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(54) **A WASHING AND/OR DRYING MACHINE AND A METHOD FOR OPERATING A WASHING AND/OR DRYING MACHINE**

(57) A washing and/or drying machine (102) comprises a drum (104); a sensor (118) configured to sense rotation of the drum (104); and a controller arrangement (114) in communication with the sensor (118). The washing and/or drying machine (102) has a first power mode and a second power mode. The first power mode is a lower power consuming mode than the second power mode. The controller arrangement (114) is configured to place the washing and/or drying machine (102) into the second power mode and to cause an alarm (130) to be activated, in response to the sensor (118) sensing rotation of the drum (104) whilst the washing and/or drying machine (102) is in the first power mode.

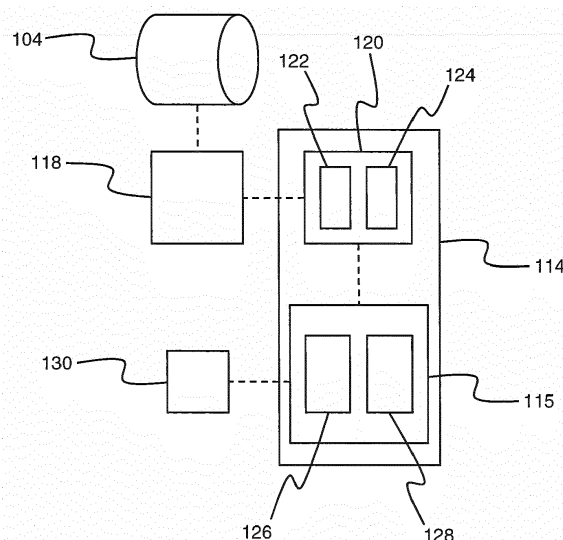


Figure 2

Description

Technical Field

[0001] The present disclosure relates to a washing and/or drying machine and a method for operating a washing and/or drying machine.

Background

[0002] Washing machines are used for washing washable items, including garments such as clothes. Typically a user can select a suitable washing cycle via an interface on a front face of the washing machine. The interface usually includes a number of control knobs and/or buttons. A drying machine, also known as a tumble dryer, is operable to dry items such as garments placed therein. Some washing machines have both washing and drying functionality.

Summary

[0003] According to a first aspect disclosed herein, there is provided a washing and/or drying machine comprising: a drum; a sensor configured to sense rotation of the drum; and a controller arrangement in communication with the sensor, the washing and/or drying machine having a first power mode and a second power mode, the first power mode being a lower power consuming mode than the second power mode, the controller arrangement being configured to place the washing and/or drying machine into the second power mode and to cause an alarm to be activated, in response to the sensor sensing rotation of the drum whilst the washing and/or drying machine is in the first power mode.

[0004] This allows the washing and/or drying machine to remain in a low power mode with the door open whilst still being able to alert a user if a child has climbed inside the drum (because if a child has climbed into the drum then the drum will be rotated by the child). The washing and/or drying machine therefore has reduced electricity consumption because it can be in the lower power mode between washing cycles, whilst still providing a high level of safety with regard to children entering the drum.

[0005] In an example, the controller arrangement comprises a wake-up controller and a main controller, the wake-up controller configured to place the washing and/or drying machine into the second power mode from the first power mode, and when in the second power mode the main controller configured to cause the alarm to be activated.

[0006] In an example, the first power mode comprises a standby mode of the main controller and the second power mode comprises an active mode of the main controller.

[0007] In an example, the sensor comprises a rotary encoder. In an example, the rotary encoder comprises an incremental rotary encoder.

[0008] In an example, the controller arrangement is configured to place the washing and/or drying machine into the second power mode and to cause the alarm to be activated in response to the sensor sensing rotation of the drum beyond a predetermined threshold degree of rotation.

[0009] In an example, the controller arrangement is configured to place the washing and/or drying machine into the second power mode and to cause the alarm to be activated in response to the sensor sensing rotation of the drum according to one or more rotation patterns, the one or more rotation patterns being indicative of a child or animal being present in the drum.

[0010] In an example, the one or more rotation patterns comprise one or more of: an inconsistent direction of rotation; an inconsistent speed of rotation.

[0011] In an example, the controller arrangement is configured to cause the alarm to activate for a predetermined period of time.

