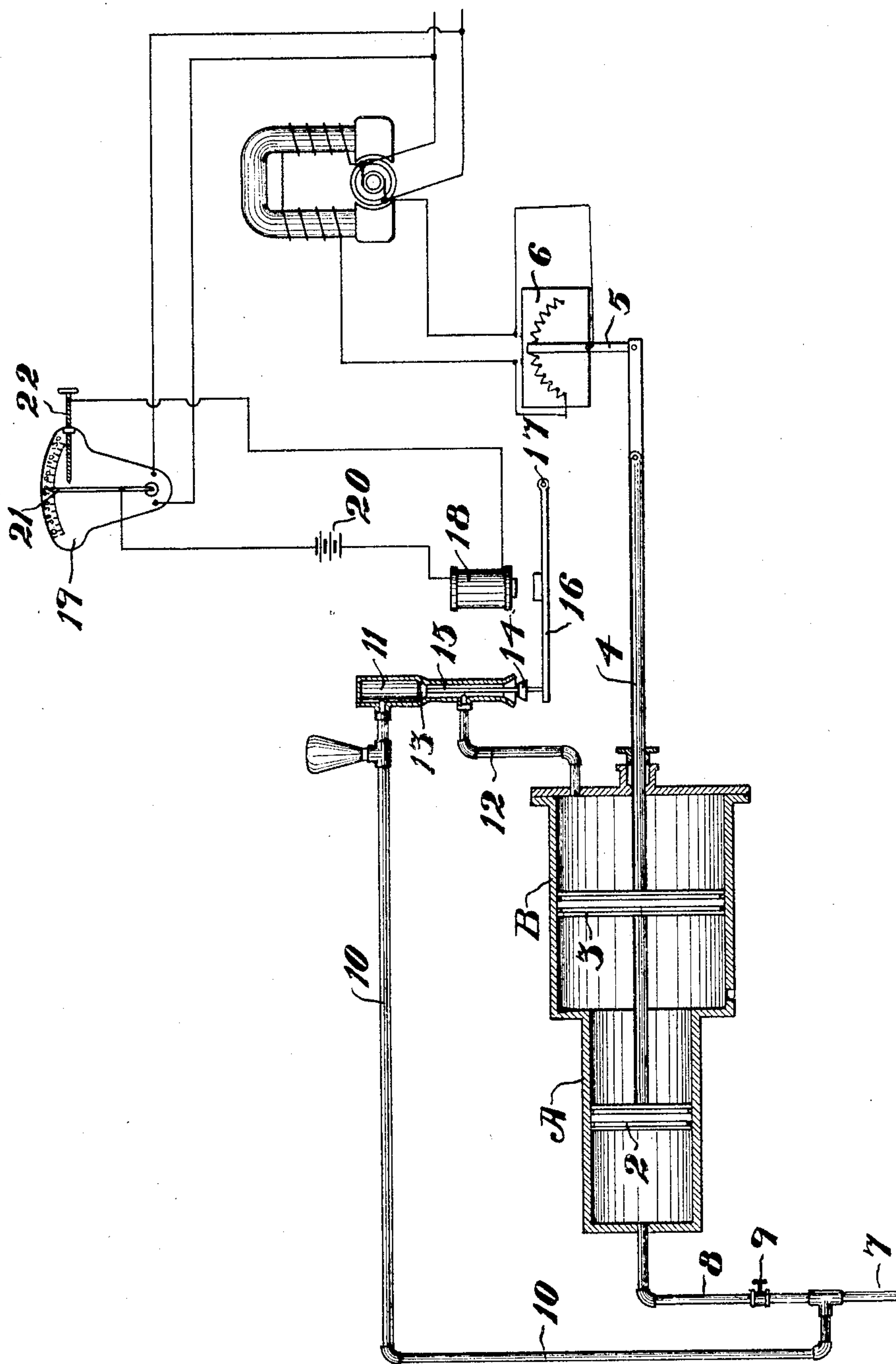


No. 779,720.

