(No Model.) 4 Sheets—Sheet 1.

J. W. THOMAS, Jr.

PNEUMATIC APPARATUS FOR HANDLING RAILWAY SWITCHES.

No. 545,750. Patented Sept. 3, 1895.

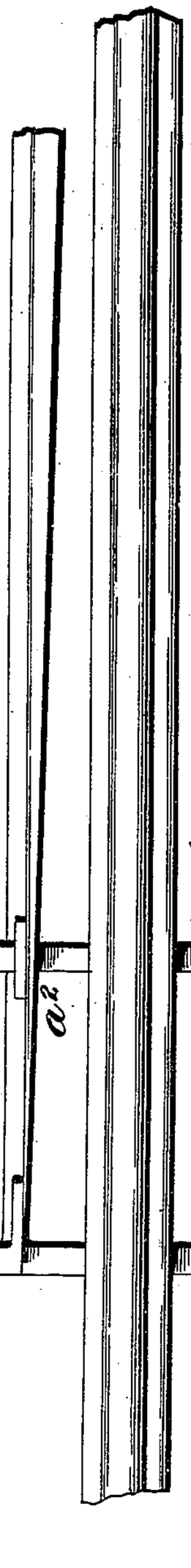

Fig. 7.

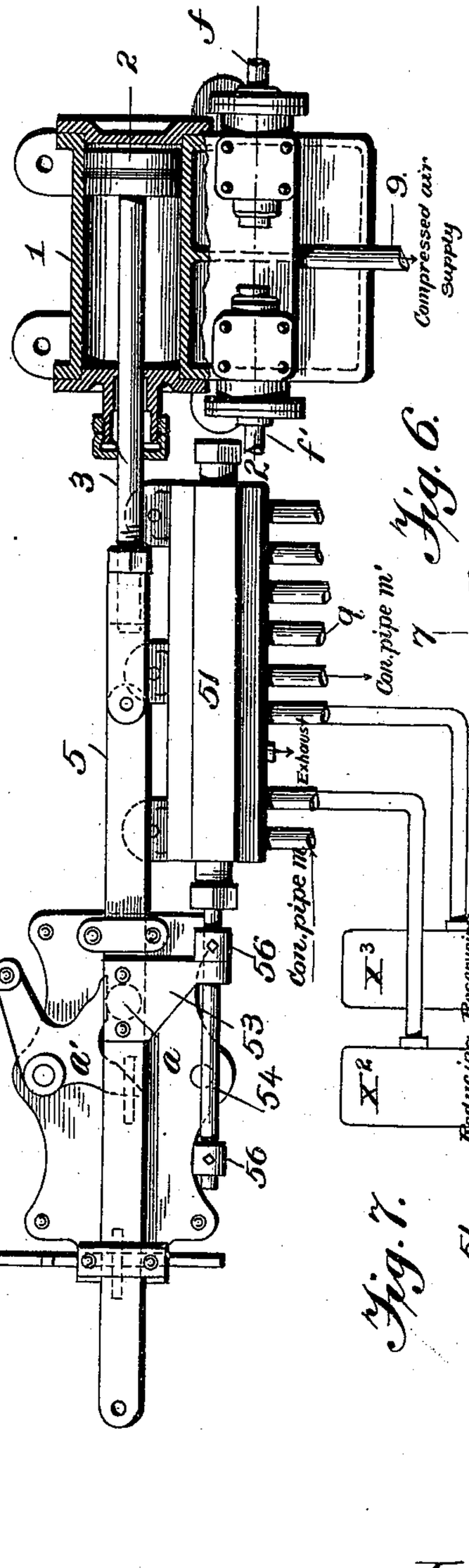

Fig. 6.

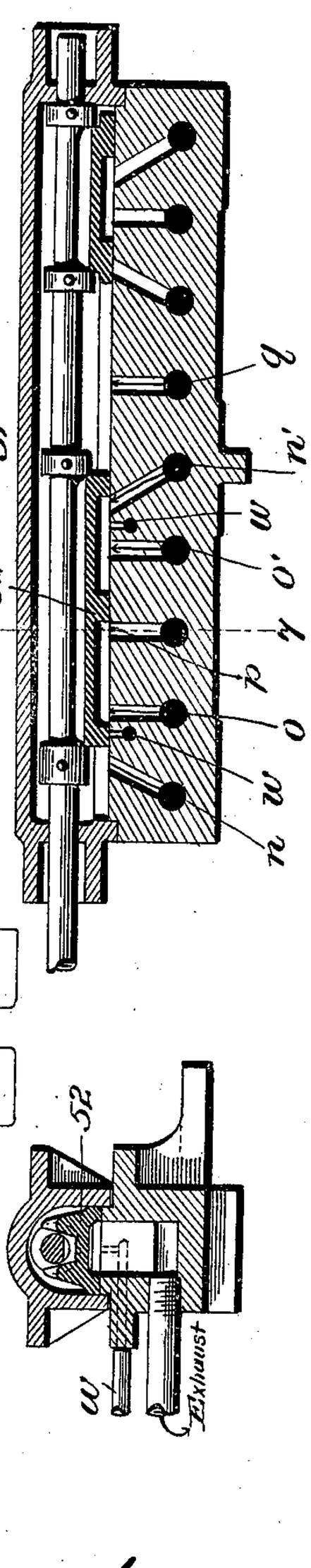

Fig. 7.

