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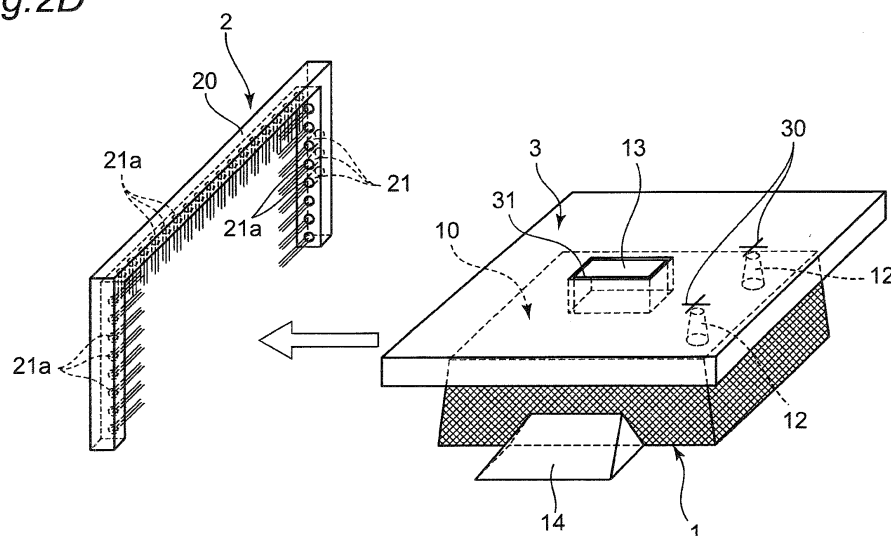
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(54) **DEVICE FOR MANUFACTURING NONWOVEN FABRIC MOLDED PRODUCT AND METHOD FOR MANUFACTURING SAME**

(57) A nonwoven fabric web (3) is mounted on a three-dimensional molding surface (10) of a molding mold (1), and water is sprayed onto this nonwoven fabric web (3) by a water jet (2). Thus, the nonwoven fabric web (3) is pressed against the molding surface (10), and fibers

(32) of the nonwoven fabric web (3) are entangled with each other while the nonwoven fabric web (3) is molded so as to conform to the three-dimensional shape of the molding surface (10), whereby a nonwoven fabric molded product (5) of a three-dimensional shape is produced.

Fig.2D



Description

TECHNICAL FIELD

[0001] The present invention relates to a device and method for manufacturing nonwoven fabric molded products having a three-dimensional shape such as masks, filters, and urethane reinforcing materials to be used for vehicle seats.

BACKGROUND ART

[0002] A conventional device for manufacturing nonwoven fabric molded products is known from JP H11-315458 A (PTL1). This manufacturing device has a male mold and female mold so that nonwoven fabric molded products are manufactured by press-molding nonwoven fabrics with the male and female molds.

[0003] With regard to the manufacture of nonwoven fabrics, generally, an unentangled nonwoven web is passed between heat rolls so as to be thermo-compression bonded, by which an entangled-and-compressed nonwoven fabric is manufactured.

CITATION LIST

Patent Literature

[0004] PTL1: JP H11-315458 A

SUMMARY OF INVENTION

Technical Problem

[0005] In actual use of the above-described conventional device for manufacturing nonwoven fabric molded products, there are problems as described below.

[0006] In order to manufacture the nonwoven fabric molded product from the nonwoven fabric, it is required to preliminarily manufacture a nonwoven fabric from a nonwoven web. Thus, a step of manufacturing a nonwoven fabric from a nonwoven web and another step of manufacturing a nonwoven fabric molded product from the nonwoven fabric are necessitated, involving elongated manufacturing time and increased manufacturing cost.

[0007] Also, since a nonwoven fabric molded product is manufactured from a nonwoven fabric by pressing with the male and female molds, changing the shape of a nonwoven fabric molded product involves changing the male and female molds, leading to an increase in the quantity of metal molds.

[0008] Further, since the nonwoven fabric molded product is manufactured from the nonwoven fabric, excess parts for the manufacture of a nonwoven fabric molded product is removed as they are in the nonwoven state. Thus, since excess parts have been compressed by heat treatment, it is difficult to reuse such excess parts.

These excess parts may occupy 40% of the entire product quantity in some products, thus resulting in waste of resources and being adverse to the environment.

[0009] Further, the nonwoven fabric cannot be partly changed in density (weight per unit area), degree of entanglement between fibers, or thickness. A nonwoven fabric molded product manufactured from the nonwoven fabric also cannot be partly changed in density, degree of entanglement, or thickness. Therefore, even with a desire for partly increasing a nonwoven fabric molded product in density, degree of entanglement, or thickness, the nonwoven fabric molded product has to be increased wholly in those terms, leading to a waste of resources unfavorably in terms of the environment.

[0010] Accordingly, an object of the invention is to provide a device and method for manufacturing nonwoven fabric molded products capable of reducing manufacturing time and manufacturing cost, decreasing the quantity of molds and contributing to resource saving favorably in terms of the environment.

Solution to Problem

[0011] In order to solve the problem, a device for manufacturing nonwoven fabric molded products according to the present invention comprises:

a mold having a three dimensional-shaped molding surface; and

fluid spraying means for spraying a fluid to an unentangled nonwoven web mounted on the molding surface of the mold so that the nonwoven web is pressed against the molding surface, and fibers of the nonwoven web are entangled with each other while the nonwoven web is molded so as to conform to a three-dimensional shape of the molding surface, whereby a three-dimensional nonwoven fabric molded product is produced.

[0012] It is noted here that the fluid refers to liquids such as water or gases such as vapor as an example, having such a high pressure as to cause the nonwoven web to be entangled. For example, with water used as the fluid, the fluid pressure is within a range of 10MPa to 20MPa. Of course, this pressure may be changed depending on thickness, hardness or the like of the nonwoven fabric molded product.

