(No Model.) 2 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr.

FLUID PRESSURE SWITCH AND SIGNAL APPARATUS.

No. 245,108. Patented Aug. 2, 1881.

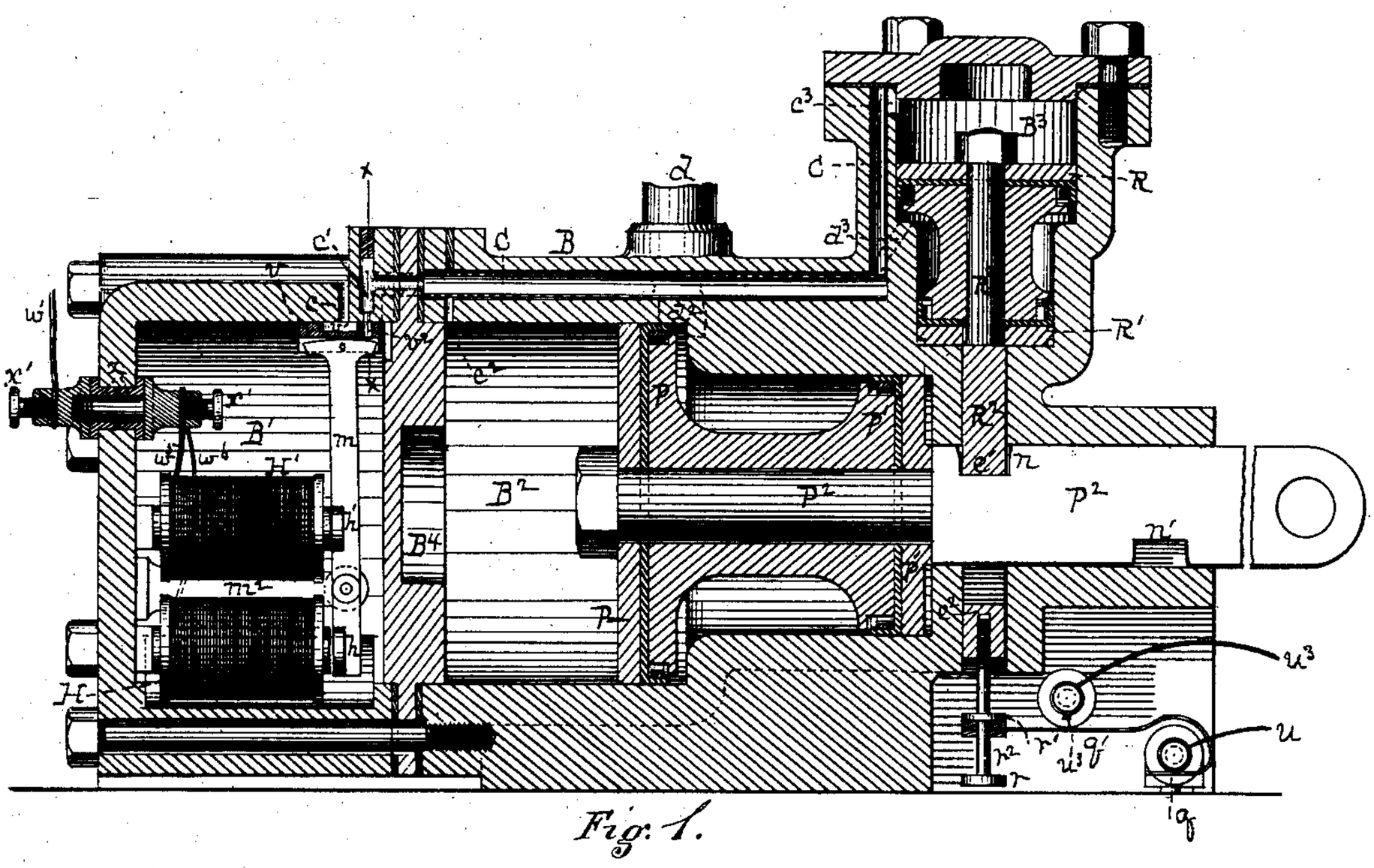

Fig. 1.

