

## SPECIFICATION

### MICROWAVE-OVEN-USE PAPER CUP AND MANUFACTURING METHOD THEREOF

#### FIELD OF THE INVENTION

The present invention relates to microwave-oven-use paper cups.

#### BACKGROUND OF THE INVENTION

Conventionally, paper cups have been widely used as containers for hot drinks and instant food sold in automatic bender machines, etc. In some cases, a paper cup containing a drink or food is directly put into a microwave oven, and heated and subjected to cooking. As shown in FIG. 51, a generally-used paper cup P is provided with a trunk member 1 and a bottom member 2. The trunk member 1 mainly forms a trunk portion 11. The top end of the trunk member 1 is curled outward to form a top curl portion 12, and the bottom end thereof is bent inward to form a turned-up portion 13. Here, the bottom member 2 mainly forms a bottom face portion 21. The peripheral edge portion of the bottom member 2 is bent downward at virtually right angles to form a bent portion 22. The trunk member 1 and the bottom member 2 are joined to each other by sandwiching the bent portion 22 of the bottom member 2 between the turned-up portion 13 of the trunk member 1 and the lower end portion of the trunk portion 11 and heating and press-joining these portions. This portion

formed by sandwiching and joining the bent portion 22 of the bottom member 2 is referred to as a paper-combined portion Z. The bottom face portion 21 is formed as a raised bottom by the paper-combined portion Z.

When the contents of a paper cup P having this common shape are heated and cooked in a microwave oven, the paper-combined portion Z on the bottom of the paper cup tends to have a burnt portion. The reason for this is explained as follows: Cellulose of pulp that is a paper material basically absorbs microwaves from the microwave oven. Therefore, the paper-combined portion Z which has an increased paper thickness due to overlapped pieces of paper has an increased heating value. Here, the surface area of the paper-combined portion Z remains unchanged even when the paper thickness is increased. Therefore, the amount of heat release is constant even when the paper thickness is increased. Therefore, the generated heat is accumulated to increase the temperature, thereby causing a burnt portion. However, when the paper cup 1 has contents, it is less susceptible to burning. The reason is the heat generated and accumulated in the paper is absorbed by the contents. In other words, as shown in FIG. 51, the generally-used paper cup P has the paper-combined portion Z as a joined portion between the trunk member 1 and the bottom member 2, and the paper-combined portion Z is subjected to microwaves from both of the faces on the surface side and the rear side, and since this portion does not touch the contents, it tends to accumulate heat. For this reason, the paper-combined portion is susceptible to burning.

Here, with respect to cups having a heat insulating property, various cups made from a synthetic resin having a foaming property, especially foamed polystyrene resin, have been widely used. Moreover, heat-insulating containers, such as those paper cups having trunk-wrapping paper having a corrugated shape, etc., placed on the entire circumferential portion, those having a two-layered structure of inner side and outer side with a heat-insulating space between the layers and those cups in which a paper material both of the surfaces of which are coated with a polyethylene resin layer with the surface polyethylene resin layer being foamed, have been widely known.

Those cups made of foamed polystyrene resin are superior in the heat-insulating property since they are manufactured through the procedure to mold and process a resin to which a foaming agent has been added. However, it is difficult to dispose those cups made of foamed polystyrene resin as wastes after they have been used, resulting in problems from environment and hygiene points of view. Moreover, other disadvantages are low smoothness on the surface and an inferior printing property.

Those paper cups having trunk-wrapping paper having a corrugated shape, etc., placed on the entire circumferential portion and those having a two-layered structure of inside and outside cups are superior in the heat-insulating property and the environmental conservation. However, these have problems of high material and manufacturing costs.

As described above, conventionally, there have not been any paper cups which have an appropriate heat-insulating property

and low manufacturing costs, and have a paper-combined portion where a burn doesn't occur even when heated in a microwave oven.

#### DISCLOSURE OF THE INVENTION

A first object of the present invention is to provide a microwave-oven-use paper cup which has a paper-combined portion where a burn never occurs, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven, and a manufacturing method thereof.

A second object of the present invention is to provide an heat-insulating microwave oven-use paper cup which is an heat-insulating paper cup having a foamed layer with a sufficient heat-insulating effect, and which has a paper-combined portion where a burn never occurs, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven, and a manufacturing method thereof.

A third object of the present invention is to provide a microwave-oven-use paper cup having a heat-insulating property at a bottom portion which has a paper-combined portion where a burn never occurs, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven, and which prevents the contents from cooling down after the heating process.

A fourth object of the present invention is to provide a heat-insulating microwave oven-use paper cup which is a heat-insulating paper cup with a heat-insulating cover attached to its trunk portion and which has a paper-combined portion where

a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

A fifth object of the present invention is to provide a heat-insulating microwave oven use paper cup which is a paper cup having a heat-insulating property and has a paper-combined portion where a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven, and which prevents the contents from easily cooling down even when it is put on a plane face after the heating process, and can be held by the hand at its bottom portion.

In accordance with a first aspect of the present invention, a microwave-oven-use paper cup, which is provided with a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending the upper end of the trunk portion and a turned-up portion formed by turning up the lower end of the trunk portion inward, and a bottom member including a bottom face portion and a bent portion formed by bending the outer circumferential edge of the bottom face portion, with the above-mentioned bent portion being sandwiched between the trunk portion and the turned-up portion so as to be mutually joined, is characterized in that the bottom face portion is formed into a concave shape extending downward. Moreover, the bottom face portion is constituted by a lower face portion and a wall face portion, with a curved portion being formed between the lower face portion and the wall face portion.

In accordance with the present invention, since the bottom face portion of the paper cup has a concave shape extending downward, it is possible to provide a microwave-oven-use paper cup which has a paper-combined portion where a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

A manufacturing method of a microwave-oven-use paper cup in accordance with the first aspect of the present invention is provided with a paper-cup forming process in which a trunk member is wound up to a cylinder shape to form a trunk portion, the upper end of the trunk portion is bent to form a top curl portion, and this is placed with the top end of the bent portion formed by bending the outer circumferential edge portion of the bottom member facing the lower end side of the trunk portion so that the trunk member and the bottom member are joined to each other with the bent portion being sandwiched by the turned-up portion formed by turning up the lower end of the trunk portion and the trunk portion to form a paper cup, and a bottom face portion forming process which presses the inner face side of the bottom member of the paper cup to form a bottom face portion having a concave shape extending downward.

A microwave-oven-use paper cup in accordance with a second aspect of the present invention is formed as follows: a trunk member is wound up to a cylinder shape to form a trunk portion, the upper end of the trunk portion is bent to form a top curl portion, and this is placed with the top end of the bent portion

formed by bending the outer circumferential edge portion of the bottom member facing the lower end side of the trunk portion so that the trunk member and the bottom member are joined to each other with the bent portion being sandwiched by the turned-up portion formed by turning up the lower end of the trunk portion and the trunk portion to form a paper cup, and a bottom face portion of side bottom member of the paper cup formed is formed into a concave shape extending downward, seeing from the inner face side of the paper cup.

In accordance with these manufacturing method and microwave oven-use paper cup, the shape of the bottom member of the paper cup is formed into a concave shape extending downward so that it is possible to obtain a microwave-oven-use paper cup which has a paper-combined portion where a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In the manufacturing method of the present invention, in the above-mentioned paper cup forming process, the width of the turned-up portion may be set to not less than 2 mm, and also to not more than  $3/4$  of the width of the bent portion. Moreover, the width in which the trunk portion, the bent portion and the turned up portion are joined to each other may be set to not less than 2 mm from the tip of the bent portion, and also to not more than  $3/4$  of the width of the bent portion.

In the microwave oven-use paper cup of the second aspect, the width of the turned-up portion may be set to not less than

2 mm, and also to not more than  $3/4$  of the width of the bent portion, or the width of a joining section in which the bent portion, the trunk portion and the turned-up portion are joined to each other may be set to not less than 2 mm from the tip of the bent portion, and also to not more than  $3/4$  of the width of the bent portion.

A manufacturing method of a microwave-oven-use paper cup in accordance with the second aspect of the present invention is provided with a bottom member forming process in which a bottom member is pressed to form a bottom face portion having a concave shape and a bent portion on the outer circumferential edge of the bottom face portion, and a paper cup forming process in which, in the process in which the trunk member is wound into a cylinder shape to form a trunk portion and the upper end of the trunk portion is bent to form a top curl portion, this is placed with the top end of the bent portion of the bottom member facing the lower end side of the trunk portion so that the trunk member and the bottom member are joined to each other with the bent portion being sandwiched by turning up the lower end of the trunk portion to form a paper cup.

In accordance with this manufacturing method, the shape of the bottom face portion of the paper cup is formed into a concave shape so that it is possible to obtain a microwave-oven-use paper cup which has a paper-combined portion where a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

A manufacturing method of a microwave-oven-use paper cup in accordance with a third aspect of the present invention is provided with a pre-reverse bottom member forming process in which a bottom member blank is pressed to form a pre-reverse bottom face portion having a convex shape and a joining portion on the outer circumferential edge of the pre-reverse bottom face portion, a paper cup forming process in which, in the process in which the trunk member is wound into a cylinder shape to form the trunk portion and the upper end of the trunk portion is bent to form a top curl portion, this is placed with the top end of the joining portion of the pre-reverse bottom member facing the lower end side of the trunk portion so that the trunk member and the pre-reverse bottom member are joined to each other with the lower end of the trunk portion being turned up to sandwich the joining portion to form a paper cup, and a bottom member forming process in which the pre-reverse bottom face portion is reversed downward to form a bottom face portion having a downward concave shape.

In accordance with this manufacturing method, the shape of the bottom face portion of the paper cup is easily formed into a concave shape so that it is possible to obtain a microwave-oven-use paper cup which has a paper-combined portion where a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In accordance with the third aspect of the present invention, a microwave-oven-use paper cup, which is provided with a trunk

member including a cylinder-shaped trunk portion, a top curl portion formed by bending the upper end of the trunk portion and a turned-up portion formed by turning up the lower end of the trunk portion inward, and a bottom member including a bottom face portion and a bent portion formed by bending the outer circumferential edge of the bottom face portion, with the above-mentioned bent portion being sandwiched between the trunk portion and the turned-up portion so as to be mutually joined, is designed so that the bottom face portion of the paper cup is formed into a concave shape, and this paper cup is constituted by at least a foamed layer of a thermoplastic resin, and a base material layer mainly made of paper and a thermoplastic resin layer that are placed in this order from the outer face side.

In accordance with this microwave oven-use paper cup, it is prepared as a heat-insulating paper cup with a sufficient heat-insulating effect, a sliding-preventive effect and a foamed layer having a unique taste in the design aspect, and the bottom face portion of the paper cup is formed into a concave shape extending downward so that it is possible to obtain a heat-insulating microwave oven-use paper cup which has a paper-combined portion where a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In the microwave-oven-use paper cup in accordance with the third aspect of the present invention, the trunk member may have the above-mentioned foamed layer. The bottom member may have the above-mentioned foamed layer. Moreover, the trunk

member and the bottom member may have the above-mentioned foamed layer.

In accordance with a fourth aspect of the present invention, a microwave-oven-use paper cup, which is provided with a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending the top end portion of the trunk portion and a turned-up portion formed by bending the lower end of the trunk portion inward, and a bottom member including a bottom face portion and a bent portion formed by bending the outer circumferential edge of the bottom face portion, with the above-mentioned bent portion being sandwiched between the trunk portion and the turned-up portion so as to be mutually joined, is designed so that the bottom face portion of the paper cup is formed into a concave shape extending downward, and a heat-insulating member is bonded to the outer face of the bottom face portion.

In accordance with this microwave-oven-use paper cup, the shape of the bottom face portion of the paper cup is formed into a concave shape extending downward with the heat-insulating member being bonded to the outer face of the bottom face portion so that it is possible to obtain a microwave-oven-use paper cup having a heat-insulating property on its bottom face portion, which has a paper-combined portion where a burn doesn't occur, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven, and which prevents the contents from cooling down even when it is put on a lower surface after having been heated.

In the microwave-oven-use paper cup in accordance with the fourth aspect of the present invention, the heat-insulating member may be provided as corrugated cardboard or embossed sheet.

In accordance with a fifth aspect of the present invention, a microwave-oven-use paper cup, which is provided with a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending the upper end portion of the trunk portion and a turned-up portion formed by turning up the lower end of the trunk portion inward, and a bottom member including a bottom face portion and a bent portion formed by bending the outer circumferential edge of the bottom face portion, with the above-mentioned bent portion being sandwiched between the trunk portion and the turned-up portion so as to be mutually joined to form a paper cup main body, is designed so that a heat-insulating cover is attached to the outer circumference of the trunk portion of the paper cup main body and the bottom face portion thereof is formed into a concave shape extending downward.

In accordance with this microwave-oven-use paper cup which is a heat-insulating cup having a heat-insulating property with a heat-insulating cover attached to its trunk portion, the shape of the bottom face portion of the paper cup that is a main body is formed into a concave shape extending downward so that it is possible to obtain a heat-insulating microwave oven-use paper cup which is less susceptible to burning at a paper-combined portion, even when the heat-insulating paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In the microwave-oven-use paper cup in accordance with the fifth aspect of the present invention, an inward cover upper curl portion or an inward cover upper bent portion may be formed on the upper end portion of the heat-insulating cover. Moreover, an inward cover lower curl portion or an inward cover lower bent portion may be formed on the lower end portion of the heat-insulating cover.

Furthermore, an inward cover upper curl portion or an inward cover upper bent portion may be formed on the upper end portion of the heat-insulating cover, and an inward cover lower curl portion or an inward cover lower bent portion may also be formed on the lower end portion of the heat-insulating cover.

Moreover, the heat-insulating cover may have a shape which is provided with longitudinal grooves formed with predetermined intervals and flat-plate portions with a wide width, extending outward between the grooves.

