No. 733,561. PATENTED JULY 14, 1903.

A. SUNDH.

PRESSURE REGULATED SWITCH.

APPLICATION FILED JULY 11, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

FIG. 1.

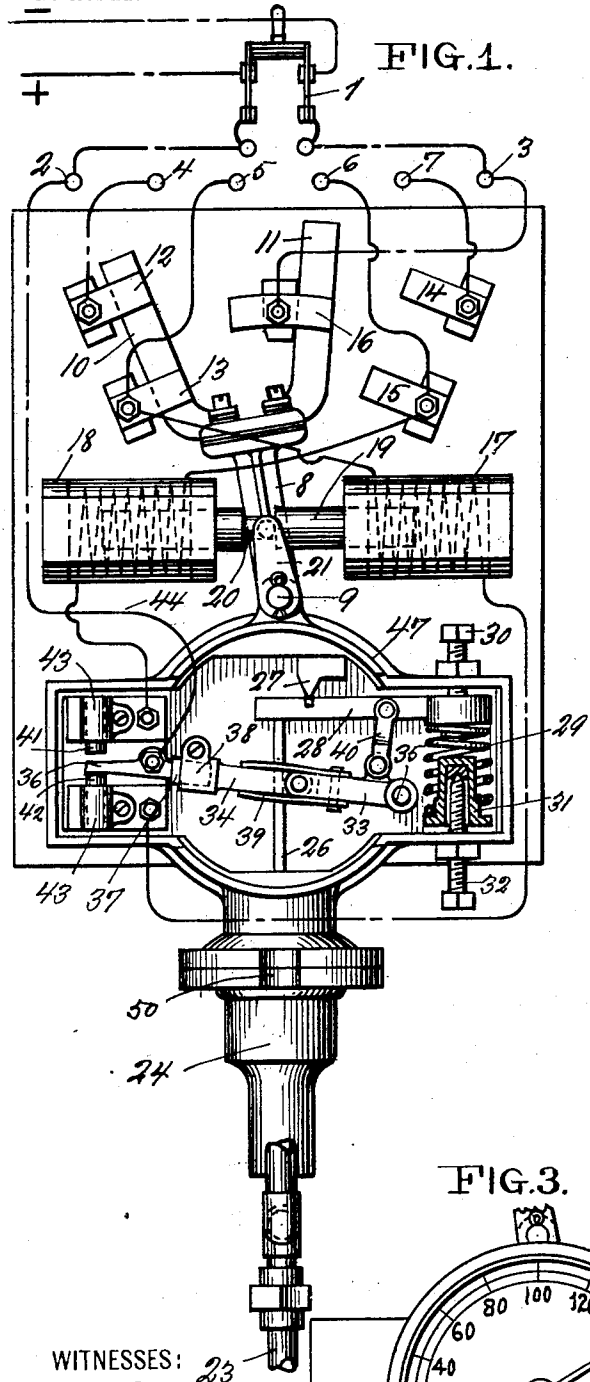


FIG. 2.

