Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2244789 C 2002/11/05

(11)(21) 2 244 789

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 1997/02/06
(87) Date publication PCT/PCT Publication Date: 1997/08/14
(45) Date de délivrance/Issue Date: 2002/11/05
(85) Entrée phase nationale/National Entry: 1998/07/30
(86) N° demande PCT/PCT Application No.: EP 1997/000546
(87) N° publication PCT/PCT Publication No.: 1997/028961
(30) Priorité/Priority: 1996/02/07 (196 04 433.2) DE

(51) Cl.Int.^{6}/Int.Cl.^{6} B32B 21/13, B32B 3/30, B27D 1/04

(72) Inventeur/Inventor:
MOSER, Karl, DE

(73) Propriétaire/Owner:
MOSER, Karl, DE

(74) Agent: BORDEN LADNER GERVAIS LLP

(54) Titre : PANNEAU DE BOIS STRATIFIE COLLE SOUS VIDE
(54) Title: VACUUM-BONDED LAMINATED WOOD PANEL

(57) Abrégé/Abstract:
The invention concerns a laminated wood panel (1) with layers of wood (3) which are stacked such that they lie flat on top of one another and are bonded to one another at flat sides (15) adjacent each other in pairs. Some of the layers of wood (3) have fibres extending transversely to one another and some of the flat sides (15) have a plurality of grooves such that, at least in some of the layers of wood (3) of which the fibres extend transversely to one another and which are adjacent each another in pairs, the grooves of the adjacent flat sides (15) intersect one another. The invention also concerns a method of producing a laminated wood panel (1), wherein layers of wood (3) are stacked on top of one another and bonded to one another, at least some of the layers of wood (3) being stacked such that their fibres extend transversely to one another. Grooves are made in the flat sides (15) of some of the layers of wood which are arranged in stacks, and the stack of wood is covered in an envelope which can be tightly closed and is evacuated at least during part of the bonding time.

ABSTRACT

The invention concerns a laminated wood panel (1) with layers of wood (3) which are stacked such that they lie flat on top of one another and are bonded to one another at flat sides (15) adjacent each other in pairs. Some of the layers of wood (3) have fibres extending transversely to one another and some of the flat sides (15) have a plurality of grooves such that, at least in some of the layers of wood (3) of which the fibres extend transversely to one another and which are adjacent each other another in pairs, the grooves of the adjacent flat sides (15) intersect one another. The invention also concerns a method of producing a laminated wood panel (1), wherein layers of wood (3) are stacked on top of one another and bonded to one another, at least some of the layers of wood (3) being stacked such that their fibres extend transversely to one another. Grooves are made in the flat sides (15) of some of the layers of wood which are arranged in stacks, and the stack of wood is covered in an envelope which can be tightly closed and is evacuated at least during part of the bonding time.

A VACUUM-CEMENTED LAMELLAR WOOD PANEL

Description

The invention relates to a lamellar wood panel, in particular a lamellar boards panel, further to a method for making a lamellar wood panel, in particular a lamellar boards panel.

Several wood lamellas, i.e. layers, are stacked on each other and bonded together to make lamellar wood panels. Depending on the cement used, most of the time it is necessary to keep the bonding joint, the space between the individual wood layers, as thin as possible to assure reliable and load-resistant bonding. As a rule, comparatively high compressions are required and applied by mechanical presses of clamping means such as screw clamps or the like to ensure the cement is uniformly distributed between the woodlayers. Cement extruding at the edges of the bonding joint tells the expert the cement is being spread uniformly.

A new manufacturing procedure which has been proposed is advantageous especially on economic grounds as regards to large-format lamellar wood panels. In this procedure, the stacked wood layers are covered by an airtight foil wrap which is part of a tightly sealable enclosure, and said enclosure is evacuated at least during part of the cement setting period. Exploiting the ambient air pressure, this procedure eliminates the need for complex and costly presses. However, this procedure incurs the drawback that the most compression achieved to cement the wood layers at best equals atmospheric pressure unless further means are employed. As a result, the applied compression may be inadequate to uniformly spread the cement and form an adequately thin bonding joint.

