No. 742,487. PATENTED OCT. 27, 1903.

H. PFIRMANN.

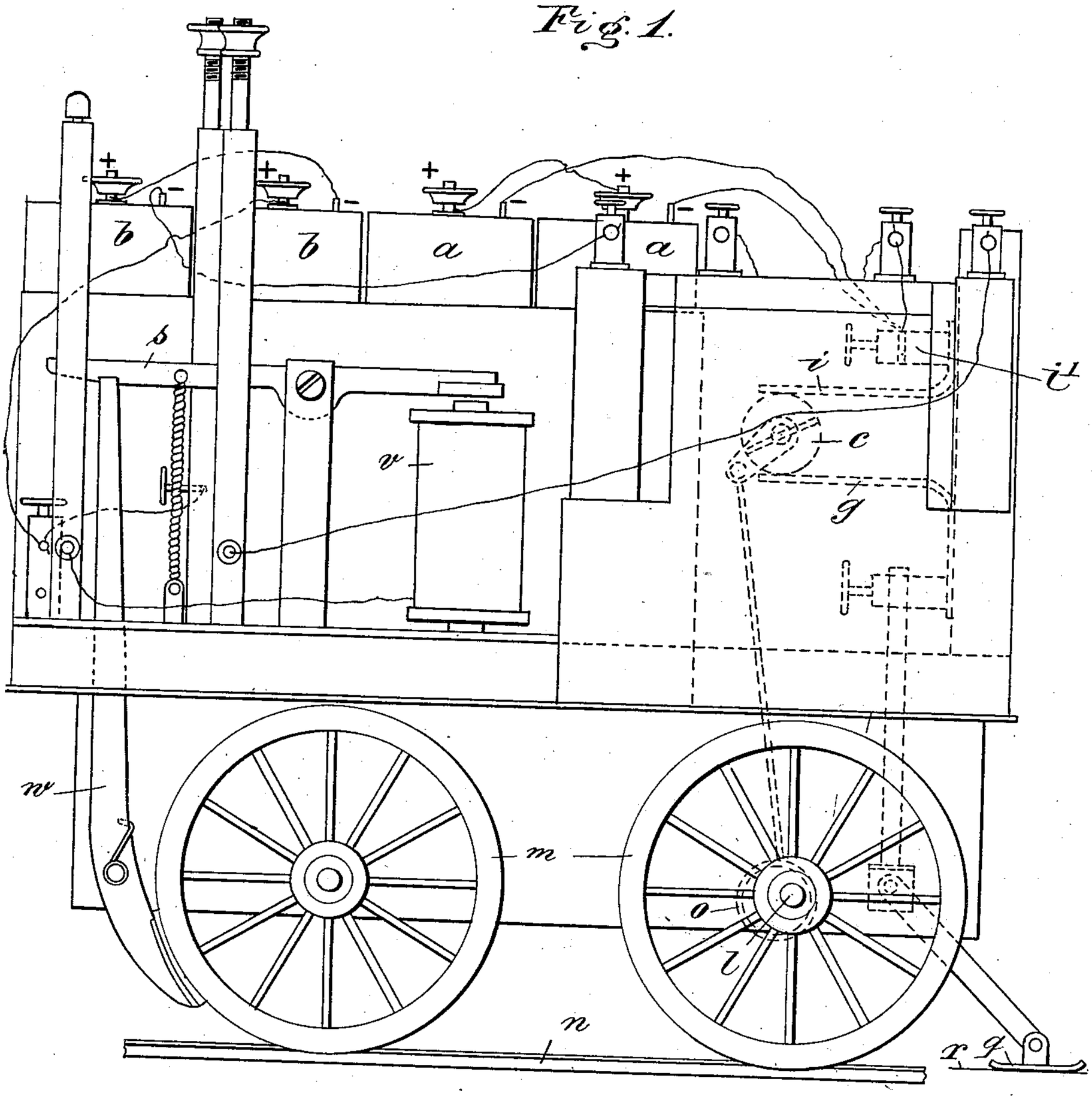
ELECTRIC SIGNALING DEVICE FOR RAILWAYS.

APPLICATION FILED DEC. 7, 1901.

NO MODEL.

6 SHEETS—SHEET 1.

Fig. 1.



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Lillie M. Perry.

Inventor:
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his attorneys

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6 SHEETS—SHEET 2.

Fig. 2.

