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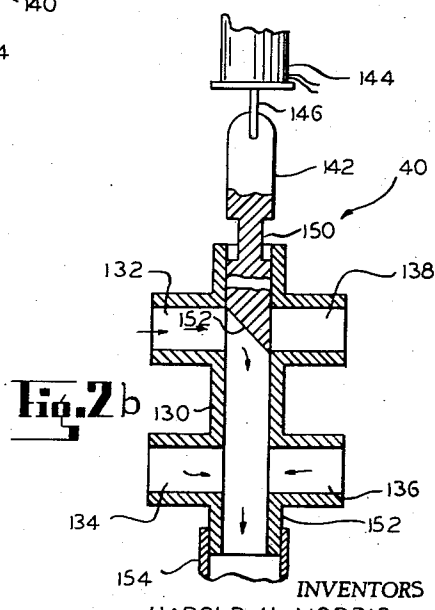
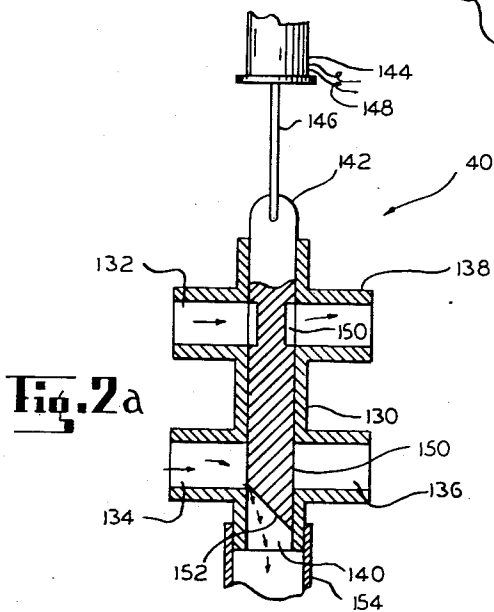
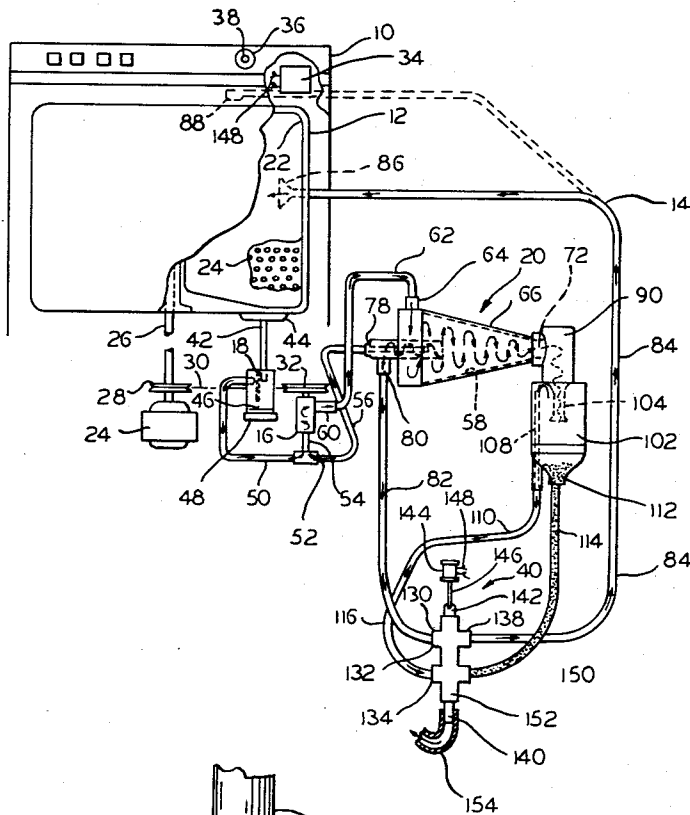
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LAUNDRY MACHINE WITH HYDRAULIC SEPARATOR

