Feb. 10, 1942. R. G. AMBERG 2,272,499

PAPER CUP AND BLANK THEREFOR

Original Filed May 6, 1939

Fig. 1

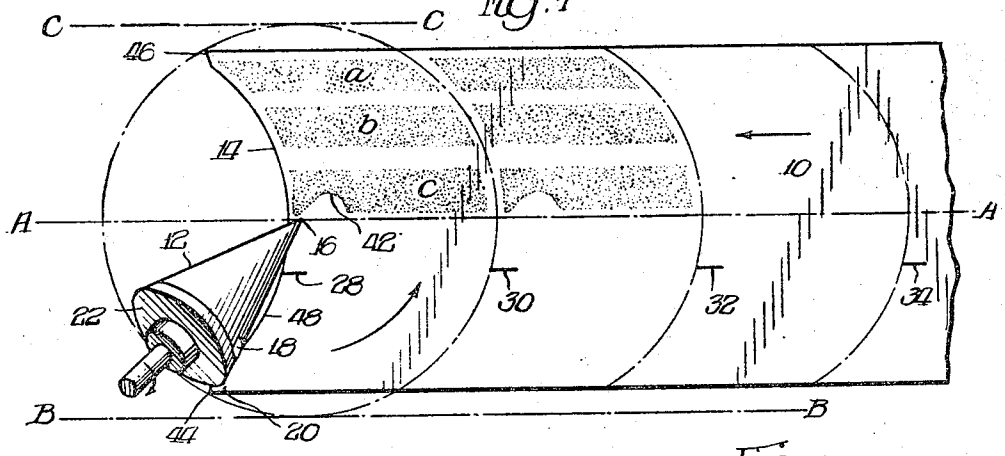


Fig. 2.

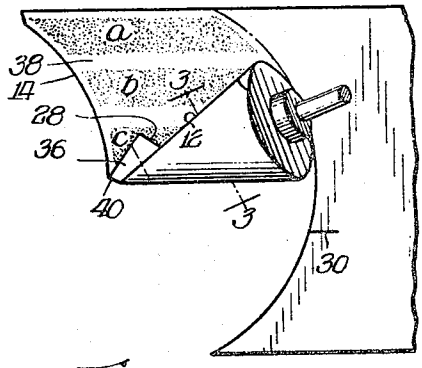


Fig. 3.

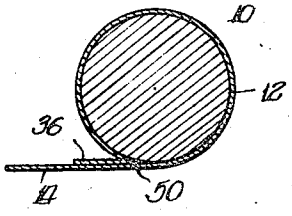


Fig. 11.

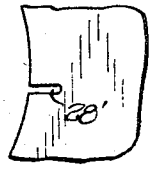


Fig. 4

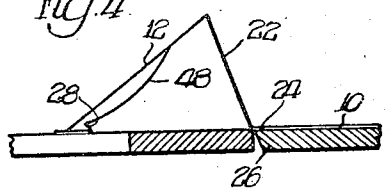


Fig. 5.

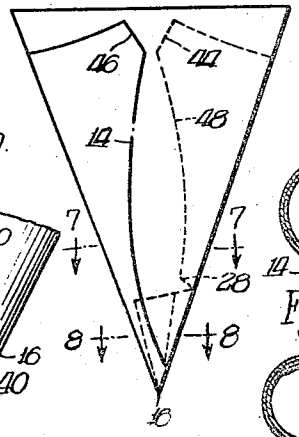


Fig. 10.

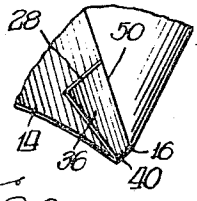


Fig. 9.

