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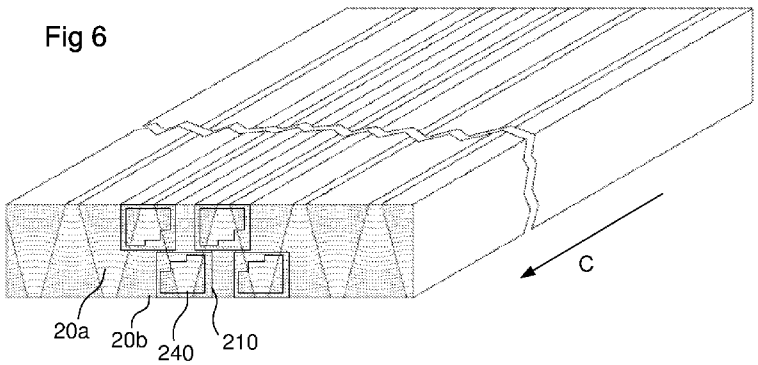
Fig 6



(57) Abstract: The present disclosure provides a laminated wood component (250) for use e.g. as a door frame or window frame. The component presents a cross section and a longitudinal direction (C), perpendicular to the cross section, and a main fiber direction, which is substantially perpendicular to the cross section. The cross section is substantially constant along the longitudinal direction and the laminated wood product is formed of at least two adjacent wood lamellae (20a, 20b). The wood component presents at least one longitudinally extending face, which is perpendicular to the cross section, and which is planed and/or profiled, and the joint plane (JP1, JP2) presents an angle (A2) to the longitudinally extending face, which is greater than 0° and less than 90°.

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METHOD OF FORMING A LAMINATED WOOD COMPONENT, AND LAMINATED WOOD COMPONENT THUS FORMED

Technical Field

The present disclosure relates to a method of forming wood components, which have good dimensional stability. Such wood components are particularly suitable for use in frames for doors and windows.

The disclosure also relates to a component which may be formed according to the method disclosed.

Background

Certain laminated wood components are subjected to greater requirements for dimensional stability than others. One example of such components is the components from which structures such as door frames and window frames are made.

These are structures that need to maintain exact tolerances over a long period of time in spite of being subjected to varying degrees of moisture and temperature.

Referring to Figs 3-5 in the attached drawings, wood components 150 have for a long time been formed from intermediate products in terms of strips, which are formed by lamination of planks 101, 102, 103, 104 of wood. The planks are typically laminated such that year rings in the outer planks are substantially parallel to the surface, which provides a plain appearance.

Such planks 101, 102, 103, 104 of wood are traditionally formed from a log according to a pattern such as the one disclosed in Fig. 1 of US5816015. That is, the plank is sawn along its length direction along a plurality of planes which all extend along the length direction of the log and which are either parallel with, or perpendicular to, each other.

Elongate planks thus formed, having a substantially constant square or rectangular cross section are dried, formatted and then dry-glued together along one or more planes which are perpendicular to the cross section, as illustrated in Figs 4 and 5, typically creating an intermediate product 110

having cross sectional dimensions on the order of 50-100 mm by 50-100 mm and a length of 0.5 to 6.0 m.

However, using the traditional formatting of the planks, the control of the orientation of the year rings in the resulting intermediate product is limited, as is also the control of the resulting end product, the wood component. Moreover, only a few parts of each log cross section actually provide a year ring orientation that is acceptable for such components. Thus, with a stricter requirement on year ring orientation, yield decreases.

Moreover, in many countries, insulation properties, also with respect to the window frame, is becoming increasingly important. This is particularly the case since insulation properties of the glass inserts are becoming so good that window frames is appearing as the weak link.

There is also the issue of yield. That is, maximizing use of the raw material.

Hence, there is a need for an improved method of making laminated wood components, such as for door frames and window frames.

Summary

It is a general object of the present disclosure to provide an improved method of making a laminated wood component for use in door frames and/or window frames. It is a specific object to provide components which are of even quality, with good dimensional stability, good strength, good insulation properties and with minimum waste of material.

It is also an object to provide an improved laminated wood component for use in making door frames and window frames, the component having good dimensional stability and insulation properties.

The invention is defined by the appended independent claims, with embodiment being set forth in the appended dependent claims, in the following description and in the drawings.

According to a first aspect, there is provided a laminated wood component for use as a door frame or window frame. The component presents a cross section and a longitudinal direction, perpendicular to the

cross section, and a main fiber direction, which is substantially perpendicular to the cross section. The cross section is substantially constant along the longitudinal direction. The laminated wood product is formed of at least two adjacent wood lamellae. The wood component presents at least one longitudinally extending face, which is perpendicular to the cross section, and which is planed and/or profiled and the wood lamellae are glued together along a joint plane that presents an angle to the longitudinally extending face, which is greater than 0° and less than 90°, preferably 1°-30° or 60°-89° . More preferably, the angle may be preferably 1°-20° or 70°-89°.

The terms “planing” and “profiling” are well known in the wood working art.

The term “face” is understood as an outwardly exposed surface.

Such a laminated wood component can be formed with optimal orientation of wood ring orientation and with optimum use of the wood raw material: whether maximum strength or insulation properties are to be prioritized.

In the wood component, an intersection between the joint plane and one of the longitudinally extending faces may be spaced from both intersections between that longitudinally extending face and other ones of the longitudinally extending faces along at least 50 % of a length of the wood component, preferably along at least 75 % or at least 99 % of the length of the wood component.

Hence, each joint plane may be visible along a substantial portion of the wood component, and preferably on only two longitudinally extending faces (front and rear).

The joint plane may present an angle to the longitudinally extending face, which is greater than 5°, preferably greater than 10° or 15°.

The wood lamellae may be glued together along the joint plane by means of a glue that is suitable for wet gluing, such as a polyurethane based glue.

The wood component may be formed from two or more, but less than six, preferably less than five or less than four, wood lamellae, which are joined in the same manner along respective joint planes.

Adjacent joint planes may be non-parallel.

The wood component may present a pair of adjacent outwardly exposed longitudinally extending faces, positive surface normals of which crossing each other, preferably at an angle of more than 20°, more than 30°, more than 45°, more than 75° or about 90°.

Such a wood component may typically be provided by a profiling operation, such as a milling cutting operation.

A positive surface normal is defined as a surface normal which extends outwardly of the surface, away from the body delimited by the surface.

In the wood component, at least one of the longitudinally extending faces may comprise at least two portions, which are parallel and separated in a direction normal to the face. That is, a face of the wood component may comprise two or more “levels” or “steps”.

At the joint plane, a bending radius of a year ring of one of the wood lamellae may be parallel +/- less than 10°, preferably less than +/- 5° or less than +/- 1°, and oppositely directed to a bending radius of a year ring of the other one of the wood lamellae, taken at the same position, seen in a thickness direction of the wood component.

In particular, the joint plane may be formed by surfaces which were formed by the same cut of the log.

The component may be formed of at least 90 % wood lamellae which are not joined in an end-to-end manner to other wood lamellae. Preferably, none of the lamellae are joined in an end-to-end manner, as this is typically performed in a dry gluing operation whereas the lamellae are preferably, but not necessarily, glued together in a wet gluing operation.

At least one of the lamellae making up the component may be formed at a portion of the log presenting a density minimum. That is, the component may have been formed at a portion of the log selected such that a density

minimum is achieved. The density minimum may be identified as a maximum radial width of early-wood type year rings.

This is based on the insight that the central part of the log displays wider year rings compared to the outermost part of the log. Within one annual ring there is the ”early-wood” (i.e. the normally lighter-colored part) which has low density and the ”late-wood” (the darker-colored part) which has high density. The proportion of late-wood normally gets higher the older the tree becomes. High density correlates strongly with high strength values and low insulation values. So, on average, in the central part of the log wood with low strength values and high insulation value is normally found. Moving radially outwardly towards the outside part of the log, the strength values get higher and the insulation value get lower.

The component may comprise a middle lamella sandwiched between a pair of outer lamellae, wherein the middle lamella is formed from a portion of a log that is closer to the pith than what the outer edge lamellae are.

With such a composition, the middle lamella may provide the best insulation properties whereas the outer lamellae provide strength.

The middle lamella may present a substantially trapezoidal cross section.

The joint plane may present an angle of 70°-89°, preferably 80°-89° to the cross section. Thus, the lamellae may be formed as tapering lamellae, i.e. lamellae that has base surfaces which taper along the longitudinal direction of the lamellae.

The longitudinally extending face may present a longitudinal edge and the joint plane may intersect at the longitudinally extending face along a line that is non-parallel with the longitudinal edge.

In the alternative, the joint plane may be perpendicular to the cross section. In this case, the lamellae may present a constant cross section, that is base surfaces which do not taper.

The wood component may further comprise at least one face lamella, which presents a rectangular cross section.

By adding a face lamella, it is possible to more precisely control the appearance of the component. For example, at least some portions of a window frame or a door frame that are to provide surfaces having positive surface normals that are parallel with a positive surface normal of the inner or outer wall surface of the wall in which the frame is arranged may be provided by forming of the face lamella.

The face lamella may be formed from a single piece of wood.

At least two exposed faces of the wood component may be formed in the face lamella, said at least two exposed faces being formed such that positive surface normals thereof cross each other, preferably at an angle of more than 20°, more than 30°, more than 45° or more than 80°.

A major surface of the face lamella may present an angle greater than 45° to a joint plane intersecting the major surface, preferably greater than 60° or greater than 70°.

As seen in cross section, year rings of the face lamella may extend at an angle of more than 45°, preferably more than 55°, to major surfaces of the face lamella.

The wood lamellae, from which the wood component is made may be selected from a group consisting of softwood, i.e. gymnosperm tree species, having a density of more than 400 kg/m^3, and hardwood, i.e. angiosperm tree species, having a density of more than 400 kg/m^3.

The wood component may present a length along its fiber direction, which may be at least 200 % of a length along a greatest length of its cross section, preferably 300 % or 500 %.

According to a second aspect, there is provided a frame for a window or door comprising a frame portion that is formed of a wood component as described above and that positioned to face perpendicular to surface of a wall in which the window or door frame is arranged.According to a third aspect, there is provided a method of forming a laminated wood component. The method comprises

a) providing a billet, formed of a plurality of elongate wood lamellae, wherein the lamella are formed along a principal fiber direction of a log, and

each of the lamellae presents a substantially trapezoidal cross section, major base surfaces of each pair of adjacent lamellae face opposite directions,

b) cutting the billet along at least one plane that is perpendicular to the trapezoidal cross section, whereby an intermediate laminate wood product is formed; and

c) forming the laminated wood product by profile cutting along at least one plane that is perpendicular to the trapezoidal cross section, such that the laminated wood product will comprise parts of at least two adjacent lamellae.

