No. 690,515. Patented Jan. 7, 1902.

A. S. COMSTOCK.

AUTOMATIC PRESSURE REGULATOR.

(Application filed Jan. 24, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

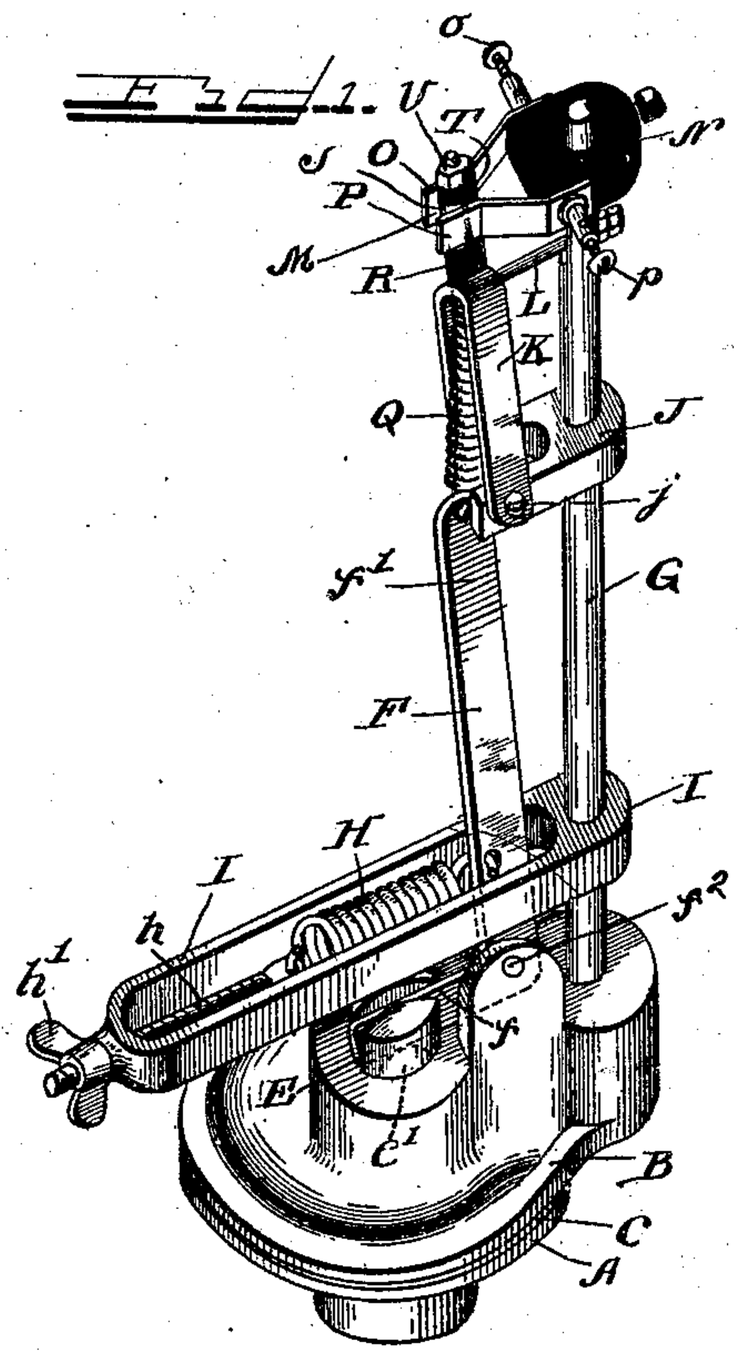


Fig. 2.

