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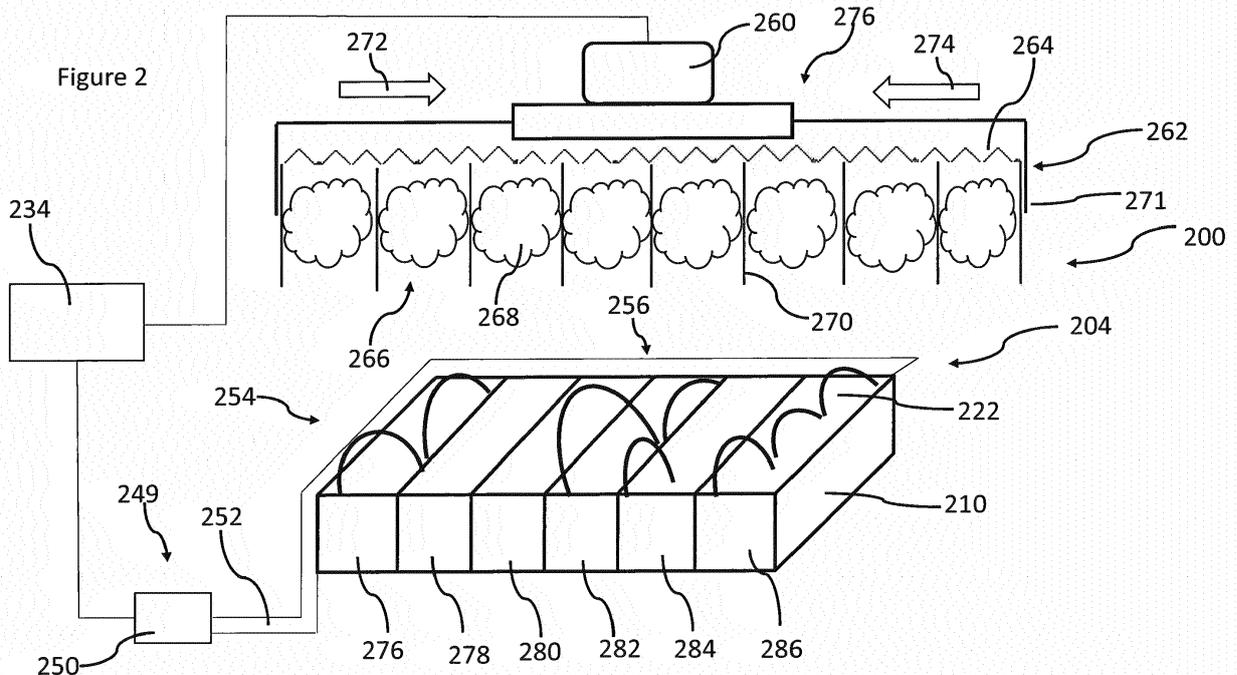
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(54) **DISHWASHING MACHINE**

(57) There is disclosed a dishwashing machine (100, 200) comprising a moisture absorption device (262) for absorbing moisture from one or more items (114, 222) drying in the dishwashing machine. The dishwashing machine comprises a controller (134, 234) for controlling

operation of a compression mechanism (276) of the moisture absorption device (262), for compressing and squeezing moisture out of the moisture absorption device (262).



## Description

### Technical Field

**[0001]** The present disclosure relates to a dishwashing machine.

### Background

**[0002]** Dishwashing machines (also referred to as dishwashers) are used for washing items such as crockery and cutlery. A known dishwashing machine comprises a washing compartment for holding one or more items to be washed, and a washing mechanism for washing those items. Typically a user can select from a plurality of pre-defined washing cycles via a user interface on a front face of the dishwashing machine.

### Summary

**[0003]** According to a first aspect disclosed herein, there is provided a dishwashing machine comprising: a moisture absorption device for absorbing moisture from one or more items drying in the dishwashing machine; the dishwashing machine comprising a controller for controlling operation of a compression mechanism of the moisture absorption device, for compressing and squeezing moisture out of the moisture absorption device.

**[0004]** According to an example, the controller is arranged to control the compression mechanism to compress the moisture absorption device in response to determining that the one or more items have been removed from the machine.