Filed Sept. 13, 1957

3 Sheets-Sheet 1



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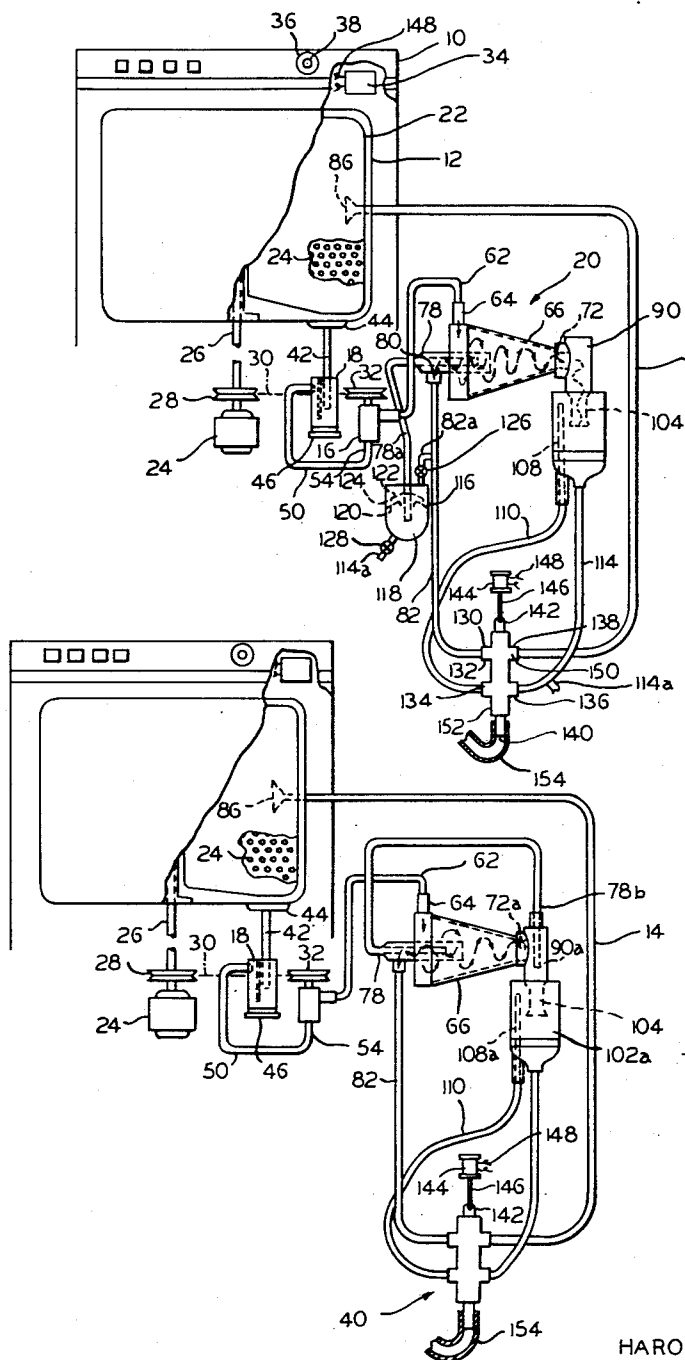


Fig. 3

Fig. 4

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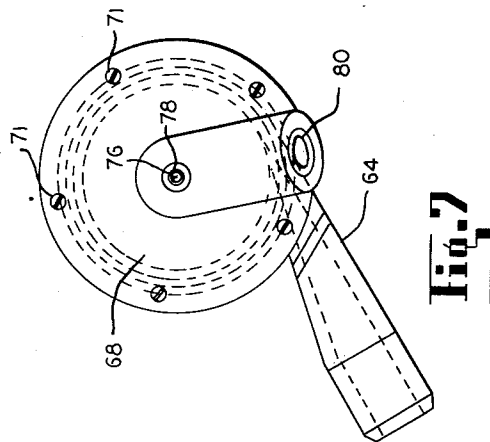


