



EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.03.2022 Bulletin 2022/12

(51) International Patent Classification (IPC):
A47L 15/42 ^(2006.01) **A47L 15/22** ^(2006.01)

(21) Application number: **20197237.9**

(52) Cooperative Patent Classification (CPC):
A47L 15/4282; A47L 15/22

(22) Date of filing: **21.09.2020**

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

(72) Inventor: **TOPAÇ, Hamdullah Cihangir**
45030 Manisa (TR)

(74) Representative: **Roberts, David**
Page White & Farrer
Bedford House
John Street
London WC1N 2BF (GB)

(71) Applicant: **Vestel Elektronik Sanayi ve Ticaret A.S.**
45030 Manisa (TR)

(54) **SPRAY-ARM ASSEMBLY FOR A DISHWASHING MACHINE**

(57) There is disclosed a spray-arm apparatus (329) for a dishwashing machine (100). The spray-arm apparatus (329) comprises a spray-arm (326) having a plurality of outlets (364, 366, 368, 370, 372) for spraying liquid during a washing cycle. The plurality of outlets (364, 366, 368, 370, 372) are arranged along a length of the spray-arm (326) between a rotational centre (374) of the

spray-arm (326) and a distal end (376) of the spray-arm. The spray-arm apparatus (329) comprises a device (378) for selectively causing a force to be applied to the spray-arm (326) so as to cause at least a portion (398) of the spray arm (326) to deflect. At least one of the plurality of outlets (364, 366, 368, 370, 372) is located on the portion (398).

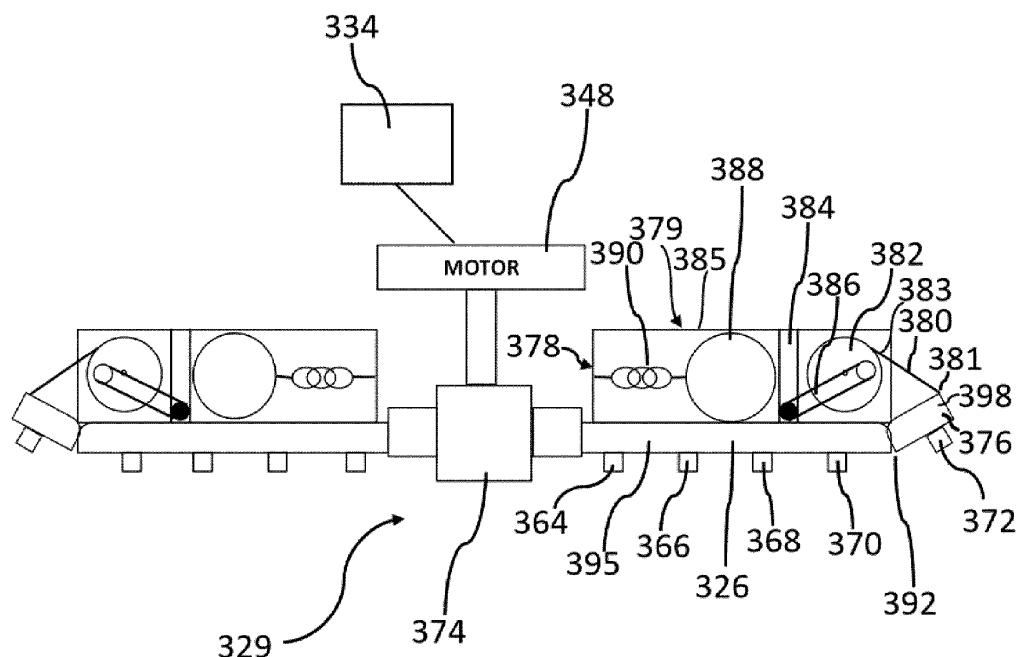


Fig. 3

DescriptionTechnical Field

5 **[0001]** The present disclosure relates to a spray-arm assembly for a dishwashing machine and a dishwashing machine comprising the spray-arm assembly.

Background

10 **[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.

15 Summary

[0003] According to a first aspect disclosed herein, there is provided a spray-arm apparatus for a dishwashing machine, comprising: a spray-arm having a plurality of outlets for spraying liquid during a washing cycle, the plurality of outlets arranged along a length of the spray-arm between a rotational centre of the spray-arm and a distal end of the spray-arm; and a device for selectively causing a force to be applied to the spray-arm, so as to cause at least a portion of the spray arm to deflect, at least one of the plurality of outlets being located on the portion.

[0004] According to some examples, the device is constructed and arranged so that the applied force is dependent upon a rotational speed of the spray-arm.

25 **[0005]** According to some examples, the device is constructed and arranged so that the applied force increases as the rotational speed increases.

[0006] According to some examples, the spray arm apparatus is in communication with a controller, the controller arranged to control the rotational speed.

