

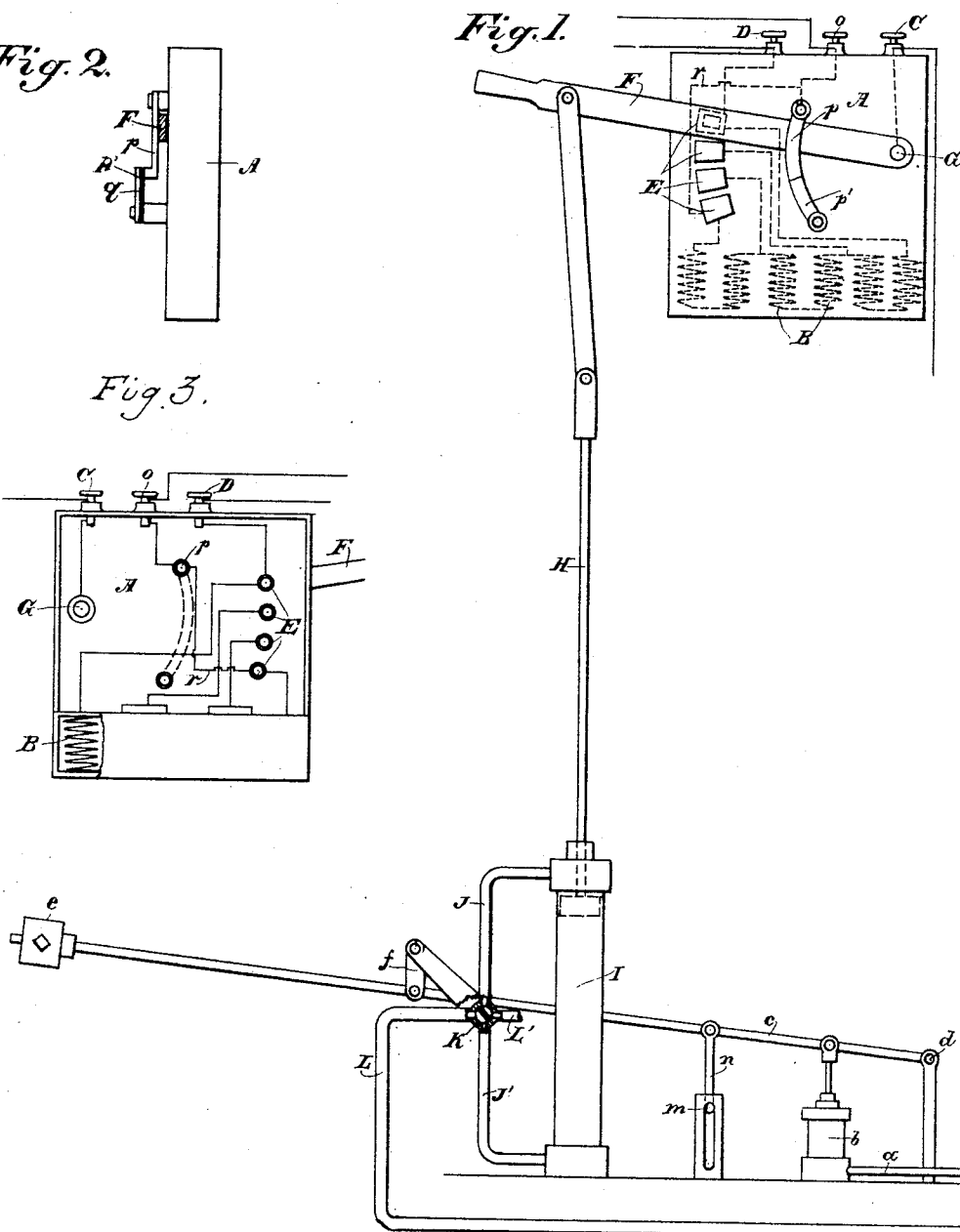
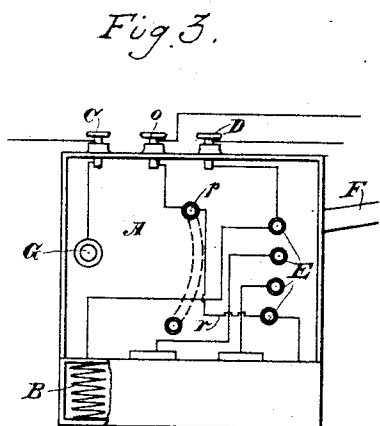
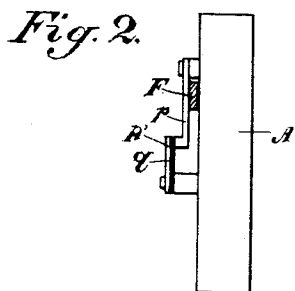
(No Model.)

