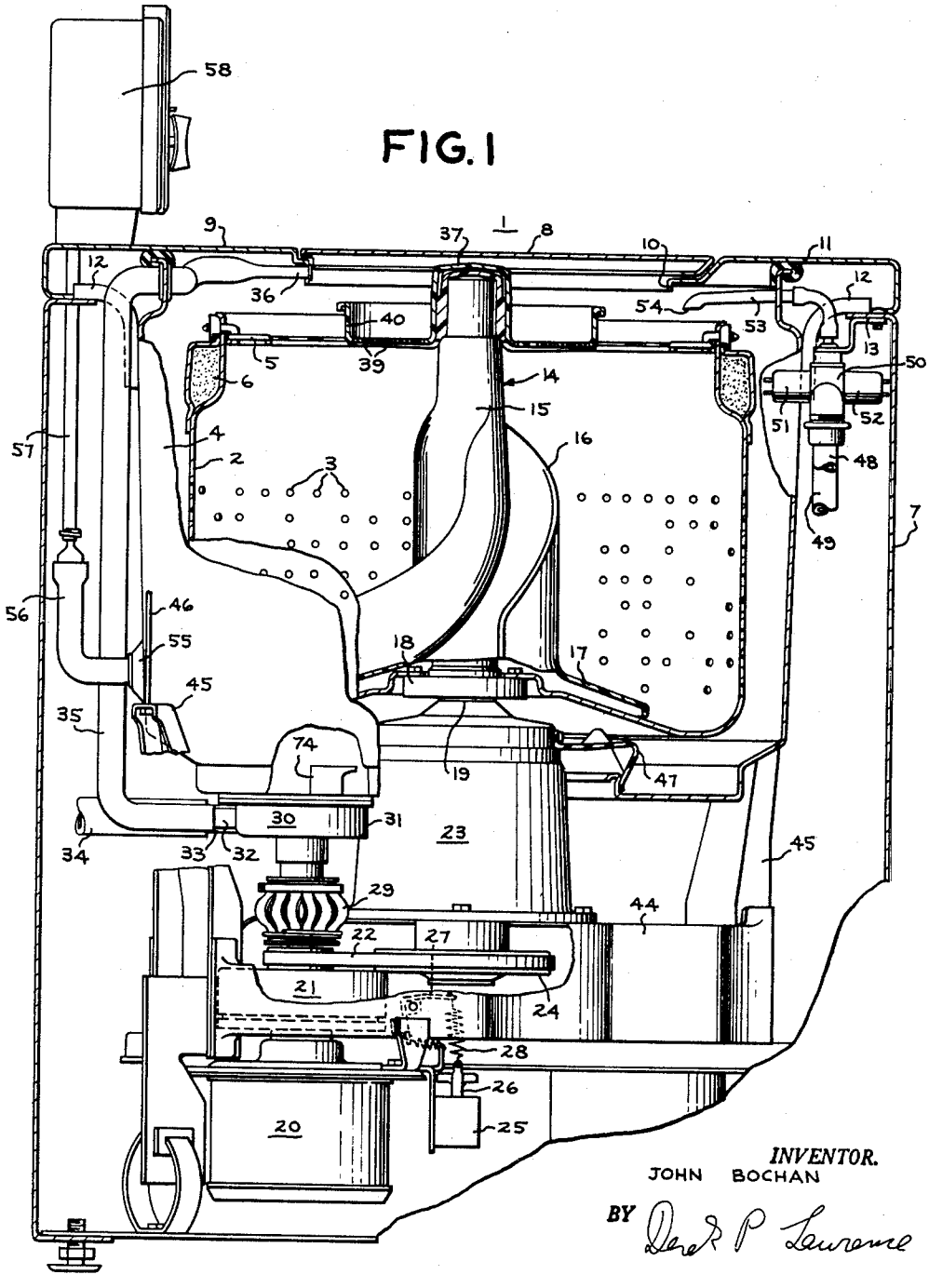
April 7, 1964 J. BOCHAN 3,127,840

CLOTHES WASHER WITH IMPROVED TURBINE TYPE PUMP

Filed Dec. 26, 1961 2 Sheets-Sheet 1

FIG. 1



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CLOTHES WASHER WITH IMPROVED TURBINE TYPE PUMP

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FIG.2

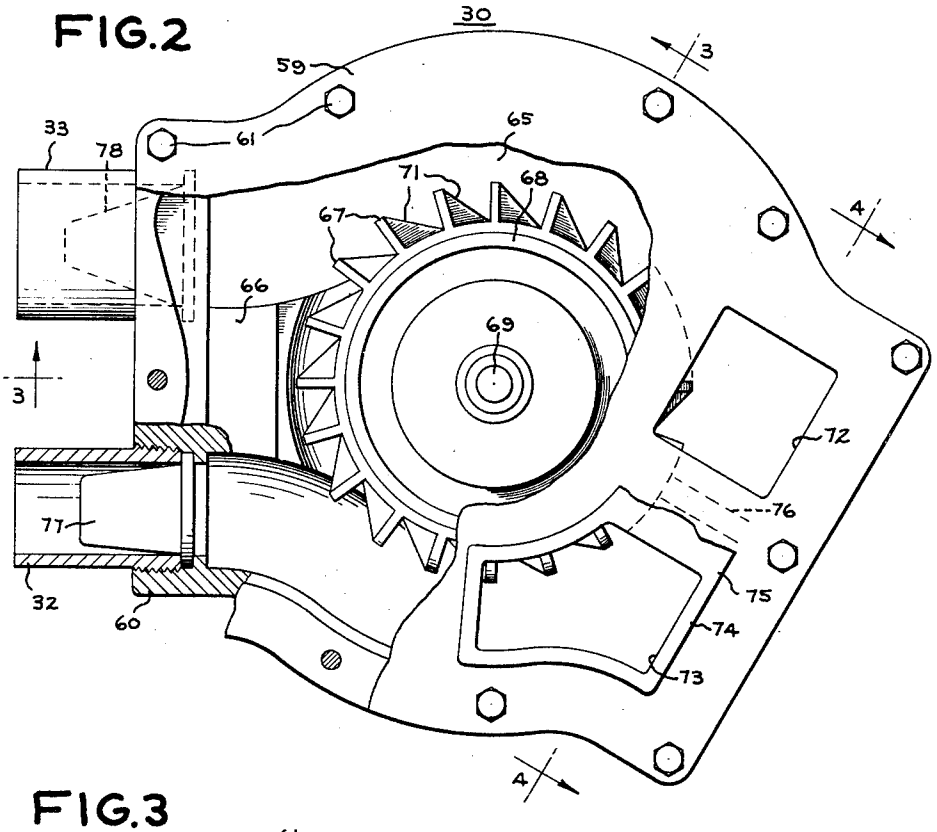


FIG.3

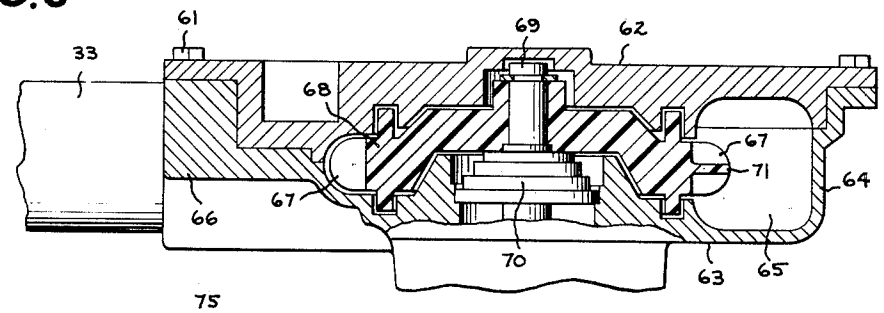
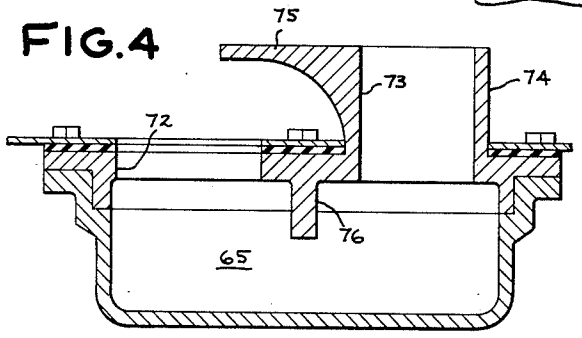


FIG.4



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United States Patent Office 3,127,840
Patented Apr. 7, 1964

3,127,840

CLOTHES WASHER WITH IMPROVED TURBINE TYPE PUMP

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Filed Dec. 26, 1961, Ser. No. 162,022
4 Claims. (Cl. 103—3)

This invention relates to laundry apparatus such as clothes washing machines, and more particularly to an improved pump for use in such machines.

