



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.06.2024 Bulletin 2024/25

(21) Application number: **22213556.8**

(22) Date of filing: **14.12.2022**

(51) International Patent Classification (IPC):
D06F 37/42 (2006.01) **D06F 25/00** (2006.01)
D06F 39/14 (2006.01) **D06F 58/20** (2006.01)
D06F 103/40 (2020.01) **D06F 105/44** (2020.01)

(52) Cooperative Patent Classification (CPC):
D06F 39/14; D06F 37/42; D06F 25/00; D06F 34/10;
D06F 34/20; D06F 58/206; D06F 2103/40;
D06F 2105/44

(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 ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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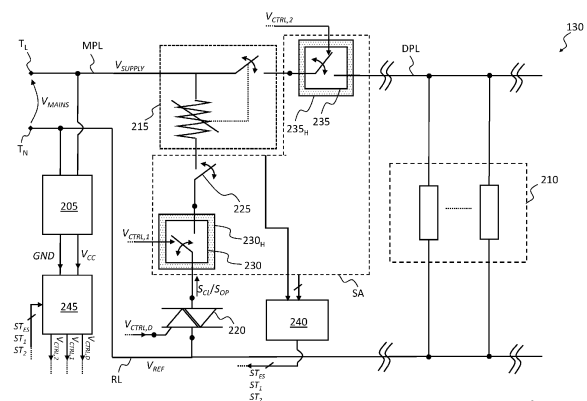
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(54) **LAUNDRY TREATMENT APPLIANCE**

(57) Laundry treatment appliance (100) comprising: a casing (105), a drum (110) mounted inside said casing (105) and designed to receive laundry, a heat pump system (125) comprising a closed recirculation circuit containing a refrigerant, a door (120) to give access to the drum (110), a main power line (MPL) providing an AC supply voltage (V_{SUPPLY}), a door power line (DPL) connectable to the main power line (MPL) to receive the AC supply voltage (V_{SUPPLY}), a door-lock device (215) switchable into a locking or unlocking state to respectively lock or unlock the door (120) to respectively allow or prevent connection between the door power line (DPL) and the main power line (MPL), a switching arrangement (SA) connected to the door-lock device (215), a driving device (220) configured to drive the door-lock device (215) to switch it into the locking or unlocking state, and a control unit (245) configured to control the switching arrangement (SA) and the driving device (220), wherein the switching arrangement (SA) comprises a first safety switch (230) switchable into a closed or an open state for respectively allowing or preventing connection between the driving device (220) and the door-lock device (215), and a second safety switch (235) switchable into a closed or an open state for respectively allowing or preventing connection between the door-lock device (215) and the door power line (DPL), the first (230) and second (235) safety switches being arranged each one in a respective sealed housing (230_H , 235_H), so as to prevent leakages of refrigerant from entering the first

(230) and second (235) safety switches, and wherein the control unit (245) is configured to control the first (230) and second (235) safety switches to avoid a concurrent closed state of the first (230) and second (235) safety switches during door-lock and door-unlock procedures.



Description

Technical field

[0001] The present disclosure generally relates to the field of laundry treatment appliances (hereinafter, concisely, "laundry appliances"), and particularly to laundry appliances for treating (e.g., washing) laundry, such as laundry washing appliances and laundry washing appliances also implementing laundry drying functions (also referred to as combined washers/dryers).

Background art

[0002] The background of the present disclosure is hereinafter introduced with the discussion of techniques relating to its context. However, even when this discussion refers to documents, acts, artifacts and the like, it does not suggest or represent that the discussed techniques are part of the prior art or are common general knowledge in the field relevant to the present disclosure.

[0003] A conventional combined washer/dryer comprises a heat pump system for performing laundry drying functions.

[0004] The heat pump system typically comprises a closed recirculation circuit (hereinafter, refrigerant circuit) containing a volatile evaporating and condensing fluid (known as refrigerant fluid or refrigerant), such as propane.

[0005] A conventional combined washer/dryer also comprises a door-lock device for safely performing laundry washing/drying functions. The door-lock device is configured to be switched between a locking state locking the door of the combined washer/dryer, and an unlocking state unlocking the door of the combined washer/dryer.

[0006] The door-lock device typically comprises a rod having one end attached to an armature of a solenoid and the other end attached to a blocking member: when the blocking member is moved by the rod due to solenoid energization, it takes a blocking position interfering with a latching mechanism of a door of the combined washer/dryer.

[0007] A conventional combined washer/dryer further comprises a driving device (e.g., a TRIAC) configured to drive the door-lock device to switch it into the locking or unlocking state.

Summary

[0008] The Applicant has realized that the known combined washers/dryers are not satisfactory.

[0009] Indeed, the Applicant has understood and ascertained that highly flammable gases (such as propane or other refrigerant) leaked or leaking from the heat pump system may be ignited by energetic sparks resulting by the switching of the door-lock device in some undesired conditions.

[0010] An example of undesired condition is represent-

ed by electric faults (including, but not limited to, short-circuit faults and/or current leakages) affecting the driving device and one or more electric/electronic loads like, for example, the element for heating the water in the washing cycle.

[0011] Another example of undesired condition is represented by electrical disturbances, such as electrical fast transients. Electrical fast transients are typically generated by sudden variations in voltages and currents due to switching and interruptions of inductive loads (such as electro-mechanical switches and relays), and/or due to bouncing of switch/relay contacts.

[0012] In view of the above, the Applicant has devised a laundry appliance comprising safety switches that, properly controlled, allow overcoming the above-mentioned drawbacks.

[0013] Particularly, an aspect of the present disclosure relates to a laundry treatment appliance (or, concisely, laundry appliance).

[0014] According to an embodiment, the laundry appliance comprises a casing.

[0015] According to an embodiment, the laundry appliance comprises a drum mounted inside said casing and designed to receive laundry.

[0016] According to an embodiment, the drum is housed in axially rotating manner inside a washing tub, so as to be able to freely rotate about a respective rotation axis. According to an embodiment, the rotation axis is a horizontal rotation axis. According to alternative embodiments, the rotation axis is a vertical rotation axis or an inclined rotation axis.

[0017] According to an embodiment, the laundry appliance comprises a heat pump system comprising a closed recirculation circuit containing a refrigerant.

[0018] According to an embodiment, the laundry appliance comprises a door to give access to the drum.

[0019] According to an embodiment, the laundry appliance comprises a main power line providing an AC supply voltage.

[0020] According to an embodiment, the AC supply voltage corresponds to an AC mains voltage. According to an embodiment, the AC supply voltage is equal or substantially equal to the AC mains voltage. According to alternative embodiments, the AC supply voltage is different from the AC mains voltage, the AC supply voltage being for example a scaled and/or filtered version of the AC mains voltage.

[0021] According to an embodiment, the laundry appliance comprises a door power line connectable to the main power line to receive the AC supply voltage.

[0022] According to an embodiment, the laundry appliance comprises a door-lock device switchable into locking or unlocking states to respectively lock or unlock the door to respectively allow or prevent connection between the door power line and the main power line.

[0023] According to an embodiment, the laundry appliance comprises one or more electric/electronic loads electrically connected to the door power line. According

to an embodiment, the electric/electronic loads are electrically connected between the door power line and a reference line directly. According to alternative embodiments, the electric/electronic loads (or at least a subset thereof) are electrically connected between the door power line and/or the reference line through one or more respective switching members, e.g., for selectively commanding a switching on/off of the relative electric/electronic loads based on the ongoing laundry treating phase. Just as an example, a drain pump and the heat pump system may be switched on at draining and drying phases, respectively, of a laundry washing and drying cycle. Just as another example, the electric/electronic loads involved in an initial phase of a selected laundry treatment cycle may be switched on only after successful door locking by the door-lock device. According to an embodiment, for each electric/electronic load, the respective switching member(s) (when provided) may be provided between the door power line and the electric/electronic load, and/or between the electric/electronic load and the reference line.

[0024] According to an embodiment, the laundry appliance comprises a switching arrangement connected to the door-lock device.

[0025] According to an embodiment, the laundry appliance comprises a driving device configured to drive the door-lock device to switch it into the locking or unlocking states.

[0026] According to an embodiment, the laundry appliance comprises a control unit configured to control the switching arrangement and the driving device during a door-lock procedure and a door-unlock procedure.

[0027] According to an embodiment, the switching arrangement comprises a first safety switch switchable into a closed or an open state for respectively allowing or preventing connection between the driving device and the door-lock device, and a second safety switch switchable into a closed or an open state for respectively allowing or preventing connection between the door-lock device and the door power line.

