Feb. 6, 1968 R. F. BRUBAKER ETAL 3,367,153

FLUID SUPPLY SYSTEM FOR AN AUTOMATIC WASHING MACHINE

Filed June 10, 1966 4 Sheets-Sheet 1

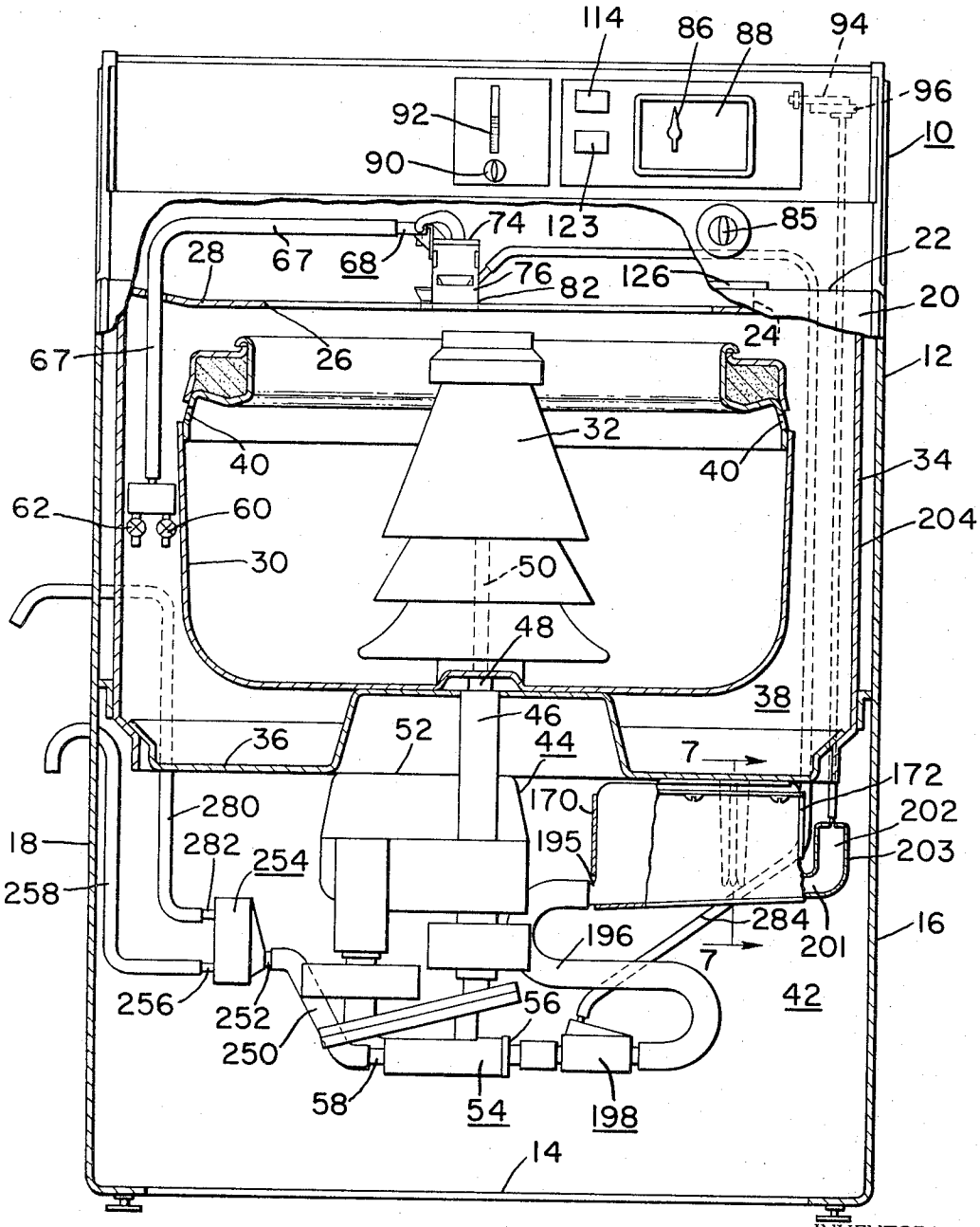


Fig. 1

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FLUID SUPPLY SYSTEM FOR AN AUTOMATIC WASHING MACHINE

Filed June 10, 1966 4 Sheets-Sheet 2

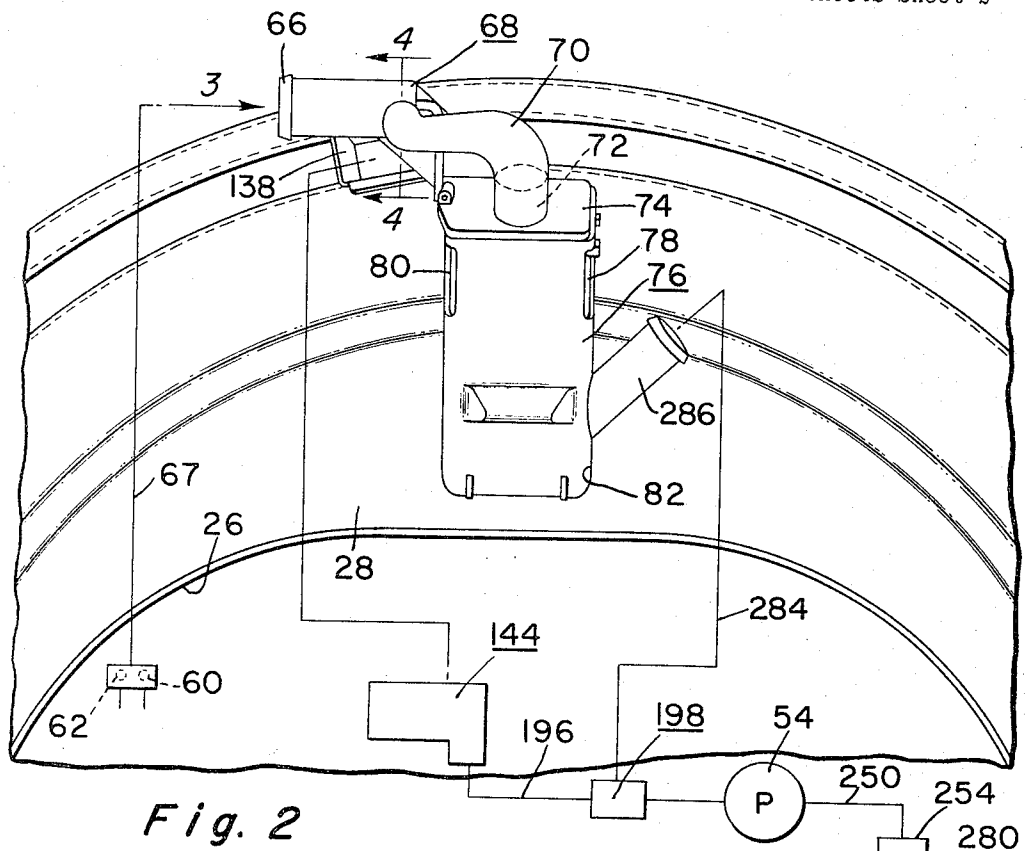


Fig. 2

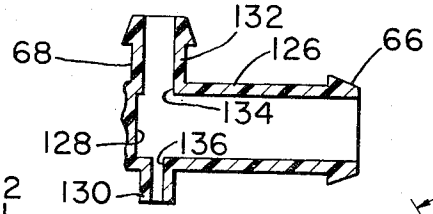


Fig. 5

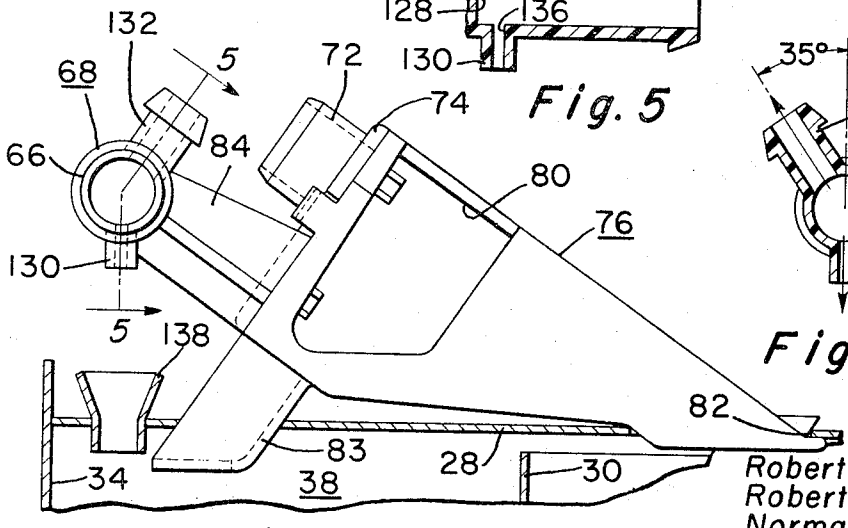


Fig. 3

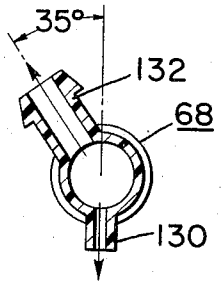


Fig. 4

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FLUID SUPPLY SYSTEM FOR AN AUTOMATIC WASHING MACHINE

Filed June 10, 1966 4 Sheets-Sheet 3

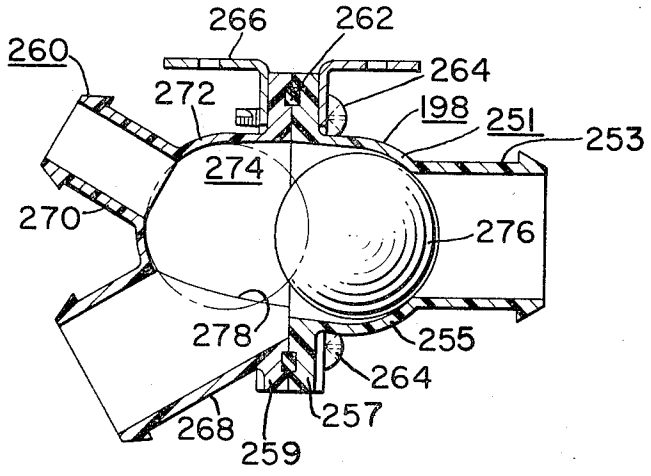


Fig. 6

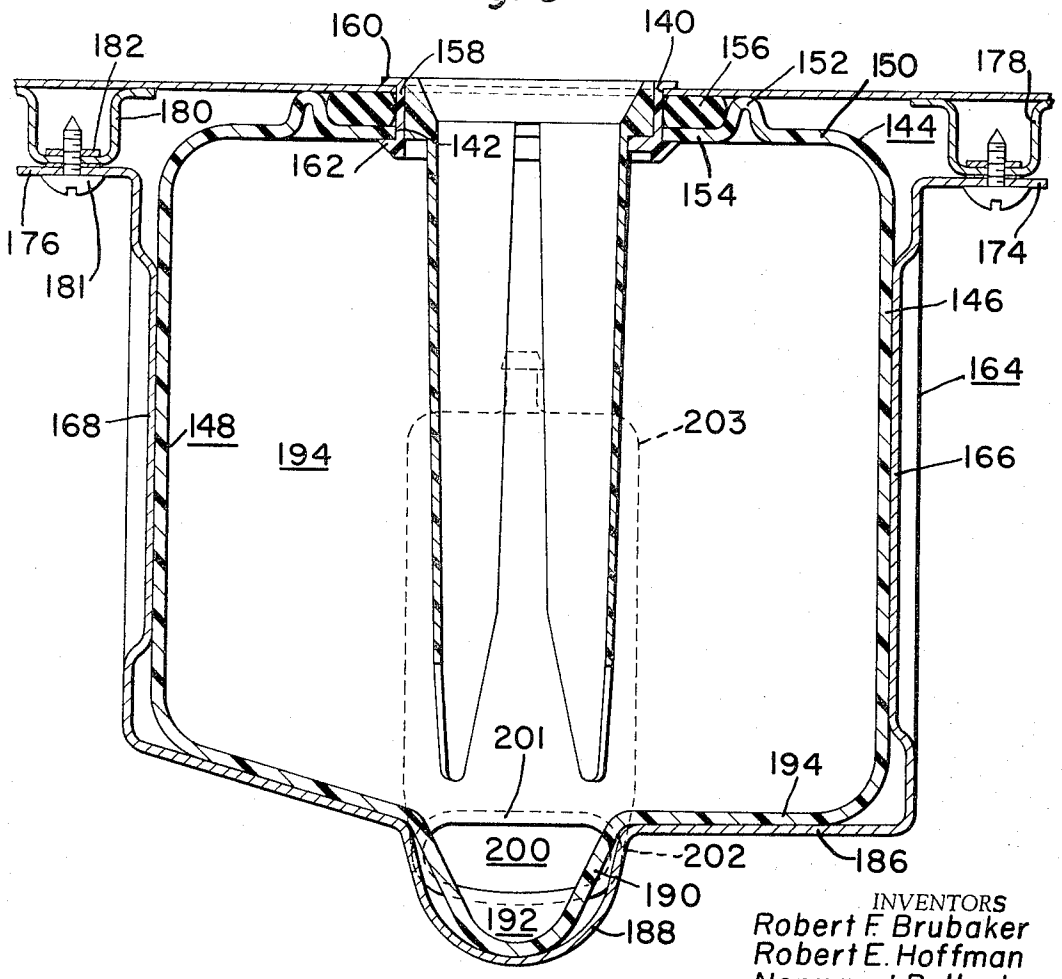


Fig. 7

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FLUID SUPPLY SYSTEM FOR AN AUTOMATIC WASHING MACHINE

Filed June 10, 1966 4 Sheets-Sheet 4

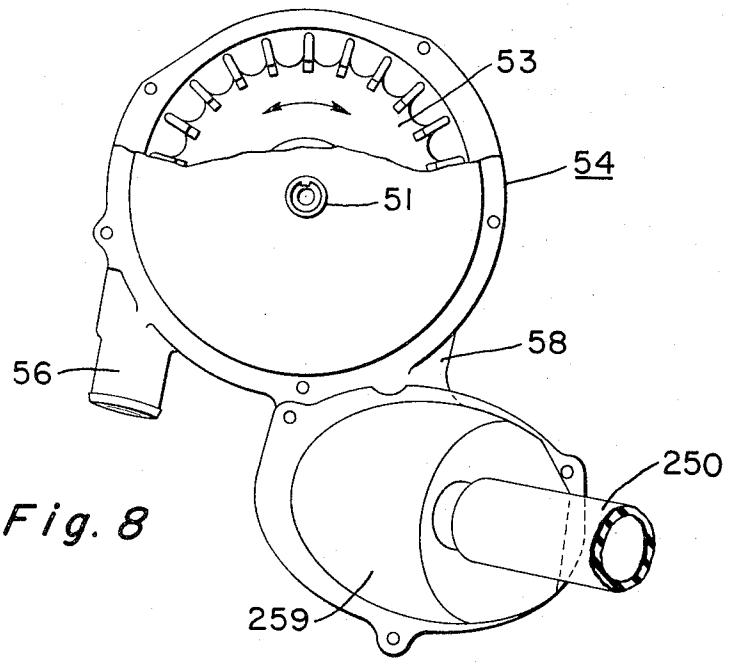


Fig. 8

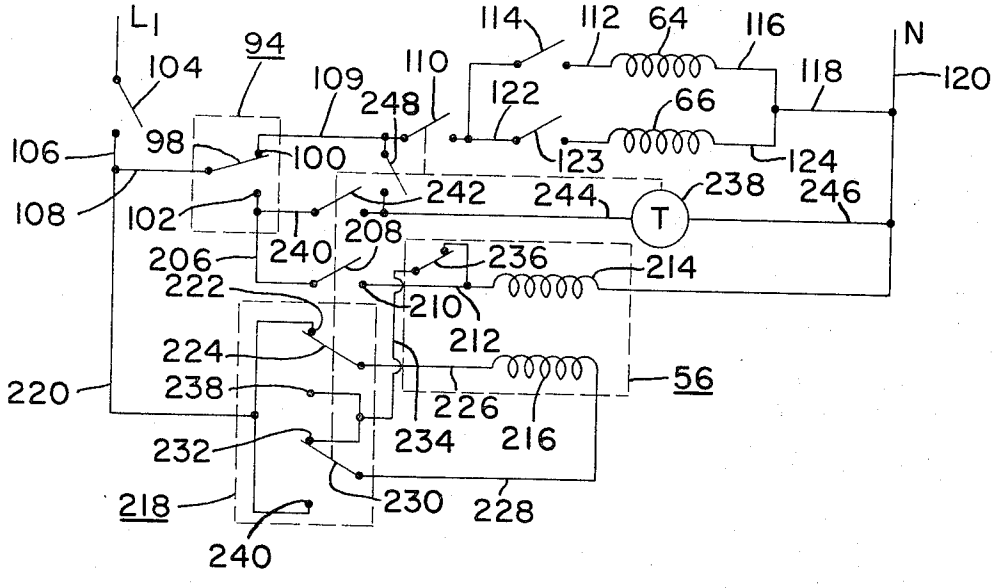


Fig. 9