Accordingly, it is the objective of the invention to create a lamellar wood panel of the above kind wherein the cement distribution is optimized.

Another objective of the invention is to offer a method of the kind described to manufacture such a lamellar wood panel which can be implemented using simple means.

The invention assumes a lamellar wood panel comprising a plurality of wood layers superposed flat on each other and bonded at contacting large faces over their surfaces, in particular over their full surfaces, with some of the contacting wood layers in mutually transverse directions, specifically in mutually perpendicular fiber directions.

At least part of the contacting and mutually bonded large faces in a lamellar wood panel are fitted each with a plurality of substantially parallel slots running essentially in the fiber direction in such manner that some of the slots on contacting wood layers with mutually transverse fiber directions cross the slots on the contacting wood layer.

The invention is based on the concept that cavities are subtended at the slots' crossing sites between the bonded wood layers, said slots acting as cement reservoirs during compression and thereby promoting uniform and laterally omnidirectional cement distribution. Because of the plurality of crossing sites distributed in the area of the bonding joint and the ensuing reservoirs, local cement accumulations during compression are precluded, and the enlargement of the bonding joint at such sites is similarly controlled.

Accordingly, a lamellar wood panel of this design is suitable for manufacturing procedures employing only modest compressions, in particular the above outlined vacuum cementing.

Bonding wood layers with equally thin bonds furthermore offers the advantage of saving cement and permits the use of more economic cements.

Because of its inherent properties, the lamellar board panel can be advantageously used as a wall component because it offers a high tightness to air, combined with a relatively low vapor diffusion impedance. The latter property is the consequence of high moisture transport rates along the intersecting slots such that humidity in the panel will quickly spread. This property is also caused by the increased ability for cross-panel diffusion, especially if the slots are fairly deep.

In regions undergoing comparatively large shear stresses, for instance where panels are stored, locally relatively large quantities of cement may be appropriately introduced locally to increase rigidity, said cement during compression then entering the slots, and following hardening providing pressure-resistant slot fillings.

The method of the invention is based on a procedure for making a lamellar wood panel, in particular a lamellar board panel, wherein a plurality of wood layers are flatly stacked on each other and are bonded together in pairwise adjacent surfaces across these surfaces, especially fully across them, at least some contacting wood layers being stacked with mutually transverse directions, specifically mutually perpendicular fiber directions.

In the method of the invention, some of the contacting faces of the wood layers comprise a plurality of nearly parallel slots running mainly in the fiber directions. These wood layers are stacked such that, the slots of some of the contacting wood layers in mutually transverse fiber

directions, shall cross. The wood stack shall be covered with a tightly sealable enclosure which is evacuated during part of the cement's setting period.

The method can be implemented using simple means and in particular does not require a mechanical press.

The slots may be processed in one operation together with the planing of the wood layers, for instance by moving the wood layer through one processing station with planes, circular saws or milling equipment.

Compressing the wood layers using an airtight foil wrap is simple and especially advantageous if the lamellar wood panel shall serve as a construction component. In such an application, large-format lamellar wood panels can be fabricated on site from individual wood elements that are easily transported. Accordingly, shipping these panels, with lengths or widths of several meters and surfaces of roughly 100 m^2 is unnecessary.

Preferably, the lamellar wood panel of the invention shall comprise slots on both large faces at least in those wood layers that are covered on both sides by wood layers with mutually transverse fiber directions.

This feature offers the advantage of improving the cement distribution in all bonding joints of the lamellar wood panel.

The slots present on both large faces may be mutually staggered, especially in mutually halfway manner.

Alternatively, the slots present on both large faces also may run pairwise in the same cross-sectional plane.

