorder be used in addition to the bell-ringer q, I close the No. 6 circuit by elevating the button d^3 so as to bring the movable contact d^4 to the fixed contact d^5, the wire 20 of the fixed contact d^5 going to the wire 19 of circuit No. 5, and the wire 23 of the movable contact d^4 going to the wire 21, which constitutes a part of circuits Nos. 6 and 7. The latter leads through a fixed contact, d^6, with which a movable contact, d^7, makes connection when the button d^3 is down, so as to close or open circuit No. 7, through which the action of the bell q is controlled. Hence it will be seen that, as regards the bell-ringing apparatus and the unlocking of the home-signal lever B′, the push-button d^3 and the switch d are substantially the same, and any suitable make-and-break mechanism adapted to the purposes in view may be substituted for either; but if the bell-ringer is not desired, circuit No. 7, with its contacts d^6 and d^7, may be omitted. The recorder is employed in order to make a record of the frequency with which the apparatus is used in the exceptional manner above indicated. To this end I provide a dial-plate, P, which, with all its appliances, I inclose in a close or locked box, P′, but with the button or knob d^3 protruding. The insulated end of the knob-stem d^8 engages the end of a sliding bar, g, suitably working in guides g', so that it may be moved upward with the button, and a spring, g^2, is added for effecting the reverse or downward movement. The bar g carries a pawl, g^3, held by a spring, g^4, in engagement with the teeth of a ratchet-wheel, h, which, as rotated, carries with it an index, h', and the parts are so proportioned that each upward movement of the button d^3 to close circuit No. 6 and unlock the home-signal lever-rod B′ shall move the index one space. A lever, k, is combined with a spring, k', and with a drum, k^2, (shown in dotted lines,) on the ratchet-wheel shaft, so as to act as a brake to prevent the ratchet-wheel from turning too far at each movement, and when one complete revolution is made a shoulder, k^3, engages the end of the lever, so as to render necessary the resetting of the apparatus by the inspector who carries the key; otherwise the signalman might use the apparatus in the exceptional way referred to oftener than he ought, and conceal the fact by rotating the index around to zero; but other suitable stop may be employed in lieu of the shoulder k^3. In this way I keep a check on the signalman as regards abnormal or irregular use of the apparatus.

As an additional element of safety, or to guard against the passing of the distant signal B^5 when at "danger," I arrange a bell-ringing circuit, No. 10, and a bell-ringer, q', at that point, and provide a pair of spring-contacts, z^2 z^3, in such relationship that when the signal B^5 is at "danger" the circuit No. 10 will be closed at that point, say, by the semaphore-arm moving one terminal into contact with the other, though other form of circuit-closer may be used. When the arm goes down or to "safety," the terminals or contacts z^2 z^3 will spring apart and break the circuit.

Included in circuit No. 10, and as a part thereof, is an armature-lever, z^4, which plays between dead and contact stops z^6 z^5. Normally the armature-lever z^4 will be held to the dead-stop z^6 by electro-magnet D^6, so as to break circuit No. 10, the magnet D^6 being in circuit No. 11 (which includes a part of a rail) of the insulated track-section r'. From one of the wires 28 of this circuit No. 11 a wire, 30, goes to an opposite track-rail of the insulated section r', so as to form a normally-open circuit, No. 12, such circuit being on the side of the distant signal B^5 from which the train approaches in the normal operation of the road. Then, when the train runs onto the

insulated section r', the wheels and axle make a cross connection between the rails, so as to close circuit No. 12 and take the current of battery v^9, so as to demagnetize magnet D^6 and let armature-lever z^4 go to contact-stop z^5 and close circuit No. 10 at that point. If, then, signal B^5 be at "danger," circuit No. 10 will be completely closed, and the large bell q' will sound, so as to call the attention of the engineer to the fact that the signal B^5 is at "danger;" but if the signal B^5 is at "safety," circuit No. 10 will not be closed, and no alarm will be given.

While for convenience of illustration I have herein shown my improvement as adapted to use in connection with a grade-crossing and the locking of the lever of a signal governing the passage of trains, I do not limit myself to such application thereof, as the locking of a switch lever or levers or a switch or bridge lock or locks may be similarly effected, and a switch, a locking-bolt, or other movable appliance connected with a railway-track and a lever operating the same would, in the combinations claimed, be the mechanical equivalents of a signal and a hand-lever, as herein described and shown.

