(No Model.)

G. WESTINGHOUSE, Jr.

INTERLOCKING SWITCH AND SIGNAL APPARATUS.

No. 246,053. Patented Aug. 23, 1881.

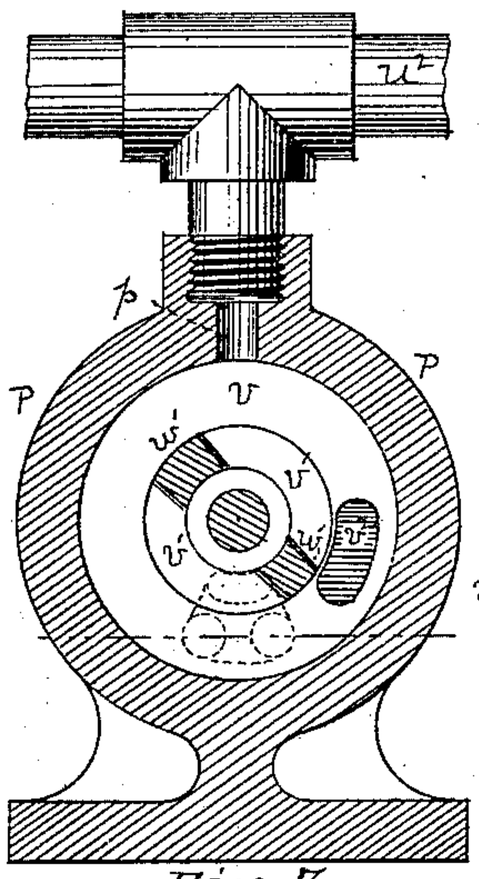

Fig: 7.

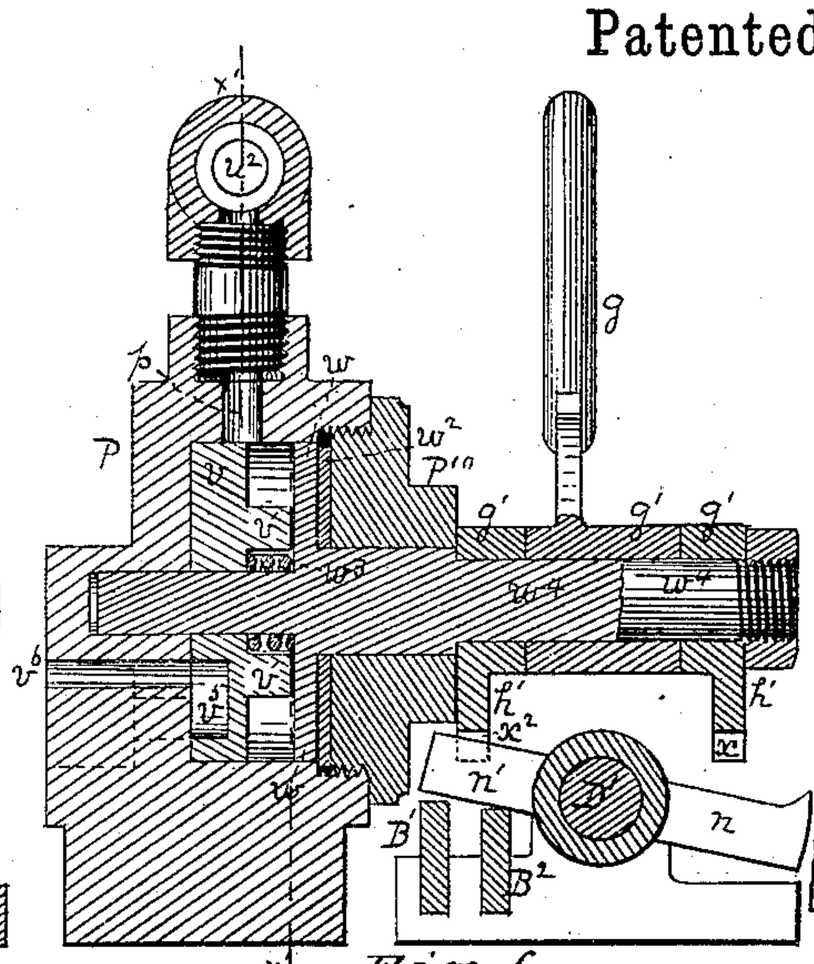

Fig: 6.

