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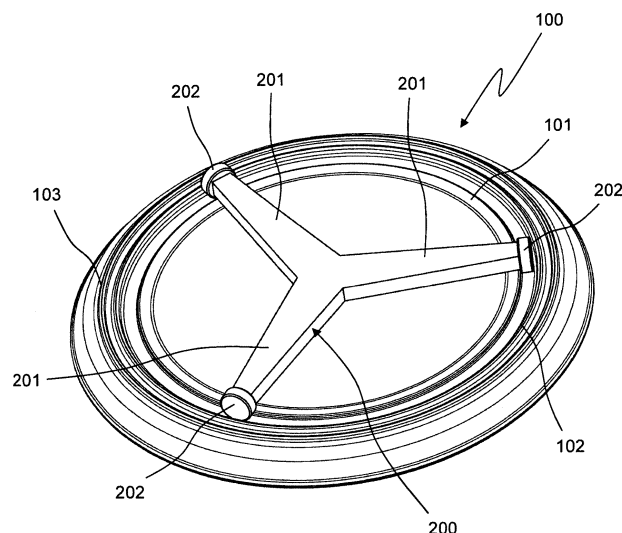
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(54) **HEATING COOKER**

(57) A heating cooker has a heating chamber (2), a plurality of rollers (202) arranged at intervals in a circumferential direction on a bottom surface of the heating chamber (2), a connecting member (201) configured to connect the plurality of rollers (202), and a turntable (100) placed on the bottom surface of the heating chamber (2) with the plurality of rollers (202) interposed therebetween.

The turntable (100) includes a first radial movement restricting portion (101) provided on the bottom surface of the turntable (100) and on an inner circumferential side of a track on which the plurality of rollers (202) roll in a circumferential direction, the first radial movement restricting portion (101) configured to restrict radially inward movement of the plurality of rollers (202).

*Fig.3*



**Description**

## TECHNICAL FIELD

**[0001]** The present invention relates to heating cookers.

## BACKGROUND ART

**[0002]** Conventionally, there has been a heating cooker including a turntable arranged in a heating chamber and a motor for driving the turntable (see, for example, JP 2005-300134 A (Patent Literature 1)).

**[0003]** In the heating cooker, the turntable is placed on the bottom surface of the heating chamber with a plurality of rollers interposed therebetween, and a rotation shaft of the motor is connected to a lower center of the turntable.

## CITATIONS LIST

## PATENT LITERATURE

**[0004]** Patent Literature 1: JP 2005-300134 A

## SUMMARY OF INVENTION

## TECHNICAL PROBLEM

**[0005]** However, in the conventional heating cooker, since the rotation shaft of the motor is connected to the turntable, attachment and detachment of the turntable cannot be performed smoothly, and the convenience is poor.

**[0006]** For this reason, as another conventional heating cooker, there is a heating cooker in which a turntable arranged in the heating chamber is rotatably supported with a plurality of rollers connected with a connecting member, and the connecting member connecting the plurality of rollers is driven with the rotation shaft of the motor.

**[0007]** In the above-described heating cooker, since the turntable is merely placed on a plurality of rollers, the attachment and detachment of the turntable can be performed smoothly. However, in the heating cooker, when a food container or the like is taken out from the turntable after cooking, if the entire food container including food is heavy, the turntable may be dragged by the food container to come off the plurality of rollers and jump out to the outside. In particular, in a built-in type heating cooker provided with a transversely opening door, the turntable which jumps out to the outside may fall around the feet of a user.

**[0008]** In Europe and other countries, it is required to ensure safety by confirming that the turntable does not slide off the heating chamber under the test conditions stipulated in IEC Standard 60335-2-25 (subclause 22.118).

**[0009]** Therefore, an object of the present invention is

to provide heating cookers capable of preventing the turntable from sliding off the heating chamber with a simple configuration.

## SOLUTION TO PROBLEM

**[0010]** There is provided, according to an aspect of the present invention, a heating cooker including:

- a heating chamber;
- a plurality of rollers arranged at intervals in a circumferential direction on a bottom surface of the heating chamber;
- a connecting member configured to connect the plurality of rollers; and
- a turntable placed on the bottom surface of the heating chamber, with the plurality of rollers interposed between the turntable and the bottom surface of the heating chamber,
- wherein the turntable includes a first radial movement restricting portion provided on a bottom surface of the turntable and on an inner circumferential side of a track on which the plurality of rollers roll in a circumferential direction, the first radial movement restricting portion configured to restrict radially inward movement of the plurality of rollers.

**[0011]** In one embodiment, the turntable includes a second radial movement restricting portion provided on the bottom surface of the turntable and on an outer circumferential side of the track, the second radial movement restricting portion configured to restrict radially outward movement of the plurality of rollers.

**[0012]** In one embodiment, the turntable includes a third radial movement restricting portion provided on the bottom surface of the turntable and on an outer circumferential side of the second radial movement restricting portion, the third radial movement restricting portion configured to restrict movement of the plurality of rollers to the outer circumferential side.

**[0013]** In one embodiment, each of the first and second radial movement restricting portions of the turntable is an annular ridge portion projecting downward, and a height, i.e., a vertical dimension, of the first radial movement restricting portion relative to the bottom surface of the turntable is made smaller than a height of the second radial movement restricting portion relative to the bottom surface of the turntable.

**[0014]** In one embodiment, the turntable is configured such that simultaneously with or after at least one roller of the plurality of rollers coming into contact with the second radial movement restricting portion by the turntable being pulled outward in a radial direction, the other rollers of the plurality of rollers come into contact with the first radial movement restricting portion.

**[0015]** In one embodiment, the heating cooker includes a main body casing in which the heating chamber is arranged, the main body casing having a transversely

opening door for opening and closing an opening in a front surface of the heating chamber.

**[0016]** In one embodiment, the main body casing is of built-in type.

#### ADVANTAGEOUS EFFECTS OF INVENTION

**[0017]** As is apparent from the above, according to the present invention, the radially inward movement of the plurality of rollers is restricted by the first radial movement restricting portion provided on the bottom surface of the turntable and on the inner circumferential side of the track on which the plurality of rollers roll in the circumferential direction, whereas the radially outward movement of the plurality of rollers is restricted by the second radial movement restricting portion provided on the bottom surface of the turntable and on the outer circumferential side of the track. Therefore, heating cookers are realized in which the turntable is prevented from sliding off the heating chamber with a simple configuration.

#### BRIEF DESCRIPTION OF DRAWINGS

##### **[0018]**

Fig. 1 is a perspective view of a microwave oven as an example of a heating cooker according to a first embodiment of the present invention.

Fig. 2 is a longitudinal sectional view of the microwave oven.

Fig. 3 is a rear perspective view of a turntable and a roller stay of the microwave oven.

Fig. 4 is a rear view of the turntable and the roller stay as viewed from below.

Fig. 5 is a cross-sectional view taken along line V-V in Fig. 4.

Fig. 6 is a schematic diagram showing an upper surface of the turntable.

Fig. 7 is a schematic diagram showing a state where the turntable is displaced downward from the state in Fig. 6.

Fig. 8 is a longitudinal sectional view of a part taken along line VIII-VIII in Fig. 6.

Fig. 9 is a longitudinal sectional view of a part taken along line IX-IX in Fig. 7.

Fig. 10 is a schematic diagram showing a state where the turntable is displaced downward from a state in which the position of the roller stay differs from that in Fig. 7.

Fig. 11 is a schematic diagram showing an upper surface of a turntable and a roller stay in a comparative example.

Fig. 12 is a schematic diagram showing a state where the turntable is displaced downward.

Fig. 13 is a longitudinal sectional view of a part taken along line XIII-XIII in Fig. 11.

Fig. 14 is a longitudinal sectional view of a part taken along line XIV-XIV in Fig. 11.

Fig. 15 is a schematic diagram showing an upper surface of a turntable of a microwave oven as an example of a heating cooker according to a third embodiment of the present invention.

Fig. 16 is a schematic diagram showing a state where the turntable is displaced downward from the state in Fig. 15.

Fig. 17 is a schematic diagram showing a state where the turntable is displaced downward from a state in which the position of the roller stay differs from that in Fig. 16.

#### DESCRIPTION OF EMBODIMENTS

**[0019]** In the following, the heating cookers according to the present invention will be described in detail with reference to the illustrated embodiments.

##### First Embodiment

**[0020]** Fig. 1 shows a perspective view of a microwave oven as an example of a heating cooker according to a first embodiment of the present invention.

**[0021]** As shown in Fig. 1, the microwave oven of the first embodiment includes: a main body casing 1, a heating chamber 2 provided in the main body casing 1, the heating chamber 2 having an opening 2a in a front surface, and a transversely opening door 3 for opening and closing the opening 2a of the heating chamber 2. This microwave oven is a built-in type microwave oven.

**[0022]** The transversely opening door 3 is provided on the front side of the main body casing 1 rotatably around the left side of the transversely opening door. The transversely opening door 3 is provided with a transparent glass 4 having heat resistance. In addition, an operation panel 5 is provided on the right side of the front surface of the main body casing 1. This operation panel 5 includes a display unit and a button group.

**[0023]** A turntable 100 for placing an object to be heated is accommodated on a bottom surface 10 in the heating chamber 2. The turntable 100 is made of heat-resistant glass, ceramic, or the like.

**[0024]** Fig. 2 shows a longitudinal sectional view of the microwave oven. As shown in Fig. 2, a roller stay 200 is rotatably arranged on the bottom surface 10 of the heating chamber 2 arranged in the main body casing 1. The turntable 100 is supported by the roller stay 200.

**[0025]** The roller stay 200 includes three arms 201 as an example of a connecting member and three rollers 202 each rotatably attached to a tip or end of a corresponding one of the arms 201.

**[0026]** In addition, a tip or upper end of a rotation shaft 301 is connected to the center of the roller stay 200. Below the heating chamber 2, a gear box 302 to which a lower end of the rotation shaft 301 is connected, and a motor 303 for driving the rotation shaft 301 via the gear box 302 are arranged.

**[0027]** Fig. 3 shows a rear perspective view of the turn-

table 100 and the roller stay 200 of the microwave oven.

**[0028]** As shown in Fig. 3, the roller stay 200 includes three arms 201 connected to each other so as to extend radially from the center at an interval of 120°, and three rollers 202 each attached to the tip of a corresponding one of the arms 201. The three rollers 202 are arranged at intervals in a circumferential direction on the bottom surface 10 of the heating chamber 2. In Fig. 3, a connecting portion to which the rotation shaft 301 of the roller stay 200 (shown in Fig. 2) is connected is omitted.

**[0029]** On the bottom surface of the turntable 100 and on an inner circumferential side of a track on which the plurality of rollers 202 roll in the circumferential direction, an annular first radial movement restricting portion 101 for restricting radially inward movement of the plurality of rollers 202 is provided concentrically with the turntable 100 (see Fig. 5).

**[0030]** In addition, on the bottom surface of the turntable 100 and on an outer circumferential side of the track, an annular second radial movement restricting portion 102 for restricting radially outward movement of the plurality of rollers 202 is provided concentrically with the turntable 100 (see Fig. 5).

**[0031]** Furthermore, on the bottom surface of the turntable 100 and on the outer circumferential side of the second radial movement restricting portion 102, an annular third radial movement restricting portion 103 for restricting movement of the plurality of rollers 202 to the outer circumferential side is provided concentrically with the turntable 100 (see Fig. 5).

**[0032]** The first to third radial movement restricting portions 101, 102, and 103 are annular ridge portions projecting downward from the turntable 100.

**[0033]** It should be noted that in the first embodiment, a track surface on which the plurality of rollers 202 roll in the circumferential direction is provided on the same plane as the bottom surface of the turntable 100, but the track surface for the rollers may be a groove-shaped bottom portion recessed relative to the bottom surface of the turntable.

**[0034]** Fig. 4 shows a rear view of the turntable 100 and the roller stay 200 as viewed from below. The same components as those in Fig. 5 are denoted by the same reference numerals.

**[0035]** Fig. 5 shows a cross-sectional view taken along line V-V in Fig. 4, the lower side of Fig. 5 is the upper side of the heating cooker (the top surface side of the heating chamber 2 shown in Figs. 1 and 2), and the upper side of Fig. 5 is the lower side of the heating cooker (the bottom surface 10 side of the heating chamber 2 shown in Figs. 1 and 2). In Fig. 5, the same components as those in Figs. 3 and 4 are denoted by the same reference numerals.

**[0036]** As shown in Fig. 5, the roller 202 at the tip of the arm 201 rolls on the track interposed between the first radial movement restricting portion 101 and the second radial movement restricting portion 102 of the turntable 100. At this time, the plurality of rollers 202 roll on

the bottom surface 10 of the heating chamber 2 (shown in Figs. 1 and 2).

