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(54) **TANDEM WASHING MACHINES CONFIGURATION FOR RECYCLING DETERGENT AND WATER**

DOPPELKONFIGURATION EINER WASCHMASCHINE FÜR RECYCLING VON WASCHMITTEL UND WASSER

MONTAGE EN TANDEM DE MACHINES A LAVER POUR LE RECYCLAGE DE DETERGENTS ET DE L'EAU

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Description

Field of Invention:

[0001] The present invention is concerned with a tandem washing system configuration and a method of operating a tandem washing system configuration in accordance with the preamble of claims 1 and 8, respectively. Such a tandem washing system is disclosed in EP-A-0 688 894.

Background of the invention:

[0002] In a typical automatic washing machine, there are various cycles for example Pre-wash. Wash, Rinse and Spin, controlled through a programmable integrated circuit associated with a variable speed electric motor, solenoid valves and other electromechanical means. In such machines an electric water heater is also provided. These various cycles may be programmed as per the requirement of the washable load and availability of resources like water, electricity, time etc. For example, a typical automatic washing machine may be programmed to wash a predetermined load of clothes in 30 minutes to 2 hours, and with only one rinse cycle or more, with or without hot water wash etc. At each wash or rinse cycle the typical washing machine draws fresh tap water and on completion of the cycle discharges the used water through a drainage pipe. As a result, there is a heavy use of resources and subsequent discharge of used water including various quantity of detergents and impurities.

[0003] The inventor of the present invention has observed that an effective method for recycling the discharge water having varying levels of detergents will save costs and lessen environment pollution.

[0004] The prior art devices disclose storage of certain effluents of washing machine generally known as grey water, which however is generally restricted to reusing rinse water only, having traces of detergent. In U.S. patent number 5501792, Carroll, Jr. has disclosed an Energy and Water Saving Laundry System, which includes a plurality of automatic washing machines, a rinse water storage tank, plumbing which connects the storage tank to the each of the washing machines, and electrical controls which are tied into the existing control circuitry of the washing machines for selectively directing the flow of rinse water between the storage tank and the washing machine. None of the prior art devices is suitable for economic use of resources due to additional requirement of constructional and plumbing features. In most of the prior art devices, only rinse water is contemplated for recycling. Moreover, longer storage of used water may lead to growth of pathogens. There is no saving of detergent or input energy. On the whole, adverse cost-benefit ration of the prior art devices precludes them from large-scale application.

Object of the invention

[0005] It is an object of the invention to provide a tandem washing system configuration allowing efficient use of available resources.

Summary of the invention

[0006] A tandem washing system configuration in accordance with the present invention is described in claim 1 whereas a method of operating a tandem washing system configuration in accordance with the present invention is described in claim 8.

[0007] Preferred embodiments of the system are described in dependent claims 2 to 7 whereas preferred embodiments of the method are described in dependent claims 9 and 10.

Brief Description of Accompanying Drawings:

[0008]

Figure 1 shows a simple configuration of a tandem washing system configuration according to the invention by way of example, operably interconnected having a channel means comprising solenoid valve and filters.

Figure 2A shows a similar configuration of the washing system according to the invention. In this example, an additional Reservoir is added between the two automatic washing machines.

Figure 2B shows a vertical stacking configuration of the tandem washing system.

Figure 3 is a schematic presentation of an example of the channel means of the invention including a two way solenoid valve arrangement of the invention for expelling the used water if it is turbid, or directing it for recycling.

Figure 4A shows data displayed in the electronic panels and knobs according to the invention.

Figure 4B presents a chronological flow chart of tandem operation of two automatic machines in the tandem washing system configuration of the invention by way of example

Figure 5 shows a configuration of the system in which two automatic washing machines are disposed on rooftops, for further recycling.

Detailed Description of a preferred embodiment of the invention.

[0009] In Figure 1 there is a twin assembly of Washing

Machines assigned with reference numerals (100 and 200). The machines (100, 200) are connected through a channel means (300) having a two-way solenoid valve means, for channelling water from one to another. The input to the channel (300) passes through a Sieve and/or Filtration device (310), to remove suspended impurities like Lint and other large particles. Additionally, the channel means passes through an Ultraviolet or Gamma rays irradiation chamber (320) to remove pathogens. The channel is provided with a back-flush device taking input water from a tap and discharging back-flushed water into a drainage.

[0010] Both the washing machines (100, 200) have independent tap water inlets (110, 210) and effluent drainage pipes (130, 230).

[0011] Both the machines (100, 200) are controlled by a single controller (400) with a preprogrammed logic and a default setting that can be changed through electronic push buttons (410) and knobs (420), and is displayed through electronic panels (430, 440) associated with the washing machines (100, 200).

[0012] The first washing machine (100) may be used for lesser soiled, e.g. garments and the second washing machine (200) can be used for heavily soiled e.g. linen, towels, mops, shoes, doormats etc.

[0013] The controller (400) is programmed to operate the two-way solenoid valve means (300), to direct effluent of each selected cycle of the first-machine (100) as input for the second machine (200). Additionally, effluent of each cycle of the washing machines (100, 200) is dischargeable as waste water through the solenoid valve means directing the flow to the drainage pipes (130, 230).

