(No Model.) 9 Sheets—Sheet 1.

W. RAAB.

RAILWAY SWITCH.

No. 477,609. Patented June 21, 1892.

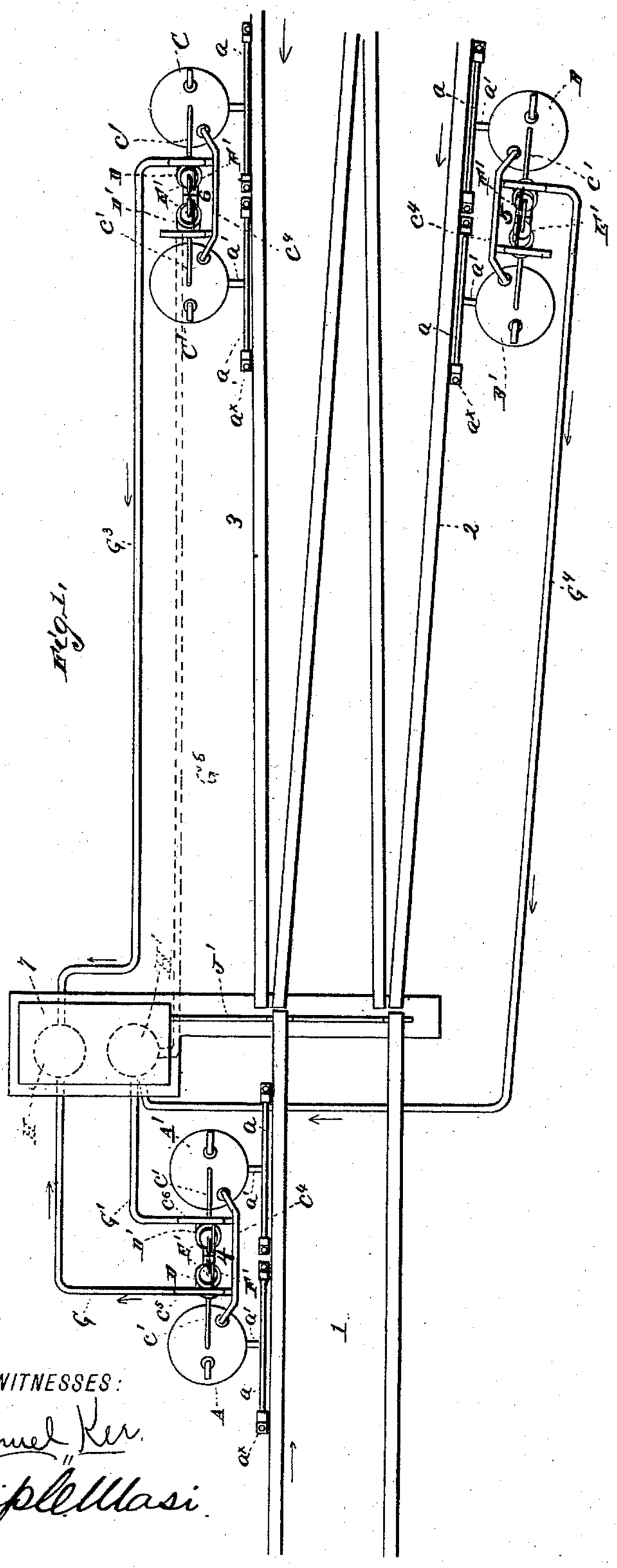

Fig. 1.

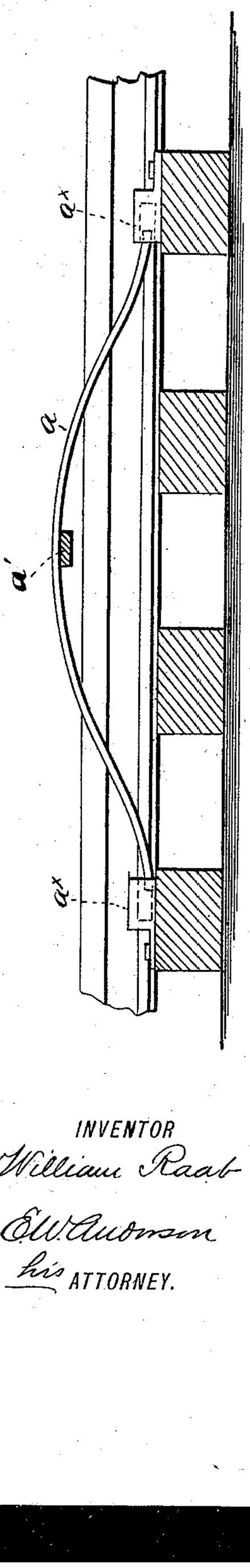

Fig. 2.

WITNESSES:

Samuel Ker.

Philip C. Masi.

INVENTOR

William Raab.

BY E. W. Anderson

his ATTORNEY.

(No Model.) 9 Sheets—Sheet 2.

W. RAAB.

RAILWAY SWITCH.

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Fig. 2.

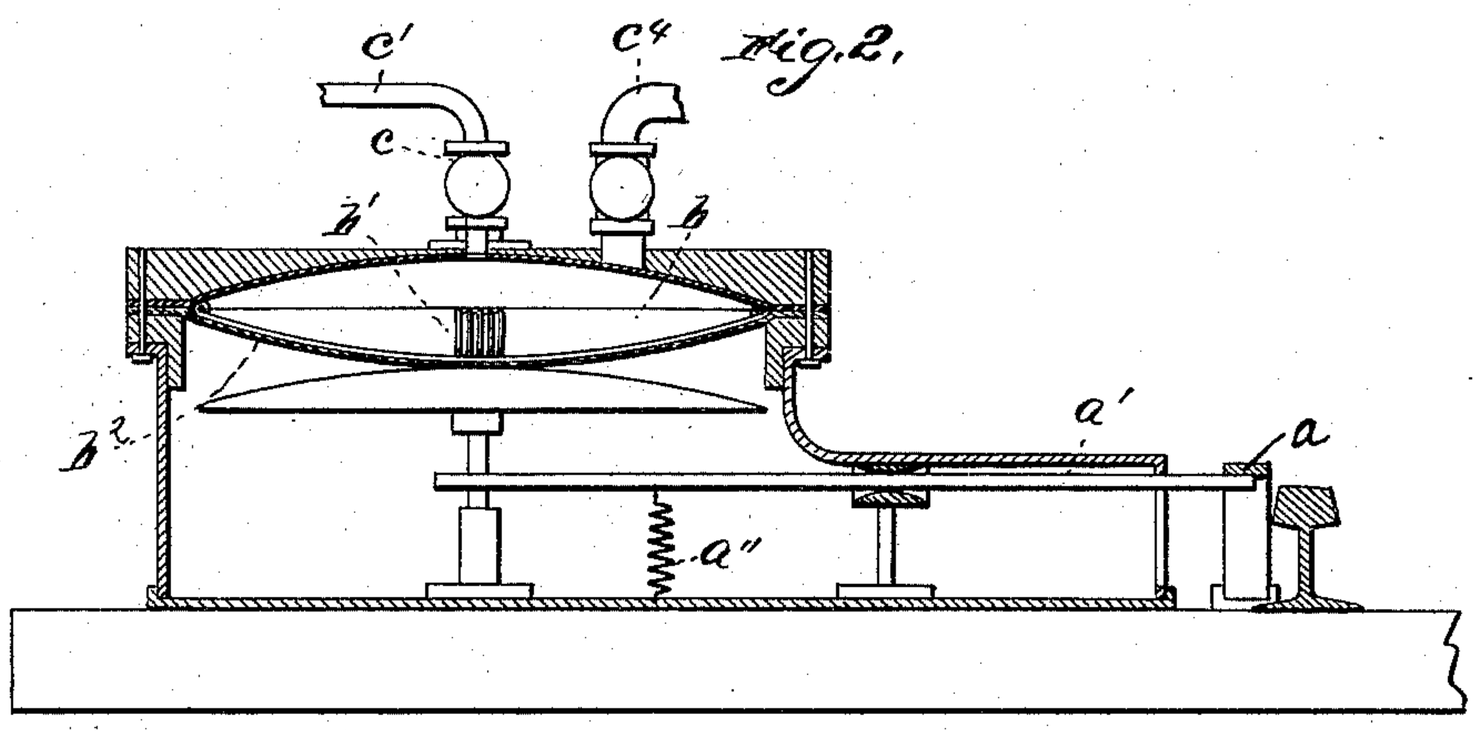


Fig. 3.

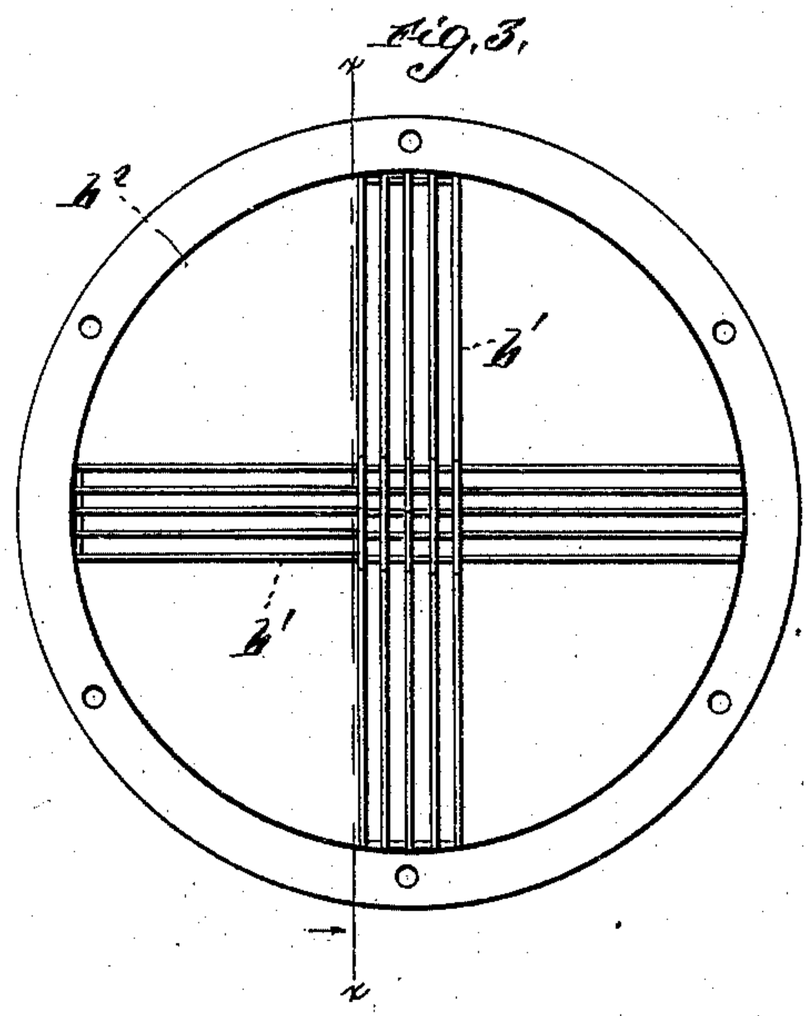
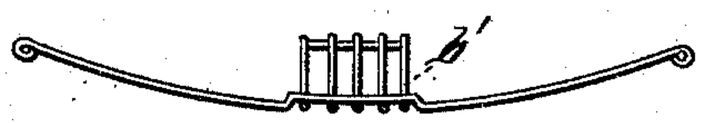


Fig. 4.