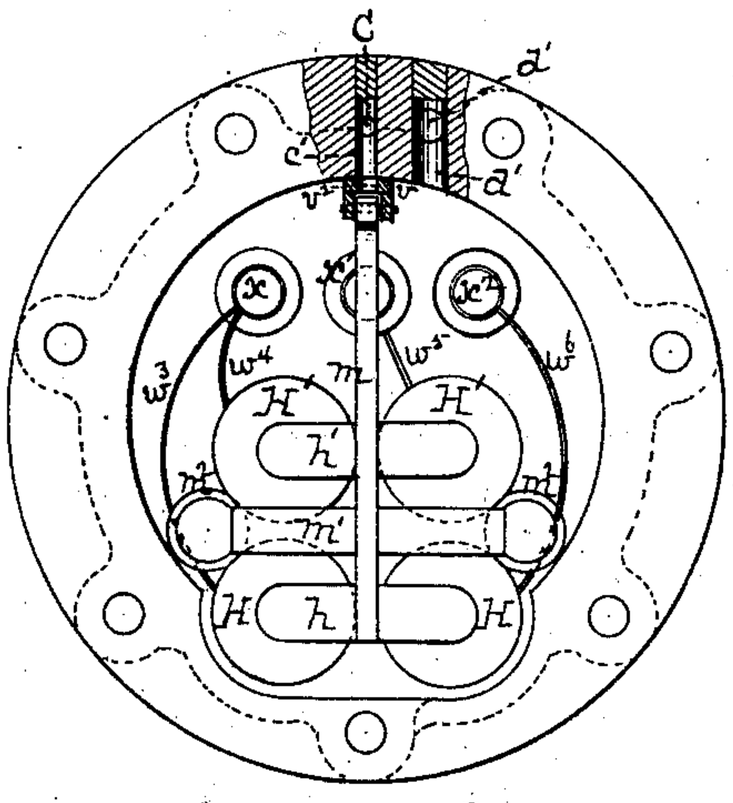

Fig. 2.

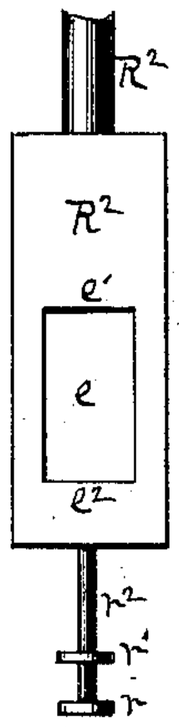

Fig. 4.

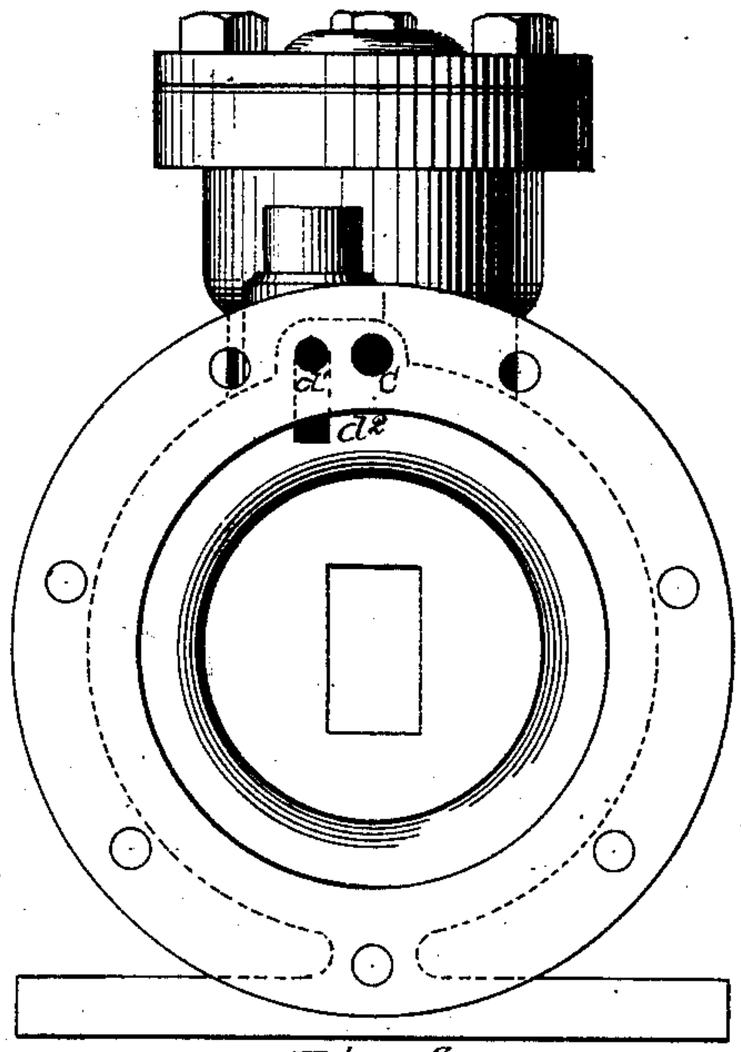

Fig. 3.

