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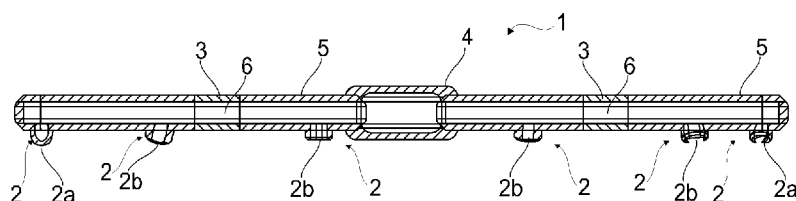
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
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(54) Title: IMPROVED SPRAY MEANS FOR USE IN A DISHWASHER

Fig. 1



(57) Abstract: The present invention relates to a spray means (1) for use in a dishwasher comprising: a tub for receiving the articles to be cleaned; a heater for heating the washing liquid; and a control unit for controlling the heater, wherein the control unit has one or more washing modes. The spray means (1) comprises one or more nozzles (2) for ejecting the washing liquid into the tub.



Description**IMPROVED SPRAY MEANS FOR USE IN A DISHWASHER**

- [0001] The present invention relates to a dishwasher. The present invention more particularly relates to the spray means of the dishwasher.
- [0002] Dishwashers are commonly known in the art. A dishwasher generally comprises: a tub for receiving the articles to be cleaned; a heater for heating the washing liquid; a control unit for controlling the heater; and one or more spray means for spraying the washing liquid onto the articles. The control unit generally comprises one or more washing modes. The spray means comprises one or more nozzles for ejecting the washing liquid into the tub. In the prior art dishwasher during the washing modes the nozzles of the spray means ejects the washing liquid respectively into the tub, and thereby onto the various articles inside the tub.
- [0003] EP2237716 (A1) discloses a prior art dishwasher.
- [0004] A problem with the prior art dishwasher is that the washing liquid which is ejected from the nozzles of the spray means impinges onto the same surface areas of the articles throughout the washing modes, and thus at least some surface areas of the articles do not directly receive the washing liquid from the nozzles. Therefore, the articles cannot be uniformly cleaned. Moreover, there is a risk that at least some surface areas of the articles are insufficiently cleaned. In such instances the consumer satisfaction decreases.
- [0005] An objective of the present invention is to provide a spray means for use in a dishwasher that solves the aforementioned problems of the prior art in a cost effective way and which has an improved cleaning performance.
- [0006] This objective has been achieved by the spray means as defined in claim 1, and the dishwasher as defined in claim 12. Further achievements have been attained by the subject-matters respectively defined in the dependent claims.
- [0007] The spray means of the present invention comprises one or more shape-memory alloys which are adapted to change the shape of the spray means in accordance with the temperature of the washing liquid.
- [0008] A major advantageous effect of the present invention is that the surface

area of the articles inside the tub can be more effectively cleaned through the spray means which changes its shape in accordance with the temperature of the washing liquid.

- [0009] In alternative embodiments, the shape memory alloys are used to form the nozzles and/or the body of the spray means that supports the nozzles. Thereby, the position of the nozzles and/or the ejection direction of the nozzles can be changed, for instance, even to an extent that the rotation direction of the spray means reverses when the shape memory alloys change their shape in accordance with the temperature of the washing liquid. These embodiments are particularly advantageous as the surface area of the articles which directly receives the washing liquid can be increased while the shape of the spray means gradually changes, and thus the cleaning performance can be improved.
- [0010] In other alternative embodiments, the shape memory alloys used in the spray means have a two-way shape memory and/or a one-way shape memory.
- [0011] Additional features and additional advantageous effects of the spray means and the dishwasher according to the present invention will become more apparent with the detailed description of the embodiments with reference to the accompanying drawings in which:
- [0012] Figure 1 – is a schematic sectional view of a spray means for use in the dishwasher according to an embodiment of the present invention, wherein the spray means has a two-way shape memory, and wherein the spray means is in the first shape at a relatively low temperature;
- [0013] Figure 2 – is a schematic sectional view of the spray means of Fig. 1, wherein the spray means is in the second shape at a relatively high temperature;
- [0014] Figure 3 – is a schematic sectional view of a spray means for use in the dishwasher according to another embodiment of the present invention, wherein the spray means has a two-way shape memory, wherein the spray means is in the first shape at a relatively low temperature, and wherein the first nozzles at the tip of the rotating spray arm eject the washing liquid in a first direction (A) which causes a clockwise rotation;

