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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Method and apparatus for forming articles made of loose material to provide doors, casings or others**

(57) A method for forming loose material (2) to provide articles (M) such as doors, casings or others, which comprises at least one step for premixing a binding element with the loose material (2), at least one step of first compaction at a first pressure and/or density value of the loose material premixed with the binding element. The

particularity of the invention consists in that it comprises at least one step of second compaction of at least one portion of the loose material at at least one second pressure and/or density value which is different from the first value to provide an article (M) with regions having different density.

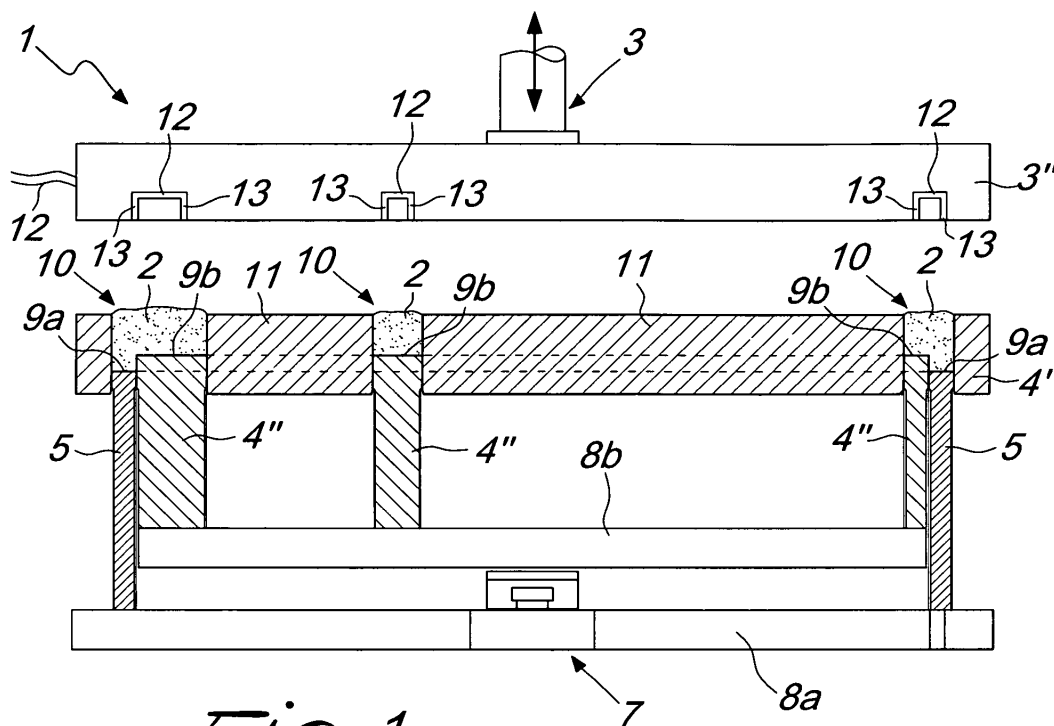


Fig. 1

Description

[0001] The present invention relates to an apparatus for forming articles made of loose material, for example of the type of wood in flakes, chips, powder or others, particularly for manufacturing doors, casings, shutters and parts of pieces of furniture, frames or others, and to the corresponding formation process.

[0002] Methods and apparatuses for forming semifinished articles of the type of wood or other materials in flakes, fibers, chips, powder or others, to provide doors, casings and others are known which entail pressing loose material such as chips, fiber or powder together with adhesives to form panels which are indeed known as chip-wood, MDF or HDF and which at the end of the method have uniform density and regular geometric characteristics.

[0003] After the pressing step, the panels have to be cut and/or bonded in order to give them the chosen shape, for example to obtain variations in thickness, shape or others.

[0004] These methods and these apparatuses of a known type are in any case not free from drawbacks, which include the fact that the cutting step after the pressing step leads to a considerable expenditure in terms of waste material and to a considerable amount of production waste.

[0005] Further, the panel bonding and cutting steps have high personnel management costs and entail a high time and energy expenditure on the part of operators assigned to finishing the semifinished articles.

[0006] The aim of the present invention is to eliminate the drawbacks cited above of the background art, by providing a method and an apparatus for forming loose material, for example of the type of wood in flakes, fiber, chips, powder or others, which allow to provide doors, casings, frames, cases, solid contoured panels with differentiated density or others, while minimizing manufacturing waste and the steps of processing after the compaction of the loose material.

[0007] Within this aim, an object of the method and of the apparatus according to the invention is to minimize the consumption of wood material or others used to produce the articles.

[0008] Another object of the invention is to reduce plant and labor costs required for the processing of the articles.

[0009] Another object of the apparatus and of the method according to the invention is to allow greater strength of the article for an equal total weight of the loose material used.

[0010] Another object is to render the article formed with the method according to the invention fire-resistant and/or water-resistant.