[0013] According to the device for manufacturing nonwoven fabric molded products in this invention, since the molding and entanglement of a three-dimensional shape from the nonwoven web can be carried out concurrently in one-time process, the conventional entangling step of manufacturing nonwoven fabric from the nonwoven web can be omitted, simplifying the steps, so that the nonwoven fabric molded product can be manufactured at low cost.

[0014] Also, since the nonwoven web is pressed against the mold by the fluid of the fluid spraying means,

the fluid spraying means fulfills the role as one mold out of a male mold and a female mold to be used for conventional press molding, allowing the one mold to be omitted. Therefore, in cases where the shape of the nonwoven fabric molded product is changed, the need is only to change the other mold, leading to a reduction of the mold quantity.

[0015] Also, since the nonwoven fabric molded product is manufactured from the nonwoven web by fluid, excess materials in the manufacture of the nonwoven fabric molded product are removed from the nonwoven web, as they are, by the fluid, and those excess materials can be reused as they are. This leads to resource saving and favorableness to the environment.

[0016] With conventional nonwoven fabrics, it has been impossible to partly change their density (weight per unit area). In the present invention, on the other hand, excess materials may be laid on necessary parts in the state of the nonwoven web before the nonwoven fabric molded product is manufactured. Thus, according to the invention, it becomes implementable to achieve a reduction in materials, as compared with conventional molded products from nonwoven fabrics, favorably in terms of the environment.

[0017] Also, with conventional nonwoven fabrics, it has been impossible to partly change their degree of entanglement between fibers or their thickness. In this invention, on the other hand, the nonwoven fabric molded product can be partly changed in degree of entanglement or thickness by changing the pressure, distance, time or angle of the fluid sprayed to the nonwoven web. As a result of this, the invention is enabled to provide the functions of the nonwoven fabric molded product (functions due to its degree of entanglement or thickness) with a minimum quantity of material, favorably in terms of the environment.

[0018] In one embodiment, in the above-described device for manufacturing nonwoven fabric molded products, a plurality of through holes for allowing the fluid to pass therethrough are provided in the molding surface of the mold.

[0019] According to the device for manufacturing nonwoven fabric molded products in this embodiment, the fluid after having been sprayed to the nonwoven web passes through the through holes of the molding surface of the mold. As a result of this, the fluid that has passed through the nonwoven web is prevented from impinging on and repelling from the molding surface. Thus, the nonwoven web can securely be pressed against the molding surface so that molding and entanglement of a three-dimensional shape from the nonwoven web can be fulfilled securely.

[0020] In one embodiment, in the above-described device for manufacturing nonwoven fabric molded products, the mold has protrusions in the molding surface, and the fluid spraying means sprays the fluid to the nonwoven

web with the protrusions stuck thereto, so that the protrusions are pierced through the nonwoven web.

[0021] According to the device for manufacturing nonwoven fabric molded products in this embodiment, the fluid spraying means sprays the fluid to the nonwoven web stuck to the protrusions so that the protrusions are pierced through the nonwoven web. As a result of this, there is no need for preliminarily providing holes that allow the protrusions to be pierced through the nonwoven web. Thus, the steps are simplified and waste of materials can be cut down.

[0022] In one embodiment, in the above-described device for manufacturing nonwoven fabric molded products,

the fluid spraying means has a plurality of nozzles for jetting out the fluid to an identical part of the nonwoven web in different directions.

[0023] According to the device for manufacturing nonwoven fabric molded products in this embodiment, the plurality of nozzles jet out the fluid to one identical part of the nonwoven web in mutually different directions. As a result of this, entanglement between fibers of the nonwoven web can be fulfilled with more complexity and more security, so that the strength of the nonwoven fabric molded product can be improved.

[0024] Also, a method for manufacturing nonwoven fabric molded products according to the invention comprises:

mounting an unentangled nonwoven web onto a molding surface of a mold, the molding surface having a three-dimensional shape; and spraying a fluid to the nonwoven web so that the nonwoven web is pressed against the molding surface, and fibers of the nonwoven web are entangled with each other while the nonwoven web is molded so as to conform to the three-dimensional shape of the molding surface, whereby a three-dimensional nonwoven fabric molded product is manufactured.

[0025] According to the method for manufacturing nonwoven fabric molded products in this invention, since the molding and entanglement of a three-dimensional shape from the nonwoven web can be carried out concurrently in one-time process, the conventional entangling step of manufacturing nonwoven fabric from the nonwoven web can be omitted, simplifying the steps, so that the nonwoven fabric molded product can be manufactured at low cost.

[0026] Also, since the nonwoven web is pressed against the mold by the fluid of the fluid spraying means, the fluid spraying means fulfills the role as one mold out of a male mold and a female mold to be used for conventional press molding, allowing the one mold to be omitted in this case. Therefore, in cases where the shape of the nonwoven fabric molded product is changed, the need is only to change the other mold, leading to a reduction of the mold quantity.

[0027] Also, since the nonwoven fabric molded product is manufactured from the nonwoven web by fluid, excess materials in the manufacture of the nonwoven fabric molded product are removed from the nonwoven web, as they are, by the fluid, and those excess materials can be reused as they are. This leads to resource saving and favorableness to the environment.

[0028] With conventional nonwoven fabrics, it has been impossible to partly change their density (weight per unit area). In the present invention, on the other hand, excess materials may be laid on necessary parts in the state of the nonwoven web before the nonwoven fabric molded product is manufactured. Thus, according to the invention, it becomes implementable to achieve a reduction in materials favorably in terms of the environment, as compared with conventional molded products from nonwoven fabrics.

[0029] Also, with conventional nonwoven fabrics, it has been impossible to partly change their degree of entanglement between fibers or their thickness. In this invention, on the other hand, the nonwoven fabric molded product can be partly changed in degree of entanglement or thickness by changing the pressure, distance, time or angle of the fluid sprayed to the nonwoven web. As a result of this, the invention is enabled to provide the functions of the nonwoven fabric molded product (functions due to its degree of entanglement or thickness) with a minimum quantity of material, favorably in terms of the environment.