In the method, the cutting may comprise cutting the billet along a least one first cutting plane that is substantially perpendicular to the base surfaces and cutting the billet along at least one second cutting plane which is substantially parallel to the base surfaces, both of said cutting planes extending substantially perpendicular to the trapezoidal cross section.

The intermediate wood product may be formed by a pair of first cutting planes, which are positioned such that the intermediate wood product will comprise parts of at least three lamellae, including a middle lamella which is sandwiched between two outer lamellae.

The intermediate wood product may be formed also by said second cutting plane, wherein the second cutting plane is positioned such that the middle lamella is formed at a portion of the trapezoidal cross section that is closer to a pith of the log than to a bark side of the log.

The intermediate wood product may be formed by a pair of first cutting planes, which are positioned such that the intermediate wood product will comprise parts of only two adjacent lamellae.

The second cutting plane may be positioned such that the intermediate wood product is formed at a portion of the log which is more than 20 % of a log radius away from a pith of the log and less than 80 % of the log radius away from the pith.

The method may further comprise joining at least two intermediate wood products in an end-to-end manner prior to said forming the laminated wood product.

The method may further comprise identifying a portion of the billet wherein a wood density is at a minimum as seen in a thickness direction of the billet, and aligning a cutting pattern for cutting the intermediate wood product based on said minimum.

Providing the billet may comprise cutting a log along a principal fiber direction of the log, into a plurality of wood lamellae, such that the wood lamellae are formed as radial sections of the log, forming the wood lamellae to provide each wood lamella with a trapezoidal cross section, whereby the wood lamellae present a respective planar major base surface that is formed at a radially outer part of the log and a respective planar minor base surface that is formed at a radially inner part of the log, arranging the lamellae as at least one layer in which planar major base surfaces of immediately adjacent lamellae face opposite directions, whereby the major base surfaces of immediately adjacent wood lamellae taper in opposite directions.

With such method, base surfaces of each pair of adjacent lamellae would taper towards opposite directions parallel with the principal fiber direction.

The method may comprise wet gluing together the lamellae side surface to side surface. Such wet gluing may be made without the cut surface, i.e. the side surfaces, being subjected to any further surface processing other than cleaning and removal of free water from the cut surface.

The forming of the lamellae may comprise a first forming step, in which the major base surfaces are formed along the outermost part of the log, preferably along a direction which is substantially parallel with the outermost surface of the log.

Alternatively, the lamellae may be formed along the longitudinal direction of the log, basically using the pith area as a reference. In such case, base surfaces would present a constant width.

The method may further comprise laminating a face lamella, which presents a rectangular cross section, to a surface of the intermediate wood product that presents an angle of more than 45˚, preferably more than 60˚ or

more than 70°, to a joint plane along which a pair of trapezoidal lamellae are joined.

The method may further comprise forming an exposed face by cutting into said face lamella.

The method may further comprise arranging at least two face lamella pieces on said surface of the intermediate wood product, wherein a joint between end portions of said face lamella pieces is offset in a longitudinal direction of the component from a joint between said at least two intermediate wood products.

The method may further comprise arranging at least two face lamella pieces on said surface of the intermediate wood product, such that said adjacent end portions of face lamella pieces are spaced from each other. In the method, providing the billet may comprise wet gluing the wood lamellae to each other side surface to side surface, wherein said wet gluing comprises gluing at a moisture content of the wood lamellae of at least 25 % by weight of dry mass, preferably at least 30 % by weight of dry mass.

Brief Description of the Drawings

Figs 1a-1h schematically illustrate a method of making an intermediate product in the form of a billet.

Fig 2a is a schematic side view of a system for producing wood lamellae

Fig. 2b is a schematic sectional view taken along line A-A of Fig. 2a.

Fig. 3 schematically illustrates a prior art method of forming an elongate wood component.

Fig. 4 schematically illustrates a prior art intermediate product from which a wood component may be formed.

Fig. 5 schematically illustrates another prior art intermediate product from which a wood component may be formed.

Fig. 6 schematically illustrates a method of forming an elongate wood component from a billet such as the one provided at Fig. 1h.

Fig. 7 schematically illustrates another method of forming an elongate wood component from a billet such as the one provided at Fig. 1h.

Fig. 8 schematically illustrates a component 250 according to the present disclosure.

Figs 9a-9e schematically illustrate components formed according to an alternative concept.

Fig 10 schematically illustrates a component according to the concept of Figs 9a-9e.

Detailed Description

The description will initially be directed to a new method of making a wood billet. This wood billet forms the starting material for making the laminated wood product which will be described with reference to Figs 6 and 7.

Fig. 1a schematically illustrates a log 2, which has been cut longitudinally into two halves 2'. The log 2 may have been debarked prior to this cutting. The cutting may be performed by any type of cutting device, such as, but not limited to, a saw, e.g. a circular saw or a band saw.

Fig. 1b schematically illustrates a log half 2' after it has provided with a longitudinally extending groove 23 along its pith and cut longitudinally into six radial sections 2"a, 2"b, as will be further described with reference to Figs 2a-2b.

Fig. 1c schematically illustrates processing of one of the radial sections 2"a, 2"b into a lamella 20a, 20b. The lamella 20a, 20b is subjected to forming of base surfaces bs1, bs2, to form a lamella 20a, 20b, which will present a trapezoidal cross section.

The base surfaces bs1, bs2 thus formed comprise a major base surface bs1, which is formed by tool 31 closest to the bark of the log and along the bark side. The base surfaces further comprise a minor base surface bs2, which is formed close to the pith and parallel with the major base surface bs1 by tool 32.

The tools 31, 32 may be any type of tool capable of forming a planar surface, including but not limited to milling cutters, circular saw blades or band saw blades.

The first tool 31, which forms the major base surface bs1, is arranged to use the bark side as reference, such that the major base side bs1 is formed along a direction parallel with the bark side.

The second tool 32, which forms the minor base surface bs2, is arranged to use the major base surface and/or the bark side as a reference, such that the minor base surface bs2 is formed along a direction parallel with the major surface and/or the bark side.

The cross section of the lamellae 20a, 20b is trapezoidal having a constant height. With the major base surface bs1 being formed substantially parallel with the bark, and with the log presenting a frusto-conical shape, it is recognized that the major base surface bs1 will taper along the central direction of the log C. That is, the log will taper in a direction towards the top of the tree from which it was formed. This direction is also parallel with the principal fiber direction of the log and of the wood lamellae.

Moreover, the minor base surface bs2 will also taper along the central direction C of the log.

The fact that the radius of the log would also diminish towards the top of the tree from which it was formed, implies that while the amount of material removed at the bark side, by tool 31, in the forming of the major base sides bs1 will be substantially constant along the length of the lamella 20a, 20b, as seen in the radial direction.

However, the amount of material removed at the pith side, by tool 32, will diminish towards as seen in the direction towards the top of the tree from which the lamella 20a, 20b was formed.

Referring to Fig. 1d, after the lamellae 20a, 20b have been formed, each lamella will have a major and a minor base surface bs1, bs2 and a pair of side surfaces ss1, ss2, which will be identical.

Referring to Fig. 1e, every second lamella 20b will now be turned or flipped about 180˚ about its longitudinal axis and about 180˚ about an axis

perpendicular to the longitudinal axis and perpendicular to the major base surface bs1, such that the lamellae will become positioned as illustrated in Fig. 1e. That is, the directions of taper Ca and Cb will extend in opposite directions.

At this point, the base surfaces of every pair of adjacent wood lamellae 20a, 20b will taper towards substantially opposite directions. Moreover, major base surfaces bs1 of every pair of adjacent wood lamellae will face substantially opposite directions, i.e. one upwards in Fig. 1e and the other one downwards in Fig. 1e.

At this point, the wood may still be “wet”, that is, its moisture content may be more than 25 % by dry mass, preferably more than 30 %. Hence, the wood has not been subjected to any accelerated or intentional drying, such as kiln drying. When wet gluing, it is recommended to reduce the amount of free water on the wood surface to a minimum. Hence, a brief surface drying step, basically having no effect except for on the very surface, may be performed, e.g. by means of a fan.Fig. 1f schematically illustrates the two lamellae 20a, 20b when arranged adjacent each other, side surface ss1 to side surface ss2 and with base surfaces bs1, bs2 of the pair of thus adjacent lamellae 20a, 20b tapering in opposite directions.

Referring to Fig. 1g, there is illustrated a pair of glue applicators 33a, 33b, which apply glue to side surfaces of lamellae 20a, 20b, respectively. A single, or even more, glue applicators may be used.

The lamellae are then arranged as illustrated in Fig. 1g, i.e. with the base surfaces bs1, bs2 of every pair of adjacent wood lamellae 20a, 20b tapering towards substantially opposite directions and major base surfaces bs1 of every pair of adjacent wood lamellae facing substantially opposite directions.

The glue used is a glue adapted for wet gluing wood, such as a water activated glue. One example of such glue is a polyurethane (PU) based glue.

The lamellae 20a, 20b will be subjected to a pressing tool 34 pressing the lamellae 20a, 20b together in directions perpendicular to the base

surfaces 20a, 20b and/or parallel with base surfaces 20a, 20b and perpendicular to longitudinal axes C.

Depending on the design of the pressing equipment, the billet 200 that is formed may be of a predetermined length or it may be continuous in a direction perpendicular to the lamellae fiber direction and parallel with the base surfaces bs1, bs2, that is, lamellae are added to one end of the billet and fed into the press while at the output side of the press, pieces of the billet 200 are sawn off at predetermined intervals.

As illustrated in Fig. 1h, after the gluing process, an intermediate wood product, here referred to as a “billet” 200 is provided, made up of wood lamellae 20a, 20b glued together first side surface ss1 to first side surface ss1 and second side surface ss2 to second side surface ss2.

In the illustrated example, the billet 200 consists of a single layer of lamellae 20a, 20b, which are arranged side surface to side surface and with major base surfaces bs1 of immediately adjacent lamellae facing opposite directions and with base surfaces bs1, bs2 of immediately adjacent lamellae tapering in width in opposite directions.

It is noted that an alternative billet may be produced from logs which are sawn according to Figs 1a-1b and wherein the lamellae are formed with the pith side as a reference. Such lamellae may have constant cross section, such that base surfaces will be rectangular rather than tapering in width.

