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(54) **SMART WASHER-DRYER MACHINE HAVING A MECHANISM OF SELF-LOADING AND AUTOMATIC TRANSFERRING**

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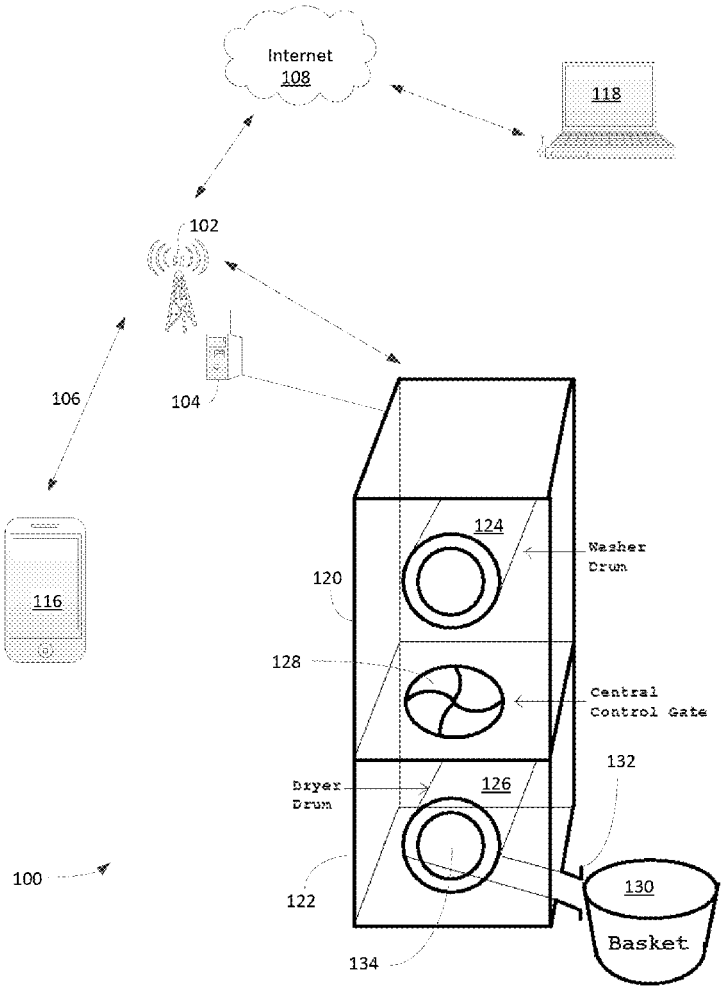
(57) **ABSTRACT**

An apparatus containing a smart washer and dryer capable of using water to clean clothes is disclosed. The apparatus, in one embodiment, includes a washing drum, washing sensor, center control gate, and dryer drum. The washing drum is structured in a cylindrical shape capable of holding water for cleaning or washing clothes with a repetitive motion. The washing sensor senses the end of or completion of washing phase associated with the washing drum and generates a wash completed signal. The dryer drum which is situated adjacent to the washing drum has a washing drum access ("WDA") door wherein the WDA door is capable of opening allowing the dryer drum to receive washed clothes from the washing drum via the center control gate based on the wash completed signal. The dryer drum is able to dry the washed clothes by extracting moisture from the washed clothes.



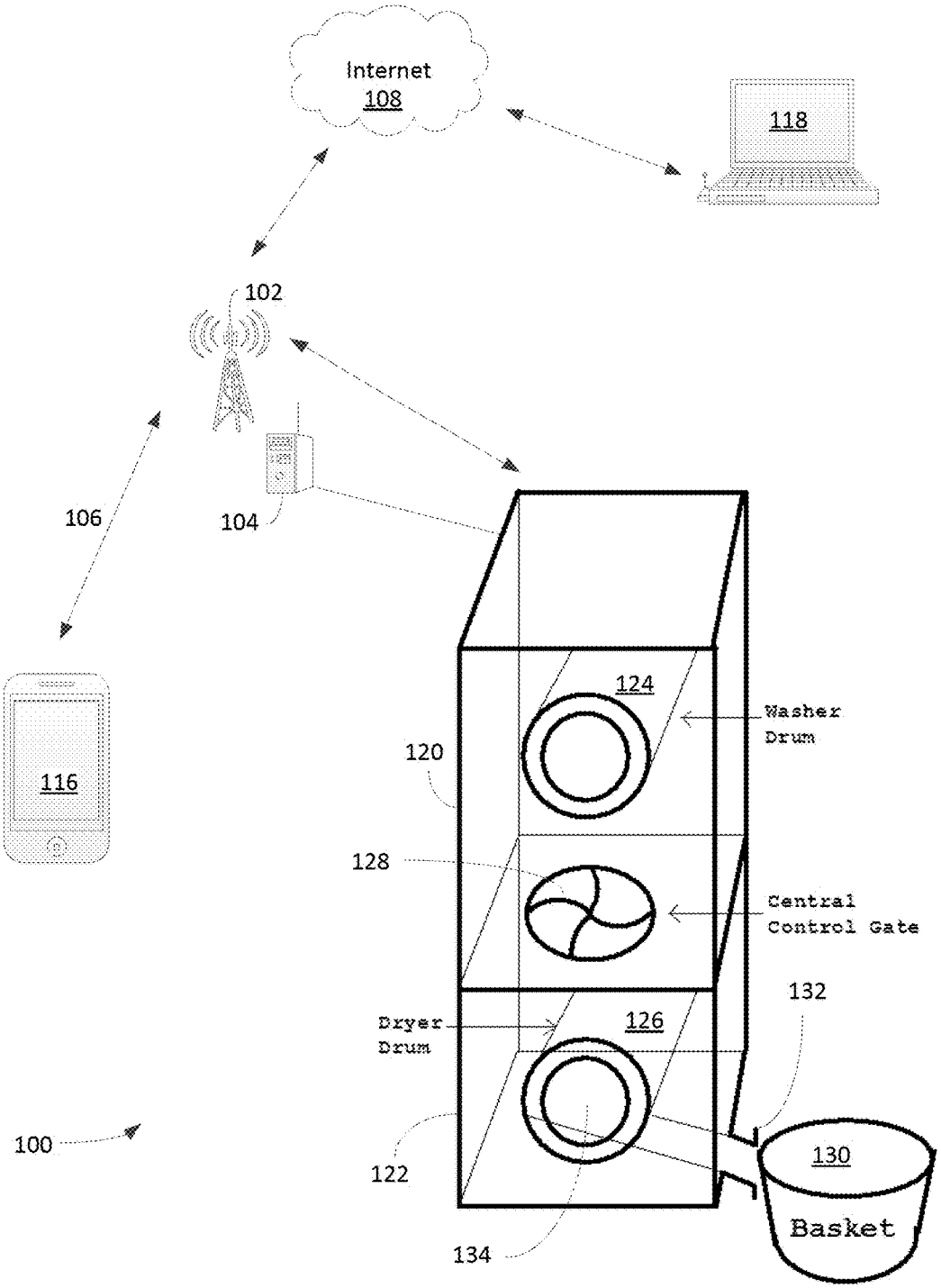

Internet
108
118
102
106
104
116
124
Washer
Drum
120
128
Central
Control Gate
132
Dryer
Drum
126
100
130
122
Basket
134

