April 5, 1960 P. SCHELL ET AL 2,931,200

MACHINE CONTAINED SUDS STORAGE AND RETURN SYSTEM

Filed July 16, 1956 4 Sheets-Sheet 1

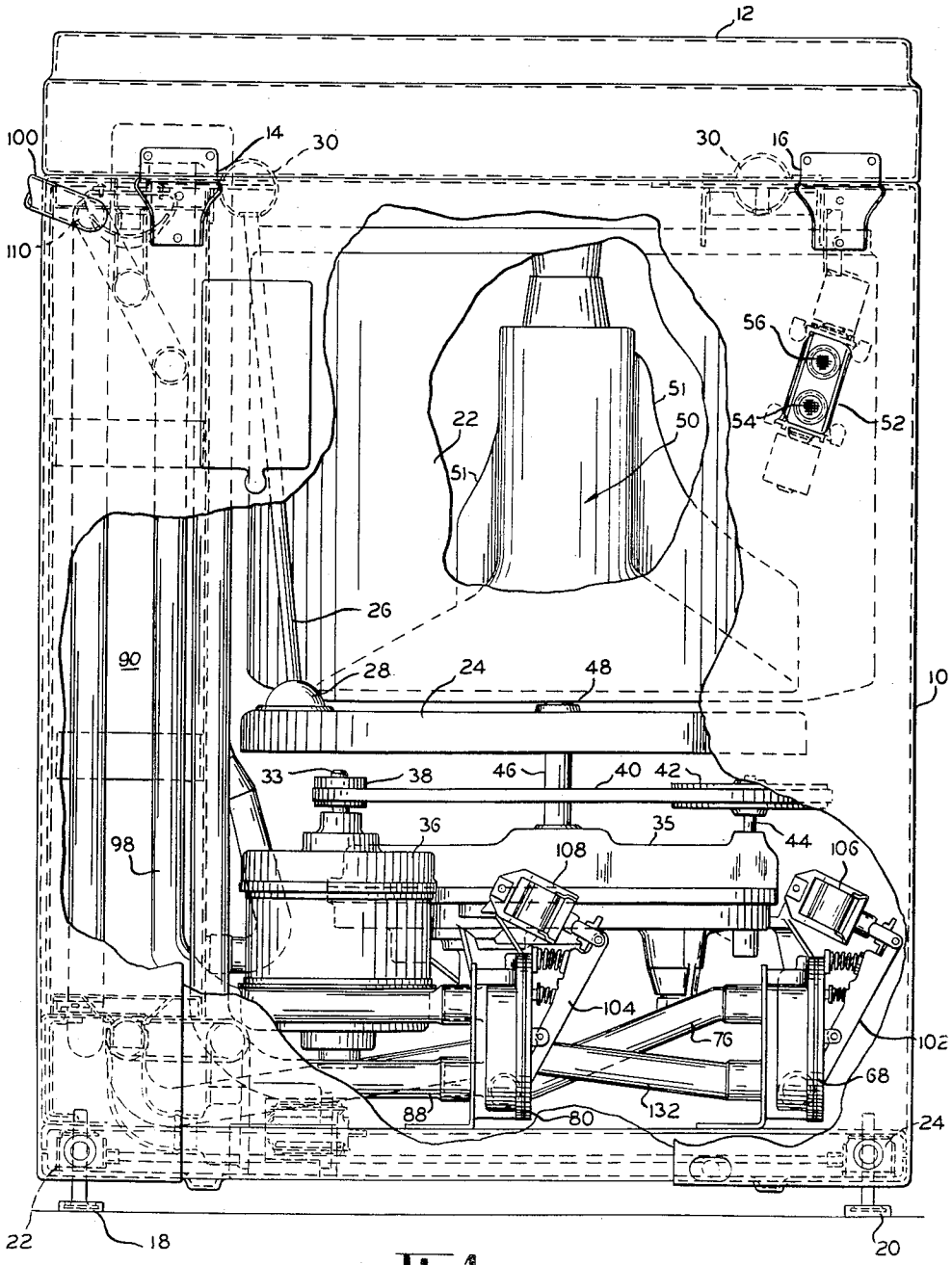


Fig. 1

INVENTORS
PAUL SCHELL
CLIFTON A. COBB
BY ROBERT A. BRENNER
GORDON J. KROLZICK

Kiel, Sherman, Means, Glass & Simpson ATTORNEYS

April 5, 1960 P. SCHELL ET AL 2,931,200

MACHINE CONTAINED SUDS STORAGE AND RETURN SYSTEM

Filed July 16, 1956

4 Sheets-Sheet 2

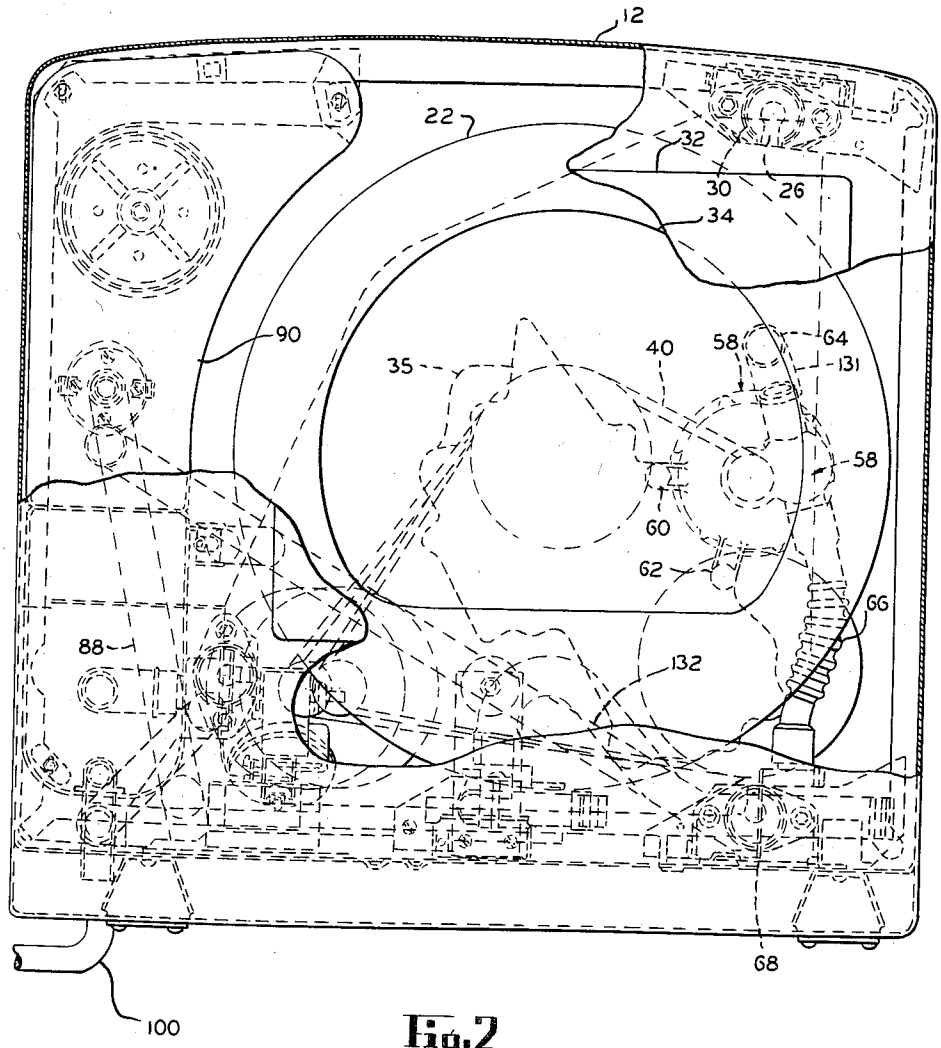


Fig. 2

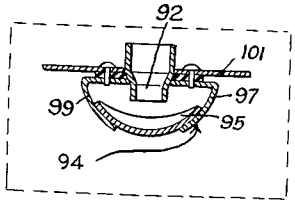


Fig. 7

INVENTORS
PAUL SCHELL
CLIFTON A. COBB
BY ROBERT A. BRENNER
GORDON J. KROLZICK

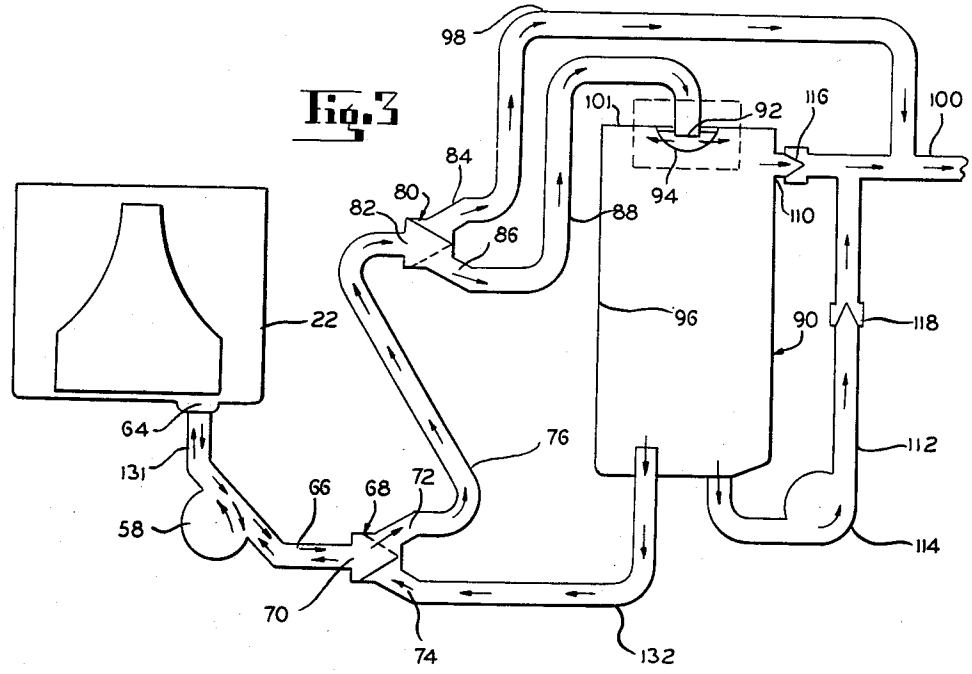
Neil, Sherman, Munn, Cates & Singleton
ATTORNEYS