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J. B. Keeler

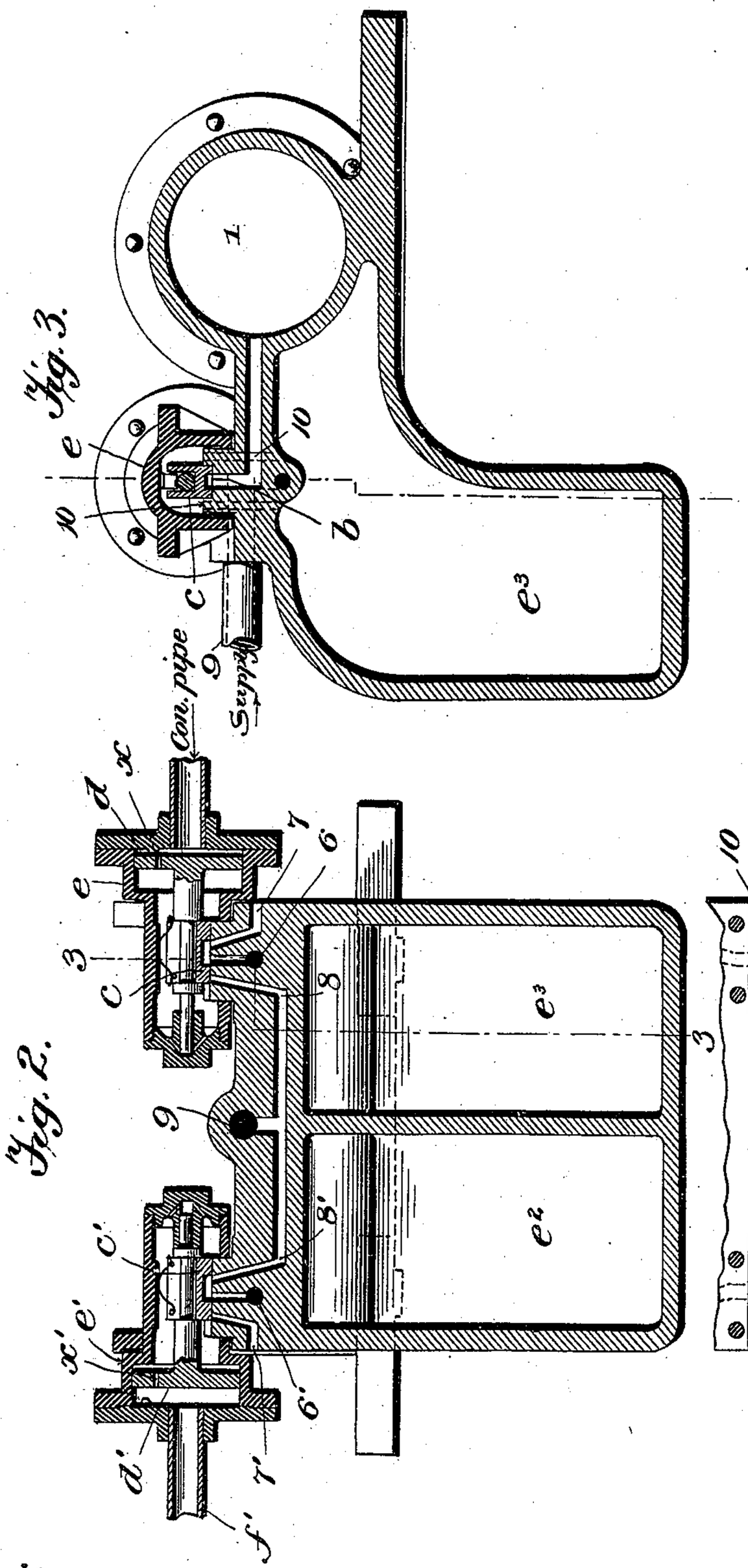
Inventor:
John W. Thomas, Jr.
by Marcellus Bailey
his Atty.

(No Model.) 4 Sheets—Sheet 2.

J. W. THOMAS, Jr.

PNEUMATIC APPARATUS FOR HANDLING RAILWAY SWITCHES.

No. 545,750. Patented Sept. 3, 1895.