FIG 1

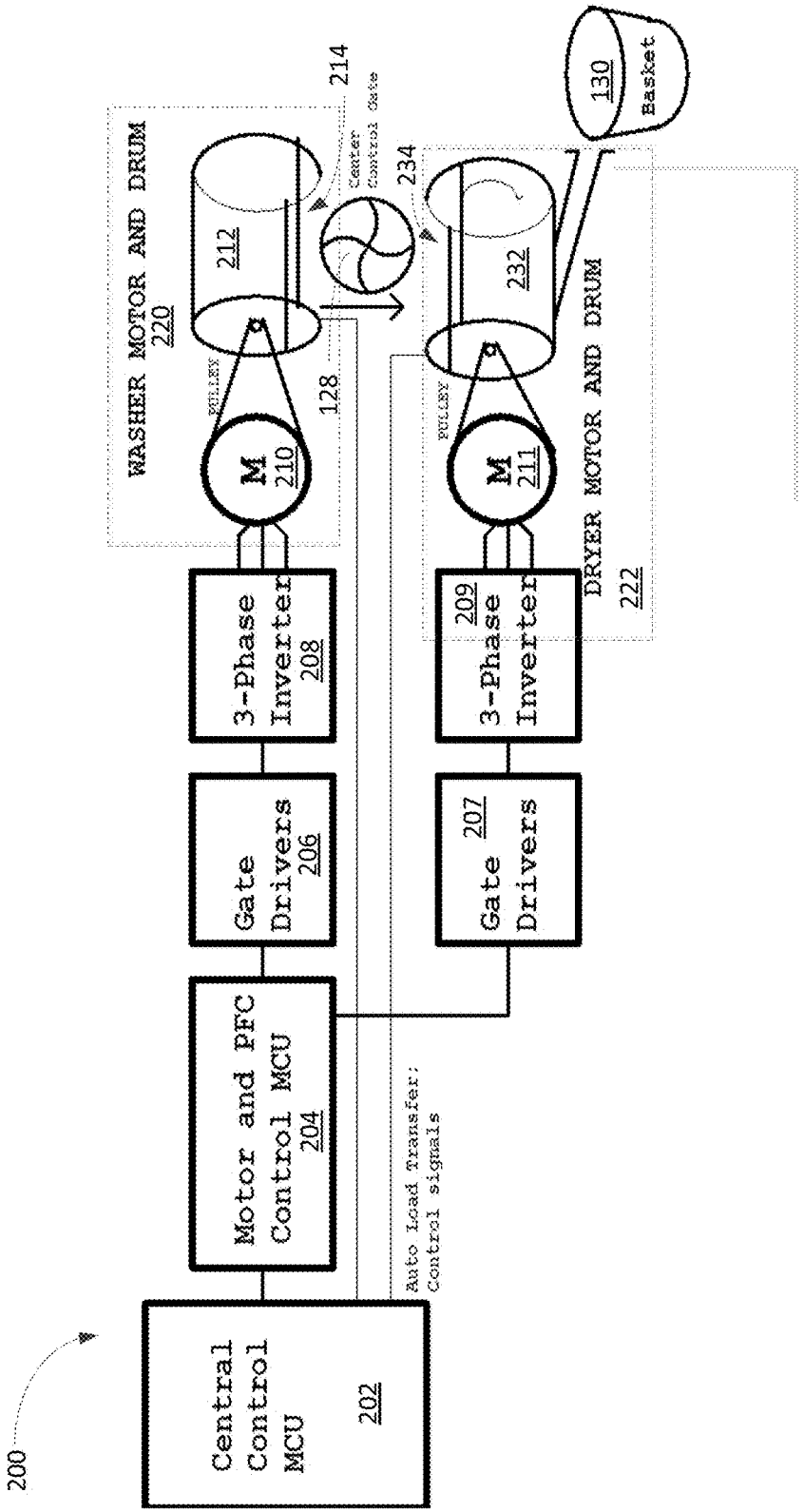

200
Central Control MCU 202
Motor and PFC Control MCU 204
Gate Drivers 206
3-Phase Inverter 208
Gate Drivers 207
3-Phase Inverter 209
Auto Load Transfer; Control signals
WASHER MOTOR AND DRUM 220
M 210
M 211
212
214
Center Control Gate
128
234
232
DRYER MOTOR AND DRUM 222
130
Basket

FIG 2

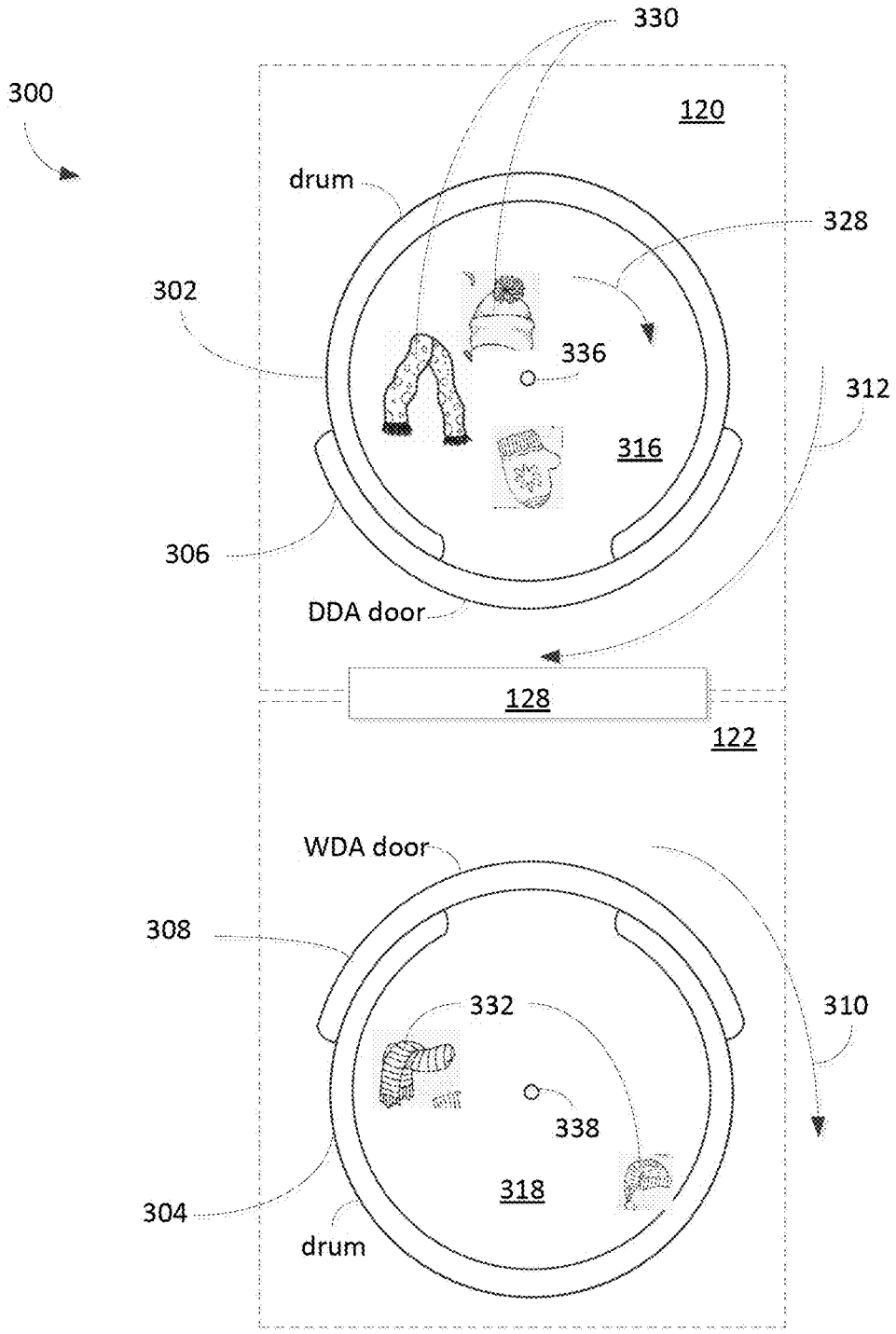

330
300
120
drum
328
302
336
312
316
306
DDA door
128
122
WDA door
308
310
332
338
318
304
drum

