No. 856,179. PATENTED JUNE 4, 1907.

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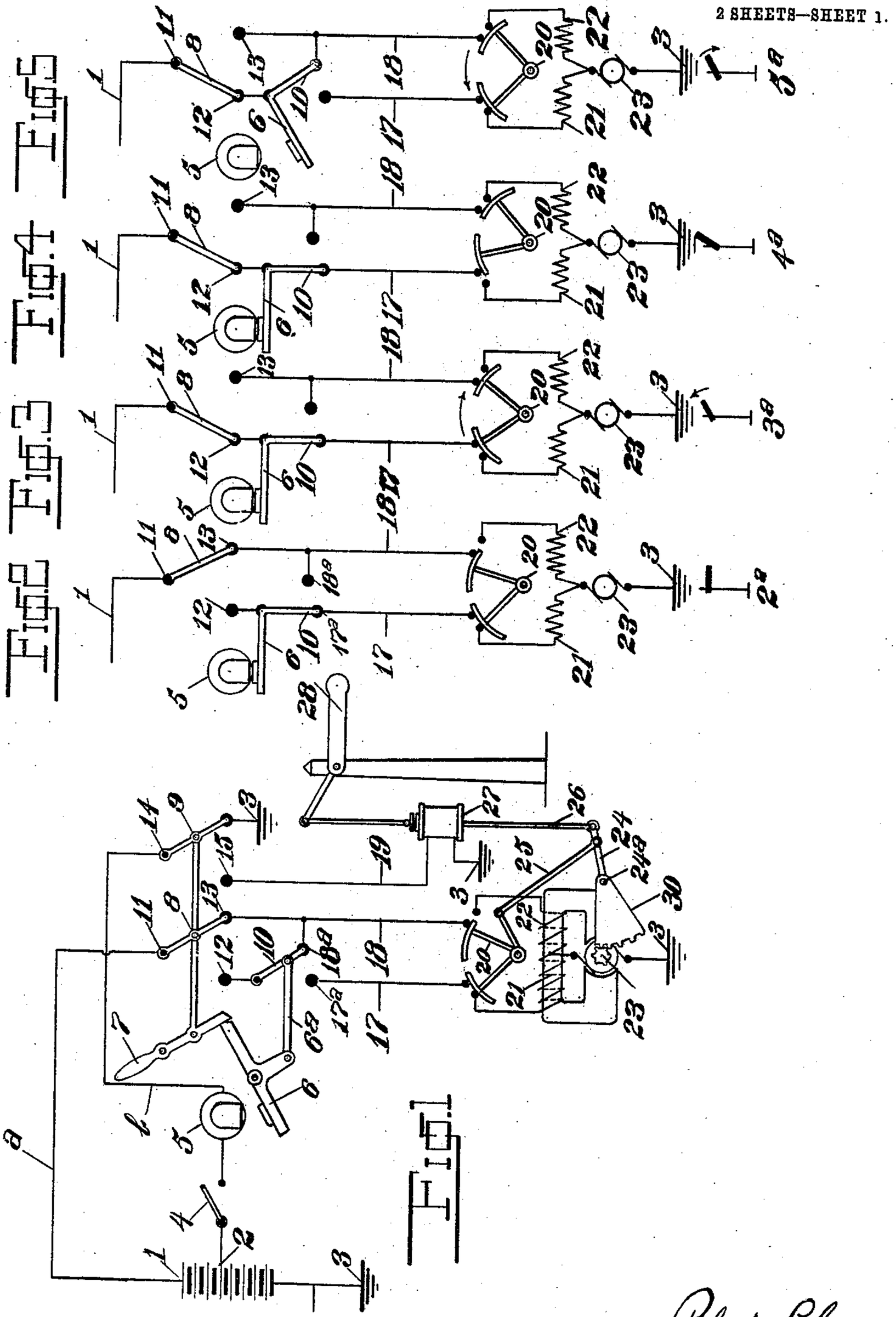
ELECTRIC SIGNAL.

