DOUBLE-WALLED PAPER CUP AND METHOD OF MANUFACTURE THEREOF

Provided are a double-walled paper cup and a method of manufacture thereof. The double-walled paper cup comprises an inner cup; and an outer sleeve configured to circumferentially envelop the inner cup and to be attached at a top and bottom circumferential edge thereof to the inner cup; wherein the top edge of the outer sleeve is folded inwards on itself to form a contact strip for attachment to a portion of the inner cup adjacent to a lip of the inner cup, the contact strip defining a gap between the inner cup and outer sleeve. The method of manufacturing the paper cup comprises using a cold glue process and a hot melt glue process to attach the outer sleeve and the inner cup together.

Abstract

Title

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Title

Double-walled Paper Cup and Method of Manufacture thereof

Field

The invention relates to a double-walled cup made of a paper material, for example, paper or cardboard. In particular, a paper cup having an inner cup and an outer sleeve attached thereto is disclosed. The outer sleeve is configured to reduce the heat transfer from the inner cup to the outer sleeve. The present invention further relates to a method of manufacturing the double-walled cup.

Background Of The Invention

Paper cups for hot and cold beverages are widely used. These cups are either single-walled paper cups or double-walled paper cups and generally have a frusto-conical shape having an increasing diameter from the bottom towards the top. Double-walled cups are generally used for hot beverages such as coffee.

More and more retailers are using conventional double-walled paper cups to make specialist tea drinks using boiling water. Such cups have an outer sleeve secured to an inner cup. Normally hot coffee is only heated to about 80 degrees Celsius. Conventional double-walled cups substantially prevent heat transfer from the inner cup to the outer sleeve of the double-walled cup by providing a gap between the inner cup and the outer sleeve. However, when it comes to boiling water at 95 degrees Celsius then the heat transfer is very high. Accordingly, conventional double-walled cups struggle to prevent excess heat transfer. The likelihood of subsequent scalding is greatly increased.

A standard technique for creating a heat insulation air gap within double-walled cups involves curling the outer sleeve up at a bottom portion thereof and when the sleeve is pushed onto the paper cup, a gap is formed at the bottom creating an air pocket between the inner cup and the outer sleeve. The air
pocket serves as insulation thereby reducing heat transfer. Figure 1 is a side view of a conventional double-walled cup. Referring to Figure 1, the double-walled cup includes an inner cup 100 for holding liquid and an outer sleeve 101. As described above, the outer sleeve 101 includes a bottom curl 102 that keeps a portion of the outer sleeve 101 separated from the inner cup 100. However, the outer sleeve 101 may contact the inner cup 100 at a section 103 near the top of the inner cup 100. Furthermore the gap between the outer sleeve 101 and the inner cup 100 decreases from the bottom curl 102 to the top section 103. The outer sleeve 101 may be attached to the inner cup 100 at the top section 103.

Increasing the gap between the inner cup 100 holding the liquid and the outer sleeve 101 reduces the heat transfer from any liquid in the inner cup 100 to the outer sleeve 101.

A technique for increasing the gap between the inner cup and the outer sleeve is disclosed in CN 1 01889805. Figure 2 illustrates such a double-walled cup. Referring to Figure 2, the double-walled paper cup comprises an outer sleeve 201 and an inner cup 200 which fits into the outer sleeve 201. An upper portion of the outer sleeve 201 is curled inwards to form a top curl 203 and a lower portion of the outer sleeve 201 is curled inwards to form a bottom curl 202. In this manner, a gap 205 is formed between the outer sleeve 201 and the outer wall of the inner cup 200.

It will be appreciated that the top curl 203 is provided at an upper portion of the sleeve 201. The top curl 203 may be virtually identical to the bottom curl 202. Furthermore, the top curl 203 may be configured in the same manner as the bottom curl 202. The provision of the top curl 203 ensures a uniform gap between the outer sleeve 201 and inner cup 200. When the outer sleeve 201 is pushed onto the inner cup 200, the top curl 203 may contact a lip 204 of the inner cup 200. However, the top curl 203 of the outer sleeve 201 may interfere
with the lip 204 of the inner cup 200, which may make it difficult for a lid to be fitted onto the cup as described below.

The increased uniform gap between the inner sleeve 201 and the inner cup 200 provides improved insulation when compared to the double-walled cup 100 of Figure 1. However, there are drawbacks with such a cup as shown in Figure 2. The provision of the top curl 203 may impinge on the lip 204 of the inner cup 200. Specifically, the top curl 203 may push the outer sleeve 201 away from the inner cup 200 such that the size of the lip 204 on the inner cup 200 is reduced. This reduced lip size may be insufficient to keep a standard lid securely in place. As is known in the art, a suitably configured lip is essential to ensure that a lid remains securely in place on the cup. Any reduction in the lip size makes it more likely that the lid will become detached from the cup during use. Such detachment is potentially dangerous and could lead to scalding.

Furthermore, the shape of the top curl 203 only provides a minimal area of contact between the outer sleeve 201 and the inner cup 200. Specifically, the outer sleeve 201 of the double-walled cup of Figure 2 only contacts the inner cup 20 at two points, a small portion of each of the top and bottom curls 203 and 202. Although the outer sleeve 201 may be attached to the inner cup 200 at these two points, a sufficient attachment area is not provided to ensure a robust connection between the inner cup 200 and the outer sleeve 201. In this regard, it is possible that the outer sleeve 201 may become separated from the inner cup 200 during use.