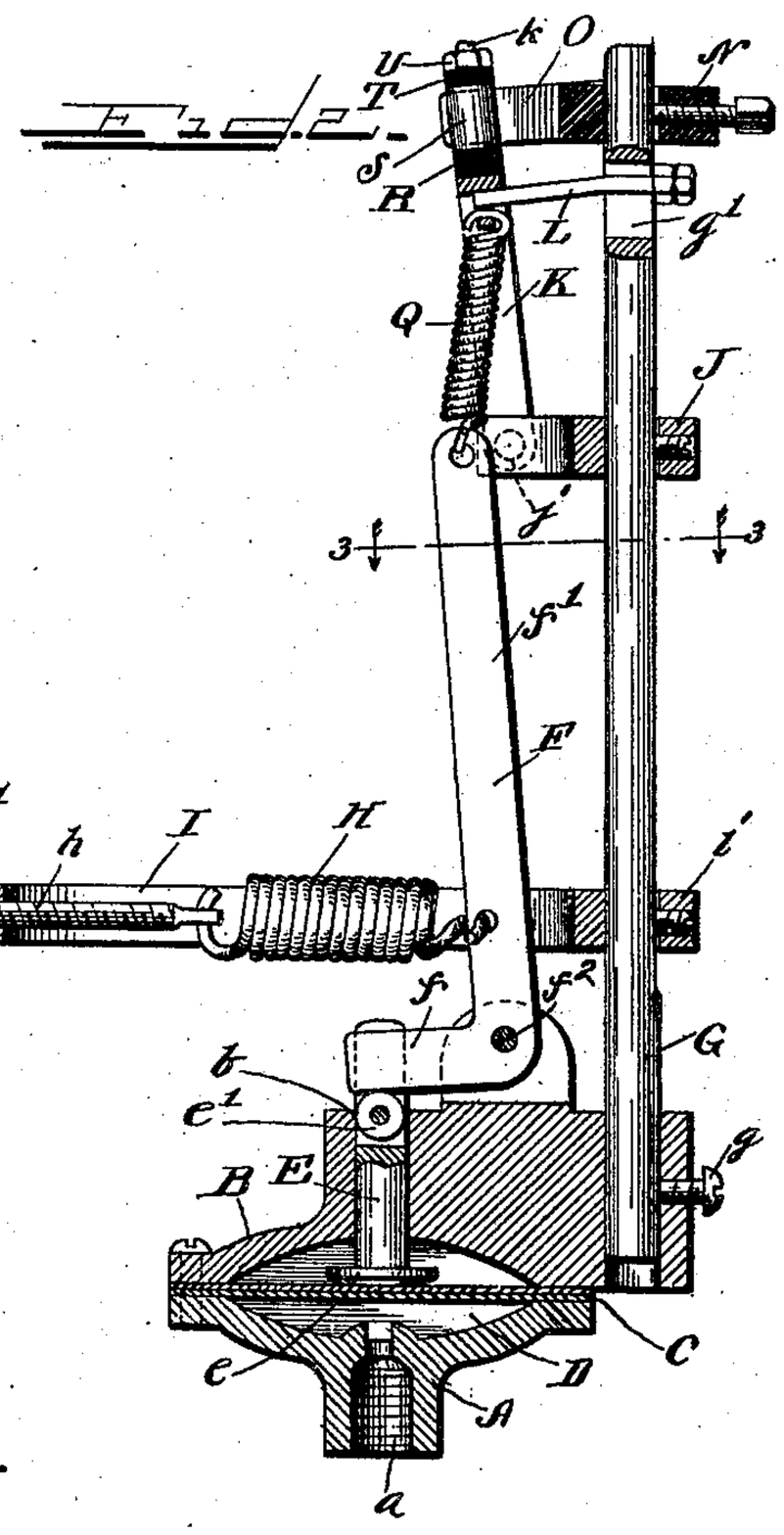
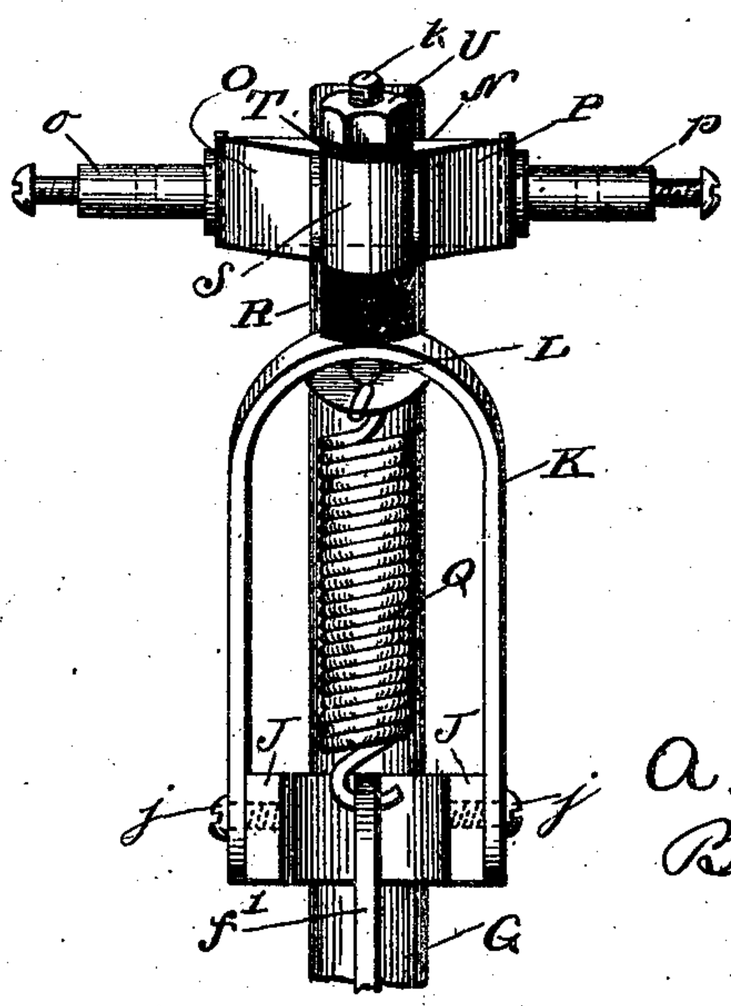