Fig. 7

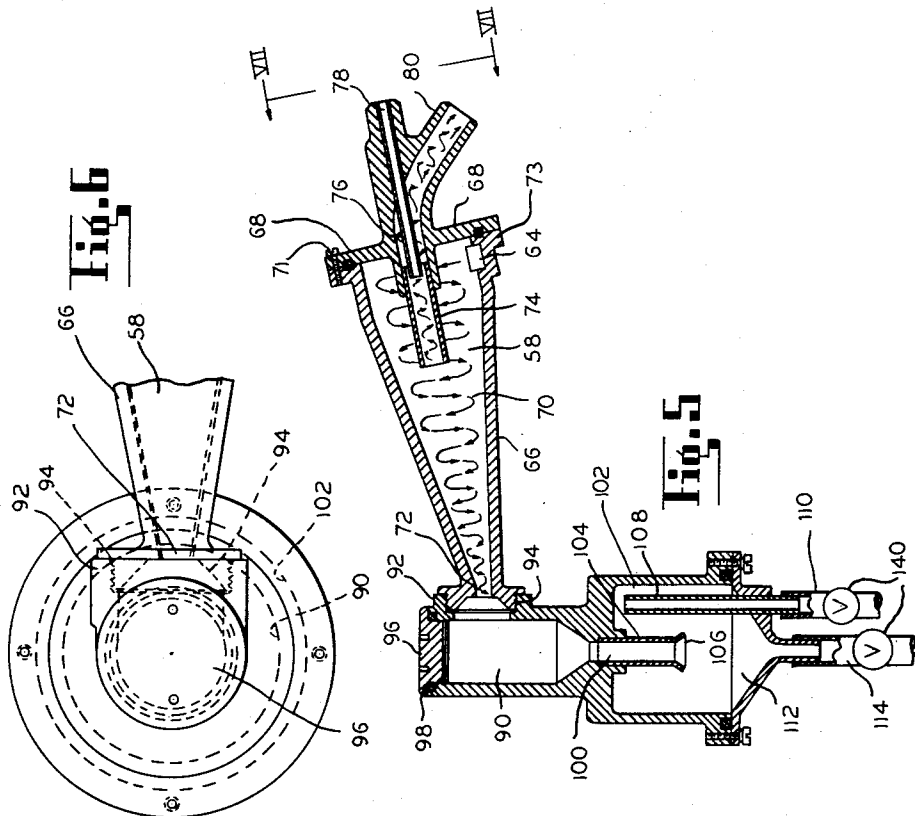


Fig. 6

Fig. 5

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LAUNDRY MACHINE WITH HYDRAULIC
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5 Claims. (Cl. 68—12)

The present invention relates to improvements in laundering machines, and more particularly to a laundering apparatus and method employing a fluid system which clears the laundering fluid and removes foreign material of a wide range in size and density, thereby being capable of successfully separating lint, soils and other foreign materials from wash water used in home laundry machines.

In a laundry machine, such as the automatic home laundry type, effective laundering of the clothes is improved with the use of clean water. Further, if the water can be cleared of foreign material, soils and lint during washing, these will not remain in the clothing. Clearing the water is of importance in suds saving systems where the sudsy wash water is stored between successive washing operations and reused, thus saving fuel for heating the water and saving soap and detergent. A machine which can reuse the wash water is of especial value in areas which suffer water shortages.

The use of ordinary filters and strainers have had limitations in the effectiveness of the cleaning ability to remove particles of all sizes, capacity, and usually have required manual attention for cleaning.

Laundry liquid as referred to herein is either a washing solution or a rinsing solution, for example, water with a liquid miscible detergent or other soluble agent therein. Soiled laundry liquid is that which is contaminated with such liquid immiscible components as are desirably removed during the washing cycle. Such immiscible components may include heavy particles or objects which do not go into suspension and lighter particles which are admixed with the laundry liquid in a washing zone to form a suspension. The suspended immiscible components, in turn, may include lint particles and the like which have a low density and soil particles having a heavier density. In other words, the immiscible components are of two phases, a heavy density phase and a light density phase.

The present invention also contemplates providing an improved fluid flow system for a domestic type automatic laundry and an improved fluid purifying or clearing system, which in the preferred form utilizes a separator means which whirls a stream of the fluid in the form of a vortex. Impurities and foreign materials of all densities and weights are removed from the fluid system at various points of the vortex and clarified fluid is continuously returned back to the washing zone. The fluid clearing system of the present invention also automatically operates to deliver the impurities and other materials removed from the fluid to a drain and is especially well suited for operation in combination with an automatic home laundry machine continuously purifying the wash water.

A feature of the invention is the provision of apparatus which will remove foreign materials which are lightweight and of a density less than water such as lint, threads and the like, which are found in wash water, either directing them to a drain or recirculating them through the fluid clearing system until a predetermined time in the cycle when they are discharged to drain.

A further feature of the invention is the provision of a fluid clearing system for an automatic washing ma-

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chine which will operate continuously during the operation of the washer and will automatically flush itself to discharge foreign materials to drain at a predetermined period in the cycle of operation.

5 An object of the present invention is to provide an improved fluid clearing system for an automatic home laundry machine or the like, which will separate impurities from the washing fluid in a continuous operation and is capable of removing impurities, soils and foreign materials of all sizes and of all densities.

10 Another object of the invention is to provide an improved apparatus and method for the separation of lightweight particles of a density less than water from a fluid such as wash water used in a laundry machine.

15 Another object of the invention is to provide a completely automatic fluid clearing system for use in a home laundry machine which is capable of continuous operation without having need of any manual attention which will automatically completely flush and clean all elements of the clearing system, thereby obviating the need for manual cleaning.

20 Another object of the invention is to provide an improved clearing system using a hydraulic cyclone separation chamber of an improved design for separation of impurities from a fluid without the loss of a significant amount of fluid during separation operation.

25 A further object of the invention is to provide an improved separation system for removing particles from a fluid wherein certain particles are retained in the system during operation, but are flushed to a drain at a predetermined time in the complete operational cycle.

30 Another object of the invention is to provide a fluid separation apparatus for removing particles both of a density heavier than water and of a density lighter than water with an improved fluid flow control means for allowing the escape of a predetermined minimum amount of fluid during operation and for periodically dumping and flushing the separated particles to a drain.

