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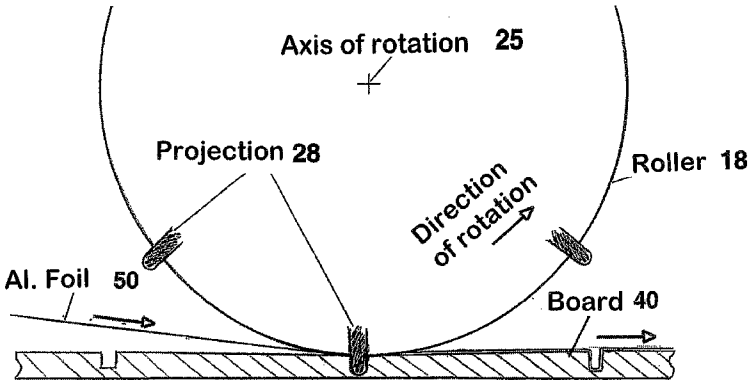
(54) **Title:** LAMINATING METHOD AND APPARATUS FOR CARRYING OUT THE SAME



(57) **Abstract:** An apparatus and a device for metal-coating a slotted woodfibre board with a sheet laminate continuously both in elongate slots in the board and on the surfaces of the board between the slots. The board is advanced in a direction transverse to the longitudinal direction of the slots by means of a horizontal conveyor on a supporting structure, sheet laminate material is fed continuously from a sheet laminate feed device, a rotatable roller secured to the supporting structure and immediately above the conveyor is rotated so that the roller surface, on rotation of the roller, follows the surface of the board that is advanced on and by the conveyor and presses the sheet laminate material against the board, and the rotation of the roller is driven so that at least one elongate projection arranged in the longitudinal direction of the roller is positioned synchronously with the slot and presses the sheet laminate into the slot. An underlying adhesive layer is heated to the melting point of the adhesive layer. By subsequent cooling of the metal layer, thermal deformation of the coated board is avoided.

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Laminating method and apparatus for carrying out the same

The present invention relates to a laminating method and an apparatus for carrying out the same. In particular, the invention relates to a method and an apparatus for coating a board with a layer of metal, which board is provided with an elongate groove, the layer of metal being attached to the board and laid in the groove.

Woodfibre boards with grooves for the installation heating cables or pipes for water-borne heat are available on the market today. The boards may be made of a porous woodfibre material in order to provide good insulation and to have a sound proofing effect, especially for damping the sound of footsteps when they constitute a part of a floor structure. Boards of this type are widely used in the building industry, and the market is growing.

Among the aforementioned building board types there is known a fibre board with grooves which preferably may be arranged in the longitudinal direction of the board, transverse to the longitudinal direction of the board, or may comprise grooves in different directions, where the board is coated with metal. Aluminium is for many uses, especially for building purposes, preferred as metal for board coating.

Metal coating of boards with grooves in continuous production has been found to pose many challenges, both as regards obtaining a favourable groove shape after the metal coating which makes it practically possible to install heating cable or pipes in the grooves and to ensure that they remain in place after installation, and as regards producing coated boards with the metal coating inserted in the grooves with good production output and uniform, predictable quality.

In the light of the above-mentioned and other problems and objects, the present invention provides an apparatus for coating a slotted or grooved board with a sheet laminate continuously both in elongate slots or grooves and on the surfaces of the board between the slots or grooves, characterised by the features set forth in attached claim 1.

Additional features of the inventive apparatus for coating a slotted or grooved woodfibre board with a sheet laminate continuously both in elongate slots or grooves in the board and on the surfaces of the board between the slots or grooves, are set forth in attached claims 2 to 18 inclusive.

The present invention further provides a method for coating a slotted or grooved woodfibre board with a sheet laminate continuously both in elongate slots or grooves in the board and on the surfaces of the board between the slots or grooves, characterised by the features set forth in attached claim 19.

Additional, advantageous features of the inventive method for coating a slotted or grooved woodfibre board with a sheet laminate continuously both in elongate slots or grooves in the board and on the surfaces of the board between the slots or grooves are set forth in attached claims 20 to 22 inclusive.

The invention will be described in more detail below with the aid of examples and the attached drawings, wherein:

Figure 1a is a perspective drawing of an exemplary embodiment of an apparatus according to the invention;

Figure 1b is a perspective drawing of the exemplary embodiment shown in Figure 1b when in use for the production of a coated fibre board;

Figure 2a is a perspective drawing of an exemplary embodiment of a pressure roller for an apparatus according to the invention;

Figure 2b is a dimensioned front elevation of the exemplary embodiment of the pressure roller shown in Figure 2a;

Figure 2c is a partly dimensioned sectional view of the exemplary embodiment of the pressure roller shown in Figures 2a and 2b;

Figure 3a is a dimensioned front elevation of an exemplary embodiment of an elongate pressure projection for mounting in a groove in the pressure roller shown in Figures 2a, 2b and 2c;

Figures 3b and 3c show in section and partly dimensioned, the exemplary embodiment of the elongate pressure projection illustrated in Figure 3a;

Figure 4a is a sectional view of the positioning of a pressure roller with projections, board with grooves and sheet laminating material in a first phase during continuous production of metal-coated board; and

Figure 4b is a sectional view of the positioning of a pressure roller with projections, a board with grooves and sheet laminating material in a second phase during continuous production of metal-coated board.

By the use of the inventive apparatus and method there is produced, for example, a metal-coated board product, preferably consisting of Al foil, from a sheet laminating material 50 on a roll 800 mm wide which comprises 40 micron (110g/m2) aluminium, a glass fibre net reinforcement (19g/m2) and LDPE plastic for laminating the glassfibre net to the aluminium (50g/m2), and a porous woodfibre board 40 of the type naturally porous woodfibre board 790x590x8 mm (LxBxH) provided with a plurality of grooves or slots. The board is produced and supplied typically by a board manufacturer according to set measurements and with ready milled grooves or slots in the full longitudinal direction of the board. In a preferred embodiment of a metal-coated board product, the board also comprises grooves located along the edge of the board but at a slight distance from the board edge, which are referred to herein as side grooves. Side groove recesses may be arranged along one or more of the board edges. The ready milled grooves into which the metal coating is to be guided may be dimensioned to a width of 4 mm +/- 0.1 and a depth of 5 mm +0/-0.5. The side grooves (for overlay of metal coating which can be perforated) are preferably dimensioned to a width of 15 mm and a depth of 5 mm +0/-0.5.

A second preferred dimension for a porous woodfibre 40 board that can be produced by the inventive apparatus and/or method, which board is especially suitable as a footstep sound damping floor structure element for supporting a heating cable or a pipe for transport of a heating medium, the heating medium preferably being hot water, is 790x1183x12 mm (LxBxH).

In one variant, the invention is adapted to produce a metal-coated board of the aforementioned types where the grooves into which the metal foil is pushed are dimensioned to a width of 4 mm +/-0.1 and a depth of 5 mm +0.2/-0.3. The tolerances of this variant may provide a more optimal performance in connection with the use of the inventive apparatus and method.