Witnesses
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C. L. Carter Jr

Inventor George Westinghouse Jr.
By Attorney. George H. Christy

(No Model.) 2 Sheets—Sheet 2.

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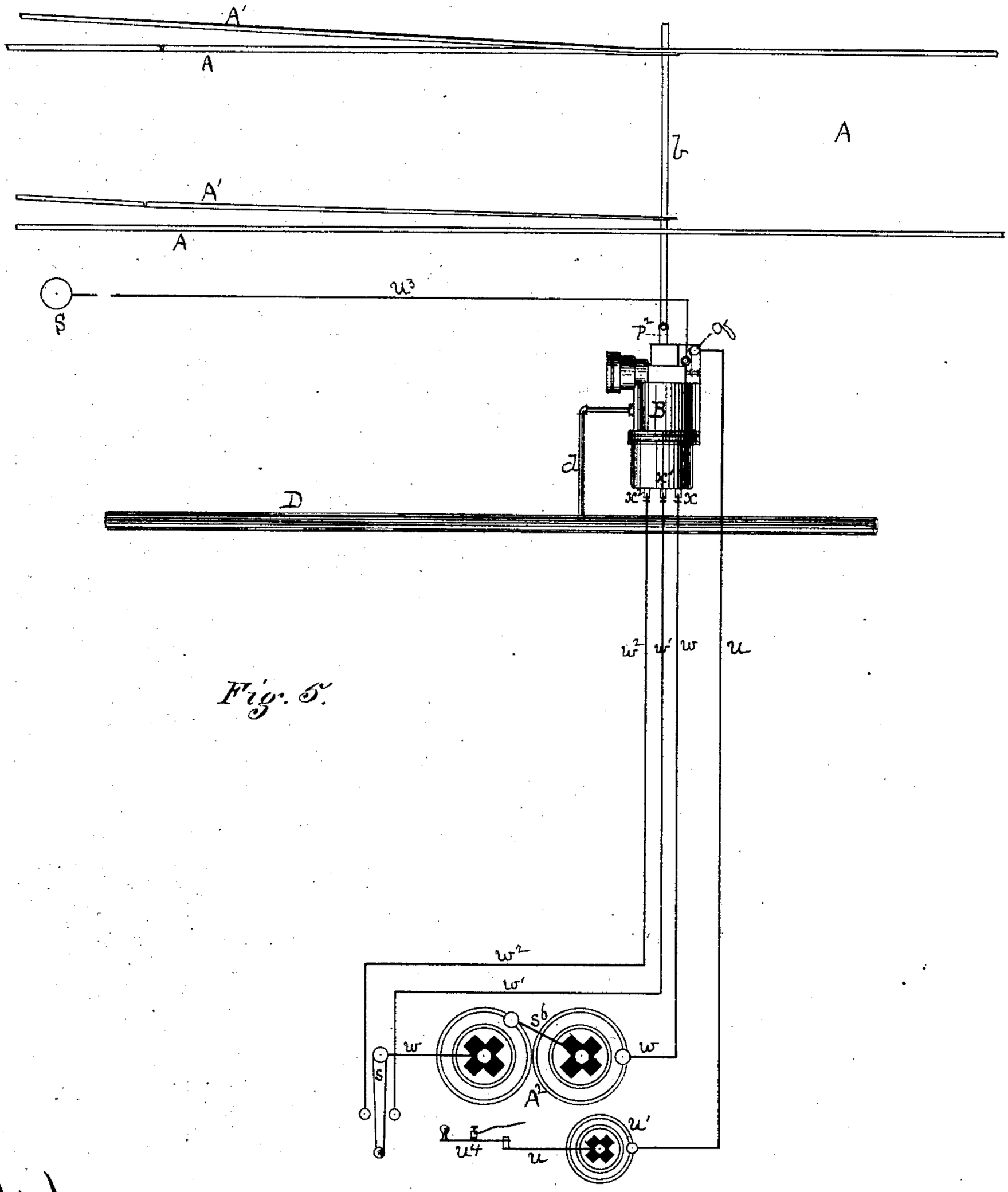

Fig. 5.

