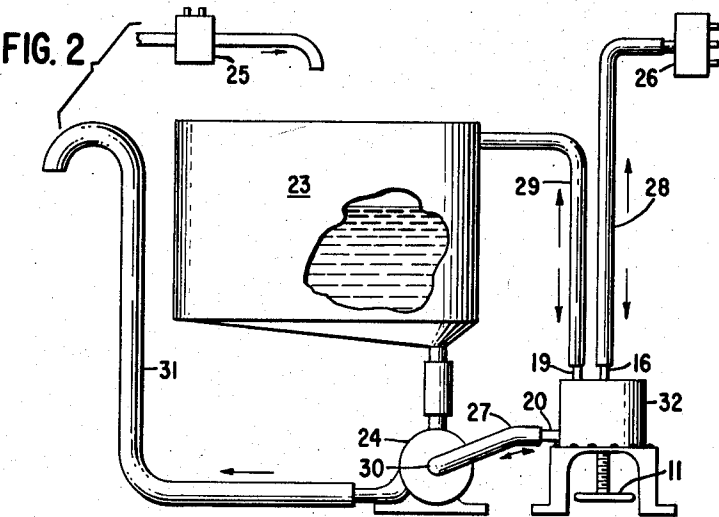
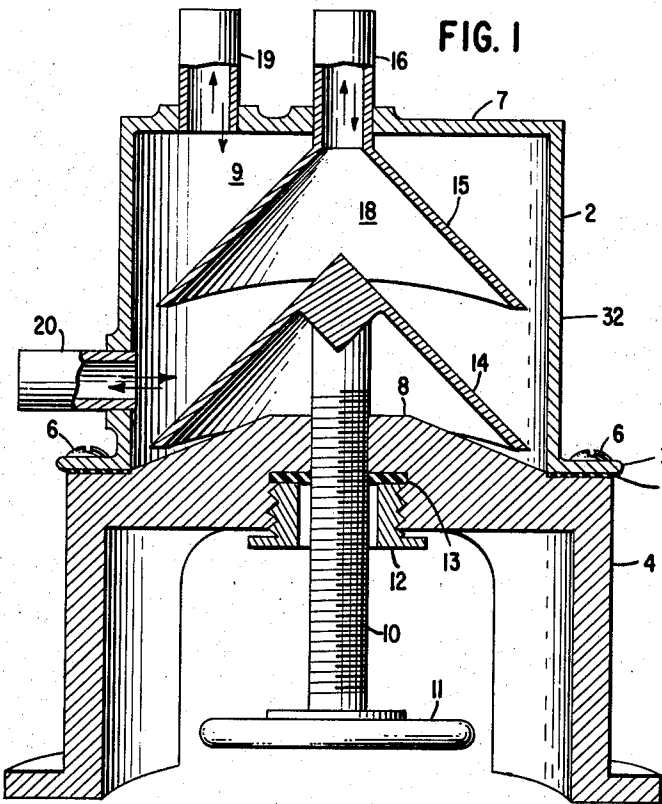


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CONTROLLING THE ADMISSION OF LIQUID TO
A TUB IN A CLEANING APPARATUS
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3,147,765 CONTROLLING THE ADMISSION OF LIQUID TO A TUB IN A CLEANING APPARATUS

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1 Claim. (Cl. 137—406)

This invention relates to an apparatus for controlling the admission of liquid to the tub of a washing machine. More specifically, the invention is concerned with a washing machine level control of the type wherein the head of liquid in the wash tub is employed to pressurize a gas in an enclosed space, which gas pressure actuates a water inlet valve to the tub. It is an object of this invention to provide an improved device for selectively adjusting the liquid level in the tub of a washing machine employing the aforementioned type of level control system.

The object of this invention is carried out through the use of a novel regulator in the washing machine level control system, which regulator enables the volume of air in the enclosed air space to be manually varied. Since the level control is of a type where the pressure in the air space opposes a constant biasing force on a diaphragm, which diaphragm automatically terminates inflow to the tub when the pressure overcomes the constant biasing force, an increase in the volume of the air space will result in termination of the inflow at a higher liquid level in the tub while a decrease in the volume of air in the air space will result in termination of the inflow at a lower liquid level in the tub.