APPLICATION FILED JAN. 19, 1906.

2 SHEETS—SHEET 1.



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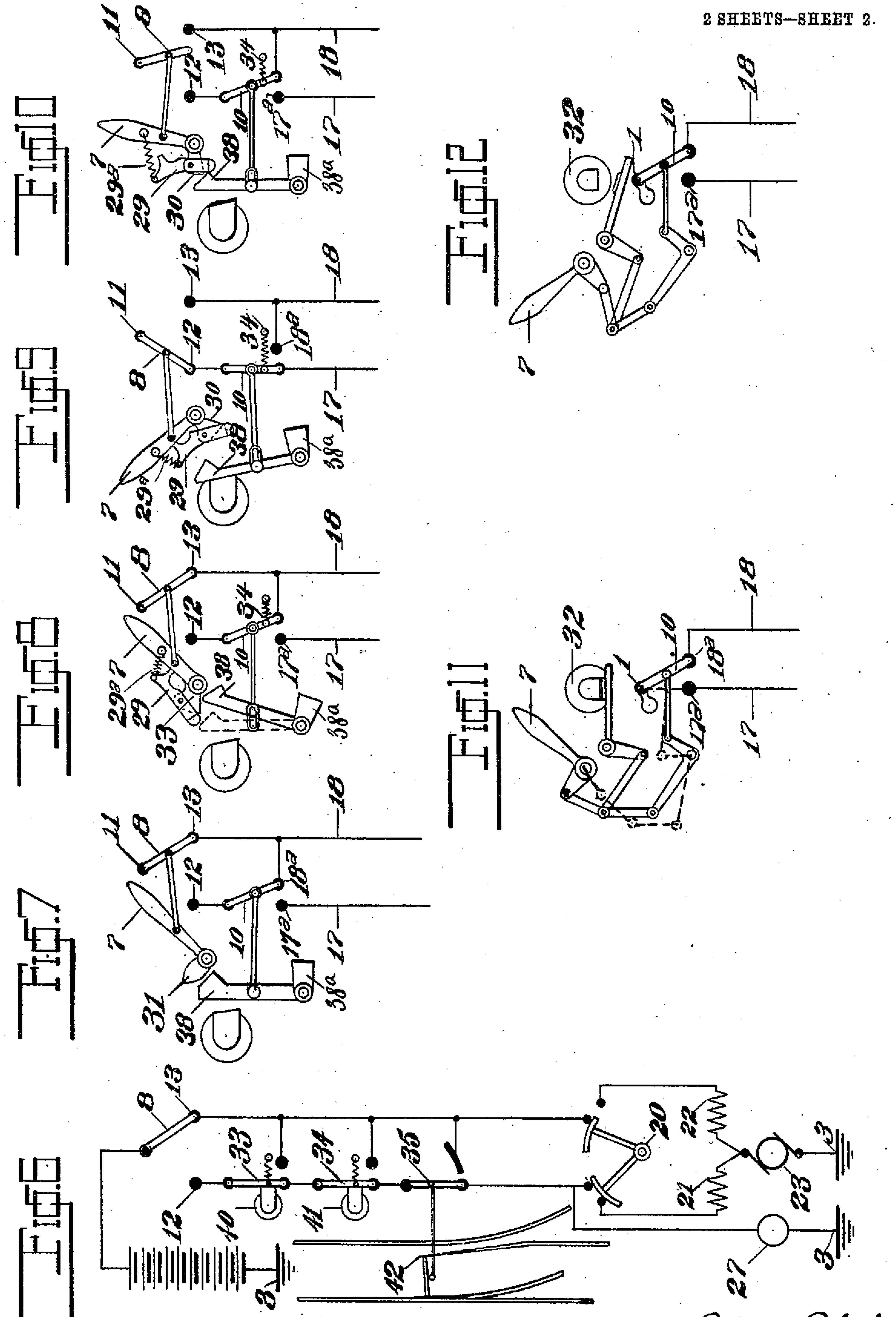

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ELECTRIC SIGNAL.