Fig. 3.



Witnesses
Ira D. Perry
J. B. Weir

Inventor
A. S. Comstock
By Raymond & Barnett
Attys

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Fig. 4.

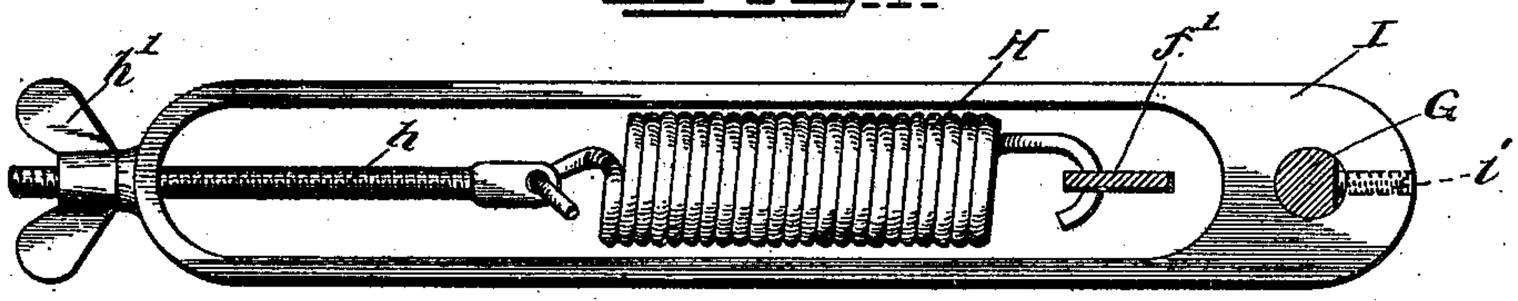


Fig. 7.