35 Another object of the invention is to provide an improved fluid recirculation system for a home laundry machine wherein large heavy foreign objects are removed from the fluid during recirculation ahead of a separation unit which operates to separate other foreign particles of densities both heavier and lighter than water, and wherein the cleared water is delivered back to the laundry machine.

40 Other objects and advantages will become more apparent with the teaching of the principles of the present invention in connection with the disclosure of the preferred embodiments in the specification, claims and drawings, in which:

45 FIGURE 1 is a front elevational view shown partially in schematic form, of a laundry machine combined with a fluid clearing system in accordance with the principles of the present invention;

50 FIGURES 2a and 2b are detailed schematic showings of the fluid control valve illustrating the operation of the flush and dump valve;

55 FIGURE 3 is a schematic showing of a portion of the fluid clearing system illustrating an alternative structure for removing the lightweight materials from the fluid;

60 FIGURE 4 is a schematic showing of a portion of the fluid clearing system illustrating another form for removing the lightweight materials from the system;

65 FIGURE 5 is a vertical sectional view showing the details of the hydraulic separator;

70 FIGURE 6 is a plan view of a portion of the separator for removing the heavy phase particles from the fluid; and,

FIGURE 7 is a sectional view taken along line VII—

VII of FIGURE 5, and illustrating the separator from the end from which the cleared fluid exits and the light phase materials are removed.

While the features of the invention are shown in the preferred arrangement, it will be understood that elements of the invention may be utilized in other environments taking advantage of their inherent features and functions. As illustrated in the drawings, with reference to FIGURE 1, the invention is shown embodied in an automatic home laundry mechanism. The laundry machine employs a fluid recirculation arrangement wherein a stream of laundry liquid is driven through a hydraulic circuit, and the soils, foreign particles, lint and the like are removed at one point in the circuit in order that clarified liquid may be returned to a treatment or washing zone in which foreign particles washed out of clothes are admixed with the fluid at another point in the circuit.

The laundry machine is shown as including a cabinet 10 which houses the operating mechanism. It will be understood that the fluid separation system is shown in enlarged form in order that the details may be better observed and described. However, in normal size relationship, the fluid separating mechanism would be much smaller in proportion to the cabinet and other elements of the laundry machine than shown in the drawings, and the separation system would be housed completely within the cabinet to make an attractive appearing unit.

The over-all system includes the elements of a tub 12, which contains the laundering fluid, a recirculating conduit means 14 which leads from the tub to withdraw fluid therefrom and returns it back to the tub, a pump means 16 in the recirculation conduit means, a trap 18 ahead of the pump, and a separation apparatus 20 for the heavy phase and light phase material suspended in the washing fluid.

The tub 12 of the laundry machine contains a laundering fluid and may be provided with a basket 22 therein which is supported for rotation about a vertical axis. The basket may be of varying design, and is shown as perforated by openings 24 for the escape of fluid when the basket is spun at high speeds to centrifugally extract the fluid from clothes therein. However, other designs of laundering machine elements may be employed, and, for example, imperforate tapered baskets may be used.

The machine could also be of the horizontal drum type or could comprise a so-called combo or, combination washer-dryer.

The basket contains laundering means for performing the washing operation, such as an agitator, and the laundering means including the agitator, the basket drive, and the drive pump, are operated by power means such as an electric motor 24. The motor connects to a gear reduction system (not shown) to drive a shaft 26 for operating the agitator and to drive the basket. The motor is shown connected to a pulley 28 over which passes a belt 30 that drives a pulley 32 connected to a drive shaft of the pump 16. The pump 16 may be continuously driven throughout the operation of the laundry machine so that whenever fluid is available in the tub 12, it will be recirculated through the clearing system, thus clearing the rinse water as well as the wash water.

The cycle of operations of the laundry machine is controlled through a pre-settable sequential control means such as a time cycle device 34, which may be provided with the usual timer motor and cam operated time switches to sequentially operate the machine through a series of washing, rinsing and drying operations or cycles. The time elapsed and operational phase of the machine may be indicated on a dial 36 provided with a knob 38 for manually setting the operation of the machine. The time cycle control device 34, of course, starts the machine and stops it at the end of operations. In the present arrangement, the time cycle means is used to control a dumping and flushing valve apparatus 40, which will be described later in detail.

The construction and operation of the fluid clearing apparatus may be best understood by following the flow of fluid through the conduit 14. In other words, a hydraulic circuit is provided through which a stream of laundry liquid is driven. At one point in the circuit, namely the washing zone foreign liquid immiscible components are admixed with the stream including settleable solids, and particles of varying density which form with the stream a suspension all of which is withdrawn from the tub 12 through an outlet conduit 42 connected to the tub 12 by a fitting 44. The outlet conduit 42 leads into the top of the trap 18 positioned directly beneath the tub 12 so that settleable solids which will not remain in suspension in the fluid, such as nails, hairpins, buttons, and the like, will settle or "drop" and deposit themselves in the bottom 46 of the trap 18. The trap has a removable base 48 for effecting periodic cleaning at infrequent intervals.