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To all whom it may concern:

Be it known that I, ROBERT PFEIL, a subject of the German Empire, and a resident of Grunewald, Berlin, Germany, have invented new and useful Improvements in Electric Signals, and in order that those skilled in the art may understand, make and use my invention I give the following specification.

My invention relates to electrically operated signals of that class which are manually controlled and are dependent upon the action of gravity or upon manual operation and gravity for their return from a set to normal position (the normal position usually being at danger); and the object of my invention is to insure an automatic and positive return of the signal to danger position independent of the action of gravity or of the operator, when conditions in the tracks, switches, crossings, blocks, relays, &c., are such as to require that the signal indicate danger.

Other objects of the invention and the means and manner by which the same is practically carried out are set forth in the following specification:

In electrically operated signals of the above described character which are brought to the clear position by the coöperation of a motor and an electromagnetic coupling device, or by the operation of a motor only, and are held in the clear position by the coupling device or an electrically holding and releasing device, the return of the signals to the danger position is effected either by gravity or by the motor, or both these means are employed in such manner that the signals are generally returned to danger position by the force of gravity alone, and then held or locked in the danger position by the motor, the motor being called upon for the return movement only where the force of gravity is insufficient. Where signals of such character are controlled by different devices (such as switch-points, block sections, relays, etc.) they have, up to the present, been so arranged that the force of gravity for returning the signals has been set in operation by certain changes of condition in any one of these devices while the motor in all cases is set in operation only by the use of a controlling lever (the signal lever) manually operated. The automatic return of the signal in consequence of the changed condition of any devices guarded by the signal—for example, by reason of the opening of a switch—always take place therefore only by means of the effect of gravity, which may be set in operation by the interruption of a current to the coupling device. Certainty of the return movement of the reversal of the motor can only be hereby obtained by the operation of the signal lever, that is, only by the act of the operator. The certainty that the signal will be actually returned to the danger position is thus dependent less upon automatic operation than upon the operator.

The object of the present invention is to render possible the operation of the motor for the return of the signal with the automatic release of the signal independent of the position of the signal lever.

In the following specification and accompanying drawings an apparatus embodying the invention is illustrated and described in connection with circuits for causing the signal to take the danger position by the interruption of the current through the coupling device, but the invention may be employed in any known circuit connections.

In the accompanying drawings, I have illustrated diagrammatically a system or apparatus embodying the invention, Figure 1 of which shows the position of the switches, signal and motor connections, the signal being in danger position. Figs. 2, 3, 4, and 5 illustrate the same circuits and connections for the motor, giving the operation of the signal from danger to safety position. Fig. 6 is a view illustrating the invention as applied to a plurality of places or devices to be guarded by the signal. Figs. 7 to 12, inclusive, illustrate modifications of the motor controlling devices in coöperation with the signal levers of different construction.

In Fig. 1, 1 represents the battery or other source of current for supplying the circuits in operating the signal, from one terminal of which leads a conductor *a* to and through a switch-blade 8, controlling the circuits 17 and 18 leading to field coils 21 and 22 respectively to the armature 23 of the motor to the other terminal 3 of the battery. Another conductor *b* leads from a terminal 2 of the battery to and through a circuit closer 4, magnet 5, switch-blade 9, which may be moved to either contact 15 or 16. Contact 16 is connected directly to the other terminal 3 of the bat-

tery and contact 15 is connected with a circuit 19 which includes an electromagnetic coupling device 27 and is also connected to the other terminal 3 of the battery.

The ordinary signal lever is indicated at 7, and with this is connected switches 8 and 9 by means of a suitable link or tie-rod, as shown. The armature lever 6 of the magnet 5 is shown in the dropped position in Fig. 1, and this position locks the signal lever 7. The armature lever 6 is connected by any suitable means, such as a link 6^a with a switch 10, arranged to move from contact 17^a to contact 18^a and to connect either one of said contacts according to its position, with contact 12. Contacts 17^a and 18^a are connected to the conductors 17 and 18 which lead to the motor coils 21 and 22 respectively.