[0028] According to an embodiment, the first and second safety switches are arranged each one in a respective sealed housing, so as to prevent leakages of refrigerant from entering the first and second safety switches. In alternative embodiments, the first and second safety switches are arranged in a same sealed housing.

[0029] According to an embodiment, the control unit is configured to control the first and second safety switches so as to avoid a concurrent closed state of the first and second safety switches during door-lock and door-unlock procedures.

[0030] According to an embodiment, the control unit is configured to control the first and second safety switches to electrically isolate the door-lock device from the door power line when the door-lock device is switched between the locking and unlocking states, and to electrically isolate the door-lock device from the driving device when the door power line is connected to the main power line.

[0031] According to an embodiment, during the door-lock procedure the control unit is configured to perform the following steps:

- 5 (i) switch the first safety switch into the closed state;
- (ii) control the driving device to drive the door-lock device to switch it into the locking state;
- (iii) switch the first safety switch into the open state, and
- 10 (iv) switch the second safety switch into the closed state.

[0032] According to an embodiment, during the door-unlock procedure the control unit is configured to:

- 15 (a) switch the second safety switch into the open state;
- (b) switch the first safety switch into the closed state;
- (c) control the driving device to drive the door-lock device to switch it into the unlocking state, and
- 20 (d) switch the first safety switch into the open state.

[0033] According to an embodiment, the laundry appliance further comprises one or more sensing circuits configured to provide one or more signals indicative of a state of at least one among the door-lock device, the first safety switch and the second safety switch.

[0034] According to an embodiment, the control unit is configured to perform each one of at least one among steps (ii), (iii), and (iv) if a respective previous step has been a successfully performed. According to an embodiment, the control unit is configured to perform each one of at least one among steps (ii), (iii), and (iv) if a respective previous step based on said one or more signals has been successfully performed. In alternative embodiments, none of the steps (ii), (iii), and (iv) is performed based on a successful performing of the respective previous step.

[0035] According to an embodiment, the control unit is configured to perform each one of at least one among steps (b), (c), and (d), if a respective previous step has been successfully performed. According to an embodiment, the control unit is configured to perform each one of at least one among steps (b), (c), and (d) if a respective previous step based on said one or more signals has been successfully performed. In alternative embodiments, none of the steps (b), (c), and (d) is performed based on a successful performing of the respective previous step.

[0036] According to an embodiment, the laundry appliance comprises additional sensing circuits configured to provide additional status signals indicative of an operating condition of one or more electric/electronic loads and/or of the respective switching members. The additional sensing circuits and/or the additional status signals may be omitted in basic embodiments.

[0037] According to an embodiment, the laundry treatment appliance comprises a combined washer/dryer.

[0038] According to an embodiment, the laundry appliance is a laundry appliance located or adapted to be located in a home or household environment (*i.e.*, a laundry appliance for domestic use). In any case, the principles of the present disclosure also apply to laundry appliances outside the household environment (including, but not limited to, laundry appliances for professional use).

[0039] Without losing generality, the principles of the present disclosure equivalently apply to other types of laundry appliances (such as dryers).

[0040] Without losing generality, the principles of the present disclosure equivalently apply to any type of electric appliance equipped with a refrigerant circuit (which may therefore be potentially affected by refrigerant losses) and with one or more spark-generating devices (*e.g.*, other than the door lock device).

[0041] Another aspect of the present disclosure relates to a method for operating the laundry appliance.

[0042] According to an embodiment, the method comprises controlling the first and second safety switches to avoid a concurrent closed state of the first and second safety switches during the door-lock procedure and door-unlock procedure.

[0043] According to an embodiment, the method comprises controlling the first and second safety switches to electrically isolate the door-lock device from the door power line when the door-lock device is switched between the locking and unlocking states, and to electrically isolate the door-lock device from the driving device when the door power line is connected to the main power line.

[0044] According to an embodiment, the method comprises, during the door-lock procedure:

- (i) switching the first safety switch into the closed state;
- (ii) driving the door-lock device to switch it into the locking state;
- (iii) switching the first safety switch into the open state, and
- (iv) switching the second safety switch into the closed state.

[0045] According to an embodiment, the method comprises, during the door-unlock procedure:

- (a) switching the second safety switch into the open state;
- (b) switching the first safety switch into the closed state;
- (c) driving the door-lock device to switch it into the unlocking state, and
- (d) switching the first safety switch into the open state.

[0046] According to an embodiment, the method comprises performing each one of at least one among steps (ii), (iii), and (iv) if a respective previous step has been

successfully performed. According to an embodiment, the method comprises performing each one of at least one among steps (ii), (iii), and (iv) if a respective previous step based on said one or more signals has been successfully performed. In alternative embodiments, none of the steps (ii), (iii), and (iv) is performed based on a successful performing of the respective previous step.

[0047] According to an embodiment, the method comprises performing each one of at least one among steps (b), (c), and (d), if a respective previous step based on said one has been successfully performed. According to an embodiment, the method comprises performing each one of at least one among steps (b), (c), and (d) if a respective previous step based on said one or more signals has been successfully performed. In alternative embodiments, none of the steps (b), (c), and (d) is performed based on a successful performing of the respective previous step.

Brief description of the annexed drawings

[0048] These and other features and advantages of the present disclosure will be made apparent by the following description of an exemplary and non-limitative embodiment thereof; for its better intelligibility, the following description should be read referring to the attached drawings, wherein:

Figure 1 shows a perspective view of a laundry appliance according to an exemplary embodiment of the present disclosure;

Figure 2 shows, in terms of simplified functional blocks, an electric circuit of the laundry appliance of **Figure 1** according to the exemplary embodiment of the present disclosure, and

Figure 3 shows an activity diagram of a method according to the exemplary embodiment of the present disclosure.

Detailed description of an exemplary embodiment

[0049] With reference to the drawings, **Figure 1** shows a perspective view of a laundry appliance **100** according to an exemplary embodiment of the present disclosure.

[0050] According to the exemplary embodiment, the laundry appliance **100** is configured to perform one or more laundry treating cycles. According to the exemplary embodiment, the laundry appliance **100** is a combined washer/dryer (*i.e.*, a laundry appliance capable of performing one or more laundry treating cycles including both laundry washing cycles and laundry drying cycles).

[0051] In the following, the terms "include" and "comprise", and derivatives thereof, are intended to 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.

[0052] According to the exemplary embodiment, the laundry appliance **100** is a laundry appliance located or adapted to be located in a home or household environment (*i.e.*, a laundry appliance for domestic use).

[0053] According to the exemplary embodiment, the laundry appliance **100** comprises electric, electronic, mechanical, hydraulic, electromechanical and/or electrohydraulic components, only the relevant ones deemed relevant for the understanding of embodiments of the present disclosure being illustrated and discussed in the following for the sake of conciseness.

[0054] According to the exemplary embodiment, the laundry appliance **100** comprises a cabinet or casing **105**. According to the exemplary embodiment, the casing **105** is substantially parallelepiped-shaped, and is structured for resting on the floor (or on another flat or substantially flat surface).

[0055] According to the exemplary embodiment, the laundry appliance **100** comprises a washing tub (not shown). According to the exemplary embodiment, the washing tub is accommodated within the casing **105**. According to the exemplary embodiment, the washing tub is suspended in floating manner inside the casing **105** by means of a suspension system (not shown). Just as an example, the suspension system may comprise one or more upper coil springs connecting an upper portion of the washing tub to a top of the casing **105**, and one or more lower vibration dampers connecting a bottom portion of the washing tub to a bottom of the casing **105**.

[0056] According to the exemplary embodiment, the laundry appliance **100** comprises a (*e.g.*, rotatable) drum **110** mounted inside the casing **105** and adapted or designed to receive laundry, or laundry load (*i.e.*, laundry to be treated, such as laundry to be washed and/or dried). According to the exemplary embodiment, the drum **110** is housed within the washing tub. According to the exemplary embodiment, the drum **110** is a substantially cylindrical, bell-shaped revolving perforated drum. According to the exemplary embodiment, the drum **110** is housed in axially rotating manner inside the washing tub, so as to be able to freely rotate about a respective rotation axis. According to the exemplary embodiment, the rotation axis is a horizontal rotation axis.

