July 31, 1951 C. M. DUNLAP 2,562,533

LAUNDRY APPARATUS

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FIG. 1.

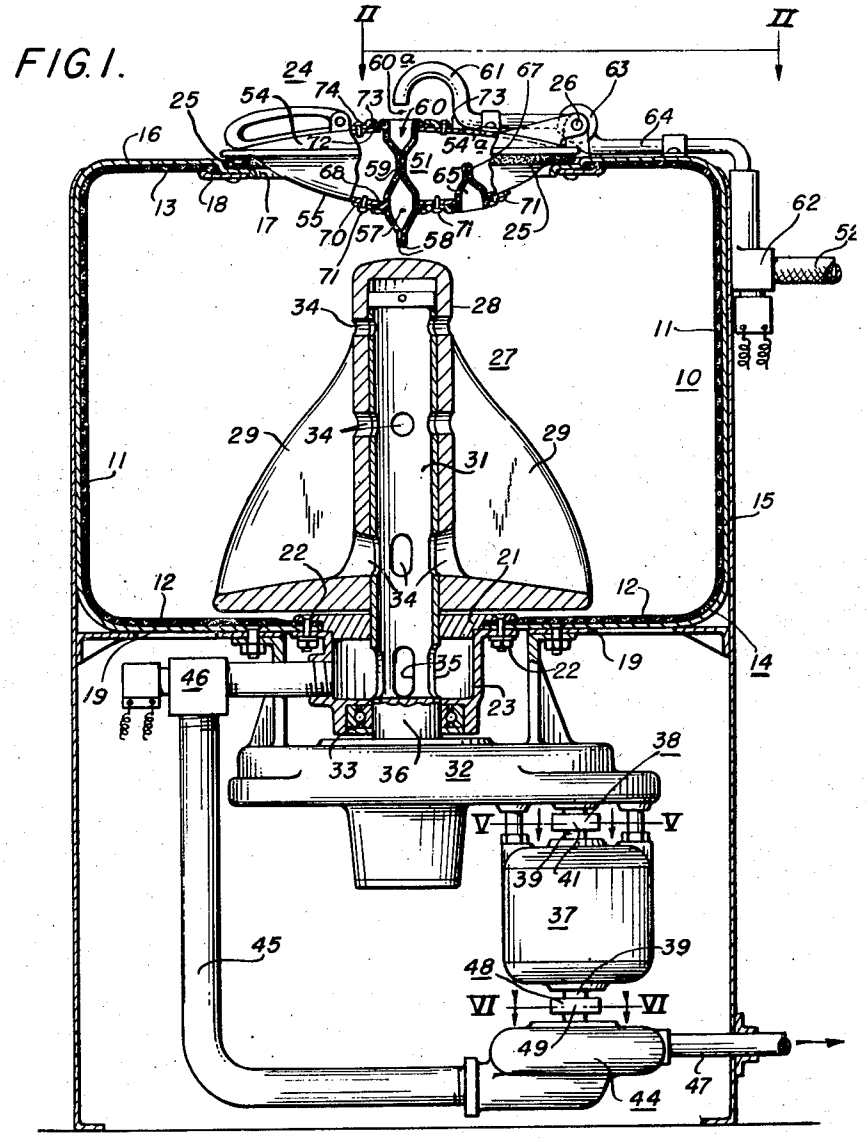
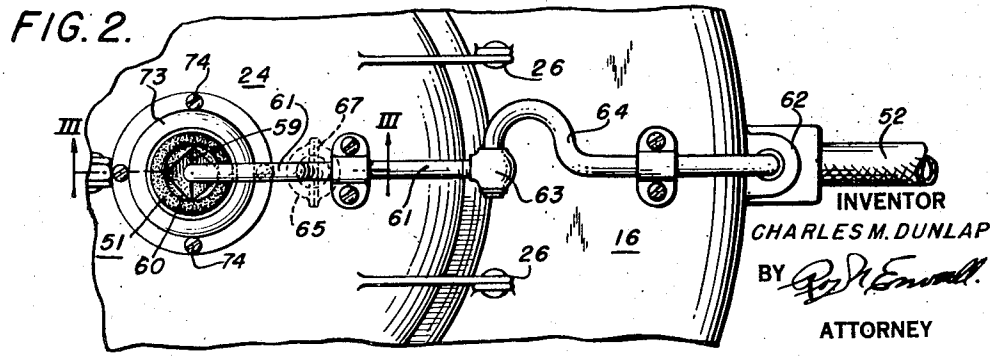


FIG. 2.



