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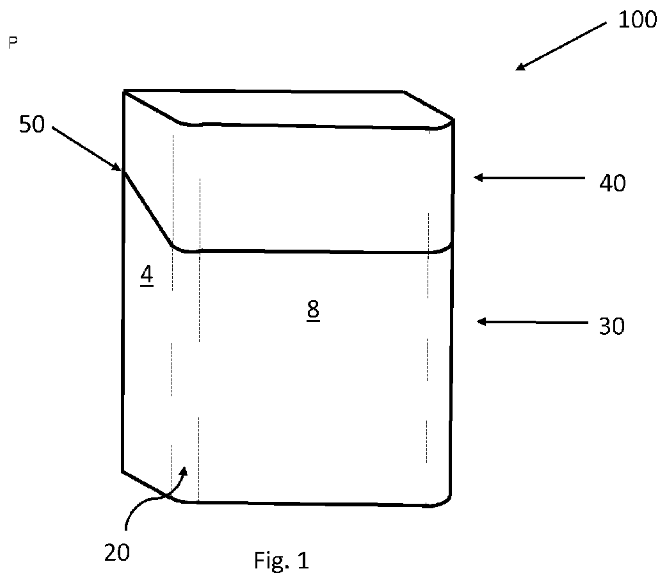

Fig. 1

(57) Abstract: A container for consumer articles is at least partially formed from a cellulose-fiber based laminar blank having a thickness (T) and defining a portion of the container, which comprises at least a first planar wall and a second planar wall that are connected to one another by a curved edge portion. The curved edge portion has an inner surface and an outer surface, and the inner surface of the curved edge portion defines an ablation area (A), having a length (L) in the longitudinal direction of the curved edge portion and a width (W) that extends across the curved edge portion. The ablation area comprises two or more ablated lines extending substantially in the longitudinal direction of the curved edge portion. Each ablated line has a minimum residual thickness (RT) that is less than the thickness (T) of the laminar blank wherein the minimum residual thickness (RT) of each of the two or more ablated lines is at least about 30 percent and less than about 60 percent of the thickness (T) of the blank. The gap between the low points of two adjacent ablated lines is more than 0.2 millimetres and less than 1.6 millimetres.

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CONTAINER HAVING IMPROVED CURVED EDGE

The present invention relates to a container for consumer goods and to a cellulose-fiber based laminar blank for forming such container, which find particular application for holding elongate consumer goods, such as smoking articles (for example, cigarettes).

Smoking articles such as cigarettes and cigars are usually provided in soft-pack packs or hard-pack packs, such as flip-top boxes or hinge-lid boxes. These typically have a box part having a box front wall, a box rear wall, box side walls and a box base. They also usually have a lid part with a lid front wall, a lid rear wall, lid side walls and a lid top side. The lid part is typically hinged to the box part along a hinge line extending across a back wall of the container. The hinge line is usually provided as a pre-folded line, a crease line or a score line.

Hard-pack containers, or at least portions thereof, are typically obtained from a laminar blank comprising a plurality of panels. In order to assemble a container, one such blank is folded so that panels of the blank can form walls of the containers.

For hard-pack packs, it is known to round off or chamfer certain edges of the box and lid to give the container a distinctive appearance. This has typically been achieved in the past by providing creasing lines or scoring lines in the blank at the areas forming the edges of the container. These lines allow the blank to be folded in such a way that the edge does not simply bend along a single line, but instead either progressively bends between two adjacent walls (in the case of a round edge), or bends at two or more discrete locations between adjacent walls (in the case of a bevelled edge).

However, such scoring or creasing lines can add complexity to the manufacturing process. Furthermore, in some cases, the visual and tactile perception of the container may be impacted, in that the outer surface is not entirely smooth and can include ridges or ripples from where the creasing has occurred.

It would therefore be desirable to provide a container for consumer goods having one or more curved edges that has an improved look. It would also be desirable to provide to provide a container for consumer goods having a curved edge portion that has improved strength and which is easier to produce. Further, it would be desirable to provide a blank for manufacturing a container for consumer goods that make the production and assembly process easier and more flexible.

According to a first aspect of the present invention, there is provided a container for consumer articles, the container being at least partially formed from a cellulose-fiber based laminar blank having a thickness (T), the laminar blank defining a portion of the container, which comprises at least a first planar wall and a second planar wall that are connected to one another by a curved edge portion; wherein the curved edge portion has an inner surface and an outer surface, and the inner surface of the curved edge portion defines an ablation area (A), the ablation area having a length (L) in the longitudinal direction of the curved edge portion and a width (W) that extends across the curved edge portion; wherein the ablation area comprises two or more ablated lines extending substantially in the longitudinal direction of the curved edge portion, each ablated line having a minimum residual thickness (RT) of at least about 20 percent, preferably at least about 25, more preferably at least about 30 percent of the thickness (T) of the blank. In addition, or as an alternative, each of the ablation lines preferably has a residual thickness of less than about 65 percent, more preferably less than about 60 percent, and even more preferably less than about 55 percent of the thickness (T) of the blank.

The present inventors have also found that, in order to obtain a curved edge portion, the claimed range of residual thickness is combined with a gap of at least about 0.2 millimetres between the low points of two adjacent ablated lines. Preferably, the gap between the low points of two adjacent ablated lines is at least about 0.4 millimetres, and even more preferably at least about 0.6 millimetres. In addition, or in the alternative, the gap between the low points of two adjacent ablated lines is less than about 1.6 millimetres, more preferably less than about 1.3 millimetres, and even more preferably less than about 1.0 millimetre.

According to a second aspect of the present invention, there is provided a laminar blank for forming a container for consumer articles, the blank having a thickness (T) and defining a portion of the container, which comprises at least a first planar wall and a second planar wall that are connected to one another by a curved edge portion; wherein the curved edge portion has an inner surface and an outer surface, and the inner surface of the curved edge portion defines an ablation area (A), the ablation area having a length (L) in the longitudinal direction of the curved edge portion and a width (W) that extends across the curved edge portion; wherein the ablation area comprises two or more ablated lines extending substantially in the longitudinal direction of the curved edge portion, each ablated line having a minimum residual thickness (RT) of at least about 20 percent, preferably at least about 25, more preferably at least about 30 percent of the thickness (T) of the blank. In addition, or as an alternative, each of the ablation lines has preferably a residual thickness of less than about 65 percent, more preferably less than about 60 percent, and even more preferably less than about 55 percent of the thickness (T) of the blank.

The present inventors have also found that, in order to obtain a curved edge portion, the claimed range of residual thickness is combined with a gap of at least about 0.2 millimetres between the low points of two adjacent ablated lines. Preferably, the gap between the low points of two adjacent ablated lines is at least about 0.4 millimetres, and even more preferably at least about 0.6 millimetres. In addition, or in the alternative, the gap between the low points of two adjacent ablated lines is less than about 1.6 millimetres, more preferably less than about 1.3 millimetres, and even more preferably less than about 1.0 millimetre.

It shall be appreciated that any features described with reference to one aspect of the present invention are equally applicable to any other aspect of the invention.

In contrast to known containers that use mechanical creasing lines for defining a curved edge portion of the container, the present invention involves the removal of material from specific locations within the portion of the blank that defines a curved edge portion of the container. The provision of ablation areas including ablated (for example, by laser ablation) lines to form the curved edge portion of the container advantageously reduces the force required for folding the blank about the curved edge portion. Further, the rounded edge of the container effectively approximates the theoretical, reference rounded shape with a relatively small number of score lines. Thus, at the same time, the strength of the container at the rounded edges may be better preserved.

This can allow the container to be conveniently formed from one such blank by a conventional packing machine. In addition, because the outer surface of the blank is unaffected by the ablation process, the resulting outer surface of the container does not exhibit localised ridges or ripples at the ablation line location (as would be the case with mechanical creasing lines).

Accordingly, bending of a blank according to the present invention, when forming a curved edge portion of a container, is easier, and results in the formation of an outer surface of the container having a curvature that is more gradual and smoother, upon visual and tactile inspection on the part of the consumer.

The blank of the present invention may advantageously be manufactured by precisely removing material from the curved edge portion with a linear ablation tool (for example, a laser or a blade). A laser is a particularly preferred ablation tool, as it is non-invasive and can be digitally programmed for improved flexibility of design. In particular, use of a laser as the ablation tool can allow for a wide variety of ablation profiles and configurations, with minimal adjustment of the laser tool being needed. Repeated passages of the ablation tool over a given portion of the blank results in the removal of a greater percentage of material, that is in a reduced residual thickness. Thus, the manufacturing process can be simplified. Laser ablation may be obtained using any suitable equipment, preferably a 1000Watt CO_2 laser as commercially available from DIAMOND, e.g. the E-1000. Ablation may be obtained in machine direction of the laminar blank or in cross direction. Laser ablation may be obtained using any suitable equipment, preferably a 1000Watt CO_2 laser as commercially available from DIAMOND, e.g. the E-1000. Ablation may be obtained in machine direction of the laminar blank or in cross direction.