[0057] According to the exemplary embodiment, the laundry appliance **100** comprises (*e.g.*, at a cabinet front) a loading opening **115** for performing laundry loading/unloading operations (*i.e.*, for loading the laundry into the drum **110** and for unloading the laundry from the drum **110**).

[0058] According to the exemplary embodiment, the laundry appliance **100** comprises a door (*e.g.*, a porthole door) **120** (shown in an open position in **Figure 1**) to give access to the drum **110** (*e.g.*, for performing the laundry loading/unloading operations). According to the exemplary embodiment, the door **120** is configured to sealably close the loading opening **115** during the operation of the laundry appliance **100**. According to the exemplary embodiment, the door **120** is hinged to a front wall of the

casing **105** to rotate about a reference axis (*e.g.*, a vertically-oriented reference axis) between open and closed positions.

[0059] According to the exemplary embodiment, the laundry appliance **100** comprises a heat pump system **125**. According to the exemplary embodiment, the heat pump system **125** comprises a closed recirculation circuit (hereinafter, refrigerant circuit) containing a volatile evaporating and condensing fluid (known as refrigerant fluid or refrigerant). Without losing generality, the refrigerant may comprise propane.

[0060] Broadly speaking, the heat pump system **125** substantially makes use of the refrigerant circuit for transferring thermal energy from a first side at a lower temperature (also referred to as cool side), to a second side at a higher temperature (also referred to as hot side).

[0061] The heat pump system **125** is not limitative for the present disclosure. Just as an example (not shown), the heat pump system **125** may comprise a compressor, a pressure-lowering device, and a heat exchanger assembly (*e.g.*, comprising both an evaporator - where the refrigerant absorbs heat thereby being vaporized - and a condenser - where the refrigerant releases heat thereby being condensed). In operation, the refrigerant, at a gaseous state, is pressurized, hence heated up, and circulated towards the hot side of the refrigerant circuit by the compressor, where the hot and highly pressurized vapor is cooled in the condenser, until it condenses into a high pressure, moderate temperature liquid. The condensed refrigerant then passes through the pressure-lowering device (such as an expansion valve), and the corresponding low pressure, expanded liquid refrigerant then enters the evaporator, wherein the fluid absorbs heat and boils. The refrigerant then returns to the compressor and the cycle of above is repeated.

[0062] According to the exemplary embodiment, the laundry appliance **100** comprises an electric/electronic system **130**.

[0063] With reference to **Figure 2**, it shows, in terms of simplified functional blocks, the electric/electronic system **130** according to the exemplary embodiment of the present disclosure.

[0064] According to the exemplary embodiment, the electric/electronic system **130** is electrically connected or connectable to line **T_L** and neutral **T_N** terminals of a mains power supply. For the purposes of the present disclosure, the line terminal **T_L** provides an AC mains voltage V_{MAINS} (for example, a 220V/110V voltage) with respect to the neutral terminal **T_N**.

[0065] According to the exemplary embodiment, the electric/electronic system **130** comprises a main power line **MPL** providing an AC supply voltage V_{SUPPLY} . According to the exemplary embodiment, the main power line **MPL** is electrically coupled to the line terminal **T_L** to provide an AC supply voltage V_{SUPPLY} corresponding to the AC mains voltage V_{MAINS} . According to the exemplary embodiment, the AC supply voltage V_{SUPPLY} is equal or substantially equal to the AC mains voltage V_{MAINS} .

[0066] According to the exemplary embodiment, the electric/electronic system **130** comprises a reference line **RL** providing a reference voltage V_{REF} . According to the exemplary embodiment, the reference line **RL** is electrically coupled to the neutral terminal T_N .

[0067] According to the exemplary embodiment, the electric/electronic system **130** comprises an AC-DC conversion circuit **205**. According to the exemplary embodiment, the AC-DC conversion circuit **205** comprises transforming, rectifying and regulation components (not shown) for receiving the AC mains voltage V_{MAINS} across the line T_L and neutral T_N terminals of the mains power supply and providing a ground voltage GND and a DC supply voltage V_{CC} (e.g., a 3V, 5V or 12V DC voltage with respect to the ground voltage GND). For the purposes of the present disclosure, the ground voltage GND and the DC supply voltage V_{CC} generated by the AC-DC conversion unit **205** are used for supplying one or more electric/electronic components of the electric/electronic system **130** (including, but not limited to, a control unit, discussed in the following).

[0068] According to the exemplary embodiment, the electric/electronic system **130** comprises a door power line **DPL** connectable to the main power line **MPL** to receive the AC supply voltage V_{SUPPLY} .

[0069] According to the exemplary embodiment, the electric/electronic system **130** comprises one or more (e.g., a plurality of) electric/electronic loads **210**. According to the exemplary embodiment, the electric/electronic loads **210** are configured to perform respective laundry treating functions during one or more laundry treating phases of a selected laundry treating cycle.

[0070] Without losing generality, the electric/electronic loads **210** may comprise, but are not limited to, one or more among the heat pump system (or one or more components thereof), a drain pump associated with a drain hydraulic circuit (not shown), a water-detergent pump associated with a water-detergent hydraulic circuit (not shown), a heating device, and/or an electric motor for drum rotation.

[0071] According to the exemplary embodiment, the electric/electronic loads **210** are electrically connected between the door power line **DPL** and the reference line **RL** directly.

[0072] According to the exemplary embodiment, the electric/electronic system **130** comprises a door-lock device **215**.

[0073] According to the exemplary embodiment, the door-lock device **215** is switchable into a locking or unlocking state to respectively lock or unlock the door **120**.

[0074] According to the exemplary embodiment, the door-lock device **215** is switchable into the locking or unlocking states to respectively allow or prevent the feeding of the AC supply voltage V_{SUPPLY} to the electric/electronic loads **210**.

[0075] According to the exemplary embodiment, the door-lock device **215** comprises a rod having one end attached to an armature of a solenoid and the other end

attached to a blocking member: when the blocking member is moved by the rod due to solenoid energization, it takes a blocking position interfering with a latching mechanism of the door **120**.

5 [0076] According to the exemplary embodiment, the door-lock device **215** is configured to lock or unlock the door **120** upon solenoid energization through respective driving signals (as better discussed in the following).

10 [0077] According to the exemplary embodiment, the electric/electronic system **130** comprises a switching arrangement **SA**. According to the exemplary embodiment, the switching arrangement **SA** is connected to the door-lock device **215**.

15 [0078] According to the exemplary embodiment, the electric/electronic system **130** comprises a driving device **220** configured to drive the door-lock device **215** to switch it into the locking or unlocking state.

20 [0079] According to the exemplary embodiment, the driving device **220** is configured to drive the door-lock device **215** to switch it into the locking or unlocking state according to a control signal $V_{CTRL,D}$.

25 [0080] According to the exemplary embodiment, the driving device **220** comprises a thyristor device (e.g., a TRIAC) having a first anode terminal coupled (e.g., directly connected) to the reference line **RL**, a second anode terminal coupleable to the solenoid of the door-lock device **215**, and a gate terminal configured to receive the control signal $V_{CTRL,D}$.

30 [0081] According to the exemplary embodiment, the control signal $V_{CTRL,D}$ may take a deactivation level (for example, corresponding to a low or relatively low voltage, such as the ground voltage GND) allowing deactivation of the driving device **220** (in which case, no electric current is allowed to flow through the driving device **220**) or an activation level (for example, corresponding to a high or relatively high voltage, such as the DC supply voltage V_{CC}) allowing activation of the driving device **220** (in which case, an electric current is allowed to flow through the driving device **220**).

35 [0082] According to the exemplary embodiment, the driving device **220** is configured to drive the door-lock device **215** by means of a driving signal (e.g., an electric current) that may be modulated according to the control signal $V_{CTRL,D}$. For the purposes of the present disclosure, the control signal $V_{CTRL,D}$ may be set at the activation level for a first time interval $T1$ (e.g., $T1=20$ ms), which results in a first or closing driving signal S_{CL} to be supplied to (the solenoid of) the door-lock device **215** to switch it into the locking state, or at the activation level for a second time interval $T2$ (e.g., $T2=60$ ms), which results in a second or opening driving signal S_{OP} to be supplied to (the solenoid of) the door-lock device **215** to switch it into the unlocking state. For the purposes of the present disclosure, by control signal $V_{CTRL,D}$ being set at the activation level for the first time interval $T1$ (or, similarly, for the second time interval $T2$) it is herein meant that, at the end of the first time interval $T1$ (respectively, the second time interval $T2$), the control

signal $V_{CTRL,D}$ is set back to the deactivation level (which, according to the exemplary embodiment, represents a default level of the control signal $V_{CTRL,D}$).

