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(54) **PILLOW CUSHION AND METHOD FOR PRODUCING PILLOW CUSHION**

(57) Provided is a pillow cushion with which it is less likely for a repulsive force to be concentrated on a user's head in an area close to the highest point of the crown, and with which it is easier to stabilize the user's head. The pillow cushion is formed from multiple filaments comprising a thermoplastic resin or a thermoplastic elastomer, the filaments being tangled three dimensionally with one

another, where the points of contact between the filaments are fuse-bonded to form a three-dimensional filament integrated body. The area that supports the crown of the user's head has a higher filament density at both edges in the directions toward right and left shoulders than at the center.

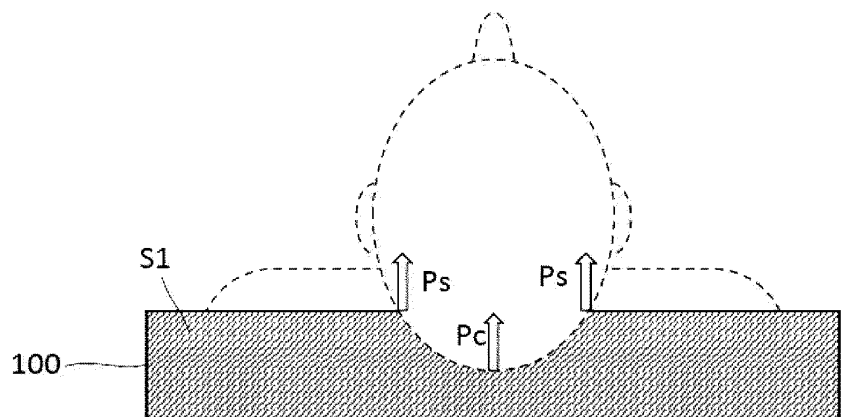


FIG. 4

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Description

Technical Field

[0001] The present invention relates to a pillow cushion and a method for manufacturing a pillow cushion.

Background Art

[0002] Conventionally, the most preferable sleeping posture during sleep is considered to be a natural upright posture (which is also referred to as a "natural position" in the present application), and it is empirically known that the cervical spine is least stressed during sleeping in a posture in the natural position. Pillows have so far been proposed with consideration given to the sleeping posture.

[0003] For example, Patent Document 1 discloses a method for manufacturing a pillow in which a first pillow unit that supports a back head portion of a user when the user sleeps on the back of the user (in a supine position), a second pillow unit that supports the cervical spine portion of the user and a third pillow unit that supports a temporal portion of the user when the user sleeps sideways (in a lateral position) are optimized based on head position information, head weight information and pillow material information.

Related Art Document

Patent Document

[0004] Patent Document 1: Japanese Patent No. 6892293

Disclosure of the Invention

Problems to be Solved by the Invention

[0005] However, problems are encountered such as a problem in which since the back head portion has a substantially spherical curved shape, when the user sleeps on the back, the load of the head is concentrated on a small part of the back head portion (usually a part in the vicinity of the apex of the back head portion) to cause a feeling of pressure and a problem in which the head of the user is unlikely to be stable, the angle of the head swings from side to side and thus the head is unstable.

[0006] FIG. 23 shows a state where a conventional pillow cushion 500 supports the back head portion of a user who takes the sleeping posture of a supine position. FIG. 23 is a cross-sectional view of the pillow cushion 500 taken along a plane S 1 which divides the pillow cushion 500 into two equal parts in a height direction. As shown in the figure, when repulsive force characteristics in the vicinity of a center part of the pillow (region which supports the back head portion) are constant, a sinking depth is the greatest in a position which supports an area in the

vicinity of the apex of the back head portion, and thus the repulsive force P_c of the pillow cushion 500 in that position is the greatest. In other words, when the repulsive force characteristics are the same, as the sinking depth is increased, the repulsive force generated in the pillow cushion is increased, with the result that, as described above, the repulsive force of the pillow cushion in the position which supports the area in the vicinity of the apex of the back head portion is the greatest.

[0007] On the other hand, since the sinking depth in the peripheral portion of a back head portion support region is decreased, the repulsive force P_s of the pillow cushion 500 in that position is lowered. Hence, the user may easily have a feeling of pressure in the vicinity of the apex of the back head portion. The head of the user rolls easily during sleeping, and thus it is likely that it is difficult to obtain a sense of stability.

[0008] An object of the present invention is to provide a pillow cushion in which a repulsive force is unlikely to concentrate on an area in the vicinity of the apex of a back head portion and thus the head of a user is easily stabilized and a method for manufacturing such a pillow cushion.

Means for Solving the Problem

[0009] A pillow cushion according to the present invention is a pillow cushion formed with a filament three-dimensional bonded member in which, in a state where a plurality of filaments formed of a thermoplastic resin or a thermoplastic elastomer are three-dimensionally entangled, contact points of the filaments are fused, and the density of the filaments in a back head portion support region is higher in both end portions in the direction of left and right shoulders than in a center portion. In this configuration, when the apex of the back head portion of the user who takes the sleeping posture of a supine position is supported by the center portion in which the density of the filaments in the back head portion support region of the pillow cushion is the lowest, in the vicinity of the apex of the back head portion in which the sinking depth of the pillow cushion is the greatest, a local increase in the repulsive force of the pillow cushion caused by the sinking depth can be suppressed. Consequently, it is possible to provide the pillow cushion in which the repulsive force is unlikely to concentrate on an area in the vicinity of the apex of the back head portion, and thus the head of the user is easily stabilized.

[0010] More specifically, in the configuration described above, the density of the filaments in the back head portion support region may be gradually increased from the center portion toward the both end portions in the direction of left and right shoulders. More specifically, in the configuration described above, the density of the filaments in the back head portion support region may be gradually increased from the center portion toward both end portions in a height direction.