Referring to the drawing:

FIG. 1 shows the regulator of the liquid level control system; and

FIG. 2 shows the entire liquid level control system including the wash tub.

Specification

Referring to FIG. 1, the liquid level regulator comprises a cylindrically shaped housing having a chamber 9 for containing air and liquid. The side wall member 2 forms the side around its extent. The top wall member is generally indicated at 7. A margin 3 extending outward horizontally from the bottom edge of wall member 2 forms a flange 3 for attaching the bottom wall member generally indicated at 4.

A gasket 5 is positioned between members 3 and 4 which are secured together by a plurality of screws around their extent, one being shown at 6. A bell housing 8 which forms a part of the bottom wall member 4 is positioned with its apex end extending upward into and is centered in the cylindrically shaped chamber 9 formed by the cylindrically shaped housing, forming a jack in which a screw 10 is screwed into a centrally located threaded hole. The screw 10 is positioned vertically and to its top end in chamber 9, a blanking cone 14 is attached, positioned with its apex end extending upward. To the lower end extending out of bottom of bell housing 8, a hand wheel for turning the screw 10 is attached. The hand wheel is indicated at 11. An air cone 15 is positioned inside of chamber 9 with its apex end extending upward communicating with its apex end an access tube 16 which extends through a central aperture in the top wall member 7. The interior surface of the air cone 15 registers with the exterior surface of the blanking cone 14. The blanking cone 14 can be raised up into the air cone 15 by the screw 10 regulating the space generally indicated at 18 which is provided for entrapped air. The collar nut 12 and collar gasket 13 positioned around screw 10 on the external side of bottom member provide against liquid leaks between screw 10 and bell member 8. An access tube 19 provides for a place to vent the top region of chamber 9 to a region in atmosphere above the highest

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liquid level communicating the chamber. Access tube 20 provides means for communicating the bottom region in chamber 9.

Combination

The combination for the liquid level regulator with a domestic type cleaning apparatus will be explained by referring to FIG. 1 and FIG. 2.

The elements forming the combination comprise a tub 23 of a cleaning apparatus for containing the liquid for which the head is to be regulated, an opening into the top of tub 23 for receiving the liquid and materials to be cleaned, an opening into the bottom of the tub a centrifugal type liquid pump 24 positioned into the opening in the bottom of tub with its intake port for removing the vitiated liquid at the conclusion of the cleaning process, a conduit 31 forming a loop communicating with the discharge port of the pump 24 with its lower end and a region higher than the highest liquid level in tub with its elevated end providing means for preventing liquid syphon from tub when the pump impeller is at rest.

A solenoid operated liquid admission valve 25 controls the flow of liquid from a source of supply to the tub. A diaphragm which is made pressure responsive to air for operating an electrical switch and is referred to as element 26 is the liquid admission control apparatus, wherein one of its wall members forming an air chamber comprises of a movable wall member responsive to air pressure from within the air chamber. The diaphragm is spring biased for absorbing energy from the compressed air providing energy for returning the diaphragm to its initial position when the air pressure is released from the compressed air chamber. The movement of the diaphragm is used for controlling a electrical switch for energizing the solenoid valve 25. When the diaphragm is in its initial position, the electrical switch is closed and the solenoid valve 25 energized. When the diaphragm is moved to its second position by air pressure, the switch is opened and the solenoid valve 25 is deenergized where-in further flow of liquid to tub is terminated.

The liquid level regulator 32 is interposed between the pump 24 and the liquid admission control mechanism 26. The liquid level regulator 32 is positioned near the pump 24 and at near the same altitude. Conduit 27 means communicates a low pressure region generally indicated at 30 in pump housing adjacent the center of the impeller thereof with a region in bottom of chamber 9 in liquid level regulator 32 through its access tube 20. Compressed air tube 28 communicates the access tube 16 communicating the air cone 15 in chamber 9 of the liquid level regulator 32, and the liquid admission control mechanism 26 thereby exposing the diaphragm within 26 to the pressure within air cone 15 and tube 16.

Conduit means 29 communicates the top region of chamber 9 in liquid level regulator 32 with its lower end and a place in atmosphere above the highest liquid level in tub 23 with its elevated end venting chamber 9 to atmosphere through its access tube 19.