FIG 3

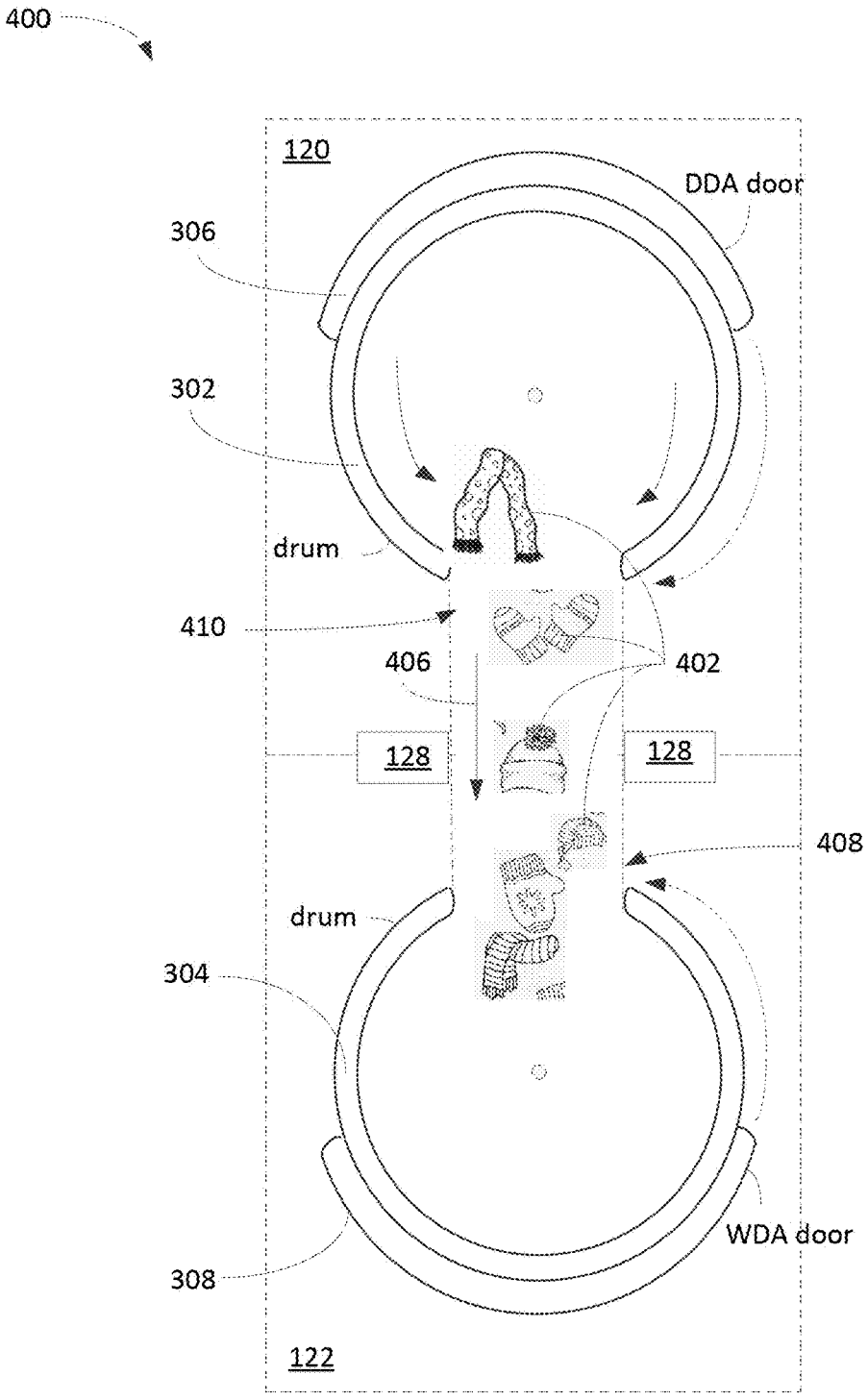

400
120
DDA door
306
302
drum
410
406
402
128
128
408
drum
304
WDA door
308
122

FIG 4

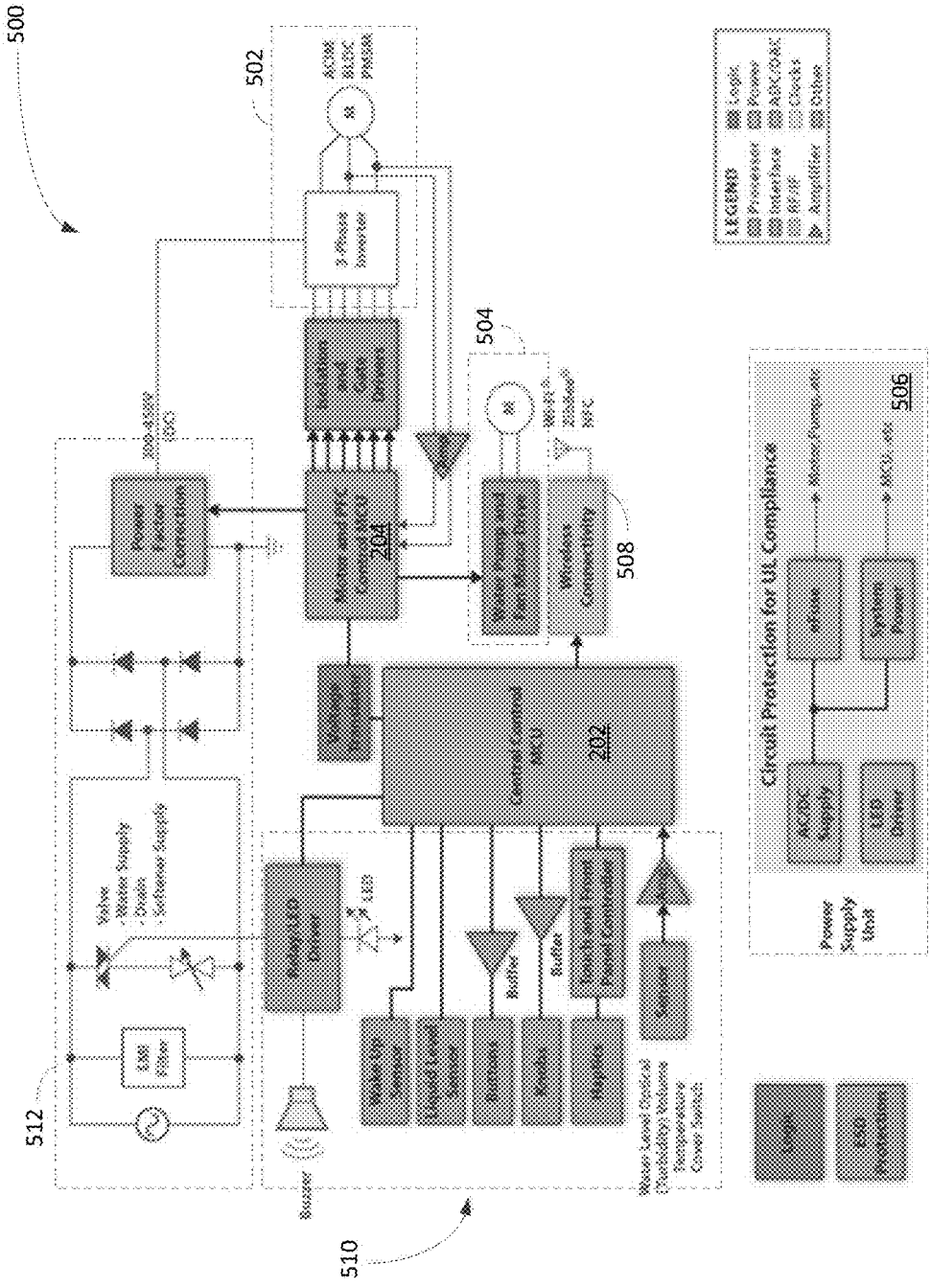

500
502
504
506
508
510
512
202
204
LEGEND
Circuit Protection for UL Compliance

FIG 5

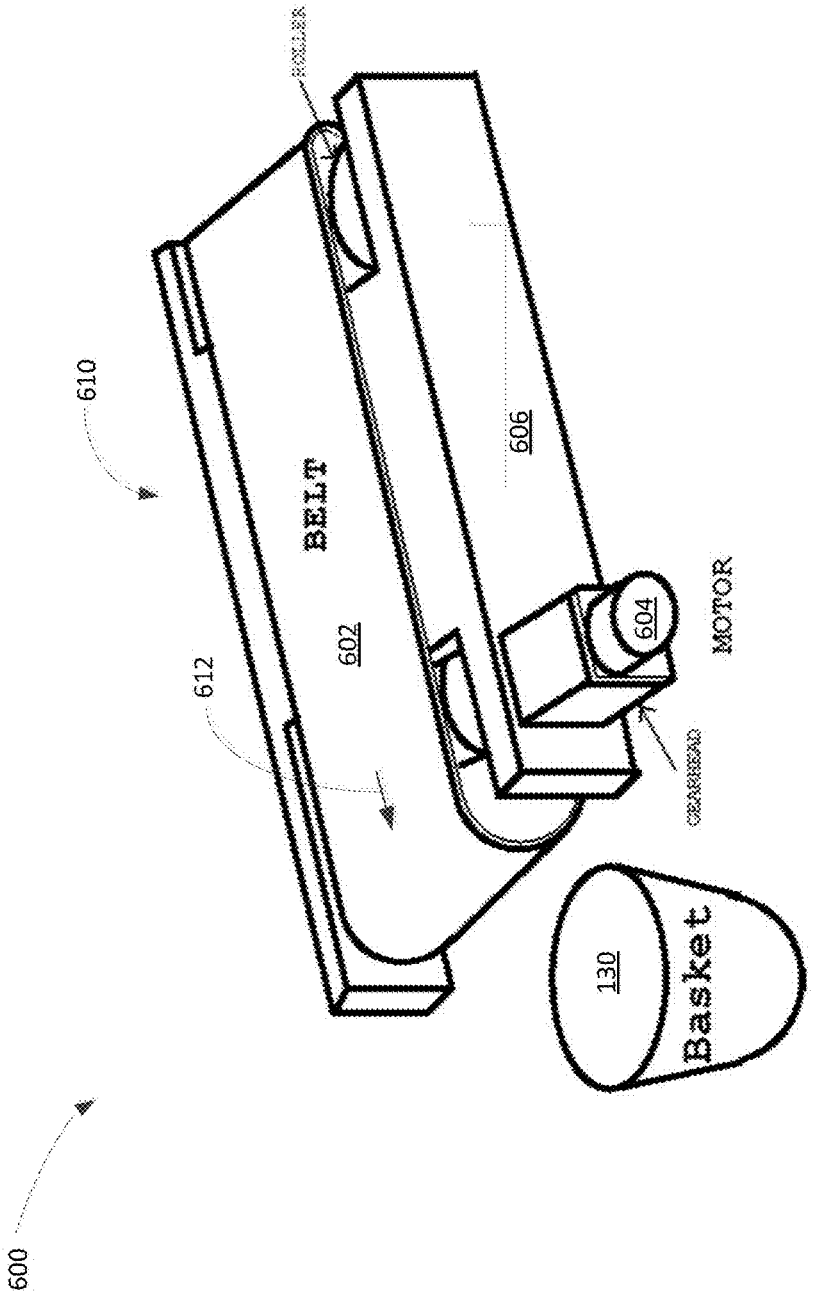



FIG. 6A

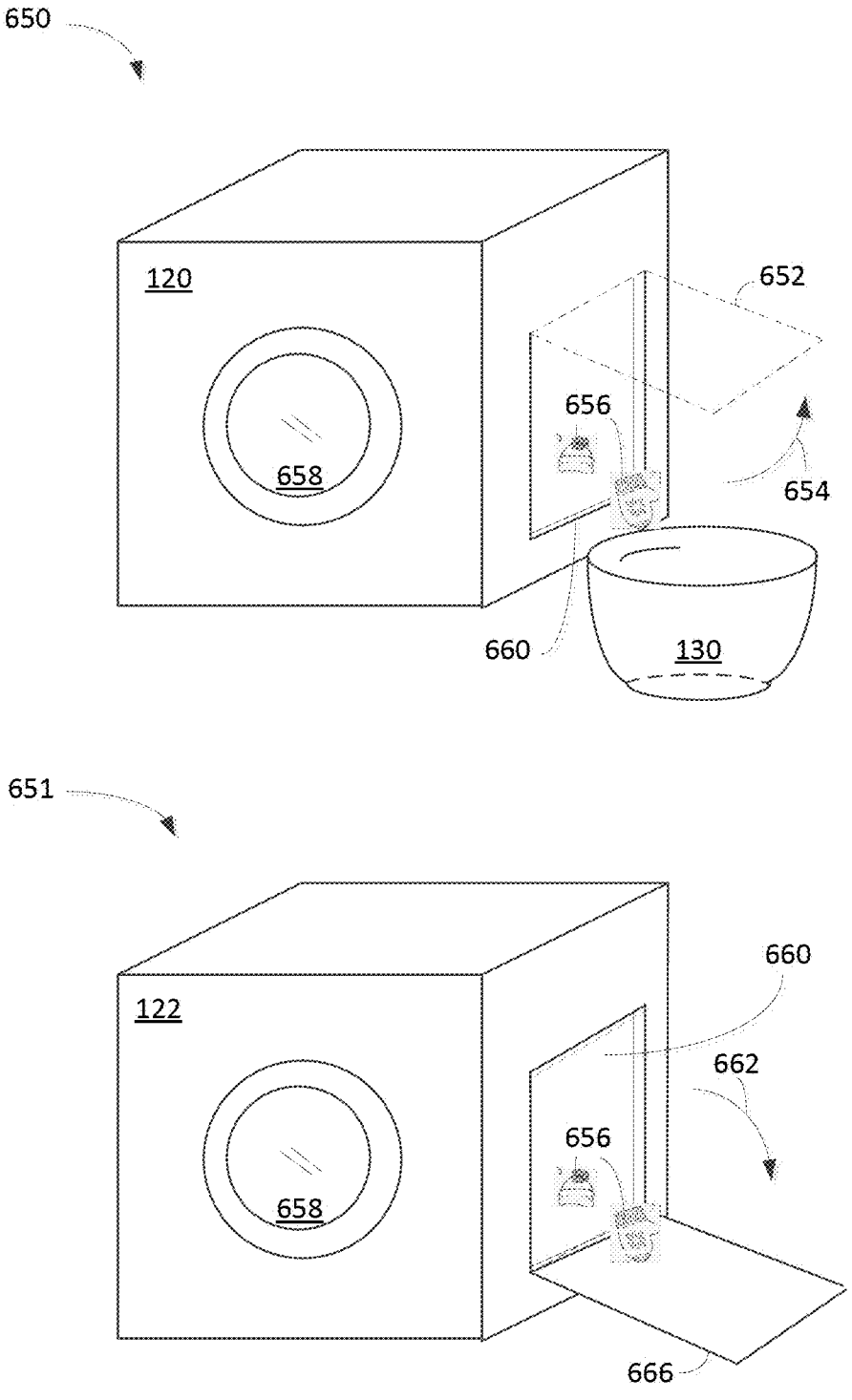



FIG. 6B

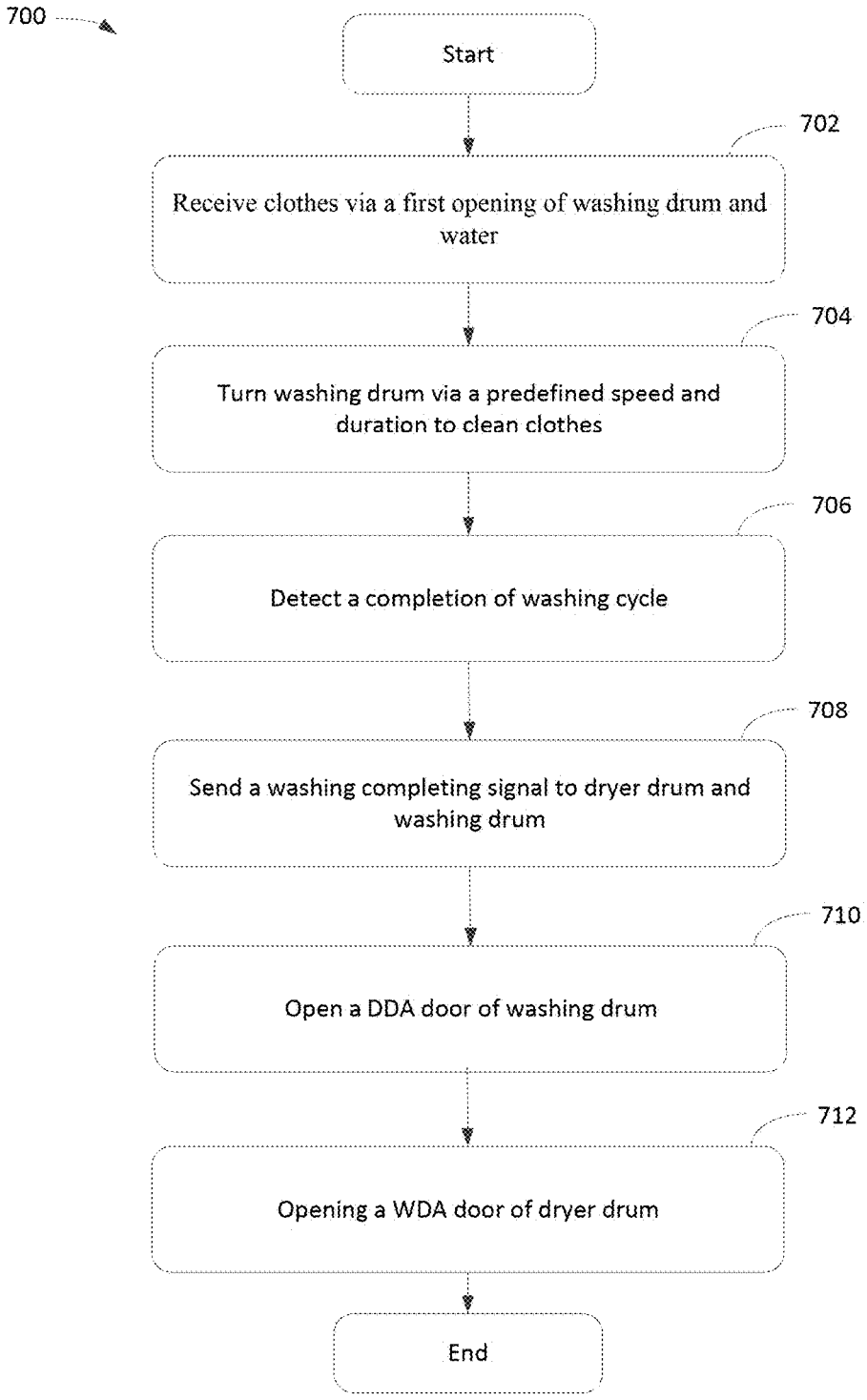

700
Start
702
Receive clothes via a first opening of washing drum and water
704
Turn washing drum via a predefined speed and duration to clean clothes
706
Detect a completion of washing cycle
708
Send a washing completing signal to dryer drum and washing drum
710
Open a DDA door of washing drum
712
Opening a WDA door of dryer drum
End

FIG 7

# SMART WASHER-DRYER MACHINE HAVING A MECHANISM OF SELF-LOADING AND AUTOMATIC TRANSFERRING

## FIELD

**[0001]** The exemplary embodiment(s) of the present invention relates to cleaning equipment. More specifically, the exemplary embodiment(s) of the present invention relates to a washer and dryer machine.

## BACKGROUND

**[0002]** A washing machine, also known as laundry machine or washer, is a machine for cleaning or laundering clothes and/or fabric articles using water. A convention washing machine could have either top loading or front loading. The top load design, for example, places the clothes in a vertically mounted perforated basket where clothes are loaded through the top of the machine, which may be covered with a door on the top of washing machine. The front loading washing machine is a horizontal-axis design allowing loading clothes through a door located at the front of the machine. To wash clothes, the clothes or fabric articles are pushed by multiple paddles inside of the drum and then dropped repeatedly until the clothes are washed and/or cleaned. Once the washing cycle or phase is completed, the washed clothes which are often wet are manually transferred to a dryer.

