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DESCRIPTION



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PAPER CUP FORMICROWAVE OVEN, PAPER CUP CORRESPONDING TOMICROWAVE
OVEN, AND MANUFACTURING METHOD THEREOF

TECHNICAL FIELD

The present invention relates to a paper cup used in a microwave oven.

BACKGROUND ART

Conventionally, paper cups have been widely used as containers for accommodating hot drink or instant food in automatic venders. Although not generally carried out, paper cups accommodating drink or daily dish have been heated directly with the microwave oven for cooking.

However, when a paper cup having an ordinary shape and accommodating a content is heated with a microwave oven for cooking, a rim of the bottom of the paper cup may be burnt. The reason is as follows. Basically, cellulose of pulp of paper material absorbs microwave from the microwave oven. Consequently, paper thickness increases at a portion where papers overlaps, so that the quantity of heat generation increases. However, because the surface area of the rim of the bottom is so small that the amount of heat radiation is small, generated heat is accumulated in the rim of the bottom. As a result, the temperature of the rim increases thereby leading to burning. However, if there is any content in the cup, the heat generated and accumulated

in the paper is absorbed by the content, thereby making it difficult to burn. Further, irradiating microwave from both sides, inside and outside of the rim of the bottom causes that burning to occur. That is, an ordinary paper cup, as shown in FIG. 32, has a rim 3 as a joint portion between a body member 1 and a bottom member 2. This rim 3 never contacts the content, so that it is likely to accumulate heat and because it is irradiated with microwave from both side, inside and outside, it is likely to be burnt.

To solve this problem, a paper cup for a microwave oven having no rim has been disclosed in Japanese Patent Application Laid-Open No. 11-11541. Actually, in a paper cup for a microwave oven having no rim as shown in FIG. 33, no burning is observed.

However, in the paper cup for a microwave oven having no rim, a joint portion between the body member 1 and the bottom member 2 is insufficient and as a result, there may occur a leakage depending on the content.

DISCLOSURE OF INVENTION

An object of the present invention is to provide a paper cup for a microwave oven and a paper cup corresponding to a microwave oven, in which, when such a content as drink, instant food is accommodated in the same cup and cooked by heating with a microwave oven, the content never overflows and no burning is generated at any portion thereof, and a manufacturing method thereof.

As a result of consideration for solving the

above-described problems, the first paper cup for a microwave oven of the present invention comprises a body member and a bottom member and is formed by folding inward a rim which joins the body member and the bottom member with each other. In this paper cup for a microwave oven, the bottom face of the bottom member has inwardly concave shape.

According to the first paper cup for a microwave oven of the present invention, by folding the rim of the same paper cup inward, it is possible to acquire a paper cup in which when such a content as drink, instant food is accommodated in the paper cup and cooked by heating with a microwave oven, the content never overflows and no burning is generated at any portion of the same paper cup.

A second paper cup for a microwave oven of the present invention comprises a body member and a bottom member, and therein a bending portion is formed by bending a lower portion of the rim which joins the body member and the bottom member with each other inward at an angle equal to or more than 90° . A gap width of a space between the bending portion and a bottom face portion of the bottom member may be equal to or less than 5 mm at a largest portion thereof. The bending portion may be provided with a concave wedge.

According to the second paper cup for a microwave oven of the present invention, by bending the lower portion of the rim of the same paper cup inward, it is possible to acquire a paper cup for a microwave oven in which when such a content as drink, instant food is accommodated in the paper cup and cooked

by heating with a microwave oven, the content never overflows and no burning is generated at any portion of the same paper cup.

The third paper cup for a microwave oven of the present invention is a paper cup for a microwave oven comprising a body member formed cylindrically by winding around and a bottom member in which a bent portion is produced by bending an outer peripheral rim thereof, the bent portion being sandwiched and joined by a folding back portion formed by folding back a bottom end portion of the body portion and the body portion so as to form a rim, wherein a bending portion is formed by bending a lower portion of the rim inward and a convex portion which is convex inward in the center of an inner face of the bottom face portion of the bottom member is formed. A gap width of a space between the bending portion and the bottom face portion may be equal to or less than 5 mm at a largest portion thereof.

The method for manufacturing the third paper cup for a microwave oven of the present invention is a method for manufacturing a paper cup for a microwave oven comprising the steps of: forming a cylindrical body portion by winding around; forming a bent portion by bending an outer peripheral rim of the bottom member; forming a rim by sandwiching and joining the bent portion by a folding back portion formed by folding back a bottom end portion of the body portion and the body portion; forming a bending portion by bending a lower portion of the rim inward; and, forming a convex portion which is convex inward in the center of an inner face of the bottom face portion of

the bottom member by providing a clamping portion of a press die with no air escape hole while a receiving portion is formed in a hollow cylindrical shape with an air escape hole.

According to the third paper cup for a microwave oven and its manufacturing method of the present invention, by forming the folding back portion by folding back the lower portion of the rim of the paper cup inwardly and, providing the convex portion which is convex in an inward direction in the center of the inner face of the bottom face portion, it is possible to obtain a paper cup for a microwave oven in which when such a content as drink, instant food is accommodated in the paper cup and cooked by heating with a microwave oven, the content never overflows and no burning is generated at any portion of the same paper cup.

The first paper cup corresponding to a microwave oven of the present invention is a paper cup in which a body portion is formed by winding a body member cylindrically; a top curl portion is formed by bending a top end of the body portion; a front end of a bent portion formed by bending an outer peripheral rim of the bottom member is located so as to be directed to a bottom end of the body portion and; the bent portion is sandwiched by a folding back portion formed by folding back the bottom end portion of the body portion and the body portion so as to form a rim such that the body member and the bottom member are joined together, wherein the lower portion of the rim is inwardly folded back. The bottom face portion of the bottom member may be formed such that it is concave downward from an inner side of the cup.

According to the first paper cup corresponding to a

microwave oven of the present invention, by forming the folding back portion by folding back the rim constituted of the body member and bottom member of the paper cup inwardly, the height of the rim is decreased and further, by forming the bottom face portion of the bottom member in a concave shape in a downward direction, it is possible to obtain a paper cup corresponding to a microwave oven in which when such a content as drink, instant food is accommodated in the same cup and cooked by heating with a microwave oven, the content never overflows and no burning is generated at any portion of the paper cup.

The second paper cup corresponding to a microwave oven of the present invention is a paper cup comprising a body member formed cylindrically by winding around and a bottom member having a bent portion produced by bending an outer peripheral rim thereof, a body portion of the body member and the bent portion being joined together so as to form a joint portion, wherein a bottom curl portion is formed by winding the joint portion inwardly. In the paper cup corresponding to a microwave oven, the joint portion may be formed by joining the bent portion such that it is sandwiched between a folding back portion formed by folding back a bottom end portion of the body portion and the body portion.

The method for manufacturing the second paper cup corresponding to a microwave oven of the present invention is a method comprising the steps of: forming a cylindrical body member by winding around; forming a bent portion by bending an outer peripheral rim of the bottom member; forming a joint portion by joining a bottom end portion of a body portion of the body

member and the bent portion with each other; and forming a bottom curl portion by winding the joint portion inwardly or a method for manufacturing a paper cup comprising the steps of: forming a cylindrical body member by winding around; forming a bent portion by bending an outer peripheral rim of the bottom member; forming a joint portion by joining the bent portion such that it is sandwiched between a folding back portion formed by folding back a bottom end portion of a body portion of the body member and the body portion; and forming a bottom curl portion by winding the joint portion inwardly.

