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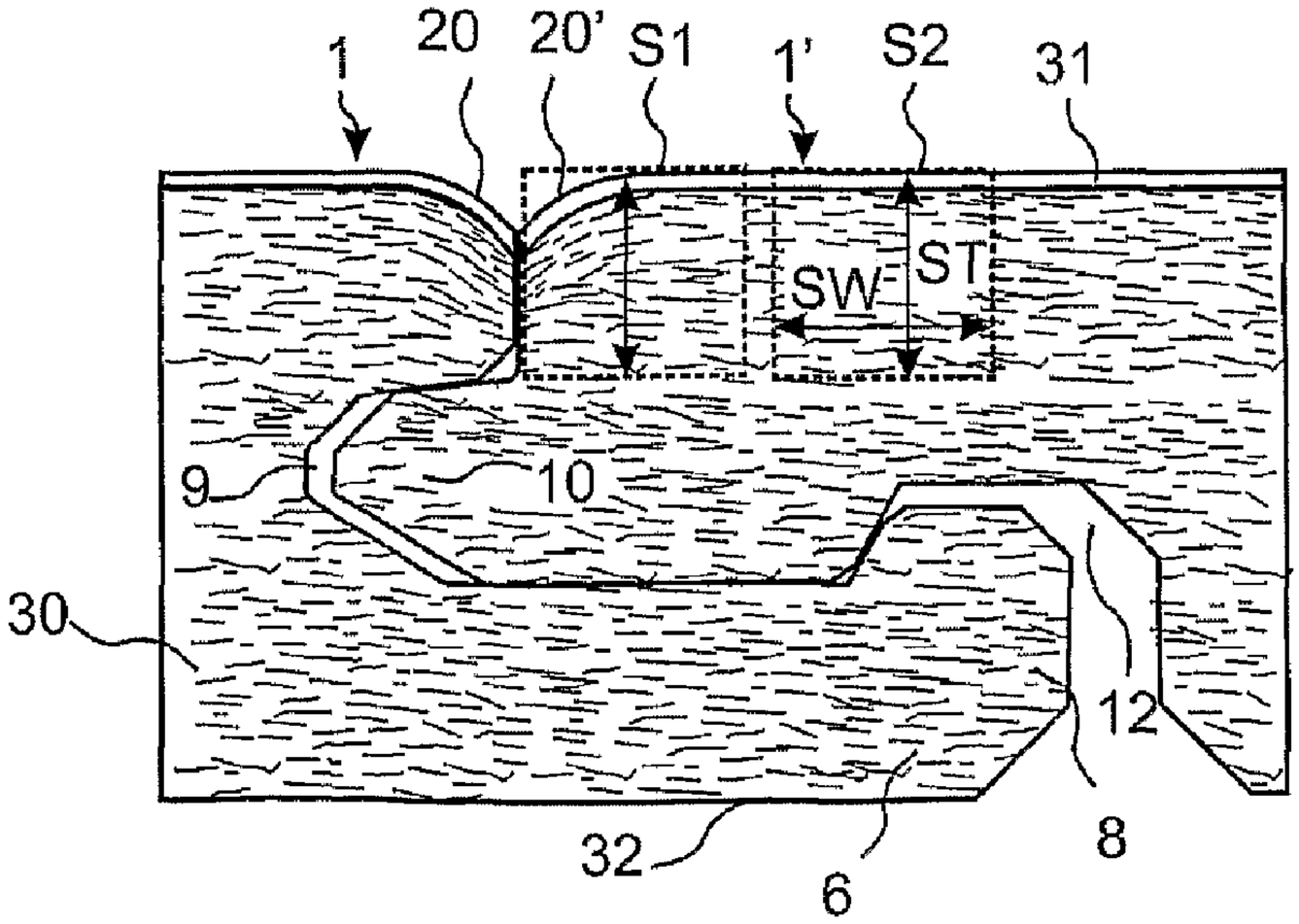

(57) Abrégé/Abstract:
A method of making a floorboard is disclosed. The floorboard comprises a mechanical locking system, a wood fibre based core and a surface layer arranged on the upper side of the core. The outer flat parts of the surface layer constitute a floor surface and a horizontal plane. The floorboard has an edge portion with an edge surface which is located under the horizontal plane. The method comprises applying the surface layer on the core to form a floor element, cutting the floor element into floor panels, applying a pressure on the surface of the edge portion of the floor panel, compressing the core under the surface layer, bending the surface layer permanently towards the rear side, forming an edge groove at the edge of the floor panel before applying the pressure, and forming the mechanical locking system at the edge of the floor panel after applying the pressure.

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ABSTRACT

A method of making a floorboard is disclosed. The floorboard comprises a mechanical locking system, a wood fibre based core and a surface layer arranged on the upper side of the core. The outer flat parts of the surface layer constitute a floor surface and a horizontal plane. The floorboard has an edge portion with an edge surface which is located under the horizontal plane. The method comprises applying the surface layer on the core to form a floor element, cutting the floor element into floor panels, applying a pressure on the surface of the edge portion of the floor panel, compressing the core under the surface layer, bending the surface layer permanently towards the rear side, forming an edge groove at the edge of the floor panel before applying the pressure, and forming the mechanical locking system at the edge of the floor panel after applying the pressure.

BUILDING PANEL WITH COMPRESSED EDGES

Technical field

The present invention generally relates to building panels, especially floorboards, which have a wood fibre based core, a surface layer and compressed curved edge portions. More particularly, the present invention relates to interlocked building panels with compressed edge portions located below the panel surface. The invention relates to panels with such edge portions and to a method to produce such panels.

Field of Application of the Invention

The present invention is particularly suitable for use in floating floors, which are formed of floorboards comprising a wood fibre based core with a surface layer and which are preferably joined mechanically with a locking system integrated with the floorboard. A floorboard with a mechanical locking system has a rather advanced edge profile and curved edge portion are more difficult produce than traditional furniture components. The following description of prior-art technique, problems of known systems and objects and features of the invention will therefore, as a non-restrictive example, be aimed above all at this field and in particular to laminate flooring with mechanical locking systems. However, it should be emphasized that the invention can be used in optional floorboards with optional locking systems, where the floorboards have a core and at least one surface layer and where these two parts are possible to be formed with a pressure force applied to the surface layer. The invention can thus also be applicable to, for instance, floors with one or more surface layers of wood

applied on a wood fibre core. The present invention could also be used in building panels i.e. wall panels, ceilings and floor strips such as dilatation profiles, transition profiles or finishing profiles.

Definition of Some Terms

In the following text, the visible surface of the installed floorboard is called **"front side"**, while the opposite side is called **"rear side"**. **"Horizontal plane"** relates to a plane, which extends along the outer flat parts of the surface layer at the front side. **"Vertical plane"** relates to a plane, which is perpendicular to the horizontal plane and at an outer edge of the surface layer. By **"up"** is meant towards front side, by **"down"** towards rear side, by **"vertical"** parallel with the vertical plane and by **"horizontal"** parallel with the horizontal plane.

By **"edge portion"** is meant a part of the edge, which is below the horizontal plane. **By "floor surface"** is meant the outer flat parts of the surface layer along the horizontal plane. By **"edge surface"** is meant the surface of the edge portion. By **"locking system"** is meant cooperating connecting means, which interconnect the floorboards vertically and/or horizontally. By **"mechanical locking system"** is meant that joining can take place without glue.

Background of the Invention, Prior-Art Technique and Problems thereof

Laminate floors and other similar floorboards are made up of one or more upper layers of decorative laminate, decorative plastic material or wood veneer, an intermediate core of wood fibre based material or plastic

material and preferably a lower balancing layer on the rear side of the core.

Laminate flooring usually consists of a core of a 6-9 mm fibreboard, a 0.2-0.8 mm thick upper decorative surface layer of laminate and a 0.1-0.6 mm thick lower balancing layer of laminate, plastic, paper or like material. Thicker laminate flooring with a thickness of 12-16 mm or more could be produced. Such floors will have favourable sound properties. Extremely thin floorings with thicknesses of 3-6 mm could also be produced. Such thin floorings could be used in installations with floor heating and the thin floor panel will transfer heat to the surface more efficiently than traditional floor panels. The surface layer provides appearance and durability to the floorboards. The core provides stability, and the balancing layer keeps the board plane when the relative humidity (RH) varies during the year. The floorboards are laid floating, i.e. without gluing, on an existing subfloor. Traditional hard floorboards in floating flooring of this type are usually joined by means of glued tongue-and-groove joints.

In addition to such traditional floors, floorboards have been developed which do not require the use of glue and instead are joined mechanically by means of so-called mechanical locking systems. These systems comprise locking means, which lock the boards horizontally and vertically. The mechanical locking systems can be formed by machining of the core. Alternatively, parts of the locking system can be formed of a separate material, which is integrated with the floorboard, i.e. joined with the floorboard in connection with the manufacture thereof.

The most common core material is fibreboard with high density and good stability, usually called HDF - High Density Fibreboard. Sometimes also MDF - Medium Density Fibreboard - is used as core. MDF and HDF contain ground wood fibres, which by means of binding agents are combined into a sheet material.

Laminate flooring and also many other floorings with a surface layer of plastic, wood, veneer, cork and the like are produced in several steps. As shown in figure 1a - 1d the surface layer and the balancing layer is produced in a separate step and are then applied to a core material by for example gluing a previously manufactured decorative layer and balancing layer to a fibreboard. Such a production process is used when a floor panel has a surface of a decorative high pressure laminate (HPL) which is made in a separate operation where a plurality of sheets of paper impregnated with a thermosetting resin, such as melamine and/or phenol are compressed under high pressure and at a high temperature.

The currently most common method when making laminate flooring, however, is the direct pressure laminate (DPL) method which is based on a more modern principle where both manufacture of the decorative laminate layer and the fastening to the fibreboard take place in one and the same manufacturing step. One or more papers impregnated with a thermosetting resin such as melamine or similar types of resins are applied directly to the board and pressed together under pressure and heat without any gluing.

Figures 1a - 1d shows how laminate flooring is produced according to known technology. As a rule, the above methods result in a floor element (3 in fig 1b) in the

form of a large laminated board, which is then sawn into several individual floor panels (2 in fig 1c), which are then machined to floorboards (1 in fig 1d). The floor panels are individually machined along their edges to floorboards with mechanical locking systems on the edges. The machining of the edges is carried out in advanced milling machines where the floor panel is exactly positioned between one or more chains and belts or similar, so that the floor panel can be moved at high speed and with great accuracy past a number of milling motors, which are provided with diamond cutting tools or metal cutting tools, which machine the edge of the floor panel. By using several milling motors operating at different angles, advanced profiles can be formed at speeds exceeding 100 m/min and with an accuracy of ±0.02 mm.

The upper edges of the floorboards are in most cases very sharp and perpendicular to the floor surface and in the same plane as the floor surface.

Recently laminate floors have been developed with decorative grooves or bevels at the edges, which looks like a real gap or a bevel between solid wood floor such as planks or parquet strips.

It is known that such edges cold be made in several different ways.

In recent years, laminate floors, which are imitations of stones, tiles and the like, have become more and more common. It is known that the method that is used to manufacture decorative edge portions of such floors could also be used to produce edge portions, which look like a gap in solid wood floors. This is shown in figure 2a and

2b. The starting material is a decorative paper with printed edge portions, which is impregnated with melamine resin. Uncontrolled swelling takes place in this operation. In the subsequent lamination, the decorative impregnated paper is placed on a core and lamination takes place against an embossed metal sheet, which forms a depression (20) in those parts of the floor element (3) where edge portions are to be formed. This is shown in figure 2a. The result is a floor element (1,1') whose front side has an embedded or embossed edge pattern corresponding to the intended edge portions between floorboards, as shown in figure 2b.

This manufacturing method suffers from a number of problems, which are above all related to difficulties in positioning the decorative paper and metal sheets in connection with laminating and the difficulty in positioning floor element and floor panels in the subsequent sawing and machining of the edges. The result is a floor panel with edge portions, which show considerable and undesired variations in structure and design as shown in figure 2b. Another problem is that this method is only suitable for embossed textures which are less than about 0,2 mm deep and which cannot be made deeper than the thickness of the surface layer. Further disadvantages are that although the edge is below the floor surface, it is sharp and parallel with the surface. The inventor has analyzed and evaluated the possibilities to use this traditional technology and to produce compressed edge portions in DPL floor panels with a shape of for example a bevel or a convex curved edge. Some of the main conclusions are shown in figure 2e and described below.

