July 31, 1951 J. J. ROTHWELL ET AL 2,562,437

PRESSURE OPERATED CONTROL SWITCH

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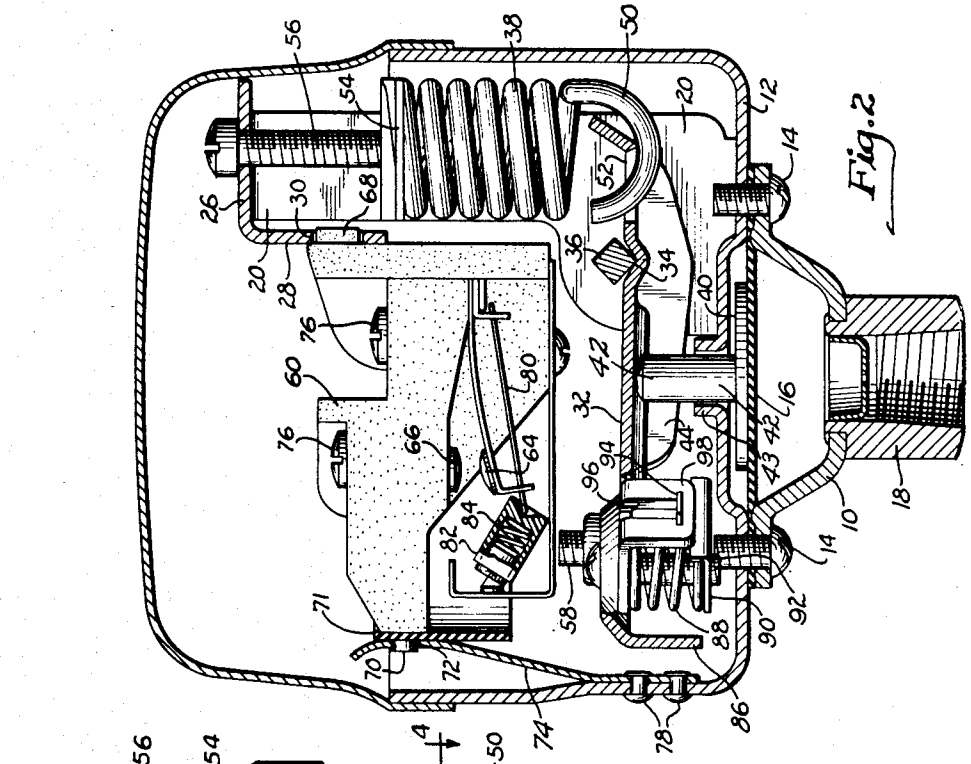


