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

(11) EP 3 315 210 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.05.2018 Bulletin 2018/18

(51) Int Cl.:
B05C 5/02 *(2006.01)* ***B05C 11/10*** *(2006.01)*

(21) Application number: **17197342.3**

(22) Date of filing: **19.10.2017**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **28.10.2016 IT 201600109468**

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(54) COATING HEAD, ADAPTABLE TO THE OUTLINE OF A PANEL EDGE OR OTHER PIECES TO BE COATED

(57) Vacuum coating head (1) for coating panel (5) or other essentially flat pieces edges comprising a recess reproducing with suitable increase the outline of the panel to be coated, which recess is configured to work in a condition facing an edge to be coated, which is slid along said recess crossing it from side to side; in said recess at least a nozzle comprising a plurality of slits (11, 12, 13) is open, to apply a coating material on said edge, in which recess also suction nozzles (11, 12, 13) are open controlling said coating step, said recess comprising:
- a body (4) of said head (1) provided with said at least nozzle in the form of a plurality of slits (11);
- a top form (7) for upward limiting said recess, comprising a plurality of slits (13);
- a lower form (8) for downward limiting said recess, comprising a plurality of slits (12);
characterized in that upward and downward limitation of said recess is obtained through said forms (7, 8) made each of a unique solid body, having a shape complementary to the edge of the panel to be coated.

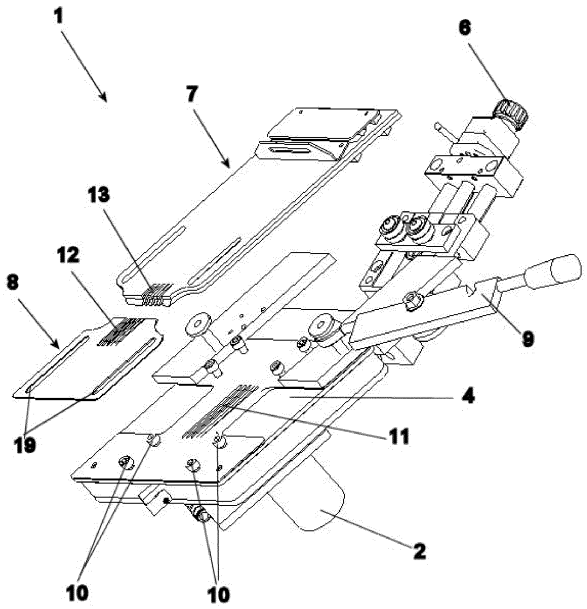

FIG. 4

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Description

[0001] The present invention relates to the technical field of machines for coating panels made of sundry materials (wood, glass, fibrocement, etc.) through the technology of coating with the aid of suction, as will better explained in the following. In particular, the present invention relates to a coating head, a so-called vacuum coating head.

[0002] In the art, coating machines of this kind are known, comprising a head provided with a chamber supplied with a coating product to be used for coating the panel. Documents of the known art are e.g. US 5,976,249 of JOSEF SCHIELE OHG and IT 1.341.136 of Makor.

[0003] The application IT BO2011A000287, of the same applicant as the present one, describes a vacuum coating head comprising a recess reproducing with suitable increase the outline of a panel edge crossing said recess. In the recess there is provided at least a nozzle to apply a coating product on said edge; in said recess there are provided suction nozzles controlling the coating step, wherein the two opposed walls of said recess are formed by bodies fixed to an adjacent supporting body, with means allowing to adjust said bodies, to provide a coating head suitable for the treatment of edges of variable thickness. Said bodies are provided with slits frontally closed toward the outside, which overlap and connect with the other front to corresponding slits of said supporting body, with which said supplying and suctioning nozzles are formed. Said bodies are made of plates having a linear side, parallel to the edge to be coated and to its direction of forward movement, with which they can be registered to coat edges having different outlines in dimension and shape.

[0004] The slits in the recess allow to coat the edge with a constant and continuous layer of coating material, thanks to the continuous forward movement with constant speed of the panel to be coated, through the suctioning action performed by the slits which continuously suction air through the recess of the coating head and along the surface to be coated of panel edge.

[0005] The viscosity of the coating material, the flow rate of the suctioning, the outline and the dimensions of the recess with relation to the edge outline determine the coating on the edge which, with the longitudinal speed of the forward movement of the panel, determine the thickness of the coating deposed on the edge itself. The suctioning action performed by the slits, in addition to suctioning coating material and preventing its leakage from the coating head, acts as control dosing of the coating material along the panel edge, ensuring a constant thickness of the coating material according to its viscosity and the constancy over time of the pressure of said coating material, panel forward movement, and distance of the edge from the walls of the recess of coating head.

[0006] Nonetheless, in use the solution of a coating head realized through a plates pack is not free from drawbacks.

[0007] A first drawback of the solution described in IT BO2011A000287 is the set-up time of the coating head: in fact, to set up the machine according to a different outline of the panel edge, a human operator must interpose a layer simulating the coating thickness, and then she/he must manually arrange the plates so that they match as much as possible with the new profile of the panel to be coated.

[0008] A second drawback is the fact that, with the change of thickness of the panel, the plate pack must be adjusted to the new shape.

[0009] Aim of the present invention is providing a coating head having a nozzle realized through an assembly of two forms which cooperate to provide an opening having dimensions and shape suitable for the edge to be coated, which can be easily and rapidly replaced with the change of panel edge outline.

[0010] This object is achieved by an apparatus and a method having the features of the independent claims. Advantageous embodiments and refinements are specified in claims dependent thereon.