WITNESSES:

Samuel Ker

Philip C. Masi.

INVENTOR

William Raab

BY E. W. Anderson

his ATTORNEY.

(No Model.) 9 Sheets—Sheet 3.

W. RAAB.

RAILWAY SWITCH.

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Fig. 5.

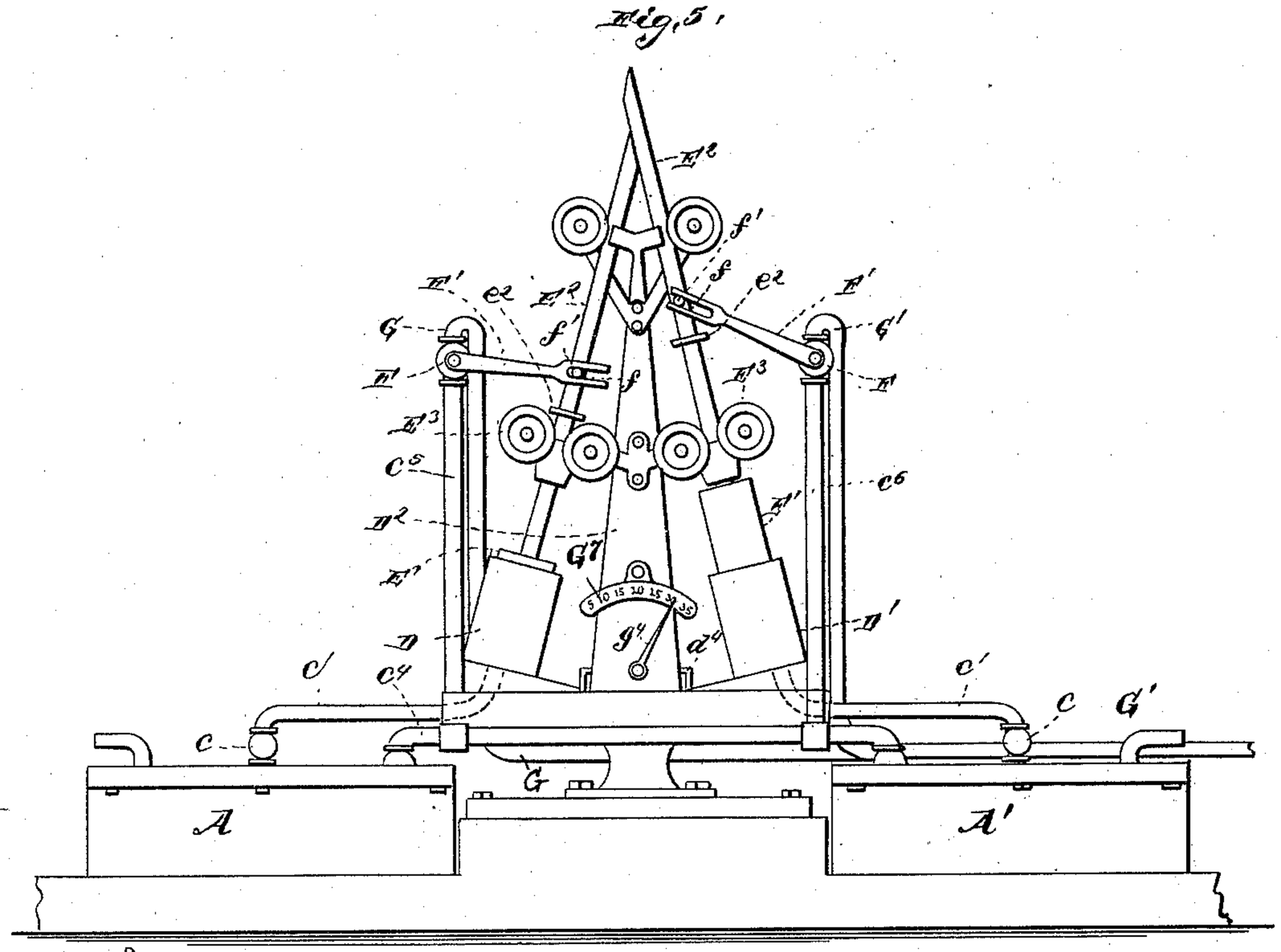


Fig. 6.

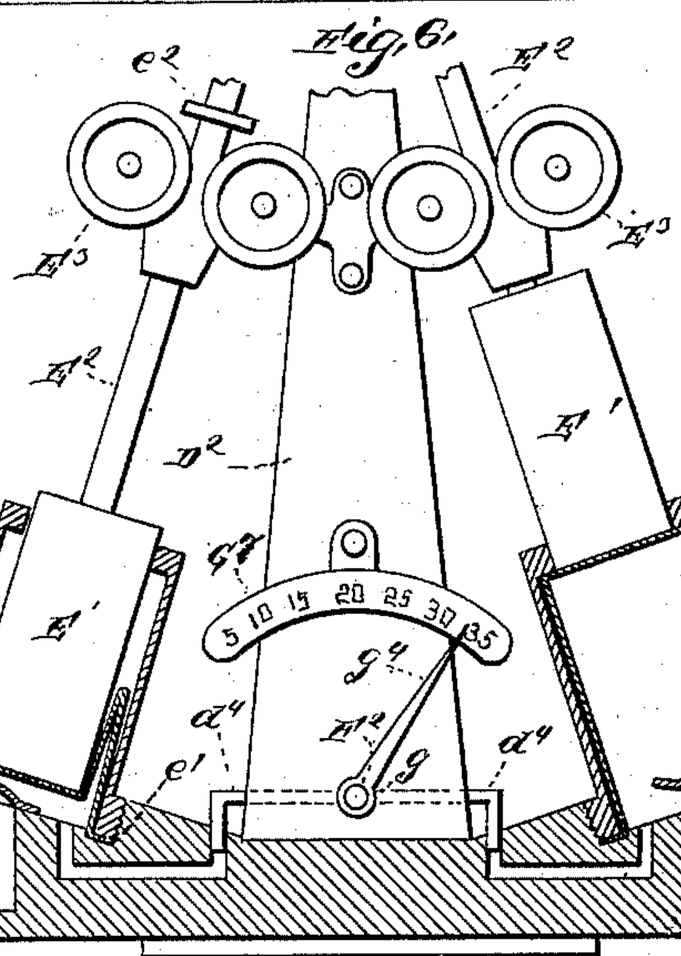


Fig. 21.

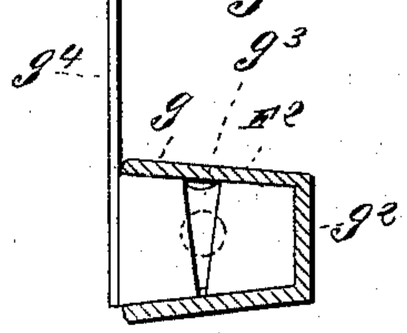
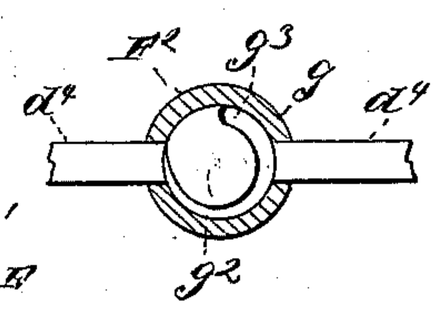


Fig. 22.



WITNESSES:

Samuel Ker

Philip T. Masi.

INVENTOR

William Raab

BY E. W. Anderson

His ATTORNEY.

(No Model.) 9 Sheets—Sheet 4.

W. RAAB.

RAILWAY SWITCH.

No. 477,609. Patented June 21, 1892.

Fig. 8.

