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(54) Procedure and apparatus for the fabrication of a blank for a structural product

(57) Procedure for the fabrication of blank for a structural product, such as a blank for a structural board, from material (1) comprising longer (L) and shorter (S) particles and possibly also particles (F) smaller than these, said particles being e.g. chips and/or fibres, in which procedure the particles are mixed with a binding agent and possible additives and passed into at least one blank former, from where the particles are brought onto a base (10), e.g. onto a belt conveyor or into a mould or onto a blank. The particles are brought onto the base (10) in given orientations so that at least part of the particles are oriented in a direction differing from the orientation of other particles.

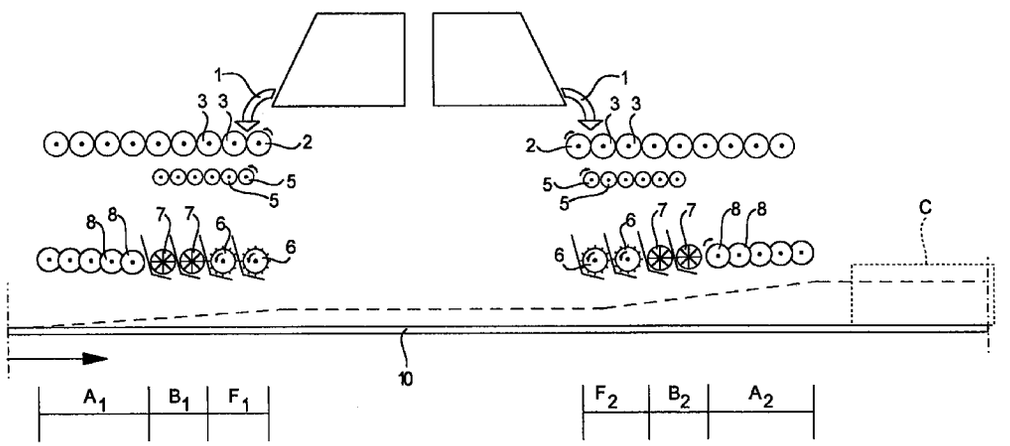

FIG. 1

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Description

The present invention relates to a procedure as defined in the preamble of claim 1. The invention also relates to an apparatus as defined in claim 10.

Elongated particles, such as chips or fibres, are used in the manufacture of structural products, e.g. boards made of wood material, especially OSB boards (oriented strand board). OSB boards are fabricated from relatively large chips of different lengths, which are scattered in suitable orientations onto a base together with a binding agent and pressed to produce boards. The chips in the surface layers are usually oriented in the longitudinal direction, i.e. in the direction of the longer side of the finished product, while the chips in the middle layer are oriented in the transverse direction or they are not oriented at all. In prior-art manufacturing procedures, separate orienting equipment is used for the surface layers and for the middle layers. This requires relatively large investments on equipment. Moreover, the equipment currently used requires a large space.

The object of the present invention is to achieve a completely new type of procedure and apparatus for the fabrication of a blank for a structural product, which make it possible to avoid the drawbacks of prior-art solutions.

The invention is characterised by what is said in the claims.

The procedure and apparatus of the invention have numerous significant advantages. Now it is possible to handle OSB chips of all sizes and lengths and orient them e.g. in transverse and longitudinal directions using the same unit. This makes it possible to produce OSB boards at considerably lower investment costs than before. The space requirement and energy consumption of the apparatus of the invention are considerably lower than in conventional solutions. Moreover, in the present solution, the material to be scattered may contain relatively short particles and these can be scattered on a desired part of the board and, if necessary, they can be oriented in a given direction. This allows e.g. better utilisation of the raw material. Using the apparatus of the invention, the material can fractionated better than before and therefore better scattering and orienting results are achieved. These circumstances signify that the quality of the final product is also improved. Thus, in a structural product blank fabricated using the procedure and apparatus of the invention, smaller particles can be used than at present without impairing the strength or rigidity of the product or its stability against deformation.