- [0015] Figure 4 – is a schematic sectional view of the spray means of Fig. 3, wherein the spray means is in the second shape at a relatively high temperature, and wherein the first nozzles eject the washing liquid in a second direction (B) which causes an anticlockwise rotation;
- [0016] Figure 5 – is a schematic sectional view of a spray means for use in the dishwasher according to another embodiment of the present invention, wherein the spray means has a two-way shape memory, and wherein the spray means is in the first shape at a relatively low temperature, and wherein the second nozzles between the hub and the tip of the rotating spray arm eject the washing liquid in a third direction (C);
- [0017] Figure 6 – is a schematic sectional view of the spray means of Fig. 5, wherein the spray means is in the second shape at a relatively high temperature, and wherein the second nozzles eject the washing liquid in a fourth direction (D) which is different that the third direction (C);
- [0018] Figure 7 – is a schematic sectional view of a spray means for use in the dishwasher according to another embodiment of the present invention, wherein the spray means has a two-way shape memory, wherein the spray means is in the first shape at a relatively low temperature, and wherein the first nozzles eject the washing liquid in a fifth direction (E) which points towards the bottom section of the tub;
- [0019] Figure 8 – is a schematic sectional view of the spray means of Fig. 7, wherein the spray means is in the second shape at a relatively high temperature, and wherein the first nozzles eject the washing liquid in a sixth direction (F) which points towards the side section of the tub.
- [0020] The reference signs appearing on the drawings relate to the following technical features.
1. Spray means
 2. Nozzle
- [0021] 2a. First nozzle
- 2b. Second nozzle
 3. Shape-memory alloy
- [0022] 4. Hub
- [0023] 5. Rotating spray arm

[0024] 6. Bending section

[0025] The spray means (1) is suitable for use in a dishwasher (not shown) which comprises: a tub for receiving the articles to be cleaned; one or more article racks which are extendably disposed into the tub; a heater for heating the washing liquid; and a control unit for controlling the heater, wherein the control unit has one or more washing modes.

[0026] The spray means (1) comprises: one or more nozzles (2) for ejecting the washing liquid into the tub (Fig. 1 to Fig. 8).

[0027] The spray means (1) of the present invention further comprises: one or more shape-memory alloys (3) which are adapted to change the shape of the spray means (1) in accordance with the temperature of the washing liquid (Fig. 1 to Fig. 8).

[0028] The dishwasher of the present invention further comprises: one or more spray means (1) which are associated with the article racks respectively (Fig. 1 to Fig. 8).

[0029] In an embodiment, one or more shape-memory alloys (3) of the spray means (1) comprises a two-way shape memory which comprises a first shape at a relatively low temperature and a second shape at a relatively high temperature. The first shape corresponds to the martensite phase. The second shape corresponds to the austenite phase. This embodiment is particularly advantageous as the spray means (1) can transit between martensite phase and the austenite phase in accordance with the temperature of the washing liquid during the various washing modes, and thus the cleaning performance can be improved as the shape of the spray means (1) gradually changes.

[0030] In an alternative embodiment, one or more shape-memory alloys (3) of the spray means (1) each has a one-way shape memory. Herein, the user can manually deform the shape of the spray means (1), for instance, prior to taking the dishwasher into operation. This embodiment is particularly advantageous as the spray means (1) can transit to its original shape in accordance with the temperature of the washing liquid during the various washing mode, and thus the cleaning performance can be improved as the shape of the spray means (1) gradually changes.