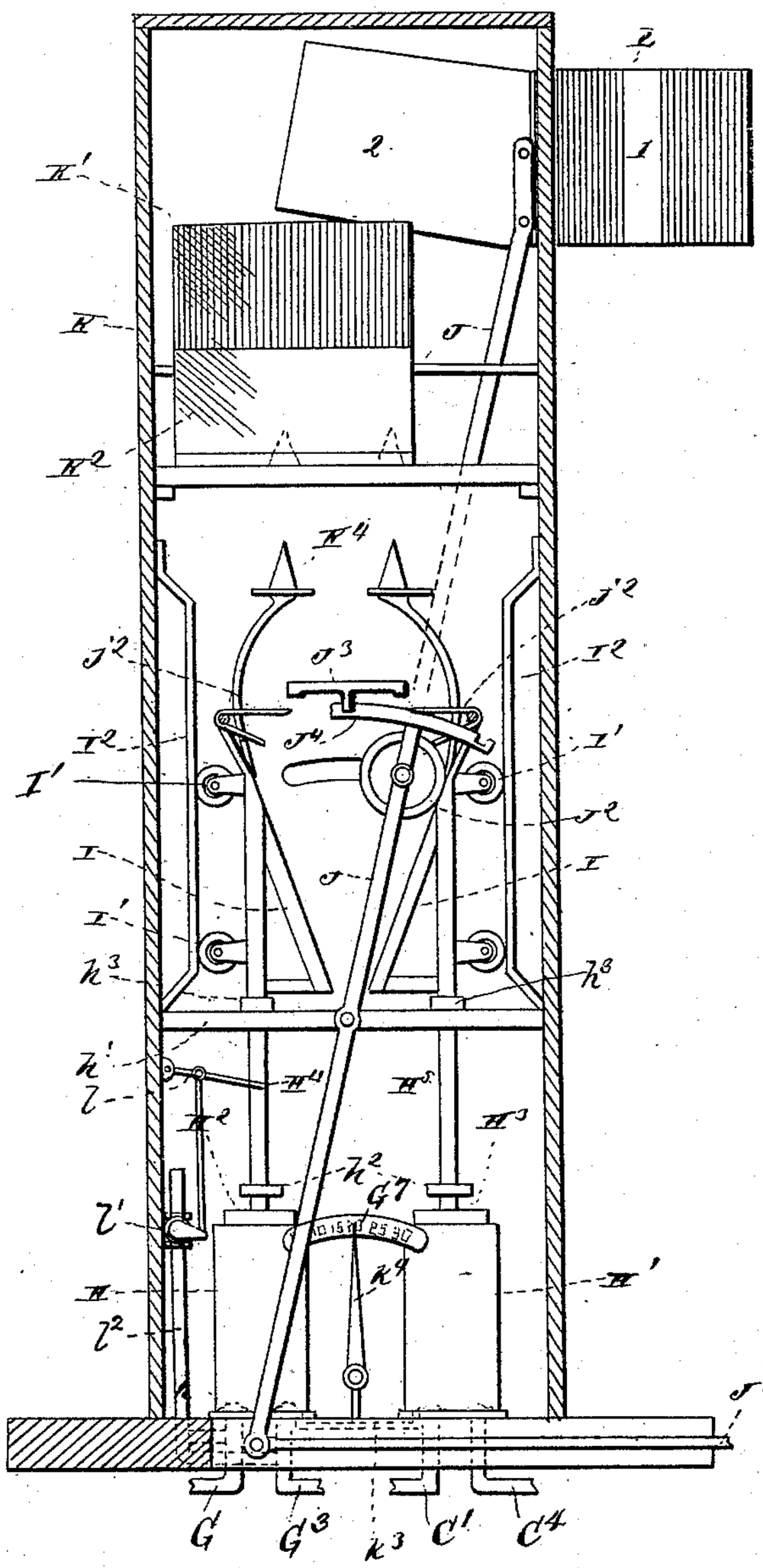
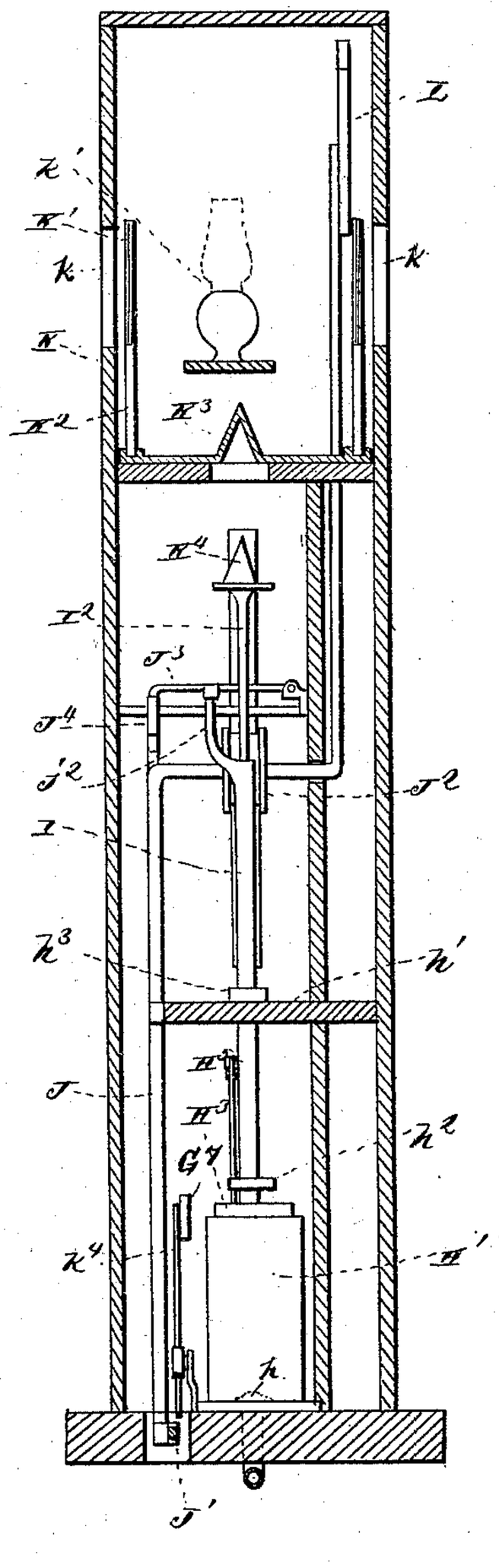


Fig. 9.



WITNESSES:

Samuel Ker

Philip C. Masi.

INVENTOR

William Raab

BY E. W. Anderson

his ATTORNEY.

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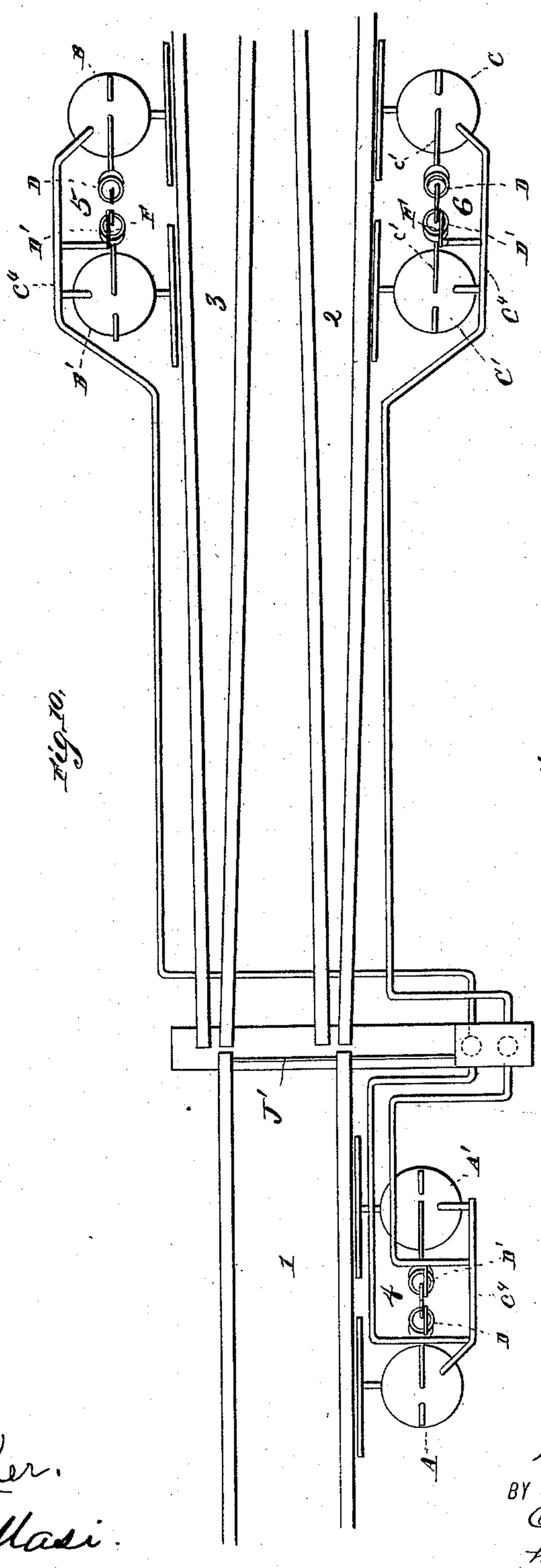
W. RAAB.

RAILWAY SWITCH.

No. 477,609. Patented June 21, 1892.



WITNESSES:

Daniel Ker.

Philip C. Masi.

INVENTOR

William Raab

BY E. W. Anderson

his ATTORNEY.

(No Model.)

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W. RAAB.

RAILWAY SWITCH.

No. 477,609. Patented June 21, 1892.

Fig. 19.

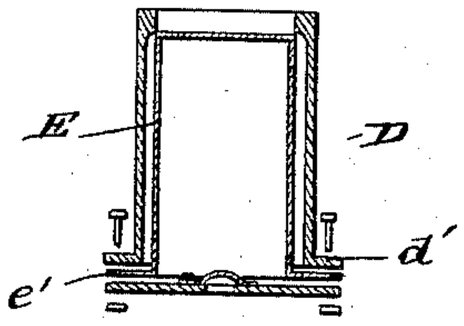


Fig. 24.

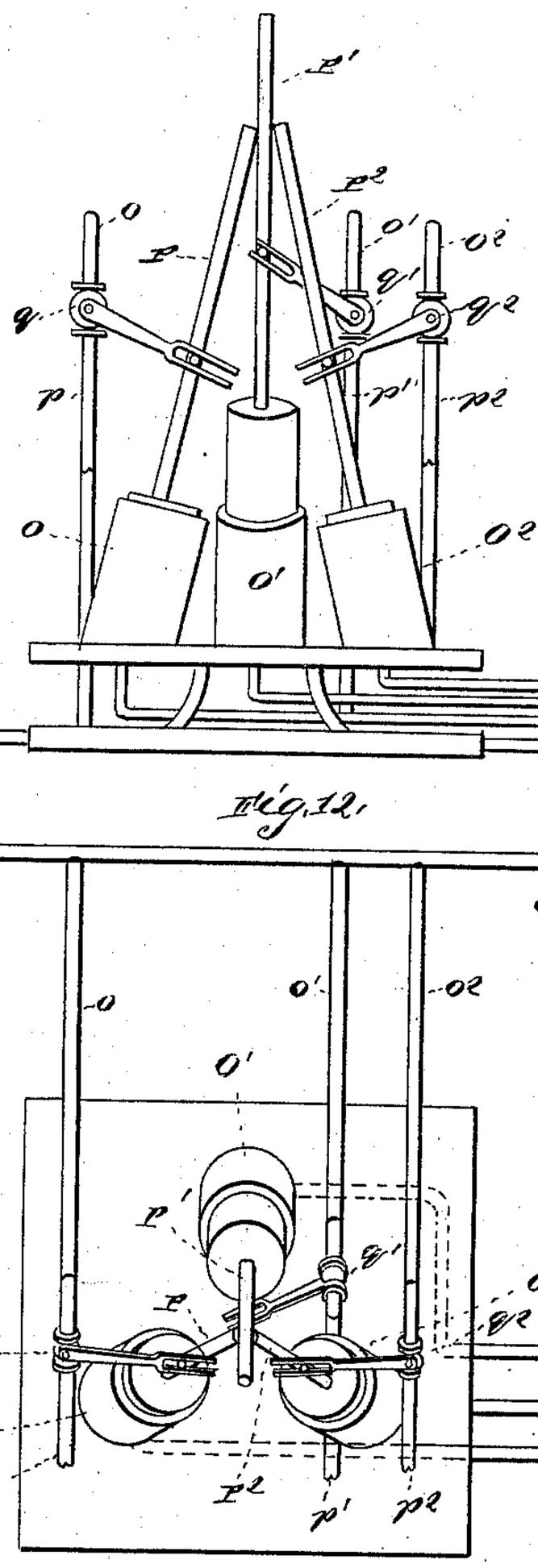


Fig. 20.

