

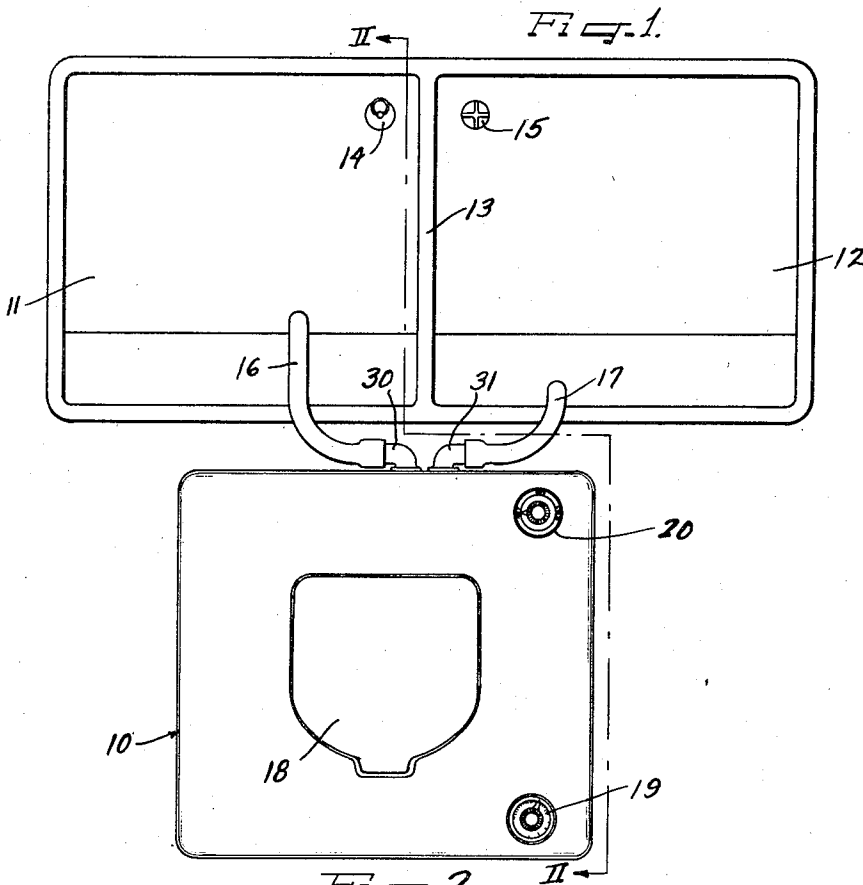
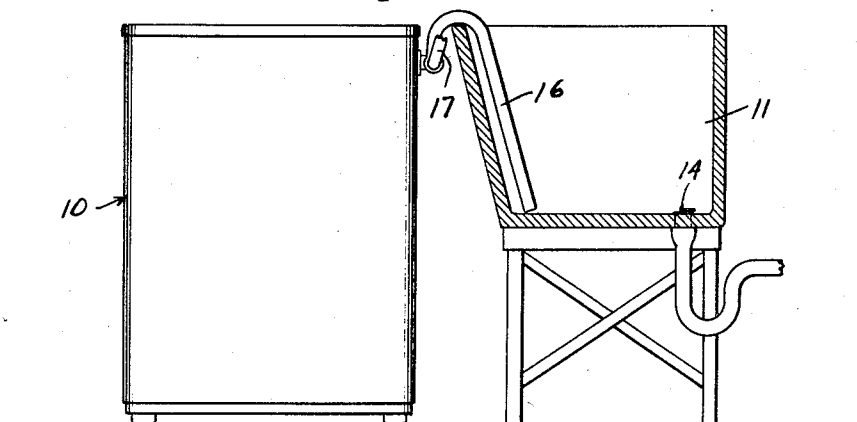
July 31, 1951

