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BOARD PAIR, WOOD COMPOSITE PANEL, AND METHOD FOR PRODUCING THEREOF

The invention relates to a pair of boards joined together along their longitudinal narrow sides profiled in the longitudinal direction having the features of the preamble of claim 1.

Furthermore, the invention relates to a wood composite panel comprising at least one layer of pairs of boards joined together at their profiled longitudinal narrow sides.

Finally, the invention relates to a method for producing said pair of boards and wood composite panels.

Monolayer or multilayer wood composite panels made of cross-laminated timber or sawn timber are known from the prior art. Multilayer composite boards made of cross-laminated timber, also known as “CLT”, are currently only produced from pinewood and are preferably composed of three bonded layers that are usually arranged crosswise to one another. Here, individual layers may be replaced by other wood materials such as oriented strand boards (OSB) or laminated veneer lumber.

Monolayer or multilayer wood composite panels offer the advantage that they may be produced in the form of large-sized “carpets,” from which components of any desired surface dimensions can be subsequently sawed off or divided off. In these methods, the individual boards are arranged lengthwise and glued together along their longitudinal narrow sides in a press. Here, the press has to apply “surface pressure” to the visible surfaces of the boards being bonded together, and usually also “side pressure” to the narrow sides of the outermost boards of the board composite. The format of the carpet producible hereby is thus limited to the size of the press, in particular its maximum pressing width.

From an economic point of view, it is usually desirable to use so-called side-cut boards for individual or all layers of a wood composite panel. To facilitate bonding of the side-cut boards, they are initially brought into shape with a square cross-section, which leads to waste. If the side-cut boards are left with or without their tree edge and the trapezoid cross-section, they form inclined interfaces along adjacent longitudinal narrow sides. Pressing such side-cut boards is particularly challenging, and the application of side pressure is essential, wherein special care must be taken to coordinate the surface pressure and side pressure in order to make sure that there will be no cupping, warping, or similar at the interfaces during or after the pressing process. EP 3 079 870 B1 describes such a method, wherein the dried side-cut boards are first divided along the board center in order to reduce cupping. This division leads to a doubling of the pieces (boards) that have to be manipulated and processed, which leads to increased costs for sawing, loss of the gap due to the division in the center, the necessity of additional glue, and increased processing time. Due to the above reasons, such wood composite panels can only be used in high-quality products, for example furniture and interior finishing.

It is the object of the present invention to provide pairs of boards and mono- or multilayer wood composite panels as well as methods for producing them that overcome or at least reduce the problems of the prior art described above.

This object is achieved by providing pairs of boards with the characteristics of claim 1 as well as wood composite panels with the characteristics of claim 10 by means of a method for producing a pair of boards according to claim 13 and a method for producing wood composite panels with the characteristics of claim 18. Preferred embodiments of the invention are set out in the subclaims, the description below and the drawings.

A pair of boards according to the invention, consisting of two boards joined together along their longitudinal narrow sides, the profiling preferably being a profiling already carried out in the sawmill in the fresh state of the boards, is characterized in that the boards originate from the same tree trunk, preferably from the same tree trunk cut to a standard raw wood length, with substantially the same moisture content and conicity, and are cut from layers of the tree trunk corresponding to one another, opposite layers of the tree trunk with respect to a longitudinal axis of the tree trunk, wherein a guide chamfer is formed on the boards to be joined, wherein the two boards have been joined in the fresh state of the boards and wherein the two boards are arranged in a neutral growth ring position in relation to one another.

Such a pair of boards is, e.g., shown in Fig. 6 and will be described in more detail below. It is still visible when the boards of the pair of boards have been joined together after production that the boards were profiled in the fresh state and originate from opposite sides of the same tree trunk. Profiling in the fresh state is recognizable from the shrinkage behavior. The fact that the boards originate from opposite sides of the same tree is recognizable by their very similar densities, a similar growth ring pattern with substantially the same pattern of growth ring widths, the same moisture content, the same quality and distance of branch formation in annual growth, and the same shrinkage behavior. These properties can, e.g., be inspected and measured comparatively at the treetop surface (also called "head log surface," located at the side of the trunk facing the treetop) and the rootstock surface (the rootstock surface is opposite to the treetop surface, i.e., facing the rootstock of the tree trunk) of the boards.

The two boards of the pair of boards have been joined in the fresh state of the boards. By already joining the boards in the fresh state in the sawmill and due to the fact that they originate from the same tree trunk and from the same location on opposite sides of the tree trunk, they have, having grown as a natural product, substantially the same quality, conicity, and in particular also approximately the same moisture content. The two boards having the same or at least a very similar moisture content is a precondition for gluing in a moist state to work, e.g., with a PU adhesive, wherein gluing with a PU adhesive in throughfeed can be supported by microwaves and/or other measures for surface heating. In addition, the boards can be two narrow side-cut boards, wherein already joining these narrow side-cut boards in the fresh state in the sawmill immediately results in a wider pair of boards. This has the advantage that for further processing, not the individual boards will have to be manipulated, but the pair of boards, which reduces the quantity of the objects to be manipulated by half. Consequently, a processing plant can handle twice the output at the same cycle speed. This is particularly advantageous since constantly higher quantities are being demanded in industrial sawmills. Also, processing the wider, more stable pairs of boards leads to less disruptions in the operation of the plant because the pairs of boards are, in contrast to often bended individual boards, parallel and straight on their outer surfaces. This significantly reduces operating costs. In addition, it is possible to process, e.g., instead of two narrow boards of 10 cm each, boards that are approximately 50% wider, of approximately 15 cm, and thus to obtain a pair of boards with a width of 30 cm having the same quality over its width, which increases yields by approximately 40-50 %.

Preferably, the pair of boards is provided with guide chamfers parallel to one another on its two narrow longitudinal sides.

In the pair of boards according to the invention, the two boards are arranged in a neutral growth ring position in relation to one another. Already joining the “twin” boards in the fresh state in the sawmill guarantees that the correct boards (from the same location on opposite sides of the same tree trunk) are assigned to one another. Also, no subsequent manual (by visual inspection) or automatic (cameras, etc.) matching is necessary, which thus excludes a source of error from the outset. Therefore, the boards matching one another can be arranged in a neutral growth ring position so that the craft rule for solid wood requiring the boards to be joined to be arranged in a neutral growth ring position is followed, which leads to neutral shrinking and swelling of the joined boards without tension or warping. With the invention, this may now be industrially implemented at unprecedentedly low costs. Arranging in a neutral growth ring position means that adjacent boards are arranged so that the growth ring sections of the boards are arranged next to one another with opposite curvatures. On the pair of boards, this is visible at the treetop and rootstock sides. Arranging the two boards in a neutral growth ring position and profiling and joining in the fresh state also prevents misgluing of the pair of boards with the inclined tree edges. The boards have corresponding shrinkage and swelling (“negative shrinkage”) so that the tensions in the adhesive joints arising over lifetime are not very high. The known higher quality of side-cut boards, i.e., boards cut from the side of the tree, e.g., regarding their higher elastic modulus, and the use of side-cut boards for the pair of boards made possible by the invention allows for the provision of pairs of boards with corresponding strength made of side-cut boards, which have been regarded as rather inferior until now (because they are thin and narrow, are present in high quantities, and inevitably have a tree edge).

In a particularly preferred embodiment of the pair of boards according to the invention, profiles of the boards at the common longitudinal joint are formed as mutually complementary dovetail profiles, the longitudinal joint optionally being provided with an adhesive, and preferably, when a plurality of dovetail profiles are formed on each board, adjacent dovetail joints are formed inversely to one another. When forming several dovetail profiles on each board, for example, adjacent dovetail joints may be formed for, e.g., approximately 10 mm board thickness (multiple thickness) inversely to one another. Preferably, the dovetail profiles are milled into the rounding of the tree edge. Due to these measures and optionally further optimization, joining the two profiled boards by pushing them into one another with continuous guidance at the continuously introducible guiding chamfer according to the invention, formed by profiling in the rounding of the tree edge, already leads to very good mechanical connection via form fit, which allows a reduction of the use of adhesive, e.g., by applying only one adhesive line in the center or one on each external side. Furthermore, e.g. depending on the quality and the need of further processing of the pairs of boards into multilayer composite panels with external visible surfaces and interior center layers, the boards may already be sorted during profiling with regard to more or less tree edge or to dosing of the adhesive (full or very or every other adhesive line) in order to produce a fully glued joint without tree edge, which is the tree bark edge, for forming the pair of boards for the visible surface, or, e.g., for certain lower qualities, such as center layers, to use less adhesive in case of less tree edge on the boards, or to join the boards solely by pushing the dovetail profiles of the boards into one another, wherein such qualities may be used as center layers in the composite panels, in particular for cross-laminated timber. By milling the dovetail profiles into the rounding of the tree edge, mainly the shape of the edge/longitudinal side of the board that has been milled off until now is used outside of the inclined connection line of the corner points, which minimized the loss of wood when creating mechanical connections for the two joining partners, which allows for an increase of yield.

It is useful to have a width of each board of the pair of boards on the narrow end of at least 30, preferably at least 40 mm, wherein the board with is preferably selectable as large as possible, e.g., in 1 mm steps. The minimum width of 30 mm is measured from the point at which the board is at least touched by the saw. Usually, the board width is at least 80 mm and stepped with at least 20 mm. Also, boards with tree edges could hardly be used in the prior art. Therefore, only thin side-cut boards could be produced, so that, in order to make better use of the tree trunk, in particular in case of larger diameters, usually two side-cut boards were cut from the tree trunk from each side, i.e., four boards in total, which causes double the workload when they processed into pairs of boards due to the large number of thin boards (double quantity). Thanks to the invention it becomes possible to also process thicker conical side-cut boards with inclined tree edges. This, in turn, results in the individual side-cut boards being much thicker than usual, in particular at least double in thickness than usually, and thus being able to be produced with higher quality, and in addition, conventional saw joints can be avoided and thus the yield can be increased, and the thicker boards can be processed into thicker pairs of boards without twisting and waste thanks to form fitting by means of dovetail joints, preferably still in the fresh state.

In a further preferred embodiment of the pair of boards according to the invention, the boards are profiled without overlap in relation to one another, and the guide chamfers are formed as stops for the formation of further dovetail profiles for connecting pairs of boards by means of the dovetail profiles at the longitudinal joints. The advantage of this embodiment is that is it possible to produce wood boards with any width from these pairs of boards without any press. These wood boards may, preferably in predefined system widths, extended by finger joints, be used as more stable construction timber as well as for longitudinal, center and transverse positions or for visible or cover layers for wood composites connected by at least one glued joint.

In an alternative embodiment of the pair of boards according to the invention, each board has a guide chamfer produced in the fresh state, and the pair of boards has been profiled in the dry state on the longitudinal narrow sides with mutually complementary hinged profiles, preferably with an overlap of 0.3 to 0.6 mm. A wood composite panel produced from such pairs of boards connected to one another on their longitudinal narrow sides is characterized in that adjacent pairs of boards are arranged in a neutral growth ring position. For producing this wood composite panel, the pairs of boards are arranged, according to craft rules, in one layer width in a neutral growth ring position and pushed through a press with the cycle width of the press, preferably a high-frequency press, in throughfeed operation with short pressing times. From such an “endless” wood composite panel, wood composite panels with any width, e.g., system widths of 250, 500, 750, 1000, 1250, 2500 mm, can be cut as needed and then machined and processed.

In wood composite panels according to the invention, consisting of at least two layers of pairs of boards arranged on top of one another, the pairs of boards of a respective layer are provided with an adhesive at their profiles, and an adhesive is applied to the surfaces of adjacent layers of pairs of boards, the pairs of boards of a respective layer being arranged parallel to one another. Thus, the layers of the wood composite panel can be pressed together and connected to one another in the same working step solely by applying surface pressure to the exterior layers so that a panel width according to the cycle width of the press, i.e., the advance length of the press, can be produced. A wood composite panel produced in this manner is produced practically during throughfeed and is already connected, wherein by arranging the pairs of boards of the same layer parallel to one another and by applying adhesive on the positioning table, another cycle width is available for further pressing in throughput operation for producing endless panels, as is shown in Fig. 4. From these panels, the desired width of wood composite panel can be cut off as needed from the endless wood composite panel.

A useful embodiment of the wood composite panel according to the invention has at least three superimposed layers of pairs of boards according to the invention, wherein the pairs of boards of a respective layer are provided with an adhesive at their profiles and an adhesive is applied to the surfaces of adjacent layers of pairs of boards, the pairs of boards of adjacent layers being arranged crosswise to one another.

