No. 840,163. PATENTED JAN. 1, 1907.

J. L. SCHUREMAN.

CONTROLLING MEANS FOR FLUID RESERVOIRS.

APPLICATION FILED JAN. 16, 1906.

3 SHEETS—SHEET 1.

Fig. 2.

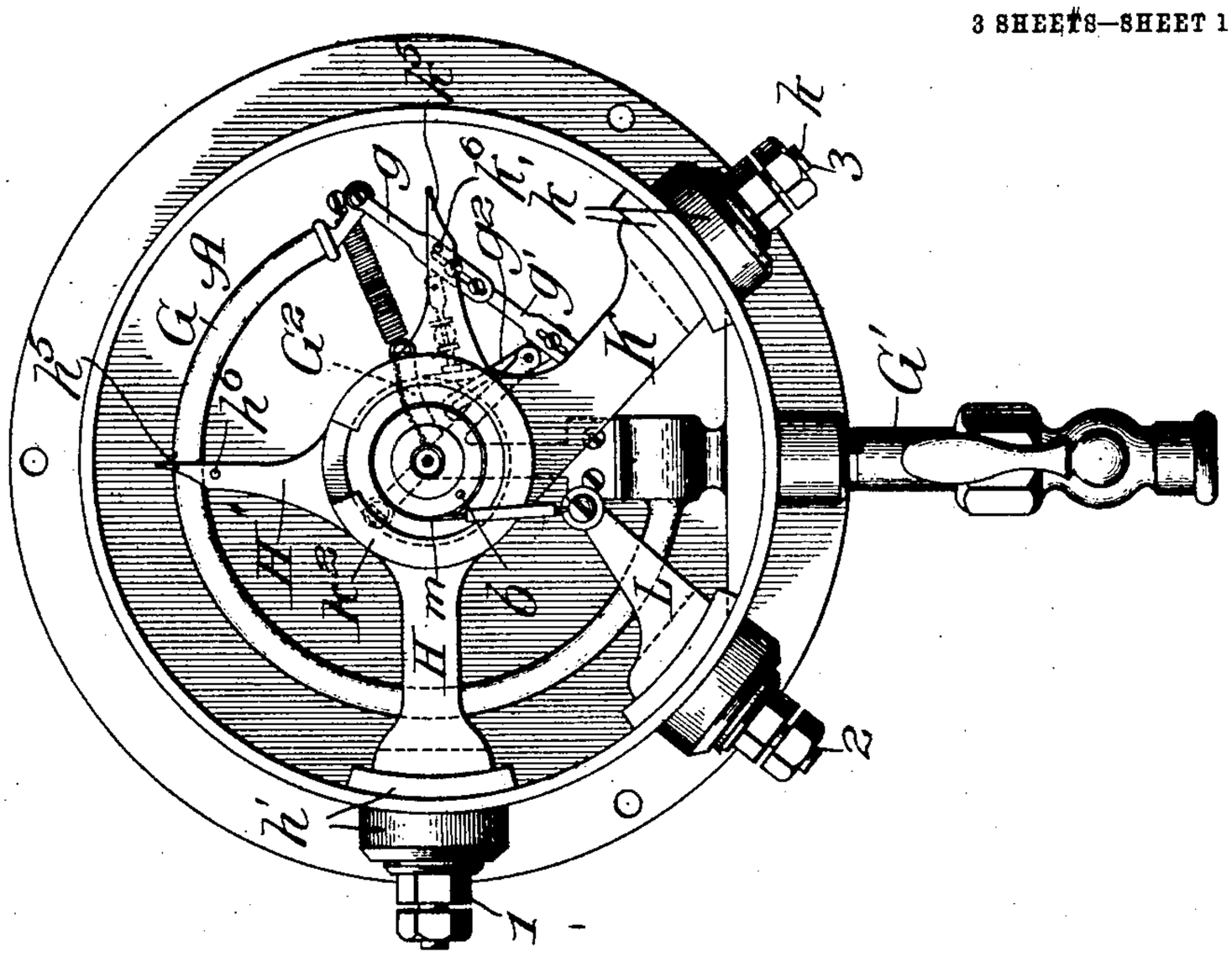
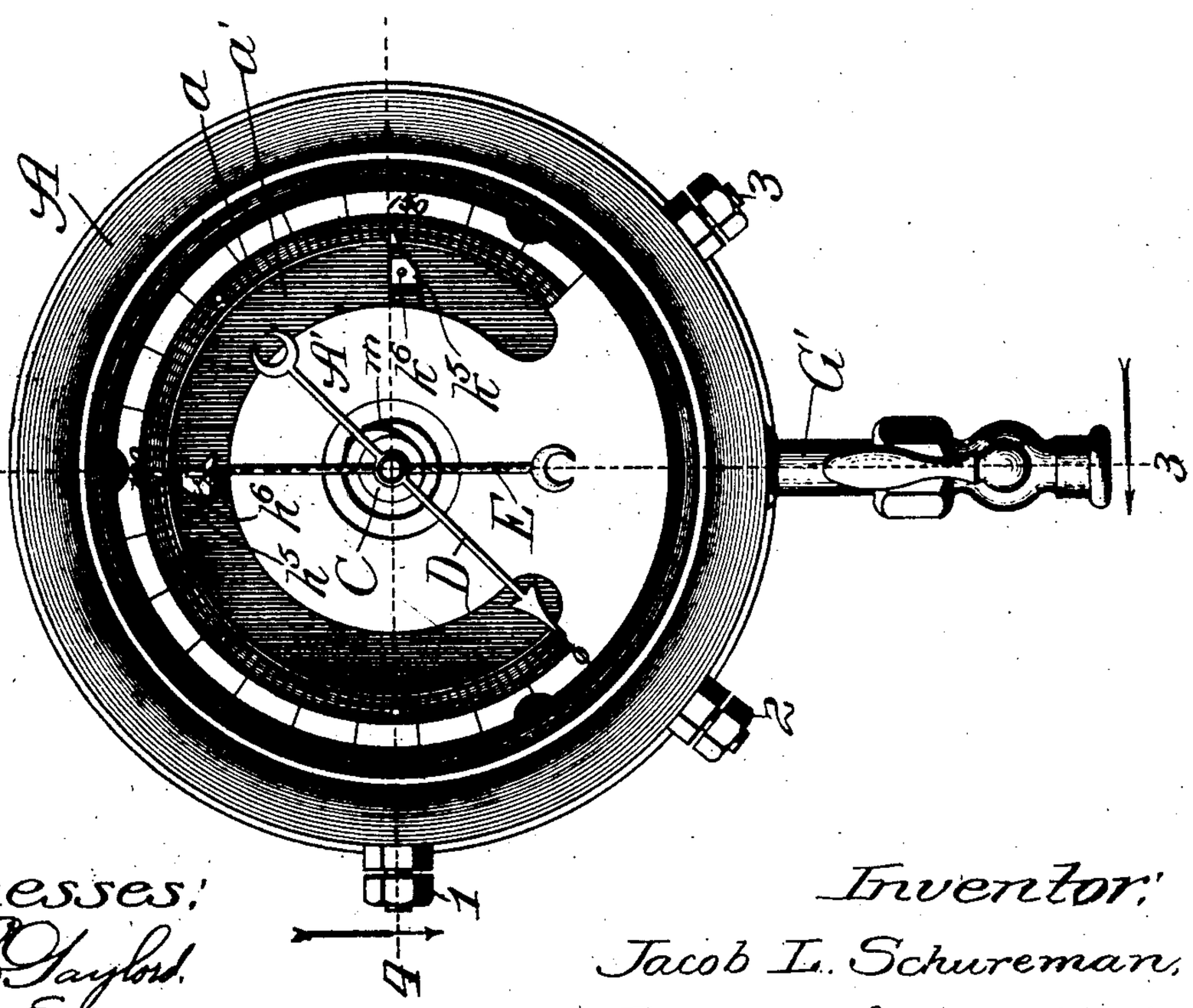


Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 3.

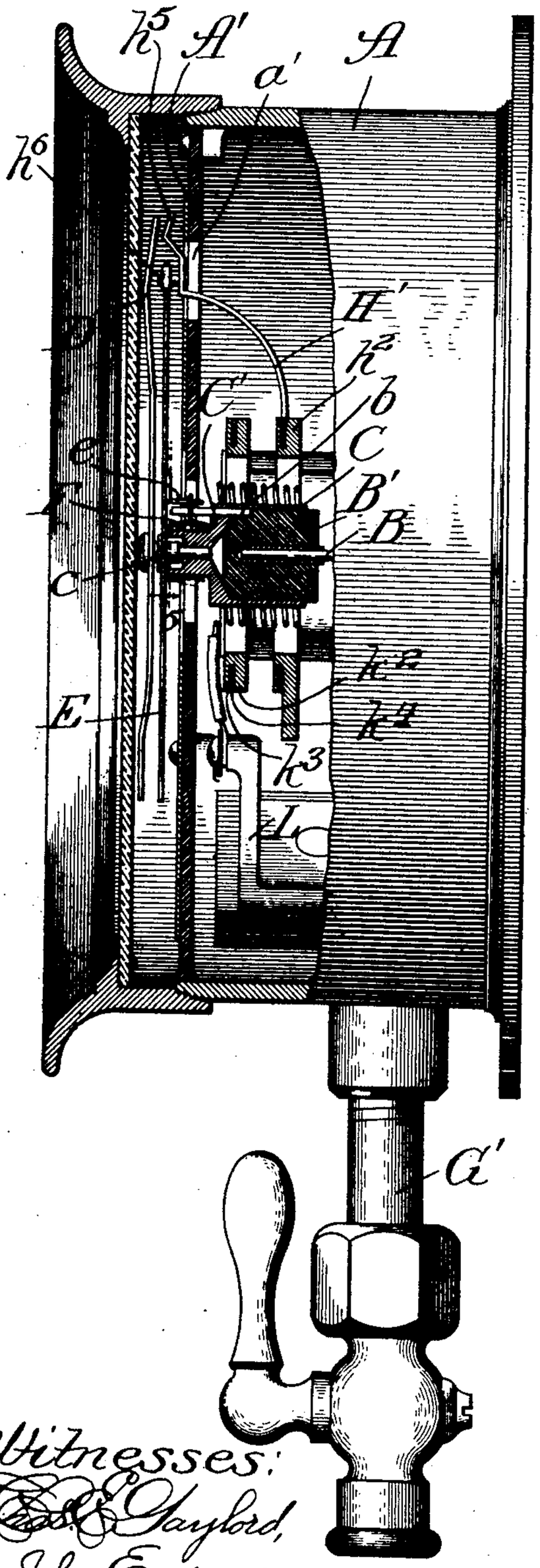
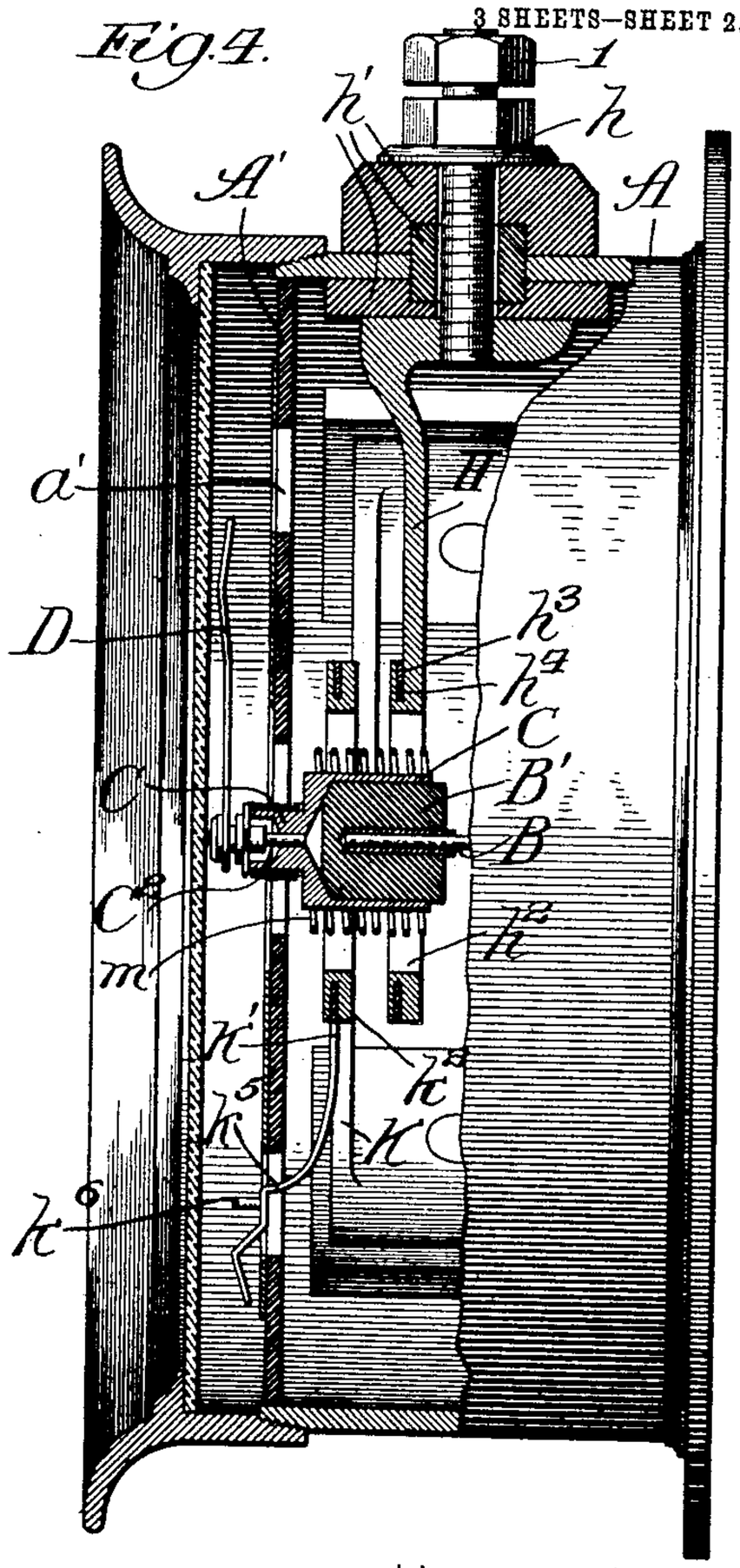


Fig. 4.