**[0037]** In addition, Fig. 6 shows the upper surface of the turntable 100. In Fig. 6, R1 indicates a ridgeline of the first radial movement restricting portion 101 shown in Fig. 3 on the back surface of the turntable 100, R2 indicates a ridgeline of the second radial movement restricting portion 102 shown in Fig. 3 on the back surface of the turntable 100, and R3 indicates a ridgeline of the third radial movement restricting portion 103 shown in Fig. 3 on the back surface of the turntable 100. Here, the ridgelines R1 to R3 are loci connecting the maximum height positions in the circumferential direction of the respective first to third radial movement restricting portions 101 to 103.

**[0038]** In Fig. 6, on the back side of the turntable 100, the three rollers 202 of the roller stay 200 are in their correct positions on the track on which the three rollers 202 roll in the circumferential direction. In addition, one of the three arms 201 of the roller stay 200 is arranged in the front-rear direction and toward the rear side (upward in Fig. 6 (toward the back side of the heating chamber 2)), and the other two arms 201 are arranged in positions opened by 60° to the left and right with respect to the front direction.

**[0039]** Here, it is assumed that L1 is a distance between a straight line A1 connecting the centers of the two rollers 202 on the lower side in the figure of the three rollers 202 and a straight line B1 parallel to the straight line A1 and passing through the center of gravity O of the turntable 100, and that M is a weight of the turntable 100. With a load pushing down the turntable 100 being applied near a lower edge of the turntable 100 (on the opening 2a side of the heating chamber 2 shown in Figs. 1 and 2) in order to rotate the turntable 100 around the straight line A1 as an axis, that is, in order to rotate the turntable 100 around the centers of the two rollers 202 on the lower side in the figure as a fulcrum, a rotation moment larger than a rotation moment  $M \times L1$  is necessary.

**[0040]** Next, Fig. 7 shows a schematic diagram showing a state where the turntable 100 is displaced downward from the state in Fig. 6. In Fig. 7, the lower side of the figure is the opening 2a side of the heating chamber 2 shown in Figs. 1 and 2, and the upper side of the figure is the back side of the heating chamber 2.

**[0041]** Tests were conducted on the turntable 100 in Fig. 7 under the test conditions stipulated in the following IEC standards.

#### Outline of IEC Standard 60335-2-25 (subclause 22.118)

**[0042]** A cylindrical container (maximum thickness of 3 mm, outer diameter of about 190 mm, height of about 90 mm, and outer bottom curvature of about 5 mm) made of borosilicate glass and filled with  $1000 \text{ g} \pm 50 \text{ g}$  cold water is placed on a turntable, and with a force in a horizontal direction which increases from 0 [N (kg·m/s<sup>2</sup>)] to

a maximum value 10 [N (kg·m/s<sup>2</sup>)] applied to the top of the cylindrical container, the container is pulled outward of a cavity without lifting the container from the turntable.

**[0043]** Under the above test conditions, as shown in Fig. 7, when the turntable 100 is pulled toward the lower side of the figure (the opening 2a side of the heating chamber 2 shown in Figs. 1 and 2) to be displaced, and one roller 202 in the upper part in the figure goes beyond the second radial movement restricting portion 102 on the outer side of the track, each of the other two rollers 202 is locked to the first radial movement restricting portion 101 on the inner side of the track.

**[0044]** Thus, the turntable 100 is prevented from coming off the plurality of rollers 202 by being dragged by the container and jumping out to the outside. Therefore, according to the microwave oven, the turntable 100 is prevented from sliding off the heating chamber 2 with a simple configuration.

**[0045]** Here, it is assumed that L2 is a distance between a straight line A2 connecting the centers of two rollers 202 on the lower side of the figure of the three rollers 202 and a straight line B2 parallel to the straight line A2 and passing through the center of gravity O of the turntable 100, and that M is the weight of the turntable 100. With a load pushing down the turntable 100 being applied near the lower edge of the turntable 100 (on the opening 2a side of the heating chamber 2) in order to rotate the turntable 100 around the straight line A2 as an axis, that is, in order to rotate the turntable 100 around the centers of the two rollers 202 on the lower side of the figure as a fulcrum, a rotation moment larger than a rotation moment  $M \times L2$  is necessary. The distance L2 at this time is slightly shorter than the distance L1 in Fig. 6, but there is no big difference in the rotation moment.

**[0046]** Therefore, setting the weight M and the distance L2 of the turntable 100 so as to make the rotation moment  $M \times L2$  larger than the rotation moment generated by the load of the container prevents the turntable 100 from tilting under the above test conditions even when the container slides on the turntable 100 to move to the vicinity of the edge of the turntable 100 on the lower side of the figure.

**[0047]** Fig. 8 shows a longitudinal sectional view taken along line VIII-VIII in Fig. 6. In Fig. 8, the same components as those in Figs. 3 and 4 are denoted by the same reference numerals. In Fig. 8, the vertical direction is opposite to that in Fig. 5, that is, the lower side of Fig. 8 is the lower side of the heating cooker (i.e., the bottom surface 10 side of the heating chamber 2 shown in Figs. 1 and 2), and the upper side of Fig. 8 is the upper side of the heating cooker (i.e., the top surface side of the heating chamber 2 shown in Figs. 1 and 2).

**[0048]** In Fig. 8, on the back of the turntable 100, the three rollers 202 of the roller stay 200 are in their correct positions on the track on which the three rollers 202 roll in the circumferential direction.

**[0049]** Here, a height, i.e., a vertical dimension, H1 of the first radial movement restricting portion 101 relative

to the bottom surface of the turntable 100 is made smaller than a height H2 of the second radial movement restricting portion 102 relative to the bottom surface of the turntable 100. Thus, the arms 201 connecting the plurality of rollers 202 do not interfere with the first radial movement restricting portion 101.

**[0050]** Fig. 9 shows a longitudinal cross-sectional view taken along line IX-IX in Fig. 7, showing a state where the turntable 100 is pulled toward the left direction in the figure (i.e., toward the opening 2a side of the heating chamber 2 shown in Figs. 1 and 2) to be displaced, and the roller 202 goes beyond the second radial movement restricting portion 102 on the outer side of the track. Each of the other two rollers 202 is locked to the first radial movement restricting portion 101 on the inner side of the track.

**[0051]** At this time, the roller 202 that goes beyond the second radial movement restricting portion 102 is caught between the second radial movement restricting portion 102 and the third radial movement restricting portion 103 to be locked. The locking of the roller 202 that goes beyond the second radial movement restricting portion 102 (between the second radial movement restricting portion 102 and the third radial movement restricting portion 103) and the locking of the other two rollers 202 to the first radial movement restricting portion 101 are combined to cause the locking force of the three rollers 202 against the turntable 100 to increase, and the turntable 100 is reliably prevented from jumping out to the outside.

**[0052]** Fig. 10 shows a schematic diagram showing a state where the turntable 100 relative to which the positions of the rollers 202 are different from those in Fig. 7 is displaced downward in the figure (i.e., toward the opening 2a side of the heating chamber 2 shown in Figs. 1 and 2). In Fig. 10, the lower side of the figure is the opening 2a side of the heating chamber 2, and the upper side of the figure is the back side of the heating chamber 2.

**[0053]** In the roller stay 200 in Fig. 10, one arm 201 is arranged in a position facing the opening 2a side of the heating chamber 2, and the other two arms 201 are arranged in positions opened by 60° to the left and right with respect to the backward direction.

**[0054]** Under the test conditions of the IEC standard 60335-2-25 (subclause 22.118), as shown in Fig. 10, when the turntable 100 is pulled toward the lower side in the figure (the opening 2a side of the heating chamber 2) to be displaced, one roller 202 in the lower part in the figure is locked to the first radial movement restricting portion 101 on the inner side of the track, and each of the other two rollers 202 is locked to the second radial movement restricting portion 102 on the outer side of the track.

**[0055]** Therefore, in the arrangement of the roller stay 200 shown in Fig. 10, the locking between the one roller 202 and the first radial movement restricting portion 101 and the locking between the other two rollers 202 and the second radial movement restricting portion 102 are combined to cause the locking force of the three rollers

202 against the turntable 100 to increase, and the turntable 100 is reliably prevented from jumping out to the outside.

**[0056]** When it is assumed that L3 is a distance between a straight line A3 passing through the center and extending in a tangential direction of one roller 202 on the lower side in the figure of the three rollers 202 and a straight line B3 parallel to the straight line A3 and passing through the center of gravity O of the turntable 100, and that M is the weight of the turntable 100, the rotation moment for rotating the turntable 100 around the straight line A3 as an axis is  $M \times L3$ , which is much larger than  $M \times L1$  in Fig. 7.

**[0057]** Therefore, setting the weight M and the distance L3 of the turntable 100 so as to make the rotation moment  $M \times L3$  larger than the rotation moment generated by the load of the container prevents the turntable 100 from tilting under the above test conditions even when the container slides on the turntable 100 to move to the vicinity of the edge of the turntable 100 on the lower side in the figure.

#### Comparative Example

**[0058]** Fig. 11 is a schematic diagram showing an upper surface of a turntable 1100 and a roller stay 200 in a comparative example. The turntable 1100 in Fig. 11 has the same configuration as the turntable 100 shown in Figs. 3 and 4 except that the first radial movement restricting portion 101 is not provided, and the same components are denoted by the same reference numerals. It should be noted that this comparative example is provided for the purpose of explaining the heating cooker of the present invention in an easily understandable manner, and is not the heating cooker of the present invention.

**[0059]** In Fig. 11, on the back of the turntable 1100, three rollers 202 of the roller stay 200 are in their correct positions on the track on which the three rollers 202 roll in the circumferential direction.

**[0060]** Next, Fig. 12 shows a schematic diagram showing a state where the turntable 1100 is displaced downward. In Fig. 12, the lower side of the figure is the opening 2a side of the heating chamber 2, and the upper side of the figure is the back side of the heating chamber 2.

**[0061]** Under the test conditions of the IEC standard 60335-2-25 (subclause 22.118), as shown in Fig. 12, when the turntable 1100 is pulled toward the lower side in the figure (i.e., toward the opening 2a side of the heating chamber 2) to be displaced, and when one roller 202 in the upper part in the figure goes beyond the second radial movement restricting portion 102 on the outer side of the track, the other two rollers 202 are not locked anywhere.

**[0062]** For this reason, in this comparative example, in the test of the IEC standard 60335-2-25 (subclause 22.118), the turntable 1100 comes off the rollers 202 to jump out to the outside.

**[0063]** Fig. 13 shows a longitudinal sectional view taken

along line XIII-XIII in Fig. 11. In Fig. 13, on the back of the turntable 1100, the three rollers 202 of the roller stay 200 are in their correct positions on the track on which the three rollers 202 roll in the circumferential direction.

**[0064]** Fig. 14 shows a longitudinal sectional view taken along line XIV-XIV in Fig. 11. Fig. 14 shows a state where the turntable 100 is pulled toward the left direction in the figure to be displaced, and the roller 202 goes beyond the second and third radial movement restricting portions 102 and 103 on the outer side of the track.

**[0065]** Thus, in the above comparative example, the turntable 1100 cannot be prevented from jumping out to the outside.

**[0066]** In contrast, in the microwave oven of the first embodiment, the radially inward movement of a plurality of rollers 202 is restricted by the first radial movement restricting portion 101 provided on the bottom surface of the turntable 100 and on the inner circumferential side of the track on which the plurality of rollers 202 roll in the circumferential direction, whereas the radially outward movement of the plurality of rollers 202 is restricted by the second radial movement restricting portion 102 provided on the bottom surface of the turntable 100 and on the outer circumferential side of the track. Thus, when a force to pull the turntable 100 in the horizontal direction to displace the turntable 100 is applied, any one of the plurality of rollers 202 is locked to the second radial movement restricting portion 102 on the outer side of the track, and the turntable 100 is prevented from being displaced in the horizontal direction. Furthermore, when the force to pull the turntable 100 in the horizontal direction to displace the turntable 100 is increased, and any one of the plurality of rollers 202 goes beyond the second radial movement restricting portion 102 on the outer side of the track, the other rollers 202 are locked to the first radial movement restricting portion 101 on the inner side of the track.

**[0067]** Thus, even when any one of the plurality of rollers 202 goes beyond the second radial movement restricting portion 102 on the outer side of the track, the movement of the turntable 100 can be restricted by locking the other rollers 202 to the first radial movement restricting portion 101 on the inner side of the track. Therefore, the turntable 100 is prevented from sliding off the heating chamber 2 with a simple configuration, and a microwave oven meeting the IEC standard 60335-2-25 (subclause 22.118) can be provided.