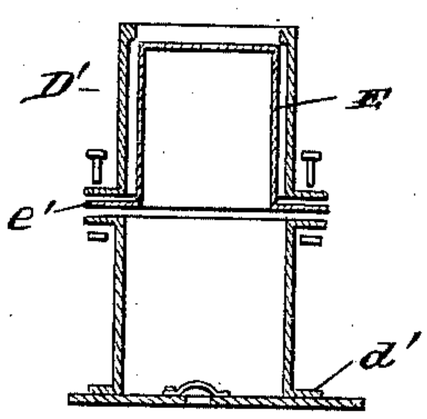


Fig. 12.

WITNESSES:

Samuel Ker.

Philip C. Masi.

INVENTOR

William Raab

BY

E. W. Anderson

his ATTORNEY.

(No Model.) 9 Sheets—Sheet 7.

W. RAAB.

RAILWAY SWITCH.

No. 477,609. Patented June 21, 1892.

Fig. 13.

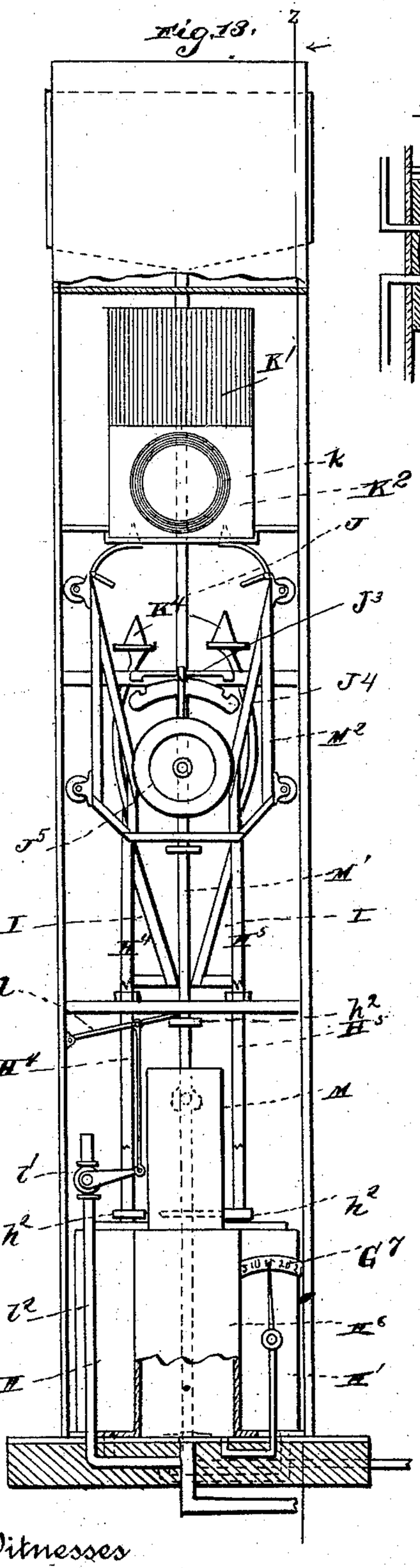


Fig. 23.

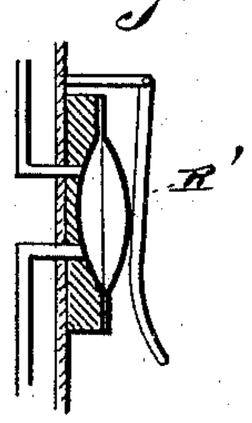
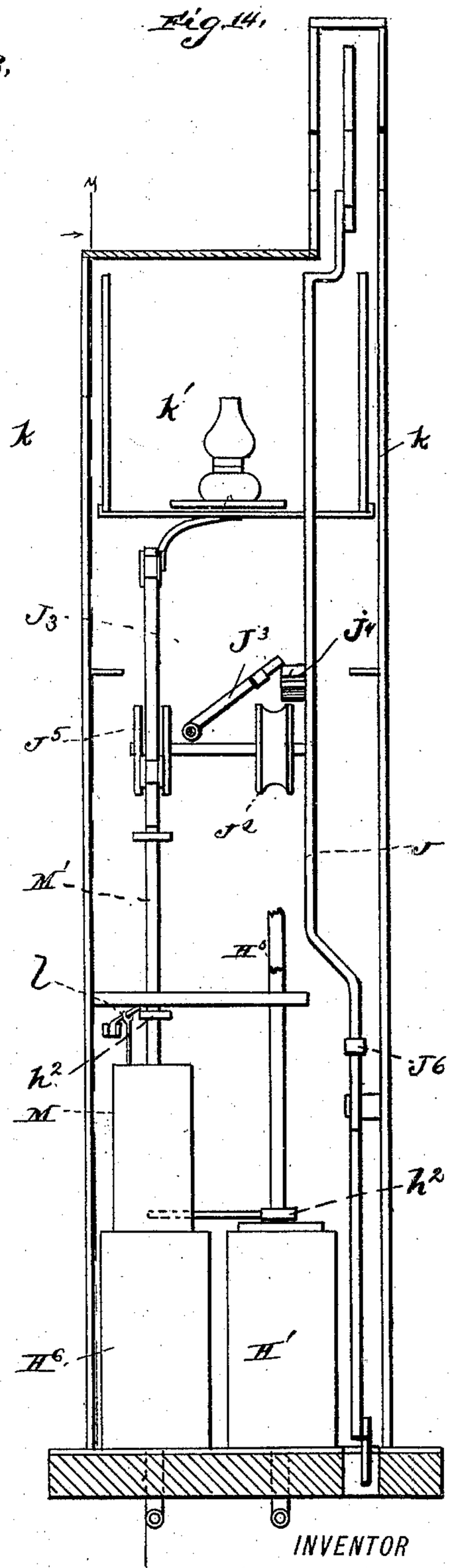


Fig. 14.



Witnesses

Samuel Ker.

Philip C. Masi.

INVENTOR

William Raab

BY

E. W. Anderson

his ATTORNEY.

(No Model.) 9 Sheets—Sheet 8.

W. RAAB.

RAILWAY SWITCH.

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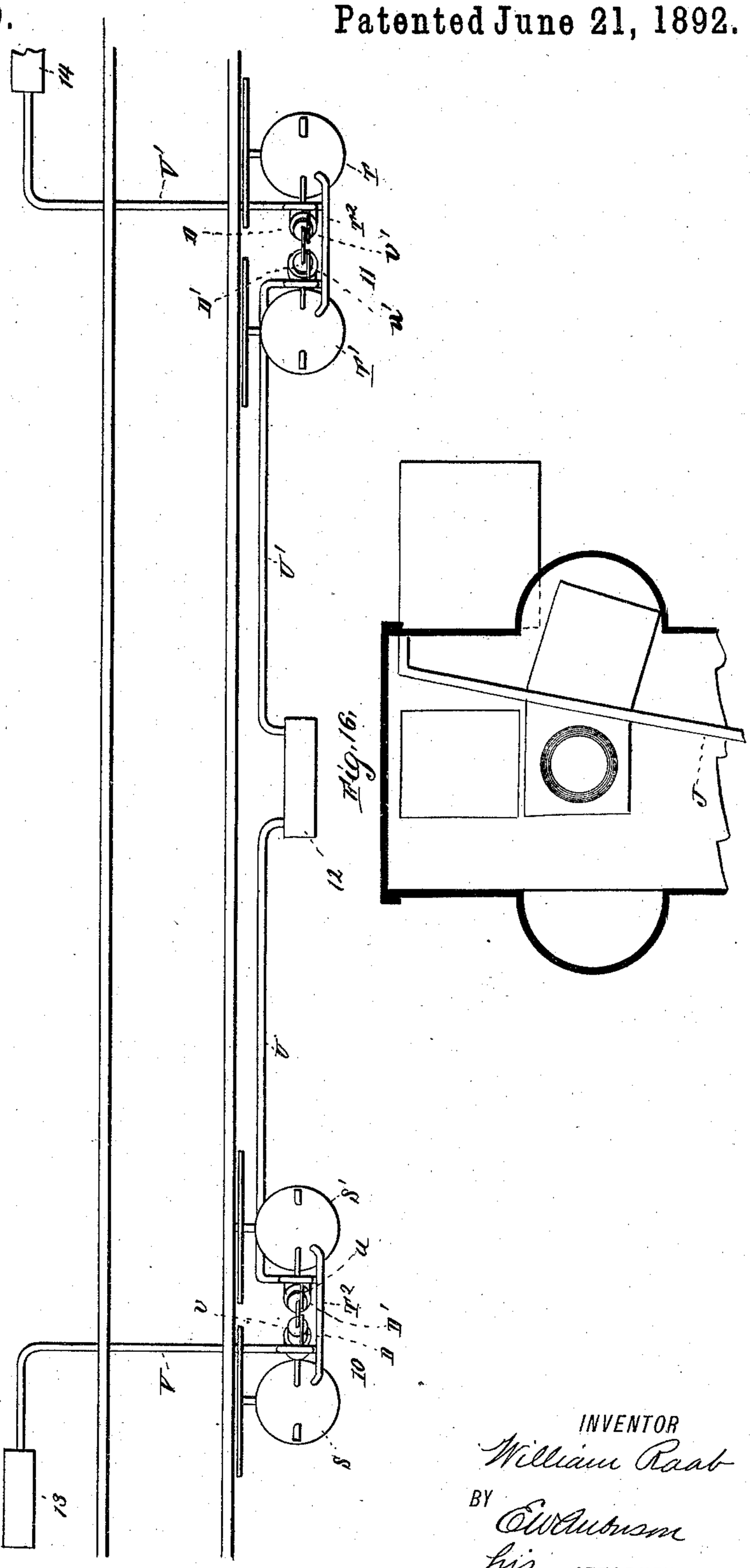


Fig. 15.