[0012] In an example, the controller arrangement is configured to cause the alarm to activate until it is deactivated by a user.

[0013] In an example, the alarm comprises one of more of: an audible alarm; a haptic alarm; a visual alarm.

[0014] In an example, the controller arrangement is configured to prevent a washing and/or drying cycle from being started until the alarm is deactivated by a user.

[0015] According to a second aspect disclosed herein, there is disclosed a method of operating a washing and/or drying machine, the method comprising: a controller arrangement placing the washing and/or drying machine into a second power mode and causing an alarm to be activated, in response to a sensor sensing rotation of a drum of the washing and/or drying machine whilst the washing and/or drying machine is in a first power mode, wherein the first power mode is a lower power consuming mode than the second power mode.

[0016] In an example, the controller arrangement comprises a wake-up controller and a main controller, the method comprising the wake-up controller placing the washing and/or drying machine into the second power mode from the first power mode, and when in the second power mode the main controller causing the alarm to be activated.

[0017] In an example, the first power mode comprises a standby mode of the washing and/or drying machine, and the second power mode comprises an active mode of the washing and/or drying machine.

[0018] In an example, the method comprises: the controller arrangement placing the washing and/or drying machine into the second power mode and causing the alarm to be activated in response to the sensor sensing rotation of the drum beyond a predetermined threshold degree of rotation.

[0019] In an example, the method comprises: the controller arrangement placing the washing and/or drying machine into the second power mode and causing the alarm to be activated in response to the sensor sensing

rotation of the drum according to one or more rotation patterns, the one or more rotation patterns being indicative of a child or animal being present in the drum.

[0020] In an example, the method comprises: causing the alarm to activate for a predetermined period of time; or causing the alarm to activate until it is deactivated by a user.

Brief Description of the Drawings

[0021] To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a perspective view of a washing machine according to an example;

Figure 2 shows schematically an example of part of a washing machine according to an example; and

Figure 3 shows an example of a method of operation of the washing machine shown in Figures 1 and 2.

Detailed Description

[0022] The present disclosure has applicability to clothes washing machines, drying machines (also known as tumble dryers) and to combination washing and drying machines. These may be termed washing and/or drying machines. For convenience, the term "washing machine" is used below, but the disclosure applies equally to drying machines and to combination washing and drying machines.

[0023] Typically, when a washing and/or drying cycle finishes, a washing machine is switched from an active mode into a low power standby mode, in which standby mode less electricity is consumed by the machine. This switching between the active mode and the standby mode may be carried out automatically, or manually (e.g. a user pressing a button on the washing machine). This saves electricity and reduces the running costs of the machine, as well as lowering its pollution to the environment. In this standby mode, most functions and features of the washing machine are deactivated. In the active mode, the available functions and features of the washing machine are activated and the washing machine is responsive to user input. The washing machine can be woken up out of the standby mode and reactivated into the active mode by a user interrupting the standby mode, for example by pressing a button on the washing machine, such as an on/off or power button (which button may also enable the washing machine to be switched from the active mode to the standby mode).

[0024] When the washing machine is in the standby mode, a door that is configured to prevent access to a drum of the washing machine may be unlocked. This allows a user to open the door to access the inside of the

drum so that the user can remove their washing load from the drum. Typically, a user may then leave the door open in order to allow moisture that has built up inside the drum during the washing cycle to escape from the drum, or the user may simply forget or choose not to close the door after unloading their washing load from the machine.

[0025] When the door of the washing machine is left open and the washing machine is unattended, a child (or a small animal such as a cat) can climb through the open door and into the inside of the drum. When a user then next uses the washing machine, the user may not notice the child inside the drum (e.g. the child may be asleep), and the user may activate the washing machine with the child inside of the machine. This can cause serious injury or death to the child.

