(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 406 697 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.07.2024 Bulletin 2024/31

(21) Application number: **23153095.7**

(22) Date of filing: **24.01.2023**

(51) International Patent Classification (IPC):
B24B 7/00 *(2006.01)* ***B24B 7/06*** *(2006.01)*
C09D 5/34 *(2006.01)* ***E04F 21/165*** *(2006.01)*
B32B 21/04 *(2006.01)* ***B32B 21/14*** *(2006.01)*
B32B 43/00 *(2006.01)* ***B44C 5/04*** *(2006.01)*
B24B 49/14 *(2006.01)* ***B24B 55/02*** *(2006.01)*
B24B 7/28 *(2006.01)* ***B27G 1/00*** *(2006.01)*
B32B 38/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B24B 7/005; B24B 7/06; B24B 7/28; B24B 49/14; B24B 55/02; B32B 43/00; E04F 21/1652;
B05D 1/40; B27G 11/00; B27M 1/02;
B32B 2038/0064

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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(54) **METHOD AND APPARATUS FOR SMOOTHING PUTTY**

(57) According to an example aspect of the present invention, there is provided an apparatus and a method for smoothing putty on plywood panel (10. The apparatus comprises a frame (12), a smoothing instrument (13) mounted on the frame (12, and elements (8, 9) connected to the frame (12) for supporting the weight of the smoothing apparatus. Further, cylindrical roll (13) mounted rotatably on the frame (12) as a smoothing instrument and an actuator (14) for rotating the cylindrical roll (13) and a liquid passage (18) within the cylindrical roll (13) for circulating liquid through the cylindrical roll (13) for controlling the surface temperature of the cylindrical roll (13) are arranged.

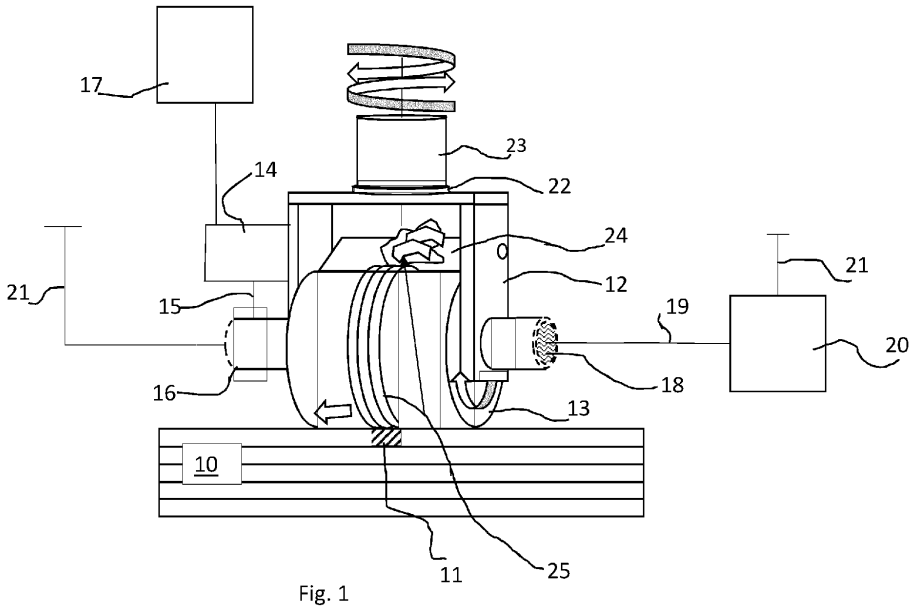

Fig. 1

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Description

FIELD

[0001] The invention relates to the technical field of automatic and semi-automatic panel processing equipment, in particular to a putty or paste smoothing method and device. More specifically, invention relates to smoothing putty on plywood panel or other wooden planar materials. The putty may have been either ready dosed on the panel or being dosed within this device with an integrated dosing equipment

BACKGROUND

[0002] Plywood panels are made for several purposes. The types of plywood used for constructing a high quality finished surface have at least one surface made of selected veneer ply in order to give the level of quality needed for the intended purpose. Sometimes this surface ply may have defects such as scratches, branch holes and cracks. These defects may be repaired by filling them with a putty or paste material that is smoothed on the defect. Usually the defect is opened or prepared by a suitable tool. Normally, the putty is dosed precisely into a defect such as an open hole, scratch, rip or a tooled opening on the panel surface (with a regulated volume, temperature and viscosity, having a volume little higher than the opening is). After dosing the putty is smoothed. The putties used must be resistant to wear and damages when set. This leads to use of putties that are highly sticky and difficult to smooth and scrape form a surface. Residual putty may be left on the sides of the defect or the putty may rise slightly above the surface of the panel. Now, when the panels are stacked, the unset putty may soil the panel stacked above it and even glue the panels together requiring separation by force. The putty also sticks easily to smoothing and spreading tools and even clothes if contacted. For these reasons, there is a need for a new method and tool for smoothing the putty.