In both cases the density of the slots on the opposite sides is the same and the material removed from the wood layer by making the slots is uniformly missing across the cross-section of this wood layer.

Moreover, at least one of the wood layers may be fitted with slots on only one of its large faces, and the depth of these slots shall be at least as deep as half the thickness of this wood layer.

Special purposes may warrant one large face without slots, i.e. for aesthetic purposes on a construction site when one large face is visible or if the slots were to hamper the deposition of a cover layer.

Together with their width, the depth of the slots affects the slots' efficacy as cement reservoirs and also the construction properties of the lamellar wood panel.

If slots are staggered on both large faces, these slots also may have a depth at least half the thickness of the wood layer.

If the slots present at both large faces run pairwise in the same cross-sectional plane, they also may optionally be of a depth at least one fourth the thickness of the wood layer.

The slots which are closely adjacent and face the opposite large faces enhance the diffusion ability of the wood layer further.

Manufacture of the lamellar wood panel of the invention is simplified when all wood layers are fitted with slots on both large faces.

An illustrative embodiment of the invention is elucidated below in relation to the drawing.

Fig. 1 is a perspective of a region of lamellar wood panel of the invention, and

Figs. 2a-2c are various cross-sections of individual wood layers of a lamellar board panel.

Fig. 1 shows a lamellar wood panel 1 comprising several wood layers 3 bonded to each other at pairwise adjacent large faces 15 over said sides' full surfaces. The wood layers 3 each comprise several wood elements in the form of boards 11 in which the wood fibers within a wood layer always run parallel. All pairwise adjacent wood layers have mutually perpendicular fiber directions. The pairwise adjacent and mutually bonded large faces 15 each are fitted with a plurality of parallel slots 13 running in the direction of the fibers whereby the slots 13 of the adjacent large faces 15 cross each other in the pairwise adjacent wood layers 3.

During the cementing of the individual wood layers 3, the cavities subtended by the slots 13 improve cement spreading and thereby contribute to forming thinner bonding joints; the mutually crossing slots improve omnidirectional distribution of the cement.

To implement this advantage for all bonding joints, and as shown in Fig. 1, the inner wood layers 3b, that is the wood layers which are covered on both sides by other wood layers must be fitted with slots 13 on their large faces 15, whereas the outer wood layers 3a need only have each their slots 13 on their inwardly pointing large faces.

In this embodiment the outer wood layers 3a are cross-sectionally as shown in Fig. 2a whereas the cross-section of the inner layers 3b is as shown in Fig. 2b.

Fig. 2a shows the cross-section of a wood layer 3 comprising slots 13 only in one of its large faces 15b whereas the opposite side 15a is without slots. The slots 13 are apart from one

another by approximately 15 to 120 mm, preferably about 20 to 30 mm and their width is a few millimeters. Regarding the diffusive properties of the individual wood layers 3 and hence of the panel 1 as a whole, the slots 13 advantageously are a depth d_a which is larger than half the thickness D of this wood layer. In order not to excessively degrade the mechanical strength of the individual wood layers 3 or of the boards 11 by the slots 13, a depth from 0.5 to 0.8 times the thickness is recommended. The machining of the slots is substantially simplified if they are straight. Even though the slots 13 are not mandatorily equidistant, such a configuration however offers an especially regular slot distribution.

Fig. 2b is a cross-section of a wood layer 3 fitted with slots 13 on both sides. The slots 13 present in both large faces 15 being centrally offset relative to one another. This slot offset also allows a slot depth d_b larger than half the thickness D of the wood layer 3.

Fig. 2c shows a variation of the wood layer of Fig. 2b. Thereby the slots 13 present at both large faces 15 also may run pairwise in the same cross-sectional plane. In this case the slot depth d_c is less than half the thickness D.

The method of the invention to manufacture a lamellar wood panel 1 may be implemented in the following manner:

The wood elements used to form the individual wood layers 3 such as panels or boards 11 move through a planing machine to coarsely eliminate the roughnesses of these elements.

