Feb. 28, 1967 D. C. PRIDHAM, JR 3,306,411

WASHING MACHINE SYSTEM OR THE LIKE

Filed May 28, 1965 3 Sheets-Sheet 1

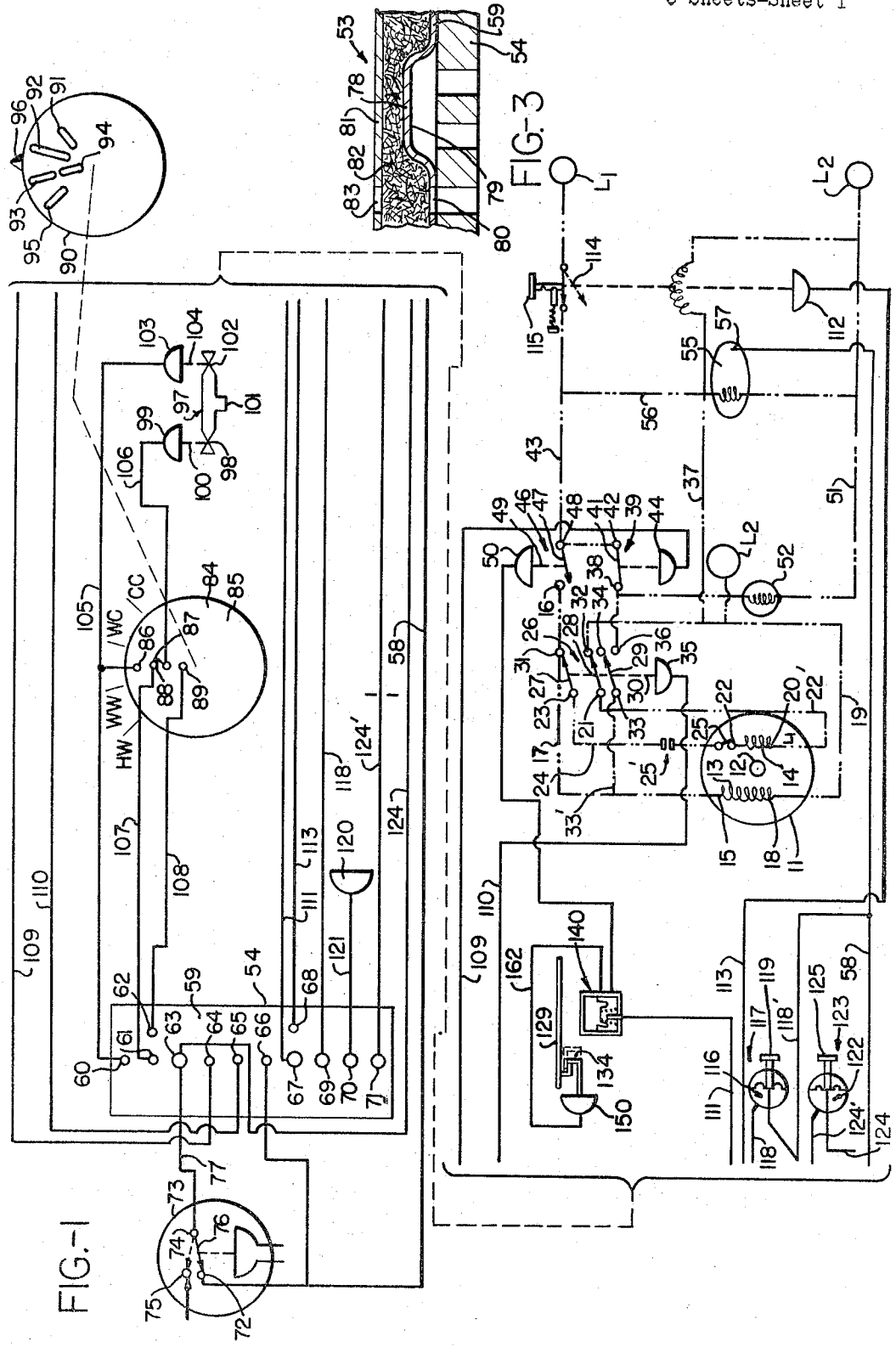


FIG. 1

FIG. 3

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WASHING MACHINE SYSTEM OR THE LIKE