Furthermore, the top curl 203 only allows about 1 mm contact between the inner cup 200 and the outer sleeve 201. Since even the most accurate hot melt gluing systems have a tolerance of 3 mm, mass production of such cups may be difficult. The circular nature of the top curl 203 means contact with the inner cup 200 is minimal. Specifically, it can be observed that the outer surface of the inner cup 200 is tangential to the top curl 203. This minimal contact area may
lead to problems with robustly securing the outer sleeve 201 to the inner cup 200.

As is known to those skilled in the art, paper cups are usually manufactured using one of two adhesive processes, namely cold glue and hot melt glue processes. Accordingly, the outer sleeve such as that shown with reference to Figure 2 is generally secured to the inner sleeve using either a cold glue or hot glue process. Cold glue is a room temperature glue that requires no heat to set. In time the agent that keeps the glue from turning solid evaporates, turning the glue hard and a solid bond is formed. The disadvantage is that this may take a minimum of about 25 minutes to start to properly bond, making it unstable in high speed manufacturing (180 pieces per minute). Once set the process is irreversible.

Hot melt is glue that is solid up to a "set" temperature and liquid once the glue achieves this temperature. Hot melt glue may be applied using heated tanks and heated guns to maintain the glue above the set temperature. Once the glue leaves the gun and is applied to a surface it quickly cools and forms a bond between two surfaces. Hot melt glue is stable for use in high speed machinery (180 pieces per minute). This bond is reversible if the same heat is applied to the material, and will become liquid again.

The hot melt glue used in paper cups has a melting point of about 130 degrees Celsius. Although this melting point is much higher than liquid coffee/tea at a maximum of about 95 degrees Celsius, the glue does start to soften even at these temperatures. Even though the hot melt glue appears solid at about 70 - 80 degrees Celsius, the bonds are significantly weakened to the point where slight external pressure can break them.

However, since even the most accurate hot melt gluing systems have a margin of error of 3 mm, using a hot melt gluing system to mass produce the conventional cup of Figure 2 may be difficult. For example, it may be difficult to
accurately apply a sufficient volume of glue to the top curl 203 to ensure a secure attachment to the inner cup 200.

Cold glue processes are even less accurate than hot glue processes. Cold glue cannot be accurately applied to an area less than 5 mm. Therefore, it is clear that accurate application of glue (using either the hot or cold glue process) to the cup of Figure 2 is problematic using known mass-production techniques.

The cold glue process is a less accurate method of gluing when compared to the hot glue process. This process relies on using centripetal force from a spinning wheel to apply a "splash" of glue around the inside of a sleeve before contact with an inner cup. For example, a cold glue process may be used to apply glue to the top section 103 of Figure 1 before sliding the outer sleeve 101 onto the inner cup 100.

Cold glue is very inexpensive which is advantageous as it may be liberally applied to the outer sleeve before contact with the inner cup. A significant amount of the cold glue may be required to keep the outer sleeve attached to the inner cup while the manufacturing process is being completed. For example, counting, moving, packing etc. of the double-walled cups may be performed whilst the cold glue is drying. However, once dry in about 10-15 minutes, the cold glue provides a very secure bond. The bond created is not affected by heat or external environmental factors in any significant way. In order to remove the outer sleeve from the inner cup, it may be necessary to tear the manufactured double-walled cup apart.

The double-walled cup of Figure 1 may have more than 10 mm of contact area at the top section 103.

It may be necessary to add a drying time pause in the manufacturing process to ensure the glue has sufficiently dried before continuing with a subsequent step of the process. It will be appreciated that such a pause in the
manufacturing process is not desirable as it would greatly decrease the manufacturing output.

Turning to the hot melt process, the glue used in this process is extremely accurate and very fast setting. There are no issues with accurately applying hot melt glue. Furthermore, the fact that hot melt glue sets relatively quickly means there is little chance of an outer sleeve becoming separated from an inner cup during any subsequent steps of the manufacturing process. Specifically, once the outer sleeve is glued to the inner cup using the hot melt process a robust connection is quickly established and maintained between the outer sleeve and the inner cup.

The problem with the hot melt process is not with the manufacturing of the double-walled cup, rather with the performance of the cup in normal use, i.e., holding hot beverages therein.

Hot melt glue has a melting point of about 130 degrees Celsius which is significantly above the boiling point of water. However, when holding tea or coffee at a temperature of 60-70 degrees Celsius, the glue bonds created by the hot glue process start to melt and soften. Such melting transforms a seemingly indestructible outer sleeve inner cup connection to a less secure connection. It is very possible that the outer sleeve may detach from the inner cup under such circumstances. That is, if force is applied to pull the outer sleeve away from the inner cup, it is possible to detach the outer sleeve from the inner cup.

Given that double-walled paper cups are typically intended for use with high-temperature liquids such as tea or coffee at about 95 degrees Celsius, the use of a hot melt process to attach the outer sleeve to the inner cup has inherent problems.
One way to overcome the structural stability problems associated with a hot melt process is to increase the volume of glue used to create a connection between the outer sleeve and the inner cup. The use of an increased volume of hot glue ensures that even if the glue softens while the double-walled cup is holding a hot beverage, the connection is still sufficient to securely hold the outer sleeve to the inner cup. However, the hot glue may be up to ten times the cost of cold glue, which greatly increases the manufacturing cost. The following table outlines the advantages and disadvantages of the cold and hot glue processes.