2 Sheets—Sheet 1.

B. C. VAN EMON.
AUTOMATIC RHEOSTAT.

No. 513,350.

Patented Jan. 23, 1894.



Witnesses,
J. H. Morse
J. F. Aschbeck

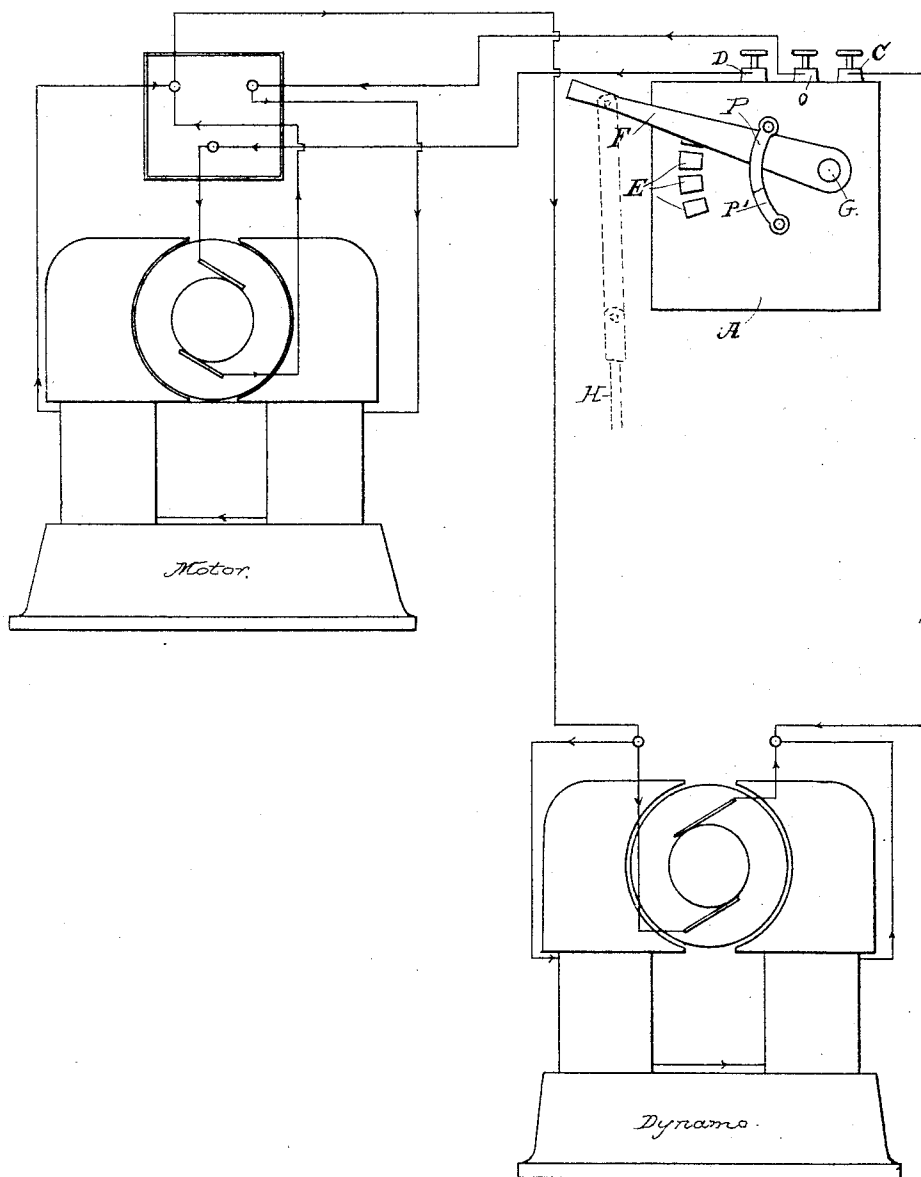
Inventor,
Barton L Van Emmon
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Fig. 4.



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UNITED STATES PATENT OFFICE.

BURTON CHARLES VAN EMON, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR
TO THE ELECTRICAL ENGINEERING COMPANY, OF SAME PLACE.

AUTOMATIC RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 513,350, dated January 23, 1894.

Application filed April 4, 1893. Serial No. 469,038. (No model.)