Operation

Referring to FIG. 1 and to FIG. 2 the operation of the combination will be shown by assuming that the tub 23 is to be filled with a predetermined head of liquid. The impeller in the pump housing is at this time at rest. A manually operated switch (not shown) is placed in the On position energizing a master drum switch (not shown) which in turn provides for a circuit of electrical energy to flow to a switch (not shown) which is controlled by the movement of the diaphragm in the liquid admission control mechanism 26.

When the diaphragm in the liquid admission control mechanism 26 is in its initial position, the switch it con-

trols is in its closed position and when the diaphragm is moved outward in response to air from within the air chamber in which the diaphragm comprises of one of its wall members, the switch is open. The diaphragm being at this time in its initial position, electrical energy flow from the master drum switch (not shown) through the diaphragm operated switch (not shown) to the solenoid operated liquid admission valve 25.

The solenoid liquid admission valve 25 is in the closed position when deenergized and in the open position when energized. At this time the solenoid liquid admission valve 25 is energized and liquid flows from a source of supply to the tub 23.

During the admission of liquid to the tub 23, the pump impeller is at rest and the pump chamber becomes flooded with liquid. Liquid flows from the low pressure region in pump chamber adjacent the center of the impeller thereof which is generally indicated at 30 to the chamber 9 in liquid level regulator 32 through conduit means 27 which communicates the low pressure region adjacent the center of the pump impeller with the access tube 20 communicating with the bottom region of chamber 9 in the liquid level regulator 32.

Excess air in chamber 9 is expelled to atmosphere through access tube 19 and the vent tube 29 which communicated the access tube 19 and a region in atmosphere above the highest liquid level in tub.

At this time, chamber 9 becomes flooded with liquid and liquid flows up into the vent tube 29 reaching an altitude corresponding to the altitude of the liquid in tub 23. The air cone 15 in chamber 9 contains a predetermined quantity of entrapped air which is responsive to the pressure of the liquid in chamber 9. The entrapped air in cone is compressed into the compressed air tube 28 by the head of liquid in tub. When a differential between the head of liquid in tub and the head of liquid communicating the air cone and compressed air tube becomes great enough to produce an air pressure sufficient to operate the diaphragm in the liquid admission control mechanism 28, the solenoid liquid admission valve is deenergized terminating further admission of liquid to tub.

The predetermined head of liquid to be admitted to the tub is controlled by controlling the space 18 in air cone 15 by a blanking cone 14 which can be moved up or down in cone 15 regulating the volume of air to be compressed into a given space in air cone and compressed air tube 28. Moving the blanking cone 14 down increases the volume of air in air cone and results in a higher level of liquid in tub at time of cutoff when further admission of liquid is terminated. Moving the blanking cone 14 up into the air cone 15 reduces the space for air in air cone and results in a lower head of liquid at time of cutoff. It is to be understood that the space for air in air cone is to be regulated in accordance to the desired head of liquid to be admitted to tub before actual admission of liquid to the washtub is initiated.

At this time, the diaphragm in the liquid admission control mechanism 26 is moved by air pressure produced in the air cone 15 by the differential between head of liquid in tub and the head of liquid communicating the air cone and compressed air tube 28 communicating the diaphragm. When the diaphragm is moved from its initial position to the second position, the switch it controls is opened and the electrical circuit between master drum switch and the solenoid liquid admission valve is interrupted causing the solenoid liquid admission valve 25 to become deenergized terminating further admission of liquid to tub. The solenoid liquid admission valve is spring biased and is dependent on the recoil of the spring for closing the admission valve. The liquid admission control mechanism 26 and the solenoid liquid admission valve 25 remain in this position during the cleaning cycle of the cleaning apparatus.

The movement of the master drum switch (not shown) is controlled by a timing device actuated by a miniature

motor. At the conclusion of the cleaning cycle, the master drum switch is rotated to a new position, deenergizing the electrical circuit to the solenoid liquid admission valve 25 and energizing a solenoid operated clutch (not shown) engaging the pump 24 impeller shaft with the motive force providing for the cleaning agitation in the washing cycle.

At this time, the clutch is engaged and the pump impeller is rapidly rotated producing a low pressure region adjacent the center of the impeller in pump housing generally indicated at 30. The liquid in the liquid level control apparatus 32 flows back to the low pressure region in pump housing adjacent the center of the impeller thereof and is disposed off with the vitiated liquid being at this time removed from the washing tub to a place of disposal.

