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MAGYARORSZÁG
Szellemi Tulajdon Nemzeti Hivatala

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(72) Feltaláló(k):
SCHIEGL, Walter, A-6380 St. Johann in Tirol (AT)

(73) Jogosult(ak):
Fritz Egger GmbH & Co. OG, 6380 St. Johann in Tirol (AT)

(74) Képviselő:
SBGK Szabadalmi Ügyvivői Iroda, Budapest

(54) **Lemez előállítására szolgáló eljárás, valamint az eljárás szerint előállított lemez**

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A method for producing a sheet and subsequently produced sheet

The invention concerns a two-stage method for the manufacture of a laminated panel, in which a base panel and a coating layer are manufactured separately, wherein the following steps are executed in sequence:

- preparation of a plurality of cellulose fibre webs, provided with an impregnation, and not pressed together,

- formation of a layered arrangement,

- traversing of the layered arrangement into a hot press,

- application of pressure to the layered arrangement with increasing pressure and temperature to form a base panel with a thickness of 2 mm and more,

- traversing of the base panel out of the hot press, and

- coating of the base panel.

A corresponding method is, for example, of known art from US 5,662,761. In the method of known art circuit boards are manufactured by creating a layered arrangement from fibre webs and intermediate laminated panels, and pressing them together. The laminated panels are manufactured in a previous separate step of the operation, as a result of which this method is relatively complex.

From the prior art laminated panels of known art consist of a plurality of layers of core papers impregnated with phenolic resin, on at least one face of which is provided a

decorative paper impregnated with melamine resin, wherein the thus coated layers are pressed together under increased pressure and increased temperature to form a compact panel. For the purpose of increasing the wear resistance another transparent paper lay, the so-called overlay paper, can be provided on the decorative paper. In the case of more stringent requirements with regard to rubbing resistance and/or cracking resistance the latter can also be equipped with hard particles, for example, of corundum (α-Al_2O_3).

The fundamental properties, testing regulations, and requirements on these so-called high-pressure decorative laminates (HPL) are defined in the European Standard EN 438 Parts 1 to 7. Here an essential distinction is made between thicknesses of 2 mm and more, and those of less than 2 mm. The latter are provided for the purpose of adherence to a substrate, while panels that are thicker than 2 mm as a rule are deployed without a substrate, that is to say they are self-supporting. The present invention preferably relates to pressure laminates, also called laminated panels, with a thickness of 2 mm and more, and their manufacture, but is not limited to the latter.

The range of deployment of laminated panels is very diverse. Thus the latter as so-called laminates are today widely used in furniture construction, as a coating layer for surfaces that are subject to greater stresses, such as working panels, or edges, as so-called compact panels, but also as self-supporting table panels, partition walls, or wall coverings. However, their application is also very widespread in the outdoors environment, for example for the cladding of facades.

For the manufacture of high-pressure laminates kraft papers impregnated with phenolic resin forming a core, and decorative papers impregnated with melamine resin forming a decorative surface, are layered and pressed together at an increased temperature. The temperatures thereby applied as a rule are of the order of 130°C, with specific pressing pressures of 8 to 10 MPa. Usually in the manufacture of laminated panels recooling presses are deployed, which before the press is opened cool the panels so as to reduce the vapour pressure present as a result of the residual moisture retained at high

temperatures. An excessive vapour pressure in the panel would at the moment of opening the press otherwise lead to cracking of the same. Presses that allow for a recooling of the pressed item, are however very expensive to procure, and moreover are subject to very high thermal loadings as a result of the frequent changes in temperature, which have a negative effect on their service life.

Melamine resins have a lower thermal stability than phenolic resins. At high pressing temperatures discolourations of the decorative designs impregnated with melamine resin can therefore occur. In this context, one talks also of yellowing. The pressing temperature is thus also limited for this reason.

To avoid the described vapour blast effect it has been recommended in DE 25 46 115 A1 that a porous layer permeable to water vapour be provided on the face of a layer stack to be pressed together that is facing away from the decorative design.

It is therefore the object of the present invention to provide a method for the manufacture of a laminated panel, and a corresponding laminated panel, with which an optimal quality of the panel is ensured in the simplest possible manner.

In accordance with a first teaching of the present invention the above derived and demonstrated object is achieved by means of a method for the manufacture of a laminated panel with the features of claim 1. The object is therefore achieved by a method of the type cited in the introduction, in that the layered arrangement is formed by arranging the cellulose fibre webs provided with the impregnation one above another, wherein the layered arrangement formed from the cellulose fibre webs is traversed into the hot press and under increased pressure and temperature is pressed together to form the base panel with a thickness of 2 mm and more, wherein after the coating operation a compact panel in accordance with the European Standard EN 438 is obtained.