WITNESSES:

Samuel Ker

Philip C. Masi.

INVENTOR

William Raab

BY E. W. Anderson

his ATTORNEY.

(No Model.) 9 Sheets—Sheet 9.

W. RAAB.

RAILWAY SWITCH.

No. 477,609. Patented June 21, 1892.

Fig. 18.

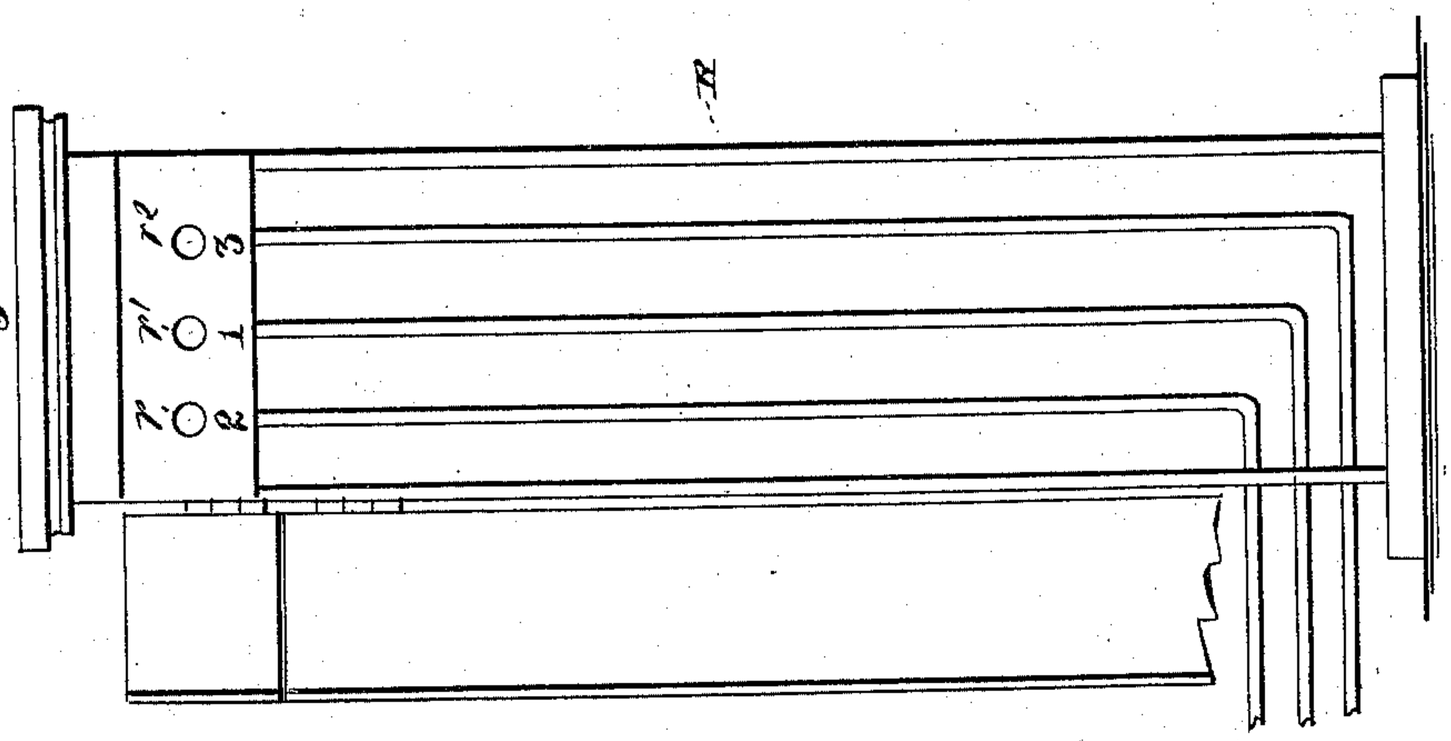
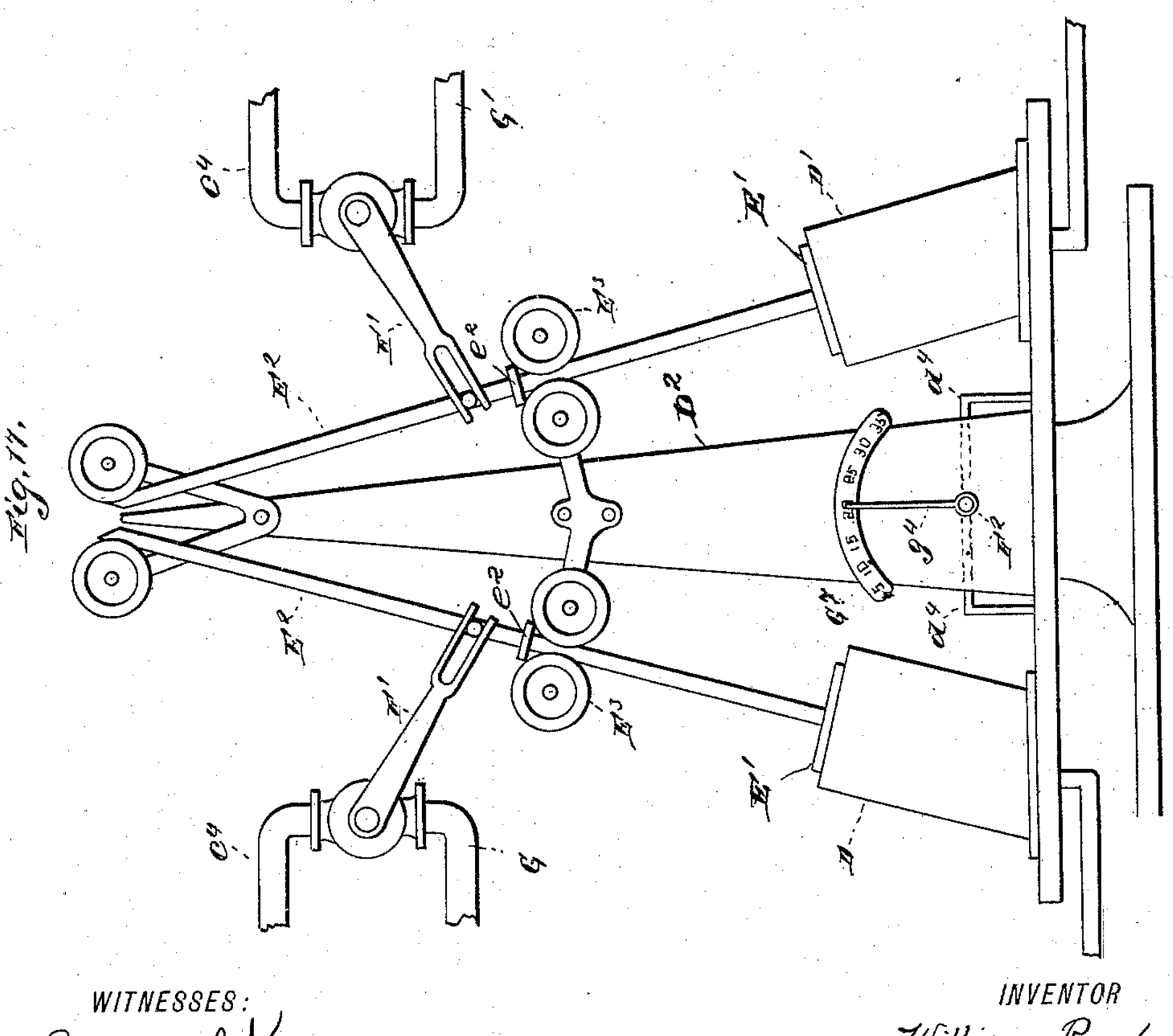


Fig. 17.



WITNESSES:
Samuel Ker
Philip C. Masi.

INVENTOR
William Raab
BY E. W. Anderson
his ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM RAAB, OF CEDAR FALLS, IOWA, ASSIGNOR OF ONE-HALF TO DANIEL WILD, OF SAME PLACE.

RAILWAY-SWITCH.

SPECIFICATION forming part of Letters Patent No. 477,609, dated June 21, 1892.

Application filed May 21, 1891. Serial No. 393,632. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM RAAB, a citizen of the United States, and a resident of Cedar Falls, in the county of Black Hawk and State of Iowa, have invented certain new and useful Improvements in Railway-Switches; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

Figure 1 is a plan view. Fig. 2 is a sectional detail of one of the pumps. Fig. 3 is a detail top plan of one-half of the same. Fig. 4 is a detail of the pump-spring. Fig. 5 is a side elevation of one of the governors. Fig. 6 is an enlarged sectional view, partly broken, of same. Fig. 7 is a detail of the pump-operating shoe. Fig. 8 is a sectional view of the switch-post, showing the switch-operating mechanism. Fig. 9 is a similar view from the side. Fig. 10 is a plan view of a modification of Fig. 1. Fig. 11 is a detail view of the lifting device. Fig. 12 is a top plan view of a three-cylinder governor with regulating-pipes connected thereto. Figs. 13 and 14 are side and front views, respectively, in section, showing arrangement of switch-posts for three tracks. Fig. 15 is a plan view of signal-operating mechanism. Fig. 16 is an enlarged detail view of the target and switch-signal. Fig. 17 is a side elevation of a modified form of governor. Fig. 18 is an elevation of a mouth-tube casing with side removed to show the governor circulating-pipes. Figs. 19 and 20 are detail views, in section, showing different forms of pressure-cylinders. Figs. 21 and 22 are sectional details of the time-valve. Fig. 23 is a sectional detail of a small pump for the mouth-tubes. Fig. 24 is a side elevation of Fig. 12.

This invention has relation to railway-switching and switch-signaling where pneumatic pressure generated by the passage of trains is used for effecting the operation of the proper switches and signals.

The objects of the invention are, first, to provide for the automatic operation of switches and switch-signals, and, second, the provision of an automatic governor therefor to effect their operation at and for the proper time.