According to the method for manufacturing of the second paper cup corresponding to a microwave oven of the present invention, by forming the bottom curl portion by winding the joint portion between the body member and the bottom member of the paper cup inwardly, it is possible to obtain a paper cup corresponding to a microwave oven in which when such a content as drink, instant food is accommodated in the same paper cup and cooked by heating with a microwave oven, the content never overflows and no burning is generated at any portion of the paper cup.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a paper cup for a microwave oven according to a first embodiment of the present invention;

FIG. 2 is a sectional view of a paper cup for a microwave oven according to a second embodiment of the present invention;

FIG. 3 is a development of a body member blank and a bottom

member blank of the paper cup for a microwave oven of the present invention;

FIG. 4 is a diagram showing process for creating the paper cup for a microwave oven of the present invention;

FIG. 5 is a partially cutout sectional view showing a state in which a heat insulating cover is wound around the paper cup for a microwave oven of the first and second embodiments of the present invention;

FIG. 6 is a partially broken sectional view showing examples of body portions in a state in which a heat insulating cover is wound around the paper cup for a microwave oven of the first embodiment of the present invention;

FIG. 7 is a sectional view of a paper cup for a microwave oven according to a third embodiment of the present invention;

FIG. 8 is a sectional view of other example of the paper cup for a microwave oven according to the third embodiment of the present invention;

FIG. 9 is a partial sectional view of the rim of the paper cup for a microwave oven according to the third embodiment of the present invention;

FIG. 10 is a diagram showing a paper cup for a microwave oven according to a fourth embodiment of the present invention;

FIG. 11 is a sectional view showing a state in which a heat insulating cover is wound around the paper cup for a microwave oven according to the third embodiment of the present invention;

FIG. 12 is a partial sectional view showing examples of a body portion in a state in which the heat insulation cover

is wound around the paper cup for a microwave oven according to the third embodiment of the present invention;

FIG. 13 is a partially cutout sectional view showing a paper cup for a microwave oven according to a fifth embodiment of the present invention;

FIG. 14 is a partially enlarged sectional view of the paper cup for a microwave oven according to the fifth embodiment of the present invention;

FIG. 15 is a partially enlarged sectional view showing examples of bent portions in the paper cup for a microwave oven according to the fifth embodiment of the present invention;

FIG. 16 is a diagram showing a process for creating the paper cup for a microwave oven according to the fifth embodiment of the present invention;

FIG. 17 is a partially cutout sectional view showing a state in which the heat insulating cover is wound around the paper cup for a microwave oven according to the fifth embodiment of the present invention;

FIG. 18 is a partial sectional view showing examples of a body portion in a state in which the heat insulating cover is wound around the paper cup for a microwave oven according to the fifth embodiment of the present invention;

FIG. 19 is a partially cutout sectional view showing a paper cup corresponding to a microwave oven according to a sixth embodiment of the present invention;

FIG. 20 is a partially sectional view showing a paper cup corresponding to a microwave oven according to a seventh

embodiment of the present invention;

FIG. 21 is a partially sectional view of an intermediate stage of the paper cup corresponding to a microwave oven according to the seventh embodiment of the present invention;

FIG. 22 is a diagram showing a process for creating the paper cup corresponding to a microwave oven according to the sixth embodiment of the present invention;

FIG. 23 is a diagram showing a process for creating the paper cup corresponding to a microwave oven according to the seventh embodiment of the present invention;

FIG. 24 is a sectional view showing a state in which a heat insulation cover is wound around the paper cup corresponding to a microwave oven according to the sixth and seventh embodiments of the present invention;

FIG. 25 is a partially sectional view showing an example of a body portion in which the heat insulation cover is wound around the paper cup corresponding to a microwave oven according to the sixth embodiment of the present invention;

FIG. 26 is a partially cutout sectional view showing a paper cup corresponding to a microwave oven according to an eighth embodiment of the present invention;

FIG. 27 is a partially cutout sectional view of a paper cup which is a basis of the paper cup corresponding to a microwave oven according to the eighth embodiment of the present invention;

FIG. 28 is a partially sectional view showing a paper cup corresponding to a microwave oven according to a ninth embodiment of the present invention;

FIG. 29 is a diagram showing a process for creating the paper cup corresponding to a microwave oven according to the eighth and ninth embodiments of the present invention;

FIG. 30 is a sectional view showing a state in which the heat insulation cover is wound around the paper cup corresponding to a microwave oven according to the eighth and ninth embodiments of the present invention;

FIG. 31 is a partially sectional view showing an example of the body portion in which the heat insulation cover is wound around the paper cup corresponding to a microwave oven according to the eighth embodiment of the present invention;

FIG. 32 is a partially cutout sectional view showing a conventional paper cup;

FIG. 33 is a partially cutout sectional view showing a conventional paper cup for a microwave oven

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinafter, the embodiments of the present invention will be described further in detail with reference to the accompanying drawings.

In an ordinary paper cup "a", as shown in FIG. 32, a bent portion 22 is formed by bending an outer peripheral rim of a bottom member 2 downward. A bottom end portion of the body member 1 is folded inward so as to form a folding back portion 12. The bent portion 22 is sandwiched between the folding back portion 12 and the bottom end portion of the body portion 11. The body portion 11, the folding portion 12 and the bent portion 22 are

pressurized on each other by heating so that they are joined together, and consequently, the paper cup "a" is formed. The joint portion between body portion 11, the folding portion 12 and the bent portion 22 is called rim 3 and a bottom face portion 21 of the bottom member 2 is constructed as a bottom raised by the rim 3. Heat is accumulated in part of the rim 3 within the microwave oven, so that the rim 3 is burnt.

[First and Second Embodiments]

FIG. 1 shows the first embodiment of the paper cup for a microwave oven of the present invention. The paper cup for a microwave oven A is formed on a basis of an ordinary paper cup "a" shown in FIG. 32 comprising the body member 1, and the bottom member 2, and the rim 3 which is a joint portion between the body member 1 and the bottom member 2. As shown in FIG. 1, the rim 3 of the paper cup "a" is folded inward so as to make it contact the bottom face 21 of the bottom member 2 and consequently, the paper cup for a microwave oven A is manufactured.

In the paper cup A for a microwave oven, to prevent a force trying to restore the rim 3 folded inward to its original state from being applied thereto worsening its stability on a flat plane, the rim 3 is folded inward, and at the same time, an inner face of the rim 3 can be bonded and fixed to an outer face of the bottom face portion 21 of the bottom member 2 with adhesive agent or by thermal adhesion.

FIG. 2 shows a second embodiment of the paper cup for a microwave oven of the present invention. A paper cup B for a microwave oven is formed based on a paper cup "b" shown in FIG.

2(a). In the paper cup "b", the bottom face 21 of the bottom member 2 of the paper cup "a" is bent in a concave shape to the inner face side. By folding the rim 3 of the paper cup "b" as shown in FIG. 2(b) so as to make contact the bottom face portion 21 of the bottom member 2, the paper cup B for a microwave oven is formed. By forming the bottom face portion 21 of the bottom member 2 in a concave shape with respect to the inner face side, the angle for folding the rim 3 is more than 90° , so that wrinkle generated at the time of the folding can be reduced, thereby improving stability of the paper cup B on a flat plane.

Next, a method for manufacturing paper cups A and B for a microwave oven will be described.

The paper cup "a" before the rim 3 is folded inward has a shape of an ordinary paper cup and is formed of a body member blank 10 and a bottom member blank 20 as shown in FIG. 3 by means of a paper cup forming machine. Generally, the body member blank 10 is produced by punching out on a preceding process and the bottom member blank 20 is produced by punching out on a paper cup forming machine.

A process for manufacturing the paper cup "a" with the body member blank 10 and the bottom member blank 20 will be described simply. To bond together the body member blank 10 to a cylindrical shape, bonding portions 10a, 10b of the body member blank 10 are pre-heated with hot wind so as to melt resin on their surfaces. Next, the body member blank 10 is wound around a body winding model (mandrel) and the bonding portions 10a, 10b are bonded with each other with pressure, so that a cylindrical

body member 1a is formed (see FIGS. 4(a), (b)). Incidentally, the body member 1a corresponds to an intermediate product on a preceding stage before a folding back portion 12 and a curl portion 13 are formed with respect to the body member 1. On the other hand, as for the bottom member blank 20, its outer peripheral rim thereof is bent so as to form a dish-like structure. The dish-like formed bottom member blank 20 is placed on a mandrel (not shown) and then, the cylindrical body member 1a is fit to the mandrel. Resin at a bonding portion (portion for forming the rim) between the cylindrical body member 1a and the bottom member blank 20 is pre-heated with hot air. By folding back a bottom end of the body member 1a inward, the outer peripheral rim bent downward of the bottom member blank 20 is sandwiched between the body member 1a and its folding back portion 12. By bonding that sandwiched portion under a pressure, the rim 3 is formed so as to joint the body member 1a with the bottom member 2. Further, by curling a top end of the cylindrical body member 1a outward, a top curl portion 13 is formed. Consequently, the paper cup "a" is completed.

To produce the paper cup B for a microwave oven of FIG. 2, by forming the bottom face portion 21 of the bottom member 2 of the paper cup "a" in a concave shape with respect to the inner face side, the paper cup "b" is obtained. As a processing method for the bottom face portion 21, a method of processing it at the same time as the forming process of the paper cup "a" and a method of processing it at a subsequent process to the forming process are available. According to the former method,

at a stage in which the bottom member blank 20 is formed in a dish-like form and fit to the mandrel, the outer peripheral rim of the bottom member blank 20 is bent and at the same time, its central portion is formed in a concave shape. Consequently, the paper cup "b" in which the bottom face portion 21 of the bottom member 2 is concave to the inner side is formed. According to the latter method, after the paper cup "a" is formed based on an ordinary method, the bottom face portion 21 is formed in a concave shape by press working.