[0030] Advantageous Effects of Invention

[0031] According to the device for manufacturing nonwoven fabric molded products in this invention, since the manufacturing device includes a mold and fluid spraying means, the nonwoven fabric molded product can be manufactured from the nonwoven web by fluid. Thus, the manufacturing time and the manufacturing cost can be reduced, and a reduction in mold quantity as well as a reduction in waste of resources are achieved, favorably in terms of the environment.

[0032] According to the method for manufacturing nonwoven fabric molded products in this invention, since the nonwoven fabric molded product is manufactured by spraying fluid to the nonwoven web. Thus, the manufacturing time and the manufacturing cost are reduced, and a reduction in mold quantity as well as a reduction in waste of resources are achieved, favorably in terms of the environment.

BRIEF DESCRIPTION OF DRAWINGS

[0033]

Fig. 1 is a schematic structural view showing a device for manufacturing nonwoven fabric molded products according to a first embodiment of the present invention;

Fig. 2A is an explanatory view showing a method for manufacturing nonwoven fabric molded products;

Fig. 2B is an explanatory view showing a method for manufacturing nonwoven fabric molded products; Fig. 2C is an explanatory view showing a method for manufacturing nonwoven fabric molded products; Fig. 2D is an explanatory view showing a method for manufacturing nonwoven fabric molded products; Fig. 2E is an explanatory view showing a method for manufacturing nonwoven fabric molded products; Fig. 2F is an explanatory view showing a method for manufacturing nonwoven fabric molded products; Fig. 2G is an explanatory view showing a method for manufacturing nonwoven fabric molded products; Fig. 2H is an explanatory view showing a method for manufacturing nonwoven fabric molded products; Fig. 3A is a schematic structural view showing a device for manufacturing nonwoven fabric molded products according to a second embodiment of the invention; and Fig. 3B is a schematic structural view showing another device for manufacturing nonwoven fabric molded products.

DESCRIPTION OF EMBODIMENTS

[0034] Hereinbelow, the present invention will be described in detail by way of embodiments thereof illustrated in the accompanying drawings.

(First Embodiment)

[0035] Fig. 1 is a schematic structural view showing a device for manufacturing nonwoven fabric molded products according to a first embodiment of the invention. As shown in Fig. 1, this manufacturing device includes a mold 1 having a three dimensional-shaped molding surface 10, and a water jet 2 for spraying water to the molding surface 10 of the mold 1. The water jet 2 is an example of fluid spraying means.

[0036] The molding surface 10 of the mold 1 is formed of a pentahedron including four side surfaces and one top surface. The molding surface 10 is provided with a plurality of through holes 11 that allow water sprayed from the water jet 2 to pass therethrough. The molding surface 10 is formed from a wire mesh as an example.

[0037] Pin-like positioning protrusions 12 and a box-shaped hole-forming protrusion 13 are provided on the top surface of the molding surface 10. A chute-shaped recess-forming protrusion 14 is provided on one side surface of the molding surface 10.

[0038] The water jet 2 has a gate-shaped body portion 20 and a plurality of nozzles 21 provided in the body portion 20. Jet holes 21a of the nozzles 21 are provided in three surfaces facing inward of the gate-shaped body portion 20.

[0039] The water jet 2 is set to such a size as to be able to stride across the mold 1. The mold 1 is enabled to relatively go closer to or farther from the water jet 2. That is, the jet holes 21a of the nozzles 21 can be op-

posed to the whole area of the molding surface 10 of the mold 1 one after another so that water can be sprayed thereto from the jet holes 21a. The pressure of this water is so high as to cause a later-described nonwoven web 3 to be entangled, e.g., being within a range of 10MPa to 20MPa.

[0040] Next, a method for manufacturing a nonwoven fabric molded product 5 from a nonwoven web 3 by using the manufacturing device having the above-described structure will be described below.

[0041] First, as shown in Fig. 2A, a nonwoven web 3 is fabricated by layering a plurality of fibers. For this fabrication of the nonwoven web 3, a conventionally known process (dry process, wet process, etc.) is used. The fibers are made from polyester as an example. The nonwoven web 3, which has not yet been processed for fiber-to-fiber entanglement, is also called fleece. It is noted here that the fiber-to-fiber entanglement refers to making fibers coupled and entangled with each other.

[0042] Thereafter, as shown in Fig. 2B, cruciform slits 30 and a pass-through hole portion 31 are bored at predetermined positions on the nonwoven web 3. The positions of the slits 30 correspond to positions of the positioning protrusions 12 of the mold 1, and the position of the hole portion 31 corresponds to a position of the hole-forming protrusion 13 of the mold 1.

[0043] Thereafter, as shown in Fig. 2C, the unentangled nonwoven web 3 is mounted on the molding surface 10 so that one surface of the nonwoven web 3 faces the molding surface 10 of the mold 1. Then, as shown in Fig. 2D, the positioning protrusions 12 of the mold 1 are stuck into the slits 30 of the nonwoven web 3, so that the hole-forming protrusion 13 of the mold 1 is fitted into the hole portion 31 of the nonwoven web 3. In this state, fore ends of the positioning protrusions 12 are not exposed from the nonwoven web 3, but those ends may be exposed from the slits 30.

[0044] Thereafter, the nonwoven web 3 mounted on the molding surface 10 is moved inward of the water jet 2. Then, from the water jet 2, water is sprayed to the other surface of the nonwoven web 3.

[0045] As a result of this process, as shown in Fig. 2E, the nonwoven web 3 is pressed against the molding surface 10 so that fibers 32 of the nonwoven web 3 are entangled with each other and moreover the nonwoven web 3 is molded so as to conform to the three-dimensional shape of the molding surface 10. It is assumed that the molding surface 10 is moved from left to right relative to the nozzles 21 as in the figures.

[0046] In this process, the water after having been sprayed to the nonwoven web 3 passes through the through holes 11 of the molding surface 10. As a result of this, the water that has passed through the nonwoven web 3 is prevented from impinging on and repelling from the molding surface 10. Thus, the nonwoven web 3 can securely be pressed against the molding surface 10 so that molding and entanglement of the three-dimensional shape from the nonwoven web 3 can be fulfilled.