Fig. 2

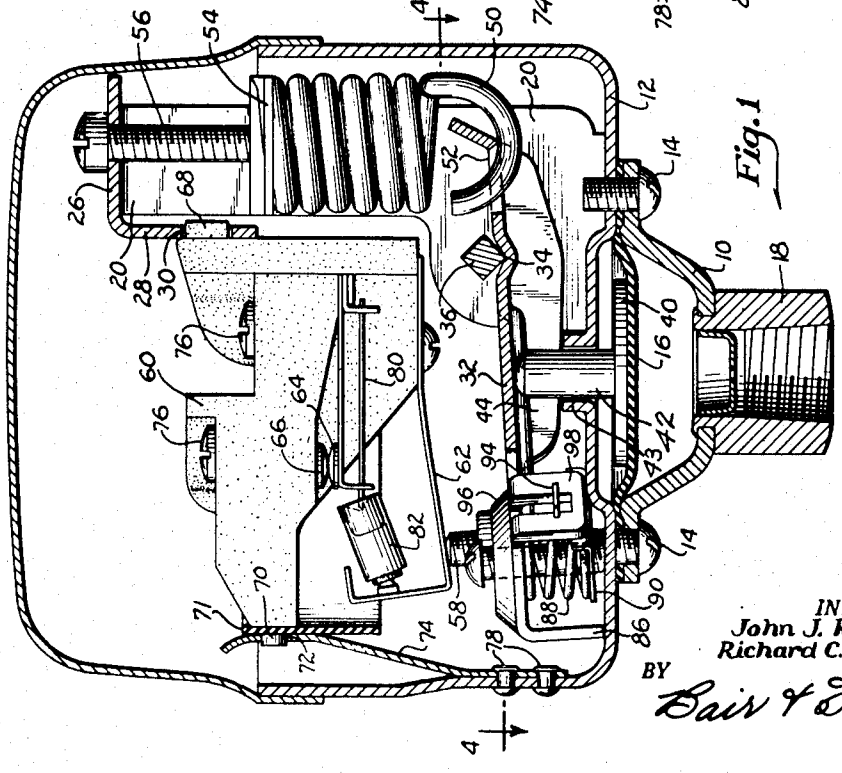


Fig. 1

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Fig. 3

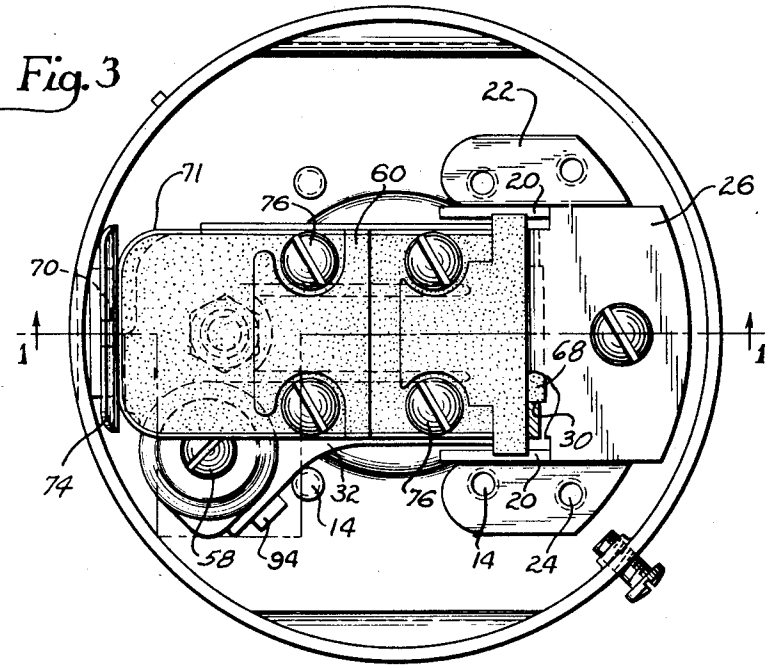



Fig. 4

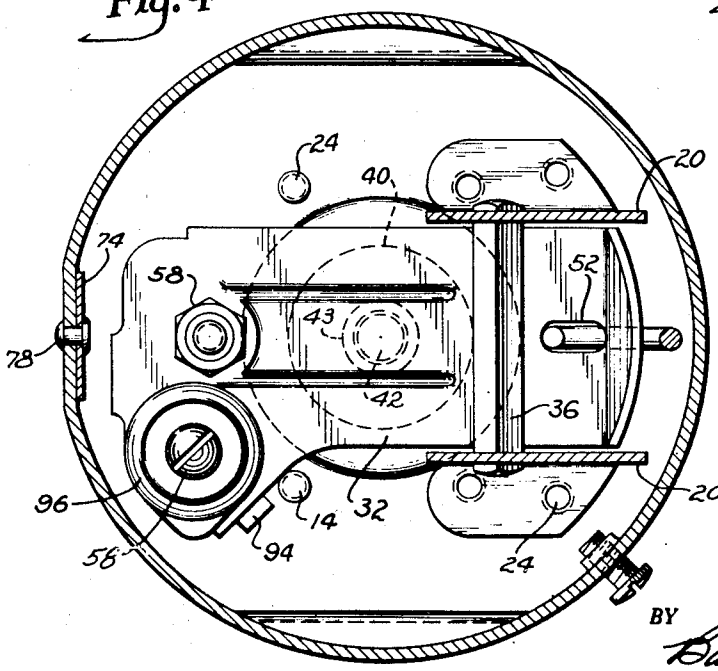
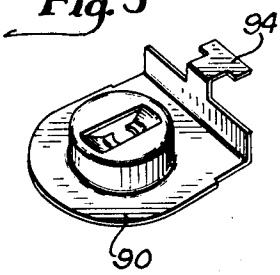



Fig. 5




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# UNITED STATES PATENT OFFICE

2,562,437

## PRESSURE OPERATED CONTROL SWITCH

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Application January 15, 1949, Serial No. 71,196

3 Claims. (Cl. 200—83)

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This invention relates to a so-called "pump switch" having a water pressure responsive diaphragm that automatically operates an electric switch connected in the circuit of a pump motor, the device being in the nature of an automatic control for domestic water systems and similar types of installations.