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3 Sheets-Sheet 2

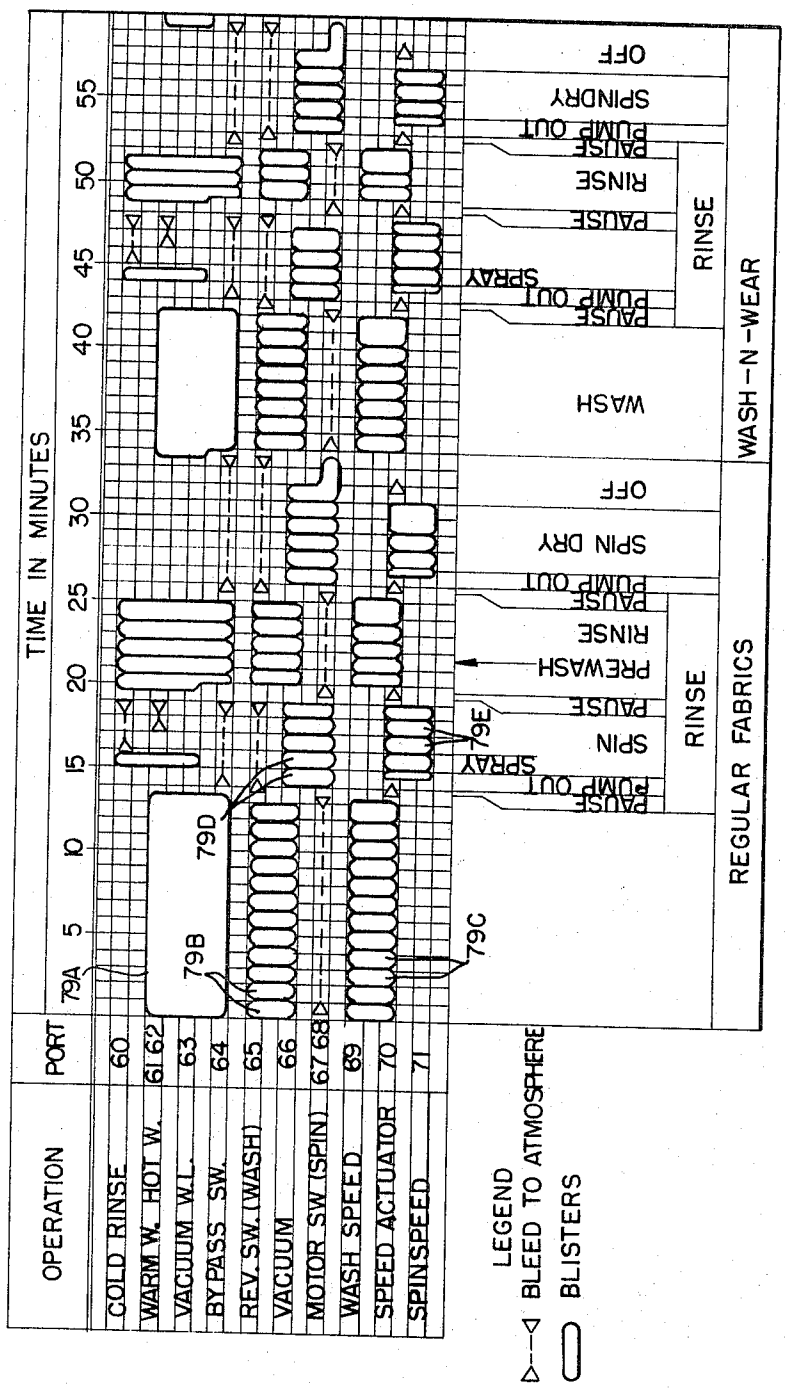


FIG.-2

WASHING MACHINE SYSTEM OR THE LIKE

Filed May 28, 1965 3 Sheets-Sheet 3

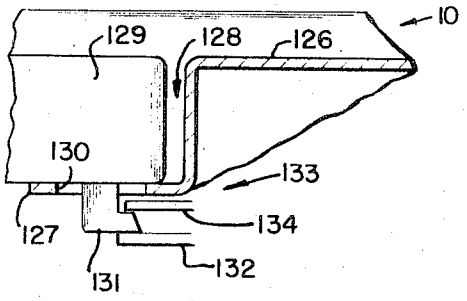


FIG.-4

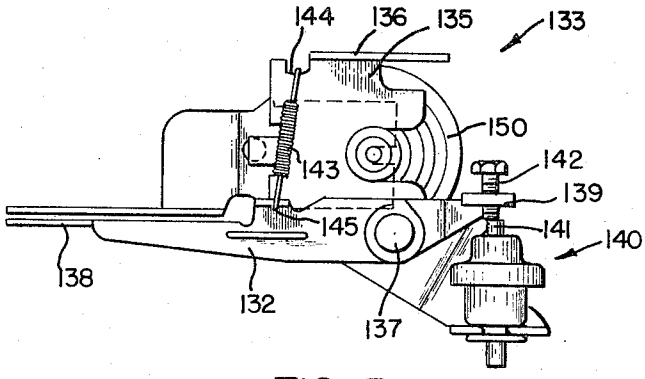


FIG.-5

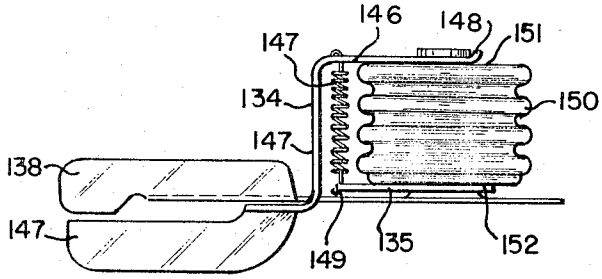


FIG.-6

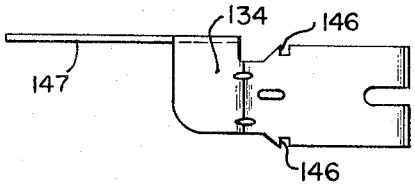


FIG.-7

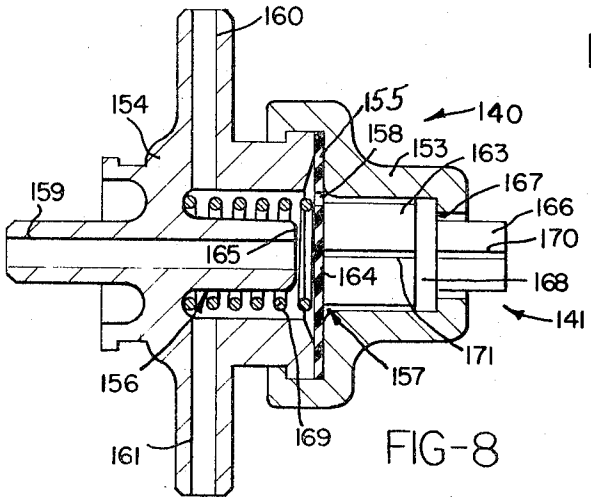


FIG-8

United States Patent Office 3,306,411
Patented Feb. 28, 1967

3,306,411

WASHING MACHINE SYSTEM OR THE LIKE

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Filed May 28, 1965, Ser. No. 459,728
20 Claims. (Cl. 192—135)

This invention relates to an improved system for controlling the operation of a domestic washing machine or the like.