[0014] The controller (400) is programmed with an interlocking logic, as explained below through a typical exemplary scenario.

[0015] The pre-wash option of the first machine (100) may include extracting fresh water from the first water inlet (110), drawing stored chemicals from disposal tray (140), soaking and tumbling the garments in the solution, and channelling the pre-washed water to the second machine (200) on spinning. The second machine (200) is programmed to complete its pre-wash cycle, spin and release the re-used pre-washed water through the drainage (230), while the first machine (100) is completing its Wash cycle after drawing fresh water through the first water inlet (110). If a hot wash option has been selected for the first machine (100) e.g. by selecting 'cotton' at knob (410), the controller (400) causes an inbuilt electrical heater equipped with a thermostat in the washing machines (100, 200) to control the water temperature at a desired level. When the first washing machine (100) completes its Washing cycle, it spins and channels hot/cold wash water (with remaining detergent) to the second washing machine (200) through the channel (300). The first machine (100) now starts a Rinse cycle while the second machine (200) starts its Wash cycle. Again if a hot wash option has been selected for the second machine (200), the temperature of recycled wash water is maintained at a desired level through the inbuilt heating device as explained hereinabove. The second machine (200) on completing its Wash cycle, spins while discharging the reused washed water through the drainage (230), and stands by for input Rinsed water from the first machine (100). Likewise, at any stage the first machine (100) may also stand by till the second machine (200) is through with a cycle and becomes ready to take intended grey water. Then the first machine (100) spins and channels Rinsed water into the second machine (200). The second machine (200) then performs the rinse operation by using the recycled water. Likewise, the first and the second machines (100, 200) repeat the process if a second rinse has been opted. Finally, the first machine (100) on completing all the selected cycles, allows its door to open and is ready for the next load. The second machine (200) may, in the last cycle, draw a specified quantity of fresh tap water for a final Rinse with or without specified disinfectants stored in a disposal tray (240). The second machine (200) then completes the cycles by final spinning of its load, at a specified RPM. A typical program cycle is shown in Figures 4A and 4B.

[0016] Additionally, the second machine (200) may be operated to perform as many fresh water cycles as desired. For example, there may be a 'double wash' option at electronic panel (440), if selected will operate the second machine (200) Io start a fresh water wash cycle before the final fresh water rinse in the above example. In this scenario, any of the fresh water cycle discharge may be stored and recycled as desirable.

[0017] The Rinse cycles may consist several short bursts of rinses in which little water is used, which may be expelled through the drainage pipes (130, 230), while the rinsed water of full rinse cycles only be channelled into the next machine.

[0018] A reservoir chamber may be also provided between the two machines (100, 200) for temporary storage of water of each cycle, operated through a second set of solenoid valve means connecting it with the machines (100, 200) on both the sides, as shown in Figures 2A and 2B. In that case, the channel (300) may be placed between the intermediate reservoir and the second machine (200). In another configuration, the filter/sieve (310) is disposed between the first machine (100) and the intermediate reservoir while the irradiation device (320) may be designed between the intermediate reservoir and the second machine (200). Both the machines (100, 200), the intermediate reservoir including the channel are configurable in a vertically stacked system as shown in Figure 2B.

[0019] The filter/sieve (310) may be provided with a known back-flush means. In case of the intermediate reservoir being provided, the program logic is accordingly set, e.g. the first machine (100) will hold from releasing grey water selected for recycling if the intermediate storage is not ready to take it. Additionally, the system may be operable to store grey water of any particular cycle of any of the machines, for later use in the starting cycle of

any of the machines as desired. If a machine is being used singly, the grey water so stored for later use may be of any cycle and in that case, if a single machine is used again, the stored water is also recycled to any cycle as selected in the controller. For example, if the machines (100, 200) arc selected to operate singly, the wash water of wash cycle of the first machine (100) may be selected for use as recycled wash water for the next load of the second, machine (200), or of the first machine (100) again, by causing the two-way solenoid valves to operate as shown in Figure 2A.

[0020] The channel (300) may also be provided with an electronic sensor (330) to check turbidity of the channelled pre-washed and/or rinsed water of the first machine (100) and beyond a specified threshold, causes the controller (400) to show a warning signal and/or halt operations. Alternatively, the controller (400); is programmable to operate a solenoid valve (340), to release the extra turbid water effluent, as shown in Figure 3B. In this scenario, the controller (400) may be further operable to cause the second machine (200) to extract fresh tap water at (210) for the next cycle. In any of the cycles, the second machine (200) may also be operable to draw additional detergents stored in the disposal tray (240).

[0021] Additional disinfection means may be provided such as Gamma ray irradiation at the first machine (100) before the start of first cycle and/or at the second machine (200) after the last cycle.

