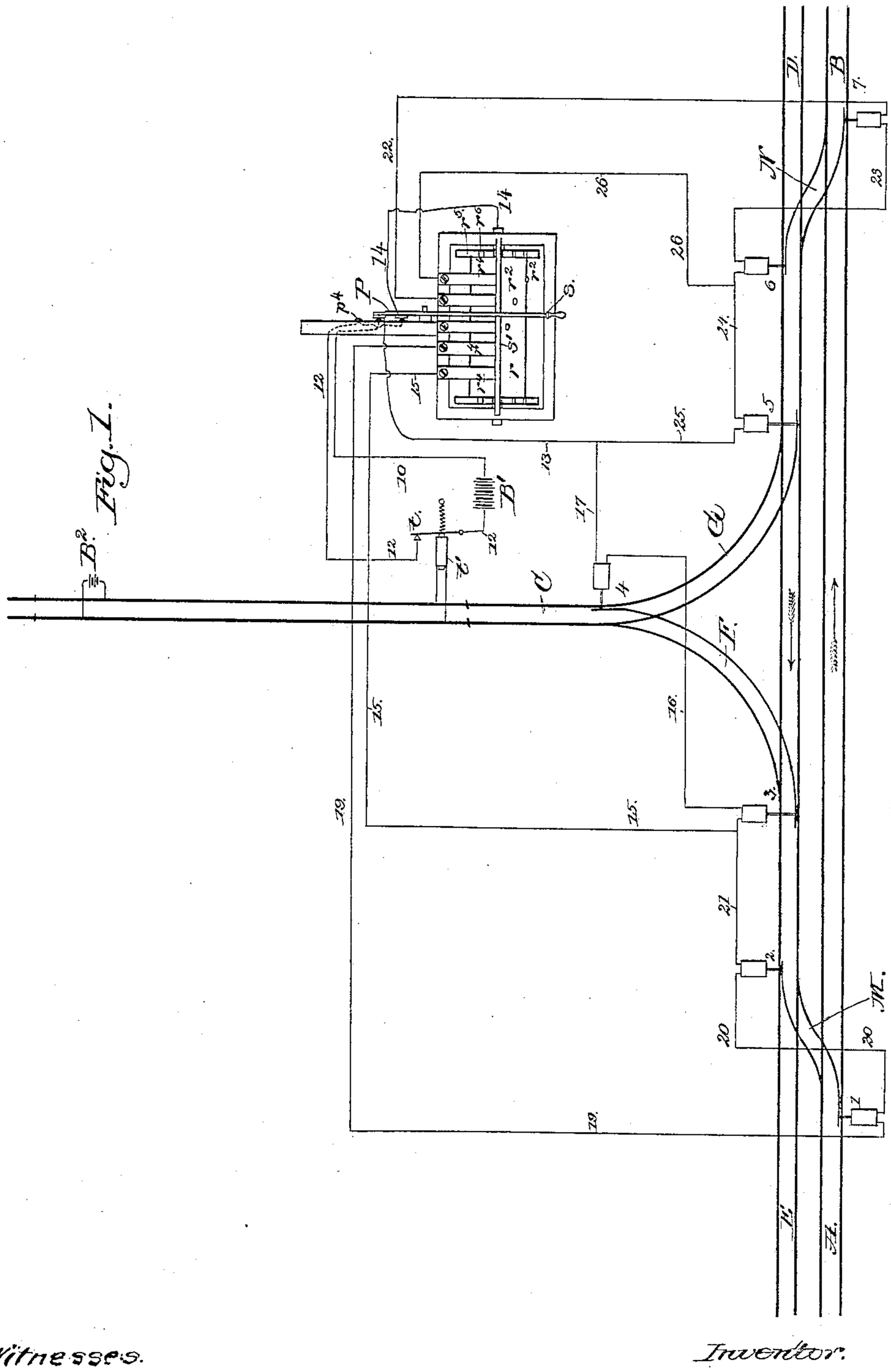
(No Model.)

3 Sheets—Sheet 1.

O. GASSETT.

INTERLOCKING SWITCH APPARATUS.

No. 292,743. Patented Jan. 29, 1884.



Witnesses.
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(No Model.)

3 Sheets—Sheet 2.

O. GASSETT.

INTERLOCKING SWITCH APPARATUS.

No. 292,743. Patented Jan. 29, 1884.

