(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 257 996 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.12.2017 Bulletin 2017/51

(51) Int Cl.:
D06F 33/02 *(2006.01)* ***D06F 58/28*** *(2006.01)*

(21) Application number: **16174134.3**

(22) Date of filing: **13.06.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Electrolux Appliances Aktiebolag**
105 45 Stockholm (SE)

(72) Inventors:
- **DE BERNARDO, Andrea**
  34180 Ljungby (SE)
- **ALTINIER, Fabio**
  33080 Porcia (IT)
- **CORSO, Lorenzo**
  33080 Porcia (IT)
- **GIROTTO, Terenzio**
  33080 Porcia (IT)
- **STOCCO, Piero**
  33080 Porcia (IT)

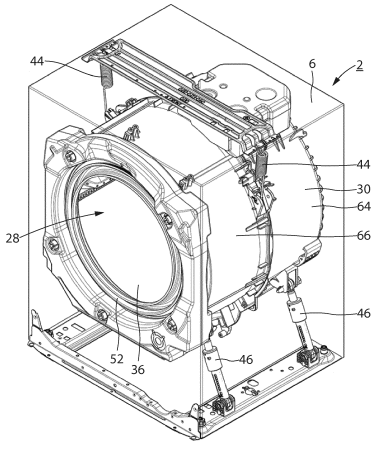
(74) Representative: **Electrolux Group Patents**
AB Electrolux
Group Patents
105 45 Stockholm (SE)

(54) METHOD FOR OPERATING A LAUNDRY TREATMENT APPLIANCE AND LAUNDRY TREATMENT APPLIANCE

(57) Method for operating a laundry treatment appliance (2), comprising a casing (6) within which a drum (36) rotated by a motor (68) is arranged, an opening (28) provided in the casing (6) for loading the laundry into said drum (36) and a door (24) adapted to open or to close said opening (28), whereby said door (24) gives access to said drum (36) and is lockable by means of a door lock (58), and whereby said appliance (2) performs a laundry treatment cycle, comprising the steps of:
a) selecting a laundry treatment process;
b) loading laundry into said drum (36);
c) starting said laundry treatment process;
d) locking said door (24) by actuating said door lock (58);
e) estimating the amount of laundry load;
f) issuing a notification if the amount of laundry lies outside a laundry load threshold range;
g) if the amount of laundry lies outside said laundry load threshold range, checking whether safety/security conditions for unlocking said door lock (58) are met; if said conditions are met, providing an unlocking enablement of said door lock (58);
h) maintaining said unlocking enablement of said door lock (58) for a prescribed waiting amount of time, thereby allowing the user to change the amount of laundry load;
i) determining if an interaction occurred which is linked to a possible access of laundry in said drum (36);
j) if said interaction did not occur, prosecuting the laundry treatment process with one set of operational parameters;
k) if said interaction has occurred, performing step d) and one of the following:
- prosecuting said laundry treatment process with said one set of operational parameters, or
- prosecuting said laundry treatment process with another set of operational parameters different from said one set of operational parameters, or

l) performing steps e) to k) up to a prescribed number of times.

FIG. 2



EP 3 257 996 A1

Description

Field of the invention

[0001] The present invention concerns the field of laundry treating techniques. In particular, the present invention refers to a method for operating a laundry treatment appliance and to a laundry treating appliance operating according to such method.

Background Art

[0002] Nowadays the use of laundry treatment machines, both "simple" laundry washing machines (i.e. laundry washing machines which can only wash and rinse laundry) and laundry washing-drying machines (i.e. laundry washing machines which can also dry laundry), as well as laundry dryers (i.e. laundry machines which can only dry laundry without washing it), is widespread.

[0003] In the present description the term "laundry treatment appliance" will refer to both simple laundry washing machines and laundry washing-drying machines. Laundry treatment appliances adapted for washing laundry generally comprise an external casing provided with a washing tub which contains a rotatable perforated drum where the laundry is placed. A loading/unloading door ensures access to the drum. Laundry treatment appliances typically comprise a water supply unit and a products supply unit, preferably a drawer, for the introduction of water and washing/rinsing products (i.e. detergent, softener, rinse conditioner, etc.) into the tub. Known laundry treatment appliances are also provided with water draining devices that may operate during different phases of the washing program to drain the dirty water.

[0004] According to the known technique, a complete laundry treating program or progress typically includes different phases during which the laundry to be washed is subjected to adequate treatments. A treating cycle usually comprises a main washing phase during which the laundry is treated by means of water and a detergent. The water is typically heated to a predetermined temperature based on the washing program selected by the user. It is also possible that hot water is introduced into the tub from the hot water mains. During the main washing phase the drum is rotated, so as to apply also a mechanical cleaning action on the laundry. At the end of the main washing phase the drum is typically rotated at high rotational speed, so in such a way that dirty washing liquid (i.e. water mixed with detergent) is extracted from the laundry, and this dirty washing liquid is drained to the outside by the water draining devices.

[0005] A successive step of the cycle typically comprises a rinsing phase which usually comprises one or more rinsing cycles/steps. In a rinsing cycle, clean rinse water may be first added to the laundry. The rinse water is absorbed by the laundry and the rinse water removes from the laundry detergent and/or dirty water not previously removed by washing liquid in the main washing cycle. The drum is then rotated to extract water and dirty water/detergent from the laundry: the dirty water extracted is drained from the tub to the outside by the water draining devices.

[0006] After a rinsing phase, one or more final spinning phases may be provided for the extraction of the residual water contained in the wet laundry. The water extracted during the spinning phase is drained towards the outside by means of the water draining devices (during or after the spinning phase).

[0007] Laundry dryers are household appliances built for drying clothes and comprise a drying chamber or drum into which the clothes to be dried are introduced. The drying chamber is rotatable supported within a cabinet and made to rotate by means of a driving motor, typically consisting of an electric motor connected to the drying chamber via a belt.

[0008] In a combined washer/dryer, the drying chamber is the drum which is arranged inside a tub, and one or more drying phases are added which typically commence after the rinsing phases. The drying phase usually involves spinning the drum and applying hot air to the laundry.

[0009] The quality of the washing and/or drying process depends on several factors. One important factor is the amount of laundry loaded into the drum. If the drum is overloaded, the various laundry pieces can not perform a tumbling motion and their mutual contact can prevent detergent to homogeneously reach all surfaces. On the other hand, the drum can be underloaded without the user noticing, allowing for more laundry to be treated in the desired laundry treatment process.

[0010] The document WO 01/71085 A1 describes performing a wash cycle in a laundry treatment appliance. At the end of the wash cycle the machine notifies the user that she or he has overloaded the machine.

Summary of the invention

[0011] The aim of the invention is to provide a method for operating a laundry treatment appliance which optimizes the quality of the laundry treatment process.

[0012] It is a further aim of the invention to provide a laundry treatment appliance which allows performing an optimized laundry treatment process.