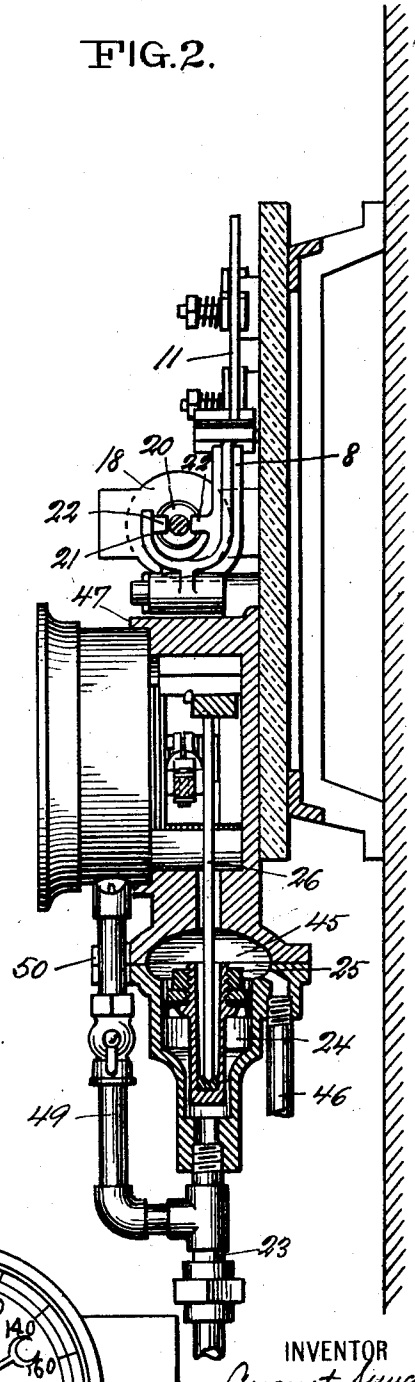
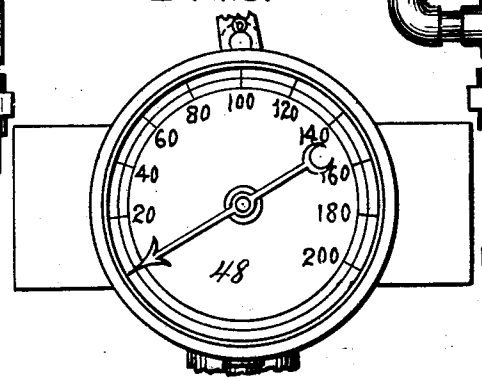


FIG. 3.



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NO MODEL. 3 SHEETS—SHEET 2.

FIG. 4.

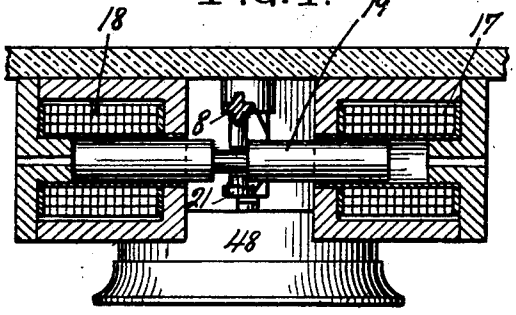


FIG. 5.

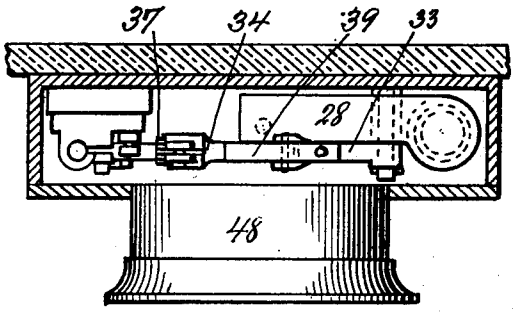


FIG. 6.

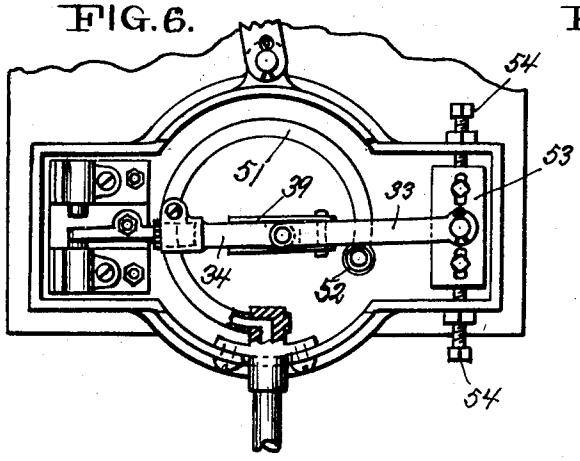


FIG. 7.