P. E. GELDHOF ET AL
SELF-PRIMING PUMP SYSTEM

2,562,610

Filed Nov. 21, 1945

5 Sheets-Sheet 1



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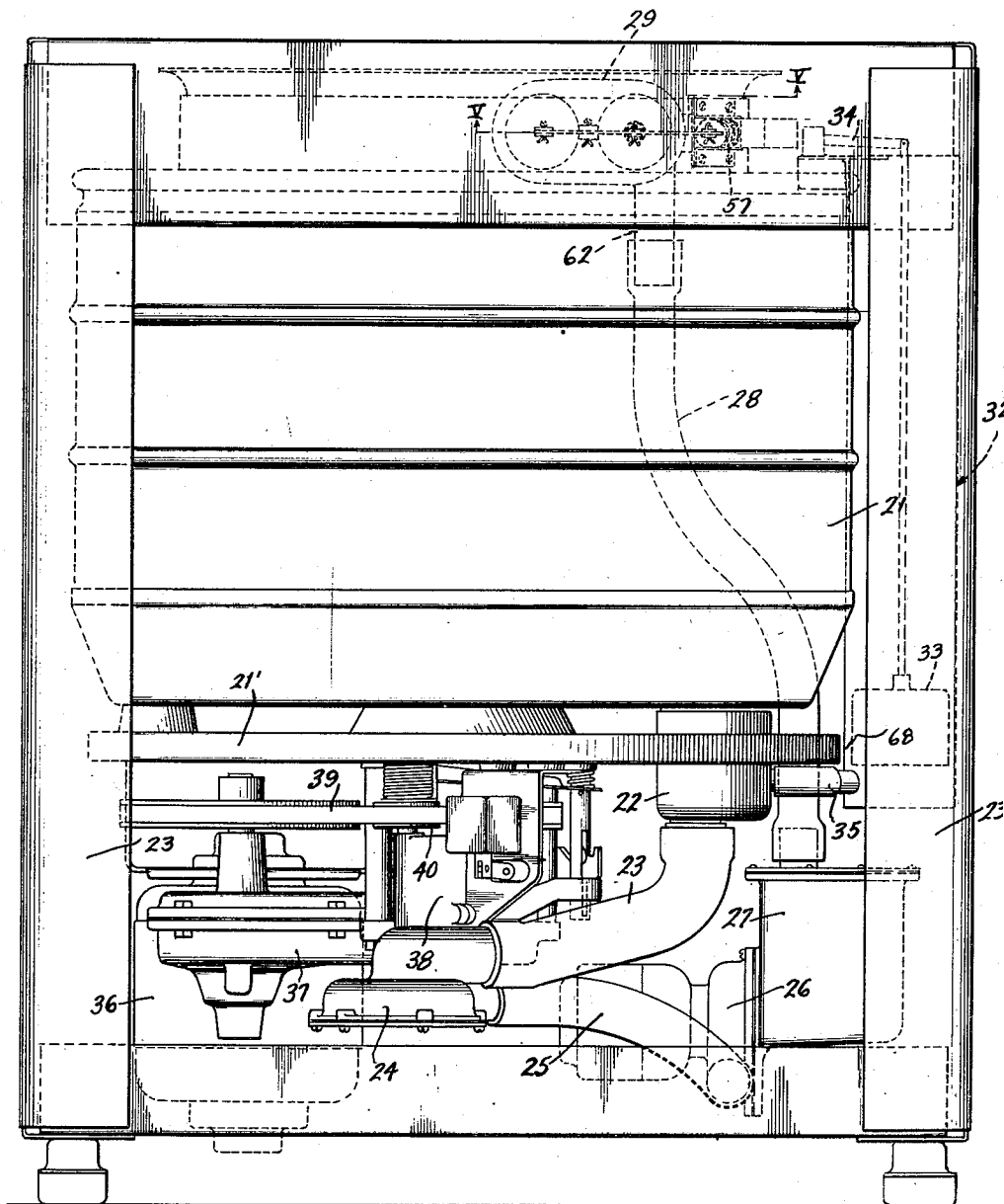
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Fig. 3.



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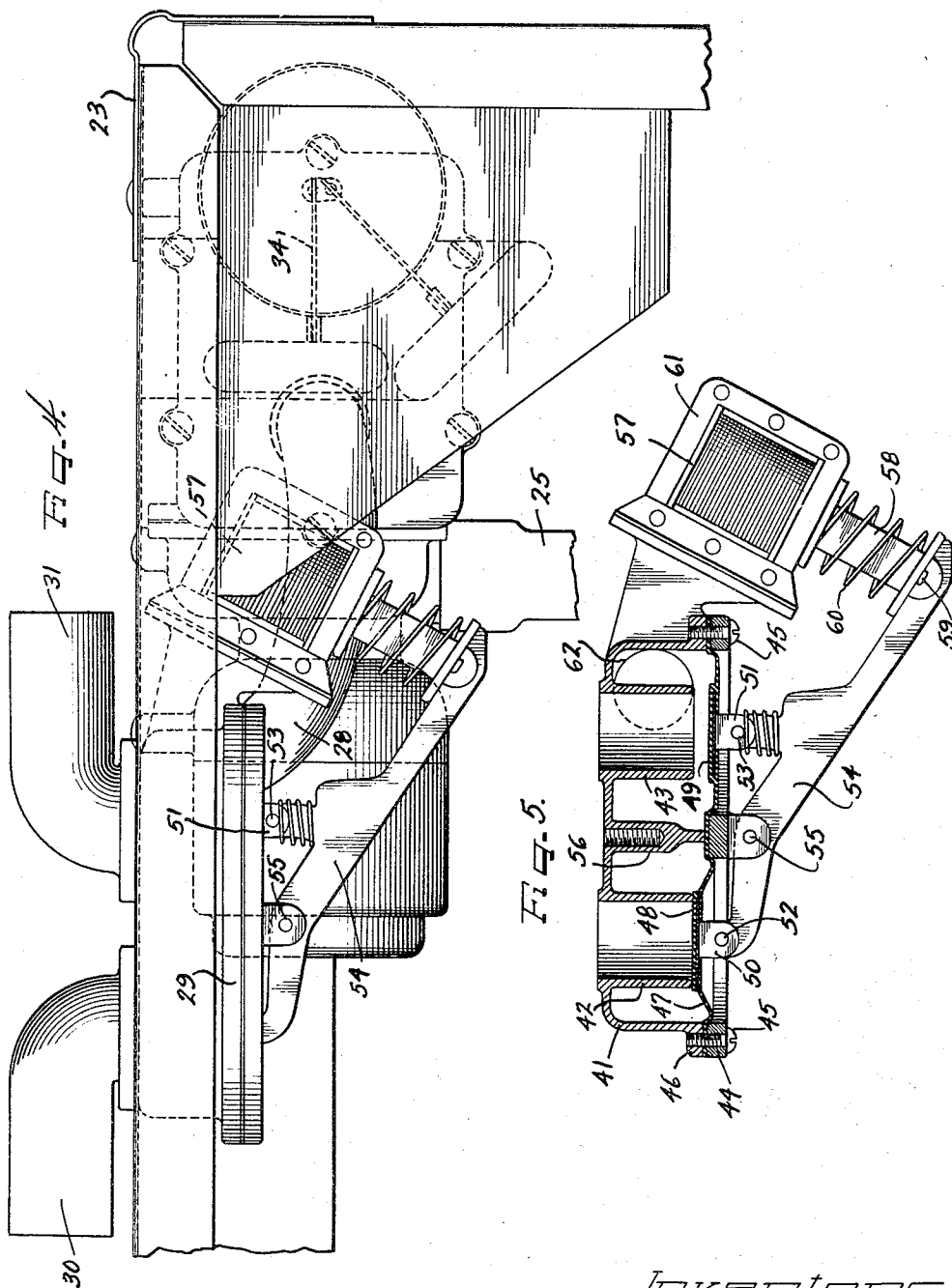
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Fig. 6.