A decorative paper with only a wood design could be used and this will give the advantage that the problem of positioning the press plate and a printed decorative edge portion could be avoided. This method has however several disadvantages. It is very difficult to form an edge with an edge depth ED of more than about 0,2 mm, which is in the same magnitude as the surface thickness ST. The maximum angle AN, which could be accomplished is less than 10 degrees. The production would be inefficient since the press cycle time and the pressing pressure must be increased. Higher angles and deeper embossing will considerably increase the risks that the paper breaks during production. It would also be very difficult to position the laminated floor element with the depressions in the subsequent sawing and milling operation. There would be considerable undesirable tolerances in the edge widths EW1, EW2 in the magnitude of 0,3 - 0,5mm. The adjacent edge and depressions 20,20′ intended to be in contact with each other would not meet at the same height position. Furthermore the laminate surface layer will be compressed, especially the transparent overlay wear layer 33, which is located over the printed decorative paper 34. All these problems will increase if the traditional width of the floorboard of 200 mm is decreased to for example 150 mm or 120mm or below 100 mm, since the number of depression will increase. In most application this would require that the pressing pressure must be increased from 300N/cm2 to 600N/cm2 or even 800 N/cm2. Considerable investments in new and more expensive pressing equipment and embossed metal sheets would be required, especially if floorboards of different widths or lengths are to be produced.

Figure 2c and 2d show another method. Decorative edge portions could be made in connection with the machining of the edges of the floor panel 1, 1'. Laminating and sawing of the floor element (3) can then take place without any specific requirements as to alignment, and swelling problems do not occur. The decorative and embedded edge portion can be provided by part of the decorative surface layer being removed so that the reinforcing layer of the laminate becomes visible (figure 2d). Alternatively, the core (30) itself can be used to create the decorative embedded edge portion. This is shown in figure 3a. The surface layer has been removed and the core (30) is uncovered within areas that are to constitute the decorative edge portion (20). A decorative grove could be made on only one edge as shown in figure 3a. The main disadvantage is that it is impossible to create a design and structure, which is the same as the surface layer. Therefore it is not possible to form an edge portion that looks like a bevel in a solid wood surface layer.

The most common method is shown in figure 3b. A part of the edge portion of a floorboard (1, 1') has been formed as a bevel 20 and this bevel is then in a separate operation covered with a separate material such as a tape, a plastic strip or it could be coloured, printed etc. Separate materials are complicated and costly to apply and it is not possible to make an edge portion with the same design and structure as the floor surface. Such edge portion has considerable lower abrasion resistance and inferior moisture properties than the floor surface. The production method is rather slow and several

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application unites are needed to meet the speed of a modern production line for laminate floorings.

Another method is shown in figure 3c. The edge portion (20) is formed in a separate material, which has been inserted or extruded into a groove. This method has the same disadvantages as the method described above.

Fig 3d show that a rounded edge portion (20) could be produced with the well-known post forming method used for furniture components. A post forming laminate surface (31) of HPL, which is so flexible that it can be formed after the production of the laminated sheet, could be glued to an already machined floorboard (1). In a second production step the edge could be heated and the laminate could be bent and glued around the edge portion. This method would be very complicated and costly, since individual floor panels have to be laminated, and is not used in laminate floorings. In theory it is of course possible to use the DPL technology and to make a direct pressing of a decorative paper and overlay on a floor panel with curved edge portions. Even in this case individual floor panels have to be handled separately in the press and this will result in a very inefficient production

The principles of the present invention are directed to edge portions in building panels, which overcome one or more of the limitations and disadvantages of the prior art.

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Summary of the invention

Some embodiments of this invention may provide building panels, especially floorboards, with curved edge portions made in one piece with the surface layer, which could be produced more efficiently than present products on the market.

Some embodiments of this invention may provide such panels with edge portions, which have improved design and abrasion properties.

According to a first principle of the invention, a floorboard is provided, with locking system, a wood fibre based core and a surface layer arranged on the upper side of the core. The outer flat parts of the surface layer constituting a floor surface and a horizontal plane. A plane, perpendicular to the horizontal plane and at the edge of the surface layer, constitutes a vertical plane. The floorboard has an edge portion with an edge surface, which is located under the horizontal plane. The edge surface at the vertical plane is at a distance from the horizontal plane which constitutes an edge depth and which exceeds the thickness of the surface layer.

The floor surface and the edge surface are made in one piece of the same material. A part of the core in the edge portion under the edge surface adjacent to the vertical plane and at a vertical distance from the edge surface has a higher density than a part of the core

under the floor surface adjacent to the edge portion and at the same vertical distance from the floor surface.

The curved edge portion could be formed on only one edge, on two opposite edges or on two pairs of opposite edges. Alternative the edge portion could be formed in panels comprising more than 4 edges.

The most efficient production is obtained if the panels have curved edges according to the first principle of the invention on two opposite edges, preferably the long edges, if the floorboards are rectangular. The short edges could have traditional straight edges. The short edges could also have at least one edge portion which is located below the surface and which is formed by any other method for example as shown and described in connection to the figures 2a - 2e, 3a - 3d, 6a -6b or 8.

Floorboards with a wood surface have often bevels or curved edges, which are different in shape and surface structure on the long edges compared to the short edges. The main reason is that the fibre orientation on the long and short edges is different. Different production methods are also used and this gives different appearance. The inventor has discovered that laminate floorboards could be produced more efficiently and with designs features, which are very similar to wood if the edge surface on long edges is different to the edge surface on one both short edges.

According to a second principle of the invention a rectangular floorboard is provided comprising pairs of opposite long and short edges, a mechanical locking system on at least one pair of edges, a wood fibre based

core and a laminate surface layer arranged on the upper side of the core. The outer flat parts of the surface layer constituting a floor surface and a horizontal plane. The floorboard has on the long edges and on at least on one of the short edges edge portions with edge surfaces, which are located under the horizontal plane. An edge surface on the long edge comprises a different material than an edge surface on the short edge.

According to one preferable embodiment of this second principle, the floorboard has one pair of long edges with an edge portion according to the first principle. On one short edge the floorboard has an edge portion where the laminate surface layer has been removed and the wood fibre based core, preferable HDF, is painted or impregnated with for example an oil based chemical.

According to a third principle of the invention, a method is provided to make a floorboard, with a locking system, a wood fibre based core and a surface layer arranged on the upper side of the core. The outer flat parts of the surface layer constituting a floor surface and a horizontal plane. The floorboard has an edge portion with an edge surface, which is located under the horizontal plane. The method comprises the steps of:

- Applying the surface layer on the core to form a floor element.
- Cutting the floor element into floor panels.
- Applying a pressure on the surface of an edge portion of the floor panel such that the core under the surface layer is compressed and the surface layer is permanently bended towards the rear side.

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According to another aspect of the second principle of the invention, a method is provided to make a building panel, with a wood fibre based core and a surface layer arranged on the upper side of the core. The outer flat parts of the surface layer constituting a panel surface and a horizontal plane. The panel has an edge portion with an edge surface, which is located under the horizontal plane. The method comprises the steps of:

• Applying the surface layer on the core to form a building element.

• Cutting the building element into building panels.

• Applying a pressure on the surface of an edge portion of the building panel such that the core under the surface layer is compressed and the surface layer is permanently bended towards the rear side of the core.

According to another aspect of the invention, there is provided a method to make a floorboard, with a mechanical locking system, a wood fibre based core and a surface layer arranged on the upper side of the core, the outer flat parts of the surface layer constituting a floor surface and a horizontal plane, the floorboard has an edge portion with an edge surface which is located under the horizontal plane the method comprising: applying the surface layer on the core to form a floor element, cutting the floor element into floor panels, applying a pressure on the surface of the edge portion of the floor panel and compressing the core under the surface layer and bending the surface layer permanently towards the rear side, forming an edge groove at the edge of the floor panel before applying the pressure, and forming the mechanical

locking system at the edge of the floor panel after applying the pressure.

Some embodiments of the invention may be very suitable to produce curved or bevelled edge portions in panels with different widths, especially narrow panels, and also in very thick (12-16 mm) and thin (3-5 mm) laminate panels as described in the introduction. Such thin and thick panels are not produced today. The production equipment and method according to the invention may be much easier to adjust to panels of different sizes and thickness than the traditional pressing and post forming technology.

Brief Description of the Drawings

Figs 1a-d illustrate in different steps manufacture of a floorboard according to known technology.

Figs 2a-e illustrate production methods to form edge portions according to known technology.

Figs 3a-d illustrate examples of different ways of manufacture of edge portions according to prior art.

Figs 4a-b illustrate press forming of an edge portion according to the invention.

Figs 5a-c illustrate different properties of a convex curved edge portion according the invention.

Figs 6a-b illustrate alternative methods to form embodiments of the invention.

Fig. 7 illustrates a dilatation profile according to the invention.

Fig. 8 illustrates an edge portion with a curved edge surface.

Fig. 9 illustrates a floorboard with edge surfaces on long and short edges comprising different materials.

Description of Preferred Embodiments

Figs 4a-4c show in four steps manufacture of floorboards according to one embodiment of the invention. Fig. 4a shows two opposite edges of two essentially similar floor panels 2, 2'that are intended to be joined together with a mechanical locking system. The floorboards have a surface layer 31 of for example HPL, DPL or wood veneer, a core 30 of HDF and balancing layer 32. As show in fig. 4b an edge groove 16, 16' is formed at the upper side of the edge and a part of the surface layer 31 is removed. This could be done in a separate operation or in connection with the sawing of the floor element 3 into floor panels 2. If the surface layer 31 is laminate, at least a part of the edge groove 16,16' and the surface

layer 31 adjacent to the edge groove 16,16′ should preferably be heated with a suitable heating device H, such as for example heating nozzles which blow an even current of hot air, with infra red radiation, micro waves, high frequency, contact heating, laser or similar known technology. The temperature should exceed 100 degree C. A preferable temperature is about 150 - 200 degree C. In many applications a temperature of about 170 degree C gives the best result. Normal laminate quality could be used as a surface layer 31 and no special post forming quality is needed. A modification of the thermosetting resins similar to the modification, which are used in post forming laminates, could however increase the production efficiency. If the surface layer 31 is a wood veneer, heating is preferably not required. The floor panel should preferably have a reference surface 17, 17′that could be used to position the floor panel correctly when edge portions and locking systems are formed. As shown in figure 4c the edge portions 20, 20′ are then compressed with a compression tool TO which preferably is heated to similar temperatures as described above. The compression tool TO could be a wheel and/or a pressure shoe or similar with a profile which preferably corresponds to the desired edge profile. Several tools could be used to form the edge portion in several steps on for example one long edge, both long edges or on long and thereafter on short edges. Of course short edges could be formed before long edges and several floorboards could be formed in the same equipment. Wheels could have different structures and this will make it possible to form an embossed edge portion. Such an edge portion could also have a random or synchronized structure. The pressing of the edges could be a continuous operation

were in the floorboard for example is displaced in relation to a fixed tool. Of course the board could be in a fixed position and a tool could be displaced in relation to the board. Other alternatives are also possible. The edge could also be formed with a traditionally pressing operation. Such a method is especially easeful for the short edges and corner sections could be formed with great accuracy. During the compression, the fibres in the core will be permanently compressed, the fibre orientations will in most cases change and the density in the edge portion 20 will increase. If the surface layer is laminate, generally in most applications no major compression of the surface layer will occur. A change in the fibre orientation might be difficult to detect in some core materials. Increased density could however be measured with grate accuracy. The edge portion 20 will be much stronger than traditional bevelled edges in laminate flooring. The abrasion resistance will be similar as in the floor surface and the visible edge portion will have the same design and structure as the floor surface. The upper parts of the core 30 under the surface layer 31, which in a DPL flooring is impregnated with melamine and in a HPL flooring with glue, supports the laminate surface layer 31 during the bending and increases the flexibility of the laminate layer. The advantage is that ordinary qualities of thermosetting decorative laminates, which are rather brittle, could be used. HDF is particularly suitable for this kind of press forming with permanent compression according to the invention since the fibre structure and the binders, which are used in HDF, are ideal for this application.

As shown in figure 4d a mechanical locking system with a tongue 10 and grove 9 for vertical locking and a strip 6 with a locking element 8 and a locking grove 12 for horizontal locking could easily be formed and positioned with high precision in relation to the compressed edge portions 20,20′. In this embodiment the press forming of the edge portions 20, 20′ is made on the floor panel 2, which thereafter is machined to a floorboard 1. The advantage is that the forming of the mechanical locking system can be made with great accuracy and the press forming will not change the dimensions of the profile, which in this embodiment is mainly the tongue 10 and the groove 9. Test production show that tolerances of 0,1 mm or lower could be obtained and this is considerably lower than what could be accomplished with the known technology Of course it is possible to form the edge portions 20, 20′ on the floorboard after the machining of the edges, but this is more complicated and the compression possibilities are more limited. In most cases further machining is then required to form the upper outer edge.