The invention also relates to a method for producing a pair of boards characterized by cutting off two boards from the same tree trunk, preferably from the same tree trunk cut to a standard raw wood length, in the fresh state of the tree trunk from layers of the tree trunk which correspond to one another and lie opposite one another with respect to a longitudinal axis of the tree trunk, forming profiles on at least one of the longitudinal narrow sides of the boards in the fresh state of the boards, arranging the two boards so that the boards lie mirrored to one another with respect to a central transverse axis, and joining the boards of the longitudinal narrow sides by pushing them into one another along their profiles, preferably in the fresh state of the boards, optimally with prior application of an adhesive to the profiles.

Preferably, the pair of boards is provided with guide chamfers parallel to one another on its two narrow longitudinal sides, and the two boards are arranged in a neutral growth ring position in relation to one another.

An exact and quick production of the pair of boards in an industrial scale is achieved by forming the profiles of the boards at the common longitudinal joint as mutually complementary dovetail profiles, wherein preferably, when a plurality of dovetail profiles are formed on each board, adjacent dovetail joints are formed inversely to one another, contrary to the prior art where the dovetail joints are formed equally to one another. The advantage of the inverse formation of dovetail profiles according to the invention is that it can be avoided that heads break or dovetail parts in the joint at the dovetail corner splinter, which occurs more easily in the prior art, in particular on the side of the inclined edge. To achieve the above object, it is further preferred that the boards are profiled without overlap in relation to one another and that the guide chamfers having a stop for the formation of the dovetail profiles and for controlled guidance at the continuous guide chamfer at the stop are pushed together without offset and deviation problems.

In a preferred embodiment of the method for producing a pair of boards according to the invention, each board is provided with a guide chamfer in the fresh state, and the pairs of boards are profiled in the dry state on their longitudinal narrow sides 5 with mutually complementary hinged profiles, preferably with an overlap of 0.3 to 0.6 mm of the hinged profiles.

A preferred embodiment of the pair of boards according to the invention is characterized in that the geometry of the dovetails in the tangential wood of the growth rings in the round tree edge at the root of the tails, preferably in a minimum width of 6 mm, is designed with higher strength for greater loads by transverse forces, wherein the central dovetails are approximately twice as high as the laterally outer dovetails in the rounding of the tree edge. For example, the center dovetails with the extended flanks have head heights of approximately 4.5 mm, 6 mm or 8 mm, and the laterally outer dovetail have head heights of approximately 2 mm, 2.5 mm, 3 mm or 4 mm. This reduces the risk of fracture due to the wedge effect at the tangential growth rings, in particular in softer early wood rings. When the dovetails in the standing wood of the radial growth rings in the trapezoidal central plank, e.g., the trapezoidal planks Z with Z', see Fig. 15, are about 3 mm wide and about 2 mm high at the root, the boards can again be connected in parallel by dovetails preferably in a grid of, e.g., 10 mm as multiple thickness into at least one pair of boards from the wedge-shaped central plank Z with Z'.

The invention also relates to a method for producing wood composite panels from pairs of wood produced according to the method for producing pairs of boards described above. This method for producing wood composite panels comprises:

flattening the pairs of boards,

forming complementary inclined profiles with hinged profiles of opposite shape on the facing longitudinal narrow sides of the pairs of boards,

arranging the pairs of boards next to each other,

applying adhesive to the longitudinal narrow sides of the pairs of boards,

joining adjacent pairs of boards on their longitudinal narrow sides, optionally with simultaneous hooking of the hinged profiles, and

pressing the pairs of boards joined together.

The method for producing wood composite panels according to the invention provides for the production of multilayer wood composite panels that are constructed in at least two layers by arranging the pair of boards in at least two superimposed layers and joining them together, the pairs of boards of each layer being arranged parallel to one another and the adjacent layers being glued together over their entire surface in the same working step. These wood composite panels are producible with very little added adhesive and thus ecologically well tolerable. By arranging adjacent boards of the pairs of boards in a neutral growth ring position, shrinkage/swelling, in particular at the glued joints, a reduced, also later in the integrated state, and only little or no tensions arises at the inclined connections at the longitudinal side walls (being formed by tree edges) due to the neutral growth ring position. This is also true for the gluing over entire surfaces of adjacent layers on pairs of boards, for which homogenous side-cut boards with their relatively flatly positioned growth rings are perfectly suitable.

According to the invention it is provided that several multilayer wood composite panels are joined together in the panel width or in predefined required widths or system widths by means of finger-jointing, the wood composite panels being layered in at least two layers, the boards first being sorted in raw wood length without end knots or knotted parts of the boards being cut to produce the pairs of boards, and the multilayer wood composite panels being cut into glued squared timbers. Finger-jointing can be subjected to a standardized tensile test so that the squared timbers can be used as long stable beams/carriers with assured quality.

Further details, features and advantages of the invention are evident from the following description of exemplary embodiments schematically shown in the drawings. In the drawings:

- Fig. 1 shows a cross-sectional view of a detail of a monolayer wood composite panel according to the invention according to a first exemplary embodiment;

- Fig. 2 shows a cross-sectional view of a detail of a monolayer wood composite panel according to the invention according to a second exemplary embodiment;

- Fig. 3A to Fig. 3D show an pair of boards according to the invention in a first embodiment in a cross-sectional view (Fig. 3A), a top view (Fig. 3B), a side view from left (Fig. 3C), and a perspective view from the top right (Fig. 3D);

- Fig. 4 shows, in cross-sectional views, details of a monolayer, two-layer, and three-layer wood composite panel according to the invention, respectively, based on the second exemplary embodiment;

- Fig. 5A and Fig. 5B show a board for a pair of boards according to the invention without (Fig. 5A) and with (Fig. 5B) a hinged profile in a mixed perspective view, the profile for connecting the boards being shown in a pushed-in state;

- Fig. 6 shows the production of a pair of boards according to the second embodiment;

- Fig. 7 and Fig. 8 show a further embodiment of a monolayer wood composite panel according to the invention in a cross-section;

- Fig. 9A shows a three-layer plywood composite panel produced from the monolayer wood composite panels of Fig. 7 and Fig. 8 in a cross-section;

- Fig. 9B shows a variation of the three-layer plywood composite panel of Fig. 9A in a cross-section;

- Fig. 10 shows a side-cut board cut from a fresh tree trunk in a cross-section;

- Fig. 11 shows a further side-cut board cut from a fresh tree trunk in a cross-section;

- Fig. 12 shows a further side-cut board that was cut from a fresh tree trunk and then divided in a cross-section;

- Fig. 13 shows a pair of boards consisting of several boards joined together by several dovetail profiles;

- Fig. 14 shows a sectional view of boards cut from a tree trunk of medium thickness;

- Fig. 15 shows a sectional view of the division of a tree trunk according to aspects of the present invention with the parallel pairs of boards made of sapwood and pairs of boards made of the wedge-shaped central plank;

- Figs. 16A to 16F show the production of pairs of boards and of wood composite panels made thereof consisting of thin tree trunks, so-called smallwood;

- Figs. 17A to 17F show an alternative production of pairs of boards and wood composite panels made thereof consisting of thin tree trunks, so-called smallwood; and

- Figs. 18A to 18E show the production of a pair of boards according to Fig. 13.

Figure 1 shows a cross-sectional view of a detail of a monolayer wood composite panel 1 according to the invention according to a first exemplary embodiment. The wood composite panel 1 is made of several boards 2 arranged next to one another, which may be side-cut boards from a block-shaped substrate 3 (see Fig. 6), for example raw round timber. The boards 2 originate from the same tree trunk, preferably from the same tree trunk cut to a standard raw wood length, and are cut from layers of the tree trunk corresponding to one another, opposite layers of the tree trunk with respect to a longitudinal axis of the tree trunk. The boards 2 have a trapezoid cross-section, wherein longitudinal narrow sides 5 form the legs of the trapezoidal cross-section, wherein adjacent boards 2 lie mirrored to one another with respect to a central transverse axis 6. The boards 2 are connected to one another along their longitudinal narrow sides 5 profiled in the longitudinal direction 4 with substantially the same wood fiber direction. The outer visible surfaces of the boards 2 connected to one another form an upper side 7 and a lower side 8 of the wood composite panel 1. The boards 2 have a board thickness 11. The longitudinal direction 4 is, according to Figure 1, perpendicular to the sheet plane. Two boards 2 each are joined together to form a pair of boards 14 (see Fig. 3). By laying the pairs of boards 14 together, a surface of boards 2 of a substantially infinite length in the transverse direction, a so-called “carpet,” can be provided solely be applying surface pressure, i.e., without any additional side pressure.

The boards are profiled in their longitudinal direction 4 on the longitudinal narrow sides 5, the profiling preferably being a profiling already carried out in the sawmill in the fresh state of the boards 2. The profile of the longitudinal narrow sides 5 has a hinged profile 9 with a hinged profile angle SW of less than or equal to 90 degrees, in the present example according to Figure 1 approximately 60 degrees. In addition, the hinged profiles 9 can, as shown in Figure 1, be offset from the central transverse axis 6. Here, the distance from the central transverse axis 6 may be approximately 0.1 mm to 0.8 mm, preferably approximately 0.3 mm to 0.6 mm, most preferably approximately 0.4 mm to 0.5 mm. Thus, by laying the boards 2 next to one another and before pressing the boards 2 to form a pair of boards 14 a wood composite panel 1, an overlap 12 between adjacent boards 2 is created. This overlap 12 can - according to the examples mentioned before for the distance from the central transverse axis 6 - be approximately 0.1 mm to 0.8 mm, preferably approximately 0.3 mm to 0.6 mm, most preferably approximately 0.4 mm to 0.5 mm. 2. The profile of the longitudinal narrow sides 5 may have more than one hinged profile 9, preferably two hinged profiles 9, the hinged profile angles SW of all hinged profiles 9 being less than or equal to 90 degrees. The hinged profile angles SW of the hinged profiles 9 or of all hinged profiles 9 are, for example, 80 degrees or less, preferably 70 degrees or less.

Figure 2 shows a cross-sectional view of a detail of a monolayer wood composite panel 10 according to the invention according to a second exemplary embodiment. The wood composite panel 10 according to the second exemplary embodiment is substantially the same as the wood composite panel 1 according to the first exemplary embodiment, with the difference that two adjacent boards 2 each are joined together, along their longitudinal narrow sides 5 contacting each other, to form a pair of boards 14 (see Fig. 3) via a dovetail profile 13. Alternatively, the boards 2 joined to form pairs of boards 14 can be provided with two or more than two, for example three, four or five, dovetail profiles 13. After joining the adjacent boards 2 to form a pair of boards 14 (see Figures 3 to 6), each pair of boards 14 has, along their outer longitudinal narrow sides 5, a profile with a guide chamfer 17 (see Fig. 5A) or a hinged profile 9 with a hinged profile angle SW of less than or equal to 90 degrees, in the present example according to Figure 2 approximately 60 degrees. Hinged profile angles SW below 80 degrees result in an additional hooking effect.

In this exemplary embodiment, the pair of boards 14 is also produced from two boards 2 joined together along their longitudinal narrow sides 5 profiled in the longitudinal direction 4, the boards 2 originating from the same tree trunk and being cut from opposite layers of the tree trunk with respect to a longitudinal axis of the tree trunk. The formation of the profile is preferably already carried out in the sawmill in the fresh state of the boards 2. The boards 2 are arranged opposite and mirrored to one another with respect to a central transverse axis 6. For example, the boards 2 are side-cut boards of a pair of boards 14 from the same trunk location of raw round timber (see Figure 6) and joined together via a dovetail profile 13. These two boards 2 then have a favorable growth ring position in relation to one another as well as substantially identical qualities with regard to fibers and moisture content. After connecting the boards, the pair of boards 14 has an substantially rectangular and stable shape, for example according to Figures 3A to 3D, without any risk of bending. By profiling and arranging in parallel such pairs of boards 14, for example according to Figures 2 to 6, a surface substantially endless in the transverse direction, a so-called “carpet,” can be provided forming a wood composite panel 10, 20 or 30.

If a surface pressure FD (see Figure 4, FD indicated by the plurality of parallel arrows) is applied to the upper side 7 and/or the lower side 8 of the wood composite panel 1 or 10 when the boards 2 are pressed to form the wood composite panel 1 or 10, the hinged profiles 9 prevent the boards 2 from being pushed apart transversely into the direction of the pressing force, i.e., substantially transversely to the direction of action of the surface pressure FD present. Overlaps 12 optionally present before pressing will be deformed and “straightened” by the action of the pressing force so that a flat and parallel uppers side 7 and lower side 8 are created. Preferably, the boards 2 are profiled so that an overlap 12 between adjacent boards 2 only arises due to the dimensioning of the hinged profile 9. For the sake of completeness, however, Fig. 2 shows overlaps 12 on adjacent boards 2 that are caused by the design of the hinged profile 9 and the dovetails 13. The embodiment of the wood composite panel 10 according to Fig. 2 only requires the application of a surface pressure FD, but not of any additional side pressure.

