

No. 788,329.

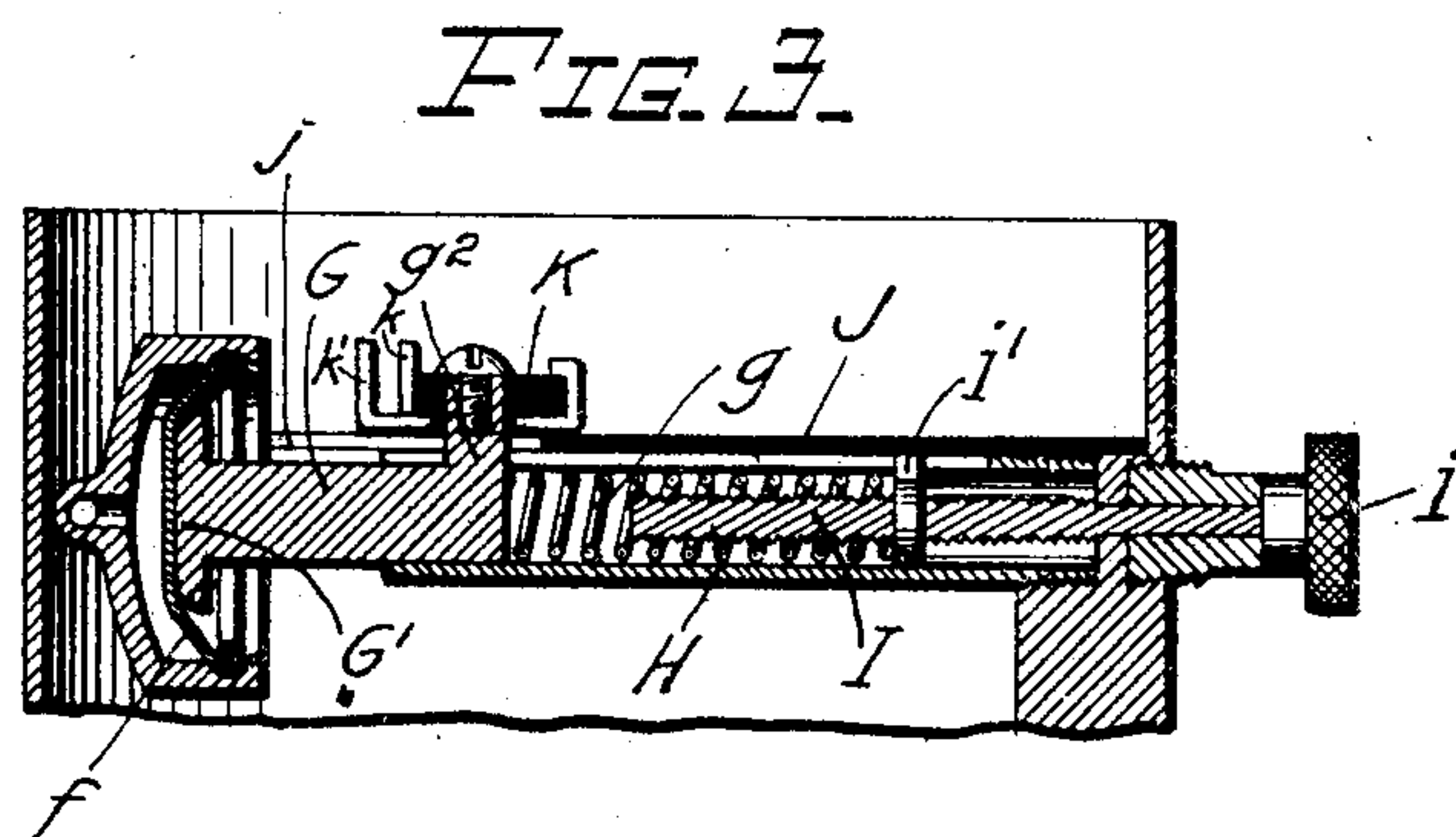