To manufacture the paper cups A and B for a microwave oven from the paper cups "a" and "b", the rims of the paper cups "a", "b" are folded. In this process, as shown in FIG. 4(a), the rim 3 is fallen inward more than 45° . Next, the fallen rim 3 is crushed by pressing with heat from up and down as shown in FIG. 4(b) or by ultrasonic fusion so as to melt resin on the surface. Further, by hardening that resin, the rim 3 is formed in a flat shape. At this time, the rim 3 may be fixed with the bottom face portion 21 with adhesive agent or by thermal adhesion. Although FIG. 4 shows procedure for manufacturing the paper cup A for a microwave oven from the paper cup "a", it is permissible to adopt a procedure for manufacturing the paper cup B for a microwave oven from the paper cup "b".

As the material used for the paper cups A and B for a microwave oven, paper is used as its main strength material while thermoplastic resin is possessed on its innermost layer. For example, paper layer/polyethylene resin layer, polyethylene resin layer/paper layer/polyethylene resin layer, foamed

polyethylene resin layer/paper layer/polyethylene resin layer, polypropylene resin layer/paper layer/polypropylene resin layer can be mentioned as material of the paper cup for a microwave oven.

As paper made of main strength material, it is preferable to use a cup raw material paper having an excellent paper cup forming suitability. Although its grammage is not restricted to any particular one, a range of 150-300 g/m² is more preferable from viewpoints of paper cup forming suitability.

The thermoplastic resin used for the innermost layer needs to have functions of protecting a content, particularly, prohibiting liquid substance from leaking and which enables bonding the body portion together by thermal seal and bonding the body portion with the bottom portion. More specifically, polyethylene, polypropylene, polyester, ethylene-vinyl acetate copolymer and the like can be mentioned. The thickness of these resin layers is preferred to be in a range of 15 to 60 μm . These thermoplastic resins are formed on the innermost layer by extrusion or laminate processing.

When the paper cups A and B for a microwave oven having the above-described structure are used in a microwave oven, they may be difficult to carry with the hand because their contents are heated, so that a paper cup for a microwave oven having a more excellent heat insulation may be necessary. Therefore, to apply heat insulation property, it is permissible to form paper cups A' and B' for a microwave oven as shown in FIGS. 5(a) and 5(b) in which a heat insulation cover 4 is wound around an

outer periphery of the body portion of the above-described paper cups A and B for a microwave oven.

The shape of the heat insulation cover 4 may be of any shape shown in FIGS. 6(a) to (d) as well as a shape in which it is tightly fit to an outer face of the body portion 11 of the paper cups A and B for a microwave oven. That is, it is permissible to curl a top end portion of a cover body portion 41 of the heat insulation cover 4 inward so as to form a cover top curl portion 42a as shown in FIG. 6(a) or fold back the top end portion of the cover body portion 41 as shown in FIG. 6(b) inward so as to form a cover top bent portion 42b. Alternatively, it is permissible to curl a bottom end portion of the cover body portion 41 of the heat insulation cover 4 as shown in FIG. 6(c) so as to form a cover bottom curl portion 43a or fold back the bottom end portion of the cover body portion 41 as shown in FIG. 6(d) inward so as to form a cover bottom bent portion 43b. It is permissible to form the cover top curl portion 42a or cover top bent portion 42b at the top end portion of the cover body portion 41 of the heat insulation cover 4 as shown in FIGS. 6(a), (b) or form the cover bottom curl portion 43a or the cover bottom bent portion 43b at the bottom end portion of the cover body portion 41 as shown in FIGS. 6(c), (d). Although FIG. 6 shows an example of a paper cup A' for a microwave oven, the same shape can be formed as for the heat insulation cover 4 of the paper cup B' for a microwave oven. In the above-described configuration, a space 5 having a gap similar to the diameter of the cover top curl portion 42a or the cover bottom curl portion 43b or the

thickness of the cover top bent portion 42b or the cover bottom bent portion 43b is formed between the body portion 11 and the cover body portion 41 of the heat insulation cover 4. Consequently, heat insulation property can be secured in the entire length in the vertical direction of the paper cups A' and B' for a microwave oven.

Although the heat insulation cover 4 can be installed on the outer periphery of the body portion 11, it does not always need to be mounted on the entire outer face of the body portion 11. It is permissible to form the heat insulation cover 4 shorter than the vertical length of the body portion 11 and mount the heat insulation cover 4 limitedly on the top portion of the outer face of the body portion 11, for example.

The material used for the heat insulation cover 4 has heat insulation property, for example, it is permissible to use a paperboard, single-side corrugated board, corrugated board, embossed paper, foam processing paper and the like.

The paperboard for use is a paperboard having a smoothed surface such as coated board, manila board, ivory board and the thickness thereof is preferred to be in a range of 200 to 400 g/m².

Although the corrugated board includes type A, B, E and F, type F or E, which has flexibility, is preferable from such a viewpoint that it is wound around the paper cup main body (body portion 11). Further, so-called single faced corrugated board, which has no liner on one side, is also available and a corrugated core may be exposed outside. Further, wave-like corrugated board

may be used.

Unlike an ordinary corrugated board, the embossed paper is produced by embossing a core paper into dot-like pattern or grid pattern having a depth of 1 to 2 mm and bonding it with a liner paper together. A single side face or both faces of the liner paper can be bonded together. The core paper is available in a range of 100 to 180 g/m² and the liner paper is available in a range of 200 to 270 g/m². The embossed paper has heat insulation effect like the corrugated board and by printing a graphic pattern on the liner paper on the front surface, its design performance can be heightened.

The structure of the foam processing paper is based on a structure of foamed thermoplastic resin layer/paper layer/thermoplastic resin. More specifically, overlaid layer structure composed of foamed low-density polyethylene resin layer/coat board/mixed resin layer of low-density polyethylene resin and high-density polyethylene resin is used. If it is wound around the body portion 11 of the paper cups A' and B' for a microwave oven, foamed resin layer may be exposed or not-foamed resin layer may be exposed.

[Third and Fourth Embodiments]

FIG. 7 shows the third embodiment of the paper cup for a microwave oven of the present invention. In the paper cup C for a microwave oven of FIG. 7, a bottom portion of the rim 3 of the paper cup "a" shown in FIG. 32 is bent inward as shown in FIG. 7(a) so as to form a bending portion "a" and a space O is provided between that bending portion 3a and the bottom

face portion 21 of the bottom member 2. A position of bending the bending portion 3a is set in a range of $1/2$ to $3/4$ of the entire width H_a (see FIG. 32) of the rim 3 from the bottom end of the rim 3. The gap width of the space O between the bending portion 3a and the bottom face portion 21 of the bottom member 2 is preferred to be less than 5 mm, which is its maximum, and more preferably, it is less than 2 mm. If the gap is over 5 mm, there is a fear that burning may occur. The bending angle can be set in a range from 90° as shown in FIG. 7(a) until a degree at which a front end of the bending portion 3a makes a contact the bottom face portion 21 of the bottom member 2 as shown in FIG. 7(b). As the bending angle of the rim 3 is increased, an effect of suppressing occurrence of wrinkle is intensified.

The paper cup C for a microwave oven of FIG. 7 may be produced based on a paper cup "c" in which the folding back portion 12 of the body member 1 serving as an inner face of the rim 3 is restricted to a width from the bottom end to a position P where the bottom portion of the rim 3 is to be bent, as shown in FIG. 8(a). If the paper cup C for a microwave oven is produced from the paper cup "c", as shown in FIG. 8(b), the bottom end portion of the body member 1 and the bent portion 22 of the bottom member 2 should be bent and then, the rim 3 can be bent around the position P easily.

In order to prevent stability of the paper cup C for a microwave oven on a flat plane from being lost by a return force which tries to restore the rim 3 bent inward to its original state, it is permissible to fix a front end of the bending portion

3a by bonding to an outer face of the bottom face portion 21 of the bottom member 2 at the same time when the lower portion of the rim 3 is bent inward.

As for the shape of the bending portion 3a of the paper cup C for a microwave oven, in addition to the above-described linear configuration, a circularly bent shape as shown in FIG. 9(a), a configuration in which a front end of the linear bending portion 3a is bent at right angle to the bottom face portion 21 as shown in FIG. 9(b), a configuration in which the front end of the bending portion 3a is bent circularly to the side of the bottom face portion 21 as shown in FIG. 9(c), and a configuration in which the front end of the bending portion 3a supports the bottom face portion 21 as shown in FIGS. 9(d), (e), (f), (g) are available.