[0007] According to some examples, the controller is arranged to vary the rotational speed of the spray-arm during the washing cycle.

30 **[0008]** According to some examples, the controller is arranged so that during the washing cycle the rotational speed is varied according to one or more of: a square wave pattern; a trapezoidal wave pattern; a ladder-type wave pattern; a sinusoidal wave pattern.

[0009] According to some examples, the device comprises a linkage constructed and arranged to apply the force to the spray-arm, the linkage attached to the spray-arm at a first end of the linkage and attached to the device at a second end of the linkage.

35 **[0010]** According to some examples, the device comprises an actuator mechanism constructed and arranged to move the linkage.

[0011] According to some examples, the actuator mechanism comprises a tethered weight constructed and arranged to move under centrifugal force towards the distal end of the spray-arm as the spray-arm rotates.

40 **[0012]** According to some examples, the actuator mechanism is constructed and arranged so that the movement of the tethered weight causes movement of the linkage via a piston and cam assembly.

[0013] According to some examples, the weight is tethered by a spring, the spring constructed and arranged to bias the weight towards the rotational centre of the spray-arm.

45 **[0014]** According to some examples, the spray arm comprises an articulated joint between the rotational centre of the spray-arm and the distal end of the spray arm, at least one of the outlets being positioned between the distal end and the articulated joint.

[0015] According to a second aspect there is provided a dishwashing machine comprising the spray-arm apparatus according to the first aspect.

50 **[0016]** According to some examples, the spray-arm apparatus is located in one or both of: an upper portion of the dishwashing machine; a lower portion of the dishwashing machine.

Brief Description of the Drawings

55 **[0017]** 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 schematically shows a plan-view of a washing compartment of a dishwashing machine;

Figure 3 schematically shows a spray-arm apparatus according to an example;

Figure 4 schematically shows a drive pattern of a spray-arm apparatus according to an example.

Detailed Description

[0018] The present disclosure has applicability to dishwashing machines or dishwashers. Dishwashing machines are used to automate the washing of items including crockery such as plates, bowls, cups, mugs etc. Items to be cleaned 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.

[0019] 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. In this example 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. 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.

[0020] 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 outlets (such as holes or nozzles) which can spray water upwardly and/or downwardly towards the items to be washed 114, while the spray arms 124 and 126 rotate.

[0021] In the example of Figure 1 the spray arm 124 is connected to shaft 125. The shaft 125 enables rotation of spray arm 124 about a central axis of the shaft 125. The shaft 125 and spray arm 124 may be considered to be comprised in a spray arm assembly 121. In the example of Figure 1 the spray arm 126 is connected to shaft 127. The shaft 127 enables rotation of spray arm 126 about a central axis of the shaft 127. The shaft 127 and spray arm 126 may be considered to be comprised in a spray arm assembly 129.

[0022] The dishwashing machine 100 further comprises water inlet schematically shown at 128 and water outlet schematically shown at 130, for enabling water to be fed into and taken out of 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 water pump is schematically shown at 150. The water pump 150 is constructed and arranged to distribute water around the dishwashing machine 100. For example, the water pump 150 can pump water to spray arms 124 and 126. Water that has been sprayed falls back down to a base or sump 152 of the dishwashing machine 100, from where that water can be recycled (after filtering, in some examples) by the pump 150.

[0024] In some examples, rotation of the spray arms 124 and 126 is caused by the force of liquid being ejected from outlets of the spray arms. Additionally or alternatively, one or more motors, shown schematically at 148 may be provided for powering rotation of the spray arms 124 and 126.

[0025] 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 a 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.

[0026] A door of the dishwashing machine 100 is schematically shown at 140. In Figure 1 the door is in an open position enabling access to washing compartment 104.

[0027] A washing cycle generally comprises three main stages: (i) wetting; (ii) injection of detergent, (iii) rinsing. 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.

[0028] Figure 2 is a schematic plan-view of a dishwashing machine 200 according to an example. A washing compartment is shown at 204. The washing compartment is generally square or rectangular in plan view. A spray arm or spray propeller is shown at 226 (and various positions of the spray arm 226 are shown in phantom). As shown schematically at 231, distal ends 276 of the spray-arm 226 trace a circular path within square washing compartment 204. This creates areas 260, 261, 262, 263, which may be referred to as "blind-spots" that are not reached by water being sprayed by the spray-arm 226. Therefore, any items located in those blind-spots may not be washed properly during a

washing-cycle, or at least not washed as well as items within circle 231. Blind spots may also occur in an unpredictable manner, for example where a large plate blocks a smaller plate.

[0029] With this technical problem in-mind, the present disclosure relates to a spray-arm apparatus in which liquid outlet(s) of the spray-arm can be selectively oriented or angled to spray liquid (such as water and/or washing liquor) into the blind-spots of a washing compartment. As will be disclosed in more detail below, some examples of the spray-arm apparatus comprise a mechanical system or device that is arranged to actuate under the centrifugal force of rotation of the spray-arm. This causes at least a portion of the spray-arm to deflect, and consequently alters a spray angle of one or more liquid outlets. Motion and operation of the spray-arm is, in some examples, controlled using electronic motion control.