<table>
<thead>
<tr>
<th>Cold Glue</th>
<th>Hot Melt Glue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inexpensive</td>
<td>Expensive, 10 times the price of cold glue</td>
</tr>
<tr>
<td>Messy and inaccurate to apply</td>
<td>Very accurate tolerance 3-5 mm</td>
</tr>
<tr>
<td>tolerance 5-10 mm</td>
<td></td>
</tr>
<tr>
<td>Needs time to dry 10-15 mins.</td>
<td>Sets almost immediately in 0.3 seconds</td>
</tr>
<tr>
<td>Needs heavy application to stay secure</td>
<td>Needs very little application to stay secure</td>
</tr>
<tr>
<td>through manufacturing process</td>
<td>through manufacturing process</td>
</tr>
<tr>
<td>Extremely secure when dry</td>
<td>Can soften whilst cup is holding hot liquids</td>
</tr>
<tr>
<td></td>
<td>causing failure and separation of outer sleeve</td>
</tr>
<tr>
<td></td>
<td>from inner cup</td>
</tr>
</tbody>
</table>

It is clear from the above table that both the cold glue and hot melt glue processes have their advantages and disadvantages. Both methods lead to problems when manufacturing double-walled cups, as described above.

Referring to Figure 2, the minimal contact area between the top curl 203 and the inner cup 200 may lead to further issues. For example, even if glue could be applied successfully between the top curl 203 and the inner cup 200,
the glued or contact area between the inner cup 200 and outer sleeve 201 would be only about 1 mm wide. This area may be too small to provide a robust connection between the inner cup 200 and the outer sleeve 201. Such a connection may lead to the outer sleeve 201 becoming detached from the inner cup 200 whilst in use.

A further drawback of the double-walled cup of Figure 2 is that secure attachment of a lid to the cup may be compromised by the provision of the top curl 203. As is known in the art, for secure attachment, a lid slips over the lip 204 of the cup and is snap-fitted in place under the lip 204. Specifically, as the lid is pushed over the lip 204, it deforms to a slightly larger diameter and once past the lip 204, returns or snaps back to its original diameter. The lip 204 may be formed from a rolled or curled section of the inner cup 200.

However, the ability of the lid to return to its original diameter is inhibited by the top curl 203 adjacent to the lip 204 of the double-walled cup. This is not possible if a rolled lip i.e., the top curl 203 is in the way. In practice, the lip 204 is generally curled the same way as the top curl 203 on the outer sleeve 201 is always curled as much as possible. Therefore, although the top curl 203 of Figure 2 is shown as being much smaller than the lip 204, in practice both will likely be of very similar size. This may lead to a significant impact on the capability of the lip 204 to securely retain the lid.

Therefore there is a need to provide a double-walled cup that reduces the heat transfer from the inner cup to the outer sleeve while still maintaining a sturdy connection between the outer sleeve and inner cup. Such a cup also needs to be configured to be easily and simply fabricated since paper cups are usually mass produced.

**Summary**

According to the present disclosure there is provided a double-walled paper cup as detailed in claim 1. A method of manufacturing a double-walled
paper cup is provided in claim 18. Also provided is a double-walled paper cup according to claim 46. Advantageous features are provided in the dependent claims.

5 Brief Description Of The Drawings

The present application will now be described with reference to the accompanying drawings in which:

Figure 1 is a side view of a conventional double-walled cup;

Figure 2 is a side view of another conventional double-walled cup;

Figure 3 is a side view of a double-walled cup in accordance with an embodiment of the present disclosure;

Figure 4 is a flow diagram illustrating a method of manufacturing a double-walled cup, in accordance with an embodiment of the present disclosure;

Figure 5 is a flow diagram illustrating a method of manufacturing a double-walled cup, in accordance with an embodiment of the present disclosure; and

Figure 6 is a flow diagram illustrating a more detailed method of manufacturing a double-walled cup, in accordance with an embodiment of the present disclosure.

Detailed Description Of The Drawings

The present disclosure provides a double-walled paper cup comprising: an inner cup; and an outer sleeve configured to circumferentially envelop the inner cup and to be attached at top and bottom circumferential edges thereof to the inner cup; wherein the top edge of the outer sleeve is folded inwards on itself to form a contact strip for attachment to a portion of the inner cup adjacent to a lip of the inner cup, the contact strip defining a gap between the inner cup and outer sleeve.

As will be explained in detail below, the present disclosure achieves improved heat insulation by defining an air gap between the inner cup and outer
sleeve. This is achieved by using a fold system on the outer sleeve to define the air gap. The bottom edge of the outer sleeve may also be configured to provide a gap between the outer sleeve and the inner cup at the bottom of the cup as is known in the art. The top edge of the outer sleeve is folded inwardly on itself to define a gap between the outer sleeve and the inner cup at the top of the cup. In this manner a continuous gap is created between the inner cup and outer sleeve from the bottom to the top of the outer sleeve. The contact strip formed by folding the top edge of the outer sleeve inwardly on itself forms a sufficient area for securely attaching the outer sleeve to the inner cup. The continuous gap reduces heat transfer from the inner cup to the outer sleeve and reduces the possibility of scalding especially when boiling water is held within the cup. As will be appreciated, the top edge of the outer sleeve is the portion of the outer sleeve that is adjacent to the lip of the inner cup, and the bottom edge of the outer sleeve is the portion of the outer sleeve that is adjacent to the base of the inner cup.