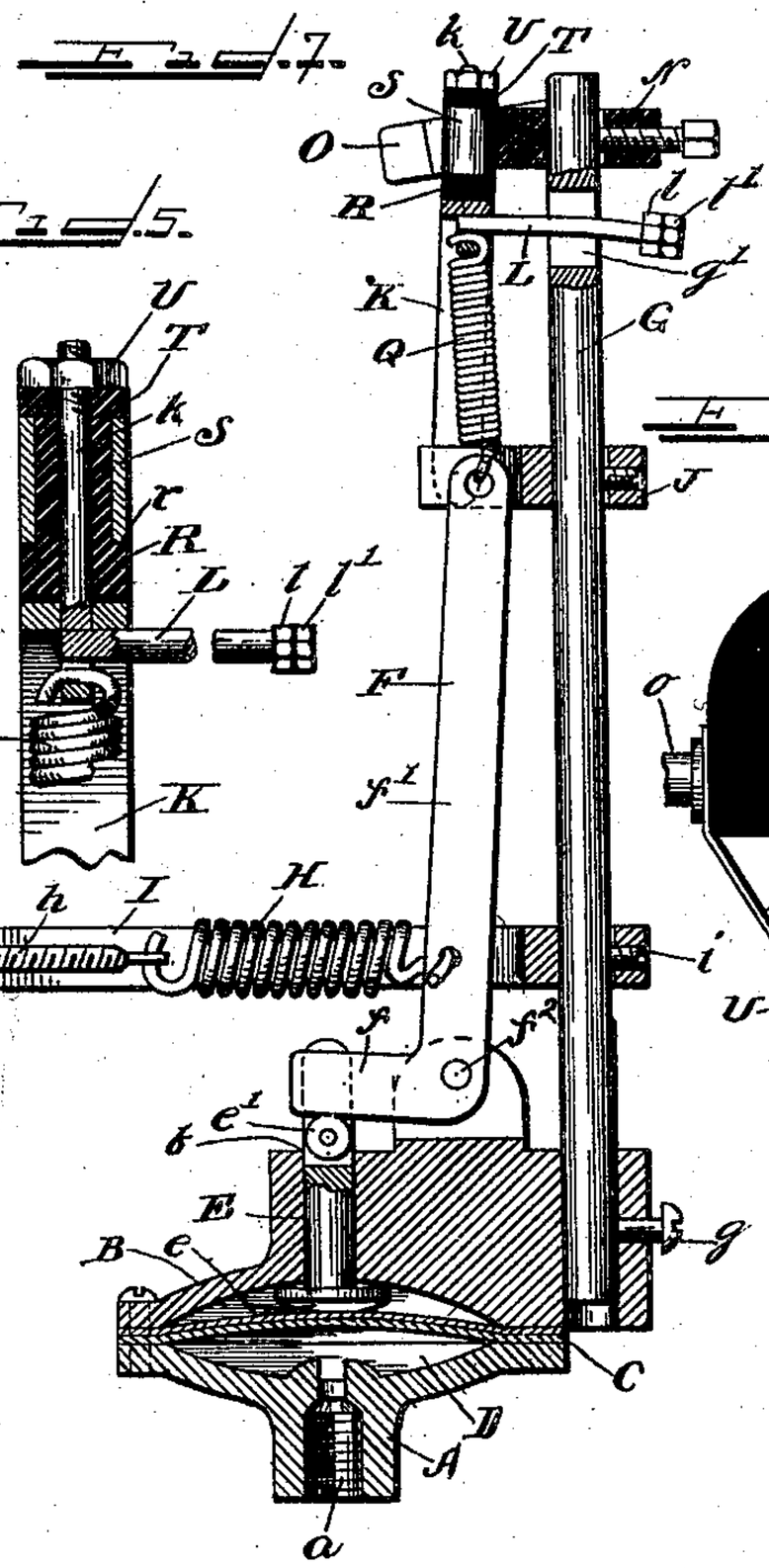
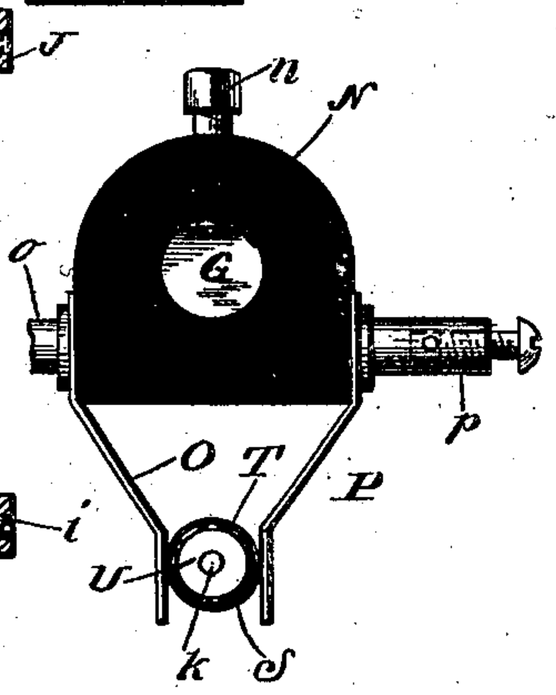


Fig. 5.