Witnesses
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By Attorney George H. Christy

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

FLUID-PRESSURE SWITCH AND SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 245,108, dated August 2, 1881.

Application filed January 6, 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 Fluid-Pressure 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, Sheet 1, is a longitudinal sectional view of a switch moving and locking mechanism illustrative of my invention. Fig. 2 is an end view, looking to the left of the fluid-pressure chamber B′ of Fig. 1, but sectioned in the upper part in the plane of the line *x x* of Fig. 1, the better to show the arrangement of the ports. Fig. 3 is an end view of the apparatus as seen when looking into the open end of chamber B^2, the piston of that chamber being removed. Fig. 4 is a face view of a portion of the locking-stem; and Fig. 5, Sheet 2, is a diagram or plan view of the apparatus as organized for use in operating a switch, the operative mechanism being turned on its side for convenience of illustration.

My present invention relates to certain improvements in apparatus for actuating railway-switches, signal-gates, and other movable parts or appliances of a railway superstructure; and it is chiefly valuable as a part of a switch and signal system in which a number or series of switches and signals are actuated from a central point commonly known as a "station" or "cabin," but at the same time it may be advantageously used to shift one or more independent or isolated switches with or without signal or signals, whereby at comparatively small stations or at special points—as meeting-points—a telegraph-operator or ticket-seller may operate a comparatively small number of switches or signals, or both, without interference with the performance of his other duties; and my present invention differs from anything now known to me in the art, among other respects in this, that I make use of an electro-magnet and armature to shift or move a valve or other device of like function, so as by such motion to call or put into action some accumulated or stored-up fluid-pressure under such conditions that the latter shall do the required work in the movement of the switch; and, as an addition to such a method of operation, I cause such action to put into operation a subsequently-acting force, such that immediately on the completion of a switch motion which makes the desired track-connection the appropriate signal shall be shifted to a corresponding position; also, the reversal of the switch motion will be preceded by the reverse movement of the signal, and, if so desired, may be followed by the setting of some other signal in like manner; also, in a system of apparatus so operating I embody a locking and unlocking attachment operated by the same pressure which shifts the switch.

In diagram Fig. 5 I have shown a main track, A, and a siding, A′, which may be connected therewith by any known construction or arrangement of movable switch-rails.

The switch-bridle *b* is connected with the stem of a piston inclosed within a case, B, which is laid in convenient proximity to the switch.

By means of an air-main, D, which may be of considerable capacity, and may extend along the track so as to connect two or more switch-actuating mechanisms, or by means of an equivalent reservoir, I provide the required operative pressure to be kept up by any suitable compressor for supplying fluid-pressure through a pipe, *d*, to the mechanism B.

At S, I have represented a signal point or post, on which any suitable signal may be arranged, as a siding or switch signal.

A main-line signal may be added and worked in any known way.

A^2 represents the switchman's cabin, or the station-house or point from which the switch is to be worked.

The mechanism B consists of a case or shell made in any suitable way, so as to form an air-chest, B′, and two differential-piston chambers, B^2 B^3, the latter having an axial line at right angles to that of the former. The air-chest B′ is separated from the piston-chamber B^2 by a close partition or diaphragm, B^4. In the chamber B^2 is a differential piston, or, in other words, two pistons, P P′, of different areas on the same stem P^2, which stem, preferably in the form of a flat bar, projects outside the case, and is se-

cured to the switch-bridle *b*. It has two notches, *n n'*, one in its upper and one in its lower edge, arranged and spaced as presently to be described. In the chamber B^3, which may be considerably smaller than the chamber B^2, I arrange another differential piston, R R', of like construction, on a common stem, R^2, which stem projects into the path of the stem P^2, but is slotted so as to form an eye, *e*, about as long as the stem P^2 is wide and about as wide as the stem P^2 is thick; and these stems are so made that when both pistons P P' and R R' are at the ends of their stroke or motion in one direction the shoulder *e'*, forming one end of the eye *e*, shall be seated in the notch *n*, and at the other ends of the stroke or motion of both, the shoulder e^2, forming the other end of the eye *e*, shall be seated in the other notch, *n'*.