Furthermore, the above-mentioned heat-insulating cover may be formed by corrugated paper sheet processed into a corrugated shape, corrugated cardboard or embossed paper sheet.

In accordance with a sixth aspect of the present invention, a microwave-oven-use paper cup, which is provided with a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending the top end portion of the trunk portion and a turned-up portion formed by turning up the lower end of the trunk portion inward, and a bottom member including a bottom face portion and a bent portion formed by bending the outer circumferential edge of the bottom face portion, with the

above-mentioned bent portion being sandwiched between the trunk portion and the turned-up portion so as to be mutually joined to form a paper cup main body, is designed so that a heat-insulating cover is attached to the outer circumference of the trunk portion of the paper cup main body and the bottom face portion thereof is formed into a concave shape extending downward and a heat-insulating member is affixed onto the outer face of the bottom face portion.

In accordance with this microwave oven-use paper cup, it is prepared as a heat-insulating paper cup with a heat-insulating cover attached to the trunk portion, and the bottom face portion of the paper cup that is a main body is formed into a concave shape extending downward so that it is possible to obtain a heat-insulating microwave oven-use paper cup which is less susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven, and since a heat-insulating member is attached to the bottom face portion thereof, the paper cup makes it possible to prevent the contents from easily cooling down even when it is put on a plane face after the heating process, and can be held by the hand at its bottom portion.

In the microwave-oven-use paper cup in accordance with the sixth aspect of the present invention, the heat-insulating member may be provided as corrugated cardboard or embossed sheet.

Moreover, an inward cover upper curl portion or an inward cover upper bent portion may be formed on the upper end portion

of the heat-insulating cover, and an cover lower inward curl portion or an inward cover lower bent portion may be formed on the lower end portion of the heat-insulating cover.

The above-mentioned cover upper curl portion or the above-mentioned cover upper bent portion may be formed on the upper end portion of the heat-insulating cover, and the above-mentioned cover lower curl portion or the above-mentioned cover lower bent portion may be formed on the lower end portion of the heat-insulating cover.

Moreover, the heat-insulating cover may have a shape which is provided with longitudinal grooves formed with predetermined intervals and flat-plate portions with a wide width, extending outward between the grooves.

Furthermore, the above-mentioned heat-insulating cover maybe formed by corrugated paper sheet processed into a corrugated shape, corrugated cardboard or embossed paper sheet.

In accordance with a seventh aspect of the present invention, a microwave-oven-use paper cup, which is provided with a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending the top end side of the trunk portion and a turned-up portion formed by turning up the lower end of the trunk portion inward, and a bottom member including a bottom face portion and a bent portion formed by bending the outer circumferential edge of the bottom face portion, the trunk member and the bottom member being jointed to each other by a paper-combined portion in which the above-mentioned bent portion is sandwiched between the trunk portion and the turned-up portion,

is designed so that the bottom face portion is formed into a concave shape extending downward, with the paper-combined portion being bent inward.

In accordance with this microwave oven-use paper cup, the bottom face portion of the paper cup formed into a concave shape extending downward with the paper-combined portion being bent inward to come closer to the bottom face portion so that it is possible to obtain a microwave-oven-use paper cup which is less susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial cross-sectional view that shows a microwave-oven-use paper cup in accordance with a first embodiment of the present invention;

FIG. 2 is a cross-sectional view that shows a shape of a bottom member of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 3 is a development that shows a trunk member blank and a bottom member blank of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 4 is a drawing that explains a method for manufacturing the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 5 is a drawing that explains another method for manufacturing the microwave-oven-use paper cup in accordance

with the first embodiment;

FIG. 6 is a partial cross-sectional view of a first paper cup prior to a modification, which is manufactured by the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 7 is a partial cross-sectional view of a second paper cup prior to a modification, which is manufactured by the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 8 is a cross-sectional view of a microwave-oven-use paper cup manufactured by modifying the paper cup of FIG. 7;

FIG. 9 is a partial cross-sectional view of a third paper cup prior to a modification, which is manufactured by the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 10 is a cross-sectional view of a microwave-oven-use paper cup manufactured by modifying the paper cup of FIG. 9;

FIG. 11 is a drawing that shows forming processes of a paper-cup forming apparatus in accordance with the manufacturing method of the microwave-oven-use paper cup of the first embodiment;

FIG. 12 is a drawing that shows a method of modifying the bottom member in the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 13 is a development that shows a trunk member and a bottom member of a microwave-oven-use paper cup manufactured

by the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 14 is a drawing that shows a method for forming the bottom member in the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 15 is a cross-sectional view that shows a pre-reverse bottom member and a microwave-oven-use paper cup prior to a turning-over process in the case when the bottom member is manufactured through another mode;

FIG. 16 is a drawing that shows a method for manufacturing a pre-reverse bottom member by the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 17 is a drawing that shows a method for manufacturing a pre-reverse microwave oven-use paper cup by the manufacturing method of the microwave-oven-use paper cup in accordance with the first embodiment;

FIG. 18 is a drawing that shows a method for manufacturing a microwave-oven-use paper cup after a reversal process from a pre-reverse microwave-oven-use paper cup prior by the manufacturing method of the microwave oven-use paper cup in accordance with the first embodiment;

FIG. 19 is a schematic cross-sectional view that shows a material construction of a trunk member and a bottom member of a heat-insulating microwave oven-use paper cup in accordance with a second embodiment of the present invention;

FIG. 20 is a schematic cross-sectional view that is a partially cut-out cross-section showing a microwave-oven-use paper cup in accordance with the second embodiment;

FIG. 21 is a drawing that explains another method for manufacturing the microwave-oven-use paper cup in accordance with the second embodiment;

FIG. 22 is a drawing that explains still another method for manufacturing the microwave-oven-use paper cup in accordance with the second embodiment;

FIG. 23 is a partially cut-out cross-sectional view that shows a microwave-oven-use paper cup in accordance with a third embodiment;

FIG. 24 is a cross-sectional view that shows a shape of a bottom member of the microwave-oven-use paper cup in accordance with the third embodiment;

FIG. 25 is a drawing that explains a method for manufacturing the microwave-oven-use paper cup in accordance with the third embodiment;

FIG. 26 is a partially cut-out cross-sectional view that shows a heat-insulating microwave-oven-use paper cup in accordance with a fourth embodiment;

FIG. 27 is a partial cross-sectional view that shows a shape of a bottom member of the heat-insulating microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 28 is a partial cross-sectional view that shows a shape of a heat-insulating cover of the heat-insulating

microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 29 is a drawing that explains a method for attaching a heat-insulating cover to the paper-cup main body of the heat-insulating microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 30 is a drawing that explains another method for attaching a heat-insulating cover to the paper-cup main body of the heat-insulating microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 31 is a partially cut-out cross-sectional view that shows an example of a heat-insulating microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 32 is a partially cut-out cross-sectional view that shows another example of a heat-insulating microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 33 is a partially cut-out cross-sectional view that shows still another example of a heat-insulating microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 34 is a partially cut-out cross-sectional view that shows still another example of a heat-insulating microwave-oven-use paper cup in accordance with the fourth embodiment;

FIG. 35 is a partially cut-out cross-sectional view that shows still another example of a heat-insulating microwave-oven-use paper cup in accordance with the fourth

embodiment;

FIG. 36 is a partially cut-out cross-sectional view that shows a heat-insulating microwave-oven-use paper cup in accordance with a fifth embodiment;

FIG. 37 is a partial cross-sectional view that shows a shape of a bottom member of the heat-insulating microwave-oven-use paper cup in accordance with the fifth embodiment;

FIG. 38 is a drawing that explains a method for attaching a heat-insulating member to the paper-cup main body of the heat-insulating microwave-oven-use paper cup in accordance with the fifth embodiment;

FIG. 39 is a partially cut-out cross-sectional view that shows an example of a heat-insulating microwave-oven-use paper cup in accordance with the fifth embodiment;

FIG. 40 is a partially cut-out cross-sectional view that shows another example a heat-insulating microwave-oven-use paper cup in accordance with the fifth embodiment;

FIG. 41 is a partially cut-out cross-sectional view that shows still another example of a heat-insulating microwave-oven-use paper cup in accordance with the fifth embodiment;

FIG. 42 is a partially cut-out cross-sectional view that shows still another example of a heat-insulating microwave-oven-use paper cup in accordance with the fifth embodiment;

FIG. 43 is a partially cut-out cross-sectional view that

shows still another example of a heat-insulating microwave-oven-use paper cup in accordance with the fifth embodiment;

FIG. 44 is a partially cut-out cross-sectional view that shows a microwave-oven-use paper cup in accordance with a sixth embodiment;

FIG. 45 is a partial cross-sectional view that shows a shape of a bottom member of the microwave-oven-use paper cup in accordance with the sixth embodiment;

FIG. 46 is a schematic cross-sectional view that shows processes for manufacturing the microwave-oven-use paper cup in accordance with the sixth embodiment;

FIG. 47 is a schematic cross-sectional view that shows processes for manufacturing the microwave-oven-use paper cup in accordance with the sixth embodiment;

FIG. 48 is a schematic cross-sectional view that shows a state in which the microwave-oven-use paper cup of the sixth embodiment is wrapped with a heat-insulating cover;

FIG. 49 is a partial cross-sectional view that shows an example of a trunk portion in a state in which the microwave-oven-use paper cup of the sixth embodiment is wrapped with a heat-insulating cover;

FIG. 50 is a cross-sectional view that shows another example of a microwave-oven-use paper cup in accordance with the first embodiment; and

FIG. 51 is a partial cross-sectional view that shows a conventional paper cup.

## BEST MODES FOR CARRYING OUT THE INVENTION

Referring to figures, the following will describe the present invention in detail. Here, in the attached drawings, the same portions in the respective drawings are indicated by the same reference numerals.

## [First Embodiment]

FIG. 1 is a partial cross-sectional view that shows a microwave-oven-use paper cup in accordance with the first embodiment of the present invention. As shown in FIG. 1(a), the microwave-oven-use paper cup A is provided with a trunk member 1 and a bottom member 2. This trunk member 1 is constituted by a trunk portion 11, a top curl portion 12 formed by curling the upper end of the trunk portion 11 outward, and a turned-up portion 13 formed by turning up the lower end of the trunk portion 11 inward. Here, the bottom member 2 is constituted by a bottom face portion 21U that is modified into a concave shape downward when viewed from the inner surface side, and a bent portion 22 formed by bending the outer circumferential edge portion of the bottom face portion 21U downward at virtually right angles. The trunk member 1 and the bottom member 2 are joined to each other with the bent portion 22 of the bottom member 2 being sandwiched between the turned-up portion 13 of the trunk member 1 and the lower end portion of the trunk portion 11 by heating and press-joining these members.

As shown in FIG. 1(b), the bottom face portion 21U of the bottom member 2 has a U-letter shape that is modified into a

concave shape extending downward when viewed from the inner surface side. As shown in FIG. 1(c), the bottom face portion 21U is preferably formed into a tray shape constituted by a lower face portion 21Ua and a wall face portion 21Ub. Here, the lower face portion 21Ua is preferably designed to have a plane shape, and the wall face portion 21Ub is preferably placed close to the turned-up portion 13 of the trunk member 1. A curve face portion R is preferably formed between the lower face portion 21Ua and the wall face portion 21Ub. The curve face portion R is preferably set to have a curvature radius in the range of 3 to 10 mm, more preferably, 5 to 8 mm. In the case of a curvature radius of less than 3 mm, pin-holes might be generated and that might cause leakage. In contrast, in the case of a curvature radius exceeding 10 mm, a paper-combined portion 2 becomes susceptible to burning.

The maximum depth d of the bottom face portion 21U is desirably set to not less than 70 % of the width from the upper end of the turned-up portion 13 of the trunk member 1 to the turned-up portion 13. By setting this to not less than 70 %, it becomes possible to in a microwave-oven effectively shield irradiation of microwaves directed from the rear side of the paper-combined portion 2, and consequently to sufficiently prevent the paper-combined portion 2 from burning. In the case of less than 70%, the paper-combined portion 2 becomes susceptible to burning.

The distance x (see FIG. 2) between a lower end face X and the lower face portion 21Ua formed by the lower end of the

trunk portion 11 is preferably set to a range between less than 8 mm upward and less than 2 mm downward, more preferably, a range from 0 to 3 mm upward. As shown in FIG. 2(a), in the case when the distance x extends upward exceeding 8 mm, there might be a reduction in the effect for shielding microwaves directed from the rear side of the paper-combined portion 2. In contrast, as shown in FIG. 2(b), in the case when the distance x extends downward exceeding 2 mm, there might be degradation in the stability of the microwave oven-use paper cup.

Next, the following description will discuss a manufacturing method of a microwave oven-use paper cup A.

The microwave oven-use paper cup A is formed by a trunk portion blank 10 and a bottom portion blank 20, as shown in FIG. 3. The manufacturing method can be mainly classified into the following two methods.

As shown in FIG. 4(a), in one method, a paper cup a, which has the same shape as generally used paper cups, is first manufactured. The manufacturing process of the paper cup before modification of the bottom member 2 is carried out by a paper-cup forming apparatus in the same manner as the generally-used paper cups. In general, with respect to the trunk portion blank 10, those punched out beforehand in the pre-process are used. The bottom portion blank 20 is formed through the process of punching out on the paper-cup forming apparatus. With respect to the paper cup having a raised bottom face portion 21, the bottom face portion 21 is modified in the next process to have a concave shape extending downward as shown in FIG. 4(b); thereby forming

the bottom face portion 21U having a U-letter shape.

In another method, as shown in FIG. 5(a), a trunk member 1a and a bottom member 2b are beforehand manufactured in different processes. Then, as shown in FIG. 5(b), in the next process, the trunk member 1a, formed into a cylinder shape, and a bottom member 2b having the bottom face portion 21U being U-letter-shaped get joined to each other with the bent portion 22 of the bottom member 2b being sandwiched by the turned-up portion 13 of the trunk member 1a and the lower end portion of the trunk portion 11.

