

[54] **LOW PROFILE PRESSURE SWITCH WITH PLUNGER ADJUSTING MEANS**

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[51] Int. Cl. **H01h 35/34**

[58] Field of Search 200/166 M, 83 R, 83 S, 200/83 T, 83 U, 83 WM, 249; 337/319

[56] **References Cited**

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Primary Examiner—Robert K. Schaefer

Assistant Examiner—Gerald P. Tolin

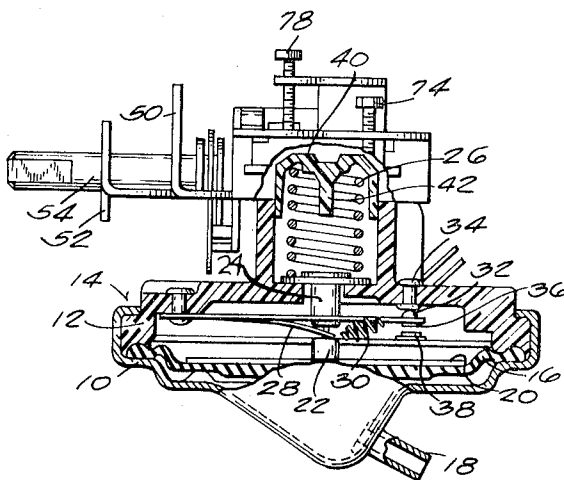
Attorney, Agent, or Firm—Michael, Best & Friedrich

[57] **ABSTRACT**

To minimize space requirements, a small adjusting

cam is mounted beside and projects below the side of the central housing of the pressure switch. The cam actuates a follower lever which, in turn, actuates an adjusting lever acting on the calibrating (pressure adjusting) spring plunger. The double lever arrangement achieves a motion multiplying effect permitting use of a small cam and, hence, reduces space requirements. The adjusting lever is movable about an axis, one end of which is adjustable by means of a calibrating screw which prevents transmission of forces from the calibrating tool to the lever and thus allows automatic calibration. The extra low setting of the pressure switch is determined by another calibrating screw fixed in the mounting bracket to prevent transmission of adjusting forces to the lever and permit automatic calibration. The cam may be rotated to an extra low position in which the follower lever has no effect on the position of the adjusting lever, the position of the adjusting lever being determined solely by the extra low calibrating screw. A second extra low setting is provided, in which position the cam actuates an arm which may be connected to a clutch or switch altering the speed of a timer, for example, to permit alteration in the operational characteristics of the washing machine in combination with the extra low setting.