Automatic clothes washing machines virtually always include a drain pump which is put into operation in order to effect draining of liquid from the machine after washing and rinsing operations. This pump is generally operated by the same power source, usually an electric motor, which operates the washing system of the machine so that the motor will alternatively provide a washing action in the machine or serve to drain liquid out of the machine. An additional function which has been provided in several commercially available washing machines in recent years is recirculation of the wash liquid during the washing operation, usually for filtering purposes.

Various factors, including the ability to pass small rigid articles carried out by wash water, durability, serviceability, and the like have led to a general trend in the washing machine industry to utilize turbine type pumps for the removal of the liquid from the machine, as opposed to centrifugal type pumps. It is well known that, with a turbine type pump, direction of flow through the pump can be reversed simply by reversing the rotation of the pump impeller, as opposed to centrifugal type pumps wherein flow necessarily is always in a generally radially outward direction through the pump. In the concurrently filed application Serial No. 158,288 of James M. Pinder, filed December 11, 1961, assigned to the assignee of the present invention, there is disclosed and claimed a turbine type pump which effects, by reversing the impeller rotation, both the water recirculation function during the washing and rinsing operations, and the draining operation during liquid extraction operations. While the pump of the Pinder application is operative as disclosed, the flow rate tends to be somewhat low because of the tendency of such a dual-purpose pump to air lock upon reversal and thus provide a less effective pumping action. This, in turn, decreases the recirculation flow and also requires a longer draining time, both of which are aspects tending to affect, to some degree, marketability of machines including such a structure.

It is therefore an object of my invention to provide an improved single impeller turbine pump formed so as to pump with high efficiency from different inlets to different outlets when the impeller rotates in opposite directions.

A further object of my invention is to incorporate such a pump in a novel manner in a washing machine so as to provide thereby, with full effectiveness, recirculation of the liquid during washing and rinsing, and draining of the liquid during liquid extraction.

A further object of my invention is to achieve a structure wherein the sand and other heavy soils removed from clothes will tend to be removed by the pump during draining operations but will tend to pass to a position where they are not moved by the pump during recirculation operations. Yet a further specific object of my invention is to provide an improved turbine type pump having an impeller formed to provide greater flow and pressure in one direction of rotation than in the other.

Briefly stated, in accordance with one aspect of my invention I provide a turbine pump wherein the housing, with a substantially annular outer wall joined by suitable bottom and top closing walls, defines therewithin a substantially toroidal pump chamber. In this chamber there

is a rotatable impeller which has an annular series of blades extending outwardly, so that during rotation of the impeller the blades have a turbine effect on liquid in the chamber tending to pump it in one or the other direction depending upon the direction of rotation of the impeller. The outer wall has first and second circumferentially spaced outlet openings formed therein, and the top wall also has first and second circumferentially spaced inlet openings formed therein. Each inlet opening is circumferentially spaced in relation to its associated outlet opening so that liquid may be pumped from one of the inlet openings to one of the outlet openings depending upon the direction of rotation of the impeller. To insure that the liquid passes out through the appropriate outlet opening, a dam is positioned in the chamber between the outlet openings.

I propose to provide this type of pump with the inlet openings both being connected to receive liquid from the liquid receptacle of a washing machine. One of the outlets is connected so that it causes recirculation and the other outlet is connected so that it is connected to a drain. Thus, when the impeller is rotated in one direction liquid passes from the receptacle into the pump and is recirculated back into the receptacle, and when rotation of the impeller in the other direction occurs, the liquid passes from the washing machine receptacle out to drain.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention itself, however, both as to its organization and method of operation, together with further advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings.

In the drawings, FIGURE 1 is a side elevational view of a clothes washing machine including my novel pump, the view being partially broken away and partially in section to illustrate details;

FIGURE 2 is a partially sectionalized plan view of the pump of my invention;

FIGURE 3 is a view along line 3—3 in FIGURE 2; and

FIGURE 4 is a view along line 4—4 in FIGURE 2.

