

Feb. 16, 1960

L. F. ISRAEL, JR
UNI-DIRECTIONAL PUMP FOR AUTOMATIC WASHER
WITH RECIRCULATING AND FILTERING SYSTEM

2,924,959

Filed July 16, 1956

5 Sheets-Sheet 1

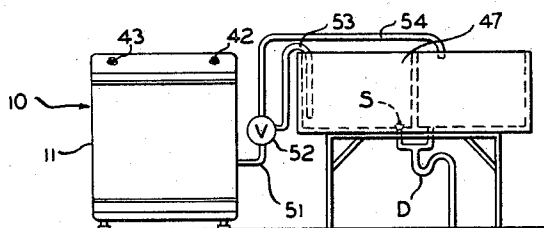


Fig. 1

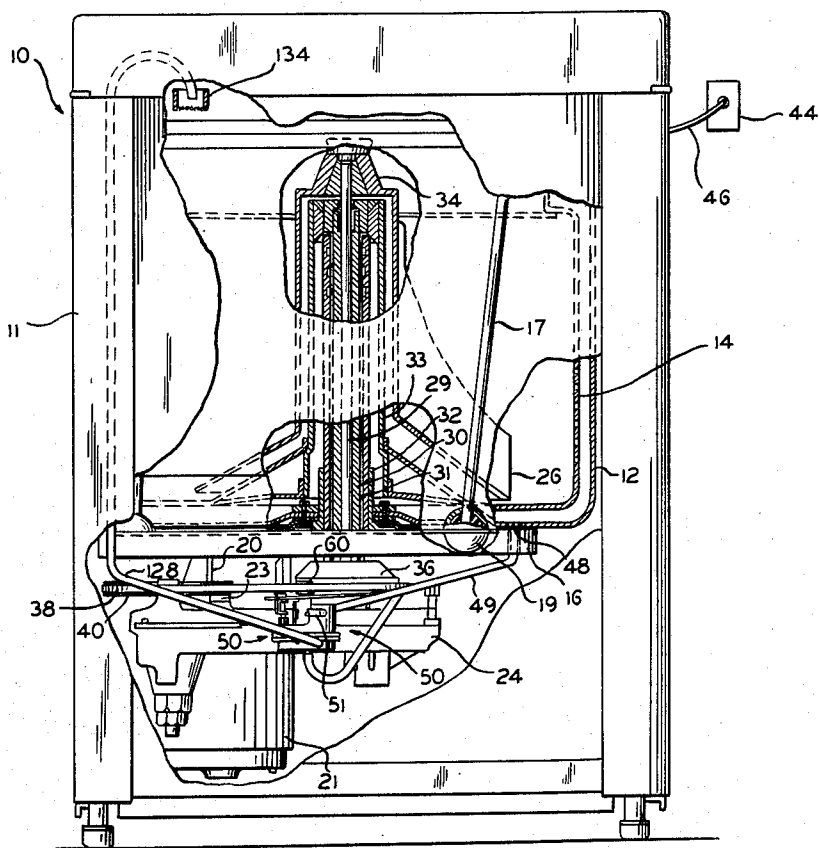


Fig. 2

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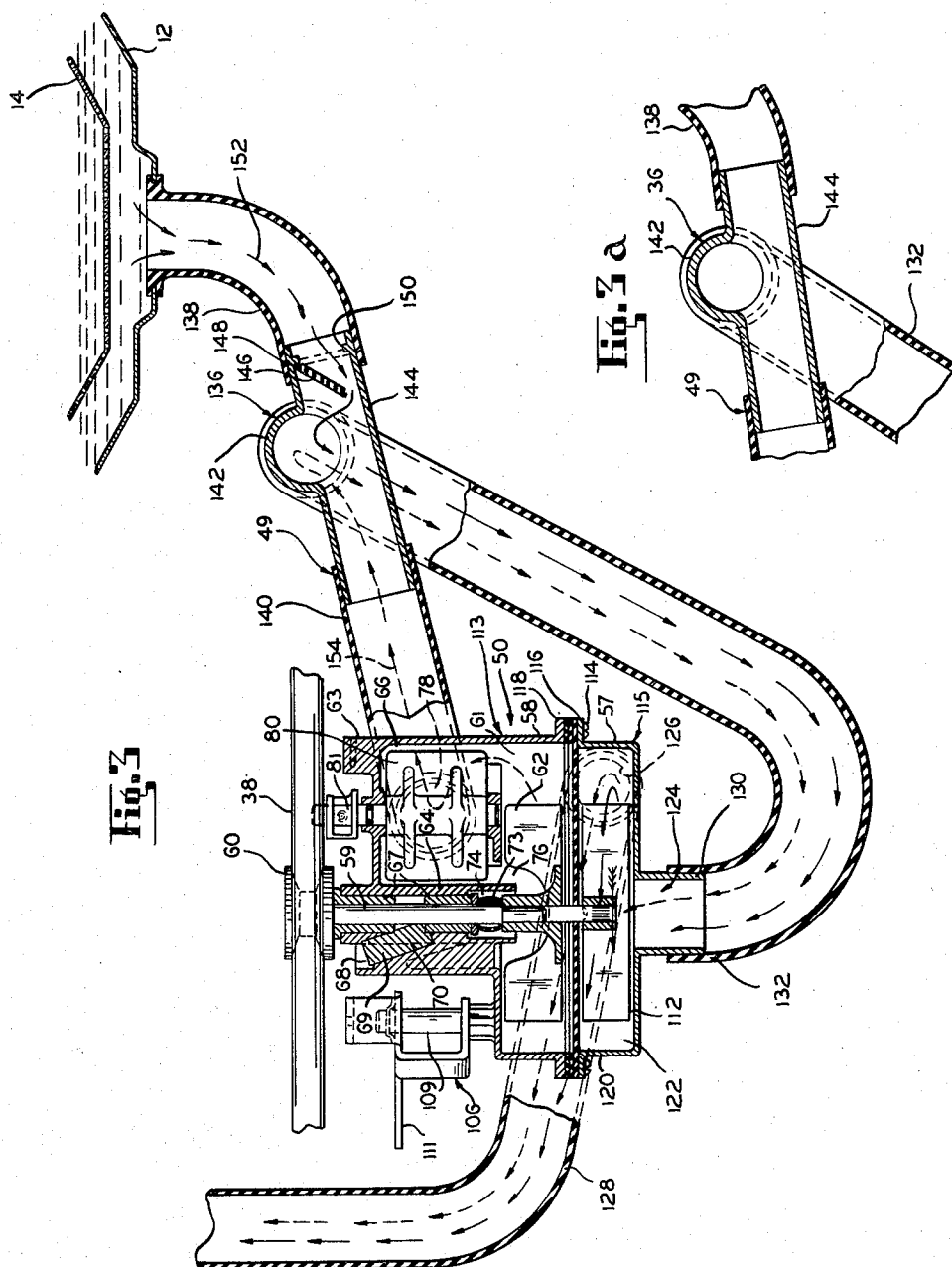
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5 Sheets-Sheet 2