In particular, it is well known that various washing machines are provided with a single electrical motor which, when its output shaft is rotated in one direction, operates the agitator of the washing machine and, when its output shaft is rotated in the opposite direction, spins the washing compartment of the washing machine.

However, it is also well known that when the washing compartment is spinning at a relatively high speed to centrifuge the water out of the laundry disposed therein, some means must be provided to turn off the electrical motor should someone accidentally open the lid or door of the washing machine which provides access to the spinning washing compartment.

In addition, it has been found that it is desirous to have some means for latching the door or lid in its closed position during the spinning operation of the washing compartment.

According to the teachings of this invention, improved pneumatic control means are provided for controlling the operation of a washing machine or the like in the above manner.

Accordingly, it is an object of this invention to provide an improved washing machine system having one or more of the novel features set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description, which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIGURE 1 is a schematic view illustrating the improved control system of this invention.

FIGURE 2 is a flow diagram illustrating the sequence of operation of the system illustrated in FIGURE 1.

FIGURE 3 is an enlarged, fragmentary, cross-sectional view illustrating the main program member of FIGURE 1.

FIGURE 4 is a schematic cross-sectional view illustrating the lid or door of the washing machine of FIGURE 1 latched in its closed position during the spinning operation.

FIGURE 5 is a side view of the latch structure illustrated in FIGURE 4.

FIGURE 6 is a top view of the structure illustrated in FIGURE 5.

FIGURE 7 is a side view of the latch member for the structure of FIGURE 5.

FIGURE 8 is an enlarged, fragmentary cross-sectional view of the valve means of FIGURE 5.

While the various features of this invention are hereinafter described and illustrated as being particularly adaptable for providing a control system for a domestic washing machine or the like, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide a control system for other devices as desired.

Therefore, this invention is not to be limited to only

the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGURE 1, the improved control system of this invention is generally indicated by the reference numeral **10** and includes an electrical motor **11** having an output shaft **12** which, when rotated in one direction, will, through suitable transmission means, operate the agitator of the washing machine **10** and, when rotated in the opposite direction, will, through suitable transmission means, spin the washing compartment of the washing machine **10**.

The motor **11** has a running winding **13** and a starting winding **14**, the running winding **13** having one side **15** thereof interconnected to a contact **16** by a lead **17** and the other side **18** thereof interconnected to power lead L^2 by a lead **19**. The starting winding **14** has one side **20** thereof interconnected to a contact **21** by a lead **22'** and the other side **22** thereof interconnected to a contact **23** by a lead **24**, the lead **24** having a capacitor **25'** therein, as well as a centrifugal switch **25** which opens upon a predetermined speed of rotation of the output shaft **12**.

A first electrical switch **26** is provided and has three switch blades **27**, **28**, and **29** interconnected together by means **30**, the blade **27** being hinged at contact **23** to bridge the contact **23** with a contact **31**, the switch blade **28** being hinged at the contact **21** and being adapted to bridge the contact **21** with a contact **32**, and the switch blade **29** being hinged at a contact **33** and being adapted to bridge the contact **33** with a contact **34**.

The means **30** of the electric switch **26** is interconnected to a pneumatic actuator **35**, which, when receiving atmospheric conditions in the chamber thereof, holds the switch blades **27**, **28**, and **29**, in the position illustrated in FIGURE 1. However, when the chamber of the actuator **35** is evacuated by being interconnected to a vacuum source or the like in a manner hereinafter described, the actuator **35** pulls the blade **27** to bridge the contact **23** with the contact **32** and pulls the switch blades **28** and **29** so that the same bridge the contacts **21** and **33** with a contact **36** for a purpose hereinafter described.

The contact **31** is in the lead **17** previously described and the contact **32** is interconnected to the power lead L^2 by a lead **37**. The contact **33** is interconnected to the lead **17** by a lead **33'**.

The contact **36** is interconnected to a contact **38** of another electrical switch **39** by a lead **40**. The switch **39** includes a movable switch blade **41** hinged at a contact **42** and adapted to bridge the contacts **42** and **38**, the contact **42** being interconnected to the power lead L^1 by a lead **43**.

The switch blade **41** is interconnected to a pneumatic actuator **44** which holds the switch blade **41** in the position illustrated in FIGURE 1 to bridge the contacts **41** and **38** when the chamber of the actuator **44** is at atmospheric condition. However, when the chamber of the actuator **44** is evacuated by being interconnected to a vacuum pump or the like, the actuator **44** by an interconnecting means **45** will move the switch blade **41** out of contact with the contact **38** for a purpose hereinafter described.