[0083] According to the exemplary embodiment, the control signal $V_{CTRL,D}$ is generated by a control unit (discussed in the following) or by a triggering circuit (not shown) under the control of the control unit.

[0084] According to the exemplary embodiment, the switching arrangement **SA** comprises a mechanical switch **225** configured to switch into a closed or an open state depending on door position. According to the exemplary embodiment, when the door **120** is moved into the closed position, the mechanical switch **225** is moved into the closed state (which allows electric current, such as the driving signal from the driving device **220**, to flow through the solenoid of the door-lock device **215**). According to the exemplary embodiment, when the door **120** is moved into the open position, the mechanical switch **225** is switched into the open state (which prevents electric current from flowing through the solenoid of the door-lock device **215**).

[0085] According to the exemplary embodiment, the switching arrangement **SA** comprises a first safety switch **230** switchable into a closed or an open state for respectively allowing or preventing connection between the driving device **220** and the door-lock device **215**, and a second safety switch **235** switchable into a closed or an open state for respectively allowing or preventing connection between the door-lock device **215** and the door power line **DPL**.

[0086] According to the exemplary embodiment, the first **230** and second **235** safety switches are arranged each one in a respective sealed housing **230_H**, **235_H**, so as to prevent gases (such as refrigerant leaked or leaking from the heat pump system **130**) from entering (and, hence, come into contact with) the first **230** and second **235** safety switches. For the purposes of the present disclosure, the sealed housing **230_H**, **235_H** is a container providing a hermetic seal, *i.e.*, any type of sealing that makes the corresponding safety switch **230**, **235** airtight (thus preventing the passage of air, oxygen, or other gases, including the refrigerant leaked or leaking from the heat pump system). Without losing generality, the sealed housing **230_H**, **235_H** may include any proper material or combination of materials. Just as an example, the sealed housing **230_H**, **235_H** may include rubber and/or plastic materials.

[0087] According to the exemplary embodiment, the first **230** and second **235** safety switches comprise electronic switches switchable into the closed or open states according to respective control signals $V_{CTRL,1}$, $V_{CTRL,2}$ received at respective control terminals.

[0088] According to the exemplary embodiment, the control signals $V_{CTRL,1}$, $V_{CTRL,2}$ are generated by the control unit (discussed in the following).

[0089] According to the exemplary embodiment, the control signal $V_{CTRL,1}$ is a digital signal. According to the exemplary embodiment, the control signal $V_{CTRL,1}$ may

take a first logic level (for example, a high logic level, *e.g.*, corresponding to the DC supply voltage V_{CC}) allowing the switching of the first safety switch **230** into the closed state, or a second logic level (for example, a low logic level, *e.g.*, corresponding to the ground voltage GND) allowing the switching of the first safety switch **230** into the open state.

[0090] According to the exemplary embodiment, the control signal $V_{CTRL,2}$ is a digital signal. According to the exemplary embodiment, the control signal $V_{CTRL,2}$ may take a first logic level (for example, a high logic level, *e.g.*, corresponding to the DC supply voltage V_{CC}) allowing the switching of the second safety switch **235** into the closed state, or a second logic level (for example, a low logic level, *e.g.*, corresponding to the ground voltage GND) allowing the switching of the second safety switch **235** into the open state.

[0091] According to the exemplary embodiment, the electric/electronic system **130** comprises one or more sensing circuits **240** configured to provide one or more signals (hereinafter, status signals) indicative of an operating condition of the door-lock device **215** and/or of the switching arrangement **SA**. For the purposes of the present disclosure, the sensing circuits **240** are configured to provide status signals ST_{ES} , ST_1 , ST_2 (or a subset thereof) indicative of the closed or open state of, respectively, the door-lock device **215**, the first safety switch **230** and the second safety switch **235** (or a subset thereof). Without losing generality, the sensing circuits **240** may be configured to provide the status signals ST_{ES} , ST_1 , ST_2 (or a subset thereof) based on a voltage sensing performed at one or more relevant contacts of, respectively, the door-lock device **215**, the first safety switch **230**, and the second safety switch **235** (or a subset thereof).

[0092] According to the exemplary embodiment, the electric/electronic system **130** comprises a control unit **245**. Without losing generality, the control unit **245** may comprise one or more processors (such as one or more microcontrollers and/or one or more microprocessors).

[0093] Broadly speaking, the control unit **245** is configured to control the operation of the laundry appliance **100**. According to the exemplary embodiment, the control unit **245** is configured to control the operation of the laundry appliance **100** based on a plurality of functionalities of the laundry appliance **100**.

[0094] As typical in modern laundry appliances, the control unit **245** may be intended to manage the whole laundry appliance operation (however, for the sake of conciseness, only aspects/functionalities of the control unit **245** relevant for the present disclosure will be introduced and discussed in the following).

[0095] For the purposes of the present disclosure, the control unit **245** is configured to control the switching arrangement **SA** and the driving device **220** during a door-lock procedure (aimed at switching the door-lock device **215** into the locking state) and during a door-unlock procedure (aimed at switching the door-lock device **215** into

the unlocking state), as better discussed in the following.

[0096] According to the exemplary embodiment, the control unit **245** is connected between a supply terminal providing the DC supply voltage V_{CC} and a ground terminal providing the ground voltage GND .

[0097] According to the exemplary embodiment, the control unit **245** is configured to generate and provide the control signals $V_{CTRL,D}$, $V_{CTRL,1}$, $V_{CTRL,2}$.

[0098] According to the exemplary embodiment, the control unit **245** is configured to receive the status signals ST_{ES} , ST_1 , ST_2 and to accordingly generate and provide the control signals $V_{CTRL,D}$, $V_{CTRL,1}$, $V_{CTRL,2}$.

[0099] With reference now to **Figure 3**, it shows an activity diagram of a method **300** implementing a door-lock procedure and a door-unlock procedure according to the exemplary embodiment of the present disclosure. Particularly, **Figure 3** shows an activity diagram which describes the flow of activities relating to the exemplary embodiment of the present disclosure. In this respect, each step or node of the activity diagram may correspond to one or more executable instructions for implementing the specified logical function on a relevant software component of the control unit **245**.

[0100] According to the exemplary embodiment, the method steps may be implemented by respective computer program products loadable into an internal memory of the laundry appliance **100**. According to the exemplary embodiment, each computer program product comprises software code means for configuring the control unit **245** (e.g., one or more respective processors) to perform the method steps when the computer program product is run on the laundry appliance **100**.

[0101] By computer program product loadable into an internal memory of an apparatus (such as the laundry appliance **100**), it is herein meant that the computer program can be introduced into the internal memory of the relevant apparatus so as achieve an apparatus programmed to be capable of, or adapted to, carrying out the corresponding method steps.

[0102] Without losing generality, the computer program product implementing the method steps may comprise, or be included in, a firmware of the laundry appliance **100**, the firmware being for example stored in a memory location of the control unit **245**.

[0103] Broadly speaking, the method **300** comprises controlling the switching arrangement **SA** and the driving device **220** to avoid a concurrent closed state of the first and second safety switches during door-lock and door-unlock procedures. More particularly, according to an embodiment, the method **300** comprises controlling the first **230** and second **235** safety switches to electrically isolate the door-lock device **215** from the door power line **DPL** when the door-lock device **215** is switched between the locked and unlocked state and vice-versa, and to electrically isolate the door-lock device **215** from the driving device **220** when the door power line **DPL** is connected to the main power line **MPL**. This allows preventing generation of sparks resulting from electric faults (such

as short-circuit faults and/or current leakages) affecting one or more of the electric/electronic loads **210** and/or the driving device **220**, and/or generation of sparks resulting from electrical disturbances (such as electrical fast transients).

[0104] According to the exemplary embodiment, the door-lock procedure implemented by the method **300** comprises the following steps **305-320**. According to an embodiment, the steps **305-320** are performed in sequence in the illustrated and discussed order (i.e., from step **305** to step **320**), although this should not be construed limitatively. According to the exemplary embodiment, as progressively detailed in the following while discussing the door-lock procedure, steps **310-320** are performed each one conditioned to a successful performing of the respective previous step (i.e., the immediately previous step) based on one or more of the status signals ST_{ES} , ST_1 , ST_2 (see decision steps **C₁-C₃**).