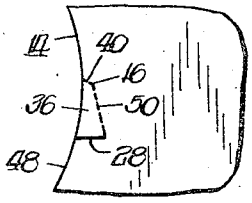


Fig. 7

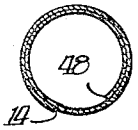


Fig. 8

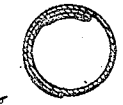
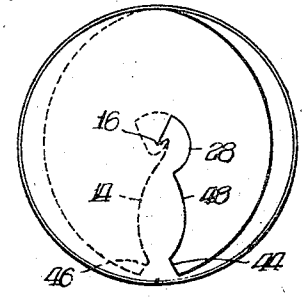


Fig. 6



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Patented Feb. 10, 1942 2,272,499

UNITED STATES PATENT OFFICE

2,272,499

PAPER CUP AND BLANK THEREFOR

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Original application May 6, 1939, Serial No. 272,080. Divided and this application October 14, 1939, Serial No. 299,497

6 Claims. (Cl. 229—1.5)

This invention relates to the manufacture of paper cups and more particularly paper cups of the type described in United States Patents Nos. 2,056,893, 2,139,613 and 2,139,614, all granted to Walter E. Amberg. The invention is especially concerned with the production of an improved type of cup by a new and improved method by which the cup is formed from a continuous strip of paper.

The type of cup described in the aforementioned patents is made practically entirely without waste, and therefore, it is one of the most economical cups ever developed. An important feature of the manufacture of this cup, as pointed out in United States Patents Nos. 2,139,613 and 2,139,614, resides in the fact that the cup is formed from a continuous strip of paper. Usually cone-shaped paper cups having a pointed apex are made by forming initially a paper blank and subsequently rolling or winding the blank thus formed into a conical vessel. In most instances it has been necessary to die-cut blanks from paper and stack them one upon another in a magazine from which they are fed singly to a pair of cup forming cones.

In other instances it has been proposed to cut the blanks from a continuous strip of paper or web and to feed the blanks thus cut singly one by one to cup forming cones. In all of these instances it has been customary to have a certain amount of waste which is produced during the die cutting, the blank forming or the cup forming operations. In the first of these instances the waste results from the paper between adjacent die cuts, in the second, by the paper which is disposed between adjacent cup blanks and is rejected as surplusage, and in the third by the excess paper which is trimmed from the blank by means of a knife engaging with the base of one of the cones.

In making paper cups of the type covered by the patents previously mentioned and according to the methods described therein, all waste may be eliminated and at the same time every portion of the paper is used in forming and reinforcing the cup. For convenience it is sometimes desirable to cut off sharp ends of the paper strip prior to or during the cup forming operation but the amount of paper thus lost is negligible from the practical point of view.

One of the problems encountered in the formation of paper cups of the type described is the proper formation of the apex of the cup in order to render the cup entirely leakproof. It will be observed, for example, in considering United States Patent No. 2,139,614, that a continuous strip of material adapted to be formed into a series of cups in succession is advanced to a forming mandrel in such a way that the forming operation begins in proximity to the leading edge of the material or more specifically, at the center of radius of curvature of that portion of the cup which is to form the mouth. The forming mandrel in this particular operation rotates around its own axis and also in an orbit, and in so doing presses against a smooth fixed surface which serves as a pad or presser plate during the operation of forming the cup. Each time the mandrel rotates in its orbit a cup is formed and discharged and at the time the mandrel discharges the cup, the paper strip advances again to be in position for another forming operation. When it is realized that this cup forming operation may take place at speeds from 150 to 250 cups per minute, or even higher, it will at once be understood that the problem of properly forming the apex becomes extremely important.

Various types of instrumentalities may be used to feed the paper strip to the forming cone, the feed being either continuous or intermittent. Many types of devices may be employed to assist the feeding operation. Likewise, a number of different devices may be employed to assist the formation of the apex of the cone, but from every standpoint it is desirable to have the machine as simple as possible. At the same time it is desirable to form the cups in such a way that leakage is practically out of the question.

With the foregoing considerations in mind, one of the objects of the present invention has been to provide a new and improved type of paper cup having a leakproof apex.

Another object has been to provide a paper cup of the character described in which the apex is formed accurately, conveniently and simply.

Still a further object is to provide a method of forming paper cups having an improved leakproof apex which is extremely simple in operation and simplifies rather than complicates the cup forming machine. Other objects will appear hereinafter.

According to this invention it has been found that in making cone-shaped cups having an apex from material so shaped that opposite sides have the same radius of curvature, one of said sides being convex and the other concave, the simple expedient of forming a slit in the leading or concave edge of the material prior to or, if desired, during the operation, leads to the production of a new and improved type of cup in which

the apex is capable of remaining leakproof even when a liquid is allowed to stand in the cup over a long period of time. This is particularly true, for example, of cups which are used as soda cups, although the accuracy with which the apex is formed is also important in connection with ordinary drinking cups.

