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(54) **METHOD FOR MANUFACTURING PANELS**

(57) Method for manufacturing panels, wherein the method at least comprises:
- the step of providing semi-finished panels (1A) with at least a substrate (15) and a decorative top layer (18);
- the step (S1) of performing a milling, sawing or scraping operation by means of one or several cutting tools (9) on at least one edge (3-4-5-6) of said semi-finished panels (1A), wherein the semi-finished panels (1A) are moved past said cutting tools (9) via a belt, air or chain conveyor (10) in a processing machine (7A-7B), and their decorative top layers (18) are moved across a sliding shoe (14) at the location of at least one of the cutting tools (9), and/or their sides which are turned away from the decorative top layer are moved past a pressure shoe (13);
characterized in that the semi-finished panels (1A) are provided with a lubricant (22) on the decorative top layer (18) and/or on the side which is turned away from the decorative top layer (18) before or during said step (S1) of performing a milling, sawing or scraping operation.

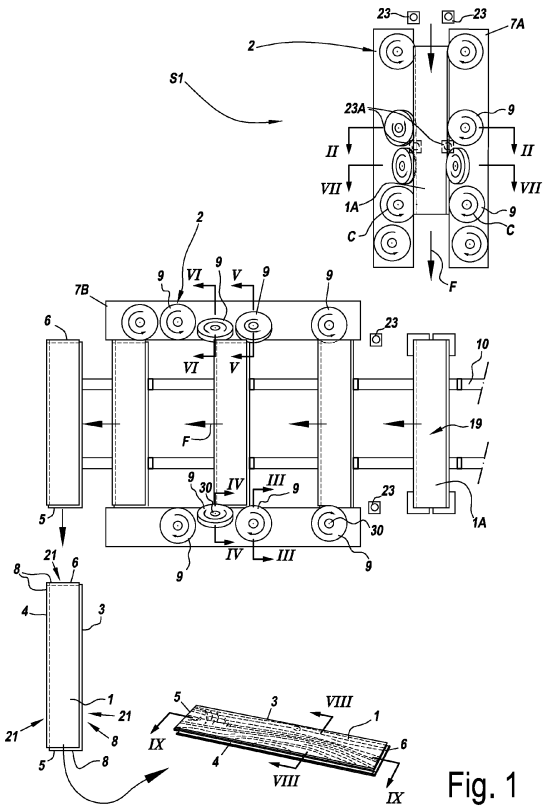

Fig. 1

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Description

[0001] The present invention relates to a method for manufacturing panels, more specifically decorative panels, such as floor panels. In particular, the present invention relates to a method wherein semi-finished panels with at least a substrate and a decorative top layer are subjected to a milling, sawing or scraping operation. This may involve decorative panels which are provided, on two opposite edges, with profiled edge regions which comprise coupling means which make it possible to couple two such panels to each other at the respective edges, wherein, in the coupled state, a locking is achieved in the plane of the panels and perpendicular to the respective edges and/or in a direction perpendicular to the plane of the coupled panels.

[0002] It is known, for example from WO 97/47834, WO 2006/103565 and WO 2011/014113, to form profiled edge regions on opposite edges of semi-finished panels by means of several successive cutting operations using rotating milling tools. These cutting operations may be performed in a continuous milling machine with continuous throughput, or in a so-called double-end tenoner, wherein the panel to be processed is conveyed through the machine, for example by means of an air conveyor, and the rotating milling tools are fitted along the trajectory of the panel edges to be processed. In this case, milling tools may be active on one or both opposite edges which run parallel with the conveying direction.

[0003] It is known from WO 2020/174358, for example, to use pressure shoes and sliding shoes in a continuous milling machine. In this case, the decorative top layers of semi-finished panels to be processed at the location of a cutting tool are moved across a sliding shoe, while their sides which are turned away from the decorative top layer are moved past a pressure shoe. The pressure shoe positions the semi-finished panel against the conveying device which is used as a reference for adjusting the cutting tools. The use of sliding shoes and/or pressure shoes has a positive effect on the accuracy of the cutting operation to be performed, but may cause wear tracks on the panel.

[0004] It is a first object of the present invention to provide an alternative method which offers a solution by means of various preferred embodiments for one or more of the problems from the state of the art.

[0005] To this end, the invention relates to a method for manufacturing panels, wherein the method comprises at least the following steps:

- the step of providing semi-finished panels, wherein these semi-finished panels comprise at least a substrate and a decorative top layer;
- the step of performing a milling, sawing or scraping operation by means of one or several cutting tools on at least one edge of said semi-finished panels, wherein the semi-finished panels are moved in a processing machine past said cutting tools via a belt, air or chain conveyor, and their decorative top layers are moved across a sliding shoe at the location of at least one of the cutting tools, and/or their sides which are turned away from the decorative top layer are moved past a pressure shoe;

with as a characteristic that the semi-finished panels are provided with a lubricant on the decorative top layer and/or on the side which is turned away from the decorative top layer, before or during said step of performing a milling, sawing or scraping operation. By applying a lubricant, the risk of damage to the panel surfaces by contact with the pressure shoes and/or sliding shoes is reduced. It goes without saying that said lubricant is preferably at least applied on the portion of the respective surfaces which is expected to come into contact with a pressure shoe or sliding shoe.

[0006] Preferably, the processing machine uses a chain conveyor for moving the semi-finished panels. A chain conveyor provides an accurate reference surface and is robust. It is for such chain conveyors that the present invention is of greatest importance, since the problems caused by the formation of wear tracks in the semi-finished panels as a result of contact with the sliding shoes and/or pressure shoes are most urgent in this case.

[0007] According to the most preferred embodiment, the lubricant comprises water. It is counterintuitive to use an aqueous lubricant, since the substrate of the semi-finished panels may be sensitive to water, as is the case, for example, when the substrate comprises a wood-based panel, such as MDF or HDF (Medium Density Fibreboard or High Density Fibreboard). Preferably, the lubricant is an aqueous solution, emulsion or suspension. In this way, the lubricant makes it possible to apply solid or more viscous additives by means of the solution, emulsion or suspension thereof in water. Preferably, the water is distilled or demineralized water and/or water with a dry matter content of 5 mg per litre or less. Due to the fact that distilled or demineralized water or water with a dry matter content of 5 mg or less is used, the risk of residue remaining behind on the semi-finished panels after the lubricant has dried is minimized. The water, for example the distilled water or demineralized water, may have an electrical conductivity at 25°C of 10 μS/cm or less. As a result thereof, the risk of electrical short-circuits in the machine can be minimized.

