(No Model.) 4 Sheets—Sheet 1

F. L. DODGSON.

SWITCH AND SIGNAL APPARATUS.

No. 513,231. Patented Jan. 23, 1894.

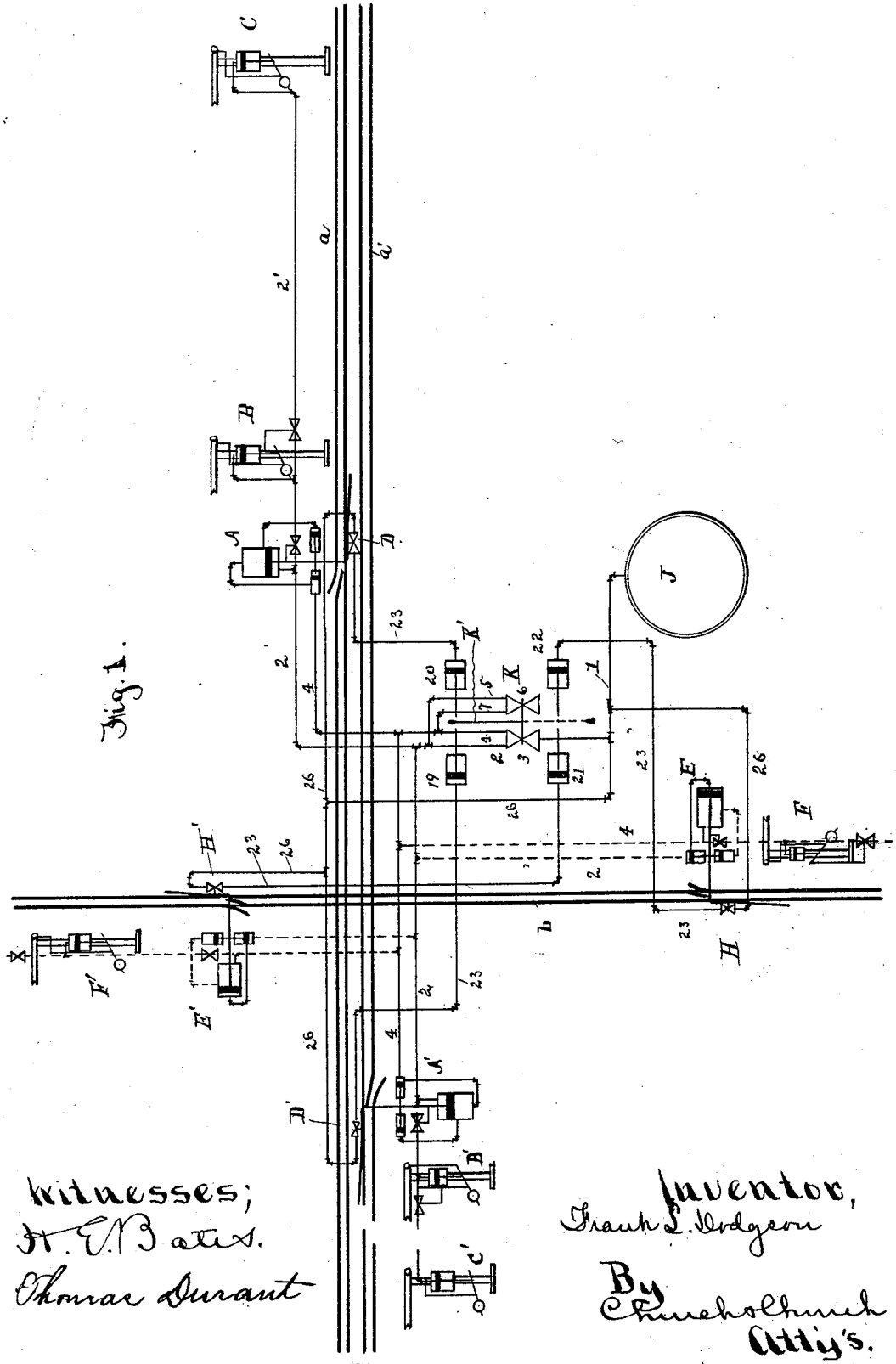

Fig. 1.

Witnesses;
H. C. Bates.
Thomas Durant

Inventor,
Frank L. Dodgson
By Church & Church
Atty's.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 2.

F. L. DODGSON.

SWITCH AND SIGNAL APPARATUS.

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Fig. 2.

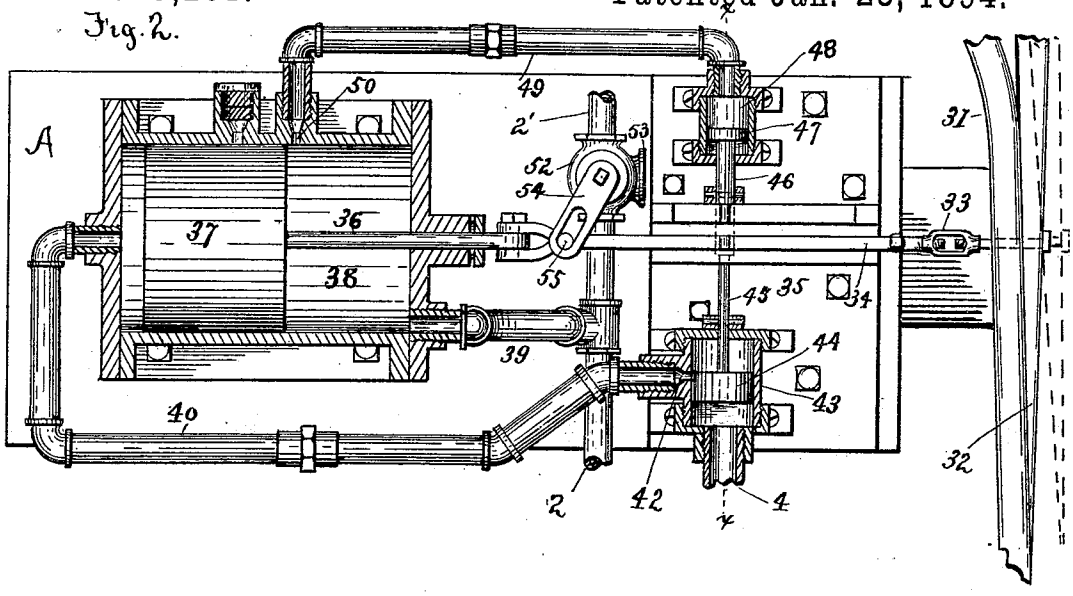


Fig. 3.