[0011] In the pillow cushion of the configuration de-

scribed above which is formed by stacking a plurality of pillow units in a thickness direction, each of the pillow units may include a first pillow unit and a second pillow unit formed with the filament three-dimensional bonded member, the density of the filaments in the back head portion support region of the first pillow unit may be gradually increased from the center portion toward the both end portions in the direction of left and right shoulders and the density of the filaments in the back head portion support region of the second pillow unit may be gradually increased from the center portion toward the both end portions in the height direction.

[0012] A method for manufacturing the pillow cushion described above includes: a molten filament supply step of discharging a plurality of molten filaments formed of a thermoplastic resin or a thermoplastic elastomer downward in a vertical direction from a plurality of nozzle holes provided in a nozzle portion; a filament three-dimensional fused member formation step of fusing, while three-dimensionally entangling the molten filaments, contact points of the molten filaments to form a filament three-dimensional fused member; and a filament three-dimensional bonded member formation step of conveying the filament three-dimensional fused member and moving the filament three-dimensional fused member in cooling water to cool and solidify the filament three-dimensional fused member, the pillow cushion according to claim 2 or 3 is manufactured by cutting the filament three-dimensional bonded member formed in the filament three-dimensional bonded member formation step, the direction of left and right shoulders in the pillow cushion is substantially aligned with the direction of the conveyance and the speed of the conveyance may be controlled such that the density of the filaments in the back head portion support region of the pillow cushion is gradually increased from the center portion toward the both end portions in the direction of left and right shoulders.

[0013] In the manufacturing method described above where the pillow cushion that is used by a predetermined user is manufactured, the speed of the conveyance may be controlled based on back head portion horizontal shape information of the user such that the density of the filaments in the back head portion support region of the pillow cushion is gradually increased from the center portion toward the both end portions in the direction of left and right shoulders.

[0014] In the manufacturing method described above where the pillow cushion in which the density of the filaments in the back head portion support region is gradually increased from the center portion toward both end portions in a height direction is manufactured, the density of the nozzle holes in the nozzle portion may be adjusted based on back head portion vertical shape information of the user such that the density of the filaments in the back head portion support region of the pillow cushion is gradually increased from the center portion toward the both end portions in the height direction.

[0015] More specifically, in the manufacturing method described above, the speed of the conveyance may be controlled based on back head portion position information and head weight information of the user.

Advantages of the Invention

[0016] In the pillow cushion according to the present invention, it is possible to provide a pillow cushion in which a repulsive force is unlikely to concentrate on an area in the vicinity of the apex of a back head portion and thus the head of a user is easily stabilized.

Brief Description of Drawings

[0017]

FIG. 1 is a perspective view of a pillow cushion 100 according to a first embodiment;

FIG. 2A is an illustrative view of the region V1 of the pillow cushion 100;

FIG. 2B is a graph on the density of filaments in the region V1 of the pillow cushion 100;

FIG. 3A is an illustrative view of the region V2 of the pillow cushion 100;

FIG. 3B is a graph on the density of filaments in the region V2 of the pillow cushion 100;

FIG. 4 is an illustrative view of the pillow cushion 100 which supports a back head portion;

FIG. 5 is an illustrative view of the pillow cushion 100 which supports the back head portion;

FIG. 6 is a schematic view of a manufacturing device 1 for a filament three-dimensional bonded member 3DF;

FIG. 7 is a cross-sectional view of the manufacturing device 1 shown in FIG. 6 which is taken along line A-A' and is indicated by arrows;

FIG. 8 is an illustrative view showing an example of a schematic configuration of a nozzle portion 16 when the nozzle portion 16 is viewed from below;

FIG. 9 is a plan view of a receiving plate 21 in the manufacturing device 1 shown in FIG. 6;

FIG. 10A is graphs showing examples of details of control of a conveyor conveyance speed;

FIG. 10B is a block diagram showing an example of the control system of the manufacturing device 1;

FIG. 11 is a graph showing an example of the distribution of the density of nozzle holes in the nozzle portion 16;

FIG. 12 is an illustrative view of the region V1 of a pillow cushion 200 according to the first embodiment;

FIG. 13 is a graph on the density of filaments in the region V1 of the pillow cushion 200;

FIG. 14A is an illustrative view on the pillow cushion 200 which supports a temporal portion and the like;

FIG. 14B is a graph showing an example of details of control of a conveyor conveyance speed;

FIG. 15 is a perspective view of a pillow cushion 300 according to a third embodiment;
 FIG. 16A is a graph on the density of filaments in the region V1 of a first pillow unit 301;
 FIG. 16B is a graph on the density of filaments in the region V2 of the first pillow unit 301;
 FIG. 17A is a graph on the density of filaments in the region V1 of a second pillow unit 302;
 FIG. 17B is a graph on the density of filaments in the region V2 of the second pillow unit 302;
 FIG. 18 is a graph on the density of filaments in the region V1 of the pillow cushion 300;
 FIG. 19 is a graph on the density of filaments in the region V2 of the pillow cushion 300;
 FIG. 20 is a perspective view of a pillow cushion 400 according to a fourth embodiment;
 FIG. 21 is an illustrative view showing a schematic configuration of a nozzle portion 116 when the nozzle portion 116 is viewed from below;
 FIG. 22 is a plan view of a receiving plate 121; and
 FIG. 23 is an illustrative view of a conventional pillow cushion which supports a back head portion.

Description of Embodiments

[0018] Embodiments of the present invention will be described below with reference to drawings. In the following description, directions for a pillow (directions orthogonal to each other) which are a height direction, the direction of left and right shoulders and a thickness direction are as shown in FIG. 1. The height direction substantially coincides with the height direction of a pillow user (hereinafter simply referred to as the "user") who takes the sleeping posture of a supine position, and it is assumed that one end side is a head top side and the other end side is a leg side. The direction of the left and right shoulders substantially coincides with the shoulder width direction of the user who takes the sleeping posture of a supine position, and it is assumed that one end side is a left shoulder side and the other end side is a right shoulder side. The thickness direction is the direction of thickness of the pillow, and it is assumed that one end side (side close to the head of the user) is a front side and the other end side is a back side.