The method involved is particularly well adapted for use in connection with the formation of cone-shaped cups having a pointed apex where a strip of material from a continuous roll is advanced to a conical former in such a manner that the forming operation begins from the leading edge of said material. According to this invention the strip of material may be partially severed at intervals throughout its length so that as it advances into the orbit of a mandrel rotating around its axis and also in a circular path against a smooth fixed surface the mandrel being equipped with a cutting edge severs the strip transversely along a line of severance which intersects the previously severed slits and thereby forms a slit in the leading edge for the next cup forming operation.

The slit thus formed in the forward edge of the strip of paper is usually spaced a substantial distance from the apex of the cup or the center of the mandrel orbit and is on that side of the apex from whence the cup forming operation is begun. The mandrel is provided with means for holding the paper against it as it rotates in contact therewith. Thus, according to a preferred method of operation, as a cone-shaped mandrel rotates about its own axis and in an orbital path, it picks up the leading edge of the paper, thereby beginning to wind the paper into the form of a cone. As the winding operation continues the cutting edge of the mandrel severs the paper along a path transversely of the longitudinal axis of the paper. The gripping means whereby the paper is gripped to the mandrel is normally placed adjacent the base or outer portion of the mandrel. During the initial stages of the winding operation the portion of the paper adjacent the gripping means will be held closely against the mandrel but the slit in the leading edge of the paper causes that portion of the paper adjacent the slit and particularly that portion of the paper between the slit and the apex point to fly outward and be more or less free from the mandrel. Prior to or during the forming operation an adhesive is applied to a face portion of the paper strip which is ultimately to form an overlap or seam in the finished cup. The face of the free portion or flap on the leading edge of the strip caused by the slit is brought into contact with this adhesive as the mandrel continues to roll in its orbit and thus, firmly seals the flap in an area adjacent the apex portion of the cup, thereby forming a glued flap of material at the apex. At the same time a reverse crease is formed between the interior point at which the slit terminates and the apex point. This flap of material becomes enveloped by the overlap as the rotation of the mandrel is completed. The cup is thereafter discharged and a new forming operation begun almost immediately. In the meantime, prior to each succeeding forming operation and during the time that the cup is being discharged, the paper strip is brought into position for the next forming operation. One of the features of this invention is to be found in the fact that the whole operation of sealing the apex in the manner described is accomplished by forming a slit in a paper strip at predetermined intervals and without the necessity for using any other instrumentalities whatsoever. The speed of operation is not decreased. Furthermore, by using a method of this type it has been found that certain devices heretofore employed to assist the advancement of the paper can be discarded, thus simplifying the machine and decreasing the cost of operation.

Other features and advantages of the invention will become apparent from a reading of the following specification in the light of the accompanying drawing, in which:

Figure 1 is a top plan view illustrating somewhat diagrammatically the method of the present invention;

Figure 2 is a view of the cup being wound upon the former of Figure 1;

Figure 3 is an enlarged cross-sectional view taken through line 3—3 of Figure 2;

Figure 4 is a view in section of the cup former and cutting knife;

Figure 5 is a side elevational view of the completed cup;

Figure 6 is a plan view of the cup shown in Figure 5;

Figures 7 and 8 are views in section taken through 7—7 and 8—8 of Figure 5, respectively;

Figure 9 is a plan view of the apex portion of the cup unwound to show the position of the creases and slit;

Figure 10 is a view in perspective of the apex of the cup partially formed as in Figure 2; and

Figure 11 shows a modified form of blank.

In the drawing the machine and method are purposely shown somewhat diagrammatically. The actual machines which have been constructed to embody the present invention contain many details of design and construction which are subject to much variation and which although useful are not considered patentable and hence, are not being disclosed or claimed herein. On the contrary, only the basic important and broadly novel features of the invention are disclosed and claimed in order that the importance of such features will not be obscured or overshadowed by the inclusion of mere details of feeding mechanisms, gluing devices, gear arrangements, supports, stackers and the like. All of these latter named instrumentalities are old and exist in many different forms so that any mechanic skilled in the art can quickly and conveniently adopt and adapt them for the practice of this invention.