With these objects in view the invention consists in the arrangement of pumps in such a manner as to furnish the required power by the passage of trains; further, in the construction and arrangement of governors connected with said pumps and of time-valves in connection therewith to govern their operation; further, in the construction and operation of switch and signal mechanism controlled by the governors and operated by the pumps and the proper connections therefor; further, in the time-valve devices connected with said switch-signals and switches, and, finally, in the general construction and arrangement of parts, as hereinafter fully specified.

In Fig. 1 of the accompanying drawings I have shown the general location and arrangement of pumps, switch-governors, switch-operating mechanism, and connections as applicable where one side track is used in connection with the main line. In this figure, 1 represents the main track, 2 the main-line switch, and 3 the side track. 4 is the governor connected with the main-line track, 5 the governor connected with the main-line switch, and 6 the governor connected with the side track. 7 is the switch-post. A A′ are the pumps operating governor 4, B B′ similar pumps for the governor 5, and C C′ the pumps of governor 6. These pumps are adapted to be operated by the passage of the car-wheels, being of similar construction to those shown and claimed by me in my patent, No. 454,767, granted June 23, 1891. A curved spring-bar *a* is secured or clamped to the ties, projecting at its central portion sufficiently above the rail to be engaged and depressed by a car-wheel. This bar is of sufficient length to receive the rear truck of a car before the forward truck has left it, so that but one action is given by the passage of a car, or, rather, rendering its action continuous during the passage of a train. Underneath this bar is a lever *a′*, connected to the pump, as illustrated in Fig. 2, so that when said lever is depressed by the action of the bar the pump is set into operation, as de-

tailed in my patent above referred to. The pump-lever a' is actuated by the springs a'' to return it to its normal position.

In order to aid the bellows b of the pump and allow a quicker action thereof, springs b' are placed thereon, bearing against the brass pressure-plate b^2 thereof. Two of these springs are preferably employed, arranged to cross each other, as shown in Figs. 3 and 4, and consisting each, preferably, of several spring-wires placed closely together and connected at their ends. I prefer this form of springs as having long life and durability.

I prefer to connect the bar a to the ties as illustrated in Fig. 7, in which the ends are held in the jaws $a^\times$ in such a manner as to allow an endwise movement of the bar under pressure.

Connected with the exhausts c of each pair of the pumps is a pipe c', communicating with its respective governor, which may be at any distance from said pumps. One of these governors is clearly shown in Figs. 5 and 6, and is constructed as follows: Inclosed in a suitable box or casing are two cylinders D D', preferably of glass, arranged on the two sides of a center post D^2 and inclined toward each other, as shown. These cylinders are open at each end and at their lower ends have each an exterior shoulder d', by means of which they are securely held in their seats on the bed-plate of the closure or casing. The pipes c' from the respective pumps A A' communicate each with the bottom of one of the cylinders through the bed-plate, a check-valve d^3 being provided opening into the cylinder and closing said pipes. In each of these cylinders is a flexible air-tight gutta-percha or rubber bag E, open at its lower end and either cemented firmly to the inside of the cylinder or provided with an outwardly-turned flange e', which is held or clamped between the lower end of the cylinder and its seat, in which case it also serves as a packing to form an air-tight joint. Resting on the upper closed ends of these bags E in each cylinder is a piston E' on a rod E^2, which works or travels between grooved guide-wheels E^3, carried by the center post. These pistons are preferably of non-corrosive metal and may be either hollow or solid. I prefer to make the cylinders of glass, as by so doing the bags therein may be readily inspected from the outside. They are also not liable to burst under the pressure employed, and being smooth do not injure the bags. As the cylinders are held in an inclined position, as above stated, the piston-rods are also inclined, meeting at their upper ends. The said upper ends are each cut obliquely at an angle corresponding to the angle of inclination of the opposite piston-rod, so that when one is in raised position it passes over and bears against the upper end of the other and prevents it being raised. A set-collar e^2 on each rod limits its downward movement.

If pump A be first set in operation by the car-wheels, sufficient air will be forced through its respective pipe c', communicating with the cylinder D, to inflate the flexible bag, raising the piston resting thereon and its rod. This will be done instantaneously, so that when the pump A' is set into operation by the wheels and air is forced through its pipe to the cylinder D' the piston in said cylinder cannot be operated, being held down by the rod operated from cylinder D, so that the air from both pumps is forced into the pipe c^4, connecting the exhausts of each pair of pumps, the operation of the pistons being the reverse if the train is passing in a direction to operate the pump A' first. It will not be possible for air from one pump to pass through into the other and thence to the wrong cylinder, inasmuch as before sufficient air can pass to the second pump to fill it and effect the operation of the wrong piston the first piston will be raised and the other prevented from operation. However, as a further security a lift-valve may be provided at the exhaust-outlet, which will not open until the pressure in the pump has become great enough to operate the piston in the cylinder. The pipe c^4, connecting the exhaust or outlet of the two pumps A A', has the branches c^5 c^6, supported upon braces or columns of the frame. These branches extend one on each side and are provided each with a valve F. Connected to each of these valves is a lever F', having at its opposite end a fork f, which engages a stud or pin f' on the piston-rod, so that as the piston-rods are raised and lowered the corresponding valve is opened or closed by the lever, or the reverse, according as it is set. When either valve is opened, the air from pipe c^4 is allowed to pass into a pipe G or G', respectively connected to the branches c^5 c^6, and is thence conducted to the switch or signal post 7. After the pumps are stopped the valve d^3 is closed by the pressure of the air in the cylinder. The air therein then escapes into a pipe d^4, a branch of which communicates with each cylinder and leads to a time-valve F^2, suitably located, as on the center post. This valve (shown clearly in Figs. 21 and 22) consists of the shell or casing g, into which lead the branches of the pipe d^4. In this shell is a core g^2, in the surface of which is formed a groove g^3, extending partially around its circumference, having at one end a greater depth and gradually narrowing and decreasing in size until it comes to a point at the opposite end. Connected to this core is a pointer or hand g^4, which moves on a register-dial or numerically-marked plate G^7, preferably on the center post. The core is so arranged that the air from the cylinder entering this valve from the pipe d^4 in order to escape must pass through the tapered groove g^3, and this groove is so arranged that the size of that portion thereof which forms the communication between the inlet and outlet of the valve will depend upon the position which the hand occupies upon the dial, so that said hand may be set at any prede-

termined time, upon which will depend the time occupied by the air in escaping from the cylinder, according as a larger or smaller opening is afforded for its passage through the valve, so that by setting the hand at any figure representing a given time a corresponding time will be occupied by the air in escaping from the cylinder or the bag therein. As long as the bag remains full of air, the piston-rod will remain in its raised position, holding the valve F open; but as soon as the air therein becomes exhausted the piston will fall by its own weight, thereby closing said valve. As the amount of air in the cylinder or bag is the same at each operation, the time occupied by its escape and the length of time the valve remains open will be always the same with the gage set at the same point. The core fits closely in the shell or casing *g*, so that no escape of air is possible except through the outlet. As the piston falls in the cylinder the bag folds into place beneath it ready to be expanded when pressure is again generated by the pumps. The guide-rollers carried by the center post hold the piston-rod steady to its movement. The top of said post is also grooved to act as a further guide therefor. If desired, the pipe c^4, instead of connecting the two pumps, may lead directly from each pump into the conducting-pipe G or G′, as shown in Fig. 17. As before stated, these pipes G G′ lead to the switch and signal operating mechanism in the post 7, as shown in Fig. 1. In this figure the governors 5 and 6 (similar in construction to the governor 4, above described) are shown as having only one pipe leading to the switch-post, as will be hereinafter more fully described.

The switching and signaling is effected in the manner and by the mechanism now to be described, said mechanism being clearly shown in Figs. 8 and 9.

In the post 7 are two cylinders H H′, of similar construction to those described in connection with the governors, but which are placed in an upright or vertical position. Each cylinder has therein a flexible bag, also similar to those used in the governors. Communicating with these cylinders are the pipes from the various governors or pressure-supplies, as more fully hereinafter specified, each pipe having a check-valve *h* opening into the cylinder. H^2 and H^3 represent the pistons of the respective cylinders, and H^4 and H^5 their respective rods, which are supported and travel in guides in cross-pieces *h′* of the post-frame, their upward and downward movements being limited, respectively, by the stop or set collars h^2 and h^3 thereon. The upper portion of each rod H^4 and H^5 carries a wedge device or cam I on its inner face, said rods also having the guide-rollers I′, which travel on vertical tracks I^2 on the post-frame in order to steady their stroke.

J is a vertical bar or lever arranged centrally of the two cylinders and pivoted at its intermediate portion to a cross-piece of the frame of the post. At its lower end it is connected to the switch-bar J′. This bar or lever J carries a grooved wheel or roller J^2, and when either of the piston-rods is raised by the expansion or inflation of its flexible bag the cam or wedge I carried by that rod will be forced into contact with said wheel J^2, thereby forcing said lever out of its vertical position toward the opposite side and by means of its connection with the switch-bar J′ move said bar to effect the proper switching of the tracks. When the piston-rod has reached the limit of its upward movement and the switching is effected, a suitable catch-lever device J^3, Fig. 11, engages a tooth on a catch-bar J^4 on the lever J to hold the lever and switch in position, where it will remain until the next operation of either piston. When either piston is again operated and the rod begins its upward stroke, a lifting device J^2, carried by the wedge, comes in contact with said catch-bar, raises it, and releases said catch-lever, allowing the switch-lever J to be again operated by the cam or wedge, the catch again locking it. When the piston-rod falls, the lifting device, which may be of spring character or loose under upward pressure, will pass by the catch-lever without releasing it. To more fully describe this operation, it may be stated that the lifting device j^2 possesses sufficient rigidity to raise the catch-lever J^3, by which operation it will be compressed so as to pass said lever as it is forced upwardly by the movement of the piston-rod, permitting said lever to assume a position where it will again engage the bar J^4 when the operation of the lever J has been completed. As above stated, when the piston-rod falls said lifting device is sufficiently loose under upward pressure thereon to pass the catch J^3. It will be seen that when either cam or wedge is raised and the lever J is in its extreme side position it will be impossible for the piston in the other cylinder to be operated, as the wheel J^2 is held against the wedge or cam on its piston-rod sufficiently to prevent it from being raised. Therefore but one piston can be operated at a time, so that if one piston has been operated by the passage of a train over one governor and the track is set therefor a train passing over one of the other governors cannot throw back the switch until the expiration of the time to which the time-valve is set.