[0047] Also, as shown in Fig. 2F, water is sprayed from the water jet 2 to the nonwoven web 3 with the positioning protrusions 12 stuck thereto so that the positioning protrusions 12 are pierced through the nonwoven web 3, thus the nonwoven web 3 being positioned in engagement with the positioning protrusions 12. It is assumed that the molding surface 10 is moved from left to right relative to the nozzles 21 as in the figures. As a result of this, there is no need for preliminarily providing holes that allow the positioning protrusions 12 to be pierced through the nonwoven web 3. Thus, the steps are simplified and waste of materials can be cut down.

[0048] As described above, molding and entanglement of a three-dimensional shape from the nonwoven web 3 are carried out concurrently in one-time process, by which the nonwoven fabric molded product 5 is manufactured as shown in Fig. 2G. The resulting nonwoven fabric molded product 5 has a three-dimensional shape conforming to the molding surface 10.

[0049] After that, the nonwoven fabric molded product 5 mounted on the molding surface 10 is dried and cooled, then removed from the mold 1 as shown in Fig. 2H. In the nonwoven fabric molded product 5, holes are formed at positions corresponding to the positioning protrusions 12, a hole is formed at a position corresponding to the hole-forming protrusion 13, and a recess is formed at a position corresponding to the recess-forming protrusion 14.

[0050] The nonwoven fabric molded product 5 is, for example, a mask, a filter, an urethane reinforcing material to be used for vehicle seats, or the like. The reinforcing material, which is to be placed between urethane placed on the bearing surface side of the seat and a back surface member placed on the back surface side of the seat, prevents peeling of urethane or prevents rustling sounds between the urethane and the back surface member.

[0051] According to the device and method for manufacturing nonwoven fabric molded products with the above-described structure, since the molding and entanglement of a three-dimensional shape from the nonwoven web 3 can be carried out concurrently in one-time process, the conventional entangling step of manufacturing nonwoven fabric from the nonwoven web 3 can be omitted, simplifying the steps, so that the nonwoven fabric molded product 5 can be manufactured at low cost.

[0052] Furthermore, since the nonwoven web 3 is pressed against the mold 1 by the water of the water jet 2, the water jet 2 fulfills the role as one mold out of a male mold and a female mold to be used for conventional press molding, allowing the one mold to be omitted in this case. Therefore, in cases where the shape of the nonwoven fabric molded product 5 is changed, the need is only to change the other mold, leading to a reduction of the mold quantity.

[0053] Also, since the nonwoven fabric molded product 5 is manufactured from the nonwoven web 3 by water, excess materials in the manufacture of the nonwoven fabric molded product 5 are removed from the nonwoven

web 3, as they are, by the water, and those excess materials can be reused as they are. This leads to resource saving and favorableness to the environment.

[0054] With conventional nonwoven fabrics, it has been impossible to partly change their density (weight per unit area). In the present invention, on the other hand, excess materials may be laid on necessary parts in the state of the nonwoven web 3 before the nonwoven fabric molded product 5 is manufactured. Thus, according to the invention, it becomes implementable to achieve a reduction in materials, as compared with conventional molded products from nonwoven fabrics, favorably in terms of the environment.

[0055] Also, with conventional nonwoven fabrics, it has been impossible to partly change their degree of entanglement between fibers or their thickness. In this invention, on the other hand, the nonwoven fabric molded product 5 can be partly changed in degree of entanglement or thickness by changing the pressure, distance, time or angle of water sprayed to the nonwoven web 3. As a result of this, the invention is enabled to provide the functions of the nonwoven fabric molded product 5 (functions due to its degree of entanglement or thickness) with a minimum quantity of material, favorably in terms of the environment.

(Second Embodiment)

[0056] Figs. 3A and 3B are main-part enlarged views showing a device for manufacturing nonwoven fabric molded products according to a second embodiment of the invention. The second embodiment differs from the foregoing first embodiment (Fig. 2E) only in the structure of the nozzles. Only this different point of structure will be described below.

[0057] As shown in Fig. 3A, a first nozzle 21A and a second nozzle 21B jet out water to one identical part of the nonwoven web 3 in mutually different directions. A jet-out direction of the first nozzle 21A is along a direction orthogonal to the molding surface 10. A jet-out direction of the second nozzle 21B is along a direction inclined by 45° relative to the molding surface 10.

[0058] As a result, entanglement between fibers 32 of the nonwoven web 3 can be fulfilled with more complexity and more security, so that the strength of the nonwoven fabric molded product 5 can be improved.

[0059] In addition, as shown in Fig. 3B, the jet-out direction of the first nozzle 21A may be along a direction inclined by 135° relative to the molding surface 10 so as to be left-right symmetrical with the jet-out direction of the second nozzle 21B.

[0060] The present invention is not limited to the above-described embodiments. For example, features of the above-described first and second embodiments may be combined together in various ways.

[0061] The gate-shaped water jet 2 is adopted as the fluid spraying means in the above embodiments. However, the fluid spraying means may also be a robot arm

capable of partly-aimed spraying.

[0062] Whereas water is used as the fluid in the above embodiments, yet the fluid may also be liquid other than water or a gas such as vapor. A fluid has a pressure that allows a high degree of entanglement of the nonwoven web 3 to be achieved. Of course, this pressure may be changed depending on thickness, hardness or the like of the nonwoven fabric molded product 5.

[0063] The nozzles 21, 21A, 21B for jetting out water to one identical part of the nonwoven web 3 are provided in a quantity of one or two in the above embodiments. However, those nozzles may be provided in quantities of three or more.

[0064] The through holes 11, although provided in the molding surface 10 in the above embodiments, may also be omitted.

[0065] Although the protrusions 12, 13, 14 are provided on the molding surface 10 in the above embodiments, yet at least one of those may be omitted.