Fig. 2.

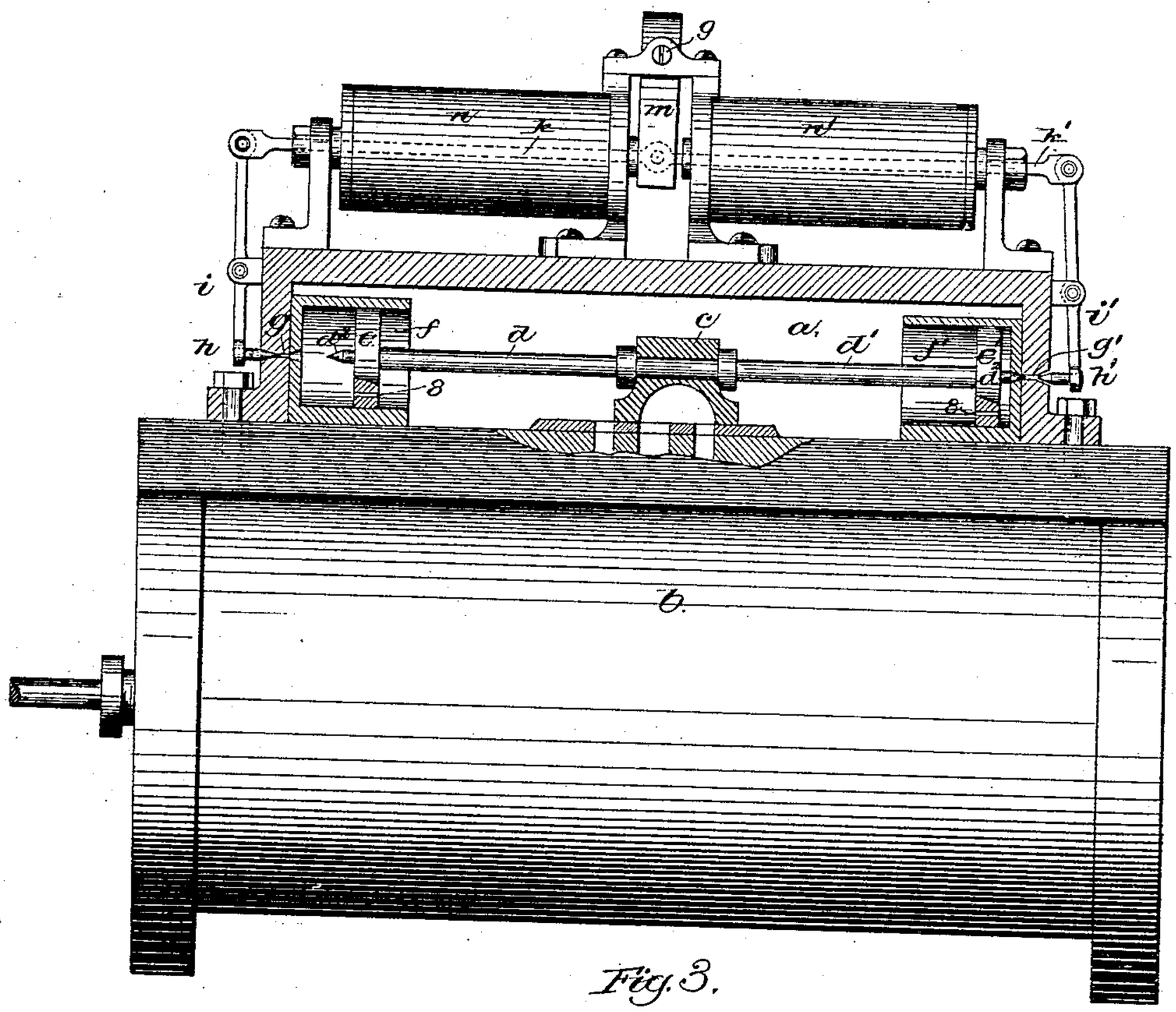
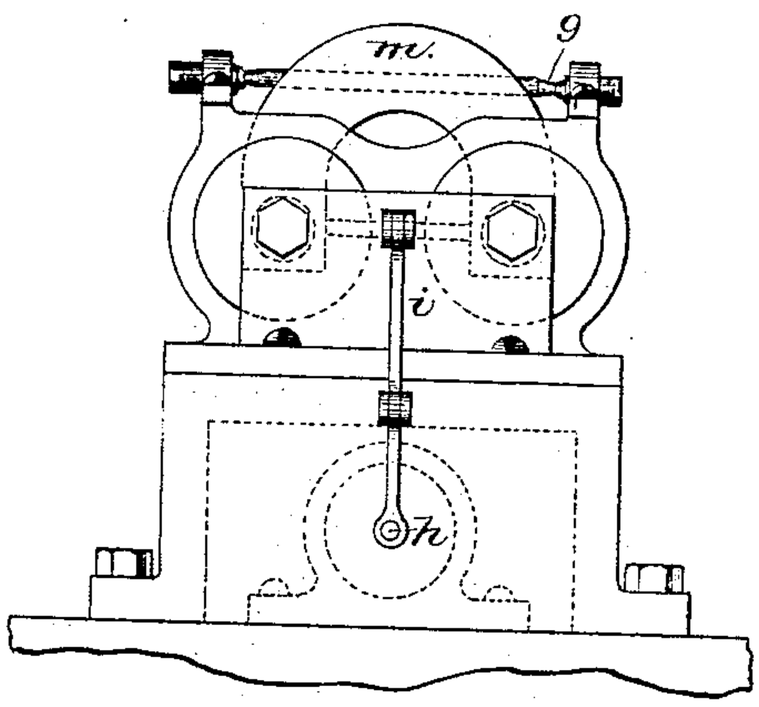