[0026] Figure 1 schematically shows a washing machine 102 according to an example. The washing machine 102 includes a main body portion 104 and a drum 106 which is arranged to hold one or more garments or items of a washing load to be washed. Washing detergent and/or fabric softener may also be placed directly in to the drum 106. Alternatively washing detergent and/or fabric softener may be placed in to a tray or holder 112 arranged for this purpose. Access to the drum 104 is controlled by a door 116. When the door 116 is in an open position, the drum 104 can be accessed from outside of the washing machine 102. When the door 116 is in a closed position, the drum 104 is inaccessible from outside of the washing machine 102. The door 116 can also be locked into its closed position to prevent it from being opened (for example during a washing cycle). A user interface 108 is provided which enables a user to select one or more washing parameters and/or settings. A display 110 is also provided which outputs information to a user of the washing machine 102. For example information displayed on the display 110 may be information regarding options selected via user interface 108, information regarding a washing cycle in progress such as time remaining etc. The washing machine 102 also includes a controller arrangement 114. The controller arrangement 114 includes a main controller 115. The main controller 115 includes a memory 126 and a processor 128. The main controller 115 is configured to control operations of the washing machine 102. For example, the main controller 115 is configured to set the washing machine 102 into a standby mode when a washing cycle has finished. This helps to conserve electricity.

[0027] The washing machine 102 also includes a suitable power connection enabling the washing machine 102 to be connected to an electricity supply such as mains electricity, as well as a suitable inlet and outlet for water. These aspects are known per se and, for conciseness, are not discussed further.

[0028] In one example, the washing machine 102 is instead a drying machine (also known as a tumble dryer). In another example, the washing machine 102 is instead a combination washing and drying machine.

[0029] Figure 2 schematically shows the drum 104 of

the washing machine 102. The drum 104 is communicatively connected to a sensor 118. The sensor 118 is configured to sense when a child or animal has entered the drum 104 through the door 116. More specifically, the sensor 118 is configured to sense rotational movement of the drum 104. Such rotation of the drum 104 may be caused by a child entering the drum 104 when the door 116 is in an open position. In an example, the sensor 118 is configured to sense rotation of the drum 104 when the washing machine 102 is in the standby mode, for example after the end of a washing cycle.

[0030] The sensor 118 may comprise a rotary encoder. The rotary encoder may include a shaft, which is connected to the drum 104 so that the rotary encoder can sense when the drum 104 rotates. The rotary encoder may comprise an incremental rotary encoder (also known as a pulse encoder). The incremental rotary encoder may be an optical incremental rotary encoder. Using an incremental rotary encoder provides a high resolution at an acceptable cost. In another example, the rotary encoder is an absolute rotary encoder. In another example, the sensor 118 is another type of sensor that can detect when the drum 104 is rotating, such as an ultrasonic sensor. In another example an encoder wheel may be placed on the drum 104, enabling rotation of the drum 104 to be optically sensed by the sensor 118. The sensor 118 may be very accurate so that it can detect even a small degree of rotation of the drum 104.

[0031] According to an example, the washing machine 102 comprises a first power mode and a second power mode. The first power mode is a lower power consuming mode than the second power mode. For example the first power mode may be considered a standby mode of the washing machine 102, and the second power mode may be considered an active mode of the washing machine.

[0032] A controller arrangement is shown at 114. The controller arrangement 114 is configured to place the washing machine 102 into the active mode and to cause an alarm to be activated, in response to the sensor 118 sensing rotation of the drum 104 whilst the washing machine 102 is in the standby mode.

[0033] In one example, the sensor 118 itself determines whether there has been rotation of the drum 104 (e.g. the sensor is configured to output a result to the controller arrangement 114 indicating that the drum has rotated). In another example, the sensor 118 is relatively simpler and simply outputs an electrical signal to the controller arrangement 114 in response to rotation of the drum, the controller arrangement 114 then performing the actual determination of whether there has been rotation of the drum 104 based on the received electrical signal. Either way, it will be appreciated that the sensor 118 is configured to sense rotation of the drum 104.

[0034] In an example the controller arrangement 114 includes a wake-up controller 120 and a main controller 115. In some examples the first power mode comprises a standby mode of the main controller 115, and the second power mode comprises an active mode of the main

controller 115. The wake-up controller 120 is configured to send a signal to the main controller 115 to wake up the main controller 115 from its standby mode and into the active mode. The wake-up controller 120 is configured to wake up the main controller 115 when the wake-up controller 120 receives a signal from the sensor 118 indicating that the drum 104 has been rotated. In an example, the wake-up controller 120 is configured to wake up the main controller 115 only when the sensor 118 detects that the drum 104 has rotated beyond a predetermined threshold degree of rotation. The wake-up controller 120 includes a memory 122 and a processor 124. In an example the wake-up controller 120 is a relatively simple device and only serves to activate the main controller 115 when the main controller is deactivated and in a standby mode. Therefore, the wake-up controller 120 consumes very little electricity when it is active.