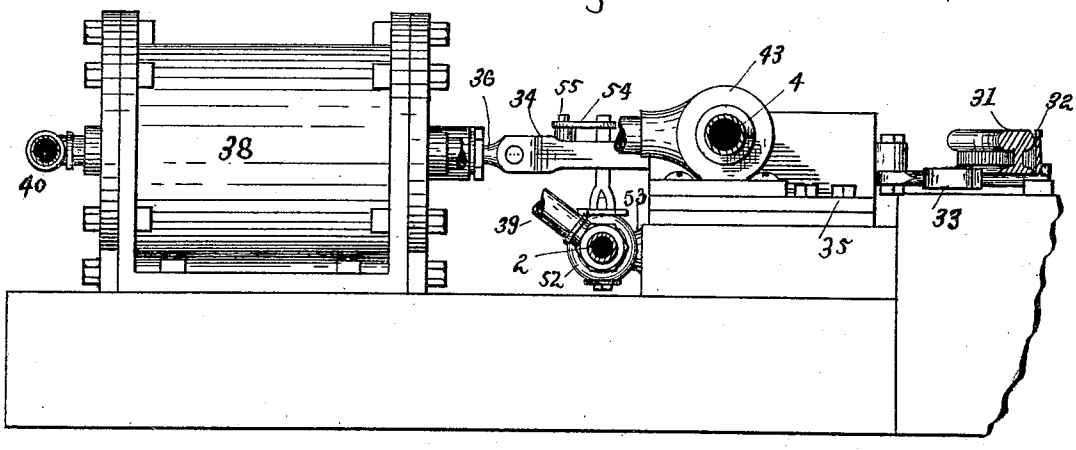
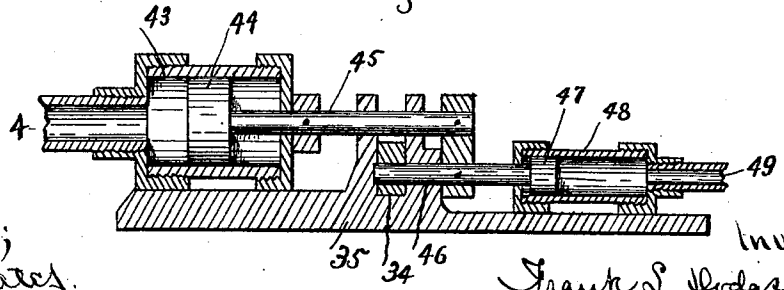


Fig. 4.



Witnesses;
H. E. Bates.
Thomas Durant

Inventor,
Frank L. Dodgson
By Church & Church
Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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F. L. DODGSON.

SWITCH AND SIGNAL APPARATUS.

No. 513,231. Patented Jan. 23, 1894.

Fig. 5.

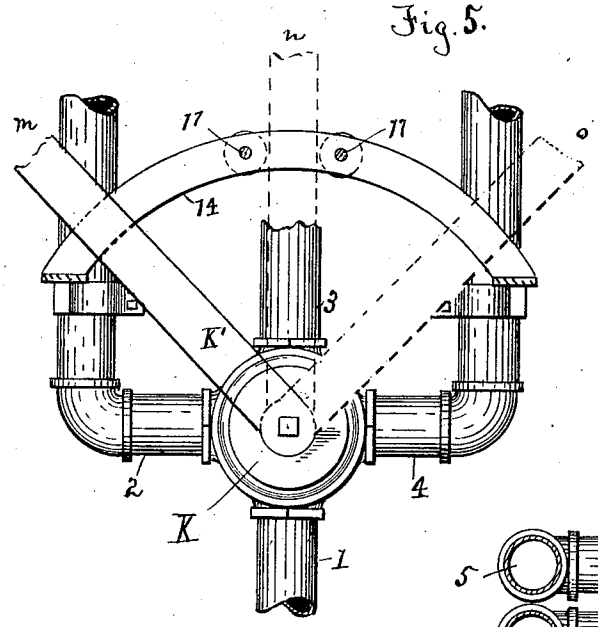


Fig. 6.

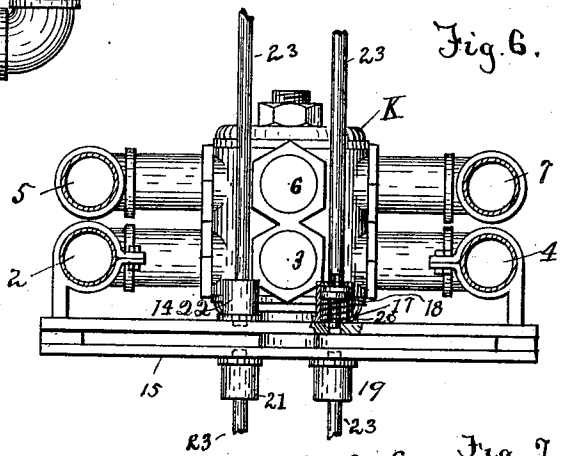


Fig. 8

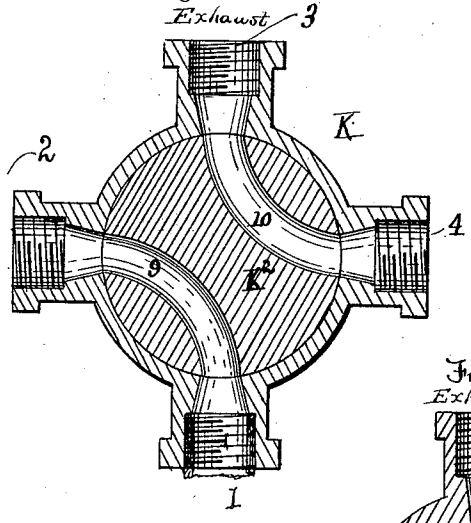


Fig. 7.