To all whom it may concern:

Be it known that I, BURTON CHARLES VAN EMON, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Automatic Rheostats; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to rheostats for varying the resistance of electric circuits by a step by step change for either reduction or increase in the length of such circuits.

It consists in certain details of constructions which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a view of my rheostat with its connections. Fig. 2 is a side view of the same. Fig. 3, is a rear view of the rheostat. Fig. 4, represents the rheostat interposed between the dynamo and motor.

My invention is more especially intended to be used in the armature circuit of a constant potential motor, for the purpose of starting and stopping the motor in the proper manner whenever predetermined actions set it free to do its work,

In the starting of a constant potential motor, it is necessary to conduct the electric current through some resistance placed in series with the armature circuit of the motor, and to gradually decrease this resistance until the armature has attained its normal speed of rotation, when, if any resistance remains, it may be completely removed. On stopping the motor, this operation is reversed, but with greater rapidity. This resistance in its entirety must be great enough to prevent the passing of a current of sufficient quantity to overheat the armature or its electrical connections. It has been the practice in the art to effect this reduction by use of a rheostat having a switch of sufficient number of points of contact so that a manually operated lever electrically connected with one terminal binding-post of the switch, will in its sweep across these points either withdraw or introduce the parts or divisions of the rheostat according to requirements.

In my invention I have so contrived the apparatus that the lever is automatically oper-

ated whenever started by any external means, and it then slowly cuts out the resistance from the circuit, or rapidly introduces it, as the case may require, without further external aid.

A is a case conveniently arranged and containing a series of resistance coils B which are fixed within it extending from side to side. These coils are connected in series so that the current of electricity introduced from the dynamo through the port C may be caused to pass through the whole of the series of coils before passing out to the armature through the binding-post D. Each of the coils is also connected with one of the insulated plates E so that by means of a lever F moving over these plates, and through which the current first passes from the dynamo, this current may be caused to pass through as many of the resistance coils as are introduced between the plates E with which the lever is in contact, and the conductor which leads to the armature of the motor. The figure shows the arrangement of the lever, which is fulcrumed as shown at G, at the common center about which the insulated plates E are arranged, and extends out beyond the contact piece to a point where it is connected with the rod H of a piston which moves in a cylinder I and by its movement the lever is moved up and down as desired.

When the lever F is moved, it successively forms contact with the insulated plates E, and as it thus moves from its point of rest at the lower end, it successively cuts out the resistance coils B until it reaches the highest point of its movement, when all the resistance will then be cut out. As this upward movement of the lever is slow, the armature of the motor is started gradually, and the electro motive force is increased as the speed of the motor increases until it reaches its normal speed when the whole of the resistance will have been cut out.

The mechanical and automatic devices may be operated in various ways, depending upon what service the motor is performing. In the present case I have illustrated my apparatus as applied to a motor which operates a pump by which water is raised from a lower reservoir to a higher one, or is forced into a press-

ure receiver for the purpose of operating water driven elevators. In such a device as this it is necessary to retain a sufficient pressure in the reservoir to operate the elevator, and when this pressure falls below the required tension, the motor will be set to work. When it reaches the proper degree, the motor will be automatically stopped.

I have not here shown the motor or any of its connections, as these may be of any suitable or required form, and it is only necessary to show the direction of the currents and the connecting wires in this invention.

The cylinder I has branch pipes J and J' opening into each end and connected with an intermediate four-way cock K which is connected with the pressure receiver and with a discharge by pipes L and L', so that when the cock is turned to admit water under pressure to one end of the cylinder, it opens communications between the opposite end and the discharge, and in this manner the piston and its connecting rod H are moved in either direction, and the lever F correspondingly moved over the contacts to increase or cut down the resistance.

The four-way cock or valve is operated as follows: *b* is a cylinder with a piston, and a piston rod connecting it with a lever *c*. One end of this lever is fulcrumed as shown at *d*, and the other moves with relation to the four-way cock K so that it is connected with it by a link *f*, or in any other suitable manner, whereby an upward movement of the lever turns the valve to deliver water under pressure into one end of the cylinder, and a downward movement into the opposite end. The cylinder *b* is connected with the pressure receiver by a pipe *a*. When the pressure in the receiver has reached the proper degree, water passing through a pipe *a* into the bottom of the cylinder *b* actuates the piston therein, and forces it up. The upper end of the piston rod is connected with the lever *c* fulcrumed at *d*, and having a weight *e* on its opposite end. This lever is connected by a joint lever *f* with a four-way cock K, as before described, and when the piston in *b* is forced up by the pressure below it, the valve K is turned to admit water to the upper end of the cylinder I and thus force its piston down. This acts through the rod H to draw the lever F down over the contact plates E until it reaches the lowest point and cuts out the current and allows the motor and pump to stop. As soon as the pressure in the receiver becomes reduced so that it can no longer hold the piston in the cylinder *b* up against the weight *e* on the lever *c*, the latter falls and through the joint lever *f* turns the four-way cock into position to allow the water in the upper part of the cylinder I to escape through the discharge pipe L' and at the same time admit water into the lower part of the cylinder which forces the piston up and through the rod H, the lever F is forced up and the current is again supplied to the motor as before described. The