Referring to Figure 4, the monolayer wood composite panel 10 can alternatively be formed as a two-layer wood composite panel 20, a three-layer wood composite panel 30, or a wood composite panel comprising more than three layers, for example four, five, six, seven, eight, nine, ten or more than ten layers. The upper side 7 of the wood composite panel 10, 20 or 30 is formed by the outer visible surfaces of the uppermost layer of pairs of boards 14 consisting of boards 2 joined together, and the lower side 8 of the wood composite panel 10, 20 or 30 is formed by the outer visible surfaces of the lowermost layer of pairs of boards 14 consisting of boards 2 joined together. In the case of a three-layer wood composite panel 30, a center layer board 15 may be formed of side-cut boards, central boards, center planks, squared timber planks, quartered planks and/or central planks of a block-shaped substrate 3. It should also be mentioned that the thickness of the individual layers of the wood composite panels can be relatively small, e.g., be a thickness of only 20 mm. Such thin layers are called lamellas, which are processed into multilayer panels having high stiffness and strength. It has been shown that the quality of these multilayer panels is higher if pairs of boards are used instead of single boards.

Fig. 5A and Fig. 5B show two boards 2 joined together to form a pair of boards 14, for example according to Figure 3, in a mixed perspective view, the dovetail profile 13 for connecting the boards 2 respectively being shown in a pushed-in state. The boards 2 are profiled without any overlap in relation to one another, and the guide chamfers 17 serve as stops for the formation of further dovetail profiles for connecting pairs of boards 14 by means of the dovetail profiles at the longitudinal joints 13.

Figure 6 shows a method for producing such a pair of boards 14 from boards 2.

The method is particularly productive and cost-effective to execute. The two boards 2 represent a “right” and “left” side-cut board of a block-shaped substrate 3, for example raw round timber, as described above. The two boards 2 are sawed from the same trunk location of the substrate 3 in their fresh state. One of the boards 2 is then turned over, and the longitudinal narrow sides 5 of the boards 2 to be joined are each profiled with opposite dovetail profiles 13, wherein the boards 2 are guided at the stop of guide chamfers 17 milled into the boards 2 along a guide chamfer direction 16. Profiling of the boards 2 is preferably carried out in the fresh state of the boards 2. The boards 2 are then, still in a moist state, joined to form the pair of boards 14, with or without PU adhesive, by pushing together the complementary partners of the dovetail profiles 13. Pushing together the boards 2 is conducted at relative speed to one another, i.e., the boards 2 can be moved in opposite directions, or one of the boards 2 can be stationary, or the boards 2 are moved into the same direction with different speeds. If gluing is conducted in the fresh state, gluing on the longitudinal narrow sides 5 can be optimized by using microwaves in order to favor a uniform reaction in the glued joint. Each pair of boards 14 is joined along the center and can be profiled at the remaining outer longitudinal narrow sides 5 with one or more hinged profiles 9. Before they are further joined and pressed into an wood composite panel 10, 20 or 30 according to the invention, the pairs of boards 14 are preferably dried. Optional storage of the pairs of boards 14 in a warm/heated environment supports the reaction in the glued joint. The fact that the boards have been profiled and joined in the fresh state is recognizable from the shrinkage behavior. The fact that the boards originate from opposite sides of the same tree can be determined by analyses, e.g., on the basis of a very similar branch formation in branch images of the board surfaces with distances showing annual growth, their comparable densities, similar growth ring patterns with approximately the same growth ring widths, the same content of moisture, which is usually present in a tree trunk, and the same quality, as well as comparable shrinking behavior. The dovetail connection provides a form-fitting connection between the boards 2.

Preferably, the two boards 2 of the pair of boards 14 are arranged in a neutral growth ring position in relation to one another.

The width of each board 2 is, at the narrow end, which is at least touched by the saw, at least 30, preferably at least 40 mm, wherein the board width is preferably selectable as large as possible, e.g. in 1 mm steps.

One embodiment of the method according to the invention for producing a wood composite panel 1, 10, 20 or 30 will be described below by way of example:

In a first method step, a plurality of boards 2 is provided. Here, any two adjacent ones of the provided boards 2 originate from the same block-shaped substrate 3 and are particularly cut in the fresh state of the substrate 3, which is preferably a tree trunk cut to a standard raw wood length, and are, as described above, joined to form pairs of boards 14.

In a next method step, each board 2 is profiled in the still fresh state along its longitudinal narrow sides 5 with profiles that are, according to the above description, at least a dovetail profile 13 and/or one or more hinged profiles 9 with a hinged profile angle SW of less than or equal to 90 degrees. When pairs of boards 14 are provided, the boards 2 of these pairs of boards 14 are joined together along their longitudinal narrow sides 5 contacting each other via at least one dovetail profile 13, and the pairs of boards 14 are each profiled along their outer longitudinal narrow sides 5 with a profile that has, according to the above description, one or more hinged profiles 9 with a hinged profile angle SW of less than or equal to 90 degrees. The hinged profiles 9 can be milled, wherein preferably initially a small edge is pre-milled as a guide chamfer 17 on the longitudinal narrow sides 5 in the wider area of the board 2 or pair of boards 14, which may then serve as a stop for the milling procedure of the hinged profiles 9 (see Figure 6). The dovetail profiles 13 and the hinged profiles 9 are always visible in the finished products. Preferably, profiling of the boards 2 is carried out on their longitudinal narrow sides 5 with circular saw blades with a beveled edge, e.g. with a beveled edge of 15 degrees for the production of dovetail profiles as well as of hinged profiles 9 with hinged profile angles SW of 15 or 75 degrees, respectively.

Then, a layer of adhesive is applied to the lateral profiles of the longitudinal narrow sides 5.

In a further method step, the pairs of boards 14 are arranged mirrored to one another with respect to the central transverse axis 6 and glued together in a press under the effect of solely surface pressure FD to the upper side 7 and/or the lower side 8 of the wood composite panel 1, 10. The so-called “carpet” formed thereby can substantially be produced with endless length. In addition, pairs of boards 14 may also be laid in several layers with the application of adhesive on their upper and lower surfaces facing one another and then pressed together by means of surface pressure. Compared to the prior art, it is new that this production process can be carried out in only one step.

Preferably, the pairs of boards 14 of the wood composite panel joined together on their longitudinal narrow sides 5 are aligned so that adjacent pairs of boards 14 are arranged in a neutral growth ring position.

The method steps described can optionally be repeated any number of times for producing further layers. The layers are preferably placed on top of one another in a parallel manner and glued together to form a wood composite panel 20 or 30. Gluing the surfaces of the formed layers can be conducted in the rough sawn state, i.e. without any previous smoothing of the surface, if a suitable press is used, e.g. a press providing pressure equalization by oil filling.

The wood composite panel 1, 10, 20 or 30 produced as described above can along at least one sawing direction, preferably substantially parallel with the longitudinal narrow sides 5, be cut off at the width. In addition, the cut-off wood composite panel 1, 10, 20 or 30 can, along its lateral narrow sides 18, be glued together with further wood composite panels and/or dovetailed.

The production of a wood composite panel 1, 10, 20 or 30 according to the method described above allows low manufacturing costs and high yields previously unattainable. The production of wood composite panels 1, 10, 20 or 30 according to the invention is preferably carried out with a high-frequency press, wherein subsequent dividing and/or finger-jointing allows for the manufacture of various products, for example mono- or multilayer cross-laminated timber panels or beams for wood construction.

Fig. 7 and Fig. 8 show a further embodiment of a monolayer wood composite panel 50 according to the invention in a cross-section. The wood composite panel 50 is composed of boards 22, wherein two boards 22 each are combined to form a pair of boards 24 and adjacent pairs of boards 24 are joined together. The term "board" as used herein also comprises "planks," i.e. thicker boards. The boards 22 have, along their longitudinal narrow sides 5, profiles in the form of dovetails 13, wherein dovetail profiles 13 of adjacent boards 22 facing one another are complementary to one another so that to boards 22 are joined together to form a pair of boards 24 by pushing the dovetail profiles 13 into one another. The boards 22 have, transverse to their longitudinal extension, a trapezoidal cross-section, the longitudinal narrow sides forming the legs of the trapezoidal cross-sections, wherein the boards 22 are in a mirrored arrangement with respect to a central transverse axis 6. It should be noted that the embodiment of Fig. 7 shows overlaps of the boards 22 at some of the dovetail profiles 13, this wood composite panel 50 can, however, also be manufactured without overlaps, as shown in the embodiments according to Fig. 9A and Fig. 9B.

The outer longitudinal narrow sides 5 of each pair of boards 24 have at least one dovetail profile 13, wherein the dovetail profiles 13 are formed so that the dovetail profiles 13 formed on the outer longitudinal narrow sides 5 complement one another when adjacent pairs of boards 24 are joined together, or are, in other words, of an opposite or complementary design.

In the embodiment of the wood composite panel 50 shown in Fig. 7 and Fig. 8, the dovetail profiles 13 can, on the longitudinal narrow sides 5 of boards 22 of each pair of boards facing one another, be spaced by approximately 0.1 mm to 0.8 mm, preferably by approximately 0.3 mm to 0.6 mm, most preferably by approximately 0.4 mm to 0.5 mm, from the central transverse axis 6, which results in an overlap when the adjacent boards 22 are joined together on the longitudinal narrow sides 5 facing one another. This overlap is levelled out by surface pressing the pair of boards 24, wherein the dovetail profiles 13 interlock and thus provide a better connection. The boards 22 are joined together in the moist, i.e., undried, state. In the embodiment of the wood composite panel 50 shown in Fig. 7 and Fig. 8, the outer dovetail joints 13 of the pairs of boards 24 are not offset to the central transverse axis 6. Thus, it is not necessary to use a press when joining together pairs of boards 24. However, it is preferable, e.g., for load-bearing uses, to only join dry pairs of boards 24 to one another. This is not an embodiment of the invention and is only described herein for illustrative purposes. It should be noted that in other embodiments of the wood composite panel 50 according to the invention, the outer longitudinal narrow sides 5 of the pair of boards 24 are also spaced by approximately 0.1 mm to 0.8 mm, preferably by approximately 0.3 mm to 0.6 mm, most preferably by approximately 0.4 mm to 0.5 mm, from the central transverse axis 6, which results in an overlap on the longitudinal narrow sides 5 when adjacent pairs of boards 24 are joined together, which is levelled out with a press.

Fig. 8 shows a monolayer wood composite panel 50 according to the invention, in which the connecting dovetail profiles 13 can be already produced on the tree edge of side-cut boards as well as with boards and planks from the whole trunk, with an angle of 25° to 90°, e.g., with the measurement data of the boards 22 and/or the pairs of boards 24. The wood composite panel can, preferably in the fresh state, be divided into standard widths (shown with dotted lines as exemplary widths A, B, C), e.g., in a 2 cm grid, providing wood composite elements in a grid of 6, 8, 10. 12, 14, 16, ... to approximately 40 cm. Dividing the wood composite panel 50 is preferably carried out longitudinally approximately in the middle of the width of the boards 22, which may be followed by a drying procedure.

It should be noted that all embodiments of the wood composite panels according to the invention and the pairs of boards according to the invention can be subjected to additional processing steps depending on the intended use, in particular to a calibration of their thickness to the same value by planning, milling and/or grinding.

Fig. 9A shows a three-layer wood composite panel 60 according to the invention in a cross-section, which is composed of three superimposed monolayer wood composite panels 50 that are glued to one another. The monolayer wood composite panels 50 are similar to those of Figures 7 and 8, with the difference that none of the dovetail profiles 13 is spaced from the central transverse axis 6 so that there is no overlap. The wood composite panels 50 free of overlaps have the necessary formats for the wood composite panel 60 and can be superimposed and glued to one another without disturbances and without any residual board projecting from the edge of the wood composite panel 60 that has to be cut off. Furthermore, it should be noted that the central wood composite panel 50 is arranged transversely (cross-wise) to the outer wood composite panels 50 so that the three-layer wood composite panel 60 forms a cross-laminated timber. Multilayer wood composite panels 60 with five, seven, nine, etc. layers can also be manufactured as cross-laminated timber. The upper side 7 of the uppermost monolayer wood composite panel 50 and the lower side 8 of the lowermost monolayer wood composite panel 50 represent the outer visible surfaces of the three-layer wood composite panel 60. The central monolayer wood composite panel 50 can be economically composed of side-cut boards, central boards, center planks, squared timber planks, quartered planks and/or central planks of a block-shaped substrate 3.