[0011] The coating head according to the present invention comprises:

- head body;
- at least a top form;
- at least a lower form;

through said two forms and said head body a recess is produced that works as a nozzle shaped on the specific edge to be coated.

[0012] It is apparent that for every distinct edge to be coated having its own form, the recess has a corresponding specific shape.

[0013] The method according to the present invention comprises the following steps:

- Producing a first pair of top and lower forms which together work as a specific nozzle for a given first edge, the forms being preferably produced removing from a block the excess material;
- Assembling, manually or automatically, said first pair of top and lower form on the supporting body, in correspondence to the exit slits of the coating material and of vacuum transmission present on the body itself;
- Coating the panels with an edge having a first given shape;

- When the batch of panels is finished and the following batch, having a different given edge, has to be coated, replacing, manually or automatically, the first pair of top and lower forms having the outline corresponding to the first batch with a second pair of top and lower forms having the outline corresponding to the second batch.

[0014] In particular, the replacement of the first pair of forms with the second pair of forms makes the set-up of the machine very rapid when the replacement is automatically performed by the machine itself. Nonetheless, it is worth noting that, even in the case the replacement is manually performed by a human operator, the set-up time is reduced, in that all the steps of fine-tuning of the recess outline are moved to the step wherein the forms are produced, preferably obtaining them by removal of material from a block.

[0015] A first advantage of the present invention consists in the possibility of a high reduction of the downtime of the coating machine connected with the replacement of the recess of the coating head.

[0016] A second advantage lies in the fact that, with the change of panel thickness, its outline being the same as in the preceding batch, said pair of forms does not need replacement, but the operator has simply to adjust their respective distance to bring the two forms at a distance suitable to the present batch of panels.

[0017] A third advantage of the present invention is in the possibility of automating the set-up of the coating machine, providing it with different forms having different outlines, and with a system allowing their replacement without human operator.

[0018] Further advantages and properties of the present invention are disclosed in the following description, in which exemplary embodiments of the present invention are explained in detail based on the drawings:

Figure 1	Lateral view of a vacuum coating head according to the present invention with panel;
Figure 2	Frontal view of a coating head with panel;
Figure 3	Frontal view of a coating head without panel;
Figure 4	Exploded view of an axonometric view of the coating head wherein the top and lower forms were removed;
Figure 5	Frontal view of the coating head wherein the top and lower forms were removed;
Figure 6A, 6B, 6C	Lateral view of three vacuum coating heads according to the present invention, each head coating a panel having a distinct edge shape.

[0019] Figure 1 shows in a lateral view a vacuum coating head 1 having a connecting piece 2 between said head and its relative system generating vacuum (not shown); two pipes 3 supplying coating material to said head 1; a body 4 wherein slits 11 are obtained (visible in the following Figures). Moreover, Figure 1 shows a panel 5 in the position wherein it stands while it is coated. Figure 1 shows an adjusting wheel 6 allowing the adjustment of recess dimensions according to the thickness of the panel to be coated; a top form 7 and a lower form 8.

[0020] Figure 2 shows said vacuum coating head 1 in a frontal view; therefore, the connecting piece 2 and the pipes 3 are not visible. On the other hand, a handle bar 9, which allows to fix the top form 7, and four knobs 18 for fixing the lower form 8 become visible. In this view, the panel 5 is shown in the position in which it stands while it is coated.

[0021] Figure 3 shows the same components as in Figure 2, but said panel 5 was removed for better clarity. This Figure shows said slits 11 obtained in said head body 4, from which the coating material pours out; said coating material undergoes suction, so that excess coating material is suctioned back through the connecting piece 2. Figure 2 shows a plurality of linear and transversal slits 11, preferably oblique with respect to the direction of forward movement of the panel, whose edge is to be coated. Said slits are arranged side by side, in the sense of forward movement of the panel and cross the body 4, opening on its back, allowing the passage of the coating material coming from a dedicated (not shown) reservoir.

[0022] This coating process allows to recover excess coating material, which is recovered and recycled thanks to the action of suction.

[0023] Figure 4 shows an exploded axonometric view of the coating head 1, wherein the top form 7 and the lower form 7 are removed from their working position. The handle bar 9 is rotated so that the top form 7 can be removed, while from screws 10 knobs 18 were removed, which keep the lower form 8 in place during the coating process. The lower form 8 is kept integral with said body 4 of coating head 1 through a pair of eyelets 19, each of which is assembled with a pair of screws 10. The knobs 18, screwed on screws 10, allow the fixing of the lower form 8 to coating head body 4.

[0024] The top form 7 is provided in its turn with a plurality of slits 13, while the lower form 8 is provided in its turn with a plurality of slits 12. Said slits 12 and 13 of the forms are arranged in phase with respect to the slits 11 of body 4, so that coating material can come out and be suctioned. Nonetheless, the top form 7 and lower form 8 can be slid so as to bring them closer together or further apart, and this allows to adjust the overall height of the slits, so that their dimensions is suitable to the thickness of the panel edge to be coated.

[0025] Figure 5 shows the coating head 1 wherein top form 7 and lower form 8 were removed; the handle bar 9 is in the position allowing their removal. This Figure shows the presence of the driving wheel 6, adjusting the vertical position

of the top form 7 through a pair of guides 14 on which a support 15 slides; on said support two bearings 16 are fixed. When the top form 7 is in its assembled status, said bearings 16 are engaged in a slot 17 of the form 7 itself. The rotation of the adjusting wheel 6 turns a threaded rod, which engages in a stationary nut integral with the sliding support 15; therefore said rotation leads, according to the direction of rotation, to a forward or backward translation of said sliding support 15.