**[0005]** According to an example, the moisture absorption device comprises one or more moisture absorbing elements, the moisture absorbing elements comprising cotton.

**[0006]** According to an example, the compression mechanism comprises a framework comprising one or more grids arranged adjacent to the one or more moisture absorbing elements, the one or more moisture absorbing elements arranged to be compressed against the one or more grids.

**[0007]** According to an example, the dishwashing machine comprises a motor for compressing the compression mechanism.

**[0008]** According to an example, the compression mechanism comprises a spring for returning the compression mechanism to an uncompressed state.

**[0009]** According to an example, water squeezed out of the moisture absorption device is collected at a base of the dishwashing machine.

**[0010]** According to an example, the dishwashing machine comprises a drying device for drying the one or more items.

**[0011]** According to an example, the drying device comprises a light radiation source, and a light conduit

extending within the dishwashing machine, the light conduit arranged to direct light from the light radiation source through the conduit and on to the one or more items.

**[0012]** According to an example, the light radiation source comprises an infra-red light source.

**[0013]** According to an example, the dishwashing machine comprises a plurality of light radiation sources.

**[0014]** According to an example, the dishwashing machine comprises a plurality of light conduits.

**[0015]** According to an example, the light conduit is flexible.

**[0016]** According to an example, the light conduit comprising a fibre optic cable.

**[0017]** According to a second aspect there is provided a dishwashing machine comprising a drying device for drying one or more items in the dishwashing machine, wherein the drying device comprises a light radiation source, and a light conduit extending within the dishwashing machine, the light conduit arranged to direct light from the light radiation source through the conduit and on to the one or more items to be dried.

### Brief Description of the Drawings

**[0018]** To assist understanding of the present disclosure and to show how embodiments may be put into effect, reference is made by way of example to the accompanying drawings in which:

Figure 1 shows schematically a dishwashing machine according to an example;

Figure 2 shows schematically a portion of a dishwashing machine according to an example;

Figure 3 shows schematically a process according to an example.

### Detailed Description

**[0019]** The present disclosure has applicability to dishwashing machines or dishwashers. Dishwashing machines are used to automate the washing of items associated with food preparation and/or cooking and/or eating. Such items include crockery such as plates, bowls, cups, mugs etc. Such items may also include cutlery such as knives, forks, spoons, or indeed any other cooking or eating utensil. Other items that may be washed include glassware, food containers etc.

**[0020]** Figure 1 schematically shows an example of a dishwashing machine 100. The dishwashing machine 100 comprises a main body 102, within which there is a washing compartment or chamber 104. The washing compartment 104 comprises a lower portion 106 and an upper portion 108. The lower portion 106 comprises a tray or rack 110 for holding items to be washed, and the upper portion 108 comprises a tray or rack 112 for holding items to be washed. The racks 110 and 112 can be moved

in and out of the washing compartment 104 on roller assemblies.

**[0021]** Items to be washed are schematically shown at 114. In this case the items to be washed are schematically represented by plates 116 and 118 on rack 112, and plates 120 and 122 on rack 120. Of course there may alternatively be any other type of item to be washed or combination of items to be washed. In the example of Figure 1 a washing mechanism 123 comprises spray arm 124 in lower portion 106, and spray arm 126 in upper portion 108. In other examples the upper spray arm 126 is omitted. Each spray arm comprises a series of holes or nozzles which can spray water upwardly towards the items to be washed 114, while the spray arms 124 and 126 rotate.

**[0022]** The dishwashing machine 100 further comprises water inlet 128 and water outlet 130 for enabling water to be fed to and taken away from the dishwashing machine respectively. In some examples a heater element (not shown) is provided for heating water as necessary. In other examples hot and cold water is drawn from a building's supply as required. A power connection is schematically shown at 132, which enables the dishwashing machine to be connected to mains electrical power for powering the dishwashing machine.