[0022] Separate motors are provided to run both the machine (100, 200) in tandem, controlled through the common controller (400), incorporated with interdependent logics such as explained herein above by way of examples. Likewise, there may be other options, with an essential interlock of wash cycles in the first and the second machine (100) and (200) in such a way that whenever the second machine (200) is not ready to take intended input of grey water from the first machine (100), the next cycle of the first machine (100) will remain on hold, and vice-versa i.e. the second machine (200) will hold the next cycle till the first machine (100) has performed a corresponding task selected. There may also be an option of switching off the interlock program. Then both the machines (100, 200) become independent machines operable separately like conventional washing machines.

[0023] In that case the controller (400) may operate both the machines(100, 200) independently, or two separate conventional controllers of the machines (100, 200) may operate each machine individually.

[0024] Figure 4A shows a typical example situation of text displayed at the panels (430, 440). The Knob (410) preferably has wash type options for (100), e.g. Cotton, Synthetic etc. Likewise, the knob (420) has options for the second machine(200), like Soiled (for heavily soiled items like mops, doormats, shoes etc.), Linen etc.

[0025] Display panels (430, 440) shows typical default setting and maneuverability of individual cycles in each machine. In the example display panel, 5 cycles in each machine are selectable as yes/no (y/n) options. Against each of these 5 cycles at the display panel (430), there is an additional option selections viz. 'Recycle or Not' at the display panel (430). Similarly, against each of the 5 options at the display panel (440). Recycled or Fresh water usage is displayed, depending on selections in the first machine (100). Upon selecting a particular cycle option in one machine, certain options are automatically selected in the other. For example any selected cycle at the display panel (430) also selected as Recycle will automatically lead to the corresponding cycle of the other display panel (440) selected as 'y' and 'Recycled'. Likewise, if any cycle at the display panel (440) is selected as "Freshwater" the corresponding previous cycle in the other display panel (430) displays as 'n' against 'Recycle', and operate the first machine (100) accordingly. As such, various permutations and combinations are applicable by selecting options at the knobs (410) (420) and at the display panels (430, 440). A typical chronological sequence of tandem operation of the two machine cycles corresponding to the default selections of Figure 4A is shown in Figure 4B.

[0026] To simplify the panel options at the display panels (430, 440), pre-set combinations may be selectable through text displays like "Max Cleaning + Low Water Saving" for example in case of the default setting shown here. However, if all cycles are selected for Recycle in the example situation, the text display may be "Max Cleaning + Highest Water Saving". Likewise, if only Wash and one Rinse cycle is selected and both are also selected for Recycle, the text can be "Min Cleaning + Max Water Savings. If however, additionally Pre-Wash is also selected, it could be "Medium cleaning + Max Water Saving" and if yet another Fresh Rinse is selected at the display panel (440), it could be "Medium Cleaning + Low water Saving" etc. In each of these selections, further program logic, also known as Fuzzy logic in automated washing machines, may be applied, such as shortening the length of wash cycle automatically if the selection is "Min Cleaning + Max Power Saving" etc. The tandem type configurations of the washing system may be preferably horizontal as shown here, or a vertically stacked twin i.e. the first machine (100) on top of the second machine (200), to save space or any other desirable reason.

[0027] Typical Wash Cycles for both the machines (100, 200) operating in tandem, controlled through the common controller (408) is shown below for example:

Various advantageous features of the washing machine are the following:

1. Any cycle of the first machine (100) dischargeable as effluent and rest recyclable as input for the second machine (200).

2. Fresh water at any cycle option for the second machine (200) as well, e.g. last rinse as exemplified above.

3. Any selected cycle of the first machine (100), also being selectable as 'recycle' in the second machine (200).

4. Independent temperature controls of the machines (100, 200)

5. Different Wash logic selectable in the first and second machine(100, 200); e.g. 'delicate' in the first machine 100 and 'hard' in the second machine (200).

6. Controlling cycles in the machines (100, 200), depending on selection of washables types e.g. Cotton in the first machine (100) and heavily Soiled kitchen mops in the second machine (200).

7. Interlocked delay operations like starting the machines (100, 200) at a particular time, or stopping at a particular stage e.g. after pre-washing at the first machine (100). Additionally, keeping the first machine (100) on 'hold' till the second machine (200) is not ready to take the intended input of grey water from the first machine (100).

8. On finishing the cycles of a particular machine earlier, allowing the door to open for taking away the cleaned laundry and placing next load to be washed.

9. After removing the laundered material , grey water is returned from the machine still in use to the emptied one, for further use in any of the machines as selected. The 2nd Rinse water may be redirected to the first machine (100) for temporary storage and subsequent use for the first cycle of the next load in the second machine (200).

10. Likewise, when only the first machine (100) is used, using the second machine (200) for storing grey water of any cycle, e.g. either wash or rinse, for later use in any cycle of the first machine (100).

11. On switching off the interlock logic, both the machine (100, 200) are operable independently as two conventional machines. 12. Interrupted disposal of Detergent, Bleach and other Solvent through disposal trays (140, 240) in both machines (100, 200); i.e. any of the cycle may be interrupted to operate the machine to extract specified material stocked in the disposal tray (140, 240).

[0028] The multiple combination may have one or more of any type of automatic washing machine such as front loading tumble or top loading agitator etc. For example the first machine may be front loading tumble wash suitable for delicate clothes and the second may be top loading agitator wash more suitable for heavily soiled linen etc.