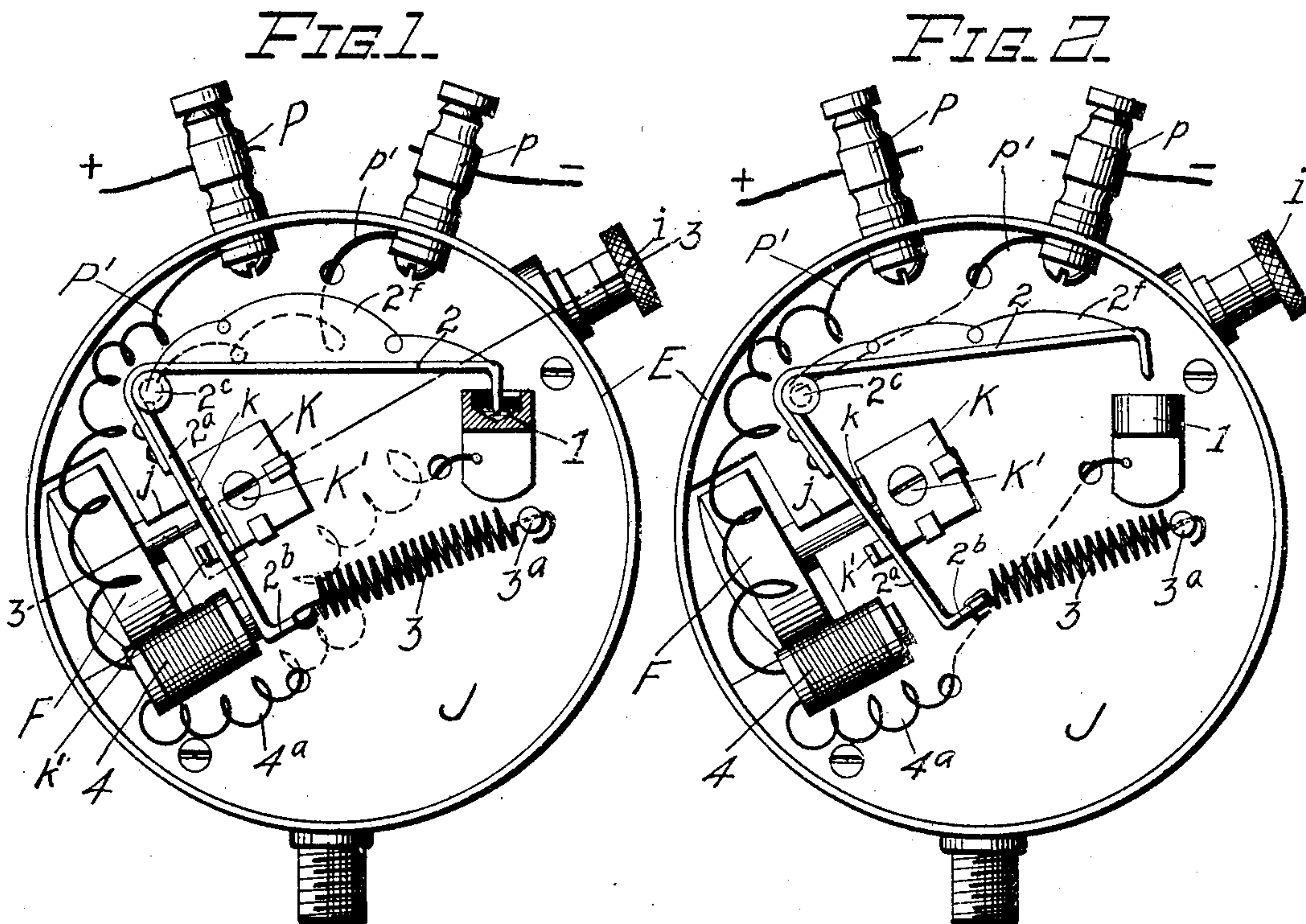
PATENTED APR. 25, 1905.