In the following, the invention will be described by referring to the attached drawings, in which

Fig. 1 presents a diagram representing an apparatus according to the invention in lateral view,

Fig. 2 presents lateral view of a scattering/orienting unit as used in the apparatus of the invention, and

Fig. 3 presents a structural product blank fabricated by the method of the invention, showing a cross-section taken at point C in Fig. 1.

A procedure for the fabrication of a blank for a structural product, such as a blank for structural board, from material 1 comprising longer L and shorter S particles, such as longer and shorter chips and/or fibres, and possibly particles F smaller than these, in which procedure the particles are mixed with a binding agent and possible additives and then passed into at least one blank former, from where the particles are brought onto a base 10, such as a belt conveyor or a mould or a blank coming from a previous apparatus. The particles are brought onto the base 10 in given orientations so that at least part of the particles are oriented in a direction substantially different from the direction of orientation of other particles. Preferably at least part of the particles is oriented substantially in the longitudinal direction of the base 10 and part of them is oriented in the transverse direction relative to the base 10.

At least one surface layer A_1 (Fig. 3) of mainly longer particles L is brought onto the base, and smaller particles F, S are brought onto the first layer to form one or more middle layers B_1, F_1, F_2, B_2, upon which at least one more layer of longer particles L is brought to form a second surface layer A_2. Fig. 1 shows two scattering/orienting units, the first one of which is used to form the lower layers A_1, B_1, F_1 of the blank 10 while the second one is used to form the upper layers. F_2, B_2, A_2. The dimensions of the figure are not in proportion to reality but they have been modified for the sake of clarity.

From the structural product blank, an actual product, such as a structural board, is obtained by pressing the blank in a press. In a typical case, the middle layer B_1, F_1, F_2, B_2 is transversely oriented relative to the direction of advance of the base 10 while the surface layers A_1, A_2 are longitudinally oriented.

In the procedure of the invention, the material 1 to be processed is conveyed onto a preliminary roller set 3 in a blank former, to be screened mainly by particle length. At this stage, at least part of the material being screened falls down below the plane formed by the rollers through the gaps between them while the possible remainder is passed down over the tail end of the roller set 3. At least part of the material falling down below the preliminary roller set 3 through the gaps between the rollers, screened by an intermediate roller set 5 placed under the preliminary roller set, is passed via an orienting mechanism 6, 7, 8 onto the scattering base 10. Of the material passed onto the intermediate roller set 5, the smallest particles F, S are passed down below the plane formed by the intermediate rollers 5 through the gaps between the rollers of the intermediate roller set 5

while the longer particles L are passed down over the tail end of the roller set 5 via the orienting mechanism 6,7,8 onto the scattering base 10. By means of the orienting mechanism 6,7,8, part of the particles is oriented substantially in the longitudinal direction of the base and part of the particles is oriented in the transverse direction of the base.

The longer particles L are fractionated by length before being oriented and/or scattered. When brought onto the scattering base 10, the longer particles L are oriented by means of orienting elements 8, preferably longitudinally relative to the track.

The shorter particles S and particles F smaller than these are fractionated by size before being oriented and/or scattered. The shorter particles S and possibly part of the smallest particles F are mainly transversely oriented by means of orienting elements 6,7 when brought onto the scattering base 10. The smallest particles F are scattered onto the scattering base 10 in such a way that the shorter they are, the closer to the final middle layer of the board to be pressed they are positioned in the mat formed on the scattering base.

In the cross-section of the blank, the particle size F,S,L typically increases from the middle towards the upper or lower surface. The smallest particles F are brought onto the base so that they are mainly placed in the middle layer in the cross-section of the structural product blank and that their amount decreases towards the surface layers as seen in the cross-section of the blank.

By using an arrangement as illustrated by Fig. 1, a symmetrical blank for a structural product is obtained. Fig. 3 shows a part of the blank sectioned at point C.