[0029] The tandem type washing system may be placed on the roof-top for further recycling of effluent waters of the first machine (100) and/or the second - machine (200) discharged through their associated drainage pipes(130, 230). In this configuration, the said drainage pipes (130, 230) are connected to a storage device such as a reservoir (500). The reservoir may pass the effluent water through a Channel means that may be similar to the channel means (300), shown here at (505). The channel means (505) may lead to a storage tank (510) that may have filtration means such as divider plates with descending level of pores or no-porous plates placed in such a way that it allows overflow to the next chamber. Additionally, the storage tanks may have transparent panels that allow solar rays to pass through in the stored water, for prevention of and further breakdown of pathogens. A solar heater may also be employed if the water is desired to be heated.

[0030] The biggest advantage of this novel construction is that the effluent grey water discharged and stored at the roof top does not require any pumping. As the fresh water used for washing is generally already stored at the rooftops, there is net saving of energy. The grey water may be further processed using sun-rays and may be supplied through a separate pipelines for flushing (520), gardening (530), car-wash (540) and the like. Moreover, laundering at roof top will also facilitate drying clothes under the sun, further saving efforts to carry the washed clothes there. An additional drainage pipe running through the bottom of all compartments (550) may be connected to a hydrant (560) for any use including for ground water recharging through a pit (570), additional water source in emergencies like fire as shown (580).

[0031] In a different scenario, more than two machines may be interconnected serially, e.g. a third machine operable to extract selected effluents of the second and/or first machine, and so on. This type of modular configuration may be more useful in an industrial situation where heavily soiled load maybe more.

[0032] Many known devices and processed may be used to clean the final effluents of the tandem washing machines placed at the rooftops. Through additional mechanical means, alternative drainage and fool-proofing systems may be provided for contingencies like power-failure, system crash and/or overflow etc.

[0033] Although the present invention has been described in detail here, various changes, substitutions, and alterations may be readily ascertainable by those skilled in the art.

Claims

1. A tandem washing system configuration comprising at least two automatic washing machines (100, 200) of identical construction, placed in parallel or vertically, adjacent to each other being flowably connected via a channel means (300) having a two-way solenoid valve, each of the two automatic washing machines (100, 200) having individual tap water inlets (110, 210), separate effluent drainage outlets (130, 230), disposal trays (140, 240) containing washing chemicals, individual heating devices, separate processors, and identically designed rotatable means, the system configuration is provided with a micro-processor-based controller (400) which causes the second automatic washing machine (200) to use as an input for the discharged water of at least one cycle of the first automatic washing machine (100) transmitted via the interconnected channel means (300) by means of the two-way solenoid valve, and the controller (400) being operable to cause the automatic washing machines (100, 200) to function at tandem in respect of wash cycle, wash load, washable material, intended consumption of resources, selected time and duration for operation, thereby optimising the operational inputs and wash quality of each washing machine (100, 200); **characterized in that**
the channel means (300) comprises a filtration device (310) with a back flush means and a turbidity sensor (330) to determine the turbidity of the discharged water.

2. The tandem washing system configuration as claimed in claim 1, whereby the channel means (300) comprises an irradiation device (320) to remove pathogens from the discharged water.

3. The tandem washing system configuration as claimed in claim 1, comprising a solenoid valve means (340) to release turbid water in case the turbidity sensor (330) determines turbidity of the discharged water to be less than a predetermined level.

4. The tandem washing system configuration as claimed in claim 1, wherein the controller (400) is operable to cause the second automatic washing machine (200) on hold, in case the turbidity of the discharge water from the first automatic washing machine (100) as determined by the turbidity sensor (330) exceeds a threshold value.

5. The tandem washing system configuration as claimed in claim 1, comprising an intermediate reservoir chamber provided between the first and the second automatic washing machines (100, 200) for temporary storage of discharge water of each cycle, the system is operable to hold the first automatic washing machine (100) from releasing grey water selected for recycling if the intermediate storage is not ready to take it.

6. The tandem washing system configuration as claimed in claim 1, whereby the channel (300) is placed between the said intermediate reservoir and the second automatic washing machine (200).

7. The tandem washing system configuration as claimed in claim 5, whereby the filter/sieve (310) is disposed between the first automatic washing machine (100) and the said intermediate reservoir and the irradiation device (320) is disposed between the intermediate reservoir and the second automatic washing machine (200).

8. A method of operating a tandem washing system configuration having at least two automatic washing machines (100, 200) comprising; applying a microprocessor based controller (400) for causing the second automatic washing machine (200) to use as an input the discharged water of at least one cycle of the first automatic washing machine (100), filtering the discharged water through a filtration device (310) and transmitting said discharged water via an interconnected channel (300) by means of a two way solenoid valve, **characterized by** determining the turbidity of the discharge water by applying a turbidity sensor (330) and holding the second automatic washing machine (200) in case the turbidity exceeds a threshold value.