W. J. PUGH.

PRESSURE CONTROLLED ELECTRIC SWITCH AND AIR GAGE.

APPLICATION FILED AUG. 20, 1904.

2 SHEETS—SHEET 1.



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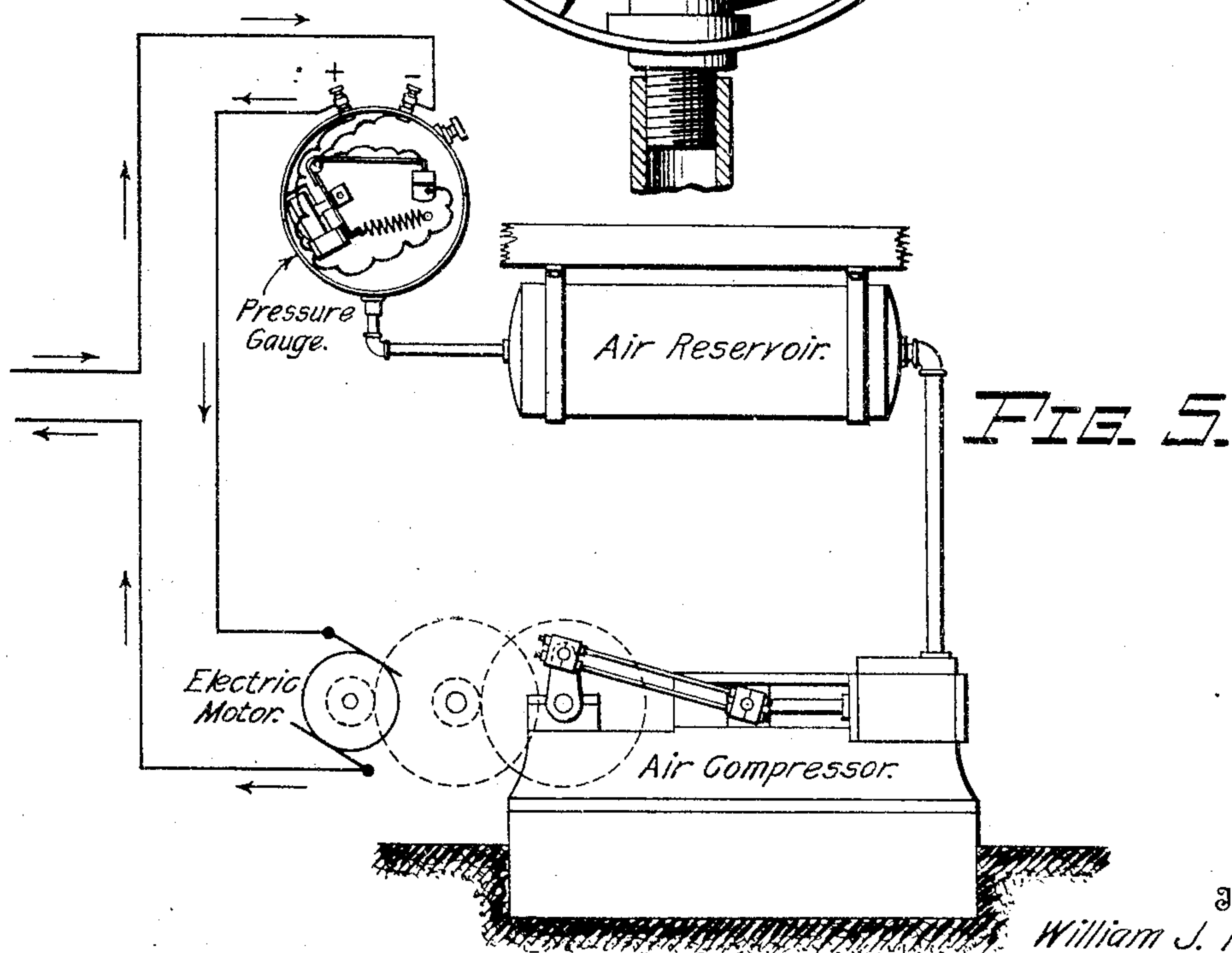
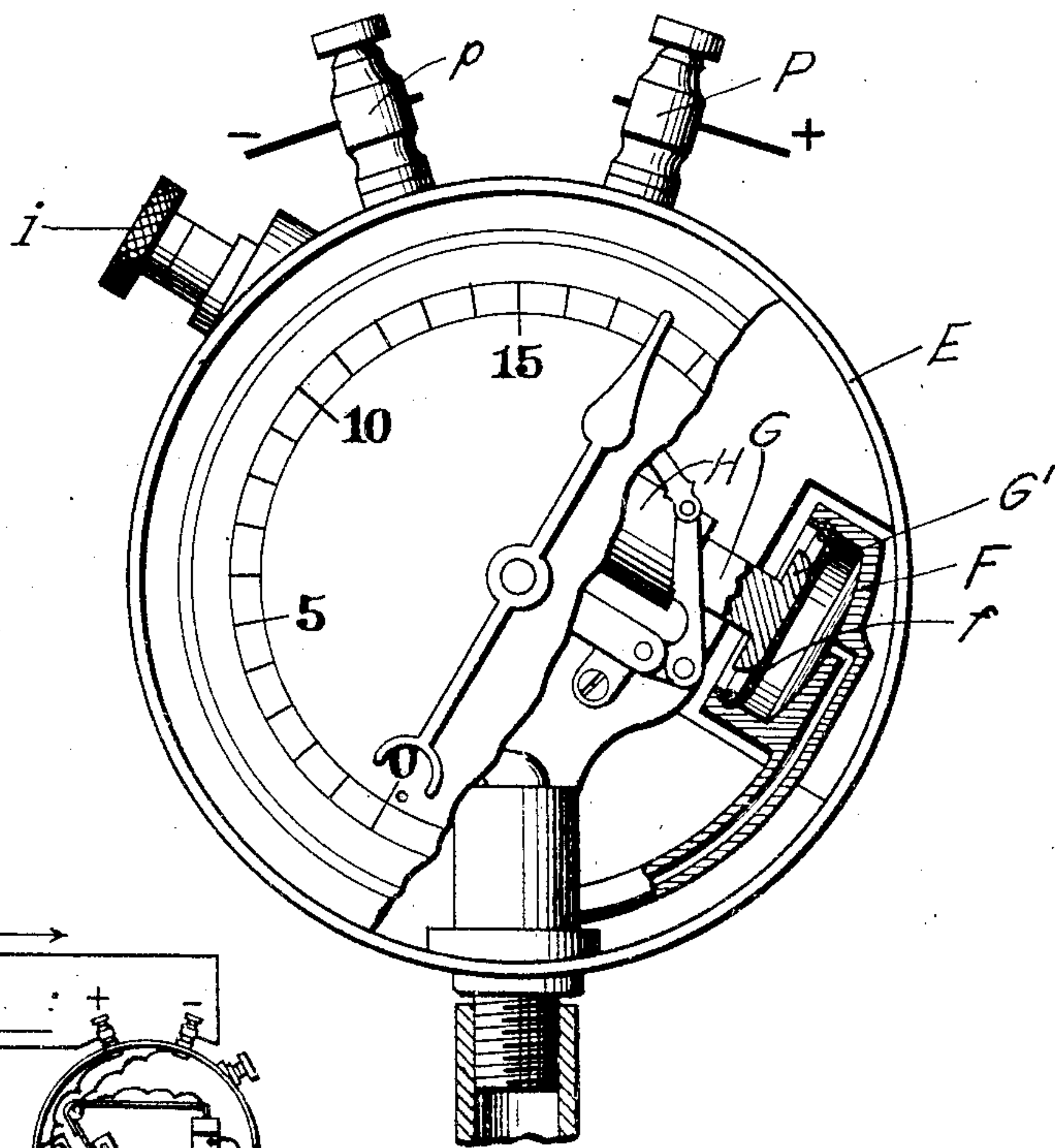
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2 SHEETS—SHEET 2.