[0008] According to a first practical possibility of the above most preferred embodiment, the lubricant comprises a monovalent, bivalent or polyvalent alcohol, preferably glycol or ethane-1,2-diol. The lubricant may thus be an aqueous solution or emulsion of glycol or ethane-1,2-diol. For example, the water of the solution or emulsion is distilled water, demineralized water and/or water with a dry matter content of 5 mg/l or less. The inventor has found that particularly good sliding properties are achieved, while the lubricant evaporates virtually completely or completely after performing the milling, sawing

or scraping operation, so that the risk of soiling of the panels is minimal. In this case, additional cleaning operations which, as such, could cause damage to the panel surface, can be excluded.

[0009] In the context of said first possibility, a lubricant which is an aqueous solution or emulsion of 1.5% to 15 wt% of a bivalent or polyvalent alcohol or of glycol, preferably 1 to 5 wt%, for example 4 wt% or approximately 4 wt% is preferably used. The limited amount of alcohol or glycol results in an efficient lubricant which has a suitable volatility to remain efficient during the trajectory of the panel through the processing machine and will disappear shortly after the latter has exited the processing machine, so that further processing operations or conveying operations cannot be inhibited in any way by the lubricant.

[0010] According to a second practical possibility of the above most preferred embodiment, the lubricant comprises starch. Thus, for example, the lubricant may be an aqueous suspension of starch, for example a suspension of 1.5 to 15 wt% of starch. For example, the water of the suspension is distilled, demineralized, and/or has a dry matter content of 5 mg/l or less. Such a lubricant is particularly efficient and leaves a readily removable deposit of starch behind on the surface of the panels after drying.

[0011] Preferably, the lubricant is at least applied at the entrance of said processing machine, preferably the lubricant is applied while the semi-finished panels are already situated on the belt, air or chain conveyor. In this way, the lubricant can be applied more accurately, for example substantially on the portion of the respective surfaces which is expected to make contact with a pressure shoe or sliding shoe.

[0012] Preferably, during the step of performing a milling, sawing or scraping operation, said semi-finished panels are moved past at least two cutting tools, and their decorative top layers are moved across a first and second respective sliding shoe at the location of both cutting tools, and/or their sides which are turned away from the decorative top layer are moved past a first and second respective pressure shoe, wherein the lubricant is at least applied at a position between said first and second respective sliding shoe and/or pressure shoe. Applying lubricant between respective sliding shoes, and preferably at several locations along the trajectory of the panel edges through the processing machine, is mainly attractive with volatile lubricants, such as lubricants with a boiling point of 100°C or less, or with less efficient lubricants, such as with a lubricant which consists for at least 98% by weight of water, distilled water, mineralized water or water with a dry matter content of 5 mg per litre or less.

[0013] Preferably, the boiling point of the lubricant, at atmospheric pressure, is in the range from 85 to 120°C, and preferably in the range from 100°C to 120°C. The inventors have found that such a lubricant, for example water with approximately 4% by weight of glycol, remains effective during the trajectory of the panel through the processing machine and disappears shortly after the latter has exited the processing machine.

[0014] Preferably, the lubricant is at least applied by means of one or several spraying, sprinkling or atomizing nozzles, preferably at least at the entrance of the processing machine. According to an alternative, it is also possible to at least use an absorptive medium in contact with the decorative top layer and/or the side of the semi-finished panels which is turned away from the latter, such as with a sponge or cloth, the absorptive medium having absorbed the lubricant and preferably being saturated with the latter. According to yet another alternative, the lubricant is at least applied by means of brushes, for example of the paintbrush type, and/or by means of one or several rollers.

[0015] Preferably, the semi-finished panels are pressed with their decorative top layers against said belt, air or chain conveyor by means of a top pressure device. Preferably, said top pressure device comprises one or several belts. Such a top pressure device is sufficiently flexible to be effective in case of any differences in thickness between successive semi-finished panels. Preferably, the difference in thickness between successive semi-finished panels is limited to a maximum of 0.25 millimetres. By limiting the thickness tolerance, the top pressure device can be adjusted more accurately, so that the risk of excessive wear tracks may be reduced.

[0016] Preferably, said processing machine is a so-called double-end tenoner with continuous throughput, wherein, as mentioned above, a milling or scraping operation is performed by means of one or several cutting tools, preferably simultaneously, i.e. at the same location along the trajectory of the semi-finished panel through the processing machine, on two opposite edges of the semi-finished panels, preferably on both edges by means of one or several sliding shoes, pressure shoes and/or by using a lubricant. Preferably, at least one pair of opposite cutting tools along the trajectory of the semi-finished panel through the processing machine are rotating cutting tools, which are preferably simultaneously active on said opposite edges, wherein the cutting movement of both opposite cutting tools is preferably counter to the conveying movement of the semi-finished panel. The configuration in opposite directions results in a smooth, accurate cutting operation, but to this end, it is desirable for the semi-finished panel to be clamped on the conveying device in a more secure manner, since the risk of wear tracks being produced in such a configuration is increased. It is therefore mainly in opposed milling that the present invention is most effective.

[0017] It will be clear that, in the case of a double-end tenoner, as in the above preferred embodiment, said lubricant is preferably applied at least to opposite portions of the respective surfaces which are in each case expected to be in contact with respective opposite pressure shoes or sliding shoes. In this case, at least two spraying, sprinkling or atomizing nozzles are preferably used, i.e. at least one for each of the opposite portions of the re-

spective surfaces.

[0018] Preferably, said opposite cutting tools are fitted to a first and second drive shaft with a first and second orientation, respectively, which have one of the following properties:

- the property that both drive shafts are oriented vertically or deviate from the vertical by an angle of 10° or less;
- the property that both drive shafts are oriented horizontally or deviate from the horizontal by an angle of 10° or less;
- the property that both drive shafts enclose a first angle and a second angle, respectively, with the vertical, with the first angle being equal to the second angle or deviating from said second angle by less than 10°.

Due to the fact that the angles of both drive shafts of opposite cutting tools virtually correspond to each other, certain components of the cutting forces may be cancelled. In this way, it is possible to prevent in particular excessive moment actions on the semi-finished panel, so that the risk of wear tracks being produced is minimized.