REFERENCE SIGNS LIST

[0066]

25	1	mold
	10	molding surface
	11	through hole
	12	positioning protrusion
	13	hole-forming protrusion
30	14	recess-forming protrusion
	2	water jet (fluid spraying means)
	20	body portion
	21, 21A, 21B	nozzle
	21a	jet hole
35	3	nonwoven web
	30	slit
	31	hole portion
	32	fiber
40	5	nonwoven fabric molded product

Claims

1. A device for manufacturing nonwoven fabric molded products, comprising:

a mold (1) having a three dimensional-shaped molding surface (10); and
fluid spraying means (2) for spraying a fluid to an unentangled nonwoven web (3) mounted on the molding surface (10) of the mold (1) so that the nonwoven web (3) is pressed against the molding surface (10), and fibers (32) of the nonwoven web (3) are entangled with each other while the nonwoven web (3) is molded so as to conform to a three-dimensional shape of the molding surface (10), whereby a three-dimensional nonwoven fabric molded product (5) is

produced.

2. The device for manufacturing nonwoven fabric molded products as claimed in Claim 1, wherein a plurality of through holes (11) for allowing the fluid to pass therethrough are provided in the molding surface (10) of the mold (1). 5
3. The device for manufacturing nonwoven fabric molded products as claimed in Claim 1 or 2, wherein the mold (1) has protrusions (12, 13, 14) in the molding surface (10), and the fluid spraying means (2) sprays the fluid to the nonwoven web (3) with the protrusions (12, 13, 14) stuck thereto, so that the protrusions (12, 13, 14) are pierced through the nonwoven web (3). 10 15
4. The device for manufacturing nonwoven fabric molded products as claimed in any one of Claims 1 to 3, wherein the fluid spraying means (2) has a plurality of nozzles (21A, 21B) for jetting out the fluid to an identical part of the nonwoven web (3) in different directions. 20
5. A method for manufacturing nonwoven fabric molded products, comprising: 25
mounting an unentangled nonwoven web (3) onto a molding surface (10) of a mold (1), the molding surface (10) having a three-dimensional shape; and 30
spraying a fluid to the nonwoven web (3) so that the nonwoven web (3) is pressed against the molding surface (10), and fibers (32) of the nonwoven web (3) are entangled with each other while the nonwoven web (3) is molded so as to conform to the three-dimensional shape of the molding surface (10), whereby a three-dimensional nonwoven fabric molded product (5) is manufactured. 35 40

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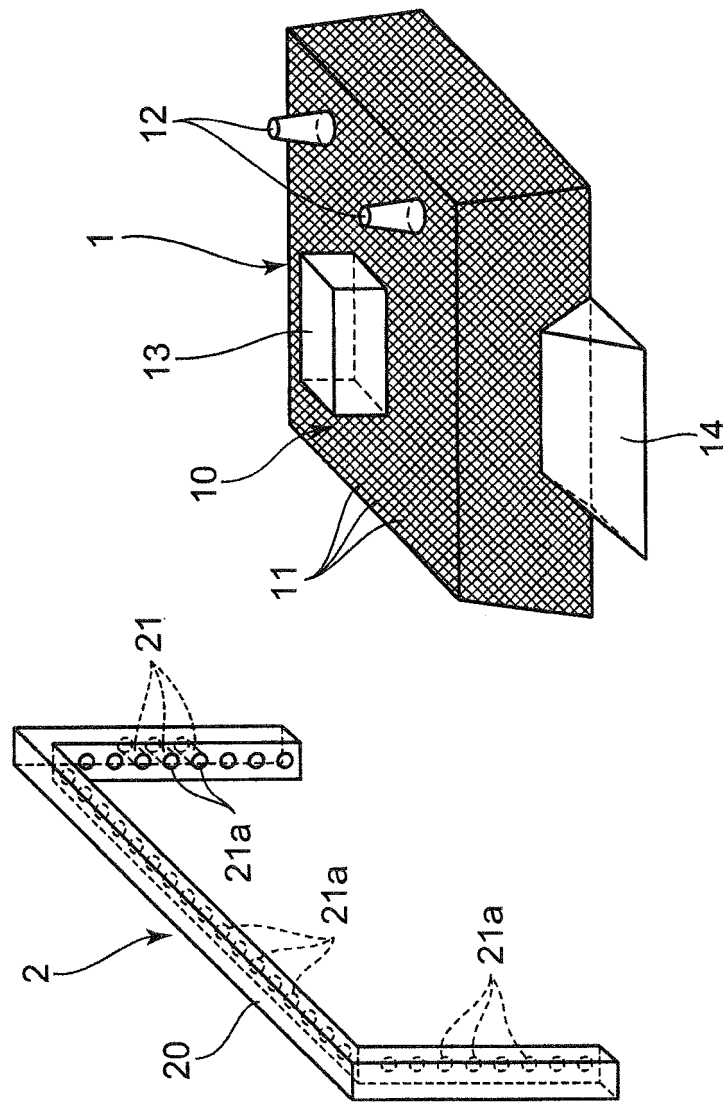