Fig. 9B shows a variation of the wood composite panel 60 of Fig. 9A, in which the boards of each pair of boards are joined together by hinged profiles 9 instead of dovetail profiles 13. Pressing of the wood composite panel 60 can be carried out in one working step.

Fig. 10 shows a cross-section of a board 2 that was cut as a thick side-cut board from a substrate 3, namely a tree trunk in the fresh state. The tree trunk has a rootstock end 3a, a center 3b, and a head 3c, i.e. the treetop end. The cross-sectional view of the board 2 is from the center 3b of the tree trunk. The board 2 has, on its tree edges WK (also called dull edges, representing the part of the boards from the tree perimeter), been provided with a hinged profile 9 on the left and several dovetail profiles 13 on the right, wherein adjacent dovetail joints 13 are formed inversely to one another. In order to show the excellent utilization of the tree volume with such a configuration of the board 2 more clearly, two rectangular boards 30, 31 have been drawn within the board with a thin line as they would result from a cutting method according to the prior art as side-cut boards with a wide saw kerf between the boards 30, 31 and a lot of residual wood from sawing next to the boards 30, 31.

Fig. 11 shows a cross-section of a further board 2 that was cut as a thick side-cut board from a substrate 3, namely a tree trunk in the fresh state. This board 2 only differs from the board 2 of Fig. 10 by the fact that several dovetail profiles 13 have been milled on the tree edges on the left and right sides.

Fig. 12 shows a cross-section of a further board 2 that was cut as a thick side-cut board from a substrate 3, namely a tree trunk in the fresh state. This board 2 corresponds to the board 2 of Fig. 11, wherein it is demonstrated that in the case of thick tree trunks and correspondingly wide boards 2, the board 2 can be longitudinally divided by longitudinal cuts along cutting lines 2d, 2e, resulting in an inner board 2a with a rectangular cross-section and smooth side surfaces and two edge-side boards 2b, 2c with tree edges as side surfaces into which several dovetail profiles are milled.

Fig. 13 shows a cross-section of a pair of boards 14 consisting of two boards 2 connected to one another by two dovetail profiles 13 formed inversely to one another, wherein a guide chamfer 17 has been milled into the outer side edges of each board, wherein the two guide chamfers 17 are arranged parallel to one another. Furthermore, a preferable implementation of the dovetail for thinner side-cut boards of, e.g., 20, 25, 30 mm is shown, where mechanical form-fitting including force-fitting can already by achieved in the head area by designing a wider root and especially center. Also, a difference in the height of the head can be formed by the designable length of the wedge slope as shown, with a representation of the connection on the pair of boards by a hinged profile to the board. Another advantage of the inverted formation of dovetail profiles according to the invention is that it can be avoided that dovetail parts break or splinter in the groove at the more pointed dovetail corners.

Fig. 14 is a front view of a tree trunk seen from the treetop side that shows that, according to the invention, several side-cut boards S1, S2, S3, S4 as well as side-cut boards S1', S2', S3', S4' from the same location opposite thereto with respect to the center axis M of the tree trunk have been cut. The longitudinal cut of the side-cut boards S1, S2, S3, S4, S1', S2', S3', S4' is made parallel with the directrix so that all side-cut boards have a constant thickness. After all side-cut boards have been cut, there remains a central plank Z with a thickness increasing over its length. The side-cut boards S1 and S1', S2 and S2', S3 and S3', S4 and S4' opposed to one another form joining partners that are joined together to form pairs of boards after the formation of profiles on their tree edges WK. This figure shows that the tree edges WK, forming the side surfaces of the side-cut boards, have different, partly very pointed angels, with respect to the base surface and the top surface of the side-cut boards so that the top surfaces on the outer side-cut boards S4, S4' are less conically tapered, almost parallel, and also have similar tree edge bevels at the treetop (pointed) and the rootstock (steep), which allows for maximum yield. The conical tapering of a tree refers to the reduction of the diameter of a trunk towards the treetop. In the further boards S3, S2, S1, the top surfaces are also less conical than in the prior art. This allows a reduction of resulting cheaper sawing side-products (wood chips and shavings for the paper or timber industries) by at least one third. In processing according to the prior art, such side-cut boards have been regarded as inferior because of their slanted side surfaces. According to the invention, however, they represent a timber raw material of high quality for the production of pairs of boards and wood composite panels.

Fig. 15 shows a cutting pattern through a substrate 3 in the form of a free tree trunk, e.g., with a diameter of at least 40 cm at the treetop, wherein the cutting pattern is shown from the outside to the central plank Z of the tree trunk and the lower half of the cutting pattern, which is not shown, is symmetrical with the upper cutting pattern half. In the drawing, initially - seen from the top to the bottom - a thick side-cut board 2 was cut, the outer (wane-side) side surfaces are preferably profiled, still in the fresh state of the cut board 2, with several opposite dovetail profiles 13 on one side, and with a hinged profile 9 on the other side. The drawing shows how this board 2 is joined, to form a pair of boards 14, with a board 2' cut from the same location on the opposite side with respect to the center axis M of the tree trunk and also provided with dovetail profiles 13 and a hinged profile 9 by pushing the two boards 2, in the longitudinal direction, into one another with their dovetail profiles 13. In this illustration it is shown that the two boards 2 were arranged in a neutral growth ring position according to craft rules, i.e., that the curvature lines of the growth rings of the two boards 2 run in opposite directions. This uppermost cut side-cut board 2 corresponds to the side-cut board 2 shown in Fig. 10. Next to this first side-cut board 2, a second side-cut board 2 is cut off, which is profiled with dovetail profiles 13 on both tree edge sides. This side-cut board 2 corresponds to the one from Fig. 11. Since this side-cut board 2 is already very wide, it is divided twice along the length so that smaller side-cut boards 2b, 2c and a central board (plank of heartwood) 2a are obtained. Fig. 15 also shows how the outer side-cut board 2c can be joined together with a board 2b' cut from the same location on the opposite side with respect to the center axis M of the tree trunk and also provided with dovetail profiles 13, in a neutral growth ring position of board 2c to board 2b, to form a pair of boards 14 mainly consisting of sapwood 2b'. A third board 2 closer to the center is already so wide that it can be divided into five boards in total, with three planks or laths as central boards. Finally, a central plank Z is cut from the substrate 3, which contains the wedge-shaped heartwood in the center axis M. This central plank Z is, e.g., divided into nine boards in total having a trapezoidal shape Z1, Z2, Z3, Z4, Z1', Z2', Z3', Z4', wherein Fig. 15 also shows how respective two squared timbers Z1 and Z1', Z2 and Z2', Z3 and Z3', Z4 and Z4' lying opposite of each other in the same location in the central plank Z can be re-joined in parallel to form pairs of boards by forming dovetail profiles 13 in the radial growth ring and pushing then into one another along the dovetail profiles 13 in a neutral growth ring position, wherein in addition to form-fitting by means of the dovetail profiles 13, gluing may be conducted. In this way, the tree trunk is used with the lowest possible amount of sawmill residue, and high-quality parallel pairs of boards and squared timber are formed, and only parallel-connected pairs of boards leave the saw, which can be further processes as described above. If, for example, the boards 2b and 2c of the boards/planks (e.g., 2a/2b/2c in Fig. 15) are joined together in the fresh state by dovetail profiles 13, pairs of boards 14 having final shapes and dimensions are obtained.

Figs. 16A to 16F show the production of pairs of boards and wood composite panels produced therefrom from thin tree trunks, so-called small wood, in a schematic representation. First, the thin tree trunk is divided lengthwise into two halves forming two - almost semicircular - boards 2, 2. A heart wedge, e.g., as in the embodiment of Fig. 15, is not formed during division. On the sides of the boards 2, 2 opposite one another, guide chamfers 17 are formed along the length of the boards 2, 2. This state is shown in Fig. 16A. Then, the two boards 2, 2 are provided with dovetail profiles 13 along the length of the boards 2, 2, see Fig. 16B. In the subsequent processing step, which is shown in Fig. 16C, the left board 2 is turned over around its transverse axis and then rotated clockwise by 90° along its length. The right board 2 is not turned over, but also turned clockwise by 90° along its length. Thus, the dovetail profiles 13 of the two boards 2, 2 face each other. In the next step, shown in Fig. 16D, the two boards 2, 2 are pushed into one another lengthwise at the dovetail joints 13 so that the two boards 2, 2 joined together form the pair of boards 14. Joining can, but does not have to be carried out with the aid of an adhesive. Applying pressure after pushing them together is not necessary. In the next step, shown in Fig. 16E, further dovetail profiles 13 are formed on the inclined longitudinal sides of the pair of boards 14. By means of these dovetail profiles 13 on the inclined longitudinal sides, the pair of boards 14 can be connected lengthwise with further similar pairs of boards 14 to form a wood composite panel 1 with any width by pushing the pairs of boards 14 into one another at the dovetail profiles, optionally with the aid of an adhesive. Pressure can be applied after joining, however, it is not necessary. The wood composite panel 1 thus produced is shown in Fig. 16F. It can be seen that the boards 2 of each pair of boards 14 as well as the adjacent pairs of boards 14 are each arranged in a neutral growth ring position.

Figs. 17A to 17F show the production of pairs of boards and wood composite panels produced therefrom from thin tree trunks, so-called small wood, in a schematic representation. The steps of the production procedure according to Fig. 17A to 17D correspond to those of Fig. 16A to 16D. For an explanation see the above description of Figs. 16A to 16D. In the next step, shown in Fig. 17E, hinged profiles 9 are formed on the inclined longitudinal sides of the pair of boards 14 instead of dovetail profiles. By means of these hinged profiles 9 on the inclined longitudinal sides, the pair of boards 14 can be joined together longitudinally with further similar pairs of boards 14 to form a wood composite panel 1 with any width by hooking the pairs of boards 14, optionally with the aid of an adhesive, into one another at the hinged profiles and then applying surface pressure. The wood composite panel 1 thus produced is shown in Fig. 17F. It can be seen that the boards 2 of each pair of boards 14 as well as the adjacent pairs of boards 14 of the wood composite panel 1 are each arranged in a neutral growth ring position. Joining of the boards 2 and pairs of boards 14 is carried out in the fresh state of the wood.

Figures 18A to 18E show the production of a pair of boards according to Fig. 13. First, two boards 2 are cut from a tree trunk as side-cut boards by means of a cut parallel with the directrix, wherein cutting the boards is carried out in corresponding positions of the tree trunk opposite one another with respect to a longitudinal axis of the tree trunk, see Fig. 18E. Guide chamfers 17 are formed on the side surfaces of the boards 2, see Fig. 18A. Then, a dovetail profile 13 is milled on one side surface of each board 2, see Fig. 18B. After that, one board 2 (in the drawing the left board 2) is turned over by 180° over its longitudinal axis. The two boards 2,2 are thus lying in opposite directions, i.e. in a neutral growth ring position, and their dovetail profiles are facing one another, see Fig. 18C. Now, the two boards 2, 2 are pushed into one another lengthwise still in the fresh, i.e. moist, state at their dovetail profiles 13 and thus form the pair of boards, as shown in Fig. 18D.

PATENTKRAV

1. Bræddepar (14) bestående af to med hinanden langs deres i længderetningen (4) profilerede langsgående smalle sider (5) forbundne brædder (2), hvor profileringen er en profilering, der allerede er udført på savmærket i bræddernes (2) friskskårede tilstand, **kendetegnet ved, at** brædderne (2) stammer fra samme træstamme, fortrinsvis fra samme i standard-råtrælængde skårede træstamme, med i det væsentlige ens fugtindhold og konicitet og er skåret fra til hinanden svarende og i forhold til en længdeakse af træstammen over for hinanden liggende lag af træstammen, hvor der er udformet en styrekant (17) på de brædder (2), der skal forbindes, hvor de to brædder (2) er blevet forbundet i bræddernes (2) friskskårede tilstand, og hvor de to brædder (2) er anbragt i neutral årringsposition i forhold til hinanden, hvor bræddeparret på sine to langsgående smalle sider fortrinsvis er forsynet med i forhold til hinanden parallelle styrekanter (17).

2. Bræddepar (14) ifølge krav 1, **kendetegnet ved, at** bræddernes (2) profileringer på den fælles langsgående forbindelse er udformet som gensidigt komplementære svalehaleprofiler (13) eller klapprofiler (9) med en klapprofilvinkel SW på mindre end eller lig med 90 grader, hvor den langsgående forbindelse eventuelt er forsynet med et klæbemiddel, og hvor fortrinsvis, ved udformning af en flerhed af svalehaleprofiler (13), på hvert bræt til hinanden stødende svalehaleforbindelser (13), eksempelvis for hver f.eks. ca. 10 mm af bræddetykkelsen, er udformet modsat i forhold til hinanden, hvor svalehaleprofilerne (13) fortrinsvis er fræset i trækantens runding.