[0019] Preferably, said panels are floor panels, wherein said step of performing a milling, sawing or scraping operation at least results in a profiled edge region on said edge, and preferably in profiled edge regions on two opposite edges. The profiled edge regions preferably comprise coupling means which make it possible for two such panels to be coupled to each other, wherein, in the coupled state, a locking is produced between the respective edges in a vertical direction, perpendicular to the plane of the coupled panels, and in a direction perpendicular to the respective edges and in the plane of the coupled panels. Preferably, said coupling means are substantially configured as a tongue and a groove which is flanked by a lower groove lip and an upper groove lip, wherein said lower groove lip extends in a horizontal direction beyond said upper groove lip. When providing such profiled edge regions, a satisfactory clamping of the semi-finished panel onto the conveying device is of great importance for the accuracy and the correspondingly correct performance of the coupling means. The risk of wear tracks being produced in such a case can be minimized by means of the lubricant of the invention.

[0020] Preferably, said decorative top layer has a decorative print with a translucent or transparent wear layer provided on top thereof. Such a top layer is usually thin, for example thinner than 1 mm, or even thinner than 0.5 mm. In this case, wear tracks may adversely affect the transparency of the wear layer and deep wear tracks may even adversely affect the decorative print. Such decorative top layers can be made in many ways in practice. Below, an enumeration of some practical possibilities is given, but this is not meant to be exhaustive.

[0021] According to a first practical possibility, said transparent wear layer comprises at least a thermosetting resin, preferably melamine formaldehyde, and preferably an alpha cellulose paper or an unfilled paper, for example having a weight of between 10 and 60 grams per square metre, preferably between 15 and 40 grams per square metre, and preferably hard particles. Preferably, said decorative print is provided on a decorative paper sheet with a weight of between 50 and 90 grams per square metre, preferably between 60 and 75 gram per square metre. Such a decorative top layer may involve a DPL ("Direct Pressure Laminate") or HPL (High Pressure Laminate).

[0022] Preferably, said step of providing semi-finished panels for panels with a decorative top layer according to the first practical possibility comprises at least the following substeps:

- the substep of providing said alpha cellulose paper or unfilled paper with thermosetting resin, wherein hard particles are provided in this substep by means of a scattering operation on at least one side of the alpha cellulose paper or unfilled paper provided with resin;
- the substep of forming a stack comprising at least a wood-based substrate, the decorative paper sheet with a decorative print, and the alpha cellulose paper or unfilled paper provided with resin and hard particles, wherein the side on which the hard particles have been provided by means of said scattering operation is directed towards the decorative print;
- the substep of compressing said stack by means of a heated press.

Scattering hard particles makes it possible to achieve an improved wear resistance of the surface of the panels, and because the scattered hard particles are turned towards the decorative print, the risk of damage to the sliding shoes and the subsequent risk of wear tracks can be minimized.

[0023] Preferably, said hard particles have an average particle size of between 20 and 200 micrometres, as determined using the laser-light scattering granulometry technique. It is mainly with such large particles that possible wear effects on the sliding shoes have to be taken into account. However, due to the fact that these particles are preferably screened off from the sliding shoes by means of at least, for example, alpha cellulose paper and the resin applied thereto, the risk of such wear effects and subsequent wear tracks on the panels can be minimized. The laser-light scattering granulometry is performed in accordance with ISO 13320, i.e. with a dynamic light scattering technique using a laser with an emission wavelength of 632.8 nm and measured at a scattering angle of 90°. In this case, for example, a Malvern® Mastersizer 2000 or a Malvern® Mastersizer 3000 may be used. In order to perform the measurement of the particle size distribution, the particles may be dispersed in a liquid, such as water.

[0024] According to a second practical possibility, said transparent wear layer comprises at least a thermoplastic material, preferably polyvinyl chloride or polypropylene or polyethylene. Preferably, said decorative print is provided on a thermoplastic film, for example a polyvinyl chloride film, a polypropylene film or a polyethylene film. The surface of the decorative top layer may be formed by a polyurethane or an acrylate lacquer which is preferably cured by radiation, such as UV and/or excimer radiation. Such a surface may be scratch-sensitive, and a lubricant may reduce the risk of scratches being produced on the decorative side of the panel during production.

[0025] In the case of panels with a decorative top layer in accordance with the first or second practical possibility, the side of the panels or semi-finished panels which is turned away from the decorative top layer may be formed by a foamed synthetic bottom layer, for example made of polyethylene or of polyvinyl chloride. Such a bottom layer is susceptible to embossments from the pressure shoes. Applying a lubricant to one or more portions of the bottom layer which are expected to come into contact with the pressure shoes is advantageous to prevent portions being ripped out of the bottom layer.

[0026] In general, panels with a soft bottom side may become damaged by contact with the pressure shoes. The use of a lubricant is therefore also of interest in the manufacture of panels, where the side of the panels or semi-finished panels which is turned away from the decorative top layer has a Shore A hardness of less than 85, measured according to ISO 48-4:2018.

[0027] Preferably, the semi-finished panels are rectangular and oblong, with said edge being an edge of the pair of long opposite edges. Preferably, the method furthermore comprises the step of performing a milling, sawing or scraping operation on at least one edge of the pair of short opposite edges. Before or during this step, a lubricant is preferably provided on the decorative top layer and/or on the side which is turned away from the decorative top layer. The lubricant and the way wherein it is provided may be identical or similar to that of the pair of long edges.

[0028] Preferably, the surface of the decorative top layer has at least portions with a gloss degree of 10 or less, measured according to DIN 67530. Such a matt top layer is highly susceptible to developing wear tracks, and it is here that the present invention is most useful.

[0029] Also in the case of glossy panels, for example panels wherein the surface of the decorative top layer has at least portions with a gloss degree of more than 10, more than 15 or more than 20, measured according to DIN 67530, it is advantageous to apply the solution. Glossy panels may have dull spots in the parts of the decorative top layer where the sliding shoes have touched the panel. A lubricant may prevent excessive loss of gloss.

[0030] According to one particular embodiment, the present invention furthermore comprises the step of diluting a solution for obtaining said lubricant. The dilution is preferably performed in the immediate vicinity of the processing machine. Thus, for example, an aqueous solution of 40 wt% of glycol may be diluted to produce a lubricant which substantially consists of an aqueous solution of 4 wt% or approximately 4 wt% of glycol. This may for example be carried out by means of a water-driven metering pump, such as by means of a metering pump of the commercially available brand Dosatron®, or by means of a venturi.