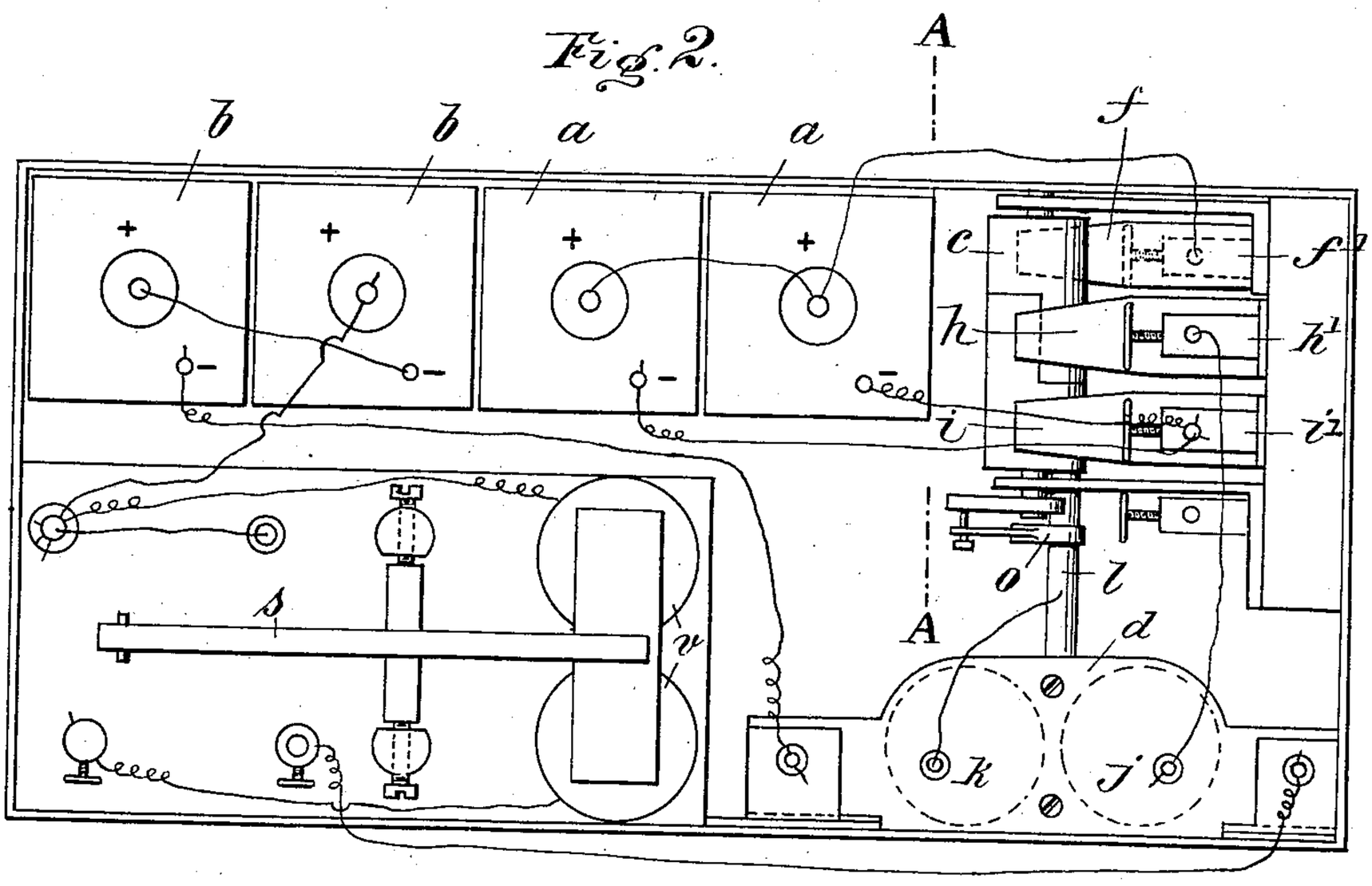


Fig. 3.

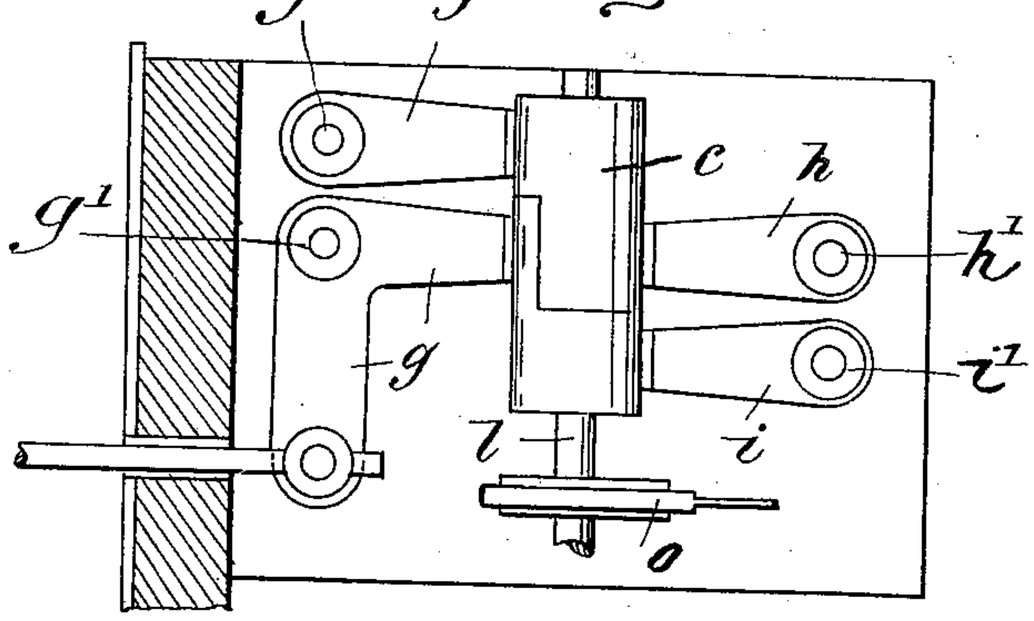
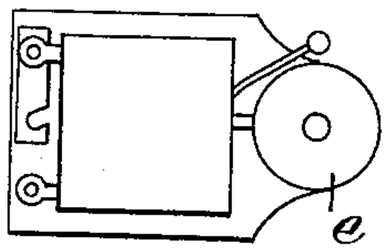


Fig. 4.



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NO MODEL. 6 SHEETS—SHEET 3.

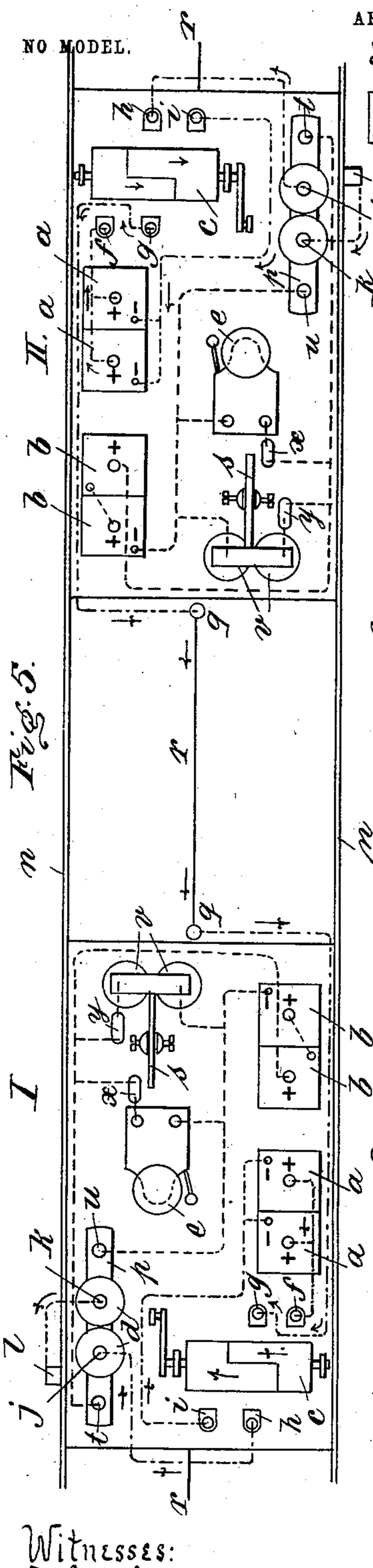

Fig. 5.