FIG. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM J. PUGH, OF DAVENPORT, IOWA, ASSIGNOR TO AUTOMATIC ELECTRIC PUMP CO., OF DAVENPORT, IOWA.

PRESSURE-CONTROLLED ELECTRIC SWITCH AND AIR-GAGE.

SPECIFICATION forming part of Letters Patent No. 788,329, dated April 25, 1905.

Application filed August 20, 1904. Serial No. 221,579.

To all whom it may concern:

Be it known that I, WILLIAM J. PUGH, of Davenport, in the county of Scott and State of Iowa, have invented certain new and useful
5 Improvements in Pressure-Controlled Electric Switches and Air-Gages; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form
10 part of this specification.

This invention is an improvement upon the pressure-controlled electric switch shown and described in Letters Patent No. 765,040, granted to me on the 12th day of July, 1904,
15 which device is especially useful for controlling the operation of electrically-controlled motors used for compressing elastic fluids, the construction being such that when the pressure reaches a predetermined point an
20 electric circuit is broken, thereby putting the motor out of operation or stopping the accumulation of pressure, and when the pressure falls below a predetermined point the said circuit is reestablished and the motor
25 started or the accumulation of pressure resumed.

The object of the present invention is to render the apparatus more positive and rapid in action and avoid any liability of arcing or
30 burning out of the apparatus in breaking the circuit; also, to increase the sensitiveness of the automatic switch, so that it will operate between very small differences in pressure.

The invention will be described with reference to the accompanying drawings and summarized in the claims appended hereto.
35

In said drawings, Figure 1 is a rear view of a gage equipped with my apparatus, with back plate removed and showing the switch closed.
40 Fig. 2 is a similar view showing the switch opened. Fig. 3 is an enlarged section on line 3-3, Fig. 1. Fig. 4 is a front view of the indicator, partly broken to show the controlling devices. Fig. 5 is a diagrammatical view
45 illustrating the electrical and pneumatic connections.

E designates an ordinary pressure-gage of any suitable construction, within the casing of which I preferably locate the electric

switch and controller constituting the present invention. The air or fluid pressure pipes of the gage communicates with a short cylinder F, which has a flexible diaphragm *f* in one end, against which rests a disk or plunger 'G' on one end of a rod G, that enters a tube H,
55 secured in the casing, and is pressed toward cylinder F by a suitable spring *g*, the tension of which can be regulated by a sliding nut *z*, engaged by a threaded rotatable but longitudinally-immovable rod I, which projects
60 through the casing and can be turned by a head-piece *i* on its outer end, as shown, so as to vary the pressure of the plunger on the diaphragm. The rod G has a laterally-projecting lug *g*², which projects through a slot
65 in the tube and through a coincident slot *j* in a partition J, of insulating material, secured in the gage-casing to support the operative electrical parts of the switch. This lug *g*² carries devices by which the switch may be posi-
70 tively opened or closed by the movement of the plunger.

The switch comprises a fixed contact 1 (which is preferably a mercury-containing cup fastened to the plate J) and a movable
75 contact 2, which is fixed on the arm 2^a of a bent or bell-crank lever which is pivoted on a fixed stud at 2^c, and its other arm, 2^b, passes lug *g*² and is connected to a contractile spring 3, the other end of which is fast to a stud 3^a,
80 said spring normally tending to rock the switch-lever and separate the contacts 1 and 2. An insulating-block K is attached to the lug *g*² by means of a screw K' or in other suitable manner and lies adjacent to the arm 2^b
85 of the switch-lever. To said block K is attached a finger *k*, which is adapted to engage arm 2^a and close the contacts when the plunger is sufficiently depressed by the spring I, and to said block K is also attached a finger
90 *k'*, which is adapted to engage the other side of arm 2^b and cause it to separate the contacts when the plunger is sufficiently elevated by the pressure in cylinder F.