SUMMARY OF THE INVENTION

[0003] The invention is defined by the features of the independent claims. Some specific embodiments are defined in the dependent claims.

[0004] According to a first aspect of the present invention, there is provided an apparatus for smoothing putty on plywood panel, comprising:

- a frame,
- a smoothing instrument mounted on the frame, and
- - elements connected to the frame for supporting the weight of the smoothing apparatus for keeping the smoothing instrument above the surface of the plywood panel,
- a cylindrical roll mounted rotatably on the frame as a smoothing instrument,
- an actuator for rotating the cylindrical roll, and
- a liquid passage within the cylindrical roll for circulating liquid through the cylindrical roll for controlling the surface temperature of the cylindrical roll.

[0005] According to a second aspect of the present invention, there is provided a method for smoothing patty spread on a surface of a plywood panel, the method comprising:

- moving a cylindrical roll over the spread patty,
- rotating the cylindrical roll when it passes over the spread patty, and
- controlling the surface temperature of the cylindrical roll during smoothing.

[0006] Some further aspects of the invention that are combinable with the first aspect as single features or in any combination are:

- the apparatus comprises a temperature controlling unit for controlling the temperature of the liquid used for adjusting the temperature of the cylindrical roll,
- the smoothing instrument is a cylindrical roll having a smooth surface, preferably of steel, stainless steel, acid resistant steel, chromium or nickel,
- the apparatus comprises an angle actuator for rotating the cylindrical roll around and axle perpendicular to its rotating axle,
- the apparatus comprises a scraper set on the surface of the cylindrical roll for removing patty from the cylindrical roll,
- the elements for supporting the weight of the apparatus are a 3D-portal,
- the temperature of the surface of the cylindrical roll is set from -5 - +60°C. The temperature control unit is used for controlling the temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIGURE 1 illustrates a smoothing device in accordance with at least some embodiments of the present invention;

FIGURE 2 illustrates schematically a plywood repair-

ing station in a top view;

FIGURE 3 illustrates the repairing station of FIGURE 2 in side view.

EMBODIMENTS

DEFINITIONS

[0008] In the present context, the term "smooth" is a surface having only random deformations caused by roughness of the surface without any regular patterns of form.

[0009] Plywood is in this context a panel of wooden material having at least one veneer ply on at least one surface of the panel.

[0010] The invention relates to the technical field of automatic and semi-automatic panel processing equipment, in particular to a temperature regulated putty or paste spreading and smoothing device. The putty may be either ready dosed on the panel or being dosed within this device with an integrated dosing equipment. The smoothing apparatus is usually fixed to a linear 3D mechanism, a 3D portal, which 1) provide accurate and stable movement in horizontal, lateral and spreading direction; 2) allows power supply and automation connection for the device.

[0011] In order to more fully understand the invention, the process of repairing defects on plywood is described below. The description is based on PUULEVYTEOLLISUUS - study book, 2017, Ritva Varis, Suomen Sahateollisuusmiesten Yhdistys ry ja Suomen Puuteollisuusinsinöörien Yhdistys ry.

[0012] The plywood structure is formed in the lay-up process, where the dry graded and prepared veneers are glued and laid up crosswise. The best quality veneers are set as the top and bottom face veneers (’plys’). The lay-ups move via pre-press to hot press, where the plywood gets its form, thickness and strength. The panels discharged from the press are stacked into bundles, which are fed onto the trimming and sawing line. Surface defects on panels can be repaired before sawing but normally, the first sawn panels are next inspected, repaired, sanded and packed for delivery.

[0013] Surface defects on panels are repaired in the finishing phase before sanding. Manual repairing with putty (pic. below) has been replaced by automatic repairing lines that can be used for both birch and softwood plywood.