April 5, 1960 P. SCHELL ET AL 2,931,200

MACHINE CONTAINED SUDS STORAGE AND RETURN SYSTEM

Filed July 16, 1956 4 Sheets-Sheet 3

Fig. 3



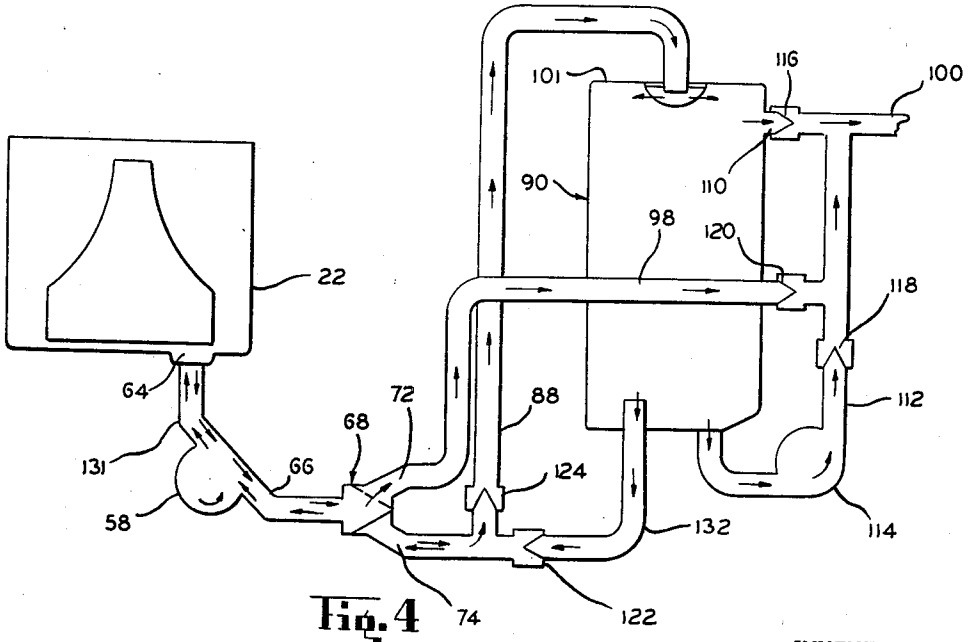


Fig. 4

INVENTORS
PAUL SCHELL
CLIFTON A. COBB
BY ROBERT A. BRENNER
GORDON J. KROLZICK

Hill, Sherman, Meroni, Gross & Simpson
ATTORNEYS

April 5, 1960 P. SCHELL ET AL 2,931,200

MACHINE CONTAINED SUDS STORAGE AND RETURN SYSTEM

Filed July 16, 1956 4 Sheets-Sheet 4

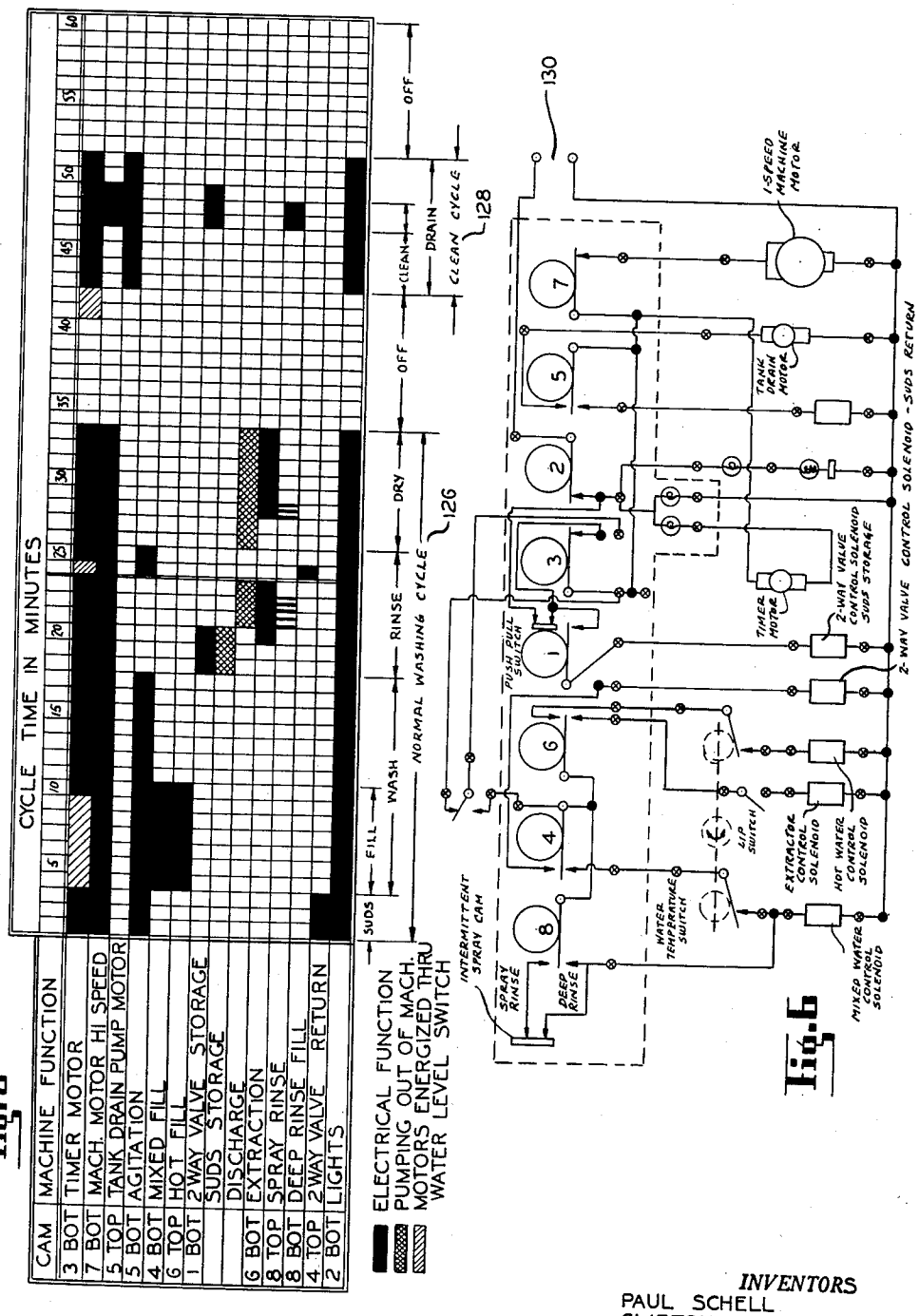


Fig. 5

Fig. 6

INVENTORS
PAUL SCHELL
CLIFTON A. COBB
BY ROBERT A. BRENNER
GORDON J. KROLZICK

Lee, Sherman, Meroni, Gress & Simpson
ATTORNEYS

United States Patent Office 2,931,200 Patented Apr. 5, 1960

2,931,200

MACHINE CONTAINED SUDS STORAGE AND RETURN SYSTEM

Paul Schell, Clifton A. Cobb, and Robert A. Brenner, all of St. Joseph, and Gordon J. Krolzick, Benton Harbor, Mich., assignors to Whirlpool Corporation, a corporation of Delaware

Application July 16, 1956, Serial No. 598,039

17 Claims. (Cl. 68—12)

This invention relates to improvements in systems for draining the fluid and for storing and returning or discarding the sudsy water from an automatic clothes washing, rinsing and extracting machine.

Automatic home laundry machines for washing, rinsing and drying clothes in a series of sequential operations, as determined by cyclic control means, have heretofore been provided with automatic pumping systems to remove the sudsy wash water and the rinse water from the clothes container or tub, and pump the sudsy water to a storage container during the extracting and rinsing operations, and to return the sudsy water to the clothes container for use in a succeeding washing operation. At the end of the multiple washing cycle when the machine is no longer to be used, the sudsy water is discarded. The rinse water is usually discarded after it has been used to rinse the clothes. To discard the rinse water and the sudsy wash water at the end of the machine operation they are usually piped to a drain.

The sudsy wash water, however, may be stored during the rinsing and drying operations of the machine in a separate sink or may be stored in a specially provided storage tank which may be contained within the washing machine cabinet. The separately provided suds tank within the washing machine cabinet creates certain problems, for the sudsy water is frequently soiled and the suds and soil will adhere within the storage tank walls when sudsy water is drained from the tank to be discarded. When the washer is again used at a later date, the material adhering to the walls of the storage tank may contaminate the new water which is to be stored during the washing cycle. Furthermore, the materials which stick to the walls of the tank between washing operations may build up on the walls and have a corrosive effect.

Further difficulties are encountered in the design of an automatic system for completely controlling the location and flow of the rinse water and of the soapy water, either to cause them to flow to storage, to discharge, or to return to the machine, in that a large number of valves, pipes, and pumps have usually been required to obtain the proper control and to obtain the flexibility required.

It is accordingly an object of the present invention to provide an improved and simplified drain mechanism for an automatic washing machine of the home laundry type which is capable of emptying the wash water from the tub, discharging the rinse water from the tub to a drain, storing the sudsy wash water between washing operations, returning the sudsy water to the washing machine for a succeeding washing operation, and discharging the soapy water to the drain either from the storage tank or directly from the washing machine.

It is another important object of the present invention to provide a system whereby the suds storage tank is automatically cleaned at the end of each washing operation, so as to remove all traces of suds and film which may adhere to the walls and may remain at the bottom of the suds storage tank.

It is another object of the invention to provide a simplified pumping and valving arrangement to achieve the desired flexibility and control of the rinse water and the wash water as they are discharged, stored, or returned to the washing machine.