K represents the signal mechanism of the switch-post.

k is the usual stationary glass-covered opening on either side, behind which is placed the lamp *k′*, also stationary.

K′ is the red glass, and K^2 the blue glass, (I specify "red" and "blue," as they are the usual colors employed,) arranged on each side and adapted to move between the lamp and opening *k*. The red glass is normally exposed at the opening. When, however, either piston is operated and the corresponding switch set, a lifting device K^4, carried by the cam or

wedge of the piston-rod, engages the frame K^3 and raises it to bring the blue glass before the openings, thus giving notice that the switch is all right to the engineer and trainmen. When the piston falls, the frame K^3 will also fall, bringing the red glass again before the openings *k*, the blue glass falling out of sight.

L is the target carried by the upper end of the lever J above the glasses and bearing, preferably near each edge, the respective numbers of the track. When the piston in cylinder H is operated and the lever J moved to effect the switching, the target will be protruded from the opposite side of the post, showing that the track operated by that cylinder is safe, said target being thrown out on the other side when the piston in cylinder H′ is operated. The opposite sides or fans of the target may be painted in different colors to be more readily distinguished in addition to bearing the number of the track which they show to be safe. An escape-pipe k^3 communicates with each cylinder in the same manner as the pipe d^4, described in connection with the cylinders of the governors, and is provided with a similar time gage and register k^4, by means of which the time required for the escape of the air from the cylinders may be governed, thereby determining the length of time the piston is elevated and the blue glass or light and target exposed. When the flexible bag in either cylinder is fully inflated and the piston-rod has reached the limit of its upward movement, the set or stop collar h^2 thereon engages a lever *l*, as shown in Figs. 8, 13, and 14, which is connected to a safety or escape-valve *l′* in a pipe l^2, which communicates with the air-supply pipe of the cylinder. The check-valve of the cylinder being closed by the pressure of the air therein, the air from the pumps will then escape from the pipe and valve. The pipe l^2 may be connected with the supply-pipe of each cylinder and the valve-lever *l* be so arranged as to be engaged by the collar of either rod, rendering but one valve necessary. When the air in the cylinder is exhausted through the time-valve and the piston falls, the escape-valve will be closed by its own weight.

The general operation of the mechanism shown in Fig. 1 will now be described.

The air-conducting pipe G from governor 4 of the main track communicates with the cylinder H in the post, as does also pipe G^3 from the governor 6 of the main-track switch. Pipe G′ from governor 4 communicates with cylinder H′ of the post, as does also pipe G^4 from governor 5 of the side-track switch. If a train comes in on track No. 2, the first wheels of the engine strike the pump B of its governor 5, inflating the bag in cylinder D, raising its piston and rod, and opening the valve in the pipe c^4, allowing the air to pass through pipe G^4 to the switch-post into cylinder H′. The piston in said cylinder is raised, throwing the lever J to one side, as above described, which by means of its connection to the switch-bar throws track No. 1 to track No. 2, exposing the proper signal to show the trainmen that the track is safe. The piston-rod of the cylinder D being raised instantly by the pump B will hold down the rod of the piston in cylinder D′, so that when the train strikes the pump B′ no action in said cylinder will be possible. Likewise a train coming in on track No. 3 will strike the pump C of governor 6, sending the air through its pipe G^3 to the cylinder H of the switch-post, raising its piston and throwing the lever J to the opposite side, switching track No. 1 to No. 3, and exposing the proper signal. As the train from either track passes out on the main line the first wheels of the engine will strike the pump A′ of governor 4, opening the valve and forcing the air to cylinder H′ to close the track on No. 2 behind the train. A train coming in on the main line and ordered onto track No. 2 or No. 3 is stopped a moment before reaching governor 4, and one of the trainmen or employés steps on the curved rail or shoe *a* of one of the pumps A A′—on A′ if track No. 2 is to be taken, and on A if the train is to go onto track No. 3. By this sufficient pressure will be generated in the cylinder connected with the pump stepped upon to open its respective valve, so that when the train reaches the pumps the pressure generated by both will pass through the pipe G or G′, as the case may be, to the cylinder H or H′ to make the proper switch and expose the signals to notify the trainmen that the track is open. As but one of the pistons in the governor and switch can be raised at once, it will be seen that a second operation is not possible until the time set by the gages has expired and the pistons raised by the first operation have fallen. The signals will then be withdrawn and notice thereby given that the first train is safe and the tracks clear. Sufficient pressure cannot be generated by stepping upon the shoe *a* to operate the switch, but only enough to open the valves in the pipes connected to the governor. A train running from track No. 1 onto either No. 2 or No. 3 reaching the first pump B′ or C′ of the respective governors will operate it to open the valve operated by the piston actuated by said pump, allowing the air to escape, there being no pipe connection therewith to the switch-post. If, however, it is desired to always leave the main line open behind the train, a pipe G^6 (shown in dotted lines, Fig. 1) may be connected with the said valve or governor 6, running to cylinder H′, so that when the train reaches the pump C′ it will operate to throw the switch back to track No. 2, the time-gages being previously set to allow this operation. No such connection will be needed with governor 5, as the track is already open.

In Figs. 13 and 14 I have shown a switch-post adapted for use with a main track and two side tracks, an additional cylinder H^6 being provided at the center in front of cylin-

ders H and H′. The lever J in this construction carries a second wheel J^5 in front of the wheel J^2, operated by the wedges or cams of the piston-rods H^4 and H^5. This wheel J^5 is operated by a double wedge or cam device M^2, carried by the piston-rod M′, operated by the piston M in the cylinder H^6, said cams or wedges engaging the opposite sides of said wheel J^5 when said piston-rod is raised. The lever J is universally pivoted or hung, so that when said wheel J^5 is engaged by the cam it operates the switch-bar to effect the switching for the middle track. The lever is raised by this movement and protrudes the target at the top of the post, bearing its proper number or color for its track at such portion. To provide for this vertical movement, the lever J has a vertical play on its pivot. The lifting device for the glasses, the locking-catch, and the connection with the safety-valve are all similar to the devices described in connection with the two track-posts. Proper communication with each cylinder is made from the respective governors, as above described. In this construction when the piston in cylinder H^6 is operated, should the lever J be at its extreme side position from a previous operation from the cylinders H or H′, the first action of the double cam or wedge device M′ will release the lock and bring said lever to a vertical position. In this position it is clamped between the two wedges or cams, and consequently, being incapable of a lateral movement, is raised thereby, carrying with it the catch J^4 and raising or tilting the lever J^3. The lever J will be retained in this raised position until the piston in the cylinder H^6 falls, carrying with it the cams or wedges. The lever J when in such position is not locked by the catch-lever J^3, (which is simply lifted thereby,) but is retained by the pressure on the piston until the expiration of the time to which the escape-valve is set. In order to prevent the lever J from dragging on the base of the stand, a collar J^6 may be formed thereon, which by its engagement with a support on the frame or, as shown, with the pivot will prevent said lever from dropping to such an extent as to contact with the base. A vertical movement will not be given said lever J by the elevation of the pistons in either of the cylinders H or H′ for the reason that the inclined faces of their cams or wedges I, which contact with the grooved wheel J^2, cannot exert any lifting force thereon, their action being in a lateral direction only.

In Fig. 10 I have shown an arrangement similar to that shown in Fig. 1, with the exception of the governors 5 and 6. These governors are constructed with only one valve F in connection therewith, arranged in each to be operated by the action of pumps B′ and C′, respectively, and cylinders D′. This valve is arranged in a branch of the pipe c^4, connecting the two pumps, so that when it is opened the air will escape without passing to the switch-post. By this arrangement a train running on the main track ahead on track No. 2 or No. 3 reaching the first pump of the governor will not operate the switch behind it, as the piston connected with the cylinder of the pump B or C cannot be operated after the train strikes the first pump. Trains running in on either of these tracks to the main line will operate the pump B or C, forcing the air directly to the proper switch-operating mechanism and raising the piston of the cylinder D not to open a valve, but to prevent the piston of the cylinder D′ being raised to open the valve F. The action of governor 4 is the same as specified in the description of Fig. 1.

Instead of raising the blue glasses by the lifting devices shown in Figs. 8, 9, 13, and 14 to show at the openings in the switch-post when the track is open, these glasses may be connected to or carried by the lever J in such a manner as to be properly exposed when said lever is moved to operate either switch, as shown in Fig. 16. In this construction the red glasses normally exposed at the openings are moved out of sight by the lifters actuated by the piston-rods and the blue glasses moved by the lever to take their places. When the piston-rod falls, the blue glasses fall back and the red lower into view. If the switch fails to operate from any cause, the red or danger signal only will be exposed.

I have hitherto described the governors as having but two cylinders; but it will be understood that any number may be employed, arranged in circular form around the center post and inclined toward the center, so that the piston-rods all come together at their upper ends, each of which is obliquely beveled to correspond with the angle of inclination of the rods, so that when any one of the rods is raised it will bear against and prevent the others from operating, as already described.

In Figs. 12 and 24 I have shown a governor having three cylinders and in connection therewith, Fig. 18, mechanism for closing the valves in their respective pipes leading to the switch-operating mechanism. This is designed for use where there are from two to four tracks or more to be switched into and out of one main track, one cylinder being provided for each track and obviates the necessity of stopping the train to effect the proper change in the governor-valves, an arrangement for three tracks being shown in the figure. In these figures (12 and 24) are the three cylinders O O' O^2, having, respectively, the piston-rods P, P′, and P^2. Q is the pipe connecting and receiving air from the pumps, and o, o', and o^2, pipes communicating therewith, and to which are connected the pipes p, p', and p^2, leading to the switch-operating mechanism for the respective tracks. q, q', and q^2 are the respective valves in the pipes o, o', and o^2 and are opened and closed, respectively, by the operation of the piston-rods P, P′, and P^2 in the same manner as described in connection with the two-cylinder governors. R, Fig. 18, represents the device for forcing

air to the various cylinders in order that any one of the piston-rods may be operated to open the valve which it operates and at the same time lock the others. This device consists of a suitable casing having the mouth-tubes r r' r^2, to which are connected pipes communicating each with the bottom of one of the cylinders of the governor. This may be located at any point and is under the control of the switchman or employé. The mouth-tubes may each bear a number designating the track which is controlled by its operation. By blowing in any one of these tubes sufficient air will be forced through the pipe connected therewith and communicating with one of the cylinders to raise the piston and open the valve operated thereby. These rods are only sufficiently heavy to open the valve (three-quarters of a pound being sufficient in some instances) and but a small amount of air is required to operate them; or instead of the mouth-piece a small bellows or other suitable pump R', Fig. 23, may be connected to the pipes for this purpose. Suppose it is desired that a train coming in on the main track shall take track No. 1, the proper switching for which is effected by the switch mechanism operated by pressure through the pipe p'. The switchman or operator applies the mouth or the pump to the mouth-tube r', leading to the cylinder O', which will raise the piston in said cylinder, opening the valve leading into pipe p', and at the same time holding down the other rods and keeping all the other valves closed. When the train reaches the pump, the pressure generated thereby will be forced through the pipe p' to effect the proper switching. Likewise by applying the pump to the mouth-tube r' or r^2 a similar operation is performed for its respective track. This style of governor may have a time-valve to regulate its operation, as described in connection with the two cylinder-governors.