[0105] According to an embodiment, the door-lock procedure is run after the door **120** is closed and after a selected laundry treatment cycle is started by the user (e.g., after a starting command of the laundry treatment cycle, i.e., a command entered by the user for starting the laundry treatment cycle).

[0106] Let be considered, after the door **120** is closed (mechanical switch **225** in the closed state) and before running of the door-lock procedure (for example, in that no laundry treatment cycle has been selected by the user or the selected laundry treatment cycle is not started by the user), an initial condition in which the door-lock device **215** is in the unlocking state, the driving device **220** is in the deactivated state, and the first **230** and second **235** safety switches are in the open state. In this condition, no driving of the door-lock device **215** takes place, and no feeding of the AC supply voltage V_{SUPPLY} to the electric loads **210** is allowed. Advantageously, no sparks arise from the switching of the mechanical switch **225** in the closed state due to electric faults affecting the driving device **220**, in that the mechanical switch **225** is electrically isolated from the driving device **220** by means of the first safety switch **230** in the open state. Advantageously, no sparks arise from the switching of the mechanical switch **225** in the closed state due to electric faults in one or more of the electric/electronic loads **210** and/or to electric disturbances affecting the door power line **DPL**, in that the mechanical switch **225** is electrically isolated from the door power line **DPL** by means of the door-lock device **215** (in the unlocking state) and the second safety switch **235** (in the open state).

[0107] According to the exemplary embodiment, the method **300** runs the door-lock procedure after (e.g., upon or in response to) the selected laundry treatment cycle is started by the user (e.g., by pressing a respective start button or key on the laundry appliance **100**).

[0108] According to the exemplary embodiment, the method **300** comprises switching the first safety switch **230** into the closed state (step **305**). According to the exemplary embodiment, the switching of the first safety

switch **230** into the closed state is achieved by setting the control signal V_{CTRL1} at the high logic level. In this condition, no driving of the door-lock device **215** takes place, in that the driving device **220** is (still) in the deactivated state. Advantageously, any sparks arising from the switching of the first safety switch **230** (e.g., due to electric faults affecting the driving device **220**) do not result in any firing risks, in that the first safety switch **230** is sealed in the respective sealed housing **230_H** (whereby no refrigerant comes into contact with the first safety switch **230** and no spark leaves the respective sealed housing **230_H**).

[0109] According to the exemplary embodiment, the method **300** comprises controlling the driving device **220** to drive the door-lock device **215** to switch it into the closed state (step **310**). According to an embodiment, the control of the driving device **220** to drive the door-lock device **215** to switch it into the closed state is achieved by setting the control signal $V_{CTRL,D}$ at the activation level for the first time interval $T1$ (e.g., $T1 = 20$ ms). In this condition, the driving of the door-lock device **215** with the closing driving signal S_{CL} takes place, and the door-lock device **215** is switched into the locking state. Advantageously, no sparks arise from the switching of the door-lock device **215** in the locking state due to electric faults in one or more of the electric/electronic loads **210** and/or to electric disturbances affecting the door power line **DPL**, in that the door-lock device **215** is electrically isolated from the door power line **DPL** by means of the second safety switch **235** (still) in the open state.

[0110] According to the exemplary embodiment said controlling the driving device **220** to drive the door-lock device **215** to switch it into the locking state (step **310**) is performed conditioned to a successful switching of the first safety switch **230** into the closed state (exit branch **Y** of decision step **C₁**), e.g., based on a value of the status signal ST_1 provided by the sensing circuits **240**. According to the exemplary embodiment, in case of unsuccessful switching of the first safety switch **230** into the closed state (exit branch **N** of decision step **C₁**), the method **300** may end, repeat the previous step, and/or run additional procedures.

[0111] According to the exemplary embodiment, the method **300** comprises switching the first safety switch **230** into the open state (step **315**). According to the exemplary embodiment, the switching of the first safety switch **230** into the open state is achieved by setting the control signal V_{CTRL1} back to the low logic level. According to the exemplary embodiment, the control signal V_{CTRL1} is set back to the low logic level after the first time interval $T1$ has elapsed. In this condition, no driving of the door-lock device **215** takes place, in that the driving device **220** is in the deactivated state. Advantageously, in this phase no accidental or spurious or undesired driving of the door-lock device **215** (e.g., due to voltage spikes in the AC supply voltage V_{SUPPLY} and/or to electric faults affecting the driving device **220**) potentially causing

the door-lock device **215** to be switched back to unlocking state, takes place, in that the door-lock device **215** is electrically isolated from the driving device **220** by means of the first safety switch **230** in the open state. Advantageously, any sparks arising from the switching of the first safety switch **230** (e.g., due to electric faults affecting the driving device **220**) do not result in any firing risks, in that the first safety switch **230** is sealed in the respective sealed housing **230_H** (whereby no refrigerant comes into contact with sparks generated by the first safety switch **230** and no spark generated by the first safety switch **230** leaves the respective sealed housing **230_H**).

[0112] According to the exemplary embodiment, said switching the first safety switch **230** into the open state (step **315**) is performed conditioned to a successful switching of the door-lock device **215** into the closed state (exit branch **Y** of decision step **C₂**), e.g., based on a value of the status signal ST_{ES} provided by the sensing circuits **240**. According to the exemplary embodiment, in case of unsuccessful switching of the door-lock device **215** into the locking state (exit branch **N** of decision step **C₂**), the method **300** may end, repeat the previous step, and/or run additional procedures.

[0113] According to the exemplary embodiment, the method **300** comprises switching the second safety switch **235** into the closed state (step **320**). According to the exemplary embodiment, the switching of the second safety switch **235** into the closed state is achieved by setting the control signal $V_{CTRL,2}$ at the high logic level. According to the exemplary embodiment, the switching of the second safety switch **235** into the closed state decrees electrical connection between the main power line **MPL** and the door power line **DPL**, and the energization of the electric/electronic loads **210** (and hence the end of the door-lock procedure). Advantageously, any sparks arising from the switching of the second safety switch **235** into the closed state do not result in any firing risks, in that the second safety switch **235** is sealed in the respective sealed housing **235_H** (whereby no refrigerant comes into contact with sparks generated by the second safety switch **235** and no spark generated by the second safety switch **235** leaves the respective sealed housing **235_H**).

[0114] According to the exemplary embodiment, said switching the second safety switch **235** into the closed state (step **320**) is performed conditioned to a successful switching of the first safety switch **230** into the open state (exit branch **Y** of decision step **C₃**), e.g., based on a value of the status signal ST_1 provided by the sensing circuits **240**. According to the exemplary embodiment, in case of unsuccessful switching of the first safety switch **230** into the open state (exit branch **N** of decision step **C₃**), the method **300** may end, repeat the previous step, and/or run additional procedures.

[0115] According to the exemplary embodiment, the door-unlock procedure implemented by the method **300** comprises the following steps **325-340**. According to the exemplary embodiment, the steps **325-340** are per-

formed in sequence in the illustrated and discussed order (i.e., from step 325 to step 340), although this should not be construed limitatively. According to the exemplary embodiment, as progressively detailed in the following while discussing the door-unlock procedure, steps 330-340 are performed each one conditioned to a successful performing of the respective previous step (i.e., the immediately previous step) based on one or more of the status signals ST_{ES}, ST_1, ST_2 (see decision steps C_4-C_6).

[0116] According to the exemplary embodiment, the door-unlock procedure is run after the selected (and ongoing) laundry treatment cycle has ended or interrupted (e.g., due to malfunctions of one or more components of the laundry appliance 100). According to the exemplary embodiment, the door-unlock procedure is run after the selected laundry treatment cycle has ended or interrupted, and in response to a positive outcome of a safety procedure aimed at assessing the absence of critical/dangerous conditions for safely accessing the drum 110. Just as an example, the safety procedure may comprise a check of one or more operative parameters of the laundry appliance 100, including (but not limited to) water level in the tub, water temperature, drum speed, working voltages).

[0117] Let be considered, before the running of the door-unlock procedure (for example, in that the selected laundry treatment cycle has not ended or interrupted, or in that no outcome of the safety procedure is available), an initial condition in which the door 120 is closed (mechanical switch 225 in the closed state), the door-lock device 215 is in the locking state, the driving device 220 is in the deactivated state, the first safety switch 230 is in the open state and the second safety switch 235 is in the closed state. In this condition, no accidental or spurious or undesired driving of the door-lock device 215 (e.g., due to voltage spikes in the AC supply voltage V_{SUPPLY} and/or to electric faults affecting the driving device 220) potentially causing the door-lock device 215 to be switched back to the unlocking state, take place, in that the door-lock device 215 is electrically isolated from the driving device 220 by means of the first safety switch 230 in the open state, and feeding of the AC supply voltage V_{SUPPLY} to the electric/electronic loads 210 (or to a selected subset thereof) is allowed through electrical connection between the main power line MPL and the door power line DPL by means of the door-lock device 215 (in the locked state) and the second safety switch 235 (in the closed state).