Another object of this invention is to provide an automatic washing machine with a self contained suds storage tank in which a single drain discharge line is provided which may be lead to a household sink drain thereby obviating the maze of pipes which is frequently necessary to obtain the proper operation with a suds storage tank arrangement.

Another object of the invention is to provide a self-contained suds storage tank which has an overflow arrangement to prevent back flow into the machine or the spillage of water into the machine operating parts when too much suds water is placed in the storage tank.

A more specific object of the invention is to provide a drain system for an automatic washing machine which is provided with a suds storage tank in which a system of check valves are used so that only one power operated control valve is necessary to control the flow of water to the suds storage tank or to the drain, or to return the suds to the washing machine.

A still further object of the invention is to provide an automatic time cycle control system in which the elements are operated so that the rinse water supply for the machine will supply water for cleansing the suds storage tank.

Another object of the invention is to provide an automatic time cycle control switching arrangement which is provided with two separate cycles which may be selectively operated so that the washer can be sent through one or more of the usual washing cycles and at the end of the washing cycles the operator can selectively choose to start another washing cycle or a new rinsing cycle, wherein the water is drained from the suds storage tank and the suds storage tank is automatically rinsed of the remaining film and suds.

Other objects and advantages of the invention will be more apparent in the following specification taken in connection with the appended drawings in which:

Figure 1 is an elevational view of the washer taken from the rear of the cabinet with portions thereof broken away to illustrate the interior construction of the related parts;

Figure 2 is a plan view of the machine of Figure 1 with portions of the cabinet broken away to illustrate the interior operating parts and with certain portions being shown in dotted lines where they are hidden by the cabinet or by other structure;

Figure 3 is a schematic view of the automatic drain system of the washer illustrating the connection between the pumps, control valves, and lines which direct the flow of water from the washer;

Figure 4 is another schematic drawing similar to Figure 3 but illustrating an alternative embodiment of the invention;

Figure 5 is a chart illustrating the operation of the various functional elements of the machine as controlled by the automatic time switch mechanism;

Figure 6 is a schematic view of the circuit diagram that is used with the machine; and

Figure 7 is a vertical sectional view in detail of the deflector for washing the suds tank.

In the drawings which illustrate the preferred embodiments of the machine, the operating parts are shown housed in a cabinet **10** which is rectangular in construction and is provided with a top **12** which is hingedly connected to the body of the cabinet by the hinges **14** and **16**. With the aid of these hinges the top **12** may be pivoted upwardly for purposes of obtaining access to the

interior of the machine for adjustment or repair of the operating parts therein.

The base of the machine is provided with feet, as shown at 18 and 20, which are adjustable in height to permit leveling of the machine. For this purpose, the feet are secured into fittings, shown at 22 and 24, which are suitably secured within the base of the cabinet 10. Since Figure 1 is an elevational view, only two of the feet 18 and 20 are shown, but it will be understood that there are two additional feet on the other corners of the machine so that the machine is supported on four feet quadrilaterally arranged.

Within the cabinet 10 is mounted a tub or liquid container 22 which contains the clothes and the liquid during the washing, rinsing and drying or extracting cycles of the machine.