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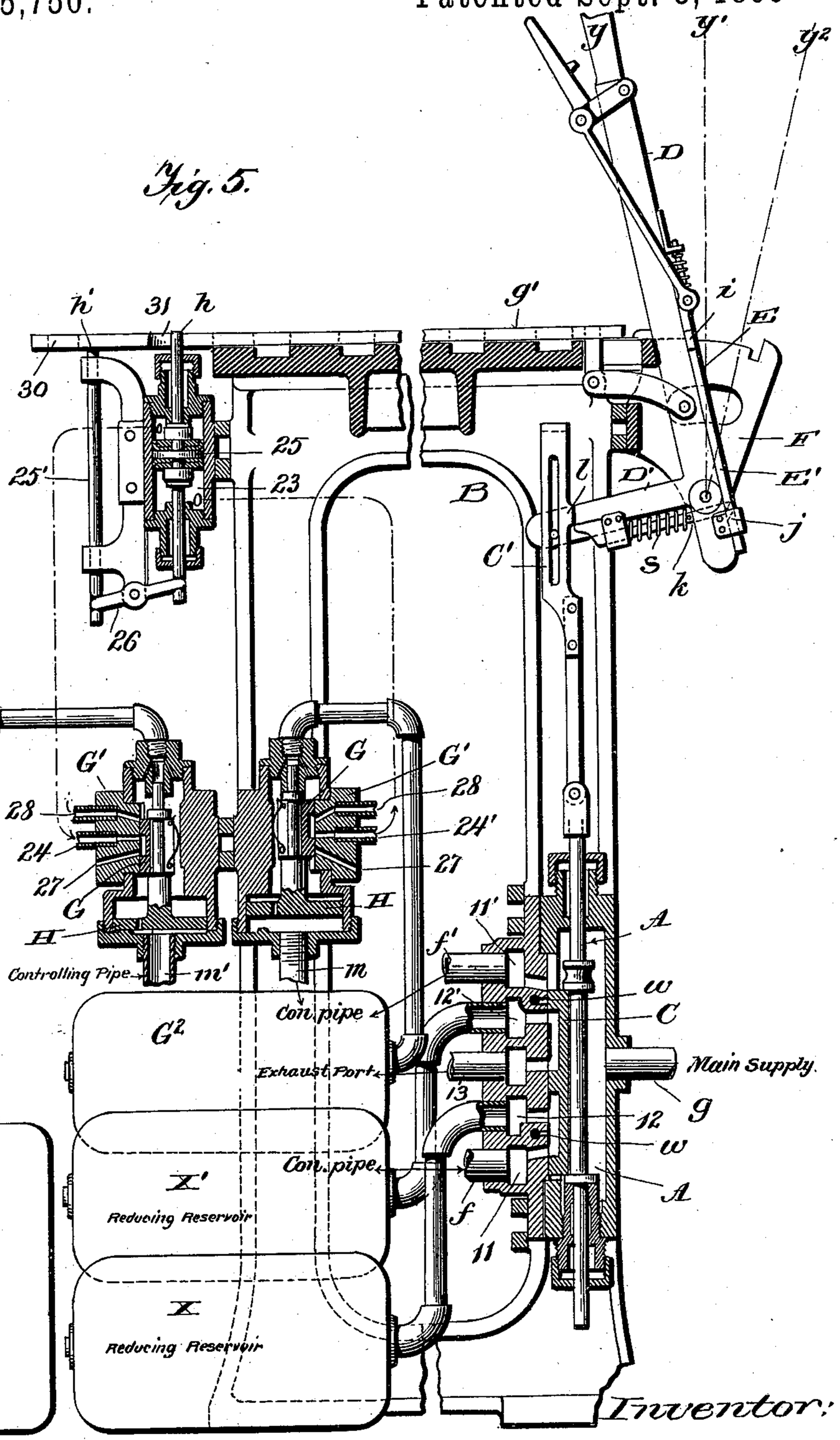
(No Model.) 4 Sheets—Sheet 3.

J. W. THOMAS, Jr.

PNEUMATIC APPARATUS FOR HANDLING RAILWAY SWITCHES.

No. 545,750. Patented Sept. 3, 1895

Fig. 5.



Witnesses:
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(No Model.) 4 Sheets—Sheet 4.

J. W. THOMAS, Jr.

PNEUMATIC APPARATUS FOR HANDLING RAILWAY SWITCHES.

No. 545,750. Patented Sept. 3, 1895.

Fig. 10.

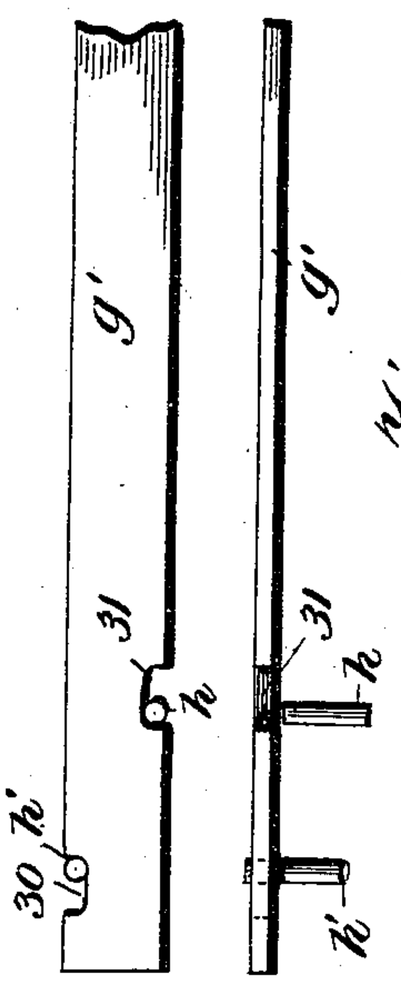


Fig. 11.

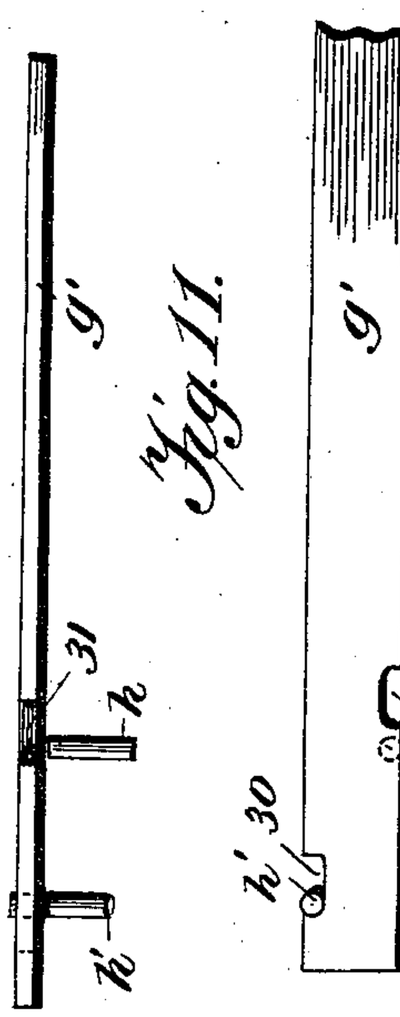


Fig. 8.