[0118] According to the exemplary embodiment, the method 300 runs the door-unlock procedure after (e.g., upon or in response to) the selected (and ongoing) laundry treatment cycle has ended or interrupted, and/or in response to a positive outcome of the safety procedure.

[0119] According to the exemplary embodiment, the method 300 comprises switching the second safety switch 235 into the open state (step 325). According to the exemplary embodiment, the switching of the second safety switch 235 into the open state is achieved by set-

ting the control signal $V_{CTRL,2}$ at the low logic level. In this condition, no driving of the door-lock device 215 takes place, in that the driving device 220 is (still) in the deactivated state. Advantageously, any sparks arising from the switching of the second safety switch 235 do not result in any firing risks, in that the second safety switch 235 is sealed in the respective sealed housing 235_H (whereby no refrigerant comes into contact with sparks generated by the second safety switch 235 and no spark generated by the second safety switch 235 leaves the respective sealed housing 235_H).

[0120] According to the exemplary embodiment, the method 300 comprises switching the first safety switch 230 into the closed state (step 330). According to an embodiment, the switching of the first safety switch 230 into the closed state is achieved by setting the control signal $V_{CTRL,1}$ at the high logic level. In this phase, no driving of the door-lock device 215 takes place, in that the driving device 220 is (still) in the deactivated state. Advantageously, any sparks arising from the switching of the first safety switch 230 (e.g., due to electric faults affecting the driving device 220) do not result in any firing risks, in that the first safety switch 230 is sealed in the respective sealed housing 230_H (whereby no refrigerant comes into contact with the first safety switch 230 and no spark leaves the respective sealed housing 230_H).

[0121] According to the exemplary embodiment, said switching the first safety switch 230 into the closed state (step 330) is performed conditioned to a successful switching of the second safety switch 235 into the open state (exit branch Y of decision step C_4), e.g., based on a value of the status signal ST_2 provided by the sensing circuits 240. According to the exemplary embodiment, in case of unsuccessful switching of the second safety switch 235 into the open state (exit branch N of decision step C_4), the method 300 may end, repeat the previous step, and/or run additional procedures.

[0122] According to the exemplary embodiment, the method 300 comprises controlling the driving device 220 to drive the door-lock device 215 to switch it into the unlocking state (step 335). According to the exemplary embodiment, the control of the driving device 220 to drive the door-lock device 215 to switch it into the unlocking state is achieved by setting the control signal $V_{CTRL,D}$ at the activation level for the second time interval T_2 (e.g., $T_2 = 60$ ms). In this condition, the driving of the door-lock device 215 with the opening driving signal S_{OP} takes place, and the door-lock device 215 is switched into the open state. Advantageously, no sparks arise from the switching of the door-lock device 215 into the open state due to electric faults in one or more of the electric/electronic loads 210 and/or to electric disturbances affecting the door power line DPL, in that the door-lock device 215 is electrically isolated from the door power line DPL by means of the second safety switch 235 in the open state.

[0123] According to the exemplary embodiment said controlling the driving device 220 to drive the door-lock device 215 to switch it into the unlocking state (step 335)

is performed conditioned to a successful switching of the first safety switch **230** into the closed state (exit branch **Y** of decision step **C₅**), e.g., based on a value of the status signal ST_1 . According to the exemplary embodiment, in case of unsuccessful switching of the first safety switch **230** into the closed state (exit branch **N** of decision step **C₅**), the method **300** may end, repeat the previous step, and/or run additional procedures.

[0124] According to the exemplary embodiment, the method **300** comprises switching the first safety switch **230** into the open state (step **340**). According to the exemplary embodiment, the switching of the first safety switch **230** into the open state is achieved by setting the control signal $V_{CTRL,1}$ back to the low logic level. According to the exemplary embodiment, the control signal $V_{CTRL,1}$ is set back to the low logic level after the second time interval T_2 has elapsed. In this phase, no driving of the door-lock device **215** takes place, in that the driving device **220** is in the deactivated state. Advantageously, in this phase any accidental or spurious or undesired driving of the door-lock device **215** (e.g., due to voltage spikes in the AC supply voltage V_{SUPPLY} and/or to electric faults affecting the driving device **220**) potentially causing the door-lock device **215** to be switched back to the locking state, are avoided, in that the door-lock device **215** is electrically isolated from the driving device **220** by means of the first safety switch **230** in the open state. Advantageously, any sparks arising from the switching of the first safety switch **230** (e.g., due to electric faults affecting the driving device **220**) do not result in any firing risks, in that the first safety switch **230** is sealed in the respective sealed housing **230_H** (whereby no refrigerant comes into contact with sparks generated by the first safety switch **230** and no spark generated by the first safety switch **230** leaves the respective sealed housing **230_H**).

[0125] According to the exemplary embodiment, said switching the first safety switch **230** into the open state (step **340**) is performed conditioned to a successful switching of the door-lock device **215** into the open state (exit branch **Y** of decision step **C₆**), e.g., based on a value of the status signal ST_{ES} provided by the sensing circuits **240**. According to the exemplary embodiment, in case of unsuccessful switching of the door-lock device **215** into the open state (exit branch **N** of decision step **C₆**), the method **300** may end, repeat the previous step, and/or run additional procedures.

[0126] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the disclosure described above many logical and/or physical modifications and alterations. More specifically, although the disclosure has been described with a certain degree of particularity with reference to preferred embodiments thereof, it should be understood that various omissions, substitutions and changes in the form and details as well as other embodiments are possible. In particular, different embodiments of the disclosure may even be practiced without the specific details (such as the numeric

examples) set forth in the preceding description for providing a more thorough understanding thereof; on the contrary, well-known features may have been omitted or simplified in order not to obscure the description with unnecessary particulars.

[0127] For example, the laundry appliance may have a different structure or include equivalent components. Moreover, any component of the laundry appliance may be separated into several elements, or two or more components may be combined into a single element; furthermore, each component can be replicated to support the execution of the corresponding operations in parallel. It should also be noted that (unless otherwise indicated) any interaction between different components generally does not need to be continuous and may be either direct or indirect through one or more intermediaries.

[0128] Moreover, the present disclosure lends itself to be implemented through an equivalent method (by using similar steps, removing some steps being not essential, or adding further optional steps); moreover, the steps may be performed in different order, concurrently or in an interleaved way (at least partly).

Claims

1. Laundry treatment appliance (**100**) comprising:

- a casing (**105**);
- a drum (**110**) mounted inside said casing (**105**) and designed to receive laundry;
- a heat pump system (**125**) comprising a closed recirculation circuit containing a refrigerant;
- a door (**120**) to give access to the drum (**110**);
- a main power line (**MPL**) providing an AC supply voltage (V_{SUPPLY});
- a door power line (**DPL**) connectable to the main power line (**MPL**) to receive the AC supply voltage (V_{SUPPLY});
- a door-lock device (**215**) switchable into a locking or unlocking state to respectively lock or unlock the door (**120**) to respectively allow or prevent connection between the door power line (**DPL**) and the main power line (**MPL**);
- a switching arrangement (**SA**) connected to the door-lock device (**215**);
- a driving device (**220**) configured to drive the door-lock device (**215**) to switch it into the locking or unlocking state, and

a control unit (**245**) configured to control the switching arrangement (**SA**) and the driving device (**220**) during a door-lock procedure and a door-unlock procedure, wherein the switching arrangement (**SA**) comprises a first safety switch (**230**) switchable into a closed or an open state for respectively allowing or preventing connec-

