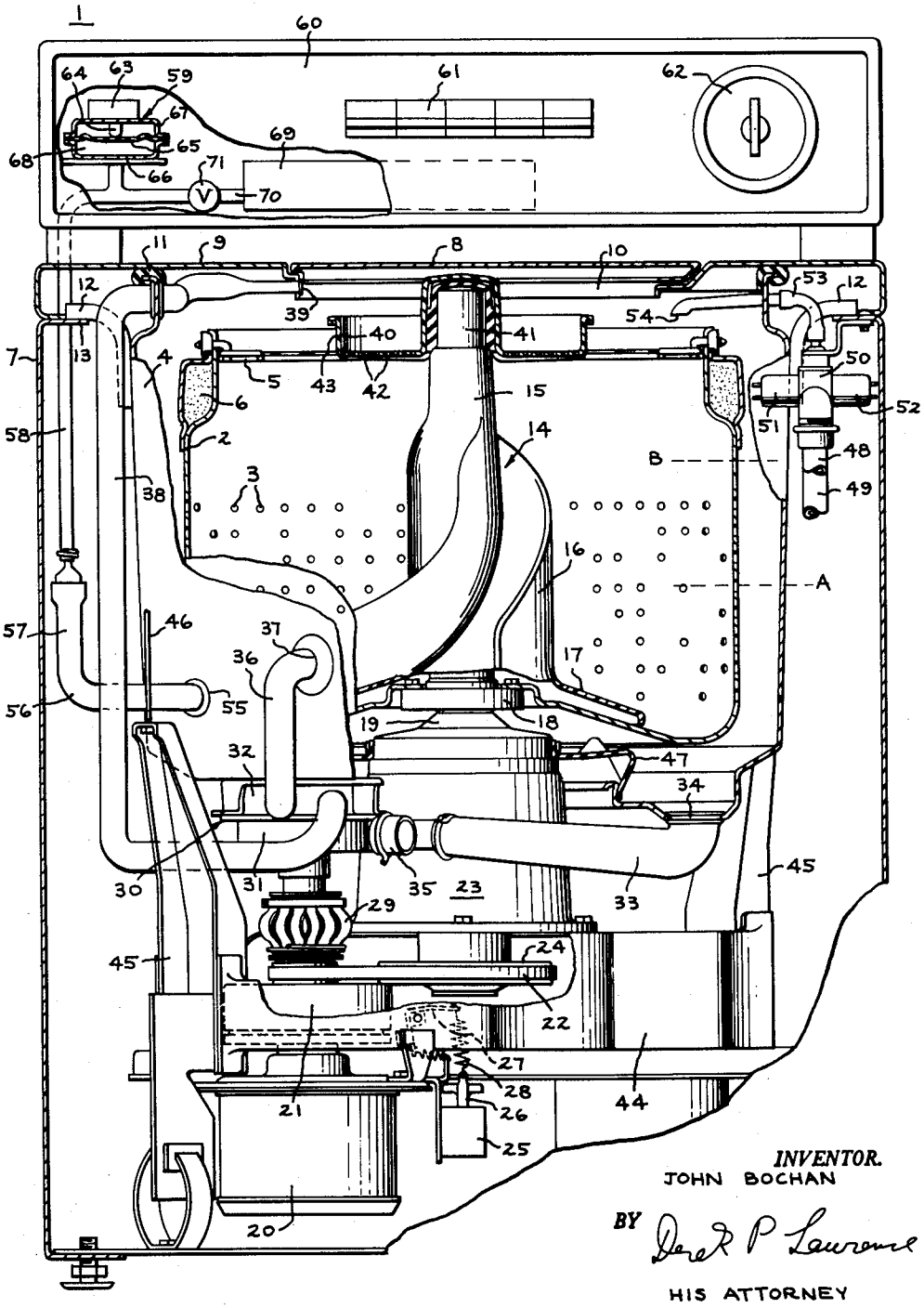
Dec. 4, 1962 J. BOCHAN 3,067,303

ADJUSTABLE WATER LEVEL SWITCH

Filed Oct. 3, 1960



INVENTOR.
JOHN BOCHAN

BY Derek P Lawrence

HIS ATTORNEY

United States Patent Office

3,067,303
Patented Dec. 4, 1962

3,067,303

ADJUSTABLE WATER LEVEL SWITCH

John Bochan, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Filed Oct. 3, 1960, Ser. No. 60,014
2 Claims. (Cl. 200—83)

This invention relates to pressure actuated switches, and more particularly to an adjustable switch of this type which is especially suited for use in clothes washing machines.