FIG. 10 shows a fourth embodiment of the paper cup for a microwave oven of the present invention. In the paper cup D for a microwave oven of the fourth embodiment, as shown in FIG. 10(a), a lower portion of the rim 3 of the paper cup "a" (see FIG. 32) having the rim 3 which is a joint portion between the body member 1 and the bottom member 2 is bent inward at substantially 90° so as to produce the bending portion 3a. This is the same as the paper cup C for a microwave oven shown in FIG. 7. Instead of the paper cup "a", the paper cup D for a microwave oven may be produced based on the paper cup "c" shown in FIG. 8(a). In the paper cup D for a microwave oven, a predetermined number of concave wedges Q are provided in the bending portion 3a (four positions in this example). As shown

in FIG. 10 (b) of a schematic sectional view, the wedge Q is formed in a concave shape such that its depth is increased as it comes near the front end of the bending portion 3a. Unless the wedges Q are provided, a number of wrinkles R may occur in the bending portion 3a as shown in FIG. 10(c). Contrary to this, if the wedges Q are provided, the wrinkles R which may occur when the bending portion 3a is bent are absorbed by the wedges Q so as to suppress generation of the wrinkles R. Thus, it is preferable in viewpoint of its appearance and further the stability of the paper cup D for a microwave oven on a flat plane is improved. The number of the wedges Q only should be to such an extent that the occurrence of the wrinkles R in the bending portion 3a is conceivable. It is preferable to provide the bending portion 3a with four to eight wedges Q at an equal interval in the circumferential direction thereof.

Next, a method for manufacturing paper cups C and D for a microwave oven will be described.

In case of manufacturing the paper cups C and D for a microwave oven, a paper cup "a" before the lower portion of the rim 3 is bent inward has an ordinary paper cup configuration. This is formed of the body member blank 10 and the bottom member blank 20 as shown in FIG. 3 by means of a paper cup forming machine. The procedure for manufacturing the paper cup "a" with the blanks 10 and 20 is the same as the paper cups A and B for a microwave oven and detail description thereof is omitted.

To manufacture the paper cup C for a microwave oven from the paper cup "a", the lower portion of the rim 3 of the paper

cup "a" is bent inward. This processing can be carried out according to the method shown in FIGS. 4(a) and (b).

Further, to manufacture the paper cup D for a microwave oven shown in FIG. 10, the wedges Q are provided at several positions on the folded bending portion 3a. This processing can be executed by pressing with an upper die having protrusions T as shown in FIG. 4(c) in thermal press procedure as shown in FIG. 4(b).

As for the material for the paper cups C and D for a microwave oven, paper is its main strength material while thermoplastic resin is provided on its innermost layer, its specific configuration of the material may be the same as the example of the first paper cups A and B for a microwave oven described previously.

To provide the paper cups C and D for a microwave oven with heat insulation property, it is permissible to form the paper cups C' and D for a microwave oven by winding the heat insulation cover 4 around the outer periphery of the body portion 11 as shown in FIG. 11.

The configuration of the heat insulation cover 4 may be made by adopting the curl portion 42a or 43a, or the bent portion 42b or 43b, as shown in FIGS. 12(a) to (d), independently or in combination as well as the configuration in which the cover 4 is closely attached to an outer face of the body portion 11 of each of the paper cups C and D for a microwave oven. The details on the configurations in FIGS. 12(a) to (d) are the same as FIG. 6 and its detailed description is omitted. Although

FIG. 12 shows an example of the paper cup C' for a microwave oven, the heat insulation cover 4 of the paper cup D' for a microwave oven may adopt the same configuration. With such a configuration, a space 5 having a gap similar to the diameter of the cover top curl portion 42a or the cover bottom curl portion 43a or the thickness of the cover top bent portion 42b or the cover bottom bent portion 43b is formed between the heat insulation cover 4 of the body portion 11 and the cover body portion 41. Consequently, heat insulation property can be secured in the entire length in the vertical direction of the paper cups C' and D' for a microwave oven.

In the paper cups C' and D' for a microwave oven, the heat insulation cover 4 may be made shorter than the length of the body portion 11 in the vertical direction thereof and attached to a upper portion of the outer face of the body portion 11. As the material used for the heat insulation cover 4, it is permissible to use the same material as that of the heat insulation cover 4 shown in FIGS. 5 and 6.

[Fifth Embodiment]

FIG. 13 shows the fifth embodiment of the paper cup for a microwave oven of the present invention. The paper cup E for a microwave oven of the fifth embodiment comprises the body member 1 and the bottom member 2, and has the rim 3 which is a joint portion between the body portion 1 and the bottom portion 2, like an ordinary paper cup. A lower portion of the rim 3 is bent inward so as to create the bending portion 3a, so that the paper cup E for a microwave oven is formed in a shape having

a space 0 between the bending portion 3a and the bottom face portion 21 of the bottom member 2.

A position where the bending portion 3a is to be bent, namely, the width h of the bending portion 3a shall be in a range of $1/2 - 3/4$ the width (entire height) H_a of the rim 3 as indicated in the partial enlargement diagram of FIG. 14(a). The gap width o of the space 0 between the bending portion 3a and the bottom face portion 21 of the bottom member 2 is preferred to be less than 5 mm as shown in FIG. 14(b), more preferably, it is less than 3 mm. If it is more than 5 mm, there is a fear that burning may occur.

Although the bending angle of the bending portion 3a is not restricted to any particular one, preferably, it is substantially 90° .

As the configuration of the bending portion 3a, a circularly bent shape as shown in FIG. 14(b) and linear shape as shown in FIG. 15 are available. Further, a configuration in which a front end of the linear bending portion 3a is bent at right angle to the side of the bottom face portion 21 as shown in FIG. 15(b) and a configuration in which the front end of the bending portion 3a is circularly bent to the side of the bottom face portion 21 as shown in FIG. 15(c) are also available. As shown in FIGS. 15(d), (e), (f), (g), the bottom face portion 21 may be supported by the front end of the bending portion 3a.

As shown in FIG. 13, the paper cup E for a microwave oven is provided with a circular convex portion 21a which is located in the center of the bottom face portion 21 and directed inward.

If the convex portion 21a is provided in the center of the bottom face portion 21, when the paper cup E for a microwave oven is used in a microwave oven with a content therein, the convex portion 21a directed inward of the paper cup E for a microwave oven is inverted to a state in which it is convex outward, thereby providing an effect of reducing a possibility of burning on the rim 3 of the paper cup E for a microwave oven. The convex portion 21a is formed circularly. Although the convex portion 21a is not restricted to any particular one, preferably, its maximum height d is 0.2 mm or more.

Next, a method for manufacturing the paper cup E for a microwave oven will be described.

The paper cup "a" before the bending portion 3a is formed by bending a lower portion of the rim 3 inward can be produced in the same manner as a case of the above-described paper cup A for a microwave oven.

In manufacturing of the paper cup E for a microwave oven, the bending portion 3a is formed by bending the lower portion of the rim 3 of the paper cup "a" inward. This procedure is carried out in following processes. First, the lower portion of the rim 3 is fallen inward more than 30° according to a method as shown in FIG. 16(a). Next, the bending portion 3a is formed circularly as if the fallen portion is crushed by thermal press from up and down or by ultrasonic fusion according to a method as indicated in FIGS. 16(b) and (c). At this time, by adopting a hallow cylindrical receiving portion 52 with an air escape hole without providing a clamping portion 51 of a press die 50

with any air escape hole as shown in FIG. 16(d), a circular convex portion 21a which is convex inwardly can be formed in the central portion of the bottom face portion 21 of the bottom member 2 as well as inner pressure is increased. If the convex portion 21a is provided inside in the center of the bottom face portion 21, when the paper cup E for a microwave oven is used in a microwave oven with a content therein, the convex portion 21a directed inwardly in the bottom face portion 21 is inverted to a state in which it is convex outward, thereby reducing a possibility of burning on the rim 3 of the paper cup E for a microwave oven.

Although as for the material for the paper cup E for a microwave oven, basically, paper is its main strength material while thermoplastic resin is provided on its innermost layer, its specific configuration of the material may be the same as the example of the first paper cups A and B for a microwave oven described previously.

To provide the paper cup E for a microwave oven with heat insulation property, it is permissible to form a paper cup E' for a microwave oven by winding the heat insulation cover 4 around the outer periphery of the body portion 11 of the paper cup E for a microwave oven as shown in FIG. 17.