Fig. 2 presents one scattering/orienting station. Typically, scattering/orienting stations are used in pairs, one being used to bestrew the lower side of the board and the other to bestrew the upper side. The scattering/orienting station depicted in Fig. 2 is used to bestrew the upper side of the blank.

Fig. 2 thus presents one of the scattering/orienting stations included in the assembly illustrated by Fig. 1, in which the material 1 to be processed, comprising longer L and shorter S particles, preferably such as longer and shorter chips and/or fibres, and possibly even smaller particles F than these, is supplied by means of a feed conveyor onto an accelerating roller 2 rotating at a high speed. The accelerating roller 2 is provided with a suitable rough surface pattern so that it hurls the material to be screened onto a preliminary roller set 3, which consists of at least two substantially parallel rollers 3, preferably rotating and placed in a substantially horizontal plane with gaps between them, allowing part of the material being processed to fall down through the gaps between the rollers while the rest is passed out via the tail end of the roller set 3. The gaps between the rollers may be individually adjustable, for instance in the way described in patent application FI 922777. In a preferred case, the gap width increases towards the tail end of the preliminary roller set 3. The accelerating roller 2 and the preliminary rollers rotate in the clockwise direction as seen in the drawing. The structure of individual rollers in the preliminary roller set 3 may be e.g. like that described in patent application FI 950518.

Disposed below the preliminary roller set 3 is a set of intermediate rollers 5, extending through at least part of the length of the preliminary roller set from its beginning as seen in the direction of material supply. The intermediate roller set 5 consists of at least two substantially parallel rollers, preferably rotating and placed in a substantially horizontal plane. Between the rollers 5 there are gaps, allowing part of the material being processed to fall down through the gaps between the rollers while part of it is passed out over the tail end of the roller set. The gaps between the rollers in the intermediate set may also be individually adjustable, e.g. as in patent application FI 922777. In a preferred case, the gap width increases towards the tail end of the preliminary roller set. The rollers may have a patterned surface, which may be a milled, faced, glued or similar type of grooved and patterned surface. The roller set may also consist of so-called disc rollers, in which case each roller is provided with discs disposed or formed at a distance from each other and having an outer diameter larger than the outer diameter of the rest of the roller. The discs of adjacent disc rollers may be disposed in an interlapping arrangement.

Disposed below the preliminary and intermediate roller sets is an orienting mechanism, which comprises orienting elements 6, 7, 8, such as orienting rollers, some of which have been arranged to orient particles coming from the preliminary roller set, possibly via the intermediate roller set, in the transverse direction and some are arranged to orient particles in the longitudinal direction. In conjunction with the orienting elements, guide elements such as guide vanes or the like may be provided.

The apparatus of the invention works as follows. The material 1 to be processed is brought to the beginning of the preliminary roller set. The accelerating roller 2 hurls the material onto the preliminary roller set 3, where the rotation and roller structure of the preliminary rollers cause the material to move on. While advancing on the preliminary roller set 3, material of elongated shape tends to be so oriented that even narrow particles cannot fall down through the gaps between the rollers too early. The rotating rollers, especially in the forepart of the preliminary roller set, cause long particles to rise up from the gaps between the rollers, thus preventing them from falling down too soon, whereas shorter particles S, F can fall down through the gaps between the rollers and thus land on the intermediate roller set 5.

The shorter particles, such as chips, are fractionated by means of the intermediate roller set 5, preferably by size, so that the smallest particles are allowed to fall down through the gaps between the rollers in the forepart of the roller set into the space below the rollers

while the largest particles fall down via the tail end of the roller set. The use of an intermediate roller set 5 makes it possible to prevent the longer chips from being intermingled with the shorter chips and, on the other hand, it allows controlled fractionation of the smallest particles.