Any proper track-instrument by which a circuit may be broken and restored in and by the passage of a train would be the equivalent of and may be substituted for the insulated track-sections described, and the reference, as claimed, by the term "track-instrument" is to an insulated section or its described substitute.

I claim herein as my invention—

1. The combination of a circuit No. 1, governed as to electrical condition by a track-instrument, an annunciator operated by the current of said circuit, a signal, a circuit No. 2, governed as to electrical condition by a track-instrument on the side of the signal opposite to the track-instrument of circuit No. 1, and a bell-ringer operated through a magnet by the current of said circuit No. 2, substantially as set forth.

2. The combination of a signal, a circuit No. 10, a circuit-closer included in said circuit and actuated by the movements of the signal, a bell-ringer actuated through a magnet by the current of said circuit when closed, a circuit No. 11, the current of which actuates through a magnet an armature-lever, which closes circuit No. 10 when the magnet of circuit No. 11 is short-circuited, and a circuit No. 12, governed as to electrical condition by a track-instrument, and connected with circuit No. 11, so as to short-circuit the magnet thereof by the passage of a train, substantially as set forth.

3. The combination of a home signal, a distant signal, hand-levers connected with and adapted to operate said signals, an electric circuit No. 8, the current of which actuates through a magnet an armature-lever adapted to lock and unlock the hand-lever of the home signal, an electric circuit No. 9, opened or closed by or from the hand-lever of the distant signal, an armature-lever actuated through a magnet by the current of said circuit, which opens and closes circuit No. 8, an electric circuit No. 5, and an armature-lever actuated through a magnet by the current thereof, which locks circuit No. 8 in a broken condition, a circuit No. 3, through a track-instrument, for unlocking the locked armature-lever, and a circuit No. 4, through a track-instrument, for closing circuit No. 8 and unlocking the hand-lever of the home signal, substantially as set forth.

4. The combination of a home and a distant signal, hand-levers connected with and adapted to operate said signals, an electric circuit No. 8, the current of which actuates through a magnet an armature-lever adapted to lock and unlock the hand-lever of the home signal, an electric circuit No. 9, opened and closed by or from the hand-lever of the distant signal, an armature-lever actuated through a magnet by the current of said circuit, which opens and closes circuit No. 8, an electric circuit No. 5, and an armature-lever actuated through a magnet by the current thereof, which locks circuit No. 8 in a broken condition, a normally-open electric circuit No. 6, which, when closed, short-circuits the magnet of circuit No. 5 and closes circuit No. 8 and a recording apparatus connected with circuit No. 6, and having a member which by its movement closes said circuit to unlock the hand-lever of the home signal and makes a simultaneous record of the unlocking thereof, substantially as set forth.

5. The combination of a signal, a hand-lever connected with and adapted to operate said signal, an armature-lever actuated through a magnet by the current of an electric circuit No. 8, to lock and unlock said hand-lever, an electric circuit No. 5, and an armature-lever actuated through a magnet by the current thereof, which locks circuit No. 8 in a broken condition, a normally-open circuit No. 6, which, when closed, short-circuits the magnet of circuit No. 5 and closes circuit No. 8, and a movable stem, switch, or button adapted to close circuit No. 6, and thereby to unlock the hand-lever, substantially as set forth.

6. The combination of a signal, a hand-lever connected with and adapted to operate said signal, an armature-lever actuated through a magnet by the current of an electric circuit No. 8, to lock and unlock said hand-lever, an electric circuit No. 5, and an armature-lever actuated through a magnet by the current thereof, which locks circuit No. 8 in a broken condition, a normally-open circuit No. 6, which, when closed, short-circuits the magnet of circuit No. 5 and closes circuit No. 8, a circuit No. 7, and a bell-ringer actuated through a magnet by the current of said circuit when opened, and a movable stem,

switch, or button adapted to close circuit No. 6 and open circuit No. 7, and thereby to unlock the hand-lever, and to maintain a continuous audible signal while the same is in an unlocked condition, substantially as set forth.

7. The combination of a stem having two movable contact-points secured thereto, recording mechanism actuated by the movements of said stem, two fixed contact-points, each of which touches one of the contact-points of the stem at one extremity of its traverse, and electric circuits having their wires connected to the fixed and movable contact-points, respectively, substantially as set forth.

In testimony whereof I have hereunto set my hand.

CHARLES A. SCOTT.

Witnesses:

J. SNOWDEN BELL,

CHARLES A. TERRY.