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United States Patent Office

3,367,153

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3,367,153

FLUID SUPPLY SYSTEM FOR AN AUTOMATIC WASHING MACHINE

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Filed June 10, 1966, Ser. No. 556,604
3 Claims. (Cl. 68—12)

ABSTRACT OF THE DISCLOSURE

In preferred form, a water inlet and water level control arrangement for an automatic washer including a combination water gap forming fill nozzle having an integrally formed proportional flow divider for directing a part of the washer inlet flow to a fill nozzle hose inlet of the fill nozzle and a second part of the divided flow through a splash guard flow director on a water container top of the washer, the washer further including control circuit means utilizing an air pressure switch in the level control system and a plurality of timer controlled switches to eliminate the need for a holding relay to prevent deenergization of the washer during predetermined periods where fluid is drained from the washer water container.

This invention relates to domestic washers and more particularly to an improved fill system for selectively directing a controlled amount of water into the washing machine and means for selectively directing the controlled amount of water through the washing machine system following a wash cycle of operation for subsequent use therein if desired.

In automatically controlled domestic washers it is desirable to include a water supply and drain system that is closely controlled to regulate the amount of water input to the apparatus in accordance with the types of loads being processed. Additionally, in such automatic washers in areas where the cost of heating water produced in the appliance as well as the cost of the water itself for use in the appliance is high, it is desirable to include a suds saver on the washer that will utilize water drained from the system following a first predetermined cycle of operation in a subsequent washing cycle of operation rather than wasting such wash water to drain.