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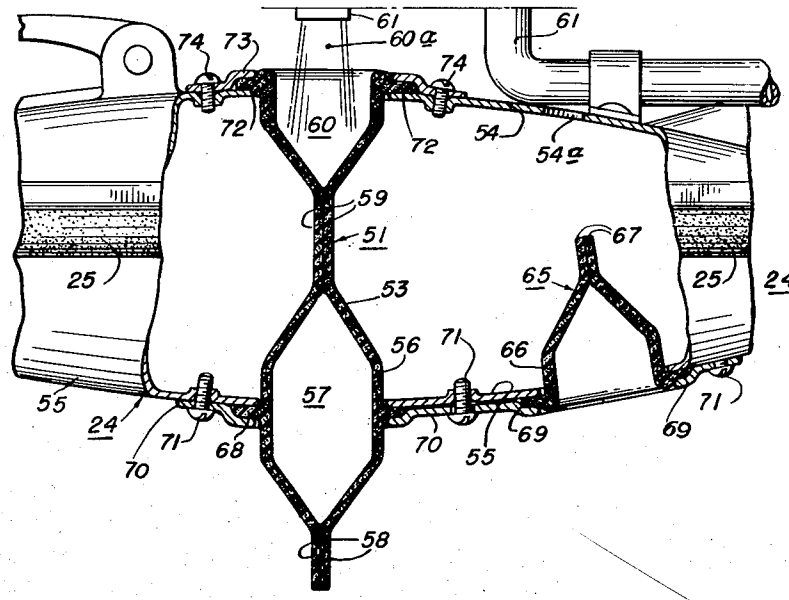


FIG. 3.

FIG. 4.

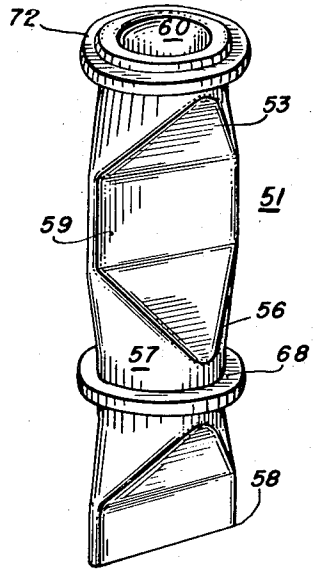
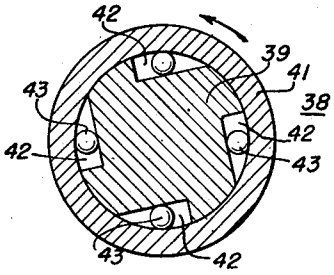


FIG. 5.



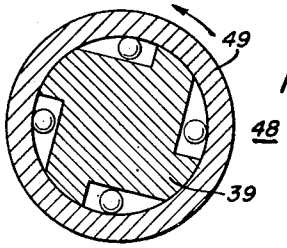


FIG. 6.

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UNITED STATES PATENT OFFICE

2,562,533

LAUNDRY APPARATUS

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8 Claims. (Cl. 68—21)

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My invention relates to clothes washing machines of the type including a tub structure in which the clothes are washed in a body of water and are dried, after the removal of free water from the tub, by withdrawing a substantial portion of the air from the tub to effect either the vaporization of water from the clothes at low pressure and temperature or the mechanically squeezing of water from the clothes where a collapsible tub formed of resilient material is employed. The latter type of machine employs a vacuum pump for discharging from the tub a substantial portion of the air contained therein after the washing water is withdrawn, whereupon the pressure of the atmosphere collapses the tub around the bundle of clothes for the extraction of water therefrom.

An object of my invention is to provide improved means for admitting water to the tub of a washer of the types set forth, wherein reverse flow of water or suds to the water mains serving the washer is prevented at all times and wherein leakage of air into the tub during extracting periods is precluded.