Referring now to FIGURE 1, I have shown therein an agitator type clothes washing machine 1 having a conventional basket or clothes receiving receptacle 2 provided over its side and bottom walls with perforations 3 and disposed within an outer imperforate tub or casing 4. The basket 2 may be provided with a suitable clothes retaining member 5 for preventing clothes from being floated over the top of the basket, and with a balance ring 6 to help steady the basket when (as will be explained) it is rotated at high speed.

Tub 4 is rigidly mounted within an appearance cabinet 7 which includes a cover 8 hingedly mounted in the top portion 9 of the cabinet for providing access to an opening 10 of the basket 2. As shown, a gasket 11 may be provided so as to form a seal between the top of tub 4 and portion 9 of the cabinet thereby to prevent escape of moisture and moist air into the cabinet around the tub. The rigid mounting of tub 4 within the cabinet 7 may be effected by any suitable means. As a typical example of one such means, I have provided strap members 12 each of which is secured at one end to an inturned flange 13 of the cabinet and at its other end to the outside of tub 4. At the center of basket 2 there is positioned a vertical axis agitator 14 which includes a center post 15 and a plurality of curved water circulating vanes 16 joined at their lower ends by an outwardly flared skirt 17. Both the clothes basket 2 and the agitator 14 are rotatably mounted. The basket is mounted on the flange 18 of a rotatable hub 19 and the agitator 14 is mounted on a shaft (not shown) which extends upwardly through the

hub 19 and through the center post 15 and is secured to the agitator so as to drive it.

During the cycle of operation of the machine 1, water is introduced into the tub 4 and basket 2, and the agitator 14 is then oscillated back and forth on its axis, that is, in a horizontal plane within the basket to wash the clothes therein. Then after a predetermined period of this washing action, basket 2 is rotated at high speed to extract centrifugally the washing liquid from the clothes and to discharge it to drain. Following this extraction operation, a supply of clean liquid is introduced into the basket for rinsing the clothes and the agitator is again oscillated. Finally the basket is once more rotated at high speed to extract the rinse water.

The basket 2 and agitator 14 are driven through suitable means from a reversing motor 20 through a drive including a clutch 21 mounted on the motor shaft. Clutch 21 may conventionally allow the motor to start without a load and then accept the load as it comes up to speed. A suitable belt 22 transmits power to a transmission assembly 23 through a pulley 24. Thus, depending upon the direction of motor rotation, the pulley 24 of transmission 23 is driven in opposite directions.

Conventionally, transmission clutch 21 may be formed as a two-speed clutch so as to provide various operating speeds for the machine, and in this connection a solenoid member 25 having a plunger 26 which operates a control member 27 through spring 28 is provided in order to achieve the two-speed operation. Specifically, when solenoid 25 is de-energized, the clutch 21 provides a direct drive between motor 20 and pulley 24, and when solenoid 25 is energized clutch 21 provides a reduced speed drive to pulley 24. A two-speed clutch of this type, particularly suited for use in the illustrated machine, is described in detail and claimed in my Patent 2,869,699 issued on January 20, 1959, and assigned to General Electric Company, assignee of the present invention.

The transmission 23 is so arranged that it supports and drives both the agitator drive shaft and basket mounting hub 19. When motor 20 is rotated in one direction the transmission causes agitator 14 to oscillate in a substantially horizontal plane within the basket 2. Conversely, when motor 20 is driven in the opposite direction, the transmission rotates the wash basket 2 and agitator 14 together at high speed for centrifugal liquid extraction. While the specific type of driving mechanism used does not form part of the invention, reference is made to Patent 2,844,225, issued to James R. Hubbard et al. on July 22, 1958, and owned by the General Electric Company, assignee of the present invention. That patent discloses in detail the structural characteristics of a transmission assembly suitable for use in the illustrated machine.

In addition to operating the transmission 23 as described, motor 20 also provides a direct drive through a flexible coupling 29 to a pump structure generally indicated at 30 which forms an important part of my invention. As will be more fully explained herebelow, pump 30 has a housing 31 with an upper surface formed with liquid inlets communicating with the bottom of tub 4. Pump 30 also has a pair of outlets 32 and 33; outlet 33 communicates through a conduit 34 with a suitable drain (not shown) and outlet 32 communicates with a conduit 35 which in turn leads to a nozzle 36. As will be explained, when motor 20 rotates in the direction to cause spinning of basket 2, pump 30 discharges liquid from tub 4 to outlet 33 and thence to drain, and in the other direction of motor rotation (in which agitation is provided) the pump discharges liquid from tub 4 through outlet 32 and then through conduit 35 and nozzle 36.