The configuration of the heat insulation cover 4 may be made by adopting the curl portions 42a, 43a or the bent portions 42b, 43b as shown in FIGS. 18(a)-(d) independently or in combination. The details on the configurations in FIGS. 18(a)-(d) are the same as cases shown in FIGS. 6 and 12, and detailed description thereof is omitted. The heat insulation

cover 4 may be made shorter than the vertical length of the body portion 11 and can be attached to an upper portion of the outer face of the body portion 11. The material of the heat insulation cover 4 in the paper cup E' for a microwave oven may be the same as cases of FIGS. 6 and 12.

[Sixth and Seventh Embodiments]

FIG. 19 shows a paper cup corresponding to a microwave oven according to the sixth embodiment of the present invention. In the paper cup F corresponding to a microwave oven, a bottom folding back portion 3a is formed by folding back a lower half of the rim 3 of the paper cup "a" shown in FIG. 32 inwardly so as to reduce the height of the rim 3.

FIG. 20 shows a paper cup corresponding to a microwave oven according to a seventh embodiment of the present invention. In the paper cup G corresponding to a microwave oven, the bottom face portion 21 of the bottom member 2 of the paper cup F corresponding to a microwave oven shown in FIG. 19 is deformed to concave downward with respect to its inner face side thereby forming a bottom face portion 21U.

As shown in FIG. 20(b), this bottom face portion 21U is deformed to concave downward as viewed from the inner face of the cup. Further, the bottom face portion 21U has a lower face portion 21Ua and a wall face portion 21Ub as shown in FIG. 20(c). A curved portion R is formed between the lower face portion 21Ua and the wall face portion 21Ub. Preferably, the lower face portion 21Ua is formed into a flat shape and the wall face portion 21Ub is brought near the bending portion 3a. Preferably, the

curvature radius of the curved face portion R is in a range of 3 to 10 mm, and more preferably, in a range of 5 to 8 mm. If the curvature radius is less than 3 mm, pinholes occur thereby leading to leakage. On the other hand, if the curvature radius exceeds 10 mm, the rim 3 is likely to be burnt.

The maximum depth d of the bottom face portion 21U is preferred to be 50% or more of the width (height) of the rim 3 from a top end of the rim 3 in a state in which the lower portion is folded back. If the maximum depth is set to 50% or more, irradiation of microwave to a rear side of the rim 3 can be blocked within a microwave oven thereby making it possible to prevent the rim 3 from being burnt. If the maximum depth is less than 50%, there is a fear that the rim 3 may be burnt.

Preferably, a distance x between the lower face portion 21Ua and a lower face X formed by a bottom end of the body portion 11 is less than 5 mm in the upward direction, and, less than 2 mm in the downward direction. If the distance x is more than 5 mm in the upward direction as indicated in FIG. 21(a), an effect of shielding the rear side of the rim 3 from microwave is lost. If the distance x is more than 2 mm in the downward direction as indicated in FIG. 21(b), the stability of the paper cup G corresponding to a microwave oven may be lost.

The sixth embodiment is effective when the height of the rim 3 is less than 10 mm, the height of the rim becomes less than 5 mm by folding back the lower portion of the rim 3 inwardly. Thus if the height of the rim 3 is over 10 mm and even after the lower portion of the rim 3 is folded back inwardly, the height

of the rim 3 is over 5 mm, the seventh embodiment is preferable in which the bottom face portion 21 of the bottom member 2 is deformed to concave downward.

Next, a method for manufacturing the paper cups F and G corresponding to a microwave oven will be described.

To manufacture the paper cup F corresponding to a microwave oven of the sixth embodiment, first, a paper cup "a" shown in FIG. 32 is produced. Its manufacturing procedure may be the same as the above-described paper cup for a microwave oven A.

To form the bottom folding back portion 3a by folding back the lower portion of the rim 3 of the paper cup "a" inwardly, the lower portion of the rim 3 is fallen inwardly more than 45° according to a method as shown in FIG. 22(a). Next, the fallen portion is pressed downward by pressing from up and down according to a method as shown in FIG. 22(b) so as to fold back the rim 3 as the bending portion 3a. Further, by applying a pressure from a side of the front surface according to a method as shown in FIG. 22(c), the rim 3 folded back as the bending portion 3a is obtained.

As described above, the bottom folding back portion 3a is formed by folding back the lower portion of the rim 3 of this paper cup "a" inwardly, so that the paper cup F corresponding to a microwave oven of the sixth embodiment can be manufactured.

To manufacture the paper cup G corresponding to a microwave oven of the seventh embodiment, the paper cup F corresponding to a microwave oven in a stage before the bottom face portion 21 of the bottom member 2 is deformed to concave is produced.

Next, the raised flat bottom face portion 21 is deformed to a U-shaped configuration. As for a process of deforming this bottom face portion 21 to concave, as shown in FIG. 23(a), after a paper cup is fit to a mandrel 101 having a convex portion 101a at a top face portion thereof, it is deformed with a head 102 having a concave portion 102a on a bottom face thereof so as to produce a U-shaped bottom face portion 21. To facilitate the forming processing, it is permissible to apply a method of heating the bottom member 2 preliminarily, a method of heating the head 102 or a method of vibrating the head 102 with ultrasonic wave. It is also permissible to apply a method of pressing a revolution roller 103 with the mandrel 102 rotating as shown in FIG. 23(b).

Although as for the composition of material used for the paper cup for a microwave oven, basically, paper is its main strength material while thermoplastic resin is provided on its innermost layer, its specific configuration of the material may be the same as the specific example described about the paper cups A and B for a microwave oven.

As for the paper cups F and G corresponding to a microwave oven, it is permissible to form the paper cups F' and G' corresponding to a microwave oven in which the heat insulation cover 4 is wound around an outer periphery of the body portion 11 as shown in FIGS. 24(a) and (b).

The configuration of the heat insulation cover 4 may be made by adopting the curl portions 42a, 43a or the bent portions 42b, 43b as shown in FIGS. 25(a) to (d) independently or in

combination as well as by attaching it to an outer face of the body portion 11. The details on the configurations in FIGS. 25(a)-(d) are the same as cases shown in FIGS. 6, 12, 18 and detailed description thereof is omitted. FIG. 25 shows an example of the paper cup F' corresponding to a microwave oven and the heat insulation cover 4 of the microwave oven correspondence paper cup G' can be formed in the same configuration. The heat insulation cover 4 can be made shorter than the vertical length of the body portion 11 of each of the paper cups F' and G' corresponding to a microwave oven and attached to an upper portion of the outer face of the body portion 11. The material of the heat insulation cover 4 of each of the paper cups F' and G' corresponding to a microwave oven may be the same as the cases of FIGS. 6, 12 and 18.

[Eight and Ninth Embodiments]

FIG. 26 shows a paper cup corresponding to a microwave oven according to an eighth embodiment of the present invention. The paper cup H corresponding to a microwave oven is produced based on the paper cup "e" as shown in FIG. 27. The paper cup "e" has the body member 1 and the bottom member 2. The bent portion 22 is formed by bending an outer peripheral rim of the bottom member 2 downward and then, the bent portion 22 is joined to a bottom end portion of the body portion 11 of the body member 1 by heating with a pressure so as to form a joint portion 3'. Then, the paper cup H corresponding to a microwave oven is manufactured by forming a bottom curl portion 3b by winding a joint portion 3' of the paper cup "e" inwardly. The height "h"

of the bottom curl portion 3b is preferred to be equal to or less than $1/2$ of the height H of the joint portion 3 before the winding.

FIG. 28 shows a paper cup corresponding to a microwave oven according to a ninth embodiment of the present invention. In the paper cup I corresponding to a microwave oven, the bottom curl portion 3c is formed by winding the rim 3 of the ordinary paper cup "a" shown in FIG. 32 inwardly. The height "h" of the bottom curl portion 3c is preferred to be equal to or less than $1/2$ of the height H_a of the rim 3 before the winding.

Next, the method for manufacturing the paper cups H and I corresponding to a microwave oven will be described.

The paper cup "e" before the joint portion 3' is wound inwardly and the paper cup "a" before the rim 3 is wound inwardly are formed of the body member blank 10 and bottom member blank 20 shown in FIG. 3 by means of a paper cup forming machine. The manufacturing procedure of the paper cup "a" is as described above. The procedure for manufacturing the paper cup "e" is different from the procedure for manufacturing the paper cup "a" in that a bottom end of the cylindrical body member 1a is joined to the outer peripheral rim bent downward of the bottom member blank 20 under a pressure so as to form the joint portion 3' thereby joining the body member 1 with the bottom member 2.