[0011] Another object of the present invention is to provide a structure which is simple, relatively easy to provide in practice, safe in use, effective in operation and has a relatively low cost.

[0012] This aim and these and other objects, which will

become better apparent hereinafter, are achieved by the present method for forming loose material to provide articles such as doors, casings or others, which comprises at least one step for premixing with a binding element said loose material, at least one step of first compaction at a first pressure and/or density value of the loose material premixed with said binding material, characterized in that it comprises at least one step of second compaction of at least one portion of said loose material at at least one second pressure and/or density value which is different from said first value.

[0013] The method according to the invention is performed preferably but not exclusively by means of an apparatus for forming loose material to provide articles such as doors, casings or others, which comprises at least one upper mold part and one lower mold part which can be moved mutually closer and superimposed with the interposition of at least one layer of loose material which is premixed with an element for binding said loose material in order to compact at least one article at a first pressure and/or density value, said lower mold part providing at least one formation chamber and comprising first means for the compaction of the loose material contained in said chamber, characterized in that it comprises second means for compaction at at least one second pressure and/or density value, which is different from said first value, of at least one portion of said loose material, said second compaction means being associated with said upper mold part and/or said lower mold part.

[0014] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment of an apparatus for forming articles made of loose material to provide doors, casings or others, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figures 1, 2 and 3 are schematic sectional views of an embodiment of the apparatus according to the invention in three different operating configurations; Figure 4 is a schematic top view of an article obtained with the method and the apparatus according to the invention.

[0015] With reference to the figures, the reference numeral 1 generally designates an apparatus for forming loose material 2 to provide articles M. The articles M are for example of the type of doors, casings or others, such as frames, cases, solid contoured panels with differentiated density, crossmembers such as stringers for pallets, and others.

[0016] The loose material 2 is of the type of a wooden material or other material in flakes, fibers, chips or powder, which is substantially homogeneous and is fed with a continuous flow. The loose material 2 receives the preliminary addition of a binding element, which is adapted to facilitate its curing during the step for formation by pressing and is moved by means of a conventional supply

line or a loading station, not shown in the figure, for example such as a conveyor belt.

[0017] The apparatus 1 comprises an upper mold part 3 and a lower mold part 4, which can be moved mutually closer and superimposed with the interposition of at least one layer of the loose material 2, which is premixed with the binding element.

[0018] In a preferred but not exclusive embodiment, the article M is provided by superimposing three layers of the loose material 2 having respectively fine, coarse and fine particle size.

[0019] In particular, loading can be performed by means of a loading device which comprises a sliding unit which can move transversely to the direction of approach between the upper mold part 3 and the lower mold part 4 and above the latter. The sliding unit is provided with a lower opening for the descent of the loose material 2 to be loaded. Inside the sliding unit there are two comb-like rollers, the discordant rotation of which allows the controlled and regular supply of the loose material 2. Advantageously, the loading device comprises a plurality of sliding units depending on the type of loading selected.

[0020] The upper mold part 3 and the lower mold part 4 are shaped so as to give, at the end of the formation process, the finished shape of the article M, which as mentioned is of the type for example of a door, a casing, or others.

[0021] The upper mold part 3 and the lower mold part 4 are suitable for pressing at least one article M at a first pressure and/or density value P1 of the loose material 2.

[0022] In particular, the lower mold part 4 is provided with a formation element 4' such as to form at least one formation chamber and comprises first means 4" for compacting the loose material 2 contained in said formation chamber.

[0023] In a preferred embodiment shown in the figure, the first compaction means 4" are associated slidably with the formation element 4' in order to retain laterally the loose material 2; the upper mold part 3 is adapted to face in an upper region the formation element 4' for the upper retention of the loose material 2 during its pressing; however, equivalent technical variations of the upper mold part 3 and of the lower mold part are not excluded in which, for example, the lower mold part 4 is provided with side walls.

[0024] In particular, the formation element 4' has a different shape and depth depending on the article M to be formed and on its structural characteristics.

[0025] In particular, the apparatus 1 comprises second independent means 5 for compacting at least one portion 6 of the loose material 2 to at least one second pressure and/or density value P2, which is different from the first value P1. In particular, the second compaction means 5 are associated with the upper mold part 3 and/or the lower mold part 4; in the particular embodiment shown, the second compaction means 5 are associated with the lower mold part 4, and also can slide with respect to the formation element 4'.

[0026] The apparatus 1 comprises means 7 for pushing the first and second compaction means 4" and 5 and the upper mold part 3, which are associated with at least one of them for the compaction of the loose material 2 at the two different pressure and/or density values P1 and P2. In particular, the stroke of the second compaction means 5 determines the second pressure and/or density value P2 and the stroke of the first compaction means 4" determines the first pressure and/or density value P1.