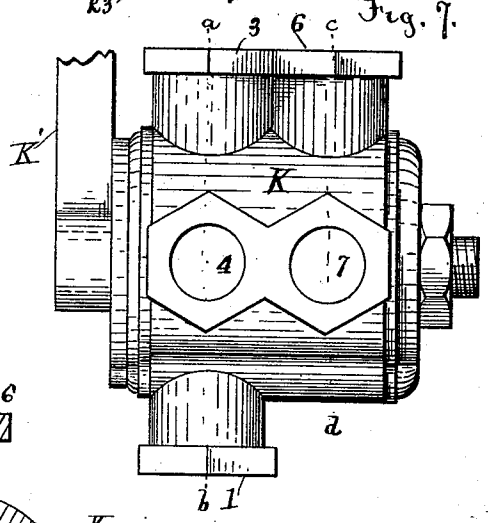
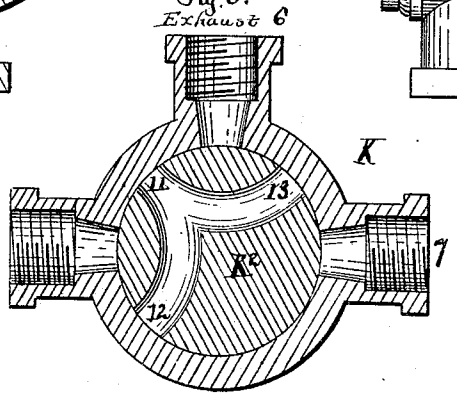


Fig. 9.



Witnesses;
J. H. Bates.
Thomas Durant.

Inventor,
Frank L. Dodgson
By
Church & Church
Atty's.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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F. L. DODGSON.

SWITCH AND SIGNAL APPARATUS.

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Fig. 10.

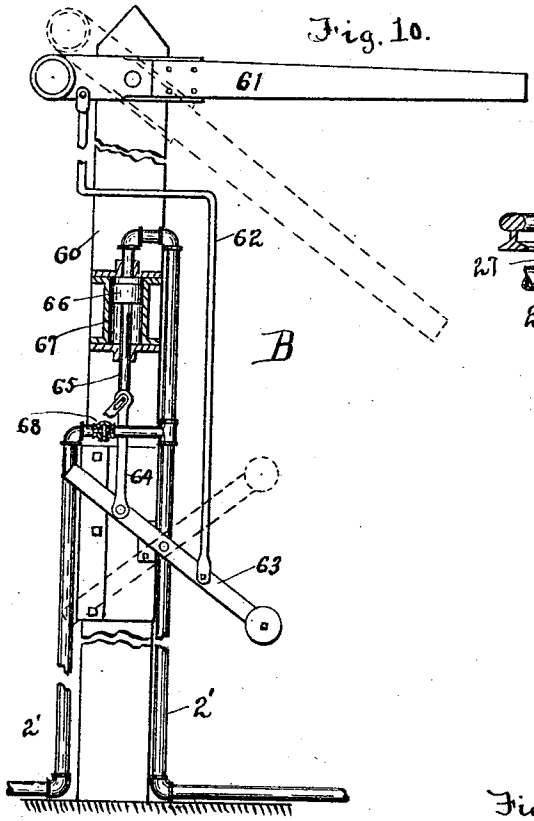


Fig. 11.

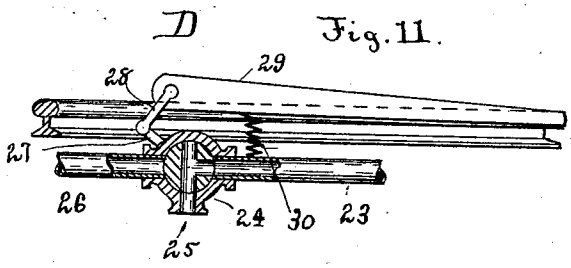


Fig. 12.

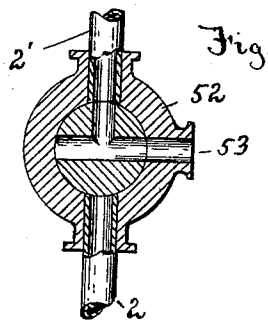
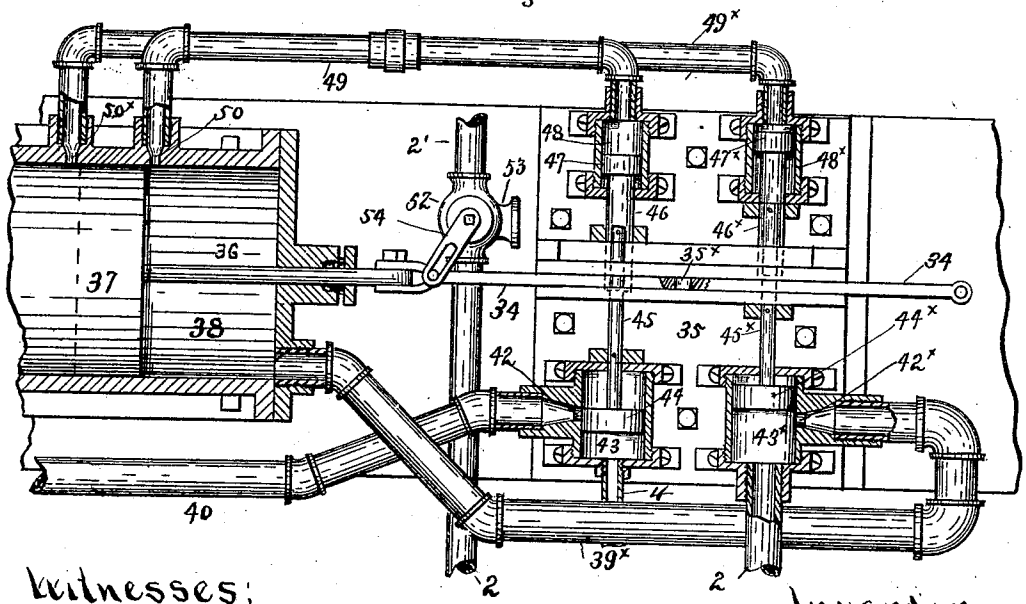