Concurrent with planing, substantially parallel slots 13 are machined in some of the wood elements essentially in the fiber direction. These slots may be milled, or in the case of straight slots, sawed into the wood.

The wood elements used for an outer wood layer 3a are placed in a vat while being laterally abutting, and, depending on the planned format of the lamellar wood panel 1 the wood elements also may be made to abut in two directions.

Preferably in automated manner, cement is then deposited on the surface of said first wood layer 3a, and the next wood layer 3b is formed by depositing further wood elements on the cement-covered large face 15 of the first layer 3a. Where called for, the latter two steps are repeated several times until the wood stack comprises a predetermined number of wood layers 3 and finally is completed by a cover layer in the form of a second external wood layer 3a.

In order to ensure that sine of the slots 13 of the contacting faces cross each other, the fiber direction of the wood layers is changed several times during stacking.

This manner of stacking increases the mechanical load-bearing capacity of the final lamellar wood panel 1 because of the rigidifying effect of the omnidirectional tensile strength. Furthermore, the mutually crossing slots subtend cavities uniformly distributed over the cement joint and subsequently serve as cement reservoirs when the wood layers are compressed, thus improving cement distribution and precluding local cement accumulations.

The preparations for the ensuing compression comprise covering the vat holding the wood stack by means of an airtight sheet wrap so that this wrap together with the tub shall form a hermetically sealable enclosure. The required compression then is easily generated by evacuating the enclosure during part of the cement's setting period.

In some of the wood-layer large faces 15, the slots 13 furthermore offer an advantageous effect during compression in that small roughnesses or warps of the boards 11 will be better compensated.

Because of the simple and economical means used , the method of the invention is especially well suited in the manufacture of lamellar wood panels at their site of use, for instance at a construction site. In this case the boards 11 already may have been delivered prefinished, that is planed and fitted with slots.

In an alternative to the above described method, the cement also may be deposited first on the boards 11 which then shall be stacked.

The method of the invention is simplified by providing the slots 13 on all the wood-layer large faces 15. In such a case planing the boards 11 and machining the slots 13 can be carried out in identical manner for all boards, and uniform boards will then be available to build the stack, said boards being stackable without having to distinguish between inner and outer boards, regardless of their orientations.

Lastly, it will be appreciated that a wood stack with a sealable enclosure also can be placed inside a overpressure container for its compression, a compensating line to the atmosphere being connected to the enclosure. A pressure on the order of 10 bars is easily generated by filling the overpressure container with a pressurized fluid, for example compressed air.

CLAIMS

1. A method for manufacturing a lamellar construction component for a building, whereby wood layers formed from a plurality of adjacent flat-lying boards are fitted with cement on their surface and are stacked flat on each other in such manner that the boards in at least part of the pairwise adjacent wood layers have mutually transverse fiber directions and whereby the wood stack is covered by an airtight foil wrap which is part of a tightly sealable enclosure being evacuated at least during part of the cement's setting period,

characterized in that

slots are fitted into the boards and the wood layers are formed in such manner that, at least in part of the wood-layer large faces, the slots run essentially in the fiber direction and approximately mutually parallel at a mutual spacing of about 15 to 120 mm, and in that the wood layers are stacked in such manner that, at in least in part of the pairwise adjacent stacked wood layers having mutually transverse fiber directions, the slots of the adjacent large faces cross one another.

2. Method as claimed in claim 1, where the wood layers formed from a plurality of adjacent flat-lying boards are fitted with cement on their full surface.

3. Method as claimed in any one of claims 1 to 2 where the boards are stacked flat on each other in such manner that the boards in at least part of the pairwise adjacent wood layers have mutually approximately orthogonal fiber directions.

4. Method as claimed in any one of claims 1 to 3 characterized in that the slots run at a mutual spacing of 20 to 30 mm.

5. Method as claimed in any one of claims 1 to 4, characterized in that slots are fitted at least into the two large faces of the wood layers stacked between the wood layers having transverse fiber directions.