When all the liquid is removed from the chamber 9 in the liquid level regulator, the diaphragm (not shown) in the liquid admission regulator 26 is returned to its initial position in response to the recoil of the spring bias to diaphragm.

At the conclusion of removing the vitiated liquid from tub and the completion of the cleaning cycle, the master drum is rotated to the off position.

Chamber 9 in the liquid level control apparatus 32 is vented to atmosphere through vent tube 29 communicating the top of chamber 9 preventing the air in the air cone 15 from being drained away to region of low pressure in pump housing during the rapid rotation of the pump impeller. Preventing low pressure to be formed in the air cone 15 after the removal of the liquid from the liquid level regulator 32 prevents pressure equalizing of the evacuated space with air saturated with liquid and soapsuds wherein the space for air in the compressed air tube and air cone would become diminished changing the ratio between the volume of air residing in the air cone and compressed air tube and the predetermined head of liquid to be admitted to the tub at the next succeeding cycle when the tub is again filled with a fresh load of liquid.

While I have shown only a hand wheel 11 and a screw 10 positioned in a jack support 8 providing means for raising and lowering the blanking cone 14 for regulating the space for air in the air cone 15, it can be readily seen that other means can be employed which would be capable of performing this operation in accordance to the liquid level to be admitted to the tub.

While the liquid level control system is shown with a domestic type of cleaning apparatus, it is not limited to such use only, but can be used in other combinations in which it is desired to control the liquid level in a vessel. Also, it can be readily seen by those learned in the art that it is susceptible to many improvements and modifications without departing from the spirit in which this invention was conceived.

It is to be understood that the component parts comprising the centrifugal water pump 24 for removing the vitiated liquid from the tub at the conclusion of the cleaning process, the solenoid operated liquid admission valve 25 controlling the flow of liquid to tub and the diaphragm apparatus 26 controlling the electrical energy for operating the solenoid liquid admission valve 25 are of the conventional type and are well understood by those learned in the art.

The master drum switch, the timer and timer motor and the OFF and ON switch which are not shown in the drawings, but referred to under the heading "OPERATION" are also of the conventional type and references to them are made for the purpose of showing the function of the liquid level regulator 32 in relation to the operating sequence of the several elements comprising the cleaning apparatus. As an example; the cleaning apparatus shown in the drawings and described in the E. O. Morton Patent No. 2,592,314 is cited as reference.

In summarizing the foregoing description it will be apparent that I have provided an improved water admis-

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sion control for an automatic washing machine wherein the quantity of liquid admitted to the tub is controlled in accordance to the space for air between the air cone and the blanking cone and wherein this space can be adjusted in accordance to the predetermined head of liquid to be admitted to the tub.

What I claim is:

In a cleaning apparatus the combination; a washtub of a cleaning apparatus for containing the cleaning liquid and material to be cleaned, a solenoid operated liquid admission valve means for controlling the liquid flow to tub, an inlet to the top of tub for receiving the liquid and materials to be cleaned, an outlet in the bottom of tub, a centrifugal pump communicating the outlet in bottom of tub with its intake port for removing the liquid from tub at the conclusion of the cleaning process, conduit means communicating the exhaust port of pump with a region higher than the highest liquid level to be maintained in tub means for preventing liquid syphon from tub when the pump is at rest, a pressure responsive diaphragm means for controlling the solenoid liquid admission valve, a liquid level regulator comprising a housing

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having a chamber for liquid and air, an air cone positioned inside of chamber with its apex pointed upward, a blanking cone positioned inside chamber with its apex end extending upward vertically into air cone, means comprising a screw and jack for adjusting the space for air between air cone and blanking cone in accordance to the predetermined liquid level to be admitted to tub, conduit means communicating the low pressure region adjacent the center of the impeller in pump housing with a region in bottom of liquid level regulator, conduit means communicating the top region in liquid level regulator chamber with a region in atmosphere above the highest liquid level to be maintained in tub, a compressed air tube communicating the apex end of air cone with the pressure responsive diaphragm for controlling the diaphragm.

References Cited in the file of this patent

UNITED STATES PATENTS

2,012,511	Hubbard	Aug. 27, 1935
2,592,314	Morton	Apr. 8, 1952
3,086,836	Ohmann	Apr. 23, 1963