9. The method of claim 8 further comprising temporarily storing the said discharged water of said first automatic washing machine (100) in an intermediate reservoir chamber and holding the first automatic washing machine (100) from releasing grey water selected for recycling if the intermediate storage is not ready to take it.

10. The method of claims 8 or 9 further comprising irradiating the discharged water to remove pathogens before recycling.

Patentansprüche

1. Tandemwaschsystemanordnung, umfassend zumindest zwei automatische Waschmaschinen (100, 200) identischen Aufbaus, welche parallel oder vertikal zueinander benachbart angeordnet sind und miteinander über eine ein Zweiweg-Magnetventil aufweisende Leitungseinrichtung (300) in Strömungsverbindung stehen, wobei jede der beiden automatischen Waschmaschinen (100, 200) eigene Leitungswassereinlässe (110, 210), separate Abwasserdränageauslässe (130, 230), Waschchemi-

kalien enthaltende Versorgungsfächer (140, 240), eigene Heizvorrichtungen, separate Prozessoren und identisch ausgestaltete Dreheinrichtungen aufweist, wobei der Systemaufbau mit einer mikroprozessorbasierten Steuerung (400) versehen ist, welche die zweite automatische Waschmaschine (200) dazu veranlasst, als einen Zulauf das ausgeleitete Wasser von zumindest einem Zyklus der ersten automatischen Waschmaschine (100) zu verwenden, welches über die zwischengeschaltete Leitungseinrichtung (300) mittels des Zweiwege-Magnetventils übertragen wird, und die Steuerung (400) dazu betreibbar ist, die automatischen Waschmaschinen (100, 200) dazu zu veranlassen, als ein Tandem bezüglich eines Waschzyklus, einer Waschladung, eines waschbaren Materials, eines beabsichtigten Betriebsmittelverbrauchs, einer gewählten Zeit und einer Betriebsdauer zu funktionieren, und dadurch die Betriebseinspeisungen und die Waschqualität jeder der Waschmaschinen zu optimieren,
dadurch gekennzeichnet, dass die Leitungseinrichtung (300) eine Filtrationsvorrichtung (310) mit einer Rückspüleinrichtung und einem Trübungssensor (330) umfasst, um die Trübung des ausgeleiteten Wassers zu ermitteln.

2. Tandemwaschsystemanordnung nach Anspruch 1, bei der die Leitungseinrichtung (300) eine Bestrahlungsvorrichtung (320) zum Entfernen von Krankheitserregern aus dem ausgeleiteten Wasser umfasst.

3. Tandemwaschsystemanordnung nach Anspruch 1, umfassend eine Magnetventileinrichtung (340) zum Abgeben von trübem Wasser für den Fall, dass der Trübungssensor (330) ermittelt, dass die Trübung des abgeleiteten Wassers geringer ist als ein vorbestimmter Grad.

4. Tandemwaschsystemanordnung nach Anspruch 1, bei der die Steuerung (400) dazu betreibbar ist, ein Anhalten der zweiten automatischen Waschmaschine (200) für den Fall zu bewirken, dass die von dem Trübungssensor (330) ermittelte Trübung des aus der ersten automatischen Waschmaschine (100) ausgeleiteten Wassers einen Schwellenwert übersteigt.

5. Tandemwaschsystemanordnung nach Anspruch 1, umfassend eine zwischen der ersten und der zweiten automatischen Waschmaschine (100, 200) vorhandene Zwischenspeicherkammer, um ausgeleitetes Wasser aus jedem Zyklus vorübergehend zu speichern, wobei das System derart betreibbar ist, dass es die erste automatische Waschmaschine (100) davon abhält, zum Wiederverwerten gewähltes Grauwasser abzugeben, wenn der Zwischenspeicher nicht dazu bereit ist, es aufzunehmen.

6. Tandemwaschsystemanordnung nach Anspruch 1, bei der die Leitung (300) zwischen dem Zwischenspeicher und der zweiten automatischen Waschmaschine (200) angeordnet ist.

7. Tandemwaschsystemanordnung nach Anspruch 5, bei der der Filter / das Sieb (310) zwischen der ersten automatischen Waschmaschine (100) und dem Zwischenspeicher angeordnet ist und die Bestrahlungsvorrichtung (320) zwischen dem Zwischenspeicher und der zweiten automatischen Waschmaschine (200) angeordnet ist.

8. Verfahren zum Betreiben einer Tandemwaschsystemanordnung mit wenigstens zwei automatischen Waschmaschinen (100, 200), umfassend:

Anwenden einer mikroprozessorbasierten Steuerung (400) zum Veranlassen der zweiten automatischen Waschmaschine (200), das von zumindest einem Zyklus der ersten automatischen Waschmaschine (100) ausgeleitete Wasser als einen Zulauf zu verwenden,
Filtern des ausgeleiteten Wassers durch eine Filtrationsvorrichtung (310) und Überführen des ausgeleiteten Wassers über eine zwischengeschaltete Leitung (300) mittels eines Zweiweg-Magnetventils,
gekennzeichnet durch ein Bestimmen der Trübung des ausgeleiteten Wassers durch Anwenden eines Trübungssensors (330) und Anhalten der zweiten automatischen Waschmaschine (200) für den Fall, dass die Trübung einen Schwellenwert übersteigt.