- tion between the driving device (220) and the door-lock device (215), and a second safety switch (235) switchable into a closed or an open state for respectively allowing or preventing connection between the door-lock device (215) and the door power line (DPL), the first (230) and second (235) safety switches being arranged each one in a respective sealed housing (230_H, 235_H), so as to prevent leakages of refrigerant from entering the first (230) and second (235) safety switches, and wherein the control unit (245) is configured to control the first (230) and second (235) safety switches to avoid a concurrent closed state of the first (230) and second (235) safety switches during the door-lock procedure and the door-unlock procedure.
2. Laundry treatment appliance (100) according to claim 1, wherein the control unit (245) is configured to control the first (230) and second (235) safety switches to electrically isolate the door-lock device (215) from the door power line (DPL) when the door-lock device (215) is switched between the locking and unlocking state and vice-versa, and to electrically isolate the door-lock device (215) from the driving device (220) when the door power line (DPL) is connected to the main power line (MPL).
 3. Laundry treatment appliance (100) according to claim 1 or 2, wherein during the door-lock procedure the control unit (245) is configured to perform the following steps:
 - (i) switch (305) the first safety switch (230) into the closed state;
 - (ii) control (310) the driving device (220) to drive the door-lock device (215) to switch it into the locking state;
 - (iii) switch (315) the first safety switch (230) into the open state, and
 - (iv) switch (320) the second safety switch (235) into the closed state.
 4. Laundry treatment appliance (100) according to any of the preceding claims, wherein during the door-unlock procedure the control unit (245) is configured to:
 - (a) switch (325) the second safety switch (235) into the open state;
 - (b) switch (330) the first safety switch (230) into the closed state;
 - (c) control (335) the driving device (220) to drive the door-lock device (215) to switch it into the unlocking state, and
 - (d) switch (340) the first safety switch (230) into
- the open state.
5. Laundry treatment appliance (100) according to claim 3, further comprising one or more sensing circuits (240) configured to provide one or more signals (ST_{ES}, ST_1, ST_2) indicative of a state of at least one among the door-lock device (215), the first safety switch (230) and the second safety switch (235), wherein the control unit (245) is configured to perform each one of at least one among steps (ii), (iii), and (iv) if a respective previous step based on said one or more signals (ST_{ES}, ST_1, ST_2) has been successfully performed.
 6. Laundry treatment appliance (100) according to claim 4, further comprising one or more sensing circuits (240) configured to provide one or more signals (ST_{ES}, ST_1, ST_2) indicative of a state of at least one among the door-lock device (215), the first safety switch (230) and the second safety switch (235), wherein the control unit (245) is configured to perform each one of at least one among steps (b), (c), and (d) if a respective previous step based on said one or more signals (ST_{ES}, ST_1, ST_2) has been successfully performed.
 7. Laundry treatment appliance (100) according to any of the preceding claims, wherein the laundry treatment appliance comprises a combined washer/dryer.
 8. Method (300) for operating a laundry treatment appliance (100), wherein the laundry treatment appliance comprises:
 - a heat pump system (125) comprising a closed recirculation circuit containing a refrigerant;
 - a main power line (MPL) providing an AC supply voltage (V_{SUPPLY});
 - a door power line (DPL) connectable to the main power line (MPL) to receive the AC supply voltage (V_{SUPPLY});
 - a door-lock device (215) switchable into a locking or unlocking state to respectively lock or unlock the door (110) to respectively allow or prevent connection between the door power line (DPL) and the main power line (MPL), and
 - a switching arrangement (SA) connected to the door-lock device (215), wherein the switching arrangement (SA) comprises a first safety switch (230) switchable into a closed or an open state for respectively allowing or preventing connection between the driving device (220) and the door-lock device (215), and a second safety switch (235) switchable into a closed or an open state for respectively allowing or preventing connection between the door-lock device (215) and the door power line (DPL), the first (230) and

second (235) safety switches being arranged each one in a respective sealed housing (230_H, 235_H), so as to prevent leakages of refrigerant from entering the first (230) and second (235) safety switches,

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wherein the method comprises controlling the first (230) and second (235) safety switches to avoid a concurrent closed state of the first (230) and second (235) safety switches during door-lock and door-unlock procedures.

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9. Method (300) according to claim 8, wherein the method comprises controlling the first (230) and second (235) safety switches to electrically isolate the door-lock device (215) from the door power line (DPL) when the door-lock device (215) is switched between the locking and unlocking states, and to electrically isolate the door-lock device (215) from the driving device (220) when the door power line (DPL) is connected to the main power line (MPL).

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10. Method (300) according to claim 8 or 9, wherein the method comprises, during the door-lock procedure:

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- (i) switching (305) the first safety switch (230) into the closed state;
- (ii) driving the door-lock device (215) to switch it into the locking state;
- (iii) switching (315) the first safety switch (230) into the open state, and
- (iv) switching (320) the second safety switch (235) into the closed state.

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11. Method (300) according to any of the preceding claims, wherein the method comprises, during the door-unlock procedure:

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- (a) switching (325) the second safety switch (235) into the open state;
- (b) switching (330) the first safety switch (230) into the closed state;
- (c) driving the door-lock device (215) to switch it into the unlocking state, and
- (d) switching (340) the first safety switch (230) into the open state.

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12. Method (100) according to claim 10, further comprising performing each one of at least one among steps (ii), (iii), and (iv) if a respective previous step (C₁-C₃) has been successfully performed.

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13. Method (100) according to claim 11, further comprising performing each one of at least one among steps (b), (c), and (d) if a respective previous step (C₄-C₆) if a respective previous step based on said one or more signals (ST_{ES}, ST₁, ST₂) has been successfully performed.

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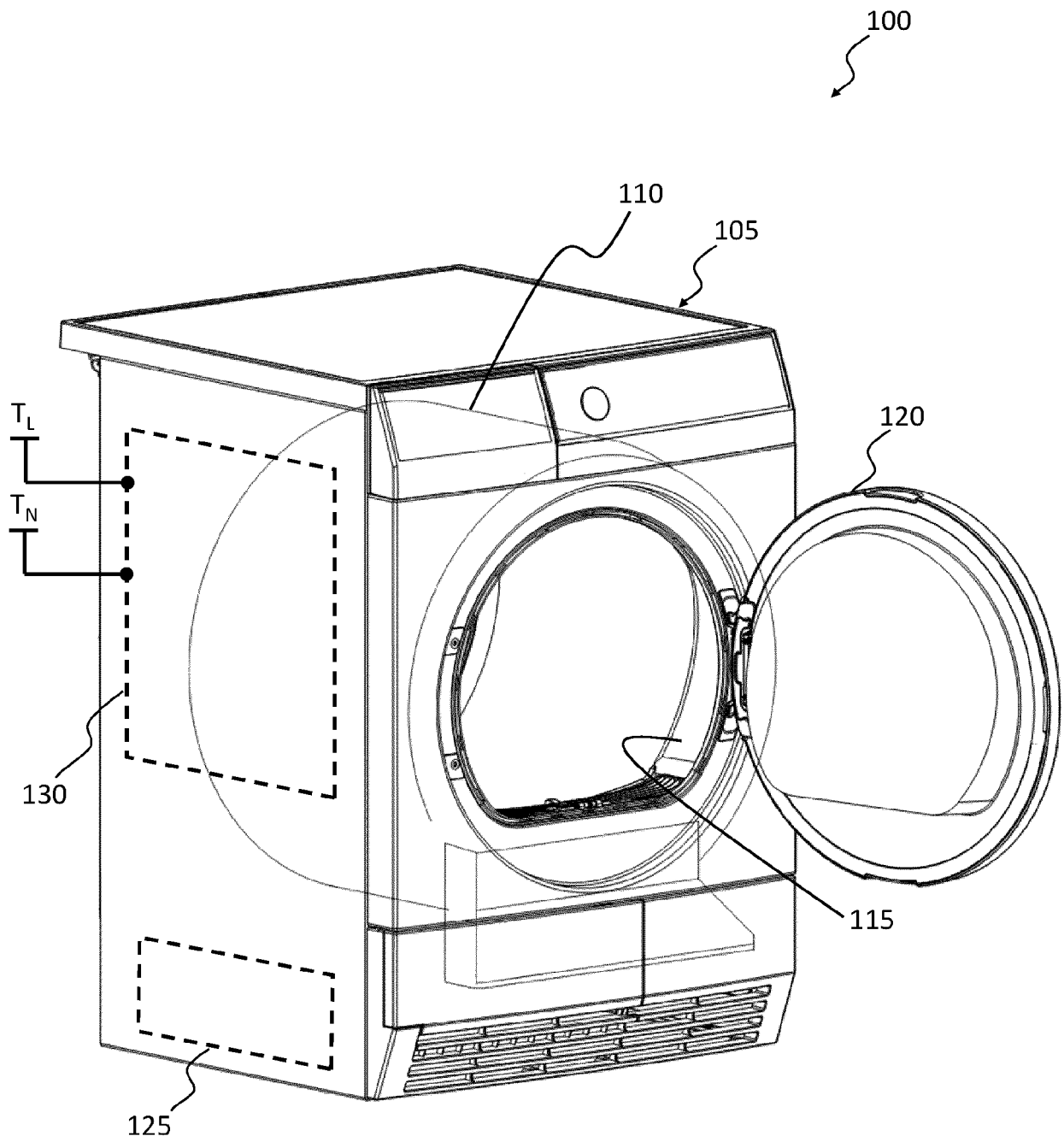