Nozzle 36 is positioned to discharge into a filter pan 37 secured on the top portion 38 of agitator 14 so as to be movable therewith. With this structure then, when the motor is rotating so as to provide agitation, pump 30 draws liquid from tub 4 and discharges it to conduit 35 so that the liquid passes from nozzle 36 into filter pan 37 and then down through a number of small openings 39 provided in the bottom of the filter pan and back into basket 2. In this manner, the filter pan 37, together with its small openings 39 and its upstanding side wall 40, causes lint which is separated from the clothes during the washing operation to be filtered out of the water and thus prevents it from being redeposited on the clothes. This type of structure is more fully described and claimed in Patent 2,481,979, issued to Russell H. Colley on September 13, 1949, and assigned to General Electric Company, owner of the present invention.

The motor 20, clutch 21, transmission 23, basket 2 and agitator 14 form a suspended washing and centrifuging system which is supported by the stationary structure of the machine (which includes tub 4) so as to permit isolation of vibrations from the stationary structure; it will be understood that such vibrations occur primarily as a result of high speed spinning of basket 2 with a load of clothes therein as mentioned above. While any suitable suspension structure may be used, one such structure may, for instance, include a bracket member 44 with transmission 23 mounted on top thereof and motor 20 mounted to the underside thereof. The bracket member in turn is secured to upwardly extending rigid members 45, and each of the two upwardly extending members 45 is connected to a cable 46 supported from the top of the machine. While only a portion of the suspension system is shown in FIGURE 1 of the drawings, such a vibration isolating system is fully described and claimed in my Patent 2,987,190 issued on June 6, 1961, and assigned to the General Electric Company, assignee of the present invention.

In order to accommodate the movement which occurs between basket 2 and tub 4 without any danger of leakage between them, the stationary tub 4 is joined to the upper part of transmission 23 by a suitable boot member 47. Boot 47 may be of any suitable configuration, many of which are known in the art, to permit relative motion of the parts to which it is joined without leakage therebetween.

Completing now the description of the machine as illustrated in FIGURE 1, hot and cold water may be supplied to the machine through conduits 48 and 49 which are adapted to be connected respectively to sources of hot and cold water (not shown). Conduits 48 and 49 extend into a conventional mixing valve structure 50 having solenoids 51 and 52, so that energization of solenoid 51 permits passage of hot water through the valve to a hose 53, energization of solenoid 52 permits passage of cold water through the valve, and energization of both solenoids permits mixing of hot and cold water in the valve and passage of warm water into hose 53. Hose 53 has an outlet 54 positioned to discharge into basket 2 so that when one or both of the solenoids 51 and 52 is energized water enters into basket 2 and tub 4.

The level to which the water rises in the basket and tub may be controlled by any suitable means. One typical means of doing this is to provide an opening 55 in the side of tub 4 adjacent the bottom thereof, the opening 55 being connected through a conduit 56 and a tube 57 to a conventional pressure sensitive device (not shown) which may conventionally be positioned within the backsplasher 58 of machine 1. With such devices, as the water rises in basket 2 and tub 4 it exerts increasing pressure on the column of air trapped in tube 57; at a predetermined pressure level the column of air then trips the pressure sensitive mechanism to shut off whichever of solenoids 51 and 52 may be energized and start the agitation which is provided during the washing and rinsing steps as described above.

Referring now to FIGURES 2, 3, and 4 in conjunction with FIGURE 1, pump 30 has a housing which is made up of an upper member 59 and a lower member 60 provided with mating peripheral flanges secured together

by a number of threaded members 61. In effect, the two members provide an upper wall 62 and a lower wall 63 which are joined by an annular outer wall 64 so as to form a substantially torodial pump chamber 65.

The previously mentioned outlets 32 and 33 communicate with chamber 65 through the annular outer wall 64, and a dam 66 is positioned in chamber 65 between the two outlets. The dam 66 substantially blocks the chamber 65 between the outlets, leaving, however, enough room for the unimpeded rotation of the blades 67 of an impeller 68 which is positioned so as to have its blades 67 extending substantially radially outwardly into the pump chamber as shown. The positioning of the impeller 68 may be effected in any desired manner. For instance, the impeller may be mounted on a shaft 69 which passes through a seal 70 (FIGURE 3) and then extends downwardly into engagement with the flexible coupling 29 mentioned in connection with FIGURE 1. The clearances of the impeller, as it rotates within the space provided for it, are relatively narrow so that there will be little leakage from the chamber 65 around the impeller and this small leakage will be stopped by the seal 70. The impeller blades 67 are generally turbine shaped, extending in planes at substantially right angles to the plane of rotation which is substantially horizontal as shown in the figures.