Fig. 3.



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(No Model.)

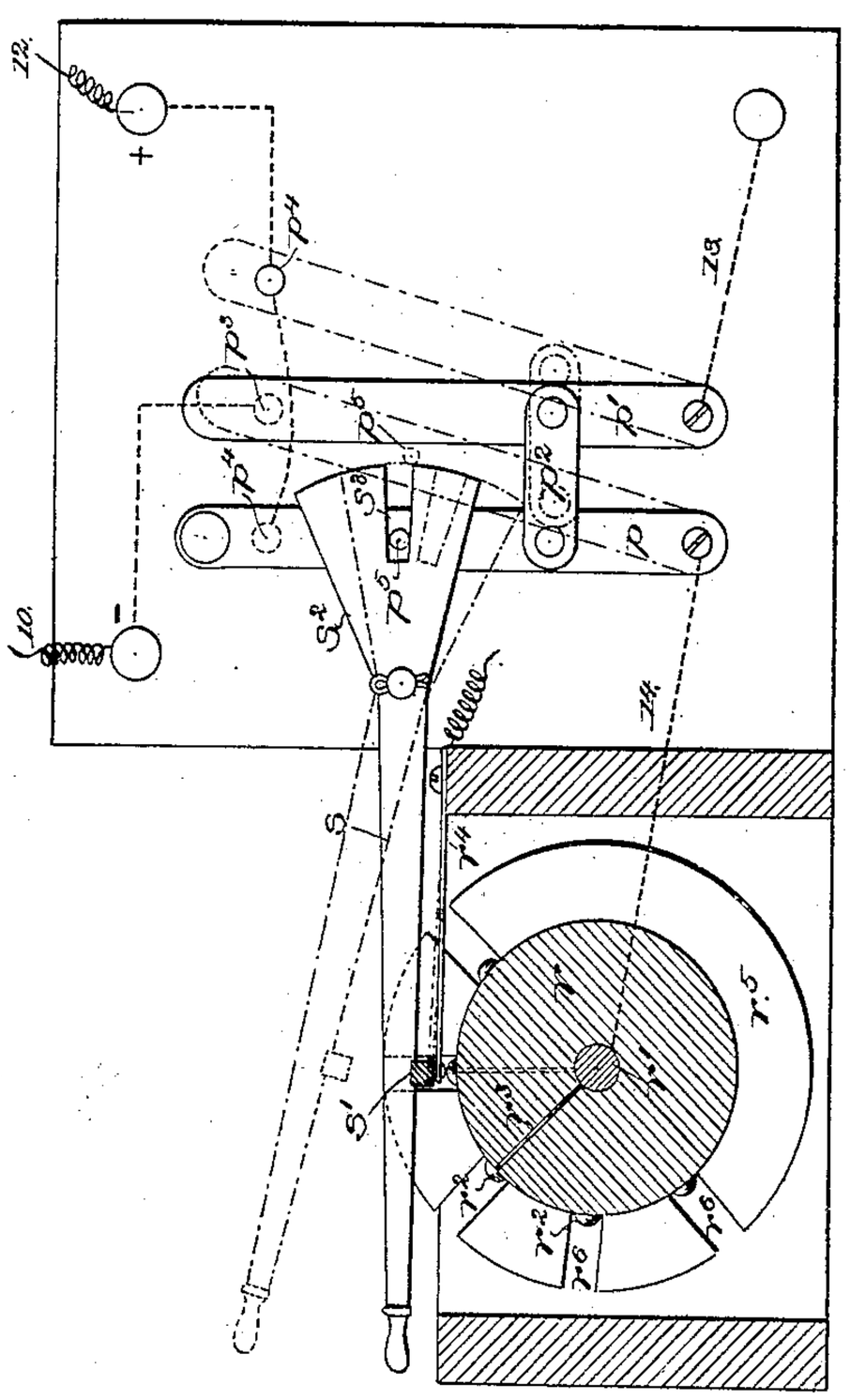
3 Sheets—Sheet 3.