The pipe *d* enters the case B and branches into three ports, (represented by dotted lines in Fig. 1,) one of said ports leading into the air-chest B', as at *d'*, another leading into the chamber B^2 at a point between the two pistons P P', as at d^2, and the third port leading into the chamber B^3 at a point between the pistons R R', as at d^3. These three ports are intended to be always open, so that the chest B' and so much of the chambers B^2 and B^3 as may be included between the double pistons therein shall at all times be filled or charged with fluid-pressure. The air-chest B' has also an exhaust-port, *c*, leading to the open air; also, a port, *c'*, opens from the air-chest B' into a passage, C, and from the latter a comparatively small port, c^2, opens into the larger end of the chamber B^2, and a comparatively large port, c^3, opens into the larger end of the chamber B^3.

An ordinary or other suitable form of slide-valve, *v*, is arranged with cavity *v'* and port v^2 relatively to the ports *c c'*, so that in one adjustment or position, as shown, communication from *c'* to *c* will be cut off and the exhaust will be closed, and so that fluid-pressure may pass freely from air-chest B' into the larger ends of B^2 and B^3. While the pressure thus introduced is the same in degree as that introduced through ports d^2 d^3 into the spaces between the double pistons, as above explained, it is at the same time greater in effect on account of the greater area of piston-surface on which it is effectively operative; hence the normal position of the apparatus will be that represented, in which both pistons are out, the piston P^2 is locked by the piston R^2, and the main-track line is unbroken; also, as will presently appear, the siding signal will be at "danger."

As a means of actuating the valve *v*, I prefer to use an electro-magnet, and as the valve must be moved in two directions, I provide two electro-magnets, H H', and for their better protection, as well as to facilitate their operation with the least possible resistance from friction, I prefer to arrange them in the air-chest B'. Each has its own armature *h h'*, and these armatures are mounted on a valve-moving lever, *m*, which is pivoted by a cross-bar, *m'*, on posts m^2 in such manner that as one armature is drawn to its magnet the other will be clear, and the connection of the end of the lever with the valve is such that it will at the end of one stroke cut off the exhaust and open the port *c*, the same being the normal position, and at the end of the other stroke cut off the supply and open the port *c'* to the exhaust *c*.

Passing through the end of the air-chest are three double-ended binding-posts, *x x' x²*, the metal stems of which are packed and insulated by suitable means, as by india-rubber gaskets *z*, which are tightly compressed by screwing up tightly the heads or ends of the binding-post.

From the cabin or station A^2 three wires, *w w' w²*, lead to the outer ends of the three binding-posts, one to each, and the wire *w*, which I term a "return-wire," or a wire from a return-circuit, leads to one binding-post, *x*, from the inner end of which two wires, w^3 and w^4, lead one to one electro-magnet, H, and the other to the other, H'. The opposite wires of the coils lead one, w^5, to the post *x'*, with which the line-wire *w'* is connected, and the other, w^6, to the other post, x^2, with which the other line-wire, w^2, is connected.

At the station or cabin a battery, s^6, is arranged on the return-circuit wire *w*, and the continuation of this wire is always in electrical communication with a key, *s*, which key, being shifted one way, makes connection with wire *w'*, so as to make a circuit through electro-magnet H', and thereby depress armature *h'* and bring the valve *v* to the normal position shown, and when the key is shifted to make contact with the wire w^2, a circuit is made through electro-magnet H, with the result of depressing armature *h* and shifting the valve to its other position, whereby the ports *c* and *c'* are brought into communication, and this is the means by which air-pressure is applied, whereby the movable rails of the switch are shifted and a siding connection is made. Bringing the port *c'* into communication with the exhaust *c* results in the escape of fluid-pressure from B^2 to B^3; but as the port c^3 leading from B^3 is somewhat larger than the port c^3 leading from B^2, the air-pressure in B^3 will escape so much the quicker, and the constantly-acting air-pressure between R and R' will give to the latter pistons a back-stroke, such as to take the shoulder *e'* out of the notch *n* in the stem P^2, and thereby unlock the differential pistons P P'. As soon as this is done fluid-pressure, acting between the pistons P P', will give them a back-stroke, with the result of moving the switch-rails connected therewith. As soon as this motion is complete the notch *n'* on the under side of the stem P^2 comes into the path of the stem R^2, and the pressure, still continuing to act between R and R', causes the shoulder e^2 to enter the notch *n'* in the stem P^2, so as to lock the switch-moving devices. Reversing the key by making a circuit through H' and breaking the other one depresses ar-