The object is also achieved in accordance with a second teaching of the present invention by means of a laminated panel with the features of patent claim 12. The object is therefore achieved by means of a compact panel in accordance with the European Standard EN 438, manufactured by means of a method as previously described, containing

- a base panel of a thickness of 2 mm and more with a plurality of cellulose fibre webs provided with an impregnation, arranged one above another and pressed together under increased pressure and increased temperature, and

- a separately applied coating layer on at least one face of the base panel.

Advantageous configurations of the inventive method and the inventive laminated panel are the subject matter of the subordinate claims and are described in detail in what follows.

The very significant point, in contrast to the prior art, consists in the fact that the laminated panel is manufactured by means of a 2-stage process. The production of the base body, that is to say the base panel, and the coating layer takes place separately. With this process there are indeed disadvantages on account of the additional coating operation, but these are more than compensated for by the more rapid production of the base body that is thus possible. In addition, the limitation to the coating in terms of a decorative paper thus no longer exists; instead almost any number of other coating methods of known art can be applied. Appropriate pre-treatments in terms of grinding, smoothing, in particular thermal smoothing, and/or the application of initial coatings, primers and/or undercoats can potentially take place. For selected coating layers a plasma treatment of the surfaces can also be advantageous. Also for various coating layers it can be of advantage if the layered arrangement from which the base panel is formed has at least one cellulose fibre web without impregnation, preferably such that the layered arrangement on one face, and/or on both faces, is provided with an outer

lay, which is formed from at least one cellulose fibre web without impregnation. In this manner a better adhesion of a coating layer is ensured.

The reduced pressing time of laminates manufactured in this manner ensues on the one hand as a result of the lack of a decorative paper impregnated with melamine resin, and the higher pressing temperature of 155 °C, preferably of more than 185 °C, particularly preferably of more than 205 °C, that is thereby possible. In the case of decorative papers impregnated with melamine resin such high pressing temperatures would lead to discolourations/yellowings, as a result of which these products would be unusable.

A further advantage lies in the possibility to grind the base panel before the application of the coating layer, as a result of which significantly smaller thickness tolerances ensue than is the case for conventional laminates. Moreover, these circumstances are extremely advantageous, in particular because it is thus possible to eliminate expensive press plates. For a laminate surface only the highest quality, high maintenance press plates can be deployed; these must be cleaned repeatedly, and from time to time, must also be refurbished and newly chromed, so as to achieve a sealed surface with the desired level of gloss and the desired structure. By means of the 2-stage process these high quality and high maintenance press plates can be eliminated.

An additional effective measure for reducing the pressing time ensues from the option of providing a porous layer permeable to water vapour on one or both faces of the laminate, that is to say, between the base body and the press plates. The surface roughness of the finished base body that thereby ensues can be removed very easily in the course of the subsequent grinding process. Through the additional layer, for example a non-woven material or a foil, in particular of plastic, the water vapour arising from the residual moisture of the impregnated cellulose fibre webs during the pressing process can exit via the surfaces of the laminate in an improved manner. The internal vapour pressure in the laminate that is being generated is thereby reduced, as a result of which the described cracking of the panel as it leaves the press can be avoided. In this manner a significant reduction of the pressing time can be achieved. It is preferable to provide

the porous layer permeable to water vapour on both faces, since otherwise, particularly in the case of greater panel thicknesses, asymmetric conditions are present, which can lead to warping of the finished panels. A further advantage of the porous layer permeable to water vapour, which can be deployed repeatedly, is furthermore, that this also acts as a parting foil and thereby always effects an easy removal of the pressed item at the exit from the press, or on the opening of the press. Also any possible contamination of the press plates is avoided.

In addition to the high operating efficiency by virtue of the reduced pressing time, important logistical advantages also ensue from the 2-stage manufacturing process. Thus it is now possible to produce base panels for storage, and to coat and/or cut these to size subsequently in response to particular orders. Since the coating operation is no longer bound to the extremely long pressing times for the manufacture of the base panel, and thus comparatively rapid coating methods can be deployed, it is possible to undercut previously quoted delivery times significantly. Just-in-time delivery is therefore comparatively easy to achieve.

The method can be executed both with the aid of cycle presses and also with continuously operating presses.