O. GASSETT.

INTERLOCKING SWITCH APPARATUS.

No. 292,743. Patented Jan. 29, 1884.

Fig. 4.



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Inventor:
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UNITED STATES PATENT OFFICE.

OSCAR GASSETT, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF PITTSBURG, PENNSYLVANIA.

INTERLOCKING-SWITCH APPARATUS.

SPECIFICATION forming part of Letters Patent No. 292,743, dated January 29, 1884.

Application filed December 4, 1882. (No model.)

To all whom it may concern:

Be it known that I, OSCAR GASSETT, of Boston, county of Suffolk, State of Massachusetts, have invented or discovered a new and useful Improvement in Interlocking-Switch 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 in three sheets, making a part of this specification.

My invention relates to an interlocking apparatus for railway switches and signals, by means of which it is possible to give the proper signal to an approaching train only when the proper switches, and these alone, have been set to direct the train as signaled.

The apparatus is shown as applied to a junction of a single-track road or branch with a double-track, main, or trunk road, provided with proper switches to enable the train to pass from the said branch to the trunk road in either direction, or the reverse, or to enable the trains to pass directly over the main double-track road in either direction. In this illustration seven switches are employed, six of which are in the double-track road, and are normally set to keep the said road intact, so that trains may pass over it in either direction without being directed on to the single-track road. The seventh switch is in the single-track road, connecting it with one or the other of two curves passing to the nearer track of the double-track road in either direction.

For convenience, the double-track road will be spoken of as running east and west, one of the tracks being occupied by trains running east, and the other by trains running west the one running west being nearer the single track, so that for a train running east on the double track to enter the single track it will be necessary for it to first cross from the east to the west track, and then from the latter to the single track; or for a train to pass from the single track onto the double track going toward the east it will be necessary for it to pass across between the two double tracks after it has entered the west double track from the branch. Either position of the switch on the single track may be assumed as the normal position, and it will be seen that certain groups of switches will have to be moved from their normal position to pass a train from the single-track to the double-track road, or the reverse.

In this invention the switches are actuated by fluid-pressure in a cylinder acting on a piston connected with the movable rails or points, the fluid entering one end of the cylinder, and exhausting from the other end, as in an ordinary reciprocating engine. The admission and exhaust of the fluid to and from the proper ends of the cylinder is controlled by a suitable valve, shown as the usual D slide-valve, working on a three-port seat, and this in turn is controlled by a smaller valve actuated by the armature of an electro-magnet, the circuit of which is extended to and controlled at the point from which the movements of all the series of switches may be governed by a single operator. As herein shown, the said armature is permanently polarized, and its movements in either direction are thus controlled by the reversal of the current in the controlling-magnet, such a reversal causing the valve of the switch-actuating cylinder to be reversed, changing the inlet and exhaust of the actuating-fluid and causing the railway-switch to be moved from the position occupied when the said reversal of the currents takes place. Different branch circuits emanating from a single battery are employed, each circuit including the controlling-magnets of the series of switches that have to be moved simultaneously to direct the train as required. The said branch circuits are connected with the battery, one only at a time, by a circuit-selecting device, which is mechanically interlocked with the current-controlling or pole-reversing device, by which the direction of the current is changed in order to cause the switches to be thrown, so that the said currents cannot be reversed until after the proper branch is closed or connected with the battery, and the said branch cannot subsequently be opened and another branch closed to move another series of switches until the pole-changer has been restored to its normal position, thus restoring all the switches to their normal position. The circuit of the actuating-battery is under the control of the

approaching trains after they have passed the signal by which they are directed, so that the switches cannot be changed while the train is between the said switches and the signals.