An aluminium foil that is provided with a reinforcing layer of a fibre net, or similar reinforcement, in combination with a meltable plastic material, such as a polyethylene plastic material, is preferably used for the production of the metal-coated board according to the inventive apparatus and method. The present inventors have found that an adaptation of the invention to reinforced metal foil of a type that is supplied by Walki/Wisa (UPM Group in Finland) known as "Alu-foil with plastic", 165GSM ALU/COEX Plastic, or a type that is supplied by Meuweissen Industrie, the Netherlands known as "5117908021 LDPE Reinforced Alu-foil" gives a very good output and an excellent end product quality. However, these materials, which comprise a layer of meltable plastic material which in connection the invention has the action of a hot-melt adhesive, do not preclude the use of other foils and/or combinations of foils, foil reinforcements, and means to bond or attach the metal coating to the board.

The inventive production apparatus preferably makes use of a plastic material which is included as a component in a reinforcing net for an aluminium foil. With the inventive apparatus or method, this plastic is melted "again", that is to say after the metal foil has been placed against the board, thus forming a connection between the woodfibre board and the aluminium foil.

During continuous production, the boards are fed into the machine, preferably fixed butt-to butt. The Al foil is pressed and formed using a roller provided with "rulers", and is thus laid on the board, and in the grooves with the aid of the "rulers". A "heated strip" is then used to melt the plastic so that the reinforced Al foil bonds to and is attached to the board in the areas between the grooves.

Immediately after the heated strip there is a cooling zone with air cooling in order to quickly lower the temperature of the Al foil, thereby ensuring that the woodfibre boards do not become bent as a result of thermally generated stresses, or at least are only given a minimum bend.

At the end of the production line the boards are then separated again and trimmed according to need, and placed on pallets for further transport or storage.

The new automatic line that is constructed according to the invention will consist of a laminating machine as described herein, preferably combined with processing equipment for milling the grooves in the board. It has been found that the tolerance limits that a woodfibre board with pre-milled grooves can have are large, and that

machining of the grooves immediately prior to the laminating machine will be extremely favourable for production output and product quality.

The actual roller that shapes the aluminium in the grooves is designed so that it has a diameter which enables it to hold the foil in place before the "pressure blade" (also referred to herein as "ruler", "die" or "projection") guides and presses or pushes the metal foil into the groove. The inventive design of the roller and "pressure blade" results in the foil being given a favourable filling material form, which will be explained below, and is such that the foil is held properly in place and is not pulled of from the last formed groove until the following attachment process has been completed.

For the relevant dimensions of board and grooves, the diameter of the roller is adapted to a total of six grooves, wherein the said "rulers", also referred to here as "pressure blades", are to be positioned so that the "rulers" by virtue of their spacing on the roller match the distribution of the grooves in the board, i.e., the spaces between the actual grooves in the board. Reference is made to Figures 2a, 2b and 2c for an example of a roller with six grooves. The appended illustrations also show arrangements for the use of fixing screws to hold "pressures blades" in place in respective grooves.

Typically, the grooves for the aforementioned production specifications are placed 98.33 millimetres centre-to-centre from each other. The diameter of the roller will then 187.8 millimetres for six "rulers". The length of the roller is 800 millimetres, as adapted to one of the dimensions (length dimension) of the board being 790 millimetres, as given above for the currently preferred dimensions of the board for metal coating. Six grooves of a depth of 15 mm + 1 and width of 4 mm + 0.1 are milled out in the roller. The depth tolerance allows adjustments by inserting shims in the groove so that the "ruler" will project the correct distance from the roller surface.

In the grooves of the roller there are mounted "rulers" which preferably are formed of a teflon material, or at least of a suitable material having teflon-like qualities, which are configured with a "tooth shape" in order to press the foil down in the groove without it being brought into permanent contact with the edges of the groove in the board. A preferred "tooth shape" can be seen from Figures 3b and 3c.

When placing the metal foil in a groove, it is preferable to push the foil to a sufficient depth in the groove to have a filling material form so that a metal layer is formed in the groove which essentially follows the side edges of the groove, and where the metal

layer does not come into contact with the bottom of the groove. It is especially preferable that the inventive apparatus and method are so adapted that the foil is placed in the groove in the board at a distance of about 0.5 millimetres from the bottom of the groove. To obtain such a filling material form of the metal layer in the groove, the "ruler" should be placed in the roller so that it projects at a distance that corresponds to the depth of the groove minus about 0.5 millimetres.

In a preferred board product coated with metal which can be associated with a standard product group with a number of groove widths that are adapted to respective typical variants of heating cable or heating pipes for installation in the board grooves, and where the metal coating in the groove has the aforementioned filling material form, the groove is made having a depth that is equal to the groove width with an addition that is in the range of 0.5 to 1.0 millimetres. By placing the "rulers" in the roller so that they project from the roller surface at a distance that is from 0.0 millimetres +0.1/0.0 to 0.5 millimetres +0.1/-0.0 less than the groove depth, it is ensured that the metal foil after placement according to the invention will be at a distance from and not in contact with the bottom of the groove.

A frequently used heating cable has a diameter of about 4 millimetres, and a suitable metal-coated board is produced by means of the invention from a board having a groove width of 4 millimetres and a groove depth of 5 millimetres, the "rulers" in the roller being mounted so that the point on the rulers that projects farthest from the roller is at a distance from the roller surface that is from about 4.3 millimetres to about 4.5 millimetres. However, the preferred distance from the roller surface to the point on the rulers that projects farthest from the roller is about 4.5 millimetres, to ensure a distance between the foil in the groove and the groove bottom and at the same time allow for variations in the depth of the groove.
In connection with other product specifications, measurements for roller diameter, roller width and groove separation, and the height, width and length of the "pressure blade" are modified.

As the roller rotates, the ruler will clamp the Al foil against the front side of the groove so that the pull in the foil comes against the Al foil roll whilst the pressure from the roller causes the already laid Al foil to remain immobile. Reference is made to Figures 4a and 4b which illustrate a sequence, where the board in the lower part of the illustrations is advanced to the right whilst the roller rotates anti-clockwise around a stationary axis of rotation.

The roller lies with a pressure of 1 bar, with the aid of an air cylinder, against the porous board. At the point where the board comes free of the roller, the heated bar lies as close as possible to the outer edge of the roller, to ensure that the melting process of the plastic on the Al foil is commenced as quickly as possible after the forming and pressing of the Al foil onto the porous board.

The actual heating zone is adapted to the aforementioned measurements 100 x 800 mm, and controlled by temperature adjustment. The temperature is preferably about 220 degrees C with the materials and dimensions that are described herein. However, the temperature can be adjusted somewhat according to the rate of advancement of the production line, and is adjusted to ensure that optimum adhesion between the Al foil and the porous board is obtained. More specifically, the best adhesion is obtained when the plastic has been melted and has penetrated into the porous board. The heated element is mounted floating to allow optimum contact between the element and board to be obtained at all times. With 25 g/m2 PE plastic, operations take place at a temperature of about 220 degrees C and with 50 g/m2 PE plastic, operations take place at a temperature of about 280 degrees C. This is done with a feed rate of the boards of 1.1 m/minute. By increasing the width of the heated bar to 200 mm, it is possible to operate at an advancement rate for the boards of about 2.2 m/minutes at the same temperatures.

Immediately after the heating zone, the Al foil is cooled so that it does not incorporate stresses into the board which may result in a bending of the board. The Al foil is cooled rapidly, and the melted plastic that functions as bonding will be cooled somewhat later and retain its plasticity. A possible bending of the board which may otherwise occur as a result of heating/cooling of Al foil is thus avoided.