Another electrical switch **46** is provided and includes a switch blade **47** adapted to bridge a contact **48** in the lead **43** with the contact **16**. However, the switch blade **47** is interconnected by means **49** to a pneumatically operated actuator **50** so that when the actuator **50** has its chamber at atmospheric conditions, the actuator **50** holds the switch blade **47** in the open position, as illustrated

in FIGURE 1. However, when the chamber of the actuator **50** is evacuated, by being interconnected to a vacuum pump or the like, the actuator **50** pulls the switch blade **47** to bridge the contacts **38** and **16** for a purpose hereinafter described.

The power lead L^2 is also interconnected to the contact **38** of the switch **39** by a lead **51**, the lead **51** having a timer motor **52** disposed therein to cause movement of a main program member **53**, FIGURE 3, over a reading head **54** for a purpose hereinafter described.

A vacuum pump **55** is provided and is placed across the power leads **43** and **51** by a lead **56**, the vacuum pump **55** having the inlet side **57** thereof interconnected to the reading head **54** by a flexible conduit means **58** in a manner hereinafter described.

The reading head **54** has a reading surface **59** interrupted by a plurality of ports **60**, **61**, **62**, **63**, **64**, **65**, **66**, **67**, **68**, **69**, **70**, and **71**, with the ports **60**, **61**, **63**, **64**, **65**, **66**, **67**, **69**, **70**, and **71** being disposed in vertical alignment while the port **62** is disposed in horizontal alignment with port **61** and the port **68** is disposed in horizontal alignment with the port **67**.

The flexible conduit **58** leading from the inlet **57** of the vacuum pump **55** is interconnected to the port **66** of the reading head **54**, as well as to a port **72** of a water level control device **73**, the water level control device **73** also having two other ports **74** and **75**. The device **73** has a valve means **76** for fluidly interconnecting the ports **72** and **74** together when the water level in the washing machine **10** is below a predetermined level. However, when the water level in the washing machine **10** is above a predetermined level, the means **76** disconnects the port **72** from the port **74** and interconnects the port **75** to the port **74**, the port **75** being interconnected to the atmosphere.

The port **74** of the water level control device **73** is interconnected to the port **63** of the reading head **54** by a flexible conduit means **77**.

The program member **53** which moves over the reading surface **59** of the reading head **54** includes a flexible reading sheet **78** having a plurality of blister means **79** formed therein in a predetermined pattern to bridge various ports in the reading head **54** in the manner illustrated in FIGURE 2, as those particular blister means **79** pass over the reading head **54**. In addition, the reading sheet **78** has a plurality of aperture means **80** passing therethrough in a predetermined pattern to be aligned with various of the ports in reading head **54** to permit air to enter those aligned ports in the manner illustrated in FIGURE 2. The reading sheet **78** is interconnected to a rigid backing member **81** in any suitable manner and is spaced therefrom by a porous compressible material **82** whereby air is adapted to enter an aperture means **83** of the backing member **81** and be filtered by the material **82** as the same passes through an aperture means **80** of the reading sheet **78** into an aligned port in the reading head **74**.

The program member **53** is adapted to move over the reading head **54** at a constant speed by the timer motor **52** previously described when the timer motor is energized in the manner hereinafter set forth to produce the cycle of operation illustrated in FIGURE 2.

A second reading head **84** is provided and has the reading surface **85** thereof interrupted by a plurality of vertically aligned ports **86**, **87**, **88**, and **89**. A program member **90** is adapted to selectively move over the reading surface **85** of the reading head **84** and has blister means **91**, **92**, **93**, **94**, and **95** formed therein in the same manner as the blister means **79** previously described to bridge certain of the ports in the reading head **84** when an indicator **96** of the program member **90** is disposed in a particular position "WH," "WW," "WC," and "CC," as illustrated in FIGURE 1 to select a water temperature of the water being directed into the washing machine by a water mixing valve **97**.

The water mixing valve **97** has a hot water inlet **98** interconnected to a pneumatic actuator **99** by means **100** whereby when the actuator **99** is at atmospheric conditions the actuator **99** closes the hot water inlet **98**. However, when the chamber of the actuator **99** is evacuated, the same opens the inlet **98** to direct water through the water mixing valve **97** to the outlet **101** thereof. Similarly, the water mixing valve **97** has a cold water inlet **102** controlled by a pneumatic actuator **103** interconnected thereto by means **104**. Thus, when the actuator **103** is at atmospheric conditions, the same holds the cold water inlet **102** in its closed position, but when the chamber of the actuator **103** is evacuated, the same opens the cold water inlet **102**.

The port **86** of the reading head **84**, and the port **60** of the reading head **54** are interconnected to the chamber of the actuator **103** by flexible conduit means **105**. The port **88** of the reading head **84** is interconnected to the chamber of the hot water actuator **99** by flexible conduit means **106**. The port **61** of the reading head **54** is interconnected to the port **87** of the reading head **84** by a flexible conduit **107**. The port **62** of the reading head **54** is interconnected to the port **89** of the reading head **84** by a flexible conduit **108**.

The port **64** of the reading head **54** is interconnected to the chamber of the actuator **44** by a flexible conduit means **109**. Similarly, the port **65** of the reading head **54** is interconnected to the chamber of the actuator **35** by a flexible conduit means **110**. The port **67** of the reading head **54** is interconnected to the chamber of the actuator **50** by a flexible conduit means **111**.