[0026] Although the embodiment shown in the figures provides for a specific mechanism for adjusting the vertical position of the top form 7, this specific embodiment has not to be interpreted as a limitation of the more general teaching according to which the top form 7 is supported by a displacing mechanism for adjusting the vertical position of the said top form 7 in relation to the position of the lower form 8 for variating the nozzle size and a control organ is provided for driving the said displacing mechanism.

[0027] The specific solution disclosed in the drawings is a preferred embodiment wherein said top form 7 and said lower form 8 can be brought closer together or further apart, preferably comprising an adjusting wheel 6 which controls a translation mechanism of a support 15, two guides 14 on which said support slides 15 and a pair of bearings 16, allowing a precise adjustments of the nozzle size through a variation of the reciprocal distance of the top and upper forms 7, 8 one from the other by a manual control action through the wheel 6.

[0028] According to the outline of the panel 5 to be coated, different top forms 7 and lower forms 8 are produced, reproducing its outline. When there is a change of production batch, a human operator manually replaces the top form 7 and lower form 8 from coating head 1. When the radius of curvature of a panel edge is the same, but the thickness of the panel 5 is different between batches, bringing the top form 7 and the lower form 8 closer together or further apart through adjusting wheel 6 will be sufficient.

[0029] Figures 6A, 6B, 6C show three lateral views similar to that shown in Figure 1, wherein the vacuum coating head is used to coat three different panels having different shapes. Panel 5A has an asymmetric bull nose edge, panel 5B has a bull nose edge with a tooth, and panel 5C has a symmetrical bull nose edge. The vacuum coating head 1 is provided with specifically produced forms 7 and 8, which are suitable for each of these shapes; moreover, the forms 7 and 8 can be brought closer together of further apart to adapt them to the thickness of each single panel 5A, 5B, 5C.

[0030] Top forms 7 and lower forms 8 are produced through machine tool in a productive step completely distinct from coating step, so as to reduce to a minimum the downtime of the coating machine which is necessary for the set-up of said coating machine comprising the vacuum head 1. Preferably, top forms 7 and lower forms 8 are obtained starting from stainless steel blades through removal of material, even if the use of other materials and technologies is possible, e.g. 3D-printing or plastic moulding of a plastic material having a sufficient hardness.

[0031] It is worth noting that the cleaning of top forms 7 and lower forms 8 is faster and easier with respect to the plate packs described in IT BO2011A000287.

[0032] In an alternative embodiment, the top form 7 and the lower form 8 are obtained not starting from a solid body, but from a plate pack wherein plates are integrally connected to each other so as to form a unique body (i.e., the plates cannot slide on each other as described in IT BO2011A000287).

[0033] The described systems using two forms, a top form 7 and a lower form 8, with a device adjusting their relative position, paves the way to an automation of the set-up of the coating machine comprising the vacuum coating head according to the present invention.

[0034] In fact, the coating machine can be provided with a stock of different top forms 7 and lower forms 8, which are picked up by a robotic arm and placed in the correct position with respect to the body 4 of coating head 1. Obviously, in this case the handle bar 9, the adjusting wheel 6, and the knobs 18 of screws 10 will be replaced by suitable fixing and adjusting elements well-known to the skilled man.

[0035] In the furniture industry, the method of panel recognition through barcodes is used: when a production batch has to be changed, a human operator detects the barcode on the following batch. An informatics system saves all the dimensional characteristics relating to batches, and therefore the control system of the coating machine, wherein the data for each batch were previously saved, can set-up the coating machine arranging the suitable top forms 7 and lower forms 8 at a suitable distance according to the detected barcode and associated to the batch to be produced.

[0036] Through the automation of top forms 7 and lower forms 8 replacement, the manual set-up time, typically lasting some minutes, can be reduced to a set-up time lasting some seconds, obtaining a reduction of set-up time of an order of magnitude. This is especially desirable in the case of batch processing, each of which comprises a small number of pieces, which is the productive reality which most of furniture manufacturers face today.

1 Vacuum coating head
2 Connecting piece
3 Pipes
4 Body with slits
5 Panel
6 Adjusting wheel

7 Top form
8 Lower form
9 Handle bar
10 Screws
11 Slits
12 Slits of top form
13 Slits of lower form
14 Guide
15 Support
16 Cuscinetti
17 Slot
18 Knobs
19 Eyelets

Claims

1. Vacuum coating head (1) for coating panel (5) or other essentially flat pieces edges comprising a recess reproducing with suitable increase the outline of the panel to be coated, which recess is configured to work in a condition facing an edge to be coated, which is slid along said recess crossing it from side to side; in said recess at least a nozzle comprising a plurality of slits (11, 12, 13) is open, to apply a coating material on said edge, in which recess also suction nozzles (11, 12, 13) are open controlling said coating step, said recess comprising:

- a body (4) of said head (1) provided with said at least nozzle in the form of a plurality of slits (11);
- a top form (7) for upward limiting said recess, comprising a plurality of slits (13);
- a lower form (8) for downward limiting said recess, comprising a plurality of slits (12);

characterized in that upward and downward limitation of said recess is obtained through said forms (7, 8) made each of a unique solid body, having a shape complementary to the edge of the panel to be coated and.
wherein said top form (7) and said lower form (8) can be brought closer together or further apart, allowing the variation and adjustment of the nozzle size, by means of a displacement mechanism (14, 15, 16) bearing at least one of the said forms (7, 8) preferably the said top form (7) and which mechanism is driven by a displacement control organ (6).

2. Vacuum coating head according to claim 1, wherein said displacement mechanism for adjusting the nozzle size comprises an adjusting wheel (6) which controls a translation mechanism of a support (15), two guides (14) on which said support slides (15) and a pair of bearings (16) connecting the said top form (7) said support (15).