An example of a production machine, which will be explained below with reference to Figure 1, comprises a roller conveyor 1, which is preferably a belt conveyor that is 800 mm wide. The conveyor is a standard belt conveyor, which has frequency-controlled operation for conveying boards through a laminating zone, a supporting structure 2 which forms a machine frame on which the belt conveyor and laminating roller, heated bar and cooling zone are mounted, step bearings, four in number, for example of the type SKF SY 25TF, on two of which the actual forming roller is mounted. These bearings can be adjusted so that it is possible to ensure the parallelism between the rulers mounted in the roller and grooves in the board. The two other step bearings are

for the mounting of the heated bar. The heated bar can be placed up or down towards the laminated board by means of a handle (crank handle) as shown at 12.

The production machine further comprises a heating station 4, preferably formed of a heated bar of aluminium 800 mm long and 100 mm wide having affixed thereto a plurality of heating elements. The heated bar is mounted floating so that it rests against the aluminium foil in such manner that it is pressed down against the board whilst the heat melts the PE plastic on the rear side of the aluminium so that it forms a laminating layer between the board and the Al foil. This heated bar is placed as close to the pressure roller as possible to prevent any deformation of the Al foil after it has been shaped to the board. In immediate connection with the heating station, we have also mounted a cooling plate of steel with air nozzles located immediately after the heated bar. With the aid of an adjustable valve, we have here the possibility of releasing pressurised air through these nozzles in order to produce an air layer between the laminated board and the cooling plate. This is done to be able to rapidly cool the aluminium after lamination. This cooling plate does not appear on the drawings as it has been installed as a result of testing.

The production machine further comprises a threaded bar 5 for adjusting perforation wheels 9. Four nuts 6, preferably locking nuts, are arranged for locking the perforation wheel mounting bracket. Two wheel mounts 7 form mounting brackets for the perforating wheels. Four washers 8 are used for fastening the perforation wheels. Two perforation wheels 9 for perforating 15 mm longitudinal grooves in the aluminium on the laminating sheet to mark and prepare for placement of the supply cable in the finished board. The purpose of this perforation is that the consumer should have it to cut along when there is a need to use this groove for the turning/introduction of electric cable during mounting. These perforating wheels are round blades in which notches have been cut. Furthermore, two Allen screws 10 and two nuts 11 are included for mounting the perforating wheels.

The production machine further comprises a lifting device 12 for the heating station 4.

Two spherical supports 13 and two swivel flanges 14 are included for suspension of pressure cylinders. Two cylinders, for example of the type 1 633 70 DNC 50 Festo, to adjust pressure on the forming roller and to be able to lift the roller for aligning roller/board/aluminium. As disclosed above, it has been found that at pressure of 1 bar in the hydraulic/pneumatic cylinders of the aforementioned type a roller pressure is

established against the foil and board whereby a very good result is achieved when forming and coating a porous woodfibre board of the previously mentioned type. For mounting air supply to the cylinders, two flex connections 16 are used, for example of the type 6142 FK M 16x1 5 Festo.

In the illustrated structure six "dies" 17 are used to push the foil into the board grooves. These dies are made preferably of plastic so that they carefully shape the aluminium foil in grooves in boards. They are partly tapered and rounded in cross-section, as shown in Figures 3a, 3b and 3c, because this gives careful treatment of the foil and it is also done to prevent them from damaging the edge of the groove on the board.

The roller 18, which in Figures 4a and 4b is not drawn to any particular scale but is merely intended as an illustration of the principle, is provided with grooves for the mounting of dies for forming the aluminium to the board. The circumference of the roller is, as indicated above, preferably equal to the board width, and thus for a preferred board dimension the circumference is 590 mm. In the embodiment shown in the drawings and which is described above, the roller weighs 92.4 kg, which is preferred in order to press the boards down against the belt 1 to ensure good quality and advancement through the laminating station. Here, as indicated above, with the aid of the cylinders 15, we can also apply extra pressure if necessary by using adjustable pressure on the cylinders.

The aluminium foil is preferably supplied from a roll. Two roll blocks 19 are preferably made of nylon to fit into the sleeve on the aluminium roll. This is to ensure correct mounting of the roll on a stand. Two bearings 20, for example, of the type 6006 2Z SKF, are used to ensure that the Al roll runs easily on the suspension roller 24. We have in addition mounted adjustable brakes between the stand on the nylon blocks for optimal control/tensioning of the withdrawal from the Al roll. Two Seger rings 21 are used for the locking of bearing 20. Two spacer sleeves 22 are used for the correct positioning of the roll of aluminium laminating material in relation to the feed-in of boards. Two stop rings 23 are used to prevent the Al roll from moving on the suspension roller 24. A blank roller 23 forms the roller for suspension of the aluminium roll.

Furthermore, guide rollers (not shown) are mounted for the aluminium foil, so that it does not wander in relation to the boards that are fed in. Today, these are manually adjustable, but will be upgraded to automatic continuous path control. In total, two

guide rollers are installed, one of which is immediately after the rolling out of the aluminium on the stand and the other immediately before the Al foil is form-pressed against the board.

Patent claims

1.
An apparatus for coating a slotted or grooved board with a metal foil layer continuously both in elongate slots or grooves in the board and on the surfaces of the board between the slots, characterised in that the apparatus comprises a conveyor on a supporting structure, arranged to support and advance the board in a direction transverse to the longitudinal direction of the slots;
a feed device for feeding a metal sheet material; and
a rotatable roller secured to the supporting structure and immediately above the conveyor so that the surface of the roller, on rotation of the roller, will follow the surface of a board that is advanced on and by the conveyor, and in such manner that the roller will press the sheet material against the board, which roller is equipped with at least one elongate projection in the longitudinal direction of the roller and a roller drive means to turn the roller so that the projection is positioned synchronously with the slot to press the sheet material down into the slot.

2.
An apparatus according to any one of the preceding claims, wherein the sheet material comprises a metal foil.

3.
An apparatus according to any one of the preceding claims, wherein the sheet material comprises a reinforcing fibre material.

4.
An apparatus according to any one of the preceding claims, wherein the sheet material comprises an adhesive material.

5.
An apparatus according to claim 4, wherein the adhesive material is a meltable material having a hot-melt glue property, preferably a plastic material of the polyethylene type.

6.
An apparatus according to any one of the preceding claims, wherein the elongate projection has at least in part a wedge-shaped cross-section with a rounded wedge tip.

7.
An apparatus according to any one of the preceding claims, wherein the projection projects from the roller surface at a distance that is smaller than a slot depth.

8.
An apparatus according to any one of the preceding claims, wherein the projection projects from the roller surface at a distance that is less than nine-tenths of a slot depth.

9.
An apparatus according to any one of claims 1 to 7 inclusive, wherein the projection projects from the roller surface at a distance that is about 4 mm for a slot depth that is from about 4.5 mm to about 5 mm.

10.
An apparatus according to any one of claims 1 to 7 inclusive, wherein the projection projects from the roller surface at a distance that is about 0.5 millimetres less than a slot or groove depth in a board that is to be metal-coated.

11.
An apparatus according to any one of the preceding claims, wherein a part of the projection has a wedge-shaped cross-section with a rounded wedge tip.