The manufacturing method shown in FIG. 4 may be further classified into several modes in accordance with states of the paper cup prior to the modification. Referred to FIGS. 6 to 10, the following description will discuss the respective modes.

FIG. 6 shows a partial cross-sectional view of the first paper cup a prior to the modification of the bottom member. In the same manner as generally-used paper cups, the paper cup a prior to the modification is provided with the trunk member 1 and the bottom member 2. The trunk member 1 mainly forms a trunk portion 11. The top edge of the trunk member 1 is curled outward to form a top curl portion 12, and the lower end of the trunk member 1 is turned up inward to form a turned-up portion 13. Here, the bottom member 2 mainly forms a bottom face portion 21. The outer circumferential edge of the bottom member 2 is bent downward at virtually right angles to form a bent portion 22. The bent portion 22 of the bottom member 2 is sandwiched by the turned-up portion 13 of the trunk member 1 and the lower

end of the trunk portion 11, and heated and press-joined at joining sections S, S; thus, the trunk member 1 and the bottom member 2 are joined to each other. The bottom member 2 of the paper cup is modified in the way shown in FIG. 4(b) so that a paper cup A, as shown in FIGS. 1 and 2, is obtained.

FIG. 7 is a partial cross-sectional view that shows the second paper cup b prior to modification of a bottom member. The paper cup b is characterized by the facts that the width m of a turned-up portion 13 that regulates the joining sections S between the trunk member 1 and the bottom member 2 is set to not less than 2 mm, and also to not more than  $3/4$  of the width n of the bent portion 22 of the bottom member 2. This arrangement in which the width of the turned-up portion 13 of the trunk member 1 is set to not more than  $3/4$  of the width of the bent portion 22 of the bottom member 2 makes it possible to easily form the bottom member 2 into a concave shape.

When the width of the turned-up portion 13 is set to less than 2 mm, the sealing width with which the trunk member 1 and the bottom member 2 are joined to each other becomes too narrow to cause a reduction in the joining intensity so that the contents might leak. Therefore, the width of the turned-up portion 13 is preferably set to not less than 2 mm. Here, in order to maintain the width of the turned-up portion 13 at not less than 2 mm, the width of the bent portion 22 needs to be set to  $4/3$  times of 2 mm.

FIG. 8 is a cross-sectional view of a microwave-oven-use paper cup B manufactured from the paper cup b. In the

microwave-oven-use paper cup B, the bottom face portion 21 of the microwave-oven-use paper cup b prior to modification is modified into a concave shape extending downward when viewed from the inner surface side to form a U-letter-shaped bottom face portion 21U. At this time, the width m of the turned-up portion 13 is made narrow at not more than  $\frac{3}{4}$  of the width n of the bent portion 22 so that a portion of the bent portion 22 that is not overlapped with the turned-up portion 13 can be turned up downward. Therefore, the bottom face portion 21U having a U-letter-shaped is easily formed. The bottom face portion 21U having a U-letter-shape is preferably set to have a tray shape constituted by a lower face portion 21Ua and a wall-face portion 21Ub. The lower face portion 21Ua is preferably allowed to have a flat shape, and the wall-face portion 21Ub is preferably placed close to the paper-combined portion Z.

FIG. 9 is a partial cross-sectional view showing the third paper cup c prior to modification of a bottom member. In this paper cup c, in the joining process of the trunk member 1 and the bottom member 2, the respective surfaces of the turned-up portion 13 and the trunk portion 11 of the trunk member 1 and the bent portion 22 of the bottom member 2 are not thermally bonded at the virtually entire surfaces, but, as shown in FIG. 9(b) which is a partial expanded sectional view, with the bent portion 22 of the bottom member 2 being sandwiched between the turned-up portion 13 and the trunk portion 11 of the trunk member 1, the lower portion of the turned-up portion 13 and the trunk portion 11 of the trunk member 1 are heated and press-joined

to each other along joining sections S, S with widths o, o on both of the surfaces of the lower portion of the bent portion 22 of the bottom member 2 so that the trunk member 1 and the bottom member 2 are joined to each other.

The microwave-oven-use paper cup c is characterized in that each of the widths o of the joining sections S among the lower portion of the turned-up portion 13 of the trunk member 1, the trunk portion 1 and both of the surfaces of the lower portion of the bent portion 22 of the bottom member 2 is set to not less than 2 mm, and also to not more than  $3/4$  of the width n of the bent portion 22 of the bottom member 2. Each of these widths o, o of the joining sections S, S is set to not more than  $3/4$  of the width n of the bent portion 22 of the bottom member 2 so that it is possible to easily modify the bottom member 2 into a concave shape. Here, the reason why each of the widths o, o of the joining sections S, S is set to not less than 2 mm is the same as that shown in the second paper cup b.

FIG. 10 is a cross-sectional view that shows a microwave-oven-use paper cup manufactured from the paper cup c. In the microwave oven-use paper cup C, the bottom face portion 21 of the microwave oven-use paper cup c prior to modification is modified into a concave shape extending downward when viewed from the inner surface side to form a U-letter-shaped bottom face portion 21U. At this time, in the bent portion 22 of the bottom member 2, the upper portion is in an unbonded state to the trunk portion 11 and the turned-up portion 13 of the trunk member 1; therefore, when the bottom face portion 21 is modified

into a concave shape, the portion not to be bonded of the bent portion 22 is also modified to form the U-letter-shaped bottom face portion 21U. Therefore, the process for modifying into the concave shape is easily carried out.

In the paper cups B and C respectively manufactured from the above-mentioned paper cup b and paper cup c, the distance x (see FIG. 2) between the lower face portion 21Ua and the lower end face X formed by the lower end of the trunk portion 11 is preferably set in the same manner as the example shown in FIG. 2.

Next, the following description will discuss a method for manufacturing a microwave-oven-use paper cup of the present invention more specifically. In the respective modes shown in FIGS. 6 to 10, in paper cups prior to modification for shaping the bottom member 2 into a concave shape extending downward, the joining sections of the trunk member 1 and the bottom member 2 or the width of the turned-up section 13 of the trunk member 1 is set in a different manner. However, the respective modes are the basically same manufacturing method in the point that they have both of the paper-cup forming process and the bottom-face portion forming process.

First, the trunk portion blank 10 and the bottom portion blank 20, shown in FIG. 3, are used, and these blanks 10 and 20 are formed into the same shape as a generally-used paper cup by a paper-cup forming apparatus. In general, with respect to the trunk blank 10, those that have been beforehand punched out in a pre-process are used, and the bottom blank 20 is punched

out on the paper-cup forming apparatus.

The following description will explain paper-cup forming processes for forming a paper cup by using the trunk member blank 10 and the bottom member blank 20. FIG. 11 is a drawing that shows one example of a paper-cup forming apparatus which forms paper cups a, b and c prior to modification. The forming apparatus 100, which is the same as that used for forming general paper cups, is provided with three portions, such as a trunk-winding formation unit (A), a bottom curl portion (paper-combined portion) forming unit (B) and a top curl portion forming unit (C). The forming processes by the use of the paper-cup forming apparatus 100 will be explained in detail. The trunk portion blank 10, transported from a feeder, is sent to a trunk-winding formation unit (A) in a state where its portion to be affixed in a cylinder shape is pre-heated by hot air 101 so that its surface resin is melted. In the trunk-winding formation unit (A), the blank 10 is wound up onto a winding mold 102 while being sucked thereto, and subjected to a thermal sealing process of winding paper. The winding paper thermally sealed into a cylinder shape is sent to a bottom curl forming unit (B). In the bottom curl forming unit (B), first, at the position of the mold 110, the bottom member blank 20, punched out, is sucked and fixed. Next, at the position of a mold 111, the trunk winding paper is inserted. Successively, at the respective positions of mold 112, mold 113 and mold 114, joining portions of the trunk member 1 and the bottom blank 20 are preheated by hot air, and the lower end of the trunk member is press-bonded while being bent inward

at the position of mold 115. Thus, the trunk member 1 and the bottom member 2 are integrally formed into one member. This intermediate product, molded into a cup shape, is passed to a top curl forming unit (C). In the top curl forming unit (C), the intermediate product is fitted into a metal mold in mold 120. Then, lubricating oil is applied thereto, and the upper end of the trunk member 1 is curled outward at the positions of molds 121, 122 and 123 to form a top curl portion 12. Lastly, the resulting molded product is discharged from mold 124 to form a paper cup.

Next, the bottom portion 21 having a raised bottom and a flat face is modified into a concave shape, and then molded into a U-letter shape. In this bottom portion forming process, as shown in FIG. 12(a), after a paper cup has been fitted to a mandrel 201 having a convex portion 201a on the upper face thereof, the bottom portion 21 is molded into a U-letter shape by a head 202 having a concave portion 202a on the lower face thereof. With respect to a method for making the molding process easier, a method for preheating the bottom member 2, a method for heating the head 202 and a method for ultrasonic-vibrating the head 202 may be listed. Moreover, in another case, as shown in FIG. 12(b), the bottom portion 21 is molded by a rotary roller 203 to press thereon with the rotating mandrel 202.

Here, as shown in FIG. 13, in the case when the bottom member 2 provided with the bottom face portion 21U beforehand modified into a concave shape extending downward and a bent portion 22 formed by bending the outer circumferential edge downward

at virtually right angles, and the trunk member 1 are manufactured in respectively different processes, and the two members are joined to each other at a post-process, the bottom member 2 may be manufactured in the following manner. That is, a bottom-member forming process is placed prior to joining the trunk member 1 and the bottom member 2, and in the bottom member forming process, a bottom member 2 is formed through a press working in which a metal mold 210 constituted by an upper mold 211 and a lower mold 212 as shown in FIG. 14 are used. The bottom blank 20 having a flat-face shape is molded into a bottom member 2 through this process. This process may be directly connected to the supplying unit of the bottom member blank of the bottom curl forming unit (B) of the aforementioned paper-cup forming apparatus, so as to carry out its operation. Alternatively, the bottom member 2, before formed outside the paper-cup forming apparatus, may be supplied from the supplying unit of the bottom member blank of the bottom curl forming unit (B) in the aforementioned paper-cup forming apparatus.

When the bottom member 2 is formed in a different process, the paper cup A may be manufactured in modes shown in FIGS. 15 through 18. In the manufacturing method in these modes, first, a pre-reverse bottom member 2' as shown in FIG. 15(a) is produced. This pre-reverse bottom member 2' is constituted by a pre-reverse bottom face portion 21U' modified into a convex shape upward and a joining portion 22 that extends downward virtually vertically along the outer circumferential edge. The pre-reverse bottom face portion 21U' has a semi-circular-arc

shape with the upper side forming a flat face. Moreover, as shown in FIG. 15(b), the maximum height  $h$  of the pre-reverse bottom face portion 21U' is set to a value that satisfies " $2 \times z + 2 > h > 2 \times z - 8$ ", supposing that the inside width of the paper-combined portion Z is represented by  $z$ .

The forming process of the pre-reverse bottom member 2' is prepared prior to joining the trunk member 1 and the pre-reverse bottom member 2'. In the forming process, the pre-reverse bottom member 2' is formed through a press working in which a metal mold 220 consisting of an upper mold 221 and a lower mold 222 shown in FIG. 16 is used. The pre-reverse member 2' is formed from the flat-face shaped bottom member blank 20 through this press working. This process may be directly connected to the supplying unit of the bottom member blank 20 of the bottom curl forming unit (B) in the aforementioned paper-cup forming apparatus so as to be carried out. Alternatively, the pre-reverse bottom member 2', which has been preliminarily molded outside the paper-cup forming apparatus, may be supplied from the supplying unit of the bottom member blank 20 of the bottom curl forming unit (B) in the aforementioned paper-cup forming apparatus.

Next, from below the trunk member 1, or from above the trunk member 1 as shown in FIG. 17, the pre-reverse bottom member 2' formed beforehand is fitted to the trunk member 1. Then, the joining portion 22 of the pre-reverse bottom member 2' is sandwiched by the turned-up portion 13 of the trunk member 1 and the lower end of the trunk portion 11, and heated and

press-joined so that the trunk member 1 and the pre-reverse bottom member 2' are joined to each other. Thus, a pre-reverse microwave oven-use paper cup A' is manufactured.

Successively, as shown in FIG. 18, the pre-reverse bottom face portion 21U' having a convex shape extending upward is reversed downward to form a bottom face portion 21U having a concave shape extending downward. Thus, a microwave-oven-use paper cup A is manufactured.

A material, which is used for the trunk member 1 and the bottom member 2 of the microwave-oven-use paper cup A of the present invention, basically contains paper as a main strength member with a thermoplastic resin being applied to the outermost layer.

With respect to paper forming the main strength member, it is preferable to use cup material paper having a superior paper-cup molding property. With respect to the basis weight of the material paper, although not particularly limited, it is preferably set in the range of 150 to 300 g/m<sup>2</sup> considering the formability to paper cups.

With respect to the thermoplastic resin for use as the innermost layer, it needs to have functions such as a sealing function for protecting the contents, in particular, an anti-leakage function for liquid-state substances, and a bonding function for allowing the trunk portion to be affixed through a thermal sealing process and for bonding the trunk member 1 and the bottom member 2. More specifically, examples thereof include polyethylene, polypropylene, polyester, nylon, ethylene

vinyl alcohol, ethylene-vinyl-acetate copolymer, etc. With respect to the thickness, it is preferably set to 15 to 60  $\mu$  m. These thermoplastic resins are applied to the innermost layer through an extruding process or a laminating process.

For example, with respect to a specific construction of materials, examples thereof include the following layers placed from the surface side: paper layer/polyethylene resin layer, polyethylene resin layer/paper layer/polyethylene resin layer, foamed polyethylene resin layer/paper layer/polyethylene resin layer, paper layer/polypropylene resin layer, polypropylene resin layer/paper layer/polypropylene resin layer, paper layer/polyester resin layer, polyester resin layer/paper layer/polyester resin layer, paper layer/nylon layer, nylon resin layer/paper layer/nylon layer, paper layer/ethylene vinyl alcohol layer, ethylene vinyl alcohol layer/paper layer/ethylene vinyl alcohol layer, etc.