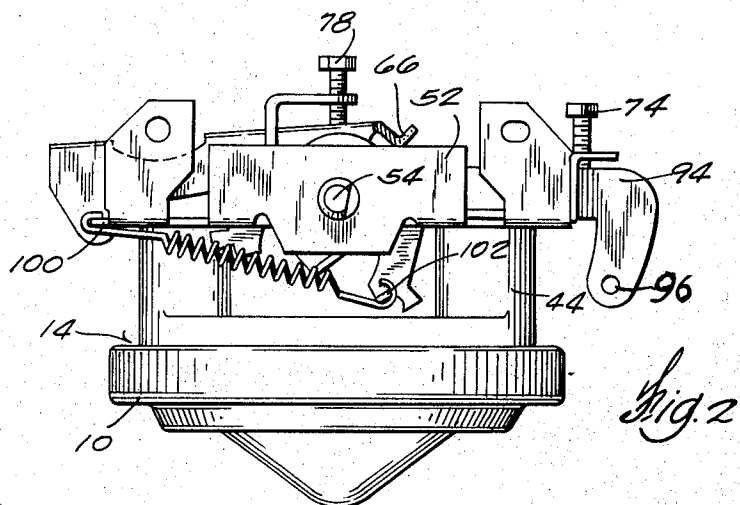
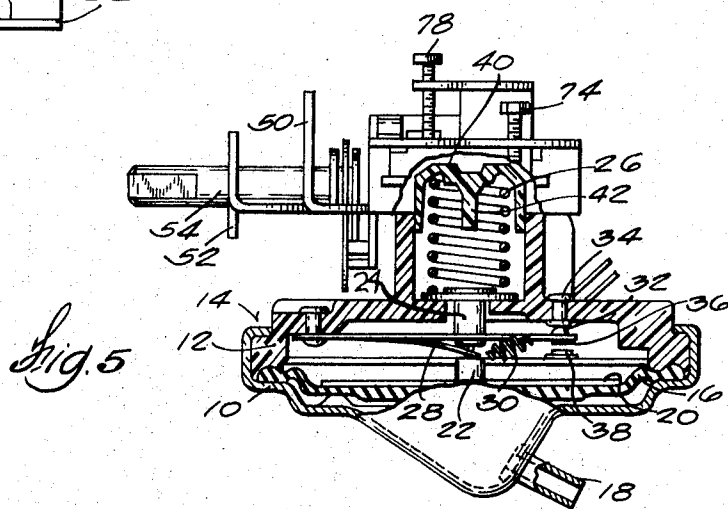
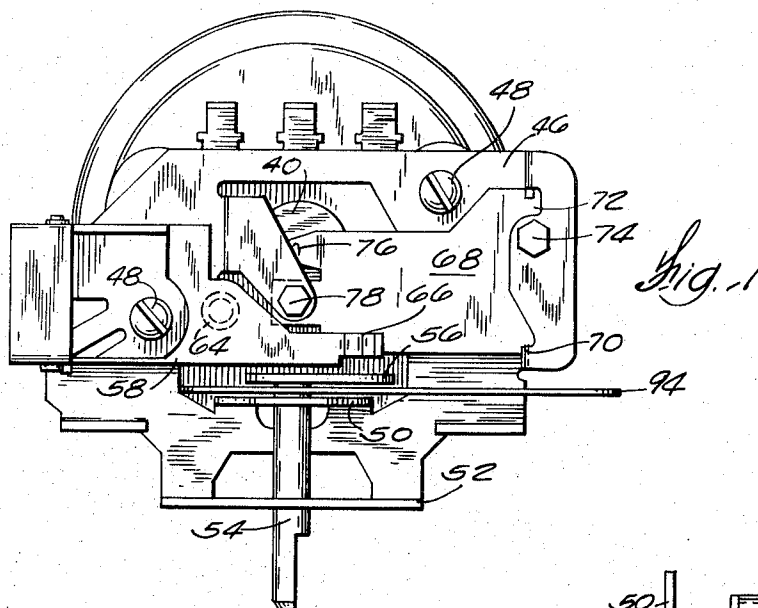
6 Claims, 10 Drawing Figures



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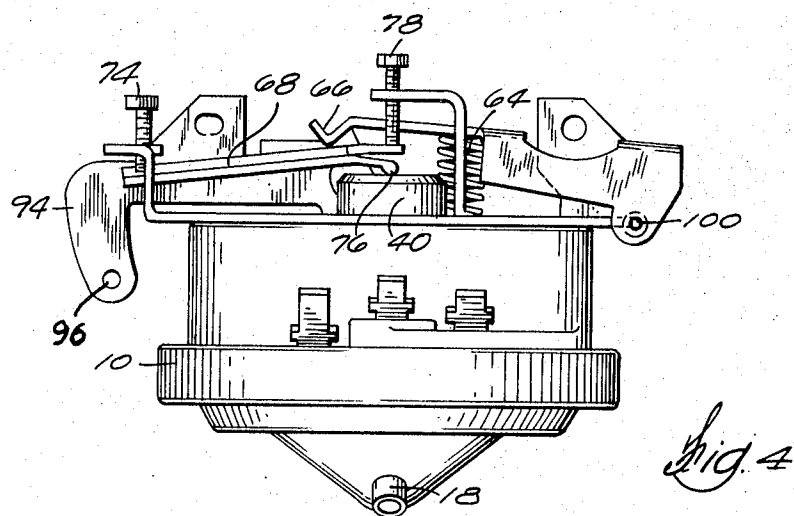
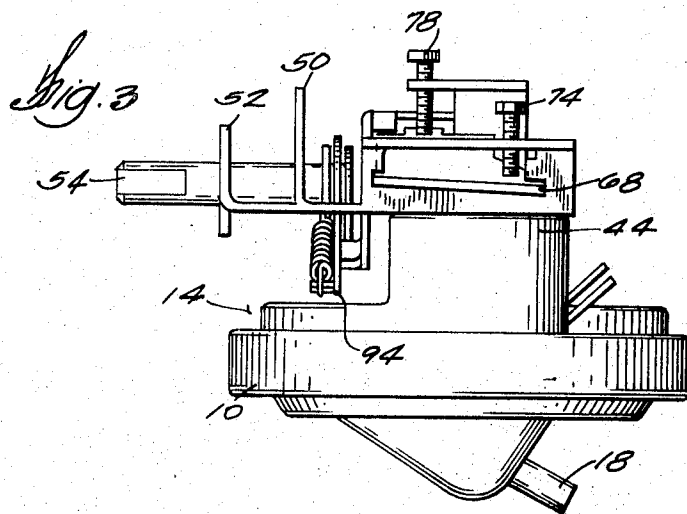