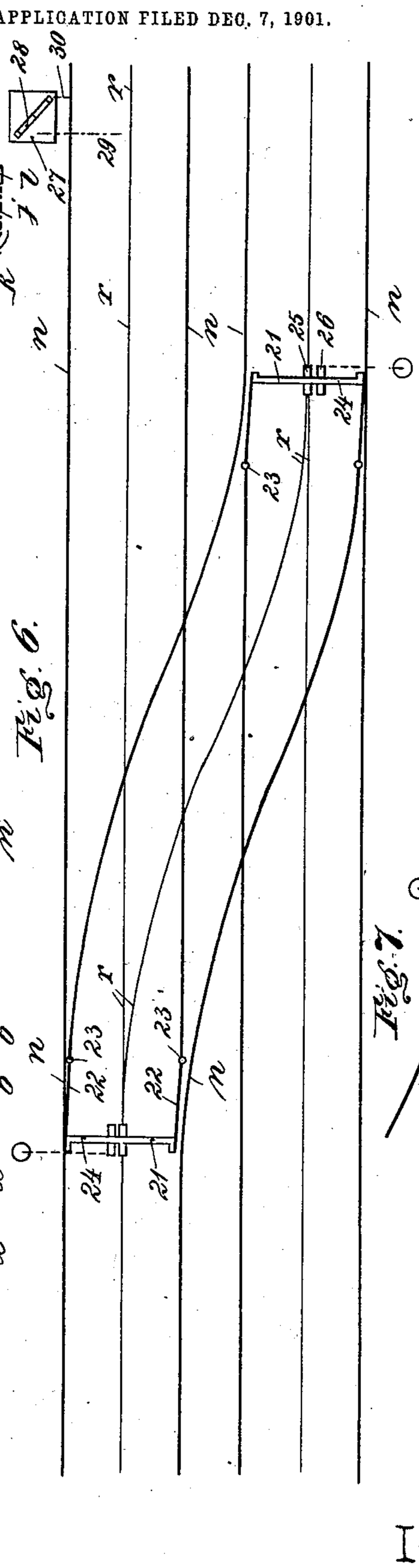

Fig. 6.

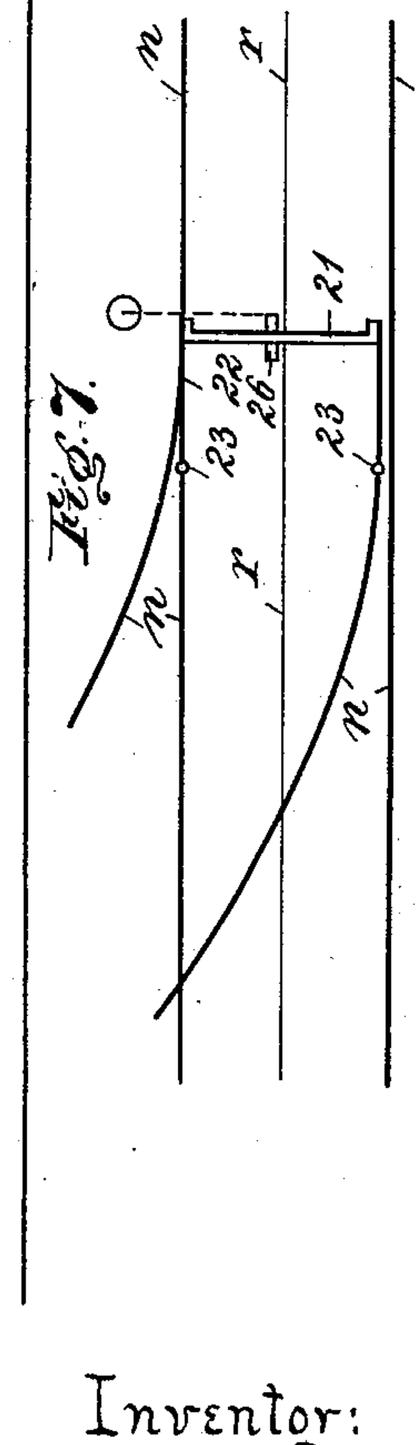

Fig. 7.

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NO MODEL. 6 SHEETS—SHEET 4.

Fig. 8.