The tub 22 is shown being carried on a floating base 24 suspended from the top of the cabinet on suspension links 26 encased in rubber at their ends and carried in sockets 28 in the base 24, and in similar sockets 30 in the upper part of the cabinet 10 for damping the oscillating movements of the tub and base during operation.

Viewing Figure 2, it will be seen that an access door 32 is provided to close a generally circular opening 34 in the top 12 of the cabinet. The door 32 is hinged along one edge to the cabinet top 12 and will pivot open to obtain access to the interior of the tub 22 for placing or removing clothes from the tub 22.

Suspended from the base 24 on suitable hangers, which are not shown, is a motor 36 and a gear casing 35. It should be mentioned at this time that elements of construction such as the hangers for supporting the motor and gear case are not shown or described in detail since they form no part of the invention. Since the invention relates primarily to the automatic liquid drainage and control system, the system may be used with automatic washing equipment of various types, and the present type is being shown by way of illustration only and not by way of limitation.

The shaft 33 of the motor 36 carries a drive pulley 38, which drives a belt 40 passing over a pulley 42 secured on a shaft 44 leading down into the gear casing 35. The gear casing contains a suitable speed reduction gear arrangement and mechanism for obtaining an oscillation of the output shaft 46 which leads up into the base 24 to connect to the agitator shaft 48. The agitator shaft 48 leads upwardly through a suitable water seal into the interior of the tub 22 and connects within the tub to drive the agitator 50. The agitator is designed with fins 51, 51 as shown, to obtain a suitable agitation of the water therein for the washing operation.

Also contained within the tub 22 is a suitable basket (not shown) for containing the clothes during the washing, rinsing and extracting operation. The basket is perforated to admit the water which is contained in the tub or container 22 and during the rinsing, and during the drying operation the basket may be spun at various speeds to centrifugally extract the water from the clothes and to cause it to pass into the tub where it is drained away.

For purposes of supplying water to the tub for the wasing and rinsing operations a suitable connection 52 is provided on the back of the cabinet with pipes or hoses leading into the tub 22 from connectors 54 and 56 which lead to a suitable supply of clean water with one of the connectors 54 being connected to hot water and the other connector 56 being connected to cold water.

In accordance with standard operation of automatic washing, rinsing and drying machines, a mixture of hot and cold water, or hot or cold water alone, are admitted to the tub 22 for the washing operation. The mixture of water that is admitted is controlled by a manual water temperature control which is positioned usually on the front of the machine or in some location where it can be reached by the operator in order that he may set the temperature in accordance with the temperature desired for the individual washing operation. The connections 54 and 56 supplying the clean water to the tub also supply water during the rinsing operation and either a hot, cold, or warm rinse is supplied to the machine as is usually determined by the automatic controls which operate the machine in its predetermined cycle.

In accordance with the present invention this clean rinse water supply will be utilized in a separate cycle of of operation for cleansing the suds storage tank and thus, the supply lines, fittings and controls which are already present in the machine to supply the rinse water are utilized for supplying cleansing water for the suds storage tank. The operation of the mechanism for cleansing the suds storage tank will be later described.

It will be recognized that the type of fittings and valves used for mixing the hot and cold water and supplying the rinse water are not important to the present invention and therefore are not included in detail to unnecessarily burden the description.

The general structure of the automatic washing, rinsing and drying machine now having been described, a description of the mechanism for controlling the drainage of the wash and rinse water from the machine and the return of the sudsy water, will be given. Connected to the base of the tub 22 is a washer pump 58, as shown in position on the machine in Figure 2 and as shown diagrammatically in Figures 3 and 4. The washer pump is suitably bolted to the gear case 35, such as by bolts 60 and 62, and a tub outlet port 64 leads to tub outlet line 131 hence to the washer pump 58. This outlet port the tub leading to the pump 58 which is also shown dia- 64 is shown in Figure 2 as an opening in the bottom of grammatically in Figure 3.

Leading from the pump 58 is a continuation or extension 66 of the washer outlet line, and this extension connects to a suds return valve 68, the valve being shown in Figures 1, 2 and 3. The valve 68 is also illustrated in the alternate embodiment of Figure 4.

As illustrated in Figure 2, the extension 66 of the washer outlet line is flexible so that it may withstand vibrations of the washer tub during operation, and the pump 58 is firmly suspended from the washer tub while the suds return valve 68 is fixedly secured to the base of the washer cabinet so that there is relative movement between the pump and the valve. The washer outlet extension 66 may be a hose having an extensible or accordian type construction, as is shown on Figure 2, or may be any similar suitable type. It will be understood that throughout the description many of the lines provided for conducting fluid may be formed of hose, pipe, or other types of conduit, but they will generally be referred to as lines as a generic term.

Although the embodiments of Figure 3 and 4 are similar up to this point, the construction varies in the alternate embodiment in the arrangement of the lines for delivering the rinse water to the drain, and for delivering the suds to the suds storage tank. The preferred embodiment of Figure 3, which is also shown in 1 and 2, will be first described. The details of the arrangement of the valves are shown in Figure 3 and their general location with respect to the machine is shown in Figures 1 and 2. The suds return valve 68 is illustrated diagrammatically in Figure 3 as having an entrance port 70 which directs the fluid through the valve through either a first outlet port 72 or a second outlet port 74. The valve 68 is bi-directional and is of the type generally known to the trade as a two way valve which is capable of connecting a first port alternately to either a second or a third port.

When the fluid is being pumped out of the washer container or tub 22, as indicated by the arrows pointing away from the tub, the fluid passes through the valve 68 and through the valve outlet port 72 into a washer discharge line 76. This line and this position of the valve are generally used for discharging the rinse water from the washer tub, but the line is also used for directing the

flow of soapy water up to the suds storage tank or to the drain if the operator does not desire to save the soapy water for a succeeding operation. Thus, in the embodiment of Figure 3, all water discharging from the tank passes up through the washer discharge line **76** and its disposition is determined by the position of the suds storage valve **80**.

The suds storage valve **80** is provided with an inlet port **82** which can be alternately connected to a first outlet port **84** or a second outlet port **86**. The outlet port **86** is connected to a suds storage line **88**, and this suds storage line curves to lead downwardly into the top of the suds storage tank **90**. Directly below the opening **92** of the suds inlet storage line is a fluid deflector **94**. This deflector, as also shown in detail in Figure 7, has a cup shaped baffle **95** with a semispherical concave face facing upwardly to receive the water coming from the suds storage line **88**, and to deflect the water outwardly against the wall **96** of the suds storage tank. The baffle **95** is suspended on brackets **97** and **99**, which are secured to the top **101** of the storage tank. This deflector aids in the suds tank washdown operation when clean water is pumped into the suds storage tank to remove the suds which adhere to the walls of the tank, and this full operation will be explained later.

Returning now to the second suds storage valve, as is shown at **80**, if the fluid coming from the washer and pressing up the washer discharge line **76** is to be directed to drain rather than to the suds storage tank, the valve will be positioned so that the port **86** will be closed and the port **84** will be open. Port **84** connects to a rinse line **98** which is so designated because it primarily functions to channel the rinse water to the drain. The line, however, may be used to conduct soapy water to the drain if the operator does not desire to store the soapy water in the suds storage tank. The rinse line connects at a junction to the drain line **100**, which leads off to a suitable drain, and this line may be comprised of a flexible hose or the like that the operator may drop into a sink. The drain line which is illustrated in Figure 1, extends out from the back of the washer cabinet **10** to lead to the suitable drain.

It will thus be seen that as the fluid is pumped from the tank, whether it be rinse water or hot soapy water, and passed through the suds return valve **68**, which is set to direct it through the washer discharge line **76**, the suds storage valve **80** either directs the fluid to the suds storage tank **90** through the suds storage line **88**, or directs the fluid through the rinse line **98** where it enters the drain line **100** to be discharged. If the fluid is hot soapy water and it can be directed to the storage tank, it will remain therein until the washer completes the rest of its cycle of operation and passes through the rinsing and drying cycles. Rinse water can, in the meantime, be directed out through the drain **100**. After the cycle is completed the hot sudsy water will be pumped back to the washer for a succeeding washing operation.