The apparatus is preferably provided with a chip orienting mechanism 6, 7, 8 placed below the roller sets 3, 5. The orienting mechanism preferably comprises, as seen in the material feed direction, a first set of orienting elements 6, designed to orient shorter particles S, F, and a second set or orienting elements 7, designed to orient longer particles L and/or S. The first and second orienting rollers 6, 7 are arranged to orient particles in a direction substantially transverse to the direction of motion of the base. Placed after the first and second orienting elements is a set of third orienting elements 8, designed to orient mainly longer particles, in the case illustrated by the figure in a substantially longitudinal direction. The orienting mechanism may also comprise other types of orienting elements besides rollers. Typically, orienting rollers for transverse orientation comprise walls 13, 14 disposed in the lengthways direction of the roller on the roller circumference, forming compartments between them. Placed in the immediate vicinity of the roller circumference is typically a guide wall 11, 12 extending over part of the circumference, so the longitudinal axis of the particles is oriented in the direction of the roller wall while the guide wall keeps the chip in the compartment. In this case, the chip falls onto the base in transverse orientation. The elements 8 for longitudinal orientation of particles may consist of e.g. disc rollers, in which case each roller is provided with discs disposed or formed at a distance from each other and having an outer diameter larger than the outer diameter of the rest of the roller. The discs on adjacent disc rollers may be disposed in an interlapping arrangement. Between adjacent rollers, there are gaps through which particles can fall down onto the base while the disc walls keep the particles substantially oriented in the longitudinal direction of the base. In prior art, widely differing types of orienting devices for both longitudinal and transverse orientation are known. The essential point in the solution of the invention is that the same assembly comprises orienting elements for both transverse and longitudinal orientation of particles.

In the case illustrated by the figure, the scattering base 10 is a scattering belt conveyor, whose direction of motion is from left to right.

Using the procedure and apparatus of the invention, it is possible to produce e.g. a structural product blank as illustrated in Fig. 3, such as a blank for a structural board, from material comprising longer L and shorter S particles and possibly particles F smaller than these, such as chips and/or fibres, and a binding agent, said blank consisting of two surface layers A_1, A_2 and at least one middle layer B_1, B_2, F_1, F_2, between them. The surface layers mainly contain longer particles L, S while the middle layer mainly contains shorter particles S, F. In the case illustrated by the example, the middle layer thus also contains the smallest particles F, the amount of which diminishes from the middle towards the surface layers A_1, A_2 as seen in the cross-section of the blank.

The particles in the surface layer A_1, A_2 are typically mainly oriented in the longitudinal direction. The particles in the middle layer B_1, B_2, F_1, F_2 are typically mainly oriented in the transverse direction. Typically, at least part of the smallest particles F is also oriented.

The smallest particles F are generally smaller than about 25 mm (1"), preferably under 6.25 mm (1/4"). The longest particles L are typically 75 mm - 150 mm (3" - 6") long. The shorter particles are typically under 25 mm - 75 mm (1" - 3") long. The particle lengths and their distribution in the structural product blank depend on the material used and on the structural product blank and its intended use.

It is obvious to the person skilled in the art that the invention is not restricted to the examples of its embodiments described above, but that it can be varied within the scope of the claims presented below. Thus, the principles applied in making the body of the apparatus, providing the rollers with bearings, driving the rollers, and so on, are considered part of the skilled person's ordinary know-how and will not be described here in detail. The widths, diameters and numbers of the roller sets and orienting elements as well as their speeds of rotation are determined according to the capacity needed and the nature of the material to be processed. The thickness of the layers in the structural product blank and the number of layers as well as the sizes and distribution of the particles in different layers depend, among other things, on the intended use and on the material of the particles and its properties.

Claims

1. Procedure for the fabrication of blank for a structural product, such as a blank for a structural board, from material (1) comprising longer (L) and shorter (S) particles and possibly also particles (F) smaller than these, said particles being e.g. chips and/or fibres, in which procedure the particles are mixed with a binding agent and possible additives and passed into at least one blank former, from where the particles are brought onto a base (10), e.g. onto a belt conveyor or into a mould or onto a blank, characterised in that the particles are brought onto the base (10) in given orientations so that at least part of the particles are oriented in a direction substantially differing from the orientation of other particles.