9. Verfahren nach Anspruch 8, ferner umfassend ein vorübergehendes Speichern des aus der ersten automatischen Waschmaschine (100) ausgeleiteten Wassers in einer Zwischenspeicherkammer und Abhalten der ersten automatischen Waschmaschine (100) vom Abgeben von zur Wiederverwertung gewähltem Grauwasser, falls der Zwischenspeicher nicht dazu bereit ist, es aufzunehmen.

10. Verfahren nach einem der Ansprüche 8 oder 9, ferner umfassend Bestrahlen des ausgeleiteten Wassers, um Krankheitserreger vor der Wiederverwertung zu entfernen.

Revendications

1. Configuration de système de lavage en tandem comprenant au moins deux machines à laver (100, 200) automatiques de construction identique, placées en parallèle ou verticalement, adjacentes l'une à l'autre étant en connexion de flux par l'intermédiaire d'un moyen (300) de canal ayant un solénoïde à deux

voies, chacune des deux machines à laver (100, 200) automatiques ayant des entrées (110, 210) individuelles d'eau du robinet, des sorties (130, 230) séparées d'évacuation d'effluents, des bacs (140, 240) contenant des produits chimiques de lavage, des dispositifs individuels de chauffage, des processeurs séparés, et des moyens de rotation de conception identique, la configuration de système est prévue avec un contrôleur (400) basé sur un microprocesseur qui fait que la deuxième machine à laver (200) automatique utilise comme une entrée l'eau déchargée d'au moins un cycle de la première machine à laver (100) automatique transmise par l'intermédiaire du moyen (300) de canal interconnecté au moyen du solénoïde à deux voies, et le contrôleur (400) étant utilisable pour faire que les machines à laver (100, 200) automatiques fonctionnent en tandem pour ce qui concerne le cycle de lavage, la charge de lavage, les matières lavables, la consommation prévue de ressources, l'heure sélectionnée et la durée de fonctionnement, optimisant ainsi les entrées opérationnelles et la qualité de lavage de chaque machine à laver (100, 200) ;
caractérisée en ce que
le moyen (300) de canal comprend un dispositif (310) de filtration avec un moyen de contre-courant et un capteur (330) de turbidité pour déterminer la turbidité de l'eau déchargée.

2. Configuration de système de lavage en tandem selon la revendication 1, dans laquelle le moyen (300) de canal comprend un dispositif (320) d'exposition à un rayonnement pour éliminer des agents pathogènes de l'eau déchargée.

3. Configuration de système de lavage en tandem selon la revendication 1, comprenant un moyen (340) à solénoïde pour libérer une eau turbide dans le cas où le capteur (330) de turbidité détermine que la turbidité de l'eau déchargée est inférieure à un niveau prédéterminé.

4. Configuration de système de lavage en tandem selon la revendication 1, dans laquelle le contrôleur (400) est utilisable pour mettre la deuxième machine à laver (200) automatique en pause, dans le cas où la turbidité de l'eau déchargée de la première machine à laver (100) automatique, telle que déterminée par le capteur (330) de turbidité, excède une valeur de seuil.

5. Configuration de système de lavage en tandem selon la revendication 1, comprenant une chambre réservoir intermédiaire prévue entre les première et deuxième machines à laver (100, 200) automatiques pour un stockage temporaire d'eau de décharge de chaque cycle, le système est utilisable pour empêcher la première machine à laver (100) automatique de libérer une eau grise sélectionnée pour un recyclage si le stockage intermédiaire n'est pas prêt à la recevoir.

6. Configuration de système de lavage en tandem selon la revendication 1, dans laquelle le canal (300) est placé entre ledit réservoir intermédiaire et la deuxième machine à laver (200) automatique.

7. Configuration de système de lavage en tandem selon la revendication 5, dans laquelle le filtre/tamis (310) est disposé entre la première machine à laver (100) automatique et ledit réservoir intermédiaire et le dispositif (320) d'exposition à un rayonnement est disposé entre le réservoir intermédiaire et la deuxième machine à laver (200) automatique.

8. Procédé de fonctionnement d'une configuration de système de lavage en tandem ayant au moins deux machines à laver (100, 200) automatiques comprenant : l'application d'un contrôleur (400) basé sur un microprocesseur pour faire que la deuxième machine à laver (200) automatique utilise comme une entrée l'eau déchargée d'au moins un cycle de la première machine à laver (100) automatique, la filtration de l'eau déchargée à travers un dispositif (310) de filtration et la transmission de ladite eau déchargée par l'intermédiaire d'un canal (300) interconnecté au moyen d'un solénoïde à deux voies, **caractérisé par** la détermination de la turbidité de l'eau de décharge en appliquant un capteur (330) de turbidité et en mettant la deuxième machine à laver (200) automatique en pause dans le cas où la turbidité excède une valeur de seuil.