**[0068]** In addition, since the movement of the rollers 202 to the outer circumferential side is restricted by the third radial movement restricting portion 103 provided on the bottom surface of the turntable 100 and on the outer circumferential side of the second radial movement restricting portion 102, when a force to pull the turntable 100 in the horizontal direction to displace the turntable 100 is applied, even if any one of the plurality of rollers 202 goes beyond the second radial movement restricting portion 102 on the outer side of the track, the movement

of the roller 202 to the outer circumferential side is restricted by the third radial movement restricting portion 103 on the outer side of the second radial movement restricting portion 102, and the turntable 100 is reliably prevented from sliding off the heating chamber 2.

**[0069]** In addition, when the turntable 100 is pulled outward in the radial direction and at least one of the plurality of rollers 202 comes into contact with the second radial movement restricting portion 102 and moves beyond the second radial movement restricting portion 102, the other two rollers 202 of the plurality of rollers 202 are locked to the first radial movement restricting portion 101 in a state where the at least one of the plurality of rollers 202 is beyond the second radial movement restricting portion 102, whereby the turntable 100 can be easily prevented from sliding off the heating chamber 2.

**[0070]** Alternatively, when the turntable 100 is pulled outward in the radial direction, the other two rollers 202 of the plurality of rollers 202 may be locked to the first radial movement restricting portion 101 simultaneously with the at least one roller 202 of the plurality of rollers 202 coming into contact with the second radial movement restricting portion 102.

**[0071]** In addition, by making the height H1 of the first radial movement restricting portion 101 relative to the bottom surface of the turntable 100 smaller than the height H2 of the second radial movement restricting portion 102 relative to the bottom surface of the turntable 100, the arms 201 connecting the plurality of rollers 202 are unlikely to interfere with the first radial movement restricting portion 101 and a degree of freedom of design is increased.

**[0072]** In microwave ovens including a main body casing 1 having a transversely opening door 3 for opening and closing an opening 2a on the front surface, a turntable 100 may fall forward when the turntable 100 is mistakenly pulled out from the opening 2a on the front surface of a heating chamber 2 of the main body casing 1.

**[0073]** In the microwave oven including such a main body casing 1 having the transversely opening door 3 for opening and closing the opening 2a in the front surface of the heating chamber 2, according to the first embodiment, the IEC standard 60335-2-25 (subclause 22.118) can be easily met and the turntable 100 is prevented from falling forward.

**[0074]** In addition, in the case of microwave ovens including a built-in type main body casing 1, when a turntable 100 is mistakenly pulled out from an opening 2a in the front surface of a heating chamber 2 of the main body casing 1, the turntable 100 may fall directly on the floor since there may be no flat mounting surface portion in front of the opening.

**[0075]** In the microwave oven including such a built-in type main body casing 1, the IEC standard 60335-2-25 (subclause 22.118) can be easily met and the turntable 100 can be prevented from falling forward.

## Second Embodiment

**[0076]** A microwave oven as an example of a heating cooker of a second embodiment of the present invention has the same configuration as the microwave oven of the first embodiment except that the third radial movement restricting portion 103 is not provided, and Figs. 1 to 10 will be referred to in the following.

**[0077]** In the microwave oven of the second embodiment, as shown in Fig. 7, when the turntable 100 is pulled toward the lower side in the figure (the opening 2a side of the heating chamber 2 shown in Figs. 1 and 2) to be displaced, and one roller 202 in the upper part in the figure goes beyond the second radial movement restricting portion 102 on the outer side of the track, each of the other two rollers 202 is locked to the first radial movement restricting portion 101 on the inner side of the track.

**[0078]** In addition, as shown in Fig. 10, when the turntable 100 is pulled under the test conditions of the IEC standard 60335-2-25 (subclause 22.118) toward the lower side of the figure (the opening 2a side of the heating chamber 2) to be displaced, one roller 202 in the lower part in the figure is locked to the first radial movement restricting portion 101 on the inner side of the track, and each of the other two rollers 202 is locked to the second radial movement restricting portion 102 on the outer side of the track.

**[0079]** According to the microwave oven of the second embodiment, the turntable 100 can be prevented from sliding off the heating chamber 2 with a simple configuration.

**[0080]** The microwave oven of the second embodiment has the same effect as the microwave oven of the first embodiment except for the effect provided by the third radial movement restricting portion 103.

## Third Embodiment

**[0081]** Fig. 15 shows an upper surface of a turntable 400 of a microwave oven as an example of a heating cooker according to a third embodiment of the present invention. The microwave oven of the third embodiment has the same configuration as the microwave oven of the first embodiment except that the second and third radial movement restricting portions 102 and 103 are not provided, and Figs. 1 to 10 are referred to in the following. In addition, in Fig. 15, the same components as those in Figs. 1 to 10 are denoted by the same reference numerals.

**[0082]** Fig. 15 shows the upper surface of the turntable 400. In Fig. 15, R1 indicates a ridgeline of the first radial movement restricting portion 101 shown in Fig. 3 on the back surface of the turntable 400. Here, the ridgeline R1 is the locus connecting the maximum height position in the circumferential direction of the first radial movement restricting portion 101.

**[0083]** In Fig. 15, on the back of the turntable 400, the three rollers 202 of the roller stay 200 are in their correct

positions on the track on which the three rollers 202 roll in the circumferential direction.

**[0084]** In the microwave oven of the third embodiment, under the test conditions of the IEC standard 60335-2-25 (subclause 22.118), when the turntable 400 is pulled toward the lower side of the figure (the opening 2a side of the heating chamber 2 shown in Figs. 1 and 2) to be displaced from the state in Fig. 15, as shown in Fig. 16, two of the three rollers 202 are locked to the first radial movement restricting portion 101 on the inner side of the track.

**[0085]** Fig. 17 shows a schematic diagram showing a state where the turntable 400 relative to which the positions of the rollers 202 are different from those in Fig. 16 is displaced downward (i.e., toward the opening 2a side of the heating chamber 2). In Fig. 17, the same components as those in Figs. 1 to 10 are denoted by the same reference numerals, the lower side of the figure is the opening 2a side of the heating chamber 2, and the upper side of the figure is the back side of the heating chamber 2.

**[0086]** In the roller stay 200 in Fig. 17, one arm 201 is arranged in a position facing the opening 2a side of the heating chamber 2, and the other two arms 201 are arranged in positions opened by 60° to the left and right with respect to the backward direction.

**[0087]** Under the test conditions of the IEC standard 60335-2-25 (subclause 22.118), as shown in Fig. 17, when the turntable 400 is pulled toward the lower side in the figure (i.e., the opening 2a side of the heating chamber 2) to be displaced, the one roller 202 in the lower part in the figure is locked to the first radial movement restricting portion 101 on the inner side of the track.

**[0088]** According to the microwave oven of the third embodiment, the turntable 100 can be prevented from sliding off the heating chamber 2 with a simple configuration.

**[0089]** In the case of Fig. 16, when it is assumed that L2 is a distance between a straight line A2 passing through the center and extending in the tangential direction of one roller 202 on the lower side in the figure of the three rollers 202 and a straight line B2 parallel to the straight line A2 and passing through the center of gravity O of the turntable 400, and that M is the weight of the turntable 400, the rotation moment for rotating the turntable 400 around the straight line A2 as an axis is  $M \times L2$ .

**[0090]** On the other hand, in the case of Fig. 17, when it is assumed that L3 is a distance between a straight line A3 passing through the center and extending in the tangential direction of one roller 202 on the lower side in the figure of the three rollers 202 and a straight line B3 parallel to the straight line A3 and passing through the center of gravity O of the turntable 400, and that M is the weight of the turntable 400, the rotation moment for rotating the turntable 400 around the straight line A3 as an axis is  $M \times L3$ , which is much larger than that in Fig. 16.

**[0091]** Therefore, setting the weight M and the distance L2 of the turntable 100 so as to make the rotation moment

$M \times L2$  larger than the rotation moment generated by the load of the container prevents the turntable 100 from tilting under the above test conditions even when the container slides on the turntable 100 to move to the vicinity of the edge of the turntable 100 on the lower side of the figure.

**[0092]** The microwave oven of the third embodiment has the same effect as the microwave oven of the first embodiment except for the effects provided by the second and third radial movement restricting portions 102 and 103.

#### Fourth Embodiment

**[0093]** The microwave oven as an example of a heating cooker according to a fourth embodiment of the present invention has the same configuration as the microwave oven of the first embodiment except that the height of the first radial movement restricting portion relative to the height of the second radial movement restricting portion is different.

**[0094]** In the microwave oven of the fourth embodiment, on the bottom surface of the turntable and on the inner circumferential side of the track on which the plurality of rollers roll in the circumferential direction, an annular first radial movement restricting portion for restricting the radially inward movement of the plurality of rollers is provided concentrically with the turntable.

**[0095]** In addition, on the bottom surface of the turntable and on the outer circumferential side of the track, an annular second radial movement restricting portion for restricting the radially outward movement of the plurality of rollers is provided concentrically with the turntable.

**[0096]** The height of the first radial movement restricting portion relative to the bottom surface of the turntable is made larger than the height of the second radial movement restricting portion relative to the bottom surface of the turntable. Thus, the locking force between the plurality of rollers and the first radial movement restricting portion is made stronger.

**[0097]** It should be noted that in the fourth embodiment, the arms connected to the rollers have a configuration that does not come into contact with or interfere with the first radial movement restricting portion.

**[0098]** The microwave oven of the fourth embodiment has the same effect as the microwave oven of the first embodiment.

**[0099]** In the first to fourth embodiments, microwave ovens as heating cookers are described, but the present invention may be applied to other heating cookers such as convection microwave ovens.

**[0100]** In addition, in the first to fourth embodiments, the microwave ovens including the roller stay 200 having three radially extending arms 201 are described, but the configuration of the roller stay is not limited to this, and a heating cooker in which a plurality of rollers are rotatably attached to an annular connecting member may be used.

**[0101]** In addition, in the first to fourth embodiments,



the annular ridge portions projecting downward provided on the bottom surface of the turntable 100 are used as the first to third radial movement restricting portions 101 to 103, but the first to third radial movement restricting portions are not limited to these, and other forms of radial movement restricting portions may be used.

**[0102]** Although some specific embodiments of the present invention are described, the present invention is not limited to the first to fourth embodiments, and various modifications can be made within the scope of the present invention. For example, an appropriate combination of the features described in the first to fourth embodiments may be one embodiment of the present invention.

**[0103]** The subject matter of the present invention and the embodiments will be summarized as follows.

**[0104]** A heating cooker according to an aspect of the present invention includes:

- a heating chamber 2;
  - a plurality of rollers 202 arranged at intervals in a circumferential direction on a bottom surface of the heating chamber 2;
  - a connecting member 201 configured to connect the plurality of rollers 202; and
  - a turntable 100 placed on the bottom surface of the heating chamber 2 with the plurality of rollers 202 interposed between the turntable and the bottom surface,
- wherein the turntable 100 includes a first radial movement restricting portion 101 provided on the bottom surface of the turntable 100 and on an inner circumferential side of a track on which the plurality of rollers 202 roll in a circumferential direction, the first radial movement restricting portion 101 configured to restrict radially inward movement of the plurality of rollers 202.

**[0105]** According to the above configuration, the radially inward movement of the plurality of rollers 202 is restricted by the first radial movement restricting portion 101 provided on the bottom surface of the turntable 100 and on the inner circumferential side of the track on which the plurality of rollers 202 roll in the circumferential direction. For example, when a force pulling the turntable 100 in a horizontal direction is applied to displace the turntable 100, one or some of the rollers 202 are locked to the first radial movement restricting portion 101 on the inner side of the track. Thus, the movement of the turntable 100 can be restricted. Therefore, the turntable 100 is prevented from sliding off the heating chamber 2 with a simple configuration.

**[0106]** In an embodiment, the turntable 100 includes a second radial movement restricting portion 102 provided on the bottom surface of the turntable 100 and on an outer circumferential side of the track, the second radial movement restricting portion 102 configured to restrict radially outward movement of the plurality of rollers 202.

**[0107]** According to the above embodiment, the radially inward movement of the plurality of rollers 202 is restricted by the first radial movement restricting portion 101 provided on the bottom surface of the turntable 100 and on the inner circumferential side of the track on which the plurality of rollers 202 roll in the circumferential direction, whereas the radially outward movement of the plurality of rollers 202 is restricted by the second radial movement restricting portion 102 provided on the bottom surface of the turntable 100 and on the outer circumferential side of the track. For example, when a force to pull the turntable 100 in the horizontal direction to displace the turntable 100 is applied, one or some of the plurality of rollers 202 are locked to the second radial movement restricting portion 102 on an outer side of the track, and when a stronger force is applied and a roller 202 goes beyond the second radial movement restricting portion 102, the other rollers 202 are locked to the first radial movement restricting portion 101 on the inner side of the track. Thus, even when one or some of the plurality of rollers 202 goes beyond the second radial movement restricting portion 102 on the outer side of the track, locking the other rollers 202 to the first radial movement restricting portion 101 on the inner side of the track allows the movement of the turntable 100 to be restricted.