Fig. 1

Fig.2A

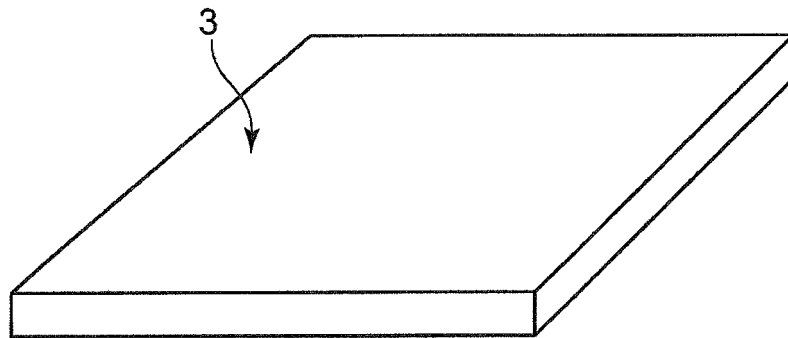


Fig.2B

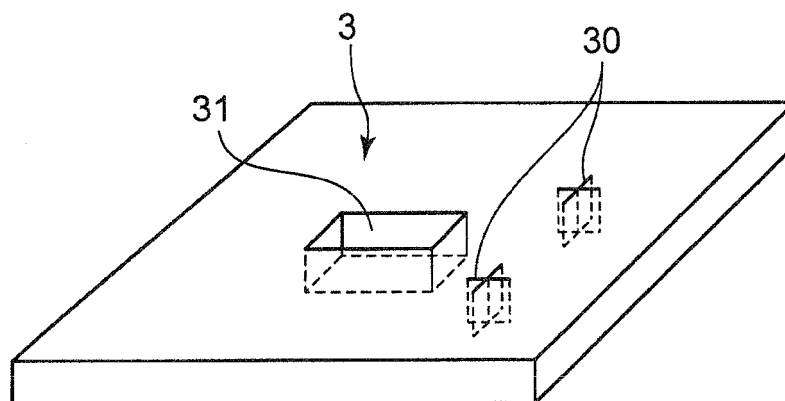


Fig.2C

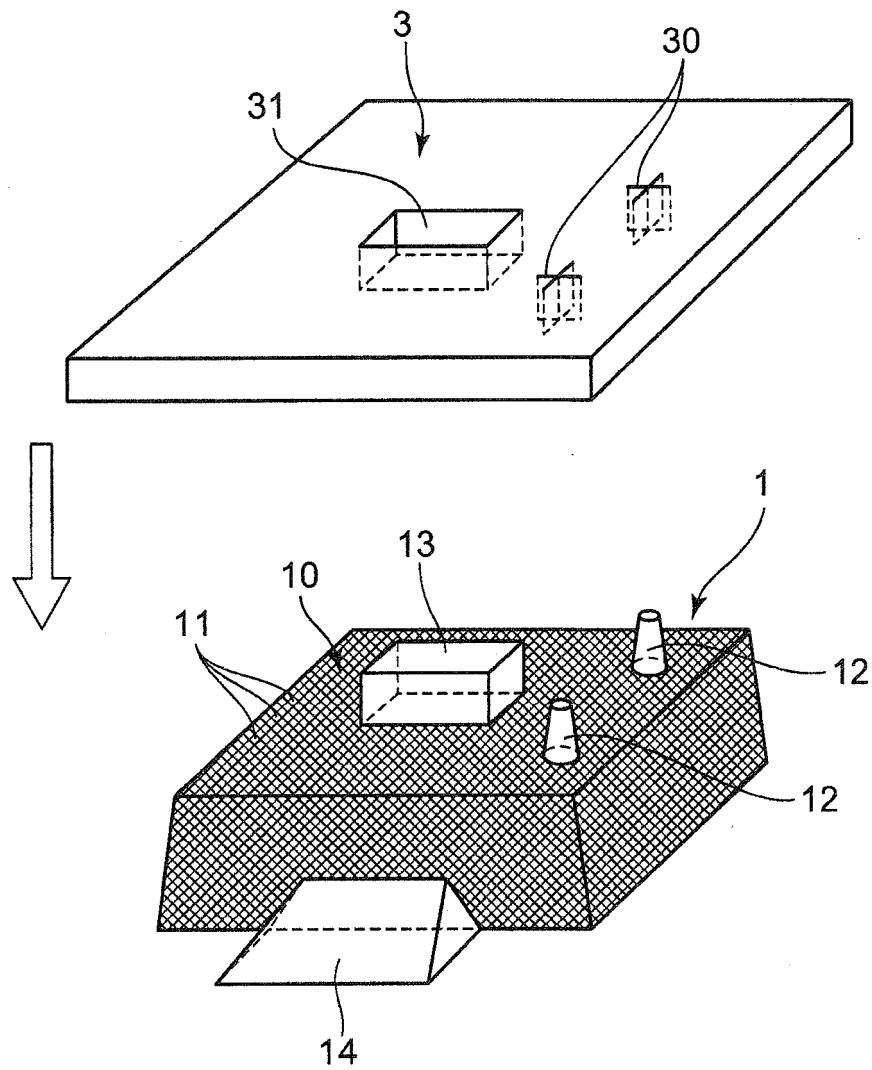


Fig. 2D

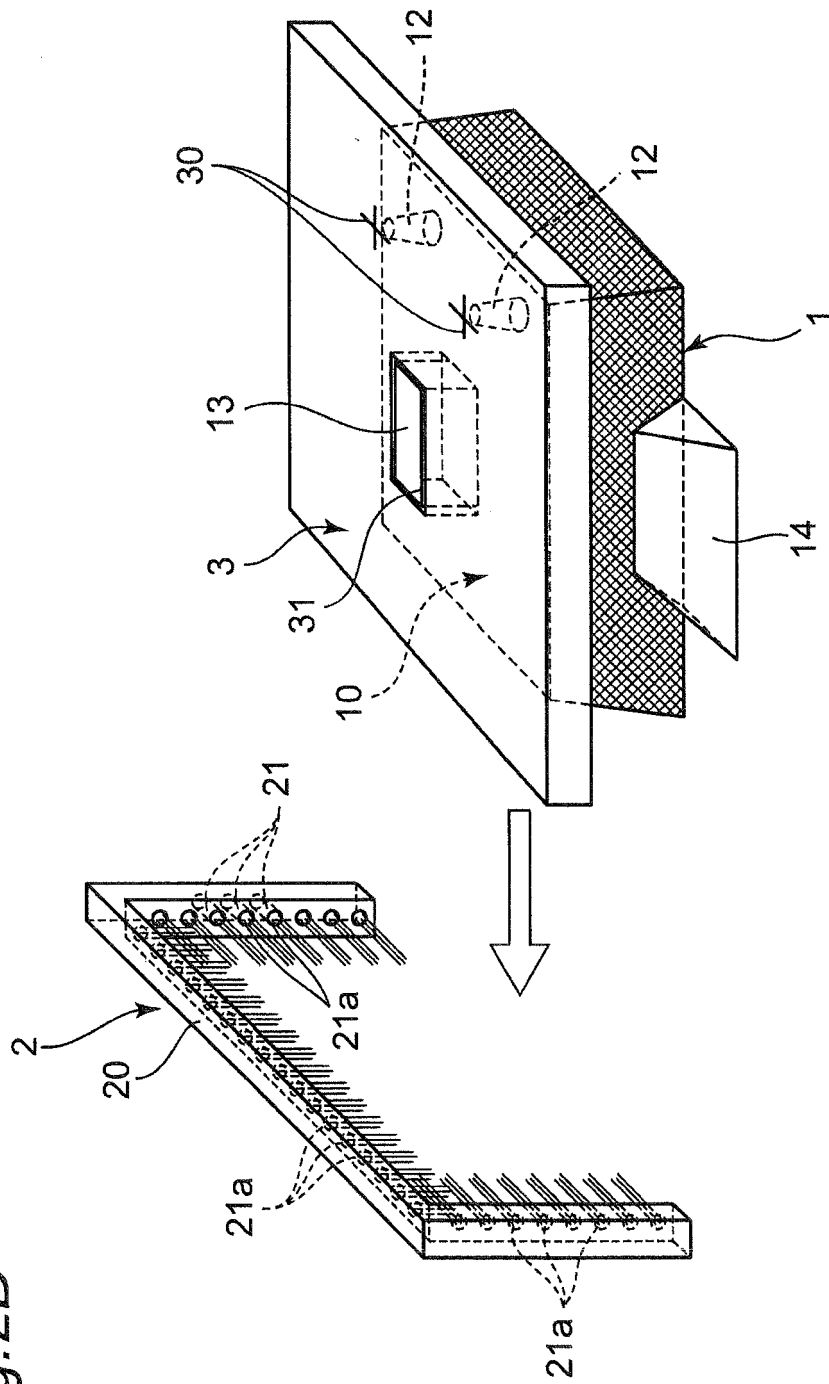


Fig.2E

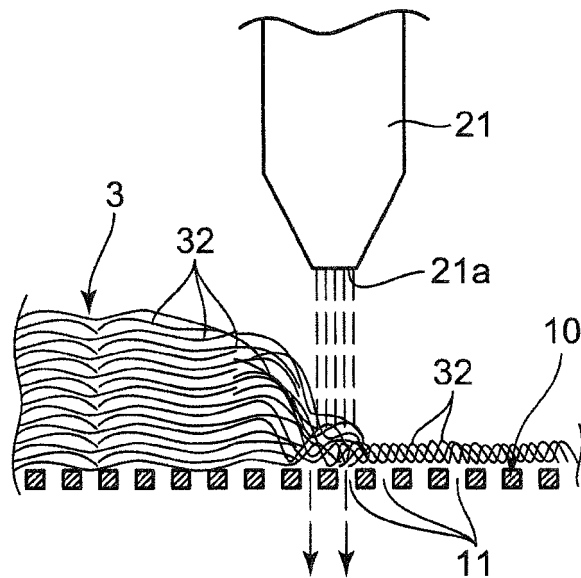


Fig.2F

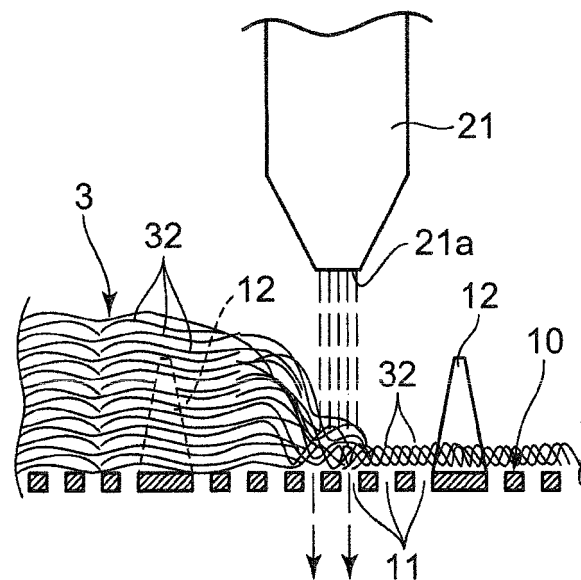


Fig.2G

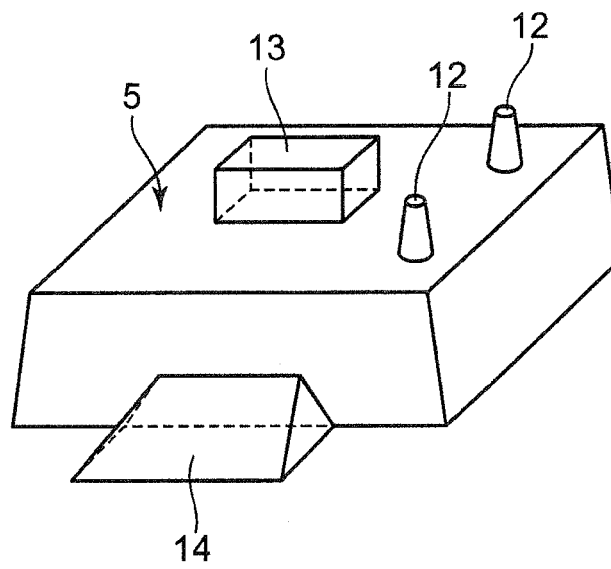


Fig.2H

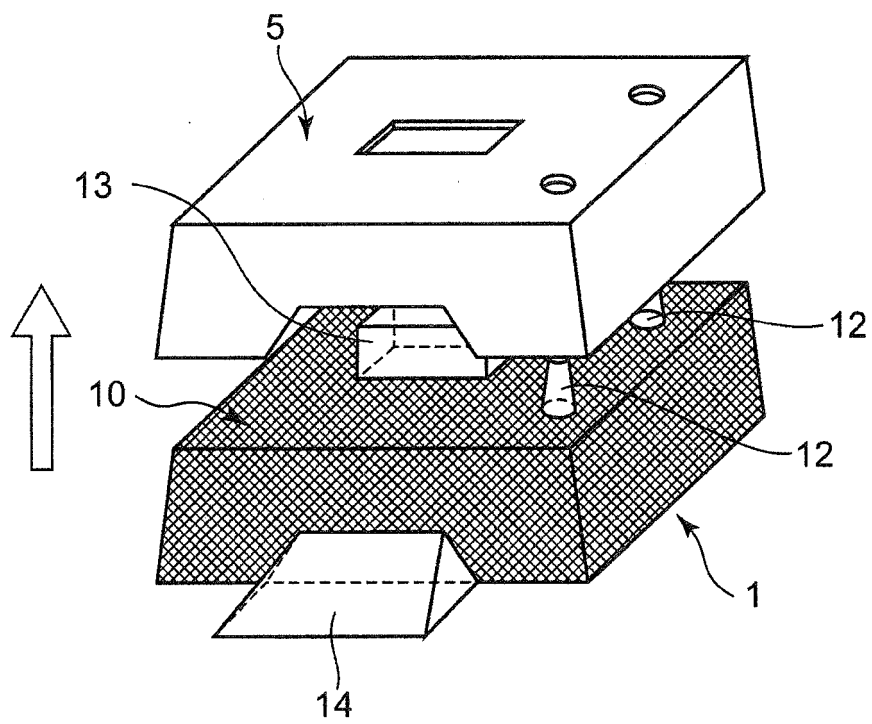


Fig.3A

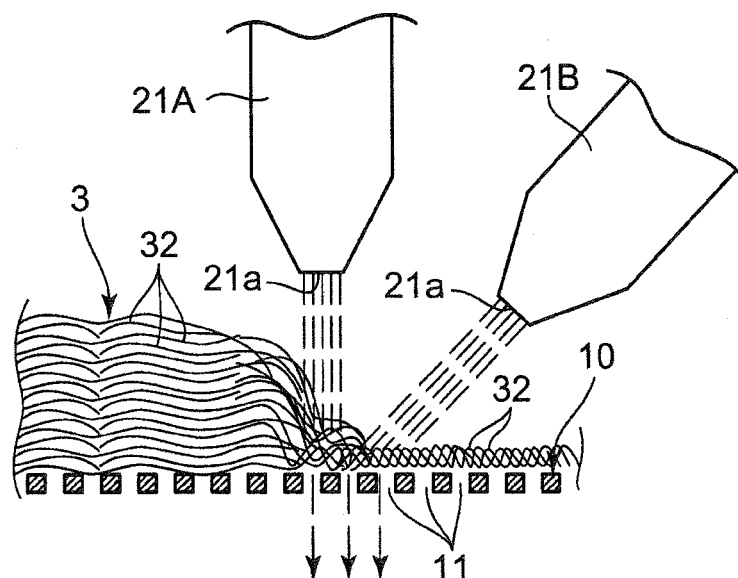
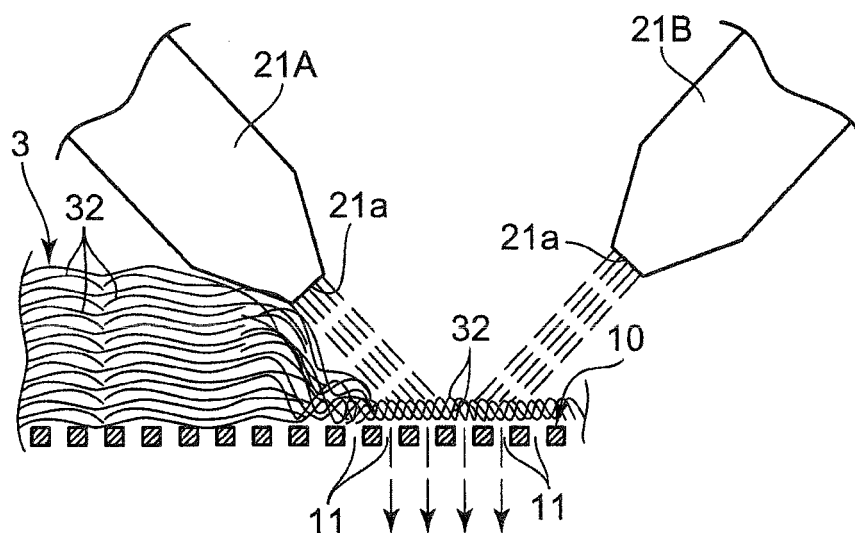


Fig.3B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/069422

A. CLASSIFICATION OF SUBJECT MATTER

D04H1/492(2012.01)i, D04H1/76(2012.01)i

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)