It is of known art for the manufacture of laminated panels to deploy cyclically operating multi-daylight presses. With these a plurality of laminates with press plates located between them are always pressed together in a pressing cycle. Here the usual pressing times are of the order of 100 minutes. What is expensive here, however, in addition to the very long pressing time, is the additional stacking of the various laminates and the provision of a multiplicity of press plates. In accordance with the prior art the deployment of cycle presses is the only option for achieving higher panel thicknesses. Continuous pressing operations, here as a rule isobaric double-belt presses, by virtue of the relatively short pressing time thereby available, are limited to panel thicknesses of a maximum of 1,2 mm.

In accordance with the method according to the invention, which allows for increased pressing temperatures, the pressing times are, however, reduced, so that the manufacture of a laminate with a thickness greater than 1,2 mm can be carried out in a continuous pressing operation. By virtue of the subsequent option of separate surface treatment in accordance with the method according to the invention it is not necessary to deploy an isobaric double-belt press, which in conventional laminate manufacture is at present the case in order to achieve a high quality sealed laminate surface. Local differences in the pressing pressure, which just do not occur in the case of isobaric presses, in contrast to isochoric presses, would lead to undesirable fogging and an irregular level of gloss. Since, however, in accordance with the present invention the coating operation takes place in a separate step, and moreover a specific pre-treatment such as grinding is possible, an isochoric double-belt press can for the first time be deployed for the manufacture of laminates. This enables a variety of press lengths, as a result of which the required pressing time can also be ensured in the case of panel thicknesses of more than 5, 12 or even 18 mm.

An additional advantage in the deployment of an isochoric double-belt press with a length of at least 10 m, preferably more than 20 m, particularly preferably more than 25 m, lies in the variable temperature control. Thus in this type of press it is possible to provide various pressing temperatures in various zones. If now at the start of the press the laminate is subjected to a high temperature, which is then reduced towards the end of the press, a certain recooling effect already takes place, which reduces the internal vapour pressure in the panel that is to be manufactured, and thus in turn reduces the risk of a cracked panel, which is the criterion determining the pressing time. There thus ensues a further possibility for reducing the pressing time required for the manufacture of a laminated panel.

As a result of the circumstances in which, in accordance with the method according to the invention, laminated panels can be manufactured for the first time by means of continually operating double-belt presses, the laminated panels are for the first time available in what are theoretically continuous lengths. With the option of cutting the

continuous flow of manufactured panel to length downstream of the double-belt press, for the first time panels with a thickness of 2 mm and more can be manufactured in virtually any length. Limitations arise simply as a result of local space conditions and the transport options that are provided. Laminated panels with a length of more than 5 m, preferably more than 8 m, particularly preferably with a length of more than 10 m, can be manufactured for the first time.

As a result of the simple option of cutting the panels to the cited dimensions, however, cuts with what is comparatively significantly reduced waste are also possible, since the large format panels cut to length downstream of the press can already be chosen with a view to the final cut dimensions of a panel that is to be cut to size later. Thus an excellent flexibility of format ensues. In the case of cycle presses this is not available, since here, by virtue of the fixed size of the press surfaces, the panel dimension that can be manufactured is already prescribed.

As stated, the aim is to select a pressing temperature that is as high as possible so as to reduce the pressing time. Temperatures above 155 °C, preferably above 185 °C, particularly preferably above 205°C, have proved to be advantageous.

As a result of the increased pressing temperatures, increased pressing pressures necessarily also ensue. Thus compared with the usual pressing pressures of some 8 to 10 MPa in conformity with conventional methods, pressing pressures of at least 15 MPa, preferably of at least 19 MPa, particularly preferably of at least 23 MPa, have proved to be advantageous.

As stated, as a result of the separate step in production of the coating operation, no limitation to the application of a decorative paper impregnated with melamine resin is necessary, in contrast to laminate manufacture in accordance with the prior art. In fact the laminated panels manufactured in 2 stages can also be painted, printed, powder coated, or also provided with other decorative materials such as wood or stone veneers, decorative or metal foils, or, of course, a decorative laminate. In addition, however, the

option is also available for a pressing operation with an impregnated decorative paper. Comparatively very good conditions are present for the application of motifs by digital printing methods. While these have already found application in the field of compact panel manufacture, as a result of the intense heat that is required during the pressing operation, they have been classified as problematical, since the inks deployed for the digital printing process do not have the required thermal resistance, or only when they have an excessively expensive composition.