2. Procedure as defined in claim 1, characterised in that at least part of the particles is substantially oriented in the longitudinal direction of the base (10) while part of the particles is substantially oriented in

the transverse direction of the base (10).

3. Procedure as defined in claim 1 or 2, characterised in that at least part of the particles is fractionated by size before being oriented.

4. Procedure as defined in any one of claims 1 - 3, characterised in that longer particles (L) are fractionated by length before being oriented and/or scattered.

5. Procedure as defined in any one of claims 1 - 4, characterised in that the longer particles (L) are brought onto the scattering base (10) either in the same orientation as the shorter particles (S, F) or in a different orientation.

6. Procedure as defined in any one of claims 1 - 5, characterised in that the shorter particles (S) and possibly part of the smallest particles (F) are brought onto the scattering base (10) either in longitudinal orientation or in transverse orientation.

7. Procedure as defined in any one of claims 1 - 6, characterised in that the shorter particles (S) and particles (F) smaller than these are fractionated by size before being oriented and/or scattered.

8. Procedure as defined in any one of claims 1 - 7, characterised in that the smallest particles (F) are so scattered onto the scattering base (10) that they will form the middle layer of the board to be pressed from the blank formed on the scattering base.

9. Procedure as defined in any one of claims 1 - 8, characterised in that the material (1) to be processed is conveyed onto a preliminary roller set (3) in a blank former, to be screened mainly by particle length, permitting at least part of the material being screened to fall down below the plane formed by the rollers through the gaps between them while the possible remainder is passed down over the tail end of the roller set (3), and that at least part of the material falling down below the set of preliminary rollers (3) through the gaps between the rollers, screened by an intermediate roller set (5) disposed under the preliminary roller set (3), is passed via an orienting mechanism (6, 7, 8) onto the scattering base (10), so that, of the material passed onto the intermediate roller set (5), the smallest particles (F, S) are passed through the gaps between the rollers of the intermediate roller set (5) while the longer particles (L) are passed over the tail end of the roller set (5) down below the plane formed by the rollers, by means of the orienting mechanism (6,7,8), onto the scattering base 10, part of the particles being oriented by the orienting mechanism (6, 7, 8) in the longitudinal direction of the base (10) and part in the transverse direction of the base.

10. Apparatus for scattering material (1) containing longer (L) and shorter (S) particles and possibly also particles (F) smaller than these, such as chips and/or fibres, preferably together with a binding agent, onto a scattering base (10), said apparatus comprising a preliminary roller set (3) consisting of at least two substantially parallel, preferably rotating rollers with gaps between them, the material to be processed being supplied onto said roller set from the beginning of the roller set in a direction substantially perpendicular to the longitudinal direction of the rollers, permitting part of the material to fall down through the gaps between the rollers while the rest is passed out via the tail end of the roller set, said apparatus being provided with orienting elements disposed below the preliminary roller set (3), characterised in that some of the orienting elements (6, 7, 8) are arranged to orient particles in a direction substantially different from particles oriented by the other orienting elements while bringing the particles onto the base (10).

11. Apparatus as defined in claim 10, characterised in that some of the orienting elements (6, 7) are arranged to orient particles in a substantially transverse direction while some of the orienting elements (8) are arranged to orient particles in a substantially longitudinal direction while bringing them onto the base (10).

12. Apparatus as defined in claim 10 or 11, characterised in that the orienting elements (6, 7) located foremost in the material feed direction orient particles in the transverse direction while the orienting elements (8) located towards the tail end orient particles in the longitudinal direction.

13. Apparatus as defined in any one of claims 10 - 12, characterised in that the apparatus is provided with mutually different orienting elements (6, 7, 8) for short particles and for long particles.

14. Apparatus as defined in any one of claims 10 - 13, characterised in that it has elements (6, 7) for orienting short particles (S, F) in the forepart of the orienting mechanism as seen in the material feed direction and after them elements (8) for orienting longer particles (L).