To accomplish this purpose, the suds return valve **68** is set to a position so that the outlet port **74** will communicate with the inlet port **70**, and when the washer pump **58** is operated in its reverse direction the suds will be returned to the washer, as indicated by the arrows which flow in the direction of the washer.

As illustrated in Figure 1, the suds return valve **68** and the suds storage valve **80** are of conventional type being enclosed in a housing and being operated by a control rocker arm with the rocker arm for the valve **68** being shown at **102**, and the rocker arm for valve **80** being shown at **104**. The rocker arms are pivoted to the valve housing, as is illustrated, and are controlled by electrically operated solenoids. Solenoid **106** controls the position of valve **68**, and solenoid **108** controls the position of valve **80**. Thus, during operation, with the machine being controlled by the cyclic time switch, the valves are operated at their proper time and move to their proper position in cooperation with the operation of the bidirectional washer pump **58** to pump the fluid from the washer to the proper location.

During the time the suds are being pumped to the suds storage tank at the end of the washing operation, the tank fills to a point where it reaches an over-flow line **110**. This over-flow line connects near the top of the suds storage tank and when the suds water reaches the level of the overflow line, it begins to flow out of the storage tank. This prevents any of the suds from backing up through the suds storage line as they are pumped into the tank if the tank fills due to the fact that there is too much fluid in the washer container **22**. This over-flow line may also function to intentially discharge a portion of the hot sudsy water by designing the storage tank and the position of the over-flow line so that it will hold only a portion of the sudsy water which is in the washer tub. With this design, for each washing operation, some of the hot sudsy water will be discharged and any cooling of the suds during the storage period can be compensated for by mixing additional hot water when the sudsy water is pumped back to the washer tank. The over-flow line **110** also connects to the drain so that no attention need be given to it, and whenever the suds storage tank overflows the water will automatically the directed to the drain line **100**.

At the end of the number of washing cycles, and when the operator is finished washing the batches of clothing, it will be desirable to discharge the suds from the suds storage tank. It is, of course, possible for the operator to set the suds storage valve **80** in the position so that the suds, when they are being first discharged from the washer, will be directed out through the rinse line **98** and through the drain **100**.

However, in the normal cycle of operations at the end of each washing operation the suds will be pumped into the suds storage tank and remain there until the housewife has completed the rinsing and extracting of a batch of clothes. At the end of the last batch, it is desirable to discharge the suds from the suds storage tank to the drain. The soapy fluid is drained from the storage tank through a suds discharge line **112** which leads from the bottom of the suds storage tank **90** to connect to the drain line **100**. It will be noted that while the suds return line, which also connects to the bottom of the suds storage tank **90** leads upwardly a short distance within the tank, the suds discharge line **112** connects directly to the bottom of the tank. This is so that the residue and silt which are carried from the washer and which settle at the bottom of the suds storage tank will remain at the bottom of the suds storage tank, and will not be carried back into the washer along the suds return line **132**, but they will be drained out through the suds discharge line **112**. For forcing the water from the suds storage tank and carrying it out to suds discharge line, a suds drain pump **114** (Figures 3 and 4) is provided. This pump is unidirectional and is preferably operated by a motor separate from that of the bi-directional washer pump **58**.

To prevent the suds, which pass upwardly through the suds discharge line, from entering the top of the suds storage tank through the over-flow line an over-flow check valve **116** is provided. This check valve permits flow only in the direction indicated by the arrows passing through the over-flow line **110** and prevents flow in the opposite direction.

A check valve **118** is also provided in the suds discharge line **112** to prevent the rinse liquid passing out through the rinse line **98** from running into the suds discharge line **112** into the suds storage tank. It will be recognized that this check valve **118** could be placed in the suds discharge line **112** below the over-flow check valve **110** or any place along the discharge line.

Thus, the common drain is used for all three of the liquid lines, the rinse line **98**, the over-flow line **110** and the suds discharge line **112**, and with the proper place-

ment of check valves the liquid which is pumped through these lines must be forced outwardly through the drain. An additional check valve could be placed in the rinse line, but with the suds storage valve 80 this will prevent back flow of liquid through the rinse line.

In the alternate embodiment of Figure 4 the suds storage tank 90 is provided with four lines connected thereto similar to Figure 3, but the arrangement of fluid conducting lines have been changed in order to be able to omit the suds storage valve 80. This solenoid operated valve 80 may be omitted by the correct placement of check valves, as will be seen and described in connection with Figure 4. As the liquid flows out of the washer outlet pipe 64 carried by the bi-directional washer pump 58 and through the extension of the washer outlet pipe 66 and subsequently through the suds return valve 68, it passes through the outlet port 72 of the valve 68. Valve 68 is again arranged so that water flowing away from the tub, in the direction indicated by the arrows, will flow through the outlet port 72.

As the fluid leaves the washer and passes through the outlet port 72 of the valve 68, passes up through a rinse line 98 which has no suds storage valve, as is the case in Figure 3, but which connects directly through the drain line 100. In this instance, a return check valve 120 is placed in the rinse line so that water entering the drain line from either the over-flow line 110 or the suds discharge line 112 will not back up into the rinse line 98.

The suds discharge line 112 is again provided with a suds discharge check valve 118, although with the connections as shown, the discharge check valve is placed lower in the line. It should be borne in mind that the connections between the three pipes, the rinse line 98, the over-flow line 110 and the suds discharge line 112, which connect to the common drain 100 may lead into each other to flow to the drain or be connected together in whatever arrangement is most convenient. In each instance, however, the check valve should be placed between the point where the fluid enters the line and the drain or the point where it connects to another line so the fluid will not back up into the source.

Continuing with Figure 4, the over-flow line 110 is again provided with a check valve 116. The arrangement is similar to that of Figure 3 with the exception that the suds storage valve 80 has been omitted and the rinse check valve 120 has been added.

In order to provide for the proper flow of suds into the storage tank when the suds storage valve has been omitted, the discharge of suds is sent out through the suds return valve 68 through the port 74, instead of 72 as was the case of Figure 3. The suds storage line 88, in this case, is connected to the suds return line 132 instead of being connected to the suds storage valve 80 as was the case of Figure 3. In order to prevent the suds from passing into the bottom of the storage tank as they are flowing from the washing machine towards the storage tank, and to insure that they will be channeled through the suds storage line 88, a suds return check valve 122 is provided in the line 132. This permits the fluid to flow only from the said storage line toward the washing machine and prevents flow in the opposite direction. In order to seal the storage line 88 and prevent it from drawing air when fluid is being sucked from the bottom of the suds storage tank into the washer by the bi-directional washer pump 58, a suds storage check valve 124 is provided in the suds storage line 88, and is positioned between the suds storage tank and the point of connection of the suds storage line 88 to the suds return line 132.

It may first appear that it would make no difference in the delivery of suds to the suds storage tank whether they passed through the suds return line 132 or passed through the suds storage line 88. Heretofore, it has been the practice in some designs to use only a single line for the pumping of suds to the suds storage tank and the return of the suds to the washing machine. In the present invention, however, there is a specific reason for the provision of an additional line, and this reason is concerned with the operation of washing down or rinsing the inside of the suds storage tank at the end of the washing operations.

When the operator has performed a number of cycles of washing, rinsing and drying operations and has pumped the suds from the suds storage tank, a certain amount of suds and film will adhere to the tank wall and will settle in the bottom of the tank. This film, if left in the tank for sometime, may have a corrosive action and may have a chemical deterioration so as to contaminate the water placed in the tank when the machine is again used at some later date.