An exemplary arrangement of such a double-walled paper cup in accordance with an embodiment of the present disclosure is illustrated in Figure 3. Referring to Figure 3, the double-walled cup comprises an outer sleeve 301 circumferentially enveloping an inner cup 300. The inner cup 300 comprises a lip 304. The double-walled cup may have a frusto-conical shape having an increasing diameter from the bottom towards the top. Each of the outer sleeve 301 and inner cup 300 may be constructed from any suitable paper or cardboard. It will be understood that the term 'double-walled paper cup' in the context of the present disclosure is intended to comprise any suitable paper or cardboard. The paper or cardboard may be coated with either PE (polyethylene) or PLA (polyactic acid).

A bottom curl 302 may be provided at a bottom edge of the outer sleeve 301. The bottom curl 302 acts as a spacer to create an air gap between the planar region of the outer sleeve 301 and the inner cup 300. The gap formed at
the bottom of the cup between the outer sleeve 301 and inner cup 300 may be at least 3 mm in width.

In principle, use of an air gap is similar to the use of an insulating material. If an air gap is created between two layers, the air trapped between the two layers, air being a poor conductor of heat, acts as a barrier to heat transfer. Heat is transferred across an air space by a combination of conduction, convection and radiation. Heat transfer from a liquid held within the inner cup 300 to the outer sleeve 301 is primarily a result of conduction. As is known to those skilled in the art, heat transfer by conduction is inversely proportional to the width of the air gap. The width and uniformity of the air gap is a very important design parameter that governs its effectiveness by controlling the heat transfer coefficient as in the case of insulation.

It will be appreciated that a contact strip 303 is provided at the top edge of the outer sleeve 301. The contact strip 303 may be formed by folding the top edge of the outer sleeve 301 inwards on itself. That is, the top edge of the outer sleeve 301 may be folded onto an inner surface of the outer sleeve 301 to form the contact strip 303. Accordingly, it will be appreciated that the contact strip 303 has a thickness that is at least double the thickness of the outer sleeve 301. The inwardly folded top edge of the outer sleeve 301 may be attached to the inner surface of the outer sleeve 301 by adhesive such as glue or any other suitable means. In the exemplary embodiment, an approximately 5 mm portion of the top edge of the outer sleeve 301 may be folded to create the contact strip 303. The portion of the top edge of the outer sleeve 301 that is folded substantially constitutes the width of the contact strip 303. It will be understood with reference to Figure 3 that the width of the contact strip 303 refers to the axial distance by which the top edge of the outer sleeve 301 is folded. The outer sleeve 301 is thus configured to be attached to the inner cup 300 along the contact strip 303. Such a configuration allows for the outer sleeve 301 to be attached to the inner cup 300 along the entire width of the contact strip 303. Furthermore, the contact strip 303 acts as a spacer between the outer sleeve
301 and the inner cup 300. It will be understood that the spacer is effectively the thickness of the outer sleeve 301. The spacer creates an air gap between the outer sleeve 301 and the inner cup 300 at the top of the outer sleeve 301, the air gap being substantially equal to the thickness of the outer sleeve 301. The outer sleeve 301 may have a uniform thickness. In one embodiment, the thickness of the outer sleeve 301 may be about 1 mm. Thus, the air gap formed may also be about 1 mm in width.

It will be understood that the air gap may decrease from the bottom curl 302 to the contact strip 303. Nonetheless, it is the provision of a continuous air gap between the outer sleeve 301 and the inner cup 300 that provides heat insulating properties.

Referring to Figure 3, the contact strip 303 of the present disclosure does not affect the ability of the lip 304 to hold a lid in place. As described previously, the contact strip 303 may be formed by folding a portion or strip at the top of the outer sleeve 301 inwards such that the strip is co-planar with the inner surface of the outer sleeve 301. Therefore the outer sleeve 301 is separated from the inner cup 300 by a distance of at least the thickness of the outer sleeve 301.

The thickness of the lip 304 is thus only reduced by approximately the thickness of the contact strip 303, which in one embodiment is about 1 mm. Considering that the lip 304 may have a thickness of about 5 or 6 mm, this is a minimal impact on the size and therefore functionality of the lip 304. Thus, in accordance with an embodiment of the present disclosure, the lip 304 of the double-walled cup is configured to securely hold a lid in place.

The contact strip 303 of the double-walled cup of the present invention provides a sufficiently large contact area between the outer sleeve 301 and the inner cup 300 to provide a secure attachment therebetween. Referring to Figure 3, the contact strip 303 provides a co-planar contact area between the inner cup 300 and the outer sleeve 301. In the embodiment of the present disclosure shown in Figure 3, the contact strip 303 provides a contact area in the form of a
strip that extends around the circumference of the outer sleeve 301. In this manner, it may be observed that the total contact area between the outer sleeve 301 and the inner cup 300 may be the width of the contact strip 303 multiplied by the circumference of the contact strip 303. The width of the contact strip 303 may be approximately 5 mm or less.

Furthermore, the contact area provided by the contact strip 303 in accordance with an exemplary arrangement of the present disclosure provides ample room for attachment of the outer sleeve 301 to the inner cup 300. As previously mentioned, the margin of error for a hot melt process is generally only 3 mm. By providing a contact strip having a width of about 5 mm, sufficient tolerance is provided for an accurate cold glue process. Moreover, provision of a strip attachment means allows for a sufficient bonding area between the surface of the inner cup 300 and the outer sleeve 301 to keep the bond stable under normal use. That is, the contact area or strip is configured to ensure that a secure bond may be achieved between the outer sleeve 301 and the inner cup 300.