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O. M. LACEY.
VOLTAGE REGULATOR.
APPLICATION FILED NOV. 9, 1903.



Witnesses,
J. J. Sorce
Dudley Moss.

Inventor,
Ora M. Lacey
By *Geo. H. Strong* atty.

UNITED STATES PATENT OFFICE.

ORRA M. LACEY, OF HANFORD, CALIFORNIA.

VOLTAGE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 779,720, dated January 10, 1905.

Application filed November 9, 1903. Serial No. 180,392.

To all whom it may concern:

Be it known that I, ORRA M. LACEY, a citizen of the United States, residing at Hanford, in the county of Kings and State of California, have invented new and useful Improvements in Voltage-Regulators, of which the following is a specification.

My invention relates to an apparatus which is designed to regulate the voltage of electrical currents.

My invention consists of the parts and the combinations of parts, as hereinafter more fully described and claimed, having reference to the accompanying drawing.

The figure is a longitudinal central section of cylinder and valve-chamber with diagrammatic wiring.

The object of my invention is to provide an apparatus by which the voltage of a current of electricity may be constantly and automatically regulated to any desired point. This I effect by a fluid-pressure acting in opposite directions upon pistons of different area, the flow of the fluid being controlled by valves actuated directly by the movements of a voltmeter, and the movement of the piston is transmitted directly to the rheostat or other controlling device.

As shown in the accompanying drawing, A and B represent two cylinders of different diameter. Each cylinder has within it a piston, as at 2 and 3. The piston-rod 4 passes out through a stuffing-box in the end of one of the cylinders and is connected with the lever-arm 5 of a rheostat, as shown at 6, so that the movement of the pistons in one direction or the other actuates the switch-lever 5 of the rheostat, thus regulating the current which is passing.

7 is a main or pipe carrying fluid under pressure, such as water having a certain pressure, from any source of supply. This pipe has two branches, one pipe, 8, which connects with the cylinder A and may have a controlling-valve, as shown at 9. The other pipe, 10, connects, through a valve-chamber 11 and a pipe 12, with the cylinder B. The two pipes 8 and 12 open into opposite ends of the cylinders A and B, and thus any pressure ad-

mitted from either pipe acts in opposition to that from the other.

In the present case I have shown the cylinder A made of smaller diameter than the cylinder B, so that an uninterrupted pressure of water flowing through both pipes 8 and 12 would have the effect, by reason of the greater area of the piston 3, to force the pistons toward the inlet end of the cylinder A, and the pressure in this cylinder would only operate by cutting off the source of supply from the cylinder B. This control of the water is effected by two valves 13 and 14, movable in the valve-chamber 11 and connected by a stem at 15, so that they will move in unison.

The valve-stem 15 is here shown as continued below the valve 14 and connected with an armature-lever 16, which is pivoted, as at 17, and in such relation with an electromagnet 18 that when the magnet 18 is energized the armature would be attracted and the valve-stem 15 would be raised, so as to open the valve 13 and close the valve 14.

The deenergizing of the magnet 18 allows the armature to drop and the valve 13 to be closed and the valve 14 to be opened.

When the valve 13 is closed, no pressure of the fluid will be admitted into the larger cylinder B, and the valve 14 being open provides a discharge for fluid within the cylinder B, so that the pressure of the fluid acting through pipe 8 upon the piston 2 in the cylinder A will move the two pistons and the piston-rod 4, which, acting upon the switch of the rheostat 6, will vary the current passing there-through.

The voltage of the controlled circuit is measured by a voltmeter, as at 19, and whenever there is a necessity for varying the voltage it will be effected by the action of the voltmeter communicated through the electromagnet 18 and its energizing source, so as to close the valve 14 and open the valve 13. When this is done, the fluid passing through the pipes 10 and 12 enters the cylinder B, and by reason of the greater area of this cylinder the pressure upon its piston will overcome that upon the piston 2 of the smaller cylinder A and force the pistons in the opposite direc-

tion to that previously described, and acting through the piston-rod 4 and the switch-lever 5 of the rheostat the tension of the passing current will be again changed in accordance with the relative disposition of the parts, the movement of the pistons to the right serving to increase the current and the movement in the opposite direction to diminish it.