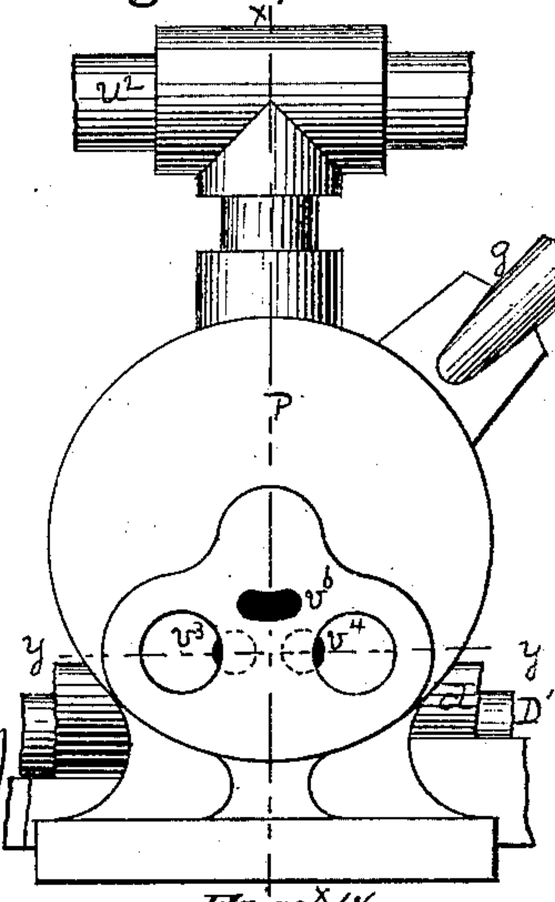

Fig: 5.

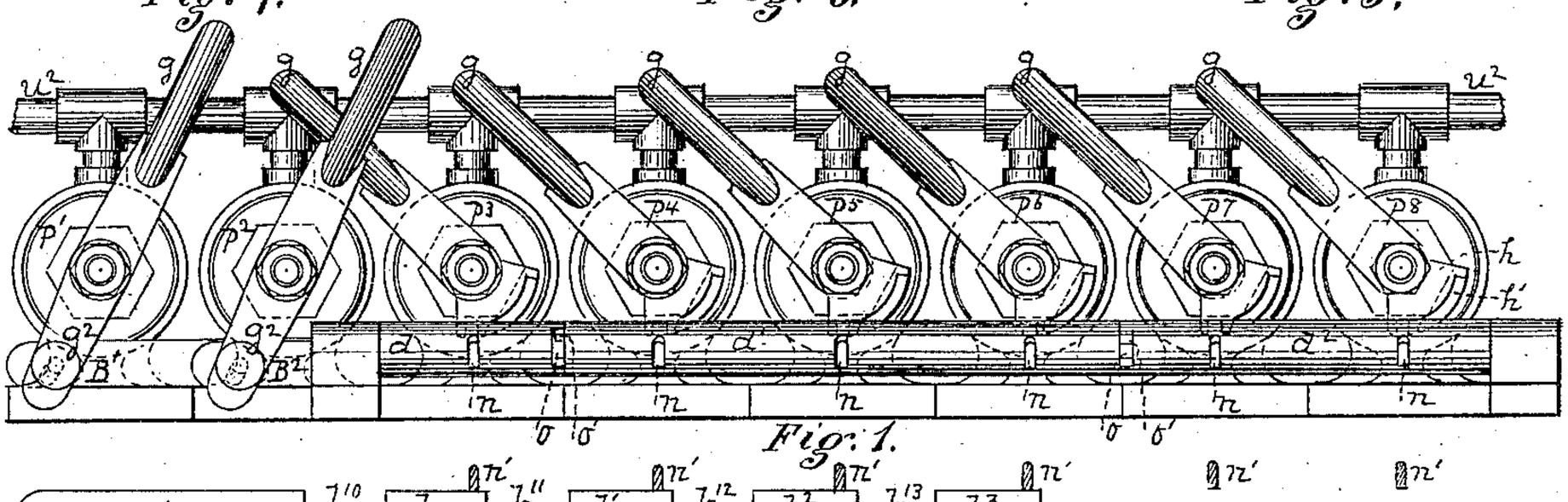

Fig: 1.