**[0023]** A controller is schematically shown at 134 for controlling operations of the dishwashing machine. The controller may comprise at least one memory and at least one processor. The controller 134 can, for example, cause the dishwashing machine to operate according to one or more pre-determined washing cycles selected via a user interface 136. The available washing cycles may differ from each other by temperature and/or duration, for example. Via the user interface 136 a user may also be able to select whether the washing cycle is for a full or half load. A display 138 is also provided which can display information to the user. This may include information such as confirming a user's washing cycle selection, as well as information such as time remaining of a washing cycle that is in progress.

**[0024]** A door of the dishwashing machine is schematically shown at 140. The door 140 is connected to main body 120 via hinges 142 and 144. In Figure 1 the door is in an open position enabling access to washing compartment 104. The door 140 may be moved to a closed position so that the washing compartment 104 is then substantially enclosed. The door 140 may also include a receptacle for holding dishwashing detergent (e.g. a dishwashing machine cube) which can be released in to the dishwashing machine during a wash. The receptacle for holding washing detergent may of course also be positioned elsewhere within the dishwashing machine. The dishwashing machine may also include one or more further receptacles for containing dishwashing machine salt and/or rinse aid, for example.

**[0025]** A washing cycle generally comprises three main stages: (i) wetting; (ii) injection of detergent, (iii) rinsing, although in some examples one or more of these

steps may be omitted. For example a rinse wash may include just a rinsing cycle. Whichever steps are included or not included, the washing of the washing load may be generally termed a washing cycle.

**[0026]** After washing, the washing load dries in the washing compartment. This may be active or assisted drying where an element, such as a heater or light source is provided for drying the washed load, or passive or natural drying where the washing load simply dries in the washing compartment over time. However drying is achieved, this may be termed a drying process. Active drying helps to remove water droplets from the washing load at the end of the washing cycle, which reduces staining of the washing load and may also improve hygiene of the washing load and dishwashing machine.

**[0027]** According to some examples, after the washing cycle the washing load is subjected to drying by a drying device or drying arrangement, so as to dry remaining water droplets on the washing load. The drying device may comprise a radiation source. The radiation source may, for example, be an infra-red (IR) radiation source. The water droplets are converted into water vapour by the drying device. A moisture absorption device in the dishwashing machine absorbs the water vapour. In some examples the moisture absorption device comprises compressed cotton. This is described in more detail with respect to Figure 2.

**[0028]** Figure 2 schematically shows a portion of a washing compartment 204 of a dishwashing machine 200 according to an example. The dishwashing machine 200 comprises drying device or drying arrangement shown generally at 249. In this example the drying device 249 comprises a radiation source 250. For example the radiation source may be a light radiation source. For example the radiation source may be an IR or UV radiation source. The radiation source is arranged to irradiate a washing load with light after a washing cycle has completed, so as to vaporize any remaining water droplets on the washing load. In this example the radiation source is attached to a light transmission conduit, pipe or tube 252. The light transmission conduit 252 is transparent. The light transmission conduit 252 may be made of a flexible material such as plastic. In this example the light transmission conduit 252 passes around a side 254 and a back side 256 of a rack 210 holding a washing load 222. This is by way of example only, and in other examples the light transmission conduit may be arranged differently. The light transmission conduit may be attached to an interior surface of the washing compartment 204 of the dishwashing machine. For example, the washing compartment 204 may comprise a base surface, a top surface or ceiling opposite the base surface, and at least one side surface between the base surface and the top surface. The side surface may include an interior surface of the door of the dishwashing machine. The light transmission conduit 252 may be arranged on one or more of these surfaces. Additionally or alternatively the light transmission conduit 252 may be attached to rack 204

(and indeed any further racks in the dishwashing machine). In such an example a spare or slack length of the light transmission conduit may be provided, so that the rack 204 can be safely pulled in and out of the dishwashing machine for loading and unloading. A take-up mechanism may be provided in such examples for taking up the slack length of the light transmission conduit. In some examples it may be said that the light transmission conduit 254 is arranged to surround or substantially surround a washing load. The light transmission conduit 252 is arranged to direct and transmit light from the radiation source 250. In some examples the light transmission conduit comprises flexible pipe or cable. In some examples the light transmission conduit may comprise one or more bends along its length. In some examples the light transmission conduit may extend in a serpentine manner in the dishwashing machine. In some examples the light transmission conduit comprises fibre optic cable.