In particular, with respect to the material for bottom member 2, it is necessary to select the construction which is modified easily when modified into a convex or concave shape, and is less susceptible to cracking and pinholes at the moment of the modification. From this point of view, constructions containing a polyester resin layer or a nylon resin layer are preferably used as the material for the bottom member 2.

The microwave-oven-use paper cup in accordance with the present embodiment provides an effective instant-food-use container that is used for heating instant noodles, side dishes, etc. or a drink-use container that is used for heating coffee,

tea, soup, etc.

[Second Embodiment]

Next, the following description will discuss a microwave-oven-use paper cup in accordance with a second embodiment of the present invention. In this paper cup, the trunk member and the bottom member are foamed so as to provide a heat-insulating property. The construction of a paper cup prior to foaming the element is the same as that of the paper cup A in the above-mentioned first embodiment. However, the material constructions of the trunk member and the bottom member are different.

In other words, the material construction prior to the foaming state of the trunk member 1 or the bottom member 2 in the present embodiment basically includes a surface thermoplastic resin layer 5, a paper layer 3 serving as a base layer, and a rear-face thermoplastic resin layer 6, which are placed from the surface side in this order, as shown in FIG. 19(a). After having been foamed, as shown in FIG. 19(b), it includes a foamed layer 5a, the paper layer 3 serving as a base layer and the rear-face thermoplastic resin layer 6, which are placed in this order from the surface side. A print layer 4 may be placed on the surface side of the paper layer 3. The print layer 4 is coated with a surface thermoplastic resin layer 5. The print layer 4 may be also placed on the surface of the surface thermoplastic resin layer 5. An aluminum foil layer or the like may be placed between the paper layer 3 and the rear-face thermoplastic resin layer 6 so as to improve a barrier property,

etc.

The base weight of the paper layer 3 serving as a base layer is preferably set in the range of 100 to 400 g/m<sup>2</sup> for the manufacturing processes of paper cups. The moisture content of the paper layer 3 is preferably stabilized in the range of 3 to 10 %, more preferably, 5 to 8 %. The moisture of the paper is evaporated and the force of the paper pressure is utilized to foam the surface thermoplastic resin layer 5 so that the foamed layer 5a is prepared.

The print layer 4 may be placed on the surface of the paper layer 3 or on the surface of the surface thermoplastic resin layer 5. The print layer 4 may be printed with colored ink partially or entirely. The position of the print, the size of the print area, the method of printing, the ink to be used or the like may be determined by selecting conventionally known techniques.

With respect to thermoplastic resin to be used for the surface thermoplastic resin layer 5 and the rear-face thermoplastic resin layer 6, examples thereof include polyethylene resin, polypropylene resin, polyester resin, polyvinyl chloride resin, polystyrene resin, etc. With respect to a method for stacking the thermoplastic resin on both of the surface and rear-surface of the paper layer 3, an extrude coating method for heating and melting the resin to be applied or a laminating method for affixing resin films each other may be used. The thickness of the pre-foaming surface thermoplastic resin layer 5 is preferably set in the range of 15 to 50  $\mu$ m.

The layer thicker than this range or the layer thinner than this range would cause difficulty in foaming. Here, the thickness of the rear-face thermoplastic resin layer 6 is not particularly limited. However, in order to foam only the surface thermoplastic resin layer 5 without foaming the rear-face thermoplastic resin layer 6, it is necessary to prevent evaporation of vapor from the rear surface. With respect to such a method, a method for placing an aluminum foil layer, etc. between the paper layer 3 and the rear-face thermoplastic resin layer 6, or a thermoplastic resin having a softening point higher than the thermoplastic resin of the surface thermoplastic resin layer 5 as the thermoplastic resin of the rear-surface thermoplastic resin 6, may be used. With respect to such a thermoplastic resin, examples thereof include high-density polyethylene resin, polypropylene, polyester, nylon, ethylene vinyl alcohol, ethylene-vinyl acetate copolymer, etc. The thickness of the thermoplastic resin layer is preferably set in the range of 15 to 60  $\mu\text{m}$ . Such a thermoplastic resin is subjected to an extruding process or a laminating process to form a rear-surface thermoplastic resin layer 6. The thermoplastic resin to be used for the rear-surface thermoplastic resin 6 needs to have functions such as a protecting functions for the contents, especially an anti-leakage function for liquid-state substances contained therein, an affixing function for the trunk member 1 through a thermal-sealing process and an adhesive function between the trunk member 1 and the bottom member 2.

In particular, with respect to the material for bottom

member 2, it is necessary to select a construction which is easily modified when the bottom face portion 21 is modified into a convex or concave shape, and is less susceptible to cracking and pinholes at the moment of the modification, and for this reason, constructions containing a polyester resin layer or a nylon resin layer are preferably used.

FIG. 20 shows a heat-insulating microwave-oven-use paper cup D on which a foamed layer 5a formed by foaming the surface thermoplastic resin layer 5 of the heat-insulating microwave-oven-use paper cup A prepared by using the material of the above-mentioned construction is placed. In the heat-insulating microwave-oven-use paper cup D, both of the portions of the trunk member 1 and the bottom member 2 are formed as the foamed layers 5a; however, the foamed layer 5a may be placed on only the trunk member 1 or only the bottom member 2.

The following description will discuss a method for manufacturing the heat-insulating microwave-oven-use paper cup D in accordance with the present embodiment.

First, a heat-insulating microwave oven-use paper cup prior to foaming of the surface thermoplastic resin layer 5 is produced. This heat-insulating microwave oven-use paper cup A is formed by a trunk portion blank 10 and a bottom portion blank 20, as shown in FIG. 3. Here, these blanks 10, 20 are obtained through a punching process in which a laminated member, formed by laminating the surface thermoplastic resin layer 5 on the surface side of a paper layer 3 and also laminating the rear-surface thermoplastic resin layer 6 on the rear-surface

side thereof, is punched out. With respect to the paper cup manufacturing methods from the blanks 10, 20, there are two methods that have been explained by reference to FIGS. 4 and 5.

The heat-insulating microwave-oven-use paper cup A prior to foaming, formed through the method shown in FIG. 4 or 5, is heated so that moisture in the paper is evaporated and a foam structure is generated in the surface thermoplastic resin layer 5 by the vapor pressure together with the air thermal expansion to form a foamed layer 5a. Thus, it becomes possible to manufacture a heat-insulating microwave-oven-use paper cup D having a foamed layer 5a on the surface thereof can be manufactured.

With respect to the heating method of the paper cup A prior to foaming, hot air, infrared rays, far infrared radiation, microwaves, high-frequency, etc., may be used. A method of heating a cup in a still state and a method of heating a cup while it is being transferred on a conveyor belt may be used. The heating temperature is preferably set in the range of 100 to 200° C and the heating time is preferably set in the range of 10 seconds to 5 minutes.

Here, the manufacturing method of the heat-insulating microwave-oven-use paper cup D in the present embodiment is not limited to the method which is above mentioned, in which a heat-insulating microwave-oven-use paper cup A prior to foaming with the bottom portion 21 of the paper cup being formed in a concave shape to provide the bottom face portion 21U, and in the next process, this is foamed to manufacture the

heat-insulating microwave-oven-use paper cup D. As shown in FIG. 21, another method may be proposed in which a paper cup having a general shape is foamed beforehand, and the bottom portion 21 of this is then modified into a concave shape in the next process to provide the bottom face portion 21U having a U-letter shape so that a heat-insulating microwave-oven-use paper cup A is manufactured.

Alternatively, as shown in FIG. 22, a foamed trunk member 1a molded into a cylinder shape and a foamed bottom member 2b having a U-letter-shaped bottom face portion 21U are preliminarily formed in respectively different processes. Then, in the next process, the bent portion 22 of the bottom member 2b is sandwiched between the turned-up portion 13 of the trunk member 1a and the lower end portion of the trunk portion 11, and joined to each other so that a heat-insulating microwave oven-use paper cup D may be formed.

With respect to the applications of the heat-insulating microwave oven-use paper cup of the present embodiment, drink-use containers used for heating coffee, tea, soup, etc. or instant-food-use containers used for heating instant noodles, side dishes, etc. may be listed.

[Third Embodiment]

Next, the following description will discuss a microwave oven-use paper cup in accordance with a third embodiment of the present invention. As shown in FIG. 23(a), the microwave oven-use paper cup E of the present embodiment is provided with a trunk member 1, a bottom member 2 and a heat-insulating member 7. The

constructions of the trunk member 1 and the bottom member 2 are the same as those of the paper cup A of the first embodiment 1. The heat-insulating member 7, made of a material having a heat-insulating property, is affixed to the outer surface of the bottom face portion 21U of the bottom member 2.

In the present embodiment also, as shown in FIG. 23(b), the bottom face portion 21U is formed into a concave shape extending downward when viewed from the inner surface side, that is, a U-letter shape. As shown in FIG. 23(c), the bottom face portion 21U is preferably formed into a tray shape constituted by a lower face portion 21Ua and a wall face portion 21Ub, and the lower face portion 21Ua is preferably designed to have a plane shape, and the wall face portion 21Ub is preferably designed to be placed close to the turned-up portion 13 of the trunk member 1. The lower face portion Ua is formed into a plane face so that the heat-insulating member 7 is easily affixed thereto. The maximum depth d of the bottom face portion 21U is set in the same manner as the first embodiment.

The distance x (see FIG. 24) between a lower end face X formed by the lower end of the trunk portion 11 and the surface (lower surface) of the heat-insulating member 7 is preferably set to the same range as the distance x shown in FIG. 2 of the first embodiment.

The heat-insulating member 7 is affixed to the outer face of the lower face portion 21Ua of the bottom face portion 21U of the bottom member 2. The heat-insulating member 7 is not necessarily affixed to all over the surface of the lower face

portion 21Ua. The heat-insulating member 7 may be partially affixed to the lower face portion 21U. The shape of the heat-insulating member 7 is not particularly limited, and may be set to a round shape, a polygonal shape, a star shape, etc. The heat-insulating member 7 is affixed to the lower face portion 21Ua so that, even when, with hot contents contained in the microwave oven-use paper cup E, the paper cup E is put on the surface of a table or the like, the thermal conduction is interrupted even if the heat-insulating member 7 contacts with the surface of it, thereby it becomes possible to prevent the contents from cooling down. Moreover, it is possible to touch the heat-insulating member 7 by the hand to hold the microwave oven-use paper cup E without feeling the heat of the contents.

The materials for use in the trunk member 1 and the bottom member 2 of the microwave oven-use paper cup E are the same as those used in the paper cup A of the first embodiment.

With respect to the material for the heat-insulating member 7, not particularly limited, any sheet-shaped material having a heat-insulating property may be available, for example, corrugated cardboard, foamed sheet, foamed processed paper, air cap sheet and embossed sheet, and the like. In particular, corrugated cardboard and embossed sheet are preferably used in terms of heat-insulating effect, processing suitability, environmental conservation and so on.

Corrugated cardboard is available in various kinds such as A type, B type, E type, F type or the like; however, the material of the heat-insulating member 7 is not limited to the particular

kind of them. Any kind of corrugated cardboard that has suitable size for the microwave-oven-use paper cup E may be used. Moreover, so-called one-surface corrugated cardboard without a liner on its one surface may be used for the heat-insulating member 7. Corrugated cardboard, the corrugated inner core of which is exposed to the outer face, may be used as the heat-insulating member 7. Moreover, corrugated cardboard processed into a waveform structure may be used as the heat-insulating member 7.

Different from normal corrugated cardboard, an embossed sheet of paper is provided with core paper that is subjected to an embossing process with a depth of 1 to 2 mm, having a pattern such as a dot pattern and a lattice pattern, and liner paper affixed thereto. The liner paper is affixed to one surface or both of the surfaces. The embossed sheet has a heat-insulating effect, and is used as the heat-insulating member 7. The core paper is used in the range of 100 to 180 g/m<sup>2</sup>, and the liner paper is used in the range of 200 to 270 g/m<sup>2</sup>.

The following description will explain a method of manufacturing a microwave-oven-use paper cup E.

With respect to a microwave-oven-use paper cup before the heat-insulating member 7 has been affixed thereto, it is manufactured in the same manner as the paper cup A in the first embodiment. The microwave-oven-use paper cup A and the heat-insulating member 7 are respectively produced separately, and as shown in FIG. 25, the heat-insulating member 7 is affixed onto the outer surface of the bottom face portion 21U of the

microwave-oven-use paper cup A by using a bonding agent.

With respect to the bonding agent, examples thereof to be used include those of solvent type, emulsion type, hot-melt type, etc., which has, as its main component, a vehicle such as cellulose type, polyvinyl acetate type, poly-acrylic type, polyolefin type, polyester type, polyamide type, polyurethane type, epoxy type, amino resin type, rubber type, diene type, etc. Moreover, the bonding agents to be used are not limited to the particular ones, but it is preferable to use the bonding agents having a heat-insulating property, which is less susceptible to separation due to heat when hot contents such as boiling water are put therein.

The microwave-oven-use paper cup E in accordance with the present embodiment provides an effective instant-food-use container that is used for heating instant noodles, side dishes, etc. or a drink-use container that is used for heating coffee, tea, soup, etc.

[Fourth Embodiment]

Next, the following description will discuss a microwave-oven-use paper cup in accordance with a fourth embodiment of the present invention. As shown in FIG. 26(a), the microwave-oven-use paper cup F of the present embodiment is provided with a paper cup main body Fa, and a heat-insulating cover Fb attached to the outer circumference of the paper cup main body Fa. The paper cup main body Fa has virtually the same structure as the paper cup A of the first embodiment, and is provided with a trunk member 1 and a bottom member 2.