The paper cup H corresponding to a microwave oven can be manufactured by forming the bottom curl portion 3b by winding the joint portion 3' of the paper cup "e" inwardly. Further, the paper cup I corresponding to a microwave oven can be

manufactured by forming the bottom curl portion 3c by winding the rim 3 of the paper cup "a" inwardly.

In these manufacturing processes, the joint portion 3' or the rim 3 is bent inward into a circular form according to the method as shown in FIG. 29(a). Next, it is wound inwardly such that it is crushed by a concave die from upward according to a method as shown in FIG. 29(b). Consequently, the bottom curl portion 3b or the bottom curl portion 3c can be formed. In the meantime, although FIG. 29 shows an example of manufacturing the paper cup H corresponding to a microwave oven, the same procedure can be applied to manufacturing of the paper cup I corresponding to a microwave oven.

Although as for the composition of material used for the paper cups H and I for a microwave oven, basically, paper is its main strength material while thermoplastic resin is provided on its innermost layer, its specific configuration of the material may be the same as the specific example described about the paper cup A and B for a microwave oven.

As for the paper cups H and I corresponding to a microwave oven, it is permissible to form the paper cups H' and I' corresponding to a microwave oven in which the heat insulation cover 4 is wound around an outer periphery of the body portion 11 as shown in FIGS. 30(a) and (b).

The configuration of the heat insulation cover 4 may be made by adopting the curl portions 42a, 43a or the bent portions 42b, 43b as shown in FIGS. 31(a) to (d) independently or in combination as well as by attaching it to an outer face of the

body portion 11 of each of the paper cups A and B corresponding to a microwave oven. The details on the configurations in FIGS. 31(a) to (d) are the same as cases shown in FIGS. 6, 12, 18 and 25. Although FIG. 31 shows an example of the paper cup H' corresponding to a microwave oven, the same configuration may be applied to the paper cup I' corresponding to a microwave oven. The heat insulation cover 4 can be made shorter than the vertical length of the body portion 11 of each of the paper cups H' and I' corresponding to a microwave oven and attached to a upper portion of the outer face of the body portion 11. The material of the heat insulation cover 4 of each of the paper cups H' and I' corresponding to a microwave ovens may be the same as the cases of FIGS. 6, 12, 18 and 25.

As specific applications of the paper cup for a microwave oven or the paper cup corresponding to a microwave oven of the present invention, containers for instant food such as instant noodle for heating and containers for hot drink such as coffee, black tea, soap and the like can be mentioned.

EXAMPLES

Next, the paper cup for a microwave oven of the present invention will be described with specific examples.

[Example 1-1]

According to the example 1-1 of the paper cup for a microwave oven of the present invention, a paper cup A for a microwave oven shown in FIG. 1 was produced. As the body member 1, material composed of cup raw material paper 280 g/m² and low-density

polyethylene resin 25 μm in this order from the surface was employed. Material composed of cup raw material paper 255 g/m^2 and low-density polyethylene resin 25 μm in this order from the surface was employed as the bottom member 2. The body member blank 10 as shown in FIG. 3 was produced by punching out and this body member blank 10 was wound around a mandrel so as to form a cylindrical body member 1a. Next, a bottom member blank 20 was fit from downward of the body member 1a with an ordinary paper cup forming machine and its bonding portion was heated with hot air. A lower end portion of the body member 1a was folded back so as to form the folding back portion 12 and finally the paper cup "a" was completed. Next, the rim 3 was bent inwardly according to the method shown in FIG. 4(a) and the rim 3 was crushed by thermal pressing based on the method shown in FIG. 4(b) (processing condition: 120°C in temperature, 600 KPa in pressure, 5 seconds in time) and resin at the joint portion of the rim was melted and solidified so as to form the rim 3 in a flat shape thereby finally producing the paper cup A for a microwave oven.

Because in the paper cup A for a microwave oven of the example 1-1, the rim 3 of the paper cup "a" was folded inwardly, when it was heated with a content therein by a microwave oven, no burning occurred in the rim 3.

[Example 1-2]

As the example 1-2 of the paper cup for a microwave oven of the present invention, the paper cup B for a microwave oven shown in FIG. 2(b) was produced. First, the paper cup "a" was produced in the same way as the example 1-1. Next, by deforming

the bottom face portion 21 of the bottom member 2 of the produced paper cup "a", the paper cup "b" was produced. Next, the rim 3 was folded inwardly and fixed to the bottom face portion 21 of the bottom member 2 with adhesive agent thereby finally the paper cup B for a microwave oven being produced.

Because the rim 3 of the paper cup "b" was folded inwardly in the paper cup B for a microwave oven of the example 1-2, when a content contained in the cup was cooked by a microwave oven, the rim 3 was not burnt. Further because the bottom face portion 21 of the bottom member 2 of the paper cup "b" was deformed to concave inward, the folding angle of the rim 3 became more than 90°, wrinkles generated upon the folding were absorbed and reduced. Consequently, stability of the paper cup B on a flat plane was improved.

[Example 1-3]

As the example 1-3 of the paper cup for a microwave oven of the present invention, a paper cup A' for a microwave oven shown in FIG. 5(a) was produced. The heat insulation cover 4 was produced using cylindrical corrugated board (F flute) corresponding to the entire outer face of the body portion 11 of the paper cup A for a microwave oven of the example 1-2 and the paper cup A for a microwave oven was fit into this cylindrical heat insulation cover 4 and then, fixed by partially bonding, so that the paper cup A' for a microwave oven shown in FIG. 5(a) was produced.

Because the rim 3 of the paper cup "b" was folded inwardly in the paper cup A' for a microwave oven of the example 1-3,

when a content contained in the cup was cooked by a microwave oven, the rim 3 was not burnt. Further, because the heat insulation cover 4 made of the corrugated board was attached to the body portion 11, heat insulation property was secured so that a heated content was unlikely to be cooled and further, heat from the content was not felt when it was held by the hand. Thus, the paper cup A' for a microwave oven could be carried with the hand.

[Example 2-1]

As the example 2-1 of the paper cup for a microwave oven of the present invention, a paper cup C for a microwave oven shown in FIG. 7(b) was produced. As the body member 1, material composed of cup raw material paper 280 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed and as the bottom member 2, material composed of cup raw material paper 255 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed. The paper cup "a" which is a basis for the paper cup C was produced in the same procedure as the example 1-1. A lower portion of the rim 3 of that paper cup "a" was folded inward and a front end of the folded bending portion 3a was folded until the front end of the bending portion 3a reaches the bottom face portion 21 of the bottom member 2. Then, the front end of the bending portion 3a was bonded to the bottom face portion 21 with adhesive agent thereby finally producing the paper cup C for a microwave oven.

Because the lower portion of the rim 3 of the paper cup "a" was folded inward in the paper cup C for a microwave oven

of the example 2-1, when a content contained in the cup was cooked by heating by a microwave oven, the rim 3 was not burnt.

[Example 2-2]

As the example 2-2 of the paper cup for a microwave oven of the present invention, the paper cup D for a microwave oven shown in FIG. 10 was produced. A paper cup "a" was produced in the same procedure as the example 2-1 and next, the lower portion of the rim 3 of the paper cup "a" was bent inward substantially 90°. Then, concave wedges Q were provided in the folded bending portion 3a at four positions in the same interval along the peripheral direction of the rim 3, thereby finally producing the paper cup D for a microwave oven.

Because the lower portion of the rim 3 of the paper cup "a" was folded inward in the paper cup D for a microwave oven of this example 2-2, when a content contained in the cup was cooked by heating in a microwave oven, the rim 3 was not burnt. Further, because the concave wedges Q were provided in four places in the same interval in the bending portion 3a, wrinkles generated upon the folding were absorbed and reduced, so that the stability of the cup on a flat plane was improved.

[Example 2-3]

As the example 2-3 of the paper cup for a microwave oven of the present invention, the paper cup C' for a microwave oven shown in FIG. 11(b) was produced. A heat insulation cover 4 was produced using a cylindrical corrugated board (F flute) corresponding to the entire outer face of the body portion 11 of the paper cup D for a microwave oven of the example 2-2 and

the paper cup C for a microwave oven was fit to this cylindrical heat insulation cover 4 and fixed by partially bonding. Consequently, the paper cup C' for a microwave oven shown in FIG. 11 was produced.