Figure 1 is a diagram illustrating the tracks, switches, and circuits, and showing the circuit-controlling instrument in plan view. Fig. 2 is a side elevation of the switch-actuating cylinder, its valve-chest being shown in longitudinal section; Fig. 3, an end elevation of the valve-chest and valve-controlling device; and Fig. 4, an end elevation, partly in section, of the interlocking circuit-selecting and pole-reversing device.

The apparatus is shown as applied to the junction of a double-track road, A B, for trains running east, and D E for trains running west, with a single-track road, C, entering the double-track road at the side D E. The greater number of the trains passing the junction will run over the main track from A to B and from D to E; but, in order to enable trains to pass from the double-track to the single-track road, or the reverse, short connecting-tracks F G branch from the track C to the track D E in either direction, while other connecting-tracks, M N, connect the tracks A B and D E at either side of the branches F G.

Switches 1, 2, 3, 4, 5, 6, and 7 serve to direct the wheels of the train in the usual manner, the said switches being normally set to cause the train to pass over the tracks A B and D E, and the switch 4 being normally set to connect the track C with the branch G. Trains will thus pass over each track of the double-track road without any change in the switches; but for a train running east on the double-track road to pass on to the single-track road—that is, to go from A to C—switches 1, 2, 3, and 4 will have to be reversed; while for trains to pass from the single-track road to the double-track road westerly, or from C to E, switches 3 and 4 only will have to be reversed. In the same way, for a train to pass from C to B, switches 5, 6, and 7 will have to be reversed; but for a train passing from D to C switch 5 only will have to be reversed.

The switches are actuated by the pressure of a fluid—such as compressed air—supplied by pipes or otherwise to the valve-chest *a* (see Fig. 2) of a cylinder, *b*, containing a piston, the piston-rod of which is properly connected with the switch-rails to cause their position to be reversed when the said piston travels through the cylinder in one or the other direction. The admission of the fluid to one or the other end of the said cylinder, and its exhaust from the opposite end to thus cause the travel of the said piston and switch, is controlled by a valve, C, (shown as of usual construction,) having a stem, *d d'*, extending from either end of it to pistons *e e'*, operating in small cylinders *f f'*, opening at one end into the chest *a*, and each having at its other end an opening, *g g'*, communicating with the external air or with a suitable exhaust-passage. These openings *g g'* are controlled by the needle-valves *h h'*, mounted upon levers *i i'*, connected by a rod, *k k'*, with the armature *m* of a double electro-magnet, *n n'*.

The pistons *e e'* do not fit tightly in the cylinders *f f'*; or they may be provided with a small passage or groove, as shown at 8, so that when one of the passages *g* or *g'*, leading to the external air, is closed, as shown at *g* by the valve *h*, the fluid from the chest *a* will enter the corresponding cylinder, *f*, acting on the rear side of the piston *e*, while, owing to the connection between the valves *h h'*, the passage *g'* of the cylinder *f'* is open, and the pressure in the cylinder *f'* on the side toward the said opening *g'* is reduced, so that the connected pistons *e e'* and valve *c* will be moved to the position shown in Fig. 2.

Each end of the stem *d d'* is provided with a small needle-like projection, d^2, which at the end of the movement will close the passage *g* or *g'*, thus causing the pressure to be equalized on all sides of the pistons *e e'*, and arresting their movement.

The armature *m* is shown as a permanently-polarized horseshoe-magnet, pivoted at 9, between the opposite poles of the electro-magnet *n n'*, in such a manner that when the polarity of the said magnet is reversed, by changing the direction of the flow of the current through its coils, the said armature *m* will swing on its pivot, thus reversing the position of the valves *h h'* relative to their seats in the passages *g g'*, thereby causing the valve *c* to be moved, and it in turn causing the position of the switch to be reversed by the actuating-fluid, by thus admitting the said fluid to one end of the cylinder *b* from the chest *a*, and permitting it to exhaust from the other end.