[0030] Figure 3 shows a spray-arm apparatus 329 according to an example. The spray-arm apparatus 329 is, in this example, an upper spray-arm which is arranged to spray liquid downwardly within a dishwashing machine. However, it will be understood that the concept is equally applicable to lower spray-arms that are arranged to spray upwardly within a washing compartment.

[0031] The spray-arm apparatus 329 has a plurality of outlets 364, 366, 368, 370 and 372 for spraying liquid during a washing cycle. The plurality of outlets 364, 366, 368, 370 and 372 are arranged along a length of the spray-arm 326 between a rotational centre 374 of the spray-arm 326 and a distal-end 376 of the spray-arm 326. It will be understood that the number of outlets shown in Figure 3 is by way of example only and that in practice more or fewer outlets may be provided. The outlets may also be referred to as holes or nozzles.

[0032] A device 378 is provided for selectively causing a force to be applied to the spray-arm 326. In examples, the applied force causes at least a portion 398 of the spray arm 326 to deflect. At least one of the plurality of outlets is located on the deflected portion 398. Accordingly, this alters an angle of liquid trajectory from one or more of the plurality of outlets 364, 366, 368, 370 and 372. In some examples, the force is applied in the region of or at the distal end 376 or tip of the spray-arm 326. In examples, the angle of liquid trajectory is altered by changing an angle of one or more of the plurality of outlets 364, 366, 368, 370 and 372. In the example of Figure 3, only the angle of outlet 372 is shown to be altered, though it will be understood that in practice the angle of more than one outlet may be altered.

[0033] In some examples, the device is constructed and arranged so that the force that is applied to the spray arm 326 is dependent on a rotational speed of the spray-arm 326. In some examples, the device 376 is constructed and arranged so that the applied force increases as the rotational speed increases. In examples, the greater the applied force the greater the angle of deflection of the portion 398.

[0034] The device 378 may be considered, in some examples, as an actuator or comprising an actuator 379, because in examples the device 378 is arranged to actuate the force that is applied to the spray-arm 326.

[0035] In some examples, the device comprises a linkage 380 that is attached to the spray-arm 326 in order to transfer or apply the force to the spray-arm 326 from the device 378. The linkage 380 is attached to the spray-arm 326 at a first end 381 of the linkage and is attached to the device 378 at a second end 383 of the linkage 380. In the example of Figure 3 the first end of the linkage 380 is attached to the distal end 376 of the spray-arm 326. In some examples the linkage 380 comprises a rope or cable or wire or the like.

[0036] According to some examples, the device 378 comprises an actuator mechanism 379 constructed and arranged to cause movement of the linkage 380. In some examples, the actuator mechanism 379 comprises a tethered weight 388 constructed and arranged to move towards the distal end 379 of the spray-arm 326 as the spray-arm 326 rotates. That is, as the spray-arm 326 rotates, the centrifugal force causes the weight 388 to move outwardly from the rotational centre 374 of the spray-arm 326. In the example of Figure 3, the actuator mechanism 379 is constructed and arranged so that movement of the tethered weight 388 causes movement of the linkage 380 via a piston 384 and cam 382 assembly. In the example of Figure 3, the piston 384 is attached to the cam 382 via a linkage 386. In examples, the linkage 386 may comprise a bar or rod or the like.

[0037] So, viewing Figure 3, when weight 388 moves outwardly due to the centrifugal force of the spray-arm 326 rotating, the weight 388 pushes on piston 384 which causes cam 382 to rotate. This causes the linkage 380 to move and in turn lifts the end or tip of the spray-arm 326. As shown, this causes outlet 372 to be angled which increases the overall spray area of the spray-arm 326. In some examples the weight 388 comprises a metal ball. For example, the weight 388 may comprise an iron ball.

[0038] In examples, the weight 388 is tethered to the device 378 by a spring 390. For example, spring 390 may comprise a helical spring. The spring 390 is biased to draw or move the weight 388 back towards the rotational centre 374 of the spray-arm 326, for example as the spray-arm 326 slows down or stops moving. In-turn, and with respect to the example of Figure 3, this will cause linkage 380 and outlet 372 to move, so that the deflection of portion 398 is decreased. In some examples, a rest-position of the portion 398 is horizontal or in-line with the rest of spray-arm 326. In some examples, in the rest position outlet 372 is oriented vertically or substantially vertically e.g. as per outlets 364, 366, 368 and 370 in Figure 3. The piston 384 and/or cam 382 may in some examples be biased to orient the portion 398 to its rest position. Of course, once the spray-arm 326 is moving this biasing force may be overcome by the actuator 379. In some examples, no biasing element is provided for returning the portion 398 to its rest position, and it is instead

allowed to return to its rest position under the force of gravity.