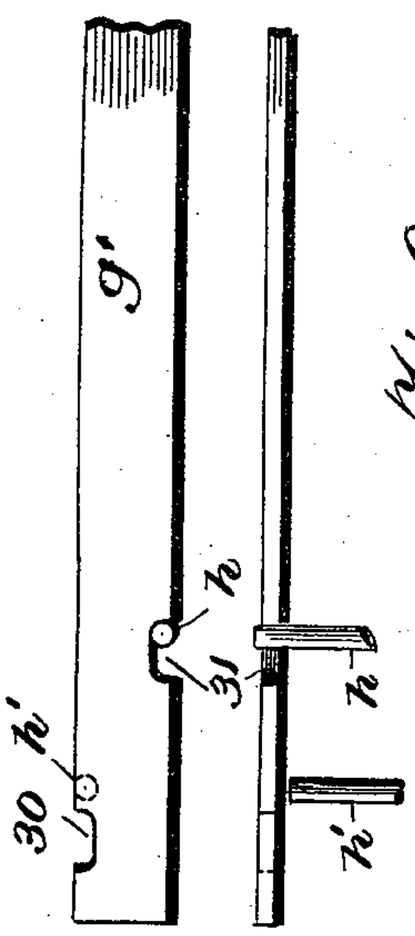


Fig. 9.

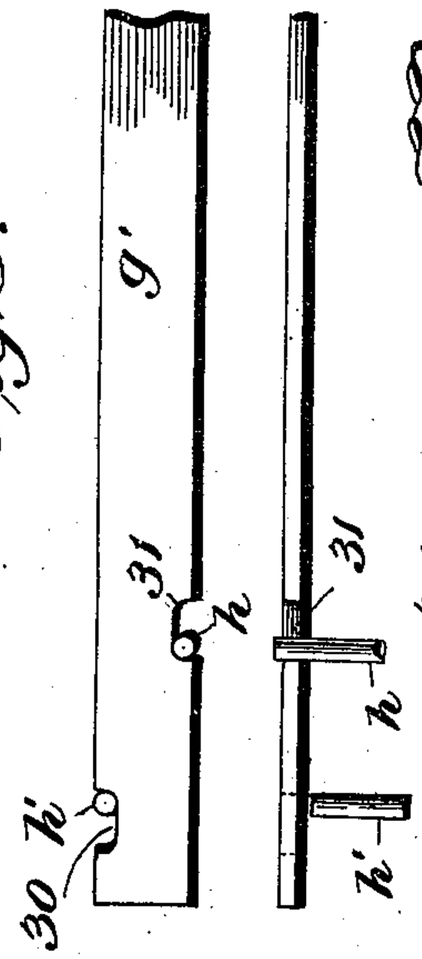
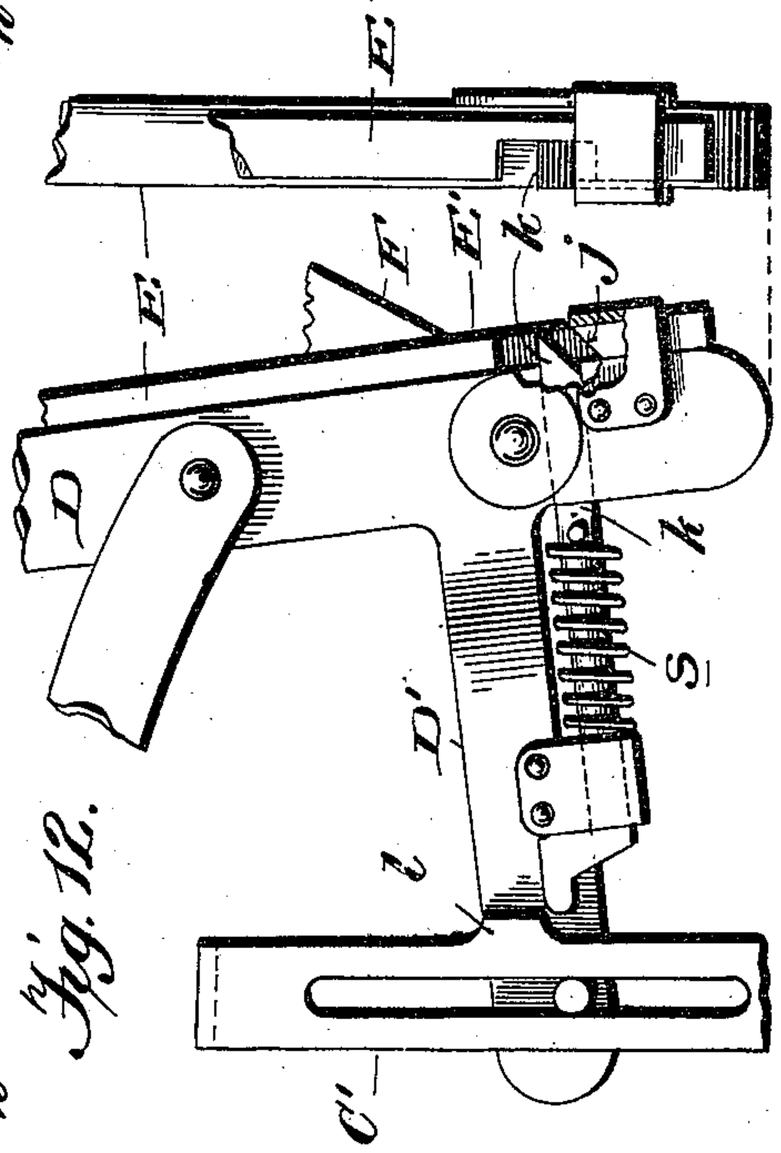


Fig. 12.



Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

JOHN W. THOMAS, JR., OF NASHVILLE, TENNESSEE.

PNEUMATIC APPARATUS FOR HANDLING RAILWAY-SWITCHES.

