No. 701,685. Patented June 3, 1902.

W. H. CUMMER.

ELECTROPNEUMATIC SWITCH SYSTEM FOR ELECTRIC RAILWAYS.

(Application filed Nov. 8, 1901.)

(No Model.) 2 Sheets—Sheet 1.

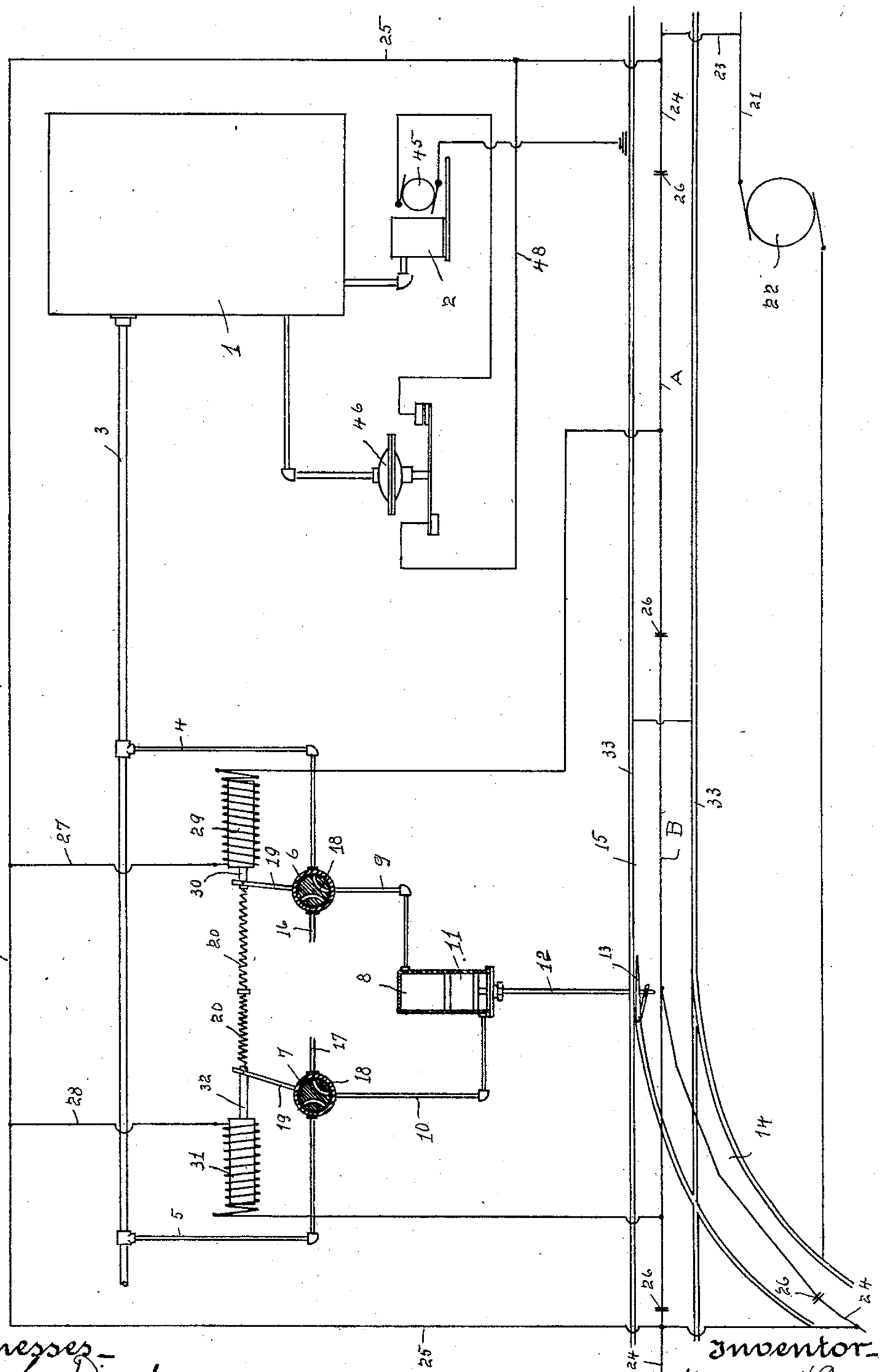

Fig. 1.