1. First embodiment

[0019] The first embodiment of the present invention will first be described. FIG. 1 is a perspective view of a pillow cushion 100 according to the first embodiment. The pillow cushion 100 is a cushion which is used for a pillow, and is formed with a filament three-dimensional bonded member 3DF. Although the pillow cushion 100 is preferably used as a pillow in a state where the pillow cushion 100 is covered with a pillow cover which is separately prepared, the pillow cushion 100 may be used as a pillow as it is.

[0020] The filament three-dimensional bonded mem-

ber 3DF is formed by fusing contact points of a plurality of filaments in a state where the filaments formed of a thermoplastic resin or a thermoplastic elastomer are three-dimensionally entangled. The pillow cushion 100 in the example of the present embodiment is formed substantially in the shape of a rectangular parallelepiped in which both end surfaces in the height direction, both end surfaces in the direction of the left and right shoulders and both end surfaces in the thickness direction are outer surfaces.

[0021] In FIG. 2A, a region (region V1) in the vicinity of a virtual plane S1 which divides the pillow cushion 100 into two equal parts in the height direction is colored. A center portion of the region V1 in the direction of the left and right shoulders supports an approximate apex of the back head portion of the user who takes the sleeping posture of a supine position (the most posterior part of the back head portion of the user in a natural position). A predetermined range from the center portion in the region V1 to both sides in the direction of the left and right shoulders is a region (hereinafter referred to as a "back head portion support region") which supports the back head portion of the user who takes the sleeping posture of a supine position.

[0022] The graph of FIG. 2B shows the distribution of the density of the filaments of the pillow cushion 100 in the region V1, the horizontal axis represents the position in the direction of the left and right shoulders and the vertical axis represents the density of the filaments in the region V1. The density of the filaments indicates the weight of the filament three-dimensional bonded member 3DF (or a filament three-dimensional fused member which will be described later) per unit volume, and as the density of the filaments is increased, the filaments are densely arranged, the number of voids is decreased and repulsive force characteristics (the value of a repulsive force generated when a certain amount of pressing is applied) are enhanced.

[0023] In FIG. 3A, a region (region V2) in the vicinity of a virtual plane S2 which divides the pillow cushion 100 into two equal parts in the direction of the left and right shoulders is colored. A center portion of the region V2 in the height direction supports an approximate apex of the back head portion of the user who takes the sleeping posture of a supine position. A predetermined range from the center portion in the region V2 to both sides in the height direction is a back head portion support region. The graph of FIG. 3B shows the distribution of the density of the filaments of the pillow cushion 100 in the region V2, the horizontal axis represents the position in the height direction and the vertical axis represents the density of the filaments in the region V2.

[0024] In each of the regions V1 and V2 of the pillow cushion 100, the density of the filaments in the back head portion support region is the lowest in the center portion, and is gradually increased from the center portion toward both end portions.

[0025] For the direction of the left and right shoulders,

as shown in the graph of FIG. 2B, in the back head portion support region Xa of the region V1, the density of the filaments of the pillow cushion 100 is the lowest Da1 in the center portion in the direction of the left and right shoulders, and is gradually increased from the center portion toward both end sides in the direction of the left and right shoulders.

[0026] The back head portion support region Xa is a region between a position Pa1 which is located only a predetermined distance from the center portion of the pillow cushion 100 to the left shoulder side and a position Pa2 which is located only the same distance from the center portion to the right shoulder side. On both end sides in the direction of the left and right shoulders relative to the back head portion support region Xa, the density of the filaments of the pillow cushion 100 is so constant as to be Da2.

[0027] For the height direction, as shown in the graph of FIG. 3B, in the back head portion support region Xb of the region V2, the density of the filaments of the pillow cushion 100 is the lowest Db1 in the center portion in the height direction, and is gradually increased from the center portion toward both end sides in the height direction.

[0028] The back head portion support region Xb is a region between a position Pb1 which is located only a predetermined distance from the center portion of the pillow cushion 100 to the head top side and a position Pb2 which is located only the same distance from the center portion to the leg side. On both end sides in the height direction relative to the back head portion support region Xb, the density of the filaments of the pillow cushion 100 is so constant as to be Db2.

[0029] Although in the present embodiment, the pillow cushion 100 is in the shape of a rectangular parallelepiped, projections and recesses may be provided in the surface or the shape of a side surface or a planar shape may be changed to a different shape such as an oval shape as long as the effects of the present invention are not impaired.

[0030] FIG. 4 shows the state of the pillow cushion 100 which supports the back head portion of the user who takes the sleeping posture of a supine position as a cross-sectional view taken along the plane S1. FIG. 5 shows the state of the pillow cushion 100 which supports the back head portion of the user who takes the sleeping posture of a supine position as a cross-sectional view taken along the plane S2. In FIGS. 4 and 5, arrows Ps schematically indicate the repulsive force of the pillow cushion 100 in the center portion of the back head portion support region, and an arrow Pc schematically indicates the repulsive force of the pillow cushion 100 in the peripheral portion of the back head portion support region.

[0031] As shown in FIG. 4, in a region in the vicinity of the center of the pillow which supports the back head portion of the user who sleeps on the back (supine position), the sinking depth of the back head portion is greatest in the vicinity of the apex of the back head portion, and

is gradually decreased from an area in the vicinity of the apex of the back head portion toward both end portions in the direction of the left and right shoulders. However, since the pillow cushion 100 has low repulsion in a position corresponding to the vicinity of the apex of the back head portion, even when the sinking depth of the back head portion is great, the repulsive force Pc can be prevented from being remarkably increased. Furthermore, since the pillow cushion 100 has higher repulsion from that position toward both end portions in the direction of the left and right shoulders, even when the sinking depth of the back head portion is decreased toward the both end portions, it is possible to suppress a problem in which the repulsive force Ps is excessively decreased.