Fig. 2a is a schematic side view of a device 300 for producing wood lamellae 20a, 20b from a half-log 2’. The device comprises a groove cutter 311 and a set 312 of radial cutters 321a, 321b, 321c, 321d and 321e. Moreover, the device 300 may comprise a conveyor arrangement 300a, 300b, 300c for causing relative movement between the log and the cutters 311, 312. Typically, the log may be moved relative to stationary cutters 311, 312. However, it is also possible to provide cutters 311, 312, which are capable of moving along the length of the half-log 2’.

The half log 2’ has typically been longitudinally cut in half prior to being introduced into the device 300. That is, the log has been cut longitudinally along a plane containing a central axis C of the log. The log may have been

pre-cut into an appropriate length, such as 1-10 m, preferably 1-5 m, 1-3 m or 1-2 m. Moreover, the log may have been wholly or partially debarked. Hence, the log can be said to present a planar surface 22 and a convex surface 21. For practical reasons, the log may be conveyed with its planar surface facing downwardly and oriented horizontally.

Fig. 2b is a cross sectional view taken along line A-A in Fig. 2a. In Fig. 2b, it is illustrated how the groove cutter 311 provides a longitudinal groove at the central portion of the log, i.e. at the pith area.

The groove cutter 311 may be formed as a circular, rotatable cutter having a cutting edge with a cross section that corresponds to a desired cross section of the groove 23.

The groove 23 formed by the groove cutter 311 may presents a substantially concave surface, which may be substantially half circular, or which may be polygonal.

The groove cutter 311 may extend upwardly from a support on which the log is to be supported with its planar surface 22 facing downwardly.

Figs 3-5 illustrate a prior art method, as was described in the background section.

Referring to Fig. 6, there is disclosed a first concept for providing laminated wood components based on the wood billet 200.

The components provided according to Fig. 6 are “3-ply” components, i.e. each component is formed of three different wood lamellae.

In Fig. 6, there is indicated a respective intermediate product profile 210 and a respective component profile 240. In the concept illustrated in Fig. 6, the profiles have been aligned to the billet 200 in such manner as to prioritize use of the low density wood from the center of the log while also making use of the higher strength wood from the bark area of the log. That is, 3-ply components are provided wherein a middle ply is taken from a portion of the log which is closer to the pith than the edge plys.

When forming the laminated wood component 250 (Fig. 8), the billet 200 will initially be processed into a number of intermediate products 210, each of which may have a substantially square or rectangular cross section.

To produce the intermediate product 210 profiles, the billet 200 may initially be cut once or more along a plane that is parallel to the base surfaces bs1, bs2, depending on desired thickness of the intermediate products. The resulting thinner slabs, or partial billets, may then be cut along planes that are parallel with a length direction of the lamellae and perpendicular to the base surfaces bs1, bs2, whereby a plurality of intermediate products are formed.

These intermediate products 210 may then be processed to components, either as they are, or subsequent to an end-to-end jointing step, in which a pair of intermediate products are joined end-to-end by e.g. finger jointing, whereby a longer intermediate product is provided.

Prior to forming the component profile 240 from the intermediate product 210, the intermediate product 210 profile may be aligned to fit with the component profile 240. Such alignment may include a step of rotating the intermediate product about its longitudinal axis. The alignment may also comprise a step of linearly displacing the intermediate product relative to the processing equipment along one or both axes of the intermediate product's cross sectional plane.

In the step where the component profile 240 is formed, an intermediate product, regardless of length, may be processed by milling and/or planing, such that an arbitrary profile is achieved.

In Fig. 7, there is indicated a respective intermediate product profile 211 and a respective component profile 241. In the concept illustrated in Fig. 7, the profiles have been aligned to the billet 200 in such manner as to entirely prioritize use of the low density wood at the central to middle part of the log. That is, 2-ply components are created, wherein the entire component is formed from wood taken from a part of the log that is inside the innermost 80 % of a log radius, preferably inside the innermost 75 % of the log radius, and that is outside the innermost 20 % of the log radius, preferably outside the innermost 25 % of the log radius.

In the concept illustrated in Fig. 7, the intermediate product 211 may be formed by initially cutting the billet 200 along a plane Cv that is parallel with the longitudinal direction of the lamellae and perpendicular to the base

surfaces bs1, bs2. Each plank thus formed may then be cut along one or more planes that are parallel with the base surfaces bs1 bs2 to form the intermediate products 211.

The intermediate products 211 may then be processed to components either as they are, or subsequent to an end-to-end jointing step, in which a pair of intermediate products are joined end-to-end by e.g. finger jointing, whereby a longer intermediate product is provided.

Prior to forming the component profile 241 from the intermediate product 211, the component profile 241 may be aligned to fit with the intermediate product profile 211. Such alignment may include a step of rotating the intermediate product about its longitudinal axis. The alignment may also comprise a step of linearly displacing the intermediate product relative to the processing equipment along one or both axes of the intermediate product's cross sectional plane.

In the step where the component profile 241 is formed, an intermediate product, regardless of length, may be processed by milling and/or planing, such that an arbitrary profile is achieved.

In particular, component profiles may be formed presenting a polygonal cross section with three, four or more longitudinally extending faces.

A component profile may comprise one or more pairs of longitudinally extending faces which present positive surface normals, which cross each other.

Fig. 8 schematically illustrates a 3-ply laminated wood component 250, which is formed as a 3-ply laminated wood component comprising a middle lamella 20b and a pair of outer lamellae 20a. The outer lamellae 20a are joined to the middle lamella 20b at respective joint planes JP1, JP2.

At least the middle lamella 20b may present a substantially trapezoidal cross section.

The joint planes JP1, JP2 provide an angle A1 relative to the cross section, which angle A1 may be 90°, or less than 90°, preferably in the range 70°-89° or 80°-89°.

The joint planes JP1, JP2 provide an angle A2 to at least one edge of the cross section profile, that is greater than 0 and less than 90, preferably 1°-15° or 75°-89°.

Moreover, the joint planes JP1, JP2 provide lines of intersection relative to respective faces F6, F4 of the component 250. Such lines provide an angle A3 relative to longitudinal edges of the faces F6, F4 which may be 0° or greater than 0°, preferably in the range 1°-20° or 5°-15°.

The laminated component 250 presents profiled faces F1, F2, F3, F4, F5, F6, of which faces F2 and F3 and faces F4 and F5 present surface normals which intersect each other.

Figs 9a-9e schematically illustrate embodiments of a wood component, in which an additional face lamella has been provided, and wherein those parts of the wood component that are to be exposed have been formed in this face lamella.

Referring to Fig. 9a, there is illustrated an intermediate component 310 with a final component profile being indicated by the line 340. The intermediate component is made up of the trapezoidal lamellae 20a, 20b as described above, with the addition of the face lamella 300.

This face lamella 300 may be a lamella which is cut in the traditional manner, i.e. according to a pattern wherein the cross section of the log to the greatest extent is divided by mutually orthogonal cuts.

The face lamella 300 may thus be formed from a single piece of wood. Alternatively, the face lamella 300 may be formed from a laminated wood, based on planar wood pieces that are laminated principal surface to principal surface.

Surfaces 301a, 301b, 301c of the finished component 340 that are to be exposed, such as those surfaces of a window or door frame that are visible when the window or door frame is mounted in a wall, may be formed in the face lamella 300, while all, or most of, the non-exposed surfaces are formed in the part of the component that is made up from the trapezoidal lamellae 20a, 20b.

In the illustrated embodiment, these exposed surfaces 301a, 301b, 301c may comprise pairs of surfaces whose positive surface normals extend substantially orthogonally relative each other.

Fig. 9b illustrates another example of a component that presents exposed surfaces 301a, 301b, 301c, 301d, 301e that are formed in a face lamella. In this example, the face lamella is made up of a pair of laminated planar pieces of wood 300a, 300b.

Fig. 9c illustrates an example where there is a pair of surfaces 301f, 301g, which face opposite directions, away from each other, and which are formed in the face lamella, which may be formed from a single piece of wood, or from a pair of laminated wood pieces 300a, 300b, as illustrated.

Fig. 9d illustrates an example, where there are a pair of exposed forwardly facing surfaces 301h, 301i formed in the face lamella 300a, 300b and also one oppositely, i.e. rearwardly, facing surface 301j. The forwardly facing surfaces 301h, 301i are formed in the same piece of wood 300b.

In the example illustrated in Fig. 9e, there are also a pair of forwardly facing surfaces 301h, 301i which may be formed in the same piece of wood 300b. There is also one rearwardly facing surface 301k, which is formed at the interface between the trapezoidal lamella 20a and the face lamella 300a.

Fig. 10 schematically illustrates an intermediate component 310, with the component profile marked as 340.The component comprises face lamellae 300 at a part thereof from which exposed surfaces are to be formed.

The component 310 may be formed by a plurality of component parts 3100 which are joined together short side to short side, for example by finger jointing.

It is understood that to provide a long intermediate component 310, the face lamellae 300 may also need to be provided by a plurality of face lamella pieces 3000. To this end, it is possible to arrange the face lamella pieces such that joints between adjacent pieces 3000 do not overlap joints between the component parts 3100. Hence, each joint 3001 between lamella pieces are offset in the longitudinal direction L relative to joints 3101 between the component parts 3100.

As illustrated in Fig. 10, end portions of the face lamella pieces 3000 may be spaced apart from each other. That is, the face lamella pieces may not be connected to each other. The space between the end portions may be on the order of 0.5-10 mm, preferably 1-5 mm.

CLAIMS

1. A laminated wood component (250) for use e.g. as a door frame or window frame,

the component presenting:

a cross section and a longitudinal direction (C), perpendicular to the cross section, and

a main fiber direction, which is substantially perpendicular to the cross section,

wherein the cross section is substantially constant along the longitudinal direction

wherein the laminated wood product is formed of at least two adjacent wood lamellae (20a, 20b), which are joined along a joint plane (JP1, JP2),

characterized in that

the wood component presents at least one longitudinally extending face (F1, F2, F3, F4, F5, F6), which is perpendicular to the cross section, and which is planed and/or profiled, and

the joint plane (JP1, JP2) presents an angle (A2) to the longitudinally extending face, which is greater than 0° and less than 90°, preferably 1°-30°, 60°-89° or 45-89°.

2. The wood component as claimed in claim 1, wherein an intersection between the joint plane (JP1, JP2) and one of the longitudinally extending faces is spaced from both intersections between that longitudinally extending face and other ones of the longitudinally extending faces along at least 50 % of a length of the wood component, preferably along at least 75 % or at least 99 % of the length of the wood component.

3. The wood component as claimed in any one of the preceding claims, wherein the wood lamellae (20a, 20b) are glued together along the joint plane (JP1, JP2) by means of a glue that is suitable for wet gluing, such as a polyurethane based glue.