3. Vacuum coating head according to claim 1 or 2, wherein said top form (7) and said lower form (8) can be brought closer together or further apart working on an adjusting device, preferably comprising rapid tightening screws (10) with knobs (18) and slots (19) provided in said lower form (8) and oriented in a direction bringing said lower form (8) closer together or further apart with respect to said top form (7).

4. Vacuum coating head according to one of the preceding claims, wherein said slits (12) of lower form (8) and said slits (13) of top form (7) are arranged in phase with said slits (11) of head body (4), the overall height of nozzles being adjustable by bringing closer together or further apart said top form (7) and lower form (8).

5. Vacuum coating head according to one of the preceding claims, wherein said top forms (7) and/or lower forms (8) are obtained by processing a pack of plates arranged so that they cannot slide on each other, so forming a solid body.

6. Method for coating panel edges or other essentially planar pieces making use of a coating head according to claims 1-5, comprising the following steps:

- Producing a first pair of top form (7) and lower form (8) which together work as a specific nozzle having an outline complementary to the outline of a given first edge;
- Assembling, manually or automatically, said first pair of top and lower forms (7, 8) on the supporting body (4), in correspondence to the exit slits (11) of the coating material and of vacuum transmission present on the body itself at a suitable distance from each other;

- Coating the panels (5) with an edge having a first given shape;
- When a first batch of panels is finished and a second batch, having a different given edge, has to be coated, replacing, manually or automatically, the first pair of top and lower forms (7, 8) having the outline corresponding to said first batch with a second pair of top and lower forms (7, 8) having the outline corresponding to a given second batch

and wherein the radius of curvature of panel edge being equal, and panel (5) thickness being different, said top form (7) and lower form (8) are brought closer together or further apart, without the need of replacement.

7. Method for coating panel edges or other essentially planar pieces according to claim 6, wherein top and lower forms (7, 8) are produced in a productive step distinct form the coating step, preferably before said coating step and through removal of material by a machine tool.

8. Method for coating panel edges or other essentially planar pieces according to claim 6 or 7, wherein the set-up of the coating machine is performed automatically by picking the suitable top form (7) and lower form (8) up from a stock inside the coating machine through a robotic arm, and fixing them with suitable fixing means to said coating head (1).

9. Method for coating panel edges or other essentially planar pieces according to claim 8, wherein the dimensions of each production batch are saved in the coating machine comprising said coating head (1), at least for what concerns the features of shape and dimensions of edge outline, and when passing from the working of a first batch to the working of a subsequent second batch, the set-up of the coating machine occurs reading the barcode of said second production batch, which records the dimensions needed for picking up and fixing said top form (7) and lower form (8) to said vacuum coating head (1), which forms are identified through said barcode, taken and mounted to replace the forms used for said first batch.