Many municipalities require that washing machines connected to their water mains be provided with devices for preventing reverse flow of water or suds to the mains in the event that, for any reason, a subatmospheric pressure is produced in the mains. These devices are commonly referred to as "vacuum breakers" and include an air gap in the conduit serving the washer so that, if a lower than atmospheric pressure prevails in the mains, air will enter the conduit through the gap and prevent the withdrawal of water from the tub. This regulation presents a problem in a washer of the types set forth as a low pressure is produced in the tub during extraction periods and, therefore, the passage of air through the vacuum breaker to the tub must be precluded.

Further objects of my invention are, therefore, to prevent, in a washer of the types set forth, reverse flow of water from the tub to the water mains serving the washer and admission of air to the tub when the latter is being evacuated for the extraction of water from the clothes.

The foregoing and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a vertical sectional view taken through a clothes washing and extracting machine constructed and arranged in accordance with my invention;

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Fig. 2 is a plan view of a portion of the machine shown in Fig. 1 as viewed from the plane II—II;

Fig. 3 is an enlarged sectional view taken along the line III—III of Fig. 2;

Fig. 4 is a perspective of the water admission device employed in the washer shown in Fig. 1; and

Figs. 5 and 6 are, respectively, sectional views taken along lines V—V and VI—VI of Fig. 1 and show unidirectional clutches employed in the washer.

Referring now to Figs. 1 and 2 of the drawing, I have shown my invention applied to a clothes washing and extracting machine of the type including a collapsible tub structure, generally indicated at 10, and having side, bottom and top walls 11, 12 and 13, respectively, integrally formed of rubber or the like. During washing periods or when the tub 10 contains a body of washing water, the walls of the tub are positioned as shown in Fig. 1 but, when a substantial portion of the air is withdrawn from the tub 10, as described hereinafter, the wall members collapse inwardly under the influence of atmospheric pressure and engage the bundle of fabrics in the tub for squeezing washing fluid therefrom. The tub 10 is supported by a casing, generally indicated at 14 and including a side wall structure 15 and a top wall 16, the latter being provided with an access opening indicated at 17. The top wall 13 of the tub is clamped in any suitable manner, as shown at 18, to the top wall 16 of the casing. The bottom wall 12 of the tub rests upon a generally horizontal partition 19 forming a part of the casing structure 14. A clamping plate 21 is employed for securing the center of the bottom wall 12 of the tub to the partition 19. As shown, bolts 22 are employed for securing the clamping plate 21 to the partition 19 and these bolts 22 also serve to support a sump structure, indicated at 23, from the underside of the partition 19.

A suitable door, indicated at 24, serves to close the access opening 17 during operating periods of the machine and is provided with a gasket 25 to provide an air-tight seal with the top wall 16 of the casing. The door 24 is suitably hinged, as shown at 26, to the top wall 16 of the casing so that the door 24 may be swung upwardly to its open position.

Arranged interiorly of tub is an agitator 27 having a center post 28 and vanes 29. The agitator is splined or otherwise secured to a hollow shaft 31 which extends downwardly through the clamping plate 21 and sump structure 23 and

driven by a conventional oscillating gear mechanism, generally indicated at 32 and carried by the casing 14. A water and air-tight seal 33 of any well known construction is provided between the shaft 31 and the sump structure 23 for preventing the escape of water from the sump and the admission of air to the sump. A plurality of water passages indicated at 34 are provided in the agitator 27 and shaft 31 for the passage of water from the tub 10 to the interior of the shaft 31 during the draining of vitiated water from the tub 10. The hollow shaft 31 is also provided with a plurality of openings 35 for the discharge of water from the hollow shaft 31 to the interior of the sump 23. It will be noted that the bottom portion of the shaft 31 indicated at 36 is solid where it passes through the seal 33 and enters the transmission 32.

During washing operations, it will be understood that the agitator 27 is oscillated by the transmission 32 for effecting the washing of clothes in a well understood manner. As the construction and operation of conventional transmissions of the type shown at 32 are so well understood in the art, further description of the transmission is deemed unnecessary. The transmission 32 is driven by a reversible, electric motor, indicated at 37, through a unidirectional clutch generally shown at 38. The motor 37 is reversible and it will be understood that its shaft, indicated at 39, when driven in the direction of the arrow in Fig. 5, serves to drive the transmission 32 through the clutch 38. The clutch 38 may be of any well understood construction. As shown in Fig. 5, the clutch 38 may include a driven sleeve 41 connected to the transmission 32 and inclined recesses 42 formed in the driving member, or shaft 39 of the motor. Balls, indicated at 43, ride in the inclined recesses 42 and bind the shaft 39 and sleeve 41 to provide a driving connection therebetween when the shaft 39 is rotated in the direction of the arrow. When the shaft 39 is driven in the opposite direction, the balls 43 move to the deep portions of the recesses 42 and, therefore, the shaft 39 will rotate freely with respect to the sleeve 41.