4. The wood component as claimed in any one of the preceding claims, wherein the wood component presents a pair of adjacent outwardly exposed longitudinally extending faces (F2, F3; F4, F5), positive surface normals of which crossing each other, preferably at an angle of more than 20°, more than 30°, more than 45°, more than 75° or about 90°.

5. The wood component as claimed in any one of the preceding claims, wherein at least one of the longitudinally extending faces comprises at least two portions, which are parallel and separated in a direction normal to the face.

6. The wood component as claimed in any one of the preceding claims, wherein, at the joint plane (JP1, JP2), a bending radius of a year ring of one of the wood lamellae is parallel +/- less than 10°, preferably less than +/- 5° or less than +/- 1°, and oppositely directed to a bending radius of a year ring of the other one of the wood lamellae, taken at the same position along the joint plane (JP1, JP2).

7. The wood component as claimed in any one of the preceding claims, wherein the component comprises a middle lamella (20b) sandwiched between a pair of outer lamellae (20b), wherein the middle lamella is formed from a portion of a log that is closer to the pith than outer edge lamellae.

8. The wood component as claimed in any one of the preceding claims, wherein the wood lamellae (20a, 20b) are glued together along a joint plane (JP1, JP2) that presents an angle (A1) of 70°-89°, preferably 80°-89° to the cross section

9. The wood component as claimed in any one of the preceding claims, wherein the wood lamellae (20a, 20b) are glued together along a joint plane (JP1, JP2) that is perpendicular to the cross section.

10. The wood component as claimed in any one of the preceding claims, further comprising at least one face lamella, which presents a rectangular cross section.

11. The wood component as claimed in claim 10, wherein the face lamella is formed from a single piece of wood.

12. The wood component as claimed in claim 10 or 11, wherein at least two exposed faces of the wood component are formed in the face lamella, said at least two exposed faces being formed such that positive surface normals thereof cross each other, preferably at an angle of more than 20°, more than 30°, more than 45° or more than 80°.

13. The wood component as claimed in any one of claims 10-12, wherein a major surface of the face lamella presents an angle greater than 45° to a joint plane intersecting the major surface, preferably greater than 60° or greater than 70°.

14. The wood component as claimed in any one of claims 10-13, wherein, as seen in cross section, year rings of the face lamella extend at an angle of more than 45°, preferably more than 55°, to major surfaces of the face lamella.

15. The wood component as claimed in any one of the preceding claims, wherein the wood lamellae are selected from a group consisting of

softwood, i.e. gymnosperm tree species, having a density of more than 400 kg/m^3, and

hardwood, i.e. angiosperm tree species, having a density of more than 400 kg/m^3.

16. The wood component as claimed in any one of the preceding claims, wherein the wood component presents a length along its fiber

direction, which is at least 200 % of a length along a greatest length of its cross section, preferably 300 % or 500 %.

17. A frame for a window or door comprising a frame portion that is formed of a wood component as claimed in any one of the preceding claims and that positioned to face perpendicular to surface of a wall in which the window or door frame is arranged.

18. A method of forming a laminated wood component, comprising:

a) providing a billet, formed of a plurality of elongate wood lamellae, wherein

the lamella are formed along a principal fiber direction of a log,

each of the lamellae presents a substantially trapezoidal cross section, and

major base surfaces of each pair of adjacent lamellae face opposite directions,

b) cutting the billet along at least one plane that is perpendicular to the trapezoidal cross section, whereby an intermediate laminate wood product is formed, and

c) forming the laminated wood product by profile cutting or planing along at least one plane that is perpendicular to the trapezoidal cross section, such that the laminated wood product will comprise parts of at least two adjacent lamellae.

19. The method as claimed in claim 18, wherein the cutting the billet comprises cutting the billet along a least one first cutting plane that is substantially perpendicular to the base surfaces and cutting the billet along at least one second cutting plane which is substantially parallel to the base surfaces, both of said cutting planes extending substantially perpendicular to the trapezoidal cross section.

20. The method as claimed in claim 18 or 19, wherein the intermediate wood product is formed by a pair of first cutting planes, which are positioned such that the intermediate wood product will comprise parts of at least three lamellae, including a middle lamella which is sandwiched between two outer lamellae.

21. The method as claimed in claim 120, wherein the intermediate wood product is formed also by said second cutting plane, wherein the second cutting plane is positioned such that the middle lamella is formed at a portion of the trapezoidal cross section that is closer to a pith of the log than to a bark side of the log.

22. The method as claimed in claim 18 or 19, wherein the intermediate wood product is formed by a pair of first cutting planes, which are positioned such that the intermediate wood product will comprise parts of only two adjacent lamellae.

23. The method as claimed in claim 22, wherein the second cutting plane is positioned such that the intermediate wood product is formed at a portion of the log which is more than 20 % of a log radius away from a pith of the log and less than 80 % of the log radius away from the pith.

24. The method as claimed in any one of claims 18-23, further comprising joining at least two intermediate wood products in an end-to-end manner prior to said forming the laminated wood product.

25. The method as claimed in any one of claims 18-24, further comprising identifying a portion of the billet wherein a wood density is at a minimum as seen in a thickness direction of the billet, and aligning a cutting pattern for cutting the intermediate wood product based on said minimum.

26. The method as claimed in any one of claims 18-25, further comprising laminating a face lamella (300), which presents a rectangular cross section, to a surface of the intermediate wood product that presents an angle of more than 45°, preferably more than 60° or more than 70°, to a joint plane along which a pair of trapezoidal lamellae are joined.

27. The method as claimed in claim 26, further comprising forming an exposed face by cutting into said face lamella.

28. The method as claimed in claim 26 or 27 in conjunction with claim 20, further comprising arranging at least two face lamella pieces (3000) on said surface of the intermediate wood product, wherein a joint between end portions of said face lamella pieces (3000) is offset in a longitudinal direction (L) of the component from a joint between said at least two intermediate wood products.

29. The method as claimed in any one of claims 26-28, further comprising arranging at least two face lamella pieces (3000) on said surface of the intermediate wood product, such that said adjacent end portions of face lamella pieces (3000) are spaced from each other.

30. The method as claimed in any one of claims 18-29, wherein providing the billet comprises wet gluing the wood lamellae to each other side surface to side surface, wherein said wet gluing comprises gluing at a moisture content of the wood lamellae of at least 25 % by weight of dry mass, preferably at least 30 % by weight of dry mass.