Turning now to Figure 1, a continuous strip of paper 10 coming from a roll or other suitable source of supply is fed by a suitable mechanism to a forming cone 12. In actual operation the forward or breast edge 14 of the paper strip is fed into the position illustrated in Figure 1 in which apex point 16 in proximity to the center of edge 14 coincides with the apex of the former 12 and when it reaches this point the former rolling over the end of the paper strip causes further feed of the paper to be temporarily suspended while a cup rolling or winding operation takes place.

The conical cup former 12 rotates about its own axis and simultaneously moves through a circular orbit of which, in the construction illustrated in Figure 1, the axis of the cone forms the center. In the position illustrated a mechanical latch or clamp 18, known in the art as a "pick-up," engages the forward extremity 20 of the paper strip and as the mandrel continues to rotate and move bodily in its circular path, the

forward end of the strip is wound around the cone 12. This winding operation starts the instant the pick-up 18 engages extremity 20 of the paper strip and continues until the formation of the cup is complete. To prevent the continuous strip 10 from being torn and twisted it is necessary to sever the cup from the end of the strip and this is done simultaneously with the cup forming operation.

As shown in Figure 4, the rear edge 22 of conical former 12 is sharpened to serve as a cutting edge and it cooperates with a cutting edge 24 formed on the forward extremity of a platform 26 across the upper surface of which paper strip 10 is fed. The contour of cutting edge 22 is arcuate and corresponds identically to the path followed by the cone edge during the course of its operation about the table or smooth surface upon which the cone shaped former 12 is mounted. As the cup is completed it is stripped from conical former 12 by any convenient stripping device such as compressed air, a movable tip or plunger forming the apex of the conical former, or a stripping wheel which engages the exterior of the cup. The glue lines *a*, *b* and *c* may be applied to the paper strip at any convenient point with any suitable type of gluing mechanism such as applicator rolls.

The essential feature of the present invention resides in the provision of the slits 28, 30, 32 and 34 at predetermined intervals in paper strip 10, as shown in Figure 1. These slits are so placed that they intersect the line of severance of cutting edge 22 with paper strip 10. Thus, as shown in Figure 2, when mandrel 12 has partially completed its orbital path and has partially formed a paper cup, slit 28 has caused a portion 36 of the leading edge of the paper to separate from the body of the paper cup and extend outwardly. This outwardly extending portion or flap 36 becomes sealed by means of glue line *c* across the upper face of the paper and is thereafter overlapped by overlapping portion 38, whereby the flap 36 is sealed within the overlapped seam. It will be observed that the winding operation causes a reverse crease 50 to be formed between the apex point and the innermost extremity of the slit, as shown in Figures 3, 9 and 10. By a reverse crease is meant a crease in which the face of the flap is bent backward or reversed with respect to the face of the strip. A regular crease 40 is also formed.

It is practically impossible for a cup made in this manner to leak. The sealing of the flap to the face of the overlap is in itself sufficient to seal the apex and the further sealing of the flap into the seam prevents any possibility of leakage either from cracking of the paper at the apex or otherwise.

As shown in Figure 1, the glue line *c* may be partially offset at point 42 in order that no glue comes into contact with the interior of the cup. This offset should be large enough to take care of the space created by pocket portion 36. In order to add to the attractiveness of the cup, the ends of the paper at points 44 and 46 may be severed in any suitable manner, thus producing an effect as shown in Figure 5. It will be observed that in Figure 5 that part of the leading edge of the strip between point 44 and slit 28 is represented by reference numeral 48, this edge being on the inside of the cup.