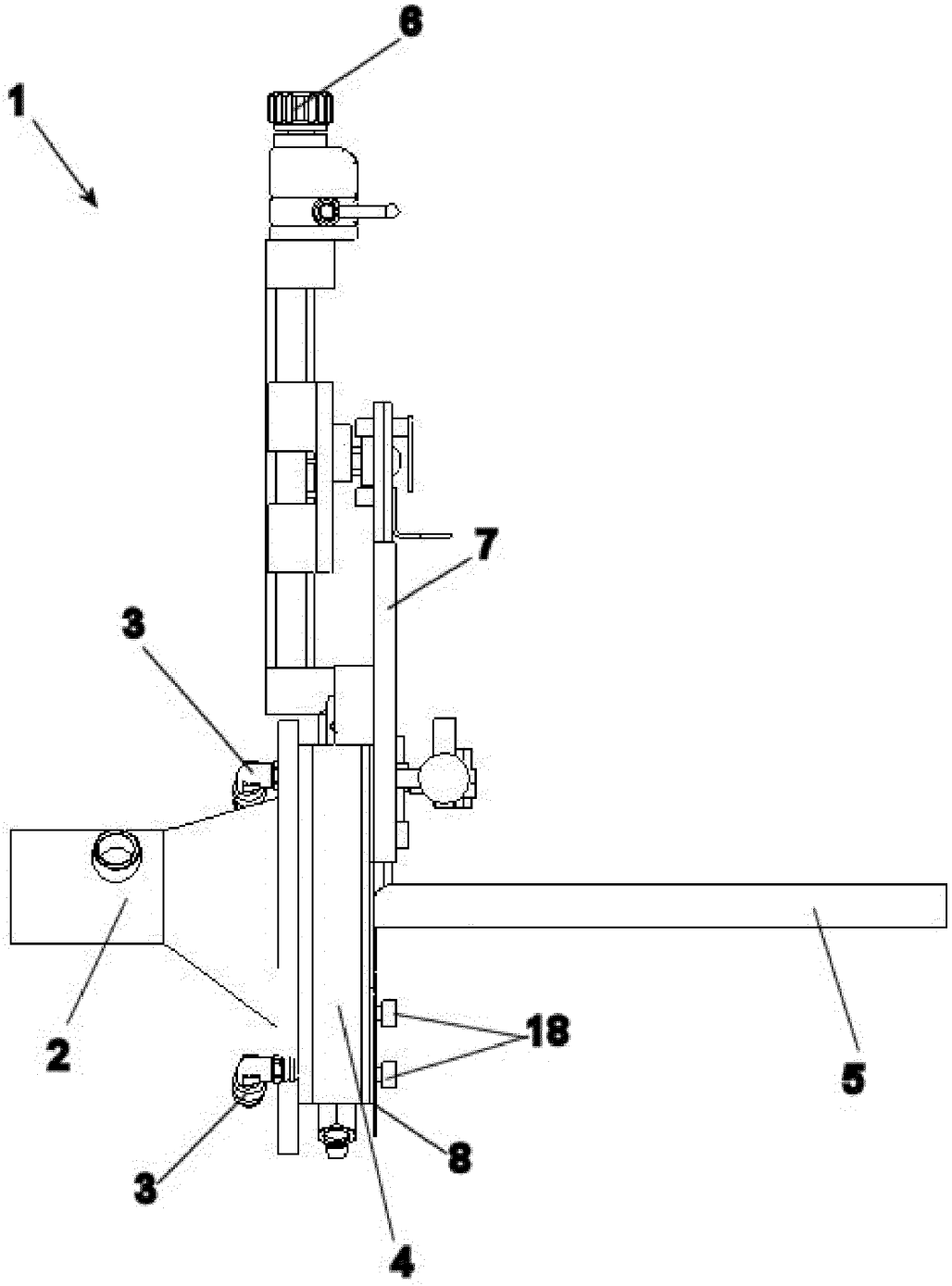

FIG. 1

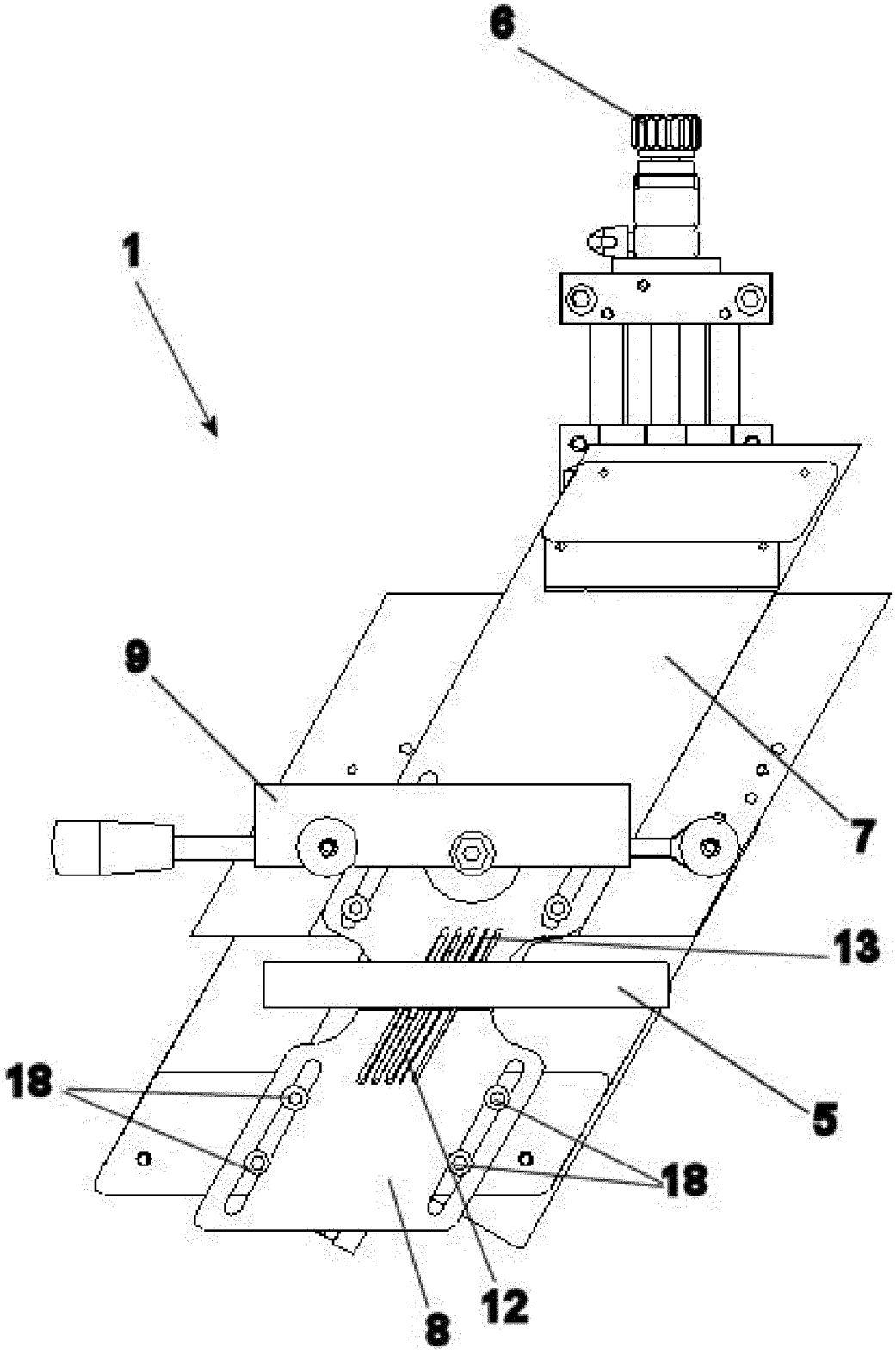

FIG. 2

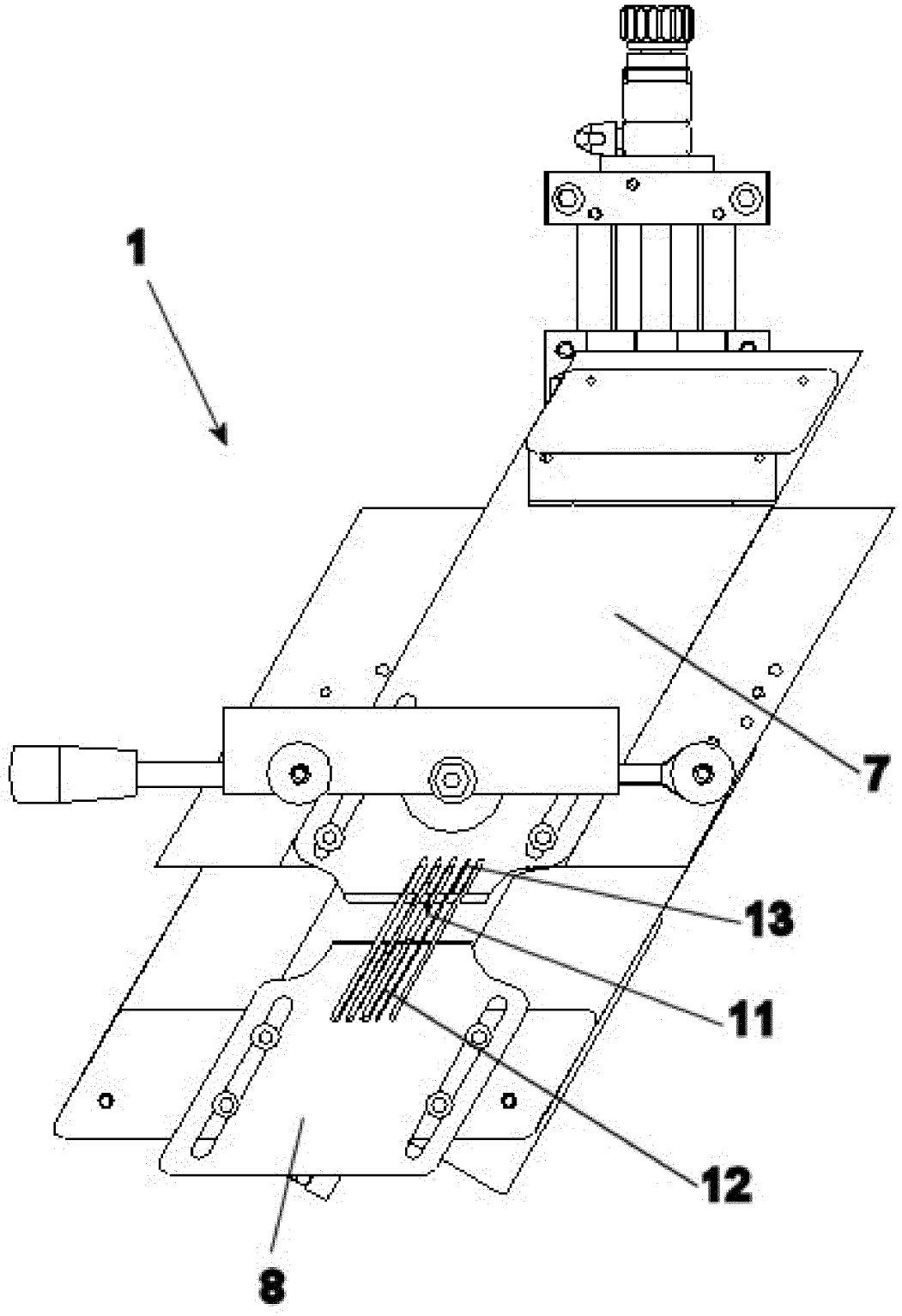

FIG. 3

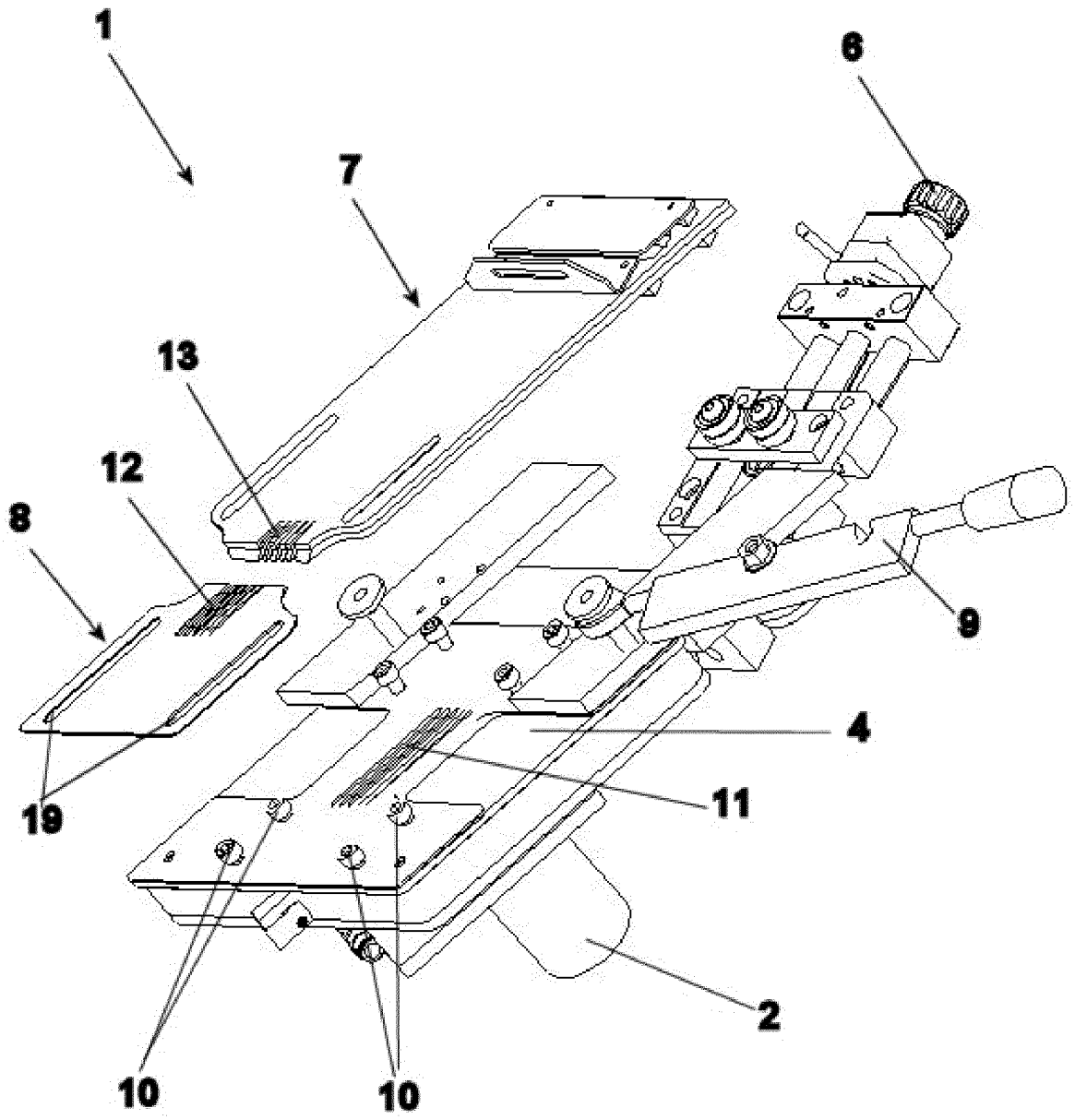

FIG. 4

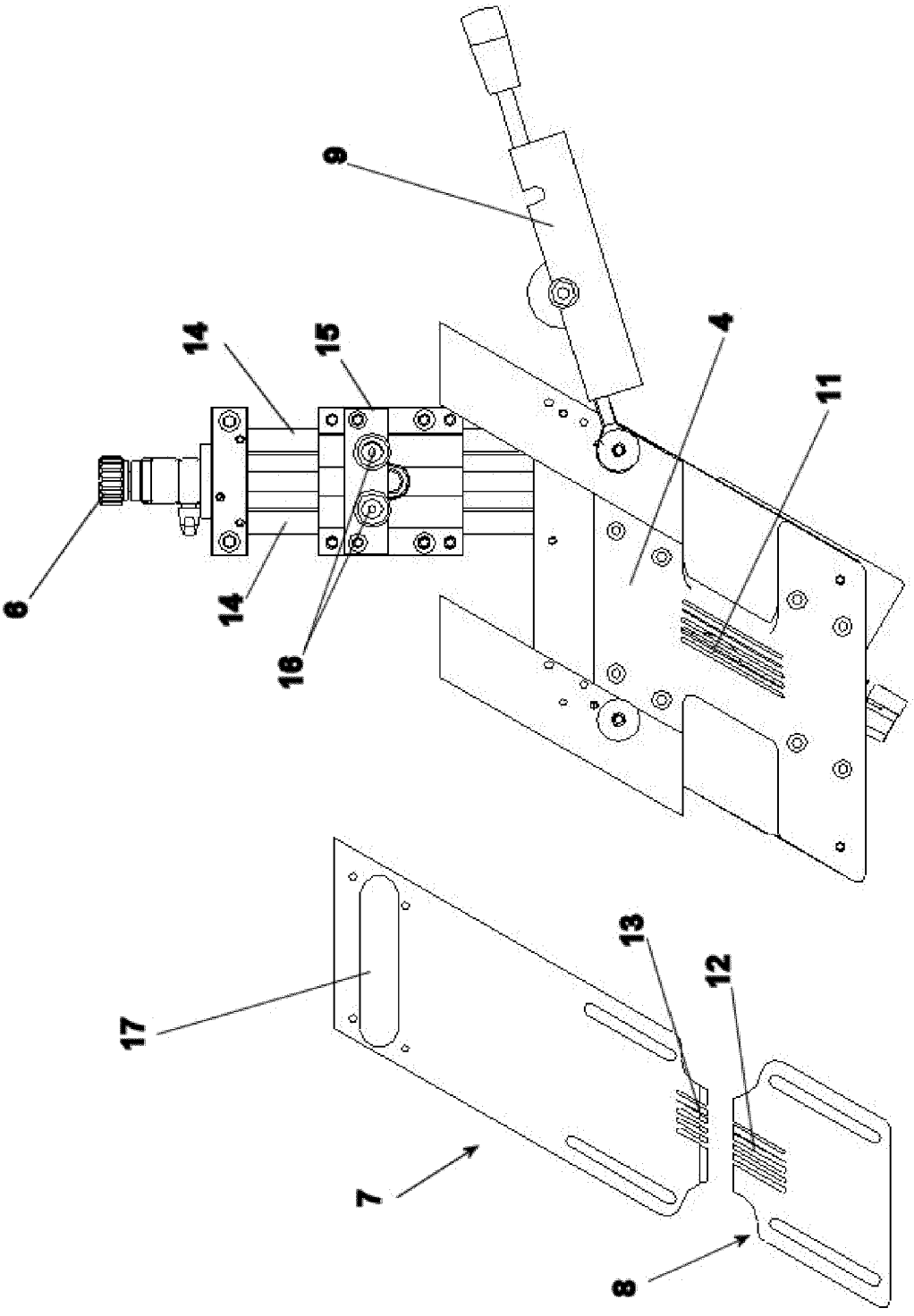

FIG. 5

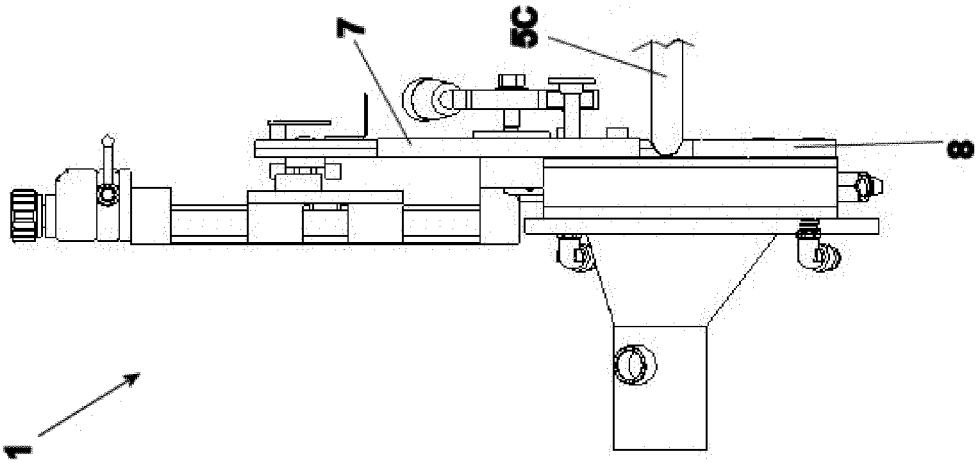

FIG. 6C

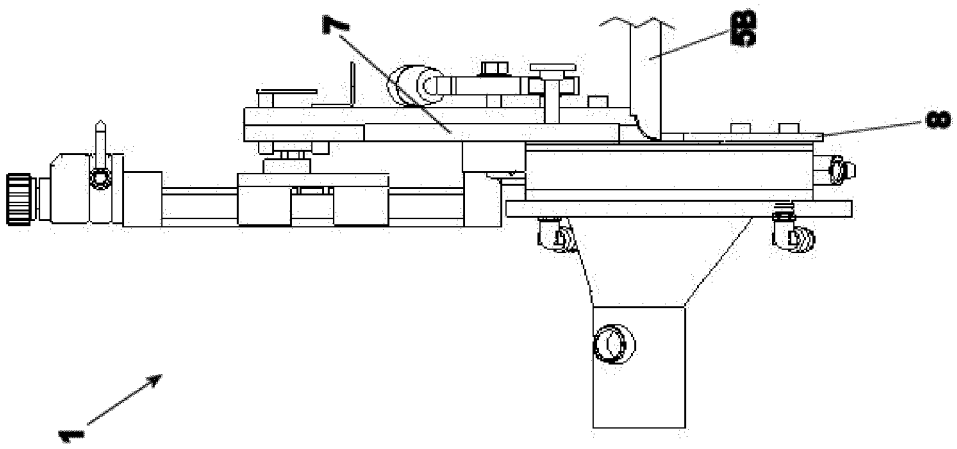