[0035] The washing machine 102 also includes an alarm 130 for alerting a user. The washing machine 102 may additionally or alternatively be communicatively connected to an external alarm, for example over Wi-Fi or via a wired connection. In one example, the alarm 130 may include an audible alarm, such as a buzzer or a siren. In another example, the alarm 130 may include a haptic alarm (e.g. a tactile alarm) such as a vibration motor. In a further example, the alarm 130 may include a visual alarm such as a warning message or warning light being displayed on the display 110. In one example, the alarm may include a warning message transmitted over a wireless connection to a user equipment (such as a user's mobile phone) for display on a display of the user equipment. The warning message may be transmitted over a shared Wi-Fi connection. In some examples, the alarm may include two or more of an audible alarm, a haptic alarm and a visual alarm.

[0036] The main controller 115 of the controller arrangement 114 is configured to cause the alarm 130 to activate in response to being woken up by the wake-up controller 120 of the controller arrangement 114. In an example, the main controller 115 is configured to cause the alarm to activate for a predetermined period of time from the time that the main controller 115 is woken up by the wake-up controller 120 (e.g. for a period of 10 minutes). In another example, the main controller 115 is configured to cause the alarm to activate until it is deactivated by a user. For example, the activated alarm may be deactivated by a user selecting a "Deactivate Alarm" function on the display 110 by using the user interface 108. In another example, the main controller 115 is configured to prevent a washing cycle from being started until the alarm has been deactivated by a user. For example, the main controller 115 may disable the user interface 108 until the alarm is deactivated.

[0037] Accordingly the alarm 130 may be activated by the main controller 115 because of the drum 104 being rotated whilst the washing machine 102 is in a standby mode. This rotation of the drum 104 may occur due to a child or a small animal entering the drum 104 whilst the

door 116 is open or unlocked. Activation of the alarm alerts the user so that the user is then aware that a child or small animal might be inside the drum 104. The activated alarm therefore prompts the user to search inside of the drum 104 to ensure that a child is not inside the washing machine 102. This reduces the chance that a child may be present in the drum 104 when the washing machine is reactivated.

[0038] In one example, the controller arrangement 114 is configured to place the washing machine 102 into the active mode and to cause the alarm 130 to be activated in response to the sensor 118 sensing rotation of the drum 104 according to one or more rotation patterns. The one or more rotation patterns may be indicative of a child or animal being present in the drum. For example, if a child climbs into the drum 104 then the rotation pattern exerted by the child on the drum 104 is likely to be irregular and inconsistent, rather than a constant rotation of the drum 104 in the same direction at a constant speed. One rotation pattern that may be indicative of a child or animal being present in the drum is therefore irregular rotation of the drum 104. In one example, the irregular rotation may be inconsistent speed of rotation. In another example, the irregular rotation may be inconsistent direction of rotation. For example, a rotation pattern may be rotation of the drum 104 in one direction followed immediately or soon after by rotation in the opposite direction. This helps to prevent the alarm 130 being activated unnecessarily, which may occur, for example, when a user spins the drum 104 manually after the user has emptied the washing load from the drum 104, in order to check if any items of the washing load remain in the drum 104.

[0039] Figure 3 shows an example of a method of the controller arrangement 114 placing the washing machine 102 into the active mode and causing an alarm to be activated, in response to the sensor 118 sensing rotation of the drum 104 whilst the washing machine 102 is in the standby mode.

[0040] At S100, the washing machine 102 is in a low power consuming standby mode. In one example, the washing machine 102 may have automatically entered the standby mode after the washing machine has completed a washing cycle. In another example, the washing machine 102 may have been manually put into a standby mode by a user. When the washing machine 102 is in the standby mode, the door 116 permitting or preventing access to the drum 104 may be open and unlocked, enabling access to the drum by a child or small animal.

[0041] At S102, the drum 104 of the washing machine 102 rotates. This rotation may be due to a child entering the drum 104.