Figure 1

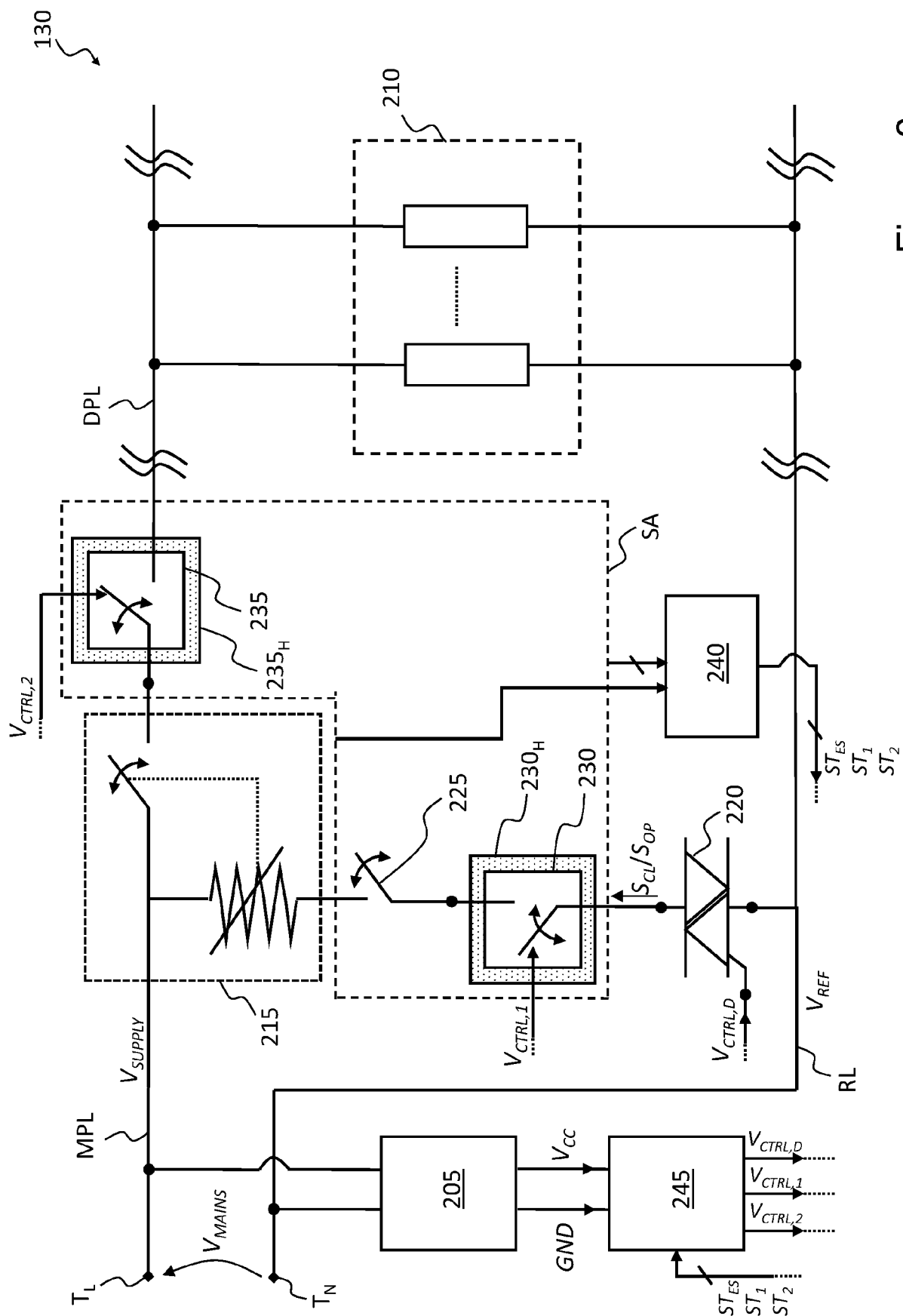
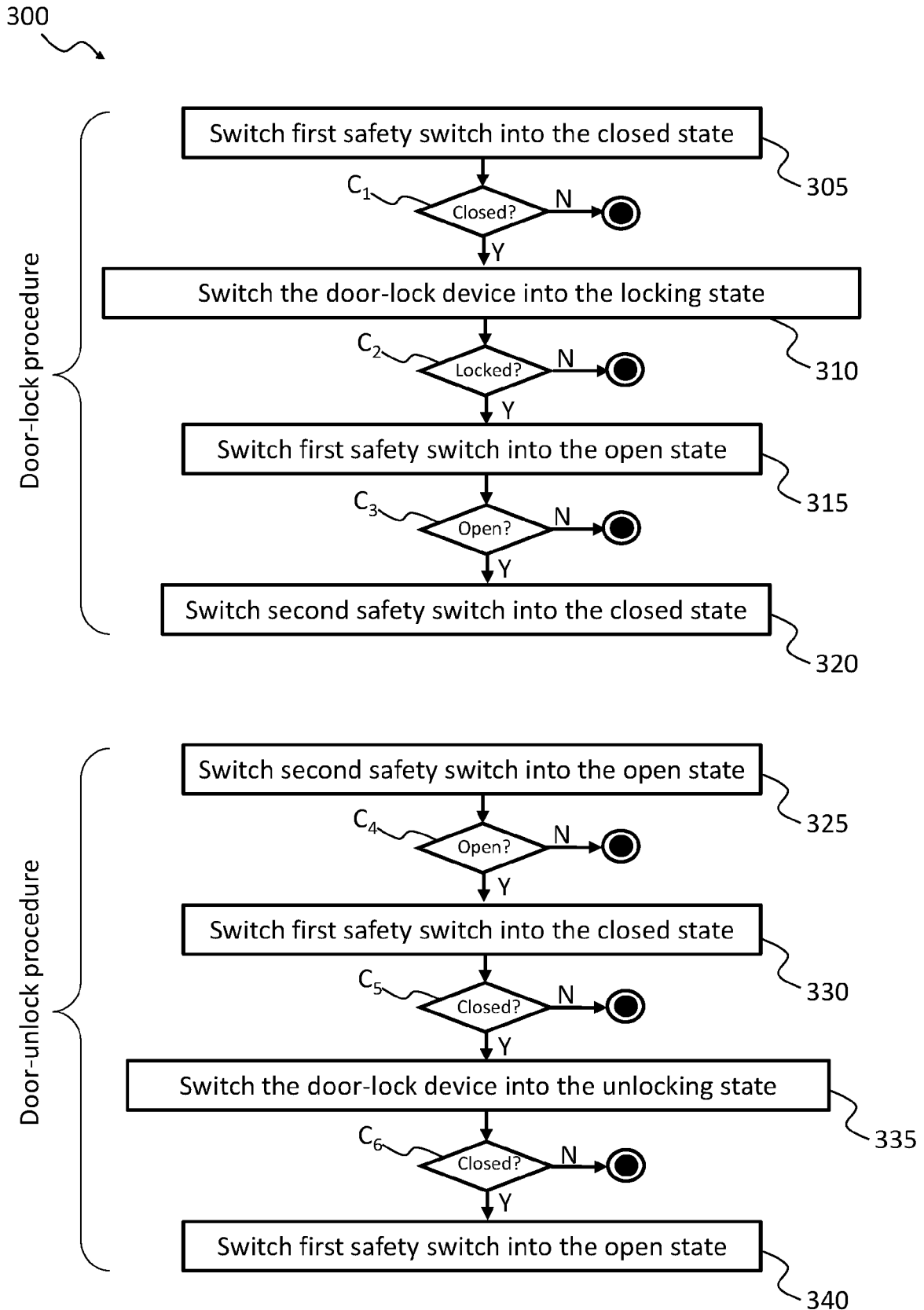


Figure 2





EUROPEAN SEARCH REPORT

Application Number

EP 22 21 3556

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 May 2023	Examiner Rakotonanahary, S
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The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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