3. Bræddepar (14) ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** svalehalernes geometri i årringenes tangentiale træ i den runde trækant ved halernes rod, fortrinsvis i en minimumsbredde på 6 mm, er udført med højere styrke for større belastning fra tværkræfter, hvor de midterste svalehaler er udformet på en sådan måde, at de er cirka dobbelt så høje som de lateralt ydre svalehaler i trækantens runding, hvor svalehaler fortrinsvis er udformet i den stående vedmasses radiale årringe i den trapezformede midterplanke, f.eks. de trapezformede brædder (Z med Z'), med en bredde på cirka 3 mm og en højde på cirka 2 mm ved roden.

4. Bræddepar (14) ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** bredden af hvert bræt (2) i dets smalle ende, i det mindste strejfet af saven, i det mindste udgør 30 mm, fortrinsvis i det mindste 40 mm, hvor brætbredden fortrinsvis kan vælges så stor som mulig, f.eks. i 1 mm-trin.

5. Bræddepar (14) ifølge et hvilket som helst af krav 2 til 4, **kendetegnet ved, at** brædderne (2) er profileret med svalehaleprofiler (13) uden overlapning i forhold til hinanden og er forbundet med hinanden til dannelse af bræddeparret (14) ved, at brædderne (2) er skubbet ind i hinanden ved deres svalehaleprofiler (13) uden pressetryk, hvor der fortrinsvis på bræddeparrets langsgående smalle sider (5) er udformet svalehaleprofiler (13) til at forbinde bræddepar (14).

6. Bræddepar (14) ifølge et hvilket som helst af krav 2 til 4, **kendetegnet ved, at** brædderne (2) er profileret med svalehaleprofiler (13) uden overlapning i forhold til hinanden og er forbundet med hinanden til dannelse af bræddeparret (14) ved, at brædderne (2) er skubbet ind i hinanden ved deres svalehaleprofiler (13) uden pressetryk, hvor der på bræddeparrets (14) langsgående smalle sider (5) er udformet klapprofiler (9), der fortrinsvis er dimensioneret på en sådan måde, at der ved sammenføjning af tørre bræddepar (14) ved hjælp af klapprofilerne (9) fremkommer en overlapning (12) med en højde på fortrinsvis 0,3 til 0,6 mm, og at denne overlapning (12) aftager under anvendelse af pressetryk.

7. Bræddepar (14) ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** brædderne (2) i bræddeparret (14) er dannet ved halvering i længderetningen af et stykke rundtømmer uden kernekile eller kerneplanke i friskskåret tilstand som de to halvdele af det delte stykke rundtømmer og er forbundet parallelt med hinanden ved hjælp af svalehaleprofiler (13) i en neutral årringsposition.

8. Bræddepar (14) ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** bredden af de med hinanden til dannelse af bræddeparret (14) forbundne brædder (2; 2a, 2b, 2c) er udvalgt på en sådan måde, at bræddeparret (14) har en færdig form og dimension.

9. Bræddepar (14) ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** respektive to over for hinanden i samme lag i midterplanken (Z)

liggende, som firskåret tømmer (Z1, Z1'; Z2, Z2'; Z3, Z3'; Z4, Z4) med svalehaleprofiler (13) i den radiale årring udformede brædder er forbundet parallelt til dannelse af bræddeparret (14).

10. Trækompositpanel (10) bestående af med hinanden på deres langsgående smalle sider (5) forbundne bræddepar (14) ifølge et hvilket som helst af de foregående krav, hvor til hinanden stødende bræddepar (14) er anbragt i en neutral årringsposition.

11. Trækompositpanel (20, 30) ifølge krav 10, bestående af i det mindste to over for hinanden liggende lag af bræddepar (14), **kendetegnet ved, at** bræddeparrene (14) i et respektivt lag er forsynet med klæbemiddel på deres profileringer, og at der er påført klæbemiddel på overfladerne af til hinanden stødende lag af bræddepar (14), hvor bræddeparrene (14) i et respektivt lag er anbragt parallelt med hinanden.

12. Trækompositpanel (60) ifølge krav 10, bestående af i det mindste tre over for hinanden liggende lag af bræddepar (14), **kendetegnet ved, at** bræddeparrene (14) i et respektivt lag er forsynet med klæbemiddel på deres profileringer, og at der er påført klæbemiddel på overfladerne af til hinanden stødende lag af bræddepar (14), hvor bræddeparrene (14) i til hinanden stødende lag er anbragt på tværs af hinanden.

13. Fremgangsmåde til fremstilling af et bræddepar (14), især et bræddepar ifølge et hvilket som helst af krav 1 til 9, **kendetegnet ved** skæring af to brædder (2) fra samme træstamme, fortrinsvis fra samme i en standard-råtrælængde skårede træstamme, i træstammens friskskårede tilstand fra til hinanden svarende, over for hinanden i forhold til en længdeakse af træstammen liggende lag af en træstamme, udformning af profileringer på respektivt i det mindste en af de langsgående smalle sider (5) af brædderne (14) i læddernes friskskårede tilstand, anbringelse af de to brædder (2) på en sådan måde, at brædderne (2) ligger spejlet mod hinanden i forhold til en tværgående midterakse (6), og forbindelse af de langsgående smalle siders (5) brædder ved at skubbe dem ind i hinanden langs deres profileringer i læddernes (2) friskskårede tilstand, eventuelt under forudgående påføring af klæbemiddel, især PU-klæbemiddel, på profileringerne.

14. Fremgangsmåde til fremstilling af et bræddepar (14) ifølge krav 13, **kendetegnet ved, at** bræddernes (2) profileringer på den fælles langsgående

forbindelse udformes som gensidigt komplementære svalehaleprofiler (13) eller klapprofiler (9) med en klapprofilvinkel SW på mindre end eller lig med 90 grader, hvor fortrinsvis, ved udformning af en flerhed af svalehaleprofiler (13), på hvert bræt (2) til hinanden stødende svalehaleforbindelser udformes modsat i forhold til hinanden, hvor brædderne (2) fortrinsvis profileres uden overlapning i forhold til hinanden, og styrekanterne (17) udformes som anslag til udformningen af svalehaleprofiler (13) til forbindelse af bræddepar (14) ved deres langsgående forbindelser ved hjælp af svalehaleprofilerne (13).

15. Fremgangsmåde til fremstilling af trækompositpaneler fra ifølge fremgangsmåden ifølge et hvilket som helst af krav 13 og 14 fremstillede bræddepar (14), **kendetegnet ved**:

plantrykning af bræddeparrene,

udformning af gensidigt komplementære skråprofiler med klapprofler (9) med modsat form på bræddeparrenes (14) mod hinanden vendende langsgående smalle sider,

anbringelse af bræddeparrene (14) ved siden af hinanden,

påføring af klæbemiddel på bræddeparrenes (14) langsgående smalle sider,

sammenføjning af til hinanden stødende bræddepar (14) på deres langsgående smalle sider, eventuelt under samtidig fastgørelse af klapprofilerne (9), og

presning af de med hinanden sammenføjede bræddepar (14).

16. Fremgangsmåde til fremstilling af trækompositpaneler (20, 30) ifølge krav 15, **kendetegnet ved, at** trækompositpanelerne opbygges i i det mindste to lag, ved at bræddeparrene (14) anbringes i i det mindste to over hinanden liggende lag og forbindes med hinanden, hvor bræddeparrene i hvert lag anbringes parallelt med hinanden,

og de til hinanden stødende lag klæbes sammen over hele deres flade i samme arbejdstrin.

17. Fremgangsmåde til fremstilling af trækompositpaneler (20, 30) ifølge krav 16, **kendetegnet ved, at** en flerhed af trækompositpaneler i flere lag forbindes med hinanden i panelbredden eller i foruddefinerede behovsbredder og/eller systembredder ved hjælp af fingersamling, hvor trækompositpanelerne lagdeles i i det mindste to lag, hvor brædderne først til fremstilling af brætparrene sorteres i råtrælængde uden endeknuder, og/eller knudrede dele af brædderne kappes af, og hvor trækompositpanelerne i flere lag skæres til limet firskåret tømmer.