[0042] At S104, the sensor 118 senses that the drum 104 has rotated and transmits a signal to the wake-up controller 120 of the controller arrangement 114 to alert the wake-up controller 120 that the drum 104 has rotated.

[0043] At S106, the wake-up controller 120 receives the signal transmitted by the sensor 118. In response, at S108, if the wake-up controller 120 determines that the

sensor 118 has sensed that the drum 104 has rotated by not more than a predetermined threshold degree of rotation, then at S110 the wake-up controller 120 takes no action. At S112, if the wake-up controller 120 determines that the sensor 118 has detected that the drum 104 has rotated by more than a predetermined threshold degree of rotation, at S114 the wake-up controller 120 transmits a "wake up" signal to the main controller 115 to activate the main-controller 115 out of the standby mode.

[0044] At S116, the main controller 115 receives the "wake up" signal from the wake-up controller 120 and, in response, wakes up into an active mode. The main controller 115 then causes an alarm 130 to activate in order to alert the user that there may be a child inside of the washing machine 102. This prompts the user to search the inside of the drum 104. In this example, the alarm 130 is active until it is dismissed by a user, for example by a user selecting a "Deactivate Alarm" function using the user interface 108.

[0045] An advantage of the described arrangement is that an alarm will be output if the drum 104 of the washing machine 102 is moved or rotated (indicating that a child is inside the washing machine 102), even though the washing machine 102 is in a standby mode. This lets a user safely keep the washing machine 102 in its standby mode between washing cycles rather than having to retain it in its active mode, whilst also allowing the user to leave the door 116 unlocked and potentially open (e.g. so that moisture can escape out of the drum 104). Consequently, the above arrangement helps to save electricity whilst maintaining a high level of safety, thereby preventing serious injury or death occurring to a child that has climbed inside the washing machine 102.

[0046] It will be understood that the processor or processing system or circuitry referred to herein may in practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be implemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

[0047] Although at least some aspects of the embodiments described herein with reference to the drawings comprise computer processes performed in processing systems or processors, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into prac-

tice. The program may be in the form of non-transitory source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other non-transitory form suitable for use in the implementation of processes according to the invention. The carrier may be any entity or device capable of carrying the program. For example, the carrier may comprise a storage medium, such as a solid-state drive (SSD) or other semiconductor-based RAM; a ROM, for example a CD ROM or a semiconductor ROM; a magnetic recording medium, for example a floppy disk or hard disk; optical memory devices in general; etc.

[0048] The examples described herein are to be understood as illustrative examples of embodiments of the invention. Further embodiments and examples are envisaged. Any feature described in relation to any one example or embodiment may be used alone or in combination with other features. In addition, any feature described in relation to any one example or embodiment may also be used in combination with one or more features of any other of the examples or embodiments, or any combination of any other of the examples or embodiments. Furthermore, equivalents and modifications not described herein may also be employed within the scope of the invention, which is defined in the claims.

Claims

1. A washing and/or drying machine comprising:

a drum;
a sensor configured to sense rotation of the drum; and
a controller arrangement in communication with the sensor,
the washing and/or drying machine having a first power mode and a second power mode, the first power mode being a lower power consuming mode than the second power mode,
the controller arrangement being configured to place the washing and/or drying machine into the second power mode and to cause an alarm to be activated, in response to the sensor sensing rotation of the drum whilst the washing and/or drying machine is in the first power mode.

2. A washing and/or drying machine according to claim 1, the controller arrangement comprising a wake-up controller and a main controller, the wake-up controller configured to place the washing and/or drying machine into the second power mode from the first power mode, and when in the second power mode the main controller configured to cause the alarm to be activated.

3. A washing and/or drying machine according to claim 2, the first power mode comprising a standby mode

of the main controller and the second power mode comprising an active mode of the main controller.

4. A washing and/or drying machine according to any one of claims 1 to 3, wherein the sensor comprises a rotary encoder.

5. A washing and/or drying machine according to any one of claims 1 to 4, wherein the controller arrangement is configured to place the washing and/or drying machine into the second power mode and to cause the alarm to be activated in response to the sensor sensing rotation of the drum beyond a predetermined threshold degree of rotation.

6. A washing and/or drying machine according to any of claims 1 to 5, wherein the controller arrangement is configured to place the washing and/or drying machine into the second power mode and to cause the alarm to be activated in response to the sensor sensing rotation of the drum according to one or more rotation patterns, the one or more rotation patterns being indicative of a child or animal being present in the drum.