Vitiated water and air are discharged from the tub 10 at the conclusion of a washing operation by means of a pump structure indicated generally at 44, the inlet of which connects by means of a conduit 45 with the interior of the sump structure 23. A suitable valve 46 shown by way of example as a solenoid operated valve, controls flow of water and air from the sump to the pump 44. The discharge side of the pump is connected by means of a conduit 47 to a suitable drain. The pump 44 is driven by the motor 37 through a clutch generally indicated at 48 and shown in Fig. 6. The clutch 48 is similar in construction to the clutch 38 and includes a driven sleeve 49 which is connected to the rotating element of the pump 44. The clutch 48 is reversely arranged with respect to the clutch 38 so that the motor 37 drives either the transmission 32 or the pump 44. As shown in Figs. 5 and 6, when the motor shaft 39 is rotated in the direction of the arrow shown in these two figures, the transmission is driven by means of the clutch 38 and the pump driving sleeve 49 is stationary. Reversing the direction of rotation of the motor will cause operation of the pump as the sleeve 49 will rotate with the shaft 39 and operation of the transmission 32 will be terminated as the shaft 39 of the motor runs free with respect to the sleeve 41 which drives the transmission.

In accordance with my invention, a device, generally shown at 51 is employed for admitting water to the tub 10, for preventing reverse flow of water or suds from the tub to a water supply conduit 52 in the event that a sub-atmospheric pressure is produced in the conduit 52 and for preventing admission of air to the tub 10 when the pump 44 is operated to evacuate the tub 10 for the extraction of water from the clothes being treated. The device 51 is shown enlarged in Figs. 3 and 4 and includes a check valve member 53 preferably, integrally moulded of a resilient material such as, for example, rubber. Preferably, the valve member 53 is carried by the door 24, the latter being formed of outer and inner panels 54 and 55 which are joined at their peripheries but which are spaced apart at their centers.

The member 53 includes a hollow body or conduit portion 56 which extends through the door wall 55 and which encloses a water passage 57. The lower or inner end of the body 56 is flattened for defining a pair of lips, indicated at 58, which are normally engaged as shown. The outer portion of the member 53 is of converging-diverging construction and includes a flattened portion which defines a second pair of normally engaged lips 59 which are intermediate an open top water receiving chamber 60 and the passage 57. Water under pressure is delivered to the chamber 60 by a pipe 61 whose discharge end is spaced above the member 53 and in alignment with the chamber 60 whereby an air gap 60*a* is defined. The pipe 61 is connected to the conduit 52 through a control valve 62 shown, by way of example, as a solenoid operated valve. As shown, the pipe 61 is fixed to the door panel 54 and moves with the door. In order to provide such movement, a swiveling conduit fitting 63 of any well-understood construction is connected to the pipe 61 and is aligned with the hinges 26. A pipe 64 fixed to the casing wall 16 connects the swivel conduit 63 and the valve 62.

When water is to be admitted to the tub, the valve 62 is energized and opened. A stream of water is directed by the pipe 61 into the chamber 60 and the kinetic energy of the stream forces the lips 59 apart to permit the flow of water to the passage 57. The kinetic energy of the stream passing to the passage 57 forces the lips 58 apart for the delivery of the water to the tub 10. When the flow of water is terminated by the closing of valve 62, the lips 58 and 59, by the inherent bias of the rubber forming the member 53, close. If at any time, a sub-atmospheric pressure obtains in the pipe 61, air will enter the pipe 61 at the gap 60*a* and, therefore, no water or suds can be withdrawn from the tub. Even though an excess of suds is present in the tub, no suds can pass to the chamber 60 and span the gap 60*a* as the pair of lips 58 and 59 are engaged to isolate the chamber 60 from the tub.