movement of the lever *c* is limited by means of a stop *m*, with which it is connected by a rod *n* as shown. After the electric current has been cut off, the motor continues to run for a short time by its momentum, and as it is shunt wound it then becomes a dynamo and gives off electric force which will produce a long spark when the lever F is drawn away to break the circuit. In order to overcome this objectionable feature and retain the current thus produced within the circuit, I make a connection which throws the current through the resistance coils which are in series with the armature.

o is a binding-post through which the current passes from the lever F to the field magnets of the motor. The lever F moves in contact with the guiding and conducting arc *p* with which the binding-post *o* is connected, so that the current passing through the lever F from the plates E, and then through the arc *p*, is thus furnished to the field magnets of the motor when the dynamo is running. When the lever F is rapidly moved down to its lowest point to cut off the current, it passes beyond the arc *p* and beneath the arc *p'* which is insulated from the arc *p* by the insulating piece shown at *q*. In rheostats, as ordinarily constructed, much difficulty has been encountered when this movement of the lever F takes place on account of the return current from the motor produced as above stated, it remaining of such strength as to jump across the space between *p* and *p'*, thus producing an objectionable spark at this point. In order to prevent this I connect the arc *p* by a wire *r* with one of the plates E in the main circuit, and this throws the current given off by the motor which becomes a dynamo, through the resistance coils which are in series with the armature, and the dynamo or motor circuit is not opened.

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

1. A rheostat consisting of a series of resistance coils connected in series and interposed between a dynamo and a motor, switch plates connected with the resistance coils, and a lever within the circuit movable over the switch plates to increase or diminish the resistance or to cut off the current, a piston movable within a cylinder and connected with the lever, pipes connecting the opposite ends of the cylinder with a pressure receiver, a cock or valve by which pressure may be introduced to either end of the cylinder and released from the other, and a mechanism to actuate this valve and admit the pressure to one end or the other of the cylinder whereby the lever is moved to cut off the current from the motor when the pressure in the receiver is sufficient, and to turn it on again when the pressure falls below the required point, substantially as herein described.

2. A rheostat in circuit between a dynamo and a motor to be driven by an electric cur-

rent therefrom, a lever whereby the current is cut off or turned on, and by which the resistance coils of the rheostat are gradually removed from the circuit, a piston movable in a cylinder and connected with the lever, a pressure receiver with pipes leading therefrom to opposite ends of the cylinder, a valve whereby pressure is admitted to either end of the cylinder, a second cylinder with a piston movable therein and connected with a lever through which the valve of the first cylinder is actuated, and a pipe leading from the pressure receiver to the second cylinder whereby the piston of the latter is moved and the intermediate mechanism actuated to cut off the electric current when the pressure within the receiver reaches the desired point, substantially as herein described.

3. A rheostat and lever situated in the circuit between a dynamo and motor, a cylinder with reciprocating piston connected with the lever, a pressure receiver supplied by mechanism driven by the motor, passages and a valve by which pressure is supplied to either end of the cylinder to move its piston and the rheostat lever in either direction, a sec-

ond cylinder connected with the pressure receiver, a lever connected with the piston of the cylinder and having a weight at its outer end, connections whereby the valve of the first cylinder is opened by the upward movement of the lever when there is sufficient pressure in the receiver and by which the movements are limited, substantially as herein described.

4. A rheostat with resistance coils connected in series, a lever in circuit between the dynamo and a motor movable over switch plates whereby the resistance is increased or diminished, or the circuit cut-off, in combination with a connection between the fields of the motor and any switch plate or resistance coil whereby the current is returned through the resistance and the circuit remains closed, substantially as herein described.

In witness whereof I have hereunto set my hand.

BURTON CHARLES VAN EMON.

Witnesses:

C. B. SESSIONS,
GEORGE E. HATCH.