[0031] In order to show the features of the invention in more detail, some preferred embodiments are described below by way of example and without being limited thereto, with reference to the accompanying drawings, wherein:

Fig. 1 diagrammatically shows a method according to the invention;

Figs. 2 to 7 show cross sections along lines II-II; III-III; IV-IV; V-V; VI-VI and VII-VII illustrated in Fig. 1; and

Figs. 8 and 9 show a cross section on an enlarged scale of the panels produced by means of the method from Fig. 1, and along the lines VIII-VIII and IX-IX illustrated in Fig. 1.

[0032] Fig. 1 diagrammatically shows how panels, more specifically floor panels 1, can be obtained by means of a method wherein, in a step S1, a milling operation is performed by means of a set 2 of cutting tools, in this case rotating milling tools 9 on at least one edge, and in this case on all edges 3-4-5-6.

[0033] The method in the illustrated example is a method for manufacturing rectangular floor panels 1 with a pair of long opposite edges 3-4 and a pair of short opposite edges 5-6.

[0034] As is illustrated in Fig. 1, the semi-finished floor panels 1A are provided with profiled edge regions 8 by means of two processing machines, more specifically continuous milling machines 7A-7B, both along their pair of long opposite edges 3-4 and on their pair of transverse or short opposite edges 5-6. In this case, so-called "continuous milling" is used. First, the semi-finished panels 1A with their pair of long opposite edges 3-4 are moved across the mechanical cutting tools 9 or milling tools. Subsequently, their short or transverse opposite edges 5-6 undergo similar processing operations.

[0035] Fig. 2 shows how such semi-finished panels 1A may be conveyed through the first processing machine 7A. To this end, the machine 7A of the example has a chain conveyor 10 and a top pressure device with belts, more specifically top belts 11, just like the machine 7B for processing the pair of short opposite edges 5-6. The semi-finished panels 1A are upside down, namely with their decorative sides 12 facing downwards, bearing against the chain conveyor 10. At the location of their edges 3-4, the panels 1 are pushed onto the sliding shoes 14 with their decorative sides 12 by means of pressure

shoes 13.

[0036] In one step (not shown), the illustrated semi-finished panels 1A are provided and in this case consist of laminate material of the "DPL" type, but as has been explained in the introduction, it is clear that the invention is not limited to the manufacture of panels 1 consisting of such a material.

[0037] The illustrated laminate material comprises a substrate 15, a decor layer 16, and a so-called overlay 17 or wear layer, wherein the decor layer 16 and overlay 17 together form the decorative top layer 18 and the decorative side 12 and consist of paper sheets impregnated with synthetics which are pressed onto the substrate 15, and wherein the decor layer 16 is also provided with a decorative print. The substrate 15 consists, for example, of a wood-based material, such as MDF or HDF. On their bottom sides 19 which are in this case, during the formation of the profiled edge regions 8, oriented upwards, the panels 1 are provided with a balance layer 20, which consists of a support sheet soaked in resin.

[0038] Fig. 2 shows that the profiled edge regions 8 to be formed on the pair of long opposite edges 3-4 of the floor panels 1 comprise coupling means or coupling parts 21, by means of which two such panels 1 can be coupled to each other along the respective edges 3-4. This is also the case with the profiled edge regions 8 of the pair of short opposite edges 5-6 to be formed.

[0039] The particular feature of the present invention is that the semi-finished panels 1A are provided with a lubricant 22 before or during said step S1 of performing the milling operation, in this case at least on the decorative top layer 18 or decorative side 12. To this end, spray nozzles 23 are provided at the entrance of the continuous milling machines 7A-7B. Alternatively, or in combination, it is also possible to provide spray nozzles 23A at a position between sliding shoes 14 and/or pressure shoes 13 in order to apply lubricant 22.

[0040] In relation to the spray nozzles 23 of the processing machine 7B, it should be noted that, in the example, these are active at a position wherein the semi-finished panels 1A are already situated on the chain conveyor 10.

[0041] The lubricant 22 is preferably an aqueous solution of glycol, for example approximately 4 wt% of glycol.

[0042] Figs. 3 and 4 show how the male coupling part 24 of the profiled edge region is formed on the edge 5. This involves a male coupling part 24 which can be fitted into a female coupling part 25 on the opposite edge 6 by means of a rotating movement W and/or a horizontal sliding movement S, as will be illustrated further in Figs. 8 and 9. The female coupling part 25 on the opposite short edge 6 is likewise formed in the same continuous milling machine 7B, as is illustrated in Figs. 5 and 6.

[0043] In the continuous milling machine 7B, a male coupling part 24 and a female coupling part 25 are produced on the short opposite edges 5-6 which are provided with horizontally active locking surfaces 27-28 which, in the coupled state, produce a locking in a horizontal direction H perpendicular to the respective edges and in the plane of the coupled panels 1. In the example, a locking is also produced in said coupled state between the male coupling part 24 and female coupling part 25 in a vertical direction V, perpendicular to said plane.

[0044] In addition, Fig. 7 shows an operation by means of opposite cutting tools 9 for forming the coupling means 21 on the pair of long opposite edges 3-4.

[0045] Figs. 1 to 7 clearly show that said processing machines 7A-7B are double-end tenoners with continuous throughput, wherein performing a milling operation by means of cutting tools 9 takes place simultaneously, namely at the same location along the trajectory of the semi-finished panel 1A through the respective processing machine 7A-7B, on two opposite edges 3-4; 5-6 of the semi-finished panels 1A, and, in this case, in each case by means of one or several sliding shoes 14, pressure shoes 13 and by using lubricant 22.

[0046] Fig. 1 furthermore also shows that the cutting movement C of one or several of the cutting tools 9, and in this case of all cutting tools 9, is counter to the conveying movement F of the semi-finished panels 1A.

[0047] Furthermore, Figs. 2 and 7 clearly show that opposite cutting tools 9-9A are fitted to a first and second drive shaft 30 with a first and a second orientation, respectively, in each case driven by a motor M. In the case of Fig. 2, both drive shafts 30 are oriented in such a way that they deviate by 10° or less from the vertical. In the case of Fig. 7, the drive shafts 30 enclose a first angle A1 and a second angle A2 with the vertical, with the first angle A1 being equal to the second angle A2 or deviating from said second angle A2 by less than 10°. In the example, similar properties are available for the orientation of the drive shafts 30 from the Figs. 3-5 and 4-6.

[0048] Fig. 8 shows the resultant profiled edge regions 8 on the pair of long opposite edges 3-4. In the example, these are identical or similar to the resultant profiled edge regions 8 of the pair of short opposite edge regions 5-6 and illustrated in Fig. 9.

[0049] It should be noted that the panels 1 in Figs. 8 and 9 are floor panels which are shown here in their orientation of use, namely with the decorative side 12 directed upwards.