Figure 5a shows a cross section of a panel edge according to the invention. In this preferred embodiment the floor panel 1 has a surface layer 31 of DPL with a surface thickness ST and an outer edge 51. The upper flat part of the surface layer 31 constitutes a horizontal plane HP and a floor surface 33. A plane perpendicular to the horizontal plane and at the outer edge 51 of the surface layer 31 constitutes a vertical plane VP. The convex curved edge portion 20, which is located under the horizontal plane HP and which extends to the vertical plane VP has an edge width EW, measured parallel with the horizontal plane HP and an edge surface 50. An edge

portion 20 is considered to be convex curved if at least some parts are convex and the remaining parts are straight as shown in figure 5a. The edge portion 20 has an edge depth ED measured vertically from the horizontal plane HP, which is equal to the distance SD from the horizontal plane HP to the outer edge 51 at the vertical plane VP. As shown I figure 5a the fibres in the edge portion 20 have been compressed and the fibre orientation have been changed such that the fibres are curved in the same direction as the edge surface 50 of the edge portion 20. The tangent line TL1, TL2 of the curved edge portion 20 has a larger angle AN2 to the horizontal plane at the vertical plane VP than at a distance from the vertical plane, for example at a distance which is 0,5*EW. The invention makes it possible to form edge portions with tangent lines TL having angles exceeding 10 degrees. It is even possible to produce edge portions with angles AN exceeding for example 15, 20,30 or even 45 degrees.

Several relationships are favourable in order to produce an edge portion (20) according to the invention.

- Edge depth ED should preferably be larger than the surface layer thickness ST. In the most preferable embodiment edge depth ED should be larger than 2 or even 3 times the surface thickness ST. The method allows forming of edge portions 20 with edge depths ED exceeding 10 times the surface thickness ST.

- The edge width EW should preferably be larger than the edge depth ED. In the most preferable embodiment edge width EW should be larger than 2 times the edge depth ED

- The edge depth ED should preferably be larger than 0,1 times the floorboard thickness T.

- The thickness ST of the surface layer 31 should be 0,1 - 0,01 times the floor thickness T.

- The tangent line TL at the edge portion which is located at the vertical plane VP should have an angle AN to the horizontal plane exceeding 10 degrees

These relationships could be used independently or in combination on one edge or on for example long and short edges. The long edges could for example be formed with a more curved edge portions than the short edges. A preferable combination is that the edge depth ED is larger than the surface layer thickness ST and that the tangent line TL of a part of the edge portion 20 has an angle exceeding 10 degrees.

Figure 5b shows the densities D profile in a part (A-A) of a floorboard 1, which has not been compressed and figure 5c shows the density profile D in a compressed edge portion (B-B) of the same floorboard. Density profiles could be measured extremely accurately with a gamma beam. The distance between measuring points could be as small as 0,04 mm. In this example the surface layer 31 of laminate, which is about 0,2 mm thick, has a density of about 1300 kg/m3. Below the surface layer 31 there is a core portion 52 which in connection with the direct pressure lamination has been impregnated with melamine and where the density varies between about 1200 - 1000 kg/m3. Under this core portion 52 there is another portion 53 where the density is slightly higher than in the middle parts of the core 30. The average density is

shown by the line AD. It should be emphasized that compression in wood fibre based board material always gives an increased density.

An alternative method is shown in figure 4d. Two test samples S1 and S2 with the same thickness ST are taken from the edge and the weight is measured. If the weight per mm is essentially the same, it is a strong indication that no materials has been removed and that the edges have been compressed. The sample thickness could be for example 2,44 mm and the sample length 20 mm along the joint. S1 could have a sample width SW of 3,46 mm and S2 of 3,04 mm. The weight of S1 is 0,167 gram and of S2 0,143 gram. S1 has a weight per mm of 0,167/3,46 = 0,048 gram and S2 0,143/3,04 = 0,47 gram. The reason for this small difference is mainly the fact that S1 contains slightly more surface layer with higher density than HDF, due to the curved shape. Similar tests in a panel where the surface layer has been laminated on a machined curved edge show that S1 has a weight of 0,062 gr/mm and S2 0,071 g/mm. This is a strong indication that core material has been removed before pressing and not compressed according to the principles of the invention

Figure 5c shows the density profile in a compressed part B-B of the edge portion 20. A part of the core 30 in the edge portion adjacent to the vertical plane VP and at a vertical distance SD from the surface layer 31, has a higher density D than a part of the core which is under the floor surface adjacent to the edge portion 20 and at the same vertical distance SD from the surface layer 31. This is as explained above contrary to traditional post forming where the edge portion is machined and the

surface layer is glued to the part of the core, which have the same or lower density.

Figure 6a shows an alternative method to form an edge portion 20 in a DPL flooring. A floorboard 1 is produced with an edge groove 19 under the surface layer 31. The upper part of the edge grove 19 consist of the surface layer 31 and a part of the core 30. This upper part of the edge grove 19 is folded against the lower part of the edge grove 19 and both parts are pressed and glued together. Figure 6b shows that this method could be used to form an edge portion of a floor panel, which is then machined to a floorboard. Both these methods are more complicated than the press forming since glue and separate machining is required. This method could be partly combined with the press forming and the core could be compressed in connection with the gluing.

Figure 7 shows a dilatation profile 4 with press formed edge portions 20, 20′, according to the invention.

Figure 8 shows a floorboard with edge portions 20 at opposite edges which are curved and where the outer adjacent parts of the edge surfaces 50 are essential parallel with the horizontal plane HP.

Figure 9 shows a floorboard where the edge surface of the edge portions 20 on the long edges 4a, 4b comprise different material than the edge surface of the edge portion 20′ of one of the short edges 5a. The long edges could preferably be formed according to the method shown in figure 5a. In this embodiment one of the short edges 5a has an edge portion 20′ in the form of a decorative grove essentially parallel with the horizontal plane HP

as shown in figure 3a. The edge surface on the long edges is a laminate made of a melamine-impregnated paper and on one short edge the edge surface is HDF fibres, which could be painted. Several combinations such as laminate/tape, laminate/printing, tape/printing, laminate/impregnation laminate/tape etc are possible to use in order to improve appearance and production cost. Of course long and short edges could be formed according to the first aspect of the invention:

The invention is especially suitable to produce laminate floorings that look like solid wood floor strips with a width of about 5-10 cm and where compressed edge portions are only formed on the long sides. Such floorboards could also easily be made in random lengths since long press formed floor panels could be produced which are thereafter machined and cut to floorboards in different lengths. Of course a machined edge portion on one short edge could also be formed. The visible wood fibres could be painted. The invention is also very suitable for laminated panels with a width of 10-12 cm or 12-15 cm where traditional methods are difficult to use.

A floor which consist of such narrow floorboards will have many curved edge portions 20 and only very cost efficient production methods such as press forming could be used in order to obtain production costs which are competitive and lower than similar solid wood floors.

Press forming is very efficient and can easily meet the speed of modern profiling lines.

The method to compress the core with a surface layer of a laminate floor element, floor panel or floorboard or a

similar building element panel according to the invention could be used to form embossed portions on other parts than the edges.

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CLAIMS:

1. A method to make a floorboard, with a mechanical locking system, a wood fibre based core and a surface layer arranged on the upper side of the core, the outer flat parts of the surface layer constituting a floor surface and a horizontal plane, the floorboard has an edge portion with an edge surface which is located under the horizontal plane the method comprising:

applying the surface layer on the core to form a floor element,

cutting the floor element into floor panels,

applying a pressure on the surface of the edge portion of the floor panel and compressing the core under the surface layer and bending the surface layer permanently towards the rear side,

forming an edge groove at the edge of the floor panel before applying the pressure, and

forming the mechanical locking system at the edge of the floor panel after applying the pressure.

2. A method as claimed in claim 1, wherein the surface layer comprises paper sheets impregnated with a thermosetting resin.

3. A method as claimed in claim 1, wherein the surface layer is a wood veneer.

4. A method as claimed in any one of claims 1 - 3, wherein the core is of HDF.

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5. A method as claimed in claim 1, the method further comprising pressing of the edge portion under heat exceeding 100 degree C.

6. A method as claimed in claim 1, the method further comprising pressing of the edge portion under heat exceeding 160 degree C.

7. A method as claimed in claims 5 or 6, the method further comprising pressing and heating of the edge portion with a heating device comprising infrared radiation.

8. A method as claimed in any one of claims 1 - 7, the method further comprising applying of the pressure by moving a pressure shoe or a pressure wheel in relation to the floor panel.