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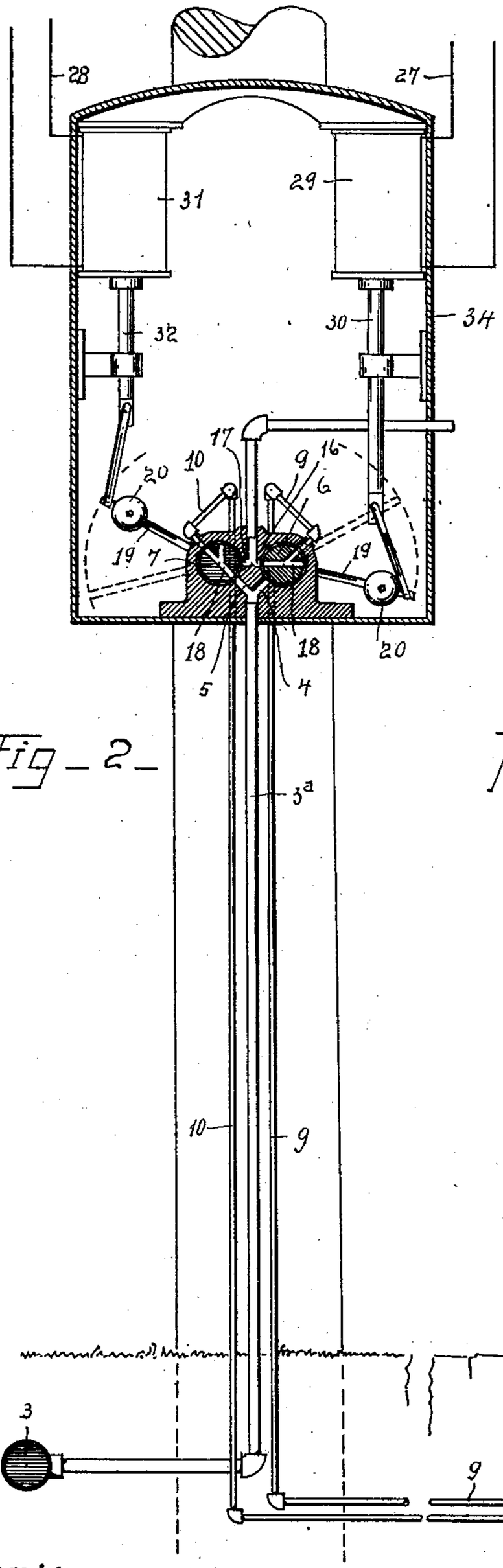

Fig_2_

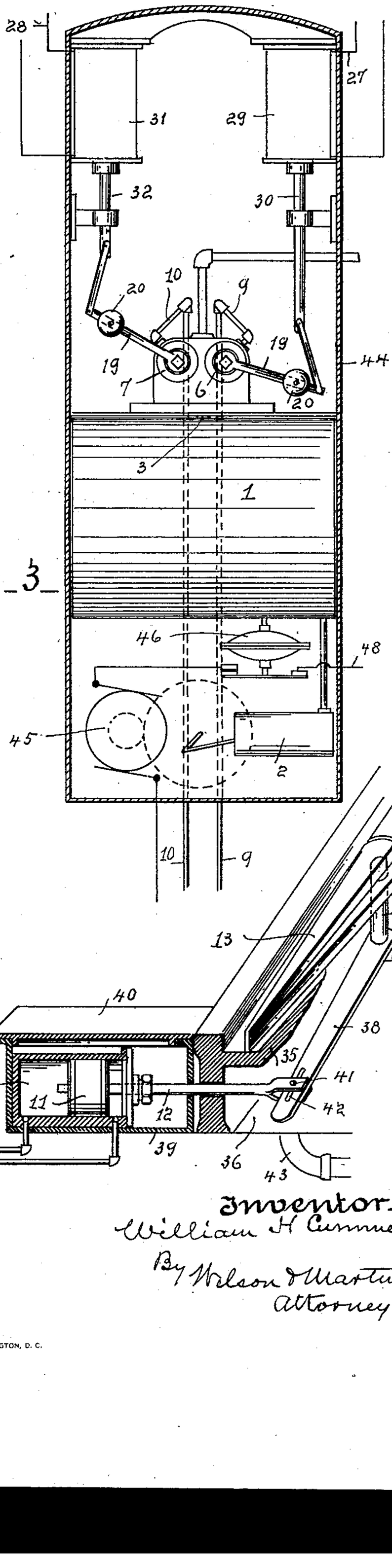

Fig_3_

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UNITED STATES PATENT OFFICE.

WILLIAM H. CUMMER, OF TOLEDO, OHIO.

ELECTROPNEUMATIC SWITCH SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 701,685, dated June 3, 1902.