15. Apparatus as defined in any one of claims 10 - 14, characterised in that it comprises a second roller set (5) disposed between the preliminary roller set (3) and the orienting elements (6, 7, 8), comprising at least two parallel rollers with gaps formed between the rollers to permit scattering of particles.

16. Apparatus as defined in claim 15, characterised in that the gap between individual rollers in the second roller set (5) is smaller than the gap between individual rollers in the preliminary roller set (3) at substantially the same horizontal position.

17. Apparatus as defined in claim 15 or 16, characterised in that the rollers in the second roller set (5) are cylindrical rollers and/or disc rollers.

18. Apparatus as defined in any one of claims 15 - 17, characterised in that the gaps between the rollers in the second roller set (5) are individually adjustable.

19. Apparatus as defined in any one of claims 10 - 18, characterised in that the apparatus comprises two successive scattering/orienting units, which together constitute a blank forming apparatus for the formation of a blank for a structural product.

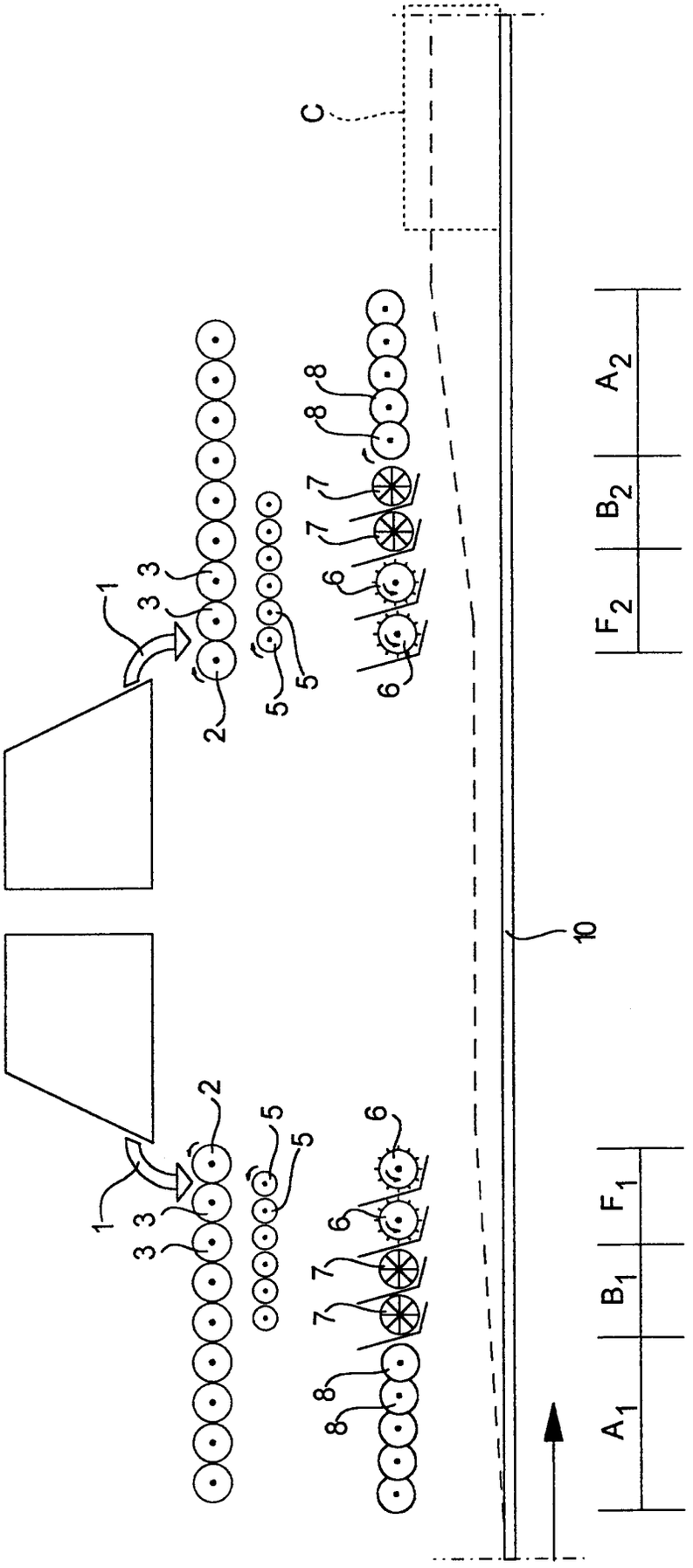

FIG. 1

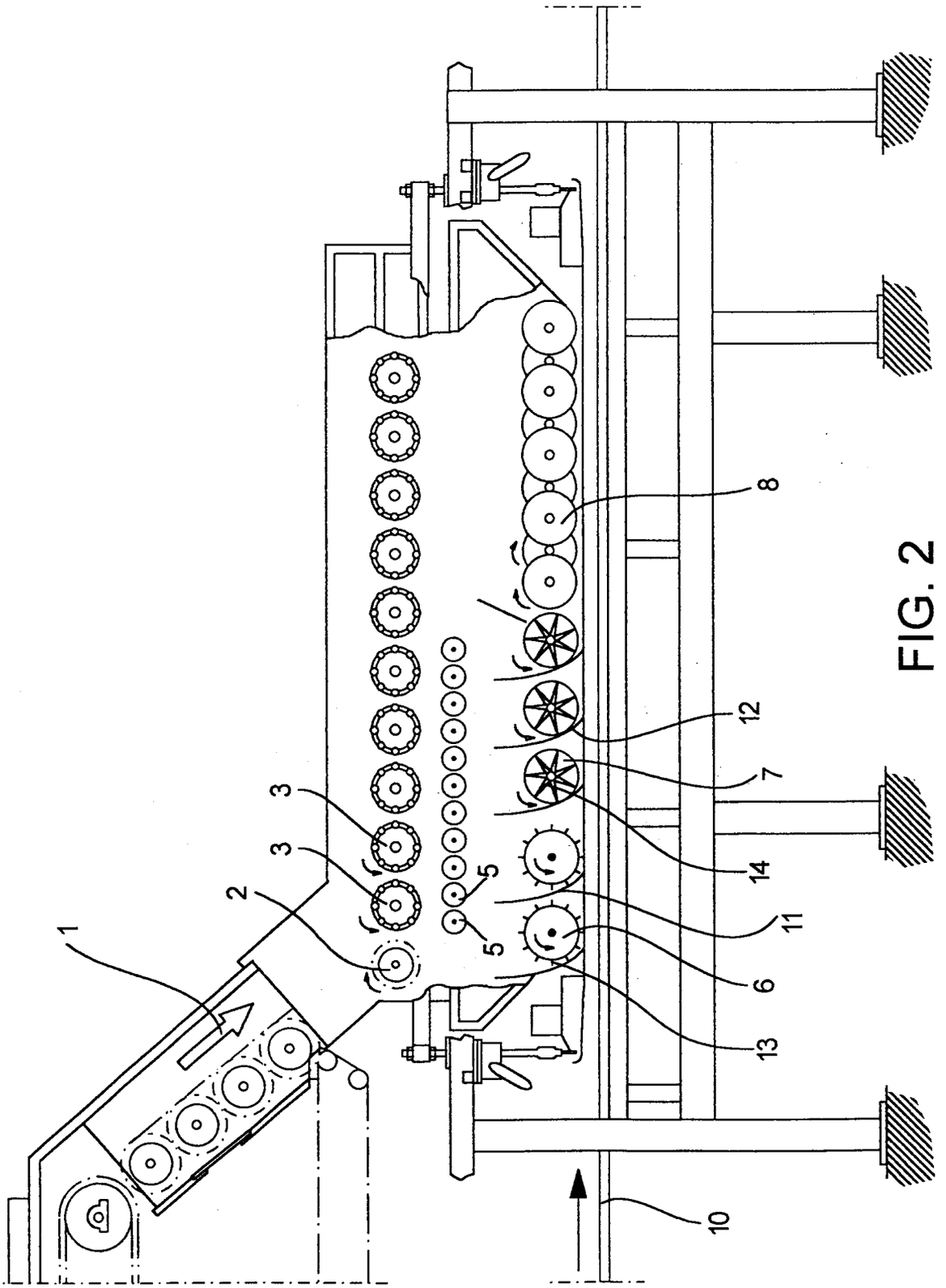

FIG. 2

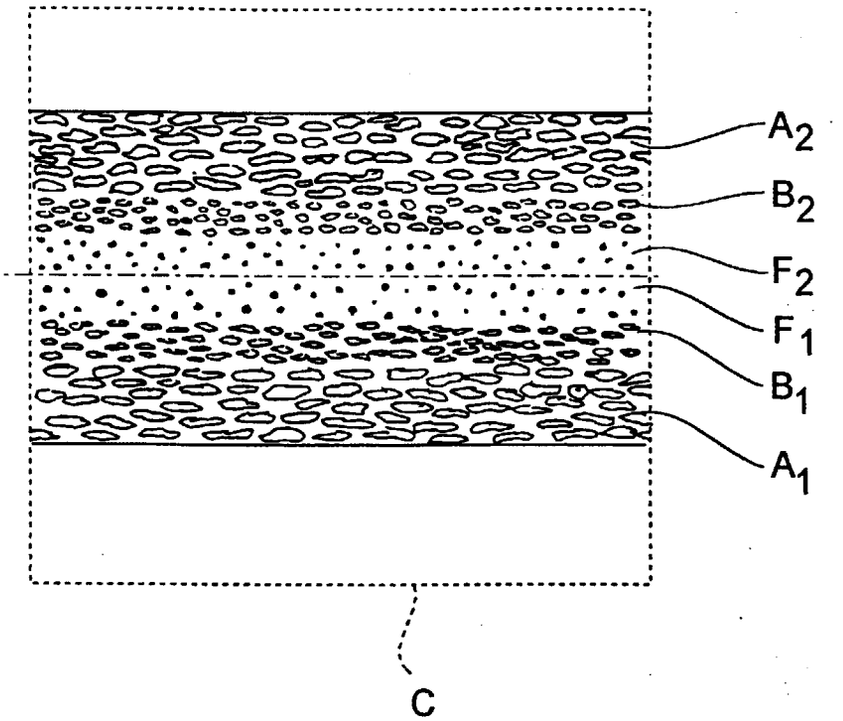

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 0312

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 31 15 728 A (SIEMPELKAMP GMBH & CO) 4 November 1982 * abstract * * page 5, line 4 - page 7, line 2; claims; figures *	1-7, 10-14,19	B27N3/14
A		6-9, 15-18	
X	DE 29 33 593 A (SIEMPELKAMP GMBH & CO) 26 March 1981 * page 6, line 1 - page 7, line 27 * * page 8, line 23 - line 39; claims; figures *	1-7, 10-14	
A		8,9, 15-19	
X	DE 44 34 876 A (DIEFFENBACHER GMBH MASCHF) 4 April 1996 * abstract; claims; figure 3 *	1,2	
A	DE 91 16 262 U (SCHLINGMANN GMBH & CO.) 27 May 1992	8	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	DE 30 17 396 A (SIEMPELKAMP GMBH & CO) 12 November 1981 * figures *	10-19	B27N
A	DE 195 13 306 A (BAEHRE & GRETEN) 10 October 1996 * abstract; figure *	10-19	
A	DE 37 31 322 A (RAUMA REPOLA OY) 31 March 1988		
A	DE 295 07 686 U (TEXPAN SPA) 27 July 1995		
A	DE 28 51 779 A (SIEMPELKAMP GMBH & CO) 4 June 1980		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 May 1998	Soederberg, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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