- [0031] In another embodiment, the spray means (1) comprises: a hub (4) which can be rotatably disposed into the tub; and one or more rotating spray arms (5) which are disposed onto the hub (4). In this embodiment, the nozzles (2) comprise: one or more first nozzles (2a) which are disposed onto the tip of each rotating spray arm (5); and one or more second nozzles (2b) which are disposed between the hub (4) and the tip of each rotating spray arm (5) (Fig. 1 to Fig. 8). In this embodiment, unlike the second nozzles (2b), the first nozzles (2a) set the rotating spray arms (5) into rotary movement when the washing liquid is ejected from the first nozzles (2a).
- [0032] In another embodiment, one or more rotating spray arms (5) comprises one or more bending sections (6) which are each formed through a shape-memory alloy (3) (Fig. 1 and Fig. 2). In this embodiment, one or more nozzles (2) are disposed between a bending section (6) and the tip of the rotating spray arm (5). In this embodiment, the shape-memory alloy (3) of the bending section (6) is adapted to bent at a predetermined angle (θ) in accordance with the temperature of the washing liquid, and to thereby change the position and the ejection direction of the one or more nozzles (2) which are disposed between the respective bending section (6) and the tip of the rotating spray arm (5) (Fig. 2). The bending section (6) can be disposed onto various positions along the rotating spray arm (5). The shape-memory alloy (3) of the bending section (6) can be designed to bend the rotating spray arm (5) at various different predetermined angles (θ). This embodiment is particularly advantageous as the rotating spray arms (5), including the second nozzles (2b) are arranged across the entire tub, and thus the cleaning performance can be improved as the shape of the spray means (1) gradually changes. Moreover, the first nozzles (2a) of the rotating spray arms (5) clean the side section of tub.
- [0033] In another embodiment, the rotating spray arm (5) has a straight shape when the shape-memory alloy (3) of the bending section (6) is in the first shape (Fig. 1). In this embodiment, the rotating spray arm (5) has a bending shape when the shape-memory alloy (3) of the bending section (6) is in the second shape of (Fig. 2).

- [0034] In another embodiment, one or more nozzles (2) of the spray means (1) each comprises one or more shape-memory alloys (3) which are adapted to change the shape of the one or more nozzles (2) in accordance with the temperature of the washing liquid, and thereby the ejection direction of the nozzles (2) respectively (Fig. 3 to Fig. 8).
- [0035] In another embodiment, one or more first nozzles (2a) and/or one or more second nozzles (2b) each comprises one or more shape-memory alloys (3) which are adapted to respectively change the shape of the first nozzles (2a) and/or the second nozzles (2b) in accordance with the temperature of the washing liquid, and thereby the ejection direction of the first nozzles (2a) and/or the second nozzles (2b) respectively (Fig. 3 to Fig. 8).
- [0036] In other alternative embodiments, the first nozzles (2a) eject in the first shape of their shape-memory alloys (3) the washing liquid in a first direction (A) which has a component in the anticlockwise direction or the clockwise direction (Fig. 3). In this embodiment, the first nozzles (2a) eject in the second shape of the shape-memory alloys (3) the washing liquid in a second direction (B) which has a component in the clockwise direction or the anticlockwise direction respectively (Fig. 4). This embodiment is particularly advantageous as the rotating spray arms (5) change the direction of rotation as the shape-memory alloy (3) transits between the martensite phase and the austenite phase. Thereby the rear surface as well as the front surface of the articles can directly receive the washing liquid during the various washing modes. Thereby, the cleaning performance can be improved.
- [0037] In another embodiment, one or more second nozzles (2b) eject in the first shape of their shape-memory alloys (3) the washing liquid in a third direction (C) (Fig. 5). In this embodiment, one or more second nozzles (2b) eject in the second shape of their shape-memory alloy (3) the washing liquid in a fourth direction (D) which is different than the third direction (C), wherein the fourth direction (D) has a radial component (Fig. 6). This embodiment is particularly advantageous as a comparatively larger surface area of the articles directly receive the washing liquid during the various washing modes. Thereby, the cleaning performance can be

improved.

