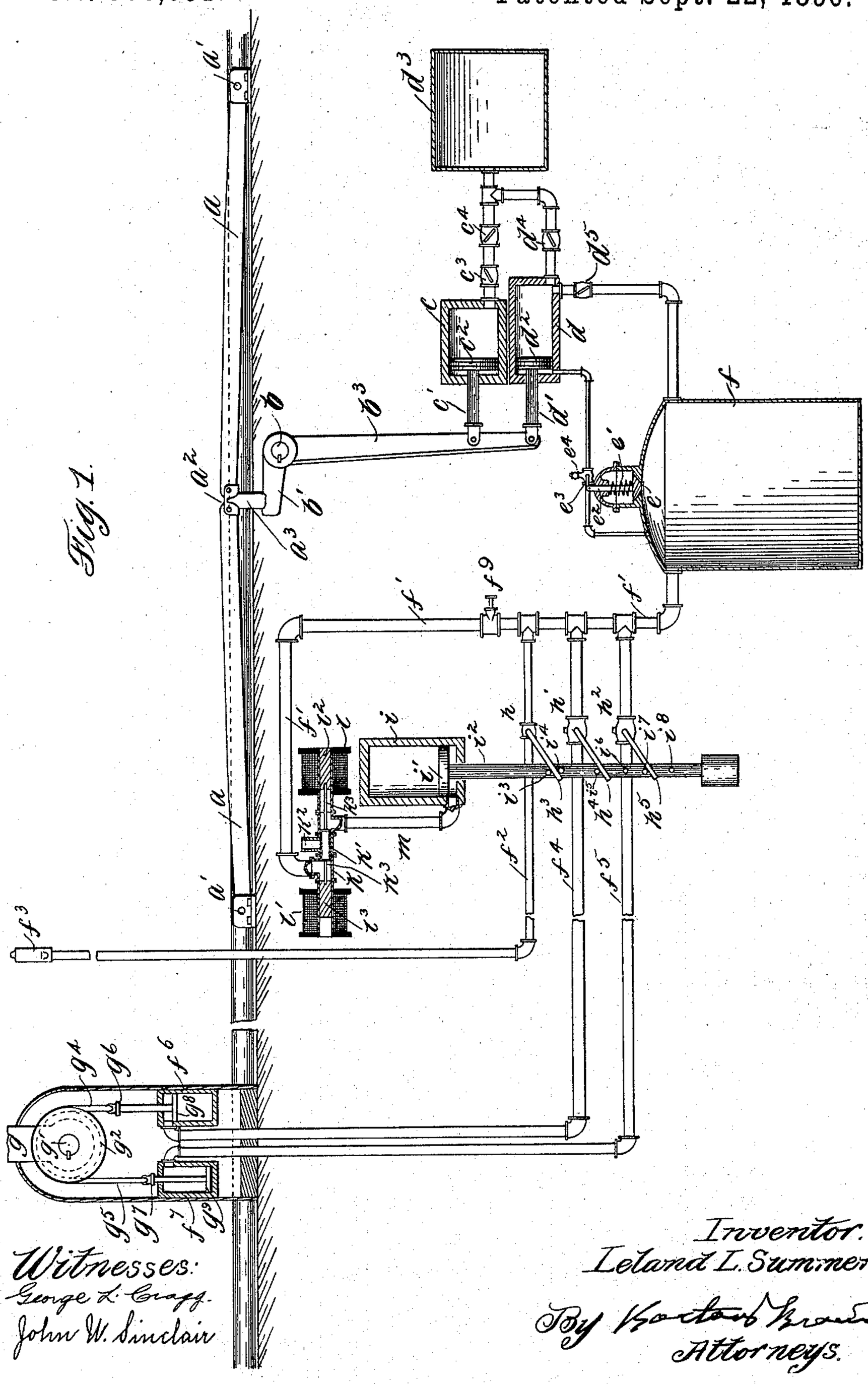
(No Model.) 5 Sheets—Sheet 1.

L. L. SUMMERS.

AUTOMATIC GATE FOR RAILWAY CROSSINGS.

No. 568,051. Patented Sept. 22, 1896.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

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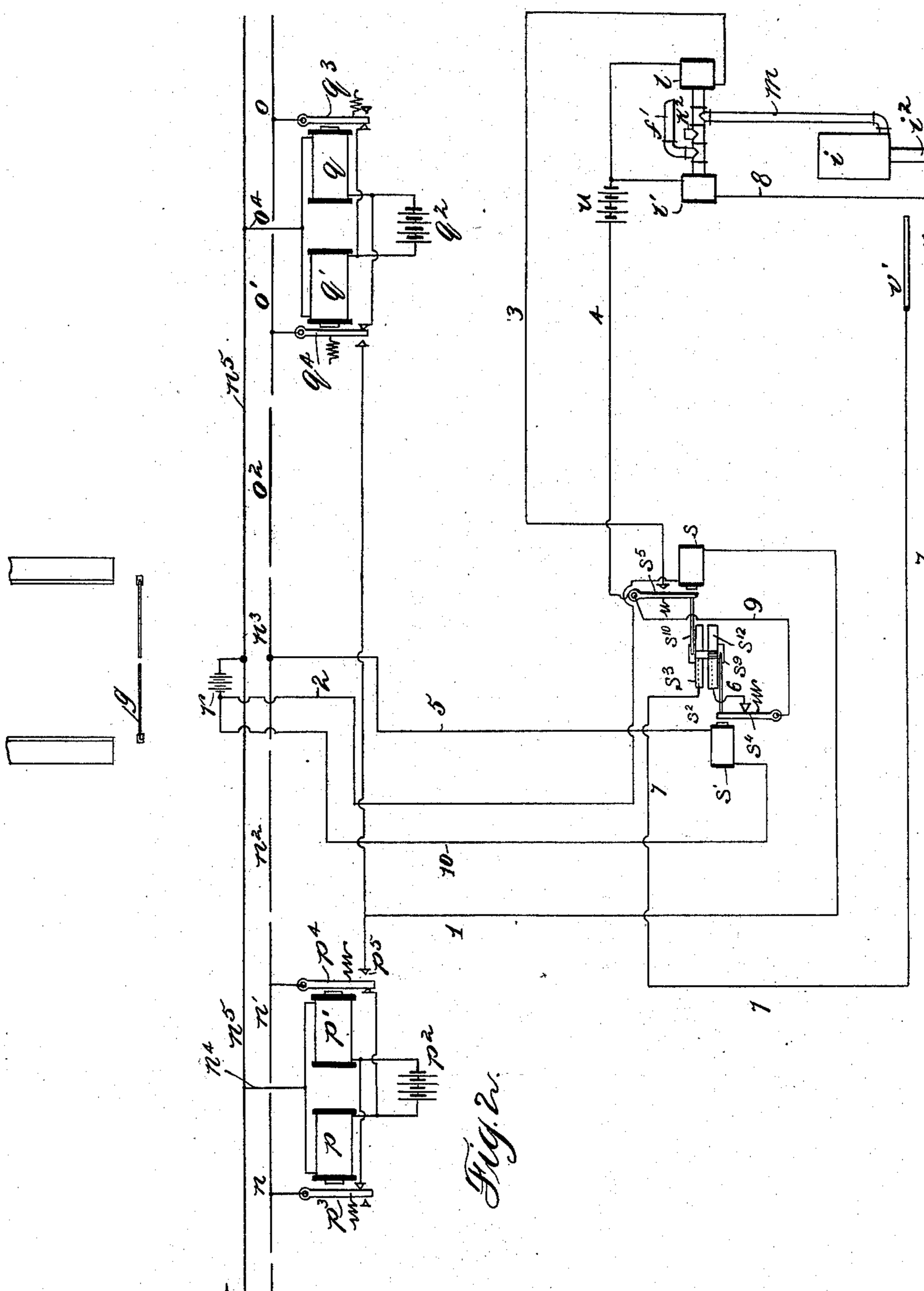
AUTOMATIC GATE FOR RAILWAY CROSSINGS.