**[0108]** In an embodiment, the turntable 100 includes a third radial movement restricting portion 103 provided on the bottom surface of the turntable 100 and on an outer circumferential side of the second radial movement restricting portion 102, the third radial movement restricting portion 103 configured to restrict movement of the plurality of rollers 202 to the outer circumferential side.

**[0109]** According to the above embodiment, since the movement of the plurality of rollers 202 to the outer circumferential side is restricted by the third radial movement restricting portion 103 provided on the bottom surface of the turntable 100 and on the outer circumferential side of the second radial movement restricting portion 102, when a force to pull the turntable 100 in the horizontal direction to displace the turntable 100 is applied, even if one or some of the plurality of rollers 202 go beyond the second radial movement restricting portion 102 on the outer side of the track, the movement of the roller or rollers 202 to the outer circumferential side can be restricted by the third radial movement restricting portion 103, and the turntable 100 can be reliably prevented from sliding off the heating chamber 2.

**[0110]** In an embodiment, the turntable 100 is configured such that simultaneously with or after at least one roller of the plurality of rollers 202 coming into contact with the second radial movement restricting portion 102 by the turntable 100 being pulled outward in a radial direction, the other rollers 202 of the plurality of rollers 202 come into contact with the first radial movement restricting portion 101.

**[0111]** According to the above embodiment, when the turntable 100 is pulled outward in the radial direction, simultaneously with at least one roller 202 of the plurality

of rollers 202 coming into contact with the second radial movement restricting portion 102 the other rollers 202 of the plurality of rollers 202 may be locked to the first radial movement restricting portion 101. Alternatively, when the turntable 100 is pulled outward in the radial direction, after at least one roller 202 of the plurality of rollers 202 comes into contact with the second radial movement restricting portion 102, the other rollers 202 of the plurality of rollers 202 may be locked to the first radial movement restricting portion 101. Thus, the turntable 100 is easily prevented from sliding off the heating chamber 2.

**[0112]** In an embodiment, each of the first and second radial movement restricting portions 101 and 102 of the turntable 100 is an annular ridge portion projecting downward, and a height, i.e., a vertical dimension, of the first radial movement restricting portion 101 relative to the bottom surface of the turntable 100 is made smaller than a height of the second radial movement restricting portion 102 relative to the bottom surface of the turntable 100.

**[0113]** According to the above embodiment, by making the height of the first radial movement restricting portion 101 relative to the bottom surface of the turntable 100 smaller than the height of the second radial movement restricting portion 102 with respect to the bottom surface of the turntable 100, the connecting member 201 connecting the plurality of rollers 202 is unlikely to interfere with the first radial movement restricting portion 101, and the degree of freedom of design is increased.

**[0114]** In addition, the heating cooker of an embodiment includes a main body casing 1 in which the heating chamber 2 is arranged, the main body casing 1 having a transversely opening door 3 for opening and closing an opening 2a in a front surface of the heating chamber 2.

**[0115]** In heating cookers including a main body casing 1 having a transversely opening door 3 for opening and closing an opening 2a in a front surface, a turntable 100 may fall forward when the turntable 100 is mistakenly pulled out from the opening 2a in the front surface of the heating chamber 2 of the main body casing 1.

**[0116]** According to the above embodiment, in the heating cooker including such a main body casing 1 including the transversely opening door 3 for opening and closing the opening 2a in the front surface of the heating chamber 2, the IEC standard 60335-2-25 (subclause 22.118) can be easily met and the turntable 100 is prevented from falling forward.

**[0117]** In an embodiment, the main body casing 1 is a built-in type main body casing.

**[0118]** In the case of the heating cooker including the built-in type main body casing 1, there may be no flat mounting surface portion in its front. Therefore, when the turntable 100 is mistakenly pulled out from the opening 2a in the front surface of the heating chamber 2 of the main body casing 1, the turntable 100 may fall directly on the floor.

**[0119]** According to the above embodiment, in the heating cooker including such a built-in type main body casing 1, the IEC standard 60335-2-25 (subclause

22.118) can be easily met and the turntable 100 is prevented from falling forward.

## REFERENCE SIGNS LIST

### [0120]

- 1: main body casing
- 2: heating chamber
- 2a: opening
- 3: transversely opening door
- 4: glass
- 5: operation panel
- 10: bottom surface
- 100, 400: turntable
- 101: first radial movement restricting portion
- 102: second radial movement restricting portion
- 103: third radial movement restricting portion
- 200: roller stay
- 201: arm
- 202: roller
- 301: rotation shaft
- 302: gear box
- 303: motor

## Claims

### 1. A heating cooker comprising:

- a heating chamber;
- a plurality of rollers arranged at intervals in a circumferential direction on a bottom surface of the heating chamber;
- a connecting member configured to connect the plurality of rollers; and
- a turntable placed on the bottom surface of the heating chamber with the plurality of rollers interposed between the turntable and the bottom surface of the heating chamber, wherein the turntable includes a first radial movement restricting portion provided on a bottom surface of the turntable and on an inner circumferential side of a track on which the plurality of rollers roll in a circumferential direction, the first radial movement restricting portion configured to restrict radially inward movement of the plurality of rollers.

### 2. The heating cooker according to claim 1, wherein the turntable includes a second radial movement restricting portion provided on the bottom surface of the turntable and on an outer circumferential side of the track, the second radial movement restricting portion configured to restrict radially outward movement of the plurality of rollers.

### 3. The heating cooker according to claim 2, wherein

the turntable includes a third radial movement restricting portion provided on the bottom surface of the turntable and on an outer circumferential side of the second radial movement restricting portion, the third radial movement restricting portion configured to restrict movement of the plurality of rollers to the outer circumferential side. 5

4. The heating cooker according to claim 2 or 3, wherein the turntable is configured such that simultaneously with or after at least one roller of the plurality of rollers coming into contact with the second radial movement restricting portion by the turntable being pulled outward in a radial direction, the other rollers of the plurality of rollers come into contact with the first radial movement restricting portion. 10 15

5. The heating cooker according to any one of claims 1-4, comprising a main body casing in which the heating chamber is arranged, the main body casing having a transversely opening door for opening and closing an opening in a front surface of the heating chamber. 20

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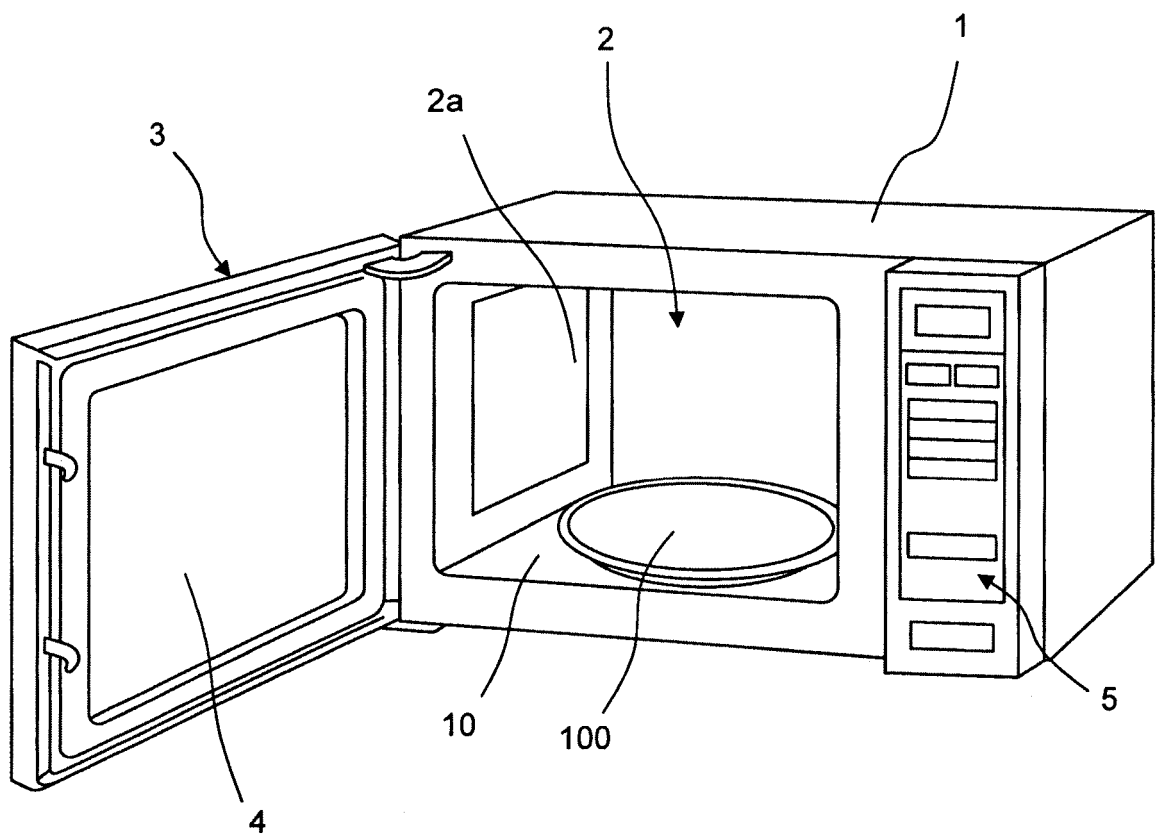
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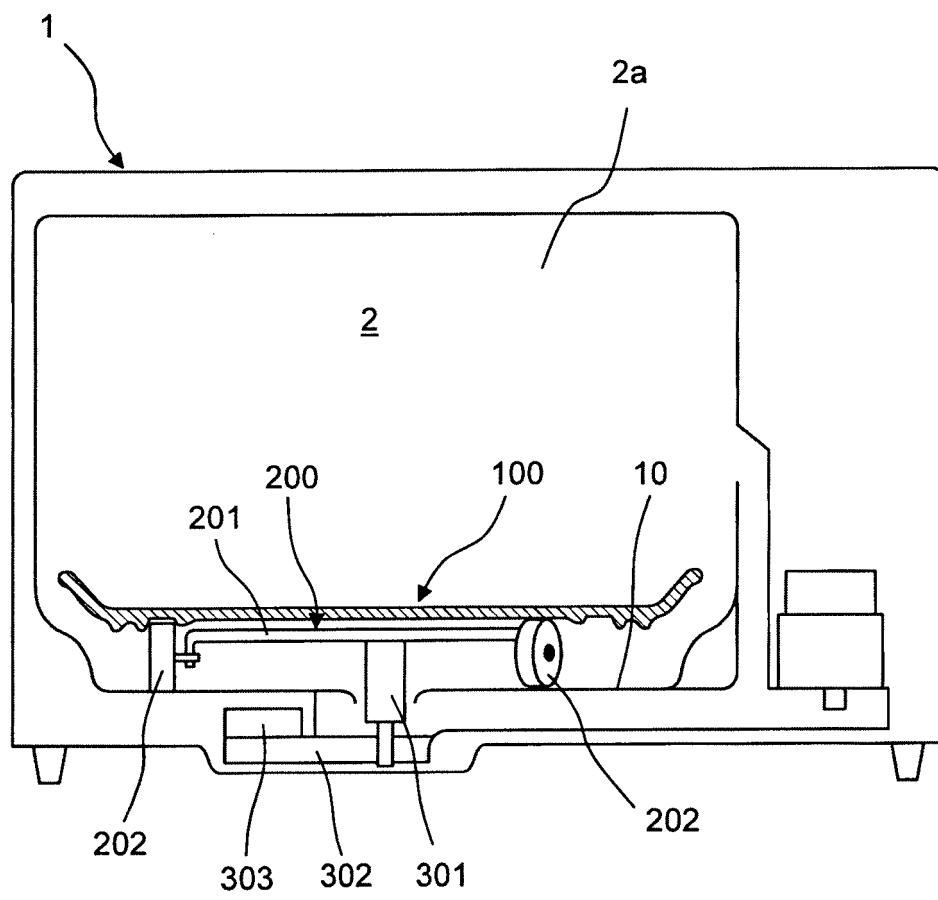
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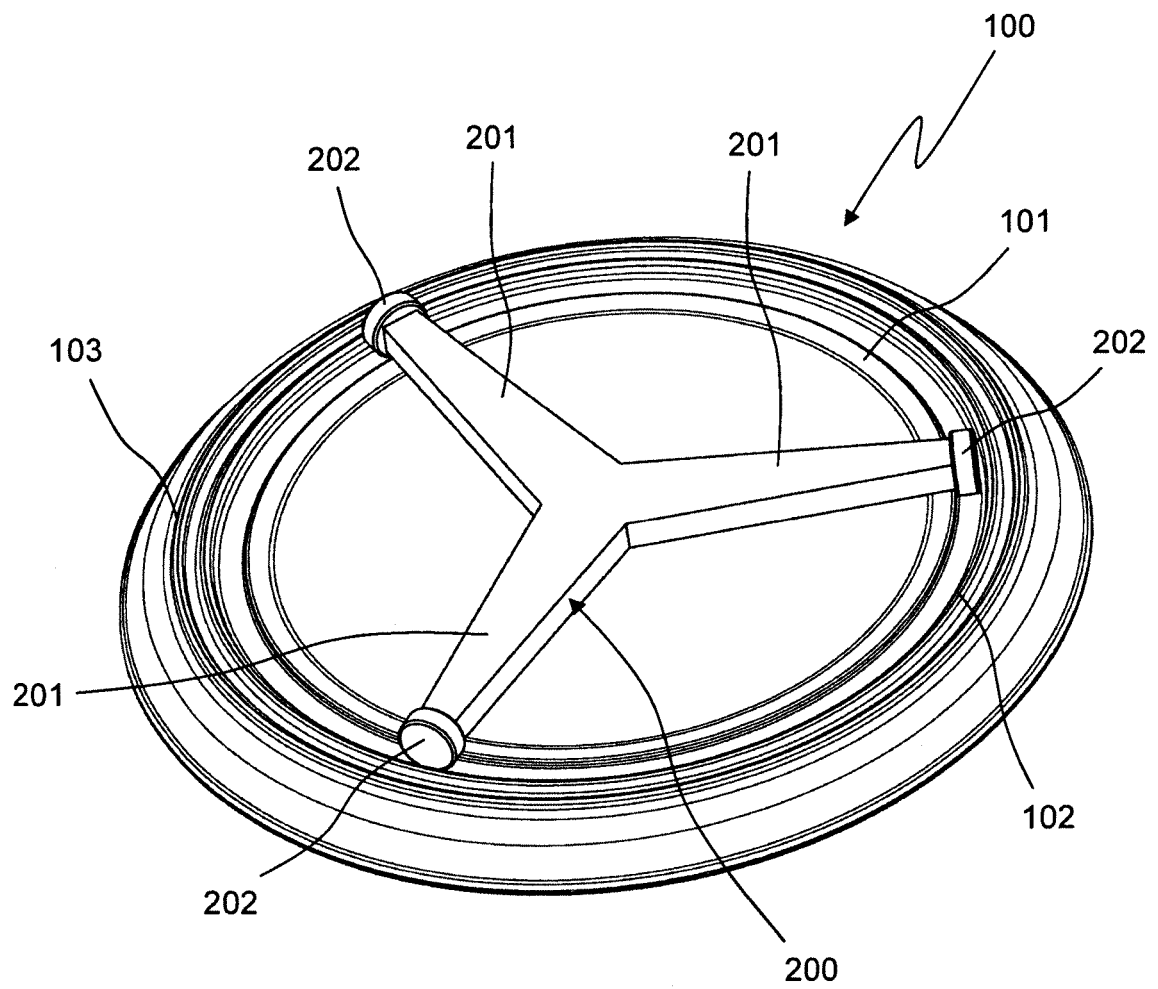
*Fig. 1*