[0039] In some examples, the device 378 comprises a casing or cover 385. In some examples an interior of the cover 385 is oiled, to reduce friction between the cover and the weight 388 and/or piston 384.

[0040] In some examples, the spray arm 326 comprises an articulated joint 392 between the rotational centre 374 of the spray-arm and the distal end 376 of the spray arm. In some examples, the articulated joint 392 comprises a hinge. In some examples, the hinge comprises a living hinge. In some examples the hinge comprises a butt hinge. In some examples, at least one outlet is positioned between the distal end 376 of the spray arm 326 and the articulated joint 392. In the example of Figure 3, a single outlet 372 is positioned between the articulated joint 392 and the distal end 376. In some examples, portion 398 comprises a portion of the spray-arm 326 between articulated joint 392 and distal end 376.

[0041] In some examples, the spray arm 326 is formed of a material that is flexible enough so that the articulated joint 392 is not required.

[0042] It will be understood that actuator 379 may take forms that differ to that shown in Figure 3. For example, an electrically powered actuator may be provided that provides the force to be applied to the spray-arm, rather than the mechanical arrangement of Figure 3. Generally it will be understood that the device 378 comprises an actuator 379 for applying force to the spray arm to alter an angle of liquid trajectory from one or more of the outlets.

[0043] For conciseness, the spray-arm apparatus 329 has been described with respect to the right-hand side of Figure 3. It will be understood that in examples the left-hand side of the apparatus 329 may operate in the same or a similar way.

[0044] According to some examples, the spray-arm apparatus 329 is in communication with a controller 334. In some examples, controller 334 is a controller of a dishwashing machine in which the spray-arm apparatus 329 is located. In examples, the controller 334 is arranged to control the rotational speed of the spray-arm 326, for example by controlling a speed of motor 348. In some examples, the motor 348 comprises a brushless direct current (BLDC) motor. In some examples the controller is arranged to vary the rotational speed of the spray-arm 326 during a washing cycle. This varies the spray trajectory of the spray-arm 326 during a washing cycle by varying the deflection of the spray-arm. This increases spray coverage during a washing cycle, and helps to eliminate blind-spots.

[0045] Figure 4 shows an example pattern by which the controller 334 may drive spray-arm 326. Speed of the spray-arm is shown on the y-axis and time is shown on the x-axis. In this example, time T represents one full revolution of the spray-arm 326. The pattern in Figure 4 is a square pattern. For one revolution the spray-arm 326 is driven at a speed slower than a nominal speed (in this example 0.8*nominal speed), and for a subsequent revolution is driven at a speed higher than the nominal speed (in this example 1.2*nominal speed), and so on.

[0046] It will be understood that in other examples the spray-arm 326 may be driven according to a different pattern. Such patterns may include: a trapezoidal wave pattern; a ladder-type wave pattern; a sinusoidal wave pattern.

[0047] In some examples, the controller is arranged to use an algorithm for controlling movement of the spray-arm 326. In some examples, the algorithm comprises a look-up table (LUT). In an example, the LUT contains spring constant k, angular velocity w of the spray arm 326, and mass m of the weight 388. The elongation distance of the spring 390 is x, and the unforced spring length is L. The relationship between these parameters is given in equation (1) below:

$$x = \frac{mw^2L}{k-mw^2} \quad (1)$$

[0048] An example LUT is provided below in Table 1

Table 1

Mass of weight	Spring length	Speed of spray-arm	Spring extension x	Bending angle
m	L	0.8w	X	10°
m	L	1.2w	1.5x	30°
m	L	0.8w	X	10°
m	L	1.2w	1.5x	30°
m	L	0.8w	X	10°
m	L	1.2w	1.5x	30°
...	...	...	...	...

[0049] In examples, the elongation distance x determines the bending angle. With reference to Figure 3, the bending angle may also be considered the amount by which portion 398 is deflected from its rest position. The bending angle

may be considered an angle formed between a non-deflected portion 393 of the spray-arm 326, and deflected portion 398 of the spray arm 326. In some examples, the bending angle determines capability to spray the corners or blind-spots of the washing compartment. In some examples, rotational speed of the spray-arm is set by controlling speed of motor 348. Therefore, controlling the speed of the motor 348 can also control the spray angle during a washing cycle, and accordingly varying the speed of the motor varies the spray angle. Therefore, different parts of the washing machine

can be sprayed in a controlled manner during a washing cycle by controlling the speed of rotation of the spray arm 326. [0050] According to examples, the spray arm apparatus 329 is comprised in a dishwashing machine. For example, the spray-arm apparatus 329 may be comprised in dishwashing machine 100 or the like. The spray-arm apparatus 329 may be an upper spray-arm apparatus or a lower spray-arm apparatus. In the example of Figure 3, the outlets 364, 366, 368, 370 and 372 point downwardly. It will be understood that the disclosed concept can also be applied to a spray-arm apparatus where the liquid outlets point upwardly.