SPECIFICATION forming part of Letters Patent No. 545,750, dated September 3, 1895.

Application filed July 11, 1895. Serial No. 555,647. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. THOMAS, Jr., a citizen of the United States, and a resident of Nashville, in the county of Davidson and State of Tennessee, have invented certain new and useful Improvements in Pneumatic Apparatus for Handling Railway-Switches, of which the following is a specification.

The invention about to be described is designed principally for the handling of railway-switches; but in some of its features it is applicable to the handling of railway-signals as well, and I desire to be understood as including such application in my claims.

The system to which my invention in the main relates, and in connection with which my present improvements will be described, is that which is the subject of my Letters Patent No. 520,812, of June 5, 1894, its characteristic features being that the proper operation of the valve or valves for admitting air to and exhausting it from the working cylinder is effected by means of two pneumatic pistons, each subjected to the action of a column of compressed air distinct and separate from that which acts on the other and delivered through controlling-pipes, one for each piston, containing air at more than atmospheric pressure at all times, the pistons being subjected, on the sides opposite those on which the controlling-pipes are located, to air-pressure opposing that in the controlling-pipes, and being actuated and controlled in their movements by alternately and at the proper times reducing and restoring the pressure in the controlling-pipes.

The invention resides in certain improvements in the apparatus, which will first be described by reference to the accompanying drawings, forming part of this specification, and will then be more particularly pointed out in the claims.

In the drawings, Figure 1 is a plan, partly in section, of the working cylinder and other appliances located in the immediate neighborhood of the switch-points to be operated. Fig. 2 is a section, on enlarged scale, of the valve mechanism and auxiliary reservoirs on line 2 2, Fig. 1. Fig. 3 is a cross-section of the parts shown in Fig. 2, together with the working cylinder on line 3 3, Fig. 2. Fig. 4 is a plan view showing the valve-seats with the valve and valve-chests removed. Fig. 5 is a sectional side elevation of the operating-lever (located in the tower) and parts connected therewith, through the agency of which the switch is controlled. In this figure appears, also, the "indicator" mechanism, by which the tappet connected to the lever is locked or unlocked, according to the position of the switch. Fig. 6 is a longitudinal vertical section of that portion of the indicator-controlling mechanism which is located near the switch, Fig. 1, and operated by or from the piston-rod of the working cylinder. Fig. 7 is a cross-section on line 7 7, Fig. 6. Figs. 8 to 11, inclusive, are diagrammatic views, taken in plan and side elevation, illustrative of the different positions assumed by the tappet and its locking or indicator pins during the operation of throwing the switch. Fig. 12 is an enlarged view showing more plainly the structural details of the latch mechanism by which the operating-lever can at will be connected to and disconnected from the slide-valve, by the movement of which the air-pressure in the controlling-pipes is regulated.

1 is the working cylinder, 2 its piston, and 3 the piston-rod, by whose movement the switch is operated by any known or suitable means. The mechanism for the purpose shown in Fig. 1 consists of a bar 5, pinned to the piston-rod and supported in suitable guides and having a pin a to engage and work the crocodile-jaw lever a', the latter being connected to the switch-points a^2 by a suitable connection a^3. The working cylinder has end ports 6 6′, communicating with like-designated ports in the valve-seats b b', Figs. 2 and 3, upon which are slide-valves c c', each controlled by a piston-valve d or d', of the equalizing type, contained in a chest e or e', which incloses its appropriate slide-valve, its seat, and equalizing-piston. In the outer head of each valve-chest is an opening entered by a controlling-pipe f or f'. In each valve-seat the central port 6 or 6′ is between an exhaust-port 7 or 7′ and a supply-port 8 or 8′, communicating with the main compressed-air supply 9. In each equalizing-piston there is a port x or x', through which air can pass gradually from one side of the piston to the other until the pressure (whatever it may be for the time being) is equalized;

and to each valve-chest is connected a reservoir e^2 or e^3 for the purpose of increasing its air capacity, each reservoir being in communication with its chest through constantly-open ports 10 or 10′.

There is nothing new, broadly speaking, in this organization. It is shown in a general way in my Letters Patent No. 520,812, Fig. 12. What is new in the structure thus far described is that the valve-seats, working cylinder and auxiliary reservoirs are assembled together in very compact and efficient shape, these parts being preferably a single casting, while the valve-seats are cast directly on the reservoir, thus doing away with intervening connecting-pipes between the reservoirs and chests. The equalizing-pistons are operated by reducing and restoring pressure in their controlling-pipes, as provided in my aforesaid patent, the reduction of pressure in the one pipe being simultaneous with the restoration of normal pressure in the other pipe.