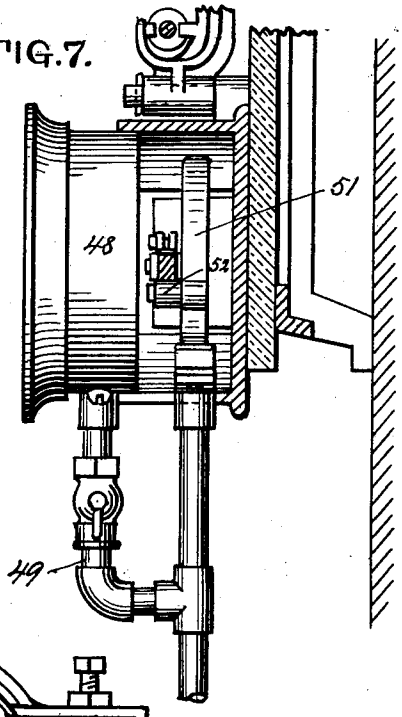
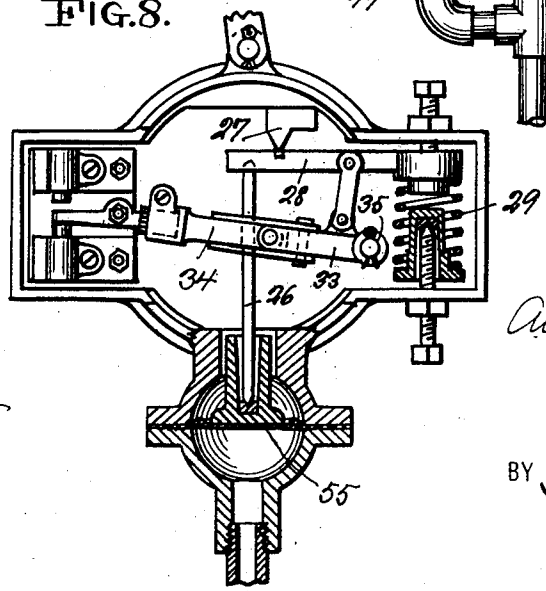


FIG. 8.



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No. 733,561. PATENTED JULY 14, 1903.

A. SUNDH.

PRESSURE REGULATED SWITCH.

APPLICATION FILED JULY 11, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

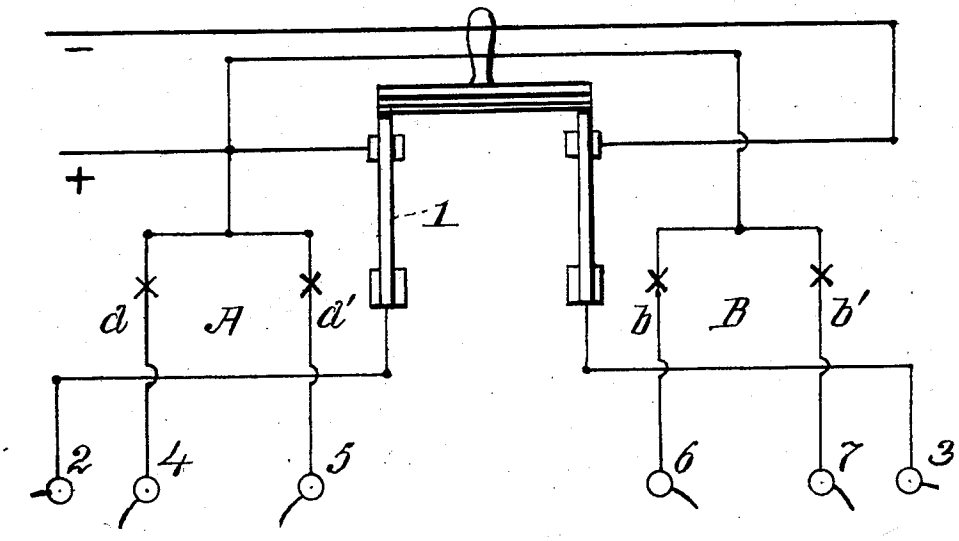


Fig. 9.

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No. 733,561. Patented July 14, 1903.

UNITED STATES PATENT OFFICE.

AUGUST SUNDH, OF YONKERS, NEW YORK.

PRESSURE-REGULATED SWITCH.

SPECIFICATION forming part of Letters Patent No. 733,561, dated July 14, 1903.

Application filed July 11, 1902. Serial No. 115,177. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDH, a citizen of the United States, residing in Yonkers, in the county of Westchester and State of New York, have invented a certain new and useful Improvement in Pressure-Regulated Switches, of which the following is a specification.

The object of present invention is the provision of means for operating electric switches in correspondence with changes in fluid-pressure, which shall have the following principal advantages.

The main switch to be controlled is operated by electromagnetic means governed in their turn by a primary switch, the whole being so constructed and combined that the circuit which is made at the primary switch is broken at another point (preferably at the main switch) as soon as the main switch has been thrown.