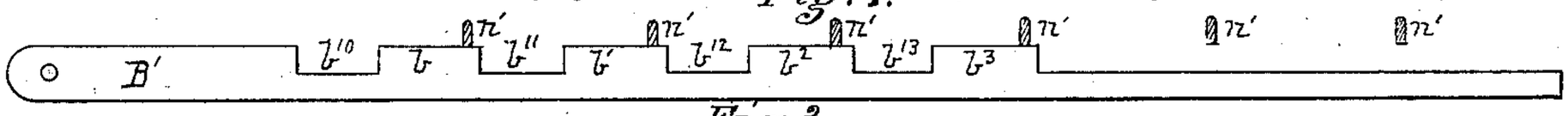

Fig: 3.

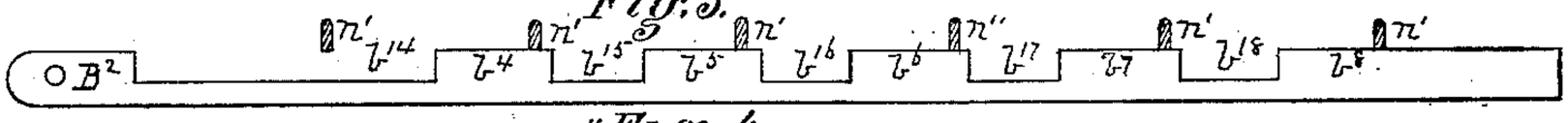

Fig: 4.

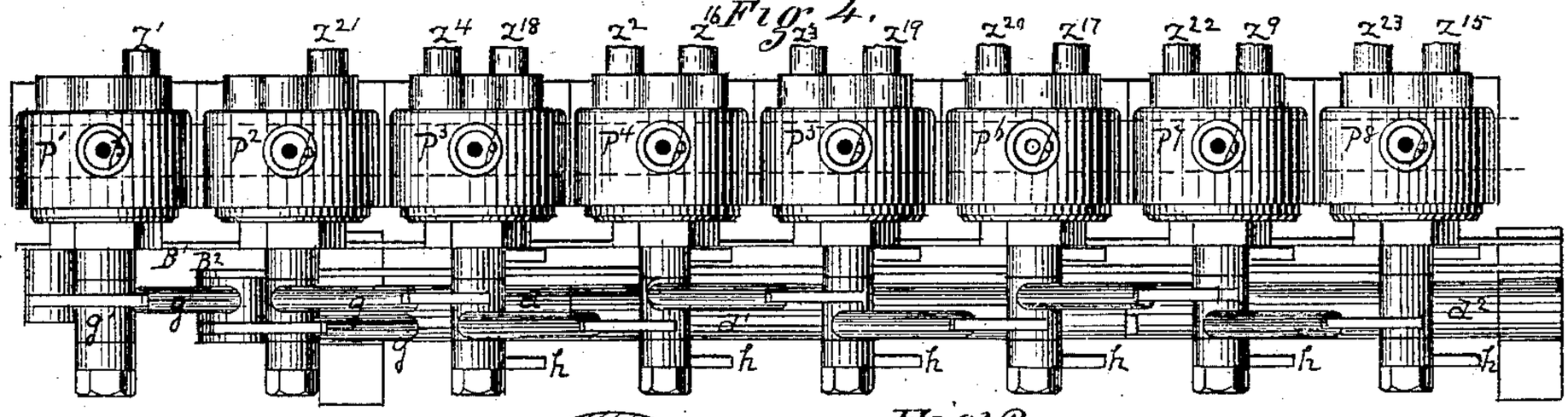

Fig: 2.