In my patent just referred to I suggested that the air-pressures used in the controlling-pipes should be sixty pounds for maximum and about fifty pounds for minimum, with a a pressure of, say, eighty pounds in the main supply. Experience, however, has demonstrated that more effective and quicker action is obtained by working at higher pressures. I therefore now work with a maximum pressure in the controlling-pipe of eighty pounds to the square inch (the same as the pressure at the main supply) and a minimum pressure of about seventy pounds. In order to reduce pressure in the controlling and other pipe-lines, I dispense with the pop or relief valves which I made use of in my Patent No. 520,812. I employ in lieu thereof what I term "reducing-reservoirs," which are alternately in communication with their pipe-lines and with an exhaust through ports controlled by a suitable valve—as, for example, there will be three ports, one for exhaust, a second leading to reducing-reservoirs, and a third leading to the controlling-pipe, and a valve for these ports, which when in one position puts the controlling-pipe in communication with the interior of the valve-chest containing air at maximum pressure (the reducing-reservoir at this time being thrown into communication with the exhaust) and in the other position puts the controlling-pipe in communication with the reducing-reservoir. When the reducing-reservoir is in communication with the controlling-pipe, air from the latter enters the reservoir, and thereby the pressure in the pipe-line is reduced proportionately to the capacity of the reducing-reservoir. When, on the other hand, the controlling-pipe is cut off from the reservoir and thrown into communication with the source of maximum air-pressure, the reservoir at this time communicates with the exhaust, is emptied of its charge of compressed air, and is in readiness to receive another charge from the controlling-pipe whenever reduction is again desired. The reducing-reservoir for this purpose can be made of any size that may be found efficient. I have found that by the employment of a nine-inch by twelve-inch reservoir in connection with three-fourth pipes containing air at eighty pounds pressure, the pressure in one hundred and twenty-five feet of such pipe can be reduced fifteen pounds; in two hundred and fifty feet, fourteen pounds; in five hundred feet, twelve pounds, and so on proportionately. In practice one size of reservoir can be used for all distances under five hundred feet, another size for distances between five hundred and fifteen hundred feet, and another size for distances over fifteen hundred feet. In the application of this portion of my improvements in the controlling-pipes $f\,f'$ these pipes are carried to the operating-table, Fig. 5, in the tower, where they communicate with ports 11 11′, respectively, in a valve-chest A on the frame of the interlocking table B. This chest contains the switch-controlling slide-valve C, which is a double-**D** valve, to operate in connection with two sets of ports pertaining to the controlling-pipes $f\,f'$, respectively. The one set of ports consists of 11 and 12, which latter communicates with a reducing-reservoir X. The other set of ports consists of 11′ and 12′, the latter communicating with a reducing-reservoir X′. 13 is an exhaust-port common to the two reducing-reservoir ports 12 and 12′. g is a pipe leading from main supply into chest A and supplying the latter with air at eighty pounds pressure.

In the position occupied by the valve C in Fig. 5, (which is its normal position, and the one occupied by it when the equalizing-pistons are in the position shown in Fig. 2), air from the main supply flows into the controlling-pipe f'. Controlling-pipe f is in communication with its reducing-reservoir X, while reducing-reservoir X′ is in communication with the atmosphere by way of the exhaust. When it is desired to reverse the switch, valve C is moved upward, thereby shutting off controlling-pipe f' from the source of main supply and putting it in communication with its reducing-reservoir X′ and at the same time putting controlling-pipe f in communication with the source of main supply and establishing communication between its reservoir X and the atmosphere by way of exhaust 13. Under these conditions, air from controlling-pipe f' will flow into its reservoir X′ (which by its previous communication with exhaust 13 has been emptied of air above atmospheric pressure), thus reducing the pressure in that controlling-pipe, while simultaneously pressure in the now uncovered controlling-pipe f will go to eighty pounds and its reservoir X, being now in communication with the exhaust 13, will be relieved of the charge of compressed air which it received from the controlling-pipe f during its communication with the latter. The effect will be, of course, to reverse the position of the equalizing-piston in Fig. 2 and

thus to throw the switch. The reducing-reservoirs X X′, as hereinbefore indicated, should be of such capacity as to reduce the pressure about ten pounds.

The switch-controlling slide-valve C is actuated by a lever D, which operates in connection with sliding interlocking tappet *g′* and locking indicator-pins *h h′* in the same general way as in my Patent No. 520,812. As also explained in my aforesaid patent, the arrangement must be such, in order to accomplish the interlocking, that the lever and its tappet can make only one-half their stroke unless the switch has properly responded. Consequently the full throw of the valve C for this purpose must take place during the first half of the stroke of the lever, after which and during the remainder of its stroke the lever should have no effect upon the valve. To this end I provide means whereby the valve is or can be intermittently connected to and disconnected from the lever. This feature in a general way is illustrated in my aforesaid patent; but I have devised for the purpose a mechanism which I believe to be an improvement upon the special devices for the purpose shown in my patent. I may and in practice do use the ordinary latch-lever E for the purpose of actuating the latch by which the operating-lever and valve C are connected. This latch-lever, in addition to the dog *i*, by which it engages the notched quadrant F, has a downwardly spring-pressed extension E′, which moves in guides on the operating-lever and is provided with an incline or cam-shoulder *j* to act upon the heel of a sliding latch or dog *k*, which is supported and adapted to move in guides on the under side of a bell-crank cam D′ of lever D, and is outwardly pressed by a spring *s*. The arm D′ has a pin which enters a vertical slot in a bar C′, pinned to the stem of valve C, in which slot the pin can move up and down when the operating-lever is not engaged with the valve. The toe or inner end of the latch *k* is in proximity to, but just out of, the path of a projection *l* on the adjoining edge of the bar C′, being held in this retracted position by the spring *s*. Normally it is just below the lever of this projection, as seen in Fig. 5. By pressing the latch-lever E toward the operating-lever its extension E′ will be drawn up and by the action of the cam or incline *j* upon the heel of the latch *k*, will force the latter forward until its toe passes beneath the projection *l* on the valve-bar C′. Then when the operating lever is swung over the valve necessarily will be moved up, the arrangement being such that it will make its full throw by the time the lever is at half-stroke. When the lever gets to this position, the latch-lever E is released, the latch *k* will, by its spring *s*, be retracted and disengaged from the valve-bar C′, and the operating-lever D will be free to move the remainder of its stroke without further actuating the valve. At the end of the stroke the toe of the latch *k* will be just above the level of the projection *l*, in readiness to be projected over that projection during the first half of the return stroke of the lever. This mechanism for connecting and disconnecting at will the controlling-valve and the operating-lever is applicable whether the lever be used as a signal or a switch lever.