[0014] Defects repaired in top/bottom ply include usually:

- Knot holes
- Resin pockets
- Bark pockets
- Bleed-through of glue
- Dents
- Overlaps
- Cracks

[0015] The surfaces of birch plywood normally require less repairing than softwood plywood. The average number of defects on birch faces is less than 5, whereas the number of defects on softwood faces is two or three times that.

[0016] In this example, the panels are placed on a unrepaired panel stack 4. The panels are first inspected by the gluing quality with the glue bond ultrasonic detector (blow detector) and next, the visual quality in top/bottom ply is inspected. The inspection is made on both surfaces (top and bottom) of the panel where as quality parameters are determined in the customer order, and performed in accordance with the standards’ quality requirements or special requirements agreed with the customer.

[0017] In an automatic panel repair line the panel surface is imaged with a 3D-scanner 6, after which the panels are transferred to the repairing station (FIGS. 2 and 3) on a conveyor 7. The operation of the line is based on machine vision, which detects and analyses the defects on the panel surface and provide coordinates for the repair cell(s).

[0018] The repairing unit(s) open the defects by milling cell 1 and in individual putty dosing cell 2 fills them with putty. The residuals from milling are sucked into the wood dust collector. The putty is normally a general-purpose wood putty with short curing time. The filling robot at the putty dosing cell 2 can also be equipped with a doser for 2-component polyurethane or epoxy putty. UV-curing putty for engineered hardwood flooring products can also be used in the repairing cells.

[0019] After repairing one side the panel it is either stacked into bundles or turned upside down right away and followed the same procedure for the other side. Finally, the ready panel is stacked into bundles on repaired panel stack 5 and taken into curing storage before sanding.

[0020] Not depending of putty material, after dosing it becomes very sticky and is causing problems in any attempt to spread it even on the panel surface. Without evening up the putty can stick to another panel in the stack or press a dent to the other panel causing sanding fault in the next stage.

[0021] Latest integrated dosing solutions with 1-component epoxy putty are getting dirty from the spreading knob but keeping still functional a couple of hours and the spreading quality is getting worse as well. Spreading knob is a just fixed ring-shaped structure around the dosing tube from various materials, plastic, composite etc. For polyurethane there is no spreading tool used because of the material curing reactivity.

[0022] Panel temperature and work environment conditions variation cause more problems with putty sticking and spreading.

[0023] In the example of FIGURES 2 and 3, the putty is smoothed out and the spreading is finalized by smoothing tool 3. The panels are transferred between successive cells and tools 1, 2, 3 by a conveyor 7. The milling tools, dosing tools and smoothing tool are arranged on a 3D-portal placed over the conveyor 7. Tools at each of the cells 1, 2, 3 are mounted on a bridge beam 8 that can be moved along a set of sidetracks 9. Tools may move also along the bridge beam 8 and in vertical direction towards and away from the conveyor and panel places on the conveyor. This allows 3D-movement for performing the reparation steps. As the typical size of panels is 1550x3100 and thickness under 15 mm, the portal has to be able to cover such an area.

[0024] FIGURE 1 illustrates a smoothing apparatus in accordance with at least some embodiments of the present invention.

[0025] The panel that is treated is depicted with reference number 10 and 11 depicts the repair area filled with putty. The smoothing apparatus has a frame 12 that in this example is formed as a U-shaped fork. A cylindrical roll 13 is mounted between the branches of the fork so that is can be rotated around its longitudinal axis by an actuator 14. The actuator is preferably an electric motor connected through a gear box 15 to the axle 16 of the cylindrical roll 13 but pneumatic or hydraulic actuators can be used if such power is easily available.

[0026] The actuator is operated by a controller 17 that sets the speed or rotation and also rotating direction, if needed. The axle 16 is hollow forming a liquid connection inside the cylindrical roll 13 through a channel 18. The inflow line 19 is depicted schematically as 19. The liquid is fed to the cylindrical roll 13 through the inflow line 19 connected to the channel 18 in the axle 16. In order to control the temperature of the cylindrical roll 13, more precisely the temperature of the surface of thereof, the temperature of the liquid is adjusted in the temperature control unit 20. The liquid flows in a closed circuit wherein the outflow from the cylindrical roll 13 is arranged through the axle 16 in a similar way as the inflow. A return line 21 circulates the liquid back to the temperature control unit 20. The temperature control unit may be any commercially available or custom made unit capable of cooling or heating a and circulating liquid. Cooling is preferable, but not always needed.