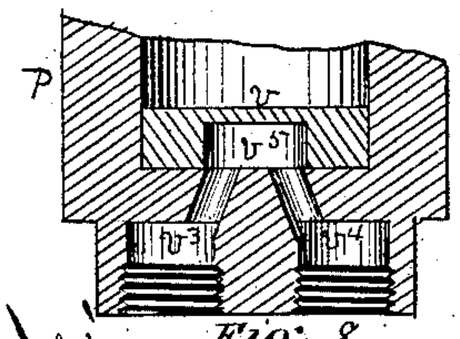

Fig: 8.

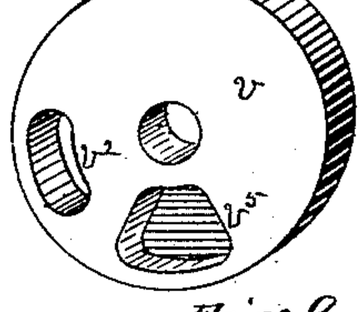

Fig: 9.

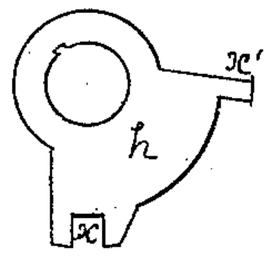

Fig: 10

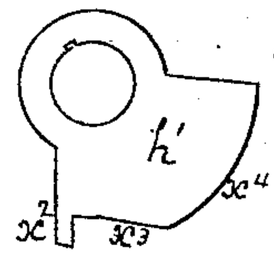

Fig: 11.

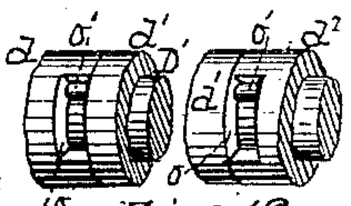

Fig: 12.

Witnesses
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GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

INTERLOCKING SWITCH AND SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 246,053, dated August 23, 1881.

Application filed June 10, 1881. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Interlocking Switch and Signal Apparatus; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a view, in elevation, of a system of valves and interlocking devices illustrative of my present invention. Fig. 2 is a top or plan view thereof. Figs. 3 and 4 are detached side views of the locking slide-bars employed, and showing, in section, the locking-arms in their relation thereto. Fig. 5 is a rear end view, to an enlarged scale, of one of the valves P^3 to P^8 of Figs. 1 and 2, together with some of the operative connections capable of being used in connection therewith. Fig. 6 is a sectional view in the plane of the line $x\ x$ of Fig. 5. Fig. 7 is a sectional view in the plane of the line $x'\ x'$ of Fig. 6, looking to the left. Fig. 8 is a sectional view, showing the valve-ports in the plane of the line $y\ y$ of Fig. 5. Fig. 9 is a detached view, in perspective, of the valve proper, showing its seating or bottom face. Figs. 10 and 11 are detached views of the front and rear sector-plates employed in operating the locking apparatus; and Fig. 12 is an enlarged view, in perspective, of the joints of the rotating sleeves of Figs. 1 and 2, as presently to be explained.

In Letters Patent No. 240,629, granted to me April 26, 1881, I showed an apparatus embodying the features of invention herein claimed, to the end that the system of apparatus therein claimed might, in one form of its possible use, be more easily understood; but I therein reserved for the subject-matter of the present invention so much of what was therein shown and described as relates distinctively to interlocking; and while the apparatus herein described is in some respects peculiarly adapted for such a system as is described and claimed in said Patent No. 240,629, it is still true that it may be usefully applied in the construction of other fluid-pressure systems of apparatus, and all such applications are hereby included as within the scope of the present invention, the general object of which is to provide an improved apparatus for effecting the locking and unlocking of one or more valves by the motion of one or more other valves in the same system. Features of construction and operation not herein explained in minute detail may be ascertained readily from said Patent No. 240,629, like letters of reference being used in both.