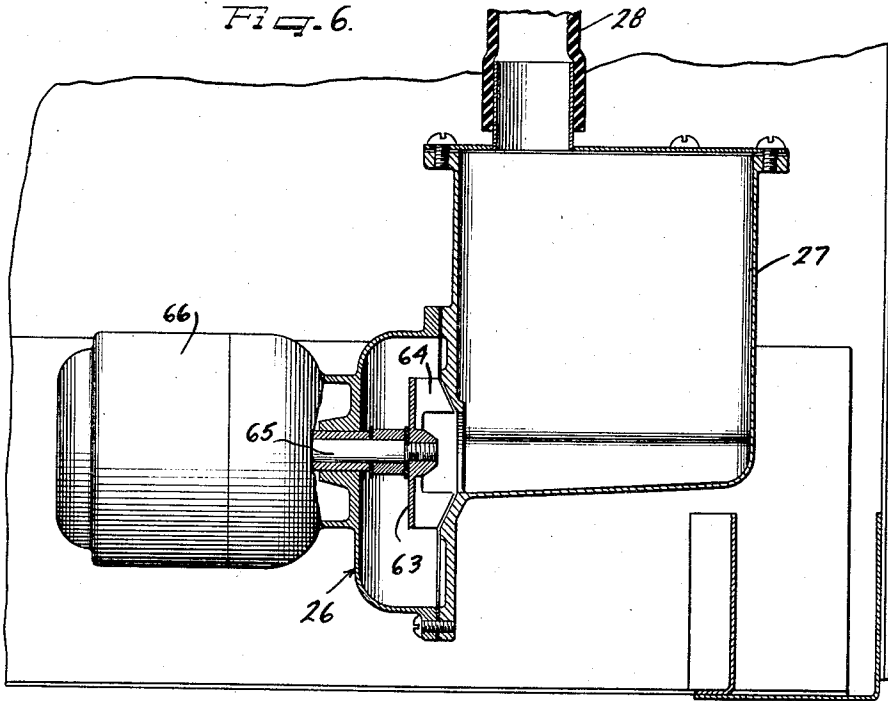
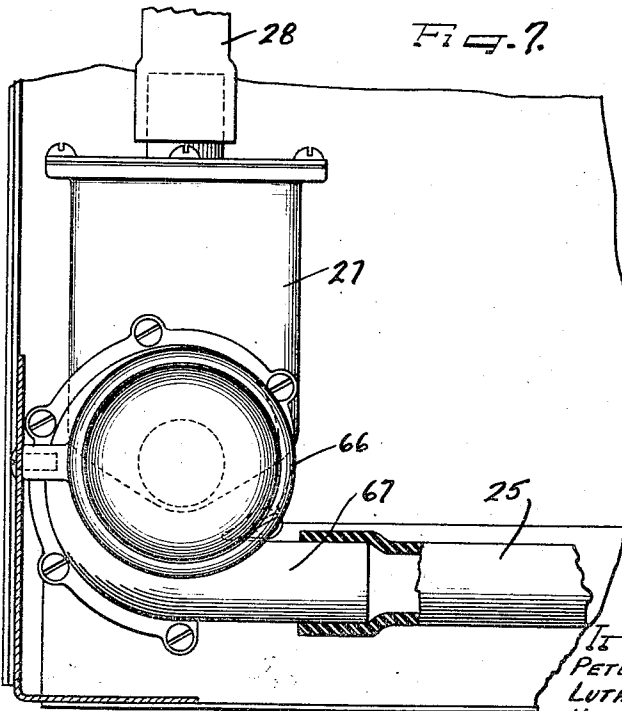


Fig. 7.