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5 Sheets-Sheet 3

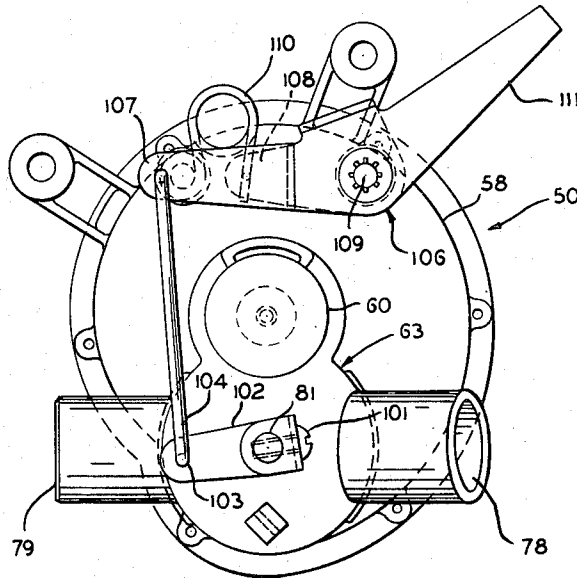


Fig. 4

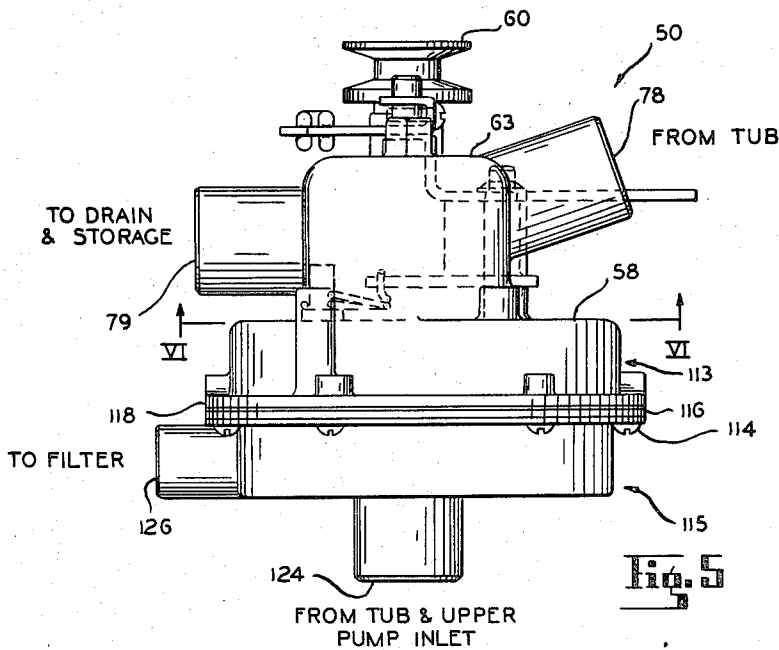


Fig. 5

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5 Sheets-Sheet 4

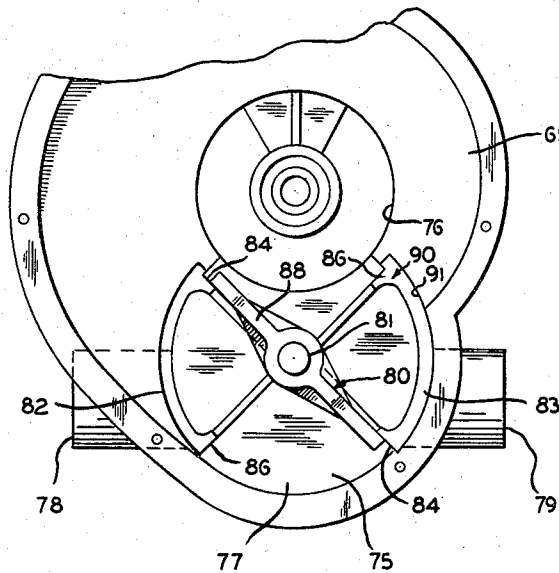


Fig. 6

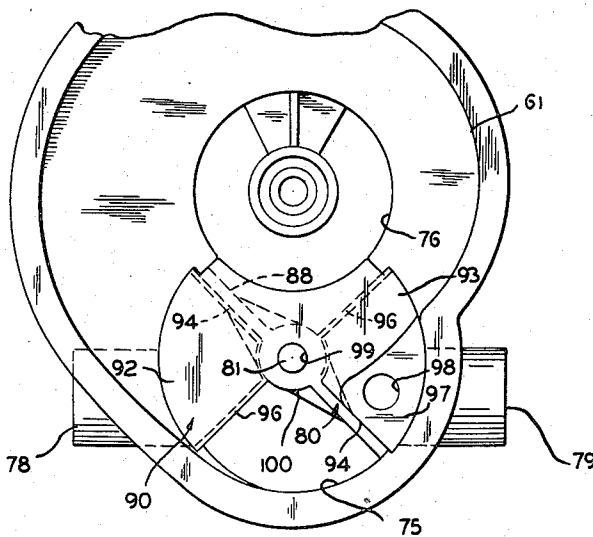


Fig. 7

SUDS RETURN	WASH FILL	WASH-PUMP OUT-SPIN	RINSE FILL	RINSE-PUMP OUT-DAMP DRY
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Fig. 8