[0032] In other words, in the region of the pillow which supports the back head portion of the user who sleeps on the back, the repulsive force between the pillow cushion 100 and the back head portion is unlikely to be increased in the center portion in the direction of the left and right shoulders, and is unlikely to be lowered from the center portion toward both end portions in the direction of the left and right shoulders. As described above, in the pillow cushion 100, it is possible to prevent the repulsive force received from the pillow from concentrating on a part of the back head portion to give the user a feeling of pressure and to cause the head to swing from side to side such that the angle of the head is unstable.

[0033] As shown in FIG. 5, in the region in the vicinity of the center of the pillow which supports the back head portion of the user who sleeps on the back, the sinking depth of the back head portion is great in the vicinity of the apex of the back head portion, and is gradually decreased from an area in the vicinity of the apex of the back head portion toward both end portions in the height direction. However, since the pillow cushion 100 has low repulsion in the position corresponding to the vicinity of the apex of the back head portion, even when the sinking depth of the back head portion is great, the repulsive force Pc can be prevented from being remarkably increased. Furthermore, since the pillow cushion 100 has higher repulsion from that position toward both end portions in the height direction, even when the sinking depth of the back head portion is decreased toward the both end portions, it is possible to suppress a problem in which the repulsive force Ps is excessively decreased.

[0034] In other words, in the region of the pillow which supports the back head portion of the user who sleeps on the back, the repulsive force between the pillow cushion 100 and the back head portion is unlikely to be increased in the center portion in the height direction, and is unlikely to be lowered from the center portion toward both end portions in the height direction. As described above, in the pillow cushion 100, it is possible to prevent the repulsive force received from the pillow from concentrating on the part of the back head portion to give the user a feeling of pressure and to displace the position of the head in the height direction such that the position of the head is unstable.

[0035] Here, as the characteristics of the pillow cushion 100, in the regions V1 and V2, in actuality, each of the back head portion support regions Xa and Xb preferably coincides with the region which supports the back head portion of the user as much as possible, and furthermore, the repulsive force applied to the back head portion of the user who sleeps on the back more preferably becomes as uniform as possible. In other words, ideally, in the example of the present embodiment, regarding the region V1, the back head portion support region Xa coincides with the region which actually supports the back head portion, and the repulsive force is the same in any position in the direction of the left and right shoulders. Ideally, regarding the region V2, the back head portion support region Xb coincides with the region which actually supports the back head portion, and the repulsive force is the same in any position in the height direction. Furthermore, ideally, as the characteristics of the pillow cushion 100, the sleeping posture of a supine position of the user coincides with a posture in the natural position. In order to achieve the manufacturing of the ideal pillow cushion 100 as described above, since individual differences such as the body shape of the user are reflected on the manufacturing process, it is useful to use information of the body shape of the user of the pillow cushion 100 and the like (such as the shape of the back head portion). This point will be described in detail again. The pillow cushion according to the present invention is not limited to the ideal pillow cushion described above.

[0036] A method for manufacturing the pillow cushion 100, a manufacturing device for the manufacturing and the like will then be described.

[0037] FIG. 6 is a schematic view of the manufacturing device 1 for the filament three-dimensional bonded member 3DF which can be used for the manufacturing of the pillow cushion 100. FIG. 7 is a cross-sectional view of the manufacturing device 1 shown in FIG. 6 which is taken along line A-A' and is indicated by arrows. Directions for the manufacturing device 1 (directions orthogonal to each other) which are an up/down direction, a left/right direction and a forward/backward direction are as shown in FIGS. 6 and 7. These directions are merely determined for convenience of description.

[0038] The manufacturing device 1 for the filament three-dimensional bonded member 3DF includes: a molten filament supply unit 10 which discharges, downward in the vertical direction, a molten filament group MF formed with a plurality of molten filaments having a diameter of 0.3 mm to 3 mm; and a fusing formation unit 20 which three-dimensionally entangles the molten filament group MF to fuse contact points and thereafter cools and solidifies the molten filament group MF to form the filament three-dimensional bonded member 3DF.

[0039] The molten filament supply unit 10 includes a pressurization melting portion 11 (extruder) and a filament discharge portion 12 (die). The pressurization melting portion 11 includes a material input portion 13 (hopper), a screw 14, a screw motor 15 for driving the screw

14, a screw heater 15a and a plurality of unillustrated temperature sensors. Within the pressurization melting portion 11, a cylinder 11a is formed which conveys a thermoplastic resin or a thermoplastic elastomer (hereinafter also collectively referred to as the "thermoplastic resin or the like") supplied from the material input portion 13 while heating and melting the thermoplastic resin or the thermoplastic elastomer with the screw heater 15a.

[0040] Within the cylinder 11a, the screw 14 is rotatably stored. At an end portion of the cylinder 11a on a downstream side, a cylinder discharge port 11b for discharging the thermoplastic resin or the like toward the filament discharge portion 12 is formed. A heating temperature for the screw heater 15a is controlled based on, for example, the detection signal of a temperature sensor provided in the molten filament supply unit 10.

[0041] The filament discharge portion 12 includes a nozzle portion 16, die heaters 18 and a plurality of unillustrated temperature sensors, and within the filament discharge portion 12, a guide flow path 12a is formed which guides, to the nozzle portion 16, the molten thermoplastic resin or the like discharged from the cylinder discharge port 11b. A plurality of (in an example shown in FIG. 7, six) die heaters 18 are provided in the left/right direction to heat the filament discharge portion 12. A heating temperature for the die heaters 18 is controlled based on, for example, the detection signal of a temperature sensor provided in the filament discharge portion 12.

[0042] The nozzle portion 16 is a thick plate which is formed substantially in the shape of a rectangular parallelepiped and which is made of metal, and is provided in a lower portion of the filament discharge portion 12 which is the most downstream portion of the guide flow path 12a. In the nozzle portion 16, a plurality of nozzle holes 16h (openings) for discharging the molten filaments are formed. As an example, the nozzle holes 16h are arranged in a staggered configuration in the forward/backward direction and the left/right direction, and a distance (pitch) between adjacent nozzle holes 16h is about 5 to 15 mm. However, a specific form of the nozzle holes 16h is not particularly limited.