D04H1/00-18/04

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 04-327255 A (Nippon Filcon Co., Ltd.), 16 November 1992 (16.11.1992), claims; paragraphs [0005] to [0008]; examples; fig. 2, 8 to 10 & US 5274893 A & EP 511025 A1	1-3, 5 4
Y A	JP 06-184894 A (Japan Vilene Co., Ltd.), 05 July 1994 (05.07.1994), claims; paragraphs [0001], [0009], [0040]; fig. 2, 3 (Family: none)	4 1-3, 5
A	JP 2009-299227 A (Kao Corp.), 24 December 2009 (24.12.2009), claims; paragraphs [0036] to [0041]; fig. 3 (Family: none)	1-5

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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Date of the actual completion of the international search
09 October, 2013 (09.10.13)Date of mailing of the international search report
22 October, 2013 (22.10.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/069422

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 03-019950 A (Asahi Chemical Industry Co., Ltd.), 29 January 1991 (29.01.1991), claims; page 4, upper right column, line 19 to lower left column, line 6; examples (Family: none)	1-5
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A	JP 2004-232187 A (Uni-Charm Corp.), 19 August 2004 (19.08.2004), claims; paragraphs [0002], [0021]; examples; fig. 4 (Family: none)	1-5

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REFERENCES CITED IN THE DESCRIPTION

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