With respect to the indicator appliances I make use of the same general plan as that set forth in my Patent No. 520,812—that is to say, I combine with the operating-lever and its slotted tappet two indicator-pins and pneumatic appliances for operating said pins connected to and controlled in their action by the movement of the switch in such manner that one or the other of the pins is caused to engage and lock the tappet before the lever completes its full throw in either direction until after the switch has been fully shifted. I have, however, modified the arrangement of devices so as to adapt the same to the application of the same general plan for reducing and restoring pressure in the pipe-lines as that employed for the purpose of controlling the movement of the switch.

As it is of the utmost importance that there should be no question that the switch has properly responded, two indication-pipes are used, it being impossible to get the proper protection with one pipe only, since at one move or the other the indication then would necessarily be obtained by a mere reduction of pressure, and as this reduction might be occasioned by a leak a false indication would follow; but with two indication-pipes, in one of which pressure must be reduced and in the other of which pressure must be increased in order to give the indication and release the operating-lever, a false indication is practically impossible.

The indication mechanism which I now prefer is as follows: The indicator-pins *h h′*, as in my patented arrangement, are so arranged that when one is up the other is down, and they operate in connection with the slots 30 31 in the tappet in the same way as set forth in my aforesaid patent. One of the indicator-pins, say, pin *h*, is on the upper end of the rod of a piston 25, adapted to move up and down in a cylinder 23, attached to the interlocking table in the tower and provided at each end with a port which is entered by a pipe 24 or 24′, through which compressed air is supplied to and exhausted from each end of the cylinder. The other pin *h′* is on the upper end of a rod 25′, supported and arranged to slide vertically in suitable guides and connected to the rod or stem of piston 25 by a centrally-pivoted lever 26, jointed at one end to the rod 25′ and at the other end to the piston-rod. Thus when one pin is down the other pin must be up.

The supply of air to the indicator-cylinder 23 is controlled by two separate slide-valves G, attached to the frame of the interlocking table in the tower, each having its own valve-

chest G′ and set of ports and being actuated each by an equalizing-piston H. To each valve-chest G′ is connected a reservoir G^2 for the purpose of increasing the capacity of the chest. The pipe 24 is led to a port in one valve-chest and the pipe 24′ is led to a port in the other valve-chest. In addition to these ports there are provided two ports 27, for exhaust and 28 for compressed-air supply, with either of which the indication-pipe is thrown into communication, according to the position of its slide-valve G. When the one pipe—*e. g.*, 24—is in communication with its supply, the other pipe 24′ is in communication with its exhaust. The equalizing-pistons H are actuated each by a controlling-pipe *m* or *m′* in the same general way as the equalizing-pistons of the switch-throwing mechanism are actuated as already described—that is to say, by increase and reduction of pressure in the controlling-pipes—the decrease of pressure being brought about by the employment of reducing-reservoirs. For this purpose I provide, in proximity to the switch movement, Figs. 1, 6, and 7, a valve-chest 51, containing two sets of ports *n o* and *n′ o′*, (with exhaust *p*, common to both,) controlled each by a separate slide-valve, in this instance a double-D valve 52, which is to be actuated from the switch movement. Port *n* communicates with controlling-pipe *m*. *o* is a port communicating with a reducing-reservoir X^2. Similarly in the other set port *n′* communicates with controlling-pipe *m′* and *o′*, with a reducing-reservoir X^3. The exhaust common to the two sets of ports is shown at *p*. The interior of chest 51 is supplied with air at full pressure through constantly-open port *q*. Beyond and to the left of these ports in Fig. 6 is another set of ports, which pertain to the pneumatic signal-selector of my patent, No. 520,813, for signal-handling apparatus, and need not be here described. The valve 52 is operated from the bar 5, Fig. 1, by an arm 53 on the bar which extends between and is adapted at the proper time to strike against one or the other of two knockers 56 56, adjustably secured on the valve-stem 54.

The bar 5 of the switch-and-lock movement has eight inches stroke, while the switch-points have only four inches, this excess of movement being to provide for the throwing of the valve 52 before the switch-points move, and the adjustment is such that the bar 5 will move two inches before the points begin to move and two inches after they are up. The throw of the valve is effected during the last two-inch "silent" portion of the throw of the switch-operating bar 5 in either direction.

The parts in Figs. 1, 5, 6, and 7 are shown in their normal position. In this position controlling-pipe *m*, being in communication with the body of chest 51, is supplied with air at eigthy pounds pressure, and controlling-pipe *m′*, being in communication with its reducing-reservoir X^3, contains air at seventy pounds pressure. Consequently the equalizing-pistons occupy the position shown in Fig. 5, and indicator-pin *h* is up and *h′* is down.

The position of the pins, relatively to the slotted tappet at this time, is indicated in Fig. 8. In reversing the switch the operating-lever is thrown from its *y* to its *y′* or intermediate position in Fig. 5. If the switch fails to respond, as it ought to when the lever reaches the *y′* position, then the stroke of the lever cannot be completed, because the indicator-pins *h h′* will remain unchanged, and pin *h*, by bringing up against the end of its slot, as in Fig. 9, will arrest further movement of the tappet, and consequently of the operating-lever. If, however, the switch does respond, then the valve 52 will shift and, through the operation of the appliances immediately and mediately controlled by it, the pins *h h′* will change position, *h* descending and *h′* rising, as shown in Fig. 10, thus allowing the operating-lever to move to its y^2 position and complete its stroke, in which event the pins and tappet would occupy the position relatively to one another, shown in Fig. 11. On the return stroke of the lever to normal a similar sequence of operations takes place. By operating the slide-valves for admitting air to and discharging it from the small indicator-cylinder (whose piston works the indicator or tappet controlling pins) by means of equalizing-pistons controlled in their movement in the manner hereinbefore described I am enabled to obtain much quicker indications, or, in other words, much more rapid responsive movement of the indicator-pins than formerly. I remark that the same plan can be adopted for working the indicator pin or pins for controlling the operation of a signal-lever, although in such case I find that but one equalizing-piston and slide-valve controlled thereby will be really needed.