**[0003]** A dryer, also known as clothes dryer or drying machine, is an appliance for home or commercial setting used to extract moisture from washed clothes and/or other wet textiles. A conventional dryer includes a rotating drum, also known as tumbler, using heated air flow to remove moisture from wet clothes. A typical dryer is a front loading machine that allows clothes to be loaded and/or unloaded through a front door.

**[0004]** A drawback, however, associated with the convention washer and/or dryer is that washed clothes generally require to be manually transferred between a washer and a dryer.

**[0005]** A conventional approach to resolve such manual transferring is to provide a combination of washer and dryer using a single drum for both washing and drying. A problem associated with the combination of washer and dryer is that it is typically small and inefficient. Another problem associated with a typical combination of washer and dryer or dryer is that the dried clothes in the dryer need to be manually moved from the dryer shortly after the clothes are dried to prevent from wrinkling. Another shortcoming is that a conventional washing machine or dryer generally does not permit remote access.

## SUMMARY

**[0006]** This invention discloses a washer and dryer ("SWD") system that allows the consumer to load dirty laundry into the machine and receive clean dry clothes in an outside laundry basket. The process of washing the clothes, transferring the wet clothes to the dryer, and subsequently transferring the dried clothes to the outside laundry basket is done automatically. Additionally, all phases of washing and drying can be controlled remotely.

**[0007]** The advantages of using the SWD machine for end users or consumers are numerous. Firstly, it greatly adds to user convenience because: several manual steps have been reduced to one manual step; and providing the user with the ability to remotely control the washing drying process. Secondly, it eliminates the need for repeat washing of moldy clothes because damp clothes were left in the washer. Thirdly, there will not be any need to re-dampen and re-dry clothes because it was left too long in the dryer.

**[0008]** The advantages of the SWD machine for manufacturers are numerous. Substantial benefits to the consumer, as outlined above, can be provided with small changes to the hardware, without new technical training and at a comparable price point.

**[0009]** One embodiment of the presently claimed invention discloses the SWD machine capable of washing clothes via self-loading and automatic transfer. For example, the embodiment of invention includes a washing drum, washing sensor, center control gate, and dryer drum. The washing drum is structured in a cylindrical shape capable of holding water for cleaning or washing clothes with a repetitive motion. The washing sensor senses the end of or completion of washing phase associated with the washing drum and generates a wash completed signal. The dryer drum which is situated adjacent to the washing drum has a washing drum access ("WDA") door wherein the WDA door is capable of opening allowing the dryer drum to receive washed clothes from the washing drum via the center control gate based on the wash completed signal. The dryer drum is able to dry the washed clothes by extracting moisture from the washed clothes. The dryer drum then transfers the dried clothes to the laundry basket.

**[0010]** Additional features and benefits of the exemplary embodiment(s) of the present invention will become apparent from the detailed description, figures and claims set forth below.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0011]** The exemplary embodiment(s) of the present invention will be understood more fully from the detailed description given below and from the accompanying drawings of various embodiments of the invention, which, however, should not be taken to limit the invention to the specific embodiments, but are for explanation and understanding only.

**[0012]** FIG. **1** is a diagram illustrating an exemplary layout of SWD machine capable of self-loading and automatic unloading for laundry clothing in accordance with one embodiment of the present invention;

**[0013]** FIG. **2** is a block diagram illustrating electrical and mechanical components of SWD machine for operating auto-load-transfer or self-loading in accordance with one embodiment of the present invention;

**[0014]** FIG. **3** is a block diagram illustrating a cutaway view of SWD machine having a washing drum with a DDA door and a dryer drum with a WDA door in accordance with one embodiment of the present invention;

**[0015]** FIG. **4** is a block diagram illustrating a cutaway view of SWD machine having a washing drum and a dryer drum in open positions in accordance with one embodiment of the present invention;

**[0016]** FIG. **5** is a schematic diagram illustrating a control flow using various electronics and mechanical components for the SWD machine in accordance with one embodiment of the present invention;

**[0017]** FIGS. **6**A-B are three-dimensional ("3D") perspective diagrams illustrating exemplary automatic transferring

mechanism configured to unload dried clothing from a dryer drum to a basket in accordance with one embodiment of the present invention; and

**[0018]** FIG. **7** is a flowchart illustrating a process of self-loading and automatic transferring dry clothes by the SWD machine to basket in accordance with one embodiment of the present invention.

## DETAILED DESCRIPTION

**[0019]** Exemplary embodiment(s) of the present invention is described herein in the context of a method, device, and apparatus for a smart washer and dryer ("SWD") machine capable of facilitating self-loading washed clothes and automatic unloading for dried clothes.

**[0020]** Those of ordinary skills in the art will realize that the following detailed description of the exemplary embodiment(s) is illustrative only and is not intended to be in any way limiting. Other embodiments will readily suggest themselves to such skilled persons having the benefit of this disclosure. Reference will now be made in detail to implementations of the exemplary embodiment(s) as illustrated in the accompanying drawings. The same reference indicators will be used throughout the drawings and the following detailed description to refer to the same or like parts.

**[0021]** In the interest of clarity, not all of the routine features of the implementations described herein are shown and described. It will, of course, be understood that in the development of any such actual implementation, numerous implementation-specific decisions may be made in order to achieve the developer's specific goals, such as compliance with application- and business-related constraints, and that these specific goals will vary from one implementation to another and from one developer to another. Moreover, it will be understood that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking of engineering for those of ordinary skills in the art having the benefit of embodiment(s) of this disclosure.

**[0022]** Various embodiments of the present invention illustrated in the drawings may not be drawn to scale. Rather, the dimensions of the various features may be expanded or reduced for clarity. In addition, some of the drawings may be simplified for clarity. Thus, the drawings may not depict all of the components of a given apparatus (e.g., device) or method.

**[0023]** As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The term "and/or" includes any and all combinations of one or more of the associated listed items.

**[0024]** The term "system" is used generically herein to describe any number of mechanical components, elements, sub-systems, devices, units, assemblies, mechanisms, or combinations of components thereof. The term "circuits," "computer," "integrated circuits," "electrical controller," "optical sensors," or "sensors," may include a processor, memory, and buses capable of executing instruction wherein the computer refers to one or a cluster of computers, personal computers, or combinations of computers thereof. The term "purifying" is used generically herein to describe reducing or altering concentration of one or more contaminants to a specified range.

**[0025]** One embodiment of the present invention discloses a self-contained washer and dryer apparatus or SWD machine using water, liquor, or other chemical compound for cleaning or washing clothes or fabric articles. The SWD machine, in one aspect, includes a washing drum, washing sensor, center control gate, and dryer drum. The washing drum is structured in a cylindrical shape capable of holding water for cleaning clothes with repetitive motion. The washing sensor senses the end of or completion of washing phase associated with the washing drum and generates a wash completed signal accordingly. The dryer drum which is situated adjacent to the washing drum has a washing drum access ("WDA") door wherein the WDA door is capable of being in an open position allowing the dryer drum to receive washed clothes from the washing drum via the center control gate based on the wash completed signal. Upon completion of self-loading, the dryer drum is activated to extract moisture from the washed clothes.

**[0026]** FIG. **1** is a diagram **100** illustrating an exemplary layout of SWD machine capable of self-loading and automatic unloading for laundry clothing in accordance with one embodiment of the present invention. Diagram **100** includes a washing machine **120**, dryer **122**, basket **130**, and wireless network tower **102**. In one example, washing machine **120**, also referred to as washing unit, is situated on the top of dryer **122**, also known as dryer unit. Wireless communication tower **102**, in one example, is coupled to portable devices **116-118** via local wireless network or Internet **108**. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if one or more components (or devices) were added to or removed from diagram **100**.

**[0027]** Washing machine or washing unit **120**, in one aspect, includes a washing drum **124** configured to contain liquid (i.e., water) for washing fabric articles and/or clothing. Washing drum **124** is configured to have a front opening for receiving articles or clothing for washing or cleaning. The front opening of washing machine **120** may be covered by a front door. Washing drum **124** can also be referred to as washer drum, washing tub, tub, drum, and/or washing container used for washing clothes. To simplify the forgoing discussion, the term "washing drum" is used hereinafter. It should be noted that washing machine **120** may include other components such as a motor, inlet water hose, outlet water hose, controller, or user interfaces. In one embodiment, washing drum **124** includes a drying drum access ("DDA") door in addition to the front opening. The DDA door is used to close a discharging opening which is used to discharge or unload washed clothing from washing drum **124** to dryer **122**.

**[0028]** The motor, not shown in FIG. **1**, is an electric generator that is able to convert electrical energy to mechanical energy which may facilitate repetitive movement of washing drum **124**. The inlet water hose, in one example, is used to channel liquid substance such as water or alcohol from exterior reservoir to washing drum **124** for washing operation. The outlet water hose, in one example, is used to guild waster liquid such as dirty water from washing machine **120** to exterior drainage pipe(s). The controller, which can be an electrical component containing processor

and memory, is used to manage user interface between washing machine **120** and the user.