Fig. 1a

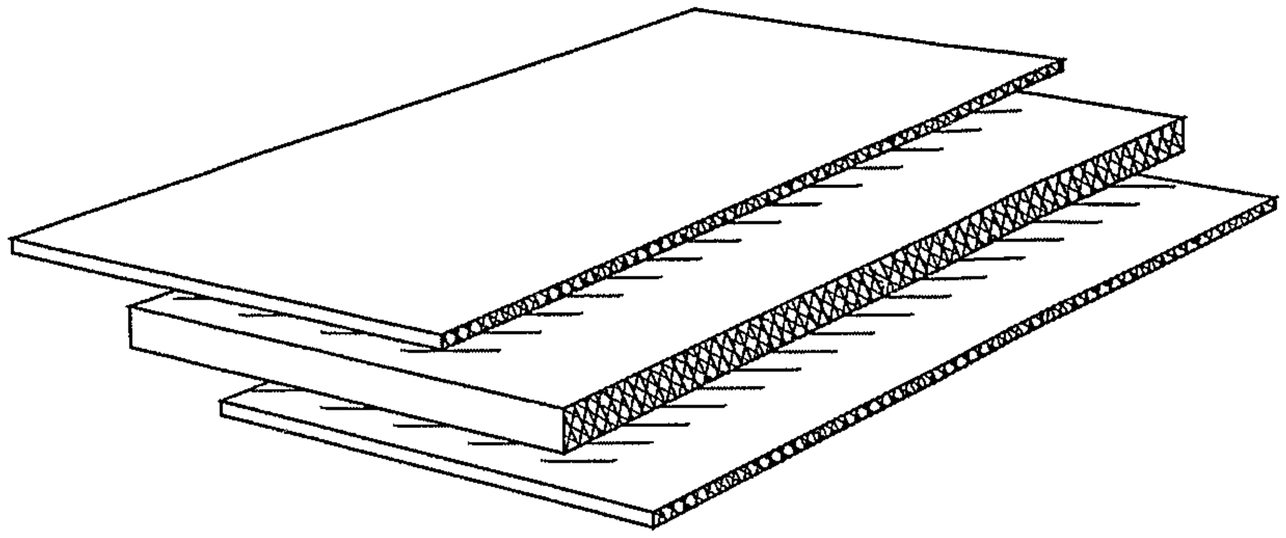


Fig. 1b

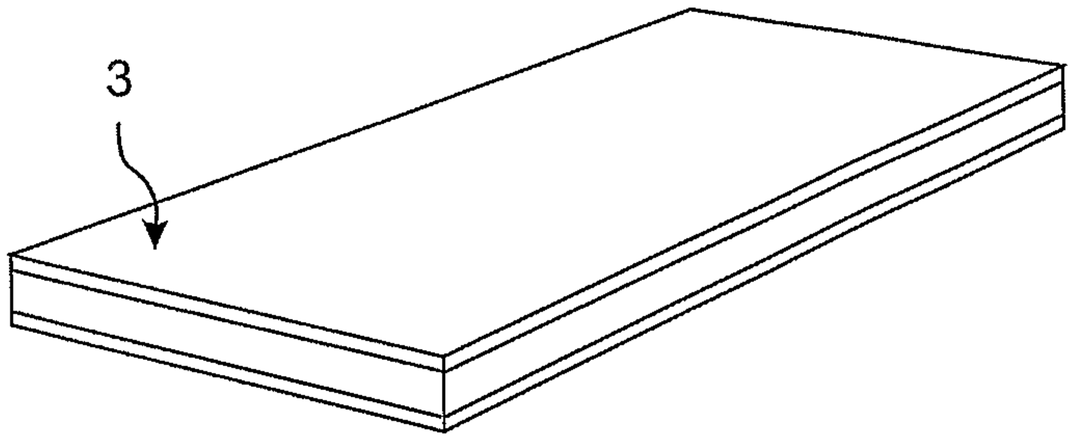


Fig. 1c

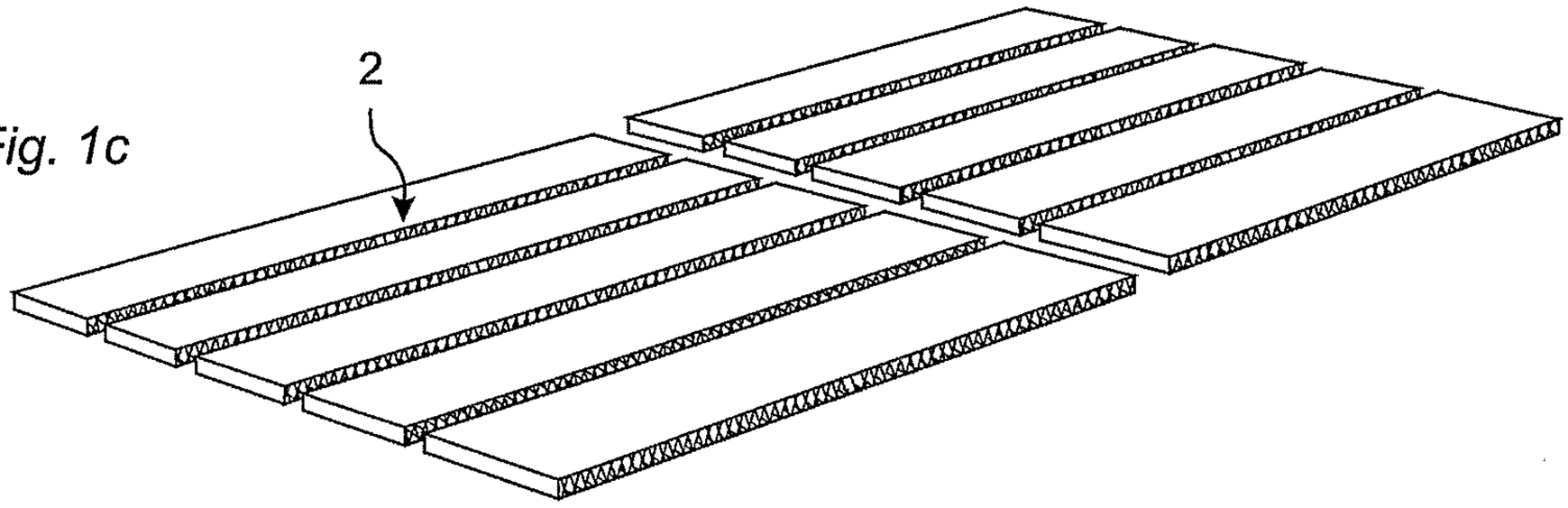
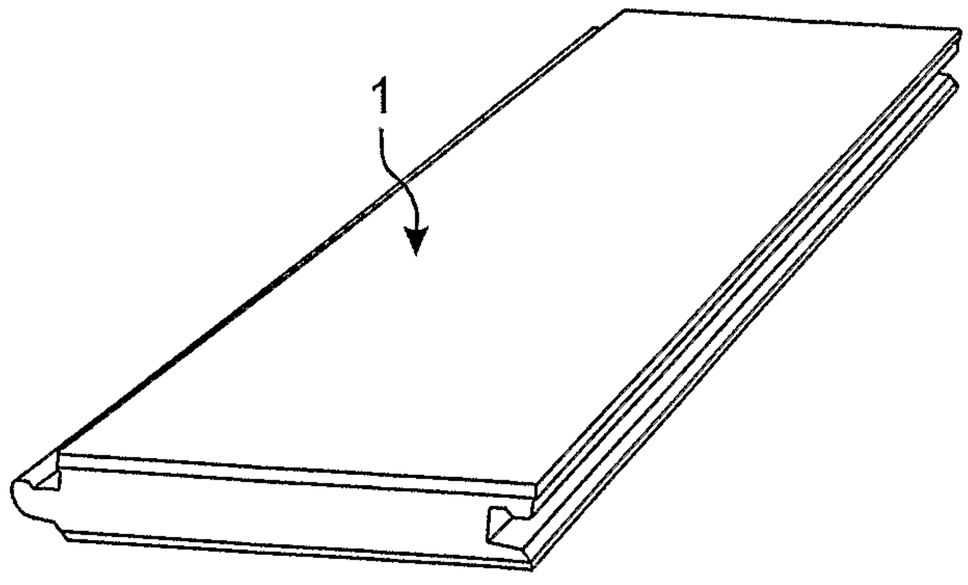


Fig. 1d



KNOWN TECHNOLOGY

Fig. 2a

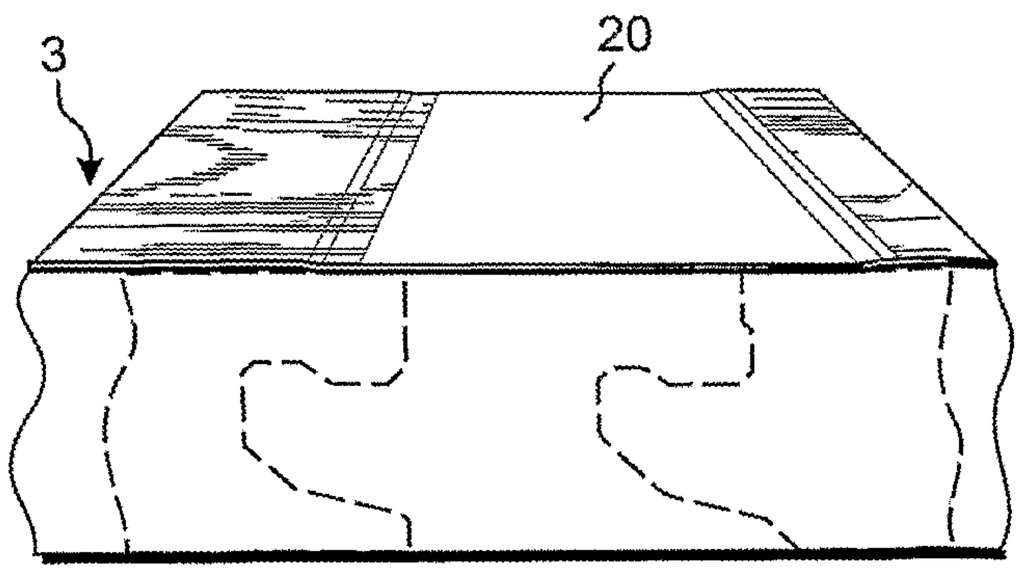


Fig. 2b

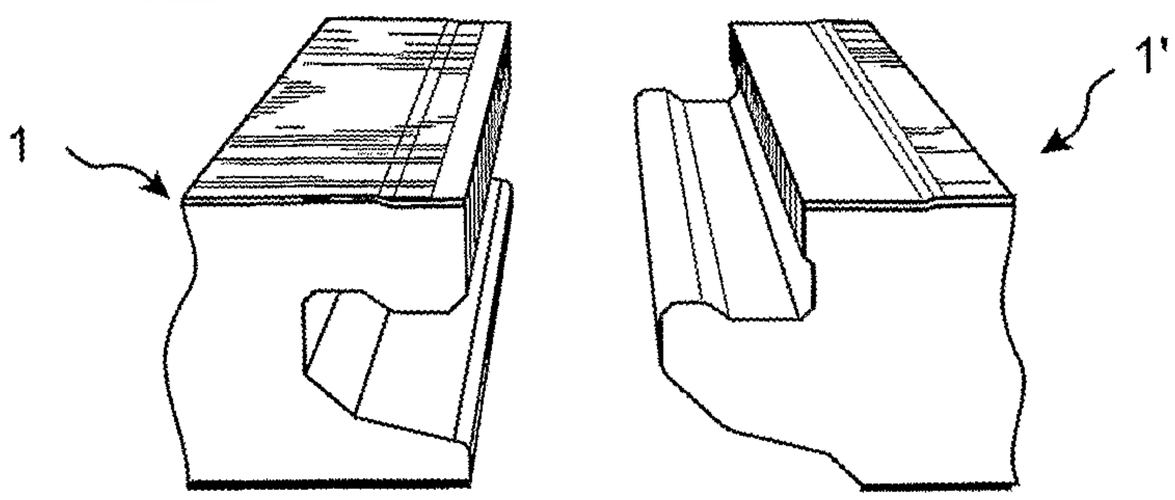


Fig. 2c

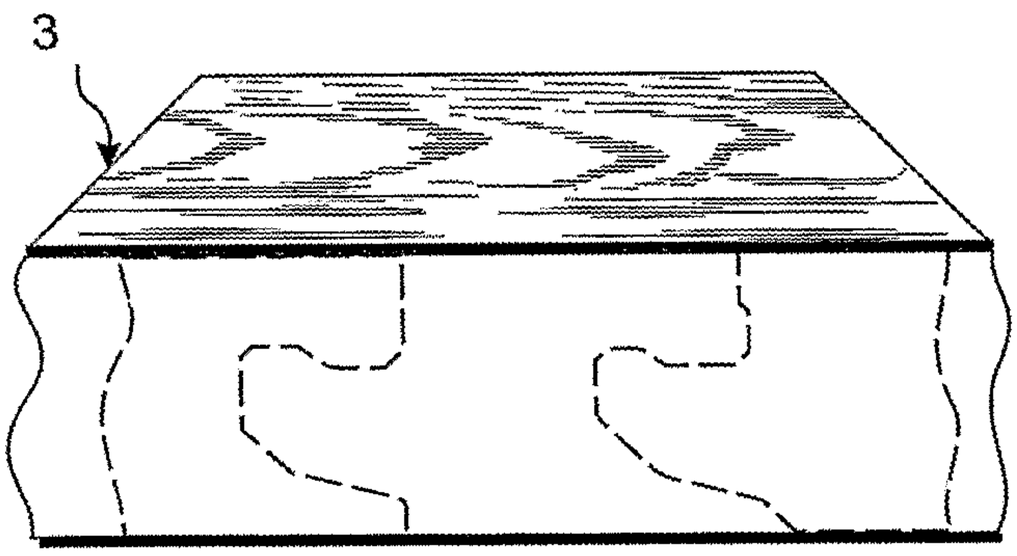


Fig. 2d

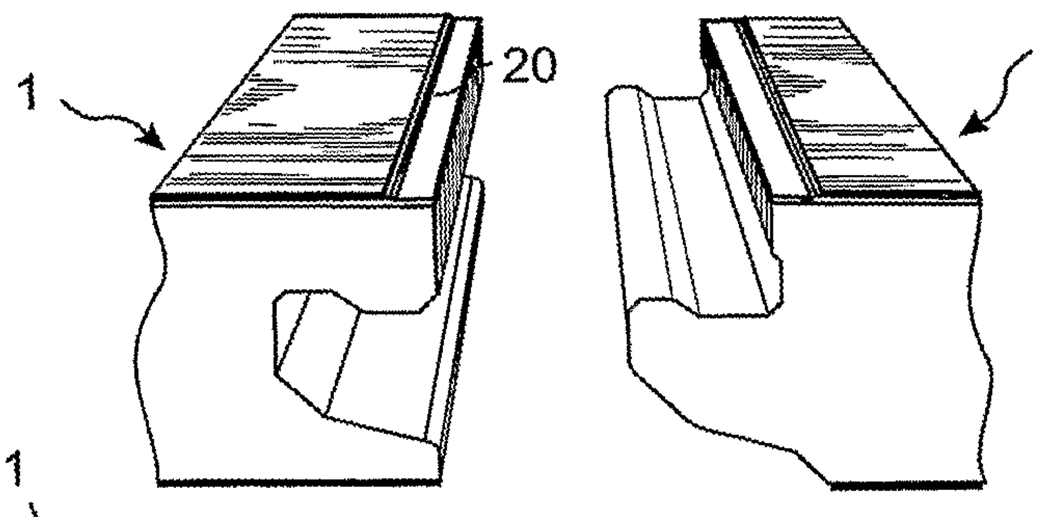
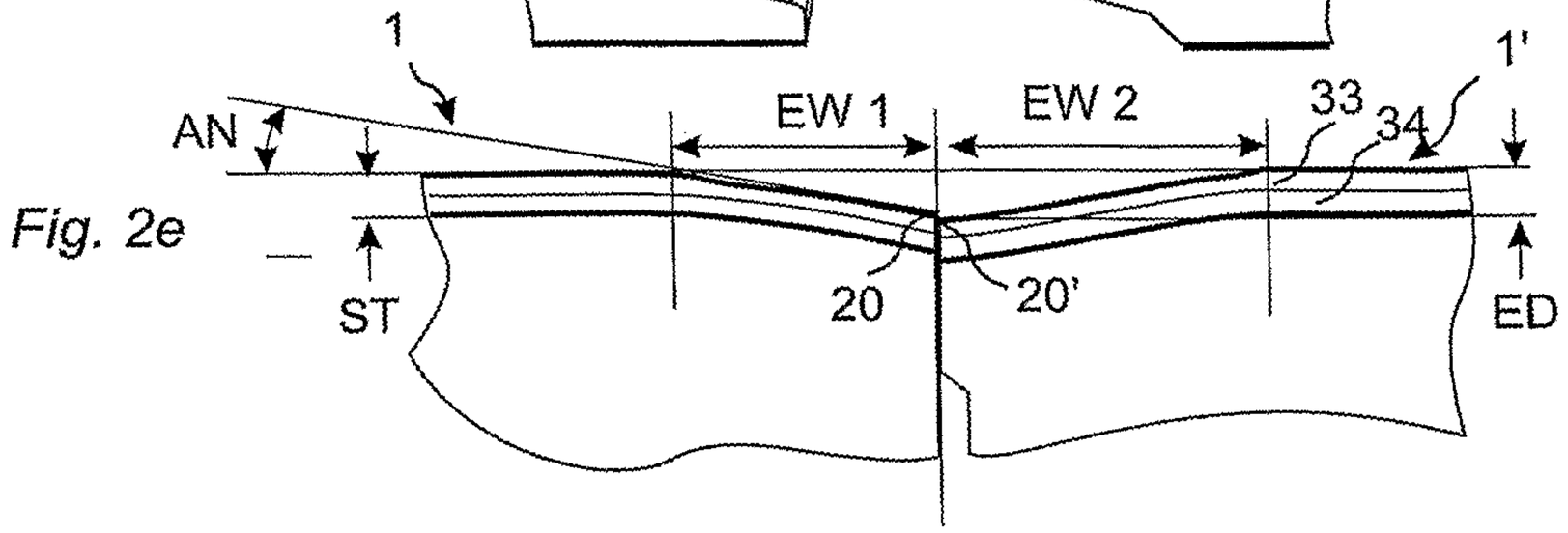