According to the modification of the invention shown in Figure 1, the line A—A forms the central axis of the strip and is also a line joining the centers of radius of curvature of the arcs along which the strip is transversely severed. Thus, point 16 which forms the apex of the cup, falls on line A—A and the corresponding point in each succeeding cup will also fall on line A—A. It is not essential, however, that the line A—A correspond to the central axis of the strip, nor that the shape of the blank which is ultimately to be formed be exactly as shown in Figure 1. For instance, the edge of the strip at which the forming operation is started may correspond to line B—B, the other edge remaining just as shown in Figure 1, or the edge of the strip may correspond to the line C—C on the other side. In either event, the longitudinal axis A—A would be to one side of the center of the strip. Where it is desired to have a cup of double thickness throughout the area adjacent the mouth of the cup, this can be accomplished by extending the width of the paper so that one edge corresponds to the line C—C and the other to the line B—B. If a cup were to be unrolled after it has been formed, as described in Figure 1, it would be found that the shape is that of a four-sided figure, two sides being curved and two sides straight, whereas, if either edge of the paper is extended to the line C—C or to the line B—B, but not both, the shape of the figure from which the cup is formed would be a three-sided figure, two sides curved and one straight, and if both edges are extended to lines C—C and B—B, the shape of the cup is a two-sided figure with both sides curved. The shape of the material from which the cup is formed is preferably such that opposite sides have the same radius of curvature, one of said sides being convex and the other concave with the concave side containing a slit, cut or other line of severance. It will be understood, however, that the invention, in its broader aspects, is not limited to the formation of cups of this particular type. For example, a similar cut or slit may be made in the lower edge of the rectangular blank shown in United States Patent No. 1,434,934, granted to Van Sant November 7, 1922.

The slit, cut or other line of severance on the forward edge preferably extends in a longitudinal direction with respect to the paper strip, although it may extend in other directions just so long as the effect of the slit during the forming operation is to permit a portion of the forward edge to separate in such a manner that the separated portion or flap is sealed face to face against an overlapping portion of the paper in the manner previously described.

The slit or partial severance of the paper strip as described in accordance with this invention may be at different points on the leading edge, or in that portion of the paper which is ultimately to become the leading edge. This will vary somewhat depending upon the desired size of the pocket portion at the apex of the cup and the size is controlled by the depth of the slit and by its distance from the apex point of the cup. Naturally with a larger sized cup a larger slit and a larger sized sealed flap portion may be formed adjacent the apex. The slit need not be severed in a single line but may be wedge-shaped or any other convenient shape. For example, as shown in Figure 11, the cut or severed portion 28 in the forward edge of the blank may have a rounded inner extremity to prevent tearing with certain types of paper when the cup is wound. For a similar purpose and to otherwise assist the formation of the crease, the table

or surface upon which the cone-shaped former is mounted may be provided with a slightly raised portion where the reverse crease is to be formed designed to complementally fit into and coincide with a hollow or dished out portion on the face of former 12, not shown. Many other variations may be made in the method described without departing from the invention.

This invention makes it possible to form with great rapidity a new and improved type of paper cup which is leakproof in every respect. As previously indicated, this type of cup is especially useful in the larger sizes of cups such as are employed as soda cups. In this type of cup the tendency to leak is unusually great because it is often customary to allow liquids to stand in such cups over a long period of time. In many instances special glues are required in order to keep a cup of this type from springing a leak at the seams, but in a cup made according to the present invention, the ordinary types of glues employed in the manufacture of paper cups may be used. It will be appreciated that this type of cup is extremely economical to manufacture. Not only can the cup be made without special attachments on the machine, but also the method of making it is such that certain attachments heretofore employed can be eliminated. For instance, among the attachments which can be eliminated are those attachments which are used to insure that the paper is fed to the forming mandrel at the proper time. With the present method of manufacture, the apex of the cup is formed accurately prior to the completion of the forming operation and the speed of the mandrel may be so coordinated with the continuous feed of the paper that no attachments are necessary to see that the paper is fed to the proper position in the mandrel orbit. Thus, the paper may be fed continuously from a roll and as the leading edge reaches the position shown in Figure 1, it will be picked up by the mandrel and the mandrel itself rolling over the paper will stop the forward motion of the paper, causing it to pile up slightly ahead of the mandrel, but as soon as the severing operation is completed the paper will immediately advance and be in position for the next swing of the mandrel through its orbit. No intermittent feed of the paper strip is necessary because the formation of the cups is automatically taken care of by coordiation of the rotating mandrel with the continuous feed.

The invention is particularly applicable to the manufacture of paper cups from a continuous strip where the cup is formed on the end of the strip and simultaneously severed as it is being wound, thereby avoiding the separate formation and handling of blanks. This is possible by virtue of the fact that the end portion of the strip retains its same relative position with respect to the remainder of the strip as it is being wound. The invention can also be employed, however, in cup forming operations where a blank is first formed. In this instance, the slit is made as already described in the forward edge of the blank which may be straight or curved. The blank may be severed transversely from a strip already containing the slits at predetermined intervals, or the blanks may be formed and then slit. Other materials besides paper may be employed, for example, regenerated cellulose, cellulose acetate, etc.