The magnets *n n'* are charged by the battery B', (see Fig. 1,) having its poles connected with a pole-changing device, P, best shown in Fig. 4 as consisting of a pair of switch-levers, *p p'*, mechanically connected by an insulating-strip, p^2, the said vibrating levers co-operating with three buttons or anvil-pieces, the middle one, *p'*, of which is connected by wire 10 (see Fig. 1) with one pole of the battery B', while the other two of the said buttons (marked p^4) are connected by wire 12 with the other pole of the battery B'. Thus by moving the said levers from the full to the dotted line position, Fig. 4, the lever *p*, which at first rested on one of the buttons p^4, and was thereby connected with the corresponding—for example, positive—pole of the battery is brought into contact with the button p^3, and thus connected with the other or negative pole, while the lever *p'* is at the same time transferred from the button n^3 to the other one of the buttons p^4, and thus disconnected from the negative and connected with the positive pole of the battery. One of the said levers, as *p'*, is connected by wire 13 with a ground or common return-wire for all the branch circuits employed

in connection with the battery B′, while the other lever, *p*, is connected with a circuit-selecting device shown as consisting of a drum, *r*, of insulating material, having a metallic axis, *r′*, electrically connected by the wire 14 with the lever *p*. The said drum *r* has, at different points along its side and around its periphery, a series of studs, r^2, electrically connected with the axis *r′*, as by the wires r^3, and a series of springs, r^4, is placed at the side of the drum in such position that by rotating the drum each one of the studs is brought beneath a corresponding one of the springs, r^4, in turn, there never being but one stud in position to be touched by its corresponding spring at any one time. The springs are normally held by their elasticity slightly above the path of the buttons, as shown by the dotted lines, Fig. 4, and a lever, *s*, is employed, provided with a bar, *s′*, extending across the ends of all the springs r^4 in such position that when the said lever is depressed from the dotted to the full line position, Fig. 4, it will press all the said springs downward, so that the one just above a corresponding button, r^2, will be brought in contact therewith, and the circuit thus connected from the switch-lever *p*, through the wires 14 and r^3, to the said springs r^4 and branch circuit leading out therefrom.

The drum *r* is provided at its ends with flanges r^5, having notches r^6, corresponding in angular position with the studs r^2, the said flanges preventing the lever *s* from being depressed except when one of the notches r^6 is in position to receive the bar *s′*, which will be only when one of the buttons r^2 is in position to be touched by a corresponding spring, r^4. The different springs r^4 are connected with the branch circuits, each including the magnets *n n′* of the group of switches that it is necessary to have operate simultaneously to direct the train, as desired. For instance, referring to Fig. 1, one of the springs r^4 is connected with wire 15, from which the circuit is continued through the magnet of the switch number 3, and thence by wire 16 to the magnet of the switch number 4; thence by wire 17 to the common return-wire 13, connected with the lever *p′* of the circuit-controlling switch P, the said circuit thus including the group of switches 3 4, which have to be moved to direct a train from C to E. The next one of the springs r^4 is connected with the circuit 19, 20, 21, 16, 17, and 13, including the magnets of the switches number 1, 2, 3, and 4, by which a train is directed from A to C.

Circuit 22, 23, 24, 25, and 13 includes the magnets of switches 5, 6, and 7, by the movement of which a train is directed from B to C, and circuit 26, 24, 25, and 13 includes the magnets of switches 5, by which the train is directed from D to C. Thus, when it is desired to have a train pass from the single track C to the track D E of the double-track road running west, it is necessary to reverse the position of the switches 3 and 4, the rest of the switches remaining unchanged. This may be accomplished by rotating the drum *r*, so as to bring the corresponding stud, r^2, beneath the spring r^4, that is connected with the circuit-wire 15, and then depressing the lever *s*, thus closing the circuit from the battery B′ over wire 10, lever *p*, wire 14, axle *r′*, wire r^3, stud r^2, spring r^4, and wires 15, 16, 17, and 13, to the lever *p′*, wire 12, and the other pole of the battery B′, the levers *p p′* being then in their normal position, which is the dotted-line position, Fig. 4.