Substantially centrally of each of the impeller blades 67 is a web or joining member 71. I propose, for a purpose to be hereinafter explained in detail, to make this joining structure 71 substantially asymmetrical, that is, between each two adjacent blades it slants down from one to the other, presenting in effect a differently shaped surface to fluids for one direction of rotation of impeller 68 than it does for the other direction of rotation of the impeller. Specifically, in the present case, each web member 71 is formed as a right angle triangle having its base extending radially and connected to one blade 67, and its apex joining the base of the adjacent blade.

Formed in the top wall 62 of pump 30 there are provided a pair of inlets 72 and 73. While the inlet 72 is, as shown in FIGURE 4, formed simply by the provision of an opening in the top wall, the inlet 73 includes a chimney shaped member 74 extending upwardly from the opening in chamber 65. This chimney member 74 may also be seen in FIGURE 1, which shows that it extends upwardly into the tub 4 so as to be spaced a small amount above the bottom of the tub. The chimney member 74 includes a flange 75 at its top which extends outwardly on the side toward opening 72 so as to extend to some degree over the opening 72. Both inlets 72 and 73 lead, of course, into chamber 65, and it is contemplated that at least a partial dam such as that shown at 76 is provided between the two inlet openings although, as will be more fully explained herebelow, under some circumstances the dam 76 may be dispensed with. Preferably, as shown, the distance through chamber 65 from inlet 72 to its associated outlet 33 is greater than the distance from inlet 73 to outlet 32. Because of the well known characteristics of turbine pumps, this causes greater flow and pressure of liquid travelling the longer path.

Completing the description of the pump structure of FIGURES 2, 3 and 4, the outlets 32 and 33 have secured therewithin respectively check valve members 77 and 78 to permit substantially unimpeded flow out through the outlets, and to prevent any backflow from the outlets into the pump.

During operation of the machine 1, the pump impeller 68, as viewed in FIGURE 2, is turned in a clockwise direction during agitation operations and in a counter clockwise direction during centrifuging operations. As a result of the clockwise rotation during agitation, liquid is drawn in through inlet 73, and then pumped around to outlet 32, the liquid being diverted by the dam 66 into the outlet. Because of partial dam 76, virtually no liquid is drawn in through inlet 72, and this effect may be further increased by enlarging the inlet 73 to a substantial extent over the size of the inlet 72. In fact, when the inlet 73 is substantially larger than inlet 72, as shown, it is possible to dispense entirely with the dam 76 between the two inlets, and virtually all flow into the pump will occur through the inlet 73 during clockwise rotation thereof.

Referring back to FIGURE 1, it will readily be seen that flow out through outlet 32 is recirculated by being passed through nozzle 36 into filter pan 37 and then back into the tub 4. Thus, the pump effects the recirculation function during agitation. When the direction of the pump is reversed, the pump draws in liquid through inlet 72 and passes it out through outlet 33.

It will be understood that if an adequate dam 76 is provided, the inlet flow occurs only through inlet 72 at this time, but if the dam has been substantially eliminated then the inlet flow will occur through both inlets 72 and 73, with the liquid then passing out through outlet 33 to drain as previously explained. In connection with this counterclockwise flow, and the shape of the impeller web members 71, it has been found that a substantial increase in the pressure and flow for one direction of the pump may be obtained by notching the joining web 71, as shown, rather than having it extend from the outer tip of one of the blades 67 to the outer tip of the next blade as is conventional. Although it might be expected that notching the web 71 in the manner shown would tend to increase flow with the impeller rotating in the clockwise direction, the result is exactly the converse, the improved results being obtained for rotation in the counterclockwise direction.