Fig. 6

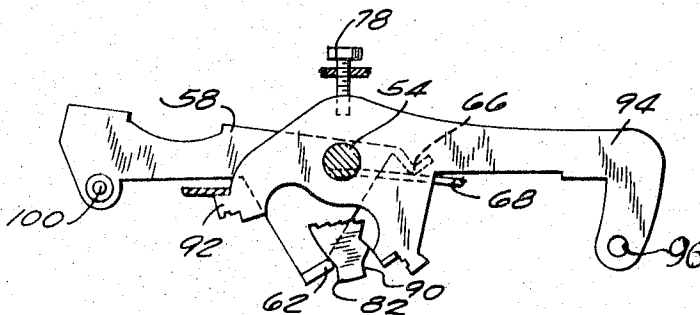


Fig. 7

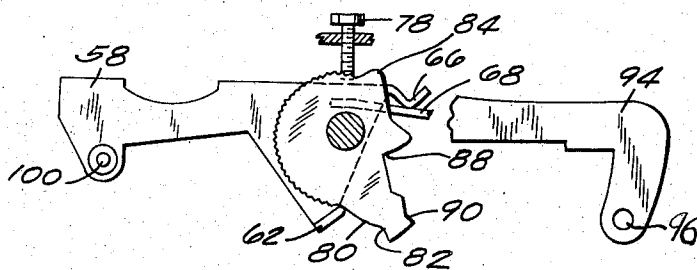


Fig. 8

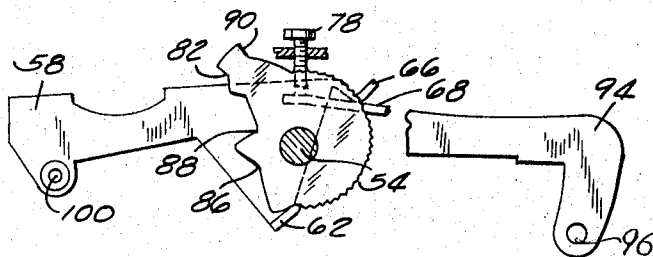


Fig. 9

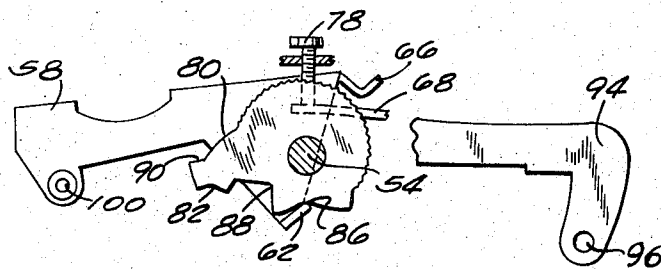
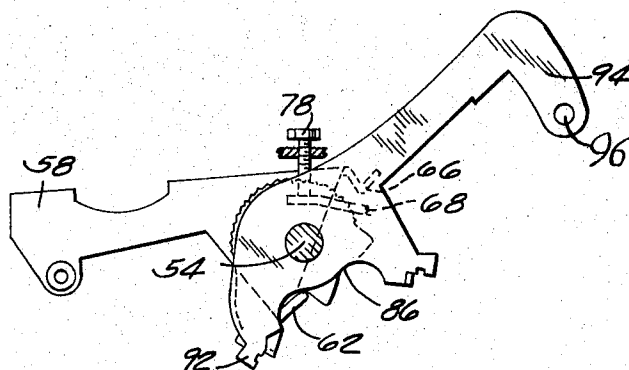


Fig. 10



LOW PROFILE PRESSURE SWITCH WITH PLUNGER ADJUSTING MEANS

BACKGROUND OF THE INVENTION

Pressure switches of the general type disclosed here are widely used in conjunction with washing machines. Styling requirements impose constant restrictions on the pressure switch and the pressure switches heretofore available were deemed too large for the back panel of a proposed washing machine. Accordingly, it became necessary to reduce the overall space requirement of the pressure switch.

In addition to the reduced size, it was also required that the pressure switch incorporate additional functions and, from a manufacturing standpoint, it was desired to retain all the better features of the prior designs, particularly those permitting automatic calibration upon completion of assembly.