[0027] The smoothing apparatus is mounted on the 3D-portal through attachment ring 22. The mounting setup includes an angle actuator 23 that is arranged to rotate the smoothing apparatus and consequently the cylindrical roll 13 around an axis that is perpendicular to the central axis of the cylindrical roll 13. The angle actuator 23 is used to set the smoothing angle over the repair area 11. An electric step motor or other actuator capable of precise setting is usable as such actuator. The smoothing may be performed longitudinally, sideways or in an angle over the repair area 11 by setting the position of the cylindrical roll 13 by the angle actuator 23. By changing the angle also the rotating direction of the cylindrical roll 13 in relation to the direction of its linear movement can be changed by rotating the cylindrical roller minimum 180°.

[0028] A scraper 24 is arranged against the surface of the cylindrical roll 13 for cleaning the putty stuck in the surface of the cylindrical roll 13. When operated, the cylindrical roll 13 is rotated on a desired operating speed and transferred over the repair area 11. The excess putty 25 is collected on the surface of the cylindrical roll and collected away by the scraper 24. The scraper 24 is a conventional scraper blade or knife.

[0029] For controlling the rotating speed of the cylindrical roll 13, the temperature of the circulating liquid and the angle actuator 23, the same controller 17 may be used. This controller may be a unit operating only the smoothing apparatus or it may be the control unit of the repair line, for example.

[0030] Normally, the putty is dosed precisely into a defect such as an open hole, scratch, rip or a tooled opening on the board surface with a regulated volume, temperature and viscosity. In practise the volume dosed is little higher than the volume of the opening. Therefore, the excess has to be smoothed ad removed.

[0031] The cylindrical roll 13 of the apparatus is kept in a certain temperature by circulating liquid (water&glykole, for example) through canals tooled inside the cylindrical roll. The cylindrical roll rotates on the surface of the board and is touching the panel surface only with . The linear mechanism controller, for example a 3D-portal described above, provides a given height, surface location and direction of movement according to the detection information from the 3D-scanner. The rotating direction and angle may differ. The roll spreads the putty by pressing and smoothens it by rotating into the defect to the level of the surface of the panel and the excess material sticks to the roll surface. The excess material is cleaned from the roll by the mechanical clamp or knife and collected to a waste or reuse bucket.

[0032] Instead of a 3D-portal, other devices for supporting and moving the smoothing apparatus are applicable. Any robot having sufficient number of axels of movement is suitable or a support compensating the weight of the apparatus so that it can be operated by hand can be contemplated. The rotating speed of the cylindrical roll 13 is preferebly adjustable in order to set is according to the transfer/working speed of the cylindrical roll.

[0033] The operating temperature is between 20 - 60°C so that the temperature of the panel is within said limit. Typical temperature is 30°C. The spreading and smoothing temperature of the putty is adjustable between 20 - 60°C so that the composition of the putty is between flexibly pasty and close to liquid.

[0034] The cylindrical roll 13 is preferably totally of metal and the surface is smooth without any tooled formations. Full metal construction is preferable as metals con-

duct heat well. However, composite structures may be contemplated, for example a roll having a surface coating of nickel or chromium alloys, or for example an aluminium alloy body and coated outer surface.

[0035] The width of the roll is typically such that it extends 20 mm over the largest size of the defect to be repaired. Thus, the width of the roll varies according to the size of the apparatus. Typically, the dimensions of the roll might be 60 mm x 55 mm and the size of the defects that are repaired 1 - 50 mm.

[0036] Even though wood dust and putty residues are quite safe and not harmful for workers, the risks of contamination are reduced even further as the operation is automated.

[0037] FIGURE 3 illustrates an example apparatus capable of supporting at least some embodiments of the present invention.

[0038] It is to be understood that the embodiments of the invention disclosed are not limited to the particular structures, process steps, or materials disclosed herein, but are extended to equivalents thereof as would be recognized by those ordinarily skilled in the relevant arts. It should also be understood that terminology employed herein is used for the purpose of describing particular embodiments only and is not intended to be limiting.

[0039] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment.

[0040] As used herein, a plurality of items, structural elements, compositional elements, and/or materials may be presented in a common list for convenience. However, these lists should be construed as though each member of the list is individually identified as a separate and unique member. Thus, no individual member of such list should be construed as a de facto equivalent of any other member of the same list solely based on their presentation in a common group without indications to the contrary. In addition, various embodiments and example of the present invention may be referred to herein along with alternatives for the various components thereof. It is understood that such embodiments, examples, and alternatives are not to be construed as de facto equivalents of one another but are to be considered as separate and autonomous representations of the present invention.