Any suitable attachment method or process for securely attaching the outer sleeve 301 to the inner cup 300 may be used. The double-walled paper cup of the present disclosure may be manufactured using either a hot or cold glue process. However, it has been found that a process that involves a combination of both hot and cold gluing processes provides optimal results.

Accordingly, a method of manufacturing a double-walled paper cup according to an embodiment of the present disclosure, comprises: forming an inner cup; forming an outer sleeve configured to circumferentially envelop the inner cup, comprising folding a top edge of the outer sleeve inwards on itself to form a contact strip for attachment to a portion of the inner cup adjacent to a lip of the inner cup, the contact strip defining a gap between the inner cup and outer sleeve; and attaching the outer sleeve at top and bottom circumferential edges thereof to the inner cup.
Figure 4 is a flow diagram illustrating a method 400 of manufacturing a double-walled cup, in accordance with an embodiment of the present disclosure. Referring to Figure 4, the method 400 includes forming an inner cup 401; forming an outer sleeve configured to circumferentially envelop the inner cup 402, comprising folding a top edge of the outer sleeve inwards on itself to form a contact strip for attachment to a portion of the inner cup adjacent to a lip of the inner cup, the contact strip defining a gap between the inner cup and outer sleeve; and attaching the outer sleeve at top and bottom circumferential edges thereof to the inner cup 403.

The inventors have found that using a two-stage gluing process involving both cold glue and hot melt glue provides optimal results in manufacturing such double-walled paper cups. Such a two stage process relies on using two gluing stations in the manufacturing process where both cold glue and hot melt processes are performed, respectfully.

The hot melt glue securely holds the outer sleeve to the inner cup during the manufacturing process and ensures a stable connection whilst manufacturing. Furthermore, the use of cold glue ensures an extremely robust connection during use of the double-walled cup, i.e., while the double-walled cup is holding a hot beverage.

Figure 5 is a flowchart illustrating a method 500 of manufacturing a double-walled paper cup, in accordance with an embodiment of the present disclosure. The process may be used to manufacture the double-walled cup as illustrated in Figure 3. The method of manufacturing the double-walled paper cup according to the present embodiment comprises using a cold glue process and a hot melt glue process to attach the outer sleeve and the inner cup together. The method may include applying the cold glue to the contact strip of the outer sleeve before the hot melt glue. The method may comprise inserting the inner cup into the outer sleeve so as to attach the outer sleeve and the inner cup together.
Referring to Figure 5, the method 500 of manufacturing the double-walled paper cup of the present disclosure may include forming the outer sleeve 501, applying cold glue to the contact strip of the outer sleeve 502, applying hot melt glue to the contact strip of the outer sleeve 503, positioning the outer sleeve and the inner cup in relation to each other 504, and attaching the outer sleeve and the inner cup together 505.

The first step may involve formation of the outer sleeve 501. The outer sleeve may be formed from a printed flat or blank. Using conventional techniques known to those skilled in the art, the sleeve may be manufactured by folding or curling a blank and gluing two ends of the blank together to form an outer sleeve having a frusto-conical shape as illustrated in Figure 3. The outer sleeve may then be transferred to a first turntable for further processing.

At the first turntable, a bottom curl may be formed at the bottom of the outer sleeve. That is, a bottom curl may be formed at the end of the outer sleeve that has the smaller diameter. As is known to those skilled in the art, the formation of a curl in the outer sleeve requires at least two stages. The next stage of the bottom curl formation involves tightening the bottom curl.

A curl may be formed in the outer sleeve by performing at least two curling stages and in addition clamping the outer sleeve in different ways during the different curling stages. The aim is to prevent the buckling of the outer sleeve wall during the curling stages such that the outer sleeve is clamped during the different curling stages in each case just below the upper rim of the cup sleeve or the already partially completed top curl. Due to this repeated clamping, the top curl may be dependably shaped without any fear of bulging or buckling of the outer sleeve.
The step of forming the outer sleeve 501 may include formation of the contact strip on the outer sleeve. Unlike the bottom curl, the contact strip may be formed in one step. The outer sleeve may be held securely just below the top of the outer sleeve to prevent buckling. A uniform strip or section of the outer sleeve may then be folded inwards as described above to form the contact strip.

After formation of the contact strip, the outer sleeve may be transferred to a second turntable and a silicone coating may be applied to the outer sleeve. The method for applying the silicone coating may be chosen as appropriate by those skilled in the art. The purpose of the silicone coating is to lubricate the paper before curling so as to prevent scraping or marking. The silicone coating also helps to form the lip as there are spinning wheels used to fold and curl lips. The silicone acts as a lubricant so the paper can be formed without damaging the surface of the print and the paper.

The next step in the formation of the double-walled paper cup is the gluing process. The gluing process may comprise the application of cold glue first 502 and then hot melt glue 503 due to the extremely short setting time of the hot melt glue. In the cold glue process, cold glue may be applied to at least a portion of the contact strip 502. A cold glue process known to those skilled in the art may be used to apply cold glue to the contact strip on the inner surface or inner circumference of the outer sleeve. The cold glue may not be applied to the entire area of the contact strip. Rather, cold glue may be applied to the contact strip of the outer sleeve so as to form at least one discontinuous portion of cold glue on the contact strip. In this regard, multiple spots of cold glue may be applied at regular intervals to the contact strip. In the hot melt glue process performed after the cold melt process, hot melt glue may be applied to at least a portion of the contact strip not covered with cold glue.