[0043] FIG. 8 shows an example of a schematic configuration of the nozzle portion 16 when the nozzle portion 16 is viewed from below. In the example shown in the figure, the nozzle holes 16h are substantially spaced in a rectangular end surface (in the present embodiment, the surface exposed to the lower side) of the nozzle portion 16. Although in the example shown in FIG. 8, an area occupied by the nozzle holes 16h per unit area (the density of the nozzle holes) in the end surface of the nozzle portion 16 is constant, the nozzle portion 16 adopted in the manufacturing device 1 of the present embodiment is adjusted such that the density of the nozzle holes is changed depending on the position in the left/right direction. This point will be described in detail again.

[0044] Examples of the thermoplastic resin or the like which can be used as the material of the filament three-

dimensional bonded member 3DF include: polyolefin resins such as polyethylene and polypropylene; polyester resins such as polyethylene terephthalate; polyamide resins such as nylon 66; thermoplastic resins such as a polyvinyl chloride resin and a polystyrene resin; and thermoplastic elastomers such as styrene elastomers, vinyl chloride elastomers, olefin elastomers, urethane elastomers, polyester elastomers, nitrile elastomers, polyamide elastomers and fluorine elastomers.

[0045] The thermoplastic resin or the like supplied from the material input portion 13 is heated and melted within the cylinder 11a and is, for example, supplied as the molten thermoplastic resin or the like from the cylinder discharge port 11b to the guide flow path 12a of the filament discharge portion 12 so as to be extruded by the screw 14. Thereafter, the molten filament group MF formed with a plurality of molten filaments is discharged downward in parallel from the nozzle holes 16h in the nozzle portion 17.

[0046] The fusing formation unit 20 includes a cooling water tank 23, a pair of front and back conveyors 24a and 24b, a plurality of conveyance rollers 25a to 25h and a receiving plate 21 which is formed with front and back plates to regulate the thickness of the filament three-dimensional bonded member 3DF. FIG. 9 is a plan view of the receiving plate 21 in the manufacturing device 1 shown in FIG. 6. In the present embodiment, a cooling water supply device 22 is provided which supplies cooling water to the receiving plate 21.

[0047] The receiving plate 21 is a metal plate including a bent portion which includes: inclination surfaces 21a that are inclined downward and are in the shape of a flat plate; and tubular vertical surfaces 21b that extend from lower ends of the inclination surfaces 21a downward in the vertical direction. The receiving plate 21 uses the front and back inclination surfaces 21a to guide end portions of the molten filament group MF in the thickness direction to the side of a center portion, and thereby reduces the dimension of the molten filament group MF in the forward/backward direction to a distance between the front and back vertical surfaces 21b, with the result that the surface is smoothed while the density of the filaments in the end portions of the molten filament group MF in the thickness direction is being increased.

[0048] The cooling water tank 23 is a water tank for storing the cooling water W. Within the cooling water tank 23, the pair of conveyors 24a and 24b and the conveyance rollers 25a to 25h are provided. The pair of conveyors 24a and 24b and the conveyance rollers 25a to 25h are driven by an unillustrated drive motor.

[0049] The molten filament group MF (a plurality of filaments formed of the thermoplastic resin or the like) discharged from the nozzle portion 17 is adjusted in thickness (dimension in the forward/backward direction) by the receiving plate 21, and is deformed by the buoyant action of the water W in the cooling water tank 23, and thus the molten filaments therein form random loops. The random loop is three-dimensionally entangled with

the adjacent random loops in a molten state, and in a three-dimensionally entangled state, the filament three-dimensional fused member is formed in which contact points of the filaments are fused.

[0050] The filament three-dimensional fused member is conveyed by the conveyors 24a and 24b and the conveyance rollers 25a to 25h while being cooled in the water W inside the cooling water tank 23. The filament three-dimensional fused member is moved in the cooling water W and is cooled and solidified, and the filament three-dimensional bonded member 3DF formed in this way is finally discharged to the outside of the cooling water tank 23. In this way, the filament three-dimensional bonded member 3DF which is continuous in the direction of conveyance is manufactured. In the filament three-dimensional bonded member 3DF, a direction (that is, a direction coinciding with the direction of conveyance) corresponding to the up/down direction in a position sandwiched between the front and back vertical surfaces 21b is assumed to be a length direction, a direction corresponding to the forward/backward direction in the position sandwiched between the front and back vertical surfaces 21b is assumed to be a thickness direction and a direction corresponding to the left/right direction in the position sandwiched between the front and back vertical surfaces 21b is assumed to be a width direction.

[0051] The filament three-dimensional bonded member 3DF manufactured by the manufacturing device 1 is sequentially subjected to cutting processing according to the size of the pillow cushion 100, and the individual filament three-dimensional bonded members 3DF generated by the cutting processing are utilized for the pillow cushion 100. In the present embodiment, the length direction of the filament three-dimensional bonded member 3DF is made to correspond to the direction of the left and right shoulders in the pillow cushion 100, the width direction of the filament three-dimensional bonded member 3DF is made to correspond to the height direction of the pillow cushion 100 and the thickness direction of the filament three-dimensional bonded member 3DF is made to correspond to the thickness direction of the pillow cushion 100.

[0052] Here, the speed of the conveyance (hereinafter also referred to as the "conveyor conveyance speed") of the filament three-dimensional bonded member 3DF caused by the conveyors 24a and 24b and the conveyance rollers 25a to 25h can be controlled by a controller CT which is provided to correspond to the manufacturing device 1. The conveyor conveyance speed is changed, and thus the density of the filaments of the filament three-dimensional bonded member 3DF can be changed in the length direction (direction of the conveyance).

[0053] Specifically, in the manufacturing device 1, the supplied amount of molten filament group MF discharged from the nozzle portion 16 is basically set constant, and as the conveyor conveyance speed is increased, the density of the filaments of the filament three-dimensional fused member in a part of the cooling water tank 23 which

is located close to the upper side of the water W (part which is located on the upper side of the conveyors 24a and 24b) is mainly lowered. By utilization of this fact, an arbitrary part of the filament three-dimensional bonded member 3DF in the length direction can be caused to have low repulsion corresponding to the decrease in the density of the filaments.