An object of the present invention is to improve the economy of operation of clothes washers by the provision of an improved fluid supply system for the washer that includes air pressure responsive means controlling means for terminating a fill period of operation wherein the air responsive means is connected to an improved pressure sealed sump forming member having an integral air trapping chamber in which air is compressed directly in proportion to the amount of water received in a large volume fluid receiving chamber of the sump member and wherein the water flow into the fluid receiving chamber is directed through an improved flow divider that will direct an amount of water into the sump means proportional to that water directed into a cleaning compartment of the apparatus irrespective of large variations in the pressure of the fluid being supplied to the machine.

A further object of the present invention is to provide an improved flow divider of the type directing a large amount of fluid into a clothes cleaning container in automatic domestic appliances and a proportionate smaller amount of fluid into a sensing system for terminating the flow of fluid when a predetermined amount of water has been directed into the water container wherein the flow divider includes means for maintaining an accurate proportional flow into the cleaning container and the system

for terminating the flow of fluid to the flow divider irrespective of wide variations in the pressure of the fluid being supplied to the flow divider whereby the control for terminating the supply of water to the flow divider and hence to the water container will accurately maintain an amount of fluid in the cleaning compartment required to produce desirable cleaning for a particular type of article and load being contained therein.

Yet another object of the present invention is to improve automatic domestic washing apparatus including an automatically controlled pressure fill system wherein a flow divider directs a large amount of fluid into a cleaning container and a proportionally smaller amount of fluid into a sensing system for terminating the pressure fill when a desired liquid level occurs in the cleaning container by the provision of improved means for collecting the smaller proportional flow of fluid for producing a positive air pressure increase which is sensed by pressure responsive means to terminate the water fill and wherein the improved means includes a sump tank having thin flexible walls divided into an integrally formed fluid receiving chamber and a separate air trapping chamber and wherein the walls of the water receiving chamber forming portion of the sump tank are reinforced by means that locate the sump tank in sealing relationship with a drain opening in a water container for receiving fluid extracted from the cleaning container of the apparatus.

Yet another object of the present invention is to improve automatic domestic washing apparatus of the type including a pressure fill system automatically controlled to terminate fill when a predetermined water level occurs in a cleaning container of the apparatus by the provision of a fluid level sensing system including a flow divider having an inlet and a dual arrangement of outlet nozzle means one of which directs water into the cleaning container of the apparatus and the other of which directs a smaller proportionate flow into a water container and wherein the divider is characterized by the ability to maintain an accurate proportionate flow through the nozzle means irrespective of wide variations in the pressure of the fluid being supplied to the inlet of the flow divider.

Still another object of the present invention is to provide an improved control system in automatic cleaning apparatus of the type inculding a cleaning container and means for receiving fluid extracted from said container and wherein the cleaning container is associated with means including a reversible electric motor for carrying out a predetermined washing cycle of operation and a fluid extraction cycle of operation, and wherein a reversible flow pump is included for selectively draining fluid from the container during one direction of rotation thereof and for preventing fluid flow from the container during an opposite direction of rotation thereof by the provision in the control system of an air pressure responsive switch means that measures a predetermined amount of sensing fluid to terminate filling of the cleaning container of the apparatus with washing fluid and wherein the air pressure responsive switch means following the fill operation is included in an energization circuit for the reversible motor which includes timer controlled contact means for conditioning the motor to operate the pump in a direction to prevent drainage of fluid from the enclosing container whereby the air pressure responsive switch means can be utilized to complete the energization circuit for the motor and wherein the timer controlled contact means are sequenced to maintain the electric motor conditioned for operating the pump in such a manner until the enclosing container is completely drained under the control of the pressure responsive switch means which is operative following the drain cycle and when fluid has been drained from the water container to complete an energization circuit through timer motor means for operating the timer con-

trol switches to condition the electric motor means for a subsequent phase of operation.

Still another object of the present invention is to improve a fluid supply system for an automatic domestic appliance of the type including a rotatable cleaning container and a water collecting container surrounding the cleaning container for receiving fluid extracted therefrom during a spin cycle of operation of the cleaning container and wherein fill terminating means including sump means are located on the water receiving container having a drain conduit therefrom connecting to a reversible pump driven by reversible electric motor means and wherein the reversible pump has an outlet thereof connected to means for selectively diverting fluid drain from the water container into a drain or into a suds saving reservoir by the provision of fluid control means interposed between the sump means of the fill terminating system and the inlet to the pump which control means are operative during rotation of the pump to drain the water container to allow free flow of fluid from the sump means through the pump and thence to either the drain or the suds saving reservoir depending upon the condition of the diverter valve in the outlet of the pump means and wherein the fluid control means is operative upon rotation of the pump in an opposite direction to close the drain conduit from the sump means to maintain the water level therein during a wash cycle of operation and wherein the water level therein during a wash cycle of operation and wherein the fluid control means is further characterized by having an outlet in communication with the inlet of the pump when the pump is directing water toward the sump means for diverting such water and directing it interiorly of the cleaning container whereby upon proper conditioning of the suds saver diverter means fluid can be drawn by said pump means from the suds saver reservoir and thence discharged into said cleaning container without passing into said water collecting container.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

FIGURE 1 is a view in vertical section of a domestic washing machine including the fluid supply system of the present invention;

FIGURE 2 is a fragmentary enlarged view of a portion of a subtop of the washing machine as it is related to the improved flow divider of the fill system and wherein the remainder of the fluid supply system of the invention is shown diagrammatically;

FIGURE 3 is an enlarged view of the flow divider of the present invention in elevation looking in the direction of the arrow 3 in FIGURE 2 including a portion of the water container and subtop of the washing machine in vertical section;

FIGURE 4 is an enlarged view in vertical section taken along the line 4—4 of FIGURE 2;

FIGURE 5 is a view in vertical section taken along the line 5—5 of FIGURE 3;

FIGURE 6 is an enlarged, sectional view of a fluid control component of the system for controlling flow therein during drain and suds savings operations:

FIGURE 7 is an enlarged view in vertical section taken along the line 7—7 of FIGURE 1;

FIGURE 8 is an enlarged view in horizontal section showing the reversible pump in the fluid supply system of the present invention; and

FIGURE 9 is a diagrammatic illustration of a control circuit incorporated in the present invention.