[0013] In a first aspect, the invention relates to a method for operating a laundry treatment appliance, comprising a casing within which a drum rotated by a motor is arranged, an opening provided in the casing for loading the laundry into the drum and a door adapted to open or to close the opening, whereby the door gives access to the drum and is lockable by means of a door lock, and whereby the appliance performs a laundry treatment cycle, comprising the steps of:

a) selecting a laundry treatment process;
b) loading laundry into the drum;

c) starting the laundry treatment process;
d) locking the door by actuating the door lock;
e) estimating the amount of laundry load;
f) issuing a notification if the amount of laundry lies outside a laundry load threshold range;
g) if the amount of laundry lies outside this laundry load threshold range, checking whether safety/security conditions for unlocking the door lock are met; if these conditions are met, providing an unlocking enablement of the door lock;
h) maintaining the unlocking enablement of the door lock for a prescribed waiting amount of time, thereby allowing the user to change the amount of laundry load;
i) determining if an interaction occurred which is linked to a possible access of laundry in the drum;
j) if this interaction did not occur, prosecuting the laundry treatment process with one set of operational parameters;
k) if this interaction has occurred, performing step d) and one of the following:

- prosecuting the laundry treatment process with the one set of operational parameters, or
- prosecuting the laundry treatment process with another set of operational parameters different from the one set of operational parameters, or

l) performing steps e) to k) up to a prescribed number of times.

[0014] Preferred embodiments of the invention are described in relation to the dependent claims and the description of the enclosed drawings.

[0015] The invention is based on the consideration that the performance of a laundry treatment appliance can be improved if the amount of laundry to be treated is adequately chosen. The effectiveness of a laundry treatment cycle depends on the ratios of water, detergent and laundry in the tub, the freedom of laundry to move in the drum and other factors. These factors can depend on the specific laundry treatment cycle chosen. Especially an overload of the laundry can prevent the laundry from getting in contact with water and detergent in a homogenous way. In the case of a drying operation, an overload can prevent hot air to reach all surfaces of the laundry in a homogeneous way.

[0016] Applicant has found that an overloading of laundry into the drum or a small amount of laundry with respect to those ideal for the selected program and performing the treatment cycle with this overload/underload condition can be prevented by communicating to the user an overload or underload condition and to allow the user to change the amount of laundry essentially before the laundry treatment phases in which the laundry is treated by water and/or air is being started. A change of laundry after the laundry treatment process has started involves accessing the door of the appliance. This access should granted only if certain safety and/or security conditions are met in order to prevent possible harm and damage to user and machine. The door lock is thus in a specific and controlled way only enabled for unlocking if these conditions are met.

[0017] The steps a) and b) can be performed in the order a), b), so that first the laundry treatment process is selected and then laundry is loaded into the drum. These two steps can also be performed in the reverse order, where first laundry is loaded into the drum and then the process is selected. It is also possible that, in both orders, these two steps overlap at least partially in time.

[0018] The term "conditions" comprises at least one condition. It comprises only one condition or two or more conditions.

[0019] Preferably, the conditions comprise the condition of the tub being filled with essentially no water or filled with water which is below a predetermined threshold water level. Preferably, this threshold water level is below the lowest point of the opening for the laundry door in the appliance.

[0020] Preferably, the conditions comprise the condition of the drum not rotating. The conditions can also comprise the condition that the drum is not driven by the motor and its rotating speed is below a rotation speed threshold value. The condition can also be realized such that the laundry treatment process is currently not in a spinning phase.

[0021] Preferably, the method further comprises the step of:

m) if the laundry treatment process is prosecuted with the laundry load being outside the laundry load threshold range, maintaining the notification during the laundry treatment process and or/issuing this and/or another notification at the end of the laundry treatment process.

[0022] In this way, the user is informed about the non-optimal condition, in which the laundry load is either too large or too small for an optimized laundry treatment. The user can recognize the link between the non-optimal load condition and the treatment result. The user is therefore prevented from linking the deficiency in the treatment result to the malfunctioning or overall quality of the laundry treatment appliance.

[0023] Preferably, providing the unlocking enablement comprises unlocking the door lock. The lock is thereby unlocked actively by the appliance, and the user can open the door and adjust the amount of laundry.

[0024] Alternatively, the unlocking enablement comprises enabling a user interaction, whereby performing this user interaction unlocks the door lock. The enabled user interaction is preferably an actuation or operation of a user interface element, preferably a button. As a preferred example, the operation of a user interface element is touching and/or pressing a button, especially a pause button, i.e. a button that will pause the current

laundry treatment phase. In a further preferred variant, the user interaction is operating a door handle. When the door handle is operated, the lock is unlocked, and the door can be opened.

[0025] Providing the unlocking enablement advantageously comprises issuing a signal and/or message. In this way, the user is notified about the new condition of the appliance. The signal can be an acoustic and/or visual signal, preferably on a display of the appliance. A message is preferably a symbol or text message on a display of the appliance, indicating that the door lock is unlocked or can be unlocked. Preferably, it is indicated that the amount of laundry load is not within an optimal range and should be changed.

[0026] The laundry treatment process is preferably prosecuted and the door lock is locked if the door has been closed after the waiting amount of time. Since the door has been closed again, spinning of the drum and, in the case of a washing process, introducing water into the tub can be performed.

[0027] The prosecution of the laundry treatment process is advantageously performed after a prescribed time interval has passed and/or if a prescribed user interaction has occurred. Since the door unlocking has been enabled, the appliance is configured and/or prepared for allowing the opening of the door. If the user actually interacts with the appliance by, for instance, pressing a button or opening the door, a further input or user interaction is needed as a trigger for the appliance to continue or prosecute the laundry treatment process. Such an input can be a further touching or pressing of a user interface element, especially a button, or the expiration of a time interval after the door has been closed after it has been opened before after the notification.

[0028] When the laundry treatment process is prosecuted, the door lock is locked and/or the appliance checks of the door lock is locked and, if it is not locked, locks the door lock.

[0029] The amount of laundry load is preferably indicated on a display of the appliance. Alternatively or combination thereto, the amount of laundry can be indicated by at least one light element on a control panel and/or user interface of the appliance. For instance, a group, especially a row, of light elements can be provided, whereby the number of lighted or blinking light elements is related the laundry load. Preferably, the respective light element is an LED.

[0030] The indication of the amount of loaded laundry is preferably indicated on a dedicated area of the display, which facilitates finding this information for the user on the display. In a first preferred variant, the amount of laundry is indicated. In a second preferred embodiment, a load range of the laundry is visually indicated. For example, the load range can be indicated by using the terms "small load", "medium load", and "large load", whereby each term refers to weight range of the laundry.

[0031] The laundry load threshold range comprises preferably a lower bound and/or an upper bound. The upper bound of the laundry load threshold range preferably corresponds to the maximum amount of laundry expected to be treated for the selected laundry treatment process.

[0032] Advantageously, on the display it is signaled that laundry amount loaded / contained in the drum can be changed. In this way, the user receives an explicit indication on the possibility to access the drum and alter the amount of loaded laundry. Preferably, during the time interval during which the user can change the laundry in the drum, a message is displayed indicating that a change of laundry is possible and/or advantageous. The message can, for instance, be "Drum overload, please remove laundry".

[0033] Preferably, the appliance comprises a tub in which the drum is rotated and step e) is performed without supplying water to the tub and/or before supplying water to the tub. In this way uncertainties in the determination of the loaded amount of laundry due to the amount of water introduced into the tub are reduced. Moreover, it is inconvenient for the user to access the drum if drum and laundry in the drum are already wet.

[0034] In step e) the laundry load amount is preferably determined by rotating the drum and measuring electrical and/or mechanical parameters related to the motor. These parameters are preferably electrical parameters, preferably from the group current, power, power voltage, and/or mechanical parameters, preferably from the group rotation speed or rotor position.

[0035] The waiting amount of time is advantageously between 10 and 60 seconds.

[0036] The waiting amount of time is preferably 30 seconds.

[0037] The laundry treatment appliance preferably is a washing machine, a dryer or a combined washer/dryer.