The fluid continues its flow in the recirculation conduit means 14 by leaving the trap 18 through the trap outlet conduit 50, which leads to a T-fitting 52 and up into the pump 16 through a pump inlet line 54. The other branch of the T is connected to a conduit 56, which carries the light phase materials that have been separated in the cyclone chamber 58 wherein the stream of fluid is vortically whirled to form a liquid vortex.

The pump 16 is a positive displacement pump or the like which forces or drives the fluid stream through the hydraulic circuit. The fluid leaves the pump 16 through the pump discharge line 60 flowing through the conduit 62 and enters the cyclone chamber 58 through the separator inlet 64.

The separator 20 operates to remove both light phase and heavy phase materials and in its preferred form employs a conical chamber which is substantially conical in shape, and is provided at or near its widest part with a tangential inlet for the fluid to be supplied under pressure and to circulate therein with a vortical flow. As a result of the shape of the chamber and the tangential inlet, the liquid body in the cyclone chamber is compelled to rapidly rotate around the axis of the chamber. The chamber is provided with a central aperture in its large end for discharging the liquid rotating therein while the separated materials gather at the apex of the chamber.

The rotational movement of the fluid or suspension in the cyclone chamber consists of two generally concentric vortices of the same rotation but of opposite axial directions with the outer one rotating toward the apex of the chamber, and the inner one rotating toward the large end. The major part of the liquid, that which is purified, rotates in the outer vortex to flow toward the axis of the chamber and passes into the inner vortex and discharges through the outlet.

In this apparatus the denser and greater particles in the suspension are thrown outwardly toward the circumference of the cyclone chamber when the fluid enters tangentially. The larger or heavier particles which have a density greater than the fluid and which are referred to as the "heavy phase" particles are thus thrown outwardly by centrifugal force caused by rotational movement and tend to move in one axial direction. The particles lighter than the fluid or the "light phase" particles are carried along with the liquid into the center of the rotating liquid body and move in an opposite axial direction for discharge through the fluid outlet. By selectively varying the size of the solids outlet at the apex of the cone variations in the character of the fluid and the waste particles to be removed can be accommodated.

As may be viewed in the drawings of FIGURES, 5, 6 and 7, which show the details of the separator unit 20, the cyclone inlet 64 enters tangentially at the large end of the cyclone chamber 58. The hydraulic cyclone separator includes a tapered conically shaped shell 66 providing the interior conically shaped cyclone cham-

ber 58 therein. The chamber 58 has a cap 68 bolted to the large upper end by studs 71 threaded into the flanged upper circular end 73 of the cyclone shell 66.

The fluid enters tangentially through the inlet 64 and whirls around within the cyclone chamber 58 in a circular outer vortex path, as indicated by the arrows 70. The centrifugal force carries the heavy phase particles against the wall of the shell 66 whereby they pass downwardly to the discharge opening 72. Simultaneously, a counter-flowing vortex is formed moving upwardly within the cyclone chamber 58 and carrying at its center the light phase particles or those which have a density less than the fluid which is, in this case, wash water. These light phase particles will include heavier hollow particles, elongated thin particles, and particularly particles such as lint and the like which are removed from the clothes in the basket during washing. This lint is particularly objectionable in that it will cling to the clothes within the tub and it will be forced against the surface of the clothes during the spin-dry operation. It is, therefore, an important feature of the invention that the separating system is capable of removing these particles of lint from the washing fluid and returning the lint-free cleared fluid back to the machine.

The lint-laden vortex will pass into the vortex-finder tube 74 which projects coaxially down into the center of the cyclone chamber. This fluid will continue to circulate carrying the very light lint materials to the very center of the vortex where they are picked up by a second coaxial vortex-finder tube 76, which is positioned withdrawn into the first larger vortex-finder tube 74, for the express purpose of removing the light phase material. The inner smaller vortex-finder tube 76 leads out through the outlet conduit 78 which connects to the conduit 56 leading back to the pump, as may be viewed in FIGURE 1.

Thus, as in the form shown in FIGURE 1, the light phase materials are removed in the cyclone separator and returned back to the pump 16. As may be observed, the pump again will receive the materials and return them back to the cyclone separator through the inlet 64. During the operation of the laundering machine and during the operation of the separator mechanism, the light phase materials will continue to be recirculated and re-separated. During some predetermined time in the operation, preferably at the end of the washing cycle, these materials will be flushed down to drain in a manner which will be later described. However, it is important that these light materials will continue to be separated and this is accomplished without the loss of any washing fluid.