One object of the invention is to provide an automatic control switch of relatively simple construction making it inexpensive to manufacture yet rugged in character and at the same time small in size which also contributes to economical manufacture.

Another object is to provide a pump switch wherein inherent close differential is had, a novel differential widening arrangement being provided in case the inherent differential is too small, the mechanism therefor being entirely mounted on and carried by the main control arm of the switch.

Still another object is to provide a switch structure in which the majority of the component parts may be stamped from sheet metal, a range spring being connected to a main arm across the pivot from the diaphragm to keep all the parts in proper operating contact, and a relatively rugged switch being mounted above the main arm and to one side of the range spring thus requiring a minimum of space within the switch housing.

With these and other objects in view, our invention consists in the construction, arrangement and combination of the various parts of our control switch whereby the objects contemplated are attained as hereinafter more fully set forth, pointed out in our claims and illustrated in the accompanying drawings wherein:

Figure 1 is a vertical sectional view through a pump switch embodying our present invention and showing the switch responding to low pressure and therefore in closed circuit position;

Figure 2 is a similar view showing the pressure high and the switch accordingly open;

Figure 3 is a plan view of Figure 1 with the cover removed, Figure 1 being taken on line 1—1 of Figure 3;

Figure 4 is a sectional view on line 4—4 of Figure 1; and

Figure 5 is a perspective view of a spring follower used in the differential widening mechanism of our switch structure.

On the accompanying drawings we have used the reference numeral 10 to indicate a pressure housing on which a switch housing 12 is mounted as by means of six screws 14. A diaphragm 16 is interposed between the housings 10 and 12 and

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its periphery serves as a sealing gasket between them. A threaded boss 18 is welded or brazed to the housing 10 and is adapted to receive a pipe or copper tube fitting for conducting water pressure from the storage tank or other part of the pumping system to the pump switch.

Within the housing 12 a pair of side plates 20 have attaching feet 22 secured to the bottom wall of the housing 12 by two of the screws 14 and two screws 24. The side plates 20 terminate in a web 26 at the top having a downturned flange 28 at one side. The flange 28 is provided with a rectangular perforation 30 for a purpose which will hereinafter appear.

A main control arm 32 is provided and it is pivotally mounted with respect to the side plates 20 by having a V-seat 34 held against a knife edge consisting of one corner of a square cross bar 36 having its ends supported by the side plates 20. A range spring 38 is the medium for holding the seat 34 engaged with the element 36, and opposing the spring is a diaphragm follower 40. The follower 40 is a disc-like plate having a central upwardly directed pin 42 guided in a guide sleeve 43 formed from the lower wall of the housing 12. The pin 42 is rounded at its upper end, which end is engaged against the under surface of the main arm 32. The main arm, it will be noted, is provided with a pair of reenforcing side flanges 44.

The range spring 38 has a hook end 50 entering a slot 52 of the main arm 32, and in its opposite end a spring plug 54 is provided in which an adjusting screw 56 is threaded. The screw 56 extends rotatably through the web 26 of the side plates 20.

The main arm 32 carries a switch actuating projection 58 in the form of a screw which is adjustable for the purpose of causing switch operation at the desired point in the travel of the main arm. The switch actuated thereby comprises a base 60 formed of insulating material and having a switch actuating blade 62 for actuating a movable contact 64 in relation to a stationary contact 66. The base 60 is secured in position by single projections 68 and 70 entering the perforation 30 of the flange 28 and a perforation 72 of a spring retainer clip 74 respectively. The clip is mounted on a wall of the housing 12 by means of rivets 78. The terminals for the switch unit are indicated at 76 and these of course would be connected in the line between the source of current supply and the pump motor.