[0038] Advantageously, the laundry load threshold range value depends on the selected laundry treatment process and/or type or kind of laundry communicated to the appliance by the user or estimated by the appliance. The appliance can, for instance, be configured such that the kind or type of laundry can be inputted as additional and separate information. The appliance can also be configured to recognize or assess the kind of laundry.

[0039] The laundry load threshold range can in a preferred variant be selected as a range from a zero amount to an upper or maximum threshold amount or value. This selection maps an overload condition of the laundry. In this case, in steps f) and g), it can be determined if the amount of laundry load is below this threshold value.

[0040] The laundry treatment appliance is preferably a combined washer/dryer, whereby the laundry treatment process is a combined washing and drying cycle, and whereby the upper bound if the laundry load threshold range of step g) is an upper value based on the maximum laundry load that can be dried in the combined washing and drying cycle. The amount of laundry that can be dried in a combined washing-drying process is usually lower compared to the amount of laundry that

can be washed with a desired quality. By choosing the threshold value in the described way, it can be assured that in both washing and drying phases, the desired quality of the treatment process can be achieved.

[0041] In a second aspect, the invention relates to a laundry treatment appliance, comprising a casing within which a drum rotated by a motor is arranged, an opening provided in the casing for loading the laundry into the drum and a door adapted to open or to close said opening, whereby the door gives access to the drum and is lockable by means of a door lock, with a control unit configured for performing a method described above.

[0042] In a preferred embodiment, the appliance is built as a, preferably front-loading, washing machine or combined washer/dryer.

[0043] Preferably, the appliance comprises a display, whereby preferably the display is arranged on a user interface.

[0044] The advantages of the invention are as follows. The method according to the invention improves the quality of the treatment of laundry by allowing optimizing the amount of laundry in the drum, thereby preventing insufficient or inhomogeneous contact of detergent with the laundry or, in the case of a drying cycle, insufficient or inhomogeneous contact with hot air. By determining again the amount of laundry after it has changed, it is possible to further optimize the loaded amount. The issuing of a warning or notification allows the user to take action and change the amount of laundry accordingly. The enabling of an unlocking condition under specific conditions provides save and secure access to the drum for accessing laundry and adjusting the amount of laundry. The displaying of a warning or notification on a display makes it convenient for the user to recognize the overload or underload condition.

Brief description of the drawings

[0045] Further features and advantages of the present invention shall become clearer from the following detailed description of some of its preferred embodiments, made with reference to the attached schematic drawings and given as an indication and not for limiting purposes.

[0046] In particular, the attached drawings are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification. The drawings together with the description explain the principles of the invention. In the drawings, corresponding characteristics and/or components are identified by the same reference numbers. In these drawings:

FIG. 1 shows a front loading washing machine in a preferred embodiment;

FIG. 2 shows the front loading washing machine of FIG. 1 in a frontal perspective view with the casing removed;

FIG. 3 shows the front loading washing machine of FIG. 1 in a perspective rear view;

FIG. 4 shows a flow chart of a method for operating a laundry treatment appliance in a first preferred embodiment; and

FIG. 5 shows a flow chart of a method for operating a laundry treatment appliance in a second preferred embodiment.

[0047] In FIGs. 1-3, a laundry treatment appliance 2 is shown which is built as a front-loading washing machine and comprises housing or casing 6 with a preferable parallelepiped shape, the casing 6 comprising a front wall 10, two side walls 14, a cover plate 20 and a rear wall (not shown). Front wall 10 and side walls 14 are preferably part of a cabinet. A front door 24 is provided which can be opened for loading or unloading laundry through an opening 28 into a washing drum and which can be closed. Door 24 can be preferably operated, especially opened and closed, by a handle 26. Door 24 is locked and/or lockable by a door lock 58 indicated schematically in FIG. 1.

[0048] Advantageously a washing tub 30 is contained within casing 6, whereby a rotatable and perforated (perforation is not shown) drum 36 is contained by the washing tub 30. Both washing tub 30 and drum 36 have a substantially cylindrical shape. Advantageously the tub 30 is suspended in a floating manner inside casing 6 by means of a number of coil springs 44 and shock absorbers 46. The drum 36 is rotated by an electric motor 68, which transmits the rotating motion of a motor shaft to the drum by a belt/pulley system 70. In a different embodiment of the invention, the motor can be directly associated with the shaft of the drum 36. The tub 30 is preferable connected to casing 6 by means of an elastic bellows 52 or gasket. Tub 30 preferably comprises two complementary hemi-shells 64, 66 structured for being reciprocally coupled to form tub 30.

[0049] Alternatively, the laundry appliance can be a combined washer and dryer or a dryer, in latter case the tub is not provided.

[0050] The preferred washing machine shown in FIG.1 on a front panel 40 comprises a drawer 42 with a front plate 34 and a handle 36 for pulling out and pushing back in drawer 42. Drawer 42 comprises at least one compartment for detergent or washing additives. Adjacent to drawer 42, preferably a rotatable or rotary knob 38 is arranged for selecting a laundry treatment program and/or at least one parameter of a laundry treatment program. Preferably, knob 38 has also a push-functionality and can be pressed for selected and/or confirmation of selected options. Knob 38 is provided on a user interface 62 which can provide further indicating and/or control elements (not shown). Knob 38 is preferably arranged on front panel 40 adjacent to drawer 42.

[0051] On front panel 40, a display 50 is arranged on

user interface 62. Display 50 comprises a dedicated area 54. A control unit 56 is indicated schematically which is configured to conduct a method which will be described below. Control unit 56 especially controls door lock 58 and can have door lock 58 on demand assume a locked or unlocked state.

[0052] In FIG. 4, a method according to the invention in a first preferred embodiment is shown as a flow chart and is discussed in connection with the appliance 2 shown in FIGs. 1-3. In a step 100, a laundry treatment process is selected. In a step 106, laundry is loaded into the drum. Both steps can be performed in the order described or in reverse order. They can also at least partially overlap in time in any of the described orders. In a step 112, the selected laundry treatment process is started. This is preferably done when a user interaction with the appliance 2 is performed. Especially preferred is the user pressing a dedicated button such as a start button.

[0053] In a step 118, the door 24 of appliance 2 is locked by actuating the door lock 58.

[0054] In a step 124, the amount of laundry in the drum is estimated. In the current embodiment, this laundry load estimation is performed by rotating the drum 36 and measuring electrical and/or mechanical parameters of motor 68 such as current, power, power voltage, rotation speed or rotor position. In another preferred embodiment, the laundry load estimation can be performed by a weight sensor which measures the weight of the laundry which is arranged in the drum 36. In this case, the step 118 can at least partially overlap with the step 106.

[0055] In a step 130, a notification is issued if the amount of laundry lies without a predetermined laundry load threshold range. This threshold range depends preferably on the laundry treatment process selected in step 100 and/or on the estimated amount of laundry in step 124. It can also depend on the kind or type of laundry loaded in the drum which can be determined by the appliance 2 or which can be inputted by the user as a separate option. The notification is issued on the dedicated area 56 of the display 50 of appliance 2.

[0056] A step 136 is performed after step 130. In step 136, if the amount of loaded laundry lies without the laundry load threshold range, the appliance 2 checks whether conditions for unlocking the door lock 58 are met. These conditions or safety/security conditions can be one or more conditions. They preferably encompass the condition that the drum 36 is not spinning and/or temperature inside the drum is not at a level dangerous for the user, and/or that the water level is below the lowest point of the lower door opening, thereby preventing water from spilling out of the tub 30 when the door 24 is opened.