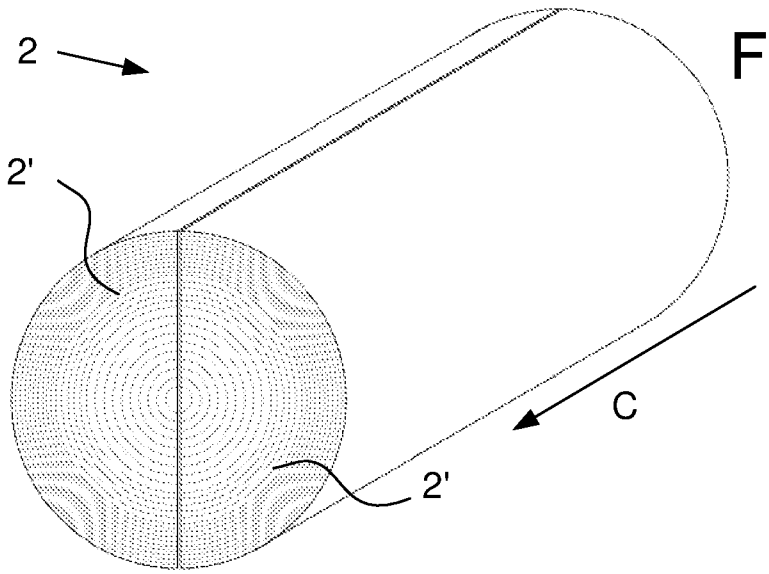


Fig 1a

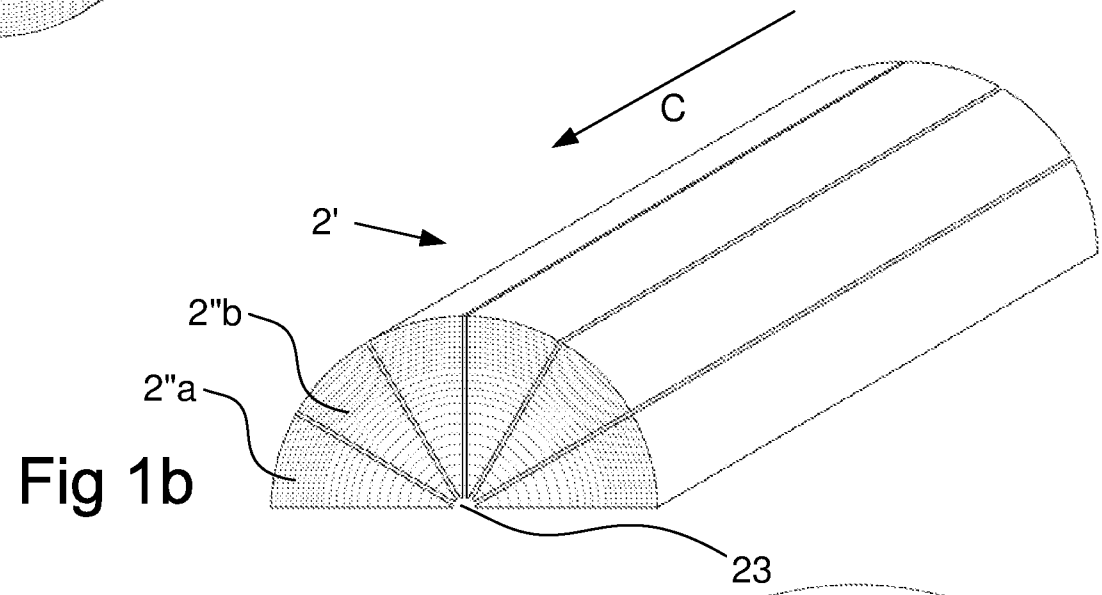


Fig 1b

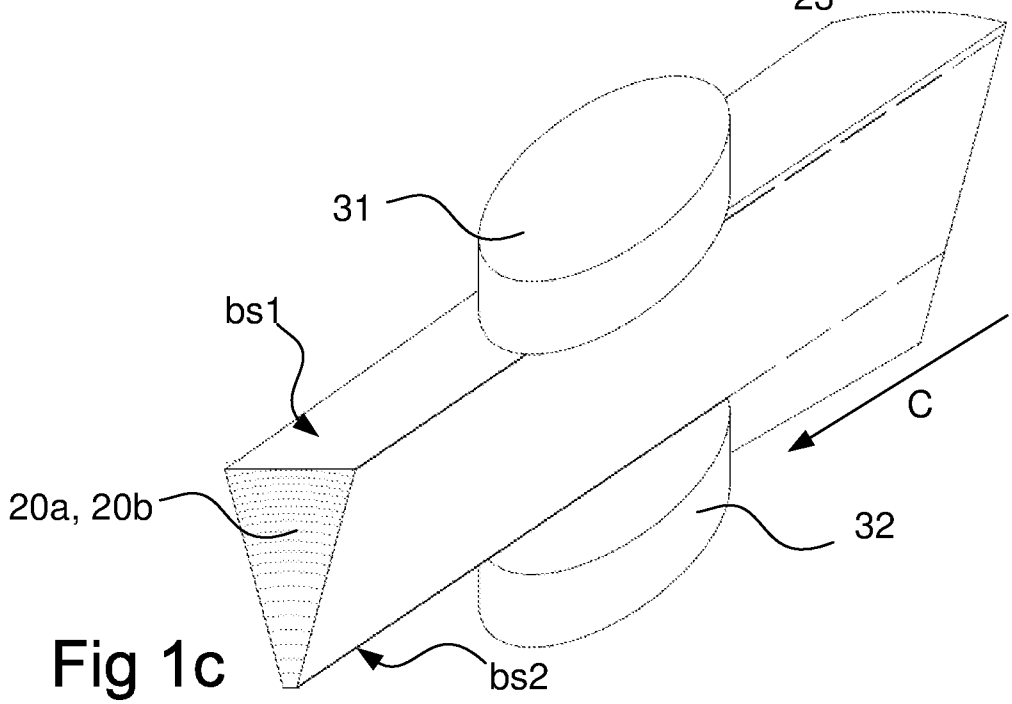
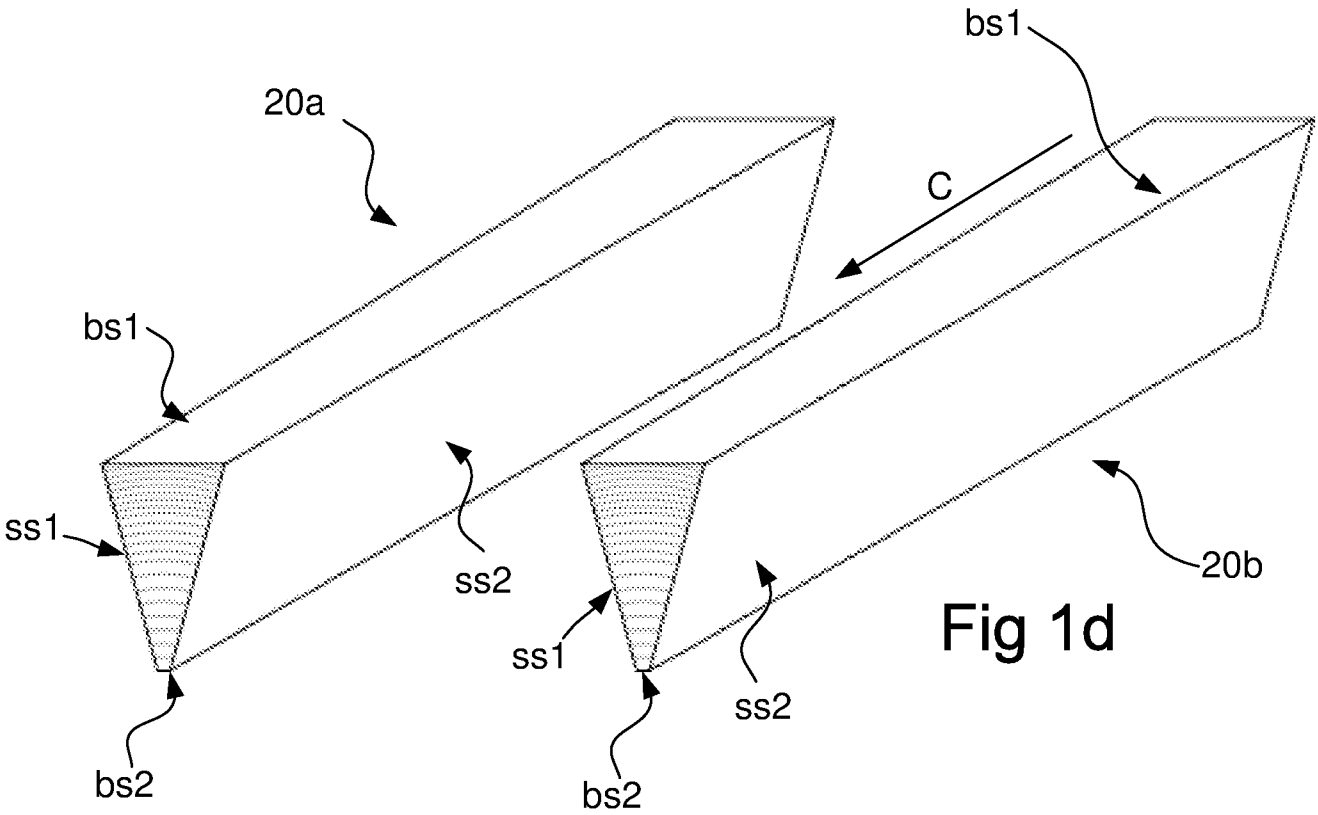


Fig 1c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20a
C
bs1
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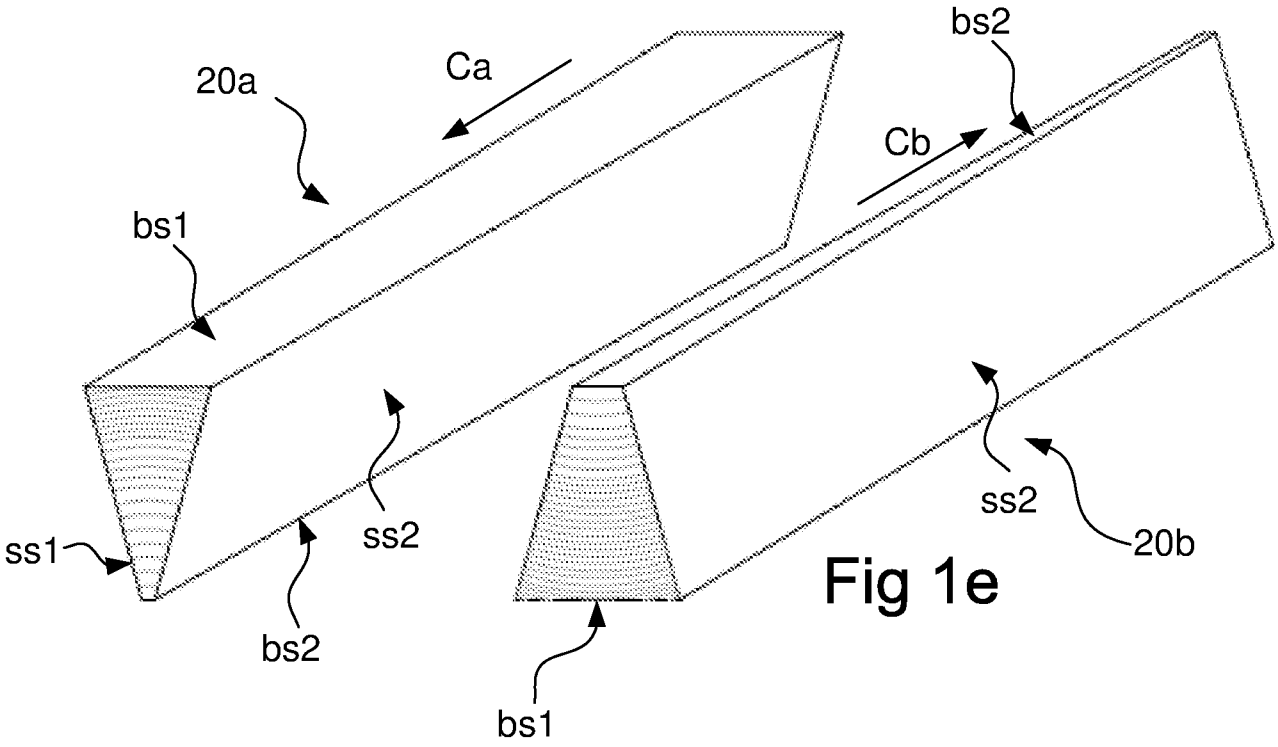
ss2
20b
ss1
ss2
bs2
bs2