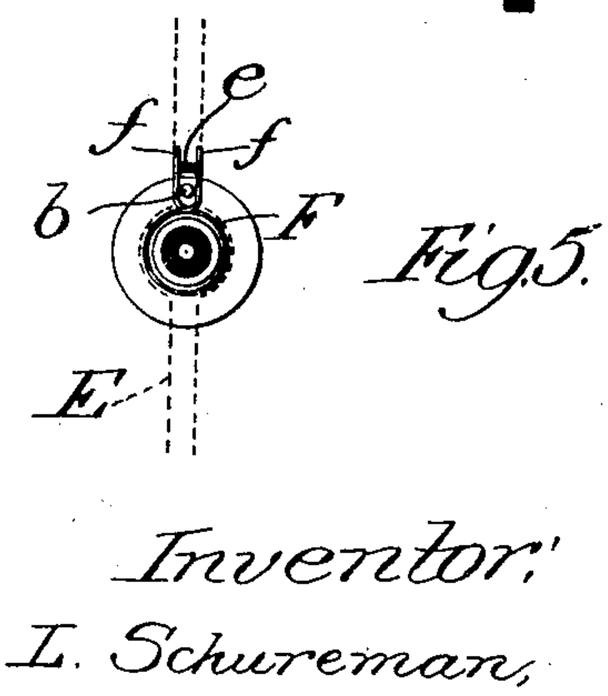


Fig. 5.

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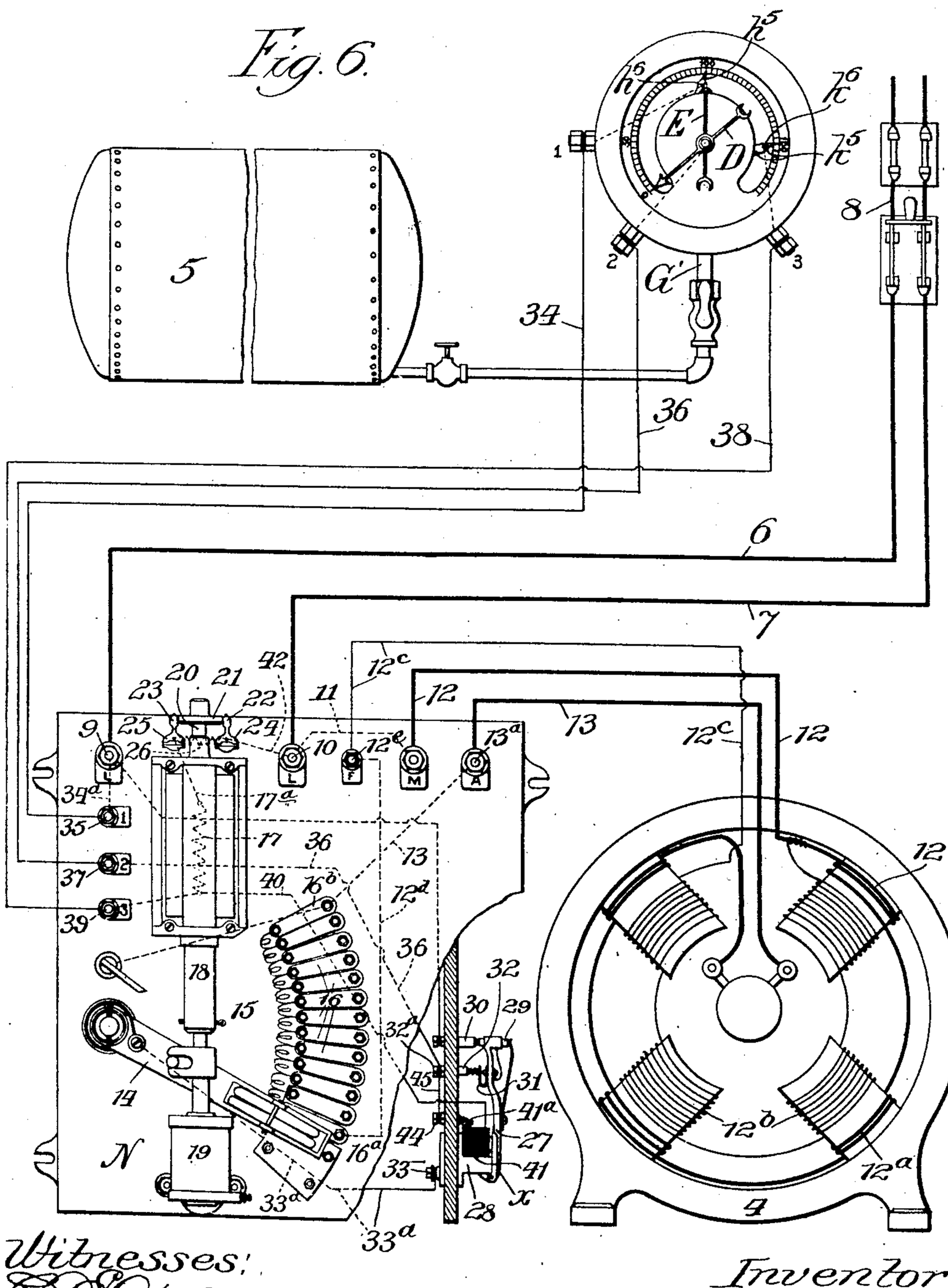
3 SHEETS—SHEET 3.