During the filling of the tub 10 with water, it is necessary to discharge air from the tub 10 as the water rises therein. A check valve shown at 65 may be provided for the discharge of air from the tub and is preferably integrally formed of resilient rubber or the like. The check valve 65 includes a wall 66 generally circular in cross section and flattened, as shown, to define a pair of lips 67 which are normally engaged. During the filling of the tub with water, air displaced thereby, forces the lips 67 apart for the discharge of such air to the space between the door panels 54 and 55 and thence the ambient atmosphere through an orifice 54*a* provided in the panel 54.

The check valve members 51 and 65 may be secured to the door 24 in any well understood manner. As shown, the members 51 and 65 are provided with respective outwardly extending flanges 68 and 69 which are clamped between the door panel 55 and a plate 70 by means of bolts 71. The outer end of the valve member 51 is provided with a flange 72 which is clamped to the outer door panel 54 by a plate 73 secured to the panel 54 by screws 74.

When sufficient water is admitted to the tub 10 as described, the valve 62 is closed and the motor 37 is energized to rotate the shaft 39 in the direction of the arrow in Figs. 5 and 6. Accordingly, the agitator 27 is oscillated to effect the washing of the clothes in a well understood manner. At the conclusion of the washing period, the direction of rotation of the motor 37 is reversed and the valve 46 is opened. Accordingly, oscillation of the agitator ceases as the clutch 38 now over runs and operation of the pump 44 is initiated as the motor shaft 39 drives the rotating element of the pump through the engaged clutch 48. Water is now discharged from the tub 10 and a partial vacuum is provided in the tub 10 as the level of the water recedes. The admission of air to the tub is prevented at this time as both pairs of lips 59 and 67 are firmly forced into engagement by the pressure of the surrounding atmosphere. Any air present in the chamber 57 will, of course, pass to the tub through the lips 58 which may be separated by any pressure difference obtaining in the chamber 57 and the tub 10.

As the pressure within the tub 10 decreases, the tub walls collapse inwardly due to atmospheric pressure. At this time, the outer portion of the bottom wall 12 will move upwardly and the side walls 11 of the tub move inwardly. These wall portions wrap around the body of fabrics in the tub and compress the body of fabrics against the agitator structure 27. After the water has been removed from the tub, continued operation of the pump 44 withdraws air and moisture from the tub. The pressure of the tub walls against the bundle of fabrics squeezes water from the fabrics, which water passes through the openings 34 to the interior of the shaft 31 and thence through the openings 35 to the interior of the sump. This extracted water then passes through the conduit 45 and is discharged by the pump 44.

At the conclusion of the extracting operation, the motor 37 is deenergized. A suitable air relief valve (not shown) may be provided for admitting air to the interior of the tub 10 so that the operator may swing the door 24 to its open position to gain access to the fabrics.

From the foregoing description, it will be apparent that I have provided an improved simple and inexpensive mechanism for admitting water to a washing machine of the type set forth herein, which mechanism effectively prevents reverse flow of water or suds from the machine when a sub-atmospheric pressure is produced in the water conduit serving the machine and, furthermore, precludes the admission of air to the machine during extraction periods.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

What I claim is:

1. In a washing machine, the combination of a tub structure for containing a body of water and the material to be washed, means for washing the material in the tub structure, a water admission member carried by the tub structure and having a wall structure formed of resilient deformable material, said wall structure defining an open end chamber at one end thereof communicating with the ambient atmosphere and a water passage at the opposite end thereof, said wall structure being flattened intermediate the chamber and passage for defining a pair of engaged lips, a conduit having the discharge end thereof spaced above said one end of the wall structure and aligned with said open end chamber, said lips being separated when engaged by a stream of water passing from said conduit to said chamber, a check valve for delivering water from said passage to the tub structure and preventing reverse flow of water or air to the passage and means for withdrawing water and air at sub-atmospheric pressure from the tub structure at the conclusion of a washing operation.

2. The combination as claimed in claim 1 including a second check valve for discharging air from the tub structure during the admission of water thereto.