The signal 28 is connected with the motor armature 23 by means of a pinion on the armature shaft and a gear sector 30 in mesh therewith. Connected to the sector 30 so as to move therewith is a lever 24, the sector and lever moving about the pivot 24^a. A connecting rod or link 26 is pivotally connected with the end of lever 24 and carries an electromagnet 27 which forms a coupling device between the motor and the signal. The armature 27^a of the magnet 27 is connected by a rod 27^b to the signal 28. By the arrangement shown and described, when the electromagnet is energized by the movement of the signal lever and the motor is cut into circuit, the downward movement of lever 24 will move the signal 28 to the safety or clear position.

The motor is so constructed that a current through conductor 17 causes a downward movement of lever 24, throwing the signal into the safety position, and a current through conductor 18 will cause an opposite movement and return the signal to the danger position. For reversing the motor various switching connections may be used. Among others, those in which the motor is connected with the conductors 17 and 18 by means of a relay. In the illustration of the invention here given the motor is shown with two field windings 21 and 22, which are connected to one brush of the armature and so connected with the motor-switch 20, which is moved by the arm 24, to which it is connected by a rod 25, that the winding 21 will be connected to the conductor 17, and the winding 22 will be connected to conductor 18. The other brush of the motor is connected with one terminal of the source of current. In the present instance it is connected to ground.

The switch 4 between the terminal 2 of the source of current and the magnet 5 is intended to represent broadly the means which controls magnet 5, which may be any place or series of places, or conditions, which determine the condition of the signal, that is, this switch represents block sections, switch-points, crossings, etc., the condition or position of which is to be indicated by the signal.

When the devices represented by Fig. 4 are in normal or safe condition, switch 4 will be closed. The magnet 5 then becomes energized, the current flowing from 2 over the switch 4, magnet 5 to terminal 14, switch-blade 9 to the other terminal 3 from the source of current. The energizing of the magnet 5 pulls the armature lever 6, and releases signal lever 7. By the throwing over of the signal lever, switches 8 and 9 are moved to contacts 12 and 15 respectively and switch 10 is moved by the movement of the armature 7 to contact 17^a. The current now flows from the terminal 2 through switch 4, and magnet 5, to conductor 19 through the electromagnetic device 27 to the other terminal 3, and the source of current. Magnet 27 thereupon becomes energized and the signal 28 is coupled to the signal operating mechanism. At the same time the motor circuit is energized the current flowing from the terminal 1 through switchblade 8 to contact 12, switch-blade 10, conductor 17 and through motor switch 20, coil 21, armature 23, to the other terminal 3 of the source of current. The motor is thus operated and the arm 24 is moved downward pulling with it the signal 28 and moving the same to safety or clear position and at the same time moving the motor switch 20 to the position shown in Figs. 3 and 4. When the motor switch 20 has reached the limit of its movement, as shown in Fig. 4, the circuit through the conductor 17 and motor coil 21 is broken as shown in that figure, and the motor is stopped. The return of the signal to danger position may now be effected by the interruption of the current through the coupling device (27), as, for example, by the opening of switch 4 or any of the devices represented thereby, or the signal may be returned by the throwing back of the signal lever. In devices heretofore known, the interruption of the current through the coupling device at the switch 4 or its equivalent effected only the release of the signal from its operating mechanism, and gravity was relied upon for the return movement of the signal. According to the present invention, however, the interruption of the current through the circuit causes a positive return of the signal by the operation of the motor, since by the interruption of this current magnet 5 is deënergized and armature lever 6 falls back, carrying with it switch 10, moving the same over to contact 18^a, and connecting the conductor 18 with the source of current as shown in Fig. 5. This conductor 18 being connected with the field coil 22 of the motor 23, causes the motor to be driven in a direction to cause the tie-rod 26 and magnet 27 to be moved upwardly carrying with it armature 27^a and the rod 27^b. The latter being