[0051] It will be appreciated that the disclosed spray-arm apparatus and dishwashing machine provides effective water spraying from the spray-arm to a washing compartment of a dishwashing machine. It will also be appreciated that in examples the spray-arm apparatus can be implemented using simple mechanical parts, with no or minimal addition of electronics. The spray-arm apparatus can be controlled using standard items of a dishwashing machine e.g. controller and motor.

[0052] 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 spray-arm apparatus for a dishwashing machine, comprising:

a spray-arm having a plurality of outlets for spraying liquid during a washing cycle, the plurality of outlets arranged along a length of the spray-arm between a rotational centre of the spray-arm and a distal end of the spray-arm; and a device for selectively causing a force to be applied to the spray-arm so as to cause at least a portion of the spray arm to deflect, at least one of the plurality of outlets being located on the portion.

2. The spray-arm apparatus according to claim 1, wherein the device is constructed and arranged so that the applied force is dependent upon a rotational speed of the spray-arm.

3. A spray-arm apparatus according to claim 2, wherein the device is constructed and arranged so that the applied force increases as the rotational speed increases.

4. The spray-arm apparatus according to claim 2 or claim 3, the spray arm apparatus in communication with a controller, the controller arranged to control the rotational speed.

5. The spray-arm apparatus according to claim 4, the controller arranged to vary the rotational speed of the spray-arm during the washing cycle.

6. The spray-arm according to claim 5, wherein the controller is arranged so that during the washing cycle the rotational speed is varied according to one or more of: a square wave pattern; a trapezoidal wave pattern; a ladder-type wave pattern; a sinusoidal wave pattern.

7. The spray-arm apparatus according to any one of claims 1 to 6, wherein the device comprises a linkage constructed and arranged to apply the force to the spray-arm, the linkage attached to the spray-arm at a first end of the linkage and attached to the device at a second end of the linkage.

8. The spray-arm apparatus according to claim 7, wherein the device comprises an actuator mechanism constructed and arranged to move the linkage.

9. The spray-arm apparatus according to claim 8, wherein the actuator mechanism comprises a tethered weight constructed and arranged to move under centrifugal force towards the distal end of the spray-arm as the spray-arm

rotates.

10. The spray-arm apparatus according to claim 9, wherein the actuator mechanism is constructed and arranged so that the movement of the tethered weight causes movement of the linkage via a piston and cam assembly.

11. The spray-arm apparatus according to claim 9 or claim 10, wherein the weight is tethered by a spring, the spring constructed and arranged to bias the weight towards the rotational centre of the spray-arm.

12. The spray-arm apparatus according to any of claims 1 to 11, the spray arm comprising an articulated joint between the rotational centre of the spray-arm and the distal end of the spray arm, at least one of the outlets being positioned between the distal end and the articulated joint.

13. A dishwashing machine comprising the spray-arm apparatus according to any of claims 1 to 12.

14. The dishwashing machine according to claim 13, the spray-arm apparatus located in one or both of: an upper portion of the dishwashing machine; a lower portion of the dishwashing machine.