FIG. 6B

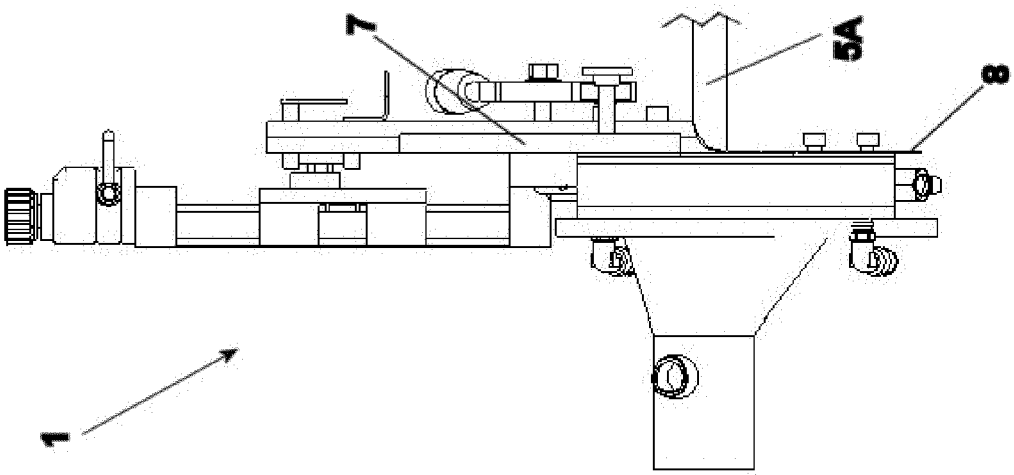

FIG. 6A

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 7342

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	IT BO20 110 287 A1 (SORBINI SRL) 21 November 2012 (2012-11-21) * abstract; figure 1 * * paragraph [0003] * * paragraph [0008] *	1-9	INV. B05C5/02 B05C11/10
X	IT FI20 090 093 A1 (MAKOR S R L UNIPERSONALE) 6 November 2010 (2010-11-06) * abstract; figure 4 * * page 5, line 9 - page 6, line 1 * * page 7, line 2 - line 4 *	1,5,6,8,9	
A	WO 02/053296 A1 (SCHIELE JOSEF OHG [DE]; SCHIELE STEFAN [DE]) 11 July 2002 (2002-07-11) * abstract; figure 1 *	1-9	
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			TECHNICAL FIELDS SEARCHED (IPC) B05C B27N B05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 February 2018	Ciotta, Fausto

CATEGORY OF CITED DOCUMENTS

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19-02-2018

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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