The voltmeter 19 is placed within the circuit of a suitably-located battery or source of electrical energy, as at 20, connection being made between the indicating-pointer 21 and one side of the battery and between an adjustable screw 22 and the electromagnet 18 and opposite side of the battery. Thus the movements of the indicator-pointer 21 will move it into contact with the adjusting-screw 22, thus completing a circuit through the battery 20 and the electromagnet 18, which will attract the armature 16 and open the valve 13 and close the valve 14.

Any variation which moves the pointer 21 away from the screw 22 will arrest the electric current, deenergize the magnet 18, allow the armature 16 to drop away, and with it the valve-stem 15, which will close the valve 13 and open the discharge-valve 14, so that pressure in the cylinder B may be reduced and the pressure in the cylinder A exert itself. In this manner the voltage of the passing current will be continually and automatically regulated.

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

1. An electric-voltage regulator consisting of cylinders, connected pistons of different areas, a rheostat with which said pistons are connected, means for admitting a fluid under pressure to opposite ends of the cylinders, valves by which the admission of the fluid to said cylinders is controlled, an electromagnet and valve-actuating armature, a source of electric energy for said magnet and a voltmeter by which the current through the magnet is controlled.

2. An apparatus for regulating the voltage of an electrical current, said apparatus consisting of cylinders axial in line having connected pistons of different areas, a piston-rod extending therefrom, a rheostat connected with and actuated by said rod, fluid-pressure pipes, one connecting with the outer end of the smaller cylinder and the other connecting with the opposite end of the larger cylinder, inlet and outlet valves located between the source of supply and the larger cylinder an electromagnet and armature therefor by which the opening and closing of said valves are effected, a source of electrical energy for said

magnet and a voltmeter within the current to be regulated, said voltmeter acting by its variations to energize or deenergize the electromagnet and open or close the fluid-pressure-controlling valves.

3. An apparatus for regulating the voltage of an electrical current consisting of cylinders axially in line having different areas, connected pistons fitting said cylinders, a rheostat located within the main electrical circuit connections between said rheostat and the cylinder-pistons whereby they are moved in unison, fluid-pressure pipes connecting with opposite ends of the two cylinders, inlet and outlet valves located in the path of the fluid to the outer cylinder, a stem by which said valves are connected to move in unison whereby one is closed and the other is opened, an electromagnet, an armature therefor connected with and actuating the said valves, a source of electric energy for said magnet, a voltmeter for the main current, said voltmeter being located in the path of the current which energizes the electromagnet, connections between the movable pointer of the meter on one pole of the battery and an adjustable point located in the line of movement of the pointer and having connection with the other pole of the battery whereby the circuit is closed when the pointer touches the screw and is opened when it moves away.

4. A voltage-regulator comprising a voltmeter, mechanism comprehending a constant fluid-pressure in one direction and a non-constant fluid-pressure in an opposite direction, connections between the voltmeter and said mechanism to control the pressures, and a rheostat operated by the pressures.

5. A voltage-regulator comprising a voltmeter, a differential piston, means for exerting a constant fluid-pressure upon the piston in one direction and an increased fluid-pressure in an opposite direction, connections between the voltmeter and the fluid-supply, and a rheostat operable through the medium of said pressures.

6. A voltage-regulator comprising a voltmeter, mechanism comprehending a constant fluid-pressure in one direction and an intermittent greater fluid-pressure in an opposite direction, connections between the voltmeter and said mechanism to control said pressures and a rheostat operatable through the medium of said pressures.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ORRA M. LACEY.

Witnesses:

S. H. NOURSE,
JESSIE C. BRODIE.