Referring now to FIGURE 1, an automatic domestic clothes washer **10** is illustrated including an outer casing **12** having a base **14**, side walls **16**, **18**, a front wall **20**, and a top **22** having an access opening **24** therethrough closed by a lid **26**. The top opening **24** provides access through an opening **26** in a subtop **28** into an upper open

end of a rotatable spin tub **30** in which soiled articles are placed. Within the spin tub **30** is located a vertically reciprocable agitator **32** for surging cleaning fluid through articles in the spin tub for removing soil therefrom. In the illustrated arrangement, the spin tub **30** is enclosed by a water container **34** having a bottom partition or bulkhead **36** that forms a space **38** surrounding the spin tub **30** into which fluid is directed during a spin cycle of operation from extraction ports **40** in the outer surface of the spin tub **30**. Beneath the bulkhead **36** is a lower machinery compartment **42** in which is located a drive mechanism **44** of the type set forth more particularly in United States Patent No. 3,087,321, issued April 30, 1963 to Brucken. As is more specifically set forth in the Brucken patent, the mechanism **44** includes a shaft housing **46** that is secured to the bottom bulkhead **36** and has a spin shaft **48** directed therethrough connected to the bottom of the spin tub **30** and an agitate shaft **50** therein directed coaxially of the spin shaft **48** and exteriorly thereof to be connected to the agitator **32** for causing reciprocable movement thereof.

Additionally, the mechanism **44** includes a reversible electric motor **52** that includes a shaft portion **51** connected to the impeller **53** of a pump **54** for operating the impeller in opposite directions of rotation to produce a bidirectional flow pattern between an inlet **56** of the pump and an outlet **58** therefrom as best seen in FIGURE 8.

Additionally, in the illustrated washing machine **10** a fill system is included which includes a cold water valve **60** and a hot water valve **62** under the control of a hot water solenoid **64** and a cold water solenoid **66**, respectively, as seen in FIGURES 1 and 9. Fluid flow through the valves **60**, **62** passes into a mixed water supply conduit **67** which has its outlet end fastened over the inlet **66** of a flow divider **68** to be more specifically discussed. From the flow divider **68** fluid is supplied through a conduit **70** to a fluid inlet **72** in the top **74** of an upstanding water inlet chute **76** having openings **78** and **80** in the sides thereof whereby the water chute **76** constitutes an air gap between the water supply and the outlet of the chute **76** which is located in an opening **82** directed through the subtop **28** so as to be aligned in fluid filling relationship with the interior of the spin tub **30**. In the illustrated arrangement the chute **76** has a locating arm **83** thereon in engagement with top **28** and the flow divider **68** has a pedestal **84** integrally formed with and upstanding from top **74** of chute **76**, as best seen in FIGURE 3.

In accordance with certain principles of the present invention, the fluid flow through the supply conduit **67**, flow divider **68** and water chute **76** is controllable to produce a wide range of water levels within the spin tub **30** each of which is suitable for a particular load or type of fabric being cleaned. Thus, when articles have been loaded into the spin tub **30** and the top is closed, the operator of the machine moves a cycle selector knob **85** on a rearwardly located control panel of machine **10** to a position where an indicator arm **86** behind a transparent window **88** is located at the beginning of one of a plurality of desired washing cycles of operation. Concurrently and in accordance with the type of the load having been placed in the spin tub **30**, the operator positions a water selector control knob **90** which is operatively connected to an indicating column **92** for visually indicating the level of the desired fill on the control panel of the washer **10**. The control knob **90** is operatively connected to an air pressure responsive switch **94** including an air pressurizable diaphragm **96** for operating a switch blade **98** into electrical engagement with a fill contact **100** and a timer motor circuit contact **102**, as seen in FIGURES 1 and 9. The switch **94** includes means (not shown) for adjustably positioning the contact **100** with respect to the switch blade **98** so as to maintain the switch blade **98** in electrical engagement with the contact **100** until the diaphragm **96** senses a greater or lesser control air pressure in accordance with the level of water selected by the control knob **90**.

Once the cycle selector knob **84** and water selector **90** have been positioned and the lid **26** has been closed, a water fill energization circuit is completed as seen in FIGURE 9 from a wire L_1 through a closed door switch **104** thence through a conductor **106** and a conductor **108** to the switch blade **98** of the air pressure switch **94** which is in engagement with the fill contact **100**. From the fill contact **100** the circuit passes through a closed cam operated timer controlled contact **110** that is positioned by the cycle control selector knob **85** in a closed position at the start of a wash cycle. The circuit thence passes through a conductor **112** having a manually positionable hot water selector switch **114** therein to one side of the solenoid coil **64** for opening the hot water valve **60**. The opposite side of the coil **64** is electrically connected to conductors **116, 118, 120** to wire N of a 115-volt power source. Also from timer control switch **110** is connected a conductor **122** having a manually operable cold water selector switch **123** therein and to one side of the cold water solenoid coil **66** that has its opposite side connected by a conductor **124** thence through conductors **118, 120** to wire N. With the switches **114, 123** closed, the water valves **60, 62** are opened and water is discharged through the supply conduit **64** into the inlet **66** of the flow divider **68**.

In accordance with certain principles of the present invention, the flow divider **68** is characterized by having an inlet pipe **126** which is opened at one end thereof to form the inlet **66** to the flow divider **68** and is closed at its opposite end across the full planar extent of the flow area through the pipe **126** by a wall **128**. The flow divider **68** also includes a depending small diameter nozzle **130** thereon and an upwardly directed nozzle **132** thereon which has a cross-sectional flow area therein in one working embodiment that is ten times greater than the cross-sectional flow area through the depending nozzle **130**. The nozzle **132** has its flow passage slightly angularly offset from the longitudinal axis of the flow area of nozzle **130** and in the case of a ten to one ratio of areas, the angle, as shown in FIGURE 4, is thirty-five degrees. As best seen in FIGURE 5, the inlet **134** to the nozzle **132** and an inlet **136** to the nozzle **130** are located in close spaced relationship to the end wall **128**. It will also be noted that the flow discharge through the nozzle **132** is directed into the flow directing conduit **70** and thence to the inlet nozzle **76** of the machine and, accordingly, fluid flow through the nozzle **132** has a definite back pressure maintained thereon. Because of this back presure and the particular illustrated configuration of the nozzles **130, 132**, including their angular relationship to one another and their location at the closed end of the pipe **126** the pressure maintained at the inlets **134, 136** of the flow divider nozzles is substantially equal whereby the nozzles **130, 132** will direct an amount of the inlet flow through the flow connecting conduit **70** into the inlet nozzle **76** and thence into the interior of the spin tub **30** and outwardly of the nozzle **130** in direct proportional relationship to the cross-sectional flow areas through these nozzles. Also, by virtue of the particular configuration of the flow divider **68** as discussed above, this proportional flow will be maintained through a wide range of pressures of the inlet fluid passing through the supply conduit **67**. For example, in the illustrated working embodiment of the invention, the flow divider **68** is able to maintain a 1 to 10 proportion of flow through the outlet nozzle **130** and the outlet nozzle **132** through a pressure variation in the supply conduit between 5 p.s.i. and 120 p.s.i.