In one embodiment, a glue gun may be used to apply two spots of cold glue in total to the contact strip. The spots of cold glue may be applied directly
opposite each other i.e., at 180 degrees to each other along the circumference of the outer sleeve. Two spots of hot melt glue may be subsequently applied to the contact strip at opposite sides thereof. In this manner, all four spots of glue are spaced evenly apart on the contact strip. Specifically in this example, each spot of glue may be separated by 90 degrees on the circumference of the outer sleeve. Each of the spots of cold glue may be approximately 2 mm x 4 mm in size.

In this manner, a discontinuous series of cold glue portions may be formed on the contact strip 303. For example two spots of cold glue may be applied and a blank space, approximately equal to the area of the two spots, left before the application of two more spots of glue. Once the cold glue application process is completed, the contact strip may have cold glue applied to about 50% of its area. The remaining area is left with no portions of cold glue. The use of two spots of cold glue should not be considered limiting; a single spot of cold glue may be applied and a space (approximately the same size of the glued area) may be left before application of another spot of cold glue. Alternatively, cold glue may be applied to a larger continuous area of the contact strip.

After application of the cold glue to the contact strip, hot melt glue may be applied to the inner surface of the contact strip using a hot melt process 503. The hot melt glue may be applied to the remaining portions of the contact strip not covered with cold glue. In this regard, one or more spots of hot melt glue may be applied to the inner surface of the contact strip. After completion of the hot melt glue process 503, the contact strip may have glue applied to substantially all portions thereof, e.g., alternating areas of hot melt glue and cold melt glue. Each of the spots of hot melt glue may be approximately 2 mm x 4 mm in size.

As mentioned above, cold glue may be applied first 502 and then hot melt glue 503 due to the extremely short setting time of hot melt glue. Specifically, due to the short drying time, the outer sleeve should be attached to the inner
cup as soon as possible after application of the hot melt glue thereto. Otherwise, if the hot melt glue is applied to the contact strip first (before the cold glue), the hot melt glue may have already dried by the time the outer sleeve comes in contact with the inner cup. Furthermore, due to the rapid drying of the hot melt glue, it is important that the application of the hot melt glue may be the last step in the manufacturing step before the outer sleeve comes into contact with the inner cup.

In an alternative embodiment, only cold glue may be applied to the inner surface of the contact strip of the outer sleeve. That is, the cold glue process may comprise applying cold glue around at least a portion of the inner surface of the contact strip as described above. In this regard, one or more spots of cold glue may be applied to the contact strip. In another embodiment, multiple spots of cold glue may be applied at regular intervals to the contact strip. The method may alternatively comprise applying cold glue continuously along the contact strip.

The next step in the process may be positioning the outer sleeve and inner cup in relation to each other 504. The inner cup may be manufactured using a separate process and provided to the aforementioned second turntable as needed. In this regard, the inner cup may be inserted into the outer sleeve. It will be understood that due to the outer sleeve having a frusto-conical shape having an increasing diameter from the bottom towards the top, the inner cup may be effectively inserted into only one end of the outer sleeve, namely the end with the greatest diameter. Thus, the insertion of the inner cup into the outer sleeve may comprise inserting the base portion of the cup through the end of the outer sleeve with the greatest diameter until both ends of the outer sleeve fit around the inner cup. The insertion of the inner cup into the outer sleeve may comprise a downward motion. After fitting the inner cup into the outer sleeve, the outer sleeve circumferentially envelops the inner cup.
The next step in the manufacturing method comprises attaching the outer sleeve to the inner cup 505. This step may involve pressing the contact strip firmly against the outer wall of the inner cup 505. This ensures that a continuous contact is achieved at all points. A roller device may be used to achieve this. For example, pressure may be applied to the inner wall of the inner cup to oppose a corresponding force applied to the contact strip. The bottom curl of the outer sleeve may also be attached to the inner cup. In this regard, the bottom curl of the outer sleeve may be attached to the inner cup using a hot melt glue process.

As alluded to above, before the inner cup is inserted into the outer sleeve, hot melt glue may be applied to the bottom circumferential portion of the inner cup. In conventional double-walled paper cup manufacturing processes, the glue is placed on the bottom circumferential portion of the outer sleeve first before the inner cup is pushed down. At the base of the cup this has the potential to cause cosmetic problems as the glue tends to be pushed down past the bottom curl as the inner cup pushes through. To prevent this, hot melt glue may be applied to the inner cup before it is inserted into the outer sleeve. This has the effect of pushing the glue up rather than away from the visible portion of the base of the cup, preventing cosmetic damage. More specifically, one or more spots of hot melt glue may be applied to the bottom circumferential portion of the inner cup corresponding to the bottom curl of the outer sleeve. Each of the one or more spots may be approximately 2 mm x 4 mm in size. The one or more spots may be applied at different positions on the bottom circumferential portion of the inner cup. In one embodiment, two spots of hot melt glue may be applied at different positions on the bottom circumferential portion of the inner cup. In an embodiment, two spots of hot melt glue may be applied at positions 180 degrees apart on the bottom circumferential portion of the inner cup. The one or more spots of hot melt glue spread upon contact with the outer sleeve.