In order to wash the suds storage tank completely clean as is desirable when a closed suds storage tank is used, such as that shown in Figures 1 and 2 which is enclosed within the cabinet of the machine, a separate wash down cycle is provided. This wash down cycle utilizes fresh water discharged into the washer container and forcibly pumps the water into the suds storage tank deflecting it against the walls of the tank to wash the residue therefrom. The water is immediately removed from the bottom of the tank in its agitated state so that any of the suds or silt which are in suspension will remain in suspension and be pumped from the said storage tank with the fluid and be discharged into the drain.

Thus, the wash down cycle of operation for cleaning the suds storage tank is similar to the operation for pumping sudsy water into the tank with the exception that clean water is used and with the exception that the suds drain pump is operated to remove the clean water from the suds storage tank. The operation of this wash down cycle will be best understood in connection with the time switch control cycling device that will be described in connection with Figures 5 and 6.

The chart which is shown in Figure 5 should be studied in connection with Figure 6 which illustrates the circuit diagram of the machine. It is to be specifically noted that the over-all cycle of operations which is represented by Figure 5 is divided into two separate and distinct cycles, the first being the normal washing cycle, as is shown by the caption 126, and the other being the wash down cycle for the suds storage tank, as shown by the caption "clean cycle" at 128. These cycles are separated by "off" areas, and in the design of the machine, it will be preferably fitted with a control knob which is not shown in detail, which has these areas marked off so that the operator can manually turn to any of the operations within the cycle, and can selectively choose either of the cycles, i.e., the normal washing cycle, or the clean cycle. In standard operation, the operator will go through a number of normal washing cycles, and at the end of the total operation will go through the clean cycle to clean out the suds storage tank and leave it in a cleansed and sanitary condition for the next washing operation which may take place some days later.

The standard washing cycle or a normal washing cycle and its details are not part of this invention and, therefore, may need be described only briefly.

The chart in Figure 5 is substantially self explanatory with the top row of the chart indicating the minutes required for the cycle time, and the total chart being laid out for 60 minutes. The time of operation and of the individual functions, however, are by way of illustration only and are not limiting. The functions of the machine are obtained through the rotation of a control cam shaft carrying cams which are positioned to sequentially operate the control switches.

In operation, electricity is supplied from the line through the terminals shown at 130, as shown in the

circuit diagram of Figure 6, and operation of the machine is begun by turning the hand switch which may be in the form of a control knob connected to the shaft carrying the cams. The cams are numbered 1–8 and are positioned to operate the switches. When the main control knob is rotated slightly to the "on" position the timer motor is started, and this motor is labeled in the circuit diagram, and need not be referred to by number. This circuit diagram of Figure 6 is labeled to indicate the most pertinent elements, but also shows certain auxiliary elements which perform no important function with respect to this invention and therefore will not be referred to. As will be seen by reference to the chart in Figure 5, the first column indicates the cam and the particular switch of the cam that is closed. For example, as listed under "Machine Function," by referring to the column marked "Cam," it will be seen that the label "3 Bot" is found. This means that cam No. 3 moves the movable contact against the bottom contact, as shown in the circuit diagram in Figure 6 and the timer motor begins. By way of illustration as we move down the column under machine function, we note that the third item is "Tank Drain Pump Motor," and that under the "Cam" column opposite this caption is the indication "5 Top." This means that cam No. 5 will move the movable switch against the top contact, and it will be seen that from the circuit diagram cam No. 5 has a movable switch which is movable against a lower or upper contact.

Thus, moving briefly through the normal washing cycle starting from "zero" time and ending at 33 minutes time, it will be seen from the first item on the chart that the timer motor runs for the complete time cycle by the cam 3 pushing the movable contact against the bottom stationary contact. The second item indicates that the machine motor which operates at high speed will also be operated throughout the cycle by the cam 7 pushing the movable contact against the stationary contact 7 at the bottom. Agitation of the water within the tub 22 of the washer by movement of the agitator 50 begins at the beginning of the operation, as does the operation of the two way valve which operates the suds return. At this point the bi-directional pump 58 will operate to pump the suds back into the washer from the previous washing operation from the storage tank, and the valve 68 will be positioned to connect the suds return line 132 to the washer outlet line 131 by way of its extension 66. When the suds have been exhausted from the suds storage tank, the hot fill or mixed fill operation begins to complete the filling of the tank. This is caused by the cams 4 and 5 pushing their contacts to engage the bottom stationary contacts. The agitation continues over the period of time until substantially 18 minutes have elapsed at which time the suds are pumped from the water container by cam 1 pushing its movable contact to the bottom. The items "Suds Storage" and "Discharge," which appear below the words "Two Way Valve (Suds Storage)" indicate mechanical functions and are not shown in connection with the circuit drawing of Figure 6.

At the end of the "Suds Storage" operation, as indicated on the chart, the "Extraction" process begins with cam 6 pushing its movable contact to the bottom to engage the stationary contact. For a short portion of the extraction process the suds go to the suds storage tank and then the two way valve is deenergized and the suds and liquid that is extracted from the clothes are directed up through the washer discharge line to the rinse line to pass out through the drain. During the rinse process, a "Spray Rinse" action occurs with the cam 8 bottoming its movable contact. Following this is a "Deep Rinse Fill" with cam 8 operating its switch against the bottom contact. The agitator is operated concurrently when cam 5 operates its switch against its bottom contact. At the end of this agitation period, the discharge pump again operates to discharge the deep rinse water out through the rinse line 98 to the drain. Subsequently, the extraction process again occurs and this is accompanied at the beginning by a spray rinse. During the extraction, the fluid is again forced out through the rinse line by the washer pump 58, and this continues to the end of the cycle, when at 34 minutes, as indicated by the time chart which shows this as an example time, the machine will automatically shut itself off to complete the normal washing cycle.

At the bottom of the chart, it will be noted that the chart is divided into general areas of operation with dimension lines indicating the areas, the first being the suds area for the return of the suds from the storage tank, the next being the fill area which overlaps the wash area, and at the end of the wash area, the rinse area occurs being terminated at the beginning of the dry area.

Following these operations, the operator may again turn the control switch to run through another normal washing cycle. If, however, there are no more clothes to be washed, the machine should then be operated to clean out the suds storage tank. To accomplish this, the operator turns the control switch so that the time cycling switch, as operated by the timer motor, cycles the machine through the "Clean Cycle." The timer motor will operate throughout this clean cycle, as indicated on the chart. The clean cycle is set between the times of 42 minutes and 51 minutes extending over a period of 9 minutes by way of example only. As soon as the clean cycle begins, the tank drain pump motor, which is shown at 114, Figure 3, operates. This will remove the sudsy water from the suds storage tank and direct it to the drain 100. At the end of a 4 minute period, the "Mach Motor Hi Speed" begins operating in order to operate the washer pump 58, which is then operated in a forward direction to deliver suds from the washer container. At the same time, the two way valve 68 is operated in cooperation with the two way valve 80 to direct the flow of fluid into the suds storage tank. Also at the same time, the spray rinse is operated to deliver the clean water to the washer tub. This clean water is, of course, immediately pumped out of the tub through the washer pump 58, and is forced upwardly into the top of the storage tank to be deflected by the deflector 94 against the side walls of the suds storage tank. The spray rinse is a limited flow of clean water and therefore, the water directed against the walls of the storage tank will be in a limited amount but in sufficient quantity to wash down the remaining suds which adhere to the wall. The suds drain pump 114 continues to operate through this period, so that as the water rinses the suds and scum from the side of the suds storage tank and has the material in suspension at the bottom of the tank it will be immediately removed from the tank so as not to permit the impurities to settle out.