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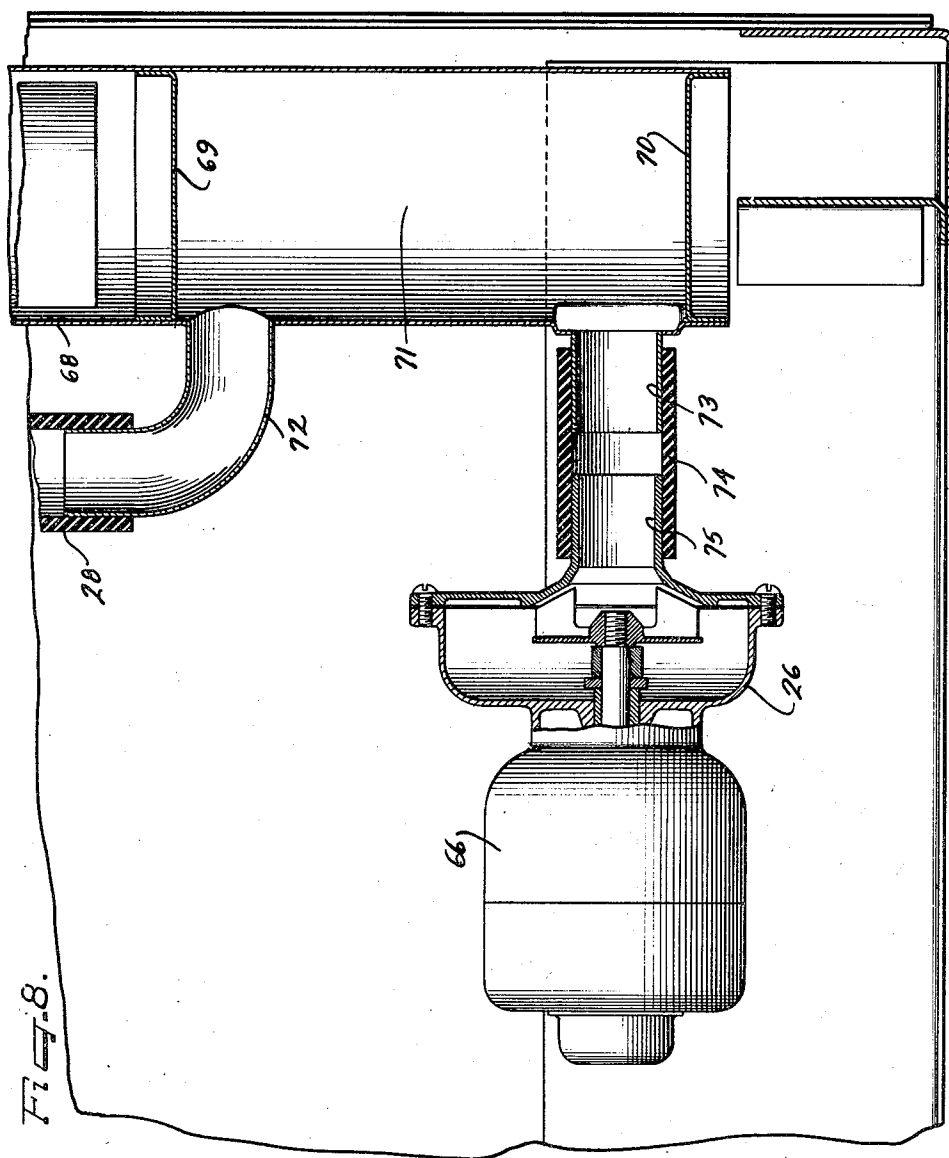
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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,562,610

SELF-PRIMING PUMP SYSTEM

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Application November 21, 1945, Serial No. 630,032

17 Claims. (Cl. 68—207)

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This invention relates to a pump and its associated fluid system, and more particularly to a washing machine suds pump and associated fluid system which, because of its design, makes the pump self priming.

In many different types of fluid systems, the problem of priming an intermittently operated pump is a serious problem, particularly when the cost of the operating mechanism is to be maintained at a minimum. This is particularly true in automatically operated household laundry machines.

It has been found in laundry machines, such, for example, as household laundry machines, that it is desirable to store the suds water which has been used in an initial operation while other operations are being carried on, and then later to pump the suds water back into the tub of the automatic washing machine. In order to minimize the cost of the automatic washing machine, it has been found desirable to employ an ordinary conventional laundry tub as a storage reservoir, since such a laundry tub is usually found in homes where automatic washing machines are used. It will, of course, be apparent that there is a problem in transporting the suds water from the laundry tub back into the automatic washing machine after it has been stored. One solution to this problem was to provide a separate pump which could be mounted directly on the laundry tub and submersed in the suds water. The principal disadvantage of such an arrangement lies in the fact that a separate unit is required from the automatic washing machine itself. It is, of course, much more desirable from the merchandising standpoint as well as from the standpoint of convenience of operation, to have the suds pump as a part of the automatic washing machine itself. The difficulty here, however, lies in the fact that ordinary and conventional arrangement of pumps would not be self priming, and some means must therefore be provided to set the pump into operation so it will draw the suds water from the laundry tub into the tub of the automatic washing machine.

One of the principal features and objects of the present invention is to provide a novel suds pump and vacuum breaking reservoir which overcomes the difficulties above referred to, and which may be mounted directly and formed as a unitary part of the automatic washing machine.

Another object of the present invention is to provide a novel method and means for priming a pump.

A further object of the present invention is to

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provide a novel fluid system for an automatic washing machine.

A still further object of the present invention is to provide a novel method and means for transferring the fluid of a laundry machine to a storage reservoir and then back again to the laundry machine.

The novel features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention itself, however, both as to its manner of construction and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a plan view of an automatic washing machine positioned beside a pair of laundry tubs and with fluid conduits connecting the automatic washing machine with the laundry tubs;

Figure 2 is an end view partly in section as taken along the line II—II of Figure 1, of the washing machine and laundry tubs;

Figure 3 is a front elevational view of an automatic washing machine with parts of the cabinet removed to illustrate the operating relationship of the several parts of the apparatus;

Figure 4 is a greatly enlarged fragmentary plan view with part of the cabinet removed to illustrate the two-way valve mechanism;

Figure 5 is a horizontal section view of the two-way valve mechanism as taken along the line V—V of Figure 3;

Figure 6 is an enlarged fragmentary view partly in section of the suds pump and its associated auxiliary reservoir;

Figure 7 is a fragmentary elevational view of the suds pump and auxiliary reservoir as viewed from the left in Figure 6 of the drawings; and

Figure 8 is a view similar to Figure 6 but showing a modified form of reservoir and suds pump.