Since the outer sleeve under downward pressure causes the bottom curl to "curl more" it does not tear apart the paper layers leaving it structurally intact.
The mechanism for attaching the bottom curl of the outer sleeve to the inner cup according to the present embodiment strengthens the bond. This ensures that a strong bond is formed between the outer sleeve and inner cup. In conventional attachment mechanisms, the paper configuration is not strong enough to ensure that the outer sleeve stays glued whilst downward pressure is applied as the inner cup is pushed downward. This is because the paper simply unravels at the contact strip, tearing very easily. This is not a problem related to the glue, but is caused because the paper is made in layers and can be easily separated if pressure in the right direction is applied. According to this embodiment of the application, the application of hot melt glue on the inner cup means the paper does not unravel and the outer sleeve is secured to the inner cup no matter what downward pressure. The process of manufacture is configured so that the hot melt glue is applied to the inner cup before being inserted into the outer sleeve. In this manner, glue is prevented from reaching below the bottom curl. The hot melt glue may be applied to the inner cup before being transferred to a joining station where it is inserted into the outer sleeve. The rate of application of hot melt glue to inner cups may be 180 cups per minute. Thus, the hot melt glue does not have time to cool before being inserted into the outer sleeve.

As described above, the gluing process comprises a cold glue process and a hot melt glue process. Both cold glue and hot melt glue may be applied to the contact strip of the outer sleeve in order to attach the contact strip of the outer sleeve to the inner cup. Alternatively, only cold glue may be applied to the contact strip of the outer sleeve in order to attach the contact strip of the outer sleeve to the inner cup. That is, hot melt glue may not be applied to the contact strip at all. The bottom curl of the outer sleeve may be attached to the inner cup using a hot melt glue process as described above.

The final step in the method may be the ejection of the completed doublewalled cup for further processing such as packaging, etc. As will be understood by those skilled in the art, the above method may take place on a single
"double-walling" machine having two turntables. Such a machine may be configured to carry out all of the steps described above and shown in Figure 5. Once a first outer sleeve has been transferred from the first turntable, after creation of the contact strip, a second outer sleeve may be supplied to the first turntable. In this way, a continuous and rapid method of manufacturing the double-walled cups can be ensured.

Figure 6 is a flow diagram illustrating a more detailed method 600 of manufacturing a double-walled cup, in accordance with an embodiment of the present disclosure. Referring to Figure 6, the process 600 comprises the outer sleeve formation 601, transfer of the outer sleeve to a first turntable for further processing 602, formation of a bottom curl 603, tightening of the bottom curl 604, creation of the contact strip 605, transfer of the outer sleeve to a second turntable 606, silicone application to the outer sleeve 607, cold glue application 608, hot melt glue application 609, attachment of inner cup and outer sleeve 610, pressing the outer wall and inner cup together 611, and ejection 612.

It should be appreciated that the gluing process involving both the application of hot and cold glue is critical to the manufacturing process. By applying cold glue and hot melt glue in this order, a rapid connection is established ensuring a continuous manufacturing process while also ensuring the long term structural integrity of the double-walled cup. Further, as described above, by application of hot melt glue to the bottom circumferential portion of the inner cup before the inner cup is inserted into the outer sleeve, the outer sleeve can be secured to the inner cup irrespective of downward pressure and glue is prevented from reaching below the bottom curl.

Furthermore, by only having to use a relatively small amount of hot melt glue, the cost of manufacturing is reduced. For example, a maximum of 50% of the area of the contact strip may have hot melt glue applied. However, in other cases, this area may be greatly reduced and the cold glue may be the main...
bonding agent used. In other cases as described above, hot melt glue may not be applied to the contact strip at all.

The present disclosure also provides a double-walled paper cup which is manufactured using any of the above-described processes. That is, the present disclosure provides a double-walled paper cup which is manufactured using a cold glue process and a hot melt glue process. Both cold glue and hot melt glue may be applied to a contact strip of the outer sleeve in order to attach the contact strip of the outer sleeve to the inner cup. Alternatively, only cold glue may be applied to the contact strip of the outer sleeve in order to attach the contact strip of the outer sleeve to the inner cup. That is, hot melt glue may not be applied to the contact strip at all. A bottom curl of the outer sleeve may be attached to the inner cup using a hot melt glue process as described above.

The words comprises/comprising when used in this specification are to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.
Claims

1. A double-walled paper cup comprising:
   an inner cup; and
   an outer sleeve configured to circumferentially envelop the inner cup and to be attached at top and bottom circumferential edges thereof to the inner cup;
   wherein the top edge of the outer sleeve is folded inwards on itself to form a contact strip for attachment to a portion of the inner cup adjacent to a lip of the inner cup, the contact strip defining a gap between the inner cup and outer sleeve.

2. The cup of claim 1, wherein the contact strip is configured to be attached to the inner cup such that the outer sleeve is separated from the inner cup by a distance of at least the thickness of the outer sleeve.

3. The cup of claim 1 or 2, wherein the contact strip is formed by folding a strip at the top edge of the outer sleeve inwards such that the strip is co-planar with the inner surface of the outer sleeve.

4. The cup of any preceding claim, wherein the contact strip is formed by attaching the inwardly folded top edge of the outer sleeve to an inner surface of the outer sleeve.

5. The cup of claim 4, wherein the inwardly folded top edge of the outer sleeve is attached to the inner surface of the outer sleeve by adhesive.

6. The cup of any preceding claim, wherein the contact strip has a thickness that is at least double the thickness of the outer sleeve.

7. The cup of any preceding claim, wherein the contact strip forms a co-planar contact area between the outer sleeve and the inner cup.
8. The cup of any preceding claim, wherein the outer sleeve is configured to be attached to the inner cup along the entire width of the contact strip.

9. The cup of claim 7 or 8, wherein the contact area between the outer sleeve and the inner cup is the width of the contact strip multiplied by the circumference of the contact strip.

10. The cup of any preceding claim, wherein the width of the contact strip is approximately 5 mm or less.

11. The cup of any preceding claim, wherein the outer sleeve has a uniform thickness.

12. The cup of any preceding claim, wherein the outer sleeve has a thickness of approximately 1 mm.

13. The cup of any preceding claim, wherein the lip is configured to receive a lid.

14. The cup of claim 13, wherein the lip has a thickness of 5 or 6 mm.

15. The cup of any preceding claim, wherein the bottom edge of the outer sleeve is configured in the shape of a bottom curl which defines a gap between the bottom of the outer sleeve and the inner cup.

16. The cup of claim 15, wherein the gap defined between the bottom of the outer sleeve and the inner cup is at least 3 mm in width.
17. The cup of claim 15 or 16, wherein the contact strip and the bottom curl define a continuous gap between the inner cup and outer sleeve from the bottom to the top of the outer sleeve.

18. A method of manufacturing a double-walled paper cup, comprising:
   forming an inner cup; and
   forming an outer sleeve configured to circumferentially envelop the inner cup, comprising folding a top edge of the outer sleeve inwards on itself to form a contact strip for attachment to a portion of the inner cup adjacent to a lip of the inner cup, the contact strip defining a gap between the inner cup and outer sleeve; and
   attaching the outer sleeve at top and bottom circumferential edges thereof to the inner cup.

19. The method of claim 18, comprising attaching the outer sleeve to the inner cup using a cold glue process and a hot melt glue process.

20. The method of claim 19, comprising applying cold glue to the contact strip of the outer sleeve.

21. The method of claim 19 or 20, comprising in the cold glue process applying cold glue to at least a portion of an inner surface of the contact strip.

22. The method of claim 21, wherein the cold glue process comprises applying cold glue discontinuously along the contact strip.

23. The method of claim 21 or 22, comprising applying cold glue to about 50% of the area of the contact strip.

24. The method of any of claims 21 to 23, comprising applying one or more spots of cold glue to the contact strip.
25. The method of claim 24, comprising applying multiple spots of cold glue at regular intervals to the contact strip.

26. The method of claim 21, wherein the cold glue process comprises applying cold glue continuously along the contact strip.

27. The method of any of claims 19 to 26, comprising applying cold glue first and then hot melt glue to the contact strip of the outer sleeve.

28. The method of claim 27, comprising in the hot melt glue process performed after the cold gluing process, applying hot melt glue to the inner surface of the contact strip.

29. The method of claim 28, comprising applying hot melt glue to at least a portion of the inner surface of the contact strip not coated with cold glue.

30. The method of claim 28 or 29, comprising forming alternating areas of hot melt glue and cold melt glue on the contact strip.

31. The method of any of claims 28 to 30, comprising inserting the inner cup into the outer sleeve immediately after application of the hot melt glue.

32. The method of any of claims 18 to 31, comprising configuring the bottom edge of the outer sleeve in the shape of a bottom curl which defines a gap between the bottom of the outer sleeve and the inner cup.

33. The method of claim 32, comprising attaching the bottom curl of the outer sleeve to a bottom circumferential portion of the inner cup.
34. The method of claim 33, comprising attaching the bottom curl of the outer sleeve to the bottom circumferential portion of the inner cup using hot melt glue.

35. The method of claim 33 or 34, comprising applying hot melt glue to the bottom circumferential portion of the inner cup.

36. The method of claim 35, comprising applying one or more spots of hot melt glue at different positions on the bottom circumferential portion of the inner cup.

37. The method of claim 35 or 36, comprising applying two spots of hot melt glue at different positions on the bottom circumferential portion of the inner cup.

38. The method of claim 37, comprising applying the two spots of hot melt glue at positions 180 degrees apart on the bottom circumferential portion of the inner cup.

39. The method of any of claims 36 to 38, wherein each of the one or more spots of hot melt glue comprise an area approximately 2 mm x 4 mm in size.

40. The method of any of claims 35 to 39, comprising applying the hot melt glue to the bottom circumferential portion of the inner cup before inserting the inner cup into the outer sleeve.

41. The method of any of claims 18 to 40, comprising inserting the inner cup into the outer sleeve.

42. The method of claim 41, wherein the insertion of the inner cup into the outer sleeve comprises inserting the base portion of the cup through the
end of the outer sleeve with the greatest diameter until both ends of the outer sleeve fit around the inner cup.

43. The method of claim 41 or 42, wherein the insertion of the inner cup comprises a downward motion.

44. The method of any of claims 41 to 43, comprising inserting the inner cup into the outer sleeve immediately after applying hot melt glue to the bottom circumferential portion of the inner cup.

45. The method of any of claims 41 to 44, comprising pressing the contact strip against the outer wall of the inner cup.

46. A double-walled paper cup manufactured using the method of any of claims 18 to 45.
400

Form Inner Cup

Form outer sleeve configured to circumferentially envelop the inner cup

Attach the outer sleeve at top and bottom circumferential edges thereof to the inner cup

Figure 4
Figure 6
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D3/22 B65D81/38
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D B65B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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column 4, line 11 - line 12; figure 3

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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

**A** document defining the general state of the art which is not considered to be of particular relevance

**E** earlier application or patent but published on or after the international filing date

**L** document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another document or other special reason (as specified)

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**X** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

**Y** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

**S** document member of the same patent family

Date of the actual completion of the international search

2 December 2015

Date of mailing of the international search report

10/12/2015

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk
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Czerny, M
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