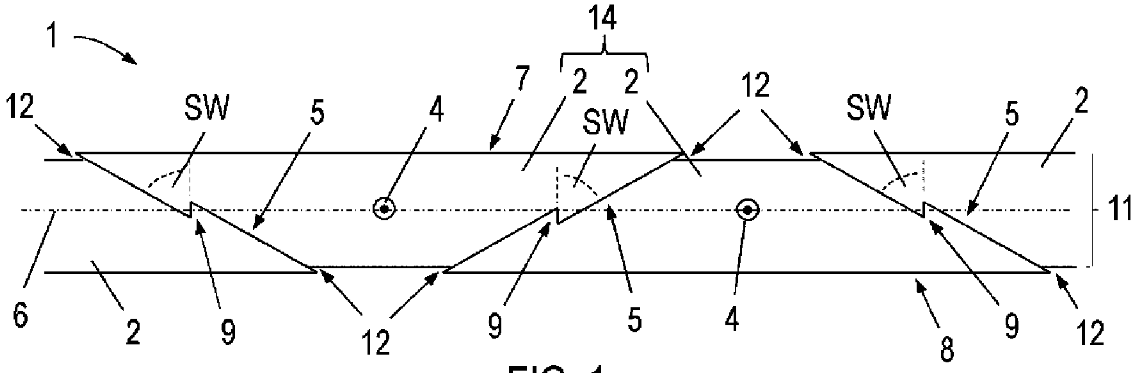

FIG. 1

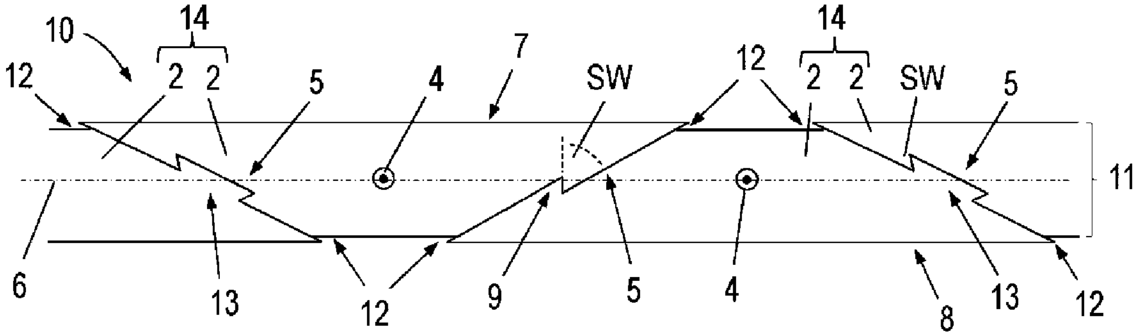

FIG. 2

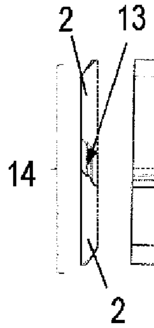

FIG. 3A

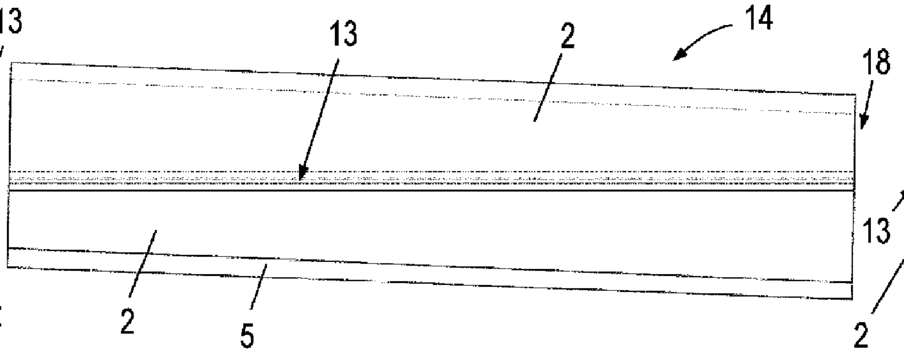

FIG. 3B

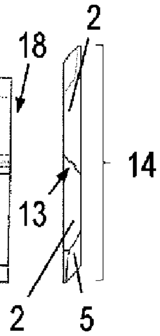

FIG. 3C

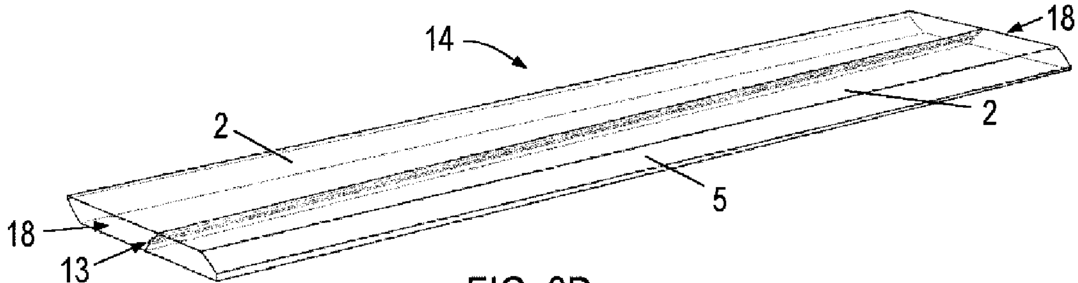

FIG. 3D

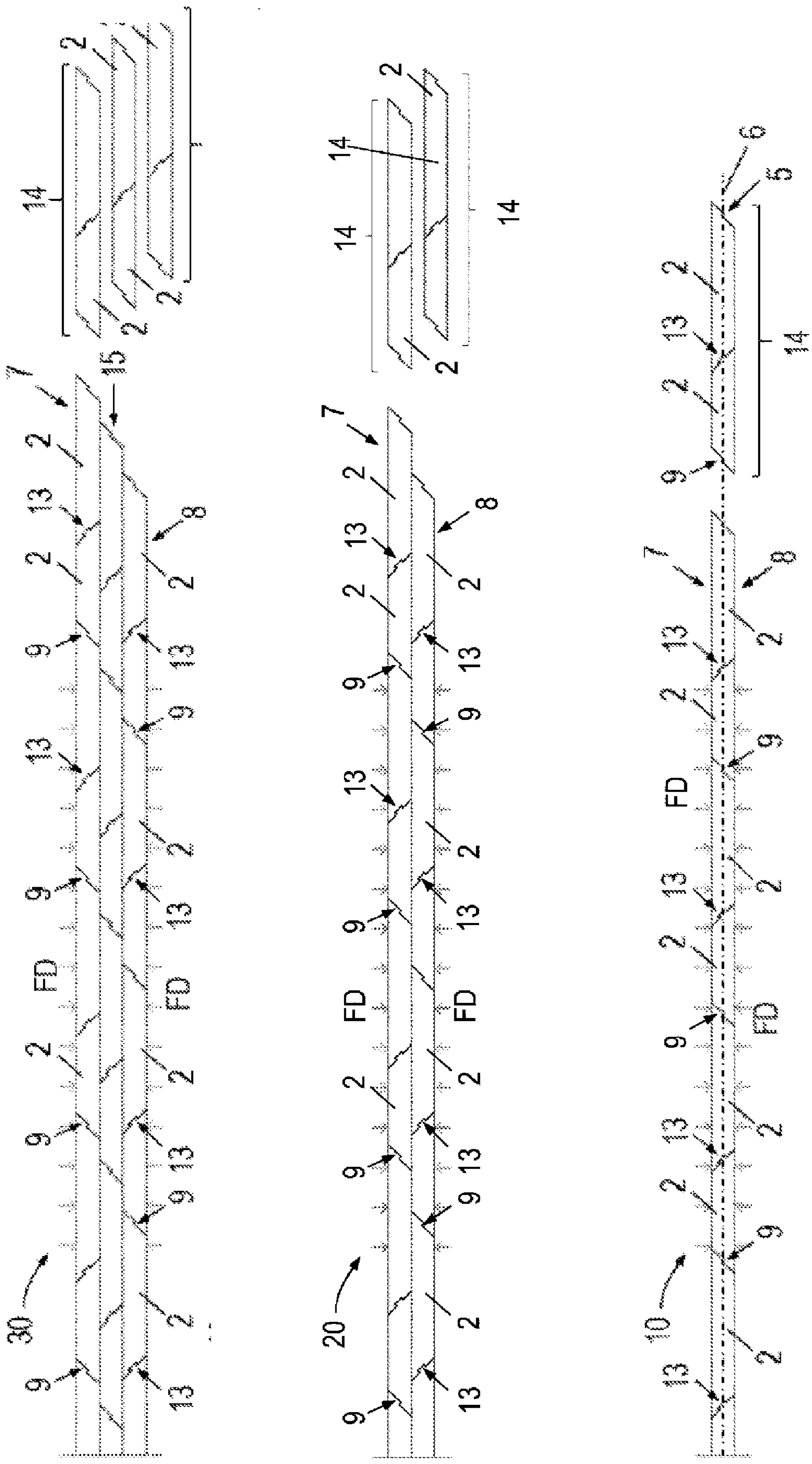

FIG. 4

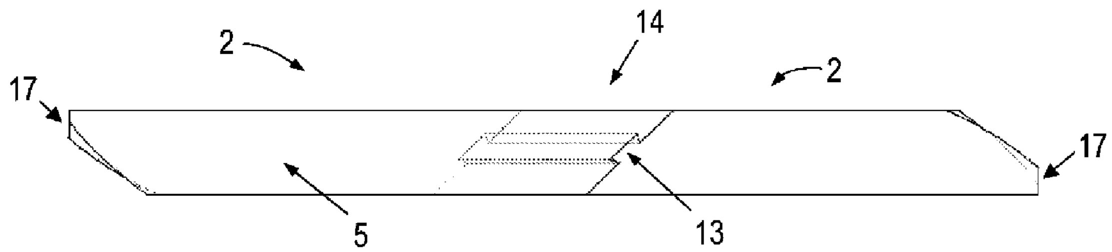

FIG. 5A

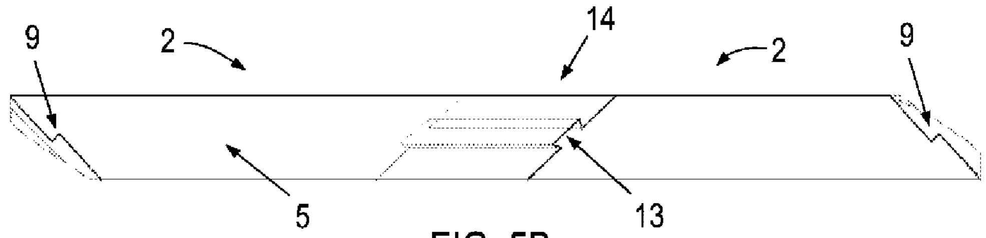

FIG. 5B

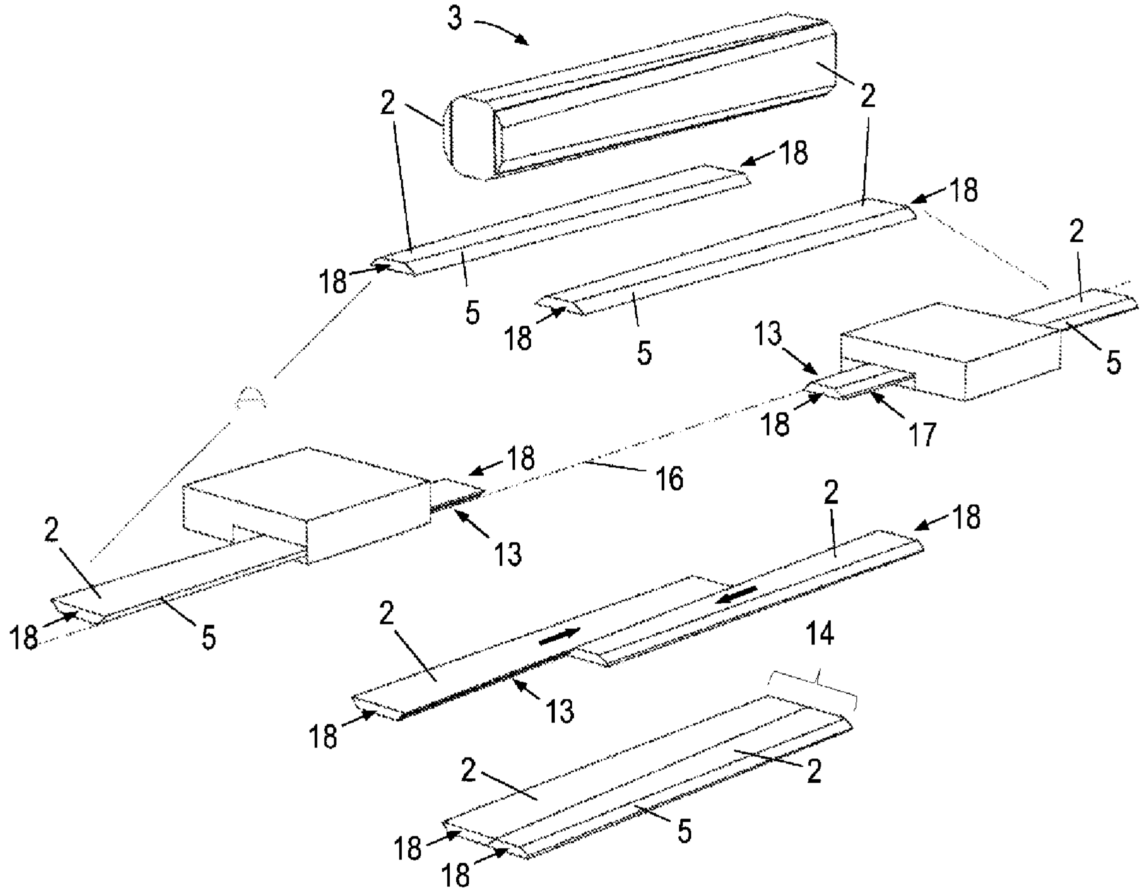

FIG. 6

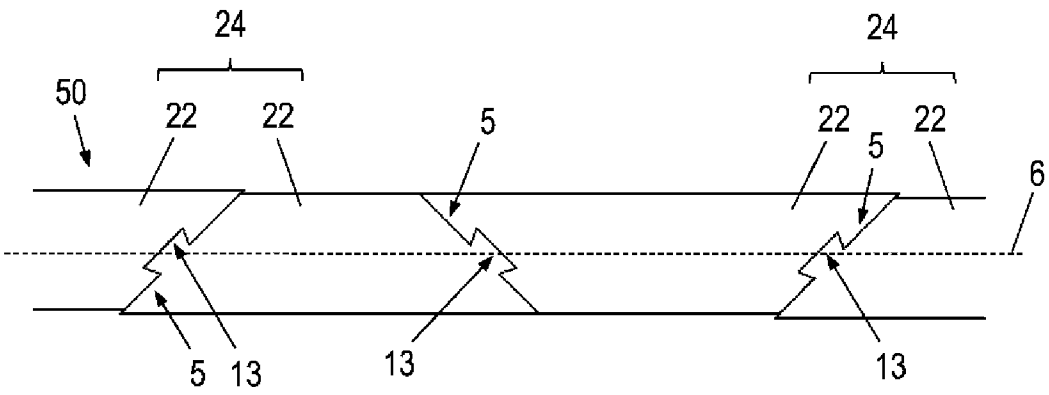

FIG. 7