The lever *s* is provided with a controlling-disk, s^2, having a slot, s^3, which is brought, when the said lever *s* is depressed, to close the said circuit, as previously described, in a position to receive the stud p^5 on the lever *p*, thus permitting the connected levers *p p′* to be moved from the dotted to the full line position, Fig. 4, reversing the connection of the poles of the battery with the wires 13 and 14, and circuit included between them, including the magnets of the switches 3 and 4, the polarity of which is thus reversed, causing the armature *m* to move and operate the valves *h h′*, thus causing the switch-points to be reversed, as before described, so that the track C is connected with the branch F, with the track E thus guiding the train from the branch C to the track E. After the train has passed, the levers *p p′* will be moved back to their normal dotted-line position, Fig. 4, thus again reversing the polarity of the magnet *n n′* of the switches 3 and 4, and restoring the said switches to their normal position.

It will be seen that, owing to the engagement of the stud p^5 with the notch s^3 of the lever *s*, the said lever cannot be moved to permit the drum to be rotated to form a new combination until the said pole-changing device P has been thus restored to its normal position, as well as the railway-switches controlled by it. The disk s^2 in a similar manner prevents the pole-changing device P from being moved to cause any of the switches to be moved from its normal position until the proper circuit has been closed by the dropping of the said lever *s* with its bar *s′* into the notches r^6 of the disk r^5, thus preventing the drum from being turned until the switches last set by it have been restored to their normal position. The said drum will be provided with any suitable pointer to indicate when it is turned to present the proper combination.

If desired, other combinations or groups of switches, with their circuits, might be employed—for instance, the controlling-magnets of switches 1 and 2 or 6 and 7 might be placed in separate circuits—as it might be desirable at times to transfer cars from one to the other of the tracks A B and D E; but it will be seen that there will never be occasion to move one switch of either of the said pairs without the other.

The signal to indicate to an approaching train the condition of the track and switches

will preferably be controlled by an apparatus such as shown in Letters Patent No. 232,344, granted September 21, 1880, one or more of the said instruments being employed in the circuit of the signal, as is necessary. For instance, a signal by the side of the track A, controlled by the rail of switch No. 1, will indicate when the track is in condition to cause the train to pass along the main track A B or from it to the single track C, since the said switch No. 1 will never be moved except with the other switches, 2 3 4. In a similar manner a signal by track D may be controlled by the switch 5, while two signals will be required by the track C—one controlled by the switch 7, which will never be moved except when a train is to pass from C to B, and the other by the switch 3 or 4 in connection with the switch 1 or 2, it being so arranged as to cause the signal to move only when the said switch 3 or 4 is moved without moving the switch 1 or 2. Thus, if both the signals at the side of the track C are in their normal position it indicates "danger," as the train could not then pass onto the double track road except by jumping the switch 5; but if the signal controlled by the switches 4 and 2 were normal, while that controlled by the switches 7 was in its abnormal position, it would show that a train could pass from C to B.

A danger-signal will be placed by the side of the track D E, and operated by every movement of the switches, to prevent a train approaching on the track D from colliding with the train upon the said track passing to or from the track C. A danger-signal will also be placed by the side of the track A, operated by the combination, by which the train is transferred from the track C to the track B; but it will not be necessary to give a danger-signal for the other combinations, as a train passing from D to C or from C to E will not interfere with trains on the track A B.

In another patent, No. 228,187, granted to me June 1, 1880, I have shown and described a switch mechanically engaged by a locking device controlled by the block-section of track leading to the switch, so that when a train is on the said block-section approaching the switch the latter can not be moved until after the train has passed off the block-section.

An important feature of the present invention consists in preventing a movement of the switch, the movements of which are under control of an electric circuit by breaking the said circuit while the train is on the block-section approaching the switch. This is illustrated in Fig. 1, where the circuit-wire 12 of the battery B′, the current of which causes the movements of the switches to take place, as before described, is provided with a circuit-breaker, *t*, controlled by an electro magnet, *t′*, in circuit with rails of a block-section of track, C, and with a battery, B^2, so arranged that when the rails of the said section are connected, as by the wheels and axles of a train, the current of the latter, B^2, is directed from the magnet *t′*, thus permitting the circuit-breaker *t* to open, and preventing any further current from passing through the switch-controlling magnets, so that the switches will be compelled to remain in the position in which they were last placed until the train has passed over the block-section. The circuit will be similarly controlled by the block-section of the tracks D and A, and the signals which indicate for the switches will be placed at the head of the same block which controls the circuit of the battery B′, so that the signals will be set to correspond with the condition of the switches before the train arrives at the said block or passes the said signal; and after a train has once passed the signal it will be certain that no change can take place in the switch before the train reaches it.