As may be viewed in FIGURES 5 and 6, the cleared fluid continues to flow out around the inner vortex-finder tube 76, and flows out through the cleared fluid outlet 80. The outlet is connected to an outlet conduit 82, which passes through the valve assembly 40 to a fluid return conduit 84, which leads back to the tub. The fluid return conduit 84 may lead to the side wall of the tub through a connection 86 or may be directed back into the top of the tub through a connection 88. This form of connection is not critical, and the cleared fluid may be returned to the tub in any desirable manner.

Referring to FIGURES 1 through 5, the heavy particles which flow downwardly through the cyclone discharge outlet 72 pass into a primary outlet chamber 90, as shown in FIGURES 5 and 6, the primary outlet chamber has an internally threaded boss 92 receiving the fitting 94 of the cyclone shell 66. The primary outlet chamber has a closure cap 96 which is threaded into the top and is provided with a gasket seal 98 for a fluid tight connection to close the chamber 90.

The heavy phase particles flow from the cyclone chamber 58 through the discharge outlet 72 and into the primary chamber 90. They then flow downwardly through the opening 100, which leads to the collection vessel 102. A chamber tube 104 projects downwardly into the col-

lection vessel and has a flared end 106 which functions to distribute fluid outwardly when the collection vessel 102 is flushed with a rapid passage of fluid through the opening 100.

In the larger collection vessel 102, the heavy particles settle from the fluid and the controlled flow of fluid escapes through the riser tube 108, which connects to the fluid escape conduit 110. This conduit as may be viewed in FIGURE 1, also connects to the flushing and dumping valve 40.

The solid particles settle in the vase 112 of the collection vessel, which tapers downwardly and has an outlet opening connecting to a flushing conduit 114. This conduit is also connected to the flushing and dumping valve 40, shown schematically in FIGURE 5.

As discussed in connection with FIGURES 1 and 5, the light density materials, which are removed through the inner vortex-finder tube 76, are delivered through conduit 56 to the inlet of the pump 16 to be continually recirculated during operation. It will be understood that this recirculation could also be achieved by connecting the conduit 56 at the other locations ahead of the pump in order to form a "flow loop" which provides for continued recirculation of the light phase materials.

Instead of directing the light phase material, which leaves through the outlet 78 of the hydraulic cyclone separator in a flow loop, the light phase material may be directed to a collection chamber 116, which is shown in FIGURE 3. The collection chamber presents a form of settling container and an inlet tube 78a projects down into a base 118 of the collection chamber and is connected to the outlet 78. The fluid leaves the inlet tube 78a and passes up past the lower baffle 120 over the upper surface of the lower baffle and out past the outer edge of an upper baffle 122. The upper and lower baffles 122 and 120 are conically shaped and project downwardly. The upper baffle 122 is suspended on the tube 78a and is of a diameter less than the inside of the collection chamber whereby it forms a flow gap 124 at its outer edge for the fluid to pass upwardly into the discharge line 82a. The lower baffle 120 is secured at its outer edge to the collection chamber and its inner edge is short of the central inlet tube 78a to form a flow passageway 126. A substantial portion of the fine material will settle at the base 118 and the cleared carrier liquid will flow through the discharge line 82a which is connected to the conduit 82, as shown in FIGURE 1, whereby the fluid is returned to the tub. Discharge line 82a could also be connected to the inlet 54 of the pump whereby the cleared fluid could be again recirculated through the cyclone chamber 58. A flow regulating valve 126 may be placed in the line 82a to limit the escape of carrier fluid.

A solids outlet line from the base of the light phase collection chamber 116 may be connected to the flushing conduit 114 by line 114a.

A control valve 128 may be provided in this line for flushing the chamber 116 when valve 40 is periodically used to flush the system.

Another manner of getting rid of the light phase materials which are suspended in the fluid that leaves through the inner vortex tube 76 of the cyclone chamber 58, is to direct it to a drain. A number of connections may be adopted for this purpose such as connecting the outlet 78 to the controlled overflow line 110, FIGURE 1.

Another manner of directing the fluid to drain is shown in FIGURE 4. In this instance, the outlet 78 is connected to line 78b, which leads in through the top of the primary outlet chamber 90a, which corresponds to the primary outlet chamber 90 of FIGURE 1. Tube 78b extends down into the primary outlet chamber past the cyclone discharge outlet 72a. The fine material will thus pass downwardly into the collection vessel 102a

and materials will settle therein with the fluid flowing through the controlled overflow riser 108a.