The primary switch is so constructed as to permit of easy adjustment for operation between extremes of fluid-pressure nearer together or farther apart at will, thus making the delicacy of the apparatus adjustable independently.

The means for operating the throwing of the main switch make provision for producing a hammer-blow, whereby certainty of operation is attained at this vital point.

The primary switch-lever is so constructed as to prevent transmittal of excessive pressures and possible breakage due to increase of fluid-pressure between working maxima.

An improved mounting is provided for the measuring or balancing spring which regulates the action of the device.

An improved structure is provided whereby the switch-controlling mechanism is conveniently related to and combined with a pressure-gage.

My invention is illustrated in a preferred form and modifications in the accompanying drawings, wherein—

Figure 1 is a face view of one form of my switch-control, the pressure-gage used as a cover being removed. Fig. 2 is a median section of the same, the pressure-gage being shown in place in elevation. Fig. 3 is a face view of the pressure-gage, showing its relation to the remainder of the apparatus. Fig. 4 is a horizontal section through the middle of the switch-throwing solenoids. Fig. 5 is a horizontal section of the device shown in Fig. 1, taken just above the upper stationary terminal or contact piece of the primary switch. Fig. 6 is a face view of a modified form of device for operating the primary switch. Fig. 7 is a central vertical section of the same, the gage being in elevation; and Fig. 8 is a partly face view and partly section of still another modification of the means for moving the primary switch. Fig. 9 illustrates diagrammatically the connections of the two translating devices.

The main current is controlled by switch 1 and led to the terminals 2 and 3. As the device is intended to bring either one of two groups A B, Fig. 9, of translating devices into circuit, according as the fluid-pressure in the pipe 23 to which the device is attached is rising or falling, it will be understood that said groups are permanently connected to the positive wire and are brought into proper electric connection with the negative wire by appropriate movements of the main switch. At 4 and 5 are the negative terminals of the group of translating devices A, which may be glow-lamps *a a'*, intended to be in circuit during rise of pressure in the pipes, while at 6 and 7 are shown the negative terminals of the group of devices B, which may be glow-lamps *b b'* and which are brought into circuit when pressure is decreasing.

The main switch-lever 8 is pivoted at 9 and carries two electrically-connected blades 10 and 11. The terminals 4 5 of one group of translating devices are connected to the fixed blades 12 13. The terminals 6 and 7 of the other group are connected to the fixed blades 14 and 15. Between the fixed terminals is a double blade-terminal 16, adapted to engage with either the blade 10 or 11, according as the lever 8 is swung to the right or left. This terminal 16 is in permanent circuit with the main negative terminal 3. When the lever 8 is swung to the left, as shown, the terminals 4 and 5 are brought into electrical connection with the terminals 3 through the fixed blades 12 and 13, the movable blades 10 11, and the middle terminal 16. When the lever 8 is swung to the right, terminals 4 and 5 are cut out of circuit, and terminals 6 and 7 in the

same way are brought into connection with the negative terminal 3.

Lever 8 is swung by the solenoids 17 and 18, acting upon a common armature-core 19, in the following manner: Turning on the same pivot 9 with the lever 8 is a bent lever 21. The two levers 8 and 21 are provided with projections 22, which enter a space 20 between shoulders on said core. The throw of the core is greater than that of the levers carrying said projection 22. Hence the core 19 is moved by its solenoid for some distance before the shoulder thereon strikes the projections 22. Thus it delivers a blow on said projections, and this transmitted to the lever 8 causes a greater celerity and certainty of action thereof.

The main switch is operated correspondingly to changes in fluid-pressure as follows: The pipe 23 is connected to the source of fluid-pressure and admits fluid to the chamber 24, where it acts on the under side of the piston 25. This piston is provided with a deep cup projecting downward into the chamber 24, in the bottom of which cup bears the transmission-rod 26, being supported thereon upon a rounded point, so as to permit of some freedom of side movement without appreciable friction at the point of bearing. On the knife-edge 27 is fulcrumed the lever 28, the shorter arm of which bears against the rod 26, while the longer arm is provided with a measuring-spring 29, which determines by its resistance the pressure at which operative movement of the primary switch takes place. The set-screw 30 acts as a stop above the lever 28.