[0027] In a preferred but not exclusive embodiment, the pusher means 7 are associated with the second compaction means 5 and with the first compaction means 4" by way of respective bars 8a and 8b. The bars 8a and 8b are arranged substantially horizontally for actuation with a translational motion along a direction which is substantially parallel to the direction of mutual approach of the upper and lower mold parts 3 and 4 respectively, of the first and second compaction means. As an alternative, each of the first and second compaction means 4" and 5 respectively may be provided with independent pusher means 7.

[0028] In particular, the pusher means 7 comprise at least one linear actuator, of the type of a conventional actuator with a hydraulic or pneumatic fluid medium, or equivalently it is possible to provide mechanical or electrical actuators depending on the construction requirements of the apparatus 1.

[0029] Advantageously, the apparatus 1 comprises a plurality of mutually independent actuators which are associated respectively with the upper mold part 3 and with the first and second compaction means 4" and 5 for the translational actuation thereof. In a preferred embodiment, the linear actuators have an action which is substantially parallel to the direction of mutual approach of the upper and lower mold parts 3 and 4 respectively. In the embodiment shown in the accompanying figures, the second compaction means 5 are associated slidably with the formation element 4', the tops 9a and 9b respectively of the second compaction means 5 and of the first compaction means 4", being in a so-called loading configuration, in which the lower mold part 4 and the upper mold part 3 are mutually spaced.

[0030] In the particular embodiment shown in Figure 1, the formation element 4' is at least partially laterally adjacent to the first and second compaction means 4" and 5 and the upper mold part 3 is raised from them; the formation element 4' defines the formation chamber, which is for example of the type of a recess 10 for accommodating the loose material 2 to be formed.

[0031] In particular, the recesses 10 have different depths depending on whether they are provided at the first or second compaction means 4" or 5 to provide regions with different density of the loose material 2 in the finished article M, depending on the quantity of the loose material 2 loaded therein.

[0032] In a second configuration, the tops 9a and 9b respectively of the second compaction means 5 and of the first compaction means 4" are mutually aligned in or-

der to form a substantially flat surface for forming an article M which has a substantially continuous and flat surface and a uniform thickness. The second configuration, termed pressing configuration, is shown in Figure 2, and has the lower mold part 4 and the upper mold part 3 mutually close for the compaction of the interposed loose material 2.

[0033] However, different configurations of the first and second compaction means 4" and 5 are not excluded in which, for example, the top 9a of the second compaction means 5 is not aligned with respect to the top 9b of the first compaction means 4" to form an article M which has different thicknesses and a discontinuous surface, and the top 9a in the second configuration can be at a higher or lower level than the top 9b.

[0034] Advantageously, the apparatus 1 comprises a plurality of second compaction means 5 at a plurality of portions 6 made of the loose material 2 for compaction to the second pressure and/or density value P2, which in particular is greater and/or lower than the first pressure and/or density value P1. The first and second compaction means 4" and 5, in cooperation with the upper mold part 3, are contoured for the shape of the finished article M and are such as to determine in said article regions with different density of the loose material 2, which is pressed according to the depth of the recesses 10. For example, if the article M is a door or a shutter, the regions with high density, located at the portions 6 of the loose material 2, are provided in the regions of installation of the hinges or others to ensure high resistance to stresses of the article M; the recesses 10 at the second compaction means 5 are therefore deeper than the recesses 10 at the first compaction means 4".

[0035] The apparatus 1 further comprises at least one core 11, which is interposed between the upper mold part 3 and the lower mold part 4 in order to form hollows or voids in the article M. The core 11 can be associated equally with at least one of the upper mold 3, the lower mold 4 and the second compaction means 5 or can be simply interposed detachably between them. In the particular embodiment, there are a plurality of cores 11, which are associated with the formation element 4', but different and technically equivalent embodiments are not excluded.

[0036] The apparatus 1 comprises means for setting the height of at least one of the first and second compaction means 4" and 5 in order to determine the depth of the recesses 10 for accommodating the loose material 2, at the portions 6 in the loading configuration.

[0037] Advantageously, the setting means comprise a control valve or other device, not shown in the figure, which is associated with each actuator in order to set the height of the top 9a and of the top 9b in order to determine the quantity of the loose material 2 inside the recesses 10 and therefore the density values of said loose material in the finished article M at the portion 6.

[0038] The apparatus further comprises means for adjusting the stroke of at least one of the first and second

compaction means 4" and 5 in order to determine the first and second pressure and/or density values, respectively P1 and P2, also not shown in the figure since they are of a known type.

[0039] The apparatus comprises means for heating the upper mold part 3 and/or the first and second compaction means 4" and 5.

[0040] Such heating means comprise at least one hydraulic circuit 12, which is associated with the upper mold part and with said first and second compaction means, for the passage of at least one first preheated fluid. In an alternative embodiment, the heating means are of the electrical type, since they are provided with a resistance or other device for heating at least one among the upper mold part 3, the lower mold part 4 and the second compaction means 5.