P, Figs. 5 to 7, represents a valve-box closed by a cap, P^{10}, and wherein is a rotary valve, v, made of a disk form, with two projecting lugs, v', on its back face, by which, through counter-lugs w' on rotary wrench w, to give it the proper motions. The valve has a port, v^2, preferably oblong in form, extending through it, so that compressed air or other fluid under pressure being admitted from a main supply-pipe, u^2, by the port p to the space between the valve v and its operating-wrench w, may be admitted through the port v^2 to a port, v^3, which communicates with the pipe or pipes leading to the switch-operating devices, and also to a port, v^4, which communicates with the pipe or pipes leading to the signal-operating devices.

As it is desirable that the switches be moved or shifted preparatory to the movement of a train in advance of the movement of the signals which indicate "safety" or "line clear" on the line of track so made, it is important that the air be turned onto the pipe communications in the order above set forth—that is to say, so that first operating through v^3 it shall put the proper fluid-pressure column or columns in motion for shifting the switches, and this is done by causing the forward end (in the direction of its motion) of the port v^2 to register first with the port v^3, and next, by a further movement of the valve, so that the port v^2 shall register with v^4, the communications shall be such that the fluid-pressure so passing through v^4 shall put the proper fluid-pressure column or columns in motion for properly shifting the signal or signals for the track-line previously made, and this is the reason for preferring the oblong form of port. The valve v also has a cavity or chamber, v^5, on its under or seating face, of such form that on a reverse movement of the valve (which first cuts

off the supply) such cavity acts as a connecting-port between the ports v^3 v^4 and an exhaust-port, v^6, leading to the open air; hence when the cavity v^5 comes over the ports v^3 and v^4 the previously applied air-pressure will escape through the port v^6, and the previously moved fluid-pressure columns will make a return-stroke or flow back under the action of any suitable reverse force applied at the switch and signal ends of such columns, and for this latter purpose a spring, weight, or back-acting fluid-pressure may be employed; hence the previously moved switches and signals will thereby be reversed in position; and it should also be observed that the reverse movement of the valve v, as described, will first uncover the port v^4, which is the signal-actuating port, as a result of which the corresponding signals will come to "danger" position in advance of the reverse shifting of the switches, which is an important feature in apparatus of this class. It should also be noted that when the pressure is turned on the flat face of the valve covers the exhaust-port v^6. The valve and its actuating-wrench are kept apart, and the valve is held to its seat in the bottom of the valve-box by a coiled wire spring, w^3, and the necessary packing is added, as at w^2, for making a tight joint. The wrench-stem w^4 projects through the cap P^{10}, and on its projecting end is keyed or otherwise secured a sleeve, g', on which is made or secured an operating valve-handle, g.

For convenience in construction, what I herein speak of as a "sleeve," g', may be made in sections, as indicated in Fig. 6; but in such case all the sections are to be keyed or otherwise secured to the stem w^4, so that all shall move or rotate together; hence all the sections will constitute mechanically a single sleeve, and as such I designate them all by one letter, g'.

The construction thus described is incorporated into each valve used—say P′ to P^8—with the omission of one port in P′ and P^2. On valve-boxes P′ and P^2, Fig. 1, the handles are prolonged so as to form crank-arms g^2, and on each of the sleeves of the other boxes, P^3 to P^8, are two sector-plates, h h', the arrangement of which on the stems relative to each other is as represented in Figs. 1 and 6, and the function of which will presently be explained; but it should also be stated that the valve-boxes P′ and P^2 contain valves only for actuating signals, and hence in these the ports v^4 for switch-pipe connections may be omitted or closed. In further description I will, for convenience, simply speak of the devices at P′ to P^8, Figs. 1 and 2, as valves. Such valves may, for convenience in locking and unlocking, be arranged in a row side by side and in compact order, as in Fig. 1, and the handles g may, in the successive valves of the series, be arranged at different distances from the ends of the stems, so that as the valves are rotated the handle of one valve may pass that of the next; or the valves may be arranged farther apart than is indicated, so that the handles arranged in the same vertical plane shall not strike or engage each other; but the front sector-plates, h, of all the valves should be in line with each other, or in a common vertical plane, and likewise the rear sector-plates, h'. Extending along between the two series of sector-plates thus formed is a cylindrical bar, D′, Fig. 6, on which are a series of sleeves, d d' d^2, Figs. 1 and 12, the number and length of each of which may be varied in accordance with the work to be done on principles presently to be explained. Each sleeve turns readily on the bar D′, and locking-arms n n' project out radially from the sleeves, one pair—that is, a front and rear one—beneath each pair of sector-plates h h'. Under one—say the rear—series of these locking-arms are two notched bars, B′ B^2, of which the one, B′, is connected with the crank-arm g^2 of the valve P′, and the other with the crank-arm g^2 of the valve P^2.