Fig. 13.



Witnesses;
H. E. Babis
Thomas Durant

Inventor,
Frank L. Dodgson
By Church & Church
Atty's.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRANK L. DODGSON, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE RAILWAY ELECTRIC AND AUTO-PNEUMATIC SIGNAL COMPANY, OF SAME PLACE.

SWITCH AND SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 513,231, dated January 23, 1894.

Application filed June 19, 1893. Serial No. 478,134. (No model.)

To all whom it may concern:

Be it known that I, FRANK L. DODGSON, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Switch and Signal Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference letters and numerals marked thereon.

My invention has for its object to provide improved signaling and switching devices for use on railways, and particularly at the crossing or intersection of two different lines of track, though capable of being used otherwise, and it consists in certain novelties of construction and combinations of parts, all as will be hereinafter fully described and the novel features pointed out in the claims at the end of this specification.

In the accompanying drawings: Figure 1 is a diagrammatic view showing my invention applied to a crossing having a double and single track; Fig. 2, a sectional plan of a switch or point-operating device; Fig. 3, an elevation of the same; Fig. 4, a cross section on the line *x—x* of Fig. 2; Fig. 5, an end elevation of the main controlling valve and operating lever; Fig. 6, a plan view of the same; Fig. 7, a side elevation of said valve; Figs. 8 and 9, sectional views on the lines *a—b* and *c—d* respectively of Fig. 7; Fig. 10, a view of a signal; Fig. 11, a section of the valve for locking the signal-operating lever showing the operating-shoe or treadle therefor; Fig. 12, a sectional view of the valve controlled by the cylinder moving the switch; Fig. 13, a view of a switch-operating device for locking the switches both open and closed.

Similar reference letters and numerals in the several figures indicate similar parts.

In the operation of crossing signals, it is desirable that the operator in the tower not only set the signals properly so that there may be no liability of two trains meeting on the crossing, but also that before the one set of signals are set to safety to permit a train to cross in one direction and the other line closed by the exposure of danger signals, the line that is closed, be put in such condition that if an engineer attempts to run by a signal held at danger, his train will either be sidetracked, or derailed, or at any rate moved off the main line. It is also desirable that when the signals are set at safety, the line on which they are exposed be safe and held in this condition until by the passage of the train they are released and returned to danger, and further, it is desirable that when a signal is turned to safety, the controlling devices in the signal tower cannot be manipulated by malicious or careless persons to derail the train while passing the signal under headway.

The above and other desirable features are accomplished by the devices herein described and shown, and parts, constituting sub-combinations may be employed in other connections than those shown herein.

In this application I have shown my invention applied to the crossing of a double track and a single track the signals and connected parts being operated by air pressure and controlled primarily by an operator in a tower located so that a free and unobstructed view of the several tracks can be had, such safeguards being provided that even though he be overpowered by maliciously disposed persons there is no possibility of so operating the signals or connected parts, as to either derail a train or cause a collision.

In Fig. 1 of the drawings, I have shown the parts of the apparatus diagrammatically, and have used the letters of the alphabet to designate the complete mechanisms employed, and numerals to designate the parts of said mechanisms, and inasmuch as the signals, switch-operating devices and locking mechanisms are the same, a specific illustration and description of one of each will be sufficient.

Referring particularly to Fig. 1 of the drawings, *a*, *a'*, indicate the two tracks of the double track road, and *b* the single track road.

A indicates the switch-operating device of the track *a;* B, the home signal thereof; C, the distant signal, and D, the releasing device.

A' indicates the switch-operating device of the track *a';* B', the home signal thereof; C',

the distant signal, and D′, the lock-controlling device.

E indicates the switch-oporating device of the track *b*, when a train is moving to the right; F, the home signal on this side; the distant signal not being shown, and H, the lock-controlling device.

E′ indicates the switch-operating device when a train is moving to the left; F′, the home signal on this side, the distant signal not being shown, and H′ the lock-controlling device.

It will be understood that what I have termed the "home" signals are the ones located close to the crossing, while the "distant" signals are those located at such a distance therefrom that a train approaching at great speed can be gotten under control before reaching the crossing if the signal is found at danger.