[0041] The apparatus 1 further comprises means for injecting at least one second hot fluid into the loose material 2, which advantageously comprise ports 13 for the discharge of the second fluid which are associated with the upper mold part 3 and with the first and second compaction means 4" and 5. In particular, the first and second fluid coincide and are of the type of water vapor or others and the discharge ports 13 are associated with terminal portions of the hydraulic circuit 12, the injected fluid allowing to heat and/or spread the loose material 2.

[0042] Finally, the apparatus 1 comprises means for extracting the formed article M, which comprise at least one pusher, such as a flap which is actuated hydraulically or others, for pushing the formed article M, which rests on the first and second compaction means 4" and 5, when the apparatus 1 is in a configuration, termed configuration for unloading the article M, shown in Figure 3, in which said first and second compaction means are in the pressing configuration and the upper mold part 3 is raised as in the loading configuration.

[0043] The apparatus 1 further comprises a unit for controlling and actuating the steps for loading, compaction of the loose material and unloading of the article M, of the type of a traditional electronic board or a PLC.

[0044] In particular, the upper mold part 3, the first and second compaction means 4" and 5, the setting means and the adjustment means, as well as the injection and heating means, are functionally associated with the control and actuation unit for the controlled and automated determination of the pressing and optimization parameters of the formation cycle.

[0045] The formation method according to the invention is as follows.

[0046] The formation of the loose material 2 to provide the articles M such as doors, casings or others provides at least one step for premixing a binding element to the loose material 2 and at least one step for first compaction, which is performed by interposing the loose material 2 between the upper mold part 3 and the lower mold part 4, at a first pressure and/or density value P 1 depending on the construction parameters.

[0047] In particular, the method has a step for second

compaction of the portion 6 to at least one second pressure and/or density value P2, which is greater or smaller than the first pressure and/or density value P1, for compaction to a presettable density value of said portion.

[0048] Advantageously, the steps of first and second compaction are performed simultaneously, but different embodiments of the method are not excluded in which the step of second compaction is performed after said step of first compaction or vice versa.

[0049] The method according to the invention can provide for the heating and/or spreading of the loose material 2 by means of the first and/or second fluid, such as water vapor or other technically equivalent, during the step of first and second compaction, in order to optimize the process of consolidation of the element that binds the loose material 2 and therefore of the article M.

[0050] In practice it has been found that the described invention achieves the proposed aim and objects and in particular the fact is stressed that the method and the apparatus for forming loose material according to the invention, by eliminating the step of cutting the semfinished article, allows to provide doors, casings, frames or others, further minimizing processing waste and the steps of processing after the compaction of the loose material.

[0051] Further, the apparatus and the formation method as conceived allow to minimize the consumption of wooden or other material used to produce the articles, reducing production waste.

[0052] Moreover, the apparatus and the method as studied allow to reduce plant and labor costs required for the processing of the articles.

[0053] Finally, the apparatus and the formation method according to the invention allow greater strength of the article for an equal total weight of the loose material used.

[0054] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0055] All the details may further be replaced with other technically equivalent elements.

[0056] In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0057] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method for forming loose material to provide articles such as doors, casings or others, comprising at

least one step for premixing with a binding element said loose material, at least one step of first compaction at a first pressure and/or density value of the loose material premixed with said binding material, **characterized in that** it comprises at least one step of second compaction of at least one portion of said loose material at at least one second pressure and/or density value which is different from said first value.

2. The method according to claim 1, **characterized in that** said step of first and second compaction are performed simultaneously.

3. The method according to claim 1, **characterized in that** said step of second compaction is performed after said step of first compaction.

4. The method according to one or more of the preceding claims, **characterized in that** it comprises the heating/spreading of said loose material during the step of first and second compaction.

5. An apparatus for forming loose material to provide articles such as doors, casings or others, comprising at least one upper mold part and one lower mold part which can be moved mutually closer and superimposed with the interposition of at least one layer of loose material premixed with a binding element of said loose material for the compaction of at least one article at a first pressure and/or density value, said lower mold part forming at least one formation chamber and comprising first means for compaction of the loose material contained in said chamber, **characterized in that** it comprises second means for compaction at at least one second pressure and/or density value, which is different from said first value, of at least one portion of said loose material, said second compaction means being associated with said upper mold part and/or said lower mold part.

6. The apparatus according to claim 5, **characterized in that** it comprises pusher means which are associated with said upper mold part and/or said first and second compaction means for the compaction of said loose material at said first value and of said portion at said second value, the stroke of said first and second compaction means determining said first and second values respectively.

7. The apparatus according to one or more of claims 5 to 6, **characterized in that** said pusher means comprise at least one linear actuator which has an action which is substantially parallel to the direction of approach of said upper and lower mold parts.