Fig. 6.



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UNITED STATES PATENT OFFICE.

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CONTROLLING MEANS FOR FLUID-RESERVOIRS.

No. 840,163. Specification of Letters Patent. Patented Jan. 1, 1907.

Application filed January 16, 1906. Serial No. 296,425.

To all whom it may concern:

Be it known that I, JACOB L. SCHUREMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Controlling Means for Fluid-Reservoirs, of which the following is a specification.

My invention relates to an improvement in gages and attendant mechanism for controlling and indicating the amount of pressure carried in a compressed-fluid tank or reservoir; and it is primarily intended for use in connection with a reservoir which in use is intermittently drawn upon for compressed air—as, for instance, for the operation of air-brakes. The reservoir receives its supply from an air-compressor operated by an electric motor, the latter being automatically started and stopped through its electrical connections with a movable electrode or contact-making hand on the gage to maintain the desired range of pressure in the tank.

One of the objections to gages hitherto employed in the connection above referred to is that at no time during the initial filling of the reservoir up to the minimum number of pounds pressure at which the motor is automatically started or at any time when the pressure falls below that point can the amount of pressure in the reservoir be ascertained by inspection of the gage, as but one electrode or movable hand is employed. This hand indicated the reservoir-pressure when it exceeded the minimum at which the motor would automatically be started through its electrical connection with adjustable stop-contacts on the gage, the hand being arrested when the pressure dropped to a point when the hand was carried into contact with the stops. It therefore was necessary in order to be able to ascertain the pressure in the tank at all times to provide two separate gages connected with the reservoir, one for opening and closing the circuit through the motor by contact with electrical stops on the gage, the other the ordinary form of pressure-gage indicating the pressure from zero to the maximum.

One of my objects is to overcome this objection by providing in a single gage means for making electrical contacts at arbitrary points on the pressure-scale for automatically starting and stopping an electric motor and in combination therewith means for indicating at all times the actual pressure in the reservoir.

A further object is to provide a novel form of construction of gage containing means through which electrical connections are made for automatically starting and stopping a motor which supplies air under pressure to a reservoir equipped with the gage.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a face view of a gage embodying my invention; Fig. 2, a front elevation of the interior mechanism of the gage; Fig. 3, an enlarged broken view partly in elevation and partly in section, the section being taken on line 3 in Fig. 1 and viewed in the direction of the arrow; Fig. 4, a similar view, the section being taken on line 4 in Fig. 1 and viewed in the direction of the arrow; Fig. 5, a section taken on line 5 in Fig. 3 and viewed in the direction of the arrow; and Fig. 6 a broken diagrammatic view showing a gage embodying my invention, its electrical connections with a reservoir or air-tank and its electrical connections with an electric motor for operating a pump , (not shown,) which supplies air to the reservoir.

A is the gage-casing, provided with a dial A′, carrying a graduated scale *a* for indicating pressures. A hand-actuating shaft B, journaled at its inner end to the casing, is insulated at its outer end from a sleeve C, surrounding it, by a block of insulating material B′, forming a hub. The sleeve C has an extension C′ of reduced diameter, in which a shaft C^2 is secured to move therewith, an indicator-hand D for indicating pressure in the reservoir at all times being rigidly secured to the outer end of the shaft C^2. The contact making and breaking hand or electrode E is loosely secured on the shaft C^2 between the outer end of the extension C′ and a shoulder *c* on the shaft C^2 to be independently movable thereon. Surrounding the extension C′ is a coil-spring F, the ends *f f* of which cross each other and always extend at opposite sides of a pin *b*, which is secured in the hub B′ in alinement with the hand D. The hand E carries an inwardly-extending finger or stop *e*, which is in position to be engaged by one end of the spring, so that when the hand E is arrested by coming in contact with one of the stops provided on contact-plates in its path, as hereinafter described, the pin *b*, acting against one end of the spring, the other

end of the spring being held immovable by the stop *e*, causes the spring to flex, permitting the shaft B and the hand D to turn beyond the point at which the hand E is arrested. Upon the return of the hand D under increase of pressure to a position in alinement with the hand E the pin *b* and stops *e* aline with each other, as shown in Fig. 6, whereupon further movement of the shaft B will cause the hands D and E to move together under the increasing pressure in the reservoir. In this movement the spring F turns on the sleeve extension C′, serving as a bearing for it.