[0057] In a decision 142, if these conditions are met, the method branches to a step 148. In step 148, the appliance 2 provides an unlocking enablement of the door lock 58. The appliance 2 does not continue with the laundry treatment process but maintains the unlocking condition of door lock 58 for a waiting amount of time which allows the user to access the drum 6 and adjust the amount of laundry by removing laundry from the drum 36 or by putting additional laundry into the drum 36 or by replacing laundry pieces. The waiting amount of time is preferably between 10 and 60 seconds.

[0058] If the conditions are not met, the method branches from decision 142 to a decision 150. In decision 150, the appliance 2 checks whether it can go into or assume a state in which the conditions for unlocking the door lock 58 can be met. For example, the appliance 2 may check if the motor 68 is stopped or can be stopped. If these conditions can be met, the method branches to step 148. If these conditions can not be met, the method branches to step 170 in which the selected laundry treatment process is prosecuted with a laundry load which lies outside the laundry load threshold range. The notification of step 130 is preferably maintained or repeated.

[0059] In a step 154 following step 148, it is determined if before the end of the waiting amount of time, a user interaction with the appliance 2 has occurred which is linked to a possible adjustment of the laundry load. In the current embodiment, this interaction is the process of opening the door 24 and subsequent closing again the door 24. Both the opening and the closing of door 24 are detected by a door sensor of appliance 2. If the appliance 2 has a weight sensor, changes in the measured weight are alternatively or in addition to the sensing of the door status the described interaction linked to a possible change of the laundry.

[0060] In a decision 160, the method branches depending on the result of step 154. If the user interaction did not occur, the method continues with a step 170 in which the selected laundry treatment process is prosecuted. The appliance 2 checks if the door lock 58 is locked and locks door lock 58 if it is not locked. The laundry treatment can be performed as known in the art. Water is introduced into the tub 30 and one or more washing, rinsing spinning phases are performed. The appliance performs step 170 with one set of operational parameters. This set of operational parameters depends on the amount of laundry in the drum 36. The parameters can also depend on the selected laundry treatment process. Operational parameters preferably comprise at least one parameter from the group: spinning speed, duration of respective phase, heating temperature, number of washing phases, number of rinsing phases, number of spinning phases.

[0061] After the washing operations, preferably comprising rinsing and spinning phases in step 170 have finished, the method reaches a step 180 in which the user may open the door 24 again to remove the washed laundry from the drum 36.

[0062] In decision 160, if the user interaction did occur, the method does one of three actions. In one option, it branches back to step 124. In step 124, the amount of laundry in drum 36 is again determined. In a second option, it prosecutes the laundry treatment process with the one set if operational parameters described above. In a third option, the method prosecutes the laundry treatment

process with a set of operational parameters different from the one set of parameters described above.

[0063] In a preferred variant, in decision 160 it is decided if it is probable that a change of laundry has occurred. Preferably, it is assumed that laundry has not changed if the time interval between opening the door 24 and closing the door 24 is smaller than a predefined minimum time interval. In this case, the time span is assumed to be too short of a laundry change at all or a considerable change of laundry that would make an accurate determination of the current laundry necessary again. In this case, the method is continued with the step 170.

[0064] In a further preferred variant, the notification given in step 130 is maintained during steps 136, 148, 154 and decision 142. If the method branches again to step 124 from decision 160, the notification is maintained if after estimating the amount of laundry in step 124 the estimated amount is still outside the laundry load threshold range. If the new estimated laundry load value is within the laundry load threshold range, the notification is removed or deleted. If the estimated laundry load value is outside the laundry load threshold range when the method reaches step 124, the notification is maintained until step 180. Preferably, the notification is maintained until a user interaction with the appliance 2 is detected such as interaction with a control element of appliance 2 on user interface 62 and/or the opening of the door 24. In this way, the user is informed about the overload condition when she or he is again interacting with the machine; hence it is very probably that she or he can recognize the notification. In this way, it is communicated to the user that a reduced quality of the laundry treatment cycle is related to the overload or underload condition.

[0065] In a further preferred variant, the notification is removed again before the method reaches step 170. The notification is then given again in step 180, i.e. after the laundry treatment cycle has finished. Also in this way, with a large probability the user will recognize the notification.

[0066] In both variants, the notification of the overload or underload condition is in two stages of the method made visible on the display 50. It is issued in step 130 after the estimation of the current laundry load and - if an overload condition still persists - is either maintained until step 170 or 180 or issued again in step 180.

[0067] In FIG. 5, a method according to the invention in a further preferred embodiment is shown as a flow chart. This embodiment is performed in the control unit of a combined washer/dryer. In a step 200, a laundry treatment process is selected. In a step 206, laundry is loaded into the drum. Both steps can be performed in the order described or in reverse order. They can also at least partially overlap in time in any of the described orders. In a step 212, the selected laundry treatment process is started. This is preferably done when a user interaction with the appliance is performed. Especially preferred is the user pressing a dedicated button such as a start button.

[0068] In a step 218, the door of the appliance is locked by actuating the door lock of the appliance.

[0069] In a step 224, the amount of laundry in the drum is estimated. In the current embodiment, this laundry load estimation is performed by rotating the drum and measuring electrical and/or mechanical parameters such as current, power, power voltage, rotation speed or rotor position. In another preferred embodiment, the laundry load estimation can be performed by a weight sensor which measures the weight of the laundry which is arranged in the drum. In this case, the step 218 can at least partially overlap with the step 206.

[0070] In a step 230, a notification is issued if the amount of laundry lies without a predetermined laundry load threshold range. The upper bound of the laundry load threshold range in this preferred embodiment for a combined washer/dryer is set as the maximum amount of laundry which can be dried in the combined washing and drying process. This upper bound or upper threshold value is usually smaller than the value of an amount of laundry that can be washed. By choosing this value in the combined process, it is reliably assured that both the washing phases and the drying phases can be effectively performed.

[0071] This threshold range depends preferably on the laundry treatment process selected in step 200 and/or on the estimated amount of laundry in step 224. It can also depend on the kind or type of laundry loaded in the drum which can be determined by the appliance or which can be inputted by the user as a separate option. The notification is preferably issued on the dedicated area of a display of the appliance.

[0072] A step 236 is performed after step 230. In step 236, if the amount of loaded laundry lies without the laundry load threshold range, the appliance checks whether conditions for unlocking said door are met. These conditions or safety/security conditions can be one or more conditions. They preferably encompass the condition that the drum is not spinning and/or temperature inside the drum is not at a level dangerous for the user, and/or that the water level is below the lowest point of the door opening, thereby preventing water from spilling out of the tub when the door is opened.

[0073] In a decision 242, if the conditions are met, the method branches to a step 248. In step 248, the appliance provides an unlocking enablement of the door lock of the appliance. The appliance does not continue with the laundry treatment process but maintains the unlocking condition for a waiting amount of time which allows the user to access the drum and adjust the amount of laundry by removing laundry from the drum or by putting additional laundry into the drum or by replacing laundry pieces. The waiting amount of time is preferably between 10 and 60 seconds

[0074] If the conditions are not met, the method branches from decision 242 to a decision 250. In decision 250, the appliance 2 checks whether it can go into or

assume a state in which the conditions for unlocking the door lock 58 can be met. For example, the appliance 2 may check if the motor 68 is stopped or can be stopped. If these conditions can be met, the method branches to step 248. If these conditions can not be met, the method branches to step 270 in which the selected laundry treatment process is prosecuted with a laundry load which lies outside the laundry load threshold range. The notification of step 230 is preferably maintained or repeated.