The smaller amount of proportional flow through the nozzle **130** is directed downwardly therefrom and thence through a tapered funnel member **138** which is located in an opening in the subtop **28** in a position to overlie the space **38** between the spin tub **30** and the water container **34**. The small amount of fluid falls through the space **38** and thence is directed across the bottom bulkhead **36** to a drain opening **140** therein which is in communication with an inlet opening **142** to an improved fluid receiving sump member **144** that has particular characteristics in accordance with the present invention to collect the small amount of water passing through the nozzle **130** so as to condition the air responsive switch **94** to terminate the fill operation by de-energizing the solenoids for maintaining valves **60, 62** open when the small amount of water from the nozzle **130** accumulates to a predetermined degree.

More particularly, in the illustrated arrangement the improved sump container **144** is characterized by having a thin outer wall **146** formed of a blow molded plastic such as polypropylene which forms a first large volume tank portion **148** that is totally enclosed through its upper extent except for the opening **142** therein. The large volume portion **148** includes an upper surface **150** thereon which has an outwardly directed ridge **152** formed therein around the opening **142** which is integrally formed with an annular seat **154** on which is located an annular seal element **156** that is retained by the ridge **152** around the opening **142**. Additionally, the seal is retained at its inner circumference by a split retainer ring **158** that has an upper flange **160** located against the upper surface of the bottom bulkhead **36** around the drain opening **140** and a bottom flange **162** that locks against the inner surface of the seat **154** around the opening **142** in the large volume tank portion **148**. The retainer ring **158** serves to compress the annular seal member **156** in sealing engagement between the water container bottom bulkhead **36** and the sump assembly **144** to prevent fluid leaking exteriorly of the water container **34** as it passes into the sump assembly **144**.

One aspect of the present invention is to provide an improved support for locating the sump assembly **144** on the bottom bulkhead **36**. This support includes an enclosure **164** having side walls **166, 168**, and end walls **170, 172** that are in juxtaposition relationship with a good portion of the planar extent of the outer surface of the sump tank portion **148** so as to prevent undesirable flexing therein as the container portion **148** fills. The side walls **166, 168** have outwardly directed flanges **174, 176** thereon which are connected to spaced apart reinforced rails **178, 180** on the bottom bulkhead **36** by suitable fastening means such as screws **181** retained in place by lock nuts **182** located interiorly of the rails **180**.

Additionally, the side walls and end walls are joined by a base member **186** which has a shallow depending convolution **188** at the center thereof in which is received a convoluted portion **190** of the sump container portion **148** that defines a flow passageway **192** from the interior **194** of the sump container portion **148** which has a gradually increasing depth throughout the length of the bottom **194** of the container portion **148** from the right end thereof to a drain outlet end thereof as viewed in FIGURE 1. As a result, initial water flow into the water receiving container portion **148** drains outwardly and thence through a drain conduit **196** which is connected to a check valve assembly **198** to be more specifically discussed subsequently. By virtue of this arrangement, as the drain conduit **196** fills and the fluid level rises in the tank portion **148**, there will be a greater water level at the outlet **195** than at an oval shaped opening **200** formed by a formed interconnector member **201** between the water receiving sump portion **148** and a smaller volume air trapping portion **202** of the sump assembly **144** that is located exteriorly of the sump support **164** at one end thereof by the oval-shaped connector neck **201**. Air trapped in portion **202** is pressurized by a raised water level in the sump and the pressurized air is directed through a conduit **203** to be sensed by diaphragm **96**.

By virtue of the inclination of the convolution **190** in the sump portion **148**, the oval opening **200** is opened immediately when the sump drains whereby compressed air within the air trapping chamber **202** is vented through the sump opening **142** thence through opening **140** into the water container space **38** to atmosphere whereby the

pressurizable bellows of the air pressure switch **94** only senses pressurization resulting from flow of sensing liquid into the sump during a fill cycle of operation. Thus, upon the occurrence of a predetermined level of fluid in the water receiving chamber **148** of the sump assembly **172** which is proportional to a desired preset water level in the spin tub **30** as established by the water selector control knob **90**, the bellows of the air pressure switch will operate the switch arm **98** to engage the contact **102** whereby a motor energization circuit is completed, a timer motor circuit is completed and the fill energization portion of the illustrated circuit is de-energized to stop water fill.

In the illustrated arrangement the motor energization circuit is completed from wire L_1 through switch **104**, conductor **106**, conductor **108** thence through switch arm **98** and contact **102** through a conductor **206** thence through a switch blade **208** of a timer controlled switch that is positioned by conventional cam means to engage a contact **210** that in turn is electrically connected by a conductor **212** to one end of a running winding **214** having the opposite end thereof electrically connected by the conductor **120** to wire N. The reversible electric motor **56** is conditioned for a predetermined rotation to effect an agitate or washing operation through the drive mechanism **44** by the presence of a start winding **216** in the circuit that is connected across a phase switch **218** at the beginning of the agitate cycle of operation from wire L_1 to conductor **106**, a conductor **220** electrically connected to a phase switch contact **222** that is electrically engaged by a switch blade **224** controlled by the timer motor and thence through a conductor **226** to one side of the start winding **216**. The opposite side of the winding **216** is connected by a conductor **228** to a second movable timer controlled switch blade **230** of the phase switch **218** which is located during the agitate cycle of operation in electrical engagement with a contact **232** that in turn is electrically connected by a conductor **234** through a motor speed responsive centrifugal switch **236** to the running winding **214**. When the motor reaches a predetermined percentage of its operating speed the centrifugal switch **236** drops the phase or start winding **216** from the circuit. The phase switch further includes contacts **238** and **240** that are selectively engaged by the timer controlled switch blades **222**, **230** following de-energization of the motor subsequent to the washing cycle of operation and precedent to a spin cycle of operation whereby the start winding **216** will condition the reversible electric motor for opposite rotation.