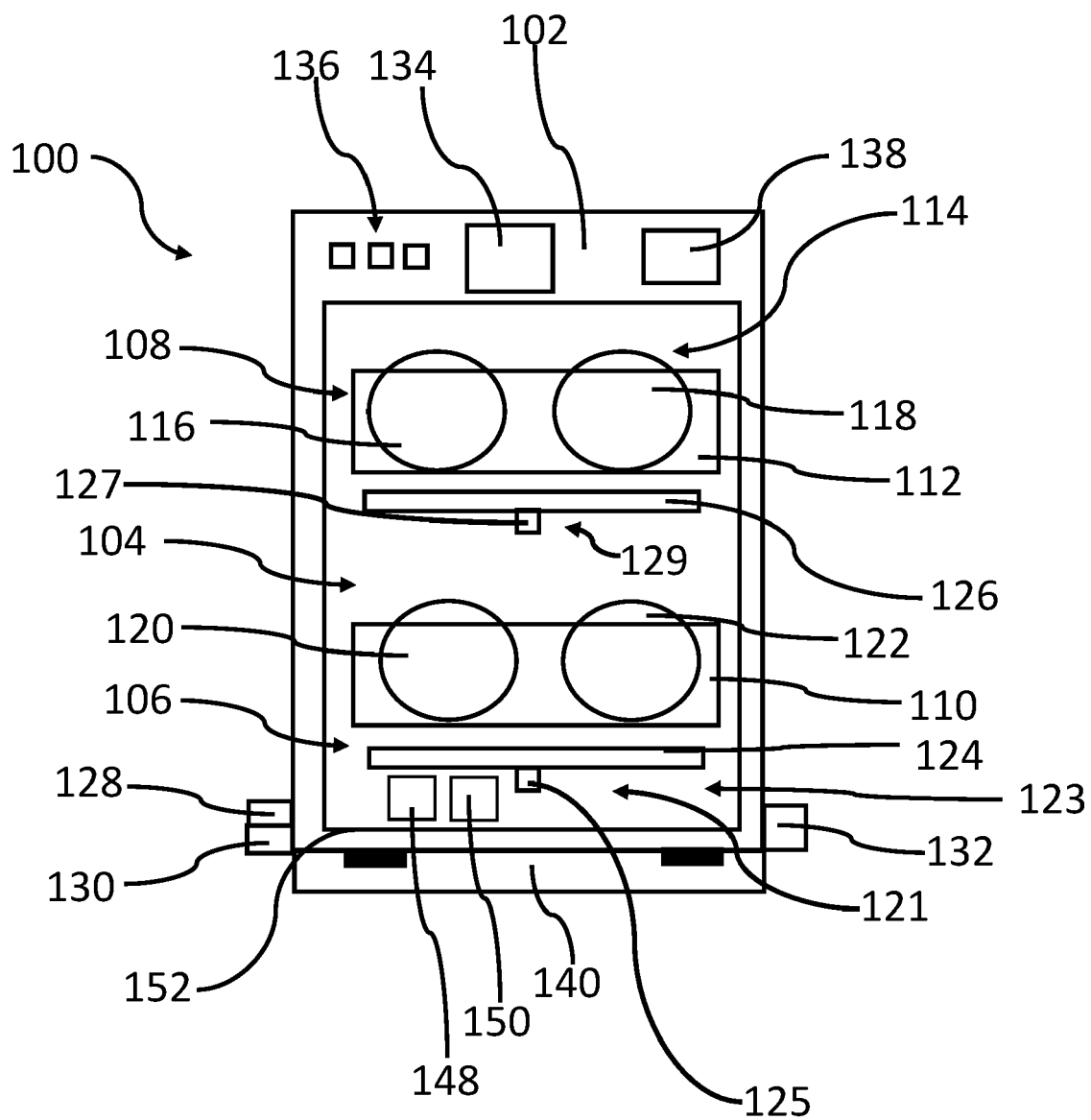


Fig. 1

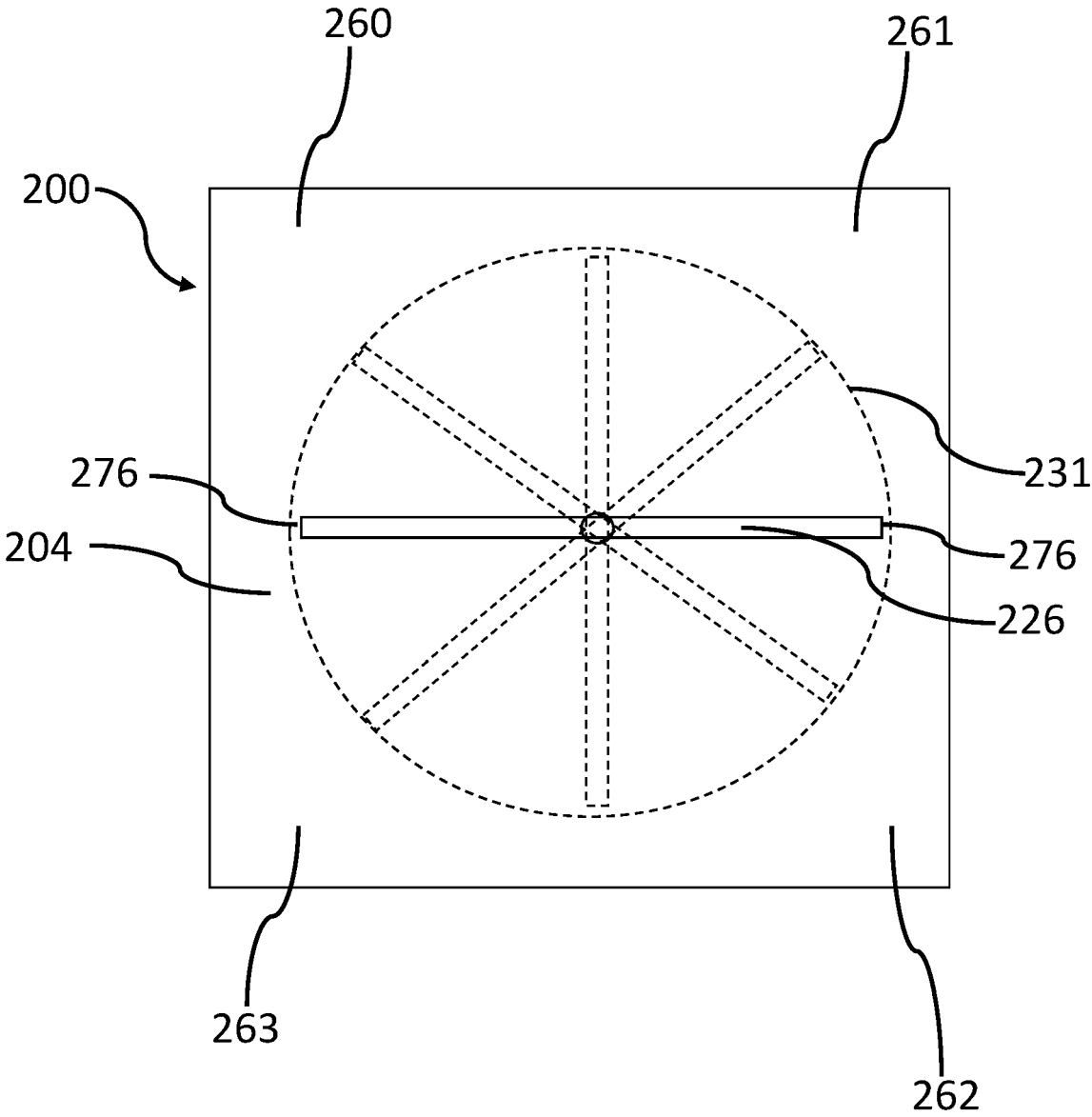


Fig. 2

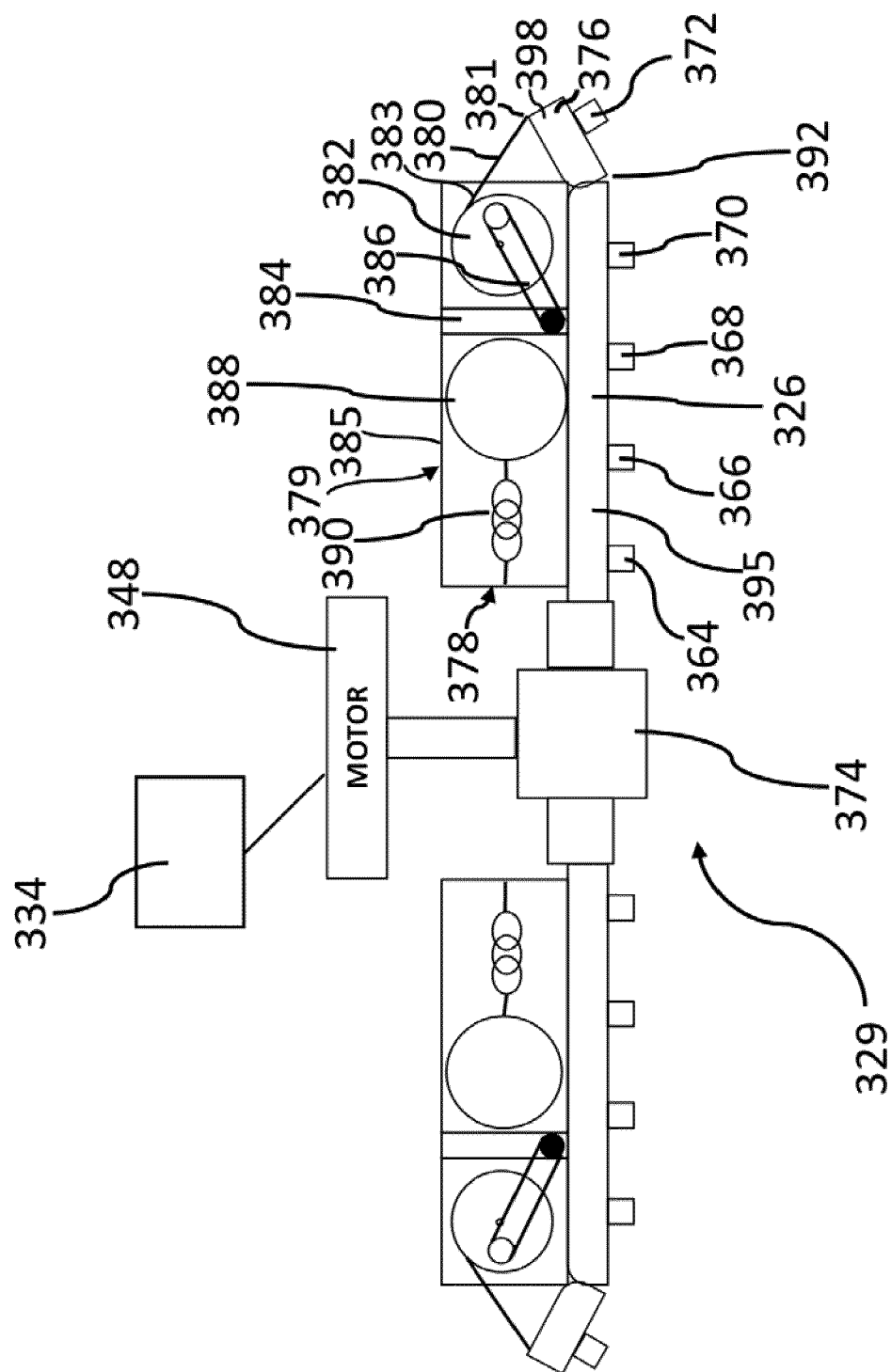


Fig. 3

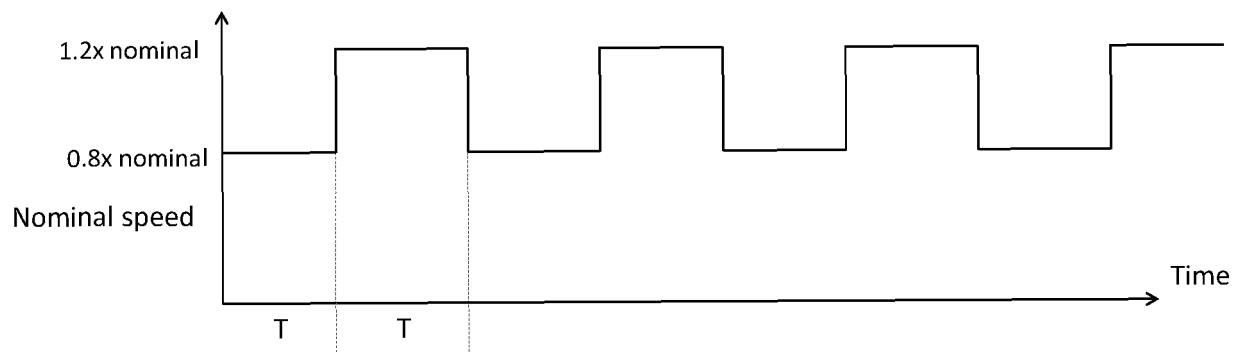


Fig. 4



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 19 7237

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2017/211393 A1 (ARCELIK AS [TR]) 14 December 2017 (2017-12-14)	1,12-14	INV. A47L15/42
A	* paragraph [0012] - paragraph [0014] * * paragraph [0020] - paragraph [0033] *	2-11	ADD. A47L15/22
A	EP 3 050 480 A1 (LG ELECTRONICS INC [KR]) 3 August 2016 (2016-08-03) * paragraph [0005] - paragraph [0024] *	1-14	
A	WO 2018/228679 A1 (HAIER DEUTSCHLAND GMBH [DE]) 20 December 2018 (2018-12-20) * page 23, line 25 - page 24, line 22 *	1-14	