[0050] The male coupling parts 24 and female coupling parts 25 of the profiled edge region 8 are substantially configured as a tongue 40 and a groove 41, respectively. The groove 41 is in this case delimited by means of a lower lip 42 and upper lip 43, wherein the lower lip 42 to be formed in the example extends beyond the upper lip 43. The illustrated male and female coupling parts 24-25 result in a coupled state of at least two of said floor panels 1, both in a horizontal direction H and in a vertical direction V in a mutual locking of the respective panels 1. In this case, the cooperation between the tongue 40 and the groove 41, in the coupled state, produces said locking in the vertical direction V. The horizontally active locking surfaces 27-28 are formed on a wall of a locking groove

44 which is provided on the bottom side of the tongue 40, and on a wall of a locking portion 45 which is situated on the top side of the lower lip 42 and extends upwards, respectively. The lower lip 42 extends beyond the upper lip 43 in the distal direction, and said upwardly extending locking portion 45 is provided on that portion of the lower lip 42 which extends beyond the distal end 46 of the upper lip 43.

[0051] In the example, the coupling parts 21 of both the pair of long opposite edges 3-4 and the pair of short opposite edges 5-6 are configured to form a single part made from the same material as the rest of the panel 1.

[0052] The present invention is by no means limited to the embodiments described by way of example and illustrated in the figures, but such methods may be brought about in various ways without departing from the scope of the invention.

Claims

1. Method for manufacturing panels, wherein the method comprises at least the following steps:

   - the step of providing semi-finished panels (1A), wherein these semi-finished panels (1A) comprise at least a substrate (15) and a decorative top layer (18);
   - the step (S1) of performing a milling, sawing or scraping operation by means of one or several cutting tools (9) on at least one edge (3-4-5-6) of said semi-finished panels (1A), wherein the semi-finished panels (1A) are moved in a processing machine (7A-7B) past said cutting tools (9) via a belt, air or chain conveyor (10), and their decorative top layers (18) are moved across a sliding shoe (14) at the location of at least one of the cutting tools (9), and/or their sides which are turned away from the decorative top layer are moved past a pressure shoe (13);

   characterized in that the semi-finished panels (1A) are provided with a lubricant (22) on the decorative top layer (18) and/or on the side which is turned away from the decorative top layer (18), before or during said step (S1) of performing a milling, sawing or scraping operation.

2. Method in accordance with Claim 1, **characterized in that** the lubricant (22) comprises glycol, for example wherein the lubricant is an aqueous solution or emulsion of glycol.

3. Method in accordance with Claim 2, **characterized in that** the lubricant (22) is an aqueous solution or emulsion of 1.5% to 15 wt% of glycol, preferably 1 to 5 wt%, for example 4 or approximately 4 wt%.

4. Method in accordance with one of the preceding claims, **characterized in that** the lubricant (22) is at least applied at the entrance of said processing machine (7A-7B), preferably wherein the semi-finished panels (1A) are already situated on the belt, air or chain conveyor (10).

5. Method in accordance with one of the preceding claims, **characterized in that** the semi-finished panels (1A) in the step (S1) of performing a milling, sawing or scraping operation are moved past at least two cutting tools (9), and their decorative top layers (18) are moved across a first and second respective sliding shoe (14) at the location of both cutting tools (9), and/or their sides which are turned away from the decorative top layer (18) are moved past a first and second respective pressure shoe (13), wherein the lubricant (22) is at least applied at a position between said first and second respective sliding shoe (14) and/or pressure shoe (13).

6. Method in accordance with one of the preceding claims, **characterized in that** the lubricant (22) is at least applied by means of one or several spraying, sprinkling or atomizing nozzles (23-23A).

7. Method in accordance with one of the preceding claims, **characterized in that** the semi-finished panels (1A) are pressed with their decorative top layers (18) against said belt, air or chain conveyor (10) by means of a top pressure device, wherein the top pressure device for example comprises one or several belts (11).

8. Method in accordance with one of the preceding claims, **characterized in that** said processing machine (7A-7B) is a so-called double-end tenoner with continuous throughput, wherein, as mentioned above, a milling, sawing or scraping operation is performed by means of one or several cutting tools (9), preferably simultaneously, on two opposite edges (3-4;5-6) of the semi-finished panels (1A), preferably on both edges by means of one or several sliding shoes (14), pressure shoes (13) and/or by using a lubricant (22).

9. Method in accordance with Claim 8, **characterized in that** at least one pair of opposite cutting tools (9) are rotating cutting tools, which are preferably simultaneously active on said opposite edges (3-4; 5-6), wherein the cutting movement (C) of both opposite cutting tools (9) is preferably counter to the conveying movement (F) of the semi-finished panel (1A).

10. Method in accordance with Claim 8 or 9, **characterized in that** said opposite cutting tools (9) are fitted to a first and second drive shaft (30) with a first and second orientation, respectively, which have one of

the following properties:

- the property that both drive shafts (30) are oriented vertically or deviate from the vertical by an angle of 10° or less;
- the property that both drive shafts (30) are oriented horizontally or deviate from the horizontal by an angle of 10° or less;
- the property that both drive shafts (30) enclose a first angle (A1) and a second angle (A2), respectively, with the vertical, with the first angle (A1) being equal to the second angle (A2) or deviating from said second angle by less than 10°.

11. Method in accordance with one of the preceding claims, **characterized in that** said panels are floor panels (1), wherein said step (S1) of performing a milling, sawing or scraping operation at least results in a profiled edge region (8) on said edge (3-4-5-6), and preferably in profiled edge regions (8) on two opposite edges (3-4; 5-6), wherein the profiled edge regions (8) comprise coupling means (21) which make it possible for two such panels (1) to be coupled to each other, wherein, in the coupled state, a locking is produced between the respective edges (3-4; 5-6) in a vertical direction (V), perpendicular to the plane of the coupled panels (1), and in a direction (H) perpendicular to the respective edges (3-4; 5-6) and in the plane of the coupled panels.

12. Method in accordance with Claim 11, **characterized in that** said coupling means (21) are substantially configured as a tongue (40) and a groove (41) which is flanked by a lower groove lip (42) and an upper groove lip (43), wherein said lower groove lip (42) extends in a horizontal direction beyond said upper groove lip (43).

13. Method in accordance with one of the preceding claims, **characterized in that** said decorative top layer (18) has a decorative print with a translucent or transparent wear layer (17) provided on top thereof.