The port **68** of the reading head **54** is interconnected to a chamber of an actuator **112** by a flexible conduit means **113**, the actuator **112** when evacuated, opening a switch blade **114** in the line **43** to terminate the cycle of operation of the system **10**. However, the switch blade **114** is adapted to be disposed in a closed position by suitable start means **115** to start the cycle of operation selected by the program member **53**.

The port **69** of the reading head **54** is interconnected to a chamber **116** of a vacuum regulator **117** by a flexible conduit **118**, the vacuum regulator having the chamber **116** thereof also interconnected to the main vacuum line **58** by a vacuum line **118'**. The vacuum regulator **117** is controlled by a knob **119** whereby the magnitude of the vacuum in the chamber **116** can be automatically controlled so that the magnitude of vacuum imposed on line **118** will be in accordance with that selected by the knob **119**, the vacuum regulator **117** selecting the speed of operation of the agitator of the washing machine **10**.

The port **70** of the reading head **54** is interconnected to a chamber of a pneumatic actuator **120** by flexible conduit means **121**, the actuator **120** controlling the speed of the transmission means for either the agitator or the washing compartment in relation to the magnitude of vacuum imposed in the chamber thereof.

The port **71** of the reading head **54** is interconnected to a chamber **122** of another vacuum regulator **123** by a flexible conduit means **124'**, the chamber **122** of the regulator **123** also being interconnected to the port **74** of the water level control device **73** by means of a flexible conduit means **124** leading to the port **63** of the reading head **54**.

The vacuum regulator **123** has a control knob **125** which will select the magnitude of vacuum being imposed on the line **124'** to be utilized for controlling the spin speed of the washing compartment of the washing machine **10**.

The washing machine **10** is provided with a top wall **126**, FIGURE 4, which has an opening **127** passing therethrough to provide access to the washing compartment (not shown) of the washing machine **10**. The top wall **126** is recessed at **128** around the opening **127** to receive a lid or door **129** hinged to the wall **126** at the left end of the door **129** in FIGURE 4.

The wall **126** has an aperture **130** passing therethrough in the recessed portion **128** thereof and is adapted to receive an L-shaped keeper **131** attached to the under side of the door **129**. The keeper **131** is adapted to engage an arm **132** of a latching structure **133** when the door **129** is closed whereby, when the washing compartment is to be spun, the lever or arm **132** causes a latching member **134** to move over the lower arm of the keeper **131** to latch the door **129** in its closed position in a manner hereinafter described.

In particular, reference is made to FIGURES 5–7 wherein the latching mechanism **133** includes a mounting bracket **135** having a top plate **136** for securing the latch structure **133** to the wall **126** of the washing machine **10**.

The arm **132** is pivotally mounted to the bracket **135** by a pivot pin means **137** intermediate the ends **138** and **139** of the arm **132**.

A valving mechanism **140** is carried by the bracket **135** in the position illustrated in FIGURE 5 and has an operating plunger **141** adapted to be engaged by a screw **142** carried by the end **139** of the arm **132** for a purpose hereinafter described. A tension spring **143** is provided and is interconnected at one end **144** to the bracket **135** and at the other end **145** to the arm **132** to tend to cause the same to normally rotate in a clockwise direction to push down on the plunger **141**.

The latch member **134** has notches **146** formed therein to pivotally mount the latch member **134** intermediate the ends **147** and **148** thereof, the notches **146** of the latch member **134** receiving suitable knife edges of the bracket means **136** to pivotally mount the same to the bracket **135**.

A tension spring **147** is provided and has one end **148** interconnected to the latch member **134** to the left of the pivot points **146** thereof as illustrated in FIGURE 6 and the other end **149** thereof secured to the bracket **135** whereby the tension spring **147** tends to move the latch member **135** in a counterclockwise unlatching direction in FIGURE 6.

A bellows construction or pneumatic actuator **150** is provided and has one end **151** attached to the end **148** of the lever **134** and the other end **152** thereof attached to the bracket **135** whereby when the bellows or actuator **150** is evacuated, the same causes the end **147** of the latch member **134** to move in a clockwise direction in FIGURE 6 to move over the keeper **131** of the door **129** to hold the same in its closed position.

The valve means **140** comprises a pair of housing members **153** and **154** suitably secured together and sandwiching a flexible diaphragm **155** therebetween, the diaphragm **155** cooperating with the housing means **153** and **154** to define two chambers **156** and **157**.

The diaphragm **155** has an offset aperture **158** passing therethrough for a purpose hereinafter described.

The housing member **154** has three ports **159**, **160**, and **161** passing therethrough and interconnecting the exterior of the valve means **140** with the chamber **156**, the port **159** being interconnected to the left hand part of the line **111** in the manner illustrated in FIGURE 1 and the port **161** being interconnected to the right part of the line **111** leading to the actuator **50** previously described. The port **160** of the valve means **140** leads to the interior of the actuator **150** by means of a flexible conduit **162**. The plunger **141** of the valve means **140** has an enlarged cylindrical portion **163** disposed in the chamber **157** and is provided with an end **164** adapted to abut against the diaphragm **155** and push the same in sealing relation against a valve seat **165** separating the port **159** from the ports **161** and **160**, the plunger **141** having a reduced cylindrical portion **166** passing through a suitable aperture **167** in the housing means **153** and carries an annular seal **168** which will seal closed the aperture **167** when the plunger **141** is moved fully to the right by a compression spring **169** in the manner illustrated in FIGURE 8.

The reduced portion **166** of the plunger **141** has one or more longitudinal grooves **170** formed therein and the enlarged portion **163** thereof also has one or more longitudinal grooves **171** formed therein for a purpose hereinafter described.