Application filed November 8, 1901. Serial No. 81,560. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. CUMMER, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented a new and useful Improvement in Electropneumatic Switch Systems for Electric Railways, of which the following is a specification.

My invention relates to an electropneumatic switch system for electric railways, and has for its object to provide a system of pneumatically-operated and electrically-controlled switches for a line of electric railway wherein the switches of the line normally free in whatever position they are left by a car may be set or retained in the required position for a following car by air-pressure turned on by a current of electricity from the line conductor established by and under the control of the rheostat of the passing car and wherein the air-pressure so turned on will be automatically released after the car has passed the switch a fixed distance and the switch again left free to be set in like manner as required for the next car.

A further object is to provide a safe and reliable system of the kind, simple and economical in construction and operation, that is not liable to be materially affected by weather conditions, and wherein the switches are free to be set in the ordinary way, if occasion requires. I accomplish these objects by equipping and connecting the switches of the line as hereinafter described, and illustrated in the drawings, in which—

Figure 1 is a view in diagram, exhibiting the application of the invention to one of the switches of a line of railway as illustrative of its application to all the other switches of the line. Fig. 2 is a part elevation, part section, and part isometric of the electropneumatic controlling and operating mechanism as installed and applied to a switch; and Fig. 3 is a part elevation and part section of an isolated electropneumatic equipment for a single switch wherein an air-compressor, an electric motor for operating it, an air-receiver, a pressure-regulator, the valves for controlling the air, and the magnets for controlling the valves are housed together in one casing.

In the drawings, 1 designates the receiver of an air-compressor 2, and 3 an air-main extended from the receiver along a line of railway or a part thereof. At each switch in the line along the extension of the main 3 are provided branch pipes 4 and 5, leading, respectively, from their connection with the main to valves 6 and 7. Valve 6 is connected with the outer end of cylinder 8 by pipe 9, and valve 7 is connected with opposite end of cylinder 8 by pipe 10. Cylinder 8 of each switch is provided with a piston 11, having a rod 12, suitably connected with the pivoted switch-point 13 of a switch-track 14 in the main track 15 for opening and closing the switch by the movement of the piston. Valves 6 and 7 are connected with exhaust-pipes 16 and 17, respectively, and each valve is provided with a two-way port 18, adapted when the valve is turned to its limit in one direction to register the port 18 of valve 6 with pipes 4 and 9 of valve 7 with pipes 5 and 10, and thus form independent connections from the main 3, one to each end of the cylinder 8, and when turned to its limit in the opposite direction to register the port 18 of valve 6 with pipe 9 and exhaust 16 of valve 7 with pipe 10 and exhaust 17, thereby forming an open independent connection from each end of cylinder to their respective exhausts. Valves 6 and 7 are each also provided with an operating-lever 19, which are each provided with weights or springs 20, adapted to hold the valve-ports normally in register with their respective exhausts.

21 represents the main lead-conductor of a dynamo 22, and 23 a branch conductor from the main lead-conductor to the section 24 of a sectional conductor forming the line conductor of the main track 15. Opposite the switch 14 section 24 is provided with a loop 25, and between the terminals of the loop are interposed in the line conductor the sections A and B, insulated from the sections 24 and from each other by the circuit-breakers 26. Section A extends along the approach to the switch, and section B is branched and extends from its insulated connection with section A beyond the switch along both the main and switch tracks. In Fig. 1 a branch of section 24 is shown extended along the switch-track as the line conductor of the switch-track from the end of section B switch branch; but the line conductor of the switch may be

connected directly with the main lead-conductor. The loop 25 is provided with the branch conductors 27 and 28. Conductor 27 extends from its connection with loop 25 to and is connected with section A of the line conductor and includes the winding of the magnet 29, the core 30 of which is connected to the lever of valve 6. Conductor 28 extends from its connection with loop 25 to and is connected with section B and includes the winding of magnet 31, the core 32 of which is connected to the lever of valve 7. The electrically-bonded rails 33 of the track 15 constitute the return of the sections of the line conductor.