In the normal position of the apparatus, which is shown in Fig. 1, the levers of P′ and P^2 are turned to the right, so as to turn on the fluid-pressure from P′ through z', to set a safety-signal on one track of the line of double-track road for indicating "main line clear;" also, fluid-pressure is turned on from P^2 through pipe z^{21} to set a like safety-signal on the other track. All other levers are turned to the left, in which position fluid-pressure is turned from the other lines, so that all switches are closed or set to make the main track clear, and all the other or the siding signals are at "danger."

Each front sector-plate has at one end (which I call the forward end) of its periphery a recess, x, Figs. 6, 10, formed by projecting lugs, and at the other or back end a stop-shoulder, x'. Each rear sector-plate has at the forward end of its periphery a lug, x^2, and at a little distance therefrom—less, however, than the length of the valve motion necessary to open the ports v^2 v^3—it has an incline, x^3, which terminates in the curved edge x^4, Figs. 6 and 11.

The front locking-arms n are weighted or pressed or forced down by a spring, so that the tendency will always be to turn the rear arm, n', upward. With the levers g of valves P^3 to P^8 in the position shown, or turned to the left, Fig. 1, the rear arms, n', will be turned up into the recesses formed in the rear sectors, h', between the lugs x^2 and inclines x^3, and while the arms n' are in this position the valve-levers g will be locked, because they cannot be moved far enough to open ports v^2 v^3, except by causing the inclines x^3 to depress the arms n', and the arms n' are held in position as against a downward motion by means of the projections b to b^3 on the bar B′, Fig. 3, and the projections b^4 to b^8, Fig. 4, or some of them, as shown.

For reasons which will presently appear I prefer, in the apparatus as here organized, to arrange the arms n n' of the valve P^3 on one sleeve, d, the arms n n' of the valves P^4 to P^6 on another sleeve, d', and those of the other

two valves, P^7 P^8, on a third sleeve, d^2. Also I cut a notch, *o*, Figs. 1 and 12, on the end of each sleeve *d* and d^2, at the end next the intermediate sleeve, d', the length of the notch being equal or about equal to the rotary motion of either sleeve in the movement of its arms n n'. In each end of the sleeve d', I insert a pin, o', so that it shall project into the adjacent notch *o*, at or near the end of the notch, toward which it will move as d' is rotated. It will now be seen that *d* or d^2 may be each or both rotated without rotating d', but that any rotary motion imparted to the latter will cause a corresponding rotation of both the former.

As already stated or implied, shifting the handle *g* of valve P′ to the left lets off the pressure, so as to shift the first main-line signal to "danger." The same movement also shifts the bar B′ to the right, so that the recesses b^{10} to b^{13} shall come beneath the locking-arms n', which before were held or locked up by the projections *b* to b^3. The locking-arms of valves P^3 to P^8 are all then unlocked, so far as the bar B′ acted as a locking device; but by reference to Fig. 4 it will be seen that all are still locked by the bar B^2, except P^3. By moving the lever of this valve over to the right I turn on the pressure through pipe z^{18} and put in motion the fluid-pressure column which leads to one switch-cylinder, so as to shift that switch to make a siding-connection from main track also. This motion of the valve next turns on fluid-pressure through pipe z^4, which leads to the signal for the corresponding siding and shifts it from "danger" to "safety." The train may then proceed onto or off of said siding, from or to the main-track, after which the lever of valve P^3 may be reversed, the signal brought back to "danger" and the main-track connection restored. Reversing P′ will relock P^3 and put the main-line signal to "safety."