Fig. 2e



KNOWN TECHNOLOGY

Fig. 3a

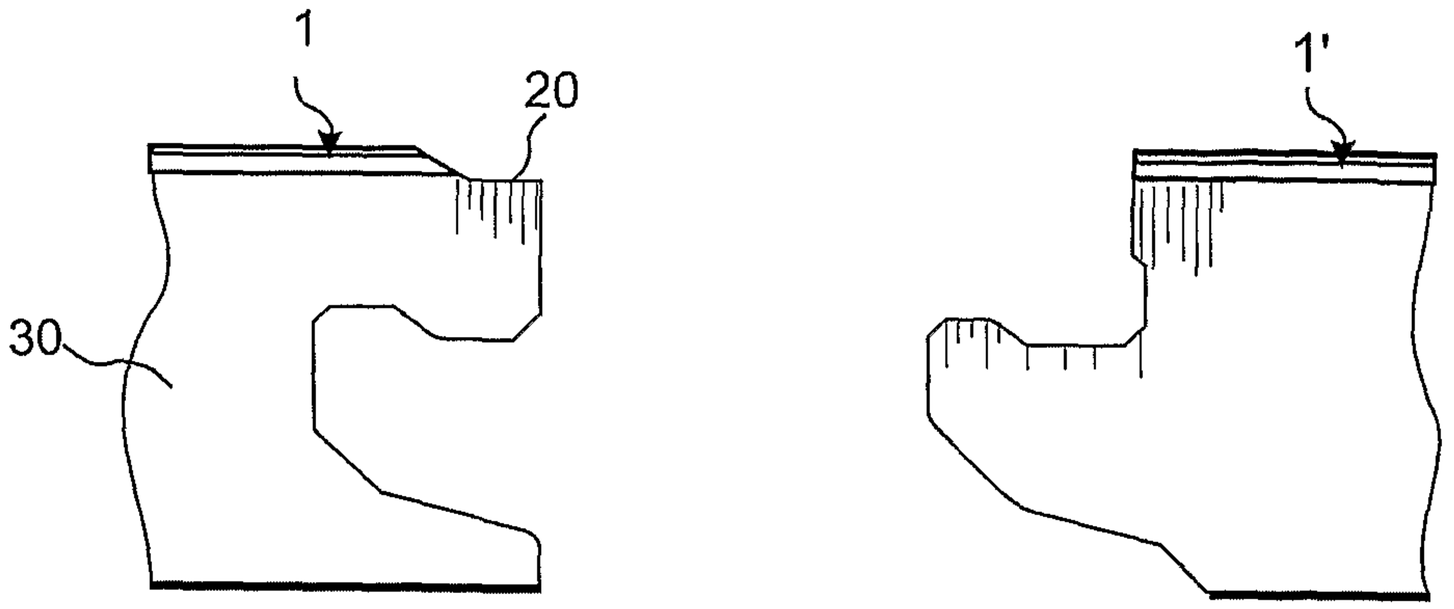


Fig. 3b

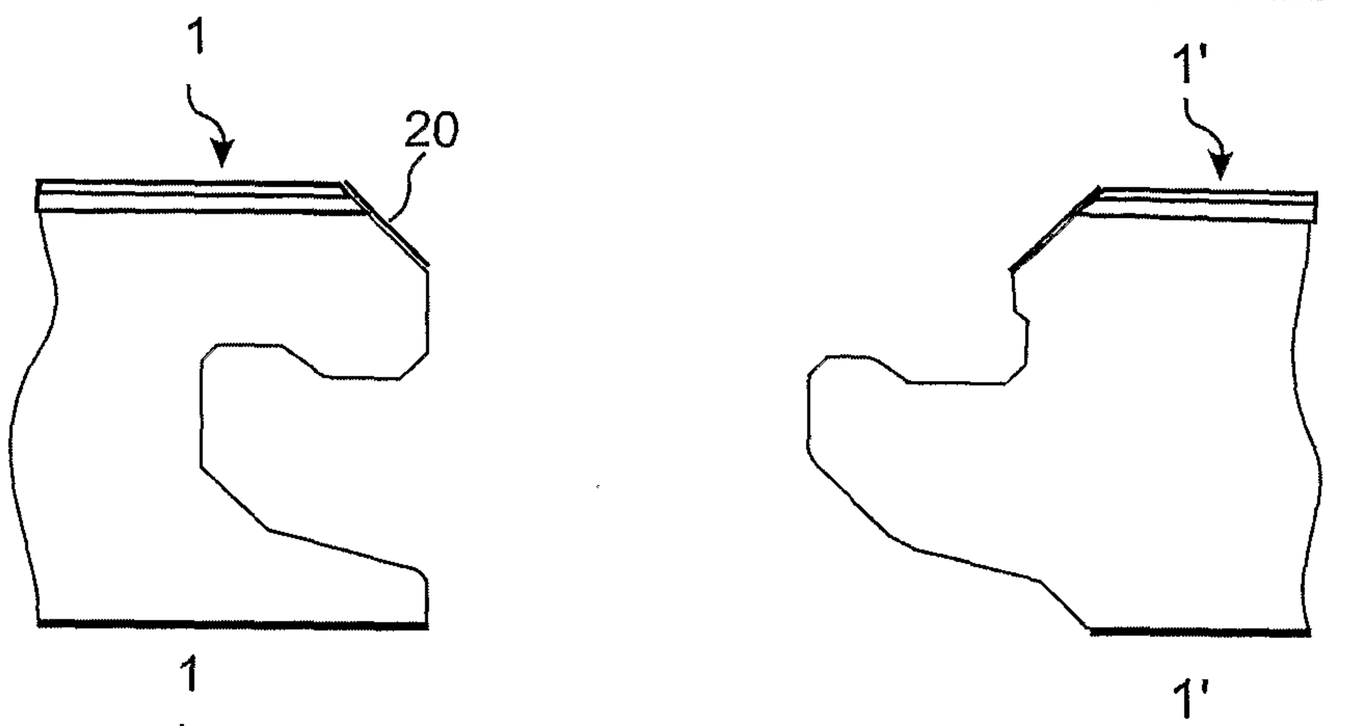


Fig. 3c

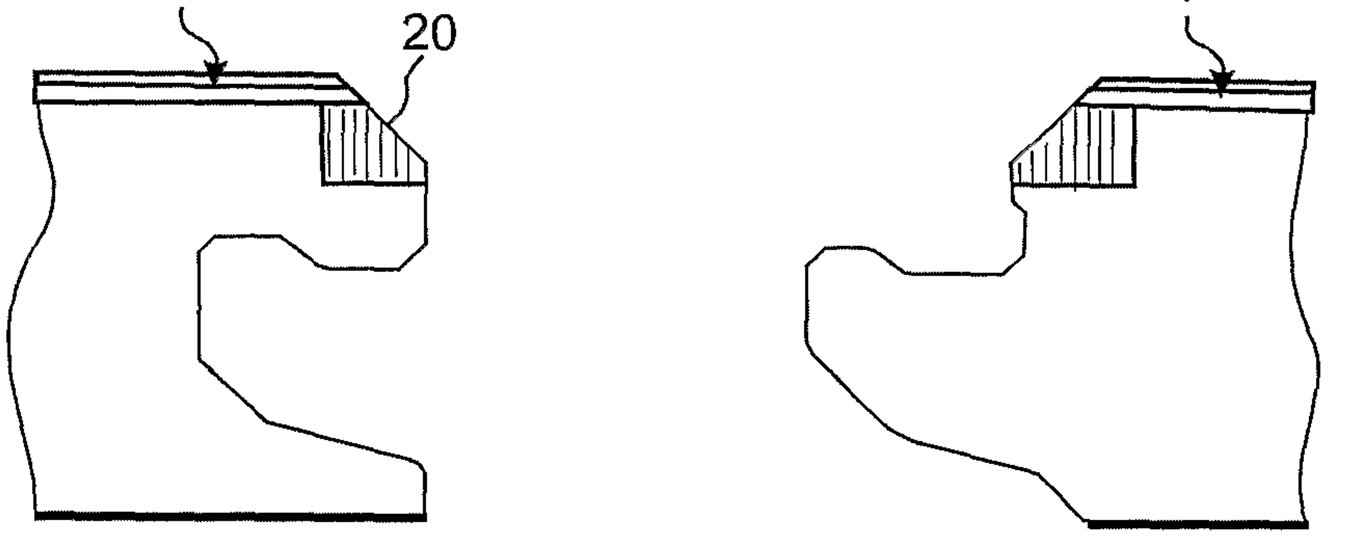
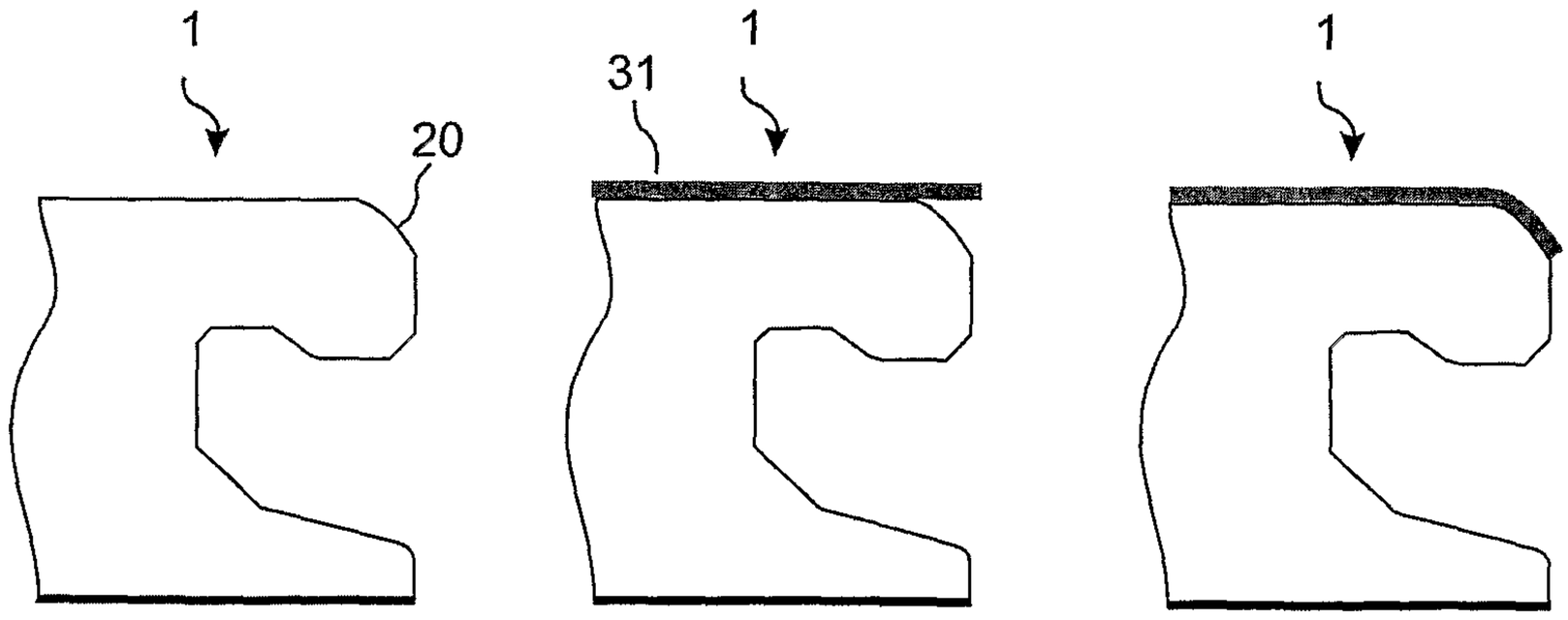