6. Method as claimed in claim 5, characterized in that slots present in the two large faces are mutually staggered.

7. Method as claimed in claim 6, characterized in that slots present in the two large faces are located one centrally relative to the other.

8. Method as claimed in claim 5, characterized in that the slots present in both large faces are pairwise located in the same cross-sectional plane.

9. Method as claimed in any one of claims 1 through 8, characterized in that slots are fitted in at least one of the wood layers solely into one of its large faces and that the depth of these slots is at least half the thickness of this wood layer.

10. Method as claimed in any one of claims 1 through 8, characterized in that slots are fitted in at least one of the wood layers solely into one of its large faces and that the depth of these slots is in the range of 0.5 to 0.8 the thickness of this wood layer.

11. Method as claimed in claims 6 or 7, characterized in that slots are fitted in at least one of the wood layers into both its large faces and that the depth of these slots is at least half the thickness of this wood layer.

12. Method as claimed in claim 6, characterized in that slots are fitted in at least one of the wood layers into both its large faces and that the depth of these slots is in the range of 0.5 to 0.8 the thickness of this wood layer.

13. Method as claimed in claim 8, characterized in that slots are fitted in at least one of the wood layers into both its large faces and that the depth of these slots is at least one-fourth the thickness of this wood layer.

14. Method as claimed in claim 8, characterized in that slots are fitted in at least one of the wood layers into both its large faces and that the depth of these slots is in the range of 0.25 to 0.4 the thickness of this wood layer.

15. Method as claimed in any one of claims 1 through 14, characterized in that slots are fitted in at least part of the wood layers solely into one of their large faces and in that during stacking said wood layers constitute at least the outer wood layers.

16. Method as claimed in claim 15, characterized in that the large faces fitted with slots of the outer wood layers are pointing inward.

17. Method as claimed in any one of claims 1 through 16, characterized in that slots are fitted in at least part of the wood layers into both of their large faces and in that during stacking the wood layers will form at least the inner wood layers.

18. Method as claimed in any one of claims 1 through 17, characterized in that slots are fitted into all wood layers in both their larger surfaces.

19. Method as claimed in any one of claims 1 to 18, characterized in that the stack of boards is placed with the

sealable enclosure into an overpressure container for compression.

20. Method according to any one of claims 1 to 19, characterized in that the slots are fitted into the work layers or into the boards in one processing step together with the planing of the wood layers or the boards.

21. Method according to any one of claims 1 to 20, characterized in that the wood layers are pressed together at the site of use of the construction component, especially at a construction site.

22. Method according to claim 21, characterized in that the wood elements intended for the formation of the wood layers are transported to the site of use.

23. Method according to claim 22, characterized in that the wood elements are boards.

24. Method according to claim 22 or 23, characterized in that the wood elements are planed and slotted boards.

25. Method according to any one of claims 1 to 24, characterized in that a cover layer is applied onto the construction component.

26. Method according to claim 25, characterized in that a cover layer is applied onto the construction component after the compression.

27. Sheet type construction component for a building, characterized in that it is manufactured by a method according to any one of claims 1 to 26.