- [0038] In another embodiment, one or more first nozzles (2a) eject in the first shape of their shape-memory alloys (3) the washing liquid in a fifth direction (E) which points directly towards the bottom section of the tub (Fig. 7). In this embodiment, one or more first nozzles (2a) eject, in the second shape of their shape-memory alloy (3) the washing liquid in a sixth direction (F) which points directly towards the side section of the tub (Fig. 8). This embodiment is particularly advantageous as the washing liquid can be prevented from directly impinging onto the side section of the tub when the shape memory alloys (3) of the first nozzles (2a) are in the first shape, and thus the noise level can be reduced, and the energy efficiency can be improved. Moreover the washing liquid cleans the side section of the tub when the shape memory alloys (3) of the first nozzles (2a) are in the second shape.
- [0039] In another embodiment, one or more shape-memory alloys (3) each changes from the first shape to the second shape at a predetermined temperature which ranges between 35 °C to 45 °C. The predetermined temperatures can be determined through the alloy composition.
- [0040] In another embodiment, the control unit comprises: at least a main washing mode; a warm rinsing mode; and a cold rinsing mode. In this embodiment, in the main washing mode and the warm rinsing mode the temperature of the washing liquid is raised through the heater above the predetermined temperature such that the shape memory alloys (3) transit from the first shape to the second shape. In this embodiment, in the cold rinsing mode the temperature of the washing liquid is kept below the predetermined temperature such that the shape memory alloys (3) transits to or remains in the first shape.
- [0041] A major advantageous effect of the present invention is that the surface area of the articles inside the tub can be more effectively cleaned through the spray means (1) which changes its shape in accordance with the temperature of the washing liquid during the various washing modes. Other advantageous effects of the present invention can be taken from the above-described embodiments.

Claims

1. A spray means (1) for use in a dishwasher comprising: a tub for receiving the articles to be cleaned; a heater for heating the washing liquid; and a control unit for controlling the heater, wherein the control unit has one or more washing modes, the spray means (1) comprising: one or more nozzles (2) for ejecting the washing liquid into the tub, the spray means (1) being characterized by further comprising: one or more shape-memory alloys (3) which are adapted to change the shape of the spray means (1) in accordance with the temperature of the washing liquid.
2. The spray means (1) according to claim 1, characterized in that one or more shape-memory alloys (3) each comprises a two-way shape memory which comprises: a first shape at a relatively low temperature; and a second shape at a relatively high temperature.
3. The spray means (1) according to claim 1 or 2, characterized by further comprising: a hub (4) which can be rotatably disposed into the tub; and one or more rotating spray arms (5) which are disposed onto the hub (4), wherein the nozzles (2) comprise: one or more first nozzles (2a) which are disposed onto the tip of each rotating spray arm (5); and one or more second nozzles (2b) which are disposed between the hub (4) and the tip of each rotating spray arm (5).
4. The spray means (1) according to claim 3, characterized in that one or more rotating spray arms (5) comprises one or more bending sections (6) which are each formed through a shape-memory alloy (3), wherein one or more nozzles (2) are disposed between a bending section (6) and the tip of the rotating spray arm (5), and wherein the shape-memory alloy (3) of the bending section (6) is adapted to bent at a predetermined angle (θ) in accordance with the temperature of the washing liquid, and to thereby change the position and the ejection direction of the one or more nozzles (2) which are disposed between the respective bending section (6) and the tip of the rotating spray arm (5).
5. The spray means (1) according to claim 4, where dependent on claim 2, characterized in that the rotating spray arm (5) has a straight shape when the shape-memory alloy (3) of the bending section (6) is in the first shape, and the rotating spray arm (5) has a bending shape when the shape-memory alloy (3)

of the bending section (6) is in the second shape.