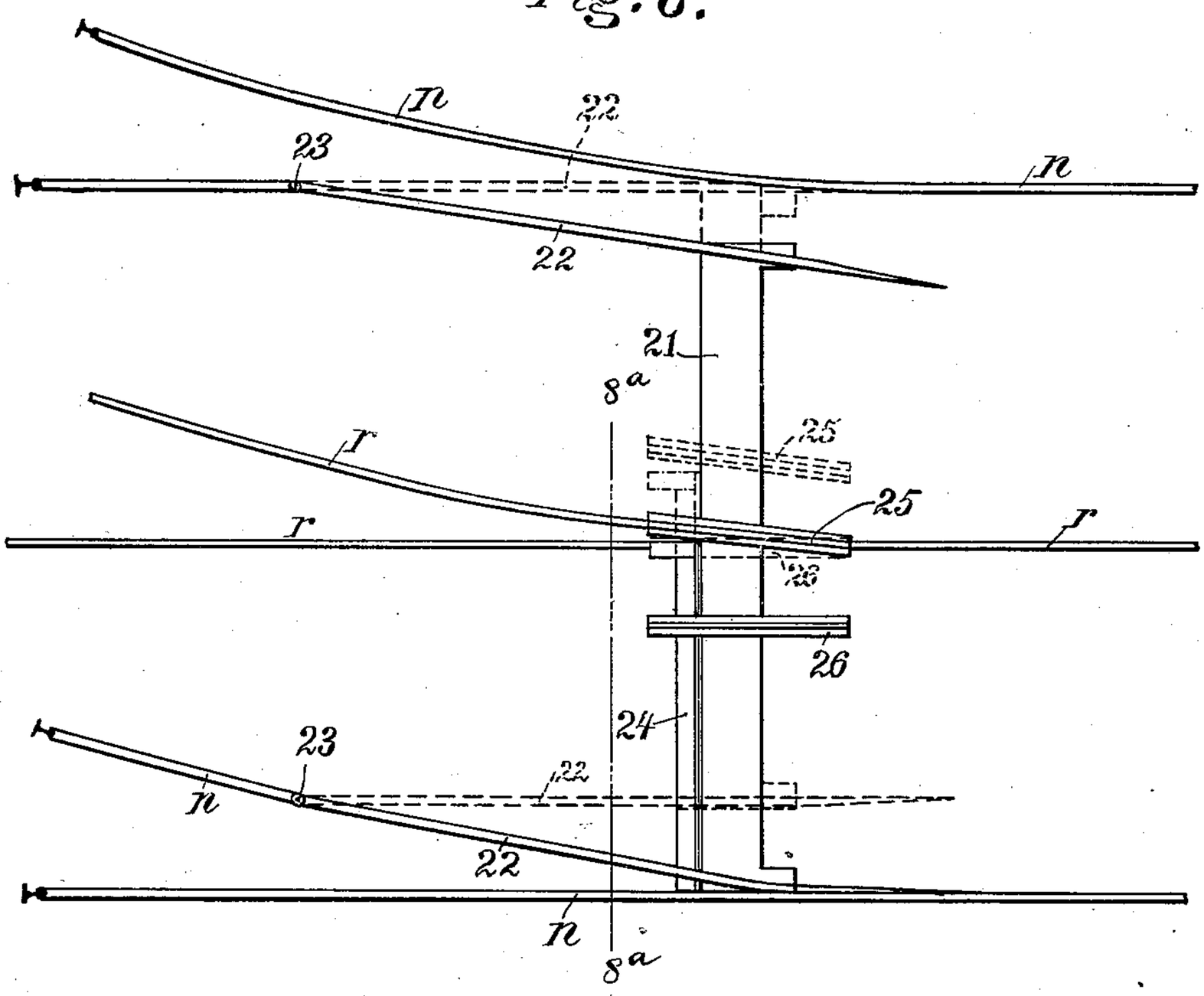
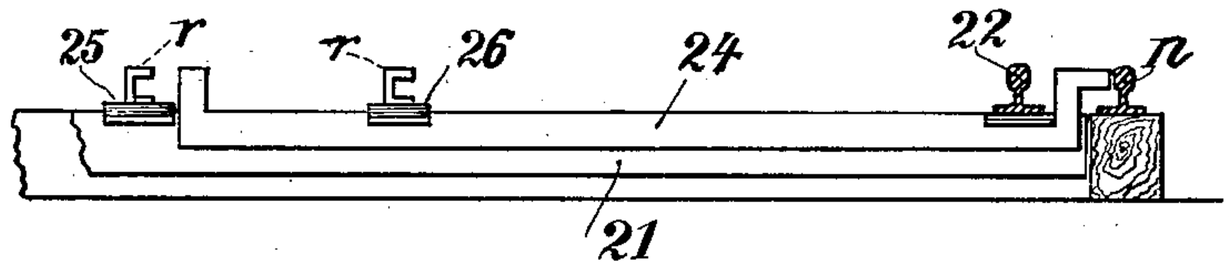


Fig. 8a.



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No. 742,487. PATENTED OCT. 27, 1903.

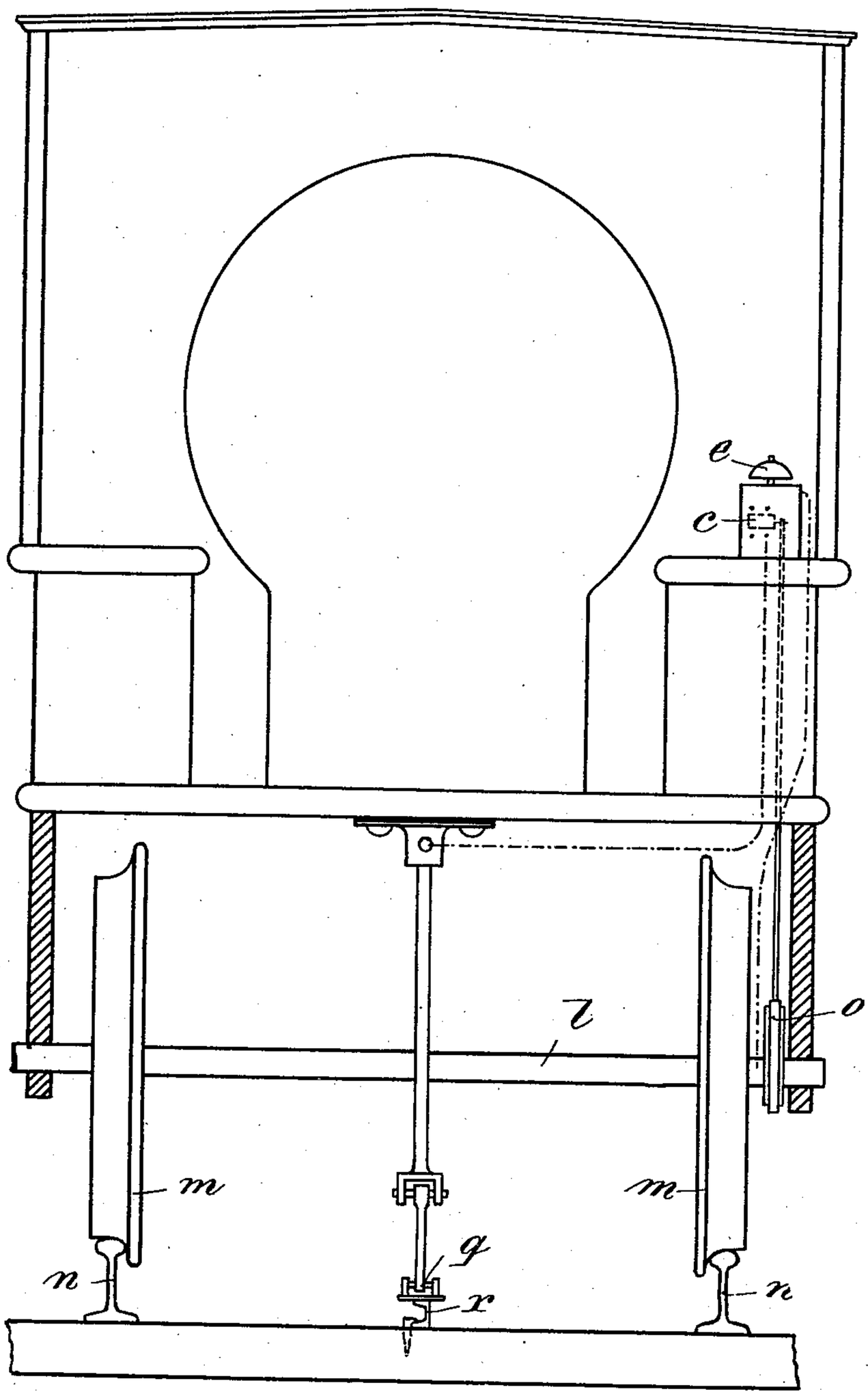
H. PFIRMANN.