mature h' and restores the valve v to the position shown. Air-pressure from B′ then enters the chambers B^2 and B^3 by ports c^2 and c^3; but on account of the greater area of the latter port such pressure first becomes effective on R, so as to shift the differential piston R R′ a part stroke, and by causing its stem R^2 to clear the notch n' unlocks the stem P^2. Fluid-pressure, then becoming effective on P, effects the reverse movement of the switch-rails, so as to restore the main track or former connection, after which P^2 is relocked by the completion of the stroke R^2, the devices then having the position shown. Like or other desired means may be employed to actuate a signal either for the main track or siding, or for both, and apparatus such as described may be combined with each switch or signal of a series or succession. I also propose, by giving the key s the form or arrangement of a lever, to combine with the apparatus described an interlocking apparatus; but this will form the subject-matter of a separate application.

For actuating the siding-signal I prefer to use a wire, u, (with ground-connection,) and battery u', which ordinarily will be in position to make or keep a closed circuit. This wire u leads to a binding-post, q, at the switch apparatus, and electrically connected therewith is a spring contact-piece, q', the end of which (having insulated bearings) is engaged by one of two stops or lugs, r r', on the prolongation r^2 of the stem R^2, and these stops are so arranged that as the stem R^2 completes its upstroke one stop, r, will cause the contact-piece q' to make electrical contact with a wire, u^3, which leads to the signal, so as, by an armature at that point, operating directly or indirectly, to shift the signal to "safety;" also, as the stem R^2 commences a downstroke the lower stop, r, moving down, allows the spring contact-piece q', by its resiliency, to clear the wire u^3, and so break the circuit and let the siding-signal go to "danger" under the action of a weight, spring, or other suitable means; but if, for any reason, the signal-circuit should not be thus broken, the stop r', engaging the contact-piece q' just at the end of the downstroke of the piston-stem R^2, will break the circuit by a positive force and let the siding-signal go to "danger," as before; hence when the siding-connection is made, and not till then, the siding-signal shows "safety," and before the siding-connection is broken the siding-signal goes to "danger." The key u^4 is simply designed to enable the operator to break the previously-closed signal-circuit if, for any reason, he should desire to set the siding-signal at "danger" without breaking the siding-track connection; but if this capacity be not desired, the wire u may be grounded at or near the switch-moving mechanism without being carried back to the cabin.

It will be understood that the apparatus may be so fitted up that the outward motion of P^2 shall make the main or any other track connection instead of a siding-connection, as described, and the reverse motion will break the track-connection so made and restore the former track-connection, whatever that may be.

Instead of a slide-valve, v, other suitable form of valve or cock may be employed, as also any known substitute for a valve, or any device capable of being actuated by one motor, so as to change the direction of the action of a previously stored-up fluid-pressure, and such changes or modifications are hereby included as within the scope of the present invention; and, in so far as relates to the general features of construction and operation, I also include herein the use of a single piston (or equivalent diaphragm) in either or both the chambers B^2 B^3 for imparting motion by fluid-pressure on one side, in which case a spring or weight may be employed to effect a reverse throw on the release of the fluid-pressure; and if the apparatus be thus constructed or organized, a single electro-magnet will suffice for giving the valve v a stroke or motion in one direction, and a spring or weight may be added for giving it a reverse motion; and while such an apparatus, in its general features of construction and combination, is hereby included as within the scope of the present invention, separate claims will be made in another application for its elements of special novelty, and the apparatus in either style of construction may be applied generally to the moving or shifting of railway-switches, draw-bridges, and attachments, movable signals, gates, or other movable parts of a railway superstructure, and other desired fluid-pressure may be employed instead of compressed air; or, still further, an ordinary steam-engine slide-valve, valve-chest, and ports may be combined with a single piston (or equivalent diaphragm) in either or both the chambers B^2 B^3, so as to supply and exhaust fluid-pressure to and from the opposite ends of such chamber, it only being essential in such case that such valve be connected with the armature of an electro-magnet, so as to receive therefrom its motion in at least one direction; and if the locking device be used, (which may be omitted in any case, if so preferred,) the ports and valve-motions should be so arranged that the unlocking action shall precede the switch, signal, or other main shifting action; and also the forms of the engaging or interlocking parts of the stems R^2 and P^2 may be varied at pleasure, provided their conjoint operation remains substantially as set forth.