Fig 1d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bs1

Fig 1e

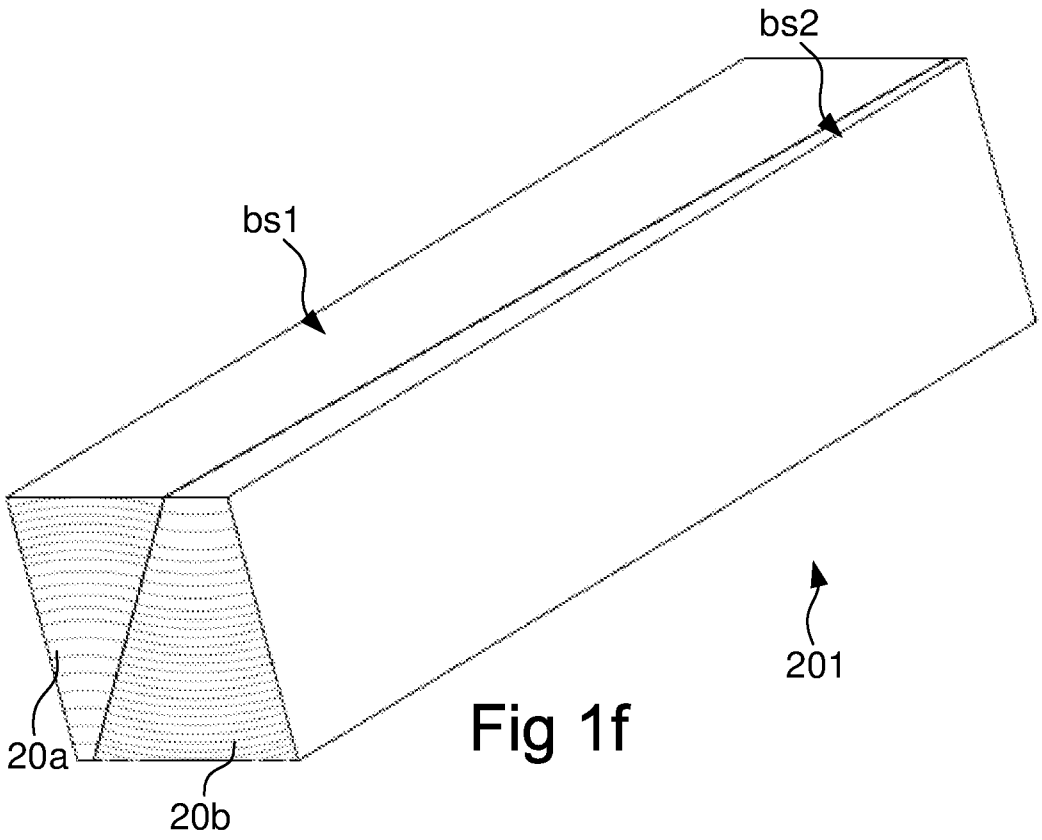


Fig 1f

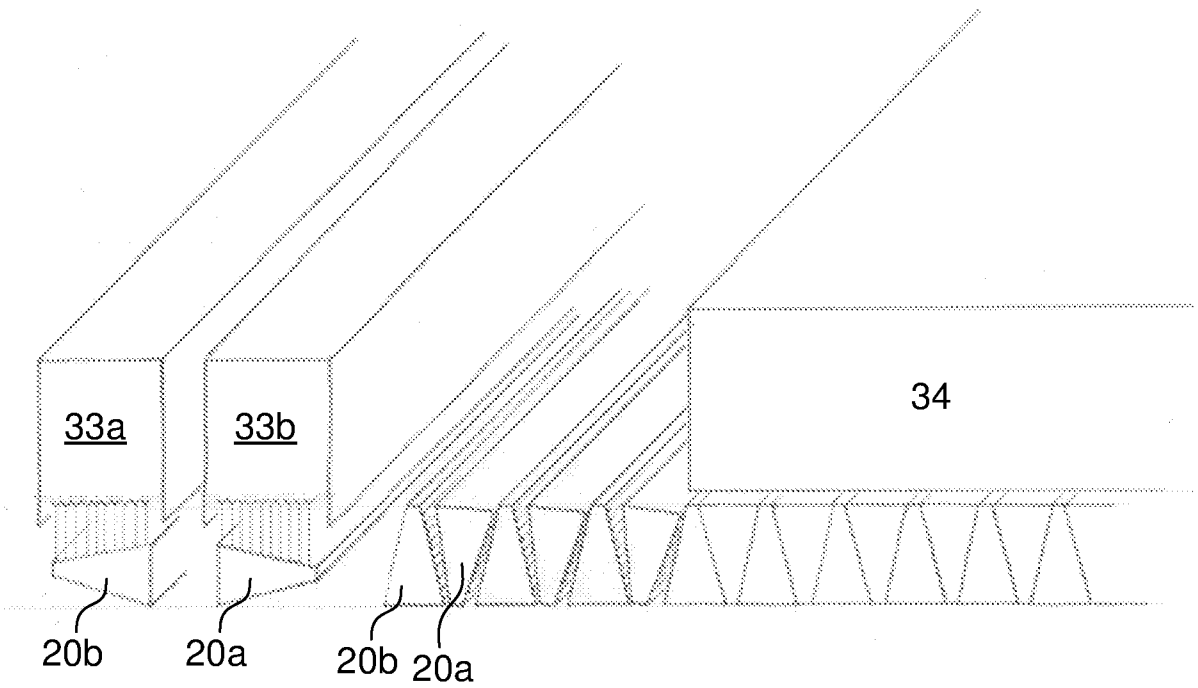


Fig 1g

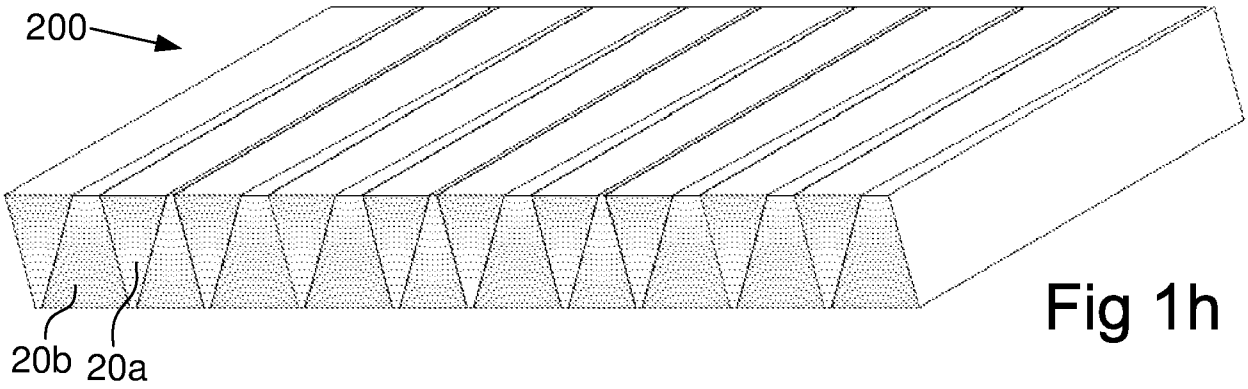


Fig 1h

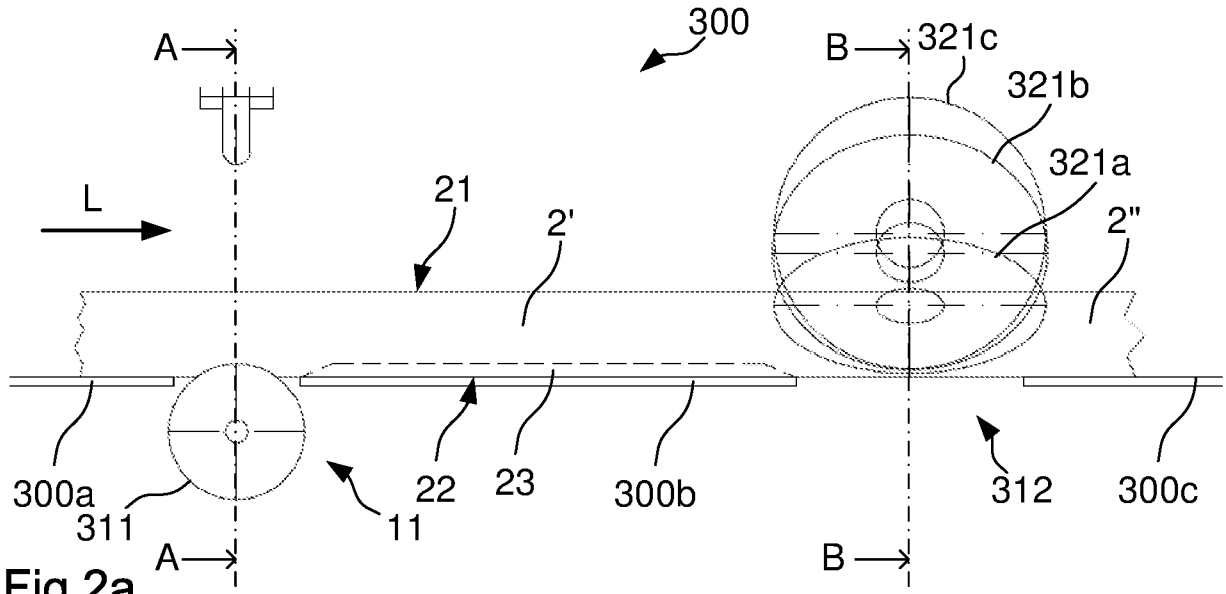


Fig 2a