A pre-treatment of the base panel for the subsequent coating operation can be required, but is by no means mandatory. Coating operations executed with decorative foils on base panels without any pre-treatment have shown that, with the deployment of, for example, single component reactive systems as the adhesive, satisfactory bonding can be achieved.

Furthermore, pressing operations with decorative papers impregnated with melamine resin have shown that the latter can be pressed together with substrates ground with a grain size of 80, with settings that are usual for the coating of wood materials. The adhesion achieved and its permanence fulfil at least the requirements set for interior spaces. For the direct coating with paints system-dependent undercoats can be deployed in order to achieve high bonding strengths.

In order to manufacture electrically conductive base panels, appropriate additives can be included in the impregnation resins. By this means it is also possible for the first time to enhance laminated panels with a powder coating. For the person skilled in the art there are various additives that can be selected for this purpose. These are mainly based on metal salts, or salts of organic acids.

In accordance with one configuration a layer can also be applied in the coating step that enables solar technological utilisation of the coating layer on at least some sections. By this is meant any utilisation of the solar radiation of the sun by means of the coating layer. One example of solar technological utilisation is the use of photovoltaic devices in

the form of solar cells. The present invention is, however, not limited to this type of solar technological utilisation.

As stated previously the object is also achieved by means of a corresponding laminated panel, wherein in accordance with one configuration the base panel can contain at least one cellulose fibre web without impregnation, which in particular forms an outer face of the base panel. Alternatively or additionally, a coating layer in the form of a paint, a print, a powder coating, a decorative material, and/or an impregnated decorative paper can also be provided. The decorative material can be a wood or stone veneer, a decorative or metal foil, or a laminate. The impregnated decorative paper can in particular be impregnated with melamine resin.

Also the coating layer, as stated, can be a coating layer enabling solar technological utilisation of the laminated panel on at least some sections. The latter can, for example, be formed in terms of dye solar cells. The key component of the cells is an organic dye, which is embedded in nano-crystalline electrodes made of titanium dioxide, for example. This converts the incident light into electrical power.

There is now a multiplicity of options for configuring and developing further the method according to the invention and the inventive laminated panel. In this regard reference is made on the one hand to the patent claims following patent claim 1, and on the other hand to the description of examples of embodiment in conjunction with the drawing.

Fig. 1 shows schematically the manufacture of a compact panel (laminated panel 1) in accordance with one possible form of embodiment of the method according to the invention.

Here a continuously operating isochoric double-belt press 2 is provided for this purpose. For purposes of feeding the press 2 a plurality of rolls 3 of already impregnated kraft paper 4 are arranged upstream of the latter, from which the webs 4a are unwound and supplied directly to the press 2. In the present case the kraft paper 4 takes the form of

one impregnated with phenolic resin, with a base paper weight of 150 g/m^2 and a coating level of 67 %. With a residual moisture of 7 % this corresponds to a surface weight for the impregnated kraft paper 4 of 270 g/m^2. The uppermost and lowermost layers are formed by a porous lay 5 of a plastic web 5a. Downstream of the press 2 the latter is then removed from the panel surfaces and rewound onto a roll 3', so that it can be used once again. To achieve higher panel thicknesses a plurality of lays of impregnated paper webs 4a can be wound onto one roll 3, in order to maintain a lesser number of unwinding stations.

The press 2 has an effective length of 22,5 m, and in some sections can be heated to various temperatures by means of appropriate heating means 6, and by means of respectively corresponding pressing sections 7 can also be subject to various pressing pressures. Thus in the present case the pressing pressure in the first (front) of the press sections 7 is selected to be 20 MPa; which then is reduced by the centre of the press 2 to approximately 17 MPa, and from that point is held constant. In the last quarter of the press length the pressing pressure is no longer prescribed, but instead is controlled as a function of distance, that is to say, the distance between the press belts 8 is prescribed so as to achieve the desired panel thickness within the smallest possible tolerances.

The feed rate is approx. 0,55 m/min, which corresponds to a pressing time of approx. 41 minutes. With a panel thickness of 9 mm this corresponds to a pressing factor, that is to say, the ratio of pressing time and panel thickness, of approximately 4,5 min/mm.

A diagonal saw 9 is provided downstream of the press 2 which cuts the continuous panel flow 1a to the desired panel length. The individual panels 1 are then cooled in a cooling star (not represented) installed downstream, and can then be intermediately stored, or also supplied directly for further processing. As in the case of the manufacture of wood materials it is useful to grind the cooled panels 1 and then to store them. The panel thicknesses desired in each case can then be supplied from the store to the coating operation in response to particular orders.