ELECTRIC SIGNALING DEVICE FOR RAILWAYS.

APPLICATION FILED DEC. 7, 1901.

NO MODEL. 6 SHEETS—SHEET 6.

Fig. 9.



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No. 742,487. PATENTED OCT. 27, 1903.

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NO MODEL. 6 SHEETS—SHEET 6.

Fig. 10.

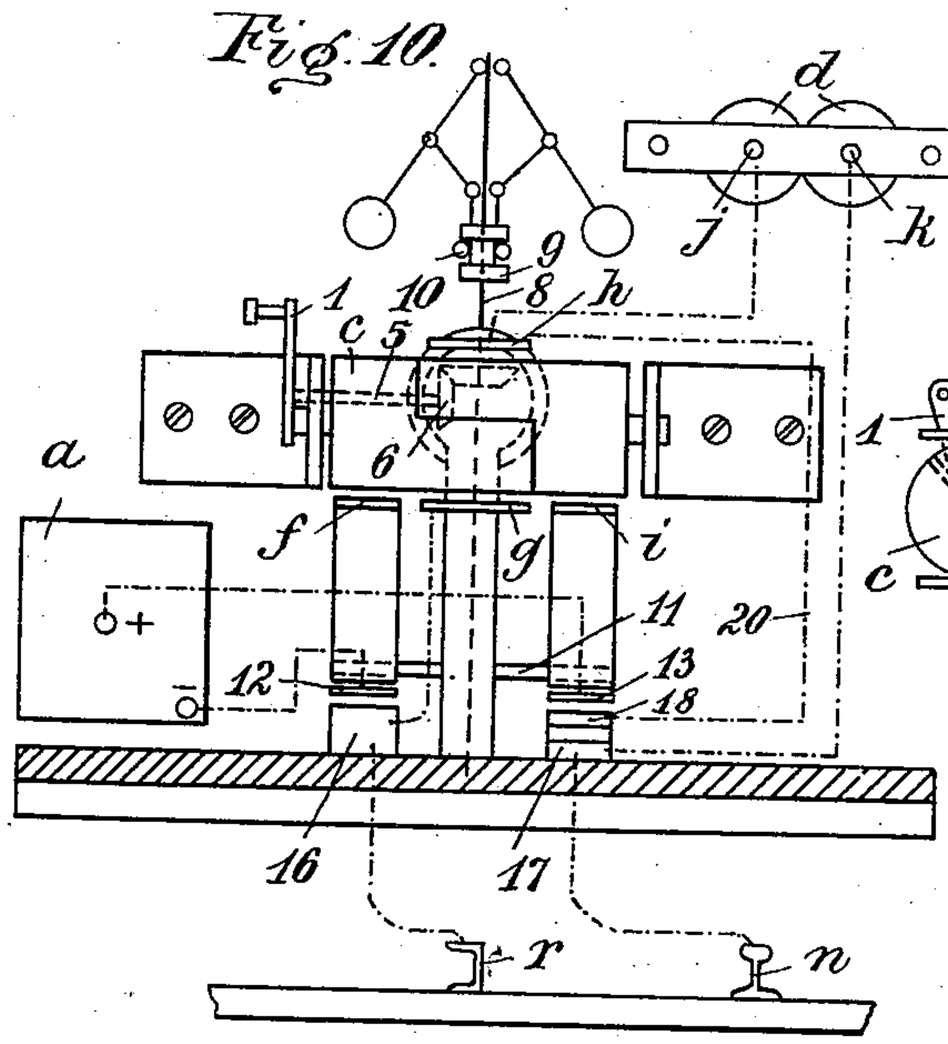


Fig. 11.

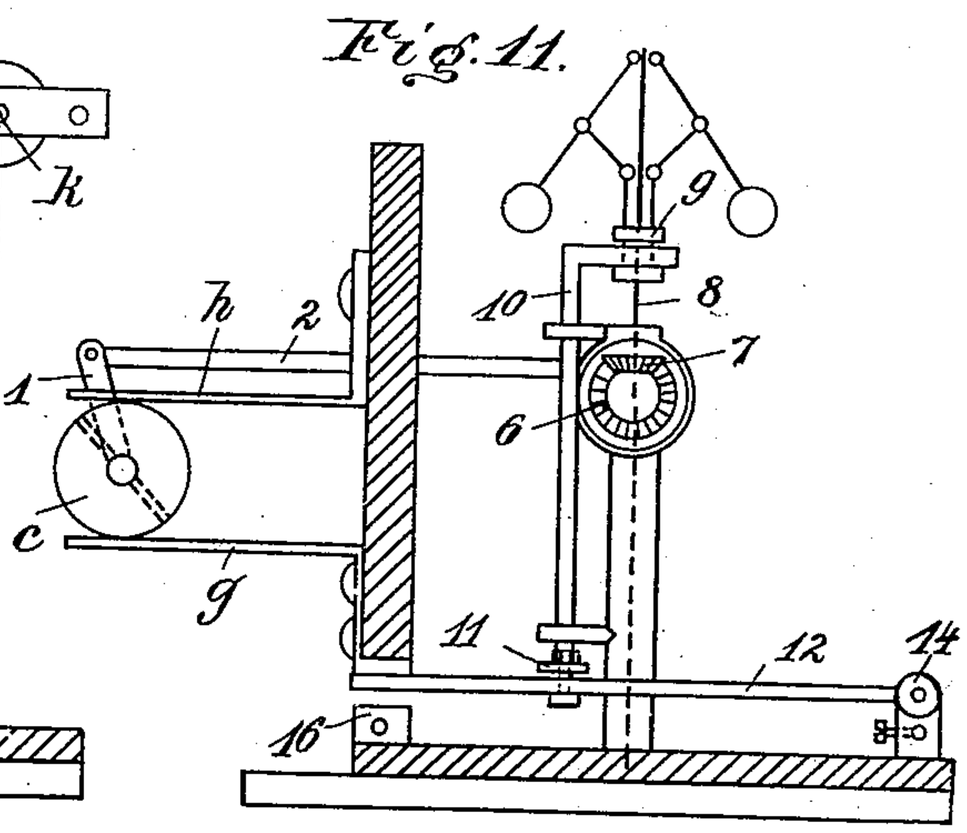


Fig. 13.