Referring first to Figures 1 and 2 of the drawings, there is illustrated therein an automatic washing machine 10 disposed beside a pair of laundry tubs 11 and 12. The laundry tubs 11 and 12 may be formed as a single unit with a central partition 13, as is the usual case with laundry tubs found in homes today. The laundry tub 11 is shown as being provided with a stopper 14 in its drain, while the tub 12 is shown as being provided with an open drain 15. As will presently be explained, the tub 11 will be used as a storage container for suds water from the automatic washing machine 10, while the tub 12 will merely be used as a collecting basin by which

fluid discharged from the washing machine 10 may be passed down the drain 15. The tub 11 is connected with the automatic washing machine 10 by means of a fluid conduit 16, while the tub 12 receives fluid discharged through the fluid conduit 17 from the automatic washing machine 10.

For a reason which will presently become apparent, the fluid conduit 16 extends over the edge of the tub 11 down to a point in close proximity to the bottom of the tub 11, as is clearly shown in Figure 2. The discharge conduit 17 may be of any convenient length, since the fluid discharged therethrough merely passes on down the drain 15.

The automatic washing machine 10 is provided with a top door or cover 18 which may be raised to obtain access to the clothes container within the machine. The control mechanism of the automatic washing machine forms no direct part of the present invention and is merely diagrammatically represented as at 19 and 20.

As may be seen best in Figure 3 of the drawings, the automatic washing machine 10 includes a fluid containing tub 21 which is mounted on a sub-base 21' which in turn is carried by the main frame 23. The tub 21 is provided with a sump 22 in fluid connection with the bottom of the tub and this sump 22 in turn is connected through a hose 23 to the intake side of the main pump 24. The outlet of the main pump 24 is connected through a flexible hose 25, the auxiliary pump 26, the auxiliary pump vacuum creating reservoir 27, and the flexible hose 28 to the two-way valve mechanism 29. The two-way valve mechanism 29 selectively communicates with the outlet nipples 30 and 31 which in turn are connected to the conduits 16 and 17 respectively.

Disposed alongside of the tub 21 is a standpipe or float chamber 32 which has at least one float therein, such, for example, as the float 33 carried on the switch actuating arm 34. The lower end of the float chamber is in open communication through the conduit 35 with the sump 22 of the tub 21.

The main operating and drive mechanism of the automatic washing machine 10 need only be referred to in general terms, since the specific character of the main drive mechanism forms no part of the present invention. As shown in Figure 3, a main motor 36 is provided which is in operating and driving relationship with the transmission mechanism 37. Both the motor 36 and the transmission 37 are mounted on the sub-base 21'. The pump 24 is also mounted on the sub-base 21' by means of the bracket 38, and the drive for the main pump 24 is obtained through the belt drive 39 which is arranged to selectively engage the pump driving pulley 40.

When the tub 21 is first filled with soapy water, which is one specific example of suds water referred to in this case, the soapy water not only fills the tub 21 but also fills the sump 22, the flexible hose 23, the pump 24, the flexible hose 25, the pump 26, the fluid reservoir 27 and up into the conduit 28 to the same height as the soapy water in the tub. During the washing cycle of the automatic washing machine the pump 24 is inoperative and no fluid is discharged from the tub 21. After the washing cycle has been completed, and it is desired to extract the water, such as by a centrifugal extraction operation, the main pump 24 is driven by the belt drive 39 from the main motor 36. The soapy water is drawn out of the tub 21 down through the sump 22, the hose 23, and then discharged by the pump 24 through the hose 25, the auxiliary pump 26, the reservoir

27, the hose 28 and thence through one side or the other of the two-way valve 29 to either laundry tub 11 or laundry tub 12.

The two-way valve mechanism which selectively directs the discharge of the soapy water to either laundry tub 11 or laundry tub 12 is illustrated in detail in Figures 4 and 5 of the drawings. Referring now to Figures 4 and 5, the two-way valve mechanism includes a housing 41 having two hollow center posts 42 and 43 extending through one side wall thereof. These hollow center posts or sleeves 42 and 43 terminate within the housing 41 in a region or plane lying in proximity to and spaced away from a web member 44 which is bolted or otherwise secured as at 45 to a flange 46 formed on the main housing portion 41. This web member 44 is arranged to clamp a flexible diaphragm 47 into position against the flange 46 to form one side wall of the housing 41. The flexible diaphragm 47 may be of any suitable material such as rubber, neoprene, or the like, and has two reinforced disc-like portions 48 and 49 which lie opposite the inner ends of the sleeves or posts 42 and 43. The reinforced disc-like portions 48 and 49 have ears 50 and 51 formed on the reinforcing portion of the diaphragm 47, and are arranged to be pinned as at 52 and 53 to a rocker arm 54 which is pivotally mounted as at 55 on a central portion of the web member 44. The web member 44 is open and free opposite the reinforced disc-like portions 48 and 49, thereby providing free access to the reinforced disc-like portions 48 and 49 through the web member 44 for the necessary hinge connections of the rocker arm 54.

The hollow center posts or sleeves 42 and 43 at their inner ends provide valve seats, and the reinforced disc-like portions 48 and 49 provide valve members for opening and closing the ends of the center posts 42 and 43. In order to reinforce the region of the web member 44 where the rocker arm 54 is pivotally mounted thereon, a substantially solid center post 56 extends through from one side of the casing wall to a position where the central part of the diaphragm 47 is seated tightly thereagainst and thus in turn reinforces the central portion of the web member 44. It is to be understood that the center post 56 is not a partition, but on the contrary, is a relatively small post and fluid flows freely therearound within the housing 41.

The outlet nipples 30 and 31 are arranged to be connected to the outer ends of the hollow center posts 42 and 43.