SUMMARY OF THE INVENTION

Through use of the construction described in the Abstract, a very compact, low profile pressure switch has been made possible. The motion to be imparted to the adjusting or calibrating spring in the pressure switch is of relatively large magnitude. Heretofore this has required a rather large cam to obtain the desired travel. The present motion multiplying leverage system permits a considerable reduction in the cam while permitting a separate loading spring to be applied to the cam follower lever to thereby obtain a considerable spring force acting on the lever. Since the present cam arrangement incorporates a detent action between the low and extra low positions and between the "extra low" and "extra low special" positions, a strong detent action is desired. With a separate spring, this action can be obtained with a good positive feel in a position of the adjusting lever which in prior designs would necessarily result in a reduction of the spring force at the very point where a strong spring force on the cam would be desired. The present design actuates an arm in the extra-low-special setting to actuate another mechanism which may be a clutch or switch causing the timer to run faster and alter the duration of the program. This added function is obtained in this pressure switch design while reducing the space requirements. This has been accomplished while retaining the automated calibrating features heretofore developed (see U.S. Pat. No. 3,600,536).

DESCRIPTION OF THE DRAWINGS

- FIG. 1 is a top plan view of the pressure switch.
FIG. 2 is an elevation taken as indicated by line 2—2 on FIG. 1.
FIG. 3 is another elevation as indicated by line 3—3 on FIG. 1.
FIG. 4 is still another elevation taken as indicated by line 4—4 on FIG. 1.
FIG. 5 is a vertical section through the switch.
FIGS. 6 through 10 are fragmentary views with parts broken away to illustrate the various operational positions of the cam and the levers in the reset, high, low, extra-low, and extra-low-special positions, respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The pressure switch portion of the present apparatus is conventional, having a lower cup 10 with its edge rolled over the upper plastic part 12, as indicated at 14, with the diaphragm 16 captured between the two parts. Pressure variations introduced through fitting 18 will cause movement of the diaphragm and pad 20 to move actuating pin 22. Diaphragm pin 22 moves spring follower 24 opposed by spring 26, the preset compression of which determines the calibration or level selection of the pressure switch. As the diaphragm pin 22 moves upward, it also actuates the tongue 28 of the toggle switch mechanism and when the spring 30 moves over center, blade contact 32 will move from the upper contact 34 and the lower blade contact 36 will snap into engagement with the lower contact 38. This type of arrangement is conventional. The position of the spring cup or plunger 40 determines the degree of compression of spring 26 and, therefore, the calibration of the pressure switch. Pin 42 depends from the plunger 40. If the plunger 40 is moved down far enough, this pin will engage the spring follower 24 and force the follower down and actuate the switch back to its normal position. This, then, makes it possible to positively reset the switch for a new level or pressure setting even though the switch has tripped.

It is in the apparatus for adjusting the position of the plunger 40 and, hence, the compression of spring 26 that the present structure differs from the prior art. It will be noted the plastic switch housing 12 incorporates a bridge-like portion 44 in which the spring plunger 40 is guided and which provides a flat surface for the purpose of securing mounting bracket 46 to the assembly by screws 48, 48. The bracket 46 is stamped and formed to provide various pivots for levers and shafts as will be apparent as the description proceeds. Two tabs 50, 52 are formed upwardly to journal shaft 54 upon which the cam 56 is secured. The shaft is designed to project through the back panel of a washing machine with a knob mounted thereon for rotation to obtain the various operational settings to be described.

A pair of upstanding ears provide the pivot points for follower lever 58 which has a depending arm portion 60 terminating in a laterally projecting follower 62 which engages the cam. The lever is biased upwardly by spring 64 compressed between the underside of the lever and the top surface of bracket 46. The lever also includes a formed actuating finger 66 which engages the edge of adjusting lever 68 which is pivoted at its right-hand end (FIG. 1) in a fixed pivot 70 and an adjustable pivot 72, the adjustment being achieved by turning bolt or screw 74 to move the corner 72 up or down while the lever rocks about pivot 70 and the point of engagement between the follower lever finger 66 and the adjusting lever 68, thus adjusting the point of engagement of the adjusting lever finger 76 with the center of the plunger 40. Since the screw 74 is fixed in the stationary bracket, forces applied to the screw during calibration cannot be transferred to the lever 68 and, hence, to the calibrating spring 26. Therefore, automated adjustment is permitted. This adjusting feature is described and claimed in U.S. Pat. No. 3,600,536.

Within the normal high-to-low range, the shape of the cam will insure proper positioning of the adjusting lever and, hence, of the plunger. When the cam is

moved to the extra-low setting (as will be described more fully hereinafter), the follower lever will move out of engagement with the adjusting lever and the position of the adjusting lever is now determined by the calibration of screw 78. The force of the tool used in turning the screw cannot be transferred to the lever 68 and, therefore, automated calibration of this setting is feasible.