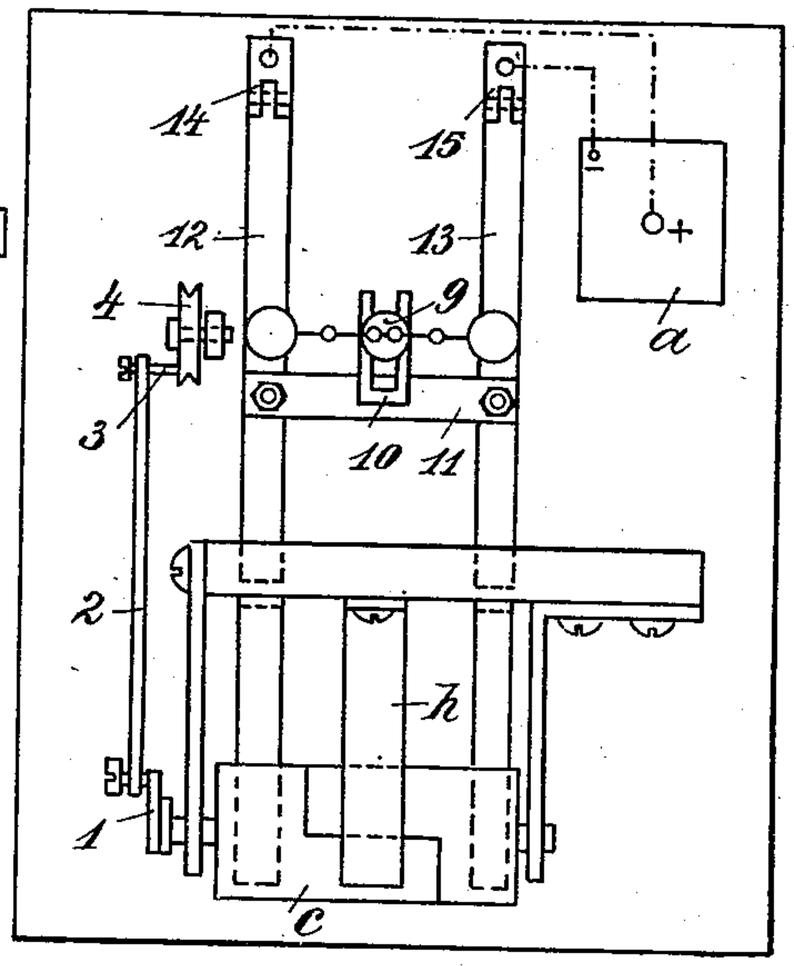
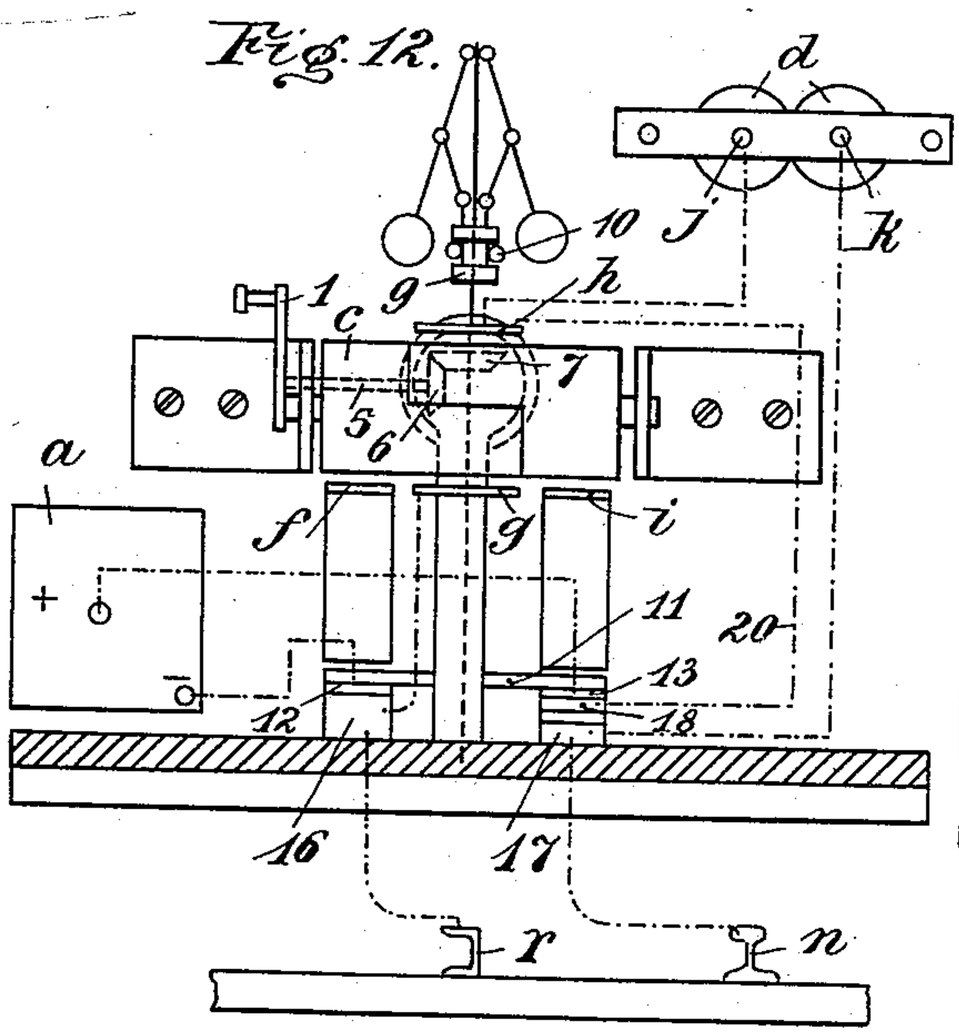


Fig. 12.



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his attorneys.

No. 742,487. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

HUBERT PFIRMANN, OF FRANKFORT-ON-THE-MAIN, GERMANY.

ELECTRIC SIGNALING DEVICE FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 742,487, dated October 27, 1903.

Application filed December 7, 1901. Serial No. 85,115. (No model.)