Fig. 3d



KNOWN TECHNOLOGY

Fig. 4a

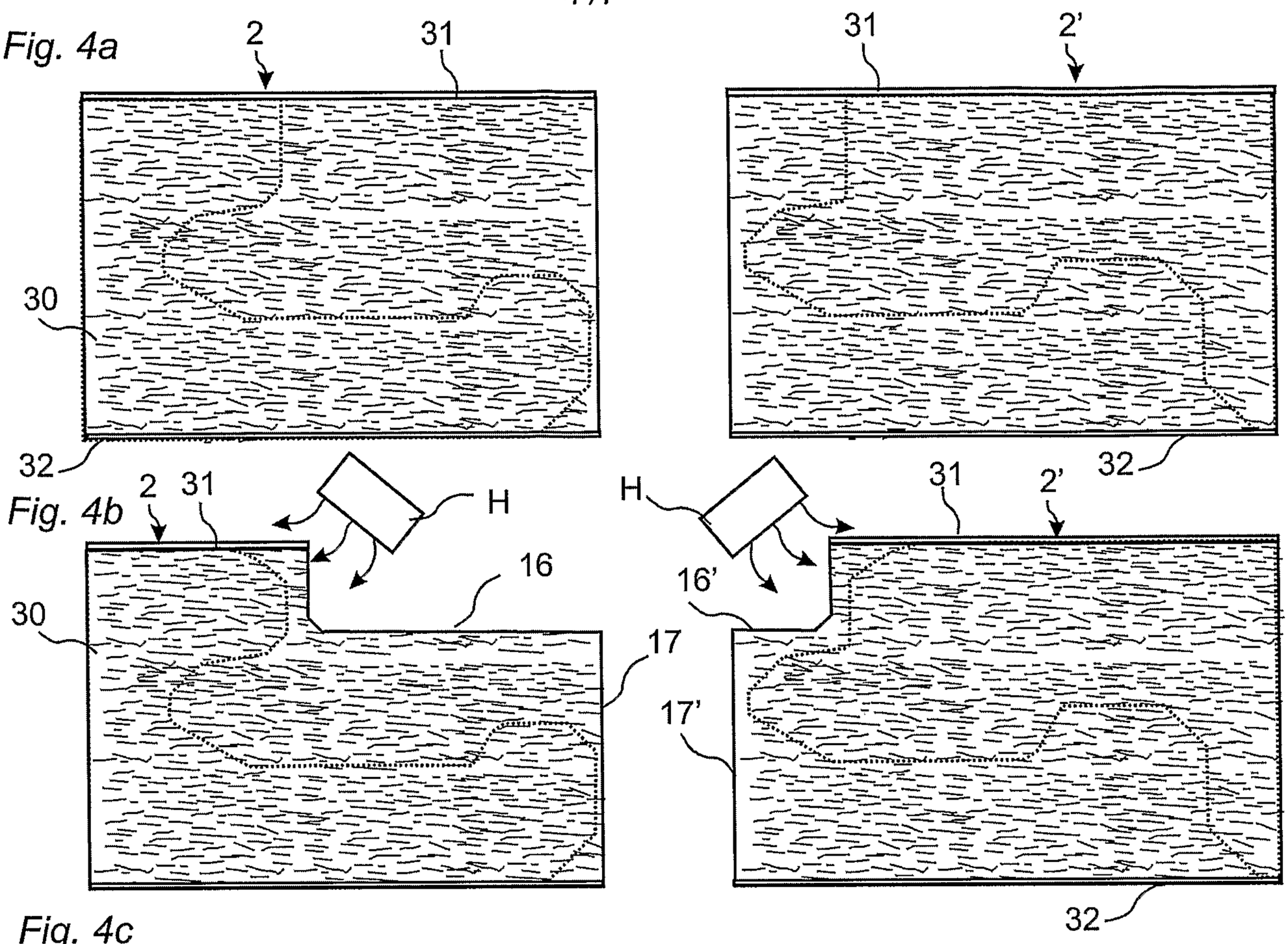


Fig. 4b

Fig. 4c

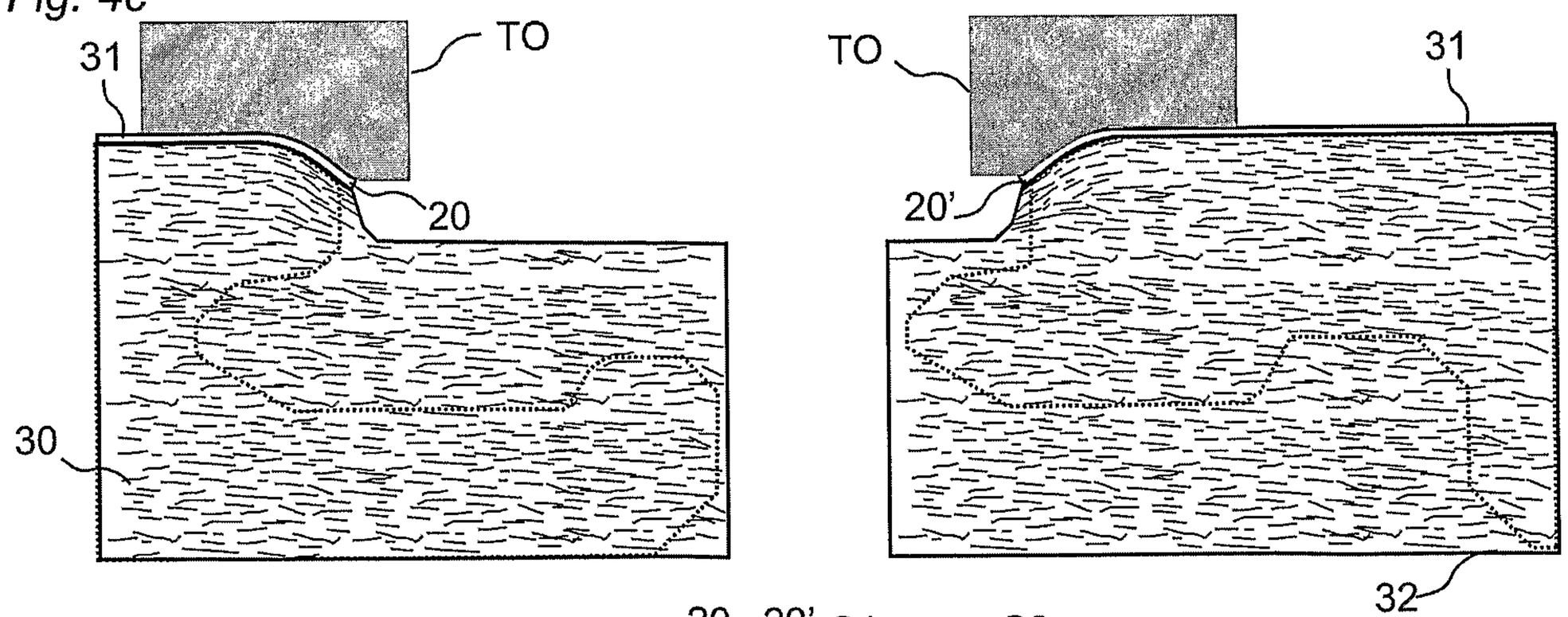


Fig. 4d

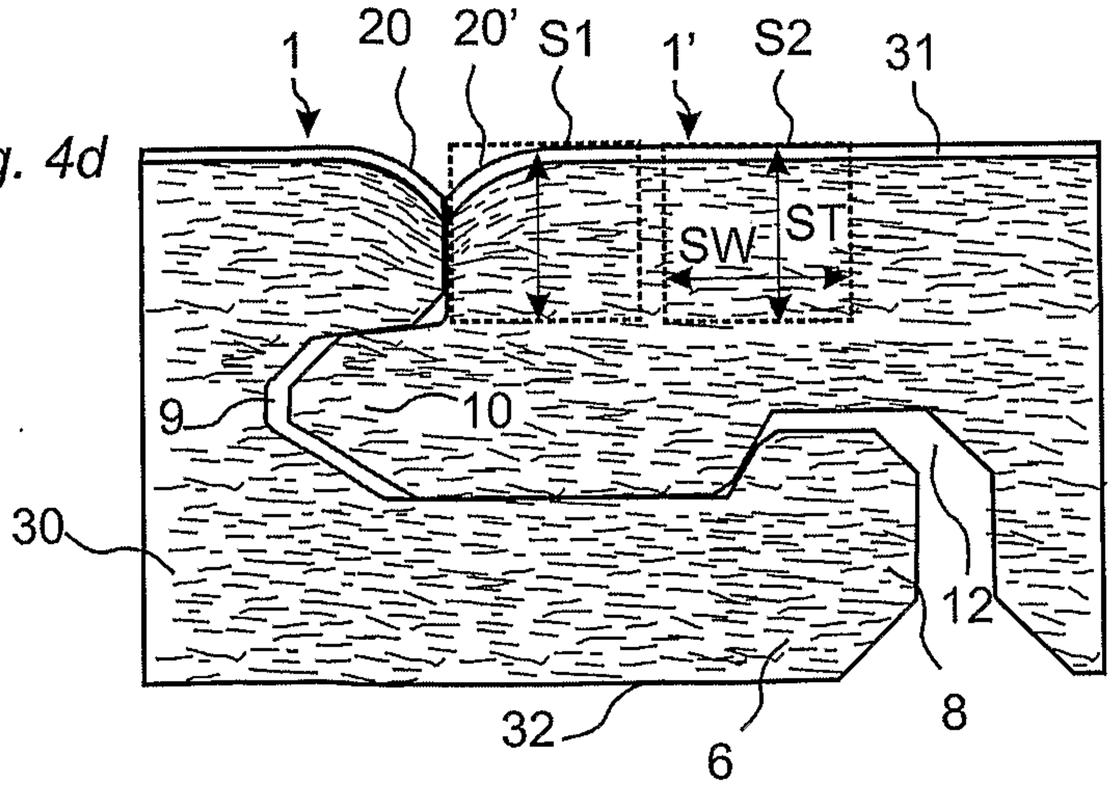


Fig. 5a

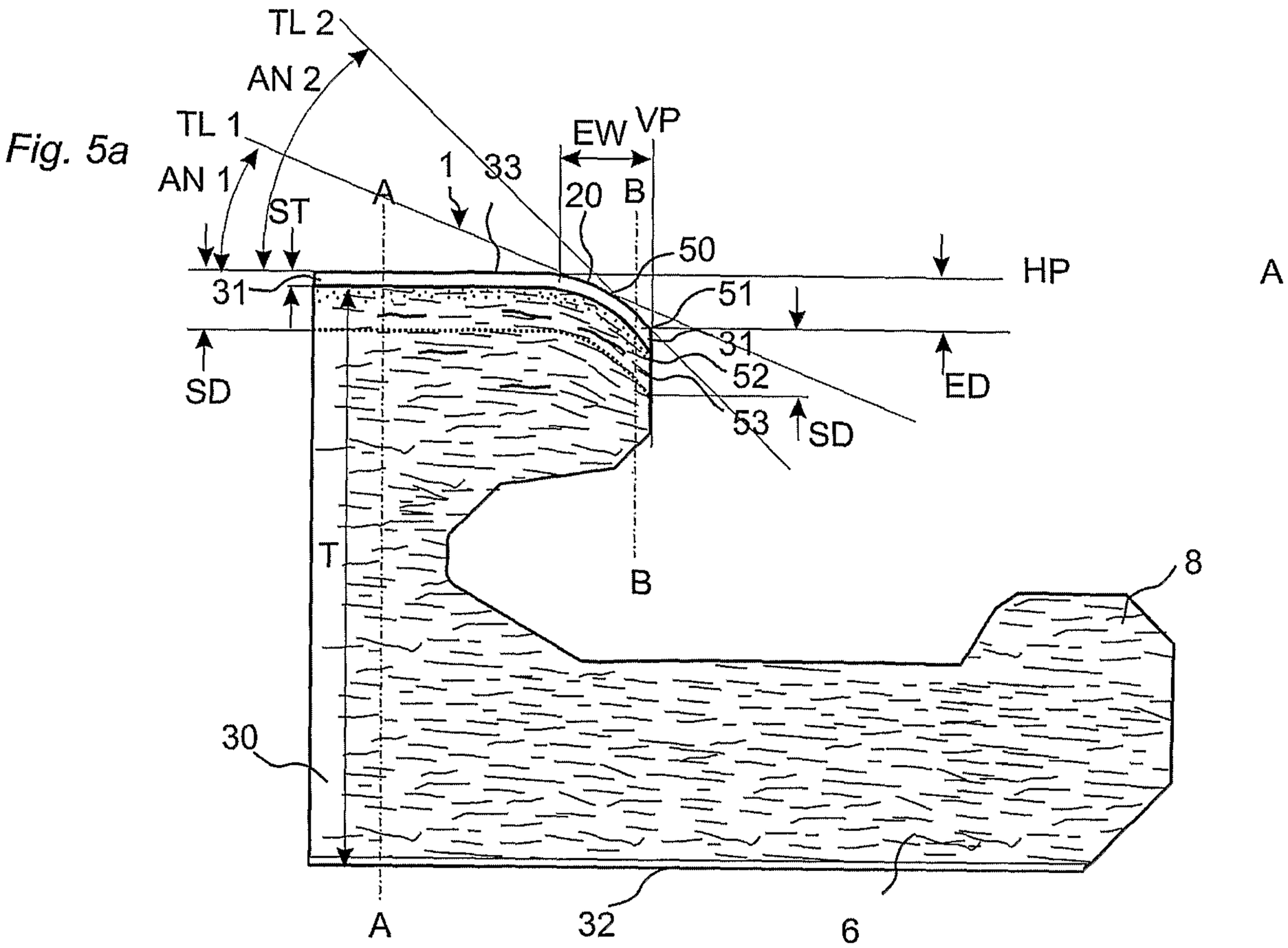