connected to the signal the signal arm 28 is brought down into the danger position as shown. The return of the signal by the motor may thus be effected, according to the present invention not only from a single place, but from any desired place or places, and in any desired manner by means which act upon the magnet 5, as, for instance by hand switches or automatically acting switches. The same purpose may be accomplished also without magnet 5, by an arrangement of switches 33, 34, and 35 in the conductors 17 and 18, as shown in Fig. 6, which switches are operated either indirectly as shown at 33 and 34, or directly, as shown at 35 from the places to be guarded by the signal. Switches 33 and 34 are operated in the usual manner by magnets 40 and 41 which are energized, when the conditions are such that the places to be guarded require a clear signal. As shown at 35, the switch is operated directly by the switch-points 42 and causes the connection of the wire 17 with the switch 8 only when the switches 33, 34 or 35 are in closed position. When any one of said switches is opened, the conductor 18 is connected in circuit, causing the return of the signal to danger. In a similar manner, well known to those skilled in the art, a signal may be made to be dependent upon relays for its action, condition of block sections, etc. The same signal changes may be made dependent upon relays or switches located in any desired place, for example, in the signal box itself so that the same changes may occur and made dependent upon any desired arrangement or apparatus. The above described arrangement may be employed in any form of apparatus on all signal circuits even if these require more than one conductor for each motor movement. It is furthermore immaterial whether or not the electromagnetic coupling device is situated in a particular or special circuit. Also the arrangement shown may be employed in controlling devices in which the motor runs in the same direction when the signal is returned to danger as when the signal is moved to safety. The conductor 18 represents in general that conductor through which current flows to move the signal into danger position irrespective of the direction of movement of the motor.

The arrangement of switch 10 in connection with magnet 5 may be advantageously carried out in the following manner: Should the power of magnet 5 be insufficient to cause the movement of switch 10, this switch may be moved by means of a suitable modification of the signal lever 7 such as is illustrated in Fig. 7. For this purpose, the signal lever is provided with a cam 31 which pushes over armature lever 28 to the pole of the magnet 5 when the signal lever is thrown over and thereby pulls over the switch 10 onto the contact 17^a of conductor 17. The magnet then is required merely to hold the armature in position. This arrangement, it is true, has the disadvantage that in the throwing back of the signal lever, the armature lever 28 which has somewhat fallen away in the meantime will be moved on to the pole of the magnet by the cam 27, though only temporarily. This advantage may be removed by arrangements such as illustrated in Figs. 8 to 10. Rigid cam 31 is replaced by a flexibly mounted cam 29, mounted on the signal lever, and held in normal position by means of a spring 29^a. In the position shown in Fig. 8, the armature lever 38 forms a lock for the signal lever by means of a stop 33 fixed on the latter, the armature lever being held in this position by means of a spring or weight 38^a. The connection between the armature lever and the switch 10 is such that the armature lever may have a slight lost motion, such as, for instance, by a pin and slot connection 6^b. This lost motion is sufficient to release the hand lever 7 from locked position and is indicated by dotted lines in Fig. 8. The winding on the magnet is so arranged that the magnet will have sufficient pull to execute this movement, but not sufficient to overcome the action of a spring 34 acting on switch 10, and normally holding the same on contact 18^a. When the signal lever is thrown over, cam 29 forces the armature lever over to the magnet, as indicated in Fig. 9. This arrangement also permits that the armature lever may fall away from the magnet. When the signal lever is thrown back as indicated in Fig. 10, stop 33 moves back the armature slightly, as indicated in that figure, but owing to its lost movement this does not effect the position of switch 10. Cam 29 thereby clears the armature lever and the switch remains in normal position. In Figs. 11 and 12 is shown a modification in which link connections are employed between the switch 10 and the signal lever, and at the same time renders them dependent upon a magnet 32. If, when magnet 32 is energized, a signal lever is moved from the normal position (Fig. 11) to the clear position (Fig. 12) the link members take the position shown in dotted lines in Fig. 11 whereby switch 10 will be moved over to contact 17^a. Upon interruption of the exciting current of magnet 32, the armature of magnet 32 falls away either by the action of a weight or spring and the parts assume the position shown in Fig. 12, and the switch 10 is moved to connect the conductor 18 in circuit for the return of the signal. The pivot point of switch 10 may also be directly connected with the terminal 1 of the source of current as represented in Figs. 11 and 12, in which case switch 8 is entirely dispensed with.