Thus, it can be seen that when the end **138** of the arm **132** of the latch structure **133** is moved downwardly in FIGURE 5 by means of the keeper **131** of the door **129** pressing thereon when the door **129** is closed, the end **139** of the arm **132** is raised upwardly a distance sufficient to permit the compression spring **169** of the valve means **130** to move the diaphragm **155** away from the valve seat **154** and have the seal **168** seal the aperture **167** in the housing means **153** whereby the ports **159**, **160**, and **161** are fluidly interconnected together.

However, should the door or lid **129** be in an open position, it can be seen that the tension spring **143** will pull upwardly on the end **138** of the arm **132** causing the screw **142** to depress the plunger **141** and place the diaphragm **155** in sealing relation against the valve seat **165** to prevent communication between the port **159** and the ports **160** and **161**. In addition, when the diaphragm **155** is seated against the valve seat **165**, the seal **168** carried by the plunger **141** is moved away from the aperture **167** so that atmosphere is adapted to pass down the grooves **170** and **171** to fill the chamber **157** and pass into the chamber **156** through the aperture **158** in the diaphragm **155** whereby atmosphere will be interconnected to the ports **160** and **161** and, thus, to the actuators **50** and **150**.

The operation of the system **10** will now be described.

Assuming that the operator desires to do a regular fabrics wash cycle, as illustrated between the "0" minute increment and "34" minute increment and movement of the program member **53** as illustrated in FIGURE 2, with a hot wash water temperature and a warm rinse water temperature, the operator moves the program number **90** so that the indicator **96** thereof points to position "HW" whereby the blister **91** thereof bridges the ports **87** and **88** for a purpose hereinafter described. Also, the operator selects the desired agitator speed by the knob **119** and the desired spin speed by the knob **125**.

With the program member **53** disposed in the "0" position thereof, the operator pulls on the lever **115** to close the switch blade **114** whereby the vacuum pump **55** and timer motor **52** are placed across the power leads L^1 and L^2 because the switches **26**, **39**, and **46** are disposed in the position illustrated in FIGURE 1, whereby the program member **59** beings to move relative to the reading head **54** under the influence of the timer motor **52**. At the "0" increment of movement of the program member **53**, it can be seen that a wide blister **79A**, FIGURE 2, will simultaneously bridge the ports **61**, **62**, **63**, and **64** of the reading head **59** and, since the water level in the washing machine **10** is below the predetermined level, the control device **73** interconnects the vacuum line **58** with the port **74** so that vacuum is at the port **63**. With vacuum at the port **63**, vacuum is fed from port **61** through line **107** to port **87** of the reading head **84** and is interconnected to the port **88** by the blister **91**, so that the hot water actuator **99** is evacuated to open the hot water inlet **98** to direct hot water through the outlet **101** of the mixing valve **97** into the washing machine.

Since the blister **79A** also bridges the ports **63** and **64** of the reading head **54**, vacuum is imposed on the actuator **44** of the switch **39** to open the switch blade **41** so that current cannot flow from L^1 to the contact **36** of the switch **26**.

Also, at the "0" increment of movement of the program member **53**, it can be seen that a plurality of vertically aligned blisters **79B** serially bridge the ports **65** and **66** whereby the vacuum at the port **66** is interconnected to the port **65** and, thus, to the chamber of the actuator **35** through the line **110** whereby the switch blades **27**, **28**, and **29** are pulled downwardly in the manner previously described, so that the switch blade **27** bridges the contacts **23** and **32** and the switch blades **28**

and 29 interconnect the contact 36 with the contacts 33 and 21.

As long as the switch blade 41 is opened by the actuated actuator 44, no current can run through the starting winding 14 of the motor 11, so that the motor 11 is inoperative during the water filling operation until the water level has reached a predetermined level in the washing machine 10.

In particular, when the water level in the washing machine 10 reaches a predetermined level, the member 76 of the water level control device 73 disconnects the vacuum port 72 from the port 74 and interconnects the atmosphere port 75 with the port 74 whereby atmosphere is now interconnected to the port 63 of the reading head 54. Since atmosphere is at the port 63 of the reading head 54, the blister means 79A interconnects that atmosphere to the ports 61 and 64 so that the actuators 99 and 44 are interconnected to atmosphere. Since the actuator 99 is now interconnected to the atmosphere, the same closed hot water inlet 98 so that no more water is fed into the washing machine by the mixing valve 97.

Similarly, the deactivated actuator 44 causes the switch blade 41 thereof to bridge the contacts 42 and 38 so that current from power line L^1 will flow through line 40, contact 36, switch blade 28, contact 21 and line 22 through the starting winding 14 of the motor 11, contact 23, switch blade 27, contact 32 and line 37 to power lead L^2 to cause the output shaft 12 of the motor 11 to operate in the proper direction for operating the agitator of the washing machine 10.

After the motor 11 has been started by current flowing through the winding 14 thereof, the current flowing through the winding 13 continues to operate the motor 11 even though the centrifugal switch 25 is subsequently opened by the speed of rotation of the output shaft 12. In particular, current flows from power lead L^1 through line 40, contact 36, switch blade 29, contact 33, line 33', and line 17 through the winding 13 to the line 19 leading to the power lead L^2.

It can be seen that the motor 11 is now operated in a manner to cause movement of the agitator of the washing machine 10 from the time the water level in the washing machine 10 has reached the predetermined level determined by the water level control 73 until the "14" minute increment of movement of the program member 53.