28. Sheet type construction component according to claim 27, characterized in that it is used as a wall element.

- 6. Feb. 1997

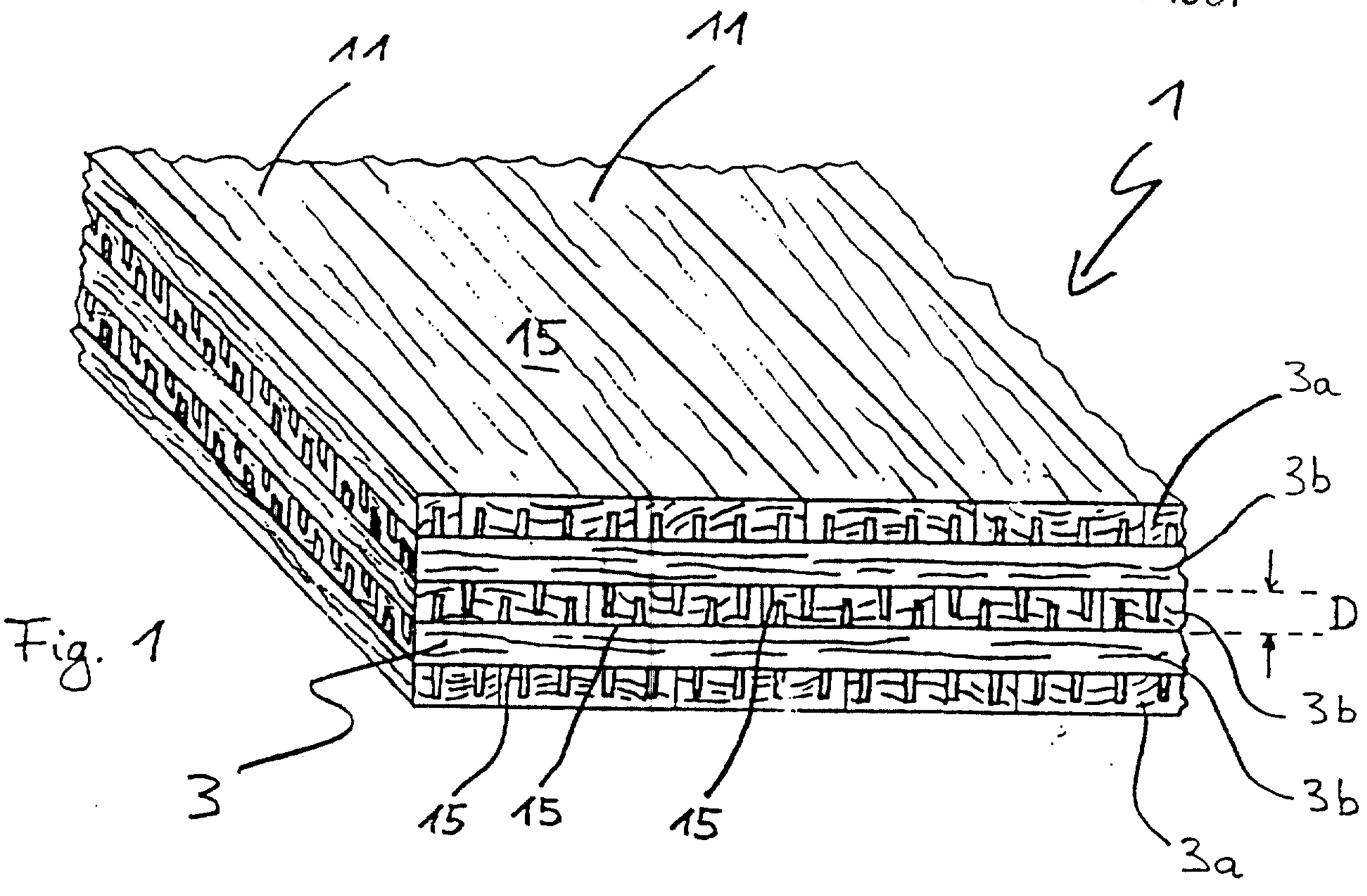


Fig. 1

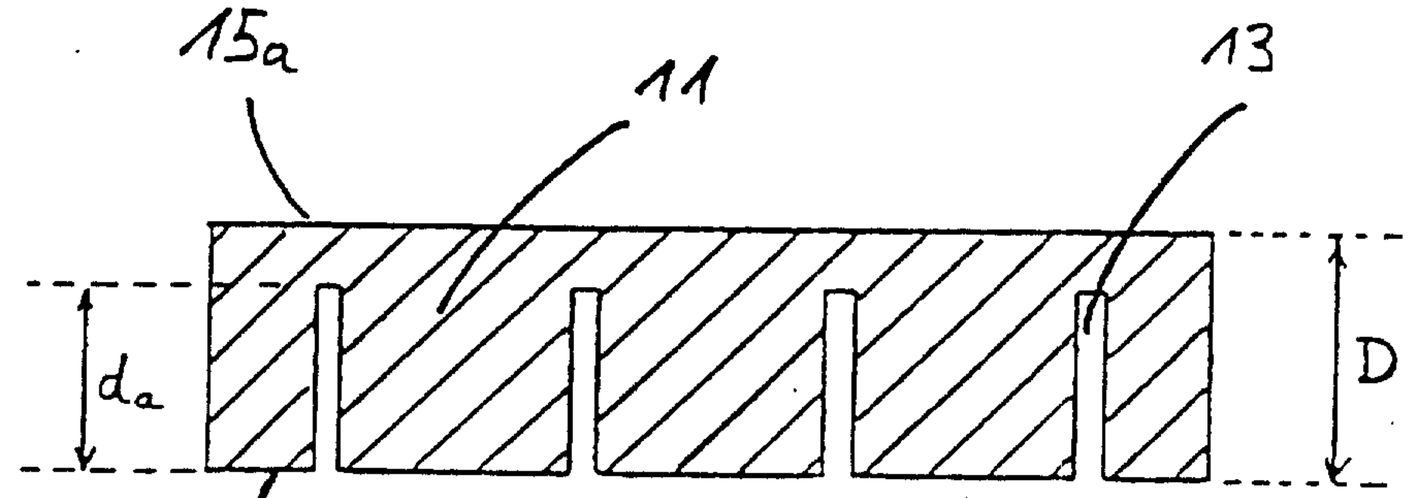