Located at or near the crossing to be protected is a reservoir J containing air under pressure for operating the signals, switches, &c., and supplied by any suitable compressing mechanism, and in the tower from which the signals, &c., are controlled is a controlling valve K, shown particularly in Figs. 5 to 9, connected by a pipe 1 with said reservoir. Referring to said figures the casing of the valve K is provided with two sets of ports, the one set with which the pipe 1 connects, having four ports, 3 being an exhaust port opening to the air, and arranged opposite the port with which the pipe 1 connects. At right angles to these ports are two other ports, one connected by a pipe 2 with the portion of the switch-operating devices A, A′, E, E′ which operate to close and lock the switches of the devices A A′, and to unlock and open the switches of the devices E E′, and the other and opposite port of the valve is connected by a pipe 4 with the portions of the switch-operating devices A A′ operating to unlock and open the switches and with the parts of the switch operating devices E E′ to close and lock them. The pipes 2 and 4 also extend beyond the switch-operating devices to the home and distant signals, said extended part being indicated by 2′ 4′. The other part of the casing of the valve K is provided with a set of three ports; 6 being an exhaust port opening to the air, and arranged at right angles is a port connected by a pipe 7 with the pipe 4, and opposite this a port connected by a pipe 5 with the pipe 2. The movable barrel or plug K^2 of the valve is provided with two passages 9 and 10 co-operating with the ports to which the pipes 1, 2, 3 and 4 are connected, and also with the three ports, 11, 12 and 13 in line with exhaust port 6 in the casing. An operating lever K′ is connected with said barrel K^2, which operates between segmental plates 14 and 15, as shown in Figs. 5 and 6, and passing through the said plates, preferably from opposite sides, are locking pins or studs 17 formed on or secured to pistons 18 operating in cylinders 19, 20, 21 and 22, which latter are connected by pipes 23 with the lock-controlling devices D, D′, H, H′ respectively. The lock controlling devices consist each of a three-way valve or cock 24, shown in Fig. 11, having an exhaust passage 25 in its casing and said casing connected at one end with the pipe 23 and at the other with the pipes 26 communicating with the main air pipe 1 leading from the air reservoir and containing air under pressure. The body or barrel of this valve is provided with an arm 27 connected by a link 28 with a pivoted shoe or treadle 29 arranged in proximity to the track and adapted to be operated by the wheels of a train, to turn the valve in a direction to open communication between the air pressure in 26 and the cylinders 19, 20, 21 or 22, as the case may be, causing the locking stud 17 of the cylinder operated upon to project between the segments and prevent the operation of the valve lever. After the passage of the train from the shoe, a spring 30 returns the latter to normal position, connects the pipe 23 with the open air and allows a suitable spring to return the piston and its locking stud to normal position permitting the free movement of the lever of the controlling valve.

In Figs. 2, 3 and 4, the construction of the parts indicated by A, A′, E, E′ in Fig. 1 is shown, constituting the switch-operating devices for the various tracks.

The end of one of the rails of the track in which the switch is applied is indicated by 31 and is turned off at one side and either terminates there or is continued forming a switch, while 32 indicates a movable switch point adapted to be moved to the position shown in dotted and full lines. The point 32 is connected by a turn buckle 33 or other adjustable connection with one end of a link 34 passing between guides in a base plate 35, and pivoted to and forming part of a rod 36 having a piston head 37 operating in a cylinder 38. In the arrangement shown, where it is only necessary to lock the switch in one direction, one end of the cylinder is connected by a branch pipe 39 with the pipe 2 and the other end is connected by a pipe 40 with a port 42 located about mid-way of a small cylinder 43 arranged at right angles to the cylinder 38, the end of said cylinder 43 being connected with the air pipe 4 extending from the main controlling valve. Operating in the cylinder 43 is a piston head 44 connected by a rod 45 with a bolt 46 connected to a piston head 47 operating in a cylinder 48 of smaller bore than cylinder 43. The outer end of the cylinder 48 is connected by a pipe 49 with a port 50 in the cylinder 38 and the bolt 46 is arranged to pass through lugs on the base plate 35 and when moved in one direction by pressure on the piston 48 to pass through an aperture formed in the link 34 and lock the latter, preventing the movement of the switch point. The piston 37 is so arranged relative to the port 50 that when in the position shown in full lines Fig. 2, the latter port is open and

the switch point closed and piston 44 is so arranged that when in the position shown, the bolt is projected through the link 34 and the port 42 is covered.

The pipe 2 from the main controlling valve is connected by a branch pipe 39 with the cylinder in front of the piston and in it is provided a three-way valve or cock 52, as shown in Fig. 12, said cock having in its casing the exhaust passage 53 to the air, and the pipe 2′ leading to the signals communicates with its other side. Attached to the upper end of the stem of this valve is a slotted arm 54 in the slot in which operates a pin 55, the arrangement of parts being such, relative to the ports in the valve, that when the switch point is closed and locked, as shown, the pipe 2′ is connected with the pipe 2 containing air under pressure, and the signals on the pipe 2′ are set at safety, but when the switch point is open, the pipe 2′ is connected with the air through port 53 as in Fig. 12 and the signals are set at danger, thereby insuring the operation of the signals to danger whenever the switch is open and preventing their operation to safety until the switch is closed and locked.

The operation of this device is as follows:—The parts are shown in Fig. 2 in a position of safety with the rail closed, ready for the passage of a train, and pressure is also in the pipe 2 holding the signals (presently described) at safety, and also the port 50 being open, the pressure is in the small cylinder 48 holding the bolt through the link 34 and the point locked. In order to open the switch and set the signals to danger, their normal position, the controlling valve K is actuated to open pipe 2 to the air and admit pressure to pipe 4. The pressure entering cylinder 43 moves the piston therein to unlock the link 34 and when the port 42 is open, the air passes into the end of the main cylinder 38 forcing the piston inward, opening the switch point and by means of valve 52, opening pipe 2′ to the air and setting the signals to danger after the point is operated, and this is the normal position of the parts. Upon operating the valve K in the opposite direction, the pressure is admitted to pipe 2 and pipe 4 is opened to the air causing the piston to be moved out to the position shown in full lines and as soon as the piston uncovers port 50 the link 34 is locked, and the air pressure in the pipe 2′ restored, holding the signals at safety again.