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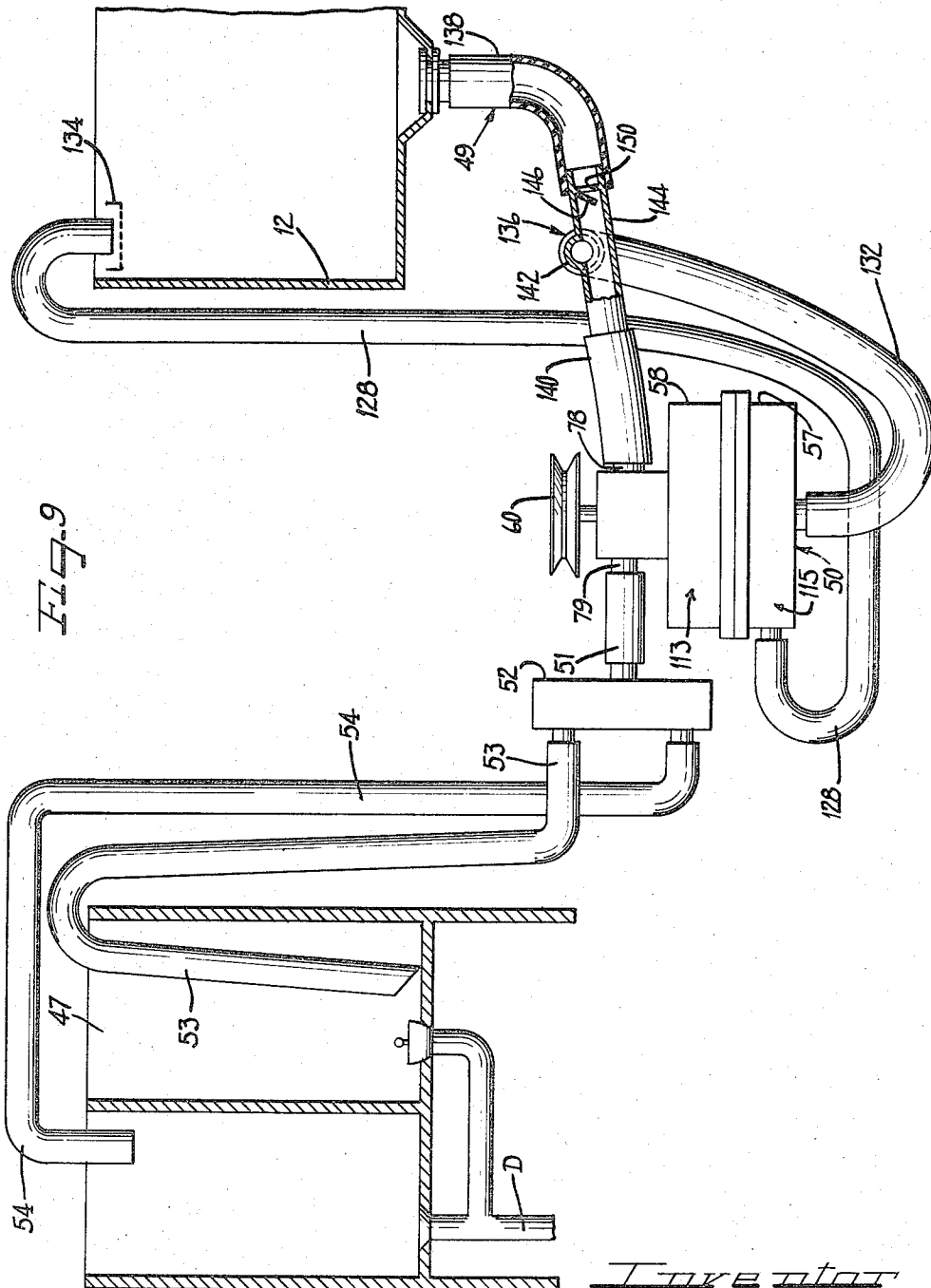
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5 Sheets-Sheet 5



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UNI-DIRECTIONAL PUMP FOR AUTOMATIC WASHER WITH RECIRCULATING AND FILTERING SYSTEM

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Application July 16, 1956, Serial No. 597,943

16 Claims. (Cl. 68—18)

The present invention relates to improvements in pumps and more specifically to a pump system which is capable of selectively pumping a fluid from any one of a plurality of sources to any one of a plurality of selected discharge locations.

In the domestic home laundry machine more desirable functions and results can be obtained if the machine is capable of performing automatically to completely control the handling of the washing fluids. In the handling of the washing fluid other activities have been added in addition to the mere admitting of a washing fluid into the washer and draining at the end of the washing period. These activities include automatically draining the wash water from the washer at the end of the washing cycle and at the end of each rinsing cycle and directing the sudsy wash water to a suds storage tank and the waste rinse water to a drain. The sudsy washing water is stored and automatically pumped back to the tub at the end of the washing operation for use in a succeeding operation. In addition to this handling of the fluid it is desirable to filter the washing water to remove lint and other foreign materials which are picked up from the clothing during the washing operation. These various fluid handling operations have greatly increased the requirements of an automatic pumping system for the washer to where a number of pumps have been required for the fluid handling operation with the associated necessity of providing driving means and control means for each of the pumps including valve means for controlling the flow through the pump. This has greatly increased the complexity of the fluid control system and has increased the cost, making it necessary in some instances for economy and space conservation to eliminate some of the desirable functions of the completely automatic system.

The present invention contemplates as one of its objects the provision of an improved pumping system which may be used in an automatic domestic washer which is capable of performing all of the desirable functions and handling of the washing fluid yet which is extremely simple in construction, thus reducing the space needed and the cost of construction of the mechanism and also obtaining a machine which will perform the functions needed without adding excessive expense.

Another object of the invention is to provide an improved apparatus which will filter the washing fluid during the washing operation.

A further object of the invention is to provide an improved pump for pumping the washing fluid to a suds storage chamber and for returning the suds for a succeeding washing operation.

A further object of the invention is to provide a simple unit pump which is operated through a single drive and will pump the wash water from the tub to a suds storage tank or drain, will circulate the wash water through a filter system during the washing operation, will return the sudsy water to the washer for a succeeding operation,

2

and will filter the sudsy water before it is returned to the washer tub.

Another object of the invention is to provide an improved multiple inlet multiple outlet unit pump construction.

Another object of the invention is to provide an improved pump unit and valve arrangement wherein a plurality of pumps can operate separately or individually and can also be operated in tandem to conduct fluid through both pump units.

Another object of the invention is to provide an improved pump unit which is driven through a single operator and which can selectively pump fluid from a single source through either one of the two pump units and from a plurality of sources can selectively pump the fluid to a selected one of a plurality of discharge conduits.

Another object of the invention is to provide an improved pumping and conduit arrangement which will improve the operation of returning the sudsy wash water to the tub from a storage chamber.

Other objects and advantages will become more apparent to those skilled in the art and those who have knowledge of the present invention from the complete disclosure contained in the specification, claims and drawings, in which like numbers are used to indicate like parts and in which:

Figure 1 is a front elevational view of an automatic washer system shown with a sink unit which can be used for draining the fluid and for storing the sudsy wash water between washing operations;

Figure 2 is a front elevational view of an automatic washer illustrating the preferred embodiment of the invention;

Figure 3 is an enlarged detail vertical sectional view of the pump unit and the conduits and valves which complete the pumping system;

Figure 3a is an enlarged detail vertical sectional view of a portion of Figure 3 illustrating a modified arrangement of the conduit arrangement;

Figure 4 is a plan view of the pump;

Figure 5 is an elevational view of the pump;

Figure 6 is a sectional view of the interior of the upper pump to illustrate the construction of the control valve and with a portion of the valve removed;

Figure 7 is another view of Figure 6 with the missing portion of the valve in place;

Figure 8 is a diagrammatic sketch indicating the periods of operation of the pump with respect to the overall operation of the automatic washing machine; and

Figure 9 is an elevational view shown in somewhat schematic form, of an overall fluid flow system embodying the principles of the invention.