Also, it should be noted that a series of vertical blisters 79C bridge the ports 69 and 70 to interconnect the controlled vacuum in the line 118 with the speed control actuator 120 to cause the transmission means being driven by the motor 11 to operate the agitator at the speed selected by the knob 119.

At the "14" minute increment of movement of the program member 53 relative to the reading head 54, it can be seen in FIGURE 2 that a suitable aperture 80 of the reading sheet 59 comes into alignment with the port 65 of the reading head 54 to permit atmosphere to return to the chamber of the actuator 35 to move the switch blades 27, 28, and 29 back to the position illustrated in FIGURE 1 to turn off the motor 11 and terminate the operation of the agitator.

Also, at the "14" minute increment of movement of the program member 53 relative to the reading head 54, a series of vertical blisters 79D bridge the ports 66 and 67 to interconnect the vacuum pump to the line 111 leading to the port 159 of the valve 140. If the door 129 is disposed in its closed position as illustrated in FIGURE 4, it can be seen that the keeper 131 has pressed the end 138 of the arm 132 to raise the end 139 so that the plunger 141 will be disposed in the position illustrated in FIGURE 8 under the force of the compression spring 169 to fluidly interconnect the port 159 with the ports 160 and 161.

In this manner, the vacuum pump 155 is interconnected to the actuators 50 and 150 to simultaneously actuate the same.

When the actuator 150 is evacuated by means of the valve means 140, the same collapses to pull the end 148 of the latch member 134 toward the bracket 135 and cause the end 147 thereof to move over the keeper 131 of the door 129 to latch the same in its closed position.

When the actuator 50 is evacuated, the same pulls the switch blade 47 to close the contacts 48 and 16 to operate the motor 11 in a manner to spin the washing compartment of the washing machine.

In particular, current now flows from lead L^1, to line 43, contact 48, switch blade 47, contact 16, line 17, contact 31, switch blade 27, contact 23, line 24, capicitor 25', centrifugal switch 25 and starting winding 14, lead 22, contact 21, switch blade 28, contact 32 and line 37 to power lead L^2 to cause the starting winding 14 to operate the shaft 12 in the opposite direction to drive the transmission means which spins the washing compartment, the starting winding 14 having the current therethrough terminated when the centrifugal switch 25 opens due to the speed of rotation of the output shaft 12. However, current now flows through the running winding 13 of the motor 11 by means of lead 17 from power lead L^1 to lead 19 leading to power lead L^2 whereby the motor 11 spins the washing compartment as long as the actuator 50 is evacuated.

Simultaneously, it can be seen that other blisters 79E of the program member 53 are bridging the ports 70 and 71 to interconnect the controlled vacuum in line 124 to the speed actuator 120 to cause the transmission means for the spinning operation to spin the washing compartment at the speed selected by the control knob 125, vacuum being directed to the chamber 122 when the water level control device 73 is in the full line position illustrated in FIGURE 1 caused by the water in the washing machine being pumped out below the predetermined level by a pump driven by the motor 11 when the output shaft 12 thereof rotates in the direction to spin the washing compartment.

If, however, the door 129 is disposed in the open position when the blisters 79D initially bridge the ports 66 and 67, it can be seen that the tension spring 143 has moved the end 139 of the arm 132 downwardly in FIGURE 5 to cause the plunger 141 to place the diaphragm 155 in sealing relationship against the valve seat 165 so the vacuum cannot be interconnected to the chamber 156. Further, when the diaphragm 155 is against the valve seat 165, atmosphere is interconnected to the chamber 156 in the manner previously described so that the actuators 50 and 150 cannot be actuated whereby the motor 11 cannot be energized to spin the washing compartment until the door 129 is disposed in its closed position.

If, however, the door 129 is disposed in its closed position and the motor 11 is operated in the above manner to spin the washing compartment by having the actuator 50 evacuated and someone should force open the door 129 by breaking the latch means 133, it can be seen that the diaphragm 155 will seat against the valve seat 165 to prevent the vacuum source from being interconnected to the actuator 50 and the valve means 140 will interconnect the atmosphere to the actuator 50 so that the same will move to its open position and turn off the motor 11.

Therefore, it can be seen that the washing machine 10 is controlled by the program member 53 in such a manner that the same will provide a cycle of operation as illustrated in FIGURE 2 in the above manner with the actuators 35, 50, and 44 controlling the motor in such a manner that the motor 11 will either operate the agitator or spin the washing compartment of the washing machine 10.

However, during the spinning operation, the door 129 must be disposed in its closed position or the motor 11 will not be operated to spin the washing compartment. Further, when the door is in the closed position and the motor 11 is to be operated to spin the washing compartment, means are provided for latching the door 129 in

its closed position. Further, should the door be forced open during the spining operation, the spinning operation will be terminated by the structure of this invention.

Accordingly, it can be seen that this invention provides an improved control system for a washing machine or the like.

While the form of the invention now preferred has been disclosed as required by the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. In a washing machine or the like having a door for access to a washing compartment and having a motor for spinning said compartment, the improvement comprising pneumatically operated actuating means for causing said motor to spin said compartment when a pneumatic signal is directed to said actuating means, a pneumatic source, passage means for interconnecting said source to said actuating means, and means disposed between said source and said actuating means and being operatively interconnected to said door for closing said passage means from said source if said door is open and for opening said passage means to said source if said door is closed.