Containers made of the laminar blank of the present invention can be obtained without a pre-bending step, which is usually required with traditional methods for obtaining round corners like embossing.

The term “edge portion” is used herein to refer to the portion of the blank defining an edge between two adjacent walls of the container. The curved edge portion being the portion of the blank defining the edge of the container residing between the first planar wall and the second planar wall.

The term “curved edge portion” is used herein to refer to an edge portion of the container having an arc-like shape as viewed in cross-section. By the term “arc-like” reference is made to any non-straight line, including circular arc, parabolic arc, hyperbolic arc, elliptical arc, etc. The curved edge portion can be measured using visual inspection by one or more test persons or microscopic measurement followed by statistical analysis, e.g. using a NIKON SMZ800 microscope on the outer surface of the laminar blank. X-Y-coordinates can be recorded on a fine grid (10 contour points) for each sample. The recorder X-Y-coordinates can be used for a linear spline interpolation and the profile of the resulting first derivative can be captured. A constantly changing or jumping first derivative indicates a curved edge portion sample.

A “cellulose-fiber-based laminar blank” is used herein to refer to a laminar blank comprising at least 50 percent by weight of cellulose fibers, based on the total fiber content of the laminar blank. The cellulose-fiber-based laminar blank of the invention may include other types of fibers, such as polymer fibers.

The term “inner surface” is used throughout the specification to refer to the side of a portion of the blank that, once the container is assembled, faces towards the interior of the container, for example towards the consumer goods, when the container is closed. Thus, the inner surface is not directly visible for the consumer when the container is closed. The term “outer surface” is used throughout the specification to refer to the side of a portion of the blank that, once the container is assembled, faces towards the exterior of the container.

The term “ablation area” is used herein to refer to the minimum area of the blank that encloses all ablated lines on the portion of the blank that forms the curved edge portion of the container.

The term “ablated line” is used herein to refer to a line along the inner surface of the edge portion from which material has been ablated (for example, removed by means of a laser beam or a blade). Accordingly, the residual thickness of an ablated line is less than the thickness (T) of the laminar blank. The ablated line is preferably provided as a groove within the blank. This may be formed with a linear ablation tool, such as a laser or a blade.

The “thickness” (T) of the blank is the thickness of the blank after it has been manufactured, but before any ablation lines or creasing lines have been formed in the blank.

That is, the thickness (T) of the blank is the thickness in any region of the blank not containing an ablated line or a crease line.

The term “residual thickness” is used herein to refer to the minimum distance measured between two opposite surfaces of the laminar blank or of a wall of the container formed from the blank. In practice, the distance at a given location is measured along a direction locally perpendicular to the opposite surfaces. The residual thickness of the ablated line may vary across a width of the ablated line, (e.g. V-shaped, U-shaped grooves).

The term “minimum residual thickness” is used herein to refer to the smallest value of “residual thickness” measured in an ablated line at a given location.

The residual thickness of each ablated line can be determined by using an Optical Profilometer for 2D Non-Contact Surface Metrology, such as the MicroSpy (RTM) Profile (commercially available from Fries Research & Technology GmbH, Bergisch Gladbach, Germany). Preferably, several points of minimum residual thickness are measured over the length of an ablated line, whereas the points of measurement are evenly spread over the length of one ablated line and the arithmetic mean is calculated.

Even more preferably, to obtain the “minimum residual thickness” according to the present invention, five measurements, evenly spread over the length of an ablated line, are performed and then the arithmetic medium is calculated.

For example, if the length of the ablated line is 80 millimetres, the residual thickness is measured at both ends of the ablated line and at three further points distanced 20 millimetres, forty millimetres and sixty millimetres respectively from one end of the ablated line, preferably from the lower end of the ablated line.

The term “gap” is used herein to refer to the distance between the low points of two adjacent ablated lines.

Preferably, several points of gap are measured over the length of a pair of parallel ablated lines, whereas the points of measurement are evenly spread over the length of the parallel portions of the ablated lines and the arithmetic mean is calculated.

Even more preferably, to obtain the “gap” according to the present invention, five measurements, evenly spread over the length of the parallel portions of the two adjacent ablated lines, are performed and then the arithmetic medium is calculated.

For example, if the length of the parallel portion of the two adjacent ablated lines is 80 millimetres respectively, the gap is measured at both ends and at three further points distanced 20 millimetres, forty millimetres and sixty millimetres respectively from one end of the parallel portion, preferably from the lower end of the ablated line.

The term “residual stiffness” is used to describe the stiffness of the residing laminar blank as measured over the minimum residual thickness of one given ablation line and is calculated using the stiffness in bending direction of the laminar blank multiplied by the percentage of residual thickness. For example, if the stiffness in bending direction of the unablated laminar blank is 100 milliNewton and the minimum residual thickness is thirty percent, then the residual stiffness in bending direction is 100 milliNewton multiplied by thirty percent equal 30 milliNewton. The stiffness of the laminar blank can be measured in accordance with ISO 2493, 15 degrees, for example by taking a sample of the blank material from a portion of the blank that is not scored or ablated (the sample may be printed or otherwise coated if it is in finished form).

Testing and conditioning at 23 degrees Celsius, 50% relative humidity according to ISO 187 two weeks after ablation.

As used herein, the terms “front”, “back”, “upper”, “lower”, “top”, “bottom” and “side”, refer to the relative positions of portions of containers according to the invention and components thereof when the container is in an upright position with the access opening at the top of the container. In particular, where the container is a hinged lid container, this refers to the container being in an upright position with the lid in the closed position and the hinge line at the back of the container. When describing containers according to the present invention, these terms are used irrespective of the orientation of the container being described.

Containers according to the present invention are at least partially formed from a laminar blank having a predetermined thickness (T). The blank defines a portion of the container, which comprises at least a first planar wall and a second planar wall that are connected to one another by a curved edge portion. An inner surface of the curved edge portion defines an ablation area that has a length in the longitudinal direction of the curved edge portion and a width that extends across the curved edge portion. The ablation area comprises two or more ablation lines, extending substantially in the longitudinal direction of the curved edge portion.

Preferably, the thickness (T) of the laminar blank is from about 300 micrometres to about 360 micrometres. More preferably, the thickness (T) of the laminar blank is from about 330 micrometres to about 350 micrometres. The thickness (T) of the laminar blank can be measured in accordance with ISO 534:2011.

The ablation area may comprise any suitable number of ablation lines to form the curved edge portion. For example, in some preferred embodiments the ablation area comprises at least four ablated lines at any given longitudinal position on the curved edge portion. If less than four ablated lines are provided at any given longitudinal position on the curved edge portion, it can become difficult to obtain a gradual curvature that approximates a theoretical curved profile, without greatly reducing the width of the ablation area, and hence curved edge portion.

The laminar blank preferably has a basis weight of from about 150 grams per square metre to about 350 grams per square metre, more preferably from about 175 to about 350 grams per square metre, and even more preferably from about 200 to about 300 grams per square metre. The basis weight is calculated using ISO 536 and may vary from plus ten percent to minus ten percent, preferably from plus five percent to minus five percent.

Preferably, the ablated width (X) of each ablation line is at least about 0.05 millimetres more preferably at least about 0.1 millimetres or at least about 0.12 millimetres. In some embodiments the ablated width of each ablation line may be at least about 0.2 millimetres or at least about 0.3 millimetres. In addition, or as an alternative, the ablated width of each ablation lines is less than about 0.5 millimetres. More preferably, the ablated width of each ablation lines is less than about 0.45 millimetres. In some preferred embodiments, the ablated width of each ablation lines is from about 0.0.5 millimetres to about 0.5 millimetres. Even more preferably, the ablated width of each ablation lines is from about 0.1 millimetres to 0.45 millimetres, more preferably from about 0.125 millimetres to 0.4 millimetres.

Preferably, the width (W) of the ablation area is at least about 2 millimetres. More preferably, the width of the ablation area is at least about 4 millimetres. In addition, or as an alternative, the width of the ablation area is preferably less than about 8 millimetres. More preferably, the width of the ablation area is less than about 6 millimetres.

Preferably, the laminar blank has a stiffness in the bending direction of at least about 50milliNewtons, preferably at least about 75 milliNewtons, most preferably at least about 90 milliNewtons. In addition, or in the alternative, the laminar blank has a bending stiffness of less than about 500 milliNewtons, preferably less than about 200 milliNewtons, more preferably less than about 160 milliNewtons. The laminar blank preferably has a bending stiffness from about 50 milliNewtons to about 200 milliNewtons. More preferably, the laminar blank has a stiffness in the machine direction of from about 75 milliNewtons to about 160 milliNewtons. Stiffness in the “bending direction” means that the bending stiffness is measured in the direction that the finished board is intended to be folded about the ablation zone.

Preferably, the laminar blank has a residual stiffness in bending direction of at least 25 milliNewtons, preferably 30 milliNewtons, more preferably 40 milliNewtons. More preferably, the laminar blank has a residual stiffness in bending direction of 100 milliNewtons or less, preferably, 85 milliNewtons or less, even more preferably of 75 milliNewtons or less.

Preferably, the laminar blank has a surface roughness of from about 0.5 micrometres to about 1.5 micrometres. More preferably, the laminar blank has a surface roughness of from about 0.75 micrometres to about 1.25 micrometres. The surface roughness may be measured in accordance with ISO 8791-4.

Preferably, the laminar blank has a surface strength of from about 1 metres per second to about 2 metre per second. More preferably, the laminar blank has a surface strength of from about 1.25 metres per second to about 1.75 metres per second. The surface roughness may be measured in accordance with ISO 3783.

The two or more ablated lines may have any suitable extension profile in the longitudinal direction of the curved edge portion. For example, an ablated line may follow a curved trajectory over at least a portion of its extension profile in the longitudinal direction of the curved edge portion. In such embodiments, the facet created by such an ablated line will have a non-linear perimeter.

In some preferred embodiments, the ablation area comprises at least two ablated lines that extend in parallel over at least a part of the curved edge portion in its longitudinal direction. This can produce a substantially rectangular shaped facet at the curved edge portion. In some particularly preferred embodiments, all ablated lines in the ablation area extend in parallel along the longitudinal direction of the curved edge portion. This can produce a curved edge portion having only substantially rectangular shaped facets.

Preferably, the first planar wall is orthogonal to the second planar wall.

Preferably, the container has a spring-back force of less than about 10 milliNewton metres between the two planar walls that are connected by the curved edge portion.

In some preferred embodiments, the laminar blank forms at least a part of the container comprising a box portion having a box front wall, a box rear wall and box side walls extending between the box front wall and the box rear wall, and wherein the curved edge portion connects one of the box side walls to the box front wall or the box rear wall. Alternatively or additionally, the curved edge portion may connect a box bottom wall with one of the box side walls, box front wall or the box rear wall.

In addition, or in alternative embodiments, the laminar blank preferably forms at least a part of the container comprising a lid portion having a lid front wall, a lid rear wall and lid side walls extending between the lid front wall and the lid rear wall, and wherein the curved edge portion connects one of the lid side walls to the lid front wall or the lid rear wall. Alternatively or additionally, the curved edge portion may connect a lid top wall with one of the lid side walls, lid front wall or the lid rear wall.

In some particularly preferred embodiments, the container comprises two or more curved edge portions along its transverse edges, longitudinal edges, or both, with each curved edge portion having any of the preferred features described above.

Containers according to the present invention find application as containers for consumer goods, in particular elongate consumer goods such as smoking articles. However, they can also be used for several other types of consumer goods, such as confectionary.

The blank is formed from a cellulose-fiber based material, preferably plant-derived and more preferably wood-derived. The blank may contain at least 50 percent by weight, preferably at least 60 percent by weight, and even more preferably at least 70 percent by weight of cellulose fibers based on the total fiber content of the blank. Preferably, the laminar blank is formed from wood-fibers cardboard or paperboard. Alternatively, the cellulose-fiber based material may also contain other fibers, such as polymer fibers. The blank may be coated or uncoated and preferably is coated on both sides.

The container may optionally comprise an outer wrapper, which is preferably a transparent polymeric film of, for example, high or low density polyethylene, polypropylene, oriented polypropylene, polyvinylidene chloride, cellulose film, or combinations thereof and the outer wrapper is applied in a conventional manner. The outer wrapper may include a tear tape. In addition, the outer wrapper may be printed with images, consumer information or other data.

Further, the consumer articles may be provided within the container in the form of a bundle wrapped in an inner package formed of metal foil or metallised paper. The inner package material may be formed as a laminate of a metallised polyethylene film, and a liner material. The liner material may be a super-calendered glassine paper. In addition, the inner package material may be provided with a print-receptive top coating. The inner package has an access opening through which consumer goods can be removed when a lid of the container is in a respective open position.

The container is preferably a rectangular parallelepiped comprising two wider walls spaced apart by two narrower walls. Hinge lid containers according to the invention may be in the shape of a rectangular parallelepiped, with longitudinal and transverse edges. In such embodiments, at least one of the longitudinal or transverse edges is curved. That is, the hinge lid container comprises one or more curved longitudinal edges or curved transverse edges, or combinations thereof. Each of said curved edges may have any of the preferred features described above.

Preferably the curved edge portion has a width of between about 2 mm and about 8 mm, preferably between about 4 and about 6 mm.

Containers according to the invention find particular application as packs for elongate smoking articles such as, for example, cigarettes, cigars or cigarillos. It will be appreciated that through appropriate choices of the dimensions thereof, containers according to the invention may be designed for different numbers of conventional size, king size, super-king size, slim or super-slim cigarettes. Alternatively, other consumer goods may be housed inside the container.

Through an appropriate choice of the dimensions, containers according to the invention may be designed to hold different total numbers of smoking articles, or different arrangements of smoking articles. For example, through an appropriate choice of the dimensions, containers according to the invention may be designed to hold a total of between ten and thirty smoking articles.

The smoking articles may be arranged in different collations, depending on the total number of smoking articles.

Containers according to the present invention may hold smoking articles of the same type or brand, or of different types or brands. In addition, both filter-less smoking articles and smoking articles with various filter tips may be contained, as well as smoking articles of differing length (for example, between about 40 mm and about 180 mm), diameter (for example, between about 4 mm and about 9 mm). Preferably, the dimensions of the container are adapted to the length of the smoking articles, and the collation of the smoking articles. Typically, the outer dimensions of the container are between about 0.5 mm to about 5 mm larger than the dimensions of the bundle or bundles of smoking articles housed inside the container.

The length, width and depth of containers according to the invention may be such that the resultant overall dimensions of the container are similar to the dimensions of a typical disposable pack of twenty cigarettes.

Preferably, containers according to the invention have a height of between about 60 mm and about 150 mm, more preferably a height of between about 70 mm and about 125 mm, wherein the height is measured from the bottom wall to the top wall of the container.

Preferably, containers according to the invention have a width of between about 12 mm and about 150 mm, more preferably a width of between about 70 mm and about 125 mm, wherein the width is measured from one side wall to the other side wall of the container.

Preferably, containers according to the invention have a depth of between about 6 mm and about 150 mm, more preferably a depth of between about 12 mm and about 25 mm wherein the depth is measured from the front wall to the back wall of the container.

Preferably, the ratio of the height of the container to the depth of the container is in between about 0.3 to 1 and about 10 to 1, more preferably between about 2 to 1 and about 8 to 1, most preferably between about 3 to 1 and 5 to 1

Preferably, the ratio of the width of the container to the depth of the container is in between about 0.3 to 1 and about 10 to 1, more preferably between about 2 to 1 and about 8 to 1, most preferably between about 2 to 1 and 3 to 1.

Preferably, the ratio of the height of the lid back wall to the height of the box back wall of the outer sleeve is between about 0 to 1 (lid located at the top edge of the container) to about 1 to 1, more preferably, between about 1 to 5 and about 1 to 10, most preferably, between about 1 to 6 to about 1 to 8.

Preferably, the ratio of the height of the lid front wall of the outer sleeve to the height of the box front wall of the outer sleeve is between about 1 to 0 (lid covering the entire front wall) to about 1 to 10, more preferably, between about 1 to 1 and about 1 to 5, most preferably, between about 1 to 2 and about 1 to 3.

The exterior surfaces of containers according to the invention may be printed, embossed, debossed or otherwise embellished with manufacturer or brand logos, trade marks, slogans and other consumer information and indicia.

Containers according to the invention may be filled and assembled using conventional apparatus and methods, modified to include the step of forming two or more ablated lines in the blank. The ablated lines may be produced using an ablation tool, such as a laser or a blade. A laser is particularly preferred as the ablation tool as it can allow for a wide variety of ablation profiles and configurations, with minimal adjustment of the laser tool being needed. For example, the laser may be repeatedly passed over a given portion of the blank to iteratively remove different amounts of material, allowing for a very finely controlled ablation profile. It is also beneficial if fine ablated lines are required, with narrow widths. It is possible to accurately control the relative movement of the laser and the blank so as to form any type of pattern with varying removal intensity (“depth”) over the ablation area.

The invention will be further described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 depicts a perspective view of a container having at least one curved edge portion according to an embodiment of the present invention;

Figure 2 is a photograph showing a magnified view of the cross section of a laminar blank according to a first embodiment of the present invention (Example 1);

Figure 3 is a photograph showing a perspective view of the blank of Figure 2 (Example 1);

Figure 4 is a photograph showing a magnified view of the cross section of a laminar blank according to a second embodiment of the present invention (Example 2);

Figure 5 is a photograph showing a perspective view of the blank of Figure 4 (Example 2);

Figure 6 is a photograph showing a magnified view of the cross section of a laminar blank according to the present invention (Example 3);

Figure 7 is a photograph showing a perspective view of the blank of Figure 6 Example 3);

Figure 8 is a photograph showing a magnified view of the cross section of a laminar blank not according to the present invention (Comparative Example 1);

Figure 9 is a photograph showing a perspective view of the blank of Figure 8 (Comparative Example 1);

Figure 10 is a photograph showing a magnified view of the cross section of a laminar blank not according to the present invention (Comparative Example 2);

Figure 11 is a photograph showing a perspective view of the blank of Figure 10 (Comparative Example 2);

As can be appreciated by the skilled person, Figure 1 shows a container 100 for consumer goods, which can be formed by folding a cardboard or paperboard laminar blank having a thickness (T).

The container 100 is a substantially rectangular parallelepiped in shape and comprises a box portion 30 and a hinge lid 40 connected to the box portion 30 along a hinge line 50 extending across the back wall of the container 100. The overall size and construction of the box 30 and lid 40 of the container 100 is substantially the same as those of a standard hinge lid cigarette pack. The box portion 30 comprises a box front wall, a box back wall, a box bottom wall, a box left side wall and a box right side wall. The hinge lid 40 comprises a lid front wall, a lid back wall, a lid top wall, a lid left side wall and a lid left side wall. The hinge lid 40 is pivotable about the hinge line 50 between a closed position and an open position. In the closed position, the hinge lid 40 cover an access opening of the container 100 and the walls of the hinge lid 40 form extensions of the corresponding walls of the box portion 30. In the open position, the hinge lid 40 pivots about the hinge line 50 to project backwardly from the box portion 30 and the access opening at the top end of the box portion 30 be fully uncovered. The box portion 30 and the hinge lid 40 may be formed together from a single laminar blank having a thickness T. The container may be assembled from the laminar blank and filled using standard apparatus.

The container comprises a first planar wall 4, which in Figure 1 is a side wall of the box portion 30. The container also comprises a second planar wall 8, which in Figure 1 is the front wall of the box portion 30. The side wall 4 and the front wall 8 are connected to each other by a curved edge portion 20. Although not visible from the perspective view in Figure 1, the inner surface of the curved edge portion 20 comprises a plurality of ablation lines that together define the curved edge portion 20, when the container 100 is assembled.

Five different laminar blanks were produced and folded to form a curved edge portion. Details of each laminar blank are provided below, and photographs of each laminar blank and their respective curved edge portions are shown in Figures 2 to 13. For all examples, the laminar blank was provided with a plurality of parallel ablation lines on its inner surface. The ablation lines were formed by applying a laser ablation tool to the inner surface of the laminar blank to remove material from said surface. This resulted in substantially V-shaped grooves being formed on the laminar blank's inner surface. The objective was to determine, which laminar blank or laminar blanks (when folded) would produce a curved edge portion having a smooth and gradual curvature that better approximates a theoretical curved profile. Testing and conditioning was conducted at 23 degrees Celsius and 50 percent relative humidity according to ISO 187, two weeks after the ablation lines had been formed.

Example 1:

Figure 2 shows a magnified view of the cross section of a laminar blank according to a first embodiment of the present invention (Example 1). Figure 3 shows a perspective view of the blank of Figure 2 (Example 1).

The blank of Example 1 had a basis weight of 240 grams per square metre, a thickness (T) of 298 micrometres. Each ablated line was measured to have a minimum residual thickness of 33 percent of the thickness (T) of the blank, and an ablated width of 0.49 millimetres.

The gap is 0.7 millimetres and the residual stiffness in bending direction is 32 milliNewtons calculated based on the stiffness in cross direction before lamination. The stiffness of the laminar blank before ablation is 197 milliNewtons in machine direction and 98 milliNewtons in the cross direction (cross-direction is the direction of bending in this example).

As can be seen from Figures 2 and 3, the blank of Example 1 was found to exhibit a well-defined curved edge portion, having gradual curvature that better approximates a theoretical curved profile. The locations of the ablation lines could not be easily identified on the outer surface of the curved edge portion.

Example 2:

Figure 4 shows a magnified view of the cross section of a laminar blank according to a second embodiment of the present invention (Example 2). Figure 5 shows a perspective view of the blank of Figure 4 (Example 2).

The blank of Example 2 had a basis weight of 270 grams per square metre, a thickness (T) of 340 micrometres. Each ablated line was measured to have a minimum residual thickness of 53 percent of the thickness (T) of the blank, and an ablated width of 0.26 millimetres.

The gap is 0.7 millimetres and the residual stiffness in bending direction is 76 milliNewtons calculated based on the stiffness in cross direction before lamination. The stiffness of the laminar blank before ablation is 290 milliNewtons in machine direction and 145 milliNewtons in the cross direction (cross-direction is the direction of bending in this example).

As can be seen from Figures 4 and 5, the blank of Example 2 was found to exhibit a well-defined curved edge portion, having gradual curvature that better approximates a theoretical curved profile. The locations of the ablation lines could not be easily identified on the outer surface of the curved edge portion.

Example 3:

Figure 6 shows a magnified view of the cross section of a laminar blank according to a second embodiment of the present invention (Example 3). Figure 7 shows a perspective view of the blank of Figure 6 (Example 3).

The blank of Example 3 has a basis weight of 240 grams per square metre, a thickness (T) of 298 micrometres. Each ablated line is measured to have a minimum residual thickness of 58 percent of the thickness (T) of the blank, and an ablated width of 0.25 millimetres.

The gap is 0.7 millimetres and the residual stiffness in bending direction is 56 milliNewtons calculated based on the stiffness in cross direction before lamination. The stiffness of the laminar blank before ablation is 197 milliNewtons in machine direction and 98 milliNewtons in the cross direction (the cross direction the direction of bending in this example).

As can be seen from Figures 6 and 7, the blank of Example 3 was found to exhibit a well-defined curved edge portion, having gradual curvature that better approximates a theoretical curved profile. The locations of the ablation lines could not be easily identified on the outer surface of the curved edge portion.

Comparative Example 1:

Figure 8 shows a magnified view of the cross section of a laminar blank not according to an embodiment of the present invention (Comparative Example 1). Figure 9 shows a perspective view of the blank of Figure 6 (Comparative Example 1).

The blank of Comparative Example 1 has a basis weight of 240 grams per square metre, a thickness (T) of 298 micrometres. Each ablated line is measured to have a minimum residual thickness of 59 percent of the thickness (T) of the blank, and an ablated width of 0.36 millimetres. .

The gap is 2.1 millimetres. The stiffness of the laminar blank before ablation is 197 milliNewtons in machine direction and 98 milliNewtons in the cross direction (the cross direction the direction of bending in this example).

As can be seen from Figures 8 and 9, the blank of Comparative Example 1 was not found to exhibit a well-defined curved edge portion. That is, the curved edge portion did not have a gradual curvature that approximates a theoretical curved profile. Instead, the curved edge portion transitioned unevenly and randomly from the first planar panel to the second planar panel, with delamination along the curved edge portion being clearly visible.

Comparative Example 2:

Figure 10 shows a magnified view of the cross section of a laminar blank not according to an embodiment of the present invention (Comparative Example 2). Figure 11 shows a perspective view of the blank of Figure 10 (Comparative Example 2).

The blank of Comparative Example 2 had a basis weight of 240 grams per square metre, a thickness (T) of 298 micrometres. Each ablated line was measured to have a minimum residual thickness of 66 percent of the thickness (T) of the blank, and an ablated width of 0.35 millimetres. The gap is 0.71 millimetres. The stiffness of the laminar blank before ablation is 197 milliNewtons in machine direction and 98 milliNewtons in the cross direction (the cross direction the direction of bending in this example).

As can be seen from Figures 10 and 11, the blank of Comparative Example 2 was not found to exhibit a well-defined curved edge portion. That is, the curved edge portion did not have a gradual curvature that approximates a theoretical curved profile. Instead, the curved edge portion transitioned unevenly and randomly from the first planar panel to the second planar panel, with delamination along the curved edge portion being clearly visible.

Figures 2 to 7 therefore indicate that, surprisingly, a cleaner looking, more well defined curved edge portion, having gradual curvature that better approximates a theoretical curved profile, can be produced when the ablation lines are applied to a laminar blank of the present invention.

CLAIMS

1. A container for consumer articles, the container being at least partially formed from a cellulose-fiber-based laminar blank having a thickness (T), the laminar blank defining a portion of the container, which comprises at least a first planar wall and a second planar wall that are connected to one another by a curved edge portion;

wherein the curved edge portion has an inner surface and an outer surface, and the inner surface of the curved edge portion defines an ablation area (A), the ablation area having a length (L) in the longitudinal direction of the curved edge portion and a width (W) that extends across the curved edge portion;

wherein the ablation area comprises two or more ablated lines extending substantially in the longitudinal direction of the curved edge portion, each ablated line having a minimum residual thickness (RT) that is less than the thickness (T) of the laminar blank;

wherein the minimum residual thickness (RT) of each of the two or more ablated lines is at least about 30 percent and less than about 60 percent of the thickness (T) of the blank; and

wherein the gap between the low points of two adjacent ablated lines is more than 0.2 millimetres and less than 1.6 millimetres.

2 A container according to claim 1, wherein the thickness (T) of the laminar blank is from about 320 micrometres to about 360 micrometres.

3. A container according to claim 1 or claim 2, wherein the ablation area comprises five or more of said ablated lines over a substantial length at any longitudinal position of the curved edge portion.

4. A container according to any one of the preceding claims, wherein the laminar blank has a basis weight of from about 160 grams per square metre to about 300 grams per square metre

5. A container according to any one of the preceding claims, wherein each of the two or more ablated lines has an ablated width (X) of less than about 0.5 millimetres, as measured transversely to the longitudinal direction of the curved edge portion.

6. A container according to to claim 5, wherein each of the two or more ablated lines has an ablated width (X) of from about 0.1 millimetres to about 0.5 millimetres, as measured transversely to the longitudinal direction of the curved edge portion.

7. A container according to any one of the preceding claims, wherein the width (W) of the ablation area is from about 2 millimetres to about 8 millimetres.

8. A container according to any one of the preceding claims, wherein the distance between adjacent ablated lines in the ablation area is less than about 1.2 millimetres.

9. A container according to any one of the preceding claims, wherein the laminar blank has a stiffness in the bending direction of from about 50 milliNewtons to about 500 milliNewtons.

10. A container according to any one of the preceding claims, wherein the laminar blank has a residual stiffness in the bending direction of from about 25 milliNewtons to about 100 milliNewtons.

11. A container according to any one of the preceding claims, wherein the laminar blank has a surface roughness of from about 0.5 micrometres to about 1.5 micrometres.

12. A container according to any one of the preceding claims, wherein the laminar blank has a surface strength of from about 1 metres per second to about 2 metre per second.

13. A container according to any one of the preceding claims, wherein the ablation area comprises at least two ablated lines that extend in parallel over at least a part of the curved edge portion in its longitudinal direction.

14. A container according to any one of the preceding claims, wherein the first planar wall is orthogonal to the second planar wall.

15. A container according to any one of the preceding claims comprising:

a box portion comprising a box portion front wall, a box portion back wall, first and second box portion side walls, and a box portion bottom wall; and a lid portion depending along a hinge line from a top edge of the box portion, wherein the lid portion is moveable about the hinge line between an open position and a closed position.

16. A cellulose-fiber based laminar blank for forming a container for consumer articles, the blank having a thickness (T) and defining a portion of the container, which comprises at least a first planar wall and a second planar wall that are connected to one another by a curved edge portion;

wherein the curved edge portion has an inner surface and an outer surface, and the inner surface of the curved edge portion defines an ablation area (A), the ablation area having a length (L) in the longitudinal direction of the curved edge portion and a width (W) that extends across the curved edge portion;

wherein the ablation area comprises two or more ablated lines extending substantially in the longitudinal direction of the curved edge portion, each ablated line having a minimum residual thickness (RT) that is less than the thickness (T) of the laminar blank;

wherein the minimum residual thickness (RT) of each of the two or more ablated lines is at least about 30 percent and less than about 60 percent of the thickness (T) of the blank; and

wherein the gap between the low points of two adjacent ablated lines is more than 0.2 millimetres and less than 1.6 millimetres.

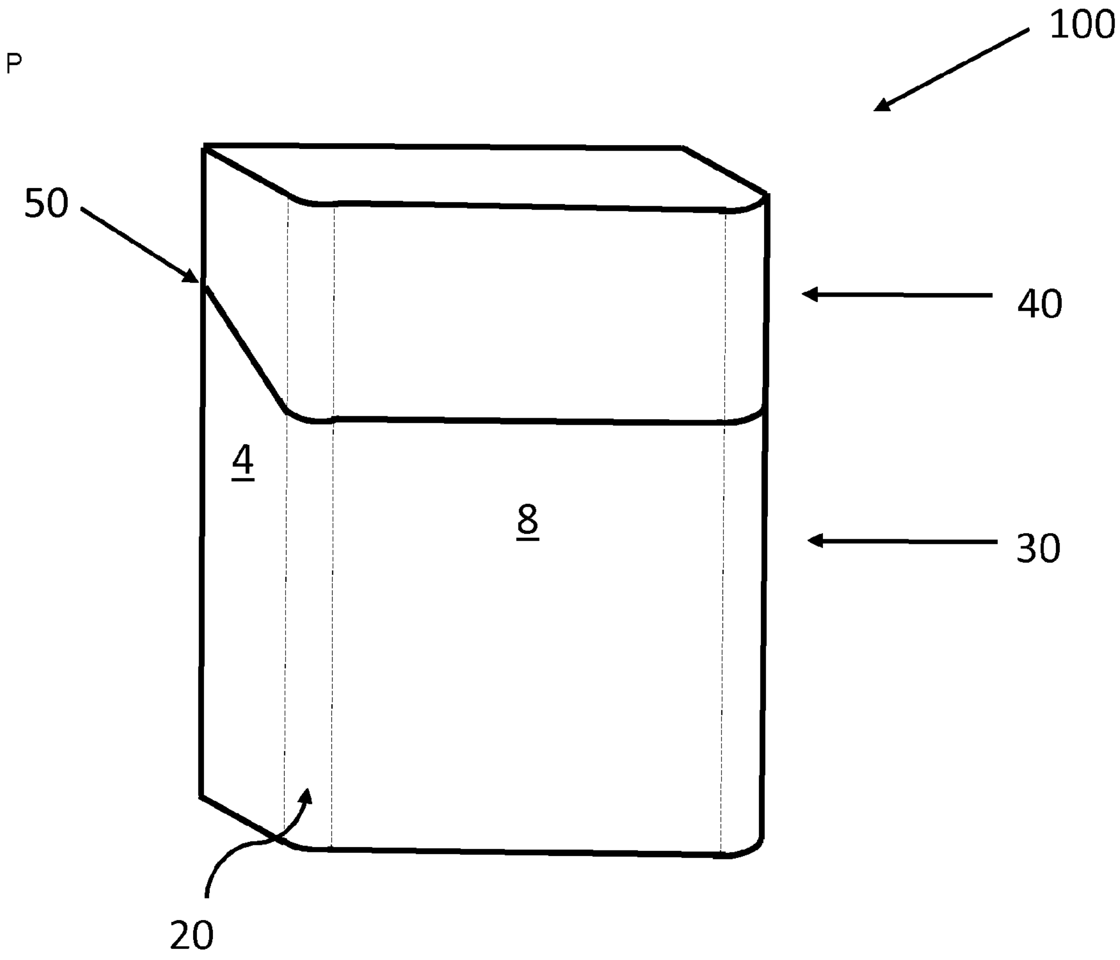

Fig. 1

Fig. 2 - Example 1

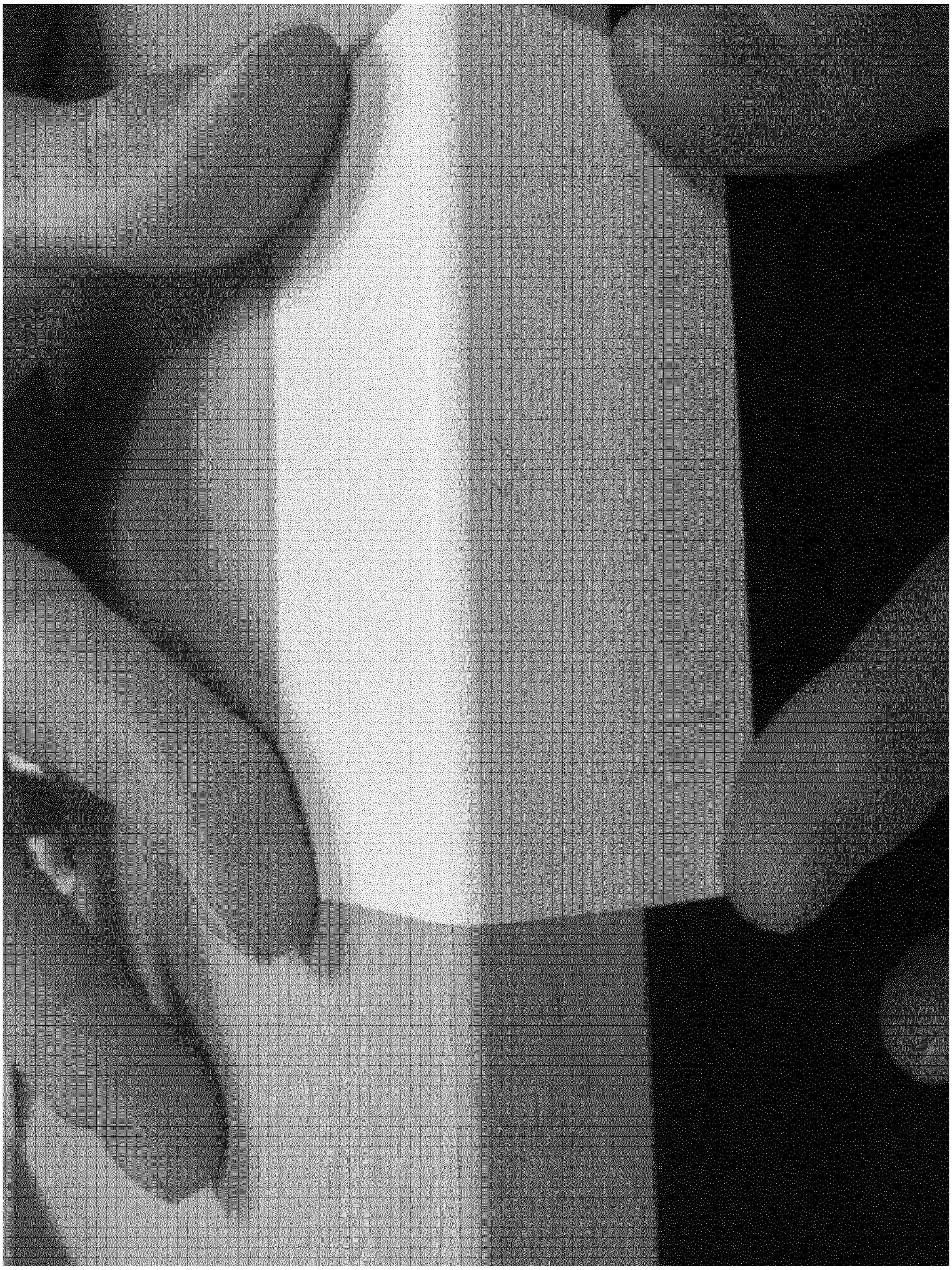

Fig. 3 - Example 1

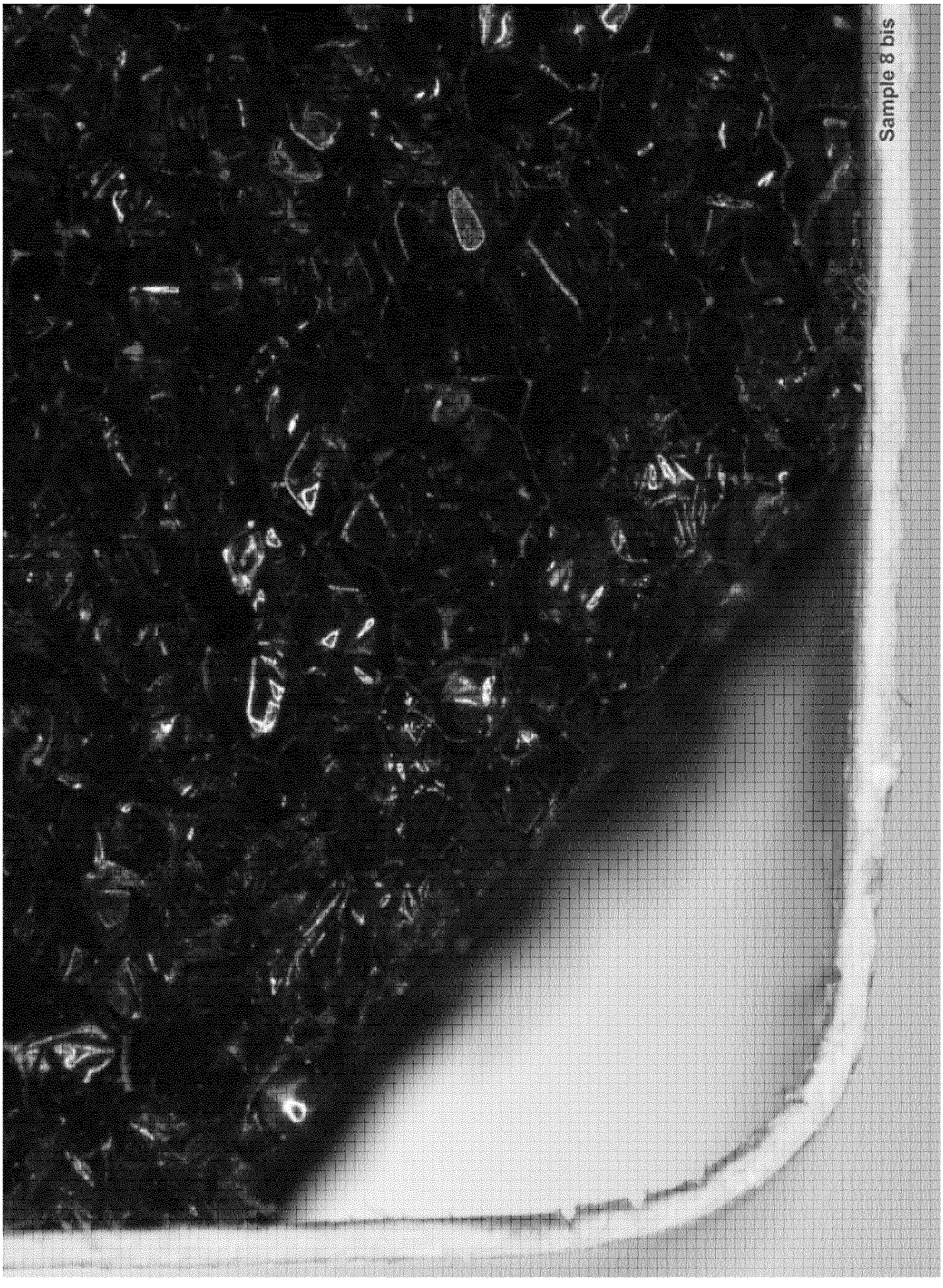

Fig. 4 - Example 2