Mounted on one side of the housing 41 is a solenoid 57 into which a laminated armature 58 extends. The laminated armature 58 is pivotally mounted, as at 59, on the rocker arm 54. A coiled spring 60 extends between the rocker arm 54 and the yoke 61 of the solenoid 57 and thus biases the rocker arm 54 in a clockwise direction, as viewed in Figure 5 of the drawings. Stated in a somewhat different manner, the compression spring 60 normally forces the disc-like central portion 48 of the diaphragm 47 tightly against the center post 42, while the disc-like portion 49 has been moved away from the hollow center post 43. Upon energization of the solenoid 57 the armature 58 is drawn into the solenoid 57 and the rocker arm is thus moved to force the disc-like center portion 49 against the hollow center post 43 while withdrawing the disc-like central portion 48 away from the hollow center post 42.

From the above description it will be apparent

that when the sleeve communicating with the nipple 30 is open, the one communicating with the sleeve 31 is closed, and vice versa. The inlet to the housing 41 is indicated as at 62 and this inlet nipple is connected to the flexible hose 28, as is shown in Figure 3 of the drawings. This air-tight seal of one port while the other port is open has an extremely important function, as will presently be explained in connection with the description of the auxiliary pump and the vacuum creating reservoir.

The pump 26 and its associated vacuum creating reservoir 27 is illustrated in detail in Figures 6 and 7 of the drawings. The pump 26 may be any form of simple centrifugal pump which includes a rotor member 63 carrying a plurality of paddles or blades 64. The rotor member 63 is mounted on the rotating shaft 65 of the electric motor 66. The discharge side of the pump 26 is a tangential discharge conduit 67 which is connected to the hose 25 previously referred to. The intake of the pump 26 is axial and is in direct communication with the fluid container 27. The upper side of the fluid reservoir 27 connects with the hose 28. This reservoir 27 is thus directly in the fluid discharge circuit of the main pump 24. The reservoir 27 furthermore is of sufficient capacity, together with the fluid which would normally stand in the hose 28, to prime the pump 26 when it is started into operation upon energization of the motor 66.

The relationship of the fluid reservoir 27 to the pump 26 will best be understood in describing the operation of the fluid discharge and the fluid return system of the washing machine.

Referring particularly to Figures 1, 2, and 3 of the drawings, let us assume that soapy water has been introduced into the tub 21 and that the clothes have been washed. The pump 24 is now started and the solenoid 57 is energized to open the port through the sleeve 42 and close the port through the sleeve 43. The pump 24 now pumps the soapy water through the hose 25, the pump 26, the reservoir 27, the hose 28, the conduit connection 62, the housing 41, the sleeve 42, the hose 16, and into the laundry tub 11. Since the laundry tub 11 is of greater capacity than the tub of the automatic washing machine 10, and since the stopper 14 prevents the soapy water from draining from the tub 11, the soapy water is retained in the laundry tub 11 for future use in the automatic washing machine 10. The automatic washing machine may then carry through its successive stages of operation and these may include, by way of example but not by way of limitation, an extracting or drying operation and then a rinsing operation in which the tub 21 is again filled, but this time with fresh water which, after it has performed its rinsing function, is discharged into the laundry tub 12. This is done by merely deenergizing the solenoid 57 so that the sleeve 42 is closed and the sleeve 43 is in open communication with the conduit portion 62 of the housing 41.

Let it now be assumed that the soapy water or suds water which has been stored in the laundry tub 11 is to be returned to the tub 21 of the automatic washing machine 10. The solenoid 57 is energized, thus sealing the port defined by the sleeve 43 and opening the port defined by the sleeve 42. At the same time the motor 66 of the auxiliary pump 26 is started. Since there is always fluid left in the reservoir 27 and in the hose 28 after the pump 24 has discharged fluid from the tub 21 it will be apparent that this

quantity of fluid acts as a means of priming the pump 26. The reservoir 27 is of sufficiently great capacity that the pump 26 may pump the fluid contained in the reservoir 27 long enough to create the necessary vacuum in the hose 28 to suck the soapy fluid up from the laundry tub 11 and get it started flowing through the pump 26. Thus we see that instead of trying to pump the soapy water directly from the laundry tub 11, the pump 26 initially pumps whatever fluid has been left standing in the reservoir 27 and the hose 28, provision being made that the quantity of the latter is sufficiently great that the necessary vacuum will be created in the hose 28 before all of the fluid contained in the reservoir 27 and the hose 28 has been passed through the pump 26 back to the tub 21 of the washing machine.

From the above description it will be apparent that this auxiliary reservoir directly in the fluid discharge path of the other pump makes it possible to mount the suds pump; that is, the pump which causes the suds water to pass from the storage compartment back into the automatic washing machine; directly on and near the bottom of the automatic washing machine. This greatly simplifies the construction and enables the use of a very low price pump.

A modified arrangement of the present invention is shown in Figure 8 of the drawings, wherein the vacuum creating reservoir is formed as a continuation of the float chamber, but separated therefrom. As shown in Figure 8, the tube 68 which forms the float chamber 32 is extended to a position substantially lower to that shown in Figure 3 of the drawings. The tube 68 has a transverse partition 69 therein which provides the bottom wall of the float chamber. A second partition 70 seals off the extreme lower end of the tube 68 and provides a fluid tight bottom wall. The region between the transverse partition 69 and the bottom wall 70 provides a vacuum creating reservoir 71 which is similar in function to the vacuum creating reservoir 27 shown in Figures 6 and 7.