Fig. 6.



Witnesses

Jm D. Perry
S. B. Weir

Inventor

Alphonso S. Comstock
By Raymond & Barnett
Attys

UNITED STATES PATENT OFFICE.

ALPHONSO S. COMSTOCK, OF EVANSTON, ILLINOIS.

AUTOMATIC PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 690,515, dated January 7, 1902.

Application filed January 24, 1901. Serial No. 44,624. (No model.)

To all whom it may concern:

Be it known that I, ALPHONSO S. COMSTOCK, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Pressure-Regulators, of which the following is a specification.

This invention relates to improvements in automatic pressure-regulators for air-pumps in which an electric motor is used either to furnish power for the pump or to control the transmission of power to the pump.

The object of my invention is to provide a sensitive, simple, positive, and quick-acting automatic regulator which shall be capable of adjustment, so as to maintain air-pressure in a tank, reservoir, or other air-receptacle, within a narrow range of a predetermined pressure, and also to provide such a regulator which shall be capable of rapid adjustment, so as to raise or lower the point at which pressure shall be maintained.

Another object of my invention is to provide such a regulator in which the electric circuit shall be quickly and sharply established and broken, so as to prevent sparking and heating.

These and such other objects are attained by the devices illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of my improved regulator. Fig. 2 is a vertical view, partly in section. Fig. 3 is an elevation of that part of my device above the line 3 3 of Fig. 2. Fig. 4 is a detail plan view of my regulating-spring, screw and yoke, and connections. Fig. 5 is a detail view, partly in section, of my circuit-closing ring and adjacent parts. Fig. 6 is a plan view of my switch-block and connection, and Fig. 7 is a vertical sectional view showing the switch thrown open.

Like letters of reference indicate the same parts in the several figures of the drawings.

Referring by letter to the accompanying drawings, A B are the lower and upper halves of a casing, between which is secured a diaphragm C, which extends across and divides a diaphragm-chamber D in a manner well understood. The lower half of the diaphragm-chamber connects through the port *a* with any compressed-air receptacle in which pressure is sought to be maintained and to which compressed air is supplied by an air-compressor or air-pump. (Not shown.) The upper half of the diaphragm-casing is provided with a vertical cylindrical passage *b*, which serves as a guide for the stem E, which moves freely therein and which is provided with a head *e*, which rests upon the upper surface of the diaphragm C. The upper half of this stem is slotted to receive the short arm *f* of a lever F, and the stem E may be provided with the roller *e'* to provide an antifriction-bearing for the arm *f*.

G is a vertical rod which may be conveniently and adjustably stepped in a socket in the upper half B of the diaphragm-casing and secured therein by a suitable locking-screw *g*. This rod G serves as a standard to which other parts of my device may be adjustably attached in the manner hereinafter set forth.

F is a lever having a short arm *f* and a vertical long arm *f'* and pivoted at f^2 to a lug formed upon the upper half B of the diaphragm-casing. In my preferred construction the lever F is held in its normal position by a spring H, which is attached at one end to the lever F and at the other end to a tension-screw *h*, which passes freely through a horizontal opening in the yoke I, which passes around the screw *h*, the spring H, and the lever F and is secured to the rod G, after which it is fitted by a locking-screw *i*. The tension-screw *h* is fitted with a thumb-nut *h'*, which is screw-threaded on the end of said screw, which projects through the yoke I. By the manipulation of this thumb-nut the tension exerted by the spring H may be increased or decreased at will.

Upon the rod G and above the yoke I is adjustably mounted and secured a second yoke J, the opposite arms of which, respectively, are pivoted at *j* to the lower ends of the arms of a vertically-disposed yoke *k*, which is provided at its upper end with a stop device L and carries an insulated switch-ring M.