As shown in FIG. 26(b), the bottom face portion 21U of the paper cup main body Fa is formed into a U-letter shape, that is, a concave shape extending downward from the inner surface side. As shown in FIG. 26(c), the bottom face portion 21U is preferably formed into a tray shape constituted by a lower face portion 21Ua and a wall face portion 21Ub, and the lower face portion 21Ua is preferably designed to have a plane shape, and the wall face portion 21Ub is preferably designed to be placed close to the turned-up portion 13 of the trunk member 1. In the same manner as the above-mentioned respective embodiments, the maximum depth d of the bottom face portion 21U is preferably set to not less than 70% of the width Y of the turned-up portion 13 from the upper end of the turned-up portion 13 of the trunk member 1 (more strictly, the width of the turned-up portion 13 added by the thickness of the bottom portion 2). Moreover, with respect to the distance x between a lower end face X formed by the lower end of the trunk portion 11 and the lower face portion 21Ua, shown in FIG. 27, is set in the same manner as the distance x of the paper cup A of the first embodiment shown in FIG. 2.

The material used for the trunk member 1 and the bottom member 2 of the microwave-oven-use paper cup F is the same as the paper cup A in the first embodiment.

The heat-insulating cover Fb is mainly constituted by a cover trunk portion 31, and attached to the outer circumference of the trunk portion 11 of the paper cup main body Fa. Here, the heat-insulating cover Fb is not necessarily attached to the entire surface of the outer circumference of the trunk portion

11. A heat-insulating cover Fb which is shorter than the longitudinal length of the trunk portion 11 of the paper cup main body Fa may be attached to the upper portion of the outer circumference of the trunk portion 11.

The heat-insulating cover Fb is formed to a shape so as to be tightly attached to the outer face of the trunk portion 11 of the paper cup main body Fa. Here, as shown in FIG. 28(a) or 28(b), the upper end of the cover trunk portion 31 of the heat-insulating cover Fb may be curled inward to form a cover upper curl portion 32a, or the upper end of the cover trunk portion 31 may be bent inward to form a cover upper bent portion 32b. As shown in FIG. 28(c) or 28(d), the lower end of the cover trunk portion 31 of the heat-insulating cover Fb may be curled inward to form a cover lower curl portion 33a, or the lower end may be bent inward to form a cover lower bent portion 33b. Moreover, the cover upper curl portion 32a or the cover upper bent portion 32b may be formed at the upper end of the cover trunk portion 31 of the heat-insulating cover Fb, and besides, the cover lower curl portion 33a or the cover lower bent portion 33b may be formed at the lower end thereof. In this shape, a void portion 35, which has a gap corresponding to the diameter of the cover upper curl portion 32a or the cover lower curl portion 33a, or to the thickness of the cover upper bent portion 32b or the cover lower bent portion 33b, is formed between the trunk portion 11 of the paper cup main body Fa and the cover trunk portion 31 of the heat-insulating cover Fb; therefore, it is possible to ensure a heat-insulating property along the entire length in the

longitudinal direction of the heat-insulating microwave-oven-use paper cup F.

With respect to the material used for the heat-insulating cover Fb, a material that has a heat-insulating property and can be wrapped around the paper cup main body Fa is used, and examples thereof include plate cardboard, one-side corrugated cardboard, corrugated cardboard, embossed sheet, foam processed paper, etc.

With respect to plate cardboard mainly used, the plate cardboards having a smooth surface, such as coat cardboard, Manila cardboard or ivory cardboard, and the thickness thereof is preferably set in the range of 200 to 400 g/m<sup>2</sup>.

With respect to the corrugated cardboard that is available in various types such as A type, B type, E type and F type, and in terms of a wrapping property onto the paper cup main body Fa, F type or E type, which is flexible, may be preferably used. Moreover, so-called one-surface corrugated cardboard without a liner on its one surface may be used, and corrugated inner cores may be exposed to the outer face, and used. Moreover, corrugated cardboard processed into a waveform structure may be used.

Different from normal corrugated cardboard, an embossed sheet of paper is provided with core paper that is subjected to an embossing process with a depth of 1 to 2 mm, having a pattern such as a dot pattern and a lattice pattern, and liner paper affixed thereto. The liner paper is affixed to one surface or both of the surfaces. The core paper is used in the range of

100 to 180 g/m<sup>2</sup>, and the liner paper is used in the range of 200 to 270 g/m<sup>2</sup>. This also has a heat-insulating effect in the same manner as corrugated cardboard, and by printing picture patterns, etc. on the liner paper affixed on the surface, it becomes possible to enhance the designing property.

The following description will explain a method of manufacturing a heat-insulating microwave oven-use paper cup F of the present embodiment.

First, a paper cup main body Fa is produced, and this paper cup main body Fa is formed by a trunk member blank 10 and a bottom member blank 20, as shown in FIG. 3. With respect to the manufacturing method of the paper cup main body Fa from the blanks 10 and 20, either of the manufacturing methods related to the paper cup A explained in the first embodiment by reference to FIG. 4 or FIG. 5 may be used.

A heat-insulating cover Fb is attached to the outer circumference of the paper cup main body Fa thus manufactured. With respect to the attachment method, in one method, as shown in FIG. 29, after a cylinder shaped heat-insulating cover Fb corresponding to the paper cup main body Fa has been formed, the trunk portion 11 of the paper cup main body Fa is inserted into the cylinder shaped heat-insulating cover Fb, and this is then attached. In the other attachment method, as shown in FIG. 30, the two end edges of the heat-insulating cover blank 30 are affixed to each other while the heat-insulating cover blank 30 of the heat-insulating cover Fb is being wrapped up on the paper cup main body Fa. The trunk portion 11 of the paper cup main

body Fa and the heat-insulating cover Fb may be partially bonded (affixed to) to each other. This bonding process may be carried out at one portion of the upper end of the heat-insulating cover Fb or at one portion of the lower end thereof, or may be carried out at a plurality of portions of the upper end and the lower end, etc. The bonding process between the paper cup main body Fa and the heat-insulating cover Fb may be carried out by using a hot-melt bonding agent or an emulsion-type bonding agent.

The heat-insulating microwave-oven-use paper cup F in accordance with the present invention provides an effective instant-food-use container that is used for heating instant noodles, side dishes, etc. or a drink-use container that is used for heating coffee, tea, soup, etc.

Here, FIGS. 31 to 35 show examples of the microwave oven-use paper cup F of the fourth embodiment. These figures will be described later.

[Fifth Embodiment]

Next, the following description will discuss a microwave-oven-use paper cup in accordance with a fifth embodiment of the present invention. As shown in FIG. 36(a), the microwave-oven-use paper cup G of the present embodiment is provided with a paper cup main body Ga, a heat-insulating cover Gb attached to the outer circumference of the paper cup main body Ga and a heat-insulating member Gc affixed onto the bottom portion of the paper cup main body Ga. The paper cup main body Ga has virtually the same structure as the paper cup A of the first embodiment, and is provided with the trunk member

1 and the bottom member 2. The heat-insulating member Gc is virtually the same as the heat-insulating member 7 of the paper cup E of the third embodiment shown in FIG. 23, and made of a material having a heat-insulating property. The heat-insulating member Gc is affixed over the outer face of the bottom face portion 21U of the bottom member 2.

In the present embodiment also, as shown in FIG. 36(b), the bottom face portion 21U is formed into a concave shape extending downward when viewed from the inner surface side, that is, a U-letter shape. As shown in FIG. 36(c), the bottom face portion 21U is preferably formed into a tray shape constituted by a lower face portion 21Ua and a wall face portion 21Ub, and the lower face portion 21Ua is preferably designed to have a plane shape, and the wall face portion 21Ub is preferably designed to be placed close to the turned-up portion 13 of the trunk member 1. The maximum depth d of the bottom face portion 21U is set in the same manner as the fourth embodiment.

The distance x (see FIG. 37) between a lower end face X formed by the lower end of the trunk portion 11 and the surface of the heat-insulating member Gc is preferably set to the same range as the distance x shown in FIG. 2 of the first embodiment.

The material used for the trunk member 1 and the bottom member 2 of the microwave oven-use paper cup G is the same as that of the paper cup A in the first embodiment. Moreover, the shape of the heat-insulating cover Gb is set to have the same structure as the heat-insulating cover Fb in the paper cup F in the fourth embodiment. In the same manner as heat-insulating

cover Fb, the shape of the heat-insulating cover Gb is set to have any shapes shown in FIGS. 28(a) to 28(d). The material used for the heat-insulating cover Gb may be the same as that of the heat-insulating cover Fb of the fourth embodiment.

Moreover, the shape and the size of the heat-insulating member Gc may be set to the same as those of the heat-insulating member 7 of the paper cup E of the third embodiment shown in FIG. 23. The heat-insulating member Gc has the same functions and effects as the third embodiment so that it becomes possible to prevent the contents from cooling down, and also to touch the heat-insulating member Gc by the hand to hold the microwave oven-use paper cup G. With respect to the material used for the heat-insulating member Gc, any sheet material having a heat-insulating property may be used, i.e. plate cardboard, corrugated cardboard, embossed sheet of paper, foam processed paper and the like may be used in the same manner as the material of the heat-insulating cover Gb. In addition to these, foamed sheet, air cap sheet, plate, ceramic plate, glass plate, etc., may be used. In particular, corrugated cardboard and embossed sheet are preferably used in terms of heat-insulating effect, processing suitability, environmental conservation, etc.

The following description will discuss a manufacturing method of the heat-insulating microwave-oven-use paper cup G of the present embodiment. First, the paper cup main body Ga is manufactured in the same manner as the paper cup A of the first embodiment. Moreover, the heat-insulating cover Gb is formed in the same manner as the heat-insulating cover Fb of

the paper cup F of the fourth embodiment, and then joined to the paper cup main body Ga.

Moreover, as shown in FIG. 38, the heat-insulating member Gc, which has been manufactured through a different process, is affixed by using a bonding agent to the outer surface of the bottom face portion 21U of the paper cup main body Ga to which the heat-insulating cover Gb has been attached.

With respect to the bonding agent, examples thereof to be used include those of solvent type, emulsion type, hot-melt type, etc., which has, as its main component, a vehicle such as cellulose type, polyvinyl acetate type, poly-acrylic type, polyolefin type, polyester type, polyamide type, polyurethane type, epoxy type, amino resin type, rubber type, diene type, etc. The bonding agent to be used is not particularly limited, but it is preferable to use bonding agents having a heat-insulating property, which is less susceptible to separation due to heat when hot contents such as boiling water are put therein.

Here, the affixing process of this heat-insulating member Gc onto the bottom face portion 21U may be carried out onto the outer surface of the bottom face portion 21U of the paper cup main body Ga prior to attaching the heat-insulating cover Gb to the paper cup main body Ga.

The heat-insulating microwave-oven-use paper cup G in accordance with the present embodiment provides an effective instant-food-use container that is used for heating instant noodles, side dishes, etc. or a drink-use container that is used for heating coffee, tea, soup, etc.

Here, FIGS. 39 to 43 show examples of the microwave-oven-use paper cup G in accordance with the fifth embodiment. These figures will be discussed later.

[Sixth Embodiment]

Next, the following description will discuss a microwave-oven-use paper cup in accordance with a sixth embodiment of the present invention. As shown in FIG. 44(a), the microwave-oven-use paper cup H is provided with a trunk member 1 and a bottom member 2. The structures of the trunk member 1 and the bottom member 2 are the same as those of the first embodiment; however, the paper cup H of the present embodiment is characterized in that the paper-combined portion 2 is bent inward. The shape of the bottom face portion 21U shown in FIG. 44(b), the curvature radius of the curvature portion R shown in FIG. 44(c) and the maximum depth d of the bottom face portion 21U are respectively set to the same as those corresponding members of the paper cup A of the first embodiment. The distance x between the lower end face X formed by the lower end of the trunk portion 11 and the lower face portion 21Ua, shown in FIG. 45, is also set to the same that of the paper cup A of the first embodiment.

Moreover, in the microwave-oven-use paper cup H of the present embodiment, the paper-combined portion 2 is bent inward so as to be placed close to the side face portion 21Ub of the bottom face portion 21U. It is preferable to set the maximum distance v between the inner face of the paper-combined portion 2 and the outer face of the side face portion 21Ub of the bottom face portion 21U to not more than 3 mm. The distance exceeding

3 mm makes the paper-combined portion Z more susceptible to burning.

The following description will explain a method of manufacturing a microwave-oven-use paper cup H in accordance with the present embodiment.

The microwave-oven-use paper cup H is formed by a trunk member blank 10 and a bottom member blank 20 as shown in FIG. 3. First, by using either one of the two methods of the first embodiment explained by reference to FIGS. 4 and 5, a microwave-oven-use paper cup A with the bottom face portion 21U of the bottom member 2 modified into a concave shape downward as shown in FIG. 46(a) is prepared. Next, the paper-combined portion Z of the paper cup A thus formed is bent inward as shown in FIG. 46(b) to form the microwave-oven-use paper cup H of the present embodiment.

With respect to the method for bending the paper-combined portion Z inward, for example, a method as shown in FIG. 47 may be used. In this method, the paper cup A is allowed to rotate around its axis line, while a pressing mold 40 having a cone-shaped outer circumferential face is being pressed onto the paper-combined portion Z from outside to bend the paper-combined portion Z inward.

The material used for the trunk member 1 and the bottom member 2 of the microwave-oven-use paper cup H of the present embodiment is the same as that used for the paper cup A of the first embodiment.

When the microwave-oven-use paper cup H having the

above-mentioned structure is used in a microwave-oven, it becomes difficult to directly hold the cup by the hand because of heated contents therein, and it is necessary to provide a microwave-oven-use paper cup having a better heat-insulating property. Therefore, in order to provide a better heat-insulating property, it is possible to provide a microwave-oven-use paper cup HA which has the shape as a heat-insulating cover Hb is wrapped up on the outer circumference of the trunk portion of the above-mentioned microwave-oven-use paper cup H as shown in FIG. 48.