[0054] By contrast, as the conveyer conveyance speed is decreased, the density of the filaments of the filament three-dimensional fused member in the part of the cooling water tank 23 which is located close to the upper side of the water W is mainly increased. By utilization of this fact, an arbitrary part of the filament three-dimensional bonded member 3DF in the length direction can be caused to have high repulsion corresponding to the increase in the density of the filaments. In other words, the conveyer conveyance speed is controlled, and thus the repulsive force characteristics of the filament three-dimensional bonded member 3DF can be adjusted in the length direction.

[0055] Each of parts (a) and (b) in FIG. 10A is a graph showing an example of details of control of the conveyer conveyance speed performed by the controller CT. In the graphs (the same is true for FIG. 14B which will be described later), the horizontal axis represents time, and the vertical axis represents the conveyer conveyance speed.

[0056] In FIG. 10A, the graph for an example where the filament three-dimensional bonded members 3DF used for manufacturing a plurality of pillow cushions 100 (including pillow cushions A to C) are formed is shown. A period from Ta1 to Ta5 corresponds to a period during which the repulsive force characteristics of the pillow cushion A are adjusted, a period from Tb1 to Tb5 corresponds to a period during which the repulsive force characteristics of the pillow cushion B are adjusted and a period from Tc1 to Tc5 corresponds to a period during which the repulsive force characteristics of the pillow cushion C are adjusted.

[0057] In the example of the part (a) in FIG. 10A, the conveyer conveyance speed is set constant during a period from Ta1 to Ta2, the conveyer conveyance speed is gradually increased during a period from Ta2 to Ta3 such that the graph is drawn to be a curve, the conveyer conveyance speed is gradually decreased during a period from Ta2 to Ta3 such that the graph is drawn to be a curve and the conveyer conveyance speed is set constant during a period from Ta4 to Ta5. A period from Ta2 to Ta4 corresponds to a period during which the repulsive force characteristics of the back head portion support region Xa are adjusted. In this way, it is possible to form the filament three-dimensional bonded member 3DF for the part corresponding to the pillow cushion A.

[0058] Thereafter, the conveyer conveyance speed is set constant during a period from Tb1 to Tb2, the conveyer conveyance speed is gradually increased during a period from Tb2 to Tb3 such that the graph is drawn to be a curve, the conveyer conveyance speed is gradually

decreased during a period from Tb2 to Tb3 such that the graph is drawn to be a curve and the conveyer conveyance speed is set constant during a period from Tb4 to Tb5. A period from Tb2 to Tb4 corresponds to a period during which the repulsive force characteristics of the back head portion support region Xa are adjusted. In this way, it is possible to form the filament three-dimensional bonded member 3DF for the part corresponding to the pillow cushion B.

[0059] Furthermore, thereafter, the conveyer conveyance speed is set constant during a period from Tc1 to Tc2, the conveyer conveyance speed is gradually increased during a period from Tc2 to Tc3 such that the graph is drawn to be a curve, the conveyer conveyance speed is gradually decreased during a period from Tc2 to Tc3 such that the graph is drawn to be a curve and the conveyer conveyance speed is set constant during a period from Tc4 to Tc5. A period from Tc2 to Tc4 corresponds to a period during which the repulsive force characteristics of the back head portion support region Xa are adjusted. In this way, it is possible to form the filament three-dimensional bonded member 3DF for the part corresponding to the pillow cushion C.

[0060] The graph shown in the part (b) in FIG. 10A shows a variation of the details of control of the conveyer conveyance speed shown in the part (a) in FIG. 10A. Although in the example shown in the part (a), in each of the period from Ta2 to Ta4, the period from Tb2 to Tb4 and the period from Tc2 to Tc4, the conveyer conveyance speed is controlled to be changed such that the graph is drawn to be a curve, in the example shown in the part (b), in each of these periods, the conveyer conveyance speed is controlled to be changed such that the graph is drawn to be a line graph (such that a speed change is constant from an arbitrary timing indicated by a dashed line to the subsequent timing).

[0061] The graph shown in the part (c) in FIG. 10A shows another variation of the details of control of the conveyer conveyance speed shown in the part (a) in FIG. 10A. Although in the example shown in the part (a), in each of the period from Ta2 to Ta4, the period from Tb2 to Tb4 and the period from Tc2 to Tc4, the conveyer conveyance speed is controlled to be changed such that the graph is drawn to be a curve, in the example shown in the part (c), in each of these periods, the conveyer conveyance speed is controlled to be changed such that the graph is drawn to be stepwise (such that a speed is constant from an arbitrary timing indicated by a dashed line to the subsequent timing). Which one of the control methods in the parts (a) to (c) in FIG. 10A is adopted can be determined, for example, according to the specifications of the manufacturing device 1 and the like.

[0062] As described above, the conveyer conveyance speed is controlled to be changed continuously or intermittently, and thus it is possible to manufacture the pillow cushion 100 in which the density of the filaments is distributed as illustrated in FIG. 2B. Furthermore, the conveyer conveyance speed may be controlled using

information of the body shape of the user and the like so that the pillow cushion 100 optimized for the individual user is manufactured. An example of the control system of the manufacturing device 1 in this case is shown in FIG. 10B as a block diagram.

[0063] In the example shown in FIG. 10B, as the information of the body shape of the user and the like, back head portion horizontal shape information Y1, back head portion position information Y2 and head weight information Y3 are input to the controller CT. The back head portion horizontal shape information Y1 is information of the shape of the back head portion (position of the surface of the back head portion) of the user in the natural position on a horizontal plane which passes through the vicinity of the apex of the back head portion. The back head portion position information Y2 is information of, when the user stands upright with the back of the user against a vertical wall in the posture in the natural position, a distance from the wall to the back head portion. The head weight information Y3 is information of the weight or the volume of a part from the chin to the top of the head.