It is generally desirable, in domestic clothes washing machines, to be able to cause the flow of water into the liquid receptacle of the machine to be stopped at different levels so that a full tub of water will not have to be used where the clothes load is a relatively small one.

Accordingly, it is an object of my invention to provide an improved adjustable water level switch.

A more specific object of my invention is to provide such a switch of the type wherein the pressure on a column of air actuates the switch, and wherein the adjustable feature is achieved by varying the volume of air on which the pressure of the water is provided.

In one aspect of my invention I provide a switch, for use in combination with a liquid receptacle such as those provided in washing machines, which is tripped from a first to a second position in response to attainment of one of a plurality of predetermined liquid levels in the receptacle. The switch has a closed chamber which is formed to have at least one flexible wall which deforms in response to a predetermined pressure increase in the chamber. The switch is positioned so that, upon so deforming, the flexible wall trips the switch to its second position. A conduit connected to the receptacle at a point substantially below the lowest of the predetermined levels extends up from the receptacle to the chamber, and in addition a rigid closed container is provided and is connected by another conduit to the chamber. By providing a manually operable valve in the second conduit, I achieve a relatively high liquid level before the switch is tripped when the valve is open and a low liquid level before the switch is tripped when the valve is closed.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention itself, however, both to its organization and method of operation, may best be understood by reference to the following description taken in conjunction with the accompanying drawing.

In the drawing, the single FIGURE is a front elevational view of a clothes washing machine including my invention, the view being partially broken away and partially in section in order to illustrate details.

Referring now to the drawing, I have shown therein an agitator-type vertical-axis clothes washing machine 1 having a conventional basket or clothes receptacle 2 provided over its side and bottom walls with perforations 3 and positioned within an outer imperforate tub 4 so that when liquid is retained within tub 4 it will, through perforations 3, also rise to the same level in basket 2 as in tub 4. Basket 2 may also be provided with a suitable clothes retaining member 5 for preventing clothes from being floated over the top of the basket, and with a balance ring 6 to help steady the basket when (as will be explained) it is rotated at high speed. Tub 4 is rigidly mounted within appearance cabinet 7 which includes a cover 8 hingedly mounted in the top portion 9 of the cabinet for providing access through an opening 10 to the basket 2. As shown, a gasket 11 may be provided so as to form a seal between the top of tub 4 and portion 9 of the cabinet thereby to prevent escape of moisture and

warm air into the cabinet around the tub. The mounting of tub 4 within the cabinet 7 may be effected by any suitable means. As a typical example of one such means I have provided strap members 12, each of which is secured at one end to an inturned flange 13 of the cabinet and at its other end to the outside of tub 4. At the center of basket 2 there is positioned a vertical-axis agitator 14 which includes a center post 15 and a plurality of curved water-circulating vanes 16 joined at their lower ends by an outwardly flared skirt 17.

Both the clothes basket and the agitator 14 are rotatably mounted. The basket is mounted on a flange 18 of a rotatable hub 19 and the agitator 14 is mounted on a shaft (not shown) which extends upwardly through the hub 18 and through the center post 15 and is secured to the agitator so as to drive it. During the cycle of the operation of the machine 1, water is introduced into the tub 4 and basket 2, and the agitator 14 and is then oscillated back and forth on its axis, that is, in a horizontal plane within the basket to wash the clothes therein. Then after a predetermined period of this washing action,, basket 2 is rotated at high speed to extract centrifugally the washing liquid from the clothes and discharge it to drain. Following this extraction operation, a supply of clean liquid is then introduced into the basket for rinsing the clothes and the agitator is again oscillated. Finally, the basket is once more rotated at high speed to extract rinse water. There are many variations on this relatively basic sequence which may be provided, such as, for instance, additional rinses, or a pause during the first spin (sometimes provided to help prevent suds locking of the the machine). However, the sequence described is a typical one for such machines.

The basket 2 and agitator 14 may be driven through any suitable means from a reversing motor as the transmission means forms no part of the present invention. However, by way of example, I have shown them as driven from a reversible motor 20 through a drive including a clutch 21 mounted on the motor shaft. The clutch allows the motor to accept the load as it comes up to speed. A suitable belt 22 transmits power to a transmission assembly 23 through a pulley 24. Thus, depending upon the direction of motor rotation, pulley 24 of transmission 23 is driven in opposite directions. Transmission clutch 21 may also be a two-speed clutch, so as to provide for various operating speeds of the machine, and in this connection a solenoid member 25 having a plunger 26 which operates a control member 27 through a spring 28 is provided in order to achieve the two-speed operation. Specifically, in the illustrated machine, when solenoid 25 is deenergized, clutch 21 provides a direct drive between motor 20 and pulley 24, and when solenoid 25 is energized, clutch 21 provides a reduced speed drive to pulley 24. A two-speed clutch of this type, particularly suited for use in the illustrated machine, is described in detail and claimed in Patent 2,869,699, issued to me on January 20, 1959, and assigned to the General Electric Company, assignee of the present invention.