[0075] In a step 254 following step 248, it is determined if before the end of the waiting amount of time, a user interaction with the appliance has occurred which is linked to a possible adjustment of the laundry load. In the current embodiment, this interaction is the process of opening the door and subsequent closing again the door. Both the opening and the closing of door are detected by a door sensor of appliance. If the appliance has a weight sensor, changes in the measured weight are alternatively or in addition to the sensing of the door status the described interaction linked to a possible change of the laundry.

[0076] In a decision 260, the method branches depending on the result of step 254. If the user interaction did not occur, the method continues with a step 270 in which the selected laundry treatment process is prosecuted with a set of operational parameters. The appliance 2 for prosecution locks door lock 58 if it has been in an unlocked state before. The laundry treatment can be performed as known in the art. Water is introduced into the tub and one or more washing, rinsing, spinning and drying phases are performed. The appliance performs step 270 with the operational parameters which have been set in step 224. After the washing operations, preferably comprising rinsing and spinning phases in step 270 have finished, the method reaches a step 280 in which the user may open the door again to remove the washed laundry from the drum.

[0077] In decision 260, if the user interaction did occur, the method does one of three actions. In one option, it branches back to step 224. In step 224, the amount of laundry is again determined. In a second option, it prosecutes the laundry treatment process with the one set if operational parameters described above. In a third option, the method prosecutes the laundry treatment process with a set of operational parameters different from the one set of parameters described above.

[0078] In a preferred variant, in decision 260 it is decided if it is probable that a change of laundry has occurred. Preferably, it is assumed that laundry has not changed if the time interval between opening the door and closing the door is smaller than a predefined minimum time interval. In this case, the time span is assumed to be too short of a laundry change at all or a considerable change of laundry that would make an accurate determination of the current laundry necessary again. In this case, the method is continued with the step 270.

[0079] In a further preferred variant, the notification given in step 230 is maintained during steps 236, 248, 254 and decision 242. If the method branches again to step 224 from decision 260, the notification is maintained if after estimating the amount of laundry in step 224 the estimated amount is still outside the laundry load threshold range. If the new estimated laundry load value is within the laundry load threshold range, the notification is removed or deleted. If the estimated laundry load value is outside the laundry load threshold range when the method reaches step 224, the notification is maintained until step 230. Preferably, the notification is maintained until a user interaction with the appliance is detected such as interaction with a control element of appliance on user interface and/or the opening of the door. In this way, the user is informed about the overload condition when she or he is again interacting with the machine; hence it is very probably that she or he can recognize the notification. In this way, it is communicated to the user that a reduced quality of the laundry treatment cycle is related to the overload condition.

[0080] In a further preferred variant, the notification is removed again before the method reaches step 270. The notification is then given again in step 280, i.e. after the laundry treatment cycle has finished. Also in this way, with a large probability the user will recognize the notification.

[0081] In both variants, the notification of the underload/overload condition is in two stages of the method made visible on the display. It is issued in step 230 after the estimation of the current laundry load and - if an overload condition still persists - is either maintained until step 270 or 280 or issued again in step 280.

[0082] The invention thus conceived can be subjected to numerous modifications and variants all falling within the scope of the inventive concept. In addition, all details can be replaced by other technically equivalent elements. In practice, all the materials used, as well as the shapes and contingent dimensions, may vary depending on the requirements without departing from the scope of protection of the following claims.

Claims

1. Method for operating a laundry treatment appliance (2), comprising a casing (36) within which a drum (6) rotated by a motor (68) is arranged, an opening (28) provided in the casing (6) for loading the laundry into said drum (36) and a door (24) adapted to open or to close said opening (28), whereby said door (24) gives access to said drum (36) and is lockable by means of a door lock (58), and whereby said appliance (2) performs a laundry treatment cycle, comprising the steps of:

    a) selecting a laundry treatment process;
    b) loading laundry into said drum (36);
    c) starting said laundry treatment process;
    d) locking said door (24) by actuating said door

lock (58);
e) estimating the amount of laundry load;

characterized in the steps of

f) issuing a notification if the amount of laundry lies outside a laundry load threshold range;
g) if the amount of laundry lies outside said laundry load threshold range, checking whether safety/security conditions for unlocking said door lock (58) are met; if said conditions are met, providing an unlocking enablement of said door lock (58);
h) maintaining said unlocking enablement of said door lock (58) for a prescribed waiting amount of time, thereby allowing the user to change the amount of laundry load;
i) determining if an interaction occurred which is linked to a possible access of laundry in said drum (36);
j) if said interaction did not occur, prosecuting the laundry treatment process with one set of operational parameters;
k) if said interaction has occurred, performing step d) and one of the following:

- prosecuting said laundry treatment process with said one set of operational parameters, or
- prosecuting said laundry treatment process with another set of operational parameters different from said one set of operational parameters, or

l) performing steps e) to k) up to a prescribed number of times.

2. Method according to claim 1 further comprising the step of:

m) if the laundry treatment process is prosecuted with the laundry load being outside said laundry load threshold range, maintaining said notification during said laundry treatment process and or/issuing said and/or another notification at the end of said laundry treatment process.

3. Method according to claim 1 or 2, whereby providing said unlocking enablement comprises unlocking said door lock (58).

4. Method according to claim 1 or 2, whereby providing said unlocking enablement comprises enabling a user interaction, whereby performing said user interaction unlocks said door lock (58).

5. Method according to one of the claim 4, whereby providing said unlocking enablement comprises issuing a signal/message.

6. Method according to claim 4 or 5, whereby said user interaction comprises actuating an input device.

7. Method according to one of the claims 1 to 6, whereby said amount of loaded laundry is indicated on a display (50) of said appliance (2).

8. Method according to one of the claims 7, whereby the indication of said amount of loaded laundry is indicated on a dedicated area (56) of said display (50).

9. Method according to claim 7 or 8, whereby on said display (50), it is signaled that the laundry amount contained in said drum (36) can be changed.

10. Method according to one of the claims 1 to 9, whereby said appliance (2) comprises a tub (30) and whereby step e) is performed without supplying water to said tub (30) and/or before supplying water to said tub (30).

11. Method according to one of the claims 1 to 10, whereby in step e) the laundry load amount is determined by rotating said drum (36) and measuring electrical and/or mechanical parameters related to said motor (68).

12. Method according to one of the claims 1 to 11, whereby said laundry treatment appliance (2) is a washing machine, a dryer or a combined washer/dryer.

13. Method according to one of the claims 1 to 12, whereby said laundry load threshold range depends on said selected laundry treatment process and/or type of laundry communicated to said appliance (2) by the user or estimated by said appliance (2).

14. Method according to claims 1 to 13, whereby said laundry treatment appliance (2) is a combined washer/dryer, whereby said laundry treatment process is a combined washing and drying cycle, and whereby said laundry load threshold range of step g) is a threshold range based on the maximum laundry load that can be dried in said combined washing and drying cycle.

15. Laundry treatment appliance (2), comprising a casing (6) within which a drum (36) rotated by a motor (68) is arranged, an opening (28) provided in the casing (6) for loading the laundry into said drum (36) and a door (24) adapted to open or to close said opening (28), whereby said door (24) gives access to said drum (36) and is lockable by means of a door lock (58),
characterized by

a control unit (56) configured for performing a method according to one of the previous claims.