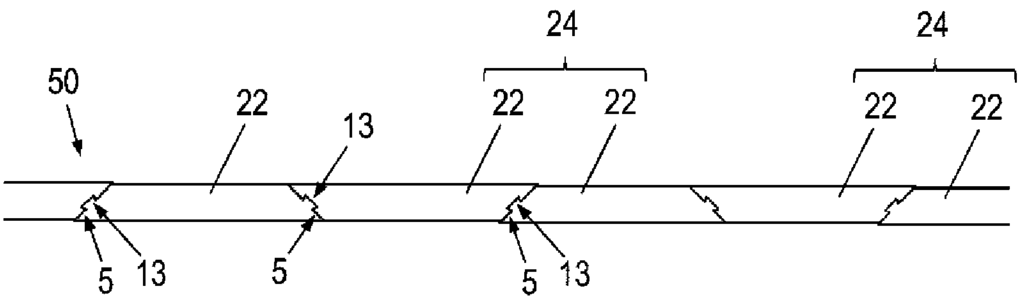

FIG. 8

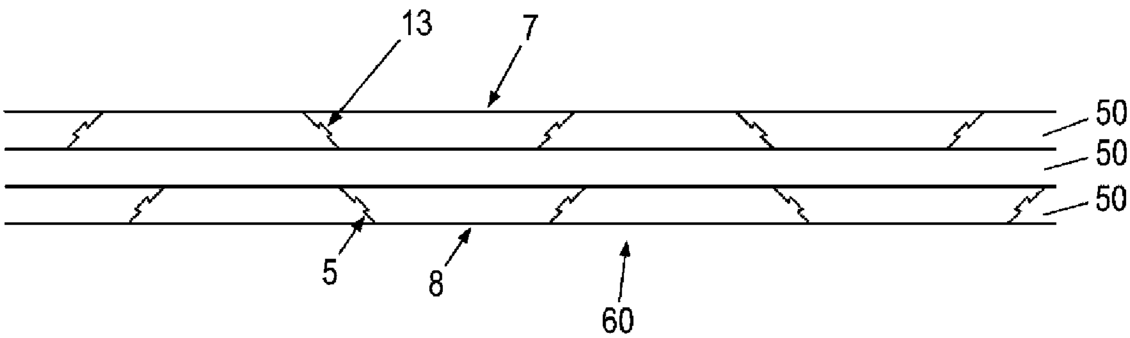

FIG. 9A

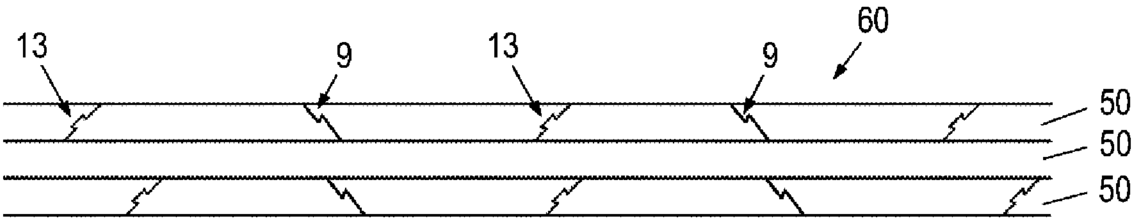

FIG. 9B

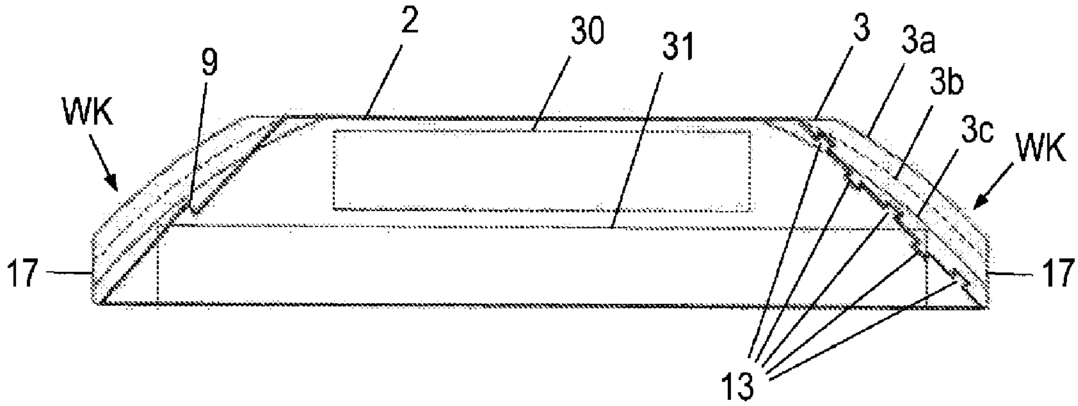

FIG. 10

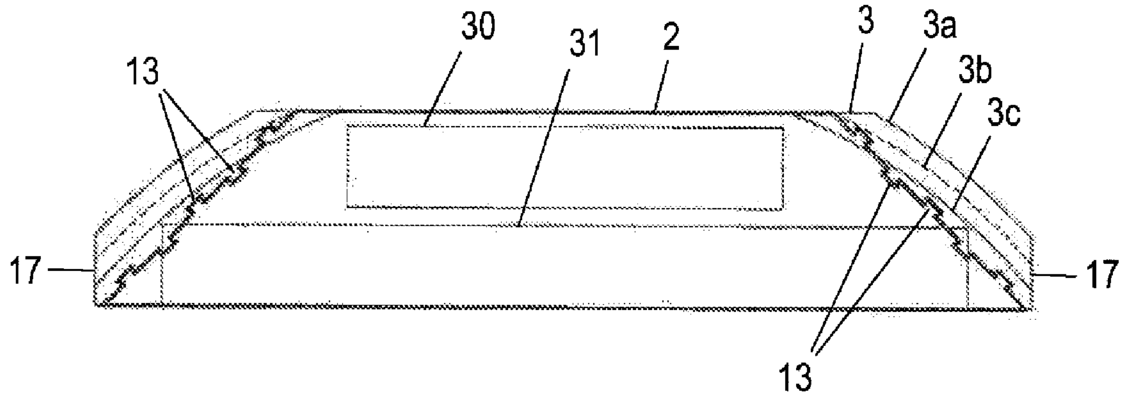

FIG. 11

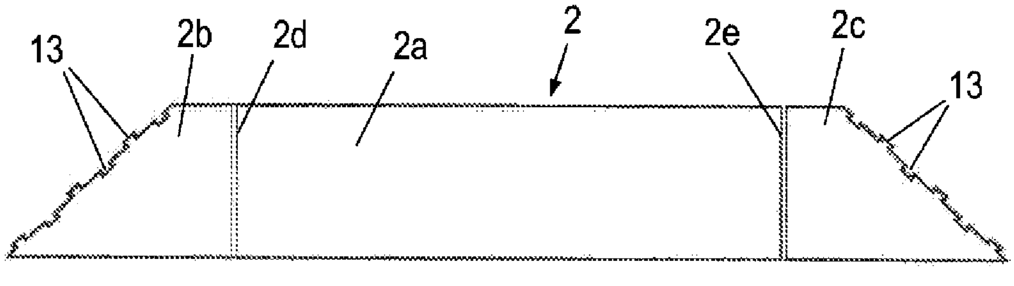

FIG. 12

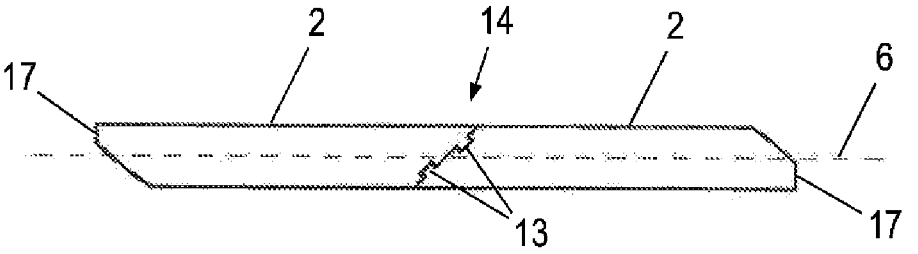

FIG. 13

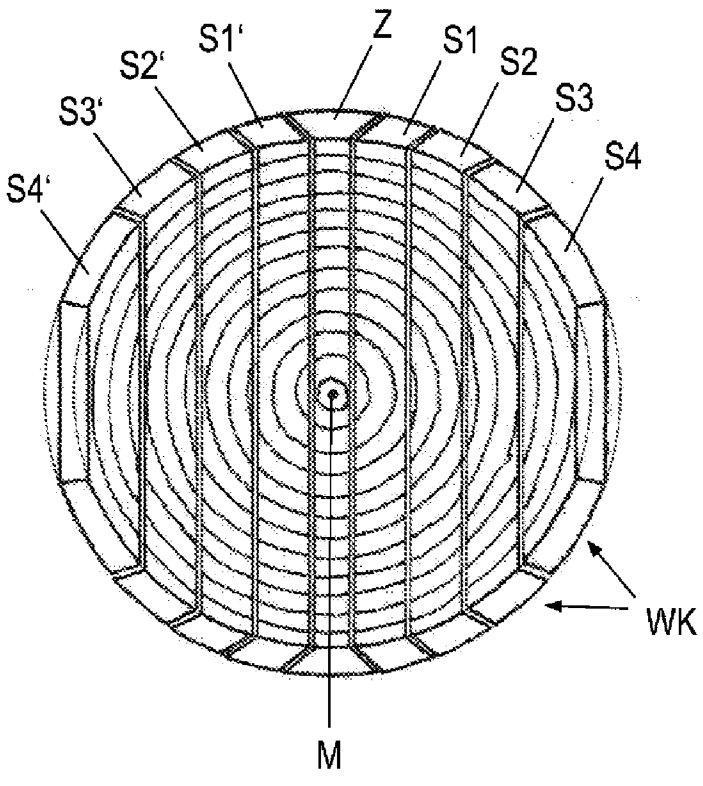

FIG. 14

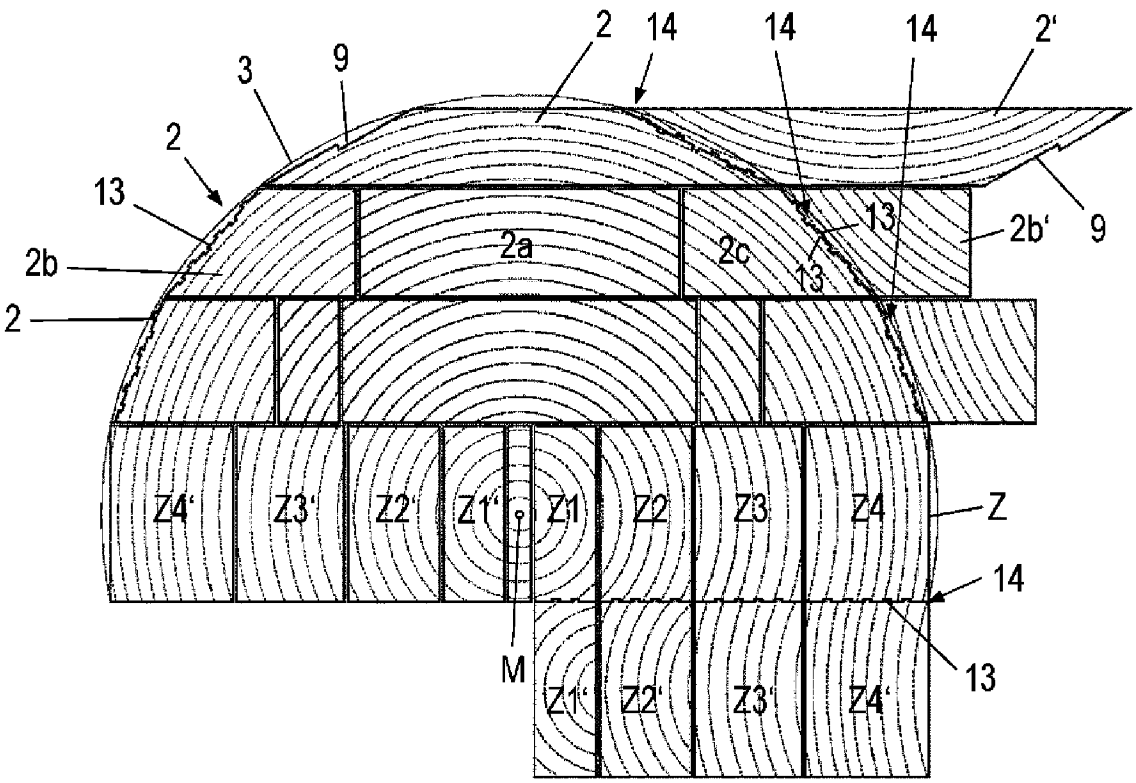
2
14
14
14
2'
3
9
2
13
2b
2
2a
2c
13
13
2b'
9
Z4'
Z3'
Z2'
Z1'
Z1
Z2
Z3
Z4
Z
14
M
Z1'
Z2'
Z3'
Z4'
13