7. A washing and/or drying machine according to claim 6, the one or more rotation patterns comprising one or more of: an inconsistent direction of rotation; an inconsistent speed of rotation.

8. A washing and/or drying machine according to any one of claims 1 to 7, wherein the controller arrangement is configured to cause the alarm to activate for a predetermined period of time, or to cause the alarm to activate until it is deactivated by a user.

9. A washing and/or drying machine according to any one of claims 1 to 8, wherein the alarm comprises one of more of: an audible alarm; a haptic alarm; a visual alarm.

10. A washing and/or drying machine according to any one of claims 1 to 9, wherein the controller arrangement is configured to prevent a washing and/or drying cycle from being started until the alarm is deactivated by a user.

11. A method of operating a washing and/or drying machine, the method comprising:

a controller arrangement placing the washing and/or drying machine into a second power mode and causing an alarm to be activated, in response to a sensor sensing rotation of a drum of the washing and/or drying machine whilst the washing and/or drying machine is in a first power mode,

wherein the first the first power mode is a lower power consuming mode than the second power mode.

12. A method according to claim 11, the controller arrangement comprising a wake-up controller and a main controller, the method comprising the wake-up controller placing the washing and/or drying machine into the second power mode from the first power mode, and when in the second power mode the main controller causing the alarm to be activated. 5 10
13. A method according to claim 11 or claim 12, wherein the first power mode comprises a standby mode of the washing and/or drying machine, and the second power mode comprises an active mode of the washing and/or drying machine. 15
14. A method according to any of claims 11 to 13, comprising: 20
- the controller arrangement placing the washing and/or drying machine into the second power mode and causing the alarm to be activated in response to the sensor sensing rotation of the drum beyond a predetermined threshold degree of rotation. 25
15. A method according to any of claims 11 to 14, comprising: 30
- the controller arrangement placing the washing and/or drying machine into the second power mode and causing the alarm to be activated in response to the sensor sensing rotation of the drum according to one or more rotation patterns, the one or more rotation patterns being indicative of a child or animal being present in the drum. 35 40

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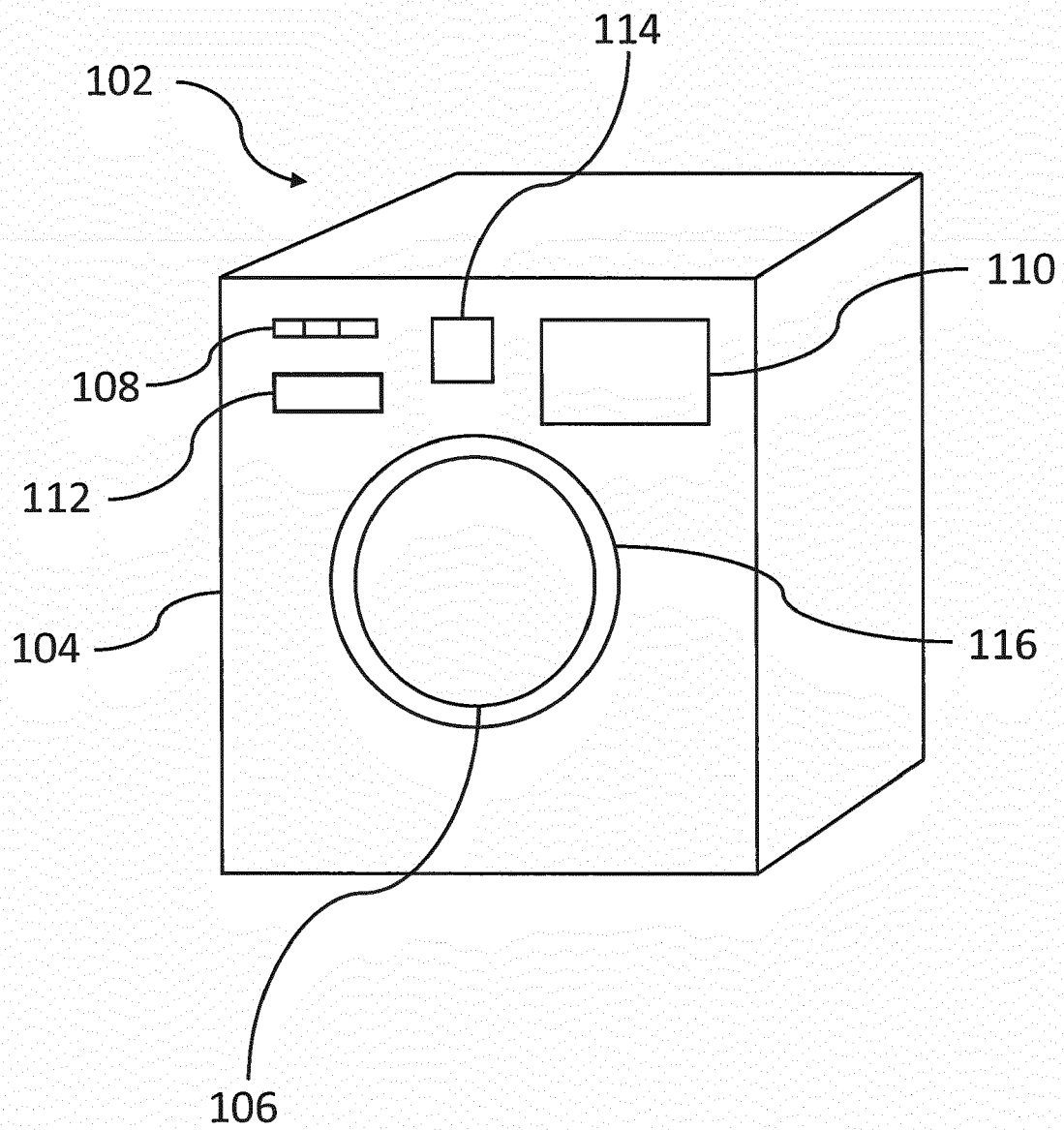