12.
An apparatus according to claim 10 or 11, wherein the wedge-shaped cross-section with rounded wedge tip has a greatest width that is about 4 mm, a height that is about 5 mm and a wedge tip half angle that is about 11 degrees.

13.
An apparatus according to claim 11 or 12, wherein the rounded wedge tip has a surface roughness that is equal to or less than 1.6.

14.
An apparatus according to any one of the preceding claims, further comprising a heating device positioned close to the roller and immediately above the horizontal conveyor in order to melt a meltable layer in the sheet laminate material after pressing the sheet laminate material against the board with the roller.

15.
An apparatus according to claim 14, wherein the heating device comprises a heated surface arranged in a floating suspension so that the heated surface is brought into sliding contact with a rolled sheet laminate material as the board advances

16.
An apparatus according to claim 14 or 15, further comprising a cooling device for cooling the sheet laminate material after heating of the sheet laminate material by means of the heating device, which cooling device is positioned immediately above the horizontal conveyor and after the heating device in the direction of travel of the board.

17.
An apparatus according to claim 16, wherein the cooling device is arranged to rapidly cool an overlying metal foil in the sheet laminate material and to retain heat in a heated underlying bonding layer in the sheet laminate material, a board with rolled sheet laminate material after heating being advanced to pass the cooling device.

18.
An apparatus according to any one of the preceding claims, further comprising a pressure device arranged to press the roller with a predetermined pressure against a board that is advanced under the roller by means of a horizontal conveyor.

19.
An apparatus according to any one of the preceding claims, further comprising a perforating device arranged to perforate in a continuous manner a strip or band shaped sheet laminate material along the side edges of the sheet laminate material.

20.
A method for coating a slotted woodfibre board with a metal sheet laminate continuously both in elongate slots in the board and on the surfaces of the board between the slots, characterised in that the method comprises
supporting and advancing the board in a direction transverse to the longitudinal direction of the slots using a horizontal conveyor on a supporting structure;
feeding sheet laminate material continuously from a sheet laminate feed device;
rotating a rotatable roller secured to the frame and immediately above the conveyor so that the roller surface, on rotation of the roller, follows the surface of a board that is

advanced on and by the conveyor and presses the laminate material against the board; and

driving the rotation of the roller so that at least one elongate projection arranged in the longitudinal direction of the roller is positioned synchronously with the slot and presses the sheet laminate material into the slot.

21.

A method according to claim 20, further comprising bringing a heated surface into sliding contact with a rolled sheet laminate material on the board during the advancement of the board, and heating the rolled-on sheet laminate material to the melting point of a meltable adhesive layer in the sheet laminate material.

22.

A method according to claim 21, further comprising rapidly cooling only an overlying metal foil of the rolled-on sheet laminate material in order to retain heat in a heated underlying bonding layer in the sheet laminate material, the board with the rolled-on sheet laminate material after heating being advanced to pass the cooling device.

23.

A method according to one of claims 20 to 22 inclusive, further comprising making the slots in the board immediately prior to feeding and pressing on the sheet laminate material.

24.

A method according to one of claims 20 to 23 inclusive, wherein the sheet laminate material comprises a metal foil layer and a plastic layer, the plastic layer preferably being formed of a polyethylene material.

25.

A method according to claim 24, wherein the plastic layer comprises a fibre reinforcement.

Fig. 1A

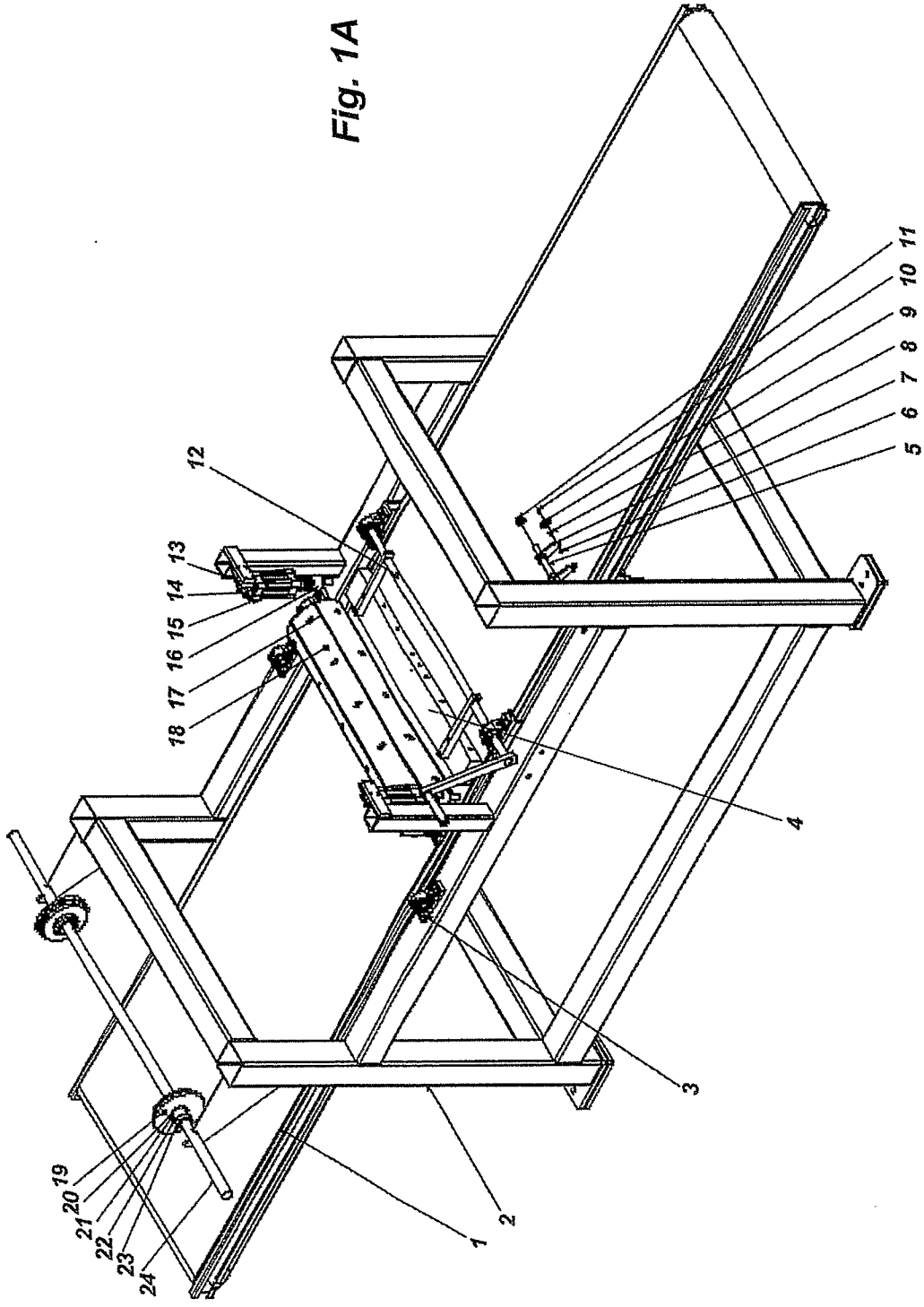
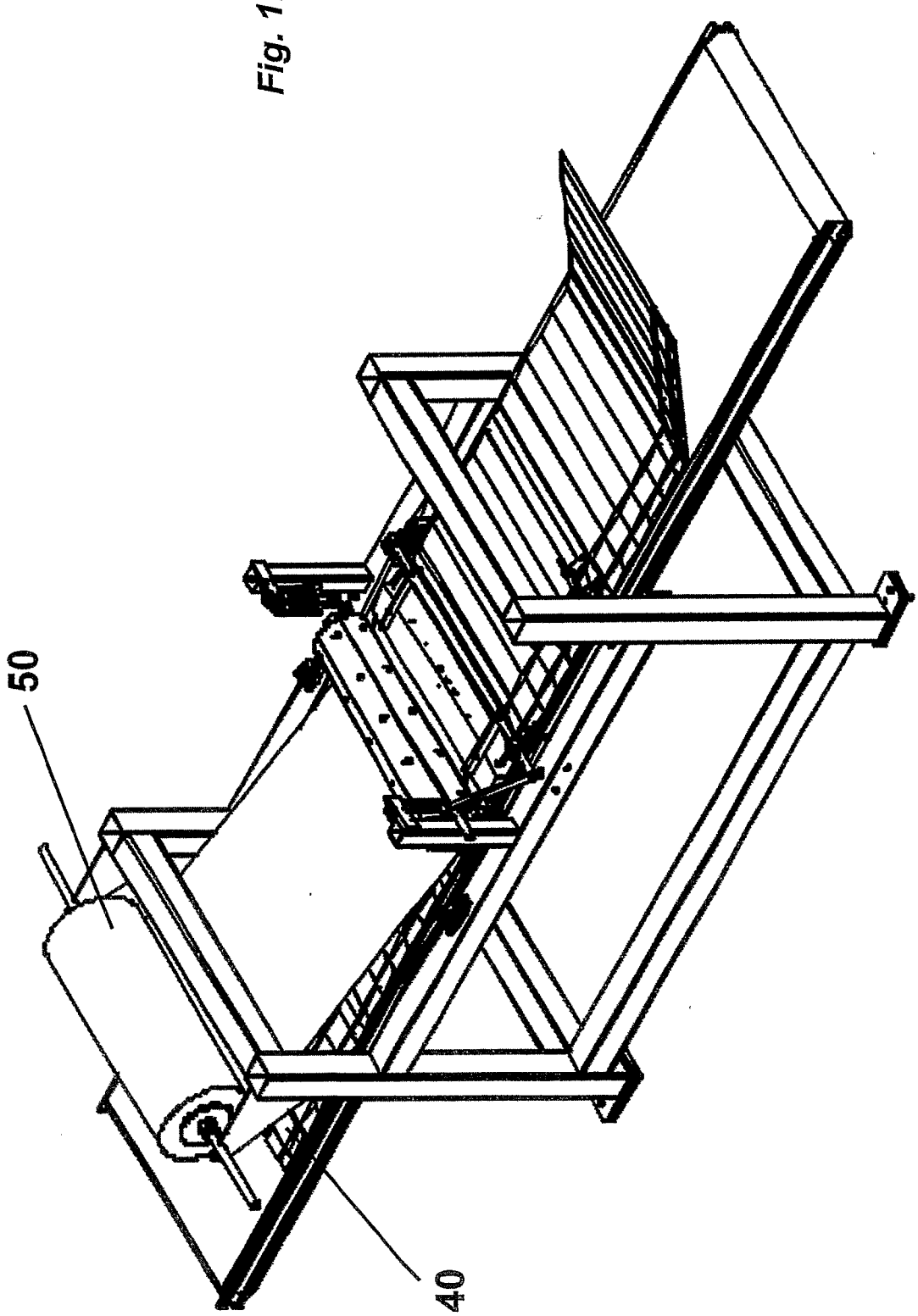