Thus constructed the operation will be as follows: For a car approaching the switch on section 24 that is destined to pass from the main track on the switch-track if the switch-bar 13 be closed when the car-trolley passes from section 24 to section A the circuit through loop 25, the branch conductor 27, the section A, and the return will be closed and the magnet 29 will energize its core 30 and pull the lever to which it is connected to open the valve 6, thereby admitting air to the outer end of cylinder 8, whereby the piston 11 will be moved to open the switch. When the trolley has passed from section A to section B, the circuit including the section A will be open, the magnet 29 will be deënergized, its core released, and the weight or spring of the lever of valve 6 will reverse it, and thereby close the branch pipe 4 and connect the pipe 9 with the exhaust of that valve, thereby releasing the air from the outer end of cylinder 8. At the same time the open circuit comprising the loop 25, the branch conductor 28, section B, and the return will be closed by the car-trolley, the magnet 31 will be energized, and the valve 7 opened to admit air through branch pipes 5 and 10 to the inner end of cylinder 8, whereby the piston 11 will be moved to close the switch in advance of the approaching car, which, propelled by the current through section B, will turn off the main track on the switch. When the trolley has left the branch of section B, extending along the switch, the circuit including the section B will be opened, the magnet 31 will be deënergized, the lever of valve 7 will be reversed, thereby closing branch pipe 5 and connecting pipe 10 with the exhaust of the valve 7, whereby the air in the inner end of cylinder 8 will be released and the switch will be left closed. If the car next following is destined to pass the switch on the main track, the operation will be as follows: When the trolley of the car has passed from section 24 to section A, the switch will be thereby opened, as before described; but before the trolley leaves the section A the circuit is opened by the motorman of the car and is allowed to remain open while the car passes over section B through the open switch by its momentum alone. When the car has passed section B in the main track, the motorman closes the circuit with the succeeding section and the car passes on, leaving the switch open for the next following car. It is obvious that if this car is destined to pass onto the switch-track the switch will remain open while the car passes section A and will be closed as soon as it passes to section B; but if the car is destined to continue along the main track the motorman will break the circuit before the car passes from its connection with section A and allow the car to run over section B through the open switch by its momentum, as before described. Thus it will readily appear that by the construction shown and described the setting of the switch in the required position for the destination of the car, whether left open or closed by the preceding car or by accident, is under the full control of the electric controller of a passing car.

The windings of the magnets 29 and 31 are preferably adapted to transmit the entire current of the branch conductors; but it may be placed in a shunt-circuit from the branch. The levers of the valves are preferably weighted or provided with springs of sufficient resistance to prevent the opening of the valves with less than a fixed amperage of current, thereby making it unnecessary to entirely cut off the current while the car is passing the switch on the main track and in order that the lights of the car may not go out while the car is running the switch under its momentum.

In Fig. 2 are shown the magnets 29 and 31 and valves 6 and 7, housed in a casing 34, secured to a pole adjacent to the switch, with the branch air-pipes and electric conductors extended from the housing to their connections. In this figure the pipes 4 and 5 are shown as Y branches of a branch 3^a, connected to main 3. By such instalment of the controlling elements of the switch they are made conveniently accessible and operative under all conditions of weather. In Fig. 2 is also shown a detail view of the switch mechanism, in which 35 is a switch-base casting having elevations on the top forming continuations of rails of the main track and switch and having an arched cavity 36 beneath. To the top of the base 35 is pivoted the switch-point 13 by the pivot 37, the lower end of which extends into the cavity 36 and is provided with the crank-lever 38. Suitably secured to the base 35 is a housing 39 for the cylinder 8, the housing being open at the top and provided with a detachable closure 40, permitting access to the cylinder. The piston-rod 12 of the cylinder extends through suitable orifices in the housing and the adjacent wall of the base 35 into the cavity 36 and is bifurcated at its outer end to receive the lever 38, to which it is pivotally connected by a pin 41 transverse the bifurcations of the piston through a slot 42 in the end of the lever. Both the housing 39 and the switch-

base are provided with suitable drainage 43 to prevent any accumulation of water in the housing or the cavity of the switch-base.

When all of the switches of a line are connected to a common air-main, the compressor 2 may be located at the central power-station and be operated by the same power that operates the dynamo. When, however, it is found desirable to locate compressors at different parts of the line and connect only part of the switches to one main, the power for operating the compressor may be taken from the main lead-conductor or from the line conductor, as indicated in Fig. 1, or they may be operated by any other independent power.

In Fig. 3 is shown housed in a single casing 44 a complete equipment for operating and controlling a single switch. For such instalment the motor 45, provided with a pressure-regulator 46, connected by branch pipe 47 with the receiver 1, is connected in circuit with the main lead-conductor or with the line conductor by the branch conductor 48, as shown in Fig. 1. The regulator or governor 46 may be of any of the well-known types or kinds used for making or breaking the circuit of the motor by means of pressures below or above a predetermined pressure.

It is apparent that the sections A and B and the magnets 29 and 31 may be connected directly with the main lead-conductor instead of the loop of the line conductor, as shown, where such connection is desirable or convenient.