Fig. 5b

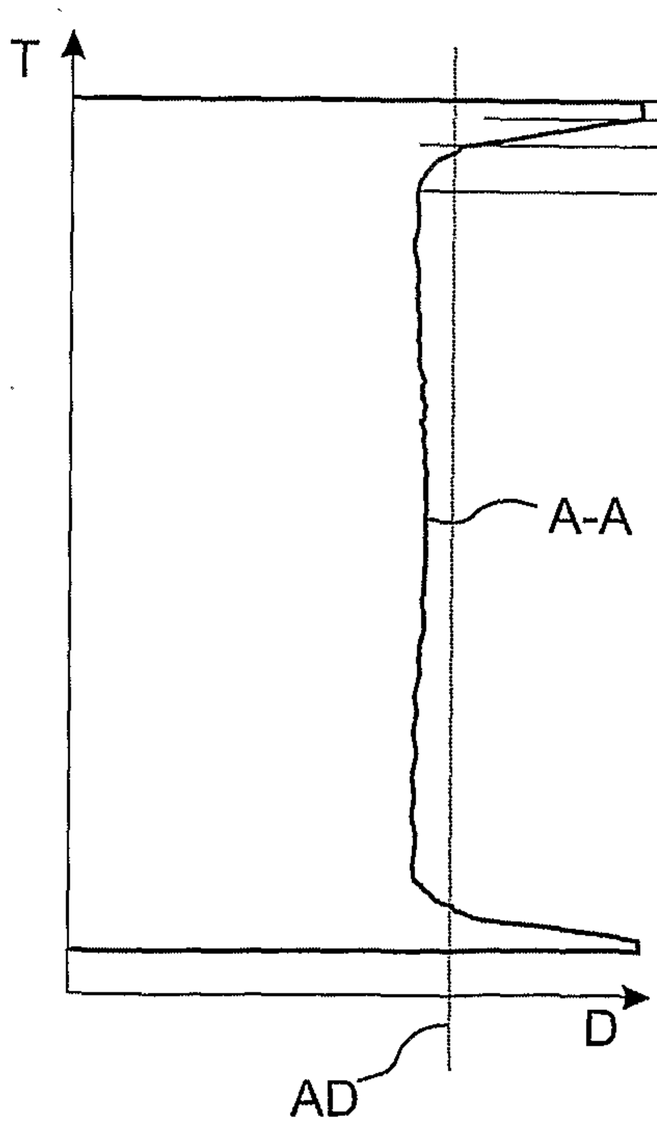


Fig. 5c

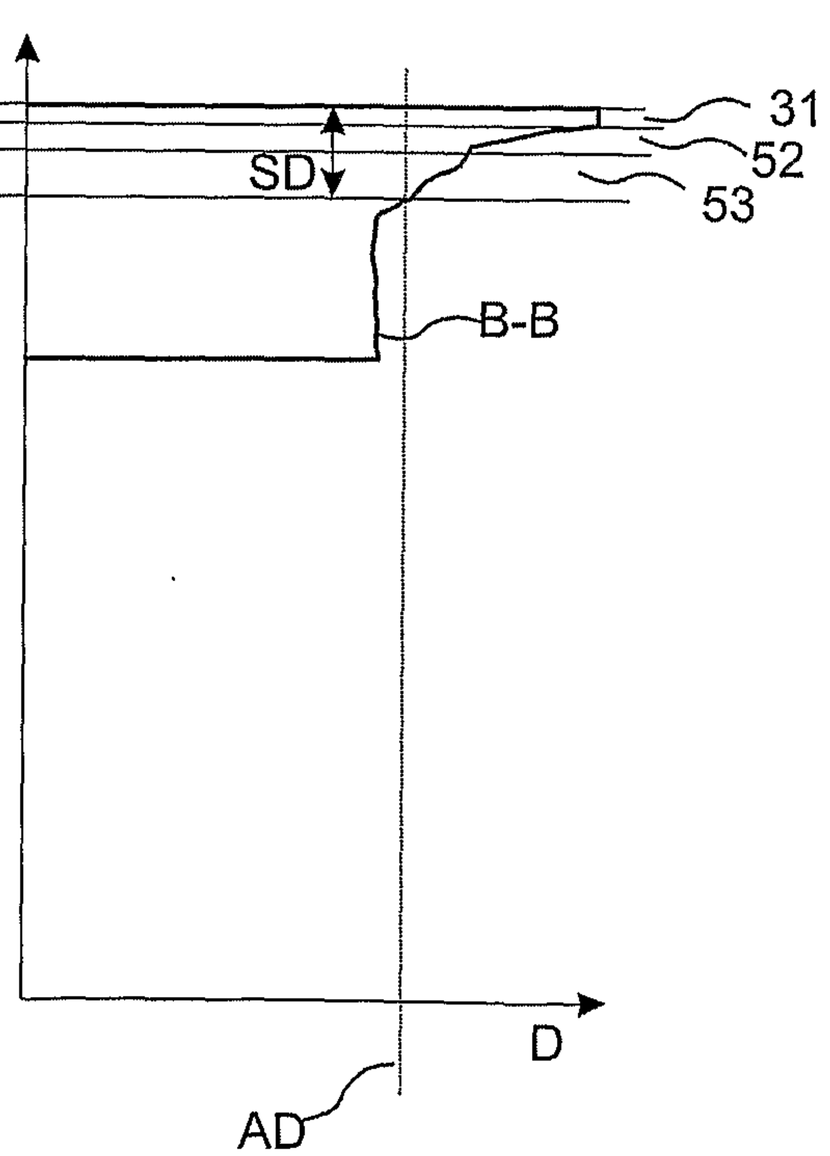


Fig. 6a

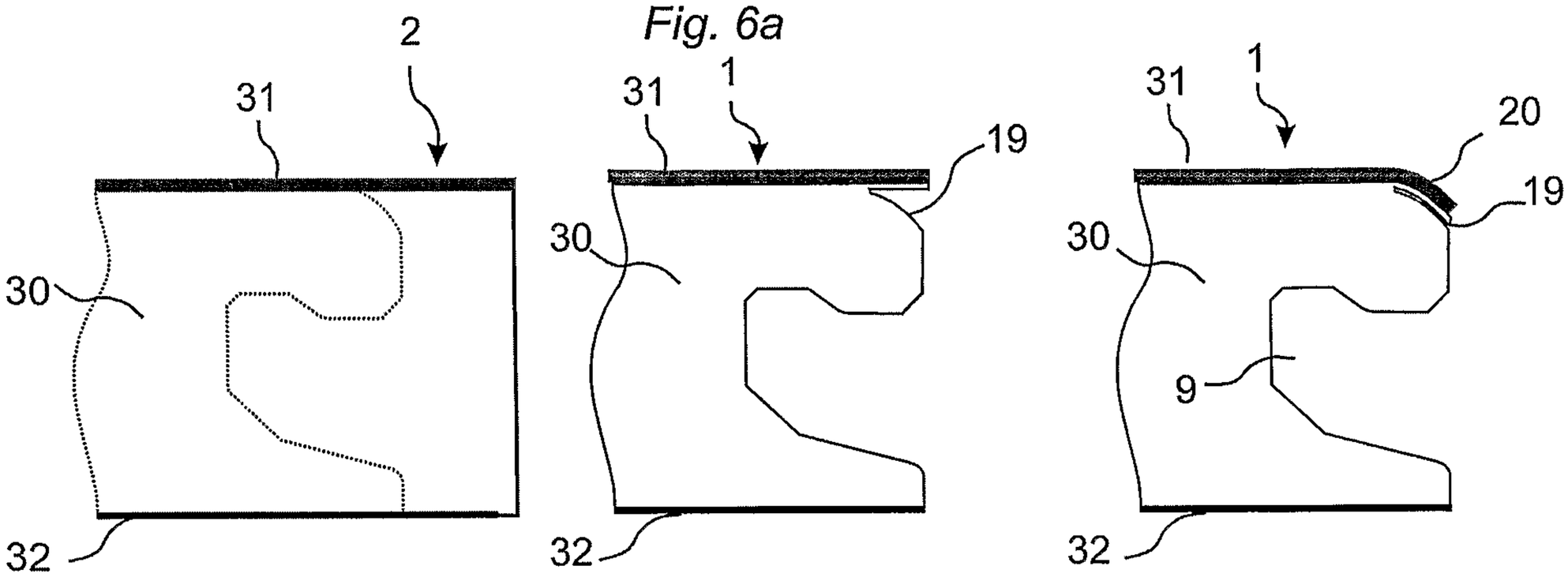


Fig. 6b

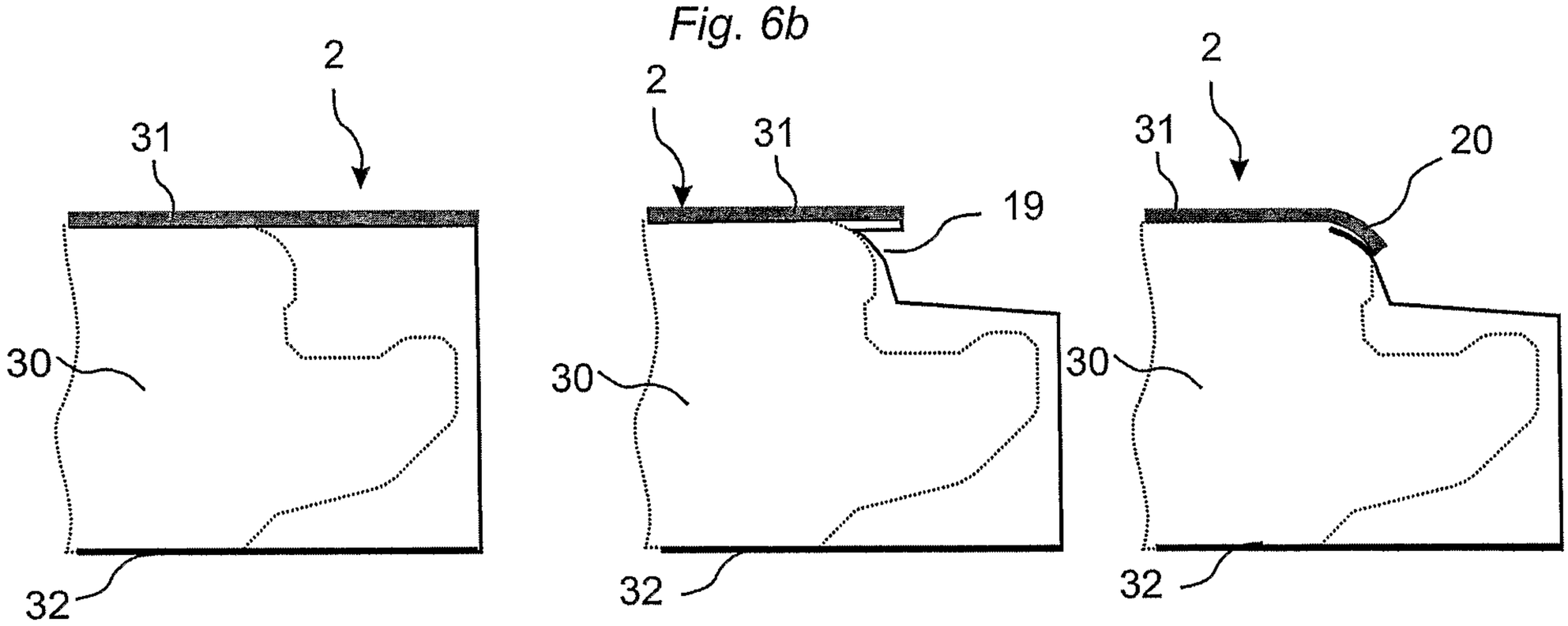


Fig. 7