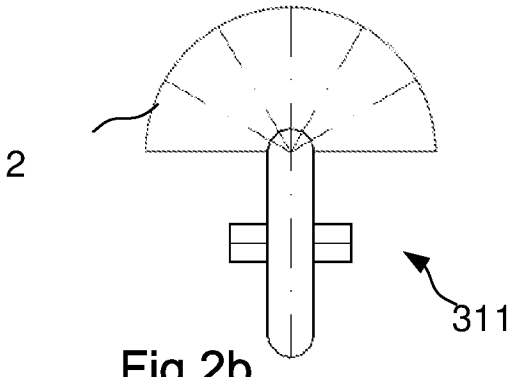


Fig 2b

Fig 3

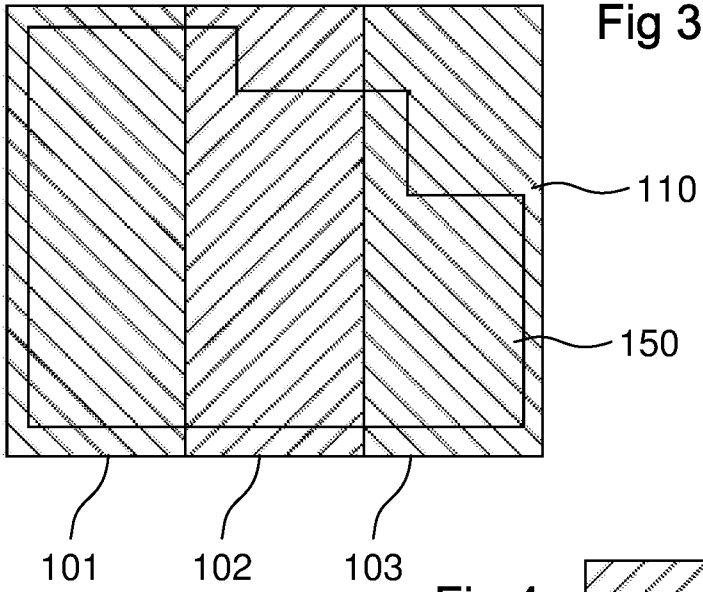


Fig 4

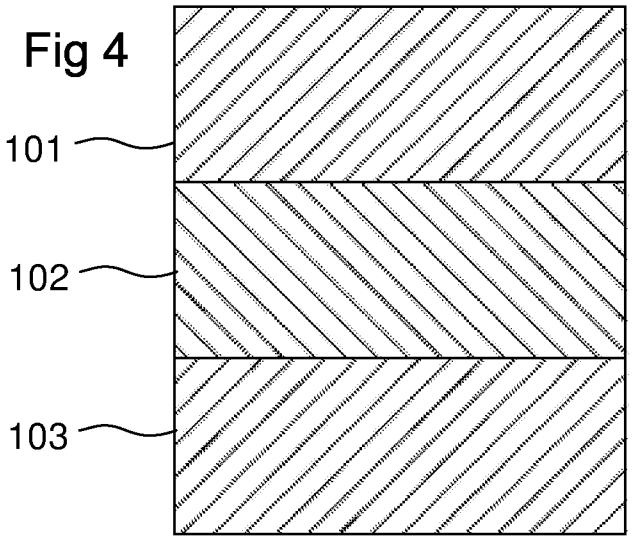


Fig 5

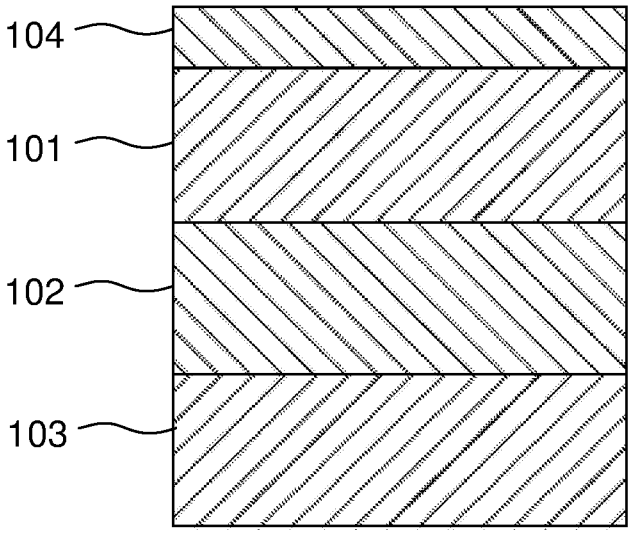


Fig 6

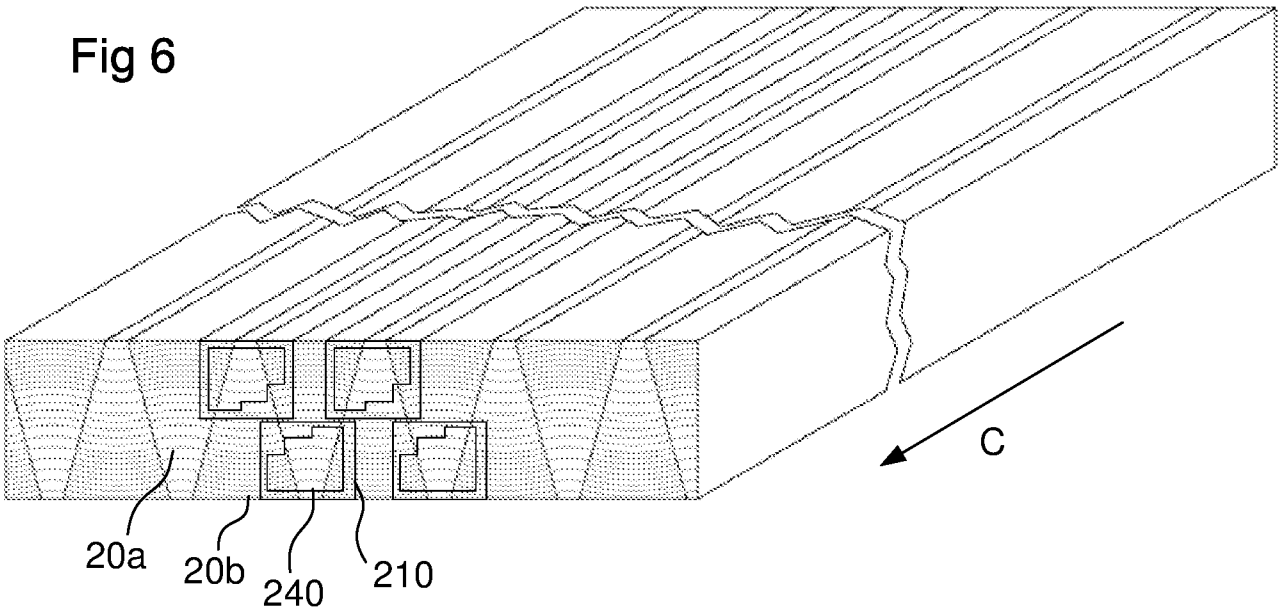
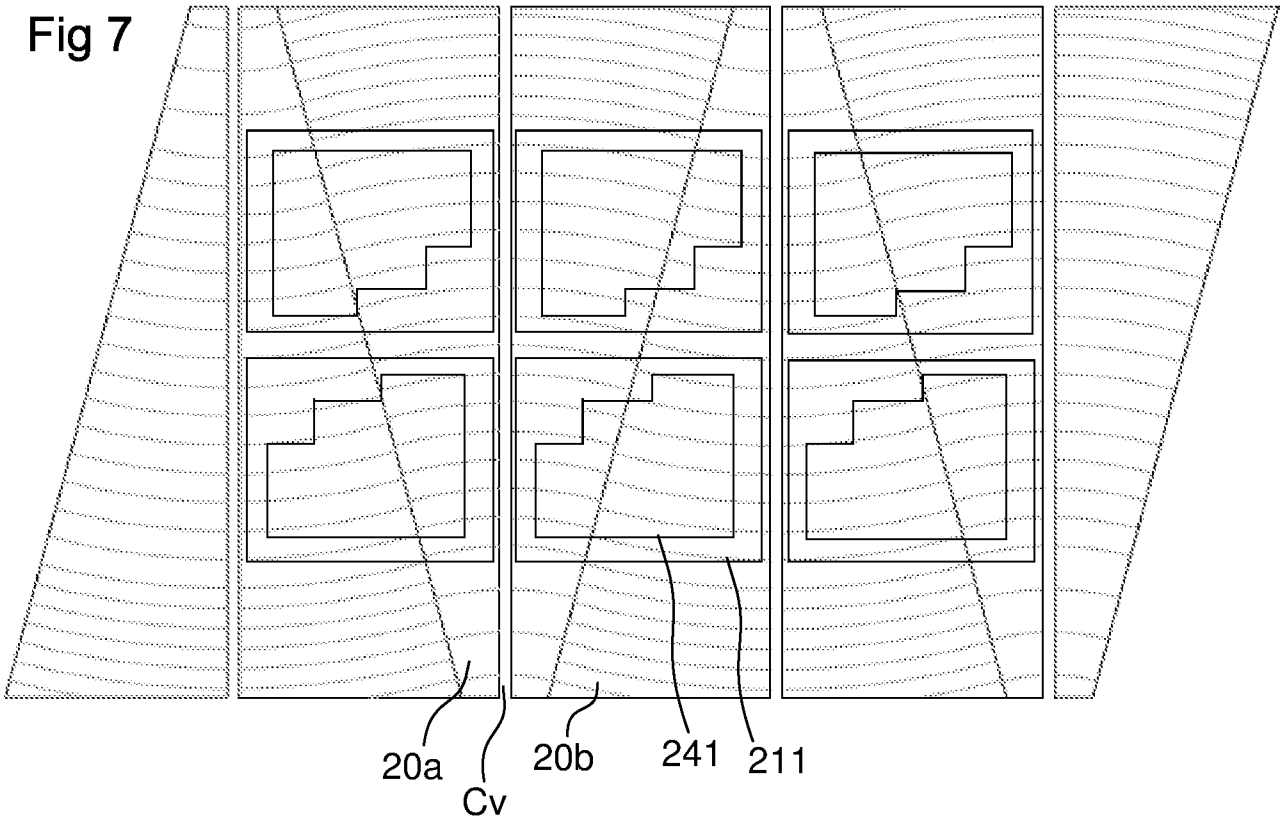