In further illustration of the varying combinations in which apparatus of this class may be used, I will briefly explain sundry other operations.

First, the main signals should be set to "danger" by shifting valves P′ P^2 to the left, as already described. Thus the bar B′ is shifted to the right, as and with the result already stated. Shifting bar B^2 to the right results in bringing the recesses b^{14} to b^{18} under the locking-arms n' of valves P^4 to P^8, so that the levers of all the valves P^3 to P^8 are then unlocked. Valves P^4 to P^6 being thus unlocked the operator turns valve P^4. The first effect results from the action of its rear sector-plate, h', on its locking-arm n'. The incline x^3 depresses the locking-arm, and that causes the partial rotation of the sleeve-section d', as a result of which the front locking-arms, *n*, of valves P^5 P^6 are rotated up into the recesses *x* of their front sector-plates, *h*, so as thereby to lock valves P^5 and P^6; also, the rotation of d', thus effected, causes, through the action of the pins o', the rotation in the same direction of the end sleeves, *d* and d^2, as a result of which the front arms, *n*, of these sections will be rotated up into the recesses *x* of the front sector-plates, *h*, of the corresponding valves, P^3 P^7 P^8, so as also to lock them; also, the downward movement of the locking-arms n', thus caused, brings such arms into the recesses b^{10} to b^{13} of bar B′, and b^{14} to b^{18} of bar B^2, so that these bars are locked, and through them the signal-valves P′ P^2 are securely locked, so that while the train is on a cross-over, or while the track is in condition for such train movement, the main-line signals are locked at "danger." It will also be seen that every valve is locked, except the one that is in motion, P^4. The movement of this valve also lets on pressure through z^{16}, (which may be branched or divided, if necessary,) to the switch-actuating mechanism of one or more switches, so as properly to set the same. As soon as this is done fluid-pressure turned on through signal-pipe z^2 to the appropriate signal-actuating mechanism will cause the proper signal to be displayed; but the operator, instead of moving valve P^4, may move valve P^5. This, in the manner described, will lock all other unlocked valves, and also turn on pressure, first through z^{19}, and afterward through z^3, with like results in kind, as already set forth; or P^6 may be moved. This motion will lock P^4 and P^5 by the movement of the locking-arms n n', and also all the other valves, in the manner stated. Fluid-pressure will then be turned on, first through z^{17}, and afterward through z^{20}, in like manner and with like effect as before. Here, as in all the other cases, the reversal of the operation described brings all to the normal position.

Where a cross-over is not desired, as in running from one main track onto an outer or middle siding, or from a single track onto a siding, or in either case in the opposite direction, it will be necessary to shift or use but one of the valves P′ or P^2. Assuming a double-track road, P^2 may be shifted to set the proper signal to protect the track to be broken, together with its bar B^2, so as to bring the recesses b^{17} and b^{18} under the corresponding locking-arms n' of the valves P^7 and P^8, thereby unlocking these valves. It will be seen from Fig. 3 that these valves are not locked by the bar B′ when in its normal position, (which it still retains,) but that all the other valves, P^3 to P^6, are locked by said bar B′. The switchman now shifts the valve P^7, and in doing so rotates the sleeve-section d^2 so as to lock valve P^8 by turning up its front locking-arm, *n*, into the recess *x* of its front sector-plate, *h*, and also locks the bar B^2 by turning the rear locking-arms, n', of valves P^7 and P^8 into the recesses b^{17} and b^{18} of bar B^2; hence all the valves are locked except P′, and as this is the valve for working the main-line signal of the other main track no harm will result from moving it if the switchman by mistake does so, except to stop all travel on that track. The apparatus being in this condition, the switchman by the

shifting of valve P^7 also turns on pressure by pipe z^9 to shift the proper switch. The further movement of the valve P^7 applies pressure through pipe z^{22} to the siding-signal, so as to clear the signal for the track thus made, and after the train passes the main track is restored by reversal, as before.