9. Procédé selon la revendication 8, comprenant en outre le stockage temporaire de ladite eau déchargée de ladite première machine à laver (100) automatique dans une chambre réservoir intermédiaire et la non libération par la première machine à laver (100) automatique d'une eau grise sélectionnée pour un recyclage si le stockage intermédiaire n'est pas prêt à la recevoir.

10. Procédé selon la revendication 8 ou 9, comprenant en outre l'exposition à un rayonnement de l'eau déchargée pour éliminer des agents pathogènes avant le recyclage.

Fig. 1

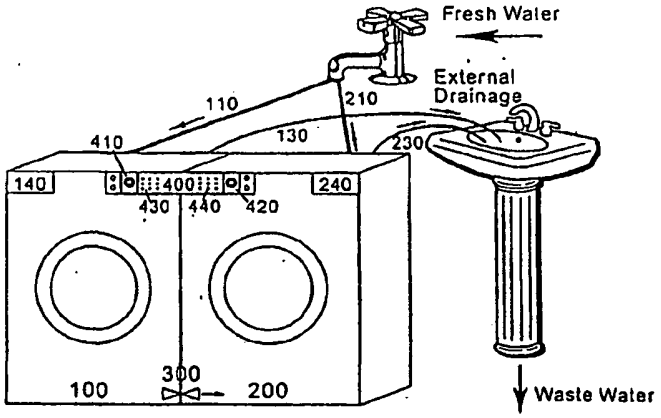


Fig. 2A

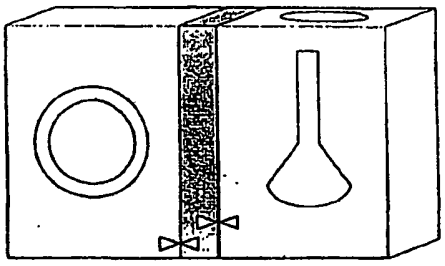


Fig. 2B

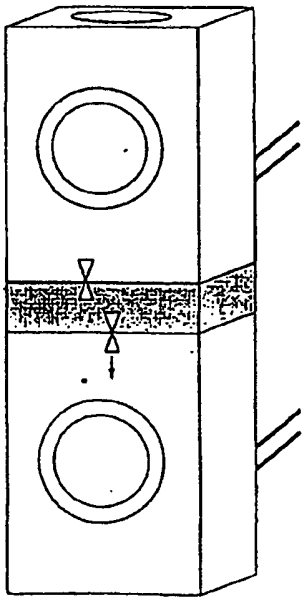


Fig. 3

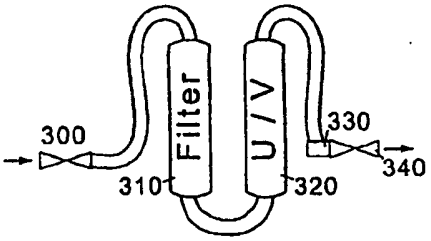
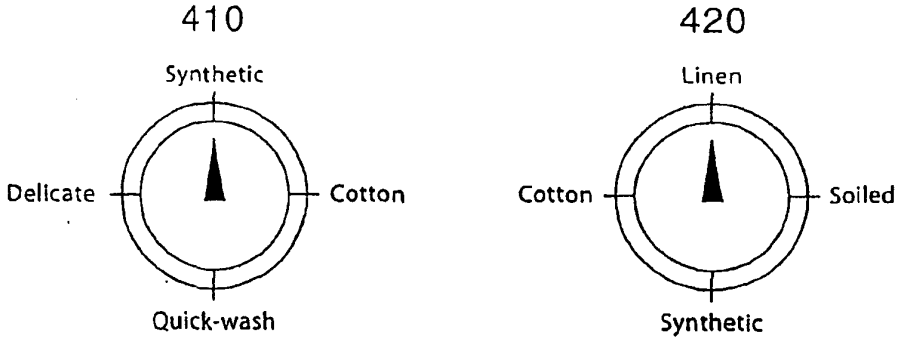


Fig. 4A
Table



Display Panels

430

Pre-wash	y N	Recycle	y N
Wash	y N	Recycle	y N
Rinse 1	y N	Recycle	y N
Rinse 2	y N	Recycle	y N
Rinse 3	y N	Recycle	y N

440

Pre-wash	y N	Recycled / Fresh
Wash	y N	Recycled / Fresh
Rinse 1	y N	Recycled / Fresh
Rinse 2	y N	Recycled / Fresh
Rinse 3	y N	Recycled / Fresh

Manually selected options are shown as ☐ (double line indicator), in the above.
Automatically selected (as a result of manual selections) are shown as ■ (reverse indicator).