6. The spray means (1) according to any one claim 1 to 5, characterized in that one or more nozzles (2) each comprises one or more shape-memory alloys (3) which are adapted to change the shape of the one or more nozzles (2) in accordance with the temperature of the washing liquid, and thereby the ejection direction of the nozzles (2) respectively.
7. The spray means (1) according to claim 6, where dependent on claim 3, characterized in that one or more first nozzles (2a) and/or one or more second nozzles (2b) each comprises one or more shape-memory alloys (3) which are adapted to respectively change the shape of the first nozzles (2a) and/or the second nozzles (2b) in accordance with the temperature of the washing liquid, and thereby the ejection direction of the first nozzles (2a) and/or the second nozzles (2b) respectively.
8. The spray means (1) according to claim 7, where dependent on claim 2, characterized in that the first nozzles (2a) eject in the first shape of their shape-memory alloys (3) the washing liquid in a first direction (A) which has a component either in the anticlockwise direction or the clockwise direction, and the first nozzles (2a) eject in the second shape of their shape-memory alloys (3) the washing liquid in a second direction (B) which has a component either in the clockwise direction or the anticlockwise direction respectively.
9. The spray means (1) according to claim 7 or 8, where dependent on claim 2, characterized in that one or more second nozzles (2b) eject in the first shape of their shape-memory alloys (3) the washing liquid in a third direction (C), and one or more second nozzles (2b) eject in the second shape of their shape-memory alloy (3) the washing liquid in a fourth direction (D) which is different than the third direction (C), wherein the fourth direction (D) has a radial component.
10. The spray means (1) according to any one of claims 7 to 9, where dependent on claim 2, characterized in that one or more first nozzles (2a) eject in the first shape of their shape-memory alloy (3) the washing liquid in a fifth direction (E) which points towards the bottom section of the tub, and one or more first nozzles (2a) eject in the second shape of their shape-memory alloy (3) the washing liquid in a sixth direction (F) which points towards the side section of

the tub.

11. The spray means (1) according to any one of claims 2 to 10, characterized in that one or more shape-memory alloys (3) changes from the first shape to the second shape at a predetermined temperature which ranges between 35 °C to 45 °C.
12. A dishwasher comprising: a tub (2) for receiving the articles to be cleaned; a heater for heating the washing liquid; and a control unit for controlling the heater, wherein the control unit has one or more washing modes, characterized by further comprising: one or more spray means (1) as defined in any one of claim 1 to 11.
13. The dishwasher (1) according to claim 12, characterized in that the control unit comprises: a main washing mode; a warm rinsing mode; and a cold rinsing mode, wherein in the main washing mode and the warm rinsing mode the temperature of the washing liquid is raised through the heater above the predetermined temperature of claim 11, wherein in the cold rinsing mode the temperature of the washing liquid is kept below the predetermined temperature of claim 11.