FIG. 15

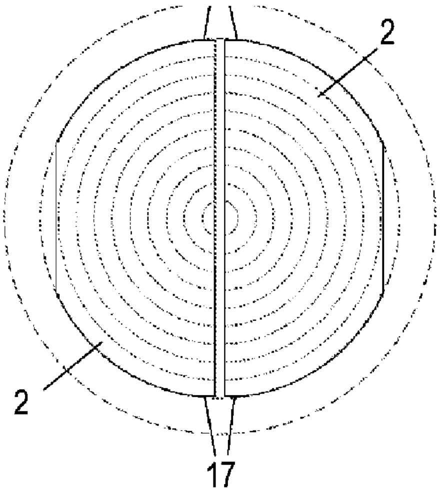

FIG. 16A

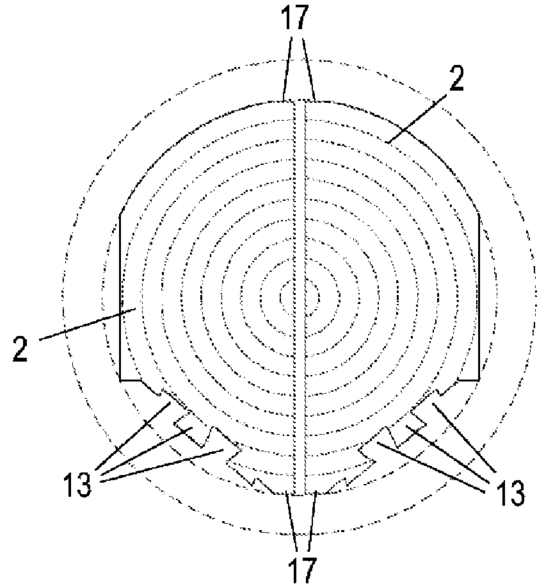

FIG. 16B

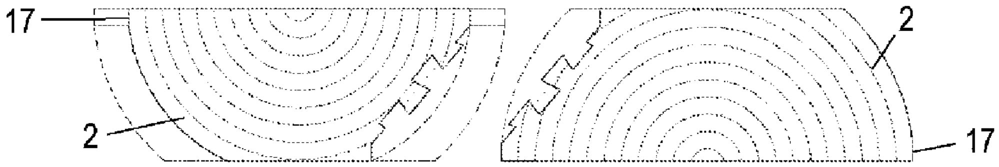

FIG. 16C

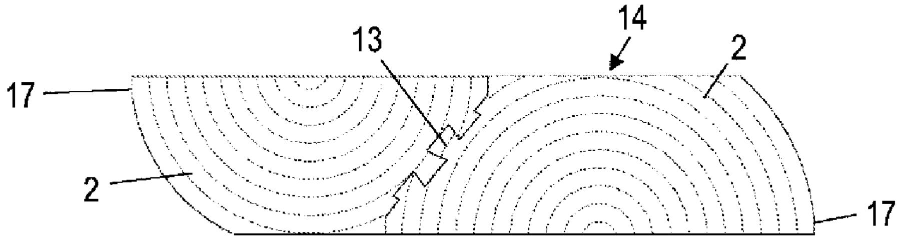

FIG. 16D

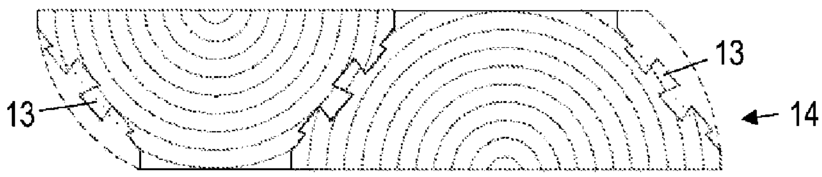

FIG. 16E

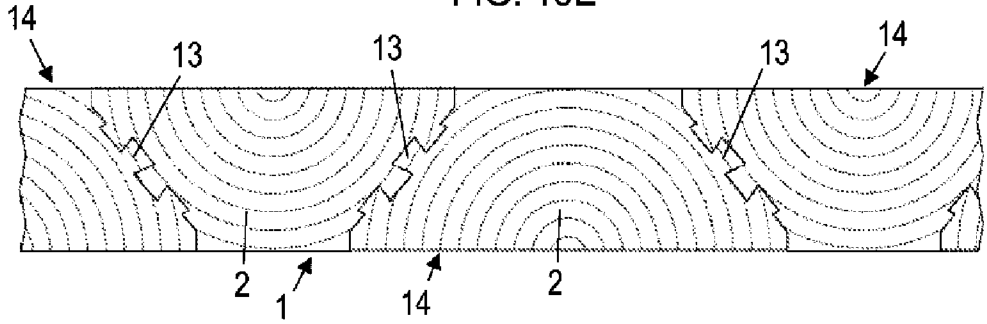

FIG. 16F

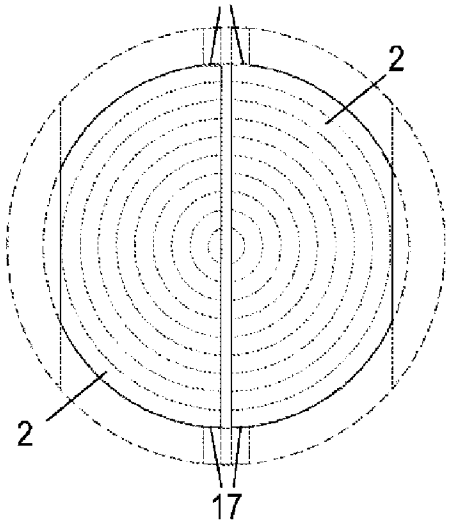

FIG. 17A

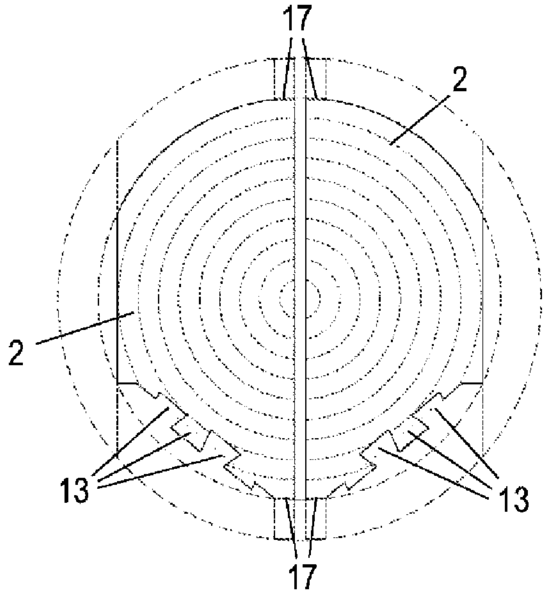

FIG. 17B

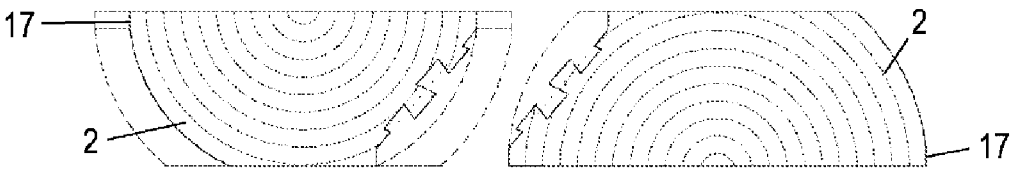

FIG. 17C

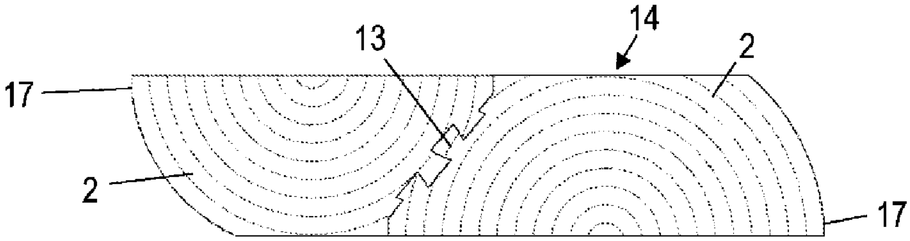

FIG. 17D

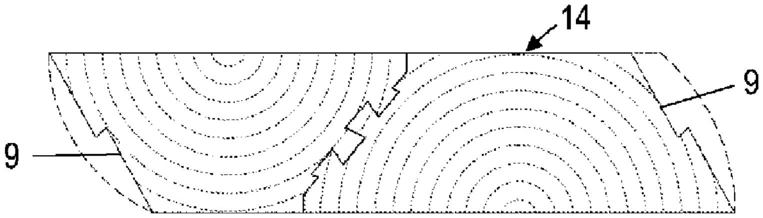

FIG. 17E

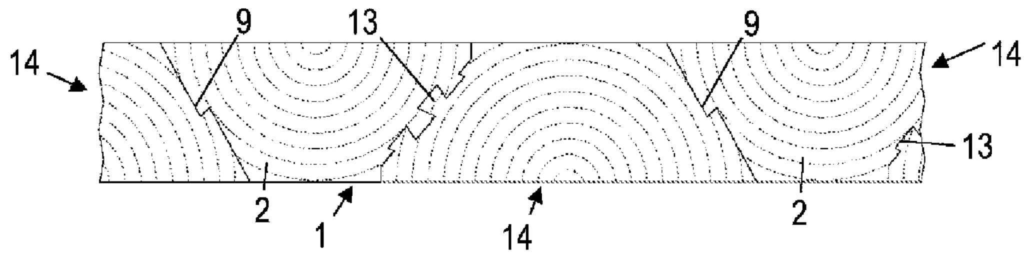

FIG. 17F

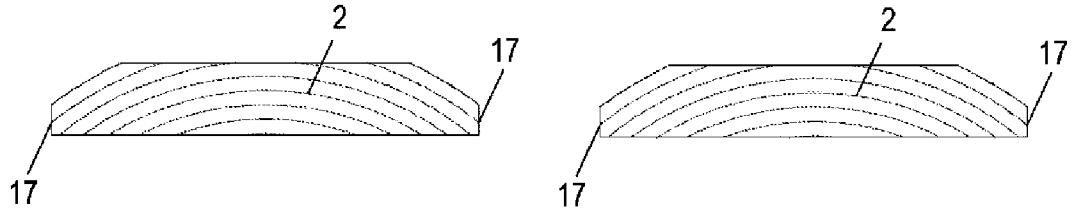

FIG. 18A

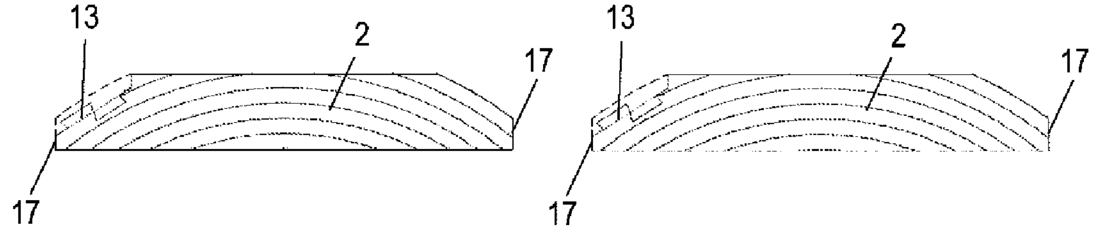

FIG. 18B

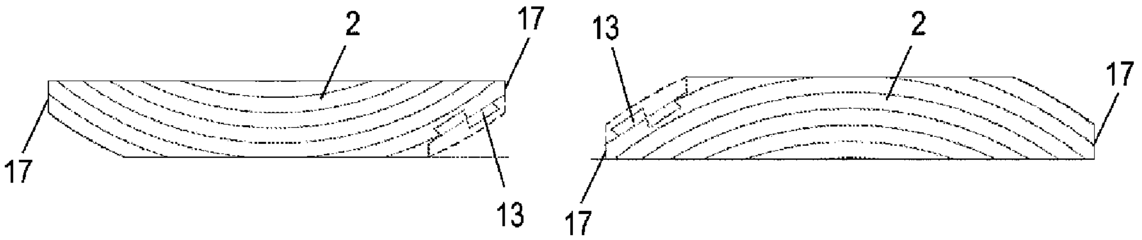

FIG. 18C

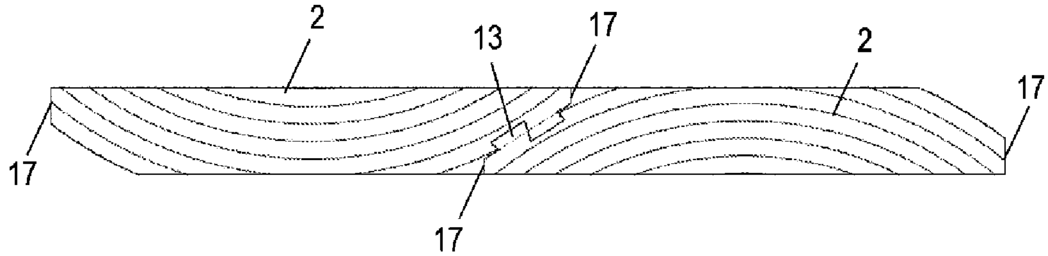

FIG. 18D

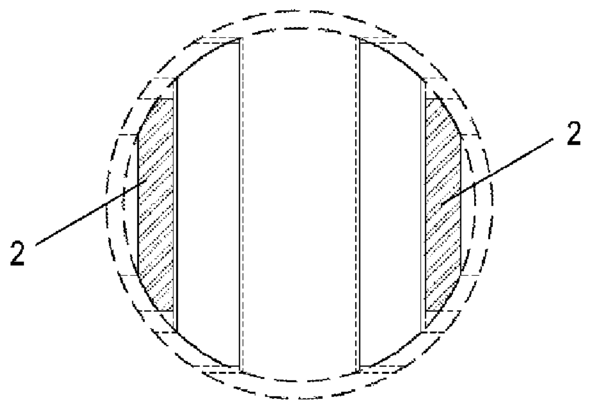

FIG. 18E