**[0029]** Dryer or dryer unit **122**, in one aspect, includes a drum **126** with an opening **134**, motor, and ventilation channel wherein the ventilation channel is used to guild moisture from drum **126** to exterior venting pipes or exterior area. Opening **134**, in one example, is used for front loading which can be closed or covered by a front door mounted at the front of dryer **122**. A function of dryer **122** is to extract moisture or water from washed clothes using drum **126**. In one embodiment, drum **126** includes a washing drum access ("WDA") door used to cover a self-loading opening which is used to accept or receive washed clothing from washing drum **124** to drum **126** via DDA door.

**[0030]** In one embodiment, the SWD machine stacks washing machine or unit **120** on top of dryer or dryer unit **122** separated by a central control gate **128**. Central control gate **128**, in one aspect, is located at the center of the SWD machine. Central control gate **128** can open and close for facilitating function of self-loading which allows washed clothes to be automatically transferred from washing drum **124** to dryer drum **126** via the DDA and WDA doors.

**[0031]** During washing cycle, the DDA door and WDA door are in closed condition. After the washing cycle, the DDA door of washer drum **124** and the WDA door of dryer drum **122** are aligned and opened. When central control gate **128** opens, the washed clothes are allowed to automatically drop or self-load from washer drum **124** to dryer drum **126**. After self-loading, both DDA and WDA doors including central control gate **128** are closed before the dry cycle begins.

**[0032]** Dryer **122**, in one aspect, further includes a function of automatic transferring for transferring or unloading dry clothes from drum **126** to basket **130** via a side outlet **132**. Alternatively, the mechanism of unloading dry clothes can also be accomplished via a front opening via the front loading door. In one embodiment, the unloading or transferring dry clothes from drum **126** to basket **130** can be achieved through an unloading force created by spinning speed of drum **126**. Alternative, a belt conveyor can be used to facilitate moving or transferring dry clothes from drum **126** to basket **130**. In yet another embodiment, a pressurized air can be used to unload dry clothes from drum **126** to basket **130**. It should be noted that basket **130** is an exemplary destination location. Other destinations such as tub or space can also be used in place of basket **130**.

**[0033]** The SWD machine, in one embodiment, also includes a wireless communication system capable of communicating with user(s) or provider(s) via network or wireless network(s). For example, the wireless communication system is able to connect to the network via network provider **104** through landline and/or wireless via tower **102**. The user, for example, can access or control the SWD machine via his/her smart phone **116** or computer **118**. In one example, smart phone **116** can be iPhone® while computer **118** can be a laptop computer. A user, for instance, can turn on the SWD machine remotely via his/her mobile. Alternatively, the user can stop or monitor the progress of washing or drying cycle remotely.

**[0034]** An advantage of using SWD machine containing both washer function and dryer function is that it provides self-loading of wet clothes and automatic transferring of dry clothes. In addition, the SWD machine includes both washer and dryer in a single structure which allows utilizing similar parts (i.e., one set of display, motor, electronics and wheels) for small footprint, cost, space, and money.

**[0035]** FIG. **2** is a block diagram **200** illustrating electrical and mechanical components of SWD machine for operating auto-load-transfer or self-loading in accordance with one embodiment of the present invention. Diagram **200** includes a central control multi-chip unit ("MCU") **202**, motor and power factor controller ("PFC") MCU **204**, gate drivers **206-207**, 3-phase inverters **208-209**, motors **210-211**, and washing drum **212**, dryer drum **232**. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if one or more components (or blocks) were added to or removed from diagram **200**.

**[0036]** Diagram **200** illustrates a control flow of SWD to perform and manage an auto-load-transfer ("ALT") function. The ALT function, in one embodiment, includes self-loading and automatic transferring wherein self-loading is a function allowing washed clothing to be automatically loaded into a dryer drum from a washing drum. The automatic transferring refers to a function facilitating automatic transferring dried clothing from the dryer drum to a basket **130** generally located outside of the SWD. In one example, washer motor and drum **220** are located at the top portion of diagram **200** as indicated by numeral **220**. Dryer motor and drum **222** are located at the bottom portion of diagram **200** as indicated by numeral **222**. A center control gate **128** is situated in the center between washing drum **212** and dryer drum **232**.

**[0037]** During an operation, after a timer of washing function is expired, the washing cycle, for example, is ended. Central control MCU **202** subsequently sends a signal to central control gate **128** to open the gate between washer and dryer. Central control MCU **202** also transmits door control signals to both washer drum **212** and dryer drum **232** for opening DDA door **214** and WDA door **234**. Upon DDA door **214** and WDA door **232** are aligned, washer drum **212** opens DDA door **214** and dryer drum **232** opens WDA door **232** for facilitating self-loading. The washed clothes subsequently move or drop out of washer drum **212** via DDA door **214** and they fall into dryer drum **232** via WDA door **234**.

**[0038]** The SWD, in one aspect, includes an auto-load sensing feature capable of sensing whether all washed clothes inside of washing drum **212** have been loaded or dropped in dryer drum **232** during the self-loading process. If washed clothes are in drum **232** via self-loading process, central control MCU **202** issues commands to close central control gate **128**, DDA door **214**, and WDA door **234** before the drying cycle starts. In one example, a drying timer may be activated to clock the time period for the duration of drying cycle. Upon expiration of the drying timer, dryer drum **232** will stop at a proper position to discharge dry clothes into basket **130** or an exterior area for makeup and folding.

**[0039]** Alternatively, a washing sensor and drying sensor could be used in place of timers. For example, when the washing sensor detects that the washing machine or washer is done with washing, the washing sensor reports the completion of washing cycle to central control MCU **202**. When the drying sensor detects the clothes inside drum **232** are dry, the drying cycle ends. To sense the dryness of clothes, the drying sensor, for example, detects the current moisture level in drum **232** is at or below a predefined dry

level. Once the drying sensor issues a commend indicating the clothes are dry, the automatic transferring of dried clothing from drum **232** to basket begins.

**[0040]** Central control MCU **202**, in one example, is the brain for the washer-dryer machine in which MCU monitors and manages input and output ("IO") from a control panel, temperature setting, hall sensors, and/or controlled signals to electromechanical devices. The exemplary electrical and/or mechanical devices include, but not limited to, door locks, buzzers, water inlet valve, water outlet valve, water heater, dryer heater, and the like. A function of MCU **202** is to manage, direct, and monitor the operations of the washer and dryer.

**[0041]** Motor and PFC Control MCU **204**, for example, has pulse-width modulations ("PWMs"), analog-to-digital converters ("ADCs"), as well as build-in communication ports used for controlling three-phase ("3-phase") motors such as motors **210-211**. Gate drivers **206-207** are used to drive MOSFET and/or insulated-gate bipolar transistor ("IGBT") power switches which are used for managing drums and fan motors such as motors **210-211**. The 3-phase inverters such as motors **208-209** include three single-phase inverter switches wherein each single-phase is connected to one of the three load terminals. A function of the 3-phase inverter is to drive variable-frequency applications and high power applications such as HVDC (high-voltage direct current) power transmission.

**[0042]** Motor **210** or **211**, in one example, may be structured without brush(s) and commutator(s) for simplifying motor design. Motor **210** or **211** and PFC control MCU **204** may be configured to replace functions usually performed by the commutator as well as to properly energize windings which create needed rotations. Three-phase BLDC (Brushless DC) devices or motors generally provide excellent performance characteristics with or without positioning sensors. A benefit of using the 3-phase BLDC is that the BLDC is relatively inexpensive with relatively long lifespan. In one embodiment, motors **210-211** can be substituted with one motor which can be configured to drive, control, and manage both washer drum **212** and dryer drum **232**.

**[0043]** The SWD machine or unit, in one embodiment, includes a wireless connectivity component which can be used to connect to other home appliances via a home network or WIFI network. A home network includes a set of connectable home appliances and intelligent devices through a wireless router or switch. The connectable home appliances include, but not limited to, washer-dryer, refrigerator, electronic oven, power outlets, lights, door lock, fire alarm, smartphone, et cetera. The smartphone may be used as a control center controlling connected home appliances and devices.

**[0044]** With wireless connection, the SWD machine can provide optimal washing and drying options. For example, the SWD machine can make better choices for fabric care and energy efficiency via remote monitoring. Also, monitoring cycle time and machine status can also be carried out in real-time. Furthermore, sending notification to a destination such as a user can also be performed when a cycle is finish. The SWD machine can further obtain sensed information to determine and acknowledge if rinse agent is low. To save energy and resource, the SWD machine can select more efficient dryer cycle(s) to dry clothes based on sensed information. Auto-delay laundry cycles to avoid energy peak rate(s) can be performed based on predefined information, sensed information, and/or real-time information.

**[0045]** In one embodiment, the SWD machine is configured to provide auto-fold feature. For example, the SWD machine can fold clothes or fabric articles to prevent clothes from wrinkling. Also, the SWD machine is configured to store folded clothes into a predefined location or closet after the dry cycle.