The preferred embodiment of the pumping system embodying the invention is illustrated in the form of an automatic washer. It is to be understood, however, that the features, advantages, and methods of the invention may be utilized in alternative embodiments and may be used in various fluid circulating systems and the details of the disclosure are therefore not to be taken as limiting.

For purposes of illustrating the principles of the present invention, however, there is shown in Figures 1 and 2 an automatic washing, rinsing and extracting machine 10 having a cabinet 11 forming an enclosure for a tub 12 which is adapted to confine a pool of liquid such as water or laundry liquid, thereby restricting the pool of laundry liquid within the confines of a treatment zone.

A receptacle or container indicated at 14 is rotatably mounted within the tub 12 and the tub 12 is carried on a floating base 16 suspended from the top portion of the cabinet on suspension links 17 encased in rubber at their ends and carried in a corresponding plurality of sockets

19 in the base 16 and in similar sockets at the upper part of the cabinet (not shown) for damping oscillatable movement which may occur between the base and the cabinet.

Suspended from the base 16 on a hanger bracket 20 is an electric motor 21 which operates as the drive motor for the machine. A power take-off shaft drives a motor pulley 23 forming a component of a pulley system for driving the rotatable components of the laundry machine.

A gear casing is indicated at 24 through which an oscillatable drive mechanism actuates an independently operable washing element or agitator 26 located interiorly of the container or receptacle 14, and, hence, interiorly also of the tub 12.

The gear casing 24 is also suspended from the base 16 and is positioned in fixed parallel spaced relation with respect to the base 16. Although not necessary to a proper understanding of the principles of the present invention, it may be noted that the gear casing 24 is of a form utilizing two parts, a lower part housing an oscillatable drive gearing for oscillatably driving the washing element or agitator 26 and an upper part housing operating and control mechanism of the machine.

With respect to the actuation of the washing element or agitator 26, however, there is shown an oscillatable drive shaft at 29 rotatably carried in the gear casing 24 in a boss at the lower part of the gear casing 24. The shaft 29 is also journaled within a rotatable drive sleeve 30 concentrically disposed within a stationary sleeve 31 and inwardly with respect to a hollow center post 32. The hollow center post 32 forms a closure for the central part of the bottom of the tub 12 and extends upwardly from the bottom of the tub 12.

The sleeve 31 is carried in the hollow center post 32. The rotatable sleeve 30 provides a support for a hollow upright support member 33 attached in firm assembly with the container or receptacle 14. Thus, the container or receptacle 14 is supported near its upper end for spinning. The washing element or agitator 26 is locked to the upper end of the shaft 29 as at 34 and will be oscillatably driven upon corresponding oscillatable movement of the shaft 29.

The rotatable sleeve 30 is driven by a drive sheave 36 or spin pulley, as it may be referred to herein, mounted on the lower portion of the sleeve 30 through a clutch of the friction-disk-type, the clutch being controlled by suitable actuating mechanism well known to those versed in the art.

A driving belt 38 (Figures 2 and 3) is trained over the pulley 23 of the drive motor 21 and over the sheave or pulley 36 operatively connected to the shaft 29, thereby to rotate the container or receptacle 14 at a speed suitable for extracting liquid from clothes contained therein upon actuation of the clutch mechanism.

The belt 38 is also trained over a drive pulley 40 which constitutes the main drive pulley of the machine and which is fastened to a shaft (not shown) extending out of the oscillatable drive mechanism housed within the gear casing 24. It will be understood that the shaft 29 will be oscillatably driven by the motor 21 through the oscillating mechanism and a detailed description of the driving mechanism does not appear to be necessary to a proper explanation of the present invention.

It will be understood that the washing machine 10 is provided with a sequential controller for automatic operation of the machine through a series of washing, rinsing and extraction periods. The sequential controller is particularly characterized by the utilization of presettable means to selectively and automatically actuate the driving means of the machine through a selected programming schedule. The actuating element or presettable means of the sequential controller is indicated on Figure 1 by the reference numeral 42. A water temperature selection means is indicated at 43. Hot and cold water from the usual domestic supply is furnished to the machine

and the details of such mechanism will not be described herein as such details are not necessary to an understanding of the present invention. The electrical components of the machine are energized from the usual domestic outlet indicated at 44 through a conductor wire indicated at 46 (Figure 2).

As shown in Figure 1, the machine 10 is shown in proximity to a laundry tub or receptacle 47 particularly adapted to operate as a laundry liquid storage means or suds storage reservoir. The tub 12 has an outlet 48 (Figure 2) to which is connected a conduit 49 leading to the pump of the present invention, indicated generally by the reference numeral 50. A second conduit 51 leads from the pump 50 to a two-way valve 52 (Figure 1). From the two-way valve 52 leads a first conduit 53 having its end disposed within the receptacle 47. A second conduit 54 is connected to the two-way valve 52 and leads to drain. With a conventional type laundry stand, this arrangement is conveniently effected by keeping a stopper S in the compartment of the receptacle 47 to be used as a liquid reservoir and by leading the conduit 54 into the other compartment directly open to the drain indicated at D.

In accordance with the principles of the present invention, it is contemplated that upon the completion of the washing cycle, the laundry liquid maintained as a pool of laundry liquid within the tub 12 will be drained out of the tub 12 and temporarily stored in the receptacle 47. Thereafter, the rinsing and extracting procedures can be carried out in the laundry machine 10. The stored laundry liquid is then available for further use in washing additional batches of materials to be laundered and is returned to the tub 12 by the pump 50.

Referring now to Figs. 3 through 7 the details of the pump embodying the preferred form of the invention will be described. The mechanical disposition of the pump on the laundry machine with relation to the remainder of the operative parts is illustrated in Fig. 2. The pump body is suitably secured to the gear casing 24 and shaft 59, which is shown in the detailed drawings of the pump, carries on the end thereof a pulley 60 over which is threaded a drive belt 38. Accordingly, whenever the motor 21 is operated, the pulley 60 and the shaft 59 will be unidirectionally rotated.

The body is divided into two parts, with an upper portion 58 and a lower portion 57. The upper portion will be first described.

The upper portion of the pump body 58 has formed therein a volute pumping chamber 61 in which is rotated a centrifugal impeller 62 fastened on the shaft 59 driven by the pulley 60, see Fig. 3.

The upper portion of the casing housing 58 further includes a large boss 63 which provides a bearing housing indicated generally at 64, as well as a space which shall be generally referred to as a distribution chamber 66 adjacent to the volute pumping chamber 61. The bearing housing seats one or more bearing sleeves indicated at 67 thereby journaling the shaft 59. A hollow oil reservoir at one side of the bearing housing 64 is indicated at 68. The reservoir recess 69 is filled with a packing material 70. The packing material is generally for the purpose of retaining oil and bears against the rotating shaft 59 to maintain it in a lubricated state and to conduct oil to the bearing members 67, 67. A seal indicated generally by the number 73 is contained within the recess 74 at one end of the bearing housing.