Because the lower portion of the rim 3 of the paper cup "a" was folded inward in the paper cup C' for a microwave oven of the example 2-3, when a content contained in the cup was cooked by heating in a microwave oven, the rim 3 was not burnt. Further because the heat insulation cover 4 made of the corrugated board was attached to the body portion 11, heat insulation property was secured so that a heated content was unlikely to be cooled and further, heat from the content was not felt when it was held by the hand. Thus, the paper cup C' for a microwave oven could be carried with the hand.

[Example 3-1]

As the example 3-1 of the paper cup for a microwave oven of the present invention, a paper cup E for a microwave oven shown in FIG. 13 was produced. As the body member 1, material composed of cup raw material paper 280 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed and as the bottom member 2, material composed of cup raw material paper 255 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed. The paper cup "a" which is a basis for the paper cup E was produced in the same procedure as the example 1-1. A lower portion of the rim 3 of that paper cup "a" was folded inward so as to form an outwardly expanding circular bending portion 3a. Then, as a receiver 52 of the press

die 50 shown in FIG. 16, a hollow cylindrical one is employed so as to provide a circular convex portion 21a which is convex inwardly in the center of an inner side of the bottom face portion 21, thereby a paper cup E for a microwave oven being produced.

In the paper cup E for a microwave oven of this embodiment, the lower portion of the rim 3 of the paper cup "a" was folded inward circularly and at the same time, a circular convex portion 21a, which was convex inwardly, was provided in the center of an inner face of the bottom face portion 21. Consequently, when the paper cup E for a microwave oven with a content is used in a microwave oven, the configuration of the convex portion 21a which is convex inwardly in the bottom face portion 21 is inverted to a configuration convex outwardly, thereby decreasing a danger that the paper cup E for a microwave oven may be burnt remarkably. Thus, when the content contained in the cup was cooked by heating in the microwave oven, the rim 3 was not burnt.

Using the paper cup E for a microwave oven of the present invention having the bending portion produced by bending at least part of the lower portion of the rim inward circularly and provided with the circular convex portion which is convex inwardly in the center of the inner face of the bottom face portion, various kinds of contents were accommodated in the cup and cooked in a microwave oven actually. Table 1 shows results of that experiment.

Evaluation method: add water of 200 ml to a paper cup and verify changes in the paper cup.

○: no occurrence of discoloration and burning

△: discoloration

×: burning

Evaluation with household microwave oven (NE Co., 500W)

Bending portion	Convex portion	Heating time (min)				
		1	3	6	10	15
None	None	○	△	×	×	×
Yes	None	○	○	○	○	×
Yes	Yes	○	○	○	○	○

Evaluation with household microwave oven (HI Co., 500W)

Bending portion	Convex portion	Heating time (min)				
		1	3	6	10	15
None	None	○	○	△	×	×
Yes	None	○	○	○	○	○
Yes	Yes	○	○	○	○	○

Evaluation with household microwave oven (TO Co., 500W)

Bending portion	Convex portion	Heating time (min)				
		1	3	6	10	15
None	None	○	○	○	△	△
Yes	None	○	○	○	○	○
Yes	Yes	○	○	○	○	○

Evaluation with household microwave oven (TO Co., 500W)

Bending portion	Convex portion	Heating time (min)				
		1	3	6	10	15
None	None	○	○	×	×	×
Yes	None	○	○	○	○	△
Yes	Yes	○	○	○	○	○

[Example 4-1]

As the example 4-1 of the paper cup for a microwave oven of the present invention, a paper cup F for a microwave oven shown in FIG. 19 was produced. As the body member 1, material composed of cup raw material paper 280 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed and as the bottom member 2, material composed of cup raw material paper 255 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed. The paper cup "a" which is a basis for the paper cup F was produced in the same procedure as the example 1-1. The height of the rim 3 of the paper cup "a" was set to 10 mm. By folding back the lower portion of the rim 3 inward through a process indicated in FIG. 22, the bending portion 3a was formed thereby finally, the paper cup F corresponding to a microwave oven whose rim was 5 mm being produced.

Because the rim 3 of the paper cup "a" was folded back inward in the paper cup E corresponding to a microwave oven of the example 4-1, when a content contained in the cup was cooked by heating in a microwave oven, there was no burning at any portion

of the paper cup. Additionally, the stability of the paper cup on a flat plane was excellent.

[Example 4-2]

As the example 4-2 of the paper cup corresponding to a microwave oven of the present invention, the paper cup G corresponding to a microwave oven shown in FIG. 20 was produced. As indicated in the example 4-1, the lower half of the rim 3 which is 15 mm in height was folded back so as to form the bending portion 3a and the paper cup F corresponding to a microwave oven shown in FIG. 19 was produced with its rim 3 which is 7 mm in height. Next, the bottom face portion 21 of the bottom member 2 of the paper cup F corresponding to a microwave oven was deformed to concave downward thereby finally, the paper cup G corresponding to a microwave oven having the bottom face portion 21U U-shaped in a depth of 5 mm being produced.

In case of the paper cup G corresponding to a microwave oven of the example 4-2, when a content contained in the cup was cooked by heating in a microwave oven, there was no burning at any portion of the paper cup. Additionally, the stability of the paper cup on a flat plane was excellent.

[Example 4-3]

As the example 4-3 of the paper cup corresponding to a microwave oven of the present invention, the paper cup F' corresponding to a microwave oven shown in FIG. 24(a) was produced. A heat insulation cover 4 was produced using a cylindrical corrugated board (F flute) corresponding to the entire outer face of the body portion 11 of the paper cup F for a microwave

oven of the example 4-1 and the paper cup F for a microwave oven was fit to this cylindrical heat insulation cover 4 and fixed by partially bonding. Consequently, the paper cup F' for a microwave oven was produced.

Because the rim 3 of the paper cup "a" was folded inward in the paper cup F' for a microwave oven of the example 4-3, when a content contained in the cup was cooked by heating in a microwave oven, there was found no burning at any portion of that paper cup. Further because the heat insulation cover 4 made of the corrugated board was attached to the body portion 11, heat insulation property was secured so that a heated content was unlikely to be cooled and further, heat from the content was not felt when it was held by the hand. Thus, the paper cup F' for a microwave oven could be carried with the hand.

[Example 4-4]

As the example 4-4 of the paper cup corresponding to a microwave oven of the present invention, the paper cup G' corresponding to a microwave oven shown in FIG. 24(b) was produced. A heat insulation cover 4 was produced using a cylindrical corrugated board (F flute) corresponding to the entire outer face of the body portion 11 of the paper cup G for a microwave oven of the example 4-2 and the paper cup G for a microwave oven was fit to this cylindrical heat insulation cover 4 and fixed by partially bonding. Consequently, the paper cup G' for a microwave oven was produced.

Because the rim 3 of the paper cup "a" was folded inward in the paper cup G' for a microwave oven of the example 4-4,

when a content contained in the cup was cooked by heating in a microwave oven, there was found no burning at any portion of that paper cup. Further because the heat insulation cover 4 made of the corrugated board was attached to the body portion 11, heat insulation property was secured so that a heated content was unlikely to be cooled and further, heat from the content was not felt when it was held by the hand. Thus, the paper cup G' for a microwave oven could be carried with the hand.

[Example 5-1]

As the example 5-1 of the paper cup for a microwave oven of the present invention, a paper cup H for a microwave oven shown in FIG. 26 was produced. As the body member 1, material composed of cup raw material paper 280 g/m^2 and low-density polyethylene resin $25 \mu\text{m}$ in this order from the surface was employed and as the bottom member 2, material composed of cup raw material paper 255 g/m^2 and low-density polyethylene resin $25 \mu\text{m}$ in this order from the surface was employed. A body member blank 10 shown in FIG. 3 was produced by punching out and then, a cylindrical body member 1a was formed by winding this body member blank 10 around a mandrel. Next, a bottom member blank 20 was fit from downward of the body member 1a using an ordinary paper cup forming machine and its bonding portion was heated with hot air. An outer peripheral rim of the bottom member 2 was bent downward so as to form a bent portion 22, and this bent portion 22 and a bottom end portion of the body member 1 were bonded together by heating with a pressure, so that a paper cup "e" having a joint portion 3' as shown in FIG. 27 was produced. Next, a bottom

curl portion 3b was formed by winding the joint portion 3' inward thereby a paper cup H corresponding to a microwave oven being completed.

Because the joint portion 3' of the paper cup "e" was wound inward in the paper cup H corresponding to a microwave oven of the example 5-1, when a content contained in the cup was cooked by heating with a microwave oven, there was no burning at any portion of the paper cup. Additionally, the stability of the cup on a flat plane was improved.