Though the arrangement just described answers all purposes for a crossing switch or derailing point, it is sometimes desirable that the switch be locked positively when set either open or closed and this may be accomplished by the arrangement of parts shown in Fig. 13, in which the parts shown in Figs. 3, 4 and 5 are employed and in addition another set of locking cylinders indicated by $43^{\times}$ and $48^{\times}$, the former connected to the main or pipe 2 and having the piston-head $44^{\times}$, the rod $45^{\times}$, and bolt $46^{\times}$ connected to the head $47^{\times}$ operating in the cylinder $48^{\times}$. The port $50^{\times}$ in cylinder 38 is connected by pipe $49^{\times}$ with the end of cylinder $48^{\times}$ and the port $42^{\times}$ in cylinder $43^{\times}$ is connected by a pipe $39^{\times}$ with one end of the cylinder 38. The link 34 is provided with an aperture $35^{\times}$ with which the bolt $46^{\times}$ co-operates to lock the switch open. The operation of this arrangement of parts to lock the switch open, is substantially the same as the corresponding parts, operating to lock the switch closed heretofore described, and this double arrangement can be as well applied to the system shown in Fig. 1, if desired, but to simplify the illustration I have shown it detached. Pressure being admitted to the pipe 2 and exhausted from pipe 4 in this construction, the piston $44^{\times}$ is moved to unlock the link 34 if the latter is locked with the switch open and this movement admits pressure to the inner end of cylinder 38 through port $42^{\times}$, moves the piston to the position shown in full lines and then admits pressure to the pipe 49 through port 50 locking the link when the operation is complete by the actuation of piston 47. In short the operation is precisely the same as the arrangement heretofore described, except in reverse order.

The signals, which I prefer to employ, are semaphore arms or targets held normally at danger by weights and operated positively by air pressure to safety and in Fig. 10 is shown a view of one of them, consisting of a post 60 having an arm 61 pivoted thereon and connected by a rod 62 with a weighted lever 63, said lever being connected by a link 64 with a piston rod 65 having a piston 66 operating in a cylinder 67, which cylinder is connected with the air pipe 2′.

Both the "home" and "distant" signals are as far as the operating parts are concerned, the same, but the one illustrated in this figure is preferably used as a "home" signal, and in order to insure the retention of the distant signal at danger until the home signal is operated, I arrange in the pipe 2′, beyond the point of its connection with the cylinder 67, a three-way cock 68 connected with and operated by the piston rod 65, the position of the cock when the signal is at normal, (danger) position being such that the pipe 2′ beyond the signal and leading to the distant signal is open to the air allowing the weight to hold the arm up, but when pressure is admitted to pipe 2′ by the main controlling valve the home signal is set at safety and said cock 68 is operated by the piston and the pressure is then admitted to pipe 2′ beyond it, operating the distant signal, as will be understood. This arrangement insures the quick operation of the distant signal to danger, as the air does not have to pass clear to the main controlling valve K to reduce the pressure.

It will be understood that although I have described the crossing as one containing a double and a single track, the arrangement of parts is the same for a double as a single

track, excepting that the outside rails of both tracks are opened when the signals are set at danger instead of both sides of a single track road.

The operation of the present construction is as follows:—In normal position the handle of the valve K is between the locking bolts; pipes 5 and 7 communicating with the open air and with the pressure, are cut off from pipes 2 and 4, the signals are at danger and the switches are left in the position to which they were moved last. In Fig. 1 they are shown closed on the track *b*. Assuming a train approaching the crossing on the track *a*, or *a'*, the operator in the tower turns the handle of the lever to the position in full lines Fig. 5, and moves the valve to the position in Figs. 8 and 9. This admits pressure to the pipe 2, through passage 9 in the valve, and operates the pistons of the switch-operating devices A, A', to close the switches on the line *a*, *a'*, and when these are closed and locked, the valves 52 are opened by the pistons admitting air to the pipes 2' on these lines operating first the home and then the distant signals B, B', and C, C', to safety. At the same time the pistons of the switch-operating devices E, E', are held with the switches open and the signals F, F', and G, G', at danger, because the pipe 2 is connected with the outer ends of the pistons 37 by the valve pistons 44. The pipe 4 is connected by the passage 10 of valve K with the exhaust passage 3 and the passages 11, 12 and 13 connecting with the pipes 5, 6, and 7 are closed. When the train approaches the crossing and preferably just after passing the home signal B or B', the wheels engage the protector shoe 29 of the lock-controlling devices D or D', operating the valve 24, admitting pressure from pipe 26 to the piston in cylinder 19 and projecting the bolt 17 through the segments between which the lever of valve K operates. This effectually prevents the operation of the valve K to the position in dotted lines Fig. 5, as the protector shoe is quite long and therefore even after giving the safety signal to the engineer on track *a* to go ahead, it would be impossible to derail the train by opening the switch in front of him, but it might be necessary, if the train stops on the protector shoe, to set the distant signal C at danger to prevent another train from coming up on track *a*, which may be accomplished by moving the operating lever of the valve K up against the bolt 17 projected through the segments. This would cause the passages 11, 12 and 13 in the plug K^2 of the valve K to connect the pipes 5 and 7 with the exhaust passage 6 and permit the air in said pipes to pass out allowing the weights on the signals to return them to danger, but it will be noted the switches on lines *a* and *a'* would not be changed because they are closed and locked and can only be changed by the entrance of air pressure in pipe 4. This operation is accomplished, it will be noted, by reason of the fact that a movement of the valve plug K^2 through ninety degrees is necessary to operate the switches, while a movement of nearly forty-five degrees only will cause the connection of the pipes 5 and 7 with the exhaust. After the train has passed the crossing in safety the operator in the tower, if he desires to leave the double track road *a*, *a'* safe and the single track closed, returns the lever to the position *m* in Fig. 5, thus returning the signals to safety. Normal position of lever K is central at *n* thus leaving signals at danger, and the switches left in the position to which they were last moved the air in pipe 2 being exhausted through exhaust port 6. When desirable to allow the passage of a train on the single track road, it is only necessary to move the lever of the valve K to the position *o* in dotted lines, when pipe 4 will be connected with pipe 1 by passage 10, and pipe 2 connected with the exhaust 3, the air pressure then closing the switches on these tracks and operating the signals to safety, at the same time actuating the signals on the double track road to danger and opening the corresponding switches.