Referring now more particularly to Figures 3 and 6, it will be noted that the volute pumping chamber 61 is of the usual scroll configuration, however, there is no tangentially disposed outlet as in an ordinary volute type pump. Rather, there is an enlarged discharge space indicated at 75. A chamber is provided by the boss 63 of a generally figure-8 shaped configuration consisting of two overlapping generally cylindrical recesses. One lobe of this chamber constitutes what shall be referred to

5

herein as an inlet recess 76. The recess 76 is in register with the eye of the centrifugal impeller 62 and extends generally concentrically around the bearing housing 64. The other lobe of this chamber constitutes what shall be referred to herein as the outlet recess 77.

Conduit means having an opening in opposite ends of the recess 77 include a first pump conduit 78 and a second pump conduit 79. The first and second pump conduits 78 and 79 constitute inlet and outlet means for the pump. In order to establish selective communication between the first and second pump conduits 78 and 79 and the inlet chamber 76 in the discharge portion 75 of the volute pumping chamber, a distributor valve taking the form of a butterfly valve 80 is provided. The butterfly valve 80 is carried on a shaft 81 journaled in the pump housing 58 and is selectively angularly displaceable within the outlet recess 77.

At the edges of the openings leading into the outlet recess 77 the first and second pump conduits 78 and 79 are provided, as integral parts of the casing, with bosses 82 and 83 having diametrically opposed pairs of shoulders 84 and 86. These shoulders engage the adjoining edge portions of the blade 88 forming part of the butterfly valve 80.

In the position of the butterfly valve 80 illustrated in Fig. 6, the blade 88 contacts the shoulders 84, 84 thereby forming a passage communicating the pump conduits 79 with the inlet recess 76 while forming a second passage communicating the pump conduit 78 with the outlet portion 75 of the volute pumping chamber, particularly that portion of the outlet or discharge portion 75 registered with the outlet recess 77.

By angularly positioning the butterfly valve in its second position with the blade 88 contacting and engaging the shoulders 86, 86, passage is formed communicating the pump conduit 78 with the inlet recess 76 while establishing a separate passage communicating the outlet portion of the outlet recess 77 in register with the discharge portion 75 of the volute pumping chamber 61 with a pump conduit 79.

In order to insure that the separate passageways established by movement of the butterfly valve 80 will be sealed from one another, thereby to prevent by-passing of fluid flowing through the pump conduits 78 and 79, a separate insertable baffle member 90 is employed. The baffle member 90 is most clearly illustrated in Fig. 7 and includes a curved wall 91 which prescribes the limits of the inlet recess 76 in register with the eye of the impeller 62 as well as pie-shaped portions on opposite sides thereof indicated at 92 and 93, respectively, fitting and engaging against the boss portions 82 and 83, thereby to overlie the portions of the outlet recess 77 which must be separated from one another. On its inner surface the baffle member 90 has ribs providing abutment surfaces 94, 94 and 96, 96 for engaging the adjoining edge portions of the blade 88 on the butterfly valve 80.

The baffle member 90 also carries a terminal plug 97 which is formed as an upstanding boss and which operates to separate a discharge portion 74 of the volute pumping chamber 61 from the inlet portion of the volute pumping chamber. A lightening hole 98 is provided in the boss 97.

An aperture 99 is also formed in the baffle member 90 and snugly receives the end of a shaft 81 in the butterfly valve 80.

When the baffle member 90 is assembled in place, as shown in Fig. 7, the open area left between one set of the abutment surfaces (the surfaces 94 and 96) forms a side outlet port for the volute pumping chamber 61. This port is indicated in Fig. 7 by the reference numeral 100.

The shaft 81 on the butterfly valve 80 projects outwardly of the housing or casing 58 and has connected thereto, by means of a set screw 101, a shutter arm 102, Fig. 4. The end of the shutter arm 102 is apertured at 103 and pivotally connects to the end of a tie rod 104.

6

A linkage assembly is provided which includes a pivoted lever member 106. The lever member 106 has a pair of arms 107 and 108 extending from one side of the pivot axis established at 109 journaled in the housing 58. The other end of the tie rod 104 is pivotally connected to the arm 107 and a toggle spring 110 is operatively connected between the housing 58 and the other arm 108. It will be understood that the lever member 106 and the spring 110 have two over center positions, corresponding to the two positions of adjustment of the butterfly valve 80, thereby biasing and retaining the lever member 106 and the linkage components associated therewith including the butterfly valve 80 to positions of adjustment.

The lever member 106 includes a third arm 111 which projects from the opposite side of the pivot axis established from the pivot pin 109. In operation the pump 50 is selectively operated under control of a sequential controller at different portions of the washing, rinsing, and extracting periods as will later be described. The inlet and outlet flow through the pump conduits 78, 79 are alternately reversed through operation of the butterfly valve 80 thereby to supply and remove a pool of laundry liquid to and from the treatment zone as required for the washing, rinsing, and extracting periods of the machine operation.

Positioned directly below the upper portion 58 of the housing and clamped thereto is the lower housing 57. The lower housing comprises a toroidal shaped chamber containing an impeller 112 which is suitably secured to the common drive shaft 59 which carries the upper impeller 62 of the first pump. With rotation of the common shaft 59 both the upper impeller 62 and the lower impeller 112 rotates in a common direction and fluid is passed through the first and second pumps.

The lower pump 115 enclosed by the housing 57 is attached to the upper housing 58 such as by screws 114 arranged to pass through holes in the annular flange 116 at the edge of the housing 57. The flange 118 at the base of the upper housing 58 is threaded to receive the screws, and a separator plate 120 is clamped between the two housings to divide the pumping chamber 122 of the second or lower pump from the chamber 61 of the upper pump. The dividing member 120 may be formed of circular sections of metal which may be reinforced by sealing members such as rubber or cork diaphragms.

While the flow through the upper pump is bi-directional with the directional flow of liquid being controlled by the position of the butterfly valve 80, the flow through the lower pump is unidirectional. Liquid passes into the pump through the inlet port 124 which enters at the bore of the hub of the impeller 112. The fluid leaves the pump through the discharge port 126 which leads tangentially from the toroidal casing. The relative positions of the inlet port 124 and the discharge port 126 are shown in the detailed drawing of Fig. 3 as well as the external view of Fig. 5. The discharged fluid from the second lower pump is directed out through the discharge port 126 through the discharge conduit 128.