Near the top of the rod G is adjustably secured a switch-block N, provided with a pair of spring-electrodes O and P, which are electrically connected with the binding-posts *o* and *p*. The construction of the switch-block and related parts is more fully shown in de-

tail in Figs. 5 and 6. The switch-block N is composed of insulating material and is provided with a perforation for receiving the rod G, to which the switch-block is adjustably secured by the screw *n*. To opposite edges of the switch-block are secured the binding-posts *o* and *p*, between which and the switch-block are fastened the spring-electrodes O and P in such a manner as to make electrical contact with the binding-posts *o* and *p*, respectively.

Through a perforation in the upper end of the yoke K is fitted a button-head screw *k*. I first flatten the head of this screw substantially in a plane with the body of the screw, and into a transverse perforation therein I fit one end of the stop device L, which should then be securely brazed into the perforation in the head of the screw *k*. I also provide the flattened head of the screw *k* with a perforation for receiving one end of a coil-spring Q, the other end of which is attached to the upper end of the long arm on the lever F. I also prefer to braze the screw *k* to the yoke K at the point where the screw *k* passes through the perforation in the upper end of the yoke K. The projecting part of the stop device L has free play through a vertical slot *g'* in the rod G and is provided at its outer end with an adjusting-nut *l* and a jam-nut *l'*.

The screw *k* is fitted with a thimble R of insulating material. The upper part of this thimble is reduced, thereby providing a shoulder. Over this reduced portion of the thimble is fitted a switch-ring S, of copper or other metal, affording a suitable electrical conductor. This ring rests upon the shoulder *r* of the thimble R and is securely held in place by the ring or washer T of insulating material, which is slipped over the screw *k* and abuts against the upper ends of the thimble R and the switch-ring S. A nut U is screwed upon the upper end of the screw *k* and securely locks the parts in position.

The switch-block is interposed in an electric circuit, which controls the operation of the air-pump. This may be either the circuit from a dynamo to an electric motor running the air-pump or a circuit controlling the operation of a belt-shifting or similar device, by means of which the compression of air may be started and stopped.

The operation of my device is as follows: The degree of pressure to be maintained in the compressed-air receiver having been determined, the device is set by tightening the thumb-nut *h'* upon the tension-screw *h* until the tension of the spring H, which must be overcome by air-pressure upon the diaphragm C, corresponds with the pressure which is to be maintained in the pressure-chamber. The apparatus is now in its normal position, as shown in Figs. 1 and 2, the circuit connecting with the binding-posts *o* continuing through the electrode O, the switch-ring S, the electrode P, and the binding-posts *p* and is insulated from all other parts of my apparatus by the switch-block N, the thimble R, and the washer or ring K. While the apparatus is in this position, the pump or air-compressor supplies compressed air to the air-receiver and continues in full operation until the pressure in the air-receiver, and so on the under side of the diaphragm-chamber D, which is in open communication with the air-receiver, exceeds the predetermined point. Thereupon the air-pressure upon the under side of the diaphragm C will lift the diaphragm C and the head of the stem E resting thereon. This of course will simultaneously move the short arm *f* of the lever F in an upward direction and swing the long arm *f'* of the lever F toward the rod G and against the tension of the spring H. As the long arm *f'* is swung in the direction of the rod G it carries the lower end of the spring Q with it. The spring Q being under tension holds the yoke K and the parts mounted thereon in their forward normal position until as the long arm *f'* of the lever F is swung backward it carries the lower end of the spring Q past the axis of the pivots *j*, by which the yoke K is secured to the yoke J. As soon as the line of tension from the lower end of the screw *k* through the spring Q to the upper end of the lever F passes the axis of these pivots the spring Q snaps the yoke K into the position shown in Fig. 7, thus carrying the switch-ring S back against the switch-block N and out of contact with the electrodes O P, thereby breaking the circuit and stopping the air-compressor. The parts will remain in this position with the circuit broken so long as the pressure against the under side of the diaphragm C continues to be sufficient to overcome the tension of the spring H. As soon, however, as such air-pressure becomes less than such spring tension the spring will draw the long arm *f'* of the lever F away from the rod G, the lower end of the spring Q will be carried back and toward its normal position and as soon as the line of tension through the spring Q passes in front of the axis of the pivots *j* the tension exerted by the spring Q will snap the yoke K to its original position and will of course snap the switch-ring S into position between the spring-electrodes O P, thereby reëstablishing the circuit and restarting the air-compressor. The stop device limits the forward movement of the yoke K, so that while the spring Q will snap the switch-ring S into contact with the spring-electrodes and will firmly hold the switch-ring in such contact it cannot carry the switch-ring past the electrodes and so out of contact in that direction.