8. The apparatus according to one or more of claims 5 to 7, **characterized in that** it comprises a plurality of said actuators which are mutually independent

and are associated with said upper mold part and with said first and second compaction means for their translational actuation between a first configuration, termed loading configuration, in which said lower mold part and said upper mold part are mutually spaced, the top of said second compaction means and said first compaction means, in said first configuration, forming recesses for accommodating at a different depth said loose material to be formed, and a second configuration, termed pressing configuration, in which said lower mold part and said upper mold part are mutually closer for the compaction of the loose material interposed between them, the tops of said first and second compaction means, in said second configuration, being mutually aligned to form a substantially flat surface of the formed article.

9. The apparatus according to one or more of claims 5 to 8, **characterized in that** it comprises a plurality of said second compaction means at a plurality of said portions for the compaction of each portion at said second value, which is higher and/or lower than said first value.
10. The apparatus according to one or more of claims 5 to 9, **characterized in that** it comprises means for setting the height of the top of said first and second compaction means in order to determine the depth of said recesses for accommodating the loose material at said portions in said loading configuration, said setting means comprising at least one valve for controlling said actuator.
11. The apparatus according to one or more of claims 5 to 10, **characterized in that** it comprises means for adjusting the stroke of at least one of said first and second compaction means to determine said first and second pressure values.
12. The apparatus according to one or more of claims 5 to 11, **characterized in that** it comprises means for heating said upper mold part and/or said first and second compaction means, said heating means comprising at least one hydraulic circuit which is associated with at least one among said upper mold part, said lower mold part and second compaction means for the passage of at least one first preheated fluid.
13. The apparatus according to one or more of claims 5 to 12, **characterized in that** it comprises means for injecting at least one second hot fluid into said loose material, said injection means comprising ports for the discharge of said second fluid which are associated with said upper mold part and/or said first and second compaction means.
14. The apparatus according to one or more of claims 5

to 13, **characterized in that** said first and second fluids coincide, said discharge ports being associated with end portions of said circuit.

15. An article comprised in the group of doors, casings and others, comprising at least one loose material such as wood in chips, flakes, powder or others, formed by compaction at a first pressure and/or density value, **characterized in that** it comprises at least one portion of said loose material formed by compaction at a presettable second pressure and/or density value which is different from said first value.
16. The article comprised in the group of doors, casings or others according to claim 15, formed according to the method and/or the apparatus according to one or more of the preceding claims.

Amended claims in accordance with Rule 137(2) EPC.

1. A method for forming wooden material (2) to provide articles such as doors, casings or others, comprising at least one step for premixing with a binding element said wooden material (2), superimposing at least two layers of wooden material (2), having different particle sizes, at least one step of first compaction at a first pressure and/or density value of the wooden material (2) premixed with said binding material, at least one step of second compaction of at least one portion of said wooden material (2) at at least one second pressure and/or density value which is different from said first value, **characterized in that** said steps of first and second compaction are performed at least in part simultaneously,

2. The method according to claim 1, **characterized in that** it comprises the heating/spreading of said wooden material (2) during the step of first and second compaction.

3. An apparatus (1) for forming wooden material (2) to provide articles such as doors, casings or others, comprising at least one upper mold part (3) and one lower mold part (4) which can be moved mutually closer for the compaction of at least one article at a first pressure and/or density value, said lower mold part (4) forming at least one formation chamber and comprising first means (4'') for compaction of a wooden material (2) contained in said chamber and second means (5) for compaction at at least one second pressure and/or density value, which is different from said first value, of at least one portion of said loose material (2), said second compaction means (5) being associated with said lower mold part (4), said upper mold part (3) and said first and second compaction means (4'', 5) can translate between a first

configuration, termed loading configuration, in which said lower mold part (4) and said upper mold part (3) are mutually spaced, the top (9a, 9b) of said second compaction means (5) and said first compaction means (4"), in said first configuration, forming recesses (10) for accommodating at a different depth said wooden material (2) to be formed, and a second configuration, termed pressing configuration, in which said lower mold part (4) and said upper mold part (3) are mutually closer for the compaction of the wooden material (2) interposed between them, the tops of said first and second compaction means (5), in said second configuration, being mutually aligned to form a substantially flat surface of the formed article, **characterized in that** when the top (9a, 9b) of said second compaction means (5) and said first compaction means (4") are mutually aligned to form a substantially flat surface of the formed article said upper mold part (3) and said first and second compaction means (4", 5) translate simultaneously for compacting the wooden material.

4. The apparatus (1) according to claim 3, **characterized in that** it comprises pusher means (7) which are associated with said upper mold part (3) and/or said first and second compaction means (5) for the compaction of said wooden material (2) at said first value and of said portion at said second value, the stroke of said first and second compaction means (5) determining said first and second values respectively.

5. The apparatus (1) according to claim 4, **characterized in that** said pusher means (7) comprise at least one linear actuator which has an action which is substantially parallel to the direction of approach of said upper and lower mold parts (3, 4).