The make-and-break mechanism for operating the signal, instead of being combined with the locking and unlocking stem R^2, may be arranged in connection with the stem P^2, if so preferred, or with any moving part of the switch-moving apparatus, whereby the shifting of the movable rails shall make and break a signal-operating circuit.

The return-wire w is not absolutely essential, and may be omitted, provided battery and

ground connections are provided for the other wires in accordance with principles well known in the art. But as I propose to use wires made up into cables, it will cost but little more for the lengths required to get a three-wire cable than a two-wire cable, and all trouble from ground-connections will then be avoided.

I am aware that it is not new to combine a weight and an armature by a somewhat complicated arrangement of catches, stops, and connections with the rotating cock of a compressed-air reservoir, a cylinder, piston, and winding-gear in such manner that the stops or catches actuated by armature motion shall permit the weight to shift the rotary cock one way and the fluid-pressure to shift it the other way; but I am not aware of any prior system of apparatus of this class in which the valve which opens and closes the fluid-pressure-supply port was actuated in either direction by or from the armature, so that the motion of the armature was transmitted at once or directly to the valve by a positive motion or stroke; and for this purpose it is immaterial what the interposed connections are through which such motion is transmitted, provided the motions of both be positive and simultaneous.

I claim herein as my invention—

1. In a mechanism for operating a movable part or appliance of a railway superstructure, the combination of a fluid-pressure-supply port, a valve to open and close such port, and an electro-magnetic armature arranged to open and close such valve by a direct positive motion simultaneous with its own, substantially as set forth.

2. The combination of a fluid-pressure-supply port, a valve to open and close such port, an electro-magnetic armature arranged to open and close such valve by a direct positive motion simultaneous with its own, and a piston device for transmitting the effective force of such fluid-pressure to the part or appliance to be moved, substantially as set forth.

3. In an apparatus for operating a movable part or appliance of a railway superstructure, the combination of a shifting piston and stem for effecting the movement desired, a locking piston and stem arranged at right angles thereto, and interlocking devices on the two stems, whereby the latter stem, at the end of its stroke in either direction, shall lock the former in place, substantially as set forth.

4. In a mechanism for operating a movable part or appliance of a railway superstructure, the combination of a valve, a motor under control of the operator for moving the valve, an independent or second motor brought into effective operation by such valve motion, a piston device for transmitting the effective force of such second motor to the part or appliance to be moved, and an auxiliary-piston device, also operated by such second motor for locking or unlocking the main piston, substantially as set forth.

5. In combination with the stem of the locking and unlocking piston and an electric-circuit wire leading thence to a signal, a make-and-break mechanism arranged in such circuit and operated by the locking and unlocking piston, substantially as set forth.

6. A differential piston, $P' P^2$, subject to a continuously-acting fluid-pressure in one direction and an intermittently-acting fluid-pressure in the other direction, in combination by suitable ports with a valve for regulating the intermittent pressure and one or more electro-magnets for giving motion to the valve, substantially as set forth.

7. An apparatus having in combination the differential-piston chambers $B^2 B^3$, a differential piston in each of such chambers, suitable ports for supplying a continuously-acting pressure to said pistons in one direction, and ports $c^2 c^3$, of different areas, for supplying and exhausting an intermittently-acting pressure in the other direction, whereby the piston of the larger port shall be caused to move in advance of the other, substantially as set forth.

8. An apparatus having in combination a fluid-pressure chamber, B′, differential-piston chambers $B^2 B^3$, a differential piston in each, a continuous fluid-pressure supply to the fluid-pressure chamber and to each of the piston-chambers to actuate the pistons one way, and a valve-governed port for alternately admitting fluid-pressure from chamber B′ to the piston-chambers for actuating the pistons the other way and exhausting such fluid-pressure, substantially as set forth.

9. In combination with a switch-signal or gate-moving piston and cylinder, a fluid-pressure chamber, B′, a valve for governing the supply and exhaust, and a pair of electro-magnets the armatures of which are connected with the valve, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEORGE WESTINGHOUSE, JR.

Witnesses:

R. H. WHITTLESEY,

GEORGE H. CHRISTY.