Effective operation in both directions of rotation of the pump is obtained with no air locking. By locating the inlet in the top wall, rather than as conventionally done in the side wall, all air within the chamber 65 will inherently tend to bubble up through the unused inlet and thus escape. Thus, even if there is air in the chamber, it can be passed out through the inlet not being used. In addition, the entry of air into the chamber may be decreased to a minimum by the provision of the check valves 77 and 78 so that the outlet which is experiencing suction (outlet 32 during counterclockwise rotation and outlet 33 during clockwise rotation) will not be caused to have air drawn through it into the impeller chamber 65. Thus, my improved structure pumps effectively in both directions of rotation with the air locking problem being inherently eliminated by the pump structure.

A further advantageous feature of the structure described lies in the provision of the chimney 74 surmounting the inlet 73. It will be recalled that the inlet 73 is used during recirculation. During recirculation, it is not desired to recirculate sand and other heavy soils which during the washing operation tend to sink to the bottom of the tub 4. The chimney structure 74 tends to cause water to be taken in at a level above the heavy concentration of these soils so that only a minimal amount of such soils is passed through with the recirculating water, the major part of them sinking down below the top of the chimney 74 and not being drawn into the pump until substantial suction occurs at inlet 72; they are then flushed out through the pump and down the drain as desired.

The flange 75 at the top of chimney 74 has the beneficial effects of preventing any vortex from being formed above inlet 72 during draining operations. The circular motion of impeller 68 tends to create such a vortex, and when the liquid level is decreased during draining, the presence of the vortex would cause entry of air into the pump chamber, thereby impairing pump operation. Flange 75 breaks up the circular flow pattern above inlet 72 and thus prevents the undesired vortex from forming.

It will thus readily be seen that a number of highly advantageous and desirable features are incorporated in the pump structure disclosed in FIGURES 2 through 4 and in its inclusion in the machine of FIGURE 1.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is therefore aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A turbine pump comprising a housing having a substantially annular outer wall and top and bottom walls closing the ends of said outer wall, said housing defining therewithin a pump chamber, a rotatable impeller having an annular series of blades extending outwardly into said chamber and forming with said walls a substantially toroidal space, said outer wall having first and second circumferentially spaced outlet openings formed therein, check valve means positioned to permit flow from said chamber through said outlet openings and to prevent flow from said outlet openings into said chamber, said top wall having first and second circumferentially spaced inlet openings formed therein in circumferentially spaced relation to said first and second oulet openings respectively, said inlet openings both opening into said toroidal space, and dams positioned respectively in said chamber between said inlet openings and between said outlet openings.

2. The apparatus defined in claim 1 wherein said inlet openings are substantially adjacent each other.

3. A turbine pump comprising a housing having a substantially annular outer wall and top and bottom walls closing the ends of said outer wall, said housing defining therewithin a pump chamber, a rotatable impeller having an annular series of blades extending outwardly into said chamber and forming with said walls a substantially toroidal space, said outer wall having first and second circumferentially spaced outlet openings formed therein, check valve means positioned to permit flow from said chamber through said outlet openings and to prevent flow from said outlet openings into said chamber, said top wall having first and second circumferentially spaced inlet openings formed therein in circumferentially spaced relation to said first and second outlet openings respectively, said inlet openings extending into communication with said toroidal space, and a dam positioned in said chamber between said outlet openings, one of said inlet openings having connected thereto and extending upwardly a chimney member having its opening substantially above the other end of said inlet openings.

4. A turbine pump comprising a housing having a substantially annular outer wall and top and bottom walls closing the ends of said outer wall, said housing defining therewithin a pump chamber, a rotatable impeller having an annular series of blades extending outwardly into said chamber and forming with said walls a substantially toroidal space, said outer wall having first and second circumferentially spaced outlet openings formed therein, check valve means positioned to permit flow from said chamber through said outlet openings and to prevent flow from said outlet openings into said chamber, said top wall having first and second circumferentially spaced inlet openings formed therein in circumferentially spaced relation to said first and second outlet openings respectively, and a dam positioned in said chamber between said outlet openings, said inlet openings both extending into communication with said toroidal space, one of said inlet openings being substantially larger than the other of said inlet openings whereby upon rotation of said impeller in one direction liquid enters only through one inlet opening and upon rotation of said impeller in the other direction the liquid tends to enter through both said inlet openings.

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CERTIFICATE OF CORRECTION

Patent No. 3,127,840 April 7, 1964

John Bochan

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, line 3, strike out "end".

Signed and sealed this 28th day of July 1964.

(SEAL)

Attest:

ESTON G. JOHNSON
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents