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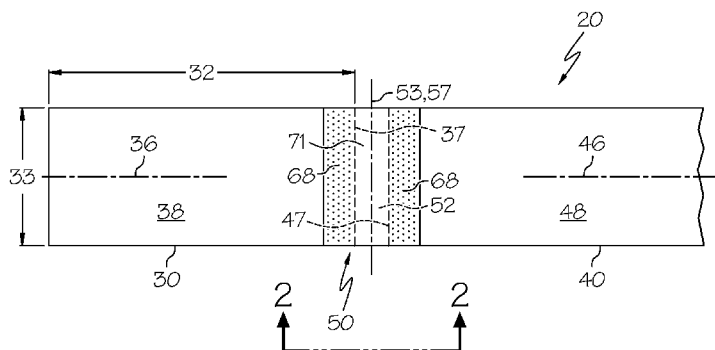


FIG. 1

(57) **Abstract:** Glass web including a first glass-web portion (30), a second portion (40), and a splice joint (50) coupling the first glass-web portion to the second portion, wherein the splice joint includes a splice member (60) with at least one gas-permeable attachment portion. In further examples, methods of splicing a first glass-web portion to a second portion include the step of splicing the first glass-web portion to the second portion with a splice member, wherein the step of splicing includes attaching a gas-permeable attachment portion of the splice member to the first glass-web portion.

GLASS WEBS AND METHODS OF SPLICING

[0001] This application claims the benefit of priority of U.S. Provisional Application Serial No. 61/716685 filed on October 22, 2012 the content of which is relied upon and incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure relates generally to glass webs and methods of splicing and, more particularly, to glass webs and methods of splicing a first glass-web portion to a second portion.

BACKGROUND

[0003] There is interest in using glass in roll-to-roll fabrication of flexible electronic or other devices. Flexible glass web can have several beneficial properties related to either the fabrication or performance of electronic devices, for example, liquid crystal displays (LCDs), electrophoretic displays (EPD), organic light emitting diode displays (OLEDs), plasma display panels (PDPs), touch sensors, photovoltaics, etc. A critical component in the use of spooled flexible glass in roll-to-roll processes is the ability to splice web segments together (either be it one glass portion to another, or a glass portion to a leader/trailer material). The splice technology for the plastic, metal, and paper industry is mature, and techniques are known. Glass web, however, has a unique set of properties and requires unique splice designs and processes.

[0004] To enable use at higher temperatures that a glass web enables, recently wider splice tape with increased surface area has been used. This wider splice tape enables more adhesion between the leader/trailer and the glass web. The wider splice tape, however, also allows an increased chance for entrapped gas between the tape and the web. This entrapped gas under the tape can expand to form gas blisters, for example, when the spliced web is put into a vacuum deposition system. The expansion may become even more significant when heat is introduced. Mechanical failures of the splice and also fracturing of the glass web have been observed and attributed to these entrapped gas blisters under the splice tape. Accordingly, there is a need for practical solutions for splicing glass web portions to one another or to other web materials, for example

leader/trailer material, that reduce the potential for entrapped gas blisters and the probability of splice failure.

SUMMARY

[0005] There are set forth various structures and methods for splicing glass web portions to one another as well as to other web materials, for example, leader/trailer materials. Throughout the disclosure the term “glass” is used for the sake of convenience, but is representative of other like brittle materials. For example, glass can refer to transparent glass (e.g., display-quality glass), glass ceramics, ceramics, and other materials that may be formed into flexible web or ribbon. The structures and methods disclosed herein provide a manner of achieving with glass, functions similar to those to which manufacturers are accustomed to for polymer, paper, and metal web material systems. These structures and methods also provide a splice that is less susceptible to forming gas blisters and/or more capable of slowing down growth, preventing growth, reducing the size, or even removing formed gas blisters entirely. As such, the structures and methods can help prevent failing of a splice joint due to blister formation.

[0006] The inventors have found various aspects of the splice joint itself, as well as of the manner of preparing the splice joint, that lead to a more durable glass web, i.e., one that will not form gas blisters when placed into a vacuum deposition system. For example, the inventors found that the portions of a splice member that attach to web portions can be gas-permeable. Gas permeability can be provided by either using materials to make the splice member that are gas permeable or by providing perforations that extend through the splice member. Thus, as the splice member is applied to the web portions, gas can escape through the gas-permeable splice member as opposed to becoming entrapped between the splice member and the web portions. Additionally, heat or pressure can be applied to the splice member to further remove any gas that may collect between the splice member and the web portions.

[0007] Additional features and advantages will be set forth in the detailed description which follows, and in part will be readily apparent to those skilled in the art from the description or recognized by practicing the invention as exemplified in the written description and the appended drawings. It is to be understood that both the

foregoing general description and the following detailed description are merely exemplary of the invention, and are intended to provide an overview or framework to understanding the nature and character of the invention as it is claimed. By way of non-limiting example the various features of the invention may be combined with one another in various aspects as follows:

[0008] In a first aspect, a glass web includes a first glass-web portion, a second portion, and a splice joint coupling the first glass-web portion to the second portion, wherein the splice joint includes a splice member including at least one gas-permeable attachment portion.

[0009] In one example of the first aspect, the second portion includes a second glass-web portion.

[0010] In another example of the first aspect, a thickness of the first glass-web is from about 10 microns to about 300 microns.

[0011] In another example of the first aspect, the splice member includes a first surface facing the first glass-web portion and a second surface opposite the first surface, wherein the gas-permeable attachment portion extends all the way through the splice member from the first surface to the second surface.

[0012] In another example of the first aspect, the splice member includes a flexible membrane.

[0013] In another example of the first aspect, the flexible membrane is gas-permeable.

[0014] In another example of the first aspect, the attachment portion includes at least one vent aperture configured to provide gas permeability to the attachment portion. For instance, the splice member can include a first surface facing the first glass-web portion and a second surface opposite the first surface, wherein the at least one vent aperture extends all the way through the splice member from the first surface to the second surface. In another example, the at least one vent aperture includes a plurality of vent apertures arranged in a pattern to provide gas permeability to the attachment portion. In yet another example, the vent aperture includes a transverse dimension of less than or equal to about 2 mm.

[0015] In another example of the first aspect, the gas-permeable attachment portion includes a carrier layer and an adhesive layer attaching the carrier layer to the first glass-web portion.

[0016] In another example of the first aspect, the gas-permeable attachment portion includes an end portion of the second portion.

[0017] In another example of the first aspect, the splice joint is a butt joint including a gap between the first glass-web portion and the second portion. For example, the first glass-web portion can include a longitudinal axis and a width, and the gap is substantially perpendicular to the longitudinal axis across the width.

[0018] In another example of the first aspect, the first glass-web portion includes a first longitudinal axis, the splice member includes a longitudinal axis that is disposed substantially perpendicular to the first longitudinal axis.

[0019] The first aspect may be provided alone or in combination with any one or more of the examples of the first aspect discussed above.

[0020] In a second aspect, a method of splicing a first glass-web portion to a second portion includes the step (I) of splicing the first glass-web portion to the second portion with a splice member, wherein the step of splicing includes attaching a gas-permeable attachment portion of the splice member to the first glass-web portion.

[0021] In one example of the second aspect, the splice member includes a first surface and a second surface opposite the first surface and the gas-permeable attachment portion extends all the way through the splice member from the first surface to the second surface, wherein step (I), the first surface is attached to the first glass-web portion.

[0022] In another example of the second aspect, step (I) further includes attaching another gas-permeable attachment portion of the splice member to the second portion.

[0023] In another example of the second aspect, prior to step (I), the method includes the step of providing a gap between an end of the first glass-web portion and an end of the second portion, wherein step (I) provides a splice joint including a gap between the end of the first glass-web portion and the end of the second portion.

[0024] In another example of the second aspect, each of the first glass-web portion and the second portion include a first major surface and a second major surface with a thickness defined between the first and second major surface, and step (I) attaches

the splice member to the first major surface of the first glass-web portion and the first major surface of the second portion. For instance, step (I) can provide a splice joint with the first major surface of the first glass-web portion configured to be oriented substantially coplanar with the first major surface of the second portion.

[0025] In another example of the second aspect, step (I) includes applying pressure to the splice member to attach the gas-permeable attachment portion of the splice member to the first glass-web portion.

[0026] In another example of the second aspect, step (I) includes applying heat to the splice member to attach the gas-permeable attachment portion of the splice member to the first glass-web portion.

[0027] The second aspect may be provided alone or in combination with any one or more of the examples of the second aspect discussed above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The above and other features, aspects and advantages of the present invention are better understood when the following detailed description of the invention is read with reference to the accompanying drawings, in which:

[0029] **FIG. 1** is a top view of a glass web having a splice joint;

[0030] **FIG. 2** is a side view of a glass web as seen along the direction of arrow 2 in **FIG. 1**;

[0031] **FIG. 3** is a cross-sectional view of a splice joint as taken along line 3-3 in **FIG. 2**;

[0032] **FIG. 4** is a side view of a glass web having a splice joint according to a second embodiment;

[0033] **FIG. 5** is a cross-sectional view of a splice joint as taken along line 5-5 in **FIG. 4**;

[0034] **FIG. 6** is a top view of a glass web having a splice joint according to a third embodiment;

[0035] **FIG. 7** is a side view of a glass web as seen along line 7-7 in **FIG. 6**;

[0036] **FIG. 8** is a cross-sectional view of a splice joint as taken along line 8-8 in **FIG. 7**;

[0037] **FIG. 9** is a top view of a glass web having a splice joint according to a fourth embodiment;

[0038] **FIG. 10** is a side view of a glass web as seen along line 10-10 in **FIG. 9**;

[0039] **FIG. 11** is a cross-sectional view of a splice joint as taken along line 11-11 in **FIG. 10**;

[0040] **FIG. 12** is a side view of a splice member in accordance with a method as described in the specification;

[0041] **FIG. 13** is a view similar to **FIG. 12**, demonstrating the step of attaching a first web portion to the splice member;

[0042] **FIG. 14** is a view similar to **FIG. 13**, demonstrating the step of attaching a second web portion to the splice member;

[0043] **FIG. 15** is a view similar to **FIG. 14**, demonstrating the step of attaching a second splice member to the first and second web portions using a roller; and

[0044] **FIG. 16** is a view similar to **FIG. 15**, demonstrating the step of applying pressure and/or energy to the second splice member once the second splice member is attached to the web portions to remove gas entrapped between the web portions and splice members.

DETAILED DESCRIPTION

[0045] The present invention will now be described more fully hereinafter with reference to the accompanying drawings in which example embodiments of the claimed invention are shown. Whenever possible, the same reference numerals are used throughout the drawings to refer to the same or like parts. However, the claimed invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. These example embodiments are provided so that this disclosure will be both thorough and complete, and will fully convey the scope of the claimed invention to those skilled in the art.

[0046] **FIG. 1** illustrates an example embodiment of a glass web **20** which includes a splice joint **50** that couples a first glass-web portion **30** to a second portion **40**. The first glass-web portion **30** may comprise a flexible glass web that can include glass (e.g., transparent glass for example display quality transparent glass), glass ceramic, and ceramic materials and can also include multiple layers of inorganic and organic material.

The glass web can also include additional layered materials on one or both surfaces including inorganic and organic films, coatings, and laminates. The first glass-web portion **30** can be produced by way of a down-drawn, up-draw, float, fusion, press rolling, or slot draw, glass forming process or other techniques. The second portion **40** may be glass web that includes similar materials to the first glass-web portion **30**, or the second portion **40** may be a leader or trailer made of a material other than glass, for example, polymer, paper, or metal (e.g., metal foil).

[0047] As shown in **FIGS. 1 and 2**, the first glass-web portion **30** includes a length **32**, a width **33**, and a thickness **34**. The first glass-web portion **30** includes a longitudinal axis **36** and an end **37** and, similarly, the second portion **40** includes a longitudinal axis **46** and an end **47**. The first glass-web portion includes a first major surface **38** and a second major surface **39**. Similarly, the second portion **40** includes a first major surface **48** and a second major surface **49**. In just some examples, the length **32** of the first glass-web portion **30** can range from about 30 cm to about 1000 m and the width **33** can range from about 5 cm to about 1 m. In just some examples, the thickness **34** can range from about 10 microns to about 300 microns (for example, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 125, 150, 175, 200, 225, 250, 275, or 300 microns), or, for example, from about 50 microns to about 200 microns. The dimensions of the second portion **40** can be the same or different from the first glass-web portion **30**.

[0048] The splice joint **50** couples the first glass-web portion **30** to the second portion **40**. There may be various different embodiments of the splice joint **50** itself. For example, a first embodiment illustrated in **FIGS. 1-3** shows a one-sided butt joint with a gap **52** between the two portions **30**, **40**. In the example embodiment, ends **37**, **47** are placed adjacent to one another so that longitudinal axis **36** may be coaxial with longitudinal axis **46**, though, there may be embodiments where axis **36** and axis **46** are not coaxial. Additionally, ends **37**, **47** are spaced apart by a gap **52** having a width **54**. The gap **52** extends along a longitudinal axis **53** that may be optionally substantially perpendicular to the longitudinal axis **36**. The width **54** of the gap **52** can be between about 0.1 mm and about 5 mm (for example, 0.1, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.4, 1.6, 1.8, 1.9, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, or 5.0 mm) although other width sizes may be incorporated in alternative examples. The width **54** may be sized so that the ends **37**, **47** do not rub

against one another as the portions **30**, **40** rotate about the axis **53** (or an axis parallel therewith within the width **54**) as when, for example, bending around a roller in a downstream process through which the web **20** is conveyed. However, it should be appreciated that other widths may be used for the gap without departing from the scope of the invention. Moreover, there may be instances when the two portions **30**, **40** are directly adjacent without any gap there between.

[0049] The splice joint **50** includes a splice member **60**. The splice member **60** may be a self-adhesive tape, a film to which adhesive is applied, or a film which is laid over adhesive on the first glass-web portion **30** and the second portion **40**. Alternatively, the splice member **60** may be a non-metallic member to which an electrostatic charge may be applied so as to electrostatically couple it to the first glass-web portion **30** and the second portion **40**.

[0050] As shown, the splice member **60** in the example embodiment can optionally include a carrier layer **62**, an adhesive layer **64**, and a longitudinal axis **57**. The splice member **60** can further include attachment portions **65**, **66**. These attachment portions **65**, **66** connect the web portions **30**, **40** through the splice member **60**. The carrier layer **62** can comprise a film made of a flexible membrane for example a polymer, metal, or other material. The adhesive layer **64** can comprise, in some examples, a pressure sensitive or curable adhesive. The adhesive layer **64** of the splice member **60** may be applied to the portions **30**, **40** and arranged so attachment portion **65** attaches to the first glass-web portion **30** and attachment portion **66** attaches to the second portion **40**. Additionally, the splice member **60** may be arranged so that longitudinal axis **57** may be substantially perpendicular to longitudinal axis **36**. In this embodiment, the splice member **60** is shown coupled to the first major surfaces **38**, **48**. However, alternatively, the splice member **60** may be coupled to one or both of the second major surfaces **39**, **49** in further examples.

[0051] One or both of the attachment portions **65**, **66** may be gas permeable. This can be accomplished in various ways. For example, the splice member **60**, or portions of the splice member **60**, may be gas permeable. In further examples, one or more apertures (e.g., perforations) may be provided through the splice member at the attachment portions **65**, **66**. For example, **FIG. 3** is a cross-sectional view of attachment portion **65** which

shows a plurality of vent apertures **68** that extend through the splice member **60** from a first surface **71** to second surface **72** opposing the first surface **71**. The vent apertures **68** can provide gas permeability to the carrier layer **62** and/or the adhesive layer **64** that may not, in some examples, be gas permeable without the apertures **68**. In some examples, the carrier layer **62** and/or the adhesive layer **64** may be gas permeable while also including the apertures **68**. In such examples, the apertures **68** may enhance the gas permeability of the otherwise gas permeable layer. The vent apertures **68** can be any shape, though circular shapes may provide the highest strength and least resistance to tearing for the splice member. Each vent aperture **68** can include a transverse dimension of between about 1 micron and about 2 mm (for example, from 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 125, 150, 175, 200, 250, or 300, microns to 0.5, 0.75, 1, 1.25, 1.5, 1.75, or 2 mm) . Thus, as the attachment portion **65** is applied to the first glass-web portion **30**, gas can escape through the vent apertures **68** rather than collecting between the attachment portion **65** and the first glass-web portion **30**.

[0052] The plurality of vent apertures **68**, if provided, can optionally be arranged in a pattern to provide gas permeability to the attachment portions **65**, **66**. For example, the vent apertures **68** may be arranged in the form of an array, as shown in **FIG. 1**. However, the vent apertures **68** may also be randomly positioned across the splice member **60**. Moreover, the apertures **68** may be positioned partially across surface **71**, as shown in **FIG. 1**, or the apertures **68** may be positioned across the entire surface **71**.

[0053] A second embodiment of the splice joint **50** will be explained in connection with **FIGS. 4-5**. In this embodiment, mainly the differences from the first embodiment will be described, with the understanding that the remaining elements are similar, for example identical, to those described in connection with the first embodiment, and wherein like reference numerals denote like elements throughout the embodiments. The second embodiment similarly has a first glass-web portion **30**, a second portion **40**, and a splice member **60**; all of which are arranged and have similar, for example identical, characteristics as in the first embodiment set forth above. However, the second embodiment further includes a second splice member **80** coupled to the second major surfaces **39**, **49** to form a double-sided splice joint.

[0054] The second splice member **80** may have similar, for example the same, characteristics as set forth above in connection with the splice member **60** of the first embodiment. For example, as shown in **FIG. 4**, the second splice member **80** can include a carrier layer **82**, adhesive layer **84**, attachment portion **85**, and attachment portion **86**. The adhesive layer **84** of the second splice member **80** may be applied to the portions **30**, **40** and arranged so attachment portion **85** attaches to the first glass-web portion **30** and attachment portion **86** attaches to the second portion **40**.

[0055] In some examples, both attachment portions **85**, **86** are gas permeable similar to the attachment portions **65**, **66** of the first splice member **60**. This can be accomplished either by using materials for the splice member **60** that are gas permeable and/or by providing perforations that extend through the attachment portions **85**, **86**. For example, **FIG. 5** is a cross-sectional view of attachment portion **85** which shows a plurality of vent apertures **88** that extend through the second splice member **80** from a first surface **91** to second surface **92** opposed to the first surface **91**. The vent apertures **88** can facilitate making the carrier layer **82** and adhesive layer **84** gas permeable. Alternatively, the vent apertures **88** could only extend through the carrier layer **82**. Each vent aperture **88** can include a transverse dimension of between about 1 micron and about 2 mm although other size apertures may be used in further examples. Thus, as the attachment portion **85** is applied to the first glass-web portion **30**, gas can escape through the vent apertures **88** rather than collecting between the attachment portion **85** and the first glass-web portion **30**.

[0056] As with the first splice member **60**, the plurality of vent apertures **88** can be arranged in a pattern to provide gas permeability to the attachment portions **85**, **86**. However, the vent apertures **88** may also be randomly positioned across the splice member **80**. Moreover, the apertures **88** may be positioned partially across surface **91**, or the apertures may be positioned across the entire surface **91**.

[0057] A third embodiment of the splice joint **50** will now be explained in connection with **FIGS. 6-8**. In this embodiment, mainly the differences from the other embodiments will be described, with the understanding that the remaining elements are similar, for example identical, to those described in connection with the other embodiments, and wherein like reference numerals denote like elements throughout the

embodiments. In this embodiment, the splice member **60** may be part of the second portion **40**. The splice member **60** can similarly have a carrier layer **62** and an adhesive layer **64**, as shown in **FIG. 7**. Alternatively, the splice member **60** may be a non-metallic member to which an electrostatic charge may be applied so as to electrostatically couple it to the first glass-web portion **30**.

[0058] In the example embodiment, the adhesive layer **64** of the splice member **60** is arranged and applied to the first glass-web portion **30** so that the second portion **40** overlaps the first glass-web portion **30**. Longitudinal axis **36** may be coaxial with longitudinal axis **46**, although there may be embodiments wherein axis **36** and axis **46** are not coaxial. Additionally, although the splice member **60** is shown in **FIGS. 7-8** as being coupled to the first major surface **38**, alternatively, the splice member **60** may be coupled to the second major surface **39** instead.

[0059] Similar to the first embodiment, the splice member **60** can be gas permeable, particularly in the vicinity of the portion that attaches to the first glass-web portion **30**. This can be accomplished either by using materials for the splice member **60** that are gas permeable or by providing apertures (e.g., perforations) that extend through the splice member **60**. For example, **FIG. 8** is a cross-sectional view of the splice member **60** which shows a plurality of vent apertures **68** that extend through the splice member **60** from surface **71** to surface **72**, making the carrier layer **62** and adhesive layer **64** gas permeable. Each vent aperture can include various transverse dimensions, for example, between about 1 micron and about 2 mm. Thus, as the splice member **60** is applied to the first glass-web portion **30**, gas can escape through the vent apertures **68** rather than collecting between the splice member **60** and the first glass-web portion **30**.

[0060] Also similar to the first embodiment, the plurality of vent apertures **68** can optionally be arranged in a pattern to provide gas permeability to the splice member **60**. For example, the vent apertures **68** may be arranged in the form of an array, as shown in **FIG. 6**. However, the vent apertures **68** may also be randomly positioned across the splice member **60**.

[0061] A fourth embodiment of the splice joint **50** will now be explained in connection with **FIGS. 9-11**. In this embodiment, mainly the differences from the other embodiments will be described, with the understanding that the remaining elements are

similar, for example identical, to those described in connection with the other embodiments, and wherein like reference numerals denote like elements throughout the embodiments. In this embodiment, attachment portions **65, 66** of the first splice member **60** are coupled to the first major surface **38** and the second major surface **49** respectively. Meanwhile, attachment portions **85, 86** of a second splice member **80** are coupled to the first major surface **48** and second major surface **39** respectively. The splice members **60, 80** are shown as being disposed side-by-side across the width **33**, however, in some circumstances this need not be the case. Instead, the second splice member **80** may include an aperture through its middle portion and the first splice member **60** may be inserted therethrough (or *vice versa*). Further, the splice members **60, 80** may be disposed across less than the entire width **33**.

[0062] For the example embodiment, in order to couple the first splice member **60** to the first major surface **38** and the second major surface **49** as described above, adhesive layer **64** may be provided on surface **74** and adhesive layer **69** may be provided on surface **73**. Similarly, in order to couple the second splice member **80** to the first major surface **48** and the second major surface **39**, adhesive layer **84** may be provided on surface **93** and adhesive layer **89** may be provided on surface **94**. As with the other embodiments, the adhesive layer **64, 69, 84, 89** can comprise a pressure sensitive or curable adhesive. Moreover, there may be embodiments wherein splice members **60, 80** do not have an adhesive layer. For example, splice members **60, 80** can be non-metallic members to which an electrostatic charge may be applied so as to electrostatically couple the splice members **60, 80** to portions **30, 40**.

[0063] Attachment portions **65, 66, 85, 86** may be gas-permeable. Similar to other embodiments, this can be accomplished using gas-permeable materials for the splice members **60, 80**. In addition or alternatively, as shown in **FIGS. 9 and 11**, the attachment portions **65, 66, 85, 86** can include apertures (e.g., perforations). **FIG. 11** is a cross-sectional view of splice member **60, 80**. As shown in **FIG. 11**, a plurality of vent apertures **68** extend through the first splice member **60** from the first surface **71** to the second surface **72** and a plurality of vent apertures **88** extend through the second splice member **80** from first surface **91** to the second surface **92**. Each vent aperture **68, 88** may include a transverse dimension of between about 1 micron and about 2 mm although

other sized apertures may be used in further examples. Thus, as the splice members **60**, **80** are applied to the first glass-web portion **30**, gas can escape through the vent apertures **68**, **88** rather than collecting between the splice members **60**, **80** and the first glass-web portion **30**.

[0064] **FIGS. 12-16** demonstrate an example method for splicing a first glass-web portion **130** to a second portion **140** for the representative splicing configuration shown in **FIG. 16**. Any of the aspects, for example all of the aspects of splicing illustrated in **FIGS. 12-16** may be applied to any of the embodiments of the disclosure, for example, as discussed above with respect to **FIGS. 1-11** above. As shown in **FIG. 12**, a first splice member **160** may be placed on a surface **100** so that surface **171** of the first splice member **160** faces support surface **100**. The first splice member **160** may be a self-adhesive tape or a tape to which adhesive is applied. Alternatively, the splice member **160** may be a non-metallic member to which an electrostatic charge may be applied. The first splice member **160** in the example embodiment includes carrier layer **162**, adhesive layer **164**, attachment portion **165**, and attachment portion **166**. The carrier layer **162** can comprise a tape made of a flexible membrane. The adhesive layer **164** may comprise a pressure sensitive adhesive, curable adhesive (with thermal, UV, or other energy source) or other adhesive type. Attachment portions **165**, **166** may be gas-permeable. As discussed above, this can be accomplished for example either by using materials for the splice member **160** that are gas permeable or by providing apertures (e.g., perforations) that extend fully or partially through the attachment portions **165**, **166** from surface **171** to surface **172**.

[0065] Next, a first glass-web portion **130** is provided, as shown in **FIG. 13**. The first glass-web portion **130** may comprise a glass web that can include glass (e.g., transparent glass for example display quality transparent glass), glass ceramic, and ceramic materials and can also include multiple layers of continuous or patterned inorganic and organic material. The first glass-web portion **130** can be produced by way of a down-drawn, up-draw, float, fusion, press rolling, or slot draw, glass forming process or other techniques. The first glass-web portion **130** includes an end **137**, a first major surface **138**, and a second major surface **139**. The length **132** of the first glass-web portion **130** can range from about 30 cm to about 1000 m and the width **133** can range

from about 5 cm to about 1 m. The thickness **134** can range from about 10 microns to about 300 microns, for example from about 50 microns to about 200 microns. The first glass-web portion **130** may be applied to the first splice member **160** so that attachment portion **165** is coupled to the first major surface **138**.

[0066] Next, a second portion **140** is provided, as shown in **FIG. 14**. The second portion **140** may be glass web that includes similar materials to the first glass-web portion **130**, or the second portion **140** may be a leader or trailer made of a material other than glass, for example, polymer, paper, or metal. The dimensions of the second portion **140** can be the same or different from the first glass-web portion **130**. Similar to the first glass-web portion **130**, the second portion **140** includes an end **147**, a first major surface **148**, and a second major surface **149**. The second portion **140** may be applied to the first splice member **160** so that attachment portion **166** is coupled to first major surface **148** and ends **137**, **147** are spaced apart by a gap having a width **154**. Additionally, the first major surface **138** of the first glass-web portion **130** may be oriented to be substantially coplanar with the first major surface **148** of the second portion **140**. The width **154** of the gap may be between about 0.5 mm and about 5 mm although other sizes may be provided in further examples.

[0067] According to the method just described, a single-sided splice joint can be formed similar to the first embodiment described above. However, a double-sided splice joint can be formed with the additional step of providing a second splice member **180**, as shown in **FIG. 15**. The second splice member **180** can have the same characteristics as the first splice member **160**. For example, as shown in **FIG. 15**, the second splice member **80** can include a carrier layer **182**, adhesive layer **184**, attachment portion **185**, and attachment portion **186**. The second splice member **180** may be optionally rolled onto the portions **130**, **140** (e.g., by roller **200**) so attachment portion **185** attaches to the second major surface **139** of the first glass-web portion **130** and attachment portion **186** attaches to the second major surface **149** of the second portion **140**. The rolling process for adhering splice member **180** can adhere the splice member **180** to web portions **130**, **140** concurrently or sequentially. This rolling process can be used for application of either or both splice members **160**, **180**. Alternatively, a rolling process can be used to apply the web portion **130** or **140** to a stationary splice member **160** or **180**. In some

examples, both attachment portions **185, 186** may be gas permeable similar to the attachment portions **165, 166** of the first splice member **160**.

[0068] Once the second splice member **180** is applied to the portions **130, 140**, heat or pressure or some other energy source can be applied to the splice members **160, 180** to perform any required adhesive curing, bond strengthening or remove any gas that is entrapped between the splice members **160, 180** and portions **130, 140**. For example, as shown in **FIG. 17**, a roller **200** can apply pressure to surface **191** of the second splice member **180**. As pressure is applied, gas can escape through the gas-permeable attachment portions **165, 166, 185, 186**. Additionally, heat or light or other energy can be applied to the splice members **160, 180** to cure the adhesive materials. For example, as schematically shown in **FIG. 16**, the roller **200** may include an optional heating mechanism **202** such that pressure and heat may optionally be provided simultaneously. Alternatively, the heat light or other energy can be applied to the splice members as the roller **200** is attaching the splice member to the web portions.

[0069] It should be emphasized that the above-described embodiments of the present invention, particularly any “preferred” embodiments, are merely possible examples of implementations, merely set forth for a clear understanding of various principles of the invention. Many variations and modifications may be made to the above-described embodiments of the invention without departing substantially from the spirit and various principles of the invention. All such modifications and variations are intended to be included herein within the scope of this disclosure and the present invention and protected by the following claims.

[0070] For example, the application of the splice member(s) may be performed in a vacuum in order to further facilitate the removal of gas entrapped between the web portions and the splice member.

What is claimed is:

1. A glass web comprising:
a first glass-web portion;
a second portion;
a splice joint coupling the first glass-web portion to the second portion, wherein the splice joint comprises a splice member including at least one gas-permeable attachment portion.
2. The glass web of claim 1, wherein the second portion comprises a second glass-web portion.
3. The glass web of claim 1 or claim 2, wherein a thickness of the first glass-web is from about 10 microns to about 300 microns.
4. The glass web of any one of claims 1-3, wherein the splice member comprises a first surface facing the first glass-web portion and a second surface opposite the first surface, wherein the gas-permeable attachment portion extends all the way through the splice member from the first surface to the second surface.
5. The glass web of any one of claims 1-4, wherein the splice member comprises a flexible membrane.
6. The glass web of claim 5, wherein the flexible membrane is gas-permeable.
7. The glass web of any one of claims 1-6, wherein the attachment portion comprises at least one vent aperture configured to provide gas permeability to the attachment portion.
8. The glass web of claim 7, wherein the splice member comprises a first surface facing the first glass-web portion and a second surface opposite the first surface, wherein the at least one vent aperture extends all the way through the splice member from the first surface to the second surface.
9. The glass web of claim 1, wherein the gas-permeable attachment portion comprises an end portion of the second portion.
10. A method of splicing a first glass-web portion to a second portion comprising the step of:

(I) splicing the first glass-web portion to the second portion with a splice member, wherein the step of splicing includes attaching a gas-permeable attachment portion of the splice member to the first glass-web portion.

11. The method of claim 10, wherein the splice member comprises a first surface and a second surface opposite the first surface and the gas-permeable attachment portion extends all the way through the splice member from the first surface to the second surface, wherein step (I), the first surface is attached to the first glass-web portion.

12. The method of claim 10 or claim 11, wherein step (I) further includes attaching another gas-permeable attachment portion of the splice member to the second portion.

13. The method of any one of claims 10-12, wherein step (I) includes applying pressure to the splice member to attach the gas-permeable attachment portion of the splice member to the first glass-web portion.

14. The method of any one of claims 10-13, wherein step (I) includes applying heat to the splice member to attach the gas-permeable attachment portion of the splice member to the first glass-web portion.

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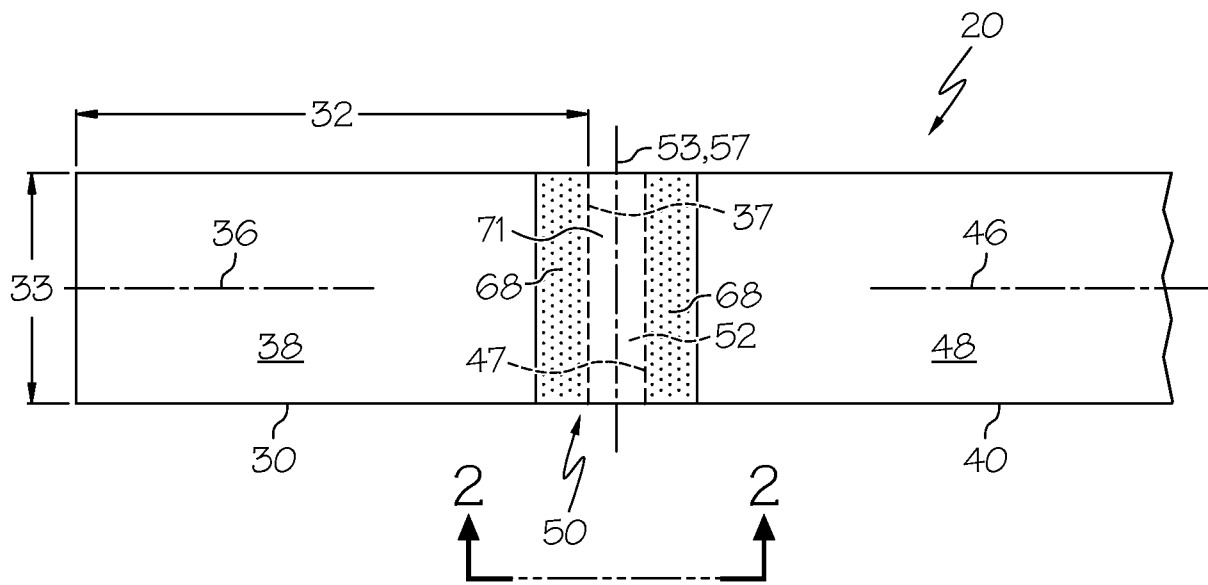


FIG. 1

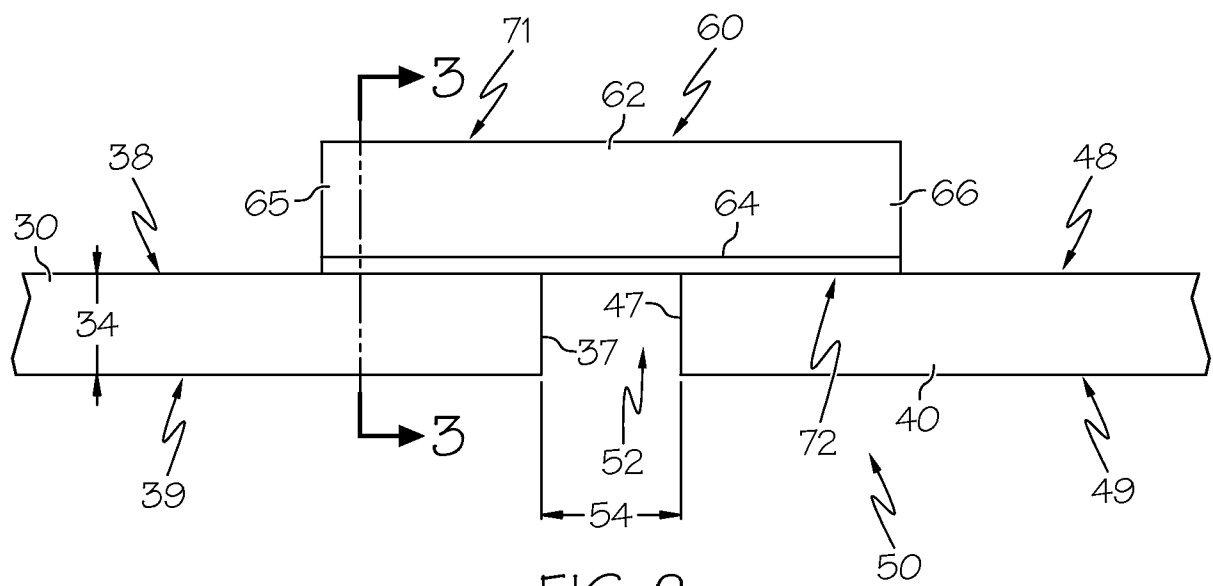
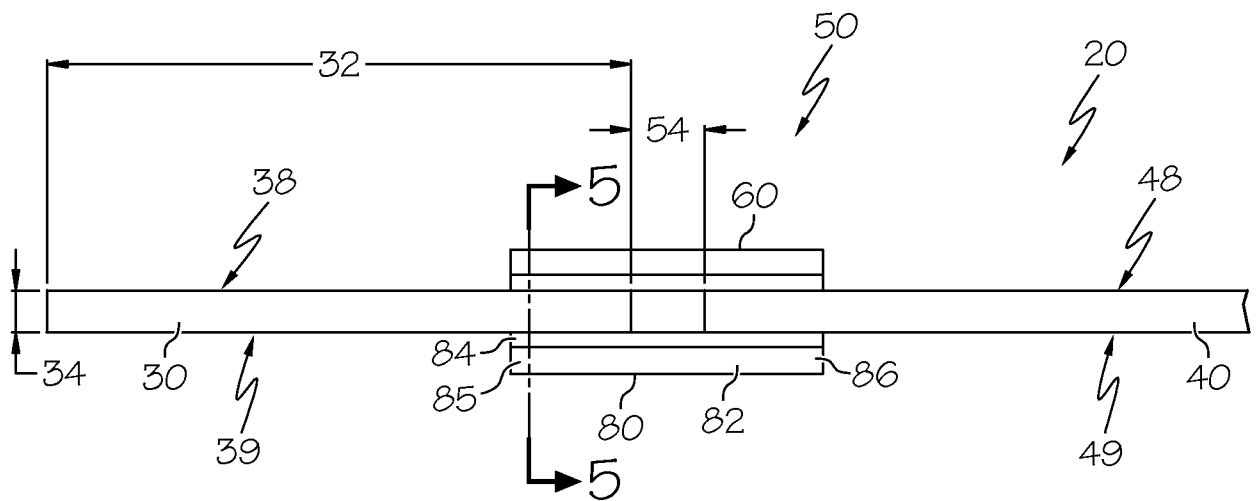
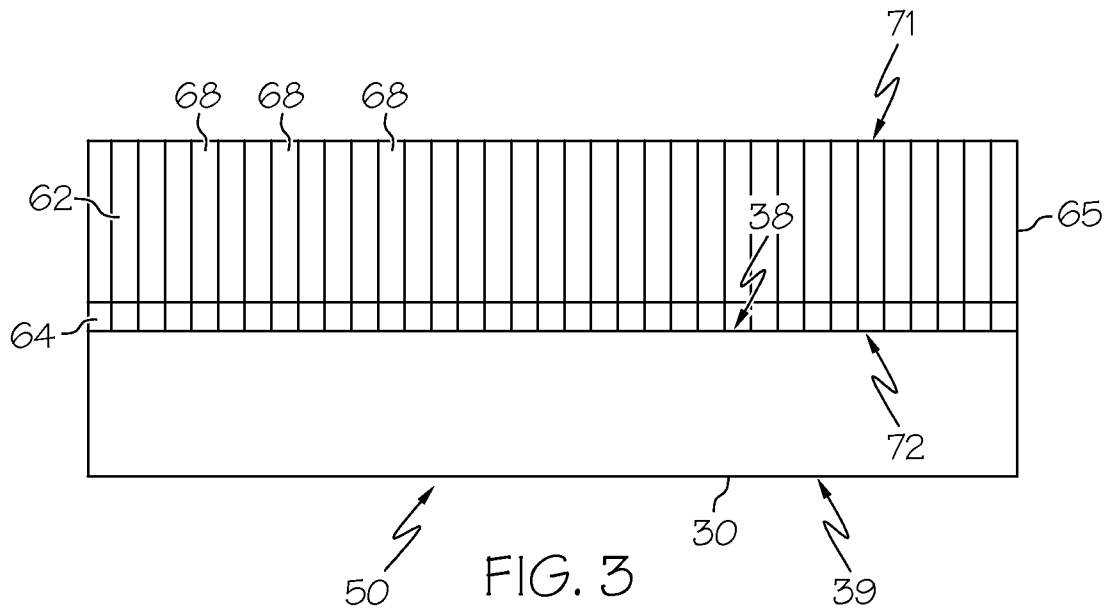
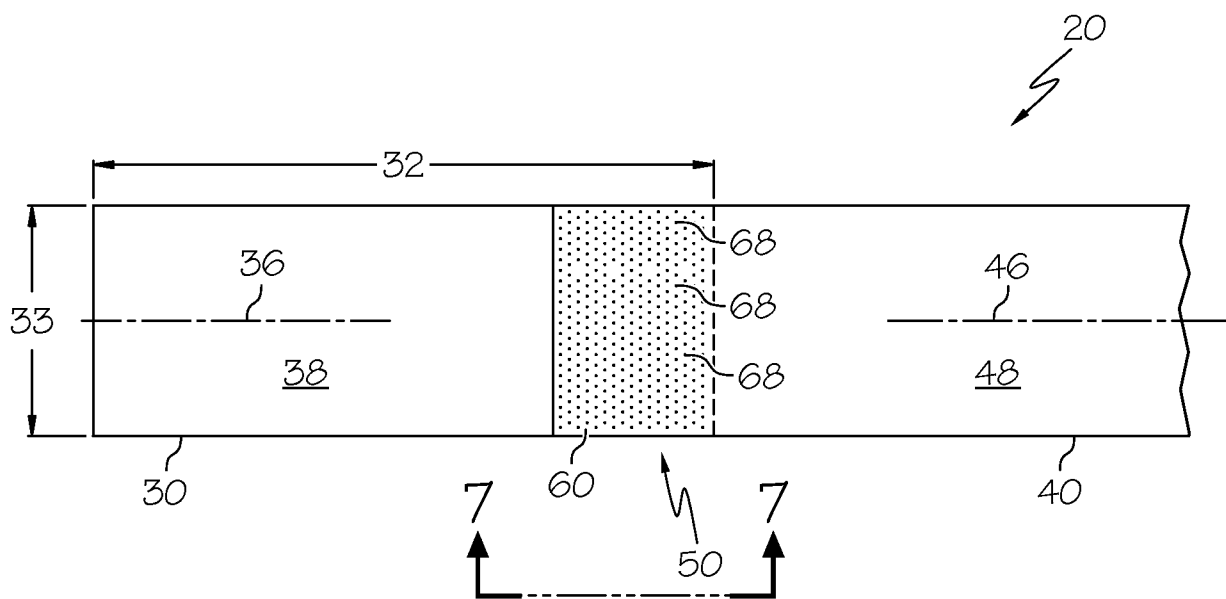
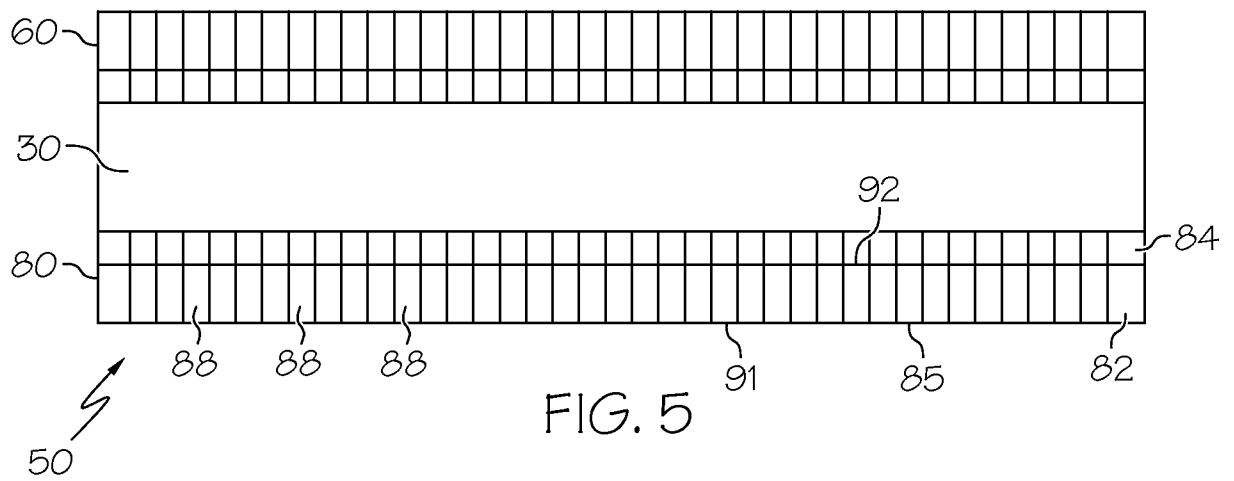


FIG. 2

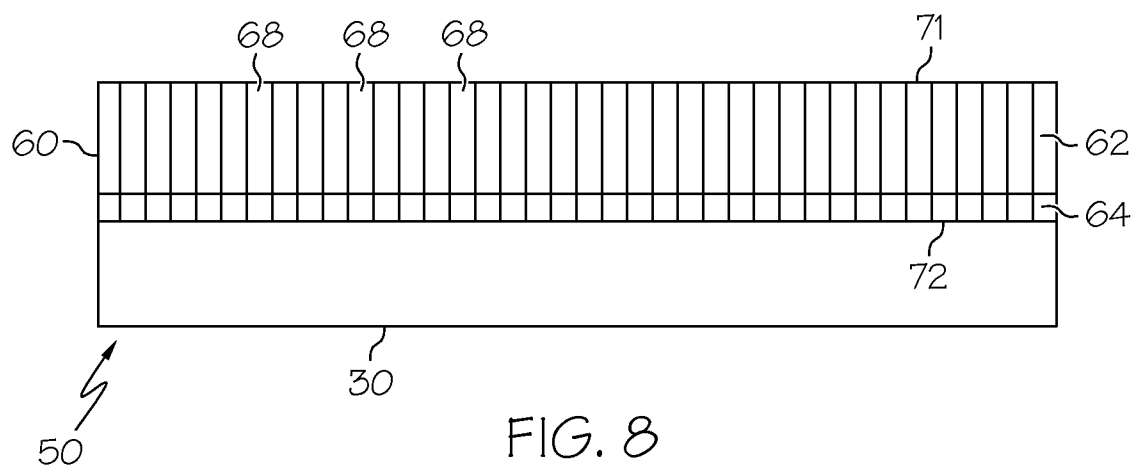
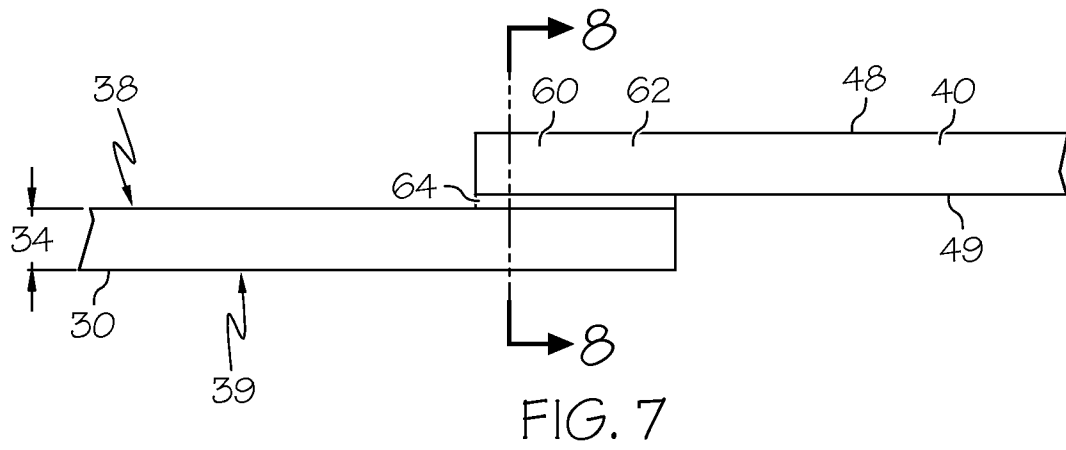
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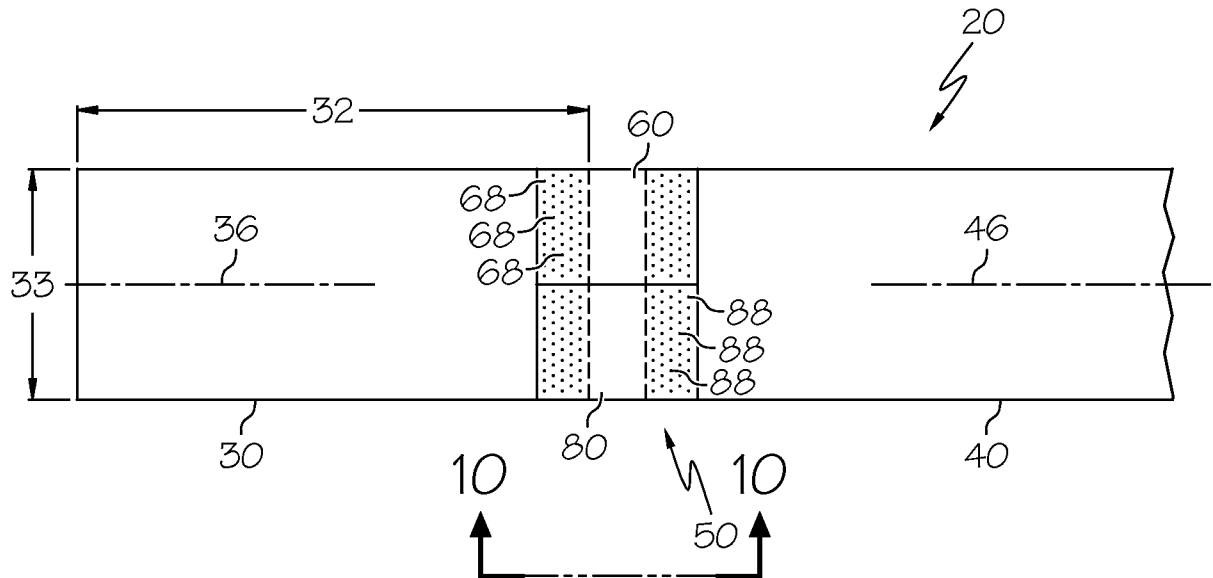
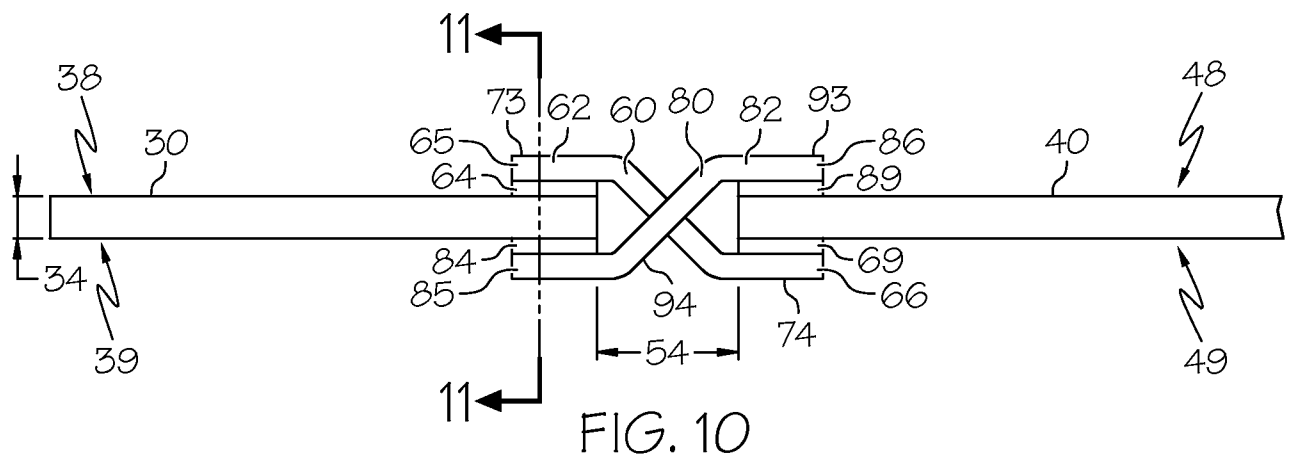
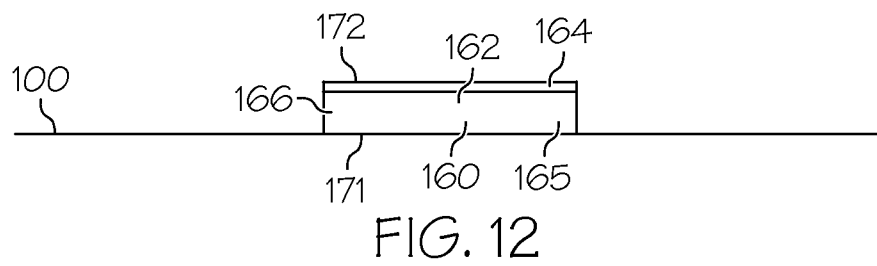
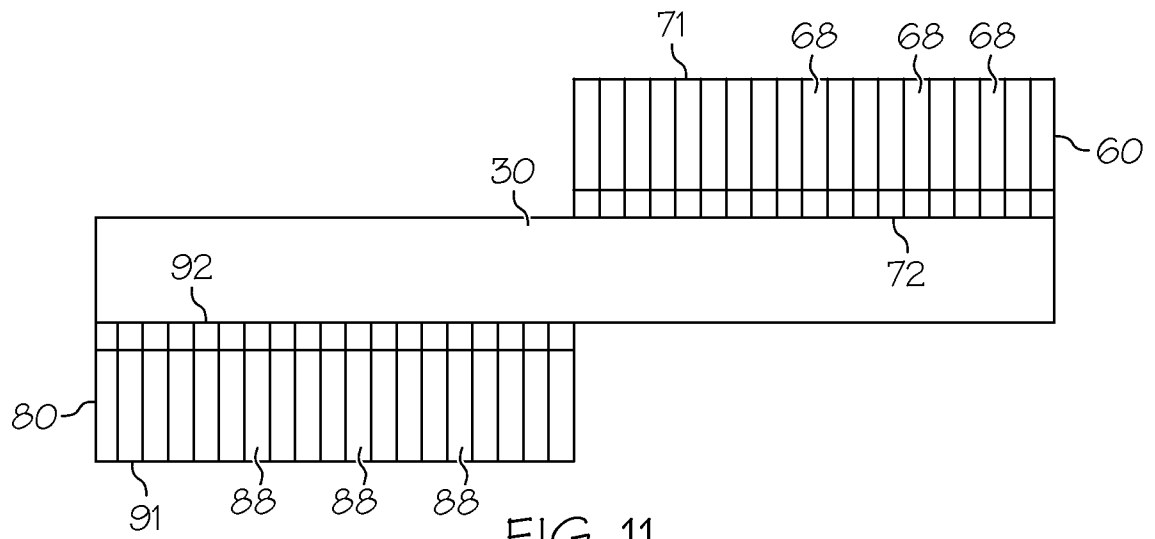


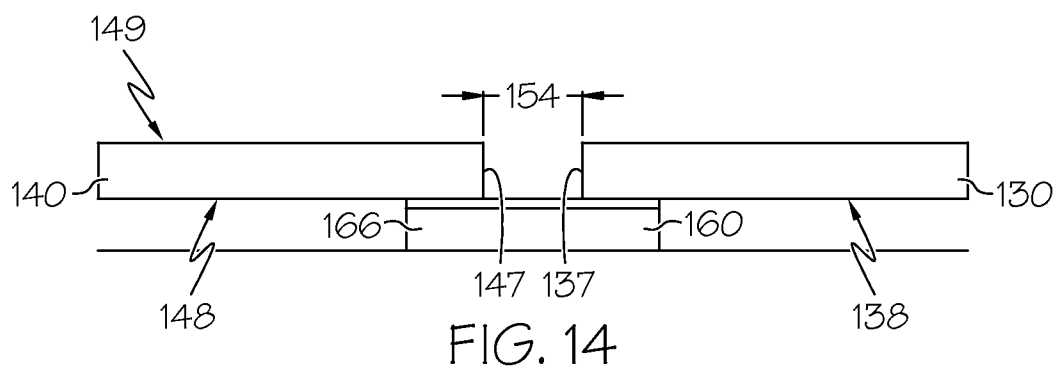
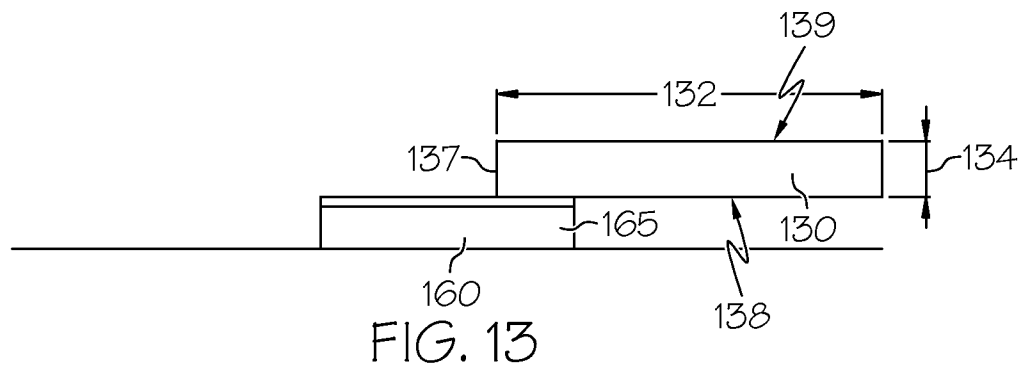
FIG. 9



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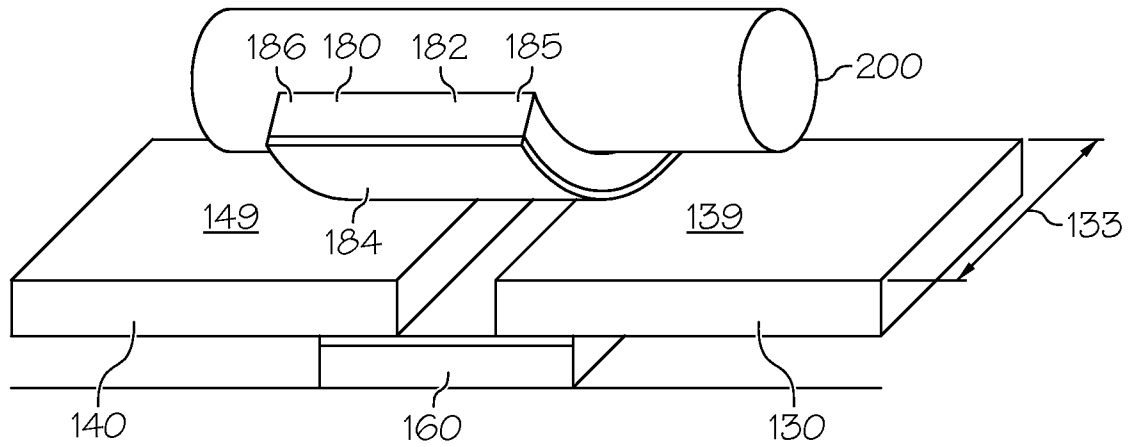


FIG. 15

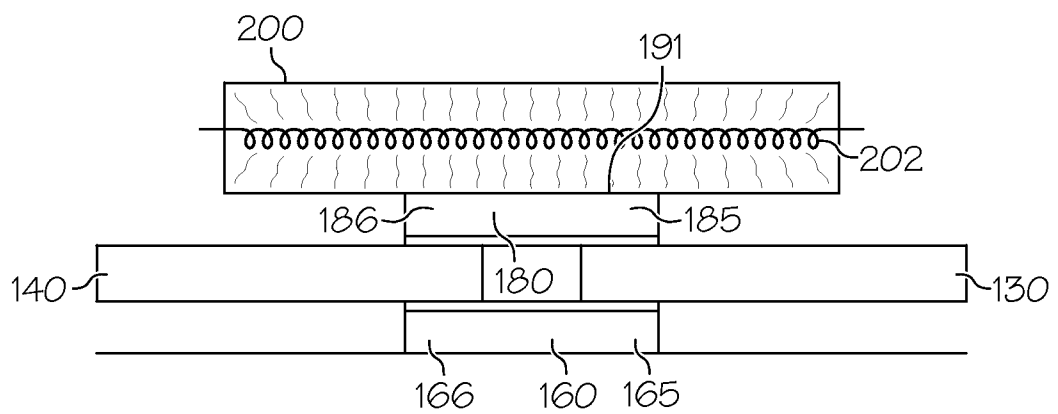


FIG. 16

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/066005

A. CLASSIFICATION OF SUBJECT MATTER

INV. B65H19/18

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)

B65H

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012/074971 A2 (CORNING INC [US];	1-6,9-14
A	GARNER SEAN MATTHEW [US]; MERZ GARY EDWARD [US]; TOS) 7 June 2012 (2012-06-07) paragraphs [0080], [0081]; claim 9; figures -----	7,8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"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

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Date of the actual completion of the international search

21 January 2014

Date of mailing of the international search report

27/01/2014

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Authorized officer

Haaken, Willy

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/066005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012074971 A2	07-06-2012	CN 103347829 A	09-10-2013
		JP 2013544228 A	12-12-2013
		TW 201235317 A	01-09-2012
		US 2013236675 A1	12-09-2013
		WO 2012074971 A2	07-06-2012