In accordance with the present invention, the heavy phase and light phase materials are periodically dumped and the cyclone chamber is periodically flushed. As may be illustrated in connection with the constructional examples shown, the operation of the flushing and dumping valve 40 is illustrated in FIGURES 2a and 2b.

The valve 40 has a body 130 with inlets 132, 134 and 136 and the outlets 138 and 140. Flow through the valve is controlled by spool valve member 142 which slidably projects into the valve body 130. The spool valve is controlled by a solenoid 144 which connects to the movable spool valve by a link 146. The solenoid 144 is energized through electrical leads 148, which are shown leading to the time control mechanism 34. During normal operation, the valve spool is in the position shown in FIGURE 2a; and during the flushing and dumping operation, the valve spool moves to the position of FIGURE 2b.

The valve spool 142 has a reduced portion or an annular groove 150 which permits the fluid to flow from the inlet 132 to the outlet 138. The inlet 132 is connected to the clear fluid outlet 80 of the cyclone through conduit 82. Outlet 138 is connected to the fluid return conduit 84 so that the cleared fluid flows back to the tub.

The valve spool also has a tapered end 152 which provides for a limited controlled flow between the valve inlet 134 and the valve drain outlet 140. The outlet discharges to a drain 154. The inlet 134 receives fluid from the controlled overflow conduit 110 leading from the collection vessel 102. Thus, the valve plunger 142 in its normal position permits the tapered face 152 to just clear inlet 134 and permits a controlled leakage of fluid from the collection vessel. This is merely a sufficient flow to aid in carrying the heavy suspended materials through the cyclone passageway 72 and down into the collection vessel for settling, but which is not sufficiently large to permit a substantial loss of washing fluid. Thus, heavy particles settle at the base 112 of the collection vessel. A controlled escape of fluid is permitted through the riser tube 108 and down through the controlled overflow conduit 110 and the fluid flows past the inclined face 152 of the end of the spool valve 142 and down to the drain 154.

When the valve spool 142 is moved to open position by energization of the solenoid 144, as shown in FIGURE 2b, a rush of fluid is permitted through the valve to the drain 154 to dump the separated foreign particles and flush the separation system. The valve spool 142 raises to a location where all of the inlets 132, 134, and 136 are connected to the drain outlet 140. The tapered end 152 of the valve blocks the fluid return conduit 138 back to the washer to prevent any of the flushing fluid from accidentally flowing back to the tub.

In flushing and dumping position of the valve spool 142, the fluid from cyclone outlet conduit 82 is permitted to flow directly to drain 154. A free flow is also permitted from the controlled overflow conduit 110 leading from the collection vessel.

The base of the collection vessel through the flushing conduit 114 is also opened to flush the settled sediment down to the drain 154. This increase in flow through the large discharge opening 72 at the base of cyclone chamber 58 greatly increases the flow through the base of the cyclone chamber and thereby enlarges the central vortex within the chamber. The light phase materials which have been continually recirculating through the cyclone light phase separation system, will in part, be flushed out through the heavy phase separation system discharging through the passageway 72 at the base. However, since much of the fluid escapes through passageway 72, the circulation through the light phase end of the cyclone will be slowed. The vortex in the cyclone will enlarge and the particles will not concentrate as closely at the small light phase vortex-finder tube 76; and instead pass out through the large vortex-

finder tube 74. They will then flow through the clear outlet conduit 82, and pass down through drain.

The increased flow through the cyclone chamber will also flush the inner walls of the chamber itself, thus removing the settling which may have accumulated there. The flared end 106 of the tube 104 in the collection vessel will tend to discharge fluid against the walls of the collection vessel to flush it clean.

This dumping and flushing operation, created by opening the spool valve 40, can be done intermittently during any cycle of operation and is preferably performed at the end of the washing operation. At this time, the loss of washing water by flushing will not matter substantially and a complete and thorough flushing of the cleaning system is automatically accomplished without requiring manual attention. The flushing may be done, however, without the loss of a large quantity of water and the remainder of the water may be directed to a suds saver system through a valving arrangement, not shown.

Although the operation of the overall system will have become apparent from the description of the individual elements, the summary of operation may be helpful in understanding certain of the advantages of the invention. Washing fluid is contained in the tub 12 and during the washing operation is continually recirculated through a fluid recirculation means 14. Very heavy particles incapable of being suspended in the fluid are caught in the trap 18 as the fluid leaves through the outlet conduit 42. The fluid cleared of these heavy particles passes safely through the positive displacement pump 16 and is delivered to the fluid inlet 64 of the cyclone chamber 58.

Upon entering tangentially into the cyclone chamber, the fluid flows downwardly in the vortex path and the heavy phase particles pass through the discharge passageway 72 into the primary outlet chamber 90. They then flow downwardly to the tube 104 into the collection vessel 102 where the particles settle at the base 112.