Certain other types of cups have heretofore been made from blanks having a cut or line of severance extending to the apex point of the cup but this type of cut or line of severeance would defeat the purpose of this invention. It is important for the purpose of this invention that the cut or line of severance terminate in the body of the blank thereby causing the formation of a reverse crease between the point of termination of the cut and the apex point, as distinguished, for example, from Hutt et al., U. S. Patent 2,114,470, where the line of severance terminates below the apex point and is primarily for the purpose of forming an overlapping shoulder. A reverse crease or flap is formed not between the interior point of termination of the cut and the apex point, as in the present invention, but between the apex point and a side edge. The method described in the aforesaid patent does not lend itself to the formation of cups on the end of a continuous strip. Furthermore, it is of outstanding importance in the present invention that the reverse flap caused by the cut in the edge of the material be sealed to the face portion of the material as the cup is wound, whereas the flap or wing in the above mentioned patent is said to be provided to prevent slippage and is not sealed to the blank.

This application is a division of my co-pending application Serial No. 272,080, filed May 6, 1939, which is directed more particularly toward a method or process of making cone-shaped vessels having a pointed apex, as herein disclosed.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A blank for forming cone-shaped paper cups having a pointed apex, comprising opposite curved sides of the same radius of curvature and two straight parallel sides intersecting said curved sides, one of said curved sides being convex and the other concave with the center of radius of curvature of the convex side within the blank and the concave side having a slit therein at a point between the apex point and one of the straight sides, said slit terminating in the body of the blank and being so directed that a reverse crease is formed in the body of the blank between the point of interior termination of the slit and the apex point when the blank is wound into a cup.

2. A blank for forming cone-shaped paper cups having a pointed apex, comprising two opposite curved sides intersecting each other, one of said sides being convex and the other concave with the same radius of curvature and with the center of radius of curvature of the convex side within the blank, the concave side having a slit therein between the apex point and the point of intersection of the two sides, said slit terminating in the blank at a point separated from the apex point and being so directed that a reverse crease is formed in the body of the blank between the point of interior termination of the slit and the apex point when the blank is wound into a cup.

3. A blank for forming cone-shaped paper cups having a pointed apex, comprising two curved sides and a straight side, one of said curved sides being convex and the other concave with the center of radius of curvature of the convex side within the blank, the concave side having a slit therein terminating in the blank at a point intermediate between the apex point and the straight side and so directed that a reverse crease is formed in the body of the blank between the point of interior termination of the slit and the apex point when the blank is wound into a cup.

4. A cone-shaped cup having a pointed apex formed from a blank comprising sides of the same

radius of curvature, one of said sides being convex and the other concave with the center of the radius of curvature of the convex side within the blank and with a slit in the concave side terminating in the blank at a point separated from the apex point, said blank being wound around the center of radius of curvature of the convex side as the apex point and said slit being so positioned that a reverse crease is formed in the body of the blank between the point of interior termination of the slit and the apex point thereby forming a flap and said flap being sealed face to face with an overlapping portion of the blank.

5. A cone-shaped cup having a pointed apex formed from a blank, comprising opposite curved sides of the same radius of curvature and two straight parallel sides intersecting the said curved sides, one of said curved sides being convex and the other concave, with the center of the radius of curvature of the convex side within the blank and with a slit in the concave side terminating in the blank at a point intermediate between the apex point and one of the straight sides, said blank being wound around the center of radius of curvature of the convex side as the apex point and said slit being so positioned that a reverse crease is formed in the body of the blank between the point of interior termination of the slit and the apex point.

6. A cone-shaped cup of substantially true conical form wound from a blank, comprising two curved sides and a straight side, one of said curved sides being convex and the other concave, with the center of radius of curvature of the convex side within the blank and with a line of severance in said concave side terminating in the blank at a point intermediate between said center of radius of curvature of said convex side and the straight side, and so positioned that a reverse crease is formed in the body of the blank extending substantially between the point of interior termination of the slit and said center of radius of curvature of said convex side, said blank being wound substantially around the center of radius of curvature of the convex side as the apex, with the convex side forming the mouth of the cup.

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