No. 568,051. Patented Sept. 22, 1896.



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(No Model.) 5 Sheets—Sheet 3.

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AUTOMATIC GATE FOR RAILWAY CROSSINGS.

No. 568,051. Patented Sept. 22, 1896.

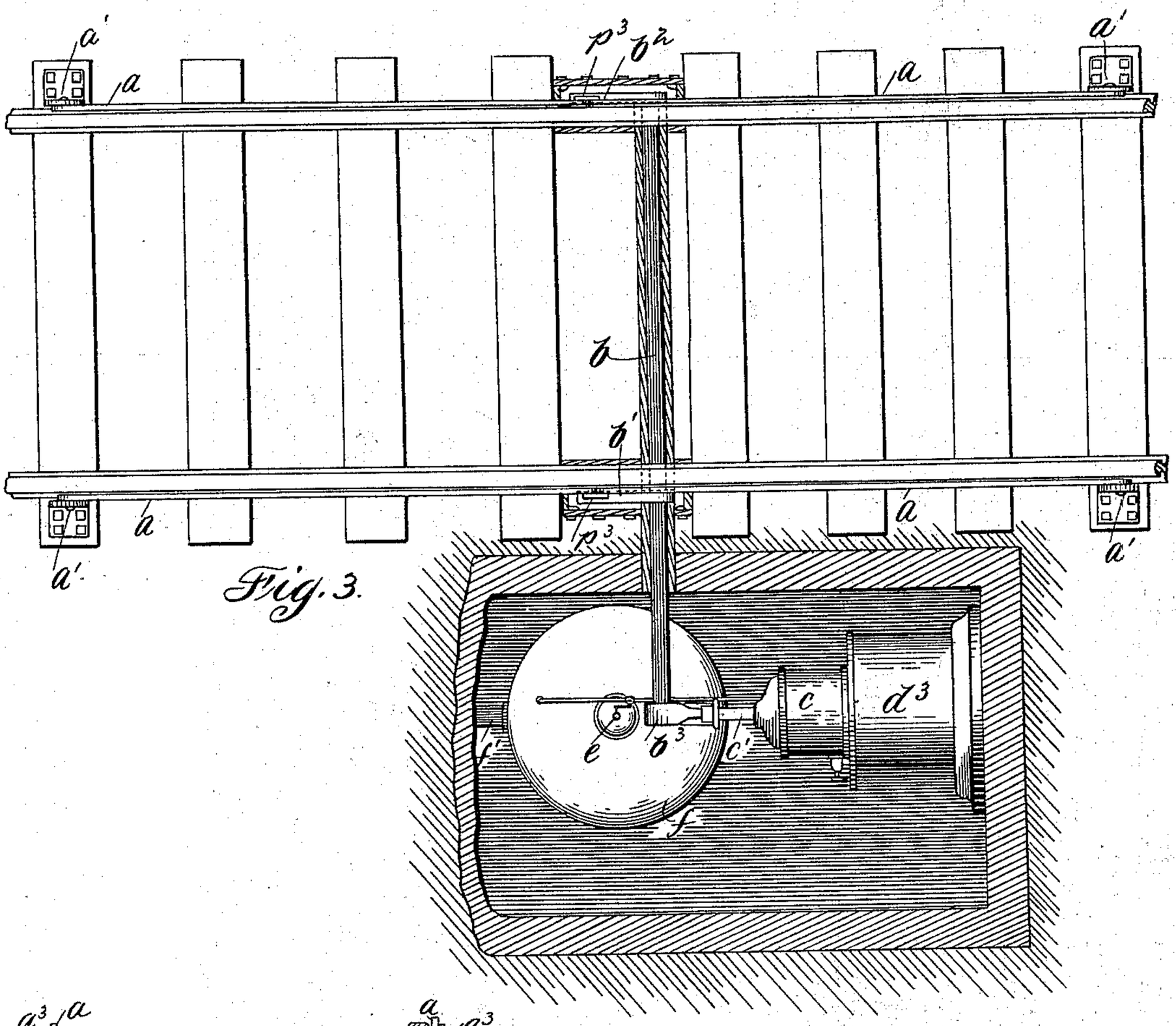

Fig. 3.

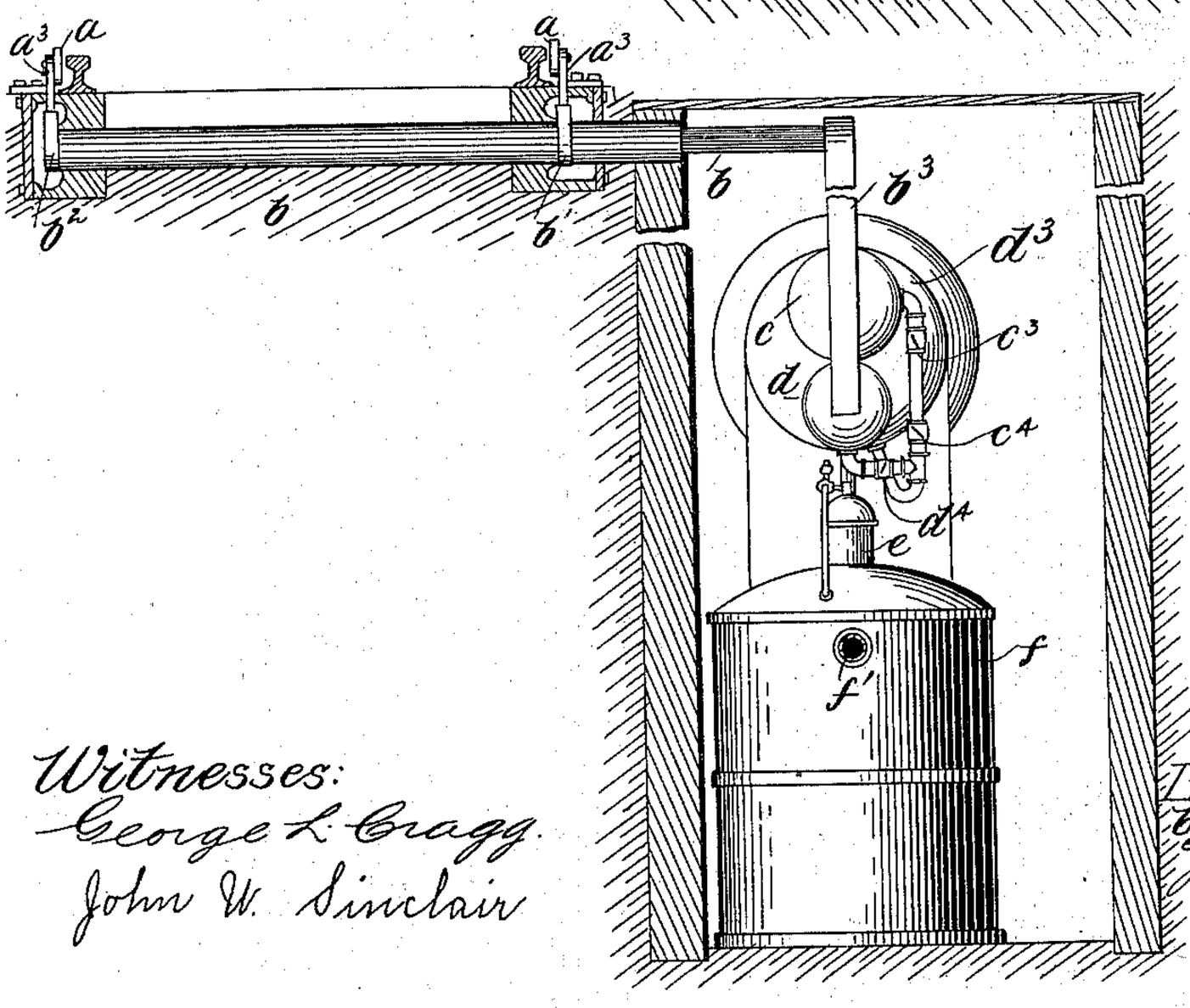

Fig. 4.