In order to provide means for adjusting the pressure of the spring 29 and to permit of its free non-frictional and non-binding movement, said spring surrounds an inverted cup 31 and bears upon a flange thereon. A set-screw 32, having a rounded point of small area, bears upon packing in the bottom of said cup. In this way I diminish friction and permit side motion or swing of the cup and spring, while by moving the screw 32 in or out I produce changes in tension of the spring 29 as desired.

The lever 28 is connected to lever 33, pivoted at 35, by means of a link 40. The lever 33 has a prolongation 34 pivoted to it and held between the flat springs 39. A contact-piece 36 is secured in the insulating-sleeve 37 at the end of prolongation 34 by means of the screw-clamp 38.

In the path of contact 36 are fixed terminals 41 42, preferably of carbon, adjustably held in place by screw-clamps 43. By loosening said clamps said terminals can be set more or less to limit the path of movement of contact 36. The nearer these terminals 41 and 42 are placed together the more sensitive will be the device—that is to say, the less variation in pressure will produce action one way or the other of the main switch.

By means of the wire 44 the terminal 36 is kept in permanent electrical connection with the positive terminal 2. The terminal 41 is in permanent connection with one terminal of the solenoid 18 and the terminal 42 with one end of the solenoid-coil 17. The opposite end of the coil 17 is connected, as shown, with the terminal 13, (or any other fixed terminal on the same side of the main switch,) and the opposite end of the coil 18 is permanently in connection with one of the terminals on the other side of the main switch, as 15.

Above the piston 25 I prefer to supply a leakage-chamber 45, which is not made tight, but which while permitting free movement of the rod 26 upward into the main casing allows any water that may leak by the piston to escape by the drip-pipe 46.

The operation of the device is as follows, the parts being as shown in Fig. 1: Owing to increase of pressure in pipe 23, rod 26 has risen, thus swinging lever 33 downward on its pivot 35 and bringing contact 36 against contact-terminal 42, as shown in Fig. 1. Circuit is thus established from positive main terminal 2 to solenoid 17, fixed terminal 13, lever-blades 10 11, middle terminal 16, and negative main terminal 3. Solenoid 10 then draws lever 8 to the right, breaking circuit at 12 13 and establishing connection at 14 15. Thus the translating devices connected to 4 5 are cut out, and those connected to 6 7 are cut in. The latter, as already stated, correspond to decrease in fluid-pressure. As pressure decreases in pipe 23 the piston 25 and rod 26 slowly descend and with them the shorter arm of the lever 28. The spring 29 under the longer arm of 28 raises said longer arm, and through the link 40 the lever 33 is swung upward. This acts, through the springs 39, to raise the terminal 36 until at length said terminal touches 41. This energizes solenoid 18 by means of current finding its way to the negative terminal through 15 and blade 11. The main switch is at once thrown into the position shown in Fig. 1, and devices 4 and 5 are brought into circuit, while the circuit through 36 and 41 is broken at 15. The pressure then increases, thrusting the rod 26 upward against the spring 29 until once more terminal 36 is brought into contact with 42, when the cycle above described is repeated. It will be apparent, first, that the pressures at which operation takes place are determined by the tension on the spring 29, and the delicacy of action is determined by the distance apart of the terminals 41 and 42, and, second, that the circuit is made by contact 36 at a place where the necessary movement is very small and broken at another place—namely, the main-switch lever—where the arcing would do no harm. The switch-lever 33 is provided with the prolongation 34, connected by a yielding joint in order to prevent damage in case of undue pressure on said lever. The springs 39 at the joint aforesaid will then

yield, allowing the part 33 to move by itself. It is usually desirable to add a pressure-gage, so that check readings may be taken. This gage 48 I utilize as a cover for the front of the containing-box, preferably placing it in a recess 47. A branch pipe 49 connects the gage with the pipe 23.

In the modification shown in Fig. 6 I employ the curved spring-pipe 51, well known in steam-gages and aneroid barometers, instead of the piston and rod 26. This pipe is connected directly to the source of fluid-pressure and is provided with an insulating-offset 52, which projects under the lever portion 33 and operates thereon in opposition to the weight thereof. The resilience of the pipe does away with the necessity for a spring 29. In this form I prefer to pivot the lever 33, as at 53, upon a movable plate, adjustable by means of the screws 54. By moving this plate up or down I can vary the pressure at which the spring-pipe 51 acts.