Any suitable means for rotating the shaft under varying pressures may be provided, those shown being the ones employed in gages of standard make. They comprise a flexible normally curved tube G in the back of the gage-casing A, connected at one end with a valved air-pipe G′, extending from a reservoir 5, Fig. 6, and at its opposite end by a well-known combination of links and levers $g\ g'\ g^2$, with a spring-held toothed segment G^2 meshing with a pinion (not shown) on the shaft B, whereby the extending and flexing of the tube causes the shaft B to rotate in opposite directions.

H is a metal bracket rigidly secured to the inner wall of the casing by a screw *h*, passing through insulating material *h′* and carrying a binding-post 1. The bracket H terminates at its opposite end in a flat segment of a ring h^2. The segment h^2 surrounds the sleeve C and is out of contact therewith and is provided about its periphery with an annular groove h^3, in which groove an outwardly-curved contact-plate H′, provided with a split-ring portion h^4, is frictionally held at its ring portion to permit the contact-plate to be adjusted on its bearing h^2. The outer end of the contact-plate H′ projects through an arc-shaped opening *a′* in the dial and terminates in a pointer h^5, registering with the scale. The pointer h^5 carries an outward projecting pin h^6 in the path of movement of the hand E for making electrical contact between the pointer h^5 and the hand E when the hand encounters the pin h^6. A similar bracket K is secured to the opposite side of the casing by a screw *k*, passing through insulating material *k′*, the screw terminating in a binding-post 3. The bracket K terminates in a flat segment of a ring k^2, provided about its periphery with an annular groove k^3, the ring portion k^2 surrounding the sleeve C, but out of contact with it.

K′ is a curved contact-plate, like the plate H′, provided with a flat split-ring end portion k^4. The split-ring end portion k^4 is frictionally held in the annular groove k^3 to adapt it to be adjustable about its bearing k^2. The curved plate K′ terminates at its outer end in a pointer k^5, which extends through the slot *a′* in the dial A and registers with the scale thereon, the pointer k^5 being provided with an outward-projecting pin k^6 in the path of movement of the hand E for making electrical contact with it. Fastened to and surrounding the sleeve C is a coil M, of insulated wire, connected at one end through a bracket L with a binding-post 2. The coil M forms electrical connection between the binding-post 2 and the hand E.

Referring to Fig. 6, connections between the gage, air-pump, and motor are as follows: The wires 6 7 are the main-line wires extending from a source of electrical current-supply (not shown) and provided with a switch 8. A motor 4 actuates an air-pump (not shown) for maintaining the desired air-pressure in the reservoir 5. The main-line wires extend to binding-posts 9 and 10, respectively, on a wall-plate N, which carries the controlling mechanism to be described. The motor shown is of the compound-wound type, a wire 11 connecting one of the terminals 12 and the heavy magnet-winding 12^a with the binding-post 10 on the wall-plate. The finer winding 12^b of the motor connects at one of its terminals with the winding 12^a and at its other terminal 12^c, through a wire 12^d and a binding-post 12^e, with a contact 16^a in a rheostat 15. The armature-terminal 13 of the motor leads to a contact 16^b of the rheostat through a binding-post 13^a. The arm of the rheostat is designated 14 and the contacts of varying resistance located between the contacts 16^a and 16^b by the numeral 16. The rheostat 15, as shown, is of the form adapted to be operated to gradually cut out resistance in the motor-circuit through the action of a solenoid 17 on a sliding metal bar 18, positioned at one end in the solenoid. The bar 18 is pivotally connected between its ends to the arm 14 and works at its opposite end in a dash-pot 19. A bar 20 in the path of movement of the bar 18 carries an insulated metal disk 21, which normally rests in contact with arms 22 and 23, extending from insulated posts 24 and 25, respectively. A resistance-coil 26 is provided between the posts 24 and 25, through which coil the current passes when the bar 18 encountering the bar 20 moves the latter and its disk out of engagement with the arms 22 and 23. A magnet-switch for opening and closing the circuit through the motor comprises a swinging arm 27, hinged to a standard 28, the arm 27 being adapted to be held normally in spring-raised position, in which position the switch is open and the circuit through the motor is broken. The magnet-switch shown is provided with two sets of electrodes, electrodes 29 and 30 forming the main electrodes and electrodes 31 and 32 the auxiliary electrodes. The arm 27 is connected with a binding-post 33 and carries the electrodes 29 and 31, with which the arm is electrically connected. The arm 14 of the rheostat also

connects with the binding-post 33 through the wire 33ª. A wire 34 extends from the binding-post 1 on the gage to a binding-post 35, the binding-post 35 being connected directly through a wire 34ª with the binding-post 9. A wire 36 extends from the binding-post 2 on the gage to the electrode 32 through binding-posts 37 and 32ª, and a wire 38 extends from the binding-post 3 on the gage to a binding-post 39 on the wall-plate. A wire 40 leads from the binding-post 39 to one of the terminals of an electromagnet 41 of the magnet-switch X, the wire 40 being connected between its terminals with one end of the solenoid 17, the other end of the solenoid being connected with the post 25 by a wire 17ª. A wire 43 connects the binding-post 9 with the electrode 30, and a wire 45 connects the electrode 32 with the other terminal of the magnet 41 through binding-posts 44 and 32ª.