**[0046]** FIG. **3** is a block diagram **300** illustrating a cut-away view of SWD machine having a washing drum with a DDA door and a dryer drum with a WDA door in accordance with one embodiment of the present invention. Diagram **300** illustrates a washing unit **120**, dryer unit **122**, and central control gate **128**. Central control gate **128**, in one example, is situated between washing unit **120** which is placed on top of gate **128** and dryer unit **122** which is situated below gate **128**. Depending on the applications, central control gate **128** may be removed or replaced for free movement of content between washing drum **302** and dryer drum **304**. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if one or more components (or blocks) were added to or removed from diagram **300**.

**[0047]** The SWD machine illustrated in diagram **300**, in one embodiment, integrates a washing unit **120** and dryer unit **122** in a single machine wherein washing unit **120** is placed on top of dryer unit **122**. An advantage of having washing unit **120** on top of dryer unit **122** is that the washed clothing can travel from washing unit **120** to dryer unit **122** by gravitational force. Another benefit for having washing unit **120** on top of dryer unit **122** is to save space. Depending on the applications, washing unit **120** can also be situated side-by-side with dryer unit **122** or washing unit **120** is situated below dryer unit **122**.

**[0048]** The SWD machine, which can also be referred to as washing and drying machine or washer and dryer machine, includes washing drum **302** and dryer drum **304** wherein washing drum **302** includes a washing sensor capable of sensing washing cycle, water temperature, spinning speed, and the like. Washing drum **302**, in one aspect, has a cylindrical shape configured to hold water for cleaning or washing clothes and/or flexible fabric articles using water with a repetitive motion. In one embodiment, washing drum **302** includes a DDA door **306** which is in closed position when washing drum **302** is in operation for cleaning clothes inside the drum or tub as indicated by numeral **316**. To clean or wash clothes, washing drum **302**, in one example, turns around a center **336** in a direction as indicated by arrow **318**.

**[0049]** The washing sensor, not shown in diagram **300**, is coupled to washing drum **302** and senses the completion or end of the washing phase(s) or cycle(s) associated with washing drum **302**. The washing sensor, coupled to the central control MCU, is capable of forwarding detected or sensed information to the central control MCU. Upon receipt of sensed situation such as end of washing cycle(s), the central control MCU will provide subsequent instruction (s) or commend(s) such as aligning DDA and WDA doors **306-308**, and opening DDA and WDA doors **304-306**.

**[0050]** Dryer drum **304** is situated adjacent to washing drum **302** wherein dryer drum **304**, in this embodiment, is situated below washing drum **302**. Alternatively, dryer drum **304** can be placed next to washing drum **302** in a horizontal plane. Dryer drum **304**, in one aspect, includes a WDA door **308** for self-loading process. For example, upon receipt of

the signal of washing completed from the washing sensor, WDA door **308** can be activated to be in an open position allowing washed clothes such as clothing **330** in washing drum **302** to automatically fall or drop into dryer drum **304** via center control gate **128**. Dryer drum **304** is operable by turning around a center **338** to tumble clothing **332** inside of drum as indicated by numeral **318**. A function of dryer unit **122** is to extract moisture from the washed clothes.

**[0051]** The SWD machine, in one embodiment, further includes a laundry delivery component or system capable of unloading dry clothes in dryer drum **304**. For example, the laundry delivery system which is adjacent to dryer drum **304** and capable of transferring the dried clothes from dryer drum **304** to an exterior location such as a basket via the laundry delivery system via an opening at dryer drum **304**.

**[0052]** A drying sensor, in one example, can be installed in dryer unit **122** and configured to monitor the moisture level in dryer drum **304**. When the drying sensor senses the washed clothes are dried since the moisture level has reached to a predefined dry level, the dry sensor sends a signal to stop drying cycle and begin to unload the dried clothes from dryer drum **304**. To properly remove or extract moisture from the wet clothing, a drying vent is used coupling to dryer drum **304** for directing the moisture away from dryer drum **304**.

**[0053]** One advantage of using the SWD machine is that washing drum **302** and dryer drum **304** have large volume and they can also operate independently. Another advantage of using the SWD machine is that it is capable of auto-transferring dried clothes to outside of dryer drum **304**.

**[0054]** FIG. **4** is a block diagram **400** illustrating a cut-away view of SWD machine having a washing drum and a dryer drum in open positions in accordance with one embodiment of the present invention. Diagram **400** is similar to diagram **300** except that diagram **400** illustrates an open position during a process of self-loading allowing the washed clothes to be dropped from washing drum **302** to dryer drum **304** via a self-loading opening **410**. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if one or more components (or blocks) were added to or removed from diagram **400**.

**[0055]** Diagram **400** illustrates a self-loading or automatic loading operation in which both DDA door **306** and WDA door **308** are in open positions to create self-loading opening **410** through central control gate **128**. Self-loading opening **410**, in one embodiment, allows washed clothes or wet clothes **402** to drop from washing drum **302** to dryer drum **304** via a gravitational force. In one embodiment, a self-loading sensor coupled to washing drum **302** is used to determine whether all clothes **402** have been dropped or traveled to dryer drum **304**. Washing drum **302**, in one embodiment, is configured to agitate or shake the drum if the self-loading sensor detects that some wet clothes **402** are still attached to washing drum **302**.

**[0056]** When all of clothes **402** arrive to dryer drum **304**, WDA door **308** will close the opening of dryer drum **304** whereby dryer drum **304** begins tumble dry the clothes. After the opening of washing drum **302** is closed, washing unit **120** is ready for the next washing cycle. It should be noted that depending on the applications, central control gate **128** can be removed or reconfigured.

**[0057]** The SWD machine, in one embodiment, is a cleaning system utilizing liquid substance such as water, liquor, and/or chemical compounds for washing and drying clothes. The SWD machine contains washing drum **302**, dryer drum **304**, and washing sensor wherein washing drum **302** is configured to provide a set of variable spinning motions to clean one or more fabric objects via a stream of liquid. While the fabric object can be a piece of clothes made by a fabric material, the stream of liquid can be a stream of water, liquor, or chemical compounds. Washing drum **302** further includes a washing open which may be used by a user for manually loading dirty laundry into washing drum **302**. In one aspect, DDA door **306** can be open allowing content such as clothing in washing drum **302** to travel to dryer drum **304** passing through WDA door **308** via gravity.

**[0058]** The washing sensor, in one example, is coupled to washing drum **302** and is configured to sense washing phases or cycles associated with washing drum **302**. While washing drum **302** is coupled to a motor and/or water hose for performing a washer function, dryer drum **304** is also coupled to a motor and a vent for performing a dryer function. In the present embodiment, washing drum **302** is situated on top of dryer drum **304** wherein dryer drum **304** is closer to the ground.

**[0059]** Dryer drum **304**, situated below washing drum **304** closer to ground, includes WDA door **308** and a dryer opening wherein the dryer opening can be used by a user for manually removing the dried clothes from dryer drum **304**. When WDA door **308** is open, dryer drum **304** receives washed fabric object or clothes from washing drum **302** based on a signal indicating the completion of the washing cycle generated by the washing sensor. A function of dryer drum **304** is to extract moisture from the washed fabric objects or clothes.

**[0060]** The SWD machine, in one aspect, includes a delivery component capable of automatically unloading dry clothes from dryer drum **304**. The delivery component, for example, is coupled to dryer drum **304** and configured to transfer dried fabric object such as clothes from dryer drum **304** to an exterior location via a dryer delivery opening. In one embodiment, WDA door **308** can be used to allow dried clothes to exit from dryer drum **304**. The delivery component, in one embodiment, includes an air compressing element capable of pushing, expelling, or blowing dried clothes from dryer drum **304** to a nearby exterior location. Alternatively, the delivery component includes a spinning controller able to push dried clothes from dryer drum **304** via a pushing or expelling force generated by the spinning speed of dryer drum **304**. Dryer drum **304**, in one example, includes a drying sensor configured to monitor moisture level inside of dryer drum **304**. The SWD machine, in one aspect, includes a drying vent which is coupled to dryer drum **304** for guiding the moisture away from dryer drum **304**.

**[0061]** FIG. **5** is a schematic diagram **500** illustrating a control flow using various electronics and mechanical components for the SWD machine in accordance with one embodiment of the present invention. Diagram **500** illustrates a washing control component **504**, drying control component **502**, circuit protection component **506**, wireless component **508**, user interface **510**, and resource management **512**. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if one or more components (or circuitry) were added to or removed from diagram **500**.

**[0062]** FIG. **6**A is a three-dimensional ("3D") perspective diagram **600** illustrating an exemplary automatic transferring mechanism configured to unload dried clothing from a dryer drum to a basket in accordance with one embodiment of the present invention. Diagram **600** includes a conveyor belt **610** and basket **130** wherein conveyor belt **610** is design to transport articles on a belt conveyor, also known as a belt conveyor system, to basket **130**. Belt conveyor **610**, in one example, includes belt **602**, frame **606**, pulleys, rollers, gearhead, and motor **604**. Belt **602** is coupled with the pulleys to form an endless loop for carrying clothing articles. For example, when the pulleys rotate powered by motor **604**, belt **602** will carry articles or dried clothing with belt **602** in a direction indicated by an arrow **612**.