Adjacent to the outer end of switch-lever
95 2^b is an electromagnet 4, which is adapted when energized to attract arm 2^b as its armature, move it against the resistance of spring

3, close the contacts, and hold the switch closed.

The electrical circuit is as follows: A binding-post P on the casing is connected by wire 5 P' to one terminal of magnet 4, the other terminal of which is connected by wire 4" to contact 1. The stud 2^c, on which the switch-lever is pivoted, is in electrical connection with contact 2 and also by wire p' with a sec- 10 ond binding-post p on the casing, said binding-posts P p being respectively connected to the opposite terminals of an electric circuit, including the motor or controller or other device which is to be cut in or out of 15 action by the making or breaking of the circuit between contacts 1 and 2.

Assuming that the apparatus is to be used in connection with an air-pump, the gage is connected to the receiver or reservoir in 20 which the air is stored, so as to indicate the pressure therein, while the switch is connected in circuit with the motor, such connections being fully described and shown in my afore-said patent. The spring H is adjusted so that 25 the switch will remain closed until the pressure reaches the desired point, and in the retracted position of the plunger the finger k will engage arm 2^b and close the switch. When the switch is closed, the magnet is en- 30 ergized and will hold the switch closed until the circuit is broken, while finger k moves away from arm 2^b as the pressure accumulates. As the pressure accumulates the plunger is forced outward, moving finger k away from 35 arm 2^b, which, however, is held by the magnet until finger k' engages the arm 2^b and the plunger moves outward sufficiently to cause arm 2^b to separate the contacts. The instant this occurs the magnet 4 is deenergized be- 40 cause of the breakage of the current, and spring 3 immediately throws the switch fully open, so that no arcing occurs. By employing a mercury contact the breaking and closing of the circuit is facilitated. The danger of arc- 45 ing is practically eliminated by the action of the magnet in speedily and fully closing the switch the instant a circuit is closed and by the action of spring 3 in fully opening the switch the instant the magnet is deenergized. 50 The fingers k k' are slightly separated, so as to allow one to wholly disengage the arm 2^b before the other contacts therewith. Obviously by regulating the tension of spring H the switch may be caused to operate at any 55 desired pressure, and by properly adjusting the fingers k k' the device can be caused to cut the circuit in or out with very small variations in the pressure, and thus a practically uniform pressure can be maintained in the 60 storage-chamber. In order to insure perfect conduction of the current when the switch is closed between the contact 1 and the stud 2^c, (which is connected to post P by wire conductor p,) a fine light wire 2^f may be con- 65 nected to and between the point of the switch-

arm 2 and the stud 2^c, and in case the oil or loose fit between the switch-lever and the stud 2^c should at any time cause a bad contact or break the circuit or retard the current the wire 2^f affords a perfect circuit and owing to its 70 inherent elasticity will not interfere with the free movements of the switch-lever.

While I have described the device as applied to air-compressing apparatus, I do not restrict myself thereto. 75

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

1. In combination, a contact, an angular switch-lever pivoted at its bend and having a 80 contact on one arm, means engaging the other arm of said lever to open the switch, more powerful opposing means for closing the switch, a pressure-controlled device engaging the latter arm of the lever for overcoming the 85 more powerful means, and an electromagnet for holding the switch closed until the pressure-controlled device moves the switch until the weaker means can snap the switch open, substantially as described. 90

2. In combination, a contact, a switch-lever, a spring for throwing said lever open; a more powerful opposing spring for closing the switch, a pressure-operated device for overcoming the more powerful spring, said 95 device having a pair of insulated fingers adapted to alternately engage the switch, and an electromagnet for holding the switch closed until the pressure-operating device has sufficiently overcome the powerful spring to en- 100 able the weaker spring to snap the switch open, substantially as described.