**[0029]** In the example of Figure 2 the washing rack 210 comprises compartments 276, 278, 280, 282, 284 and 286. In some examples the light transmission conduit 254 may pass along or between these compartments. For example the light transmission conduit 254 may pass between the compartments in a serpentine manner.

**[0030]** It will be understood that the light transmission conduit 250 enables a surface area of a washing load to be more fully irradiated than if, for example, a bulb placed in the washing compartment is used for irradiation purposes. The light transmission conduit enables irradiation of sections of the washing compartment which may otherwise be shaded from light (e.g. by tall plates in the washing load).

**[0031]** Although in the example of Figure 2 a single irradiation source 250 and a single light transmission conduit 254 is shown, it will be understood that in other examples there may be more than one irradiation source and/or light transmission conduit. That is in some examples there may be considered to be a network of light transmission conduits. The network of light transmission conduits may originate from a single irradiation source, or from multiple irradiation sources.

**[0032]** As the water droplets are excited by the irradiation incident thereon (e.g. IR light), the water droplets are vaporized in to water vapour. A moisture absorption device, shown generally at 262, absorbs this water vapour, so as to aid the drying process. The moisture absorption device 262 comprises one or more moisture absorbing elements 266, one of which is labelled at 268. In this example eight moisture absorption elements 266 are provided, although in other examples more or fewer may be provided. Larger dishwashing machines may have relatively more of such moisture absorption elements, and smaller dishwashing machines may have relatively fewer of such moisture absorption elements. In some examples the one or more moisture absorption elements 266 comprise cotton, for example cotton wool. The cotton may be compressed cotton (i.e. pre-compressed prior to insertion in to the machine and prior to further compression

by the compression mechanism, in use).

**[0033]** According to some examples the one or more moisture absorbing elements 266 can be compressed or squeezed, so as to squeeze or wring out water that has been absorbed by the one or more water absorbing elements 266. To this end, a compression device 276 is provided. The compression device 276 comprises a motor 260 which is arranged to cause a frame 271 holding the moisture absorbing elements 266 to be compressed, when the motor 260 is driven, as represented by arrows 272 and 274. The frame 271 may be considered a piston. In this example the frame 271 comprises a plurality of plates or grids, each plate or grid being adjacent to a respective moisture absorbing element 266. In Figure 2 such a plate or grid is shown at 270. A spring 264 is arranged to return the compression device back to its uncompressed state after the moisture has been squeezed out of the moisture absorbing elements 266. The spring may be a compression spring, such as a helical spring. Additionally or alternatively the motor 260 may be driven in a reverse direction to decompress the compression device 276. In some examples the compression device 276 is arranged to operate after a washed load has been removed from the dishwashing machine. This ensures that water squeezed out of the moisture absorbing elements 266 does not drip back on to the washed load which has been dried. In some examples operation of the compression device 276 is carried out automatically after a washing cycle has been completed and the washing load has been removed from the dishwashing machine 200. To this end the controller is capable of determining when the washing load has been removed. This may be based upon a determined weight of items in the dishwashing machine, which may be determined using weighing scales in communication with the controller 234. Additionally or alternatively an optical sensor or camera may be in communication with controller 234, and can provide information to the controller 234 indicative of when the dishwashing machine has been emptied. Additionally or alternatively a user of the dishwashing machine may be able to control operations of the compression device 276, for example via the user interface of the washing machine.

**[0034]** The moisture absorption device 262 described above can therefore be dried by having the water squeezed or wrung out of it. By drying the moisture absorption device 262 its hygiene levels and longevity can be improved compared to if the moisture absorption device was not dried. Water squeezed out of the moisture absorption device 262 can be collected at a base of the dishwasher.

**[0035]** A controller 234 is operable to control the operation of the drying device and the compression device 276, in addition to controlling other aspects of the dishwashing machine. For example the controller 234 may determine when to operate the drying device and when to operate (e.g. compress and decompress) the compression device 276.

**[0036]** An example operation is shown in the flow chart of Figure 3. This assumes that the dishwashing machine has been loaded by a user with a load to be washed.