The transmission 23 is so arranged that it supports and drives both the agitator drive shaft and the basket mounting hub 19. When motor 20 is rotated in one direction, transmission 23 causes agitator 14 to oscillate in a substantially horizontal plane within the basket 2. Conversely, when motor 20 is driven in the opposite direction, the transmission rotates the wash basket 2 and agitator 14 together at high speed for centrifugal liquid extraction. While the drive mechanism forms no part of the invention, reference is made to Patent 2,844,225, issued to James R. Hubbard et al. on July 2, 1958, and owned by the General Electric Company, assignee of the present invention. That patent discloses in detail the

structural characteristics of a transmission assembly suitable for use in the illustrated machine.

In addition to operating the transmission 23 as described, motor 20 also provides a direct drive through a flexible coupling 29 to a pump structure generally indicated at 30 which includes two separate pumps 31 and 32 both operated simultaneously in the same direction by motor 20. Pump 31 has an inlet connected by a conduit 33 to an opening 34 formed in the lowest part of tub 4, and an outlet connected to a conduit 35 which leads to an external drain (not shown). Pump 32 has an inlet connected by a conduit 36 to an opening 37 formed relatively low in the side of the tub 4, and an outlet connected to a conduit 38 which terminates in a nozzle 39 above the basket 2. When the motor operates in the direction effective to provide oscillation of agitator 14, it causes pump 32 to draw water from the tub through conduit 36 and discharge it through nozzle 39. Conversely, when the motor is operated in the opposite direction, pump 31 is made effective and pumps water from tub 4 through conduit 33 and then out through conduit 35 to the drain.

The nozzle 39 of conduit 38 is positioned above the basket so as to discharge into a filter pan 40, secured on a top portion 41 of agitator 14 so as to be movable therewith. Thus, when the motor is rotating in the direction to pump water up through conduit 38, the liquid taken from tub 4 through conduit 36 is discharged into filter pan 40. The liquid so discharged then passes through a number of small openings 42 provided in the bottom of the filter pan back into basket 2. In this manner, the filter pan 40 with its small openings 42 and its upstanding side wall 43 causes lint which is separated from the clothes during the washing operation to be filtered out of the water and thus prevents it from being redeposited on the clothes. This type of structure is more fully described and claimed in Patent 2,481,979, issued to Russell H. Colley on September 13, 1949, and assigned to General Electric Company, owner of the present invention.

The motor 20, transmission 23, basket 2, and agitator 14 form a suspended system which is suspended from the stationary structure of the machine so as to permit isolation of vibrations from the stationary structure. It will be understood that such vibrations occur primarily as a result of high speed spinning of basket 2 with a load of clothes therein as mentioned above. While any suitable suspension structure may be used, I prefer to use a suspension structure which includes a bracket member 44 which has transmission 23 mounted on top thereof and motor 20 mounted to the underside thereof, the bracket member being in turn secured to upwardly extending rigid members 45. Each upwardly extending member 45 is connected to a cable 46 supported from the top of the machine. While only a portion of the suspension system structure is shown in the drawing in order not to obscure unduly the features of my invention, such a vibration isolating system is fully described and claimed in my copending application Serial No. 843,611 for Vibration Isolating System, filed on September 21, 1959, now U.S. Patent No. 2,987,190, and assigned to General Electric Company, assignee of the present invention. Such a suspension system provides for flexible support of the motor, transmission, agitator and basket so as to isolate the vibrations in that system from the casing of the machine.

In order to accommodate the relative movement which occurs between basket 2 and tub 4 without any danger of leakage of liquid between them, the stationary tub 4 is joined to the upper part of transmission 23 by a suitable flexible boot member 47. Boot 47 may be of any suitable configuration, many of which are known in the art, to permit relative motion of the parts to which it is joined without leakage therebetween.

Hot and cold water is supplied to machine 1 through conduits 48 and 49 which are adapted to be connected

respectively to sources of hot and cold water (not shown). Conduits 48 and 49 extend into a conventional mixing valve structure 50 having solenoids 51 and 52 so that energization of solenoid 51 permits passage of hot water through the valve into a hose 53, energization of solenoid 52 permits passage of cold water through the valve, and energization of both solenoids permits mixing of the hot and cold water in the valve and the passage of warm water into the hose 53. Hose 53 communicates with a nozzle 54 positioned to discharge into basket 2 so that when one or both of solenoids 51 and 52 are energized water enters into the basket 2 and tub 4.