As it is difficult, if not almost a matter of impossibility, to keep the pipe-lines perfectly tight and free from leakage, (having reference here more particularly to the controlling-pipe lines,) I have introduced a system of feed-ports *w*, (shown in Figs. 5 and 6,) by which the pipes when at lower pressure are supplied with air at minimum pressure—that is, seventy pounds. These ports are connected to a source of air-supply maintained at seventy pounds pressure, and when the controlling-pins, by reason of their temporary connection with their reducing-reservoirs, have the air-pressure in them reduced, these ports at that time will be in communication, through the D slide-valve, with said pipes, thus supplying any deficiency of pressure that may have been occasioned by leakage. This feature is applicable to the pipe-lines, whether used in a switch or a signal system.

I remark that while for the purpose of operating the switch I prefer to employ pneumatic pistons of the equalizing type, and have so illustrated my invention, yet I can employ for the purpose pneumatic pistons of the differential type as well—such, for example, as

illustrated in Figs. 1 and 11 of my Patent No. 520,812. In such case all that would be needed would be to couple controlling-pipes *f f'* of Fig. 3 of my present application to 14 15, respectively, of the differential-piston mechanism of my patent, and I desire to be understood as including any such substitution in my claims.

Having now described my improvements and the manner in which the same are or may be carried into effect, I state in conclusion that I do not restrict myself, narrowly, to the structural details hereinbefore described and illustrated, since, manifestly, they can be varied considerably without departure from my invention; but

What I claim herein as new, and desire to secure by Letters Patent, is as follows:

1. The combination with the working cylinder for actuating the switch or other device, valve mechanism for admitting the working fluid to and exhausting it from said cylinder, the operating lever in the tower and a double valve actuated thereby, of two pneumatic pistons for controlling the valve mechanism of the working cylinder, controlling pipes one for each piston, two sets of ports (one for each controlling pipe) controlled by the double valve, and consisting each of an exhaust port; a port connected to a reducing reservoir, and a port connected to the controlling pipe to which the reservoir pertains, whereby when one controlling pipe is placed in communication with the source of compressed air supply, its reducing reservoir is put in communication with the exhaust, and the other controlling pipe is put in communication with its reducing reservoir, substantially as and for the purposes hereinbefore set forth.

2. The combination with the operating lever and its tappet, and the pressure regulating valve controlled thereby, of a projection or shoulder on the stem of the valve or some part moving in unison therewith, a spring retracted dog or latch mounted on and carried by the lever, and means also carried by the operating lever whereby said dog or latch may at will be moved against the stress of its retracting spring in a direction to engage said projection or shoulder, substantially as and for the purposes hereinbefore set forth.

3. The combination with the operating lever and its tappet, the pressure regulating valve and the latch projection, or shoulder on the valve stem or some part moving in unison therewith, of the spring retracted dog or latch mounted on the operating lever, and the latch lever also mounted on said operating lever and provided with a cam or incline to act against the heel of the latch or dog and press it inward against the stress of its retracting spring, substantially as and for the purposes hereinbefore set forth.

4. The bell crank and operating lever and its tappet, the pressure regulating valve, a bar pinned to the stem of said valve and having a pin and slot connection with the operating lever, and a latch projection or shoulder on said bar in combination with the spring retracted latch or dog on the operating lever, and the latch lever also mounted on the operating lever and provided with a cam or incline to act upon the heel of the said latch or dog, substantially as and for the purposes hereinbefore set forth.

5. The combination with the working cylinder, the operating lever and its tappet, the indicator pins and indicator cylinder, of valve mechanism for admitting and exhausting air to and from said cylinder, an equalizing piston, mechanism for actuating said valve mechanism, and a controlling pipe for said equalizing piston mechanism, a reducing reservoir, and a slide valve mechanism connected to and operated by the piston of the working cylinder or some part moving therewith, and controlling ports comprising an exhaust port, a port connected to the controlling pipe, and a port connected to the reducing reservoir which is thrown into communication with either the exhaust or the controlling pipe according to the position of the slide valve, substantially as and for the purposes hereinbefore set forth.

6. The combination of the working cylinder, the operating lever and its tappet; the indicator pins and indicator cylinder; the two valves for controlling admission and exhaust of air to and from said cylinders; the two equalizing piston mechanisms one for each valve; two controlling pipes one for each piston; two reducing reservoirs one for each controlling pipe and a slide valve mechanism connected to and operated by the working piston or some part moving therewith and controlling two sets of ports one for each equalizing piston mechanism, consisting of a port connected to one of the controlling pipes, a port connected to the reducing reservoir pertaining to that pipe and an exhaust port—these parts being combined and arranged together for joint operation, substantially in the manner hereinbefore set forth.

7. The combination with the controlling pipe lines the reducing reservoirs for the same and the valve controlled parts through which said lines are connected to their reservoirs at appropriate times, of feed ports *w* supplied with air at reduced pressure, from a suitable source of supply, arranged to communicate with the pipe line, at the time the latter are in communication with their reservoirs, substantially as and for the purposes hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 8th day of June, 1895.

JOHN W. THOMAS, JR.

Witnesses:
R. T. SAUNDERS,
C. W. HARDIN.