With respect to the shape of the heat-insulating cover Hb, in addition to a shape in which it is tightly attached to the outer face of the trunk portion 11 of the microwave-oven-use paper cup H as described above, as shown in FIG. 49(a) or 49(b), the upper end of the cover trunk portion 31 of the heat-insulating cover Hb may be curled inward to form a cover upper curl portion 32a, or the upper end may be bent inward to form a cover upper bent portion 32b. Moreover, as shown in FIG. 49(c) or 49(d), the lower end of the cover trunk portion 31 of the heat-insulating cover Hb may be curled inward to form a cover lower curl portion 33a, or the lower end may be bent inward to form a cover lower bent portion 33b. Moreover, the cover upper curl portion 32a or the cover upper bent portion 32b may be formed at the upper end of the cover trunk portion 31 of the heat-insulating cover Hb, and besides that, the cover lower curl portion 33a or the cover lower bent portion 33b may be formed at the lower end thereof. In this shape, a void portion 35, which has a gap corresponding

to the diameter of the cover upper curl portion 32a or the cover lower curl portion 33a, or to the thickness of the cover upper bent portion 32b or the cover lower bent portion 33b, is formed between the trunk portion 11 of the microwave-oven-use paper cup H and the cover trunk portion 31 of the heat-insulating cover Hb; therefore, it is possible to ensure a heat-insulating property along the entire length in the longitudinal direction of the heat-insulating microwave-oven-use paper cup HA.

With respect to the material used for the heat-insulating cover Hb, a material that has a heat-insulating property is used in the same manner as the material for the heat-insulating cover Fb or Gb of the aforementioned fourth or fifth embodiment; and, examples thereof to be used include plate cardboard, one-side corrugated cardboard, corrugated cardboard, embossed sheet, foam processed paper, etc.

Here, the basic structure of the foam processed paper is a foaming thermoplastic resin layer/a paper layer/a thermoplastic resin layer. More specifically, for example, a laminated layer member consisting of a foaming low-density polyethylene resin layer/coat paper/a mixed resin layer of a low-density polyethylene resin and a high-density polyethylene resin may be used. In the case where it is wrapped around the microwave oven-use paper cup H, a foamed resin layer may be placed on the surface, or a non-foamed resin layer may be placed on the surface.

The microwave-oven-use paper cup in accordance with the present invention provides an effective instant-food-use

container that is used for heating instant noodles, side dishes, etc. or a drink-use container that is used for heating coffee, tea, soup, etc.

#### Examples

Based upon examples, the following description will discuss the present invention in detail.

#### [First Example]

##### • (1) of First Example

A material having a structure consisting of 280 g/m<sup>2</sup> of cup base paper/25  $\mu$ m of low-density polyethylene resin placed from the surface was used as a material of the trunk member 1, and a material having a structure consisting of 255 g/m<sup>2</sup> of cup base paper/25  $\mu$ m of low-density polyethylene resin placed from the surface was used as a material of the base member 2. First, a trunk portion blank 10, shown in FIG. 3, is punched out, and this trunk portion blank 10 was wrapped around a mandrel to form the cylinder-shaped trunk member 1. Next, through processes shown in FIG. 11, the bottom blank 20 was fitted to the trunk member 1 from below, the joined portion was being heated by hot air, and the lower end of the trunk member 1 was turned up inward to form a turned-up portion 13. Successively, the upper end of the trunk member 1 was curled outward to form a top curl portion 12. The bottom face portion 21 of a manufactured paper cup a was modified into a concave shape extending downward in the next process to form a bottom face portion 21U having a U-letter shape so that a microwave-oven-use paper cup A corresponding to FIG. 1 was formed. Moreover, a microwave-oven-use paper cup A' as

shown in FIG. 50, which had a U-letter-shaped bottom face portion 21U in which the curvature radius of the curved face portion R between the lower face portion 21Ua and the wall face portion 21Ub was set to 6 mm, with the distance x between the lower end face X formed by the lower end of the trunk portion 11 and lower face portion 21Ua being set to 1 mm, was also formed.

• (2) of the first Example

The same materials as (1) of the first example were used, and a paper cup b, shown in FIG. 7, was formed through the same sequence of processes. In the paper cup b thus formed, the width m of a turned-up portion 13 of the trunk member 1 was set to 5 mm, the width n of a bent portion 22 of the bottom member 2 was set to 10 mm, and the width of the turned-up portion 13 was set to 1/2 of the width of the bent portion 22. Moreover, the bottom member 2 was modified into a concave shape by the method shown in FIG. 12 to form a microwave-oven-use paper cup B (FIG. 8) having a U-letter-shaped bottom face portion 21U. Since the width m of the turned-up portion 13 was set to not more than 3/4 of the width n of the bent portion 22, the bottom member 2 was easily modified into a concave shape.

• (3) of the First Example

The same materials as (1) of the first example were used, and a paper cup c, shown in FIG. 9, was formed through the same sequence of processes. In the paper cup c thus formed, the bent portion 22 of the bottom member 2 was sandwiched by the turned-up portion 13 and the trunk portion 11 of the trunk member 1. The lower portion of the turned-up portion 13 of the trunk member

1 and the trunk portion 11 were heated and joined to each other along a portion with a width of 6 mm from the lower end of the bent portion 22 on both of the surfaces of the lower portion of the bent portion 22 having a width of 10 mm. Moreover, the bottom member 2 was modified into a concave shape by a method shown in FIG. 12 to form a microwave-oven-use paper cup C (FIG. 10) having a U-letter-shaped bottom face portion 21U. With respect to the bent portion 22 of the bottom member 2, since the trunk portion 11 of the trunk member 1 and the turned-up portion 13 were still un-bonded at the rest 4 mm of the upper portion, this un-bonded portion was also modified to form a U-letter-shaped bottom face portion 21U so that it becomes possible to easily modify the bottom member 2 into a concave shape.

• (4) of the First Example

The same materials as (1) of the first example were used, and a paper cup A, shown in FIG. 1, was formed through the following sequence of processes. First, a bottom member blank 20, shown in FIG. 3, was punched out, and a bottom member 2, shown in FIG. 13, was formed through press working in which a metal mold 210 as shown in FIG. 14 was used. In the same manner, a trunk member blank 10 was punched out, and this trunk member blank 10 was wrapped on a mandrel to form a cylinder shaped trunk member 1. Next, through processes as shown in FIG. 12, the bottom member 2 preliminarily formed was fitted to the trunk member 1 from below, and the bonding portion was heated by hot air, after that, the lower end of the trunk member 1 was turned up inward to form

a turned-up portion 13. Next, the upper end of the trunk member 1 was curled outward to form a top curl portion 12; thus, a microwave-oven-use paper cup A was produced.

• (5) of the First Example

The same materials as (1) of the first example were used, and a paper cup A, shown in FIG. 18, was formed through the following sequence of processes. First, a bottom member blank 20, shown in FIG. 3, was punched out, and a pre-reverse bottom member 2', shown in FIG. 15(a), was formed through press working in which a metal mold 220 as shown in FIG. 16 was used. In the same manner, a trunk member blank 10 was punched out, and this trunk member blank 10 was wrapped on a mandrel to form a cylinder shaped trunk member 1. Next, through processes as shown in FIG. 12, the pre-reverse bottom member 2' preliminarily formed was fitted to the trunk member 1 from below, and the bonding portion 22 of the pre-reverse bottom member 2' was sandwiched between the turned-up portion 13 of the trunk member 1 and the lower end of the trunk portion 11, and heated and press-bonded so that the trunk member 1 and the pre-reverse bottom member 2' were joined to each other, and the upper end of the trunk member 1 was curled outward to form a top curl portion 12; thus, a pre-reverse microwave-oven-use paper cup A' (FIG. 18) was formed. Further, as shown in FIG. 18, a pre-reverse bottom face portion 21U' having a convex shape extending upward was reversed downward to prepare a microwave-oven-use paper cup A having a bottom face portion 21U having a concave shape extending downward.

[Second Example]

A material having a structure consisting of  $40\text{ }\mu\text{m}$  of low-density polyethylene resin/ $280\text{ g/m}^2$  of cup base paper/ $25\text{ }\mu\text{m}$  of a mixed resin layer between a low-density polyethylene resin and a high-density polyethylene resin placed from the surface was used as a material of the trunk member 1, and a material having a structure consisting of  $30\text{ }\mu\text{m}$  of low-density polyethylene resin/ $220\text{ g/m}^2$  of cup base paper/ $25\text{ }\mu\text{m}$  of low-density polyethylene resin placed from the surface was used as a material of the bottom member 2. First, a trunk portion blank 10, shown in FIG. 3, is punched out, and this trunk portion blank 10 was wrapped around a mandrel to form a cylinder-shaped trunk member 1. Next, through processes shown in FIG. 12, the bottom blank 20 was fitted to the trunk member 1 from below, and while the joined portion was being heated by hot air, the lower end of the trunk member 1 was turned up inward to form a turned-up portion 13. Successively, the upper end of the trunk member 1 was curled outward to form a top curl portion 12. The bottom face portion 21 of the manufactured paper cup was modified into a concave shape extending downward in the next process to form a bottom face portion 21U having a U-letter shape so that a microwave-oven-use paper cup A. Moreover, this microwave-oven-use paper cup A was heated in a drying device at  $120^{\circ}\text{C}$  for 3 minutes so that the surface thermoplastic resin layer 5 was foamed; thus, as shown in FIG. 20, a heat-insulating microwave-oven-use paper cup D having a foamed layer 5a on its surface was obtained.

[Third Example]

A paper cup A shown in FIG. 1 was prepared by using the

same materials through the same sequence as (1) of the first example. Next, by using E type corrugated cardboard as a material, a round heat-insulating member 7, which has an area slightly smaller than the circumference of the lower end of the microwave oven-use paper cup A, is punched out through a punching process to be formed. This heat-insulating member 7 was bonded to the outer surface of the lower face portion 21Ua of the bottom face portion 21U of the microwave-oven-use paper cup A by using a bonding agent of a poly-acrylic resin of an emulsion type; thus, a microwave-oven-use paper cup E shown in FIG. 23 was produced.

[Fourth Example]

• (1) of the Fourth Example

A paper cup main body Fa shown in FIG. 31 was prepared by using the same materials through the same sequence as (1) of the first example. Next, by using corrugated cardboard (F flute) as a material, a cylinder-shaped heat-insulating cover Fb1 corresponding to the entire outer surface of the trunk portion 11 of the paper cup main body Fa was formed, and the paper cup main body Fa was fitted to this cylinder-shaped heat-insulating cover Fb1, and partially bonded to be secured; thus, a heat-insulating microwave-oven-use paper cup F1 as shown in FIG. 31 was produced.

In this heat-insulating microwave-oven-use paper cup F1 of (1) of the fourth example, since the heat-insulating cover Fb1 using corrugated cardboard as its material was attached to the trunk portion 11 of the paper cup main body Fa, it was allowed to have a heat-insulating property, and since the bottom face

portion 21U of the paper cup main body Fa had a concave shape extending downward, no burning occurred at its paper combined portion when the paper cup having the contents was heated and subjected to cooking in a microwave oven.

• (2) of the Fourth Example

FIG. 32 shows a heat-insulating microwave-oven-use paper cup F2 of (2) of the fourth example. This cup F2 of the present example has basically the same structure as the cup F1 of (1) of the fourth example. However, it is different from the cup F1 in that the length in the longitudinal direction of the heat-insulating cover Fb2 attached to the outer circumference of the trunk portion 11 of the paper cup main body Fa is made shorter than the length in the longitudinal direction of the paper cup main body Fa, and the heat-insulating cover Fb2 is attached to an upper portion of the outer face of the trunk portion 11 of the paper cup main body Fa.

As shown in FIG. 32, in the heat-insulating microwave-oven-use paper cup F2 of (2) of the fourth example, the length in the longitudinal direction of the heat-insulating cover Fb2 is made shorter so that it becomes possible to reduce the material costs.

• (3) of the Fourth Example

FIG. 33 shows a heat-insulating microwave-oven-use paper cup F3 of (3) of the fourth example. This cup F3 of the present example has basically the same structure as the cup F1 of (1) of the fourth example. However, its heat-insulating cover Fb3 uses plate cardboard (coated cardboard  $270 \text{ g/m}^2$ ) as its material,

and is attached along the entire length of the outer surface of the trunk portion 11 of the paper cup main body Fa in the longitudinal direction. Further, the lower end of the heat-insulating cover Fb3 is curled inward to form a cover lower curl portion 33a, and made in contact with the lower end of the trunk portion 11 of the paper cup main body a, and secured thereto, and the inner face of the upper end portion of the heat-insulating cover Fb3 is bonded at a position on the lower side of the top curl portion 12 of the trunk portion 11 of the paper cup main body Fa so that a void portion 35 is formed between the outer face of the trunk portion 11 of the paper cup main body Fa and the inner face of the cover trunk portion 31 of the heat-insulating cover Fb3.

As shown in FIG. 33, in the heat-insulating microwave-oven-use paper cup F3 of (3) of the fourth example, the void portion 35 having a gap corresponding to the diameter of the cover lower curl portion 33a at its lower portion is formed between the trunk portion 11 of the paper cup main body Fa and the cover trunk portion 31 of the heat-insulating cover Fb3; therefore, the heat-insulating microwave-oven-use paper cup F3 is allowed to have a high heat-insulating property at its lower portion.