Fig. 1B



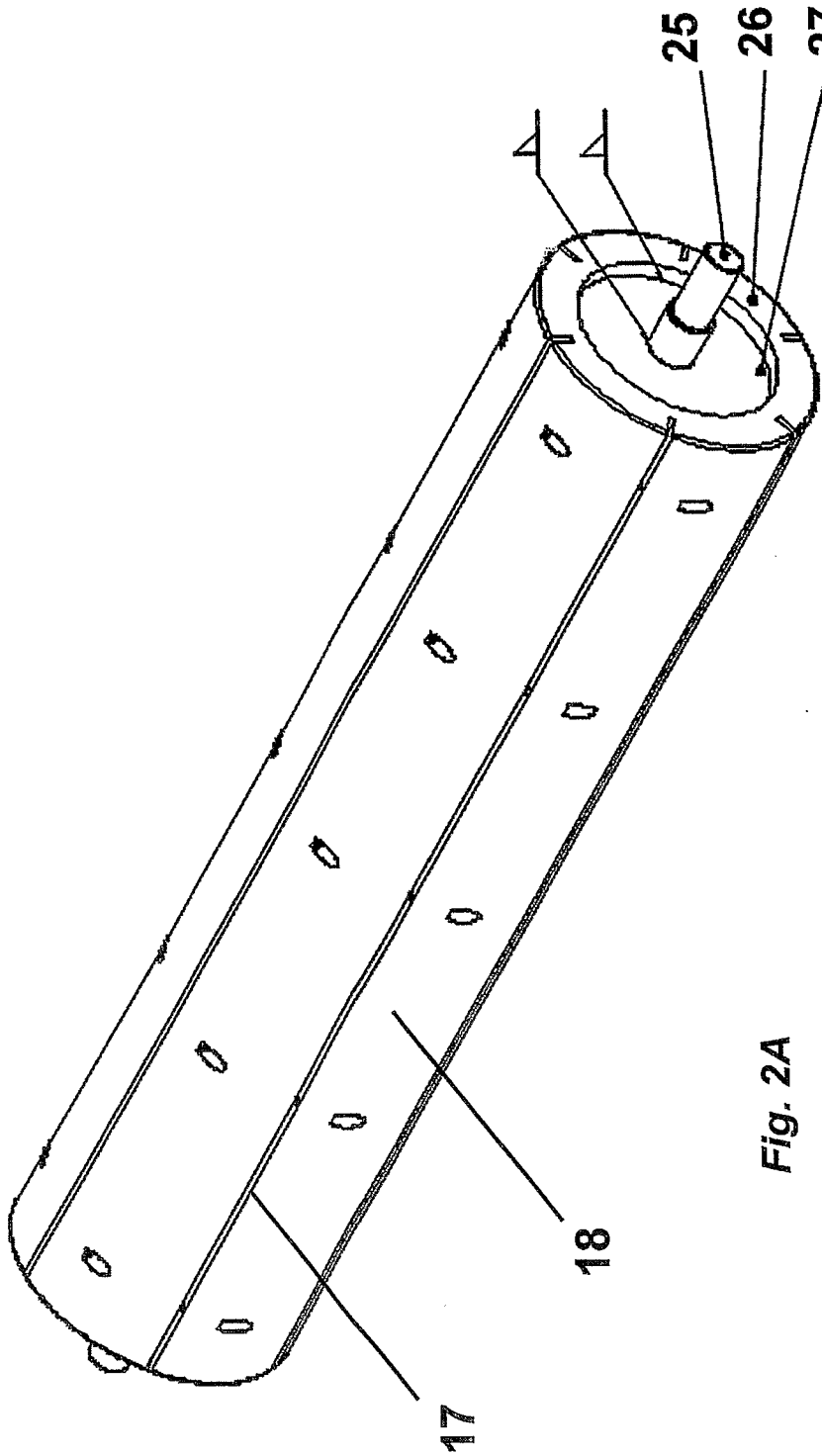


Fig. 2A

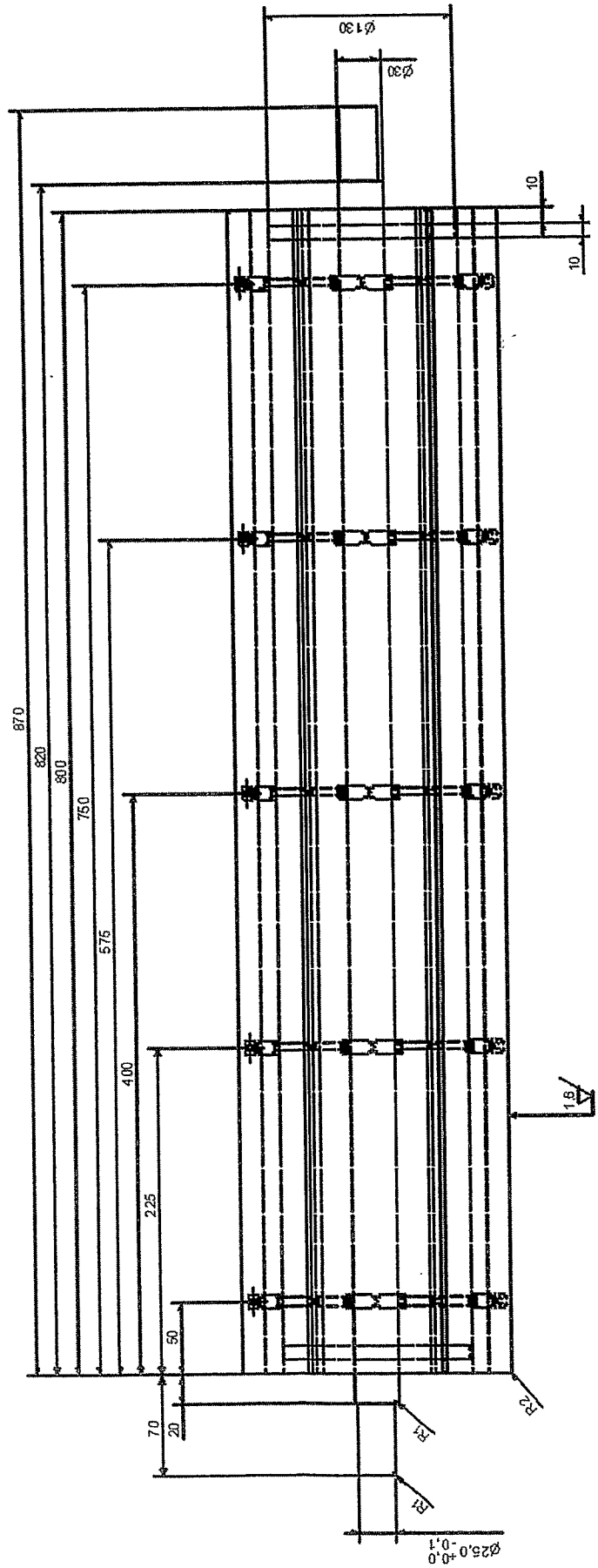

Ø130
Ø30
10
10
870
820
800
750
575