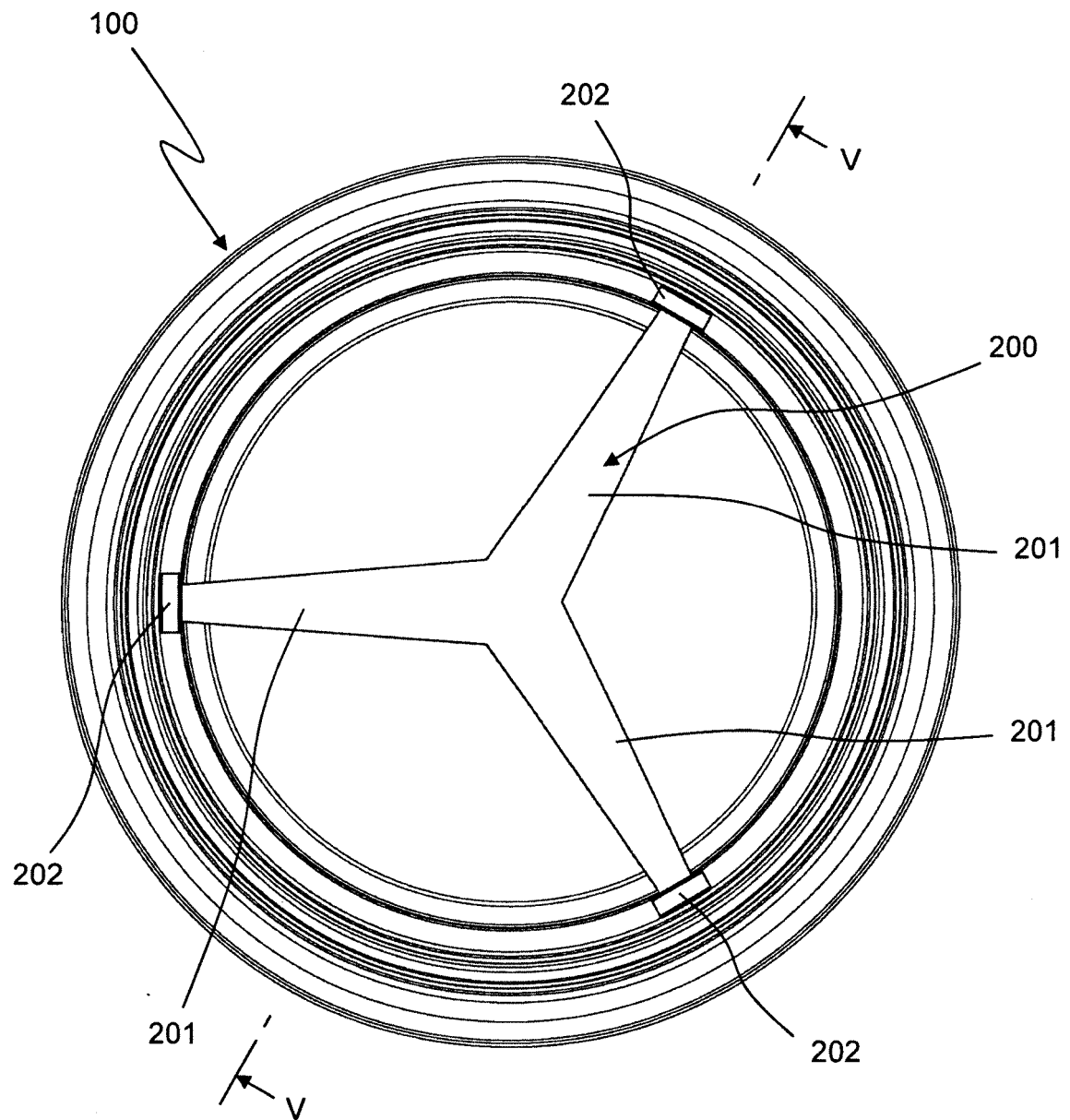
*Fig.2*



*Fig.3*



*Fig.4*



*Fig.5*

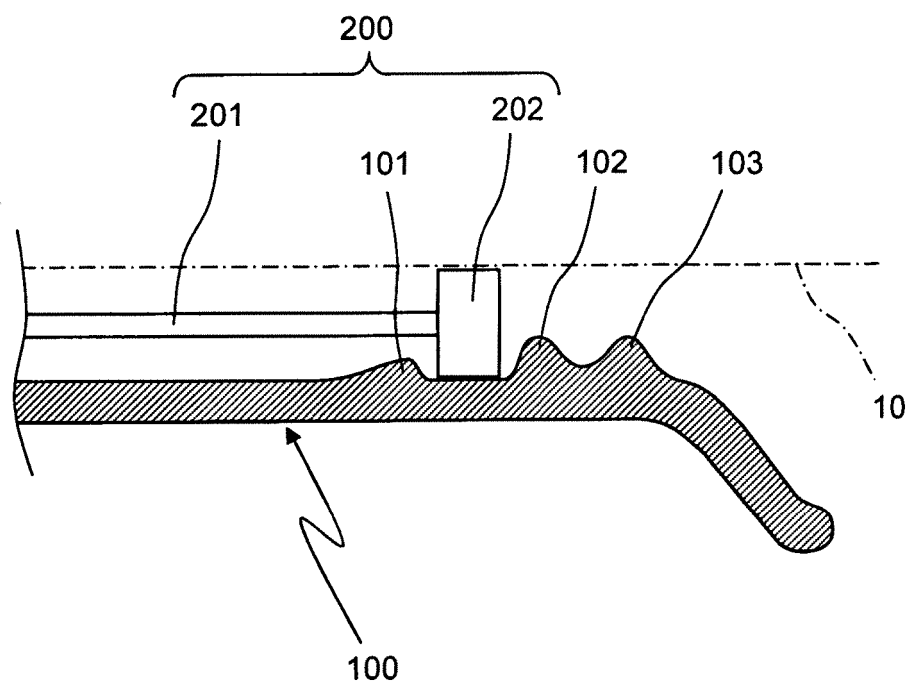




Fig.6

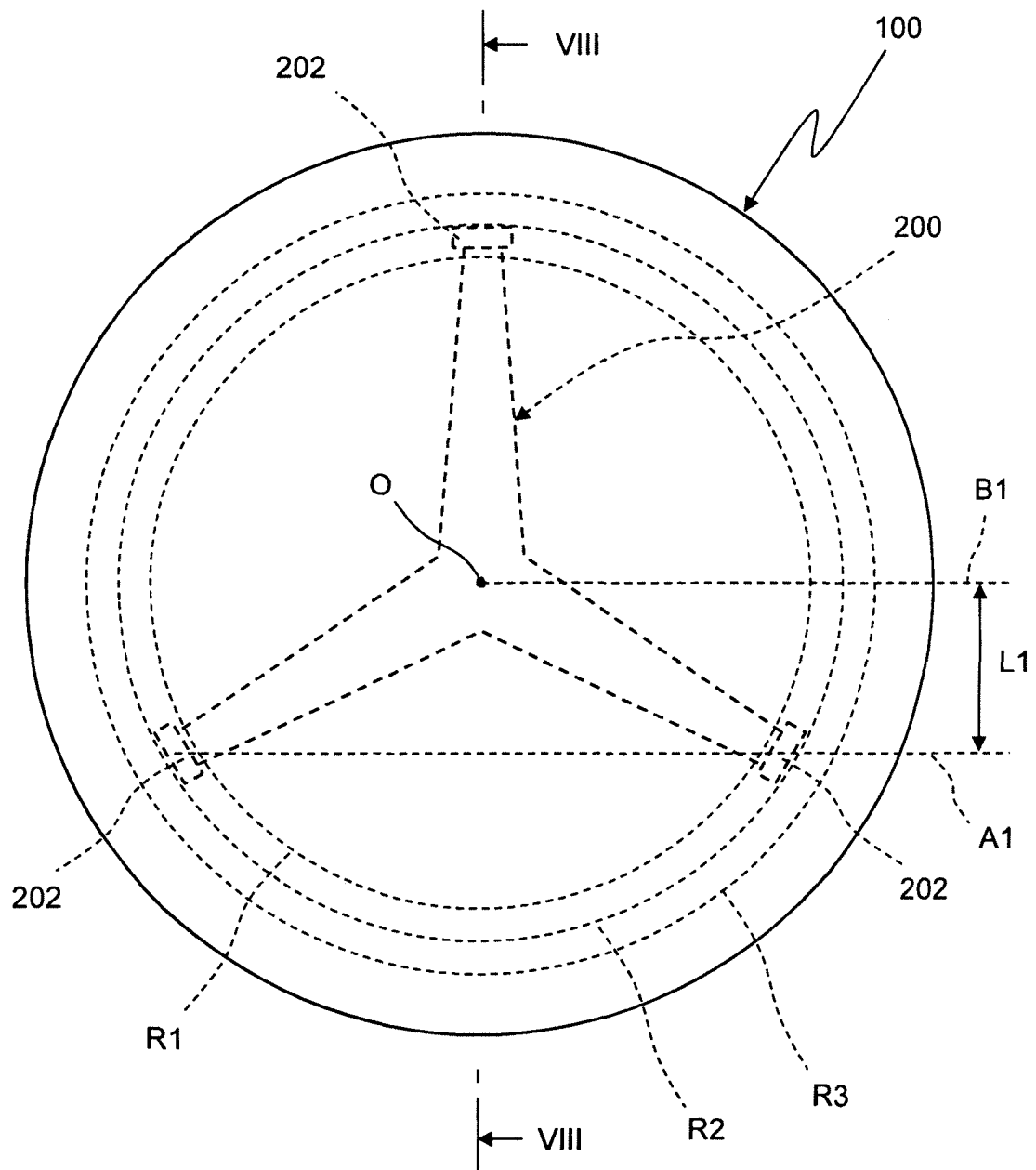
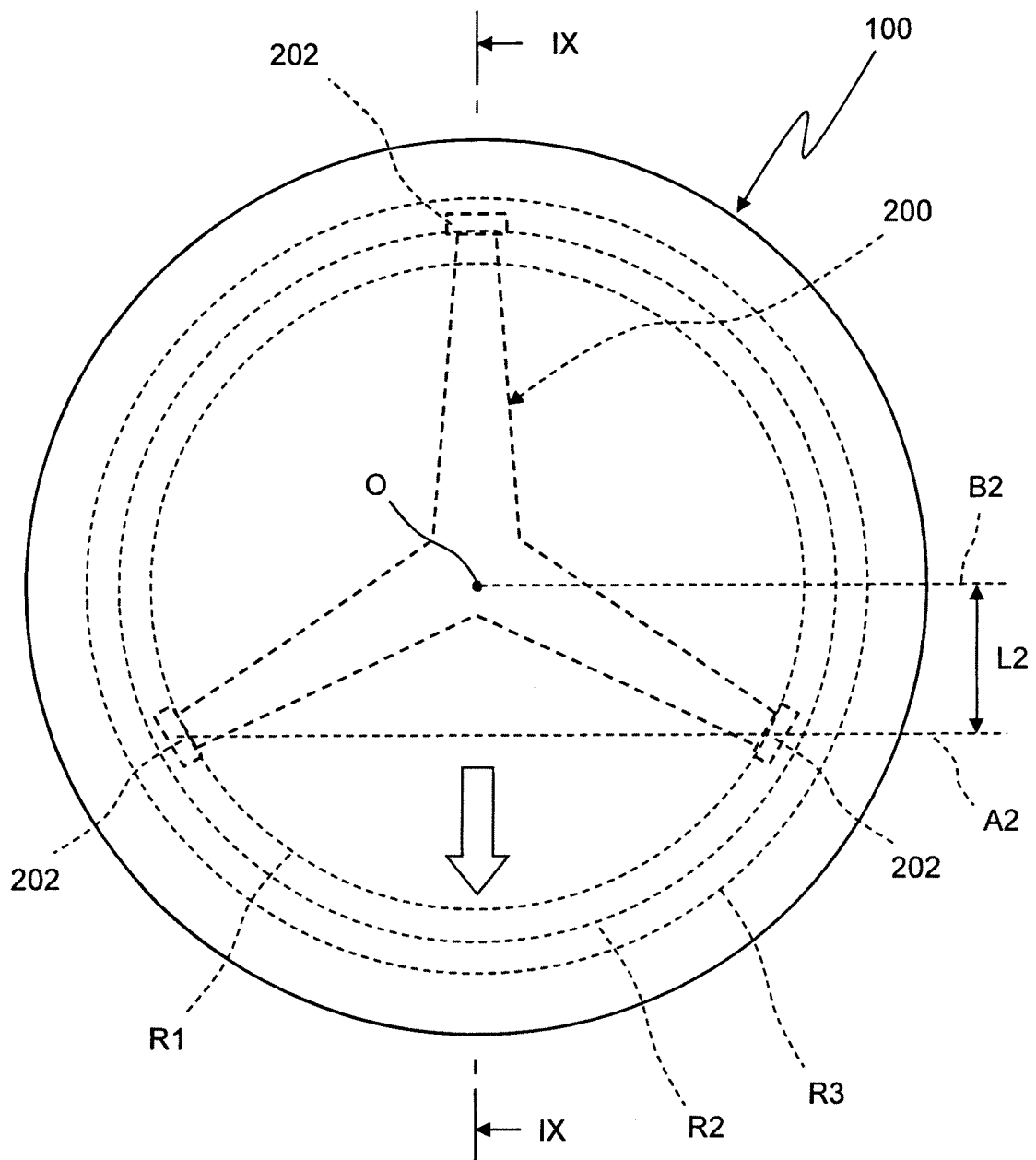
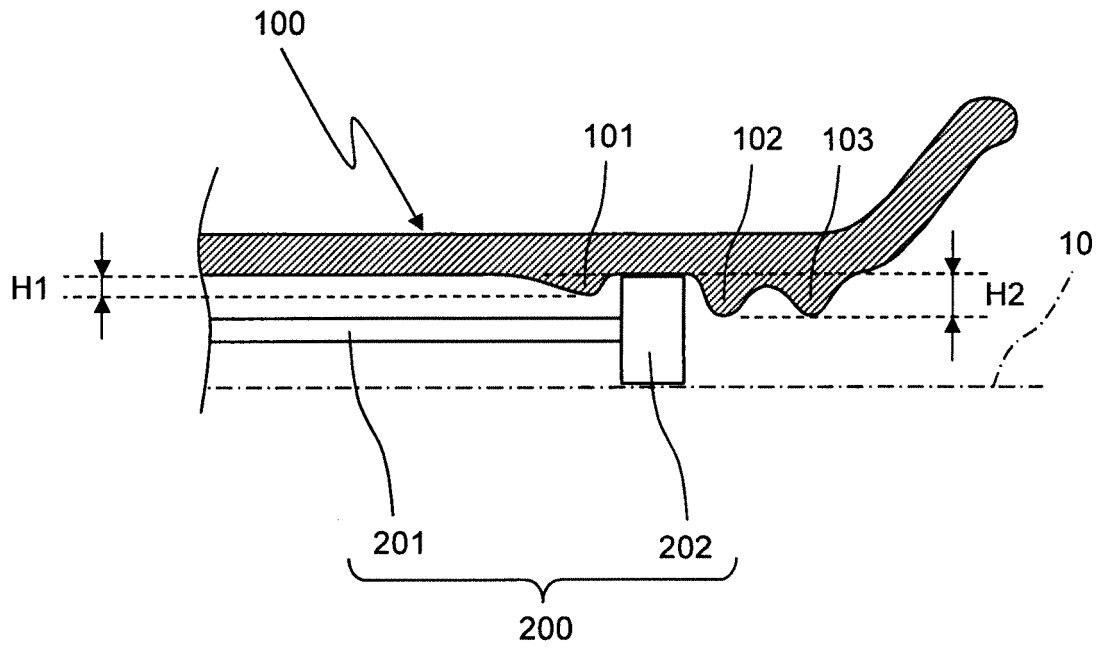