To all whom it may concern:

Be it known that I, HUBERT PFIRMANN, merchant, residing at Leerbachstrasse 72, Frankfort-on-the-Main, in the German Empire, have invented new and useful Improvements in Electric Signal Devices for Railways, of which the following is a specification.

My invention relates to an electric signal for railways, and has for its object to provide an audible or visible signal between approaching locomotives on the same track in which the battery or source of electricity is carried on the locomotives or other parts of trains, and this when the two locomotives or trains are in danger of a butting collision or in proximity to a misplaced switch.

The several features of my invention distinguishing it from prior devices of this kind and the various advantages resulting from my invention are essentially the following, viz: the use of only one conductor rail or wire between the track-rails and the possibility of varying at will the effect of the signal-current at distances—for example, two thousand, one thousand, five hundred, two hundred meters or more or less—this being obtained by a corresponding cross-section for the resistance of the conductor-rail.

The features of my invention are more fully set forth in the description of the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a side elevation of the device placed on a car-truck of same dimensions to show how the commutator is driven from the wheel-axle and how the brake is driven. Fig. 2 is a top view of Fig. 1. Fig. 3 is a sectional detailed view on line A A, Fig. 2. Fig. 4 is a detailed view showing the manner of electrically connecting the signal-bell. Fig. 5 is a diagram of the circuit connections of two locomotives or trains being in a dangerous proximity to each other. Fig. 6, on the same sheet, is a diagram of a section of a railroad-track and conductor-rail on the switch and a diagram of the device for giving a signal from a signal-box in case obstacles should be found on the track. Fig. 7 is a diagram of a switch leading to a "dead" track. Fig. 8 is an enlarged detail view of a part of Fig. 6. Fig. 8^a is a cross-sectional elevation on line 8^a 8^a of Fig. 8. Fig. 9 is a diagram showing the preferred position of the device upon a locomotive. Fig. 10 is a detailed front view of the commutator and regulator when the locomotive or train is running. Fig. 11 is a side view of Fig. 10. Fig. 12 is a front view corresponding to Fig. 10 of the commutator and regulator, but when the locomotive or train is standing. Fig. 13 is the top view of Figs. 10 to 12.

The device, placed by preference on the locomotive (see Fig. 9) or on any suitable part of the train, is of about a size of ten centimeters height, ten centimeters width, and twenty centimeters length and is essentially composed of a battery of dry cells *a a b b*, a commutator *c*, a relay *d*, an electric bell *e*, and, if desired, a magnet *v*, Figs. 1 and 2.

In Figs. 1 and 9 I have shown the commutator *c*, which is rotated from the wheel-axle *l* by means of an eccentric *o* and a connecting-rod. *f g h i* indicate contact-brushes each of which is connected to a terminal *f' g' h' i'*, respectively, Fig. 3.

In Figs. 2 and 5 the current may be traced as follows: Commencing with the battery, the positive poles of the cells *a a* are connected to the brush *f* of the commutator *c* and brush *h* to the terminal *j* of the relay, the other relay-terminal being connected to wheel-axle *l* and through the wheels *m* to the tracks *n n*. Commutator-brush *g* is connected to an insulated trolley *q*, traveling on the single electrical conductor or conducting-rail *r*, located between the track-rails and preferably made of flat iron of ⌐ shape in cross-section. Brush *i* is electrically connected to the negative terminals of the cells *a a*. The relay-terminals *t u* are respectively connected to the positive terminal and to the negative terminal of the cells *b b*. In this relay-circuit there is included the electric bell *e*, and, if desired, the magnet *v*, releasing a brake-lever *w*, Fig. 1, for braking the train as soon as it comes into proximity to a danger-point. Either the bell *e* or the magnet *v* or both of them may be cut out of the circuit by means of switches *x y*.

In this signal device as well as in other devices of the same kind two circuits are used—a distance-circuit and a local circuit controlled by the distance-circuit and operating the bell or any other warning device, or, if desired, the brake.

The mode of operation of this device will be readily understood by reference to the diagram Fig. 5. This diagram indicates two engines or trains I II heading toward each other and approaching to a dangerous proximity to each other. In this case the current beginning from the positive terminals of cells *a a* on locomotive I passes through brush *f* to the commutator *c*, thence upon the continued rotation of the said commutator from wheel-axle *l* through brush *h* to the relay-terminal *j*, thence through the windings of the relay-magnet, thence through the relay-terminal *k* to the wheel-axle *l* and wheels into the track-rails *n n*, thence along these rails through the wheels and axle of the locomotive II to relay-terminal *k*, through the windings of the relay-magnet to the terminal *j*, and thence through brushes *h i* of the commutator *c* to the negative terminal of the cells *a a*, thus completing the circuit. On the other hand, from the positive terminal of these cells *a a* the current passes to brush *f*, through the commutator *c* to brush *g*, thence to trolley-contact *q*, track-rail *r*, thence along the rail to trolley *q* of the locomotive I, thence to brush *g*, through the commutator to brush *i*, and finally to the negative terminal of cells *a a*. In this manner, the relay *d* being energized and its armature *p* attracted, the local circuit of the cells *b b* is closed, and the bell *e* included in this circuit will ring, or any other warning device will be operated, or in case the magnet *v* is used, this magnet being energized will attract its armature *s*, Fig. 1. By this means brake *w* is allowed to be applied and the locomotive or train brought to a standstill. The same takes place in the reversed direction, so that a closed circuit is obtained between two locomotives or trains being in a dangerous proximity to each other. The bells *e* or any other warning devices are then operated or the brakes *w* applied, and in this latter case the two trains are automatically brought to a standstill within a predetermined distance from each other.

The regulation of the sphere of action of the current, and therefore of the distance within which two trains heading in the same direction and approaching each other or one train approaching another standing train or an open switch may automatically be brought to a standstill, is effected by varying the tension of the elements *a a* on one hand and the cross-section or resistance of the conductor-rail *r* on the other hand, and this cross-section is relatively an extremely small one. Lastly, this regulation of the distance may be obtained within certain limits by means of corresponding adjustment of the relay-armature through adjusting-screws, so as to cause the apparatus to operate at two thousand, one thousand, six hundred, five hundred meters or more or less.

When a locomotive or train is running, then quick successive positive and negative impulses of current are carried into the conducting-rail by the successive quick oscillations of the commutator caused by the eccentric on the wheel-axle *l*. In consequence of the inequality of the commutator oscillations on any condition positive and negative impulses of current must stand opposite each other on the long track.