Each of the ports 78 and 79 of the upper pump 113, and the inlet port 124 and the discharge port 126 of the lower pump 115, are in the form of short lengths of conduit. Each of these conduits is shaped and sized so as to be connected to a pipe or tube or conduit which will conduct the fluid either to or away from the port. As is illustrated in detail in Fig. 3, in connection with the inlet port 124, the ports are integral with the pump housing which may be in the form of annular metal bosses 130 over which may be telescopically slid a rubber tube or hose 132 which comprises the inlet conduit for the port 124.

The discharge conduit 128 for the lower pump 115 leads upwardly through the washing machine cabinet as shown in Fig. 2 to deposit the fluid into a strainer or a filter 134 which is so positioned so as to feed the fluid

directly into the tub 12. The fluid which is circulated by the lower pump 115 is thus forced through the discharge conduit 128 into the filter 134 to flow down into the tub 12.

The intake conduit 132 for the lower pump 115 is connected to the intake conduit 49 of the first pump, this being connected to the intake port 78 of the first pump and to the tub. The intake conduit 49 for the first pump leads upwardly to connect to and receive the fluid that flows out of the tub 12. The intake conduit 132 for the lower pump connects to the intake conduit 49 for the upper pump at a point midway between the connection of a conduit to the tub and to the pump. For connecting the two conduits a special T-shaped fitting 136 is provided which may be formed of aluminum, another metal, or plastic. The upper portion of the first intake conduit 138 which connects the tub is formed of rubber hose and the lower portion 140 is also formed of rubber hose. The connector member 136 is T-shaped and is positioned so that the outlet 142 of the T projects upwardly. This position permits the fluid to flow in body portion 144 downwardly in the sloping conduit 140 without running out through the outlet 142. Thus, if liquid flows from the tub it will flow down through the conduit without passing out through the outlet 142 unless the lower portion 140 of the conduit is blocked by setting the butterfly valve 80 in a position to make the conduit 140 the discharge for the pump, thus preventing water from entering the upper pump.

The T-shaped connector member 136 also carries a check valve 146 which is hinged attached at its top edge 148 at a location between the tub and the connection of the intake conduit 132 for the lower pump. An annular ridge 150 extends around the inside of the connector member 136 above the check valve so that the depending check valve 146 will seat against the flange and prevent the flow of fluid back to the washer when the fluid flows in that direction. By the action of the weight of the valve 146 and the flow of the fluid from the tub, the valve is swung to open position when the fluid flows out of the tub toward the lower pump 115.

The flow of water from the tub is indicated by the solid line arrows 152. When the butterfly valve 80 is set so as to reverse the flow of fluid through the upper pump 113 the fluid 152 coming down out of the tub cannot pass downwardly through the intake conduit 49 to enter the upper pump because it will be blocked by the revolving impeller 62. The fluid will then pass outwardly through the intake conduit 132 for the lower pump and be forced upwardly by the pump through the discharge conduit 128 to be circulated through the filter 134 at the top of the washer. When the butterfly valve 80 is set in the other direction however so as to permit the flow through the upper pump 113 to be in the usual direction, the fluid will flow down past the outlet 142 of the connector member 136 along the base of the inlet conduit 140. Thus with normal operation of the pump and the butterfly valve in its normal position the fluid flowing out of the tub will pass into the upper pump through the intake conduit 49 and be discharged through the discharge conduit 51 of the upper pump as is shown in Fig. 1.

If the butterfly valve 80 is set in the pump reversal position and fluid is present in the suds storage chamber, and the two-way valve 52 is set to the proper position, the fluid will be drawn in through the discharge conduit 51 and discharge port 79 and pumped upwardly out through the intake conduit 49 of the upper pump following the dotted line path indicated by the arrows 154. The fluid flowing upwardly will close the check valve 146 and instead of flowing up into the washer tub 12 the fluid will flow in through the intake conduit 132 of the lower pump following the path of the dotted arrows to pass upwardly and be discharged through the filter 134 at the top of the machine.

In Figure 3a a modified form of the T-shaped connector member is illustrated with the depending check valve 146 omitted. This arrangement will alter the operation of the pump when the sudsy fluid is being returned to the washer, but the operation will remain the same when the fluid is being recirculated to the filter and when the fluid is being pumped from the tub to the storage chamber. In the latter two operations, which recirculate and filter the fluid, or pump the washing fluid to a storage chamber, the check valve 146 is opened by the flow of the fluid in the direction indicated by the arrows 152 in Figure 3. With the modification of Figure 3a, when the sudsy fluid is to be returned to the washer, the butterfly valve 80 is set in the pump reversal position and the fluid will be pumped by the upper pump out through the intake conduit 49. When the fluid reaches the T-shaped connection 136 it will divide, with a portion passing up through the conduit 138 and the remainder passing through the outlet 142 of the T-shaped connector member 136. The fluid which passes up through the conduit 138 will be returned directly to the tub 12 and the fluid which passes through the conduit 142 will pass downwardly through the lower pump to be delivered through the conduit 128 and returned to the tub through the filter. Thus, through this arrangement, an improved more rapid return of sudsy fluid to the tub is achieved and the action of both of the pumps is utilized for returning the fluid. Thus, a single pump unit is utilized for returning the sudsy fluid through two return conduits and a dual pump system is utilized for achieving a rapid return of the fluid through the conduit means.

Thus, it will be seen that with the pump turning in a single direction three combinations of fluid flow can be obtained. In the first combination, as previously described, the butterfly valve 80 is set in the reverse position for the upper pump 113. If no fluid is available to the discharge conduit 51 of the upper pump, the pump will rotate without pumping fluid but will prevent the fluid from entering the pump. The fluid will then flow out of the tub 12 following the path of the solid line arrows 152, and not being able to pass into the upper pump through the inlet conduit 49 against the revolving rotor, it will pass through the inlet conduit 132 of the lower pump and be circulated up through the filter.

In the second combination afforded by the pump unit the butterfly valve 80 is set in the same reverse position but fluid is available to the discharge conduit 51. The impeller 62 of the upper pump will then draw fluid and force it out through the inlet conduit 49 to close the check valve 146 and force the fluid down through the lower pump.

The third flow combination is achieved by turning the butterfly valve 80 to the forward flow position for the upper pump. The liquid then flowing out of the tub 12 will by-pass the outlet 142 of the connector 136 and not enter the intake conduit 132 of the lower pump but will continue to flow through the intake conduit 49 of the upper pump to be discharged out the discharge conduit 51 to pass either into the suds storage tank through line 53 as shown in Fig. 1 or to drain through line 54 depending upon the setting of the two-way valve 52.

This operation of the multiple unit pump is very susceptible to use with an automatic washer. The sequential control mechanism will control the position of the butterfly valve 80 to utilize the unit pump in first, obtaining a continuous circulation of the washing water through the filter during the washing operation, second draining the water from the tub to pass it to the suds storage chamber at the end of the washing operation, and third returning the suds to the washer for a succeeding washing operation but insuring that the suds will be passed through the filter to be cleaned before being reused.