An important aspect of the present invention is that during the agitation or wash cycle of operation wherein the energization circuit for the motor is conditioned as illustrated in FIGURE 9, it is important to note that the motor is rotating in a direction to cause the bidirectional pump **54** to have the impeller **53** thereof driven by the motor so as to discharge water from the pump through the inlet **56** thereof toward the drain conduit **196**. By virtue of this operation the water level in the sump assembly **144** for maintaining the air trapped in the portion **202** of the sump is maintained so that the air pressure responsive switch **94** will be retained in electrical contact with the contact **102** so that during the washing cycle of operation the energization circuit for the motor **56** will be maintained without the need for a separate holding circuit independent of the pressure responsive switch **94**.

Another feature of the invention resides in the interrelationship of the air pressure responsive switch **94** and the energization circuit for a timer motor **238** for cycling the aforementioned described timer actuated switches of the control system. As seen in FIGURE 9, during the washing cycle the movable switch arm **98** of the air pressure switch contacts the contact **102** so as to complete a timer motor energization circuit from wire L_1 through switch **104**, conductors **106**, **108**, the switch **94** thence through a conductor **240** to a closed timer controlled switch **242** that is connected by conductor **244** to one side of the timer motor **238** which has the opposite side thereof connected to conductor **246** thence to conductor **120** and wire N. This circuit is maintained during the washing cycle of operation whereby the timer **238** will advance timer controlled switches in a predetermined cycle of operation.

Following the washing cycle of operation the timer motor **238** advances cams to open the energization circuit for the main winding **214** whereby the motor is stopped during which time the timer **238** positions the phase switch **218** so as to energize the start winding **216** to condition the motor for a reversed direction of rotation from that produced during the washing cycle of operation. Additionally, timer controlled switch **242** is closed and a timer controlled switch **248** is opened between conductors **109**, **244**. Thence during the start of a spin cycle of operation during which time the pump **54** is operated to drain fluid from the sump assembly **144**, the timer motor is energized. Following a predetermined number of timer motor controlled advances the switch **242** is opened and the switch **248** is closed. Usually at this phase of the operation the air pressure responsive switch **98** is still positioned against the contact **102** and accordingly the timer motor **238** is de-energized for the remainder of the drain or spin cycle of operation. By virtue of this arrangement the spin cycle of operation will continue with fluid being centrifuged from the spin tub **30** into the water container **34** thence to drain into the sump assembly **144** where it is drawn down through the drain conduit **196**, across the flow control assembly **198** thence into the inlet of the pump **56** to be discharged to the outlet **58** thence through a discharge conduit **250** and into an inlet **252** of a solenoid controlled diverter valve **254** that is conditioned during regular washing cycles of operation to divert fluid through a first outlet **256** of the valve **254** that is connected to a drain pipe **258** for discharging fluid from the water container **54** to an exterior drain. An air expansion chamber **259** on the discharge side of the pump prevents air from the sump **144** from air locking the pump during drain out.

At the end of the drain operation when all fluid has been drained from the water container **34** and the sump assembly **144** so as to condition the switch blade **98** of switch **94** to engage the fill energization circuit contact **100**, the air pressure switch and timer control switch **248**, which was previously closed as discussed above, are utilized to re-energize the timer motor **238** to advance the machine through its subsequent cycles of operation.

According to other concepts of the present invention, in the fill and drain system illustrated is incorporated an improved suds saver system that utilizes a part of the pressure fill control system, if desired, following a washing operation to direct the fluid from the water container **34** to a suds saving reservoir during the spin cycle of operation of the machine. Furthermore, the suds saving system includes means for returning the wash fluid from the suds saving reservoir following the spin cycle of operation in order that it might be used in a subsequent washing operation. More specifically, in the illustrated arrangement, as seen in FIGURE 6, the check valve assembly **198** includes a first housing portion **251** having an inlet fitting **253** thereon and a hemispherical portion **255** that has a radially outwardly directed flange **257** thereon that is adapted to mate with the radially outwardly directed flange **259** of a second housing portion **260**. The flanges **257**, **259** are recessed to receive an annular sealing member **262** therebetween which is held in sealing engagement between the housing portions **251**, **260** by suitable fastening means including screws **264** directed therethrough with the upper screw, as seen in FIGURE 6, connecting brackets **266** to the flow director member **198** for securing it to suitable fixed support means of the washing apparatus **10**. The housing portion **260**

includes a large diameter tubular fitting **268** thereon and also a small diameter tubular fitting **270** thereon both of which communicate with a hemispherical portion **272** of the housing part **260**. The hemispherical portions **272**, and **255** form an interior space **274** within the flow control member **198** in which is located a movable ball check element **276** that is positionable when the pump **54** is driven in a direction to discharge fluid from its inlet **56** into the position illustrated in FIGURE 6. Upon opposite rotation of the pump **54**, so as to drain fluid from the sump assembly **144**, the movable ball check element **276** is shifted interiorly of the chamber **274** along an internal ramp **278** formed on the inside surface of the hemispherical portion **272** of the body part **260** into the position shown in dotted lines in FIGURE 6. During the spin cycle of operation of the machine **10** wherein washing fluid in the water container **34** is drawn by the pump **54** so as to be directed into the drain pipe **258**, the movable check valve **276** will block fluid flow through the small diameter tubular fitting **270** and allow fluid flow from the inlet fitting **253** thence into the chamber **274** and downwardly and around the movable check valve element **276** and thence through the large diameter fitting **268** which is connected by suitable conduit means to the inlet **56** of the pump **54**.

During the washing cycle of operation when the pump **54** is rotated in an opposite direction as discussed above, the pump will prevent flow from the flow control assembly **198** thereby to retain the fluid sensing level in the sump assembly **144** during this phase of operation.

During a predetermined return of fluid from the suds saving reservoir the pump **54** is operated in a similar fashion but the diverter valve **254** is conditioned so that a conduit **280** that communicates with the suds saving reservoir at one end thereof and is connected to a second outlet **282** of the diverter valve **254** at its opposite end is located by the diverter valve **254** in communication with the inlet **252** and thence through the conduit **250** to the outlet **58** of the pump **54**. Because of the direction of rotation of the impeller **53** causing it to discharge through the inlet **56** fluid in the suds saving reservoir is drawn through the conduit **280**, diverter valve **254**, conduit **250** and thence is discharged into the large diameter tubular fitting **268** of the check valve assembly **198** so as to cause the movable check valve element **276** to shift into the solid line position shown in FIGURE 6. Thus, the fluid directed into the tubular fitting **268** will be forced through the chamber **274** and exteriorly thereof through the small diameter tubular fitting **270** which is connected to suds saving return conduit **284** having the opposite end thereof connected to an inlet fitting **286** that extends upwardly from one side of the inlet nozzle **76** to the spin tub as best seen in FIGURE 2.