3. In a pressure-controlled electric switch, the combination of a plunger actuated in one direction by pressure, and in the opposite di- 105 rection by a spring, an angular switch-lever pivoted at its bend and adapted to be closed by the spring-actuated movement of said plunger, an electromagnet adapted to engage an armature on said lever and hold the switch 110 closed during the initial pressure-actuated movement of the plunger, and a spring for opening the switch, substantially as described.

4. In a pressure-controlled electric switch, the combination of a pivoted switch-lever, a 115 mercury-contact, a spring for throwing the lever to open position, an electromagnet for holding said lever in closed position, and a pressure-controlled spring-retracted plunger, having a pair of separated fingers loosely em- 120 bracing an arm of the switch and adapted to alternately contact with and move the lever to assist in the opening and closing of the switch, substantially as described.

5. In combination, a fixed contact, a pivot- 125 ed switch-lever carrying the movable contact, a spring for throwing the switch open, an electromagnet for holding the switch closed, a direct electrical connection between the switch and its pivot, said electromagnet being 130

in circuit with the switch-contacts and energized when the switch is closed, and means for overcoming the electromagnet, substantially as described.

5 6. In combination, a fixed contact, a pivoted switch-lever carrying a movable contact, a direct electrical connection between the switch-lever and its pivot, a spring for throwing the switch open, an electromagnet for
10 holding the switch closed, said electromagnet being energized when the switch is closed, and means for positively overcoming the spring and the magnet alternately to respectively cause the closing and opening of the
15 switch.

7. In combination, an insulated plate, a fixed cup-contact thereon, a switch-lever pivoted on said plate and carrying a movable contact, a spring connected to said lever for throwing
20 said switch open, and an electromagnet adapted to engage an arm of the lever to hold the switch closed against the action of said spring, said magnet being in circuit with the said contacts and energized only when the switch is
25 closed; with a device for positively closing the switch by spring-pressure, and a pneumatically-controlled device for positively opening the switch, all substantially as and for the purpose described.

30 8. In a pressure-controlled electric switch, the combination of a contact, a switch-lever carrying a movable contact; a spring for moving the switch-lever to open the contact; and a magnet for holding the lever in closed position;
35 with a plunger adapted to be moved one way by pneumatic pressure, a spring for moving the plunger in the opposite direction, an insulated block carried by the plunger, opposite fingers attached to said block on opposite
40 sides of the switch-arm adapted to alternately

and respectively positively close the switch, under the action of the plunger-spring, and open the switch under the action of the pneumatic pressure, substantially as described.

9. In an electric pressure-controlled switch, 45 the combination of a cylinder, a plunger working therein, a spring for depressing said plunger, an adjustable means for varying the tension of said spring; a pivoted switch-lever, a finger connected to said plunger for closing 50 the switch, and a second finger connected to said plunger to open the switch, and a spring for snapping the switch fully open; with an electromagnet engaging the switch-lever to hold said switch closed until the plunger has 55 raised sufficiently to permit the switch to be snapped open, all substantially as described.

10. In a pressure-controlled electric switch, the combination of a plunger subjected to air-pressure on one side, a rotatable threaded 60 rod, a traveling nut on said rod, and a spring interposed between said nut and plunger to counteract the air-pressure; with a switch-lever beside said plunger, an electromagnet for holding the switch-lever in closed position, 65 and devices connected to said plunger, respectively adapted to positively close the switch under the spring-actuated movement of the plunger, and to disengage the switch from the magnet under the pressure-actuated move- 70 ment of the plunger, and a spring to snap the switch open, substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

WILLIAM J. PUGH.

In presence of—

JOHN HEINZ,

GEORGE BUTENSCHOEN.