Although the main object of this invention as herein described, is to actuate the signals of a crossing and to operate the switches so that if the signals are not obeyed an accident will result, which will insure caution on the part of the engineer, it is obvious that practically the same arrangement of parts can be used for operating switches alone, the signals then being merely incidental if employed at all.

The devices herein described as switch-operating devices can of course be employed in other connections, if desired, and I do not therefore wish to be understood as confining my invention to either the relations or constructions herein shown unless specified in the claims.

I claim as my invention—

1. The combination with two intersecting tracks, pneumatic signals therefor, and a reservoir containing fluid under pressure, of a switch located in each track, a movable piston for actuating each switch, pipes connecting the signal switches and the reservoir, and a single controlling valve for admitting, by a movement in one direction, fluid to actuate the signals and switches of the two tracks in opposite directions simultaneously, substantially as described.

2. The combination with two independent intersecting tracks, and pneumatic signals therefor, and a reservoir containing fluid under pressure, of a switch located in each track, a movable piston for actuating each switch, connecting pipes, and a valve controlling the admission of fluid simultaneously to opposite sides of the pistons by a single operation in either direction, substantially as described.

3. The combination with two intersecting tracks, and a reservoir containing fluid under pressure, of a switch located in each track,

pneumatic signals corresponding to the switches and actuated simultaneously with the latter, pistons operating the switches, connecting pipes, and a single controlling valve admitting pressure simultaneously to opposite sides of the pistons by a single movement in either direction, substantially as described.

4. The combination with two intersecting tracks and a reservoir containing fluid under pressure, of a switch located in each track, pneumatic signals corresponding to the switches and actuated simultaneously with the latter, pistons operating the switches, connecting pipes, and a controlling valve admitting pressure simultaneously to opposite sides of the pistons and an automatic switch-locking device for each switch, actuated when the switch has been moved in one direction, substantially as described.

5. The combination with two intersecting tracks and a reservoir for fluid under pressure, of a switch located in each track, pneumatic signals corresponding to the switches, and actuated simultaneously with the latter, pistons operating the switches, connecting pipes, and a controlling valve admitting pressure simultaneously to opposite sides of the pistons, an automatic switch-locking device for each switch actuated when the switch has been moved in one direction, a valve locking device, and shoes on the tracks controlling said locking device, substantially as described.

6. The combination with two intersecting tracks, and a reservoir for fluid under pressure, of a switch located in each track, pistons operating the switches, pneumatic signals corresponding to the switches and controlled by the operation of the latter, connecting pipes, a valve controlling the admission of pressure simultaneously to opposite sides of the pistons and an automatic switch-locking device for each switch actuated when the switch has been moved in one direction, substantially as described.

7. The combination with two intersecting tracks, and a reservoir for fluid under pressure, of a switch located in each track, pistons operating the switches, pneumatic signals corresponding to the switches and controlled by the operation of the latter, connecting pipes, a valve controlling the admission of pressure simultaneously to opposite sides of the pistons, a valve locking device and shoes on the tracks controlling said locking device, substantially as described.

8. The combination with two intersecting tracks, and a reservoir for fluid under pressure, of two switches in each track, one on each side of the crossing, a pneumatic signal for each switch, pistons operating the switches, connecting pipes and a valve controlling the admission of pressure simultaneously to opposite sides of each pair of pistons, substantially as described.

9. The combination with two intersecting tracks and a reservoir for fluid under pressure, of a switch located in each track, cylinders, and pistons therein operating the switches, connecting pipes, a valve controlling the admission of fluid simultaneously to opposite sides of the pistons, and also controlling the exhaust from said cylinders without causing the admission of fluid, and pneumatic signals operated in one direction when the switch moving pistons are actuated and in the other direction automatically when the pressure is removed, substantially as described.

10. The combination with two intersecting tracks, and a reservoir for fluid under pressure, of a switch located in each track, cylinders and pistons therein operating the switches, connecting pipes, a valve controlling the admission of fluid simultaneously to opposite sides of the pistons, and also controlling the exhaust from said cylinders without causing the admission of fluid, pneumatic signals operating in one direction when the switch moving pistons are actuated and automatically in the other direction, a shoe on the track and a valve locking device controlled by the shoe, arranged to prevent the movement of the valve to admit fluid to one side of the switch pistons, but permitting the exhaust therefrom, causing the actuation of the signals, substantially as described.

11. In a railway appliance, the combination with two movable switch points, a cylinder and piston for each point, a reservoir for fluid under pressure, of fluid passages between the cylinders and reservoir and a valve for admitting pressure from the reservoir to the cylinders to actuate the pistons in opposite directions simultaneously: whereby one switch may be opened and the other closed by a single operation, substantially as described.

12. In a railway appliance the combination with two movable switch points, a cylinder and piston for each point, a reservoir for fluid under pressure, of fluid passages between the cylinders and reservoir and a single reversible valve for admitting pressure from the reservoir to the cylinders to actuate the pistons in opposite directions simultaneously, whereby one switch may be opened and the other closed by a single operation of the valve in either direction, substantially as described.

13. The combination with the movable switch point, a main cylinder and a piston operating therein having a rod connected to the point, of a supplemental cylinder having a port communicating with one end of the main cylinder, and a fluid main connected thereto, a piston in said cylinder controlling the port to the main cylinder, a bolt connected to the said piston cooperating with the rod of the main piston, and a second piston connected thereto, a cylinder for the last mentioned piston, a passage connecting it with the main cylinder controlled by the main piston, and a fluid main connected to one end of the main cylinder, substantially as described.