FIG. 1

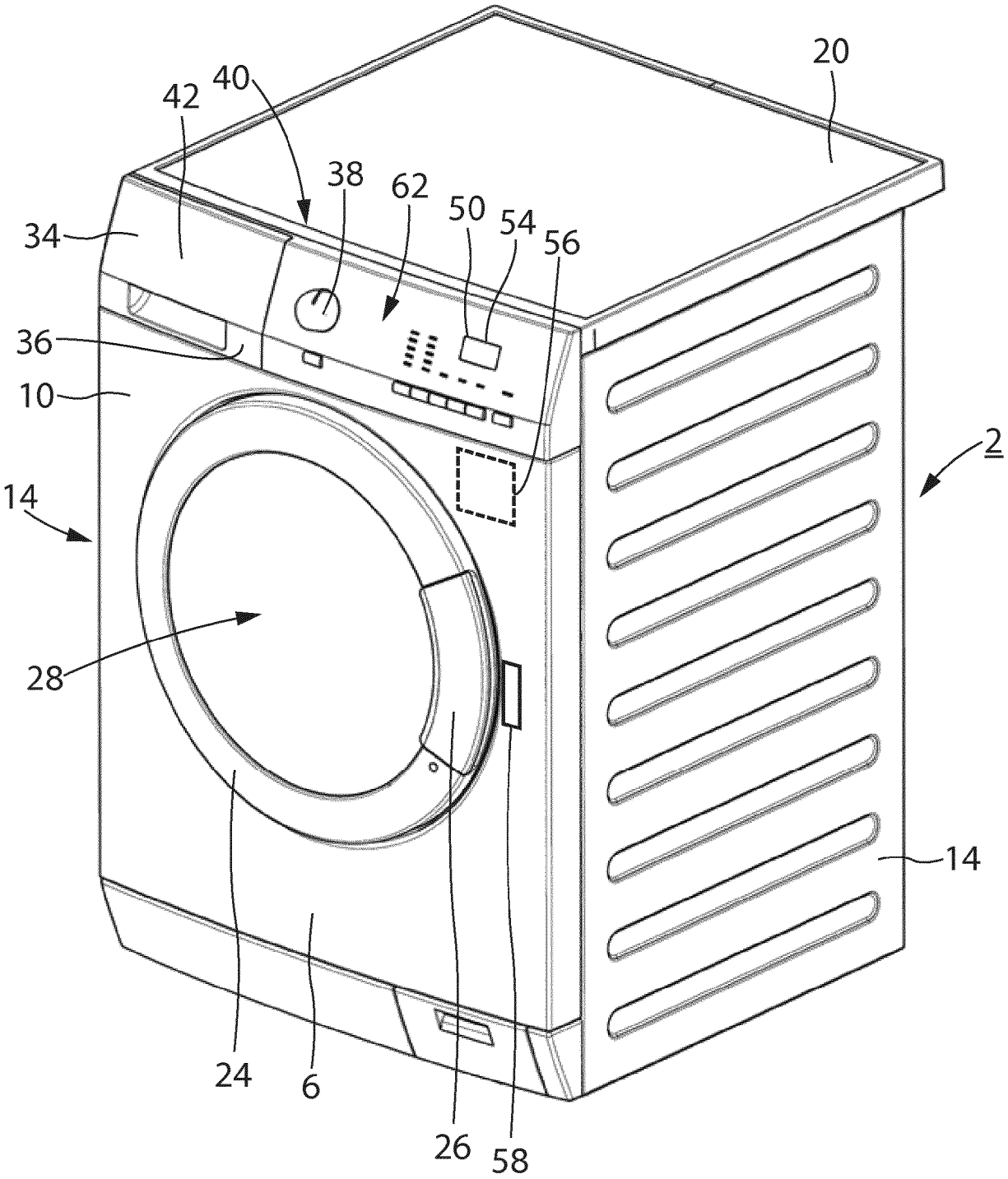


FIG. 2

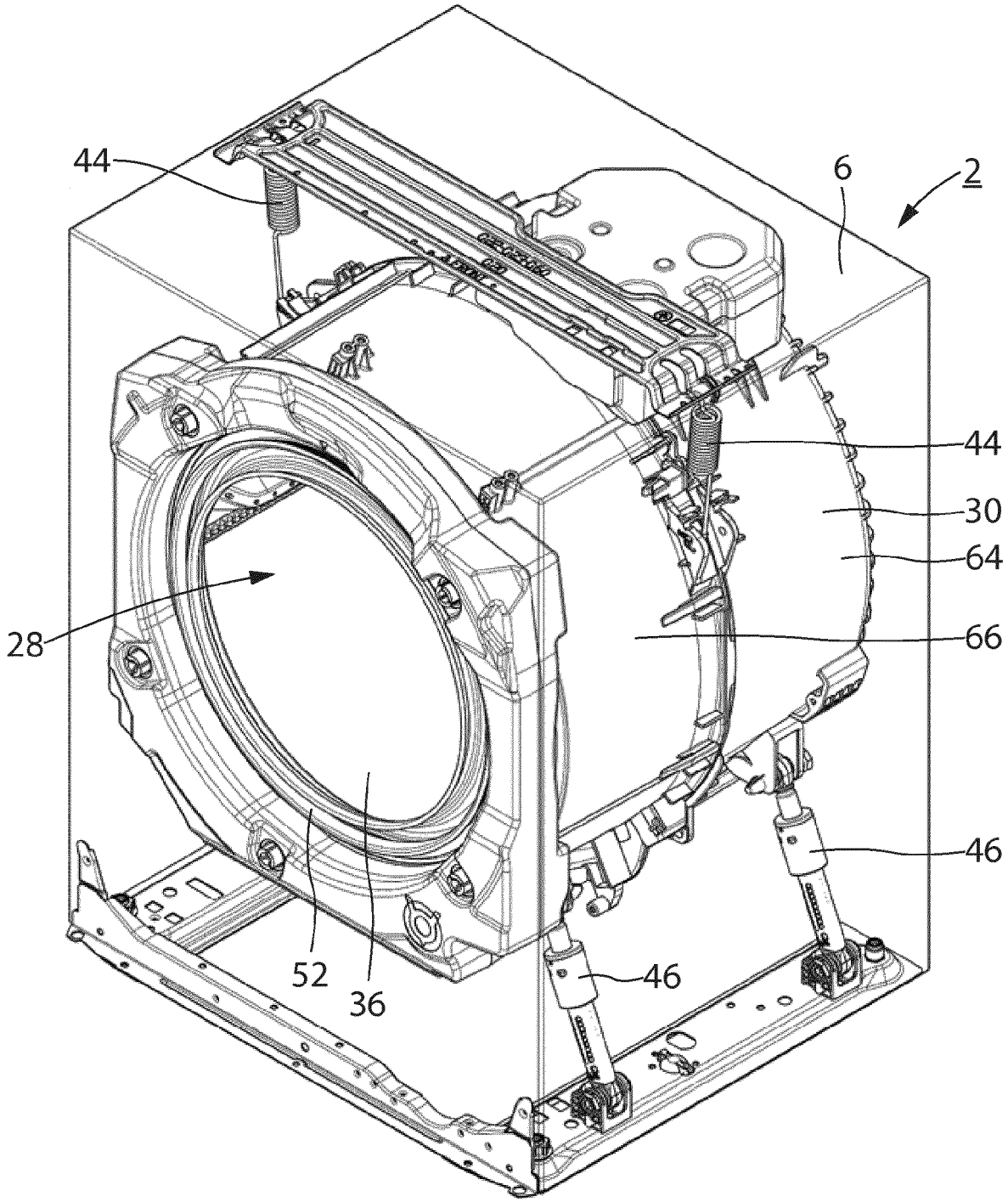


FIG. 3

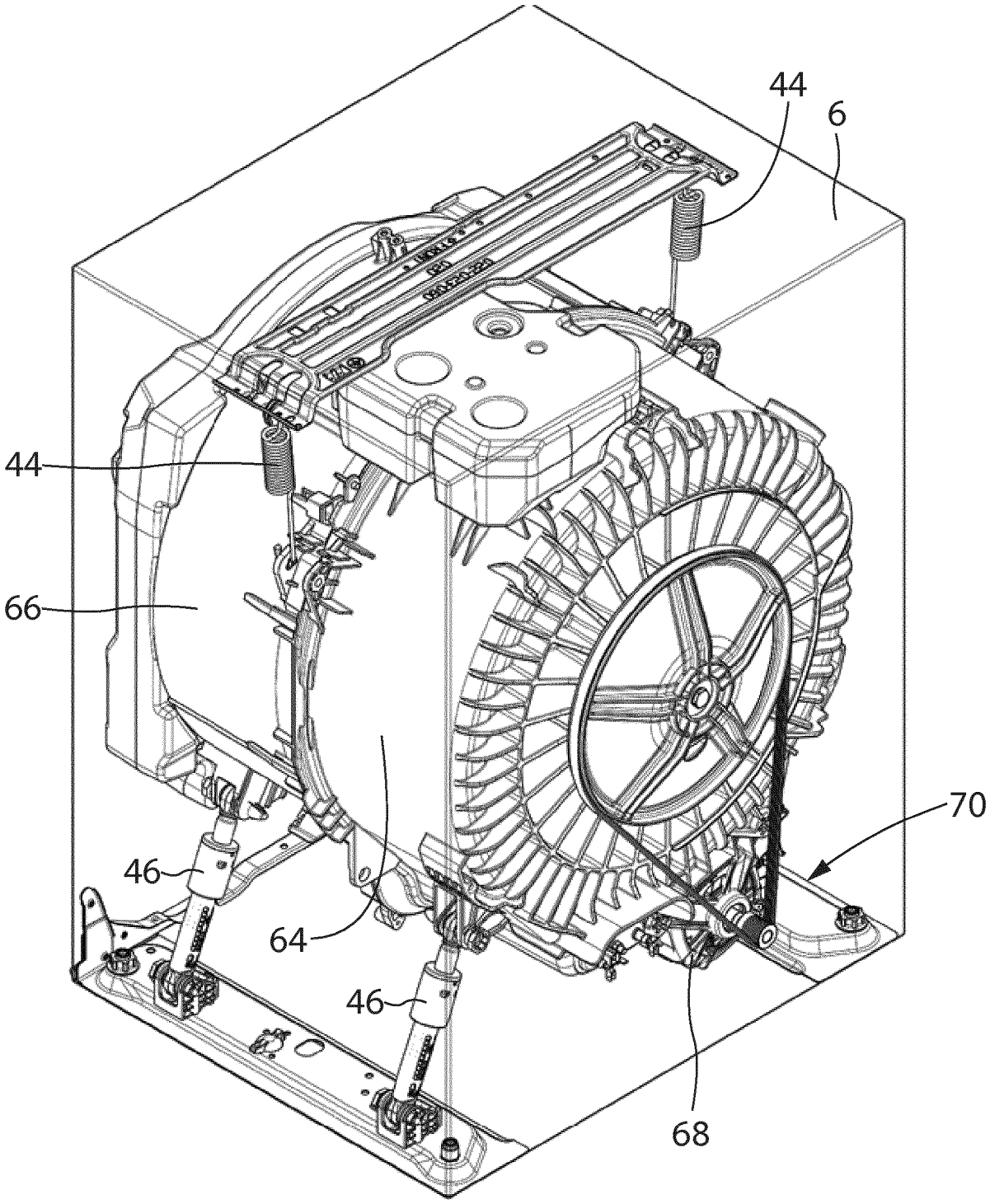


FIG. 4

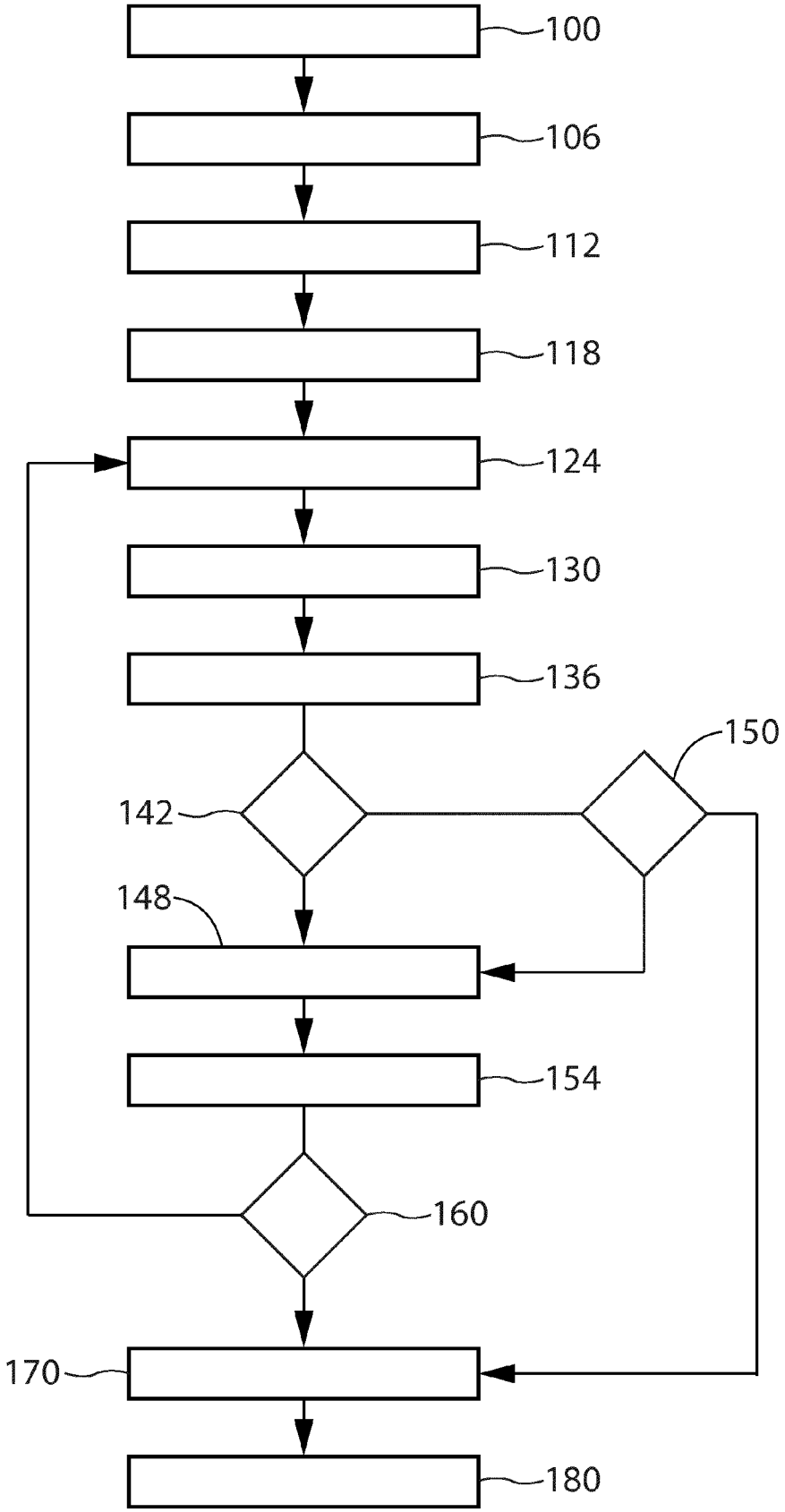
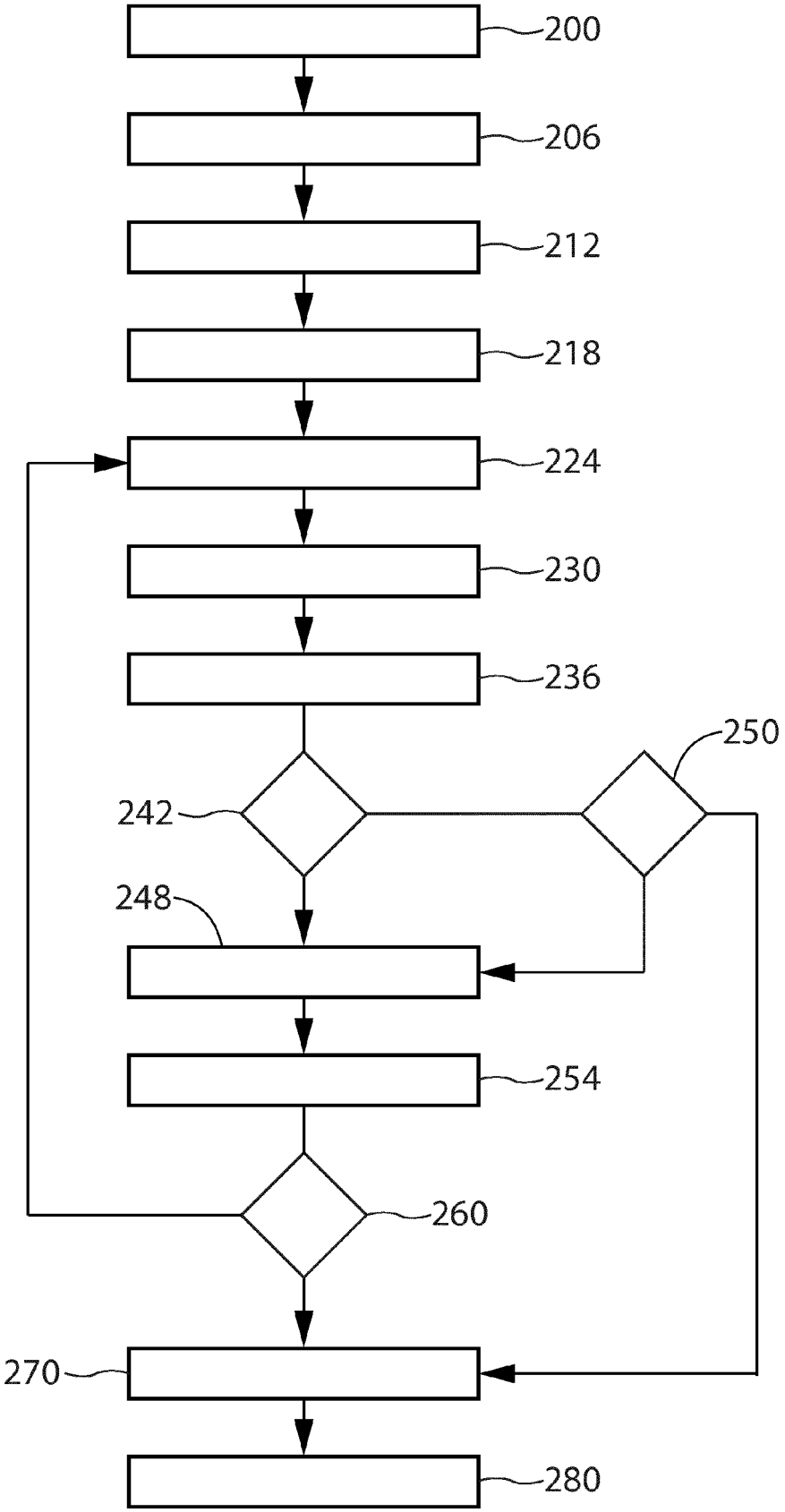


FIG. 5



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 17 4134

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 458 058 A1 (ELECTROLUX HOME PROD CORP [BE]) 30 May 2012 (2012-05-30) * paragraph [0021] - paragraph [0042] * * paragraph [0050] - paragraph [0105] * * figures 1-11 *	1-15	INV. D06F33/02 D06F58/28
A	US 2004/148709 A1 (KIM JONG HO [KR] ET AL) 5 August 2004 (2004-08-05) * paragraph [0010] - paragraph [0015] * * paragraph [0023] - paragraph [0033] * * claims 1-7; figures 1-4 *	1-15	
A	EP 2 716 811 A1 (ELECTROLUX HOME PROD CORP [BE]) 9 April 2014 (2014-04-09) * paragraph [0005] - paragraph [0011] * * claims 1-15; figures 1-8 *	1-15	