The operation of spraying clean rinse water into the tub to be pumped out of the tub by the washer pump 58 and be forced against the walls of the storage tank with the concurrent operation of the suds drain pump continues for a period of several minutes, and, for purposes of illustration, the machine motor and consequently the washer pump operate for 3 minutes during which time the two way suds storage and suds return valves 80 and 68 are energized. The spray rinse lasts for a period of only 2 minutes and the remaining minute is used by the pump to remove the residual rinse water from the tub. The suds drain pump is kept running for an additional 2 minutes until the water will run down off the walls of the suds storage tank to remove as much water therefrom as possible. At the end of these operations the cleaning cycle has been completed, and the washing machine has automatically turned itself off to be in condition to rest for substantial periods of time until it is again used as a washer.

As a summary of operation, the washer is put through its standard cycle of washing, rinsing, and drying opera-

tions, and the sudsy soapy water is pumped into the suds storage tank between each operation.

The structure requires a total of four lines to be connected to the suds storage tank, and the lines are connected to each other to a single drain and to lead the washer without intereference or without back flow or mixing of the water due to the proper placement of two way directional valves and check valves. If the suds are returned to the washer for a succeeding washing operation, the suds return valve **68** is positioned to permit the fluid to pass through the bi-directional washer pump into the washer. When the suds are to be directed to the suds storage tank after the washing operation, the two way valve **68** is controlled to direct the suds through the washer discharge line **76**, through the suds storage valve **80**, and through the suds storage line **88** into the suds storage tank.

During the rinsing cycle and while the suds are being stored in the suds storage tank, the suds storage valve **80** is set so that the water will pass out through the rinse line to the drain. If too much sudsy water is placed in the suds storage tank, it will pass out through the over-flow line **110**, and water from the drain is prevented from backing into the over-flow line by the over-flow check valve **116**.

In the alternative embodiment of Figure 4, the suds storage valve **80** is omitted, and a check valve **120** is placed in the rinse line **98**. Also a check valve **122** is placed in the suds return line **132** and the suds for storage are directed through the other side of the valve **68** when being pumped to the suds storage tank. A check valve **124** is placed in the suds storage line to prevent air from entering the suds return line when the bi-directional pump is employed to return suds to the washing machine.

When the operator has finished washing the number of batches desired, she cleans the operating tank by turning the control switch to the clean cycle. This operates the washer pump, as shown in Figure 3, to force the fluid down past the suds return valve **68**, into the washer discharge line **76**, past the suds storage valve **80**, through the suds storage line **88** and into the suds storage tank **90**. Clean water is used, and in the preferred embodiment, the standard rinsing operation is performed to supply clean water to the washer, the water being passed out of the washer container through the washer outlet line. As the clean water enters the suds storage tank, it strikes the deflector **94** to be deflected against the walls **96** of the suds storage tank to wash down the walls and run to the bottom of the tank.

The suds drain pump **114** is kept running during the cleaning operation, and passes the clean water containing the suds up out through the suds discharge line **112** through the drain **100**.

Thus, it will be seen that we have provided an automatic drainage system for a washer which meets the objectives hereinbefore set forth, and which is simple and economical in construction so as to be inexpensive to manufacture, easy to assemble, and be easily contained within the limited space of a washer storage cabinet which also must contain a suds storage tank.

The separate cleaning cycle of operation utilizes the operating elements required for the standard washing and suds storage cycle, and requires little additional expense to provide and yet performs an important function which makes the use of a washer with a combined suds storage tank in the same cabinet practical.

We have, in the drawings and specification, presented a detailed disclosure of the preferred embodiments of our invention, but it is to be understood that we do not intend to limit the invention to the specific form disclosed, but intend to cover all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by our invention.

We claim as our invention:

1. A drain mechanism for an automatic washing machine having a container for fluid for washing and rinsing clothes and being provided with a tank for the storage of suds between washing operations, the mechanism comprising a container outlet pipe leading from the container, a two-way flow directing valve connected to the container outlet pipe and having a first outlet port connected to the suds storage tank near the top thereof and a second outlet port connected to a drain, an outlet pump connected to said container outlet pipe for forcing fluid to the storage tank or to the drain depending upon the position of said control valve, a fresh fluid inlet valve leading to the container for supplying, rinsing and washing water thereto, and an automatic time switch for controlling the sequence of operation of the mechanism and having additional clean cycle means operative to simultaneously operate said two-way flow directing valve and fresh fluid inlet valve to direct the fresh water into the suds tank and to operate the washer pump to forcibly drive a stream of fresh water into the suds storage tank, and baffle means at said port to deflect the stream of water against the walls to wash the suds from the walls of the storage tank.

2. An automatically operated drain mechanism for a washing machine having a container for fluid for washing and rinsing and being provided with a suds storage tank, the mechanism comprising a container outlet pipe leading from the container to the suds storage tank to remove washing fluid from the container, said outlet pipe including a deflector to direct fluid against the walls of the suds storage tank, a pump in the container outlet line for forcibly removing the fluid from the container, a two-way control valve connected in the outlet pipe between the pump and the suds storage tank to direct the flow of fluid to the suds storage tank from the container or to direct flow of fluid to a drain, a suds drain means for emptying the suds storage tank to the drain, means for admitting fresh water into the container for a washing, rinsing or suds storage rinse operation, and an automatic time switch control means controlling the sequence of operations of the machine, said automatic time switch first operating said suds drain means to empty the storage tank of suds and discharge the suds to the drain, the automatic time switch means having additional clean cycle means for next simultaneously operating the fresh water admitting means, the pump, and the control valve to direct fresh water from the container and force it into the suds storage tank to wash down the suds which adhere to the tank wall.

3. A drain mechanism for an automatic washing machine having a container for water for washing and rinsing clothes and being provided with a separate suds storage tank, the mechanism comprising a washer container outlet line leading from the container to the suds storage tank, a first control means in said container outlet line selectively operable for directing the water from the washer container to the suds storage tank or for returning the water from the tank, a second control means connected to the suds storage tank for directing the water from the suds storage tank to a drain, and a third control means for admitting fresh water into the washer container and operative to direct either a flow of water for washing operations or for rinsing operations, and a presettable sequential controller operative through a series of washing steps to actuate said control means and operating either said first or third control means to admit either a flow of fresh water into the tank or a return of suds from the suds storage tank for a washing operation, and the controller subsequently operating the first control means to causes a removal of the suds from the washer container to store them in the suds storage tank, said sequential controller independently operable through a series of storage tank rinsing steps to actuate said second control means to empty the suds from the suds storage tank to a drain and subsequently to actuate said third and first control means to admit fresh water for a rinsing

operation flow into the container, and to direct the fresh rinse water into the suds storage tank, and means to cause said fresh rinse water to engage the inner surfaces of the side walls of said suds storage tank to rinse the residue materials which adhere to the tank walls from the tank.

4. An automatic drain mechanism for a washing machine having a container for fluid for washing and rinsing operations comprising a suds storage tank receiving suds between washing operations, a container outlet line leading from the container for emptying fluid from the container, a washer pump positioned in the line, said washer pump being bi-directional to discharge liquid from the line or to return sudsy water to the washer container, a suds return valve positioned in the outlet line between the washer pump and the suds storage tank with one port connected to the bottom of the suds storage tank for the return of suds to the washer container and a second port connected to the top of the suds storage tank to direct either soapy water from the washer into the suds storage tank or to direct clean rinse water into the suds storage tank, control means for controlling the valve to direct the water into the storage tank or to return sudsy water from the storage tank, and a deflector mounted at the top of the tank to deflect clean water against the walls of the suds storage tank for a storage tank cleaning operation.