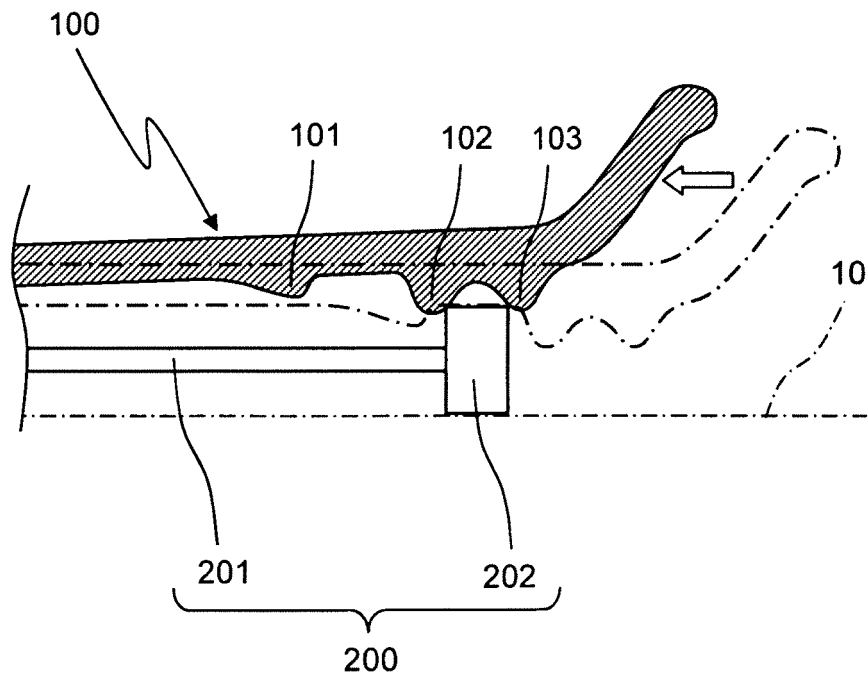
Fig.7



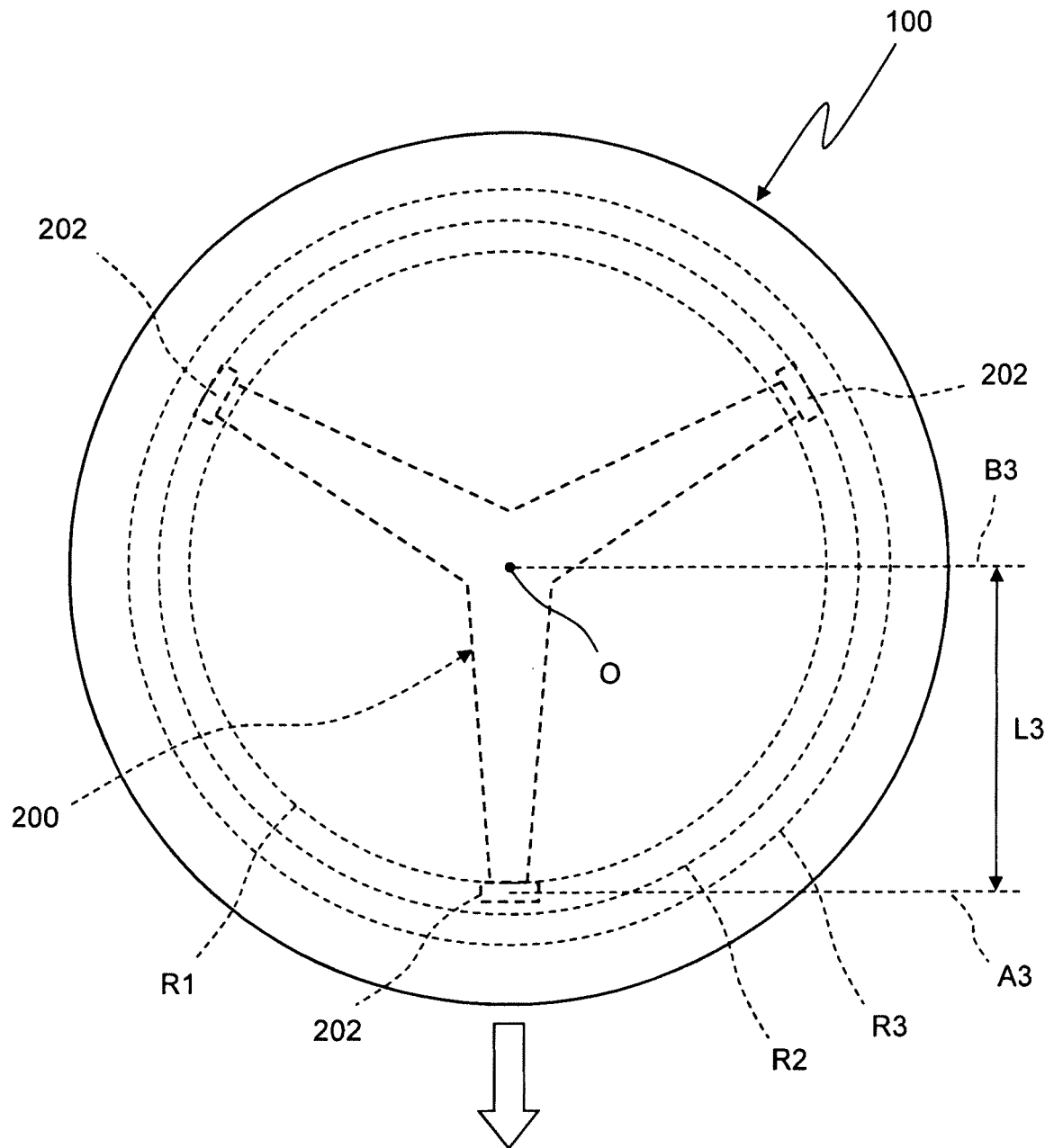
*Fig.8*



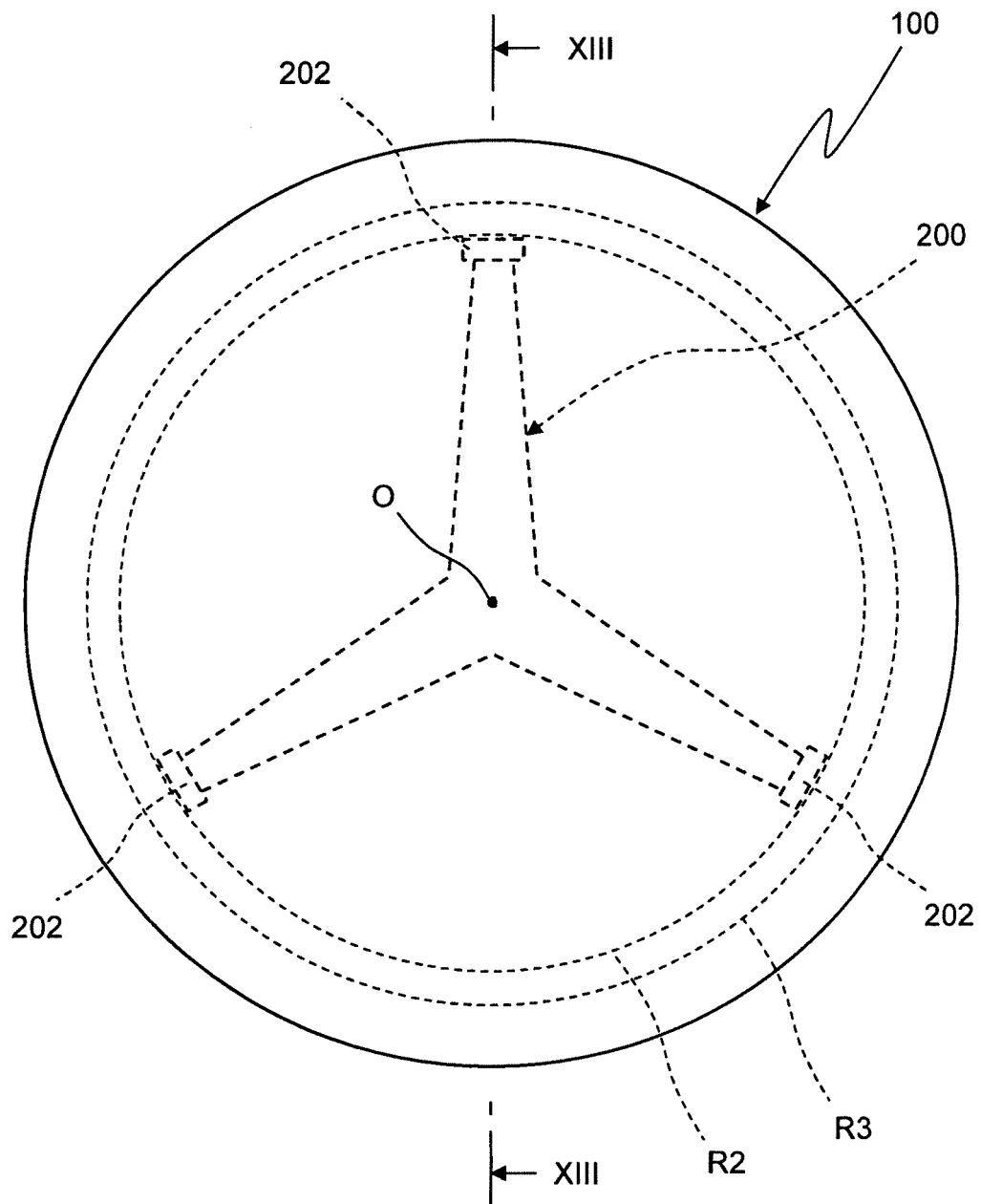
*Fig.9*



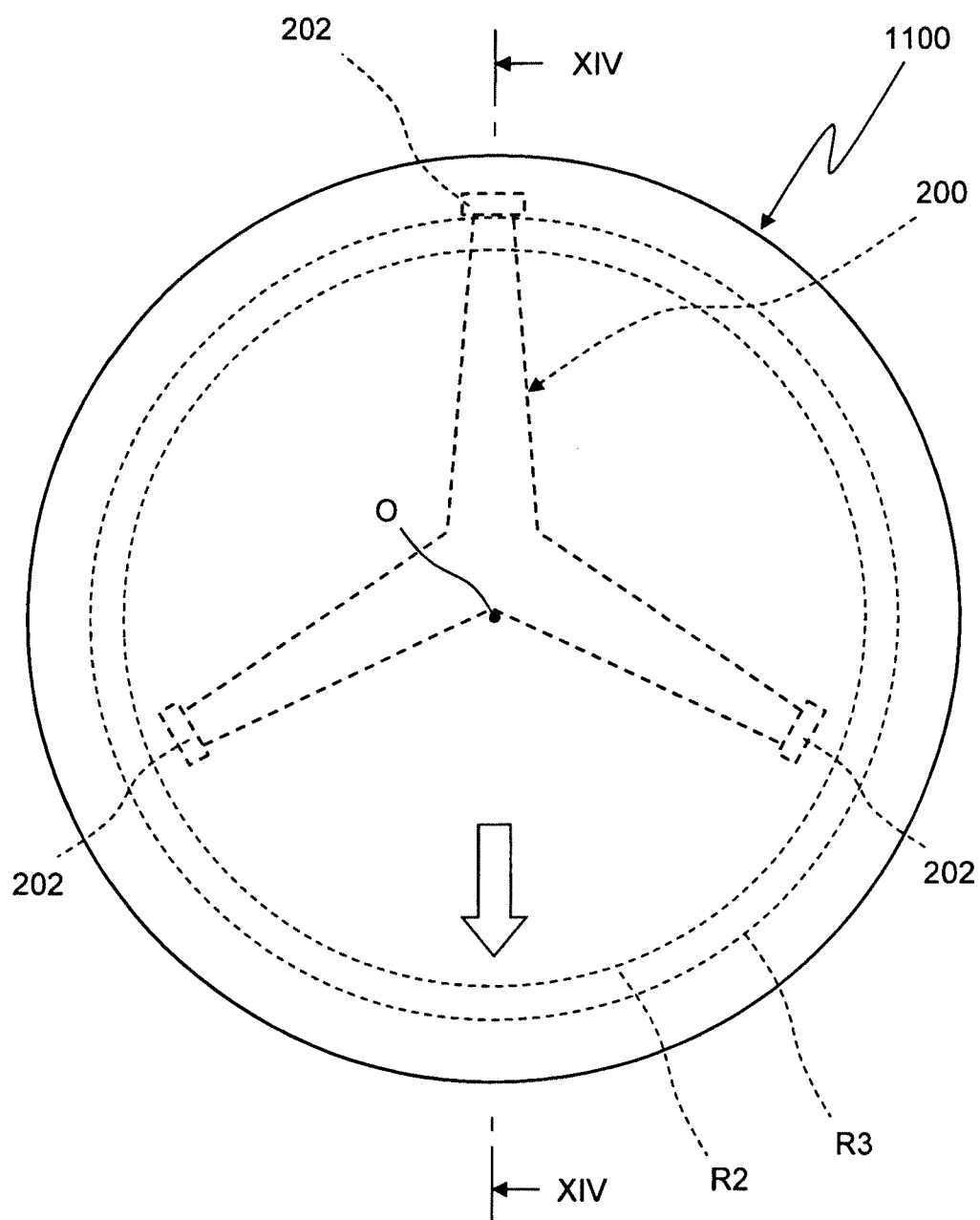
*Fig.10*



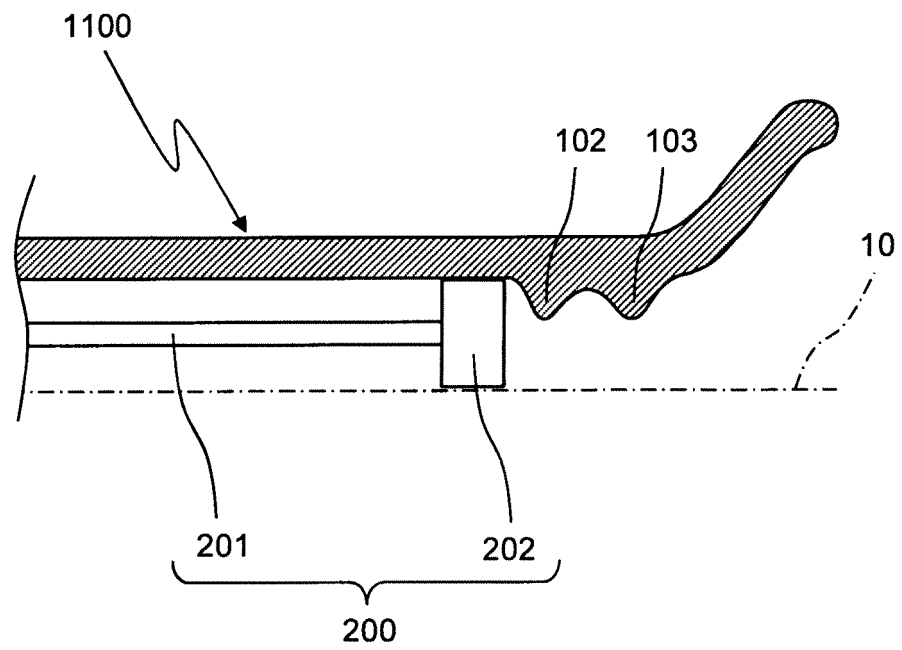
*Fig.11*



*Fig.12*



*Fig.13*



*Fig.14*

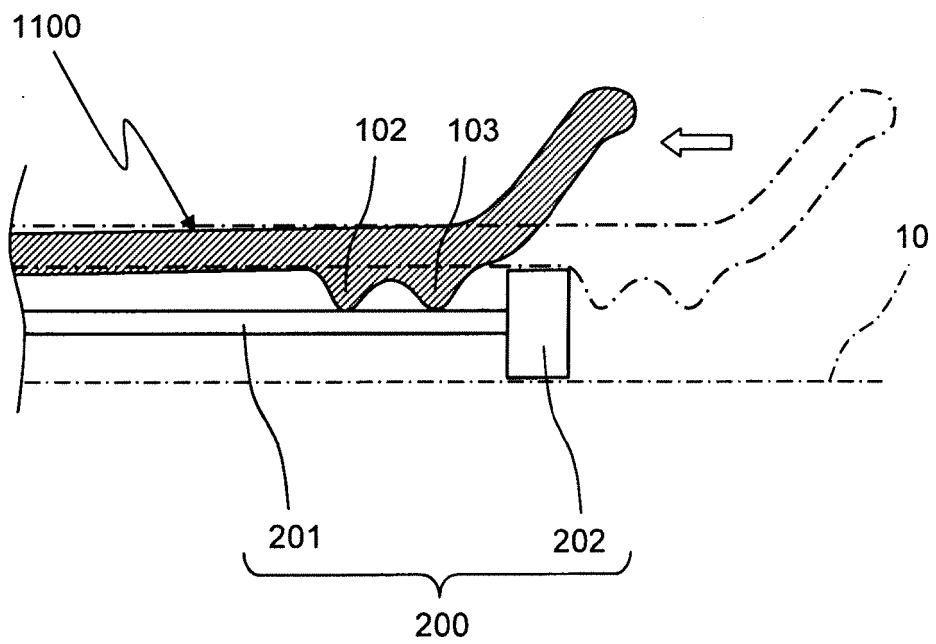


Fig. 15

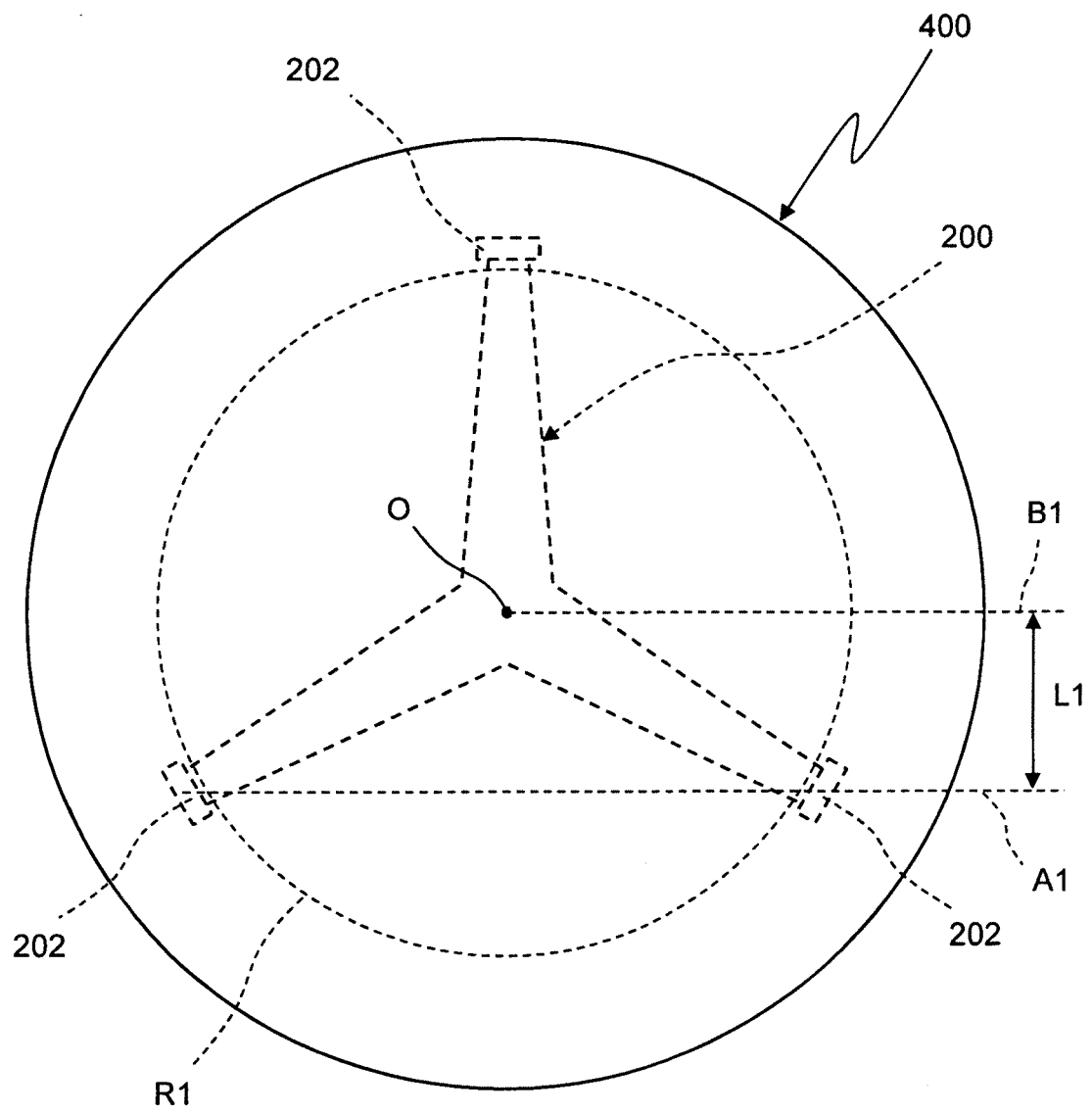
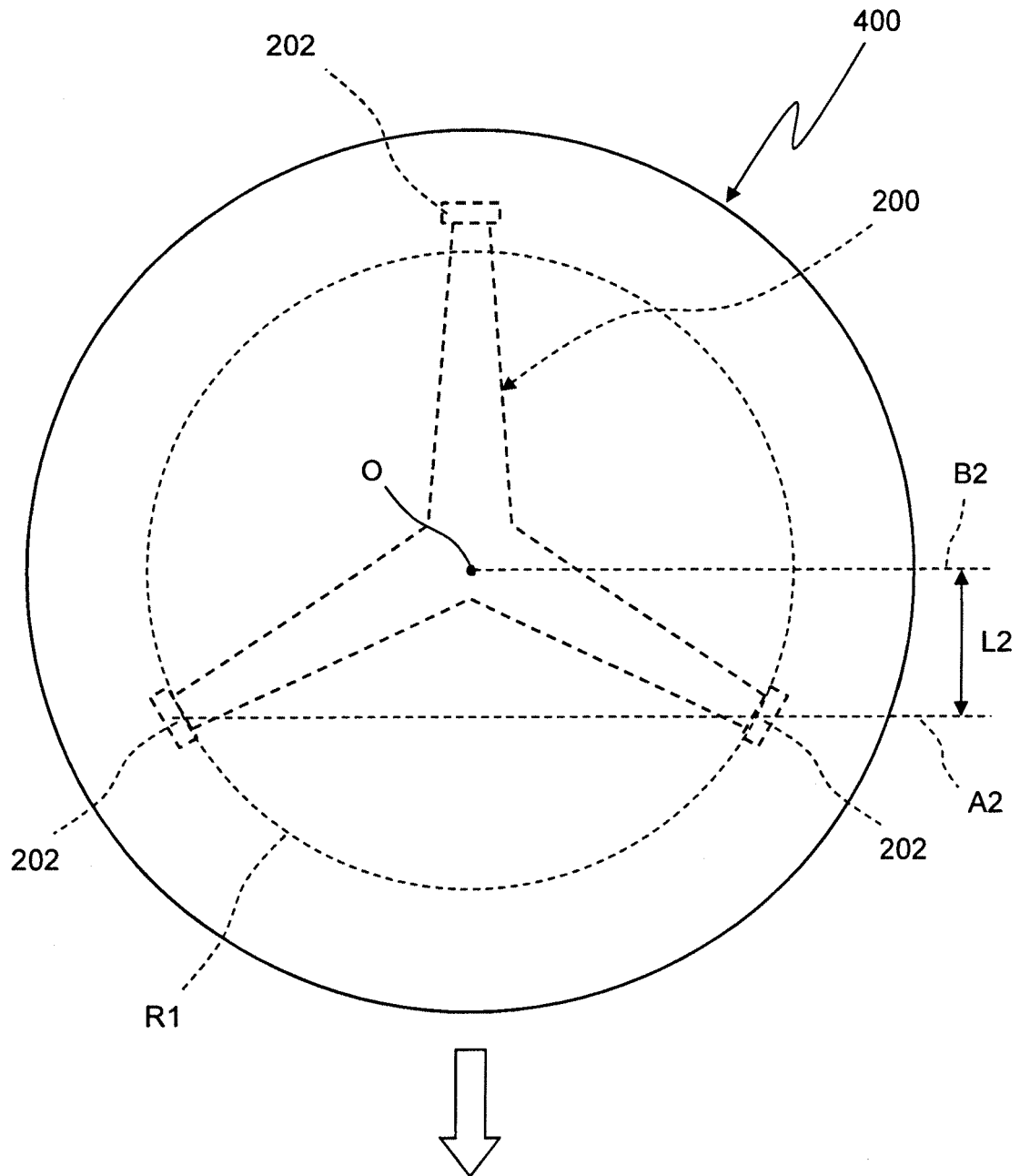
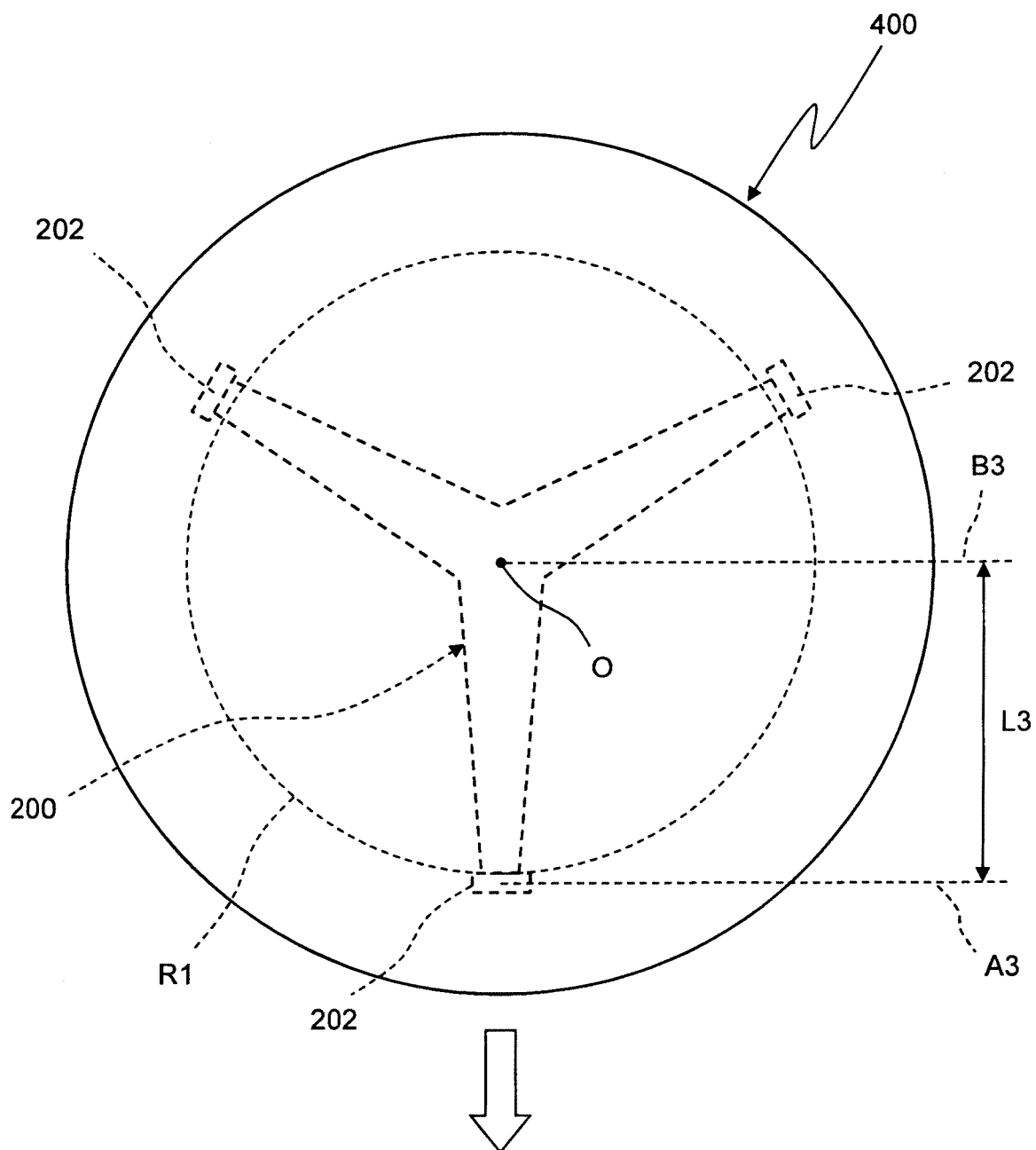




Fig. 16



*Fig.17*



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/074816

## A. CLASSIFICATION OF SUBJECT MATTER

F24C7/02(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24C7/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016  
 Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | JP 2011-214801 A (Sharp Corp.),<br>27 October 2011 (27.10.2011),<br>paragraphs [0025] to [0038]<br>& US 2013/0020315 A1<br>paragraphs [0038] to [0050]<br>& WO 2011/125870 A1 & EP 2554912 A1<br>& CN 102812299 A | 1, 5                  |
| X         | JP 2004-071216 A (Sharp Corp.),<br>04 March 2004 (04.03.2004),<br>paragraphs [0019] to [0032]; fig. 1 to 5<br>(Family: none)                                                                                      | 1, 2, 5               |