• (4) of the Fourth Example

FIG. 34 shows a heat-insulating microwave-oven-use paper cup F4 of (4) of the fourth example. This cup F4 of the present example has basically the same structure as the cup F1 of (1) of the fourth example. However, its heat-insulating cover Fb4

uses plate cardboard (coated cardboard 270 g/m<sup>2</sup>) as its material, and is attached along the entire length of the outer surface of the trunk portion 11 of the paper cup main body Fa in the longitudinal direction. Further, in the heat-insulating cover Fb4 which is provided with a cover lower curl portion 33a directed inward at its lower end portion and a cover upper bent portion 32b placed inward at its upper end portion, the outer face of the trunk portion 11 of the paper cup main body Fa and the inner face of the cover upper bent portion 32b of the upper end portion of the heat-insulating cover Fb4 are bonded to each other at a position on the lower side of the top curl portion 12 of the paper cup main body Fa so that a void portion 35 is formed between the outer face of the trunk portion 11 of the paper cup main body Fa and the inner face of the cover trunk portion 31 of the heat-insulating cover Fb4.

As shown in FIG. 34, in the heat-insulating microwave-oven-use paper cup F4 of (4) of the fourth example, a void portion 35 having a gap that corresponds to the diameter of the cover lower curl portion 33a at its lower portion and also corresponds to the thickness of the cover upper bent portion 32b at its upper portion is formed between the trunk portion 11 of the paper cup main body Fa and the cover trunk portion 31 of the heat-insulating cover Fb4. Although the void portion 35 at the upper portion is slightly smaller than the void portion 35 at the lower portion, the heat-insulating microwave-oven-use paper cup F4 is allowed to have a high heat-insulating property along its entire length in the longitudinal direction.

• (5) of the Fourth Example

FIG. 35 shows a heat-insulating microwave-oven-use paper cup F5 of (5) of the fourth example. This cup F5 of the present example has basically the same structure as the cup F1 of (1) of the fourth example. However, its heat-insulating cover Fb5 uses plate cardboard (coated cardboard 270 g/m<sup>2</sup>) as its material, and is attached along the entire length of the outer surface of the trunk portion 11 of the paper cup main body Fa in the longitudinal direction. The heat-insulating cover Fb5 which is provided with a cover lower curl portion 33a directed inward at its lower end portion and a cover upper curl portion 32a placed inward at its upper end portion, is bonded to the outer face of the trunk portion 11 of the paper cup main body Fa at a position on the lower side of the top curl portion 12 of the paper cup main body Fa.

As shown in FIG. 35, in the heat-insulating microwave-oven-use paper cup F5 of (5) of the fourth example, a void portion 35 having a gap that corresponds to the diameter of the cover lower curl portion 33a at its lower portion and also corresponds to the diameter of the cover upper curl portion 32a at its upper portion is formed between the trunk portion 11 of the paper cup main body Fa and the cover trunk portion 31 of the heat-insulating cover Fb5. Since the void portion 35 having a wide gap along the entire length in the longitudinal direction of the heat-insulating microwave-oven-use paper cup F5 is formed, it is possible to provide a superior heat-insulating property.

## [Fifth Example]

## • (1) of the Fifth Example

A paper cup main body Ga shown in FIG. 39 was prepared by using the same materials through the same sequence as (1) of the first example. Next, by using corrugated cardboard (F flute) as a material, a cylinder-shaped heat-insulating cover Gb1 corresponding to the entire outer surface of the trunk portion 11 of the paper cup main body Ga was formed, and the paper cup main body Ga was fitted to this cylinder-shaped heat-insulating cover Gb1, and partially bonded to be secured; thus, a heat-insulating microwave-oven-use paper cup G1 as shown in FIG. 39 was produced.

Further, by using corrugated cardboard (E flute), a round heat-insulating member Gc having the almost same area as the lower face portion 21Ua of the bottom face portion 21U of the paper cup main body Ga was formed, and this heat-insulating member Gc was bonded to the outer surface of the bottom face portion 21U of the paper cup main body Ga by using a bonding agent.

In this heat-insulating microwave-oven-use paper cup G1 of (1) of the fifth example, since the heat-insulating cover Gb1 using corrugated cardboard as its material was attached to the trunk portion 11 of the paper cup main body Ga, it was allowed to have a heat-insulating property, and since the bottom face portion 21U of the paper cup main body Ga had a concave shape extending downward, no burning occurred at its paper combined portion when the paper cup having the contents was heated and subjected to cooking in a microwave oven. Moreover, since the

heat-insulating member Gc was affixed onto the outer surface of the bottom face portion 21U of the paper cup main body Ga, it becomes possible to prevent the contents from cooling down, and also to touch the heat-insulating member Gc by the hand to hold the microwave-oven-use paper cup G1 without feeling the heat of the contents.

• (2) of the Fifth Example

FIG. 40 shows a heat-insulating microwave oven-use paper cup G2 of (2) of the fifth example. This paper cup G2 of the present example has basically the same structure as the cup G1 of (1) of the fifth example. However, it is different from the cup G1 in that the length in the longitudinal direction of the heat-insulating cover Gb2 attached to the outer circumference of the trunk portion 11 of the paper cup main body Ga is made shorter than the length in the longitudinal direction of the paper cup main body Ga and the heat-insulating cover Gb2 is attached to an upper portion of the outer face of the trunk portion 11 of the paper cup main body Ga.

As shown in FIG. 40, in the heat-insulating microwave-oven-use paper cup G2 of (2) of the fifth example, the length in the longitudinal direction of the heat-insulating cover G2 is made shorter so that it becomes possible to reduce the material costs.

• (3) of the Fifth Example

FIG. 41 shows a heat-insulating microwave-oven-use paper cup G3 of (3) of the fifth example. This paper cup G3 of the present example has basically the same structure as the cup G1

of (1) of the fifth example. However, its heat-insulating cover Gb3 uses plate cardboard (coated cardboard 270 g/m<sup>2</sup>) as its material, and is attached along the entire length of the outer surface of the trunk portion 11 of the paper cup main body Ga in the longitudinal direction. Further, the lower end of the heat-insulating cover Gb3 is curled inward to form a cover lower curl portion 33a, and this cover lower curl portion 33a was made in contact with the lower end of the trunk portion 11 of the paper cup main body Ga, and secured thereto, and the inner face of the upper end portion of the heat-insulating cover Gb3 is bonded at a position on the lower side of the top curl portion 12 of the trunk portion 11 of the paper cup main body Ga so that a void portion 35 is formed between the outer face of the trunk portion 11 of the paper cup main body Ga and the inner face of the cover trunk portion 31 of the heat-insulating cover Gb3.

Moreover, in the same manner as (1) of the fifth example, the heat-insulating member Gc that uses corrugated cardboard (E flute) was bonded to the outer surface of the bottom face portion 21U of the paper cup main body Ga by using a bonding agent.

As shown in FIG. 41, in the heat-insulating microwave oven-use paper cup G3 of (3) of the fifth example, a void portion 35 having a gap corresponding to the diameter of the cover lower curl portion 33a at its lower portion is formed between the trunk portion 11 of the paper cup main body Ga and the cover trunk portion 31 of the heat-insulating cover Gb3; therefore, the heat-insulating microwave-oven-use paper cup G3 is allowed to

have a high heat-insulating property at its lower portion.

Moreover, since the bottom face portion 21U of the paper cup main body Ga had a concave shape extending downward, no burning occurred at its paper combined portion when the paper cup having the contents was heated and subjected to cooking in a microwave oven. Moreover, since the heat-insulating member Gc was affixed onto the outer surface of the bottom face portion 21U of the paper cup main body Ga, it becomes possible to prevent the contents from cooling down, and also to touch the heat-insulating member Gc by the hand to hold the microwave-oven-use paper cup G3 without feeling the heat of the contents.

• (4) of the Fifth Example

FIG. 42 shows a heat-insulating microwave-oven-use paper cup G4 of (4) of the fifth example. This paper cup G4 of the present example has basically the same structure as the cup G1 of (1) of the fifth example. However, its heat-insulating cover Gb4 uses plate cardboard (coated cardboard 270 g/m<sup>2</sup>) as its material, and is attached along the entire length of the outer surface of the trunk portion 11 of the paper cup main body Ga in the longitudinal direction. Further, in the heat-insulating cover Gb4 which is provided with a cover lower curl portion 33a directed inward at its lower end portion and a cover upper bent portion 32b placed inward at its upper end portion, the outer face of the trunk portion 11 of the paper cup main body Ga and the inner face of the cover upper bent portion 32b of the upper end portion of the heat-insulating cover Gb4 are bonded to each other at a position on the lower side of the top curl portion

12 of the paper cup main body Ga so that a void portion 35 is formed between the outer face of the trunk portion 11 of the paper cup main body Ga and the inner face of the cover trunk portion 31 of the heat-insulating cover Gb4.

Moreover, in the same manner as (1) of the fifth example, the heat-insulating member Gc that uses corrugated cardboard (E flute) was bonded to the outer surface of the bottom face portion 21U of the paper cup main body Ga by using a bonding agent.

As shown in FIG. 42, in the heat-insulating microwave-oven-use paper cup G4 of (4) of the fifth example, a void portion 35 having a gap that corresponds to the diameter of the cover lower curl portion 33a at its lower portion and also corresponds to the thickness of the cover upper bent portion 32b at its upper portion is formed between the trunk portion 11 of the paper cup main body Ga and the cover trunk portion 31 of the heat-insulating cover Gb4. Although the void portion 35 at the upper portion is slightly smaller than the void portion 35 at the lower portion, the heat-insulating microwave-oven-use paper cup G4 is allowed to have a high heat-insulating property along its entire length in the longitudinal direction.

Moreover, since the bottom face portion 21U of the paper cup main body Ga had a concave shape extending downward, no burning occurred at its paper combined portion when the paper cup having the contents was heated and subjected to cooking in a microwave oven. Moreover, since the heat-insulating member Gc was affixed onto the outer surface of the bottom face portion 21U of the

paper cup main body Ga, it becomes possible to prevent the contents from cooling down, and also to touch the heat-insulating member Gc by the hand to hold the microwave-oven-use paper cup G4 without feeling the heat of the contents.

• (5) of the Fifth Example

FIG. 43 shows a heat-insulating microwave-oven-use paper cup G5 of (5) of the fifth example. The shape of this paper cup main body Ga is the same as that of (1) of the fifth embodiment; however, its heat-insulating cover Gb5 uses plate cardboard (coated cardboard 270 g/m<sup>2</sup>) as its material, and is attached along the entire length of the outer surface of the trunk portion 11 of the paper cup main body Ga in the longitudinal direction. The heat-insulating cover Gb5 which is provided with a cover lower curl portion 33a directed inward at its lower end portion and a cover upper curl portion 32a placed inward at its upper end portion, is bonded to the outer face of the trunk portion 11 of the paper cup main body Ga at a position on the lower side of the top curl portion 12 of the paper cup main body Ga.

Moreover, in the same manner as (1) of the fifth example, the heat-insulating member Gc that uses corrugated cardboard (E flute) was bonded to the outer surface of the bottom face portion 21U of the paper cup main body Ga by using a bonding agent.

As shown in FIG. 43, in the heat-insulating microwave-oven-use paper cup G5 of (5) of the fifth example, a void portion 35 having a gap that corresponds to the diameter of the cover lower curl portion 33a at its lower portion and

also corresponds to the diameter of the cover upper curl portion 32a at its upper portion is formed between the trunk portion 11 of the paper cup main body Ga and the cover trunk portion 31 of the heat-insulating cover Gb5. Since the void portion 35 having a wide gap along the entire length in the longitudinal direction of the heat-insulating microwave-oven-use paper cup G5 is formed, it is possible to provide a superior heat-insulating property.

Moreover, since the bottom face portion 21U of the paper cup main body Ga had a concave shape extending downward, no burning occurred at its paper combined portion when the paper cup having the contents was heated and subjected to cooking in a microwave oven. Moreover, since the heat-insulating member Gc was affixed onto the outer surface of the bottom face portion 21U of the paper cup main body Ga, it becomes possible to prevent the contents from cooling down, and also to touch the heat-insulating member Gc by the hand to hold the microwave-oven-use paper cup G5 without feeling the heat of the contents.

#### [Sixth Example]

A paper cup a shown in FIG. 6 was prepared by using the same materials through the same sequence as (1) of the first example. The bottom face portion 21 of the manufactured paper cup a was modified into a concave shape extending downward in the next process to form a bottom face portion 21U having a U-letter shape in which the curvature radius of the curved face portion R between the lower face portion 21Ua and the side face portion 21Ub was set to 6 mm with the distance x between the lower end

face X formed by the lower end of the trunk portion 11 and lower face portion 21Ua being set to 1 mm; thus, a microwave-oven-use paper cup A' shown in FIG. 50 was formed. Moreover, the paper combined portion Z was bent inward so that, as shown in FIG. 46, a microwave-oven-use paper cup H of the present invention was produced, in which the paper combined portion Z was placed close to the side face portion 21Ub of the bottom face portion 21U with the maximum distance between them being set to 2 mm. [Comparative Example]

By using the same material as the first example, a paper cup of a comparative example was formed according to the conventional shape, the trunk member 1 of which has the same shape as the first example with respect to the external diameter, the height, and the like of the trunk portion 11 of the trunk member 1, and which has a plane bottom face portion 21 of the bottom member 2.

Here, 200 ml of water was put into each of the paper cups of the first through third embodiments and the sixth embodiment as well as the paper cups, for comparative example, having the same external dimensions as these examples, and heated and subjected to cooking by a microwave oven (made by NEC Co., Ltd., home-use high-frequency output microwave oven MC-E2: 500 W). Consequently, in the examples, none of the paper cups had burned portions. In contrast, in the comparative examples, after a lapse of two minutes from the start of heating, the paper combined portion was discolored into brown, and after a lapse of five minutes, the paper combined portion had a burned portion.

Moreover, when the cup containing the heated contents was held by the hand, the microwave-oven-use paper cup of the second example of the present invention was easily held with less feeling the heat in comparison with the comparative examples. Furthermore, in the case of the paper cups of the third example, when the paper cup was put onto the surface of a table or the like with the hot contents held therein, although the surface of the heat-insulating member was placed in contact with the surface, the contents was not cooled down abruptly, and the microwave-oven-use paper cup could be held by grabbing the surface of the heat-insulating member by the hand without feeling the heat.