The arrangement shown by Figs. 10 to 13, inclusive, is for admitting current into the commutator of standing locomotives or trains. *c* indicates the two-part commutator. *f g h i* indicate four brushes engaging the commutator. Keyed on the axle of this commutator is a crank 1, Figs. 11 and 13, connected by a rod 2 to a stud 3 on a pulley 4, Fig. 13, this being connected by an endless belt to the wheel-axle. On axle 5 of the belt-pulley is keyed a bevel wheel 6, gearing with a second bevel-wheel 7 on the vertical governor-axle 8. A draw-bar 10, carrying on its lower end a cross-piece 11, engages a socket 9 of the governor. Fixed to this cross-piece, but insulated from it, are two metal bands 12 13, hinged at 14 15 and raised and lowered by the draw-bar and cross-piece. Beneath this latter a metal block 16 is provided which is electrically connected to the insulated trolley 9 and conductor-rail *r*, Figs. 10 and 12. Another metal block 17 is electrically connected to wheel-axle *l*, wheels, and track-rails *n n*, and a metal piece 18, insulated from this block 17, is fixed on the same. The mode of operation of this device is as follows: When the locomotive is running, the strap-pulley 4 is driven from the wheel-axle, the governor is driven by the bevel-wheels 6 7, and the commutator *c* oscillated by the connecting-bar 2 and crank 1. A continuous changing of the current will be obtained in this way. The governor rotates on the slightest movement of the locomotive and raises metal pieces, engaging them with the joining-piece of the commutator-brushes by means of the draw-bar 10 and cross-piece 11. In Fig. 10 the current may be traced as follows: Commencing with the elements *a* the current passes through both of the metal pieces 12 13, the brush-joining pieces to the commutator *c* and to brushes *g h*, so that in the presence of danger the current will operate a device to prevent disaster either by means of relay *d* and bell *e* or of the automatic brake, if such brake is employed, or by means of both the brake and an alarm. When the locomotive is standing, the governor also is at a standstill. The draw-bar 10, Fig. 12, is lowered and rests upon the metal blocks 16 or 18. In this position of the parts the current may be traced as follows: from positive pole of the element *a* to the metal piece 13, thence into the insulated metal piece 18 through a special conductor 20 to brush *h*, thence to the relay-terminal *j* through magnet-windings, relay-terminal *k* to metal block 17, and thence through wheel-axle and wheels *m* into the track-rails *n n*.

The device may also be employed to pre-

vent a head-on or side collision of a running train with another train standing on a siding in case the switch leading to the siding should be misplaced. The arrangement for this purpose is indicated in Figs. 6 and 8. On the connecting-piece 21 of the switch-tongues 22, pivoted at 23, an interruption of the conductor-rail is provided. An insulated contact-piece 24 is carried by this connecting-piece 21. This contact-piece 24 electrically connects the conductor-rail *r* to the track-rail *n* when the switch is open. If, therefore, a train or locomotive is going from the left to the right and the switch condition is that shown in Figs. 6 and 8, the distance-circuit of this train will be closed by contact-piece 24 and the warning device operated as soon as the train or locomotive reaches a point at such a distance from the point of danger as corresponds to the sphere of action of the warning device. By this means a collision of a train or locomotive standing on the siding with one about to enter the siding may be prevented. A second insulated piece 25 or the connecting-piece 21 forms a connection between the conducting-rail *r* and the part of the conducting-rail which is at the right of the switch, so that a warning-signal is given as soon as on the neighboring track a train or locomotive is in a dangerous proximity to the standing train. A third insulated piece 26 serves for producing a connection for the parts of the conducting-rail before and behind the connecting-piece 21 when the switch is closed. By this means two trains or locomotives approaching each other on the through-track receive warning-signals when they come within a predetermined distance from each other. Should the switch lead into a dead track, as shown in Fig. 7, then only one insulated contact-piece 26 corresponding to the switch might be provided on the connecting-piece 21 of the switch-tongues, as in this case only the through-track has a conductor-rail *r*. Finally, for being able to stop a train approaching an obstacle on the track in the signal-box 27, Fig. 6 at the right, a lever 28 is provided, which by a given rotation may connect two conducting-wires 29 30, connected to track-rails *r n*, and which by this means closes the circuit. In this manner not only trains approaching the signal-box may be warned by the watchman, but also trains having already run past this box.

From the foregoing it may be seen that this device specified automatically gives a warning-signal to or stops the locomotive or train, first, in case another train or locomotive is or comes into dangerous proximity to the first-mentioned train on the same track; second, in case a quick-running train is in a dangerous proximity to a slow-running train moving in the same direction; third, in case there should be danger of head-on or sidewise collision owing to a misplaced switch or to a wrong signal; fourth, in case the switch should be placed on a dead track, and, fifth, in case a conducting obstacle should be placed or fall on the track within the sphere of action of the device. Even if the obstacle is not conducting, the alarm may be given or the brakes applied by the action of the operator in the signal-tower.

What I claim as new and of my invention, and desire to secure by Letters Patent, is—

1. In a safety device for railways, the combination, with sources of electricity carried on the rolling-stock, and a conductor separate from the track-rails and forming therewith a track-circuit, of electric connections on the rolling-stock between the sources of electricity and said track-circuit, relay-magnets, commutators, and switches included therein, governors controlling said switches, local circuits controlled by the relays and electrically-actuated devices in said local circuits.

2. In a safety device for railways, the combination, with sources of electricity carried on the rolling-stock, and a conductor separate from the track-rails and forming therewith a track-circuit, of electric connections on the rolling-stock between the sources of electricity and said track-circuit, commutators driven by the movement of the rolling-stock and arranged to send current impulses into the track-circuit, a governor for each commutator, an electric switch controlled by each governor to close the circuit when the respective engine or train is standing still, relays mounted on the rolling-stock and included in the track-circuit, a local circuit controlled by each relay, and an electrically-actuated device in each local circuit.

3. In a safety device for railways, the combination with sources of electricity carried on the rolling-stock, a track-circuit, and electric connections on the rolling-stock between the sources of electricity and the said track-circuit, of commutators driven by the movement of the rolling-stock and arranged to send current impulses into the track-circuit, a governor for each commutator, said governor being arranged to complete the circuit when the rolling-stock is standing still, and relay mechanism arranged to be operated by said impulses.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HUBERT PFIRMANN.

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KARL ENGEL.