400
225
50
70
20
R2
R1
R1
1.6
Ø25,0 +0,0 -0,1

Fig. 2B

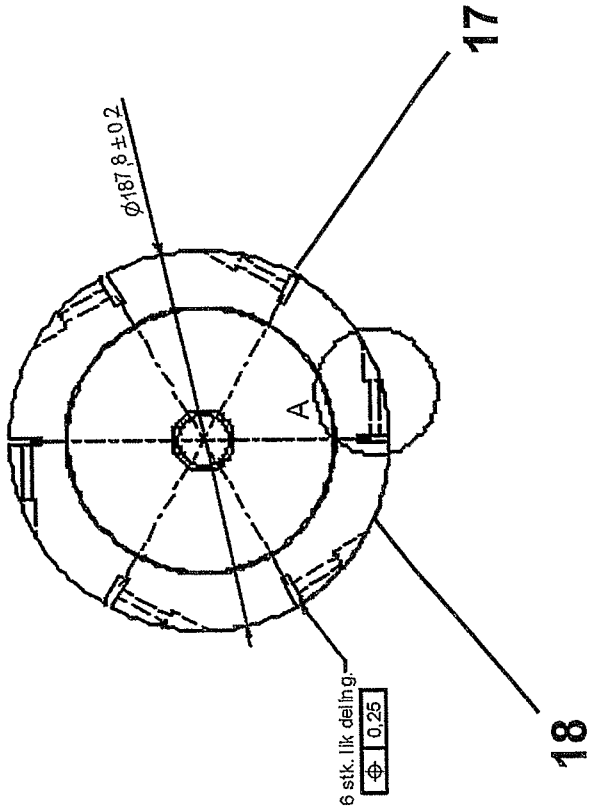
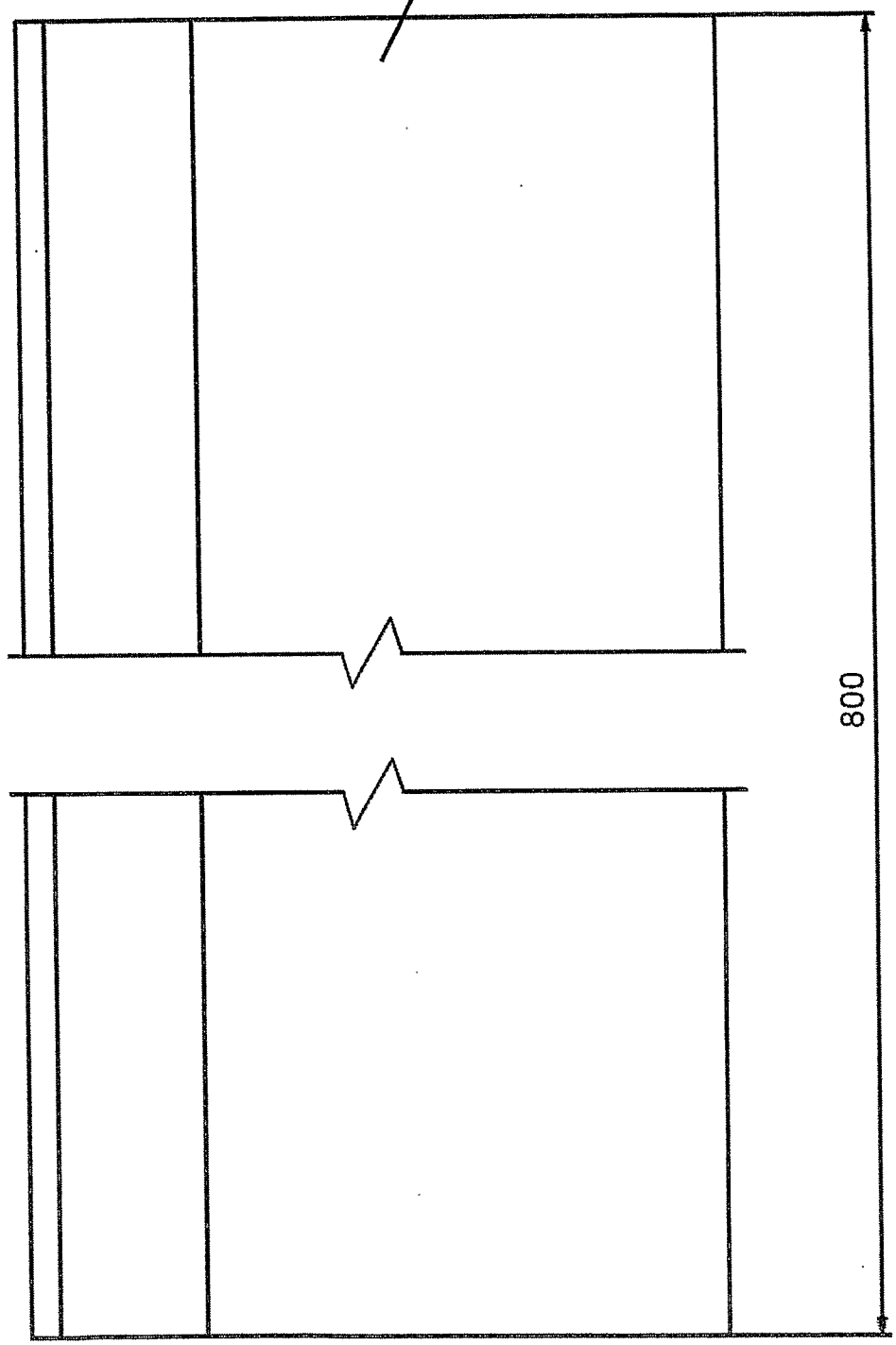