While the track-rails are shown as the return for the system, it is apparent that the operation will be the same whatever suitable conductor may be used for the return.

What I claim to be new is—

1. In an electropneumatic switch system for electric railways, the combination with a main line of track electrically equipped for operating cars thereon, of a switch in the main track provided with mechanism for opening and closing the switch by air-pressure; an air-supply connected to the switch mechanism; a valve in the connection adapted, when opened, to admit air from the air-supply to the switch mechanism; and means to open the valve by a current of electricity through the current-controller of a passing car.

2. In an electropneumatic switch system for electric railways, an open independent electric circuit comprising a main lead-conductor connected to a dynamo, a section of the line conductor insulated therefrom and connected to the main lead-conductor by a feed-conductor for the section including the winding of a magnet, and a return-conductor, adapted to be closed by the wiring of a car, in combination with a main line of track; a switch-track therefrom; a switch-point adapted to close or open the switch-track; means to operate the switch-point by air-pressure to open or close the switch; an air-supply connected to the switch; a valve in the connection adapted, when open, to admit air to open the switch, and, when closed, to release the air and leave the switch free; means to electrically open the valve by a current through the winding of the magnet, established by the closing of the circuit by a passing car, and means to automatically close the valve when it is electrically released by a breaking of the circuit.

3. In an electropneumatic switch system for electric railways, an open independent electric circuit comprising a main lead-conductor connected with a dynamo; a section of the line conductor, insulated therefrom and connected to the main lead-conductor by a feed-conductor for the section having included therein the winding of a magnet, and a return-conductor, adapted to be closed by the wiring of a car, in combination with a main line of track, a switch-track therefrom, a switch-point adapted to close or open the switch-track, means to operate the switch-point by air-pressure to open or close the switch; an air-supply connected to the switch; a valve in the connection adapted, when open, to admit air to close the switch and, when the valve is closed, to release the air and leave the switch free; means to electrically open the valve by a current through the winding of the magnet established by the closing of the circuit by a passing car; and means to automatically close the valve when electrically released by a breaking of the circuit.

4. In an electropneumatic switch system for electric railways, a main line of track, a switch-track therefrom, a switch adapted to close or open the switch-track, means to operate the switch by air-pressure, to open or close the switch, an air-supply connected to the switch-operating mechanism, a valve in the connection adapted, when open, to admit air to open the switch and, when closed, to release the air and leave the switch free, in combination with an open independent electric circuit comprising a main lead-conductor connected to a dynamo; a line conductor connected to the main lead-conductor, and looped around the switch; an insulated section of the line conductor in alinement therewith within the loop, a feed-conductor for the section connected to the section and the loop, having included therein the winding of a magnet, and a return-conductor, the open circuit thus formed being adapted to be closed by the wiring of a car, means to electrically open the air-valve by a current through the winding of the magnet established by the closing of the circuit by a passing car, and means to automatically close the valve when it is electrically released by a breaking of the circuit.

5. In an electropneumatic switch system for electric railways, the combination with an electrically-equipped railway-track, having a plurality of switches, of an air-compressor; a receiver for the air-compressor; an air-main extending from the receiver along the track

by the switches; a cylinder for each switch, having a piston operatively connected to its switch-point, and adapted, when moved in one direction, to open, and in the opposite direction, to close the switch; a branch pipe from the air-main to each end of the cylinder; a two-way valve in each branch pipe, adapted, when opened, to admit air to the cylinder and when closed, to release it therefrom; a lever for each valve; means connected to the levers to yieldingly hold the valves normally closed and automatically close them when opened and released; a loop in the line conductor around each switch; an approach and a passing section of the line conductor spanning the loop; circuit-breakers connecting the sections with each other and with the line conductor; an independent feed-conductor for each section, connecting the section with the loop and including the winding of a magnet having its core linked to the lever of a valve and adapted to be moved to open the valve by a current through the winding of a magnet, that of the approach section with the lever of the valve adapted to admit air to the cylinder to open the switch, and of the passing section, with the valve adapted to admit air to the opposite end of the cylinder and close the switch, and a return-conductor, forming with each section, its feed-conductor, and the loop, an independent open circuit, adapted to be closed by the wiring of a passing car, and kept closed or open by the current-controller of the car while the car is passing the section, and automatically opened again when the car has passed the section.

In witness whereof I have hereunto set my hand this 4th day of November, A. D. 1901.

WILLIAM H. CUMMER.

Witnesses:
C. R. KONOPAK,
CHAS. A. BOAKE.