Another operation possible in the system, as illustrated, is to set and lock signals and switches so as to run a train from one siding onto a main track, and thence onto another siding. For this purpose the apparatus is worked as in the case last supposed, except that the valve P^8 is to be rotated instead of P^7. This valve P^7 will be locked by the rotation of d^2, and the other valves will be locked as before. Fluid-pressure will also be applied through pipes z^{15} and a branch, so as to operate two switch-cylinders and the corresponding switches; also fluid-pressure through pipe z^{23} will be applied so as to shift the proper signal to "safety," which is the signal for the line of track so made. Reversal results, as before, in restoration of main track. While I have described with some particularity the locking and unlocking combinations and their several results, it will be understood that in the use and operation of the combinations hereinafter claimed I do not limit myself to the specific organization herein described.

The skilled constructer may vary the arrangements of notches and recesses on the bars B' B^2, and the lengths and orderly operation of the sleeves d to d^2, or other like sleeves on the shaft D', according to the work to be done. The making up and working out of track combinations, and varying the operative machinery with reference thereto, are already a branch of the art the principles of which are understood by those skilled therein, and unnecessary parts being omitted and the proper modifications made, such as will be within the knowledge of the skilled mechanic, the apparatus may be applied to the switches and signals of a single-track road as well as to various arrangements of switches and signals on a double-track road. The same features of improvement, some or all of them, may by the skilled constructer be adapted to the interlocking of railway-gates, draw-bridges, and signals, as well as of signals and switches, and such use is included herein, it being understood, however, that in the combinations hereinafter claimed a gate-moving mechanism may take the place of a switch-moving mechanism, or be added to the switch-moving mechanism, and that a signal may be provided therefor, either specially or in connection with that switch-moving track combination of which the gate-actuating mechanism may form a part.

The inclines x^3 of the sector-plates h', as a means for actuating a movable locking device, operate simply as eccentrics, and any known suitable form of eccentric may take the place of the incline in each case, as the mechanical equivalent thereof, or as substantially the same thing.

I claim herein as my invention—

1. As a means of locking one valve by the motion of another, the combination of recessed sector-plates h h' on each valve-stem, a pair of oscillating arms, n n', for each pair of sector-plates, and a moving locking-bar, substantially as set forth.

2. In combination with a series of recessed sector-plates, h h', and oscillatory arms n n', one or more recessed bars, B' B^2, by the adjustments of which to cause the locking or unlocking of other valves, substantially as set forth.

3. As a means of locking valves P' P^2, or either of them, (when shifted for putting main-line signal or signals at danger,) a recessed bar, B' or B^2, shifted in position by the valve motion, in combination with an oscillatory arm, n', whereby, on the shifting of the bar and the depression of such arm by the motion of an unlocked valve, an arm will enter a recess and lock the bar, substantially as set forth.

4. A series of sleeves, d d' d^2, two or more in number, arranged on a shaft, D', and arms n n' thereon, in combination with suitable eccentrics for rotating the same, and slot and pin o o', for causing one to rotate the other, while leaving the latter free to be rotated without imparting motion to the former, substantially as set forth.

5. The combination of a valve, P' or P^2, having a single port by which to make an operative connection with a signaling apparatus, one or more valves, P^3, P^4, &c., each having at least two separate ports, through one of which to make connection with a signaling apparatus, and through the other of which to make connection with a mechanism for actuating a switch or other like movable appliance, and an interlocking mechanism actuated by the valve motions, substantially as set forth, whereby the opening movement of the former valve or valves shall unlock the latter and the opening movement of the latter valve or valves shall lock the former.

6. The signal-operating valves P' and P^2, in combination with two or more switch and signal operating valves, such as represented from P^3 to P^8, and with interlocking mechanism operative by the valve motions, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEORGE WESTINGHOUSE, JR.

Witnesses:

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GEO. H. CHRISTY.