It will be noted that my device will invariably make and break the circuit with a sudden quick snap, thereby avoiding all the disadvantages which accompany a gradual making and breaking of the circuit in such devices. Further, while I am aware that the precise construction of my device may be

modified and varied considerably from the construction shown in the accompanying drawings, yet the device as there constructed has the merit of being economical to make and readily and simply assembled. It is important that the various parts be assembled with proper relation to each other, and this is facilitated in my preferred construction by my adjustably mounting of the various parts upon the rod G. While I have shown the yokes I and J and the switch-block N adjustably mounted upon the rod G and have also shown the stop device L as provided with an adjusting-nut, it is not intended that in the ordinary use of the device such adjustments shall be used; but they are merely shown as affording a convenient method of assembling the parts and for readily adjusting them with relation to each other in the first instance. If this is properly done, no further adjustments need ordinarily be made during the life of the device, except as parts may be repaired and replaced from time to time. It is also obvious that with my construction any faulty or damaged parts may be removed and replaced without requiring any especial skill in so doing.

It will be observed that in my device I have produced a pressure-regulator which is quite compact and entirely self-contained and which may be furnished completely assembled, so that all that is necessary to put it in service in connection with any air-compressor is to couple it at A with any convenient source of pump-pressure and to interpose the switch in the electric circuit by suitable connections with the binding-posts *o p*.

Various modifications may be made in my device, such as substituting a movable weight upon a graduated lever for the adjustable tension-spring and attachments shown or by using any of the well-known forms of adjustable spring-controlled diaphragms; but such modifications and others which will readily suggest themselves to those skilled in this art do not constitute a departure from the spirit of my invention and are contemplated thereby.

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

1. In a pressure-regulator, the combination with a diaphragm exposed to pump-pressure, of a lever actuated by said diaphragm, an electric switch, a movable support for said switch, an adjustable mounting for said support, and a yielding connection between said lever and said switch-support, substantially as described.

2. In a pressure-regulator, the combination with a diaphragm exposed to pump-pressure, of a lever actuated by said diaphragm, an electric switch, a movable support for said switch, an adjustable mount for said switch-support, a tension-spring attached to said lever and to said switch-support, and means for normally holding said lever against pump-pressure, substantially as described.

3. In a pressure-regulator, the combination with a diaphragm exposed to pump-pressure, of a lever operated by said diaphragm, a supporting-rod, a switch-block mounted upon said supporting-rod, a yoke mounted upon said supporting-rod, a switch-support movably attached to said yoke and carrying a switch adapted to coöperate with electrodes mounted upon said switch-block to open and close an electric circuit, and a yielding connection between said lever and said switch-support, substantially as described.

4. In a pressure-regulator, the combination with a diaphragm exposed to pump-pressure, of a lever operated by said diaphragm, a supporting-rod, a switch-block mounted upon said supporting-rod, a yoke mounted upon said supporting-rod, a switch-support movably attached to said yoke and carrying a switch adapted to coöperate with electrodes mounted upon said switch-block to open and close an electric circuit, a yielding connection between said lever and said switch-support, and a stop to limit the forward movement of said switch, substantially as described.

5. In a pressure-regulator, the combination with a diaphragm-casing containing a diaphragm exposed to pump-pressure, of a lever actuated by the movement of said diaphragm, means for normally holding said lever against pump-pressure, a rod attached to said diaphragm-casing, a switch-block mounted upon said rod, a yoke mounted upon said supporting-rod, a switch-support movably attached to said yoke and carrying a switch adapted to coöperate with electrodes mounted upon said switch-block to open and close an electric circuit, a yielding connection between said lever and said switch-support, and a stop to limit the forward movement of said switch, substantially as described.

ALPHONSO S. COMSTOCK.

Witnesses:
OTTO R. BARNETT,
M. E. SHIELDS.