14. Method in accordance with Claim 13, **characterized in that** said transparent wear layer (17) comprises at least a thermosetting resin, preferably melamine formaldehyde, and preferably an alpha cellulose paper with a weight of between 10 and 60 grams per square metre, preferably between 15 and 40 grams per square metre, and preferably hard particles.

15. Method in accordance with one of the preceding claims, **characterized in that** said lubricant is at least applied on the portion of the respective surfaces which is expected to come into contact with a pressure shoe or sliding shoe.

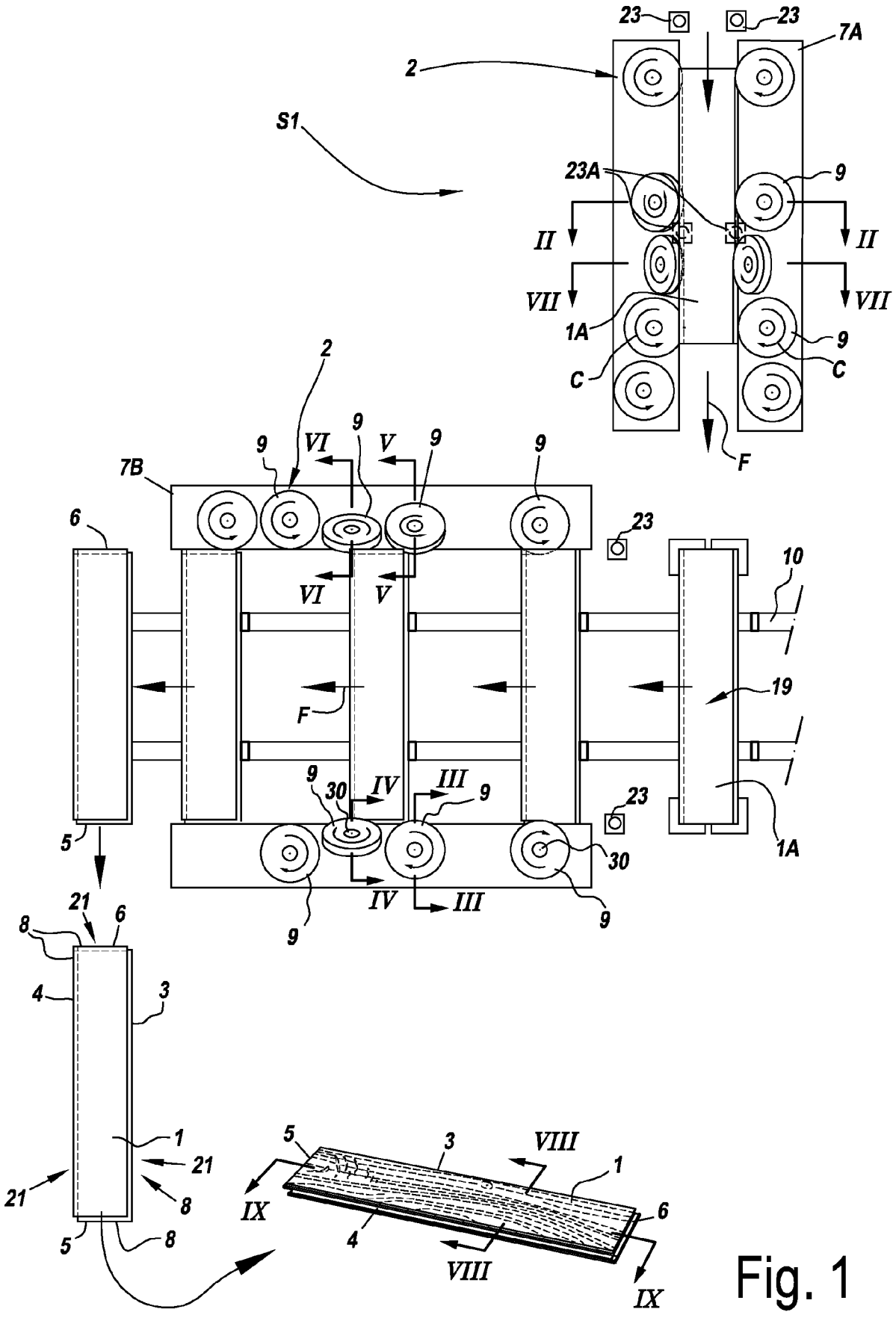
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Fig. 1

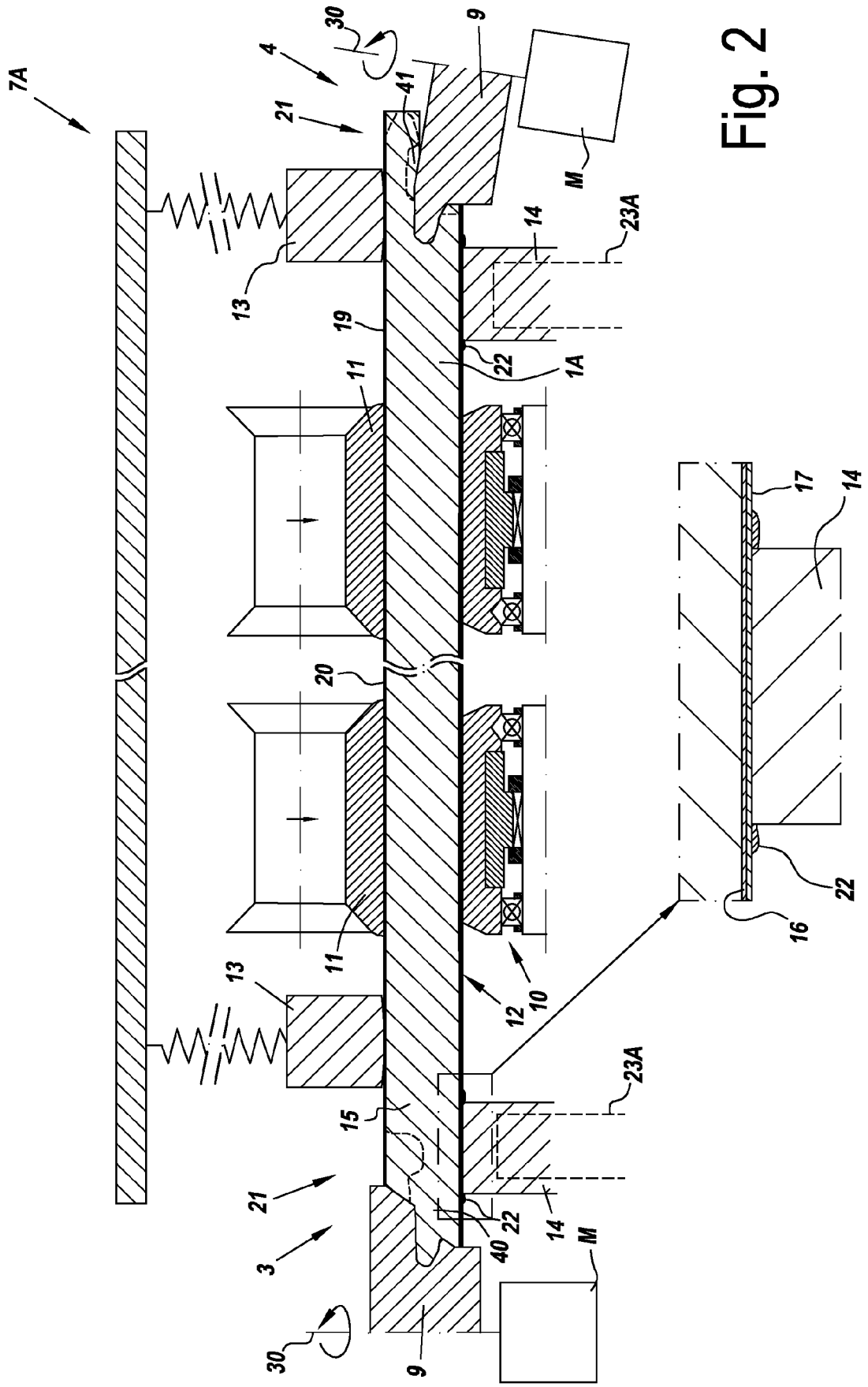
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Fig. 2