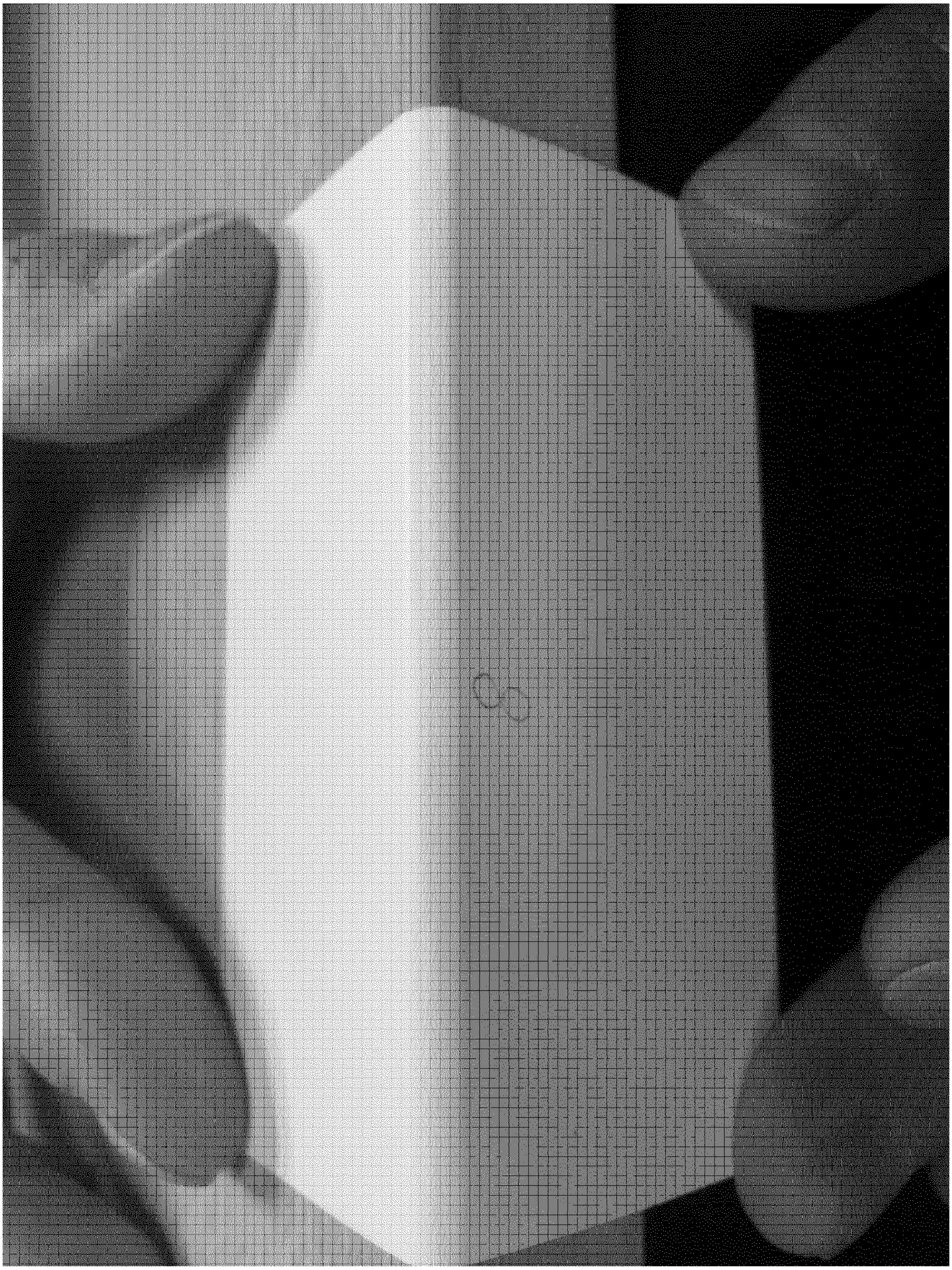

Fig. 5 - Example 2

Fig. 6 - Example 3

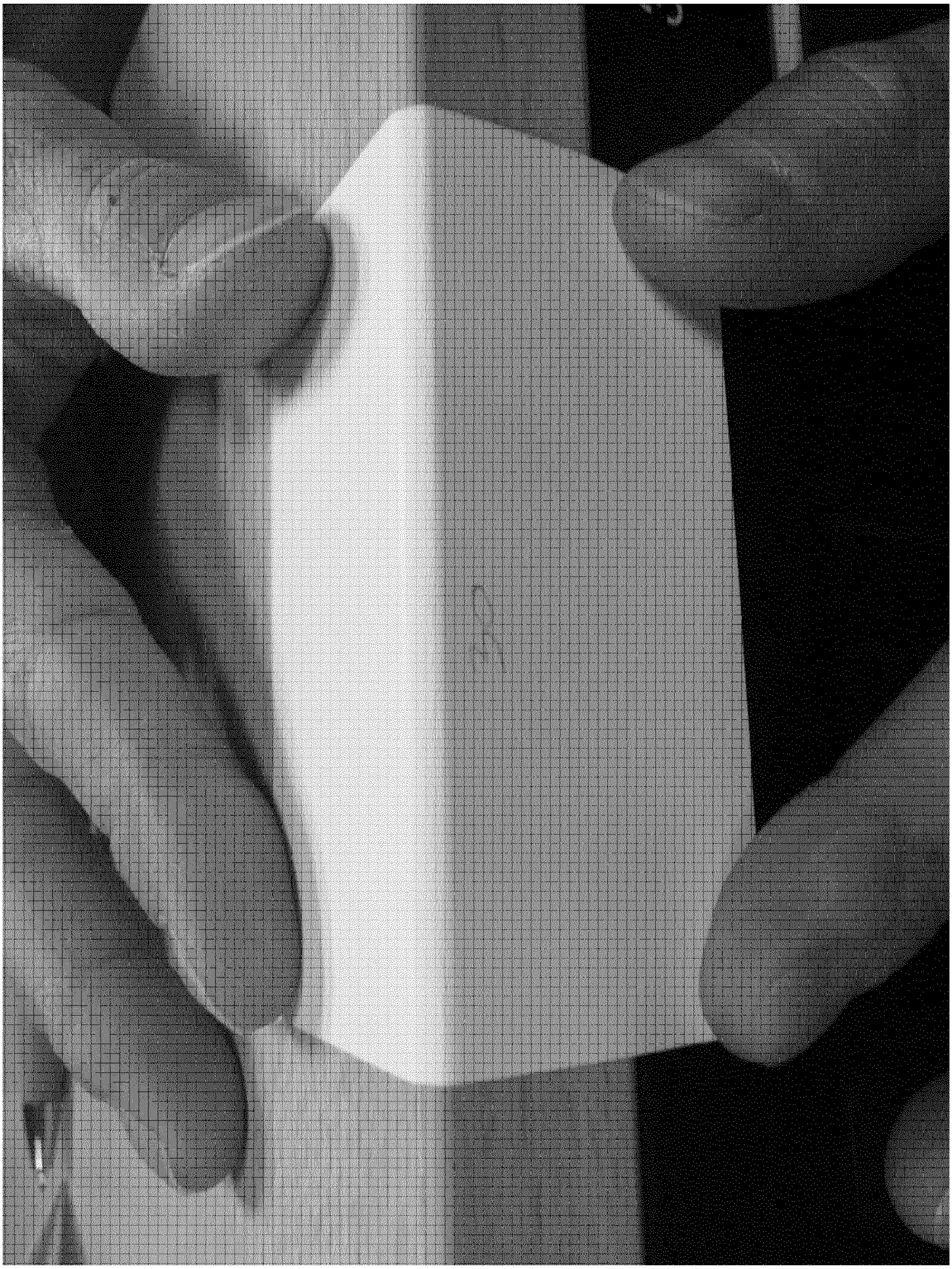

Fig. 7 - Example 3

Fig. 8 - Comparative Example 1

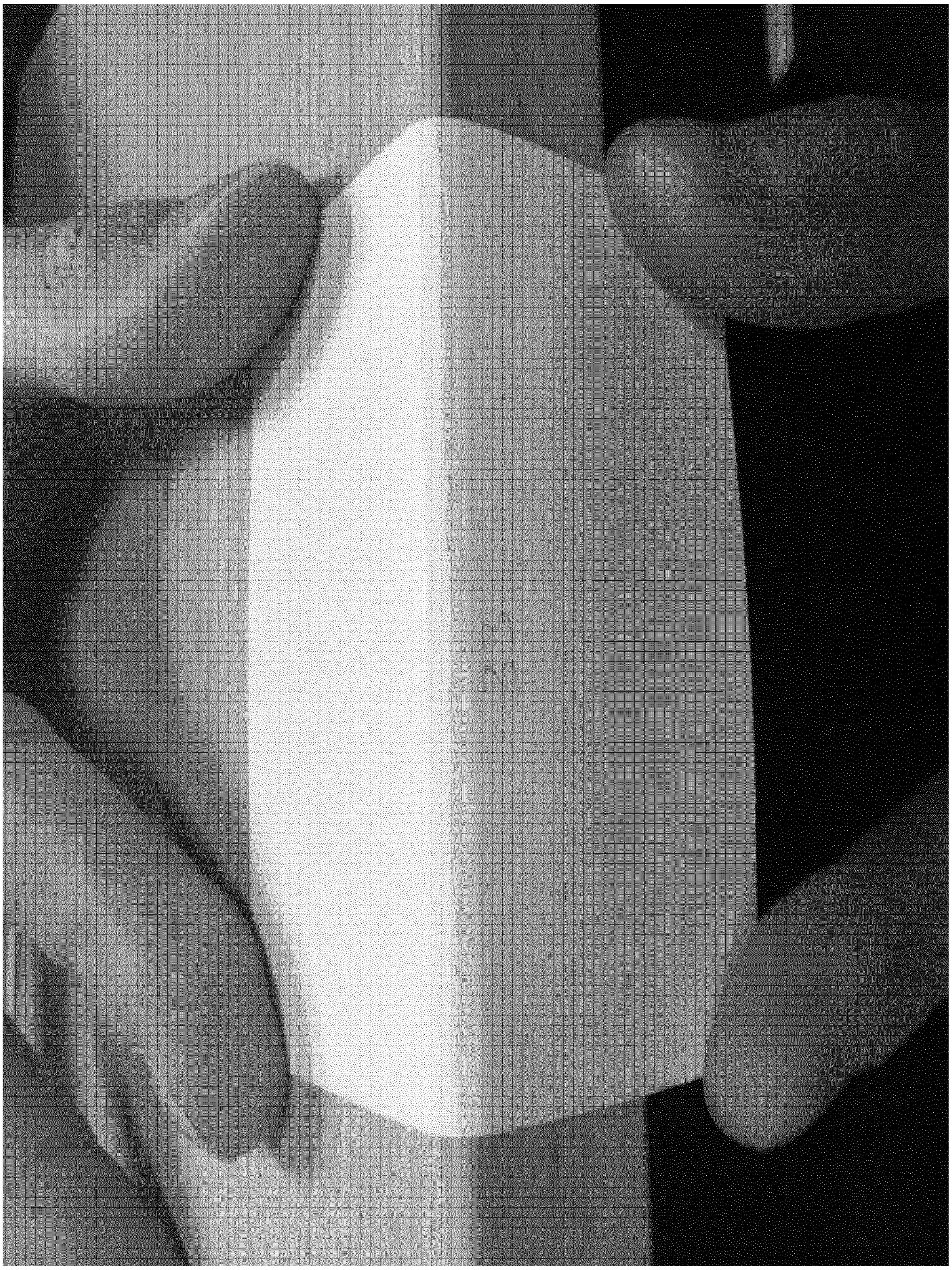