| X         | JP 9-068315 A (Toshiba Corp.),<br>11 March 1997 (11.03.1997),<br>paragraphs [0058] to [0076]<br>(Family: none)                                                                                                    | 1-5                   |

☒ 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  
07 November 2016 (07.11.16)Date of mailing of the international search report  
15 November 2016 (15.11.16)Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
Tokyo 100-8915, Japan

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/074816

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                  | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | JP 3-017436 Y2 (Sharp Corp.),<br>12 April 1991 (12.04.1991),<br>column 6<br>(Family: none)                                                                                                                                                          | 1-5                   |
| X         | Microfilm of the specification and drawings<br>annexed to the request of Japanese Utility<br>Model Application No. 127282/1990 (Laid-open<br>No. 082607/1992)<br>(Toshiba Corp.),<br>17 July 1992 (17.07.1992),<br>pages 8 to 14<br>& JP 4-082607 U | 1-5                   |
| A         | JP 3-167780 A (Toshiba Corp.),<br>19 July 1991 (19.07.1991),<br>entire text; all drawings<br>& US 5166486 A<br>entire text; all drawings<br>& EP 425198 A2 & AU 6387390 A<br>& CA 2028334 A & AU 622049 B<br>& CA 2028334 A1                        | 1-5                   |
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| A         | JP 2013-57508 A (Mitsubishi Electric Corp.),<br>28 March 2013 (28.03.2013),<br>paragraphs [0058] to [0084]<br>(Family: none)                                                                                                                        | 1-5                   |
| A         | JP 2-47367 Y2 (Sharp Corp.),<br>13 December 1990 (13.12.1990),<br>entire text; all drawings<br>(Family: none)                                                                                                                                       | 1-5                   |

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

**REFERENCES CITED IN THE DESCRIPTION**

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