[0064] The controller CT controls the conveyer conveyance speed based on the information Y1 to Y3 described above to be able to obtain the pillow cushion 100 which is as ideal as possible for a particular user. In other words, the controller CT controls the conveyer conveyance speed to be able to obtain the pillow cushion 100 on which the user can sleep on the back in the posture in the natural position as much as possible, in which the back head portion support region Xa in the region V1 coincides with the region actually supporting the back head portion as much as possible and in which the repulsive force received by the back head portion from the back head portion support region Xa becomes as uniform as possible.

[0065] The information Y1 to Y3 described above for a plurality of users may be input to the controller CT, and thus the controller CT may control the conveyer conveyance speed based on the input information to be able to sequentially obtain the pillow cushions 100 which are as ideal as possible for the users. In this way, it is possible to use the same manufacturing device 1 to continuously manufacture a plurality of pillow cushions 100 which are individually adjusted to have the distribution (that is, the distribution of the repulsive force) of the density of the filaments optimized for the users.

[0066] As described previously, the nozzle portion 16 adopted in the present embodiment is adjusted such that the density of the nozzle holes is changed according to the position in the left/right direction. The density of the nozzle holes is changed as described above, and thus the density of the filaments of the filament three-dimensional bonded member 3DF can be changed in the width direction (direction corresponding to the height direction of the pillow cushion 100).

[0067] In this way, it is possible to manufacture the pillow cushion 100 in which in the region V1, the distribu-

tion of the density of the filaments illustrated in FIG. 2B is achieved by the control of the conveyer conveyance speed and in the region V2, the distribution of the density of the filaments illustrated in FIG. 3B is achieved by the adjustment of the density of the nozzle holes. The adjustment of the density of the nozzle holes may be performed, for example, by replacing the nozzle portion 16 removably installed in the manufacturing device 1 with a nozzle portion having a different density of the nozzle holes or by providing a shutter (mechanism for opening and closing the nozzle hole 16h) for each of the nozzle holes 16h in the nozzle portion 16 and changing the degree of closing of the shutter.

[0068] The change of the density of the nozzle holes in a predetermined part of the end surface of the nozzle portion 16 can be realized, for example, by one or both of the change of the inside diameter of the nozzle holes 16h included in that part and the change of the number of nozzle holes 16h per unit area included in the part. As the density of the nozzle holes is increased, a larger number of molten filaments are discharged from the part, and thus the density of the filaments of the filament three-dimensional bonded member 3DF in the position corresponding to the part where the density of the nozzle holes is increased is increased accordingly. By utilization of this fact, in the nozzle portion 16, the density of the nozzle holes is changed in the left/right direction, and thus the density of the filaments of the filament three-dimensional bonded member 3DF is changed in the direction (width direction) corresponding to the left/right direction, with the result that the repulsive force characteristics can be changed in the width direction.

[0069] FIG. 11 is a graph showing an example of the distribution of the density of the nozzle holes in the nozzle portion 16. In FIG. 11, the horizontal axis represents the position in the left/right direction, and the vertical axis represents the density of the nozzle holes. In the example shown in the figure, the density of the nozzle holes in the nozzle portion 16 is low in the center in the left/right direction, and is gradually increased from the center toward the left end and the right end. The density of the nozzle holes is changed continuously or intermittently in the left/right direction, and thus it is possible to manufacture the pillow cushion 100 in which in the region V2, the distribution of the density of the filaments as shown in FIG. 3B is achieved.

[0070] When the density of the nozzle holes is adjusted by changing the number of nozzle holes 16h per unit area, for example, in the center portion of the region V2, 40 to 60 holes per 10 square centimeters are set, in the left and right ends of the region V2, 80 to 100 holes per 10 square centimeters are set and thus the distribution of the density of the filaments shown in FIG. 3B is obtained. When the density of the nozzle holes is adjusted by changing the inside diameter of the nozzle holes 16h, for example, in the center portion of the region V2, the inside diameter is set to 0.5 to 0.7 mm and in the left and right ends of the region V2, the inside diameter is set to

0.8 to 1.0 mm and thus the distribution of the density of the filaments shown in FIG. 3B is obtained.

[0071] The adjustment of the density of the nozzle holes can be performed based on back head portion vertical shape information which is information of the shape of the back head portion (position of the surface of the back head portion) of the user in the natural position on a virtual plane (plane which divides the user into two left and right parts) that passes through the vicinity of the apex of the back head portion. In this way, it is possible to manufacture the pillow cushion suitable for the shape of the back head portion of the user. For example, it is preferable to adjust the density of the nozzle holes based on the back head portion vertical shape information such that the repulsive force characteristics of the region V2 capable of supporting the back head portion of the user with a repulsive force which is as uniform as possible can be obtained.

[0072] Although in the present embodiment, the repulsive force characteristics of the pillow cushion 100 are adjusted both in the direction of the left and right shoulders and in the height direction, it is possible to adjust the repulsive force characteristics only in the direction of the left and right shoulders without adjusting the repulsive force characteristics in the height direction (that is, the repulsive force characteristics are set constant in the height direction). In this case, the adjustment of the density of the nozzle holes is not needed, and it is preferable to adopt the nozzle portion 16 illustrated in FIG. 8.

[0073] As described above, the pillow cushion 100 of the present embodiment is formed with the filament three-dimensional bonded member 3DF in which, in a state where a plurality of filaments formed of the thermoplastic resin or the like are three-dimensionally entangled, contact points of the filaments are fused. In the pillow cushion 100, the density of the filaments in the back head portion support region is higher in both ends in the direction of the left and right shoulders than in the center portion. Hence, in the pillow cushion 100, the repulsive force is unlikely to concentrate on an area in the vicinity of the apex of the back head portion, and thus the head of the user is easily stabilized.

[0074] The density of the filaments in the back head portion support region of the pillow cushion 100 is gradually increased from the center portion toward both end portions in the direction of the left and right shoulders, and furthermore, is gradually increased from the center portion toward both end portions in the height direction. In this way, the repulsive force received by the back head portion which is in the shape of a substantially spherical curved surface can easily be further dispersed.