[0041] Furthermore, the described features, structures, or characteristics may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of lengths, widths, shapes, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention can be practiced without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

[0042] While the forgoing examples are illustrative of the principles of the present invention in one or more particular applications, it will be apparent to those of ordinary skill in the art that numerous modifications in form, usage and details of implementation can be made without the exercise of inventive faculty, and without departing from the principles and concepts of the invention. Accordingly, it is not intended that the invention be limited, except as by the claims set forth below.

[0043] The verbs "to comprise" and "to include" are used in this document as open limitations that neither exclude nor require the existence of also un-recited features. The features recited in depending claims are mutually freely combinable unless otherwise explicitly stated. Furthermore, it is to be understood that the use of "a" or "an", i.e. a singular form, throughout this document does not exclude a plurality.

INDUSTRIAL APPLICABILITY

[0044] The invention is applicable in wood working industry.

REFERENCE SIGNS LIST

[0045]

1	milling cell
2	putty dosing cell
3	smoothing tool
4	unrepaired panel stack
5	repaired panel stack
6	3D-scanner
7	conveyor
8	bridge beam
9	side track
10	panel
11	repair area
12	frame
13	cylindrical roll
14	electric motor
15	gear box
16	axle
17	controller
18	channel
19	inlow line
20	temperature control unit
21	21 return line
22	attachment ring
23	angle actuator
24	scraper
25	excess putty

Claims

1. An apparatus for smoothing putty on plywood panel (10), comprising:

   - a frame (12),
   - a smoothing instrument (13) mounted on the frame (12, and
   - elements (8, 9) connected to the frame (12) for supporting the weight of the smoothing apparatus,

   characterized of

   - a cylindrical roll (13) mounted rotatably on the frame (12) as a smoothing instrument,
   - an actuator (14) for rotating the cylindrical roll (13), and
   - a liquid passage (18) within the cylindrical roll (13) for circulating liquid through the cylindrical roll (13) for controlling the surface temperature of the cylindrical roll (13).

2. An apparatus according to the claim 1, wherein the apparatus comprises a temperature controlling unit (20) for controlling the temperature of the liquid used for adjusting the temperature of the cylindrical roll (13).

3. An apparatus according to the claim 1 or 2, wherein the smoothing instrument is a cylindrical roll (13) having a smooth surface, preferably of steel, stainless steel, acid resistant steel, chromium or nickel.

4. An apparatus according to any of the claims 1 - 3, wherein the body of the cylindrical roll (13) is of metal.

5. An apparatus according to any of the claims 1 - 4, comprising an angle actuator (23) for rotating the cylindrical roll around and axle perpendicular to its rotating axle.

6. An apparatus according to any of the previous claims, comprising a scraper (24) set on the surface of the cylindrical roll (13) for removing patty from the cylindrical roll (13).

7. An apparatus according to any of the previous claims, wherein the elements for supporting the weight of the apparatus are a 3D-portal (8, 9).

8. A method for smoothing patty spread on a surface of a plywood panel, comprising:

   - moving a cylindrical roll over the spread patty,
   - rotating the cylindrical roll when it passes over the spread patty, and
   - controlling the surface temperature of the cylindrical roll during smoothing.

9. A method according to the claim 8, comprising setting the temperature of the surface of the cylindrical roll (13) from-5- +60°C.