Any automatically selected option above can be de-selected, upon which the corresponding options at 430 are automatically selected. For example, if in the above default selection combination, Pre-wash at 440 is de-selected as Fresh and selected as Recycled, as shown below, the panel at 430 will show y and y

Pre-wash	y N	Recycle	y N
Pre-wash	y N	Recycle	y N
Pre-wash	y N	Recycle	y N

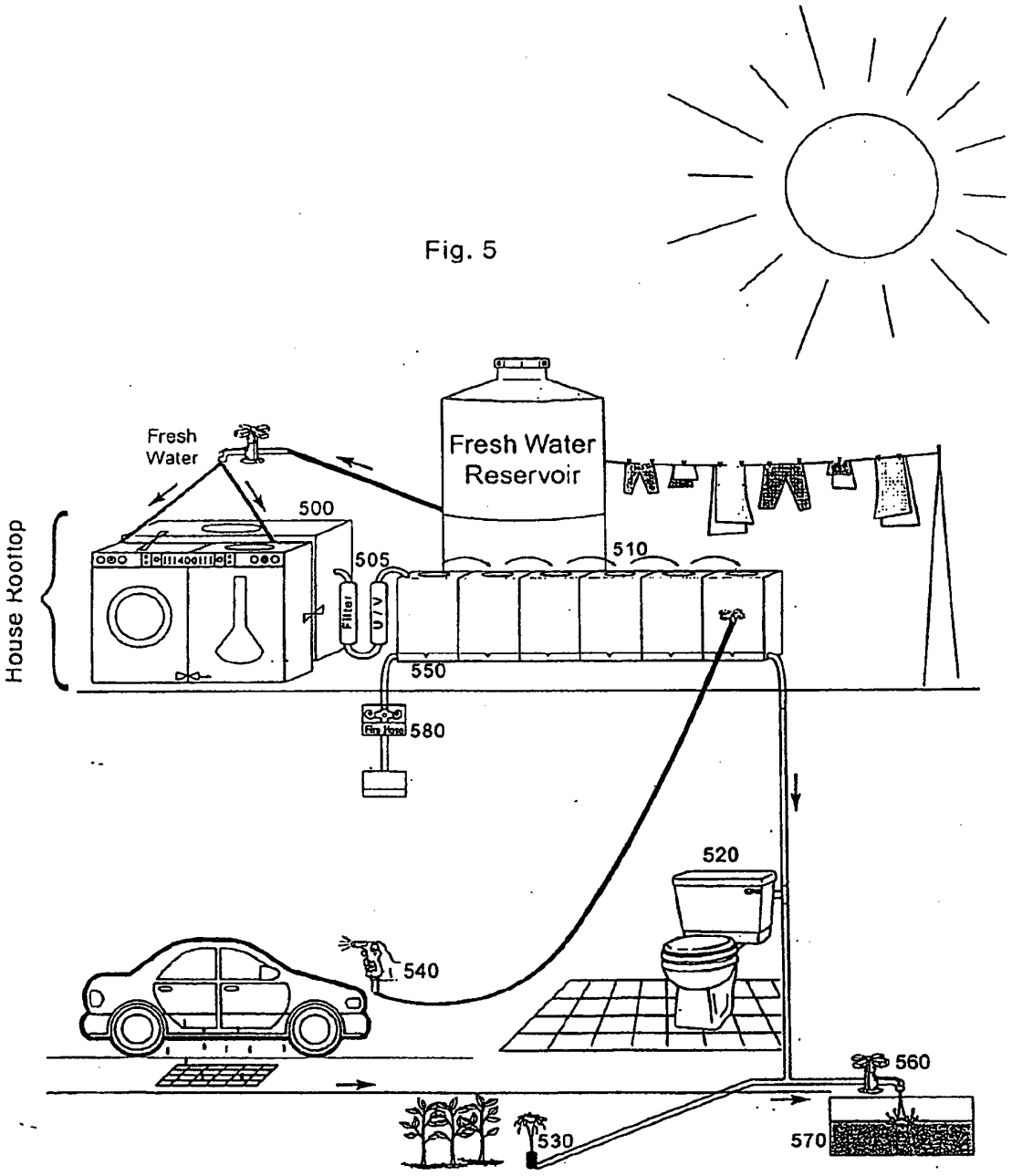
Pre-wash	y N	Recycled / Fresh
Pre-wash	y N	Recycled / Fresh
Pre-wash	y N	Recycled / Fresh

Fig. 4B, Table

The following is a typical chronological sequence of operation of both the machines in tandem, in response to a program selection such as the default program shown in A:

Timeline	Machine 100	Machine 200
0.00-0.10	Fill, Pre-wash	Fill, Soak...
0.11-0.15	Spin	...soak
0.16-0.30	Wash...	Pre-wash...
0.31-0.45	...wash	...pre-wash, Spin
0.46-0.50	Spin	Fill Washed water from 1
0.51-1.00	Rinse...	Wash
1.01-1.10	rinse	Spin
1.10-1.20	Spin	Fill Rinsed water from 1
1.21-1.30	2nd Rinse...	Rinse
1.31-1-35	2d Rinse	Spin
1.36-1.40	Spin	Fill 2nd Rinsed water from 1
1.41-1.45	Ready for next load	2nd Rinse
1.46-1.50		Spin
1.51-1.52		Fill Fresh Water
1.53-1.59		3rd Rinse
2.00-2.05		Spin

Fig. 5


Fresh Water
Fresh Water Reservoir
500
505
510
House Rooftop
Filter
U / V
550
580
520
540
560
530
570

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0688894 A **[0001]**
- US 5501792 A, Carroll, Jr. **[0004]**