In Fig. 15 I have shown an arrangement of the pumps and governors for a system of signals to give notice of the approach of a train. 10 and 11 represent two governors located at a suitable distance from each other and having the pumps S S' and T T', respectively, connected therewith. T^2 is the pipe connecting the two pumps of each governor. 12 is a signal-post located between the two governors, and 13 and 14 signal-posts, respectively, in advance of each governor. U and U' are pipes leading from the respective governors to the central post 12 and communicating with the pipe T^2 by valves u u', operated by the piston and rods of the cylinders D'. V and V' are pipes leading from the governor to the respective advance posts 13 and 14 and communicating with the pipe T^2 by means of the valves v v', operated by the piston and rods of the cylinder D. The signal mechanism at the posts may be of any construction capable of being operated by air-pressure, such as that described in connection with the switch-operating mechanism. The valves u u' and v v' are normally left open. A train approaching governor 10, striking the pump S, will raise the piston in the cylinder D, closing the valve v in the pipe V, and at the same time holding down the rod of cylinder D' and the valve u open, so that the air-pressure generated by the pump will be forced ahead through pipe U to the post 12 to display the signal denoting the approach of the train. When the train has passed the signal and reached the pump T', the valve u' will be closed by its operation, the valve v' held open, and the pressure forced ahead through pipe V' to post 14 to display the signal there. If a train comes in the opposite direction, the operation is the same, forcing the pressure to the middle post and then to the advance post 13. In either case all valves are closed to prevent the signals being displayed behind the train and the pressure forced ahead to operate the signals in advance. The same arrangement is applicable to switches in place of the signal-posts. When there is only a middle signal 12 to be operated, as at a crossing, to give notice of the approach of a train from either direction, the pipes V V' are dispensed with and the valves v v' arranged so that when open they will allow the air to escape. The time-valves may be set to insure the display of the signals the proper length of time, and by varying the distance at which the governors are located from the crossing they may be displayed when the train is at any distance.

Figs. 19 and 20 represent different forms of cylinders which may be employed. Fig. 19 shows the form already described. Fig. 20 shows the cylinder made in two sections—an upper and a lower—secured together by flanges and bolts therethrough. The flexible bag is one-half the length of the cylinder and is secured between the two flanges. When inflated it occupies the upper half or section and when at rest falls down into the lower section.

The apparatus herein described may be successfully employed in yards where a large number of tracks are used. It is evident that these governors may be of any size and may be operated by hydraulic as well as by pneumatic pressure and that they may be used in connection with other mechanism for which a governor is necessary. It is also evident that the arrangement and construction described may be slightly varied in details without departing from the spirit and scope of the invention; but,

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

1. The switch-operating mechanism actuated by pressure generated by the passage of the train, and time-controlled governors between the generators and the switch-operating mechanism, substantially as specified.

2. The combination, with the pneumati-

cally-operated switch and signal mechanism, of the train-actuated pumps and the time-controlled governors in connection with said pumps, substantially as specified.

3. The governor having the flexible expansible bags, the pistons operated thereby, and means for preventing more than one piston from being operated at a time, substantially as specified.

4. The governor having the cylinders, the pressure-supply connected therewith, the pistons in said cylinders, and a time-valve in the outlet to said cylinders for controlling the operation of said pistons, each piston when operated effecting a lock to prevent the operation of a second piston, substantially as specified.

5. The governor having the cylinders, the pressure-supply pipes communicating therewith, the valves therefor, the pistons operating in said cylinders, and the time-valve connected therewith, and means for preventing more than one of said pistons from being operated at once, substantially as specified.

6. The governor having the cylinders, the flexible bags therein, the pistons operated thereby, and the time-valve, and means for preventing more than one of said pistons from being operated at once, substantially as specified.

7. The governor having the cylinders, the pistons operating therein, the piston-rods connected thereto, and means for preventing more than one of said pistons from being operated at once, substantially as specified.

8. The governor having the inclined cylinders, the pistons operating therein, and the piston-rods having the obliquely-beveled upper ends, substantially as specified.

9. The governor having the inclined cylinders, the flexible bags therein, the pistons operated by said bags, the piston-rods so arranged that but one can be operated at the same time, and the time-valve, substantially as specified.

10. The governor having the inclined cylinders, the pressure-pipes communicating therewith, the valves therefor, the flexible bags therein, the pistons operated by said bags, the piston-rods having the meeting beveled upper ends, the pressure-outlets, and the time valve and register connected with said outlets, substantially as specified.

11. The combination, with the pressure-supply, the conducting-pipes connected therewith, and the valves in said pipes, of the governor adapted to operate said valves, and means operated by said governor, whereby but one valve can be opened at once, substantially as specified.

12. The combination, with the pumps, the pipes connected therewith, and the valves in said pipes, of the governor having the pressure-actuated pistons and the piston-rods operated thereby and adapted to operate said valves, and means for preventing more than one of said rods from being operated at the same time, substantially as specified.

13. The combination, with the pumps, the pipes connected therewith, and the valves in said pipes, of the governor having the pressure-actuated pistons, the piston-rods connected therewith and opening and closing said valves, means for preventing more than one of said rods from being operated at the same time, and a time-valve for governing the length of the operation of said rods, substantially as specified.

14. The switch-operating mechanism having the pressure-operated pistons, the rods connected therewith, and the wedge or cam device carried by said rods, said wedges or arms being so arranged that but one piston can be operated at once, substantially as specified.

15. The combination, with the switch-bar and the lever connected therewith, of the piston-actuated rods, and means carried by said rods for operating said lever, and devices on said rods, whereby but one piston can be operated at once, substantially as specified.

16. The combination, with the switch-bar and the lever connected therewith, of the piston-actuated rods, means carried by said rods for operating said lever, and means for preventing more than one rod being operated at a time, substantially as specified.

17. The combination, with the switch-bar and the lever connected therewith, of the piston-actuated rods, the wedge or cam devices carried by said rods and operating said lever, and the catch and catch-releasing devices, substantially as specified.

18. The combination, with the switch-bar and the lever connected therewith, of the piston-actuated rods, the wedge or cam devices carried by said rods and operating said lever, the catch and catch-releasing devices, and the escape time-valve, substantially as specified.

19. The combination, with the switch-bar and the switch-lever connected therewith, of the lever-operating mechanism comprising the cylinders, the pipes communicating therewith, the flexible bags therein, the pistons operated by said bags, the piston-rods, the wedge or cam devices carried thereby, the time-valve, and the escape-valve, substantially as specified.

20. In a switch and signal apparatus, the combination, with the piston-rods and the cam or wedge devices carried thereby, of a lever connected to the switch-bar and operated by the movement of said piston-rods, and thereby operating signal devices, said lever and cam mechanism being so arranged that but one piston can be operated at the same time, and time-valves for governing the length of each operation, substantially as specified.

21. In a switch and signal apparatus, the combination, with the piston-actuated rods

and the switch-lever operated thereby, of the reciprocating glass-carrying frame actuated by said rods, and means whereby but one of said rods can be operated at once, substantially as specified.

22. In a switch and signal apparatus, the combination, with the piston-actuated rods and the switch-lever operated thereby, of the reciprocating glass-carrying frame operated by said rods, and the targets operated by said lever, the piston-cylinders, the time-gage, and the escape-valve operated by said piston-rods, substantially as specified.

23. The combination, with the piston-actuated rods and the switch-lever operated thereby, of the reciprocating glass-carrying frame operated by said rods, the targets operated by said lever, the piston-cylinders having time-valve-controlled outlets and escape-valve mechanism operated by said piston-rods, substantially as specified.

24. The combination, with the pumps, the conducting-pipes having the valves therein, and the governors arranged to operate said valves, said governors having means operated thereby, whereby but one valve can be opened at the same time, of the signals operated by pressure from said pumps in advance of the train, regulated by said governors, substantially as specified.

25. In a switch and signal operating device, the combination, with the piston-cylinders having pressure-outlets, of the pumps, the valved conducting-pipes leading therefrom, switch-operating mechanism connected with said pumps, and the governors arranged to control the admission of pressure through said pipes, and automatically-operated means whereby but one valve and one switch can be operated at once, substantially as specified.

26. The combination, with the cylinders, the pressure-supply pipes, and the valves therefor and the flexible bags therein, of the time-valve having the pipes communicating with said cylinders, and means whereby the piston in any cylinder cannot be operated until the expiration of the time set by said valve, substantially as specified.

27. The combination, with the pumps and the pipes connected thereto and communicating with switch and signal operating mechanism, of the governors adapted to operate valves in said pipes, said governors comprising a series of pressure-actuated pistons so arranged that but one piston can be operated at the same time, and means for controlling the operation of the governors, substantially as specified.

28. The combination, with the pumps and the pipes connected thereto and communicating with switch and signal operating mechanism, of the governors adapted to operate valves in said pipes, and pipes leading from said pumps to the operating mechanism of said governors, and means for preventing said governor from operating more than one valve at a time, substantially as specified.

29. The herein-described apparatus for operating switch and signals by pressure generated by the passage of the train, comprising a series of pumps operated by the train, pipes leading from said pumps to governors automatically operated by the pressure, valved pipes leading from said governors to the switch and signal operating mechanism, means whereby said governors are prevented from operating more than one valve at a time, and time-valves for governing the length of each operation, substantially as specified.

30. The combination, with the piston-cylinders and the pistons therein, of the piston-rods connected to said cylinders and so arranged that the upward movement of any rod will hold down and prevent all the other rods in the series from being operated, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM RAAB.

Witnesses:
DANL. WILD,
J. G. SEDGWICK.