Fig. 1

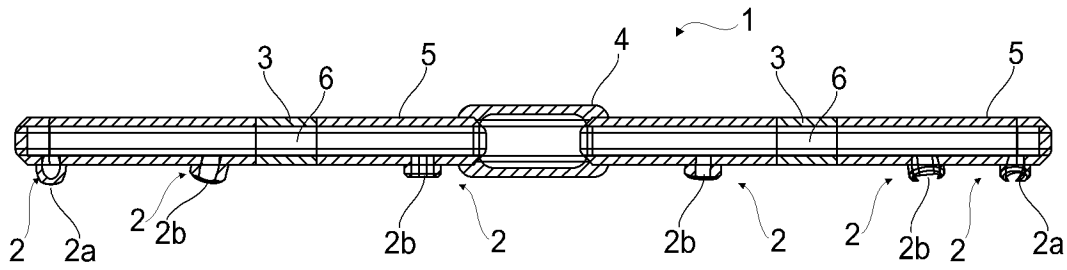


Fig. 2

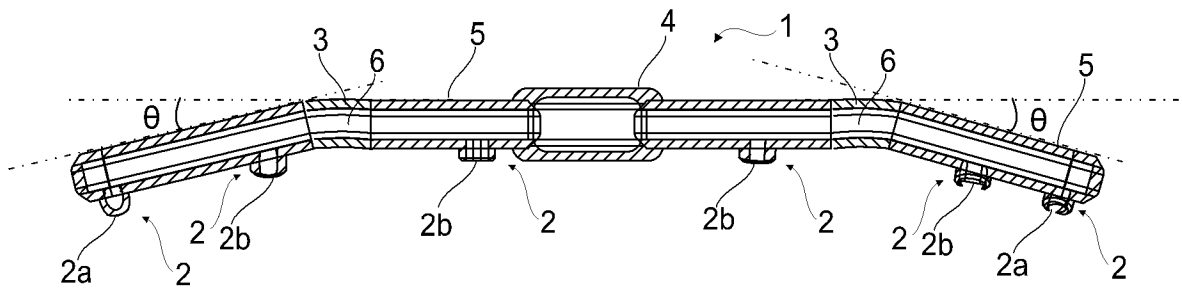


Fig. 3

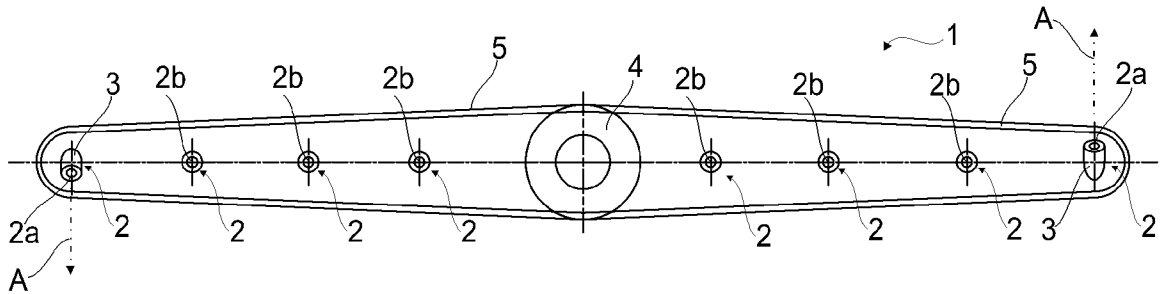


Fig. 4

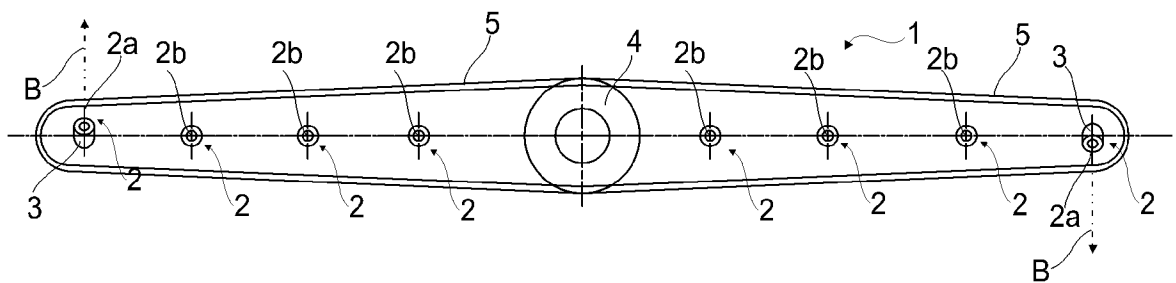


Fig. 5

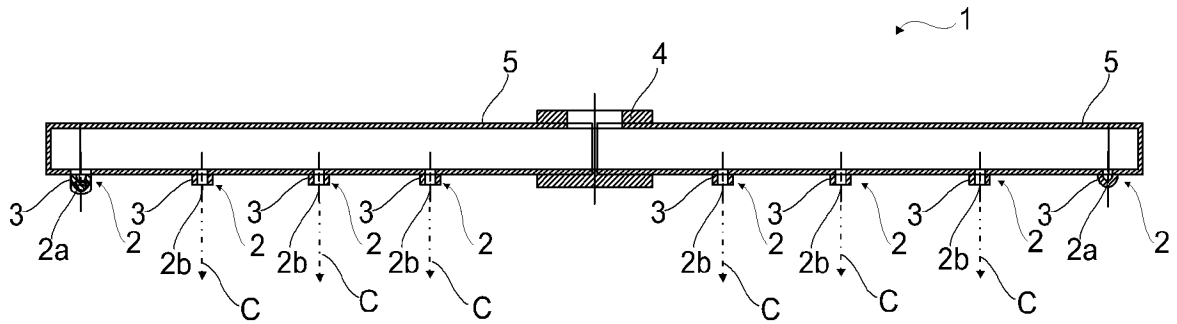


Fig. 6

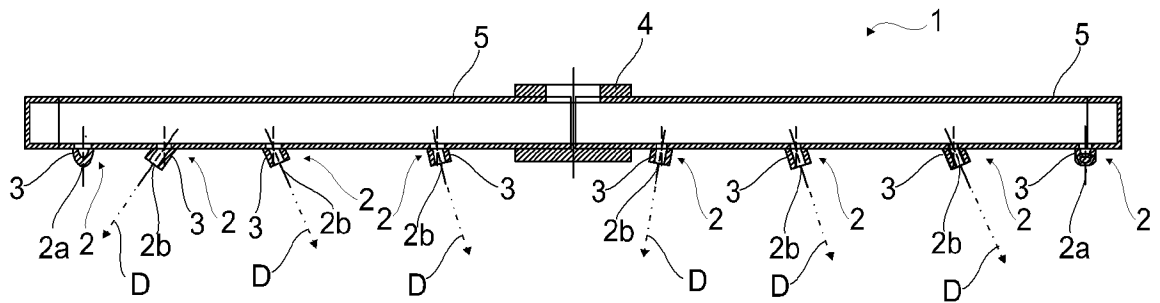


Fig. 7

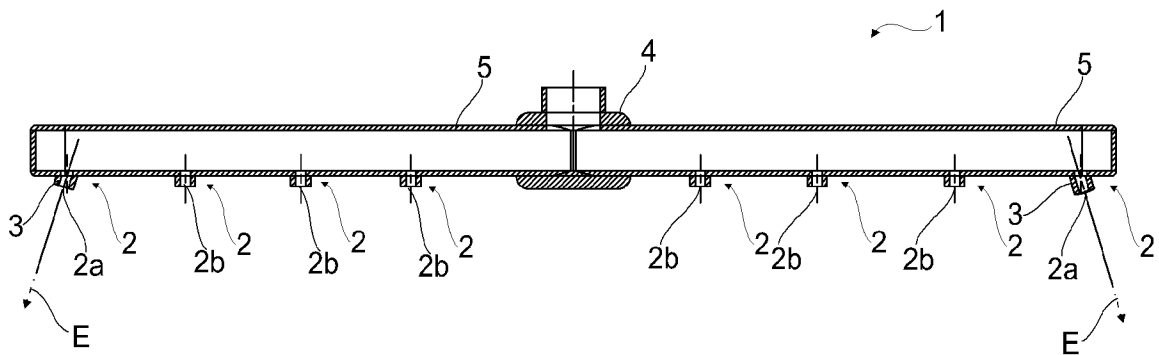
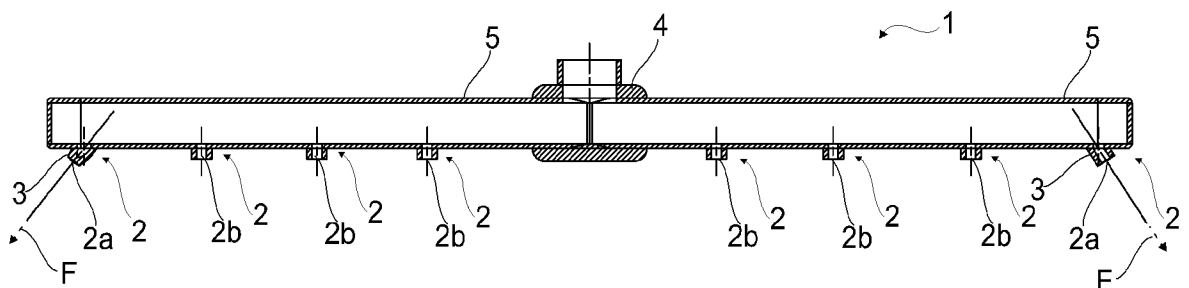


Fig. 8



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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ADD.
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B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
A47L
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 2012/279530 A1 (THIYAGARAJAN RAMASAMY [US]) 8 November 2012 (2012-11-08) abstract; figures 3A-3C,4,5 -----	1-3,7,9
A	EP 2 891 446 A1 (MIELE & CIE [DE]) 8 July 2015 (2015-07-08) abstract; figures 1-8 -----	1,3

Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search 21 July 2016	Date of mailing of the international search report 01/08/2016
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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