Fig. 9 - Comparative Example 1

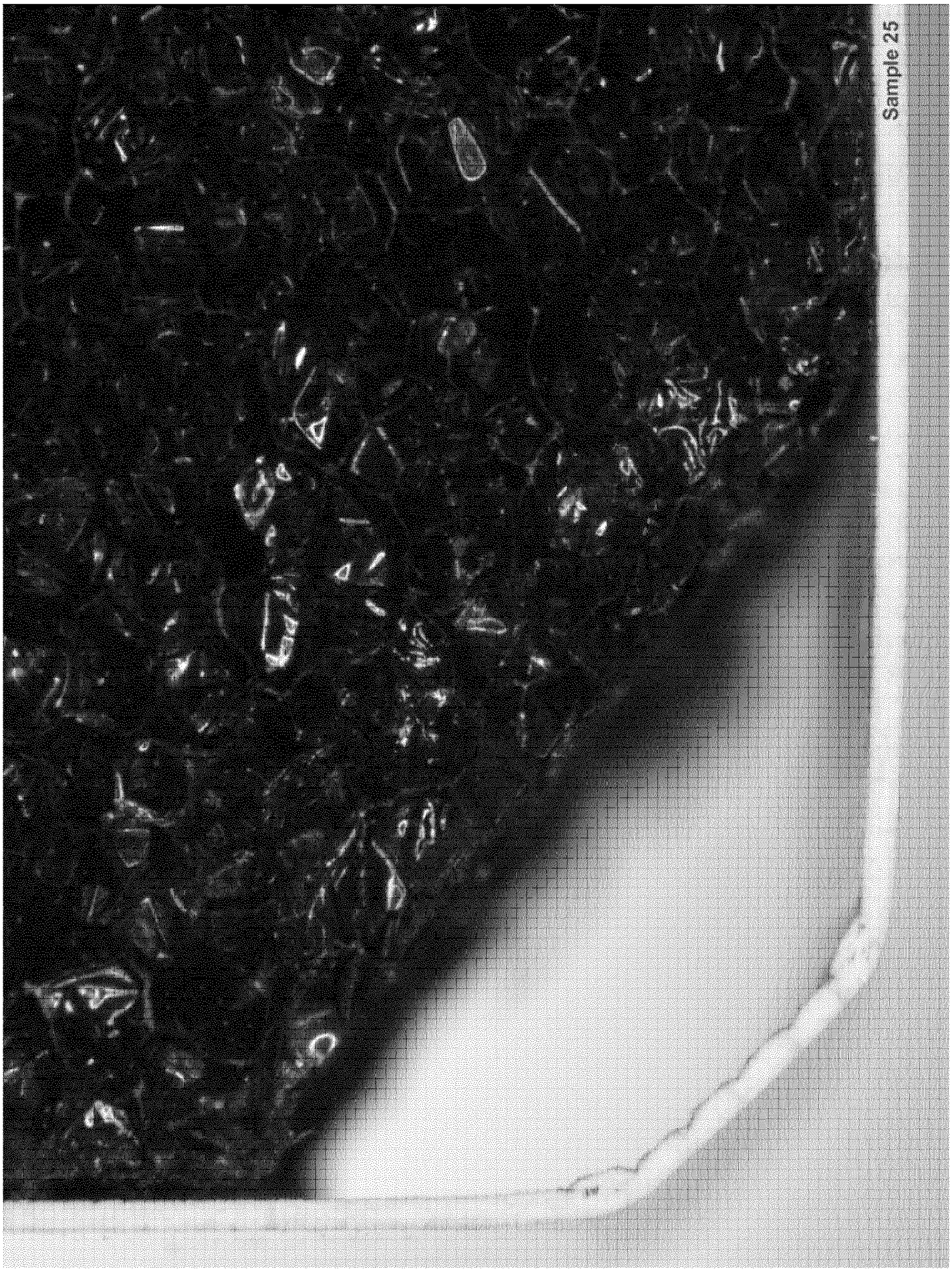

Fig. 10 - Comparative Example 2

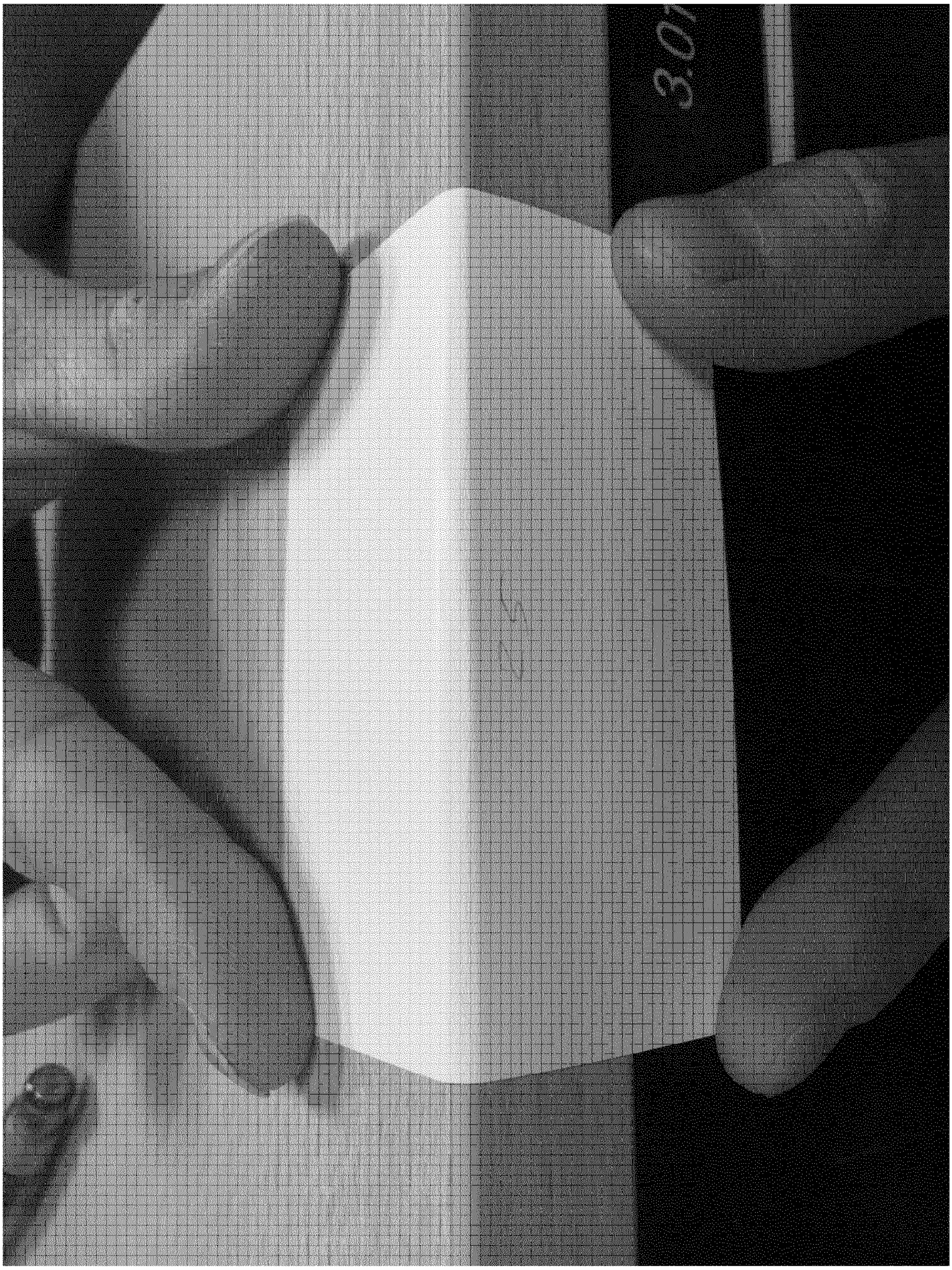

Fig. 11 - Comparative Example 2