Fig. 2a

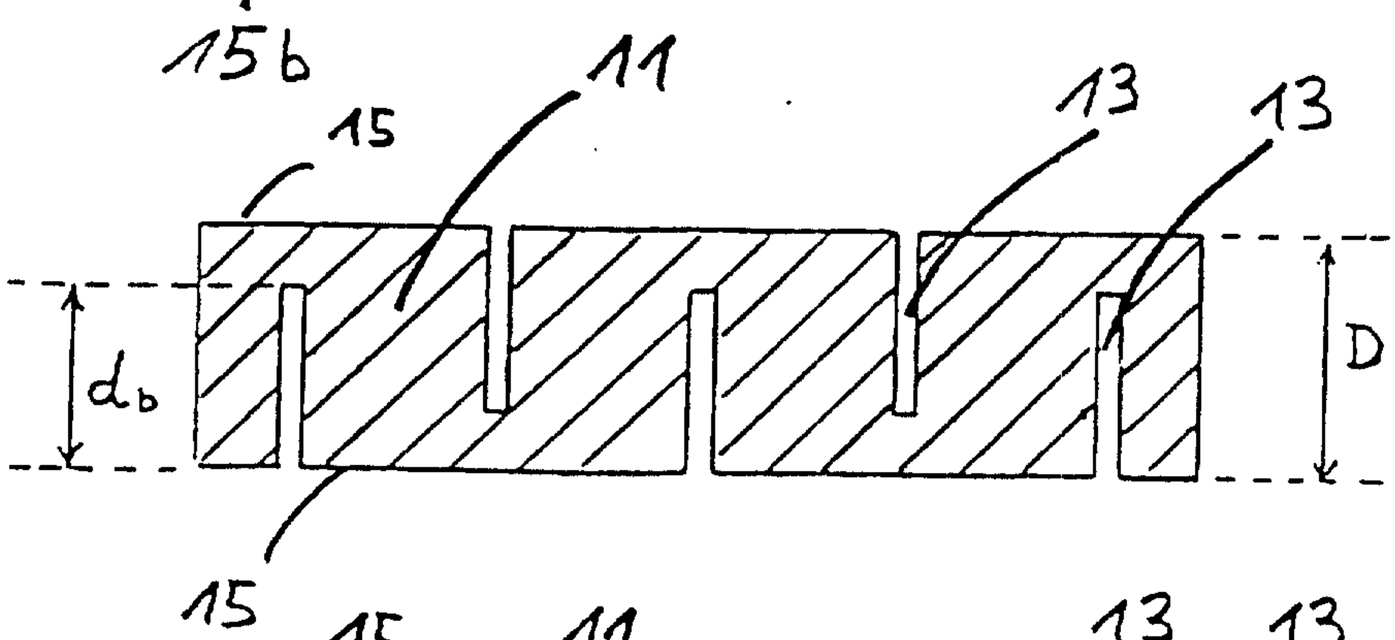


Fig. 2b

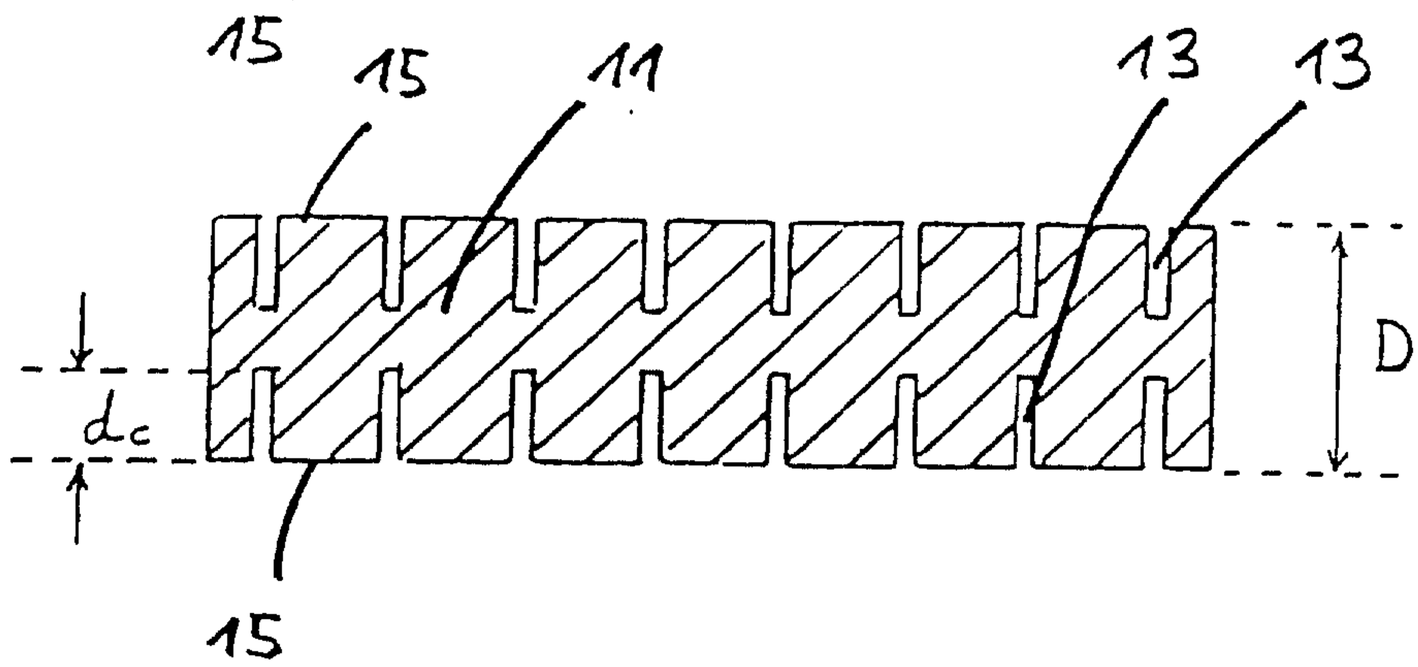


Fig. 2c