14. The combination with the movable switch point, a main cylinder and a piston op-

erating therein having a rod connected to the point, of a supplemental cylinder having a port communicating with one end of the main cylinder, a fluid main connected thereto, a piston in said cylinder controlling the port to the main cylinder, a bolt connected to the said piston cooperating with the rod of the main piston and a second piston connected thereto, a cylinder for the last mentioned piston, a passage connecting it with the main cylinder controlled by the main piston, a fluid main connected to one end of the main piston and a valve operating by a single movement to connect either of the fluid mains to the reservoir and the other to the open air, substantially as described.

15. The combination with the movable switch point, a main cylinder and a piston operating therein having a rod connected to the point, of two supplemental pistons connected for simultaneous operation and a bolt connected to them co-operating with the main piston rod to lock it, a valve controlling the supply of fluid to one side of the main piston operated from the supplemental piston, a valve actuated by the main piston controlling the supply of fluid for actuating the rod in one direction, a fluid main connected with one side of one of the supplemental pistons, a fluid main connected with one end of the main cylinder, and valve mechanism for admitting fluid to either of the fluid mains, substantially as described.

16. The combination with the movable switch point, a main cylinder and a piston operating therein having a rod connected to the point, of two supplemental pistons connected for simultaneous operation and a bolt connected to them cooperating with the main piston rod to lock it, a valve controlling the admission of fluid to one side of the main piston operated from the supplemental piston rod, a valve actuated by the main piston controlling the supply of fluid for actuating the supplemental rod in one direction, a fluid main connected with one side of one of the supplemental pistons, a fluid main connected with one end of the main cylinder, a reservoir for fluid under pressure, and a reversible valve adapted to connect either one of said mains with the reservoir and the other with an exhaust simultaneously, by a single operation, substantially as described.

17. The combination with the movable switch point, a main cylinder and a piston operating therein, having a rod connected to the point, of two pairs of supplemental pistons, each pair being connected for simultaneous operation, and a bolt connected to each pair for cooperating with the main piston rod to lock it, one of each pair of pistons connected with a fluid main and controlling the admission of fluid to one side of the main piston and the other piston of each pair being actuated by fluid controlled by the operation of the main piston, the said pairs of supplemental pistons being arranged to operate simultaneously as set forth, and valve mechanism for admitting fluid to the mains, alternately, substantially as described.

18. The combination with the movable switch point, the main cylinder having the ports 50, $50^{\times}$, the piston 37 operating therein having the link 34 connected to the point, the cylinders 43, $43^{\times}$, and 48, $48^{\times}$, the former having the ports 42, $42^{\times}$, the pistons 44, $44^{\times}$, and 47, $47^{\times}$, the rods 45, $45^{\times}$, connecting them having the bolts 46, $46^{\times}$, thereon, the pipes $39^{\times}$, 40, 49, $49^{\times}$ and pressure mains 2 and 4, substantially as described.

19. The combination with the movable switch point, the main cylinder, the piston operating therein and the link connecting it to the point, of the two supplemental pistons, each having bolts and arranged for locking the link when at the extreme of movement in either direction, fluid mains arranged to conduct air under pressure to each of said supplemental pistons, valve devices operated by said pistons controlling the operating of the main piston, valve devices operated by the main piston controlling the reverse movements of the supplemental pistons and means for admitting fluid to the pressure mains, alternately, substantially as described.

20. The combination with the switch point, a cylinder for actuating the point, and a fluid main, of a signal held normally at danger position, an actuating piston for operating the signal to safety position, a branch pipe leading from the main to the signal, a valve actuated by the switch operating piston, operating to connect the branch pipe to the main or to the open air, substantially as described.

21. The combination with the switch point, a cylinder, a piston for actuating the point, an automatic locking device for the point, and the fluid main, of a signal normally held at danger position having an actuating piston for operating it to safety position, a branch pipe leading from the signal to the main, and a valve actuated by the switch operating piston operating to connect the branch pipe to the main or to the open air, whereby the signal will not be operated until the switch has been operated and locked, substantially as described.

22. The combination with two signals, each embodying a movable arm, a weight for moving it in one direction, and a piston for operating it in the opposite direction, of a main for supplying fluid under pressure to the pistons, and a three-way valve in the main between the two signals, actuated by one of the pistons to open the main to the air when pressure in said main is reduced, substantially as described.

23. As a means for actuating railway appliances, as switches, the combination with two movable pistons and cylinders therefor, a reservoir for fluid under pressure, pipes or mains connected to each end of said cylinders and valve devices for simultaneously connecting the opposite ends of the cylinders

alternately with the fluid reservoir, whereby the alternate positive operation of the pistons will be effected, substantially as described.

24. The combination with a reservoir for fluid under pressure, two switches each having a cylinder, and a piston operating therein, connected to the switch point, and two signals operated by fluid pressure corresponding to the switches, of two fluid mains, one connected to the cylinder of one switch to open it and to the signal of the other switch to operate it to safety and the other main connected to the signal of the first mentioned switch to operate it to safety and to the cylinder of the second switch to close it, and a valve device for simultaneously connecting either one of said mains with the fluid reservoir and the other one with the open air, substantially as described.

25. The combination with two intersecting tracks, of two switches in each track, one on each side of the crossing, each switch having a cylinder, and an operating piston therein connected to the switch point, a series of signals, one for each switch, and a reservoir for fluid under pressure, of two fluid mains, one connecting with the cylinders of the switches of one track to open them and the cylinders of the switches of the other track to close them, and also with the signals of the first mentioned track to set them at danger, and of the other track at safety, and the other main connected with the cylinders and signals to operate them in the opposite direction and a valve operating to connect either of said mains with the reservoir and the other one to the open air, simultaneously, substantially as described.

FRANK L. DODGSON.

Witnesses:
FRED F. CHURCH,
T. H. SMYTH.