6. The apparatus (1) according to one or more of claims 3 to 5, **characterized in that** it comprises a plurality of said second compaction means (5) at a plurality of said portions (6) for the compaction of each portion at said second value, which is different than said first value.

7. The apparatus (1) according to one or more of claims 3 to 6, **characterized in that** it comprises means for setting the height of the top of said first and second compaction means (5) in order to determine the depth of said recesses (10) for accommodating the wooden material (2) at said portions (6) in said loading configuration, said setting means comprising at least one valve for controlling said actuator.

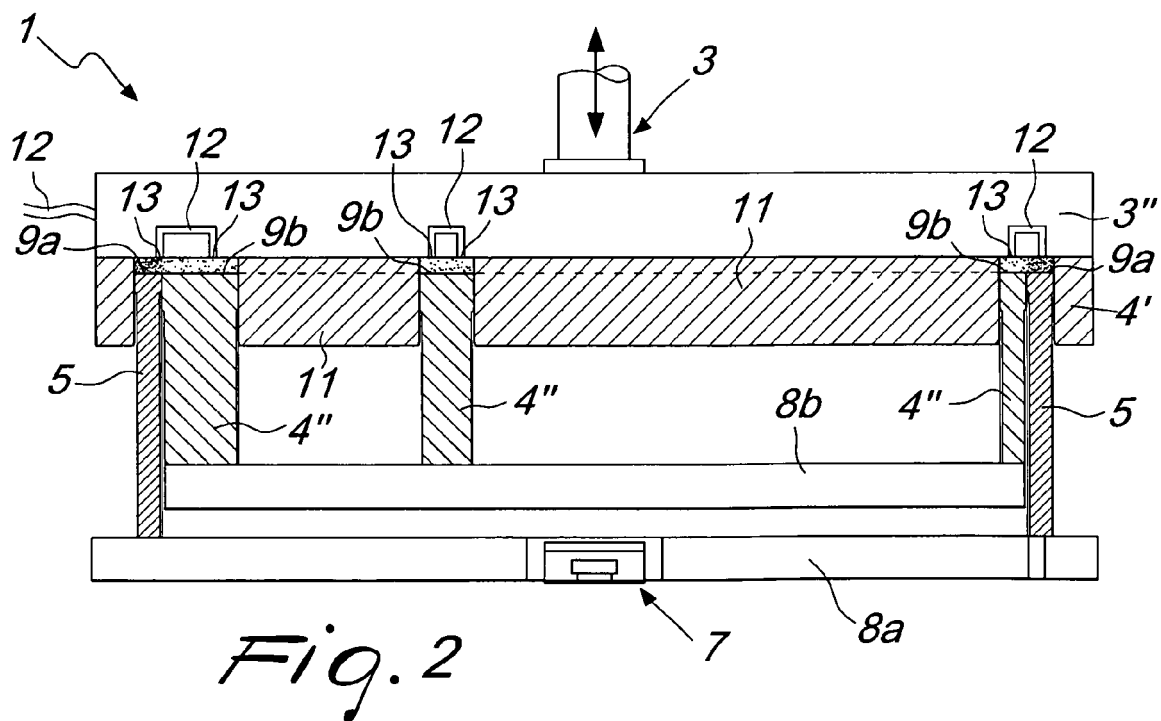
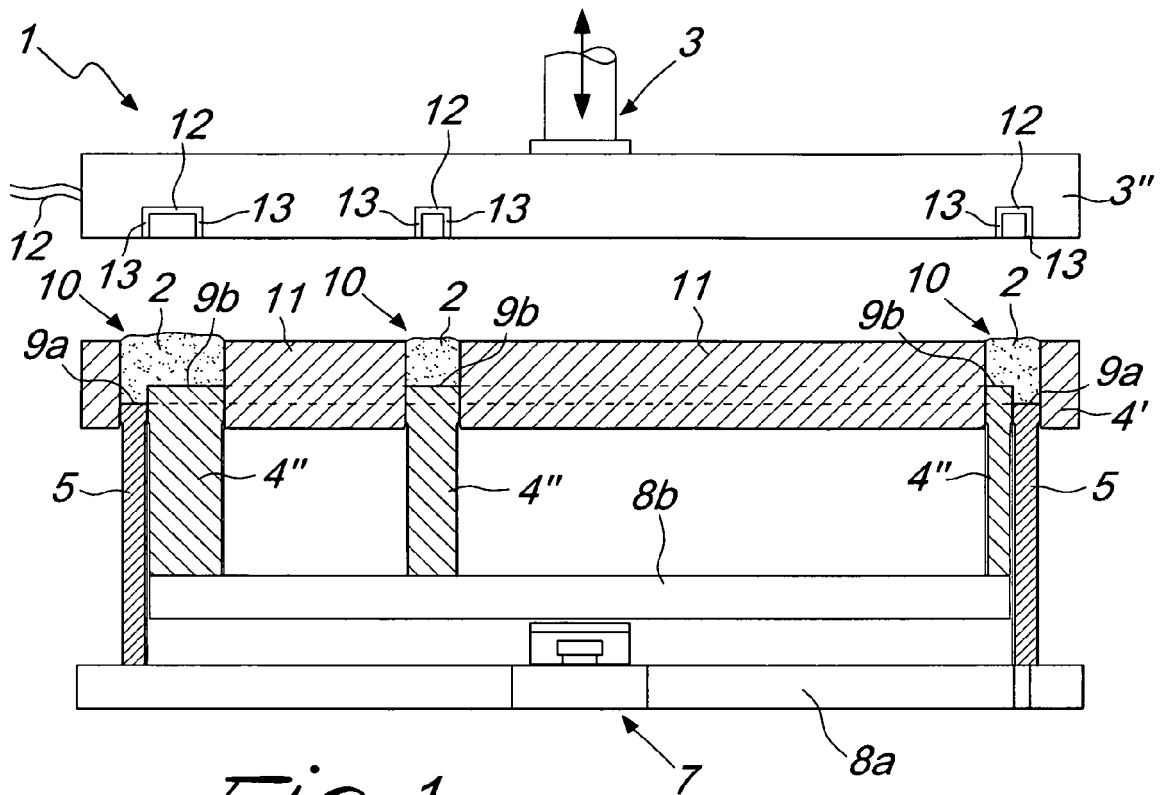
8. The apparatus (1) according to one or more of claims 3 to 7, **characterized in that** it comprises means for adjusting the stroke of at least one of said