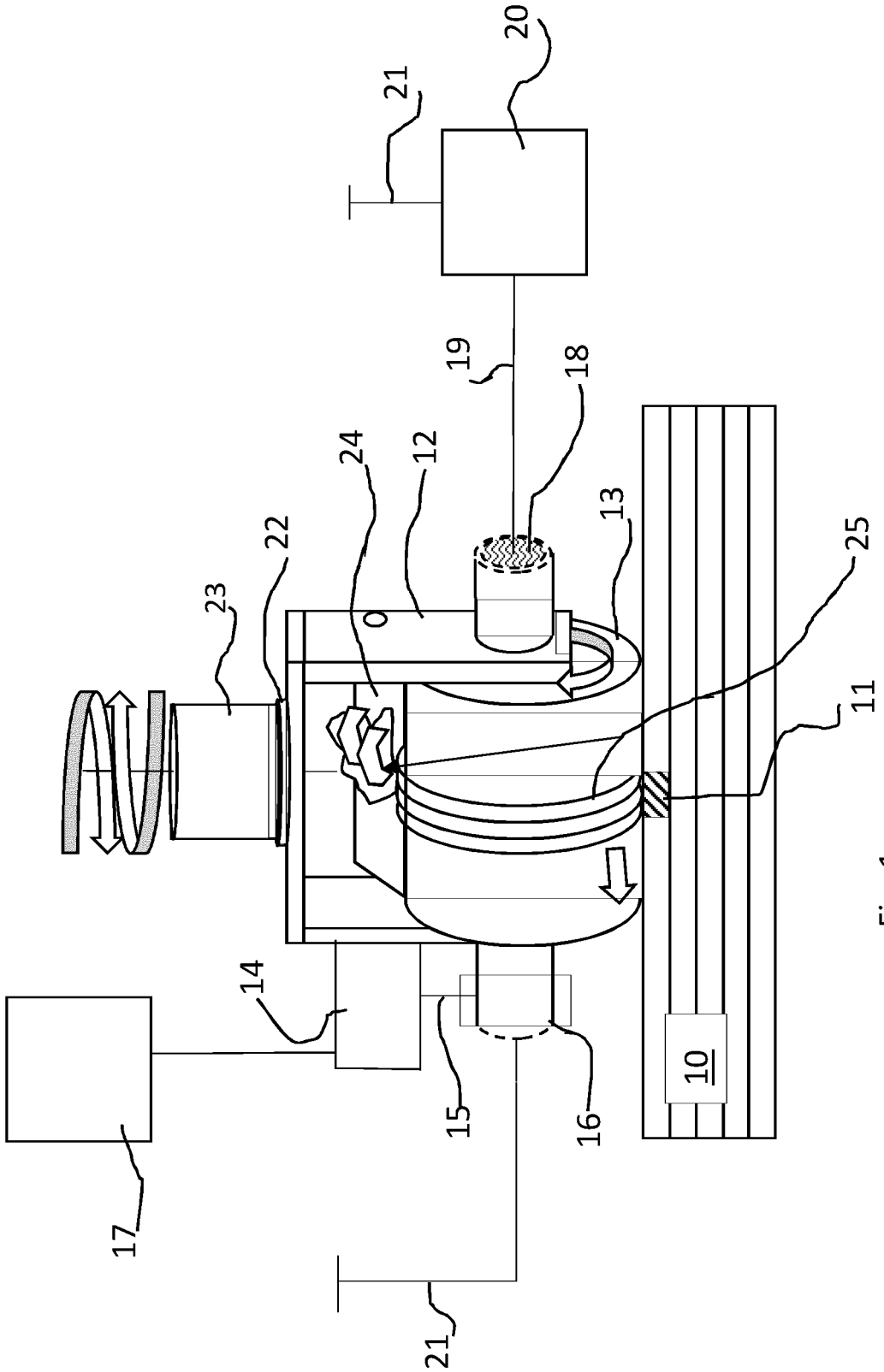

Fig. 1

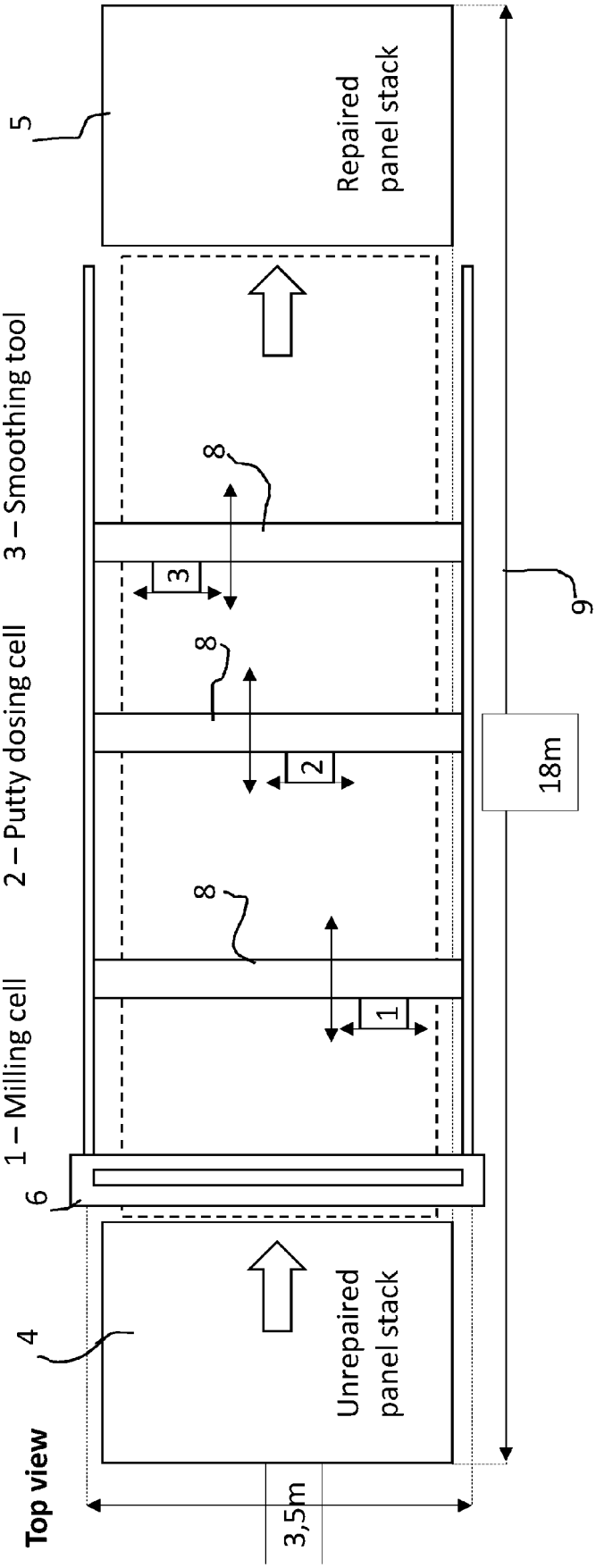
Top view
4
Unrepaired panel stack
5
Repaired panel stack
6
1 – Milling cell
2 – Putty dosing cell
3 – Smoothing tool
8
8
8
1
2
3
9
18m
3,5m

Fig. 2

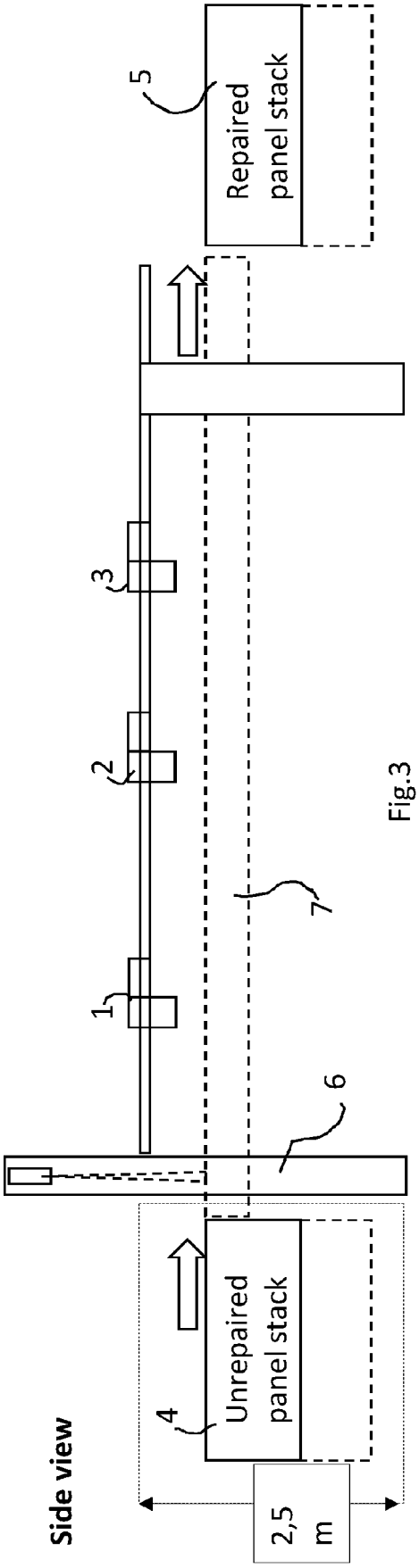
Side view
Repaired panel stack
Unrepaired panel stack
2,5 m
1
2
3
4
5
6
7

Fig.3

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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 3095

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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
Munich	26 June 2023	Herrero Ramos, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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