It is obvious that a neutral armature might be employed to actuate the valves *h h′*, which control the movements of the switch, the said armature being provided with a retractor, which would cause it to move in one direction, and it being moved in the other direction by the attraction of a magnet in the usual manner. In this case the pole-changing device P would be replaced by an ordinary circuit-closer or switch, which would normally be opened, the opening of the circuit insuring the normal position of the switches, and the device *t t′* would have to be omitted or its construction and operation modified.

The drum *r*, with its studs and springs, constitutes a circuit-selecting device, since it determines the path which the current will travel; while the pole-changing device P is properly the current or circuit controlling device, as it controls the condition of the current, or of the circuit which has been selected as a path for the said current by the current-selecting device.

The invention is not limited to any particular construction of the said circuit-selecting and circuit-controlling devices, as it is obvious that an indefinite variety of constructions might be devised, all operating in substantially the same way, the movements of one being controlled by and dependent upon the movements of the other, for the purpose herein described.

That part or feature of the construction of the apparatus herein described, embracing a piston as a means of actuating a main or distributing valve, in combination with an electrically-actuated valve or valves by which to regulate the action of fluid-pressure on such piston, broadly considered, is not claimed herein, the same being the invention of another.

I claim—

1. An interlocking-switch apparatus consisting of a series of railway-switches, actuating mechanism for each switch, and electro-magnetic controlling device for the said actuating mechanism, and a series of circuits, each in-

cluding the controlling-magnets of a series or group of switches that have to be operated simultaneously to direct a train as desired, substantially as described.

2. In an interlocking-switch apparatus, the following elements, namely: a series of switches, actuating mechanism therefor, controlling electro-magnets for the said actuating mechanism, a series of circuits, each including the controlling-magnets of a group of switches that are to be operated simultaneously, and a circuit-selecting and circuit-controlling device, whereby the flow of an electric current through the desired circuit is insured, substantially as described.

3. The combination, with a series of railway-switches, their actuating mechanism, electro-magnetic controlling device, and circuits therefor, of the circuit-selecting and circuit-controlling devices, and interlocking mechanism, whereby the movements of one are dependent on the condition of the other, substantially as described.

4. The combination of a railway-switch, its actuating mechanism, and electro-magnetic controlling device therefor, with a circuit-controlling instrument in circuit with the controlling electro-magnet and itself controlled by the block-section of track leading to the said switch, whereby a change in condition of the said switch is prevented after a train has entered the section leading to it, substantially as described.

5. The railway-switches, their electro-magnetic controlling mechanism, and series of circuits, each including the controlling-magnets of a group of switches that are to be operated simultaneously, combined with the circuit-selecting device consisting of a drum having a series of studs connected with one pole of the battery, and a series of springs, one connected with each circuit, and means to force any one of the said springs into contact with its corresponding stud when in the proper position, substantially as described.

6. The switch-actuating apparatus, electro-magnet, and polarized armature controlling it, and series of circuits, each including the controlling-magnets of a group of switches, combined with a circuit-selecting device for closing any desired one of the said circuits, and a pole-changing device common to all the said circuits, and interlocking mechanism for the said pole-changing and circuit-selecting device, whereby a new circuit can be selected only when the pole-changing device is in normal position, and the said pole-changer can be moved only after a circuit is completed, substantially as described.

7. The combination of the drum having notched flanges and a series of studs all connected with the battery, and of a series of springs, one co-operating with each stud, and the spring-actuating lever controlled by the notched flanges of the drums, substantially as described.

8. The cylinder b and its main valve, and valve-actuating pistons e e', working in open-ended cylinders f f', and each operating a valve, d^2, in combination with exhaust-passages g g', valves h h', alternately opening and closing the same, and electro-magnetic apparatus for operating said last-named valves, substantially as set forth.

9. The polarized vibratory magnet m and electro-magnet n n', in combination, by rod k and levers i i', with valves h h', as a means of alternately opening and closing the exhaust-ports of a valve-moving piston, substantially as described.

10. A circuit-controlling or pole-changing mechanism consisting of connected levers p p', provided with a stud, p^5, in combination with recessed or notched disks s^2, substantially as set forth.

In testimony whereof I have hereunto set my hand.

OSCAR GASSETT.

Witnesses:
R. H. WHITTLESEY,
GEORGE H. CHRISTY.