In Fig. 8 is shown another modification in which the diaphragm 55 takes the place of the piston 25, the other parts being such as are shown in Fig. 1.

What I claim is—

1. A swinging lever, two contact-arms thereon, means for operating said lever and circuit connections; in combination with three fixed terminals disposed in succession in the path of movement of said lever; the said lever-arms being constructed and arranged to establish electrical connection between one end terminal and the intermediate terminal when said lever is at either end of said path.

2. A swinging lever, a bifurcated contact-piece thereon, means for operating said lever and circuit connections; in combination with three fixed terminals disposed in succession in the path of movement of said lever; the said bifurcated piece being constructed and arranged to establish electrical connection between one end terminal and the intermediate terminal when said lever is at either end of its path.

3. A swinging lever, two contact-arms thereon, electromagnets for operating said lever and circuit connections; in combination with three fixed terminals disposed in succession in the path of movement of said lever; the said lever-arms being constructed and arranged to establish electrical connection between one end terminal and the intermediate terminal when said lever is at either end of its path, and the said circuits including said electromagnets said terminals and said arms.

4. A swinging circuit-closing lever, fixed terminals on opposite sides thereof, solenoids also on opposite sides of said lever, an armature-core entering and movable in both solenoids and provided with shoulders receiving said lever between them; the throw of said armature being greater than that of the portion of the lever received between said shoulders; whereby a blow is delivered by said armature upon said lever to move said lever in either direction to make contact with one or the other of said terminals.

5. In combination with two translating devices to be controlled respectively conformably to changes in fluid-pressure, mechanism directly actuated by said fluid, a switch actuated by said mechanism, a second switch constructed to make and break circuit respectively to said translating devices and circuit connections; whereby the closing of said first switch by the fluid-actuated mechanism causes said second switch to break circuit to one translating device and establish circuit to the other.

6. The combination of a circuit including a circuit-closing switch-lever, mechanism for controlling said lever by changes in fluid-pressure, contacts adjustable to limit the path of movement of said lever, and a circuit including electromagnets, a swinging switch-lever controlled thereby, two translating devices and fixed contacts; whereby the movement of said swinging lever controlled by said electromagnets in turn controlled by said pressure-controlled lever, operates to break circuit to one translating device and establish circuit to the other.

7. In combination with a piston actuated by fluid-pressure, a piston-rod, a pivoted lever connected to said rod, a pivoted circuit-closing lever linked to said first lever and circuit connections; whereby the movement of said piston is imparted to said last-named lever to open or close circuit.

8. In combination with a piston actuated by fluid-pressure, a piston-rod, a pivoted lever connected to said rod, an adjustable spring connected to said lever for regulating the movement thereof, a pivoted circuit-closing lever linked to said first lever and circuit connections; whereby the movement of said piston is imparted to said first-named lever to open or close circuit.

9. In a device of the class described, fixed terminals, a swinging lever composed of two mutually-pivoted sections, a movable insulated terminal at the outer end of one section adapted to move between said fixed terminals and springs on said lever tending to preserve the two sections thereof in a constant relative angular position.

10. In a device of the class described, a switch, fluid-controlled means adapted to move said switch one way, a spring adapted to move said switch in the opposite direction, an inverted cup having an exterior flange on which said spring has a bearing and a screw whose tip makes contact within the bottom of said cup for its support.

11. In a device of the class described, a compression-lever, a fulcrum above said lever and an operating device and compression-spring impinging upon opposite ends of said lever under the same; in combination with a pivoted switch-lever in two jointed sections,

an operating-link between said compression-lever and that joint of said switch-lever next the fixed pivot and springs on said switch-lever tending to keep its two sections in a constant relative angular direction.

12. In a device of the class described, a fluid-chamber, a piston in said chamber having a hollow portion, a transmission-rod having a bearing in the bottom of said hollow portion of the piston and capable of free movement therein and a switch operated by said transmission-rod.

13. In a device of the class described, a primary switch, motive devices therefor, a source of fluid-pressure for operating said motive devices, a circular casing for said motive means and a pressure-gage covering said casing over said devices and connected operatively with said source of fluid-pressure.

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