In the high position of the cam (FIG. 7) to the low position (FIG. 8) the follower is acting on the slightly serrated surface of the cam and this, with the force of spring 64 acting on the follower lever, will hold whatever setting is selected between high and low. Contrary to past practices, the force of the calibrating spring in the pressure switch itself is not utilized for deriving the proper spring load in the follower. This makes it possible to utilize a strong spring which has additional functions which will be described hereinafter.

In order to obtain the reset function as illustrated in FIG. 6, the cam is turned in the clockwise direction so as to move the follower 62 along the steep ramp portion 80. When the maximum "rise" is reached (FIG. 6), reset is obtained. At this point the further rotation of the cam in the clockwise direction is limited by stop surface 82. On release of the knob, the ramp 80 functions along with the force of spring 64 acting on the follower lever to force the cam back to the high level pressure position of the cam as illustrated in FIG. 7. Between the position in FIG. 7 and the "low" position in FIG. 8, any water level may be selected. Going from the position in FIG. 8 to the "extra low" position in FIG. 9, the follower 62 is forced to rise up and over the detent hump 84. Once past the peak of the hump, the follower must fall into the notch 86 which is the "extra low" setting. At this point the follower lever is completely out of contact with the adjusting lever and the setting of the calibrating spring is determined solely by the adjustment of the screw 78. When going from the position in FIG. 9 to the position in FIG. 10, the follower again has to rise over a detent hump and at about the peak of the hump the projection 90 (on the opposite side of the generally radial tab on the cam from stop surface 82) picks up or engages the inturned finger 92 projecting from lever 94 so that when the follower drops into notch 88, the lever 94 has been actuated to the position shown in FIG. 10. This imparts considerable motion to lever 94 and the point of connection 96 to the external mechanism (not shown) has ample travel to shift a clutch or actuate a switch changing the speed of the timer mechanism itself and thereby changing the selected cycle to a fast (short) cycle retaining the same sequence. Lever 94 is biased to its normal position by the coil spring 98 tensioned between anchor 100 on the bracket and anchor 102 on the lever arm.

The size of the cam is kept very small in this design due to the use of the motion multiplying effect of the two levers and the ratio of the point of actuation of each lever to the point of utilizing the imparted motion. This makes for a very compact design. The spring 64 acting on the follower lever is utilized not only to obtain the detent action but also to return the cam from the "reset" position. In past designs the spring to return from the reset position was a separate spring which had

no other function in the device. Now the spring acting on the cam follower is isolated from the calibrating spring of the pressure switch. Thus the two are distinct and independent from one another.

I claim:

1. The combination with a pressure switch including a housing having a portion in which a plunger is reciprocally mounted and adjusts a calibrating spring, of a mounting bracket fixed on the housing, a shaft journaled in the bracket, a cam fixed on the shaft and disposed laterally of said housing portion and depending below the upper position of said plunger, lever means biased into engagement with the cam and acting on said plunger and adjusting the calibrating spring, an arm adapted to actuate external apparatus and mounted for movement between inoperative and operative positions, means biasing the arm to its inoperative position, and means carried by the cam removably engaged with said arm to move the arm to its operative position when the cam is moved to a specific position.

2. The combination of claim 1 in which the lever means is a compound leverage having a motion multiplying effect and including a follower lever engaging said cam and an adjusting lever which acts on said plunger, said biasing means comprising a spring acting on the follower lever.

3. The combination of claim 2 in which the cam is profiled to move the follower lever to a position out of engagement with the adjusting lever and including adjustable stop means carried by said bracket and engaged by the adjusting lever when the follower lever is moved out of engagement with the adjusting lever.

4. The combination with a pressure switch including a housing having a portion in which a plunger is reciprocally mounted and adjusts a calibrating spring, of a mounting bracket fixed on the housing, a shaft journaled in the bracket, a cam fixed on the shaft and disposed laterally of said housing portion and depending below the upper position of said plunger, a follower lever mounted on the bracket including a follower engaging the cam, an adjusting lever mounted on the bracket and engaging the plunger and engaged by the follower lever whereby motion imparted to the follower lever by the cam is imparted to the plunger, said cam causing the actuating lever to move out of engagement with the adjusting lever in one position,

and adjustable limit stop means effective to position the adjusting lever in said one position.

5. Apparatus according to claim 4 in which the levers provide a motion multiplying effect imparting greater movement to the plunger than the cam imparts to the follower.

6. Apparatus according to claim 5 including means for initially adjusting the adjusting lever relative to the plunger independently of the cam and follower.

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