While the embodiments of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A fluid distributing and level control system for a domestic clothes washer comprising means including a rotatable spin tub for effecting a washing cycle of operation and an extraction operation wherein fluid is centrifuged from articles in said spin tub during a spin cycle of operation, a water container for receiving fluid extracted therefrom during the spin cycle of operation, said water container including a bottom bulkhead having a drain opening therein, a sump tank having an inlet opening communicating with said drain opening, said sump tank having a large volume fluid receiving chamber and a separate small volume air trap chamber, means for communicating said separate chambers adjacent the bottom of each of said chambers, said sump tank having a drain opening therefrom in communication with said fluid receiving chamber thereof, means including a reversible pump selectively operable to drain fluid from said sump tank or to discharge fluid in the direction of said sump tank, fluid supply means including a supply conduit for directing fluid to said spin tub, air responsive means for conditioning said fluid supply means to prevent fluid flow through said supply conduit, said air responsive means including means in communication with said air trap chamber of said sump tank to condition the flow of fluid through said supply conduit in accordance with the pressure level in said air trap chamber of said sump tank, flow divider means including an inlet communicating with said supply conduit and first and second outlets, said first divider means outlet directly discharging fluid into said water container, said second divider means outlet having a cross-sectional fluid flow area greater than said first outlet, a short conduit connected to said second divider means outlet for directing fluid therefrom interiorly of said spin tub, fluid in said water container flowing through the drain opening in said bottom bulkhead and filling said large volume chamber of said sump tank and said means communicating between said large volume chamber and said separate small volume air trap chamber for compressing air trapped in said small volume chamber, said air responsive means responding to a predetermined level of collected fluid in said large volume chamber to condition said supply means to terminate filling of said spin tub, said reversible pump means maintaining the water level in said sump tank during a washing cycle of operation, by discharging fluid toward said sump tank, valve means interposed between said pump means and said sump tank responsive to fluid discharged toward said sump tank to block flow of fluid into said sump tank and from said sump tank whereby said air responsive means is maintained pressurized by fluid in said small volume air trap chamber to condition said fluid supply means to block fluid flow through said fluid conduit during the washing cycle of operation, said valve means including an outlet to said spin tub, an electrically energizable reversible motor for operating said pump means and said washing means following the filling of said spin tub, energization circuit means for said electric motor including switch means conditioned by said air responsive means when there is a predetermined water level in said sump tank to maintain said motor energized, said energization circuit means including a timer and timer controlled switch means conditioned following the washing cycle of operation to cause said motor means to operate said pump means to drain fluid from said sump tank during a predetermined drain cycle, said valve means having a ball check element moved by fluid draining from said sump tank to a position to block flow through said outlet to said spin tub, said ball check element being positioned to allow free flow of fluid from said sump tank during said predetermined drain cycle which is terminated by the fluid level in said sump tank reaching a point to condition said air responsive means to open said switch means.

2. In a domestic washing machine the combination of operating means including a rotatable spin tub for carrying out a wash and spin cycle of operation, means including an energizable fill valve for directing fluid into the spin tub, a water container for receiving fluid extracted from said spin tub during a spin cycle of operation, said water container including a bottom bulkhead having a drain opening therein, sump means forming a fluid receiving space in communication with said drain opening, said sump means including an air trap chamber therein, air pressure responsive means sensing the pressure in said air trap chamber, switch means controlled by said air responsive means for operating said fill valve, divider means operative during a predetermined fill period for directing a predetermined amount of fill water to said spin tub and a proportional amount of water into said water container and thence into said sump means to build-up pressure in said air trap chamber, said air pressure responsive means responding to said pressure build-up to

condition said switch means to terminate the fill at preselected variable levels, said wash and spin operating means including reversible electric motor drive means and reversible pump means driven by said reversible motor means, an energization circuit for said reversible electric motor means including said air responsive means controlled switch means and timer controlled switch means, said air responsive means responding to a predetermined water level in said sump means following a predetermined fill period to complete an energization circuit for said motor drive means through said switch controlled by said air responsive means and said timer controlled switch means, said motor drive means operating to cause said operating means to carry out a washing cycle of operation and to operate said pump means to maintain the water level in said sump means during the wash cycle to maintain pressure in said air trap chamber, said air responsive means controlled switch means responding to said maintained pressure to hold the energization circuit for said motor drive means during a washing cycle of operation, said timer controlled switch means being operative following a predetermined wash cycle of operation to condition said electric motor drive means for reverse rotation and for maintaining an energization circuit therethrough independent of said switch means controlled by said air responsive means, a timer motor, circuit means for energizing said timer motor including said switch means controlled by said air responsive means, said switch means controlled by said air responsive means maintaining said timer motor de-energized during the spin cycle of operation and drainage of fluid from said sump until all of the extracted fluid from said spin tub is removed from said system causing said air responsive means conditioned switch means to complete the energization circuit through said timer motor for advancing said timer motor to condition said timer controlled switches to de-energize said electric motor means during a subsequent fill cycle of operation.

3. In a fluid distributing level control system for an automatic clothes washer including a flow divider for directing a large amount of water into a washer spin tub for washing and a smaller amount of water into a fluid measuring and sensing system including a water container and an air pressure sensitive switch operative to terminate a fill period of operation by de-energizing a water fill valve, the improvement comprising a water container top, a first opening in said water container top overlying the spin tub, a second opening in said container top overlying the water container, a water inlet chute supported on said water container top having an outlet end supported within said first container top opening, said water chute including a removable top cover having an inlet fitting thereon, means forming an air gap opening between said cover and said outlet end of said chute, indexing means on said chute for removably securing said chute to locate said cover at a fixed disposition with respect to said second opening in said water container top, a water flow divider integrally formed with said chute cover and including an inlet adapted to be connected to a fill conduit from the water fill valve, said flow divider including a first outlet fitting, a flexible hose connecting said first outlet fitting with said inlet fitting on said water chute cover, said flow divider having a second outlet fitting angularly spaced from said first outlet fitting on the outer circumference of said inlet thereof, said second outlet fitting diverting fluid from said inlet thereof directly through said second water container opening into said water container for collection by the measuring and sensing system.

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