The fluid circulates in the cyclone chamber 58 and passes into the vortex-finder tube 74, which coaxially projects into the chamber. The light phase particles collect in the coaxial smaller inner vortex-finder tube 76 and flow back to the pump 16 in a flow loop and are continually recirculated during operation. The cleared fluid flows through the outlet 80, the cleared fluid conduit 82, and through the valve through the fluid return conduit 84 back into the tub 12.

The system is automatically flushed, preferably at the end of the washing operation by raising the spool valve 142 by energization of the solenoid 144. This opens the flushing conduit 144 to flush the heavy particles out of the base of the collection vessel and permits an increased flow through the controlled overflow 110 to drain. The increased flow in the cyclone chamber flushes the side walls of the chamber and increases the size of the inner vortex whereby the light phase particles will flow through the clear fluid outlet 80 and the clear fluid outlet conduit 82. Also a portion of the light phase particles will pass through the discharge passageway 72 and, thus the light phase particles will also be dumped to drain. The spool valve is then again closed and the system is cleaned and ready for another operation.

Thus, it will be seen that we have provided a fluid clearing system for use in an automatic laundry machine or the like which meets the objectives and advantages hereinbefore set forth. The separation apparatus and the method employed thereby remove particles of a wide variation in density to obtain a clear fluid. Further, this is accomplished without a significant loss of fluid, and because of the wide variation of foreign particles removed and the insignificant loss of fluid, the system is exceedingly well adapted to use with a laundry machine for clearing laundry fluid.

The mechanism is completely automatic and can be used in a home laundry machine without attention or servicing by the operator. Inasmuch as the fluid is

cleared during operation, it is well adapted to use in areas where water is at premium and the fluid can be used for succeeding washing operations without necessitating the provision of replacement washing water, thus effecting a saving of water, and of fuel to heat replacement water and in soap or detergent required to provide additional suds.

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

We claim as our invention:

1. A laundry machine comprising,
 - an automatic washer having presettable sequential control means for operating the machine through a cycle including a series of laundering periods, said machine comprising a tub adapted to receive laundry liquid therein,
 - washing means in said tub for admixing immiscible solids including light phase particles and heavy phase particles washed from materials contained therein with the laundry liquid,
 - pumping means having an inlet connected with the tub for driving the laundry liquid and the admixed solids drawn from the tub in the form of a stream,
 - a separator for purifying the stream of laundry liquid during selected periods of the laundry machine cycle, comprising,
 - a cyclone chamber in said separator,
 - having a tangential inlet orifice receiving the stream discharged by said pumping means and vortically whirling the stream to produce a fluid vortex in said cyclone chamber,
 - inner and outer concentrically disposed vortex finding tubes extending into said cyclone chamber at the large end of the fluid vortex and forming an annulus between said inner and outer tubes for receiving clarified effluent, said inner finding tube receiving light phase particle-rich fluid for removal thereof from the separator, effluent conduit means connected to said annulus and to said tub for returning the clarified effluent to said tub,
 - means connected to said cyclone chamber at the small end of the fluid vortex having an outlet for receiving the heavy phase particles including a collection vessel communicating with said outlet to provide a quiescent pool in which the separated solids gravitationally settle, a drain conduit connected to the bottom of said collection vessel,
 - an overflow conduit arranged to receive overflow fluid

from near the top of the collection vessel, and a dumping and flushing valve having inlet portions connected to said drain conduit and said overflow conduit and having an outlet portion leading to drain,

- said dumping and flushing valve having a separate inlet and outlet portion in said effluent conduit means, said dumping and flushing valve having actuator means including a valve spool regulated by said presettable sequential control means and having a first position wherein clarified effluent is directed through said effluent conduit means to said tub and a limited controlled flow of fluid from said overflow conduit is directed to said outlet portion,
- said valve having a second position wherein said drain conduit, said overflow conduit and said effluent conduit means are communicated with said outlet portion, thereby to flush the separator, while blocking flow through the effluent conduit means to said tub.
2. A laundry machine as defined in claim 1, and a conduit connected to said inner finding tube and to said inlet of said pumping means, thereby to recirculate the light phase particle-rich fluid.
3. A laundry machine as defined in claim 1, and a conduit connected to said inner finding tube, a settling container connected to said conduit for separating out the light phase particles, and means to direct particle free fluid from said settling container to said effluent conduit means for return of the particle free fluid to the tub.
4. A laundry machine as defined in claim 1, and a conduit connected to said inner finding tube and discharging into said collection vessel, whereupon said light phase particles will settle in said collection vessel.
5. A laundry machine as defined in claim 1, said washing means in said tub comprising a perforated vertical axis basket to confine the materials being laundered and agitating means in said basket to mechanically flex the materials.

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