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(No Model.) 5 Sheets—Sheet 4.

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AUTOMATIC GATE FOR RAILWAY CROSSINGS.

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Fig. 5.

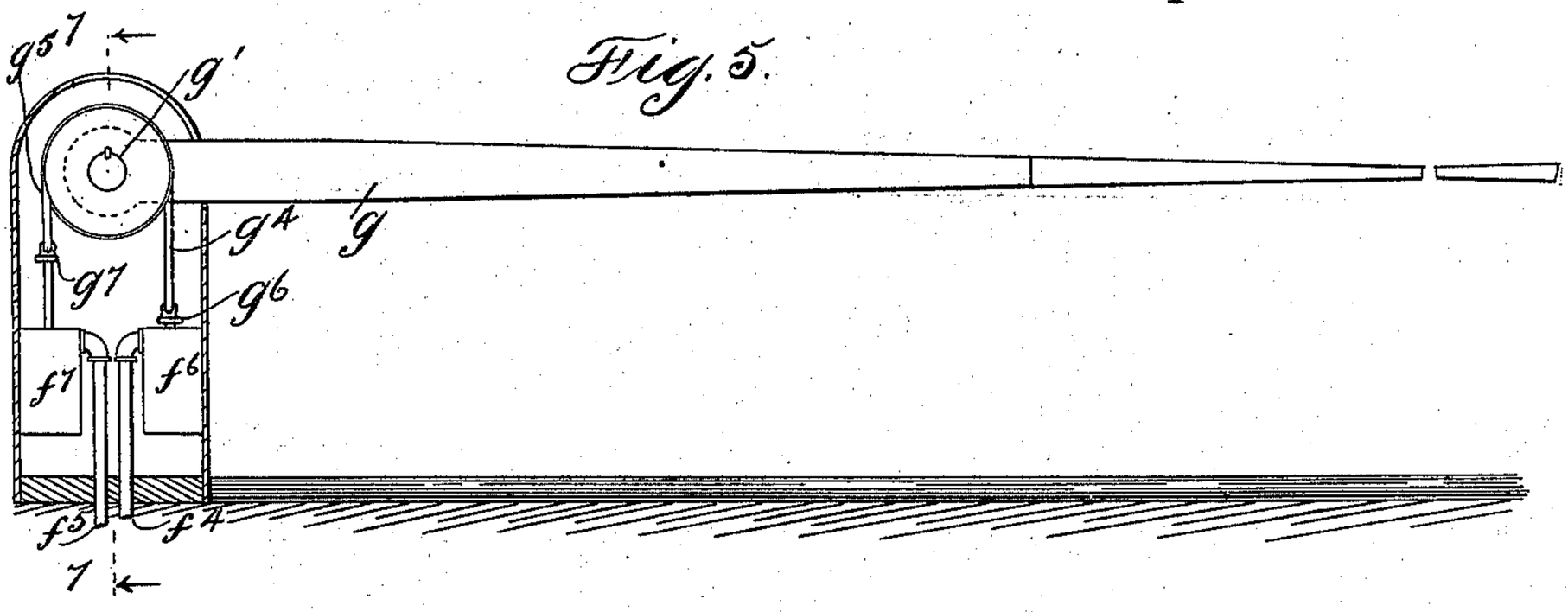

Fig. 6

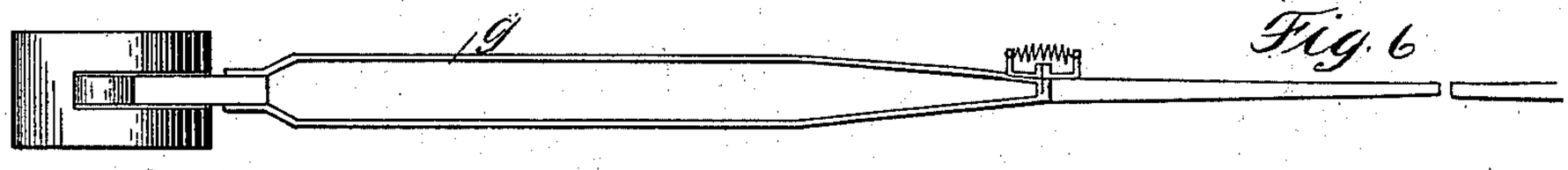

Fig. 1.

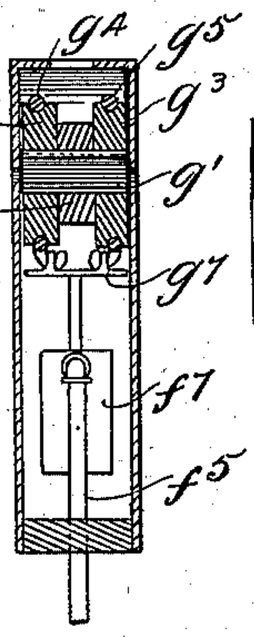

Fig. 8.

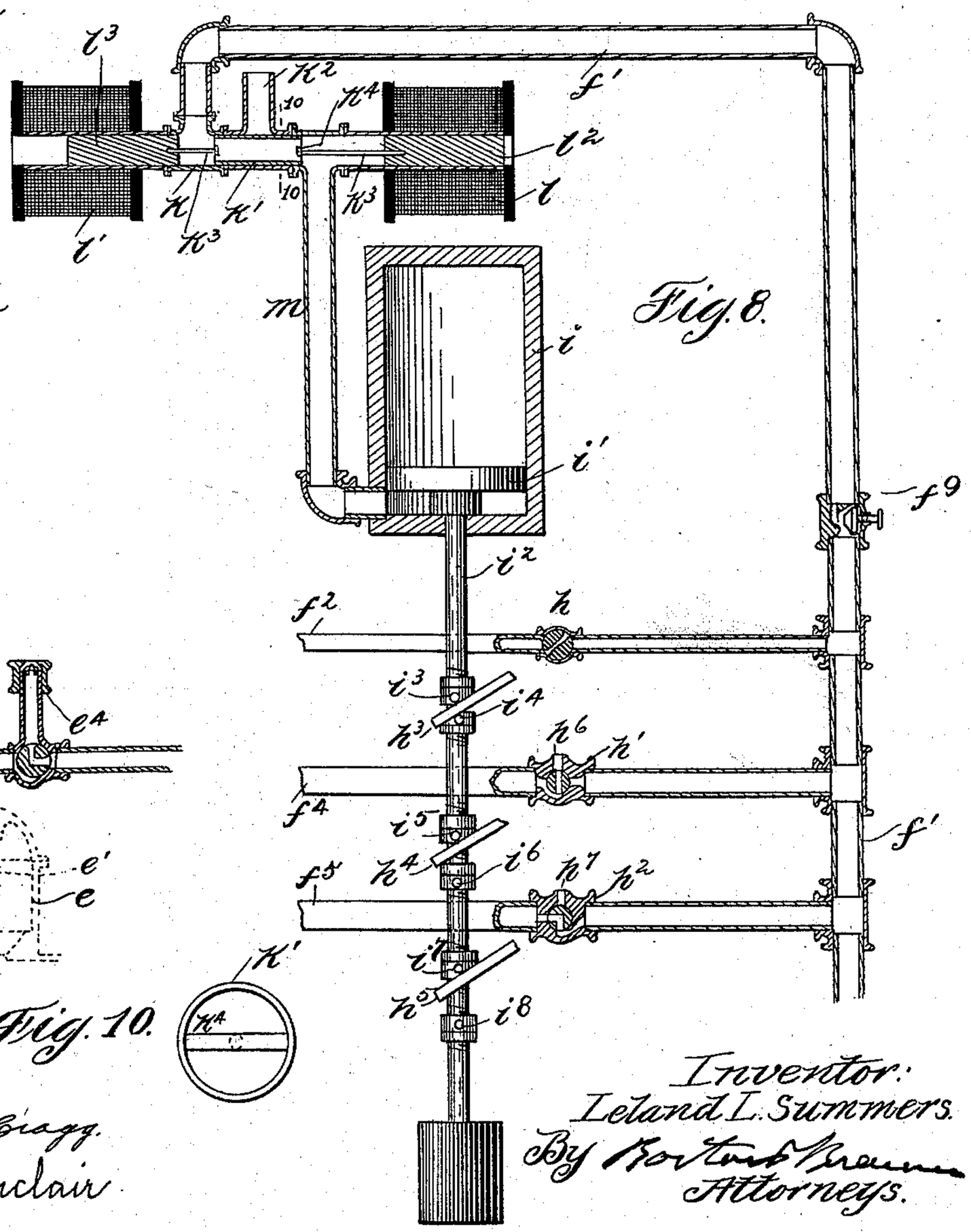

Fig. 9.

Fig. 10.

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AUTOMATIC GATE FOR RAILWAY CROSSINGS.

No. 568,051. Patented Sept. 22, 1896.

Fig. 11

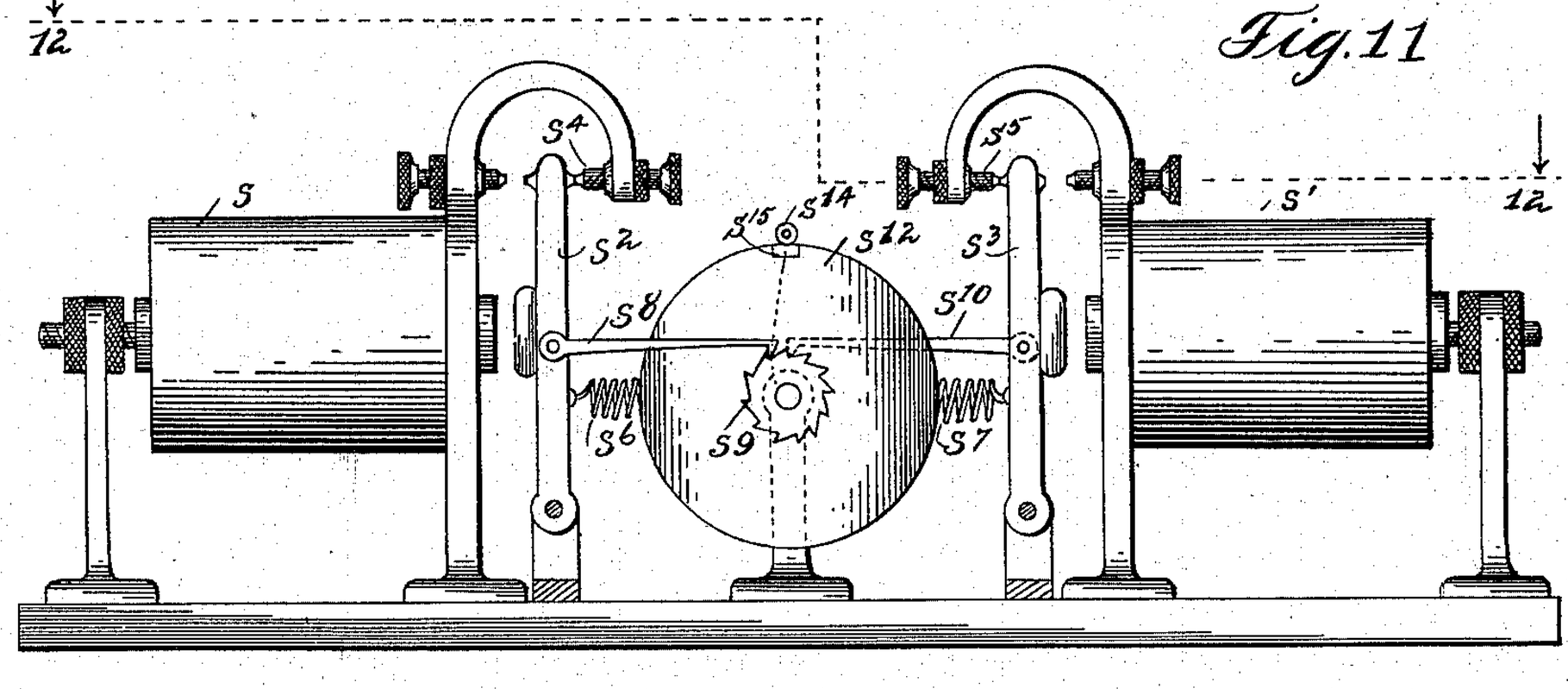
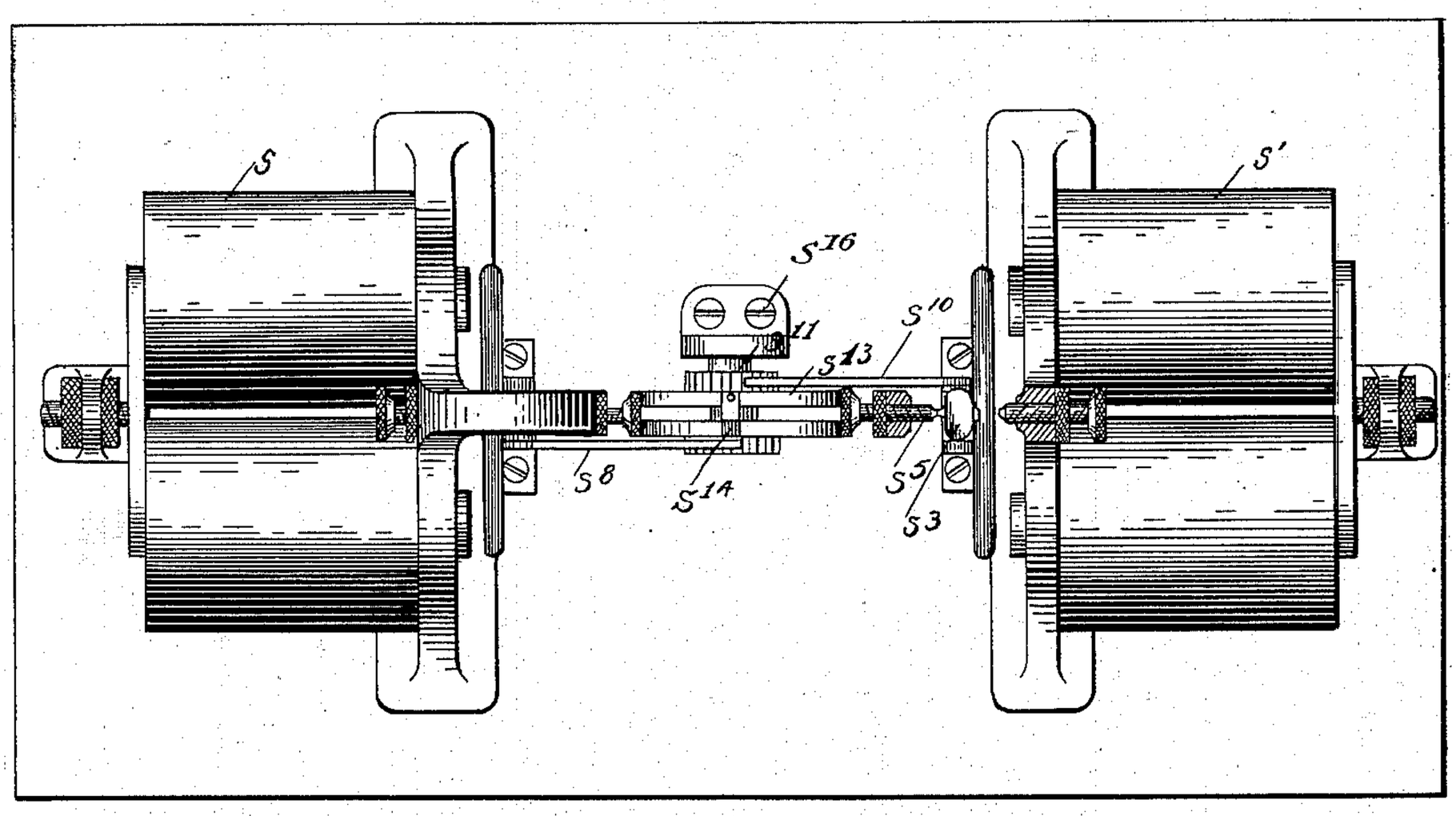


Fig. 12.



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UNITED STATES PATENT OFFICE.

LELAND L. SUMMERS, OF CHICAGO, ILLINOIS.

AUTOMATIC GATE FOR RAILWAY-CROSSINGS.

SPECIFICATION forming part of Letters Patent No. 568,051, dated September 22, 1896.

Application filed February 13, 1895. Serial No. 538,254. (No model.)

To all whom it may concern:

Be it known that I, LELAND L. SUMMERS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Automatic Gates for Railway-Crossings, (Case No. 1,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to automatic gates and signals for railways, and has for it object the provision of improved means for automatically controlling gates and signals where power having its source in the moving train has been employed.

My invention has for its further object the provision of improved means for electrically controlling the power by which the gates are operated, so as to cause the gates to be closed only when a train is approaching a crossing, and maintaining the apparatus inactive when a train is receding from a crossing.

My invention has for a further object the provision of novel means for compressing a fluid, in this instance air, and storing the same, whereby the necessary energy is supplied to operate the gates or other apparatus when occasion demands.

My invention further consists in the details of construction and combinations of parts hereinafter more particularly described.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a schematic view illustrative of the mechanism for storing up the energy and operating the gates thereby. Fig. 2 is a diagrammatic view illustrative of the circuits and electrical apparatus for controlling the stored energy. Fig. 3 is a plan of a track in connection with the levers and fluid-compressor. Fig. 4 is a view in elevation of the fluid-compressor and the reservoir for storing the compressed fluid. Fig. 5 is a side elevation of a gate. Fig. 6 is a plan view of one of the gate-arms. Fig. 7 is a sectional view of the gate-post mechanism as seen on line 7 7 of Fig. 5. Fig. 8 is a detail representation of the controlling-piston, together with the valves operated thereby. Fig. 9 is a detail view of the mechanism whereby, when the fluid has reached its predetermined amount of compression in the reservoir, the operation of the compressor is stopped. Fig. 10 is a cross-section of the cylindrical cut-off of the electrical controlling system, taken on line 10 10 of Fig. 8. Fig. 11 is a detail elevation of the relays for rotating the electrical contact-making device. Fig. 12 is a plan view thereof on line 12 12, Fig. 11.

Like parts are indicated by similar letters of reference throughout the different figures.

Near each crossing, and preferably in connection with each rail of the track or tracks, I provide levers $a\ a$, against which the wheels of the passing trains impinge to turn the same upon their fulcrums, as $a'\ a'$. Each set of levers is raised at the point where they join, as a^2, the joints being in the nature of toggle-joints, as shown most clearly in Fig. 1. The inclined levers are near enough to the track to permit the rim of the car-wheels to come in contact with them and depress the same, the levers being preferably of such proportion with relation to the car-trucks that they are depressed but once during the passage of each truck, the levers being restored to their normal position each time after being depressed by the expansion of the air that has been compressed, so that the levers are acted upon successively as the trucks pass over the same.

At the joints of the impingement-levers I provide pusher-pins a^3, a pusher-pin of one set being shown in engagement with the short lever b' and the pusher-pin of the other set being in engagement with the lever b^2, keyed to the shaft b, to which shaft the lever b' is also keyed. The shaft b may be common to all the tracks and to all the sets of impingement-levers in connection with each crossing. Linked to the lever b^3, keyed to the shaft b, are the piston-rods $c'\ d'$ of the pistons $c^2\ d^2$, working within the compressor-cylinders $c\ d$. When the pistons $c^2\ d^2$ are in the position shown, cylinder d has communication with receiver d^3 by check-valve d^4, check-valve c^4 preventing passage of air from receiver d^3 to the cylinder c, while check-valve d^5 prevents the passage of air from the pressure tank or reservoir f to cylinder d. When the impingement-levers $a\ a$ are de-

pressed by the wheels of each truck, the pistons c^2 d^2 are thrust to the other end of their strokes, the check-valve c^3 is closed to the atmosphere, check-valve c^4 is opened to the receiver d^3, check-valve d^4 is closed to the receiver, and check-valve d^5 is opened to the pressure tank or reservoir f. The atmospheric air in cylinder c is compressed into receiver d^3, while the compressed air in cylinder d that has been supplied from receiver d^3 is further compressed and passed into tank f through check-valve d^5.

After one truck has cleared the levers a a the pistons c^2 d^2 are free to be moved to their initial positions, the check-valves c^4 d^5 are closed, and check-valves c^3 d^4 are opened. The compressed air in chamber d^3 having access to cylinder d, the piston d^2 is forced back to its initial position, thereby rotating lever b^3, shaft b, and levers b' b^2 to the position shown, the pusher-pins a^3 restoring the impingement-levers a a in position to be acted upon by the next succeeding truck. As the lever b^3 is thus rotated the piston c^2 is restored thereby. As the piston c^2 is being restored it creates a suction, causing the atmospheric air to be admitted to the chamber c through the check-valve c^3.

It is obvious that if a train of extraordinary length should pass over the impingement-levers, or if the compressed air should not be used as fast as accumulated, the pressure tank or reservoir f would be overtaxed and burst if means were not provided to relieve the same from the excessive pressure. To this end I provide a safety-valve e, the spring e' whereof is sufficient to counteract the pressure in tank f to a predetermined point. When this predetermined point is reached, the plunger e^2 rotates the stem e^3 to a position which will afford a passage from that portion of the cylinder d back of the piston d^2 to the tank f. The pressure of the air in tank f being greater than the pressure of the air in receiver d^3, the piston d^2 is held at the right end of its stroke until the pressure in tank f has been sufficiently reduced. The levers a a are thereby held in a depressed condition, wherein they cannot be acted upon by the passing trucks. The check-valve e^4 normally affords communication between the portion of the cylinder d back of the piston d^2 and the atmosphere, said check-valve being adjustable and so arranged that when the piston d^2 is making its left stroke the air displaced by the piston is emitted slowly, and admitted quickly when the piston is making its reciprocating stroke. The object of thus controlling the emission of the displaced air is to counteract the force tending to restore the levers and permit the levers and pistons to be restored gradually and without the sudden shock that has been occasioned heretofore.

From the pipe f', communicating with the tank f, are branched the pipe f^2, communicating with the signal f^3, and pipes f^4 f^5, communicating with the operating-cylinders f^6 f^7, constituting what I term the "down" and "up" cylinders, respectively, of the gate g. The gate g is keyed upon the shaft g', as also are the drums g^2 g^3, mounted upon either side of the gate. Ropes g^4 g^5 are passed about said drums and secured at their ends to the crossheads g^6 g^7, to which are secured the piston-rods of the pistons g^8 g^9.

In connection with the signal-pipe f^2 and the pipes f^4 f^5 are provided valves h h' h^2, provided with stems h^3 h^4 h^5, whose functions will be hereinafter specified. The governing-cylinder i is provided with a piston i' and piston-rod i^2, upon which are mounted adjustable lugs or pins i^3, i^4, i^5, i^6, i^7, and i^8, capable of controlling the valve-stems h^3 h^4 h^5, respectively. Communicating with the pipe f' is a channel k, in which the cut-off k' and the cores l^2 l^3 of solenoids l l' are adapted to reciprocate. Pipe m communicates between the channel k and the cylinder i beneath the piston thereof.

An exhaust-nipple k^2 is provided in connection with the channel k, through which the air confined in cylinder i may find passage. Links k^3 unite the cut-off with the cores l^2 l^3 of the solenoids, narrow ribs k^4 being provided upon the ends of the cut-off, upon which said links may be supported.

As will be more fully set forth hereinafter, the solenoid l is energized to attract its core l^2 to the position shown when a train reaches any predetermined point, which should be far enough distant from the crossing to enable a signal of sufficient duration to be given before the gates are lowered. When the core l^2 is thus attracted, the cut-off k' is moved thereby to a position, as shown, which will afford a passage from the pipe f' through the cut-off and pipe m to that portion of the cylinder i beneath the piston i', whereby the piston and its rod i^2 are gradually elevated by the compressed air from tank f, a throttle-valve f^9 being provided to adjust the volume of compressed air admitted to the cylinder i, thereby regulating the time at which the gates are lowered. The lug i^4 coacts immediately with stem h^3 to open the valve h, whereby passage for the compressed air is afforded from the tank f through pipe f^2 to the whistle or other signal device f^3.

Referring more particularly to Fig. 8, the passage of valve h' normally communicates with the vent h^6 and the portion of the pipe f^4 between the valve and the down-cylinder, while the valve h^2 affords a passage between the tank f and the up-cylinder. The valves are caused to assume these positions in the process of raising the gates, as will be explained. As the piston-rod i^2 is raised the lug i^6 coacts with stem h^4 to bring the passage of valve h' in alinement with pipe f^4, whereby the compressed air from tank f may find a path to the down-cylinder f^6, sufficient lost motion being provided between the lug i^6 and stem h^4 to permit of the signal being operated the desired length of time before the gates are lowered. While a passage is thus be-

ing established between the tank f and the down-cylinder f^6 the lug i^8 is coacting with stem h^5 to bring the passage of the valve h^2 in position to establish communication between the up-cylinder and the vent h^7, thereby establishing an exhaust for the air confined in the up-cylinder, at the same time closing the port of that portion of the pipe f^5 leading to the tank f. The air from the tank f being thus admitted to the down-cylinder f^6, the piston g^8 and the cross-head g^6, to which the ropes g^4 g^5 are attached, are lowered, thereby closing the gates, as shown most clearly in Fig. 5. While piston g^8 is being lowered piston g^9 is raised, but the air in cylinder f^7 finding vent at h^7 the travel of piston g^9 is unimpeded. When the piston g^8 reaches the lower limit of its excursion, the pressure of the air is counteracted and the parts remain in the position they are caused to assume until the train has passed beyond the crossing, when the solenoid l' is energized, as will be hereinafter explained. Upon the energization of the solenoid l' the core l^3 is brought to the left of its excursion, thereby actuating the cut-off k' to close the port between pipe f' and channel k and opening the port between the exhaust-nipple k^2 and the passage k, thereby allowing the piston i' and rod i^2 to fall of their own weight, the air displaced by the piston in its downward travel finding a vent at k^2. While the rod i^2 is descending, the lugs i^3 i^5 i^7 coact with the stems h^3 h^4 h^5 to bring the valves in the position shown in Fig. 8. When the valves h' h^2 are in the position shown, passage is afforded from the tank f to the up-cylinder f^7, whereby piston g^9, which has been previously elevated, as described, is lowered by the compressed air to the position shown, the air displaced by the piston g^8 finding vent at h^6.

Referring more particularly to Fig. 2, I will now describe somewhat in detail the electrical apparatus and circuits by which the system may be controlled.

Speaking now of a single-track system, in connection with each block I provide in one side of the track insulated sections n n' n^2 on one side of each crossing to be guarded, and sections o o' o^2 on the other side of the crossing. The magnets p p' q q' are preferably included in normally closed circuits with batteries p^2 q^2. The armatures p^3 p^4 are electrically connected with sections n n', respectively, as likewise are armatures q^3 q^4 with sections o o'. Connections n^4 o^4 are introduced between the magnets p p' and the rail n^5, which in each block is a continuous electrical conductor, and magnets q q' and rail n^5, respectively, on opposite sides of the crossing.

Preferably included in normally open circuit with battery r are electromagnetic devices which may be employed in carrying out my invention, and which I will describe more particularly in connection with Figs. 11 and 12, wherein I have shown the electromagnets s s' suitably mounted upon a base-board, armatures s^2 s^3 being provided, which are normally held against the contact-anvils s^4 s^5 by the springs s^6 s^7. Armature s^2 is provided with a pawl s^8, adapted to pull the ratchet s^9 to the left while said armature is being attracted. Armature s^3 is provided with a pawl s^{10}, adapted to push the ratchet s^{11} to the left while said armature is being released from its attracted position. Ratchets s^9 s^{11} are secured to insulating-disks s^{12} s^{13}, respectively. Mounted upon disk s^{13} is a contact-roller s^{14}, normally in contact with the contact-segment s^{15}, mounted upon disk s^{12}.

The ratchet s^9 and disk s^{12} with the segment s^{15} mounted thereon are immovable with relation to each other, as are ratchet s^{11} and disk s^{13} with the contact-roller s^{14} mounted thereon. The disks s^{12} s^{13} with the parts mounted thereon are capable of independent rotation about a common shaft supported upon a standard s^{16}, mounted upon the base-board, as shown most clearly in Fig. 12. The contact-roller s^{14} upon disk s^{13} is normally in contact with segment s^{15} upon disk s^{12}.

By means which will be presently explained, when a train enters a block or section circuit is closed through magnet s, whereupon armature s^3 is attracted. The ratchet s^{11} being mounted upon the disk s^{13} with its teeth sloping in a direction to be engaged only by the pawl s^{10} when the armature s^3 is being restored to its original position upon the deenergization of magnet s, the disk s^{13} and roller s^{14}, mounted thereon, are not rotated when said magnet is energized. When the train has reached an intermediate portion of the block, and before it has reached the crossing, circuit through magnet s is opened, the armature s^3 and pawl s^{10} are restored by the spring s^7, the pawl engaging with and partially rotating the ratchet s^{11} during its restoration, whereby the contact-roller s^{14} upon disk s^{13} is removed one step from its contact with the segment s^{15}. As the train leaves the crossing circuit is closed through magnet s', whose armature s^2 is attracted, thereby actuating the pawl s^8, which engages with the ratchet s^9 to rotate the same in the direction that ratchet s^{11} was previously rotated by pawl s^{10}, that is, to the left, thereby restoring roller s^{14} to its contact with segment s^{15}.

As each train reaches an intermediate portion of the block prior to the time that the crossing is reached roller s^{14} is removed a step from its contact with segment s^{15}, and as each train leaves the crossing contact-segment s^{15} is brought a step toward the contact-roller s^{14}, until finally, when the number of trains that have cleared the crossing equals the number that have entered the block, the segment s^{15} and roller s^{14} are restored to contact.

Returning now to Fig. 2, it will be assumed that a train is passing in the direction indicated by the arrow. When the first pair of wheels, as the pilot-wheels, are upon the section n and the rail n^5, magnet p' is shunted,

the current from battery p^2 being thereby diverted through the magnet p, the connection n^4, the shaft of the car-wheels, section n, and armature p^3. The magnet p' is thus deënergized and remains deënergized until the train leaves section n, allowing its armature p^4 to be brought and remain in contact with the anvil p^5. When the first pair of wheels is upon section n' and rail n^5, circuit is closed from battery r through the electromagnet s by the conductors 1 2, rail n^5, and the shaft of the wheels. The armature of the electromagnet s is thereby attracted; but since the pawl s^{10}, when actuated upon the attraction of the armature s^3, escapes the teeth of ratchet s^{11}, the position of roller s^{14} is unchanged. When, however, the train has cleared section n, the short circuit about magnet p' established by the car wheels and axle is removed, the current from battery p^2 again finds path through magnets p p', armature p^4 is attracted, circuit through electromagnet s is broken at p^5, the armature of said electromagnet is restored, and the ratchet in engagement with the pawl s^{10} is pushed to the left by said pawl, thereby removing the roller supported upon disk s^{13} from its contact with the segment upon disk s^{12}, the purpose of which will be explained hereinafter.

When the armature of magnet s is attracted, circuit is closed from battery u at s^5 by conductors 3 and 4 through the helix of solenoid l, whose core and the parts connected therewith are moved to the position shown most clearly in Fig. 8, whereby the piston-rod i^2 is gradually elevated and the gates lowered in the manner hereinbefore described. When the rod i^2 nears the upper limit of its excursion, contact-spring v, carried thereupon, is brought in contact with spring v', thereby closing circuit from battery u at v for the purpose hereinafter set forth.

Previous to the time that section n^3 is reached by the train, rod i^2 has reached the upper limit of its excursion, the gates have been lowered, and contact has been made at v. When the train has reached section n^3, circuit is closed from battery r by the wheels and shafts of the trucks, section n^3, rail n^5, and conductors 5 10 through the electromagnet s', whose armature is thereby attracted, the pawl mounted upon said armature pulling the ratchet s^9 and the disk s^{12} to the left, thereby bringing the contact-segment upon said disk in engagement with the contact-roller upon disk s^{13}. The magnet s' remains energized until the train has left section n^3, which is placed, preferably, at the crossing. The circuit including battery u is open at s^4 during the time the magnet s' is energized. When the train has cleared section n^3, the circuit including battery r and magnet s' is open, permitting its armature s^2 to close circuit at s^4 from battery u through the helix of the solenoid l' by conductor 6, contact roller and segment controlled by the magnets s s', conductor 7, contact-springs v v', and conductors 8, 4, and 9. The core l^3, cut-off k', and core l^2 are moved to the left, thereby affording vent at k^2 for the air confined in the governing-cylinder i and permitting rod i^2 to descend, whereby the gates are raised in the manner hereinbefore specified.

When the train reaches section o', magnet q is shunted by the wheels and axle, and magnet q' remains energized, thereby maintaining armature q^4 impassive and, consequently, an open circuit through magnet s as each train leaves the block or section in the direction of the arrow.

If the train were traveling against the arrow, magnet q' would be deënergized, while magnet p' would remain energized and the magnets s s' would be successively energized in the manner and with the results described in connection with a train traveling with the arrow, the magnets p p' and sections n n' having functions and arrangements similar to magnets q q' and sections o o', respectively.

It has been seen how, when a single train traverses a block, the gates are lowered when the train leaves section n and raised when it clears the middle section n^3. If now a second, third, or more trains enter the block and clear section n before the first has entered section n^3, the contact-roller s^{14} will be removed from segment s^{15} two, three, or a number of steps, corresponding to the number of trains that have so entered the block. If there should be, for instance, five trains upon a block that have cleared section n and have not entered section n^3, the contact-roller s^{14} will be removed five steps from segment s^{15}. As each of these five trains enters section n^3 circuit from battery r is closed through magnet s' and the contact-segment s^{15} is restored a step nearer the contact-roller until finally, when the last of the five trains is upon section n^3, the segment s^{15} will be moved five steps to its contact with roller s^{14}. As the last of the five trains clears section n^3 magnet s' is deënergized, armature s^2 is restored by spring s^6, and circuit from battery u is closed at s^4 through the solenoid l', whereupon the solenoid actuates the cut-off k' whereby the gates are elevated, as hereinbefore set forth. If, however, but four trains pass the intermediate point n^3, the aforesaid contact roller and segment are still removed one step from each other, since the roller s^{14} has been moved five steps to the left by the five entering trains and the segment s^{15} has been moved but four steps to the left by the four leaving trains, and, although contact is made at s^4 each time a train passes section n^3, the solenoid will not be energized by battery u, since the circuit including the same is opened by the separated terminals s^{14} s^{15}.

When the springs v v' are in contact and circuit is closed through battery u, as described, the current from said battery has but one path through conductors 6, 7, and 8, solenoid l', and conductors 4 and 9. When the occasion arrives for closing circuit through

solenoid l, however, if circuit were not open at v, current from battery u would divide and pass through both solenoids $l\,l'$, whose cores would be both attracted in opposite directions, thereby neutralizing the effect of the solenoids.

The sections $n\,n'\,o\,o'$ should be located far enough distant from the crossing to provide ample time for the alarm to be given and the gates to be lowered before the train reaches a crossing. In practice the sections $n\,n'\,o\,o'$ may occupy a uniform distance from the crossings, the time at which the gates are lowered being controlled by the throttle-valve f^9, which may be adjusted, when the system is installed, to suit the character of the crossing.

It has been observed how a train upon entering a block actuates electromagnetic apparatus to sever an electrical connection by means of a ratchet and pawl and how when the train reaches an intermediate point of the block said electrical connection is again restored by means of another ratchet and pawl to control the operation of the gates. By placing a step-by-step contact device in circuit with the solenoid l' or other controlling device for raising the gates and providing means to break or alter circuit at said contact device when a train enters a section and to restore or alter the circuit at said contact device when the train reaches an intermediate point I am enabled to accomplish the very important object of permitting any number of trains to occupy a block at one time and to keep the gates lowered until the last train leaves the block.

I have described and shown the electric apparatus and circuits in connection with a single-track system, but the application thereof to a double-track system may readily be made by those skilled in the art.

I have shown and described two compressor-cylinders in connection with the apparatus for compressing air, but it is obvious that a lesser or greater number may be employed without departing from the spirit of my invention.

I have shown and described my invention as applied to gates, but it is apparent that my invention is applicable to signal systems or to the accumulation of power for other purposes.

While I have shown the track provided with insulated sections for controlling the circuits, other well-known means may be employed.

In the claims I have used the word "air" in the sense of any fluid or gas suitable for the present purpose.

While I have set forth that air may be compressed by the apparatus of my invention through the medium of passing trains, it is obvious that other moving bodies possessing the requisite weight to actuate the impingement-levers may be employed.

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

1. The combination with suitable actuating mechanism, of compressor-cylinders with pistons controlled by said mechanism, a receiver in connection with one cylinder, a pressure or supply tank in connection with the second cylinder, and means for admitting compressed air from said receiver to said second cylinder, whereby the pistons and actuating mechanism are restored after each operation; substantially as described.

2. The combination with suitable actuating mechanism, of a low-pressure cylinder, and a high-pressure cylinder with their pistons controlled by said actuating mechanism, and a receiver in which the compressed air from the low-pressure cylinder is received, in combination with a tank in which the air from the high-pressure cylinder is stored, and check-valves, whereby, when the pistons are making one stroke, the low-pressure cylinder communicates with the atmosphere and the high-pressure cylinder with the receiver, and when the pistons are making the reciprocating stroke communication of the low-pressure cylinder is cut off from the atmosphere but established with the receiver, and communication of the high-pressure cylinder is cut off from the receiver but established with the pressure tank or reservoir, substantially as described.

3. The combination of a governing-cylinder, a pressure tank or reservoir, a cut-off, and electromagnetic apparatus for controlling the same, with means whereby when a train enters a block or section said electromagnetic apparatus operates the cut-off to admit air under pressure from said supply-tank to said governing-cylinder and stops the admission of said air when the train leaves a block or section, and valves controlled by said governing-cylinder whereby the admission of compressed air to the operating-cylinders of the gates, or other apparatus, is regulated, substantially as described.

4. The combination of a source of compressed air, a governing-cylinder and a cut-off to control the admission of compressed air to said governing-cylinder, with solenoids provided with cores united with said cut-off, means for establishing circuit, first through one solenoid and then through the other as the train enters and leaves a block or section, whereby the cut-off is actuated, and valves adapted to be actuated by said governing-cylinder, said valves controlling the admission of air to the operating-cylinders of the gates or other apparatus, substantially as described.

5. The combination of electromagnetic apparatus adapted to control the operation of the gates, and a contact device normally in circuit with said electromagnetic apparatus, means for separating the members of said contact device by a single step as each train enters upon a block or section, means for restor-

ing said contact device by a single step as each train leaves a block or section, thus closing circuit through the gate-controlling electromagnetic apparatus by the closure of the contact device as the last train leaves the section, whereby the gates are raised, substantially as and for the purpose specified.

6. The combination of one solenoid adapted to cause the gates to be lowered when a train enters upon a block or section, a second solenoid adapted to cause the gates to be raised when a train leaves a block or section, and a contact device normally included in circuit with the latter solenoid with means for separating the members of said contact device step by step as successive trains enter upon a block or section, means whereby said contact device is restored step by step as the trains leave a block or section, whereby, when the last train has left the block or section, the aforesaid solenoid that controls the raising of the gates is actuated, substantially as and for the purpose specified.

7. The combination of a pressure tank or reservoir, a governing-cylinder with its piston and piston-rod, means for controlling admission of air under pressure to said governing-cylinder, supply-pipes, gate lowering and raising mechanism to which air under pressure from said supply-pipes may be admitted, and valves located in said pipes controlled by the piston-rod of said governing-cylinder, with means whereby, when a train enters a block or section, said piston-rod is actuated to operate the valve of the pipe leading to the lowering mechanism, and means whereby, when a train leaves a block or section clear, said piston-rod is actuated to operate the valve of the pipe leading to the raising mechanism, substantially as described.

8. The combination with suitable apparatus for raising and lowering railway-gates, of an electromagnetic device adapted to control said apparatus, a contact device controlling said electromagnetic device, means whereby, as each train or the first train of a series enters a block or section, electromagnetic devices are actuated to change the electrical condition of said contact device, means whereby, when the last train leaves a block or section, the electrical condition of said contact device is restored, and means whereby, when the last train leaves a block or section, the gates are caused to be raised, substantially as and for the purpose specified.

9. The combination of lever mechanism adapted to be actuated by a passing train or other moving body, a compressor-cylinder with its piston controlled by said lever mechanism, and a supply-tank in which the air from said compressor-cylinder may be stored, with means for admitting air under pressure back of said piston when the pressure in said tank reaches a predetermined limit, whereby the lever mechanism and compressor-cylinder are caused to remain impassive until said tank has been relieved of the excessive pressure, substantially as described.

10. The combination of lever mechanism adapted to be actuated by a passing train or other moving body, a compressor-cylinder with its piston controlled by said lever mechanism, and a pressure tank or reservoir in which the air from said compressor-cylinder may be stored, with a safety-valve provided in connection with said tank, whereby, when the pressure in the tank reaches a predetermined limit, air from said tank is admitted back of said piston thereby causing the lever mechanism and the piston to remain impassive until the tank is relieved of the excessive pressure, substantially as described.

11. The combination with a system of levers adapted to be repeatedly actuated by a passing train or other moving body, of air-compressing apparatus controlled by said levers, a receiver constituting a portion of said apparatus, and means for restoring the lever mechanism after each actuation through the agency of said receiver; substantially as described.

12. The combination of a system of levers adapted to be repeatedly actuated by a passing train or other moving body and air-compressing apparatus controlled by said levers, with a receiver constituting a portion of said apparatus and adapted to restore the lever mechanism after each actuation thereof, and a tank in which the air as it is compressed may be confined and stored; substantially as described.

13. The combination with lever mechanism adapted to be repeatedly actuated by a passing train, or other moving body, of a compressor-cylinder with a piston which is controlled by said lever mechanism, means for admitting compressed air to said cylinder whereby its piston and the lever mechanism are restored after each actuation thereof, with means for conveying the compressed air to the mechanism or device to be operated; substantially as described.

14. The combination with a pressure tank or reservoir, of a governing-cylinder, an electromagnetic device adapted to control the supply of compressed air to said cylinder, and a valve or valves controlled by said governing-cylinder whereby the admission of compressed air to the operating mechanism of the gate or other apparatus is regulated; substantially as described.

15. The combination of an electromagnetic device and a contact device controlled thereby, with means whereby said electromagnetic device is actuated to change the electrical condition of said contact device as the trains enter upon a block or section, means whereby said contact device is restored to its original electrical condition when the last train has cleared the block or section, thereby preventing the gates from being raised until the last train has cleared the block or

section, and suitable apparatus, governed by said contact device, adapted to control the operation of the gates or other apparatus; substantially as described.

16. The combination with lever mechanism adapted to be repeatedly actuated by a passing train or other moving body, of a compressor-cylinder and its piston operated by said lever mechanism, means for returning the piston by air-pressure, and means for retarding the movement of the piston on its return stroke, whereby the too sudden return of the piston is prevented; substantially as described.

17. The combination with lever mechanism adapted to be repeatedly actuated by a passing train or other moving body, of a compressor-cylinder and piston therefor controlled by said lever mechanism, means for returning the piston by air-pressure, and a valve adapted to impede the exhaustion of the air back of said piston upon its return stroke and to form a cushion and prevent the too rapid return of the piston; substantially as described.

18. The combination with gate-operating mechanism, of an electromagnet for controlling the same and a second magnet for controlling said first-mentioned electromagnet and acting to effect the operation of the gate mechanism when a train passes upon the section and to prevent the operation thereof when a train passes from the section in the reverse direction; substantially as described.

In witness whereof I hereunto subscribe my name this 11th day of February, A. D. 1895.

LELAND L. SUMMERS.

Witnesses:

GEORGE L. CRAGG,

JOHN W. SINCLAIR.