2. In a washing machine or the like as set forth in claim **1**, program means for interconnecting said source to said passage means.

3. In a washing machine or the like as set forth in claim **1**, said actuating means closing an electrical switch when said actuating means is interconnected to said source.

4. In a washing machine or the like as set forth in claim **1**, said pneumatic source being a vacuum pump.

5. In a washing machine or the like as set forth in claim **1**, said last-named means interconnecting said actuating means to the atmosphere when said door is open.

6. In a washing machine or the like as set forth in claim **1**, said last-named means comprising a housing having two ports therein separated by a valve seat, one of said ports being interconnected to the part of said passage means leading to said source and the other port being interconnected to the part of said passage means leading to said actuating means, a diaphragm carried by said housing for opening and closing said valve seat, spring means tending to hold said diaphragm away from said valve seat when said door is closed, and a movable plunger carried by said housing and when moved in one direction by the opening of said door causing said diaphragm to close said seat, said plunger and said diaphragm being so constructed and arranged that atmosphere is adapted to be interconnected to said other port when said valve seat is closed and that atmosphere is prevented from being interconnected to said other port when said valve seat is opened.

7. In a washing machine or the like having a door for access to a washing compartment and having a motor for spinning said compartment, the improvement comprising pneumatically operated actuating means for latching said door in the closed position thereof when a pneumatic signal is directed to said actuating means, a pneumatic source, passage means for interconnecting said source to said actuating means, and means disposed between said source and said actuating means and being operatively interconnected to said door for closing said passage means from said source if said door is open and for opening said passage means to said source if said door is closed.

8. In a washing machine or the like as set forth in claim **7**, program means for interconnecting said source to said passage means.

9. In a washing machine or the like as set forth in claim **7**, said actuating means moving a latch member when said actuating means is interconnected to said source.

10. In a washing machine as set forth in claim **7**, said pneumatic source being a vacuum pump.

11. In a washing machine or the like as set forth in claim **7**, said last-named means interconnecting said actuating means to the atmosphere when said door is open.

12. In a washing machine or the like as set forth in claim **7**, said last-named means comprising a housing having two ports therein separated by a valve seat, one of said ports being interconnected to the part of said passage means leading to said source and the other port being interconnected to the part of said passage means leading to actuating means, a diaphragm carried by said housing for opening and closing said valve seat, spring means tending to hold said diaphragm away from said valve seat when said door is closed, and a movable plunger carried by said housing and when moved in one direction by the opening of said door causing said diaphragm to close said seat, said plunger and said diaphragm being so constructed and arranged that the atmosphere is adapted to be interconnected to said other port when said valve seat is closed and that atmosphere is prevented from being interconnected to said other port when said valve seat is opened.

13. In a washing machine or the like having a door for access to a washing compartment and having a motor for spinning said compartment, the improvement comprising a first pneumatically operated actuating means for causing said motor to spin said compartment when a pneumatic signal is directed to said first actuating means, a second pneumatically operated actuating means for latching said door in the closed position thereof when a pneumatic signal is directed to said second actuating means, a pneumatic source, passage means for simultaneously interconnecting said source to said first and second actuating means, and means disposed between said source and said actuating means and being operatively interconnected to said door for closing said passage means from said source if said door is open and for opening said passage means to said source if said door is closed.

14. In a washing machine or the like as set forth in claim **13**, program means for interconnecting said source to said passage means.

15. In a washing machine or the like as set forth in claim **1**, said first actuating means closing an electrical switch when said first actuating means is interconnected to said source, said second actuating means moving a latch member when said second actuating means is interconnected to said source.

16. In a washing machine or the like as set forth in claim **13**, said pneumatic source being a vacuum pump.

17. In a washing machine or the like as set forth in claim **1**, said last-named means interconnecting said first and second actuating means to the atmosphere when said door is opened.

18. In a washing machine or the like as set forth in claim **13**, said last-named means comprising a housing having three ports therein with one port being separated from the other two ports by a valve seat, said one port being interconnected to the part of said passage means leading to said source and the other two ports being respectively interconnected to the parts of said passage means leading to said first and second actuating means, a diaphragm carried by said housing and opening and closing said valve seat, spring means tending to hold said diaphragm away from said valve seat when said door is closed, and a movable plunger carried by said housing and when moved in one direction by the opening of said door causing said diaphragm to close said seat, said plunger and said diaphragm being so constructed and arranged that atmosphere is adapted to be interconnected to said two other ports when said valve seat is closed and that atmosphere is prevented from being interconnected to said two other ports when said valve seat is opened.

19. A valve means comprising a housing having two ports therein separated by a valve seat, a diaphragm carried by said housing for opening and closing said valve seat, said diaphragm having an aperture passing therethrough in offset relation to said valve seat, spring means tending to hold said diaphragm away from said valve seat, and a movable plunger carried by said housing and when moved in one direction causing said diaphragm to close said seat, said plunger and said diaphragm being so con-

structed and arranged that atmosphere is adapted to be interconnected to one of said ports through said diaphragm aperture when said valve seat is closed and that atmosphere is prevented from being interconnected to said one port through said diaphragm aperture when said valve seat is opened.

20. A valve member as set forth in claim **19** wherein said plunger carries a valve member that cooperates with another valve seat of said housing that interconnects the atmosphere to said diaphragm aperture, said valve member of said plunger closing said other valve seat when said

first-named valve seat is opened and opening said other valve seat when said first-named valve seat is closed.

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