A	GB 2 314 009 A (DAEWOO ELECTRONICS CO LTD [KR]) 17 December 1997 (1997-12-17) * page 5, line 23 - page 8, line 8 *	1-14	
A	CN 105 286 752 B (FOSHAN SHUNDE MIDEA WASHING APPLIANCES MFG CO LTD; MIDEA GROUP CO LTD) 26 October 2018 (2018-10-26) * figures 1, 2 *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			A47L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 January 2021	Examiner Jezierski, Krzysztof
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

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

EP 20 19 7237

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-01-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017211393 A1	14-12-2017	NONE	
EP 3050480 A1	03-08-2016	AU 2016216254 A1	10-08-2017
		AU 2018229416 A1	27-09-2018
		CN 105832267 A	10-08-2016
		CN 106805923 A	09-06-2017
		CN 106821250 A	13-06-2017
		CN 106821251 A	13-06-2017
		CN 106913297 A	04-07-2017
		CN 106943101 A	14-07-2017
		EP 3050480 A1	03-08-2016
		EP 3173005 A1	31-05-2017
		EP 3175762 A1	07-06-2017
		EP 3178365 A1	14-06-2017
		EP 3178366 A1	14-06-2017
		EP 3178367 A1	14-06-2017
		RU 2672637 C1	16-11-2018
		US 2016220090 A1	04-08-2016
		US 2017265708 A1	21-09-2017
		US 2017265709 A1	21-09-2017
		US 2017265710 A1	21-09-2017
		US 2017265711 A1	21-09-2017
		US 2017273536 A1	28-09-2017
		US 2020253452 A1	13-08-2020
		WO 2016126086 A1	11-08-2016
WO 2018228679 A1	20-12-2018	NONE	
GB 2314009 A	17-12-1997	GB 2314009 A	17-12-1997
		JP H1080393 A	31-03-1998
		KR 980000733 U	30-03-1998
		US 5842492 A	01-12-1998
CN 105286752 B	26-10-2018	NONE	