[Example 5-2]

As the example 5-2 of the paper cup for a microwave oven of the present invention, a paper cup I for a microwave oven shown in FIG. 28 was produced. As the body member 1, material composed of cup raw material paper 280 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed and as the bottom member 2, material composed of cup raw material paper 255 g/m² and low-density polyethylene resin 25 μm in this order from the surface was employed. The paper cup "a" which was a basis for the paper cup I corresponding to a microwave oven was produced in the same way as the example 1-1. A bottom curl portion 3c was formed by winding the rim 3 of that paper cup "a" inward thereby the paper cup I corresponding to a microwave oven being completed.

Because the rim 3 of the paper cup "a" was wound inward in the paper cup I corresponding to a microwave oven of the example 5-2, when a content contained in the cup was cooked by heating with a microwave oven, there was no burning at any portion of

the paper cup. Additionally, the stability of the cup on a flat plane was improved.

[Example 5-3]

As the example 5-3 of the paper cup corresponding to a microwave oven of the present invention, the paper cup H' corresponding to a microwave oven shown in FIG. 30 was produced. A heat insulation cover 4 was produced using a cylindrical corrugated board (F flute) corresponding to the entire outer face of the body portion 11 of the paper cup H for a microwave oven of the example 5-2 and the paper cup H corresponding to a microwave oven was fit to this cylindrical heat insulation cover 4 and fixed by partially bonding. Consequently, the paper cup H' for a microwave oven was produced.

Because the joint portion 3' of the paper cup "e" was wound inward in the paper cup H' corresponding to a microwave oven of the example 5-3, when a content contained in the cup was cooked by heating with a microwave oven, there was no burning at any portion of the paper cup. Further because the heat insulation cover 4 made of the corrugated board was attached to the body portion 11, heat insulation property was secured so that a heated content was unlikely to be cooled and further, heat from the content was not felt when it was held by the hand. Thus, the paper cup H' for a microwave oven could be carried with the hand.

INDUSTRIAL APPLICABILITY

As described above, the first paper cup for a microwave oven of the present invention enables to provide a paper cup

for a microwave oven which when a content such as drink, instant food is accommodated in the same cup and cooked by heating with a microwave oven, never generates burning.

The second paper cup for a microwave oven of the present invention enables to provide a paper cup for a microwave oven which when a content such as drink, instant food is accommodated in the same cup and cooked by heating with a microwave oven, never generates burning. Because the second paper cup for a microwave oven of the present invention is provided with a space between the bending portion of the rim and the bottom face portion of the bottom member, when the cup is placed on a flat plane, heat of the content is unlikely to escape.

The third paper cup for a microwave oven of the present invention is provided with the bending portion, which is formed by bending the lower portion of the rim of the paper cup inward. Additionally, the convex portion which is convex inward is provided in the center of an inner face of the bottom face portion. Consequently, when this paper cup for a microwave oven with a content therein is used in a microwave oven, the convex configuration which is convex inward in the bottom face portion is inverted to a configuration convex outward. As a result, this paper cup for a microwave oven has a very low danger that the rim of the same cup may be burnt.

According to the method for manufacturing the paper cup for a microwave oven of the present invention, the bending portion is formed by bending the lower portion of the rim of the paper cup inward. Further, the clamping portion of the press die is

provided with no air escape hole while the receiving portion is formed in a hallow cylindrical shape with an air escape hole. As a result, the internal pressure is increased and the convex portion which is convex inward can be formed in the center of the inner face of the bottom face portion of the bottom member.

According to the first paper cup corresponding to a microwave oven of the present invention, because the bending portion is formed by folding back the body member of the paper cup and the rim of the bottom member inward, the height of the rim is reduced. Further, because the bottom face portion of the bottom member is formed in a concave shape which is concave downward, when a content, for example, drink or instant food, accommodated in the same paper cup is cooked by heating with a microwave oven, that content never overflows and there occurs no burning at any portion of the same paper cup. Additionally, if the heat insulation cover made of heat insulation material is attached to the body portion, it is possible to acquire a paper cup corresponding to a microwave oven in which the heated content is unlikely to be cooled and which can be carried with the hand without feeling heat of the content.

According to the method for manufacturing the second paper cup corresponding to a microwave oven of the present invention, the bottom curl portion is formed by winding the joint portion between the body member and the bottom member inward. Consequently, the height of the rim can be reduced to substantially less than $1/2$ the conventional example. As a result, it is possible to obtain a paper cup corresponding to a microwave oven

in which when such a content as drink, instant food is accommodated in the same paper cup and cooked by heating with a microwave oven, no burning is generated. Further, because the bottom portion of that paper cup corresponding to a microwave oven is curled, when the same cup is placed on a flat plane, its stability is high and the bottom face portion does not make a contact with that plane, so that heat of the content is unlikely to escape.

CLAIMS

1. A paper cup for a microwave oven comprising a body member and a bottom member, said paper cup being formed by folding inward a rim which joins the body member and the bottom member with each other.

2. The paper cup for a microwave oven according to claim 1, wherein the bottom face of the bottom member has an inwardly concave shape.

3. A paper cup for a microwave oven comprising a body member and a bottom member, wherein a rim which joins the body member and the bottom member with each other is bent inward at an angle equal to or more than 90° so as to form a bending portion.

4. The paper cup for a microwave oven according to claim 3, wherein a gap width of a space between the bending portion and a bottom face portion of the bottom member is equal to or less than 5 mm at a largest portion thereof.

5. The paper cup for a microwave oven according to claim 4, wherein the bending portion is provided with a concave wedge.

6. A paper cup for a microwave oven comprising a body member formed cylindrically by winding around and a bottom member in which a bent portion is produced by bending an outer peripheral

rim thereof, the bent portion being sandwiched and joined by a folding back portion formed by folding back a bottom end portion of the body portion and the body portion so as to form a rim, wherein a bending portion is formed by bending a lower portion of the rim inward, and a convex portion which is convex inward in the center of an inner face of the bottom face portion of the bottom member is formed.

7. The paper cup for a microwave oven according to claim 6, wherein a gap width of a space between the bending portion and the bottom face portion is equal to or less than 5 mm at a largest portion thereof.

8. A method for manufacturing a paper cup for a microwave oven comprising the steps of: forming a cylindrical body portion by winding around; forming a bent portion by bending an outer peripheral rim of the bottom member; forming a rim by sandwiching and joining the bent portion by a folding back portion formed by folding back a bottom end portion of the body portion of the body member and the body portion; forming a bending portion by bending a lower portion of the rim inward; and, forming a convex portion which is convex inward in the center of an inner face of the bottom face portion of the bottom member by providing a clamping portion of a press die with no air escape hole while a receiving portion is formed in a hollow cylindrical shape with an air escape hole.

9. A paper cup corresponding to a microwave oven in which a body portion is formed by winding a body member cylindrically; a top curl portion is formed by bending a top end of the body portion; with a front end of a bent portion formed by bending an outer peripheral rim of the bottom member is located so as to be directed to a bottom end of the body portion; and, the bent portion is sandwiched by a folding back portion formed by folding back the bottom end portion of the body portion and the body portion so as to form a rim such that the body member and the bottom member are joined together,

wherein the lower portion of the rim is inwardly folded back.

10. The paper cup corresponding to a microwave oven according to claim 9, wherein the bottom face portion of the bottom member is formed such that it is concave downward from an inner side of the cup.

11. A paper cup corresponding to a microwave oven comprising a body member formed cylindrically by winding around and a bottom member having a bent portion produced by bending an outer peripheral rim thereof, a body portion of the body member and the bent portion being joined together so as to form a joint portion,

wherein a bottom curl portion is formed by winding the joint portion inwardly.

12. The paper cup corresponding to a microwave oven according to claim 11, wherein the joint portion is formed by joining the bent portion such that it is sandwiched between a folding back portion formed by folding back a bottom end portion of the body portion and the body portion.

13. A method for manufacturing a paper cup corresponding to microwave oven comprising the steps of: forming a cylindrical body member by winding around; forming a bent portion by bending an outer peripheral rim of the bottom member; forming a joint portion by joining a bottom end portion of a body portion of the body member and the bent portion with each other; and, forming a bottom curl portion by winding the joint portion inwardly.

14. A method for manufacturing a paper cup corresponding to microwave oven comprising the steps of: forming a cylindrical body member by winding around; forming a bent portion by bending an outer peripheral rim of the bottom member; forming a joint portion by joining the bent portion such that it is sandwiched between a folding back portion formed by folding back a bottom end portion of a body portion of the body member and the body portion; and forming a bottom curl portion by winding the joint portion inwardly.