The operation of the apparatus is as follows: Assuming, for example, that it is desired that the pressure in the reservoir 5 be maintained between one hundred and one hundred and fifty pounds and that it is empty, the contact-plate H is turned in the groove h^3 until the pointer h^5 registers with the one-hundred-pound mark on the scale, and the contact-plate K is likewise adjusted to cause the pointer k^5 to register with the one-hundred-and-fifty-pound mark. Under these conditions the indicator D will rest at the zero-mark on the scale and the hand E at the one-hundred-pound mark against the stop h^6, as shown in Figs. 1 and 6, in which position electrical contact may be made between the hand E and the stop h^6. The switch 8 in the main line is thereupon closed by hand, which causes the current to pass through the wire 6, binding-posts 9 and 35, and wire 34 to the binding-post 1, and thence to binding-post 2 through the bracket H, contact-point h^6, hand E, coil M, and bracket L. From the binding-post 2 the current passes through wire 36 to the binding-posts 37 and 32ª. From the binding-post 32ª the current passes through the wire 45 to the magnet 41 to energize the same, passing thence through the wire 40, the solenoid-wire 17ª, post 25, disk 21, post 24, to post 10, at which last-named post connection is made with the other line-wire 7. The current from the main line thus passing through the magnet 41 to energize it, as stated, causes the armature 27 of the magnet-switch to be depressed and the main and the auxiliary electrodes 29 30 and 31 32, respectively, to contact. This drawing together of the main and auxiliary electrodes closes the circuit between the main line and the motor, the circuit then being as follows: through wire 7, binding-post 10, wires 11 and 12, thence through magnet-windings 12ᵇ, wire 12ᶜ, binding-post 12ᵉ, wire 12ᵈ, rheostat contact 16ª, arm 14, wire 33ª, to swinging arm 27 of the magnet-switch. From the swinging-arm 27 the current passes through the main electrodes 29 and 30 to post 9 through the wire 43. In addition to the circuit through the finer winding 12ᵇ of the motor a circuit is made through the heavy winding 12ª and wire 13 to the rheostat contact 16ᵇ by reason of the current dividing at the connection between the winding 12ᵇ and the wire 12. Thus when the motor starts a relatively small amount of current passes through the heavy winding, owing to the resistance offered by the rheostat; but as the arm is carried over the rheostat contacts by the action of the solenoid on the bar 18 the current increases through the heavy winding until when the contact 16ᵇ is reached the maximum current passes through the heavy winding 12ª, when the motor runs at full speed. When the magnet-switch closes, a circuit in addition to the one just described through the motor is produced, a current passing from the line-wire 6 through binding-post 9, wire 43 to the electrode 30, thence through electrodes 30, 29, 31, and 32 to binding-post 32ª. From the binding-post 32ª the current passes through the wire 45 and binding-post 44 to the magnet 41, thence through the magnet 41, through wire 40 to solenoid 17, through the solenoid and wire 17ª to post 25, thence to disk 21, post 24, and wire 42 to the binding-post 10. This circuit through the switch-magnet X is maintained with full strength until the rheostat 14 reaches the contact 16ᵇ, when the bar 18 strikes the bar 20, pushing the disk 21 out of contact with the arms 22 and 23, whereupon the current instead of passing through the low-resistance disk is forced to pass through the resistance-coil 26, which greatly reduces the current through the last-described circuit, but through which circuit enough current is maintained to keep the magnets 41 and 17 sufficiently energized to hold the switches controlled thereby closed until the current through the magnet is interrupted. When the pressure in the air-tank reaches one hundred and fifty pounds, the hand E encounters the stop k^6 and an electrical circuit will be made through wires 36 and 38, whereupon the current instead of passing through the magnet 41 traverses the following circuit: from the binding-post 9 through wire 43, electrodes 30, 29, 31, and 32, through wire 36 to binding-post 2, thence through the hand E, contact-point k^6, to post 3. From the post 3 the current passes through wire 38 to post 39, thence through the wire 40 to solenoid connection, through the solenoid 17, wire 17ª, post 25, coil 26, post 24, and wire 42 to post 10. The circuit last described being established between the line-wires 6 and 7 short-circuits the magnet 41, causing it to become de-energized, whereupon the arm 27 of the magnet-switch raises and the current through the

electrodes of the switch-magnet is broken, thus breaking the circuit through the motor. When the pressure in the tank falls to one hundred pounds, the hand E encounters the stop h^6, and a circuit is immediately made between the hand E and stop 6 for closing the switch and maintaining it closed, as described, until the contact-point k^5 is again encountered by the hand E.