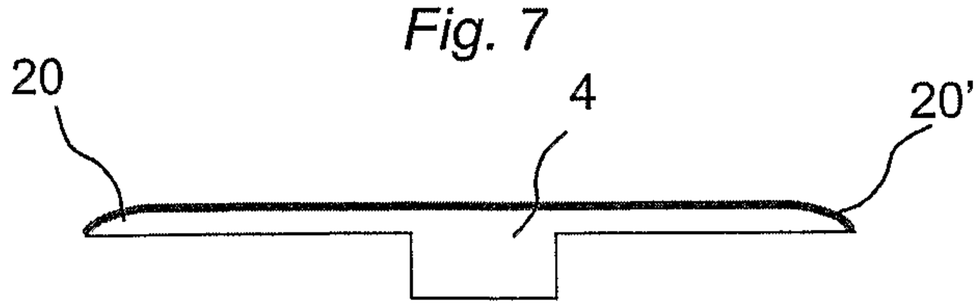


Fig. 8

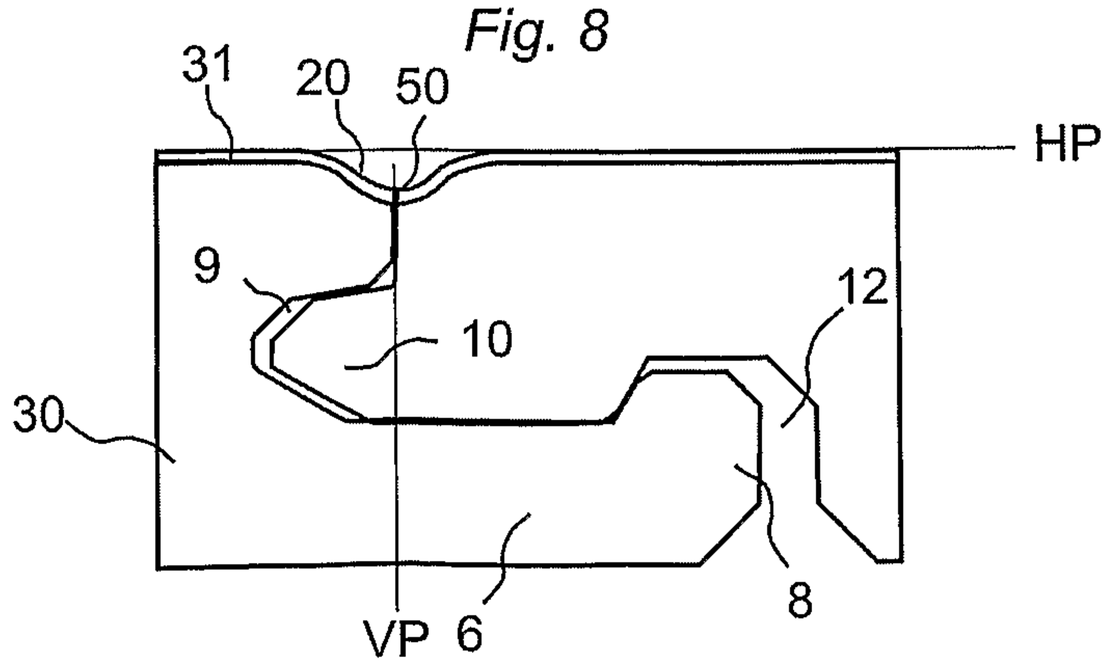
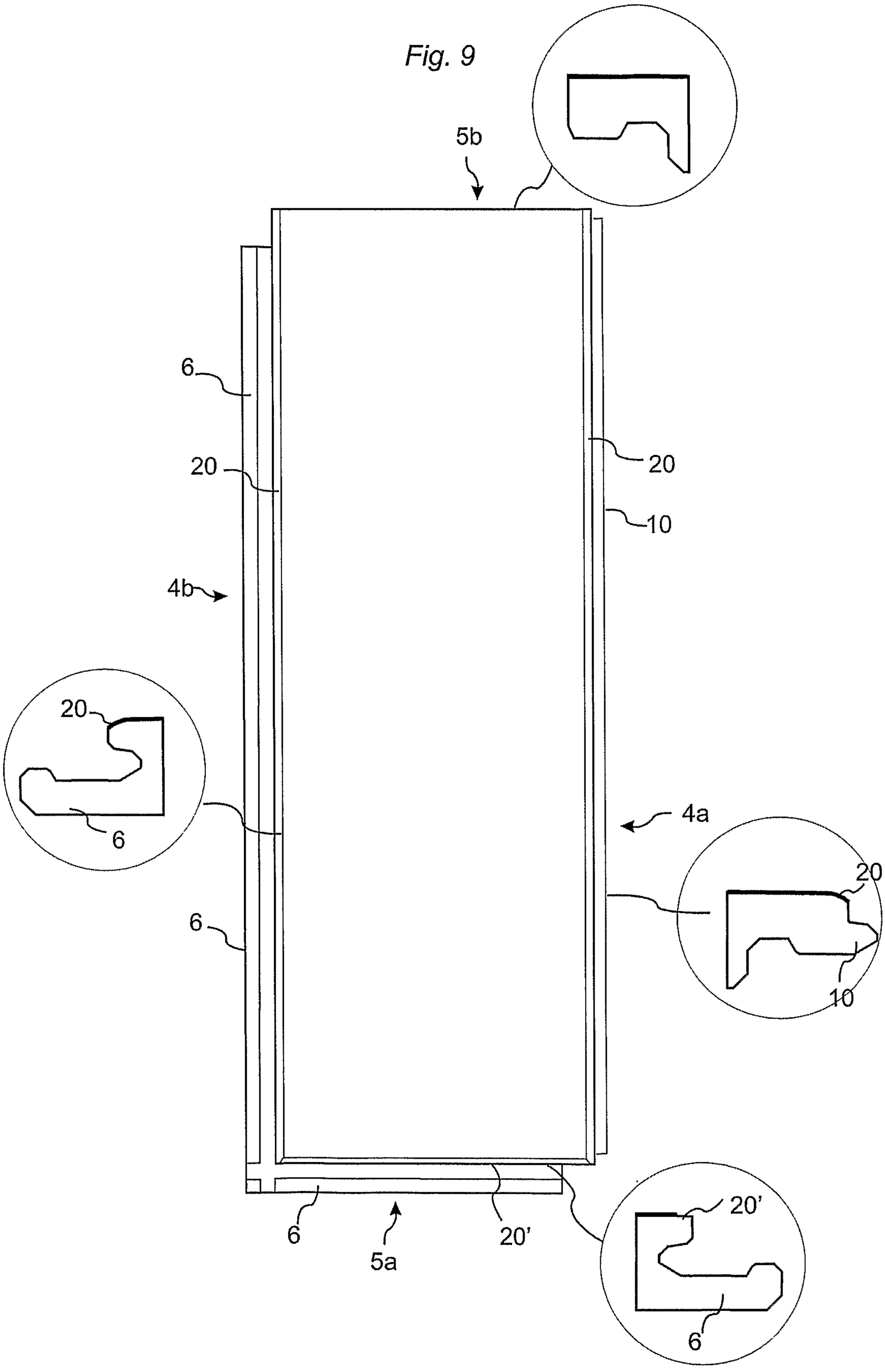
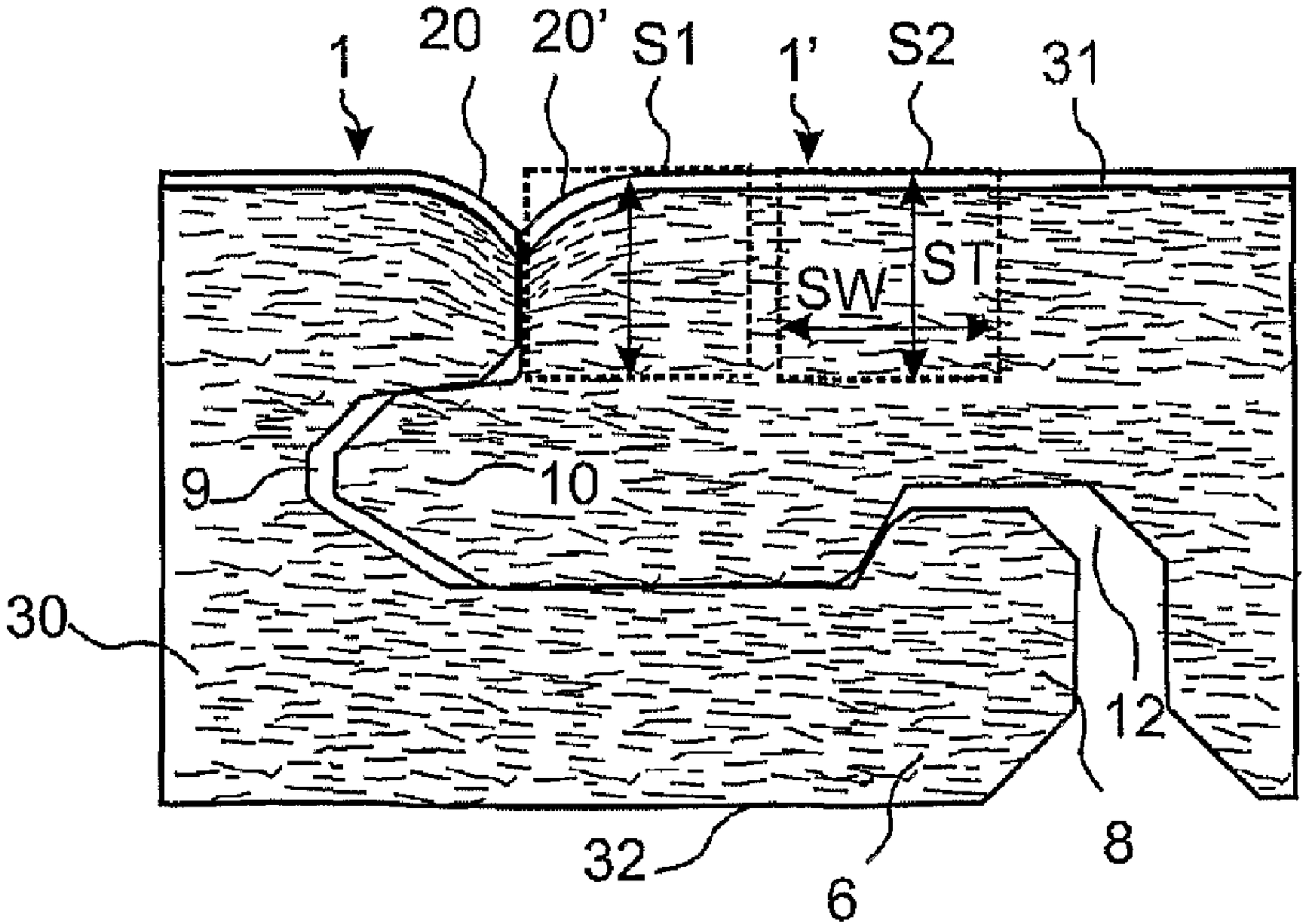


Fig. 9

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