Fig. 2C

Fig. 3A



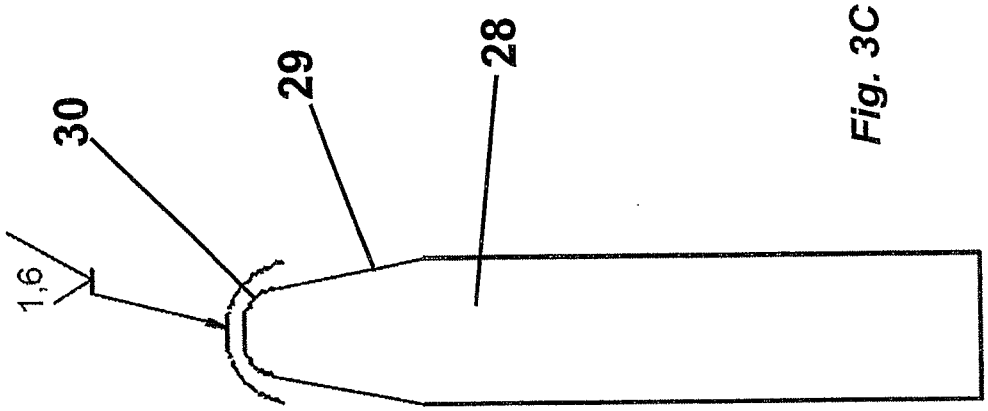


Fig. 3C

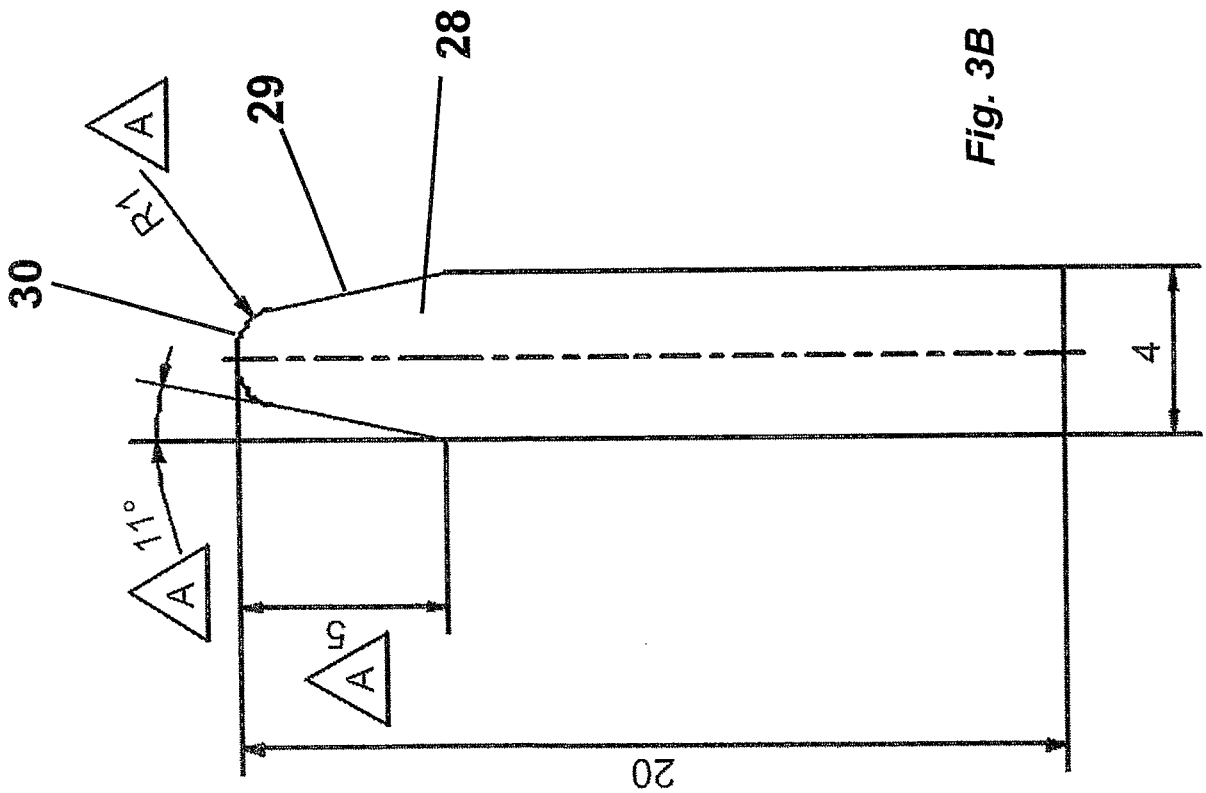


Fig. 3B

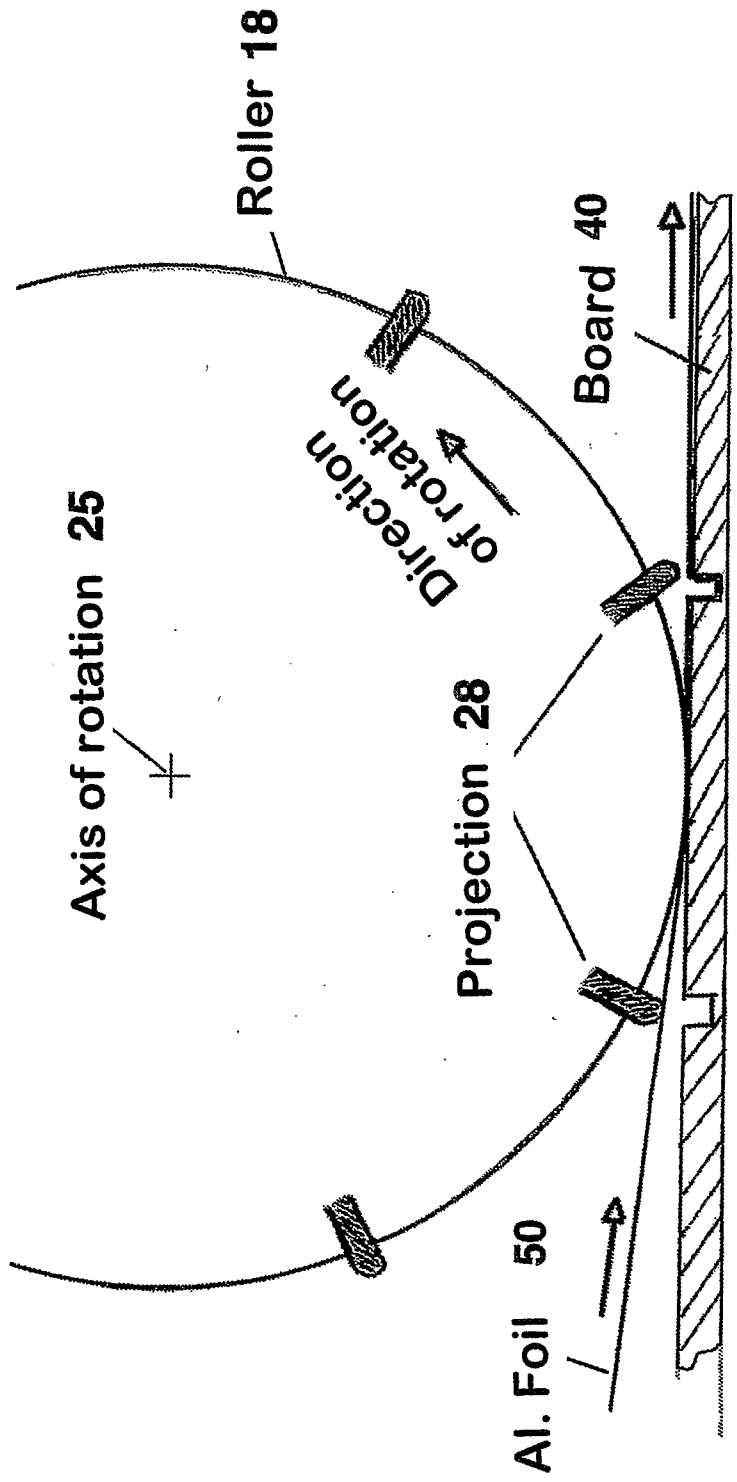

Roller 18
Direction of rotation
Board 40
Axis of rotation 25
Projection 28
Al. Foil 50

Fig. 4A

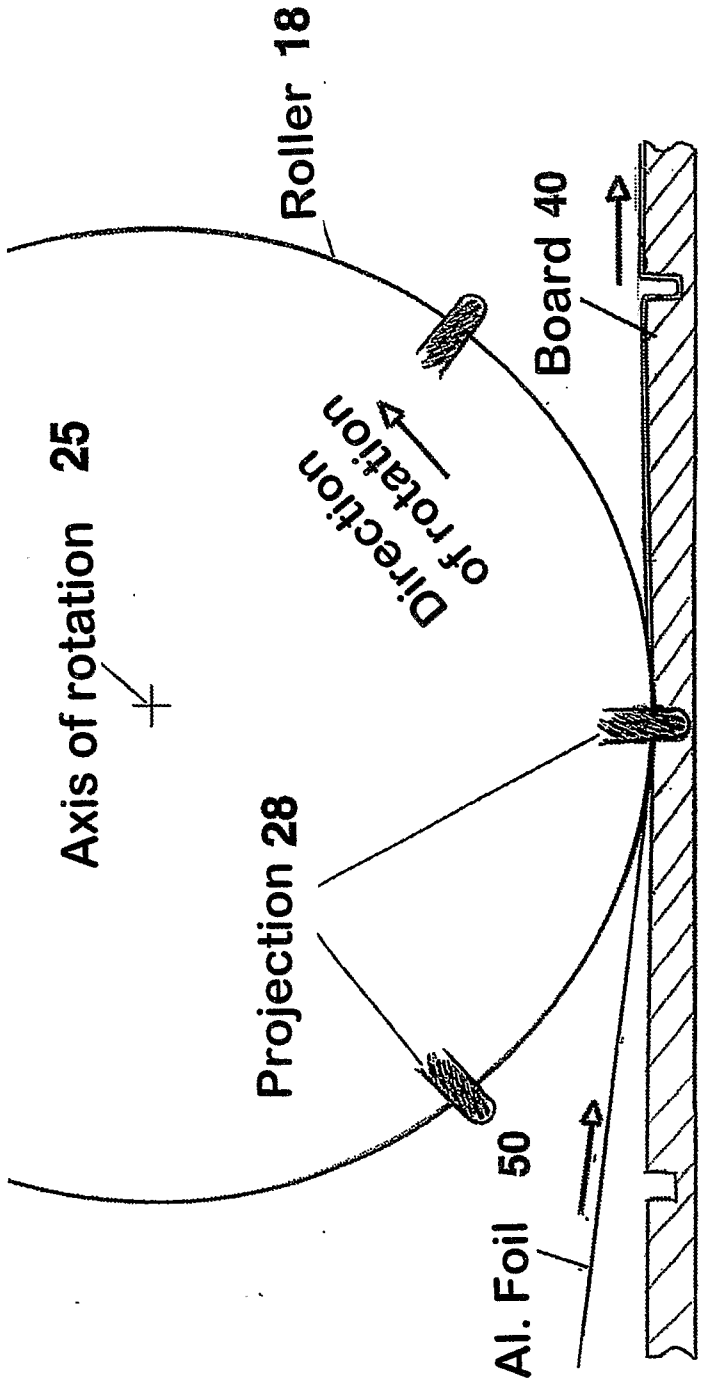

Roller 18
Board 40
Direction of rotation
Axis of rotation 25
Projection 28
Al. Foil 50

Fig. 4B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2007/000106

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B32B, E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3506533 A (E BERNER), 14 April 1970 (14.04.1970) --	1-25
A	EP 0799687 A2 (CELOTEX LTD), 8 October 1997 (08.10.1997) --	1-25
A	FR 1402212 A (DOUGLAS AIRCRAFT), 3 May 1965 (03.05.1965) --	1-25
A	US 3594249 A (H MUELLER-TAMM ET AL), 20 July 1971 (20.07.1971) --	1-25

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 2007	28 -06- 2007
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Erika Stenroos Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2007/000106

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2837743 A1 (PANELES EMBO SL), 3 October 2003 (03.10.2003) -- --------	1-25

International patent classification (IPC)
B32B 37/00 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

US	3506533	A	14/04/1970	NONE		
EP	0799687	A2	08/10/1997	GB	9606875 D	00/00/0000
FR	1402212	A	03/05/1965	NONE		
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				ES	2263302 A	01/12/2006