The level to which the water is to be allowed to rise in the basket and tub is controlled by a specific structure which forms the essence of my invention. An opening 55 is formed in the side of the tub at a level which is substantially below the lowest water level (shown by dotted line A) to be required in the tub at any time. Thus, for instance, while the opening 55 has been shown as formed in the side of the tub near the bottom thereof, it could readily be formed right at the bottom of the tub if so desired. The opening 55 is connected by a conduit 56 which may, as shown, be formed as a conventional water-carrying hose 57 extending upwardly from the opening 55 and connected at its upper end to a tube 58 which then continues to extend upwardly to a water level control mechanism generally shown at 59 which may preferably be positioned in a backsplasher structure 60 secured on top of the casing 7. Backsplasher 60 may conventionally carry various manual controls, generally indicated at 61 and 62, typical of those provided for the control of domestic washing machines.

Water level control mechanism 59 includes a switch 63 having a button 64 extending therefrom, and it will be understood without the necessity for the specific showing of an electric circuit that the solenoids 51 and 52 are placed under the control of switch 63 so that upon depression of button 64 the solenoids are caused to be deenergized to stop the flow of water into the tub 4 and basket 2. The button 64 rests against the upper surface of a flexible member such as diaphragm 65 which, together with the lower part 66 of a switch casing generally indicated at 67, forms an enclosed chamber 68 in communication with tube 58 and hose 57.

As an important feature of my invention, I provide a rigid hollow container 69 which is connected by a suitable hose or conduit 70 to the chamber 68. This may be effected, as shown, by connecting conduit 70 to hose 58 forming part of conduit 56 at a point adjacent the top thereof although of course it will be obvious that a direct connection between the casing 66 and container 69 may also be made if so desired. In the conduit 70 I provide a conventional valve structure which is shown only schematically, the internal valve structure itself not being significant to my invention. The valve is manually operable so that it may be opened or closed by the operator of the machine. When the valve is open, then the chamber 68 and the container 69 are in communication through conduit 70. When the valve is closed the container 69 is shut off from the rest of the system.

When water rises within tub 4 to a level above opening 55 a column of air is trapped in the system, and as the water level rises in the tub it will also tend to rise within the hose 57 so as to compress the air which has thus been trapped. In the conventional manner, when the pressure on the column of air achieves a certain level, it causes sufficient deformation of diaphragm 65 to depress button 64; as stated, this causes a shutting-off of the water valve controlled by solenoids 51 and 52.

When valve 71 is closed there is a relatively small volume of air being acted on by the rising water and therefore the pressure increases quickly, so that the switch shuts the water off at level A, when the level is relatively low. When a high level of water is desired, such as level B, for instance, when a full load of clothing is to be washed, the valve 71 is opened thereby increasing sub-

stantially the volume of air on which the rising water has to act and thereby decreasing the rate at which the pressure increases as the water rises in tube 4. With the valve open, the button 64 will not be depressed by diaphragm 65 until level B is reached to provide the desired result of a relatively high level. Thus, either level may be obtained by selecting, prior to filling of the basket, a larger or smaller volume in which air will be trapped by the water.

Obviously, the two different levels which may be provided by the structure described may be controlled by variation of the volume of container 69. In order to provide the two levels shown, it has been found that an additional volume of approximately one cubic foot should be provided by container 69; it will readily be recognized that in backsplashers of the type commonly provided in domestic washing machines there is generally sufficient additional room, after the controls have been provided therein, readily to permit the provision of such a container when appropriately formed.

Thus, by a most economical addition, the water level control structure 59 is made adjustable.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. For use in combination with a liquid receptacle: switch means adapted to be tripped from a first to a second position in response to attainment of one of a plurality of predetermined liquid levels in said receptacle; a substantially closed chamber including a flexible wall, said flexible wall deforming in response to a predetermined pressure increase in said chamber and being positioned to trip said switch means to said second position upon so deforming; first conduit means extending up from said receptacle at a point substantially below the lowest of said predetermined levels to said chamber; a substantially rigid closed container; second conduit means connecting said chamber and said container; and valve means arranged to open and close said second conduit means, whereby a higher liquid level is required to trip said switch means when said valve is open than when it is closed.

2. The apparatus defined in claim 1 wherein connection of said chamber and said container by said second conduit means is provided by connecting said second conduit means to said first conduit means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,834,845	Nielson	May 13, 1958
2,921,158	Taylor	Jan. 12, 1960
2,971,530	Dewey	Feb. 14, 1961