3. In a machine for washing fabrics and for extracting water therefrom, the combination of a tub structure for containing a body of washing water and the fabrics to be treated, said tub structure having at least a portion of the wall members thereof formed of resilient deformable material to provide for the collapsing of such wall members, means for agitating the fabrics in said body of washing water, a conduit extending through a wall of said tub structure and having a passage for water therein, a check valve connected to said conduit interiorly of the tub and normally closed to prevent escape of fluid from the tub structure to said passage, said check valve being opened in response to the admission of a stream of water to said passage, a second check valve structure having a body formed of resilient deformable material connected to the conduit, said body having an open top, water receiving chamber formed in the upper end thereof and communicating with the ambient atmosphere and said body including a pair of normally engaged flat lips intermediate said chamber and passage, said lips being deformed and separated when contacted by a stream of water admitted to said chamber, means for admitting water to the chamber including a conduit aligned substantially with the chamber and terminating in spaced relation with said upper end of said body and means for withdrawing water and air at sub-atmospheric pressure from the tub structure at the conclusion of a washing operation in order to collapse the resilient tub walls around the fabrics for the squeezing of water therefrom, the construction and arrangement being such that said lips are firmly forced into engagement by atmospheric pressure when a sub-atmospheric pressure is produced in the tub structure by said withdrawing means and admission of air to the tub structure is prevented.

4. In a machine for washing fabrics and for extracting water therefrom, the combination of a tub structure for containing a body of washing water and the fabrics to be treated, said tub structure having at least a portion of the walls thereof formed of resilient deformable material, means for agitating the fabrics in said body of washing water, a resilient check valve member for admitting water to the tub structure and including a body portion secured to a wall of the

tub structure, said body portion having a passage formed therein for the delivery of water to the tub structure, said body portion having a pair of normally engaged flat lips formed on the inner end thereof for closing said passage to the tub structure, said lips being separated when contacted by a stream of water admitted to the passage, said body portion being of converging-diverging construction at the outer end thereof for defining an open water receiving chamber at the outermost end of the body portion communicating with the ambient atmosphere and a second pair of flat lips intermediate said open chamber and said passage, said second pair of lips being normally engaged for closing said passage and separated when contacted by a stream of water admitted to said open chamber, said second pair of lips being exteriorly subjected to the pressure of the ambient atmosphere, a water supply conduit aligned with said open chamber and terminating in spaced relation therewith for the discharge of a stream of water under pressure to the chamber, and means for withdrawing water and air from the tub structure at the conclusion of a washing operation.

5. The combination as claimed in claim 4 including a second check valve member for discharging air from the tub during the admission of water thereto.

6. In a machine for washing fabrics and for extracting water therefrom, the combination of a casing structure having side walls and a top wall carried thereby, a collapsible tub formed of resilient material and including a bottom wall, a side wall and a top wall underlying and secured to the top wall of the casing structure, said top walls having registering access openings therein, a door hinged to the casing and closing the access opening of the tub, a check valve member including a body of resilient material carried by said door, said body having a water passage therein, said inner portion of the body having a pair of flat lips normally engaged for closing the inner end of said passage, said lips being deformed and separated when contacted by a stream of water admitted to said passage, said outer portion of said body being generally of converging-diverging construction for defining an open top chamber at the upper end of the body and a second pair of engaging flat lips intermediate the chamber and passage, said second pair of lips being normally engaged and separated when contacted by a stream of water admitted to the chamber, a water

admission conduit aligned with the chamber for directing a stream of water therein, said conduit terminating in spaced relation with the upper portion of the body and the chamber defined thereby, and means for discharging vitiated water and air from the tub at the conclusion of a washing operation.

7. The combination as claimed in claim 6 including a second check valve structure carried by said door for releasing air from the tub during the admission of water thereto.

8. In a machine for washing fabrics and for extracting water therefrom, the combination of a tub structure for containing a body of water and the fabrics to be cleaned, said tub structure having an access opening therein and said tub structure having at least a portion of the wall members thereof formed of resilient deformable material, means for washing the fabrics within the tub structure, a door for closing said access opening and hinged to the tub structure, said door having spaced apart inner and outer panels, a water admission device extending between the panels of the door and including a member formed of resilient deformable material, said member being secured to the outer panel of the door and having an open end chamber and a passage formed therein, said member having the walls thereof flattened to define a pair of normally engaging lips separating said chamber and passage, a check valve carried by the inner panel and connected to said member for the delivery of water from said passage to the tub structure, a flexible conduit carried by the tub structure and having an end thereof fixed to the door and spaced above said fitting for the discharge of water to said open end chamber, a second check valve structure for discharging air from the tub, and means for discharging water and air from the tub at the conclusion of the washing operation.

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