**[0037]** At S1 a washing cycle is initiated. This may comprise a user selecting an appropriate washing cycle and initiating the washing cycle via the user interface of the dishwashing machine.

**[0038]** At S2 the washing cycle is complete.

**[0039]** At S3 the drying cycle is initiated. This may be initiated automatically by the controller, for example in response to determining that the washing cycle has been completed. Alternatively the drying cycle is initiated by a user via the user interface of the dishwashing machine. The drying cycle may be carried out in the manner described above with respect to Figure 2, for example by means of an IR irradiation source. In some examples a duration of the drying cycle is between 15 and 20 minutes.

**[0040]** At S4 the drying cycle is complete.

**[0041]** At S5 it is determined whether the washing load has been removed from the machine. This determination step may be carried out by a user, or automatically by the dishwashing machine as described above.

**[0042]** At S6 the compression cycle is initiated to remove moisture from the moisture absorbing elements of the dishwashing machine. Again, this may be carried out by a user via a user interface of the dishwashing machine, or it may be carried out automatically by the controller of the dishwashing machine, following S5.

**[0043]** At S7, the compression cycle is complete, which ends the process.

**[0044]** It will be understood that the compression mechanism disclosed enables the moisture absorption elements to be dried without having to remove the moisture absorption device from the dishwashing machine. This is convenient for a user.

**[0045]** It will be understood that the processor or processing system or circuitry referred to herein may in practice be provided by a single chip or integrated circuit or plural chips or integrated circuits, optionally provided as a chipset, an application-specific integrated circuit (ASIC), field-programmable gate array (FPGA), digital signal processor (DSP), graphics processing units (GPUs), etc. The chip or chips may comprise circuitry (as well as possibly firmware) for embodying at least one or more of a data processor or processors, a digital signal processor or processors, baseband circuitry and radio frequency circuitry, which are configurable so as to operate in accordance with the exemplary embodiments. In this regard, the exemplary embodiments may be implemented at least in part by computer software stored in (non-transitory) memory and executable by the processor, or by hardware, or by a combination of tangibly stored software and hardware (and tangibly stored firmware).

**[0046]** Reference is made herein to data storage for storing data. This may be provided by a single device or by plural devices. Suitable devices include for example a hard disk and non-volatile semiconductor memory.

**[0047]** Although at least some aspects of the embodiments described herein with reference to the drawings comprise computer processes performed in processing systems or processors, the invention also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the invention into practice. The program may be in the form of non-transitory source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other non-transitory form suitable for use in the implementation of processes according to the invention. The carrier may be any entity or device capable of carrying the program. For example, the carrier may comprise a storage medium, such as a solid-state drive (SSD) or other semiconductor-based RAM; a ROM, for example a CD ROM or a semiconductor ROM; a magnetic recording medium, for example a floppy disk or hard disk; optical memory devices in general; etc.

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

## Claims

1. A dishwashing machine comprising:
  - a moisture absorption device for absorbing moisture from one or more items drying in the dishwashing machine;
  - the dishwashing machine comprising a controller for controlling operation of a compression mechanism of the moisture absorption device, for compressing and squeezing moisture out of the moisture absorption device.
2. A dishwashing machine according to claim 1, wherein the controller is arranged to control the compression mechanism to compress the moisture absorption device in response to determining that the one or more items have been removed from the machine.
3. A dishwashing machine according to claim 1 or claim 2, wherein the moisture absorption device comprises one or more moisture absorbing elements, the moisture absorbing elements comprising cotton.
4. A dishwashing machine according to any of claims