While I have described my invention in connection with a particular form of rheostat and motor-circuit opening and closing switch, I do not wish to be understood as limiting my invention to uses in connection with these particular devices or in connection with the particular type of motor shown, as any means controlled by the contact making and breaking hand or electrode and contacts of the gage for making and breaking the circuit through the motor or any type of motor suitable for the purpose may be employed without departure from my invention.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a pressure-gage, the combination with a scale, of an indicator adapted to indicate all pressures on the gage, an electrode movable with relation to said indicator and adapted to traverse only a portion of its range, contacts for said electrode at the opposite limits of its movement, and pressure-actuated means connected with said indicator and operating to move it and said electrode, for the purpose set forth.

2. In a pressure-gage, the combination with a scale, of an indicator adapted to indicate all pressures on the gage, and an electrode on a common axis with said indicator and movable with relation to said indicator and adapted to traverse only a portion of its range, contacts for said electrode at the opposite limits of its movement, and pressure-actuated means connected with said indicator and operating to move it and said electrode, for the purpose set forth.

3. In a pressure-gage, the combination with a scale, of an indicator adapted to indicate all pressures on the gage, and an electrode on a common axis with said indicator and movable with relation to said indicator and adapted to traverse only a portion of its range, separate arbitrarily-disposed electrical contacts for said electrode at the opposite limits of its movement, and pressure-actuated means connected with said indicator and operating to move it and said electrode, for the purpose set forth.

4. In a pressure-gage the combination of separate arbitrarily-disposed electrical contacts, a shaft, an indicator on the shaft, movable to indicate reservoir-pressure, an electrode resiliently connected with said shaft to adapt it to be moved with said indicator between said contacts and means actuated by the pressure in the reservoir for moving said indicator and electrode, whereby the indicator will show at all times the reservoir-pressures and the electrode will encounter the contacts for making electrical connection therewith.

5. In a pressure-gage, the combination of separate arbitrarily-disposed electrical contacts, a shaft provided with a stop, an indicator on the shaft and movable therewith for registering reservoir-pressure, an electrode positioned on the shaft to cause it to encounter said contacts, and provided with a stop, the electrode being loosely mounted on the shaft to adapt it to be arrested by said contacts when encountered during its varying movements, a coil-spring about the shaft having its ends crossed over said stops to cause said spring ends to be in the path of said stops, whereby the electrode will move with said indicator between said contacts and the spring will be caused to flex when the shaft is rotated beyond the points at which the electrode is arrested, and means actuated by the reservoir-pressures for moving said indicator and electrode, whereby the indicator will show at all times the reservoir-pressure and the electrode makes electrical connections with the contacts.

6. A pressure-gage comprising, in combination, a dial provided with a pressure-scale and having an opening concentric with the scale, separate electrical contacts projecting through said opening and adjustable therein relative to each other, a shaft provided with a stop, an indicator secured on said shaft for registering reservoir-pressure, an electrode positioned on the shaft to cause it to encounter said contacts and provided with a stop, the electrode being loosely secured to the shaft to adapt it to be arrested by said contacts when encountered during its varying movements, a coil-spring about the shaft having its ends crossed over said stops to cause said spring ends to be in the path of said stops, whereby the electrode is movable with said indicator between said contacts and the spring is caused to flex when the shaft is rotated beyond the points at which the electrode is arrested, and means actuated by the pressure in the reservoir for moving said indicator and electrode whereby the indicator will show at all times the reservoir-pressure and the electrode makes electrical connections with the contacts.

7. In a pressure-gage, the combination with a casing, of a central support, a movable electrode on said support, and adjustable contact members supported concentric with and surrounding said central support.

8. In a pressure-gage for the purpose set forth, the combination with a casing, of brackets secured to said casing in relatively arbitrary positions and insulated from each other, each provided with a peripherally-grooved ring portion positioned centrally of

the casing, contact-plates provided at their outer extremity with contact-points and adjustably secured on the respective ring portions of the brackets, an electrode movable between said contact-points for forming electrical connections therewith and means actuated by the pressure in the reservoir for actuating said electrode, whereby the electrode will be caused to encounter and make electrical connections with the contacts.

9. In a pressure-gage for the purpose set forth, the combination of a casing, a dial provided with an opening, contact members in said casing insulated from each other, the outer ends of said members terminating in contacts extending through the opening in said dial, said contacts being adapted to be adjusted independently of each other in said opening, an electrode movable between said contacts for forming electrical connections therewith, and means actuated by the pressure in the reservoir for actuating said electrode, whereby the electrode will be caused to encounter and make electrical connections with the contacts.

10. In a pressure-gage for the purpose set forth, the combination with a casing of a dial provided with an opening, brackets secured to the casing and insulated from each other, contact members adjustable on said brackets and terminating in contacts extending through the opening in said dial, an electrode movable between said contacts for forming electrical connections therewith, and means actuated by the pressure in the reservoir for actuating said electrode, whereby the electrode will be caused to encounter and make electrical connection with said contacts.

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In presence of—
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