A,D	WO 01/71085 A1 (DYSON LTD [GB]; DAWE ROGER MICHAEL [GB]) 27 September 2001 (2001-09-27) * page 5, line 23 - page 10, line 9 * * claim 1; figures 1-5 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) D06F
A	DE 34 36 786 A1 (MIELE & CIE [DE]) 17 April 1986 (1986-04-17) * page 4, line 7 - page 6, line 26 * * abstract; claim 1; figure 1 *	1-15	
A	DE 28 44 755 A1 (BAUKNECHT GMBH G) 24 April 1980 (1980-04-24) * page 4, line 1 - page 7, line 5 * * claim 1; figure 1 *	1-15	
A	WO 2016/003227 A1 (LG ELECTRONICS INC [KR]) 7 January 2016 (2016-01-07) * paragraphs [0034] - [0064] * * claims 1-20; figures 1-5 *	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 December 2016	Weinberg, Ekkehard

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 16 17 4134

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-12-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2458058 A1	30-05-2012	NONE	
US 2004148709 A1	05-08-2004	KR 20040046059 A	05-06-2004
		US 2004148709 A1	05-08-2004
EP 2716811 A1	09-04-2014	NONE	
WO 0171085 A1	27-09-2001	AT 295441 T	15-05-2005
		AU 3397701 A	03-10-2001
		AU 2001233977 B2	20-05-2004
		CN 1418274 A	14-05-2003
		DE 60110763 D1	16-06-2005
		DE 60110763 T2	23-02-2006
		EP 1266060 A1	18-12-2002
		ES 2241789 T3	01-11-2005
		JP 2003527904 A	24-09-2003
		MY 129799 A	30-04-2007
		TW 573092 B	21-01-2004
		US 2003029205 A1	13-02-2003
		WO 0171085 A1	27-09-2001
DE 3436786 A1	17-04-1986	NONE	
DE 2844755 A1	24-04-1980	NONE	
WO 2016003227 A1	07-01-2016	KR 20160004533 A	13-01-2016
		WO 2016003227 A1	07-01-2016

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 0171085 A1 **[0010]**