As described above, in accordance with the first microwave oven-use paper cup of the present invention, since the bottom face portion of the paper cup is deformed into a concave shape extending downward, that is, a U-letter-shape, it is possible to provide a microwave-oven-use paper cup which is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In accordance with the first manufacturing method of a microwave-oven-use paper cup of the present invention, since the bottom face portion of the paper cup is modified into a concave shape extending downward, that is, a U-letter-shape, it is possible to provide a microwave-oven-use paper cup which is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant

food, is heated and subjected to cooking in a microwave oven. Moreover, the width of the turned-up portion of the trunk portion is set to not more than  $3/4$  of the width of the bent portion of the base member, or the upper portion of the bent portion of the bottom member is made in an un-bonded state to the trunk portion and the turned-up portion of the trunk member so that the bottom member is easily modified into a U-letter shape.

In accordance with the second manufacturing method of a microwave-oven-use paper cup of the present invention, the shape of the bottom face portion of the paper cup is modified into a concave shape extending downward so that it is possible to provide a microwave-oven-use paper cup which is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In accordance with the third manufacturing method of a microwave-oven-use paper cup of the present invention, first, a pre-reverse bottom face portion modified into a convex shape extending upward is formed, and this is then reversed to form a bottom face portion having a concave shape extending downward. This method makes it possible to easily manufacture a paper cup having a bottom face portion that is modified into a concave shape extending downward. The microwave-oven-use paper cup having a bottom face portion that is modified into a concave shape extending downward, which is manufactured in this method, is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant

food, is heated and subjected to cooking in a microwave oven.

In accordance with the third microwave-oven-use paper cup of the present invention, it is possible to provide a heat-insulating microwave-oven-use paper cup, which is a heat-insulating cup having a sufficient heat-insulating effect, a sliding-preventive effect, a unique taste from the designing point of view, and the low cost for manufacturing because of using foamed layers, and which is not susceptible to burning at a paper-combined portion, even when the paper cup having contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven because of the bottom face portion of the paper cup formed into a concave shape extending downward

In accordance with the fourth microwave-oven-use paper cup, the shape of the bottom face portion of the paper cup is modified into a concave shape extending downward to be formed like U-letter and a heat-insulating member is affixed onto the outer face of the bottom face portion so that it is possible to provide a microwave-oven-use paper cup which is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven, and which has a heat-insulating property on the bottom face portion to prevent the contents from easily cooling down even when it is put on a plane face after the heating process.

In accordance with the fifth microwave-oven-use paper cup of the present invention, it is prepared as a heat-insulating paper cup with an heat-insulating cover attached to the trunk

portion, and the bottom face portion of the paper cup which is the main body is formed into a concave shape extending downward so that it is possible to obtain a heat-insulating microwave-oven-use paper cup which is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In accordance with the sixth microwave-oven-use paper cup of the present invention, it is prepared as a heat-insulating paper cup with an heat-insulating cover attached to the trunk portion, and the bottom face portion of the paper cup which is the main body is formed into a concave shape extending downward so that it is possible to obtain a heat-insulating microwave-oven-use paper cup which is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

In accordance with the seventh microwave-oven-use paper cup of the present invention, the bottom face portion of the paper cup is modified into a concave shape extending downward with the paper-combined portion being bent inward to get closer to the side face portion of the bottom face portion so that it is possible to obtain a microwave-oven-use paper cup which is not susceptible to burning at a paper-combined portion, even when the paper cup having the contents, such as a drink and instant food, is heated and subjected to cooking in a microwave oven.

CLAIMS

1. A microwave-oven-use paper cup comprising:

a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending an upper end of the trunk portion and a turned-up portion formed by turning up a lower end of the trunk portion inward; and

a bottom member including a bottom face portion and a bent portion formed by bending an outer circumferential edge of the bottom face portion, with said bent portion being sandwiched between said trunk portion and said turned-up portion so as to be mutually joined,

wherein said bottom face portion is formed into a concave shape extending downward.

2. The microwave-oven-use paper cup according to claim 1, wherein said bottom face portion is constituted by a lower face portion and a wall face portion with a curved portion being formed between said lower face portion and said wall face portion.

3. A manufacturing method of a microwave-oven-use paper cup comprising:

a paper cup forming process in which a trunk member is wound up to a cylinder shape to form a trunk portion, and an upper end of said trunk portion is bent to form a top curl portion, said trunk portion being placed with a top end of a bent portion formed by bending an outer circumferential edge portion of a bottom member facing a lower end side of said trunk portion so

that said trunk member and said bottom member are joined to each other with said bent portion being sandwiched by a turned-up portion formed by turning up the lower end of said trunk portion and said trunk portion to form a paper cup; and

a bottom face portion forming process which presses an inner face side of said bottom member of said paper cup to form a bottom face portion having a concave shape extending downward.

4. The manufacturing method of a microwave-oven-use paper cup according to claim 4, wherein, in said paper-cup forming process, an width of said turned-up portion is set to not less than 2 mm, and also to not more than  $3/4$  of an width of said bent portion.

5. The manufacturing method of a microwave-oven-use paper cup, according to claim 4, wherein, in said paper-cup forming process, an width of a joining section in which said trunk portion and said bent portion are joined to each other is set to not less than 2 mm from the tip of the bent portion, and also to not more than  $3/4$  of the width of said bent portion.

6. A microwave-oven-use paper cup in which: a trunk member is wound up to a cylinder shape to form a trunk portion, and an upper end of said trunk portion is bent to form a top curl portion, with said trunk portion being placed with a top end of a bent portion formed by bending an outer circumferential edge portion of a bottom member facing a lower end side of the

trunk portion so that said trunk member and said bottom member are joined to each other with said bent portion being sandwiched by a turned-up portion formed by turning up the lower end of the trunk portion and the trunk portion to form a paper cup, and a bottom face portion of said bottom member of the paper cup is formed into a concave shape extending downward, seeing from an inner face side of the paper cup.

7. The microwave-oven-use paper cup according to claim 6, wherein an width of said turned-up portion is set to not less than 2 mm, and also to not more than  $3/4$  of an width of said bent portion.

8. The microwave-oven-use paper cup according to claim 6, wherein an width of a joining section in which said bent portion, said trunk portion and said turned-up portion are joined to each other is set to not less than 2 mm from a tip of the bent portion, and also to not more than  $3/4$  of an width of said bent portion.

9. A manufacturing method of a microwave-oven-use paper cup comprising:

a bottom member forming process in which a bottom member is pressed to form a bottom face portion having a concave shape and a bent portion on an outer circumferential edge of the bottom face portion, and

a paper cup forming process in which, in a process in which a trunk member is wound up to a cylinder shape to form a trunk

portion and an upper end of the trunk portion is bent to form a top curl portion, said trunk member is placed with a top end of the bent portion of the bottom member facing a lower end side of the trunk portion so that said trunk member and said bottom member are joined to each other with said bent portion being sandwiched by turning up the lower end of the trunk portion to form a paper cup.

10. A manufacturing method of a microwave-oven-use paper cup comprising:

a pre-reverse bottom member forming process in which a bottom member blank is pressed to form a pre-reverse bottom face portion having a convex shape and a joining portion on an outer circumferential edge of the pre-reverse bottom face portion;

a paper cup forming process in which, in a process in which a trunk member is wound into a cylinder shape to form a trunk portion and an upper end of the trunk portion is bent to form a top curl portion, said trunk member is placed with a top end of the joining portion of said pre-reverse bottom member facing a lower end side of said trunk portion so that said trunk member and said pre-reverse bottom member are joined to each other with the lower end of said trunk portion being turned up to sandwich the joining portion to form a paper cup; and

a bottom member forming process in which said pre-reverse bottom face portion is reversed downward to form a bottom face portion having a downward concave shape.

11. A microwave-oven-use paper cup comprising:

a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending an upper end of the trunk portion and a turned-up portion formed by turning up a lower end of the trunk portion inward; and

a bottom member including a bottom face portion and a bent portion formed by bending an outer circumferential edge of the bottom face portion, with said bent portion being sandwiched between said trunk portion and said turned-up portion so as to be mutually joined,

wherein: said bottom face portion of the a paper cup is formed into a concave shape, and said paper cup is constituted by at least a foamed layer of a thermoplastic resin, and a base material layer mainly made of paper and a thermoplastic resin layer that are placed in this order from the outer face side.

12. The microwave-oven-use paper cup according to claim 11, wherein said trunk member has said foamed layer.

13. The microwave-oven-use paper cup according to claim 11, wherein said bottom member has said foamed layer.

14. The microwave-oven-use paper cup according to claim 11, wherein said trunk member and said bottom member have said foamed layer.

15. A microwave-oven-use paper cup, comprising:

a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending an upper end portion of the trunk portion and a turned-up portion formed by turning up a lower end of the trunk portion inward; and

a bottom member including a bottom face portion and a bent portion formed by bending an outer circumferential edge of the bottom face portion, with said bent portion being sandwiched between said trunk portion and said turned-up portion so as to be mutually joined,

wherein said bottom portion of a paper cup is formed into a concave shape extending downward, and a heat-insulating member is bonded to an outer face of said bottom face portion.

16. The microwave-oven-use paper cup according to claim 15, wherein said heat-insulating member is made of corrugated cardboard.

17. The microwave-oven-use paper cup according to claim 15, wherein said heat-insulating member is made of embossed paper sheet.

18. A heat-insulating microwave-oven-use paper cup, comprising:

a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending an upper end portion of the trunk portion and a turned-up portion formed by turning up a lower end of the trunk portion inward; and

a bottom member including a bottom face portion and a bent portion formed by bending an outer circumferential edge of the bottom face portion, with said bent portion being sandwiched between said trunk portion and said turned-up portion so as to be mutually joined to form a paper cup main body,

wherein a heat-insulating cover is attached to an outer circumference of said trunk portion of said paper cup main body and the bottom face portion thereof is formed into a concave shape extending downward.

19. The heat-insulating microwave-oven-use paper cup according to claim 18, wherein an inward cover upper curl portion or an inward cover upper bent portion is formed on the upper end portion of said heat-insulating cover.

20. The heat-insulating microwave oven-use paper cup according to claim 18, wherein an inward cover lower curl portion or an inward cover lower bent portion is formed on the lower end portion of said heat-insulating cover.

21. The heat-insulating microwave-oven-use paper cup according to claim 18, wherein: said cover upper curl portion or said cover upper bent portion on the cover is formed on the upper end portion of said heat-insulating cover, and said cover lower curl portion or said cover lower bent portion is also formed on the lower end portion of said heat-insulating cover.

22. The heat-insulating microwave-oven-use paper cup according to claim 18, wherein said heat-insulating cover has a shape which is provided with longitudinal grooves formed with predetermined intervals and flat-plate portions with a wide width, extending outward between the grooves.

23. The heat-insulating microwave-oven-use paper cup according to claim 18, wherein said heat-insulating cover is made of corrugated paper sheet processed into a waveform.

24. The heat-insulating microwave oven-use paper cup according to claim 18, wherein said heat-insulating cover is made of corrugated cardboard.

25. The heat-insulating microwave oven-use paper cup according to claim 18, wherein said heat-insulating cover is made of embossed paper sheet.

26. A microwave-oven-use paper cup comprising:

a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending an upper end portion of the trunk portion and a turned-up portion formed by turning up a lower end of the trunk portion inward; and

a bottom member including a bottom face portion and a bent portion formed by bending an outer circumferential edge of the bottom face portion, with said bent portion being sandwiched between said trunk portion and said turned-up portion so as to

be mutually joined to form a paper cup main body,

wherein: a heat-insulating cover is attached to the outer circumference of said trunk portion of the paper cup main body, the bottom face portion is formed into a concave shape extending downward and a heat-insulating member is affixed onto an outer face of said bottom face portion.

27. The microwave-oven-use paper cup according to claim 26, wherein said heat-insulating member is made of corrugated cardboard.

28. The microwave-oven-use paper cup according to claim 26, wherein said heat-insulating member is made of embossed paper sheet.

29. The heat-insulating microwave-oven-use paper cup according to claim 26, wherein an inward cover upper curl portion or an inward cover upper bent portion is formed on the upper end portion of said heat-insulating cover.

30. The heat-insulating microwave-oven-use paper cup according to claim 26, wherein an inward cover lower curl portion or an inward cover lower bent portion is formed on the lower end portion of said heat-insulating cover.

31. The heat-insulating microwave-oven-use paper cup according to claim 26, wherein: said cover upper curl portion

or said cover upper bent portion is formed on the upper end portion of said heat-insulating cover, and said cover lower curl portion or said cover lower bent portion also formed on the lower end portion of said heat-insulating cover.

32. The heat-insulating microwave-oven-use paper cup according to claim 26, wherein said heat-insulating cover has a shape which is provided with longitudinal grooves formed with predetermined intervals and flat-plate portions with a wide width, extending outward between the grooves.

33. The heat-insulating microwave-oven-use paper cup according to claim 26, wherein said heat-insulating cover is made of corrugated paper sheet processed into a waveform.

34. The heat-insulating microwave-oven-use paper cup according to claim 26, wherein said heat-insulating cover is made of corrugated cardboard.

35. The heat-insulating microwave-oven-use paper cup according to claim 26, wherein said heat-insulating cover is made of embossed paper sheet.

36. A microwave oven-use paper cup comprising:

a trunk member including a cylinder-shaped trunk portion, a top curl portion formed by bending an upper end portion of the trunk portion and a turned-up portion formed by turning up

a lower end of the trunk portion inward; and

a bottom member including a bottom face portion and a bent portion formed by bending the outer circumferential edge of the bottom face portion, the trunk member and the bottom member being jointed to each other by a paper-combined portion in which said bent portion is sandwiched between said trunk portion and said turned-up portion,

wherein said bottom face portion is formed into a concave shape extending downward, said the paper-combined portion being bent inward.