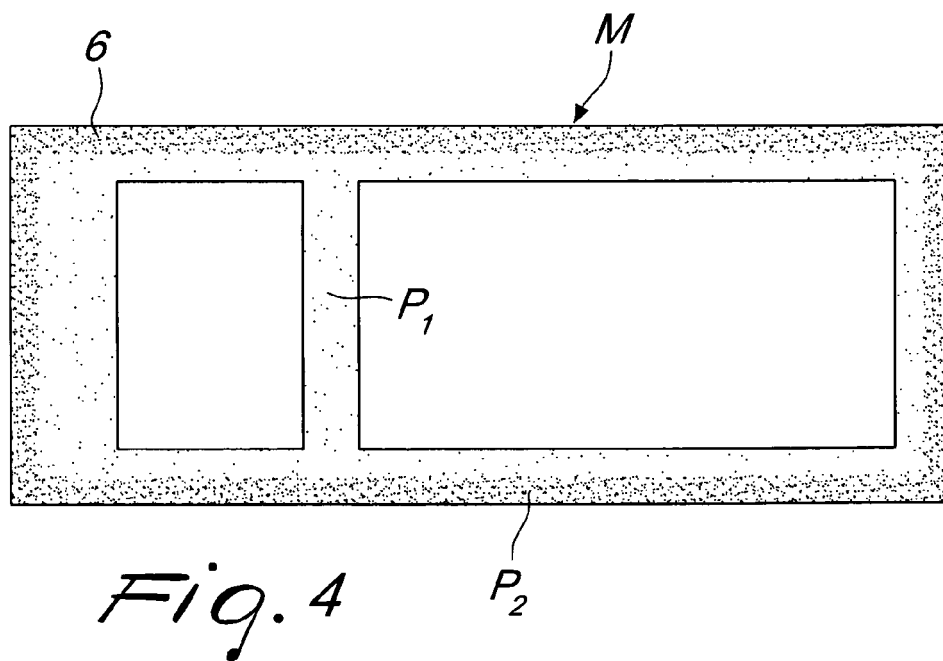
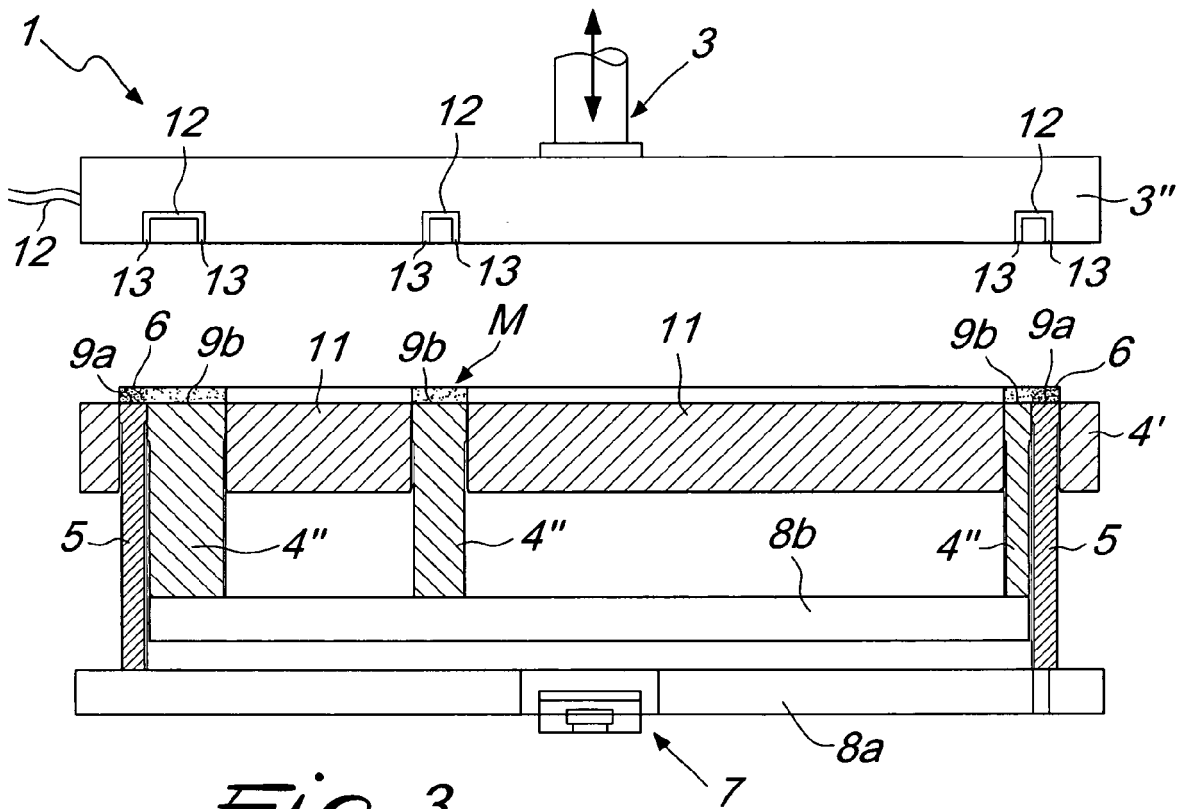
first and second compaction means (5) to determine said first and second pressure values.