An elbow pipe 72 is connected into the tube 68 just below the partition 69 and extends up into engagement with the hose 28, thus providing an open communication between the chamber 71 and the hose 28. An outlet nipple 73 is connected into the tube 68 just above the bottom wall 70. This outlet nipple 73 is arranged to receive a hose coupling 74 which also extends around the inlet nipple 75 of the pump 26. The size of the chamber 71, together with the volume of fluid which is retained in the hose 28, is sufficiently great to provide the necessary priming for the pump 26. In all other respects the modification of the invention shown in Figure 8 of the drawings is similar to that described in connection with the other figures and will not be repeated.

While we have shown particular embodiments of our invention, it will, of course, be understood that we do not wish to be limited thereto, since many modifications may be made, and we, therefore, contemplate by the appended claims, to cover all such modifications as fall within the true spirit and scope of our invention.

We claim as our invention:

1. A self-priming pumping system for returning a fluid to a container from which it has previously been discharged comprising a first container having a drain, a second container, a pump connected to said drain, a discharge con-

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duit connected to the discharge side of said pump and rising to a high point above said second container and terminating in said second container in proximity to its bottom, a second pump in said discharge conduit between said first pump and said high point, and an auxiliary reservoir between said second pump and said high point in said conduit, the combined volume of said reservoir and the portion of said conduit between said second pump and said high point being sufficient to prime said second pump, whereby said second pump may pump fluid originally discharged from said first container into said second container back to said first container.

2. A self-priming pumping system comprising a first container having a drain, a second container, a pump having its inlet connected to said drain, a discharge conduit connected to the discharge side of said pump and rising to a high point above said second container and terminating in said second container in proximity to its bottom, a second pump in said discharge conduit between said second pump and said high point, the discharge side of said second pump being on the discharge side of said first pump whereby said first pump is arranged to pump fluid from said first container to said second container, and said second pump is arranged to pump fluid from said second container to said first container, and an auxiliary reservoir between said second pump and said high point in said conduit, whereby when said second pump is started the fluid from said auxiliary reservoir and from the portion of said conduit between said second pump and said high point passes through said second pump and creates a sufficient vacuum in said conduit to start pulling the fluid from the second container up over the high point in said conduit.

3. A self-priming pumping system comprising a first container having a drain, a second container, a pump having its inlet connected to said drain, a discharge conduit connected to the discharge side of said pump and rising to a high point above said second container and terminating in said second container in proximity to its bottom, a second pump in said discharge conduit between said first pump and said high point, and an auxiliary reservoir mounted directly on the intake side of said second pump and through which fluid flows when it is discharged from said first container into said second container by said first pump, said reservoir having a volume relatively large as compared with said second pump.

4. A self-priming pumping system comprising a first container having a drain, a second container, a pump connected to said drain, a discharge conduit connected to the discharge side of said pump and rising to a high point above said second container and terminating in said second container in proximity to its bottom, a second pump in said discharge conduit between said first pump and said high point, an auxiliary reservoir disposed at an intermediate point in said conduit between said second pump and said high point, the volume of said auxiliary reservoir being relatively large as compared with the volume of said conduit between said high point and the bottom of said second container.

5. A self-priming pumping system comprising a first container having a drain, a second container, a pump through which fluid may freely flow when said pump is idle, said pump being connected on its intake side to said drain and on its discharge side to a discharge conduit, a

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second pump through which fluid may freely flow when said second pump is idle, the discharge side of said second pump being connected to the discharge side of said first pump, a fluid conduit connecting the intake side of said second pump to a second container after rising to a point substantially above the bottom of said second container, the termination of said conduit being in proximity to the bottom of said second container, and an auxiliary reservoir in said conduit in close proximity to the intake side of said second pump, the combined volume of said reservoir and the portion of said conduit between said second pump and its highest point being sufficient to prime said pump when said pump is energized to pump fluid from said second container back to said first container after it has been discharged from said first container to said second container by said first pump.

6. A self-priming pumping system comprising a first container, a second container, a final discharge drain, a pump disposed below said first container and connected thereto, a second pump, the discharge side of said second pump being connected to the discharge side of said first pump, said pumps being consecutive and arranged such that when one pump is idle fluid discharged from the other pump passes freely therethrough, a conduit connected to the intake side of said second pump and rising to a point substantially higher than the bottom of said second container and then extending downwardly into said second container to a point in proximity to the bottom thereof, a two-way valve having three ports, two of said ports being consecutively connected in said conduit between said second pump and said second container and the third port being connected to said drain, said two-way valve including valve means for selectively sealing either said port connected to said drain, or the port connected to said conduit nearest said second container, and an auxiliary reservoir between said second pump and the highest point of said conduit, the combined volume of said reservoir and the portion of said conduit between said second pump and said highest point being sufficient to prime said second pump, whereby said pump may pump fluid originally discharged from said first container into said second container by said first pump back into said first container, and whereby fluid from said first container may be finally discharged to said drain by said first pump when desired.

7. A self-priming pumping system for returning a fluid to a container from which it has previously been discharged, comprising a principal container, a storage container, a discharge conduit means connected to said principal container and having a pump therein arranged to deliver fluid discharged from said principal container to said storage container, said discharge conduit means rising to a high point above the bottom of said second container and terminating in said second container in proximity to its bottom, a second pump in said discharge conduit means between said first pump and said high point, and said fluid discharge conduit means including an auxiliary reservoir between said second pump and said high point in said conduit means, the combined volume of said reservoir and the portion of said conduit means between said second pump and said high point being sufficient to prime said second pump, whereby said second pump may pump any fluid originally discharged

from said principal container into said storage container, back to said principal container.