With reference to Fig. 8 the sequence of operations of the automatic washing machine may be seen from the diagram there shown. The multiple unit pump of course will operate only during the time that the motor is in operation and driving the drive shaft 59 of the pump. The darkened portions of the chart illustrate the time when the motor is in operation and the pump will operate during the suds return period, the wash period, the pump out period, the spin period, the rinse period, the rinse pump out period, and during the damp dry period. The operating periods of the pump may be divided into the different functions of the pump. Starting to the left of the chart in Fig. 8, when the washer is operating to pump the sudsy fluid back into the washer the sequential control will place the butterfly valve 80 in the reverse flow position so that the impeller 62 will draw the suds from the storage tank sending them up through the intake conduit 49 to close the check valve 146 and pass the suds through the lower pump 57 up through the filter 134. Thus the sudsy water will be strained and filtered before it can be used for the next washing operation. The pump is then turned off for the additional fill wherein additional hot water may be added to the sudsy water in the tub. The water and pump are then started for the wash period and since the suds return tank is now empty no fluid will be flowing through the upper pump but because of the position of the butterfly valve 80, and operation of the pump rotor the fluid coming down from the washer tank cannot enter the upper pump but will instead pass through the intake conduit 132 of the lower pump to be pumped up through the discharge conduit 128 to be continuously circulated through the filter 134 during the washing operation. Thus any lint and other similar materials that are obtained from the clothes during the washing operation will be continuously removed from the water by the water being circulated through the filter. This of course removes the foreign materials which might adhere to the clothes when the clothes are spun dry.

At the end of the wash period the butterfly valve 80 is again turned to its normal forward position and the water is permitted to flow down through the sloping inlet conduit 49 into the upper pump to be discharged out through the drain. This operation continues during the spin period and during the rinse fill period as may be seen by the chart of Fig. 8 until the pump is temporarily turned off.

When the rinse period is reached the pump is again placed in operation and the butterfly valve 80 is placed in the reverse direction so that the fluid passing out of the tub will pass downwardly through the lower pump to be continually circulated through the filter thus cleaning the rinse water that is being used within the tub. When the rinsing period is completed the butterfly valve 80 is turned to the forward flow position for the upper pump 113 thus permitting the fluid in the conduit 49 to pass through the upper pump to be discharged through the drain. This continues through the damp dry operation.

For a review of the flow of fluid, reference may be made to Figure 9.

In the filtering process, usually during washing of clothes in the tub, when the butterfly valve 80 is positioned as shown in Figure 6, no fluid will enter the upper pump 113, and fluid will flow from tub 12 through elements 132, 115, 128, 134, and back into tub 12.

When butterfly valve 80 is reversed from the position shown in Figure 6 during the pump-out operations, flow will take place from tub 12 through elements 113 and 51 to either the suds hose 53 or drain hose 54.

In the suds return operation when butterfly valve 80 is positioned in the upper pump 113 as is shown in Figure 6, pump 113 will pump toward conduit 49. This will allow flow to take place from suds tank 47 through

elements 53, 51, 113, 140, 132, 115, 128, and 134 into tub 12.

In the modification shown in Figure 3a, the flow during the suds returning operation will divide between conduits 49 and 132 to produce a partial filtering of the returned suds.

Thus it will be seen that I have provided a pump which is housed in a single unit and driven by a single drive shaft which performs the functions and meets the objectives hereinbefore set forth. As will be recognized, the pump is inexpensive and simple to construct and requires only several additional parts to form the multiple unit pump from the single upper portion. The pump requires little additional power for operation and yet performs a plurality of functions not possible with the use of the upper pump alone.

The pump system employs the pump unit with a simple check valve arrangement which in its entirety is simple to assemble and construct and requires very little space within the washer chamber. Further, there are few working parts to get out of order and the mechanism is capable of continued operation without adjustment or failure. The pump system functions to perform the necessary operations in removing the water from the tub to return the sudsy wash water as well as performing a continuous filtering of the wash water and rinse water and filtering the suds water before it is returned for subsequent use within the washer.

I have, in the drawings and specification, presented a detailed disclosure of the preferred embodiment of my invention, but it is to be understood that I 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 my invention.

I claim as my invention:

1. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit connecting the discharge port of the first pump to a drain and to a suds storage chamber, means for reversing the flow of the first pump to change the inlet port to a discharge port and the discharge port to an inlet port, and valve means in the inlet conduit of the first pump between the tub and the connection to the inlet conduit of the second pump to block the flow of fluid from the first pump to the tub and direct it through the inlet conduit for the second pump to permit the second pump to force fluid returned from said suds storage chamber through the filter back into the tub.

2. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connected to the inlet port of the second pump and to said inlet port of the first pump, means for operating the first pump to cause a flow of fluid from the tub through the inlet port and outlet port to a storage container, and for operating the first pump to cause a flow of fluid from the storage container back through said discharge conduit selectively, and means to direct

the storage fluid from the first pump inlet port through the second pump and through the fluid filter.

3. A fluid circulation system for an automatic washer comprising a tub for containing fluid for washing, rinsing and extracting operations, a housing for a first and a second pump having first and second inlet ports and first and second discharge ports for said first and second pumps respectively, said first pump mounted within the housing to direct flow of fluid from said first inlet port through said first discharge port, said second pump mounted within said housing and adapted to direct the flow of fluid from said second inlet port through said second discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit connecting the discharge port of the first pump to a drain and to a suds storage chamber, means for reversing the flow of the first pump to change the inlet port to a discharge port and the discharge port to an inlet port, and valve means in the inlet conduit of the first pump between the tub and the connection to the inlet conduit of the second pump to block the flow of fluid from the first pump to the tub and direct it through the inlet conduit for the second pump to permit the second pump to force the fluid from the suds storage chamber through the filter back into the tub.

4. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a housing for said first pump, an impeller within said housing adapted to force the fluid from the inlet port of the first pump through the discharge port of said first pump, a housing for the second pump, an impeller within said second pump housing adapted to force the fluid from the inlet port of said second pump through the discharge port of said second pump, a common drive shaft extending through said first and second housings and connected to said impellers, means for driving said drive shaft to concurrently operate said impellers, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit connecting the discharge port of the first pump to a suds storage chamber, means for reversing the flow of the first pump to change the inlet port to a discharge port and the discharge port to an inlet port, and valve means in the inlet conduit of the first pump between the tub and the connection to the inlet conduit of the second pump to block the flow of fluid from the first pump to the tub and direct it through the inlet conduit for the second pump to permit the second pump to force returned fluid from the suds storage chamber through the filter.

5. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, means for filling the tub with fresh water, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit connecting the discharge port of the first pump to a drain, a common drive for said first and second pumps,

means to operate said drive during washing, rinsing and extracting operations and to permit the pumps to remain idle during operation of said filling means, means for reversing the flow through the first pump without reversing said drive, and valve means in the inlet conduit of the first pump between the tub and the connection to the inlet conduit of the second pump to block the flow of fluid from the first pump to the tub when the flow is reversed and direct it through the inlet conduit for the second pump to permit the second pump to force fluid through the filter.

6. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a first discharge conduit adapted to connect the discharge port of the first pump to a drain, a fluid filter positioned to discharge into the tub, a second discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, a first inlet conduit connecting the inlet port of the first pump to the tub, a second inlet conduit connected to the inlet port of the second pump and leading to the first inlet conduit of the first pump to receive fluid only if the first inlet conduit of the first pump is blocked between the connection of the inlet conduit of the second pump and the tub, means for blocking flow through said inlet conduit located between the tub and the connection of the second inlet conduit, and means for preventing the flow into the first pump through said first inlet port and operative to direct the fluid from the tub through said second pump and through said second discharge conduit back into the tub.

7. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit connecting the discharge port of the first pump to a drain, and means for preventing flow through said inlet conduit to the first pump whereby the fluid will flow through the inlet conduit of the second pump to permit the second pump to force the fluid from the washer through the filter back into the tub.

8. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connected to the inlet port of the second pump and joined to the inlet conduit of the first pump to lead from the upper side thereof so that fluid may flow through the inlet conduit for the first pump without entering the inlet conduit of the second pump, a discharge conduit connecting the discharge port of the first pump to a suds storage chamber, and means for reversing the flow of the first pump to change the inlet port to a discharge port and the discharge port to an inlet port to direct fluid from the suds storage chamber through the first pump into the inlet conduit of the second pump and through the filter to direct the fluid back into the tub.

9. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to ar-

ticles for washing operations, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit adapted to connect the discharge port of the first pump to a suds storage chamber, means for reversing the flow of the first pump to change the inlet port to a discharge port and the discharge port to an inlet port, and a reverse flow preventing check valve in the inlet conduit of the first pump located between the tub and the connection to the inlet conduit of the second pump to block flow of fluid from the first pump to the tub when the flow of the first pump is reversed to pump suds from the suds storage chamber and to direct the fluid through the second pump and through the filter back into the tub.

10. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump having an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit connecting the discharge port of the first pump to a suds storage chamber, said inlet conduit leading to the inlet port of the first pump leading downwardly from the tub at an angle between vertical and horizontal, a flap valve pivotally suspended within the inlet conduit for the first pump between the tub and the connection of the inlet conduit for the second pump to the inlet conduit for the first pump and flow controlled to move to an open position with flow from the tub and to move to a closed position with the flow toward the tub, and means for reversing the flow of the first pump to change the inlet port to a discharge port and the discharge port to an inlet port to thereby force fluid through the second pump through the filter and back into the tub.

11. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a pump housing having a first inlet port and discharge port and a second inlet and discharge port, first and second impellers mounted within the housing to force fluids through their respective ports, a common drive shaft supporting said impellers, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit connecting the discharge port of the first pump to a suds storage chamber, means for reversing the flow of the first pump to change the inlet port to a discharge port and the discharge port to an inlet port, and a check valve in the inlet conduit of the first pump between the tub and the connection to the inlet conduit of the second pump closing with flow of fluid toward the tub and opening with flow of fluid away from the tub to direct fluid from the first pump through the second pump when the first pump flow is reversed to carry the fluid from the suds storage chamber through the filter back into the tub.

12. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first fluid pump hav-

ing an inlet port and a discharge port, a second pump having an inlet port and a discharge port, a fluid filter positioned to discharge into the tub, a discharge conduit connecting the discharge port of the second pump to the fluid filter to direct wash fluid therethrough, an inlet conduit connecting the inlet port of the first pump to the tub, an inlet conduit connecting the inlet port of the second pump to the inlet conduit of the first pump, a discharge conduit adapted to connect the discharge port of the first pump to a suds storage chamber, a flow reversing valve mounted on the first pump to cause the impeller to discharge fluid through the inlet port and take in fluid through the discharge port, and valve means in the inlet conduit of the first pump between the tub and the connection to the inlet conduit of the second pump to block the flow of fluid from the first pump to the tub and direct it through the inlet conduit for the second pump to permit the second pump to force fluid through the filter back into the tub.

13. A fluid circulation system for an automatic washer comprising a tub for containing fluid for applying to articles for a washing operation, a first pump, first conduit means leading from the first pump to the tub, second conduit means leading from the first pump and adapted to be operatively connected to a storage chamber for the storage of fluid between washing operations, a second pump, third conduit means leading from the second pump to the tub, fourth conduit means leading from the first conduit means to the second pump and means for simultaneously operating said pumps so that fluid from said second conduit means is passed through said first conduit means to said tub and through said fourth conduit means and said third conduit means to said tub simultaneously, to effect rapid filling of said tub.

14. A fluid circulation system for an automatic washer provided with a suds storage chamber and including a tub for containing fluid for applying to articles for a washing operation, the system comprising a first fluid pump provided with an inlet leading from the tub and an outlet leading to the suds storage chamber and adapted to empty the tub to pump the fluid into the storage chamber, said first pump being reversible to return fluid from the storage chamber to the tub, a second fluid pump provided with an outlet leading to the tub and an inlet connected to the inlet of the first pump to receive fluid from the tub for recirculating the washing fluid, a fluid filter associated with the outlet of the second pump, and means for simultaneously operating both pumps with the first pump operating in reverse to return fluid to the tub by action of both pumps with the first pump returning fluid through the inlet of the first pump and the second pump obtaining a portion of the fluid discharged from the inlet of the reversed first pump and returning the fluid through the outlet of the second pump.

15. A fluid circulation pump for a washing machine or the like comprising a pump housing having a first inlet port and a discharge port and a second inlet and discharge port, first and second impellers mounted within the housing to force fluids through their respective ports, a common drive shaft supporting said impellers, and means for reversing the flow through the first pump impeller to cause a flow into the first outlet port and out of the first inlet port without changing the direction of rotation of the drive shaft whereby the first impeller will cause a flow in either direction and the second impeller will cause a flow in one direction only with the impeller operating at the same speed.

16. A fluid circulation pump for a washing machine or the like comprising a first pump unit having an inlet and a discharge port, a second pump unit having an inlet and a discharge port, means for driving said pumps, a first inlet conduit connected to the inlet port of the first pump, a second inlet conduit con-

15

connected to the inlet port of the second pump and connected to the first conduit, and means for reversing the flow through the first pump whereby both pumps may be operated in parallel when the first pump operates in a forward direction and are operated in tandem when the first pump is reversed and fluid flows from the inlet port of the first pump to the inlet port of the second pump.

5

16

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