**[0063]** FIG. **6**B is 3D perspective diagrams **650**-**651** illustrating exemplary automatic transferring mechanisms configured to unload dried clothing from a dryer drum to a basket in accordance with one embodiment of the present invention. Diagram **650** illustrates dryer unit **122** having a front door **658** and an automatic unloading door **660** with a cover **652**. During an operation, cover **652** opens in a direction as indicated by arrow **654** allowing dried clothes **656** to travel from the dryer drum to basket **130**. In one embodiment, cover **652** is configured to provide a guide to direct dried clothes **656** toward basket **130** for wrinkle prevention.

**[0064]** Diagram **651**, which is similar to diagram **650** except that cover **666** is structured differently, illustrates dryer unit **122** having a front door **658** and an automatic unloading door **660**. During an operation, cover **666** opens in a direction as indicated by arrow **662** allowing dried clothes **656** to travel from the dryer drum to an exterior location. In one embodiment, cover **666** provides a function of ramp guiding dried clothes **656** toward the side of dryer unit **122** for wrinkle prevention. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if one or more components (or blocks) were added to or removed from diagrams **600**, **650**, and **651**.

**[0065]** In one embodiment, conveyor belt **610** is integrated into the SWD machine and is activated to provide automatic transferring dried clothing from the SWD machine to an exterior location such as basket **130**. In an alternative embodiment, conveyor belt **610** is configured to be adjustable capable of extending the length of belt to reach basket **130** using its sensing capability. For example, the user can preselect a location for the dry clothes and depending on user selected location, conveyor belt **610** uses onboard locating sensor(s) to locate basket **130** and subsequently delivers the dried clothes to basket **130**.

**[0066]** The exemplary aspect of the present invention includes various processing steps, which will be described below. The steps of the aspect may be embodied in machine or computer executable instructions. The instructions can be used to cause a general purpose or special purpose system, which is programmed with the instructions, to perform the steps of the exemplary aspect of the present invention. Alternatively, the steps of the exemplary aspect of the present invention may be performed by specific hardware components that contain hard-wired logic for performing the steps, or by any combination of programmed computer components and custom hardware components.

**[0067]** FIG. **7** is a flowchart **700** illustrating a process of self-loading and automatic transferring dry clothes operated by the SWD machine to a basket in accordance with one embodiment of the present invention. At block **702**, a laundry process for cleaning clothes by the SWD machine receives clothes or fabric clothing articles via an opening of a washing drum. The opening of the washing drum, which, in one aspect, can be closed by a front loading door, allows a user to manually load dirty laundry into the washing drum. In one example, the washing drum is coupled to an external hose for obtaining water for the washing cycle. Alternatively, other liquid such as liquor or chemical compound may be used in place of water.

**[0068]** At block **704**, after activating the washing unit of the SWD machine, the washing drum creates a movement that turns around a center via a predefined speed and duration for cleaning or washing the clothes using water. In one aspect, a user can initiate the washing process via a wireless connected device. Also, the wireless connected device, such as a smart phone or computer, can also monitor laundry cycles and status via a communication network.

**[0069]** At block **706**, a washing sensor which is coupled to the washing drum detects a completion of washing cycle carried out by the washing drum. For example, the washing sensor may be used to monitor the washing cycle(s) associated with the laundry load. For instance, if the washing sensor detects that the laundry load or clothing volume is large or the load is heavy, the washing cycle is adjusted accordingly.

**[0070]** At block **708**, upon sending a washing completing signal from the washing sensor to the dryer drum and the washing drum, the process stops the washing unit from washing operation and activates the process of self-loading. The process of self-loading, for example, transfers washed clothes from the washing drum to the dryer drum.

**[0071]** At block **710**, to perform self-loading, the WDA door and DDA door are first aligned whereby wet or washed clothes could leave the washing drum through the DDA door and drop into the dryer drum via the WDA door.

**[0072]** At block **712**, the SWD opens the DDA door on the dryer drum to allow the wet clothes move or travel from the washing drum to the dryer drum using a gravitational force. Upon detecting by a dryer sensor the completion of dryer cycle associated with the dryer drum based on the moisture level inside of dryer drum, the dried clothing can be pushed or repelled from the dryer drum to an external place via a dryer opening. Note that the dryer opening can either be located on the side wall of SWD machine or on the front wall of SWD machine. In one embodiment, a pressurized air stream is activated to blow or push the dry clothes from the dryer drum to an exterior basket via the dryer opening. In one aspect, a set of alignment sensors may be used to align the WDA door of dryer drum with the DDA door of the washing drum.

**[0073]** While particular embodiments of the present invention have been shown and described, it will be obvious to those of skills in the art that based upon the teachings herein, changes and modifications may be made without departing from this exemplary embodiment(s) of the present invention and its broader aspects. Therefore, the appended claims are intended to encompass within their scope all such changes and modifications as are within the true spirit and scope of this exemplary embodiment(s) of the present invention.

What is claimed is:

**1**. A smart washer-dryer ("SWD") machine via water, comprising:

a washing drum having a cylindrical shape configured to hold water for cleaning clothes with repetitive motion;

a washing sensor coupled to the washing drum and configured to sense a completion of washing cycle associated with the washing drum; and

a dryer drum, situated adjacent to the washing drum and configured to have a washing drum access ("WDA") door, the WDA door configured to be in an open position allowing the dryer drum to receive washed clothes from the washing drum to the dryer drum via a center control gate in response to a signal of washing completed generated by the washing sensor, the dryer drum operable to extract moisture from the washed clothes.

**2**. The machine of claim **1**, further comprising a delivery component situated adjacent to the dryer drum and configured to transfer dry clothes from the dryer drum to an exterior location via a dryer opening.

**3**. The machine of claim **2**, further comprising a drying sensor coupled to the dryer drum and configured to monitor moisture level inside of the dryer drum.

**4**. The machine of claim **2**, further comprising a drying vent coupled to the dryer drum and configured to direct moisture away from the dryer drum.

**5**. A cleaning system utilizing liquid substance, comprising:

a washing drum configured to provide a set of variable spinning motions to clean a fabric object via a stream of liquid;

a washing sensor coupled to the washing drum and configured to sense washing phases associated with the washing drum; and

a dryer drum, situated below the washing drum closer to ground, configured to have a washing drum access ("WDA") door and a dryer opening, the WDA door configured to be opened for allowing the dryer drum to receive washed fabric object from the washing drum in accordance with a washing competed signal generated by the washing sensor, the dryer drum operable to extract moisture from the washed fabric object.

**6**. The system of claim **5**, further comprising a delivery component situated adjacent to the dryer drum and configured to transfer dried fabric object from the dryer drum to an exterior location via the dryer opening.

**7**. The system of claim **6**, further comprising a drying sensor coupled to the dryer drum and configured to monitor moisture level in the dryer drum.

**8**. The system of claim **6**, further comprising a drying vent coupled to the dryer drum and configured to direct moisture away from the dryer drum.

**9**. The system of claim **8**, wherein the washing drum includes a drying drum access ("DDA") door and a washer opening, the DDA door configured to be open for facilitating washed content to travel from the washing drum to the dryer drum passing through the WDA door via gravitational force.

**10**. The system of claim **6**, wherein the fabric object is a piece of clothes made by a fabric material.

**11**. The system of claim **6**, wherein the stream of liquid is a stream of water.

**12**. The system of claim **5**,

wherein the washing drum is coupled to a motor and water hose, and is able to perform a washer function; and

wherein the dryer drum is coupled to a motor and a vent, and is able to perform a dryer function.

**13**. The system of claim **12**, wherein the washing drum is situated on top of the dryer drum against gravity.

**14**. The system of claim **6**, wherein the delivery component includes an air compressor capable of pushing dry fabric objects out of the dryer drum.

**15**. The system of claim **6**, wherein the delivery component includes a spinning controller able to push dry fabric objects out of the dryer drum via a pushing force through spinning of the dryer drum.

**16**. A method of cleaning clothes via a washing drum situated on top of a dryer drum, comprising:

receiving clothes via a first opening of the washing drum and water from an external hose;

turning the washing drum via a predefined speed and duration to clean the clothes utilizing water;

detecting by a washing sensor a completion of washing cycle performed by the washing drum;

sending a washing completing signal from the washing sensor to the dryer drum and the washing drum;

opening a dryer drum access ("DDA") door on the washing drum to allow wet clothes to leave the washing drum; and

opening a washing drum access ("WDA") door on the dryer drum to receive the wet clothes from the washing drum via gravity force.

**17**. The method of claim **16**, further comprising detecting by a dryer sensor a completion of drying cycle based on moisture level in the dryer drum.

**18**. The method of claim **17**, further comprising pushing the clothes from the dryer drum to an external place via a dryer opening.

**19**. The method of claim **18**, wherein pushing the clothes includes activating a pressurized air stream to blow dry clothes out of the dryer drum via a dryer opening.

**20**. The method of claim **16**, wherein the opening a washing drum access ("WDA") door includes aligning the WDA door with the DDA door of the washing drum.

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