8. A self-priming pumping system comprising a principal container having a drain, a storage container, discharge conduit means connected from said drain to said storage container, said conduit means having pump therein and the suction side of said pump being in communication with said principal container and having a high point therein with respect to said storage container but having a terminating portion within said storage container in proximity to its bottom, a second pump in said discharge conduit means between said drain and said high point, and an auxiliary reservoir mounted directly on the intake side of said second pump and through which fluid flows when it is discharged from said principal container into said storage container, said reservoir having a volume relatively large as compared with the capacity of said second pump.

9. A self-priming pumping system comprising a principal container having a drain, a storage container, discharge conduit means connected from said drain to said storage container, said discharge conduit means rising to a high point above said storage container and terminating in said storage container in proximity to its bottom, a pump in said discharge conduit means having its suction side in communication with said principal container, a second pump in said discharge conduit means between said drain and said high point, an auxiliary reservoir disposed at an intermediate point between the inlet port of said second pump and said high point of said discharge conduit means, the volume of said auxiliary reservoir being relatively large as compared with the volume of said conduit between said high point and the bottom of said storage container.

10. A self-priming pumping system comprising a principal container having a drain, a storage container, discharge conduit means connected to said drain and extending downwardly, then upwardly to a high point above said storage container, then downwardly again into said storage container and terminating in proximity to its bottom, a pump in said discharge conduit means having its suction side in communication with said principal container, a second pump in said discharge conduit means between said drain and said high point, and an auxiliary reservoir in said conduit means between the inlet port of said second pump and said high point through which fluid flows when it is discharged from said principal container into said storage container, said reservoir having a volume relatively large as compared with the capacity of said second pump.

11. A washing machine comprising a tub, a pump mounted below said tub and having its intake side connected to the lower part of said tub, a second pump having its discharge side connected to the discharge side of said first pump, a conduit rising from the intake side of said second pump to a high point in proximity to the top of said machine and then extending downwardly therefrom, said downwardly extending portion being arranged to be disposed in a storage container in proximity to the bottom thereof, said conduit between said second pump and said high point having a fluid containing capacity relatively great with respect to the fluid capacity of said downwardly extending portion.

12. A washing machine comprising a tub, a centrifugal pump mounted below said tub and

having its intake side connected to the lower part of said tub, a second centrifugal pump having its discharge side connected to the discharge side of said first pump, a conduit rising from the intake side of said second pump to a high point in proximity to the top of said machine, a pair of conduits at the top of said machine, at least one extending downwardly therefrom for a substantial distance, said downwardly extending conduit being arranged to be disposed in a storage tub in proximity to the bottom thereof, valve means on said washing machine for selectively connecting said rising conduit to said other two conduits at the top of said machine, the fluid capacity of said conduit between said second pump and said high point being relatively great with respect to the fluid capacity of said downwardly extending conduit.

13. A washing machine comprising a tub, a centrifugal pump mounted below said tub and having its intake side connected to the lower part of said tub, a second centrifugal pump having its discharge side connected to the discharge side of said first pump, a conduit rising from the intake side of said second pump to a high point in proximity to the top of said machine, a pair of conduits at the top of said machine, at least one extending downwardly therefrom for a substantial distance, said downwardly extending conduit being arranged to be disposed in a storage tub in proximity to the bottom thereof, valve means on said washing machine for selectively connecting said rising conduit to said other two conduits at the top of said machine, and an auxiliary reservoir in said rising conduit between said second pump and said high point, the capacity of said fluid reservoir being relatively great compared with the capacity of said second pump.

14. A washing machine comprising a tub, a centrifugal pump mounted below said tub and having its intake side connected to the lower part of said tub, a second centrifugal pump having its discharge side connected to the discharge side of said first pump, a conduit rising from the intake side of said second pump to a high point in proximity to the top of said tub, a pair of conduits adjacent the top of said tub, at least one extending downwardly therefrom for a substantial distance, said downwardly extending conduit being arranged to be disposed in a storage tub in proximity to the bottom thereof, valve means on said washing machine for selectively connecting said rising conduit to either of said other two conduits at the top of said machine, and an auxiliary reservoir in said rising conduit between said second pump and said high point.

15. A washing machine comprising a tub, a pump mounted below said tub and having its intake side connected to the lower part of said tub, a second pump having its discharge side connected to the discharge side of said first pump, a standpipe forming a float chamber disposed alongside of said tub and having a tubular portion extending down a distance substantially below said tub, a bottom wall in said standpipe, an intermediate wall in said standpipe forming a lower chamber and an upper float chamber, the intake side of said second pump being connected to said lower chamber, a conduit rising from said lower chamber to a high point in proximity to the top of said tub and then extending downwardly therefrom, said downwardly extending portion being arranged to be disposed in a storage container in proximity to the bottom

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thereof, the volume of said lower chamber in said standpipe together with its associated conduits being sufficiently great to prime said second pump.

16. A self-priming pumping system comprising a first container, a second container spaced from said first container, a conduit between said containers, pumping means in said conduit for forcing fluid in either direction through said conduit including two pumps the suction side of one of which is connected with the pressure side of the other, and a reservoir in said conduit connected between said second container and the suction side of one of said pumps and at such an elevation with respect to said pump as to maintain said pump primed.

17. A self-priming pumping system comprising a first container, a second container spaced from said first container, a conduit between said containers, pumping means in said conduit for forcing fluid in either direction through said conduit including two pumps, the suction side of one of which is connected with the pressure side

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of the other, and a reservoir in said conduit below said containers and connected with the suction side of one of said pumps.

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