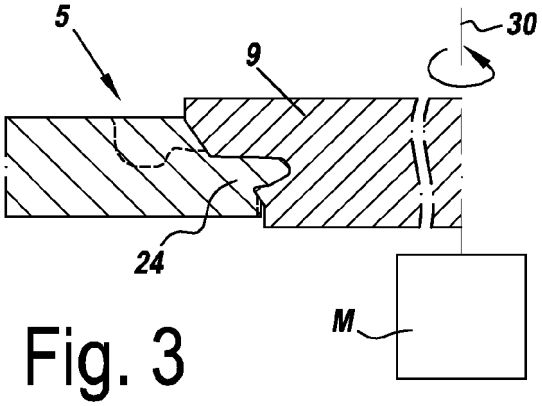

Fig. 3

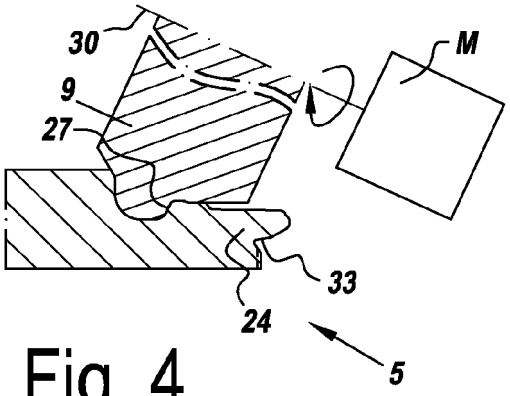

Fig. 4

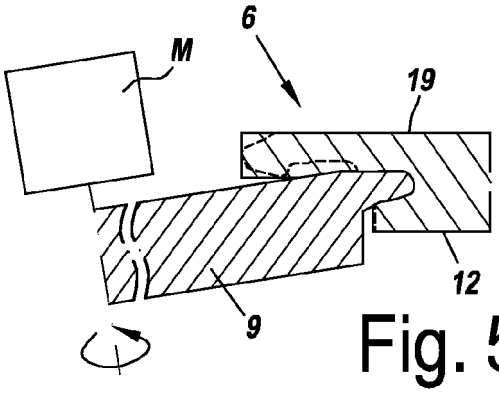

Fig. 5

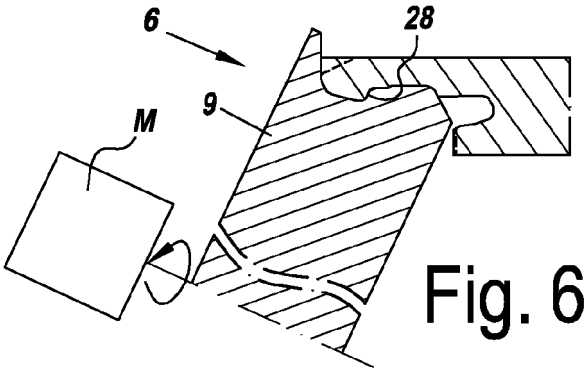

Fig. 6

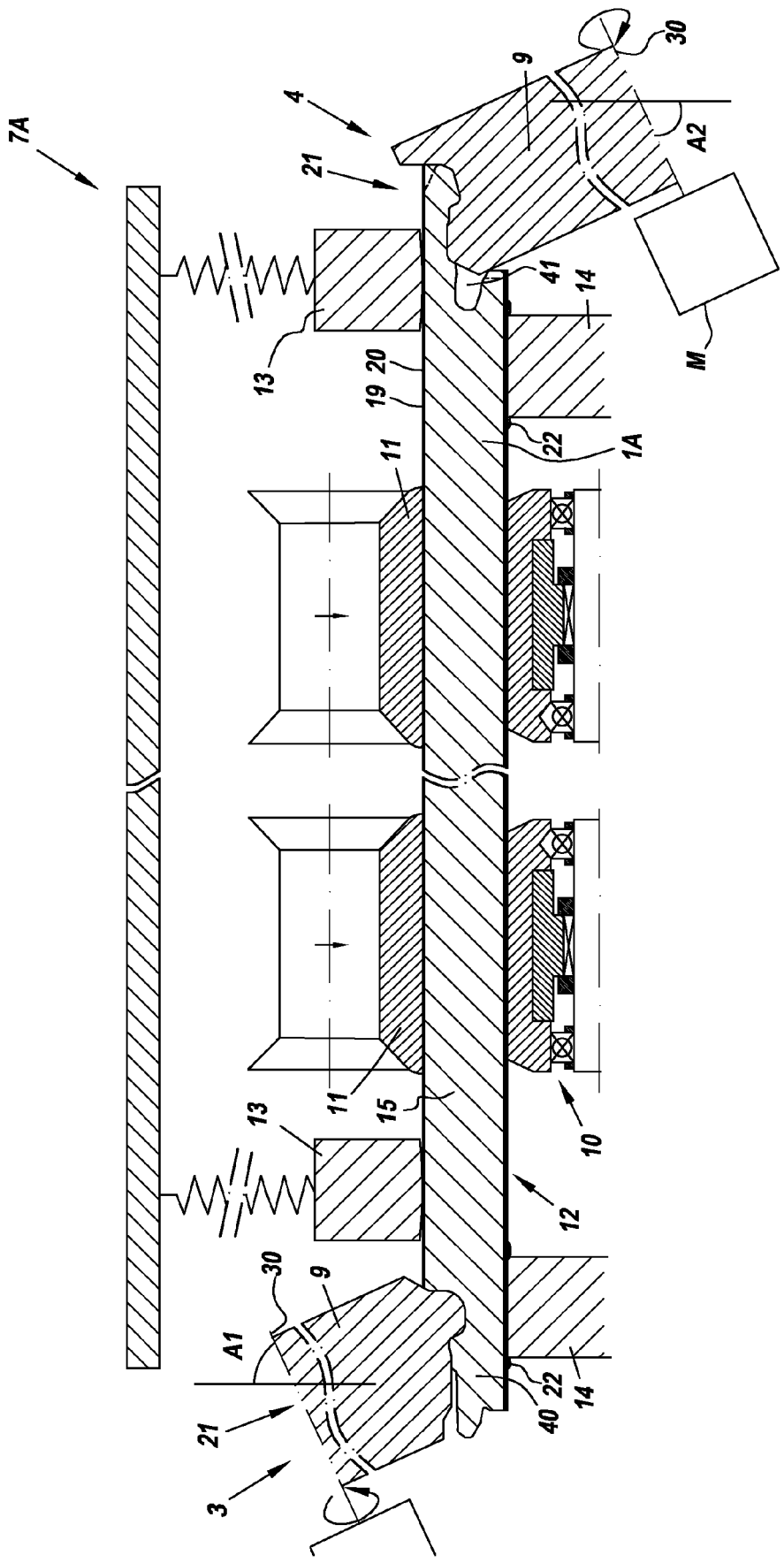

Fig. 7

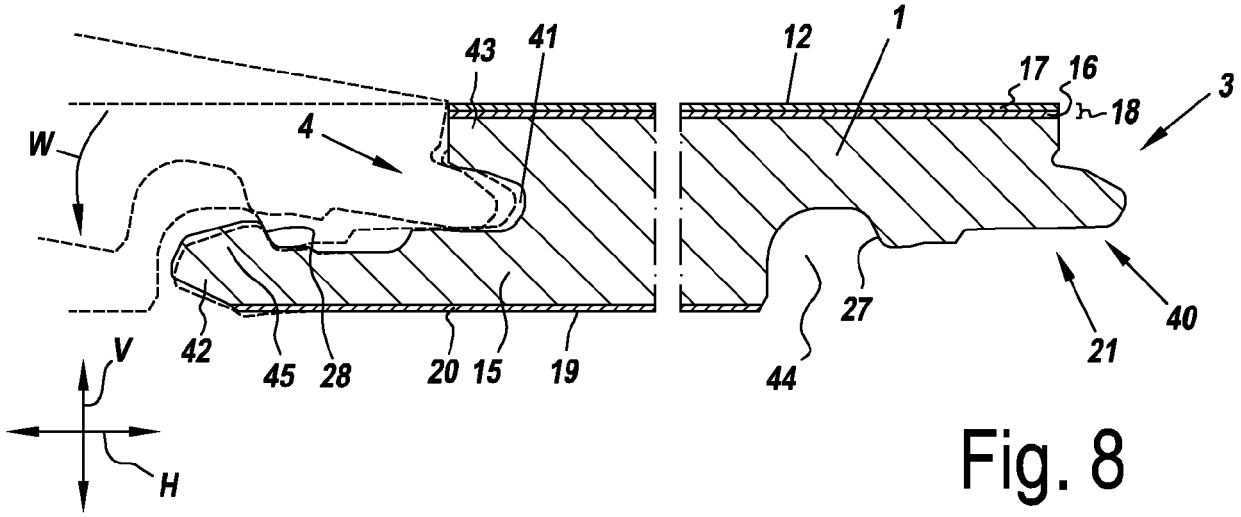
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Fig. 8