714434/DO

LEMEZ ELŐÁLLÍTÁSÁRA SZOLGÁLÓ ELJÁRÁS, VALAMINT AZ ELJÁRÁS SZERINT ELŐÁLLÍTOTT LEMEZ

SZABADALMI IGÉNYPONTOK

1. Kétlépcsős eljárás rétegelt lemez előállítására, amely eljárás során külön állítunk elő egy alaplemezt és egy bevonatot, és egymás után a következő lépéseket hajtjuk végre:

- előkészítünk több, impregnálással ellátott, egymással nem összepréselt cellulózrost szalagot,
- rétegzetet képezünk,
- melegprésbe tesszük a rétegzetet,
- a nyomás növelése és a hőmérséklet emelése közben 2 mm és ennél nagyobb vastagságú alaplemezzé préseljük a rétegzetet,
- kivesszük az alaplemezt a melegprésből, és
- réteggel vonjuk be az alaplemezt,

azzal jellemezve, hogy a rétegzetet úgy alakítjuk ki, hogy az impregnálással ellátott cellulózrost szalagokat egymásra helyezzük, a cellulózrost szalagokból álló rétegzetet melegprésbe tesszük, a nyomás növelése és a hőmérséklet emelése közben 2 mm és ennél nagyobb vastagságú alaplemezzé préseljük, és a réteggel való bevonás után egy, az EN 438 számú európai szabvány szerinti kompakt lemezt kapunk.

2. Az 1. igénypont szerinti eljárás, azzal jellemezve, hogy a rétegzet cellulózrost szalagjainak mindegyikét ugyanazzal az impregnálással látjuk el.

3. Az 1. vagy a 2. igénypont szerinti eljárás, azzal jellemezve, hogy a rétegzetet legalább egy impregnálás nélküli cellulózrost szalaggal látjuk el, továbbá különösen a rétegzetet az egyik oldalán és/vagy mindkét oldalán ellátjuk egy olyan külső réteggel, amelyet legalább egy impregnálás nélküli cellulózrost szalag képez.

4. Az előző igénypontok egyike szerinti eljárás, azzal jellemezve, hogy az impregnálással ellátott cellulózrost szalagok közül egyet vagy többet olyan impregnálással látunk el, amely villamosan vezető adalékot, különösen szerves savak sóját, előnyös módon fémsót tartalmaz.

5. Az előző igénypontok egyike szerinti eljárás, azzal jellemezve, hogy az alaplemez melegprésből való kivételének lépése és az alaplemez réteggel való bevonásának lépése között végrehajtunk egy alaplemez előkezelési lépést, amely előkezelés különösen az alaplemez csiszolását, az alaplemez simítását, előbevonatoknak, alapozó bevonatoknak és/vagy alaprétegeknek az alaplemezre való felvitelét és/vagy az

alaplemez felületeinek plazmakezelését foglalja magában.

6. Az előző igénypontok egyike szerinti eljárás, azzal jellemezve, hogy a rétegzet préselésének lépésében a hőmérsékletet legalább 155 °C-ra, különösen legalább 185 °C-ra, előnyös módon legalább 205 °C-ra emeljük, továbbá különösen a hőmérsékletet a préselés ideje alatt változtatjuk, különösen csökkentjük.

7. Az előző igénypontok egyike szerinti eljárás, azzal jellemezve, hogy a rétegzet préselésének lépésében a nyomást legalább 15 MPa-ra, különösen legalább 19 MPa-ra, előnyös módon legalább 23 MPa-ra növeljük, továbbá különösen a nyomást a préselés ideje alatt változtatjuk, különösen csökkentjük.

8. Az előző igénypontok egyike szerinti eljárás, azzal jellemezve, hogy a préselési lépés előtt vízgőz-áteresztő réteget viszünk fel a rétegzet egyik vagy mindkét oldala mellé, amely vízgőz-áteresztő réteget a préselési lépés után az alaplemezről különösen eltávolítjuk.

9. A 8. igénypont szerinti eljárás, azzal jellemezve, hogy a vízgőz-áteresztő réteg különösen porózus réteg, amely fliz anyagból vagy fóliából, különösen műanyagból készül.

10. Az előző igénypontok egyike szerinti eljárás, azzal jellemezve, hogy a melegprés egy folytonos üzemű prés, különösen kettős szalagprés, különösen amelynek préshossza legalább 10 m, előnyös módon legalább 20 m, különösen előnyös módon legalább 25 m.