Figure 1

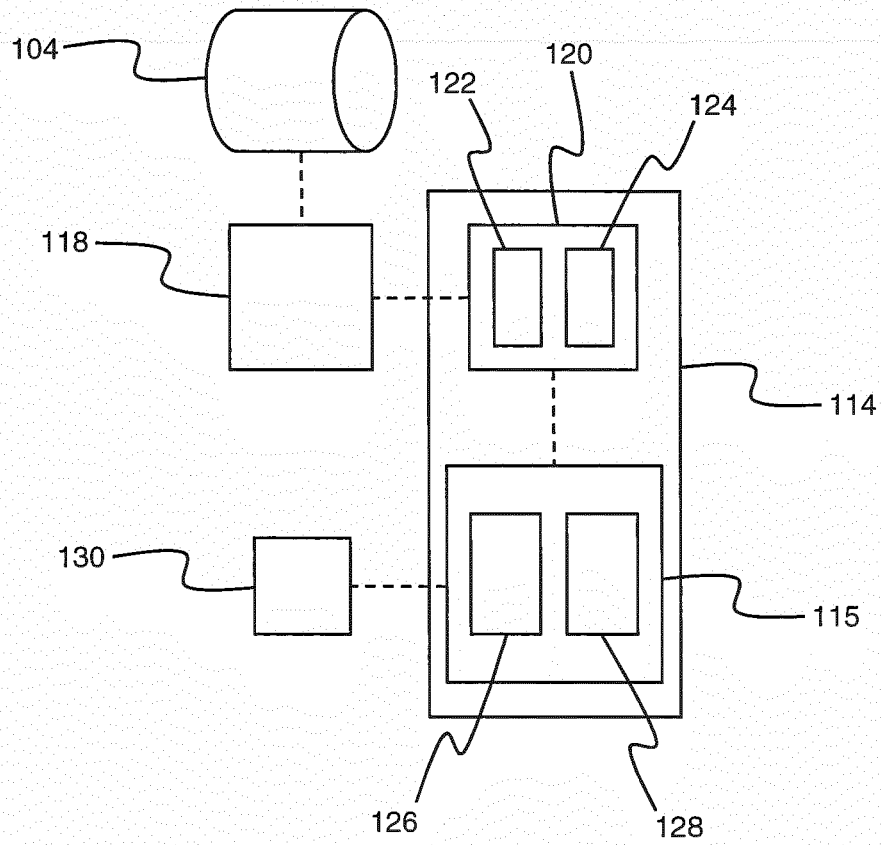


Figure 2

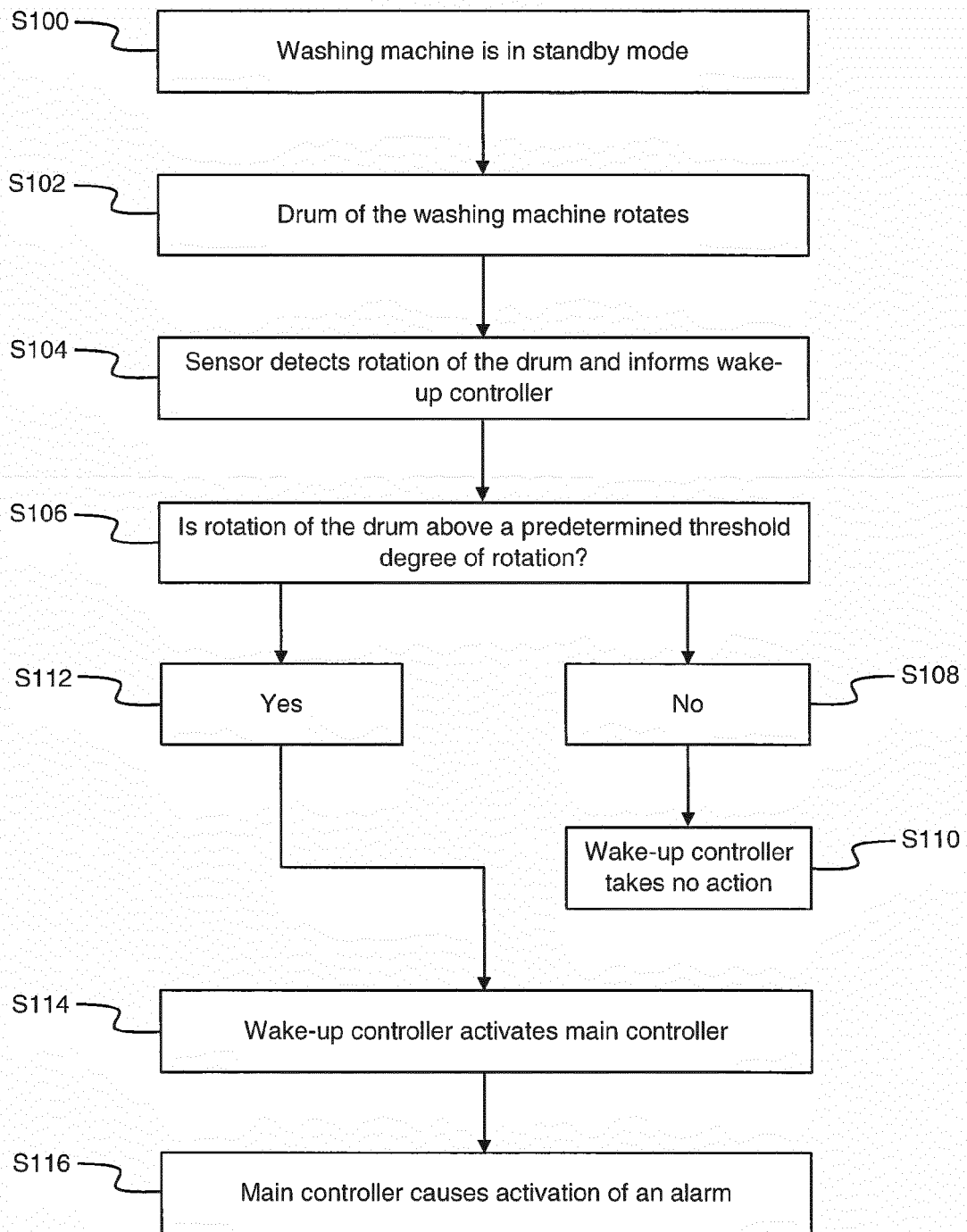


Figure 3



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 20 5085

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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A	* paragraph [0042] - paragraph [0046]; figure 1 *	2,4,12, 14	
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		28 March 2019	Sabatucci, Arianna
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 20 5085

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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28-03-2019

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