- 1 to 3, wherein the compression mechanism comprises a framework comprising one or more grids arranged adjacent to the one or more moisture absorbing elements, the one or more moisture absorbing elements arranged to be compressed against the one or more grids. 5
5. A dishwashing machine according to any of claims 1 to 4, wherein the dishwashing machine comprises a motor for compressing the compression mechanism. 10
6. A dishwashing machine according to any of claims 1 to 5, wherein the compression mechanism comprises a spring for returning the compression mechanism to an uncompressed state. 15
7. A dishwashing machine according to any of claims 1 to 6, wherein water squeezed out of the moisture absorption device is collected at a base of the dishwashing machine. 20
8. A dishwashing machine according to any of claims 1 to 7, comprising a drying device for drying the one or more items. 25
9. A dishwashing machine according to claim 8, wherein the drying device comprises a light radiation source, and a light conduit extending within the dishwashing machine, the light conduit arranged to direct light from the light radiation source through the conduit and on to the one or more items. 30
10. A dishwashing machine according to claim 9, wherein the light radiation source comprises an infra-red light source. 35
11. A dishwashing machine according to claim 9 or claim 10, wherein the dishwashing machine comprises a plurality of light radiation sources. 40
12. A dishwashing machine according to any of claims 9 to 11, wherein the dishwashing machine comprises a plurality of light conduits. 45
13. A dishwashing machine according to any of claims 9 to 12, the light conduit being flexible.
14. A dishwashing machine according to any of claims 9 to 13, the light conduit comprising a fibre optic cable. 50

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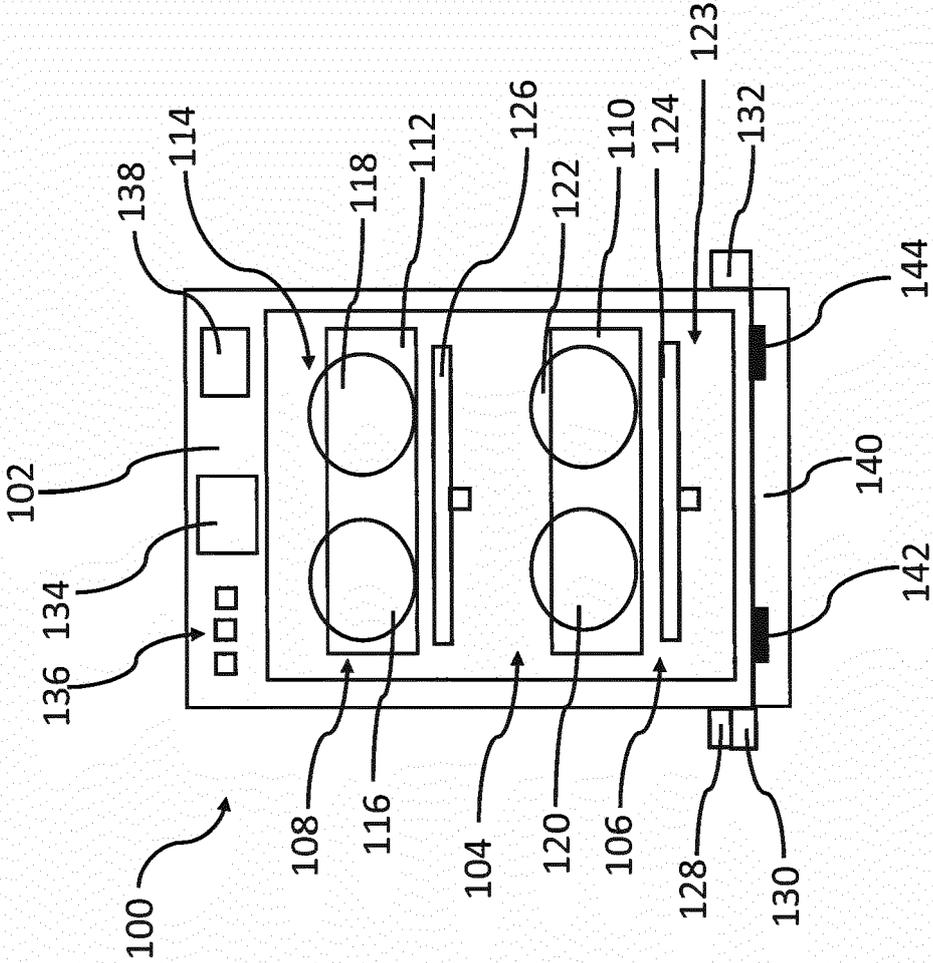