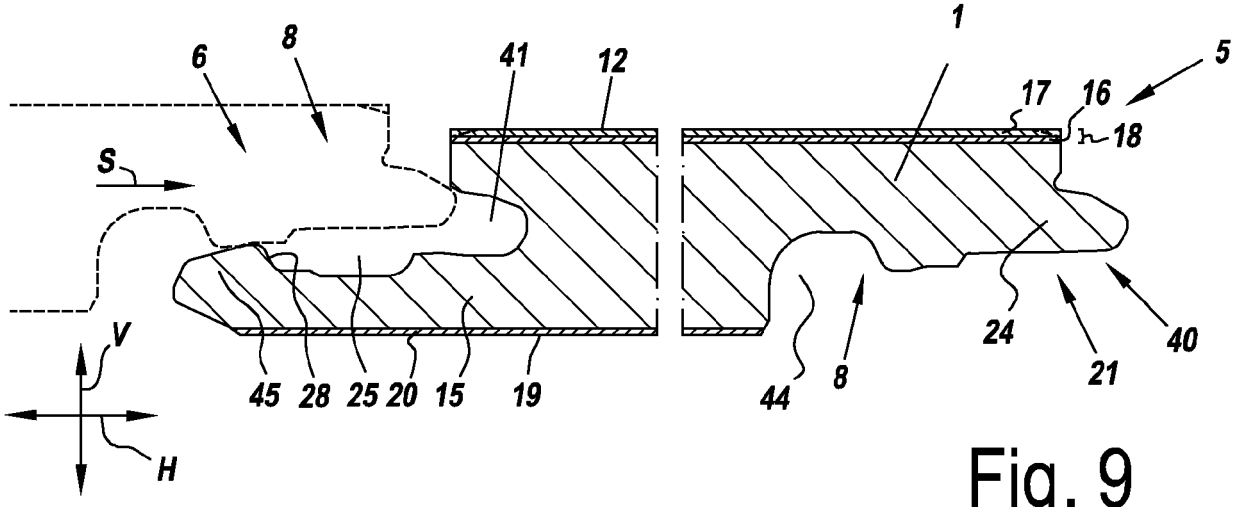
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Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 23 21 4695

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 March 2024	Mirza, Anita

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