The movable contact 64 is actuated by a toggle blade 80 connected by means of a spring ex-

tended toggle link 82 with the switch actuating blade 62. Extension is caused by a spring 84 in the toggle link as shown in section in Figure 2. This switch structure is more fully disclosed in the copending application of Rothwell, Patent No. 2,515,528, July 18, 1950. The switch arm 32 has a downwardly extending flange 86 to serve as a lower-limit stop as in Figure 1.

A differential widening means is provided in the form of a spring 88, a spring follower clip 90 therefor (see Figure 5), and a screw 92 for adjusting the tension of the spring 88. The clip 90 has fingers 94 which extend through a slot 96 in a flange 98 of the main arm 32.

*Practical operation*

In the operation of our switch structure the low pressure position is illustrated in Figure 1. The switch is closed for causing the pump motor to operate, the blade 62 being initially bent downwardly as illustrated.

As the pressure rises against the diaphragm 16, the main arm 32 will rotate clockwise around the pivot bar 36, the arm first picking up the head of the screw 92 and thereafter carrying the differential widening mechanism with it. Upon further movement the arm 32 operates the switch to the open position of Figure 2 which stops the pump motor and as water is used from the system the pressure recedes, thus permitting the range spring 38 to rotate the arm 32 counterclockwise toward the position of Figure 1 again.

During such rotation the screw 92 will engage the bottom of the housing 12 and thereafter the tension of the spring 88 will be imposed on the main arm to resist its movement and thereby widen the differential, depending on the amount of resistance offered by the spring. The tension, of course, can be increased by adjusting the screw 92 so that the clip 94 rises in respect to the main arm. The length of the screw is such that it will engage the housing about midway the total travel of the arm 32. This provides a simple arrangement for widening the differential as desired and one which is entirely carried by the main arm and is comparatively simple in construction.

Figures 1 and 2 are almost twice the size of the actual device designed for domestic water systems. It is therefore obvious that the switch structure is comparatively compact, the main arm and range spring being arranged to present an L-shaped appearance with the switch structure mounted above the horizontal arm and to the side of the upright arm of the L which features contribute to compactness by eliminating substantially all the waste space within the switch housing.

Some changes may be made in the construction and arrangement of the parts of our device without departing from the real spirit and purpose of our invention, and it is our intention to cover by our claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

We claim as our invention

1. In a pressure operated control switch, a switch housing having a guide sleeve formed on one wall thereof, a pressure housing attached to said wall and including a diaphragm, a diaphragm follower between said diaphragm and said wall and having an actuating pin guided in said guide sleeve, a main control arm operatively engaged at one point by said pin, pivoted at another point and having a connection at a third point for a range spring beyond the pivot, a range spring connected therewith, a pair of side plates for supporting said range spring, a cross bar carried by said side plates and constituting the pivot for said main arm, and a switch unit adapted to be engaged by said main arm and actuated thereby in response to the opposing forces of pressure against said diaphragm and the range spring on said main arm.

2. In a control switch, a housing, a diaphragm, a main control arm operatively connected at one point with said diaphragm, pivoted at another point and having a connection for a range spring beyond the pivot, a range spring connected therewith, a switch unit actuated by said main arm in response to the opposing forces of pressure and the range spring on said main arm, and a differential widening unit carried by said main arm comprising a spring having one end against the arm, a spring follower against the other end of the spring and slidable toward and away from said arm but held against rotation, and a screw for adjusting the position of said follower relative to said arm and thereby the tension of said spring, said screw passing rotatably and slidably through said arm and having a head held in engagement with the arm by said spring, the end of said screw projecting beyond said follower and being engageable with said housing to impose the tension of said spring on said main arm during a portion of the travel of said main arm.

3. In a pump switch of the character disclosed, a housing, a switch arm pivoted therein, pressure responsive means for moving said switch arm in one direction, a range spring for moving said switch arm in the opposite direction, and a differential widening unit carried by said main arm and comprising a spring, a clip therefor having a finger extended slidably through said main arm and a screw for adjusting the position of said clip relative to said arm and thereby the tension of said spring, said screw being engageable with said housing to impose the tension of said spring on said main arm during a portion of the travel of said main arm.

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