Fig 7



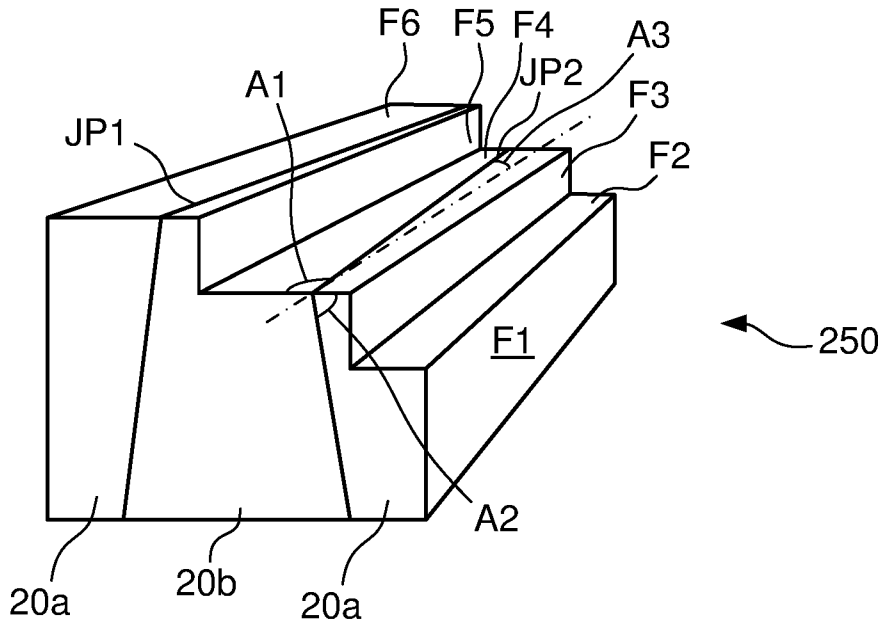


Fig 8

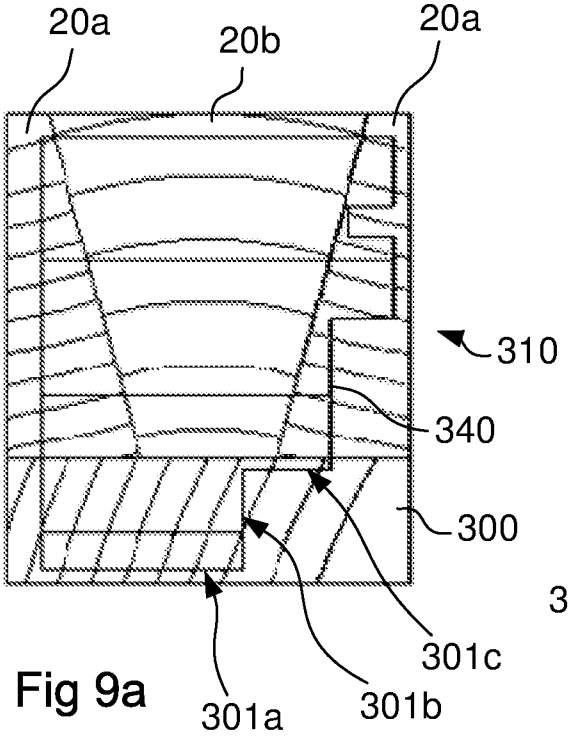


Fig 9a

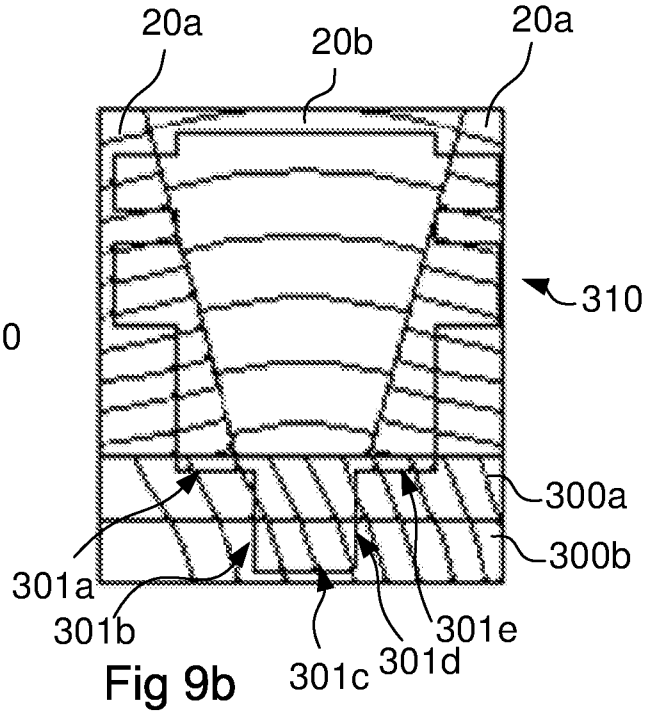


Fig 9b

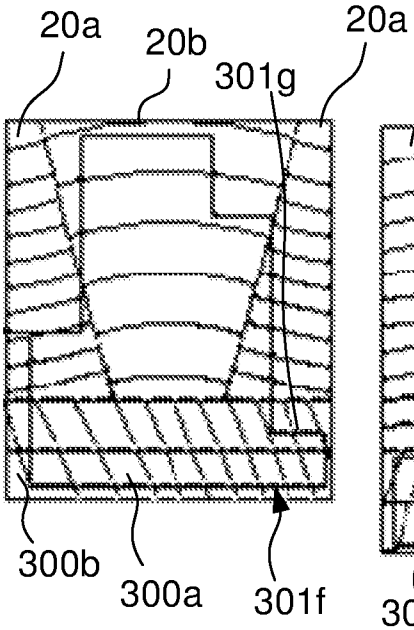


Fig 9c

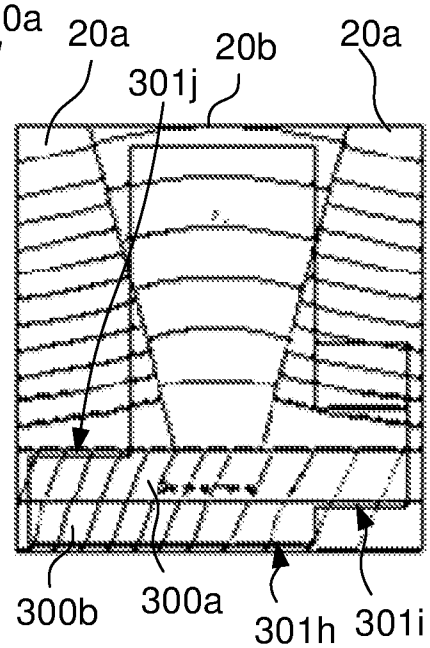


Fig 9d

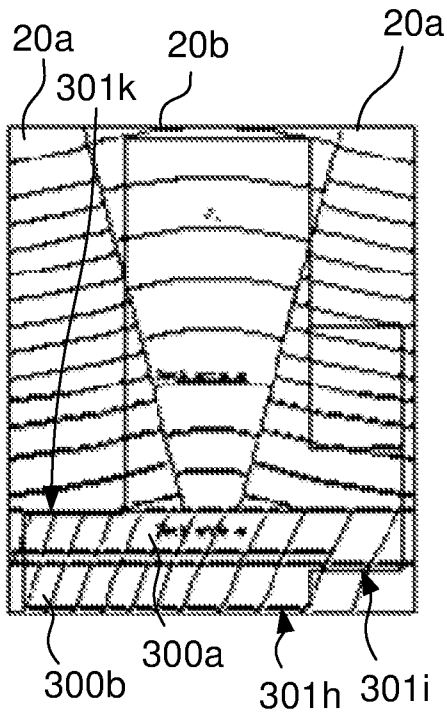
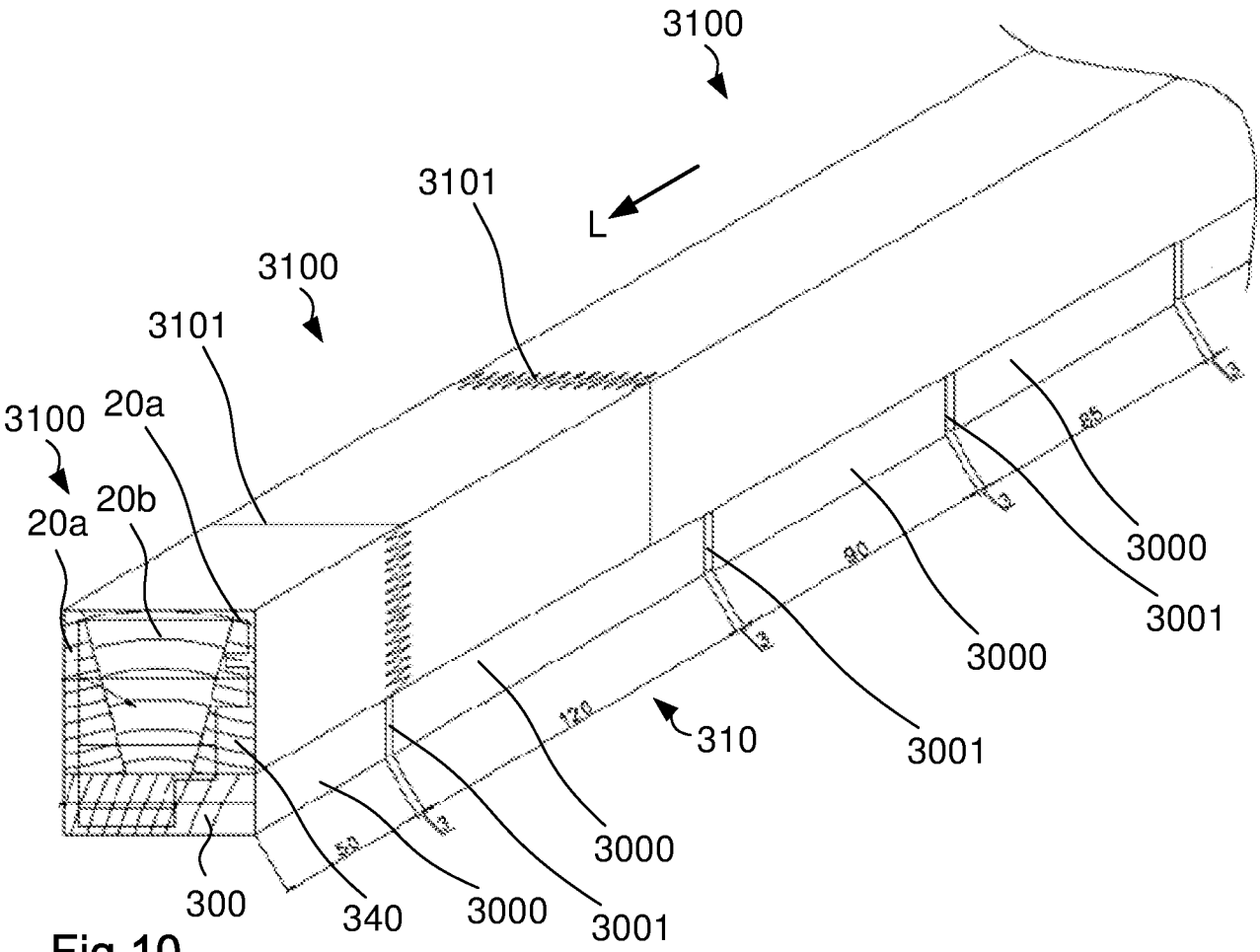


Fig 9e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3101
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3000
3001

Fig 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/055622

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: B27G, B27M, B32B, E06B

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

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data, COMPENDEX, EMBASE, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3989078 A1 (HASENWINKLE EARL DEAN), 2 November 1976 (1976-11-02); column 4, line 4 - column 5, line 15; figures 1-6; claims 1-6	1-30
	--	
X	US 3961654 A1 (HASENWINKLE EARL DEAN), 8 June 1976 (1976-06-08); column 5, line 40 - column 6, line 51; column 7, line 26 - column 7, line 65; column 10, line 33 - column 11, line 45; column 11, line 68 - column 12, line 68; figures 5-9,13-18	1-8, 10-30
	--	
X	US 4111247 A1 (HASENWINKLE EARL DEAN), 5 September 1978 (1978-09-05); column 2, line 41 - column 2, line 44; column 4, line 24 - column 5, line 22; column 5, line 50 - column 9, line 48; figures 1-10; claims 1,7-10,16-20	1-30
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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

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

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

"O" document referring to an oral disclosure, use, exhibition or other means

"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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15-12-2016	16-12-2016

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/055622

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4122878 A1 (KOHN JEAN), 31 October 1978 (1978-10-31); column 5, line 6 - column 5, line 11; column 5, line 51 - column 9, line 8; figures 1-2,5,6,10-11; claims 1-4,8-10 --	1-8, 10-30
X	WO 8904747 A1 (KNORR ANDREW KARL), 1 June 1989 (1989-06-01); page 7, line 19 - page 11, line 27; figures 4-10,14-16; claims 4-8,11 --	1-7, 9-30
A	US 5985398 A1 (BELLEGARDE RENE), 16 November 1999 (1999-11-16); abstract; column 1, line 25 - column 1, line 45 --	1-30
A	US 5816015 A1 (KIRST RALPH), 6 October 1998 (1998-10-06); whole document -- --------	1-30

International application No.
PCT/IB2016/055622

Continuation of: second sheet

International Patent Classification (IPC)

B32B 21/13 (2006.01)
B32B 21/04 (2006.01)
B27G 11/00 (2006.01)
B27M 3/00 (2006.01)
B27M 3/08 (2006.01)
E06B 1/04 (2006.01)

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US	3961654	A1	08/06/1976	CA	1004125	A 25/01/1977
				DE	2404415	A1 29/08/1974
				FR	2218172	A1 13/09/1974
				GB	1464171	A 09/02/1977
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				JP	49116206	A 06/11/1974
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US	4122878	A1	31/10/1978	AT	A823578	A 15/11/1981
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