It is obvious that magnet 32 may be made

dependent upon devices represented by Fig. 6 in the same manner as magnet 5 in Fig. 1. The switch illustrated in Figs. 7, 8 and 11 may also be arranged in any other service position and may be set by means of a stop lever, (controlling lever) or by automatically acting devices and switched into circuit after the manner shown in Fig. 6.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In an electric signal apparatus, the combination with a signal, a motor for operating the same, and manually operated means for controlling the setting of the signal, of means dependent upon the condition to be indicated by the signal for causing the motor to return the signal to corresponding position.

2. An electric signal apparatus, the combination of a signal, a motor for operating the same, energizing circuits and connections for the motor, one of said circuits causing the motor to set the signal, another of said circuits causing the motor to return the signal to normal position, and a switch controlling said circuits, said switch automatically controlled by the conditions to be indicated by the signal.

3. In an electric signal apparatus, the combination of a signal, a motor for operating the signal, a source of current for the motor, connections from the source of current to the motor, one of said connections causing the motor to move the signal to safety position, another of said connections causing the motor to move the signal to danger position, and a switch controlling said connections and means dependent upon the conditions to be indicated by the signal for operating said switch to cause the motor to return the signal from safety to danger position.

4. In an electric signal apparatus, the combination of a signal, a motor for operating the same circuits and connections for energizing the motor, one of said circuits causing the motor to set the signal, another of said circuits causing the motor to return the signal to normal position, two switches for controlling said circuits, manually operated means for operating one of said switches, and means automatically operated by changes of the conditions to be indicated by the signal for operating the other switch.

5. In an electric signal apparatus, the combination of a signal, a motor for operating the same, circuits and connections for energizing the motor, one of said circuits causing the motor to set the signal, another of said circuits causing the motor to return the signal to normal position, a switch dependent upon the conditions to be indicated by the signal for controlling said circuits, a manually operated switch for controlling said circuits, and a locking device for the manually operated switch controlled by the first named switch.

6. In an electrical signal apparatus, the combination of a signal, a motor for operating the signal, a circuit for controlling the operation of the motor, a source of current, manually operated means for connecting the motor circuit with the source of current to operate the signal, and means responsive to the condition to be indicated by the signal and acting on the motor circuit to return the signal from its set position to normal independently of the manually operated means.

7. In an electrical signal apparatus, the combination of a signal, a motor for operating the signal, circuits for controlling the motor to operate the signal in either direction, a manually operated switch for connecting the motor circuits with the source of current, an automatically operated switch for connecting the motor circuit with the source of current, and means dependent upon the conditions to be indicated by the signal for operating the latter switch independently of the manually operated switch.

8. In an electrical signal apparatus, the combination of a signal, a motor for operating the signal, and an electro-magnetic coupling device between the motor and the signal, two energizing circuits for the motor, one of said circuits for setting the signal and the other of said circuits for returning the signal to normal position, a circuit for the electro-magnetic coupling device, manually operated switches for all of said circuits, an automatically operated switch for the motor circuits, a locking device controlled by the position of the automatically operated switch, said locking device locking the manually operated switches, and means dependent upon the conditions to be indicated by the signal for operating said locking device, and an automatic switch whereby the motor is connected in circuit to return the signal to normal position independently of the manually operated switch.

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