9. The apparatus (1) according to one or more of claims 3 to 8, **characterized in that** it comprises means for heating said upper mold part (3) and/or said first and second compaction means (5), said heating means comprising at least one hydraulic circuit (12) which is associated with at least one among said upper mold part (3), said lower mold part (4) and second compaction means (5) for the passage of at least one first preheated fluid.

10. The apparatus (1) according to one or more of claims 3 to 9, **characterized in that** it comprises means for injecting at least one second hot fluid into said wooden material (2), said injection means comprising ports for the discharge of said second fluid which are associated with said upper mold part (3) and/or said first and second compaction means (5).

11. The apparatus (1) according to claim 10, **characterized in that** said first and second fluids coincide, said discharge ports (13) being associated with end portions (6) of said circuit (12).







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5261

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	US 3 103 254 A (STEDMAN CRESSWELL E) 10 September 1963 (1963-09-10) * column 4; claims 1,11,17,20; figures 1-11 * * column 7, lines 8-51 * -----	1,2,4, 15,16	INV. B27N3/08
X	US 4 812 188 A (HANSEN HARDY V [DK]) 14 March 1989 (1989-03-14) * column 3; claims 1-4; figures * -----	1,3,4	
X	US 4 355 754 A (LUND ANDERS E ET AL) 26 October 1982 (1982-10-26) * column 4, lines 9-27; claim 27; figures 1-4 * * column 5, lines 1-21 * -----	1,3,15	
X	EP 0 774 316 A1 (HONDA MOTOR CO LTD [JP]) 21 May 1997 (1997-05-21) * columns 9,10; figures 1,2,4 * -----	5-14	
X	US 2003/230827 A1 (SOH SUNG KUK [US]) 18 December 2003 (2003-12-18) * paragraphs [0024], [0065], [0066], [0086] - [0088], [0094]; figures 1,10,11 * -----	1,3,4,15	TECHNICAL FIELDS SEARCHED (IPC)
A		5-12	B30B B27N
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 October 2007	Examiner Labre, Arnaud
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 42 5261

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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05-10-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3103254 A	10-09-1963	NONE	
US 4812188 A	14-03-1989	AU 6520186 A	05-05-1987
		DE 3677003 D1	21-02-1991
		DK 463085 A	11-04-1987
		WO 8702407 A1	23-04-1987
		EP 0243423 A1	04-11-1987
		FI 872573 A	09-06-1987
US 4355754 A	26-10-1982	CA 1174029 A1	11-09-1984
		EP 0065660 A2	01-12-1982
		FI 79053 B	31-07-1989
		NO 821613 A	19-11-1982
EP 0774316 A1	21-05-1997	CN 1150922 A	04-06-1997
		DE 69623567 D1	17-10-2002
		DE 69623567 T2	09-01-2003
		SG 67943 A1	19-10-1999
		US 6004120 A	21-12-1999
US 2003230827 A1	18-12-2003	AU 2003245509 A1	31-12-2003
		WO 03106131 A2	24-12-2003