Figure 1

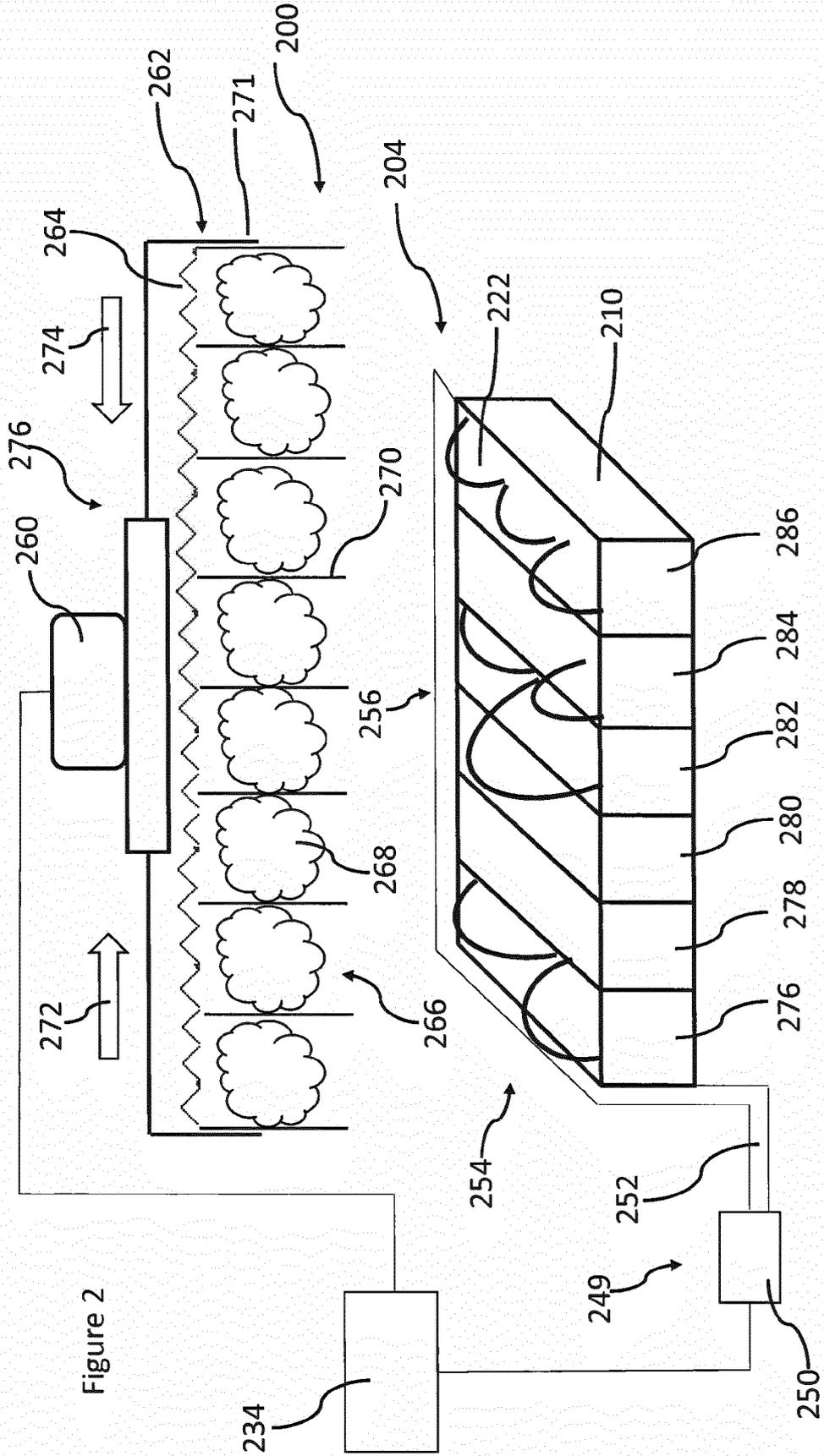
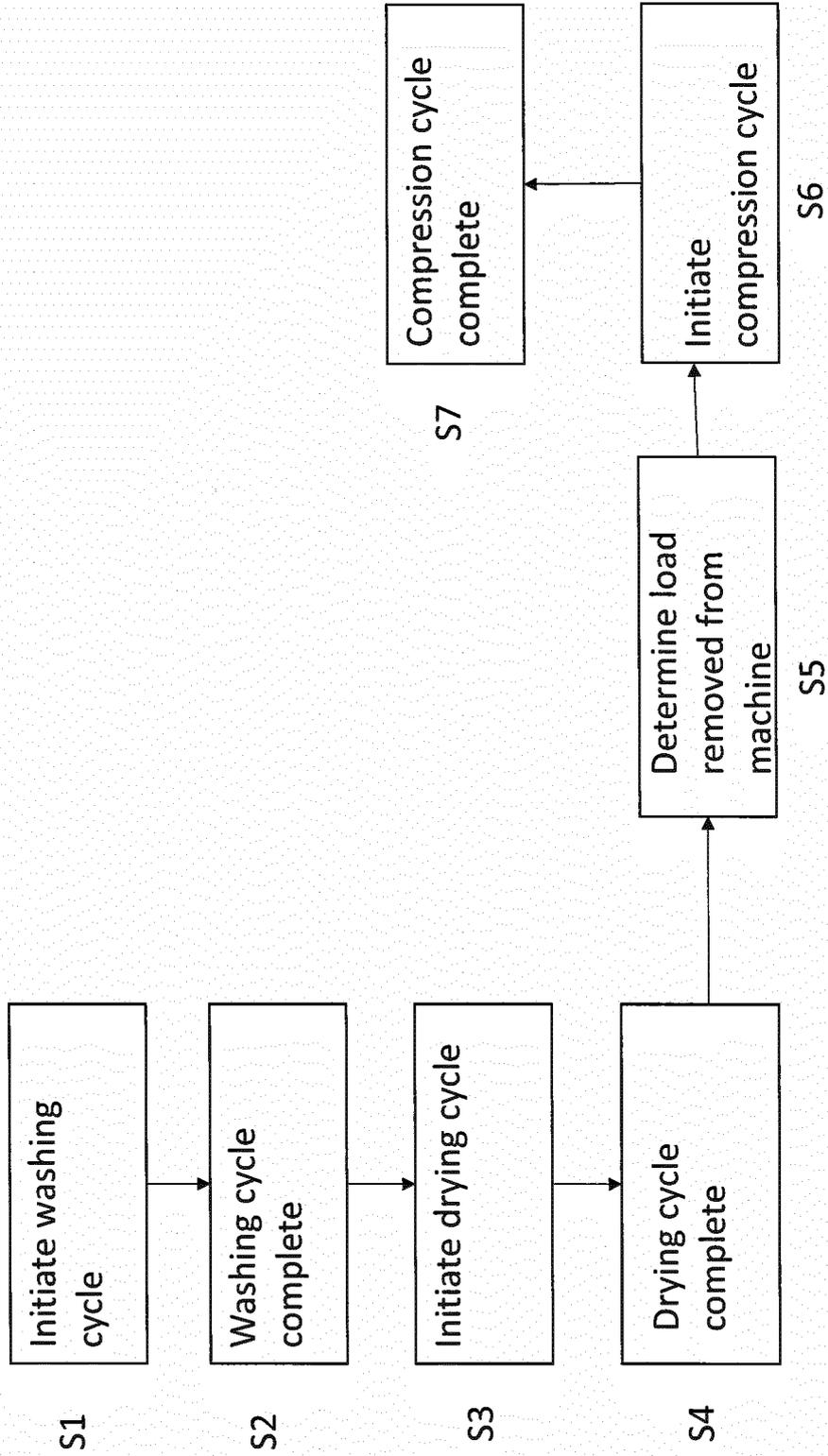


Figure 2

Figure 3





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Application Number  
EP 17 19 2447

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Place of search Munich		Date of completion of the search 2 May 2018	Examiner Uhlig, Robert
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 (P04/C01)



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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing claims for which payment was due.

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Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

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No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

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**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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see sheet B

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All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

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As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

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Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

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None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION  
SHEET B**

Application Number  
EP 17 19 2447

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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1. claims: 1-7

A dishwasher comprising a mechanical regeneration means for absorbent air drying means

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2. claims: 8-14

A dishwasher according to 1), comprising liquid water evaporation means for drying dishes

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

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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.

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