5. An automatic washdown mechanism for a suds storage tank for a washer having a washing container for fluid for washing, rinsing and drying operations, the combination comprising a container outlet line leading from the washer container to the suds storage tank, a washer pump in the container outlet line to direct fluid under pressure to the suds storage tank, a suds discharge line connected to the suds storage tank and leading to a drain, a deflector baffle positioned in the suds storage tank to receive the flow from the container outlet pipe and to direct the fluid against the walls of the suds storage tank, a suds drain pump positioned in the suds discharge line for moving fluid from the suds storage tank, and control means connected to the washer pump and the suds drain pump and having normal washing control means to control normal operations and additional clean cycle control means operative to cause simultaneous operation of said pumps during the rinsing of the storage tank.

6. A drain mechanism for an automatic washing machine having a container for washing fluid and being provided with a suds storage tank, the mechanism comprising a container outlet line for draining fluid from the container and for returning suds to the container for a succeeding washing operation, a bi-directional washer pump positioned in said container outlet line to pump water from the container or to return suds thereto, a suds storage line leading from the washer pump to the suds storage tank, a suds return line leading from the suds storage tank and connecting to the suds storage line, a suds return check valve preventing the flow of suds to the storage tank through the suds return line when the pump is forcing the suds through the suds storage line, and a suds storage check valve in the suds storage line preventing flow through the suds storage line when the pump is reversed and is delivering suds to the washing machine container from the suds return line.

7. A drain mechanism for an automatic washing machine having a container for fluid for washing, rinsing and extracting and being provided with a suds storage tank, the mechanism comprising a container outlet pipe leading from the container to drain liquid therefrom and to return suds to the washer container, a washer pump connected in the washer outlet line, said pump being bi-directional to pump the suds from the washing machine or to return suds thereto, a suds return line connected to the pump and to the bottom of the suds storage tank for returning suds to the washer, a suds storage line connected to the suds return line and adapted to convey suds from the washer pump to the suds storage tank, the suds storage line being connected to the top of the suds storage tank, and a check valve in the suds return line positioned between the connection of the suds storage line to the suds return line and the tank, and preventing flow through the suds return line toward the suds storage tank when the bi-directional pump is forcing suds into the suds storage tank through the suds storage line.

8. In an automatic washing machine having a fluid container for washing and rinsing clothes and a storage tank for the retention of suds, the combination of a container outlet line leading from the container and having an outlet near the top of the suds storage tank, a drain line branching from the container outlet line and leading to a drain for the permanent discharge of washing fluid, a control valve located at the junction of the container outlet line and the drain line to selectively control the flow of water from the container either to the drain line or to the suds storage tank, washer pump connected in the outlet line for forcing water from the container into the suds storage tank or through the drain, a first control connected to the pump discharging soapy water from the washing container at the end of the washing operation to discharge it to the suds storage tank, means for removing suds from the suds storage tank, a second control connected to said suds removing means for emptying the suds storage tank, a water inlet means connected to the container to direct clean water into the container outlet line, and a third control on the washer for operating the water inlet means to be operated in cooperative action with the first control for forcibly directing clean water through the container outlet line, and means at said outlet deflecting the clean water against the inside walls of the tank and into the tank to flush rinse the suds which cling to the walls of the tank from the tank.

9. Washing apparatus comprising, a tub for receiving fluid, a storage tank having inner side wall surfaces, conduit means interconnecting said tub and said storage tank, said conduit means having a first branch leading to the top of said storage tank and a second branch leading to the bottom of said storage tank, a fluid deflector positioned adjacent the top of said storage tank for deflecting fluid from said first branch against said inner side wall surfaces of said storage tank, pump means for moving fluid from said tub to said storage tank through said first branch and for moving fluid from said storage tank back to said tub through said second branch, a drain conduit connected to said storage tank, control means in said drain conduit for controlling fluid flow through said drain conduit, valve means for controlling fluid flow from a supply source to said tub, a sequential controller controlling operation of said pump means and said control means and said valve means and having normal washing cycle means and additional clean cycle means to flush said inner side wall surfaces and drain said storage tank during a clean cycle following a normal washing cycle.

10. The invention set forth in claim 9 in which said control means in said drain conduit is a pump.

11. Washing apparatus comprising, a tub for receiving fluid, a storage tank having inner side wall surfaces, conduit means interconnecting said tub and said storage tank, said conduit means having a first branch leading to the top of said storage tank and a second branch leading to the bottom of said storage tank, a fluid deflector positioned adjacent the top of said storage tank for deflecting fluid from said first branch against the inner side wall surfaces of said storage tank, first pump means for moving fluid from said tub to said storage tank through said first branch and for moving fluid from said storage tank back to said tub through said second branch, a drain conduit connected to said storage tank, second pump means in said drain conduit for moving fluid from said storage tank to an external drain, valve means for controlling fluid flow from a supply source to said tub, a

sequential controller having normal washing cycle means and additional clean cycle means controlling operation of said first and second pump means and said valve means to flush said inner side wall surfaces and drain said storage tank during a clean cycle following a normal washing cycle.

12. The invention set forth in claim 11 in which said storage tank is provided with an overflow conduit connected to said drain conduit and in which said overflow conduit is provided with a check valve to prevent reverse fluid flow through said overflow conduit during operation of said second pump means.

13. The invention of claim 11 in which said conduit means is provided with a two-way diverter valve controlled by said sequential controller for selectively controlling fluid flow through said first and second branches to and from said tub.

14. The invention set forth in claim 11 in which said conduit means is provided with check valves in said first and second branches for automatically controlling fluid flow through said branches to and from said tub.

15. The invention set forth in claim 11 in which a second drain conduit is connected to said conduit means and communicates therewith through a two-way valve controlled by said sequential controller and operated thereby during said washing cycle.

16. In a laundry machine, a presettable sequential controller having normal washing cycle means and additional clean cycle means operating the machine through a preselected program including a normal washing period, a container in which clothes are washed, a suds storage tank having a lower drain, and conduit means connected to said container and having an outlet positioned near the top of said suds storage tank, valve means and a pump in said conduit means, fresh water inlet means in said container for communicating said fresh water to said conduit means during the clean cycle, said valve means and said pump being regulated by said sequential controller to normally temporarily store laundry liquid from said container in said suds storage tank after a normal washing period, said additional clean cycle means of said sequential controller regulating said fresh water inlet means, said pump and said valve means after the normal washing cycle so that said pump forcibly drives a stream of fresh water to said outlet, and deflector means connected to said outlet to direct said water against said suds storage tank thereby to flush rinse the walls thereof to condition the tank to receive a new supply of laundry liquid in the next normal washing cycle.

17. A drain mechanism for an automatic washing machine having a container for fluid for washing, rinsing and extracting and being provided with a suds storage tank, the mechanism comprising a container outlet pipe leading from the container to drain liquid therefrom and to return suds to the washer container, means including a washer pump connected in the washer outlet line to pump the suds from the washing machine or to return suds thereto, a suds return line connected to the pump and to the bottom of the suds storage tank for returning suds to the washer, a suds storage line connected to the suds return line and adapted to convey suds from the washer pump to the suds storage tank, the suds storage line being connected to the top of the suds storage tank, and a check valve in the suds return line positioned between the connection of the suds storage line to the suds return line and the tank, and preventing flow through the suds return line toward the suds storage tank when the pump is forcing suds into the suds storage tank through the suds storage line.

References Cited in the file of this patent

UNITED STATES PATENTS

480,037	Rowe et al.	Aug. 2, 1892
2,267,351	Gohl	Dec. 23, 1941
2,287,927	Altorfer	June 30, 1942
2,302,012	Dyer	Nov. 17, 1942
2,303,541	Gluckman	Dec. 1, 1942
2,562,610	Geldhof et al.	July 31, 1951
2,588,774	Smith	Mar. 11, 1952
2,619,977	Hagen	Dec. 2, 1952
2,728,352	Sanders	Dec. 27, 1955