11. Az előző igénypontok egyike szerinti eljárás, azzal jellemezve, hogy a réteggel való bevonás lépése lakkozást, rányomást, porbevonást, dekoranyag, különösen fa- vagy kőfurnér, dekor- vagy fémfólia vagy rétegelt műanyag felvitelét és/vagy egy impregnált, különösen melamingyantával impregnált dekorpapírral való préselést foglal magában, és a réteggel való bevonás lépése során különösen olyan réteget hordunk fel, amely lehetővé teszi a bevonat legalább szakaszonkénti szolártechnológiai alkalmazását.

12. Az EN 438 számú európai szabvány szerinti kompakt lemez, amely az előző igénypontok egyike szerinti eljárással kerül előállításra, és amely tartalmaz

- egy 2 mm és ennél nagyobb vastagságú alaplemezt több, impregnálással ellátott, egymásra helyezett, valamint megnövelt nyomáson és felemelt hőmérsékleten préselt cellulózrost szalaggal és

- egy, az alaplemeznek legalább az egyik oldalára külön felhordott bevonatot.

13. A 12. igénypont szerinti kompakt lemez, azzal jellemezve, hogy az alaplemez tartalmaz legalább egy impregnálás nélküli cellulózrost szalagot, amely különösen az alaplemez egy külső oldalát képezi.

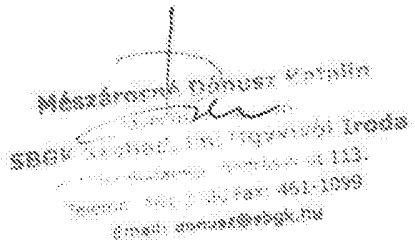
14. A 12. vagy a 13. igénypont szerinti kompakt lemez, azzal jellemezve, hogy a kompakt lemez vastagsága legalább 5 mm, előnyös módon legalább 12 mm, különösen előnyös módon legalább 18 mm, és/vagy a kompakt lemez hossza legalább 5 m,

különösen legalább 8 m, előnyös módon legalább 10 m.

15. A 12-14. igénypontok egyike szerinti kompakt lemez, azzal jellemezve, hogy a bevonat lakk, nyomat, porbevonat, dekoranyag, különösen fa- vagy kőfurnér, dekor- vagy fémfólia vagy rétegelt műanyag és/vagy impregnált, különösen melamingyantával impregnált dekorpapír.

16. A 12-15. igénypontok egyike szerinti kompakt lemez, azzal jellemezve, hogy a bevonat egy, a kompakt lemeznek legalább szakaszonkénti szolártechnológiai alkalmazását lehetővé tevő bevonat, és előnyös módon festék alapú napelemekkel rendelkezik.

(A meghatalmazott)



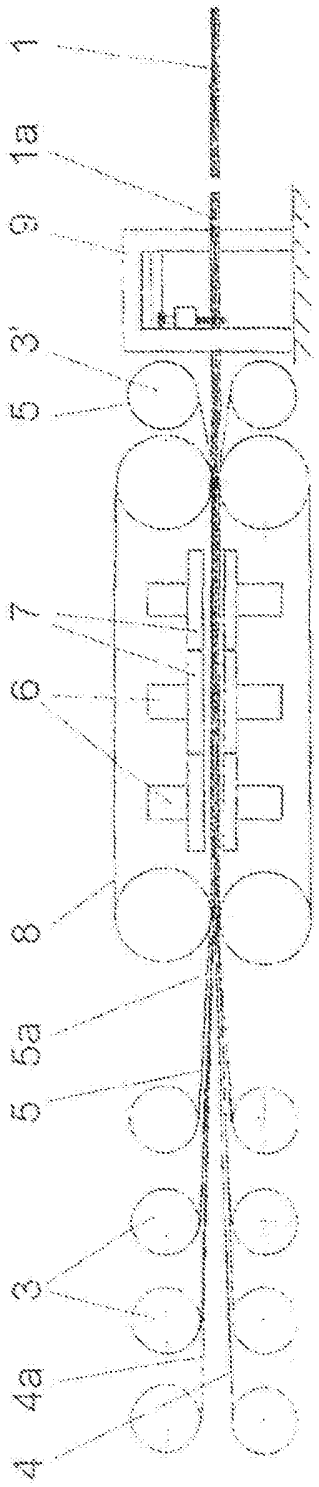


Fig. 1