[0075] The method for manufacturing the pillow cushion 100 includes: a molten filament supply step of discharging a plurality of molten filaments formed of the thermoplastic resin or the like downward in a vertical direction from a plurality of nozzle holes 16h provided in the nozzle portion 16; a filament three-dimensional fused member formation step of fusing, while three-di-

mensionally entangling the molten filaments, contact points of the molten filaments to form the filament three-dimensional fused member; and a filament three-dimensional bonded member formation step of conveying the filament three-dimensional fused member and moving the filament three-dimensional fused member in cooling water to cool and solidify the filament three-dimensional fused member, and the pillow cushion 100 is manufactured by cutting the filament three-dimensional bonded member 3DF formed in the filament three-dimensional bonded member formation step.

[0076] Furthermore, in the manufacturing method, the direction of the left and right shoulders in the pillow cushion 100 is substantially aligned with the direction of the conveyance, and the speed of the conveyance is controlled such that the density of the filaments in the back head portion support region of the pillow cushion 100 is gradually increased from the center portion toward both end portions in the direction of the left and right shoulders. By the manufacturing method described above, it is possible to easily manufacture the pillow cushion 100 in which the density of the filaments is adjusted according to the position in the direction of the left and right shoulders.

[0077] As described above, in the method for manufacturing the pillow cushion 100 used by a predetermined user, the speed of the conveyance may be controlled based on the back head portion horizontal shape information Y1 of the user such that the density of the filaments in the back head portion support region of the pillow cushion 100 is gradually increased from the center portion toward both end portions in the direction of the left and right shoulders. Based on the back head portion horizontal shape information Y1, the pillow cushion 100 suitable for the shape of the back head portion of the user who takes the sleeping posture is easily manufactured. For example, it is easy to manufacture, based on the back head portion horizontal shape information Y1, the pillow cushion 100 in which the repulsive force received by the user is set constant as much as possible in positions from the vicinity of the center of the back head portion support region toward both ends in the direction of the left and right shoulders.

[0078] As described above, in the method for manufacturing the pillow cushion 100 in which the density of the filaments in the back head portion support region is gradually increased from the center portion toward both end portions in the height direction, the density of the nozzle holes in the nozzle portion 16 may be adjusted based on the back head portion vertical shape information of the user such that the density of the filaments in the back head portion support region of the pillow cushion 100 is gradually increased from the center portion toward both end portions in the height direction. Based on the back head portion vertical shape information, the pillow cushion 100 suitable for the shape of the back head portion of the user who takes the sleeping posture is easily manufactured. For example, it is easy to manu-

facture, based on the back head portion vertical shape information, the pillow cushion 100 in which the repulsive force received by the user is set constant as much as possible in positions from the vicinity of the center of the back head portion support region toward both ends in the height direction.

[0079] As described above, in the method for manufacturing the pillow cushion 100, the speed of the conveyance may be controlled based on the back head portion position information Y2 and the head weight information Y3 of the user. Based on the information Y2 and Y3 described above, the pillow cushion 100 in which the height of the apex of the back head portion of the user who takes the sleeping posture is optimal is easily manufactured. For example, it is easy to manufacture, based on the information Y2 and Y3 described above, the pillow cushion 100 in which when the user sleeps on the back, the user takes the posture in the natural position as much as possible.

2. Second embodiment

[0080] The second embodiment of the present invention will then be described. In the description of the second embodiment, attention is focused on the description of configurations different from the first embodiment, and the description of the same configurations as in the first embodiment may be omitted.

[0081] The pillow cushion 200 according to the second embodiment is used for a pillow as with the pillow cushion 100 of the first embodiment, and is formed with the filament three-dimensional bonded member 3DF. The pillow cushion 200 is formed substantially in the shape of a rectangular parallelepiped in which both end surfaces in the height direction, both end surfaces in the direction of the left and right shoulders and both end surfaces in the thickness direction are outer surfaces.

[0082] In FIG. 12, a region (region V1) in the vicinity of a virtual plane S1 which divides the pillow cushion 200 into two equal parts in the height direction is colored. A center portion of the region V1 in the direction of the left and right shoulders supports an approximate apex of the back head portion of the user who takes the sleeping posture of a supine position. A predetermined range from the center portion in the region V1 to both sides in the direction of the left and right shoulders is a back head portion support region.

[0083] The graph of FIG. 13 shows the distribution of the density of the filaments of the pillow cushion 200 in the region V1, the horizontal axis represents the position in the direction of the left and right shoulders and the vertical axis represents the density of the filaments in the region V1.

[0084] In the region V1 of the pillow cushion 200, the density of the filaments in the back head portion support region is the lowest in the center portion, and is gradually increased from the center portion toward both end portions. More specifically, as shown in the graph of FIG. 13

for the direction of the left and right shoulders, in the back head portion support region Xa of the region V1, the density of the filaments of the pillow cushion 200 is the lowest Da1 in the center portion in the direction of the left and right shoulders, and is gradually increased from the center portion toward both end sides in the direction of the left and right shoulders.

[0085] The back head portion support region Xa is a region between a position Pa1 which is located only a predetermined distance from the center portion of the pillow cushion 200 to the left shoulder side and a position Pa2 which is located only the same distance from the center portion to the right shoulder side. On both ends in the direction of the left and right shoulders relative to the back head portion support region Xa, the density of the filaments of the pillow cushion 200 is Da2.

[0086] In the present embodiment, in a region from the position Pa1 to an end portion of the pillow cushion 200 on the left shoulder side (referred to as the "left shoulder close region" for convenience), the density of the filaments is the lowest in the vicinity of the center portion, and is gradually increased from an area in the vicinity of the center portion toward both end portions. In a region from the position Pa2 to an end portion of the pillow cushion 200 on the right shoulder side (referred to as the "right shoulder close region" for convenience), the density of the filaments is the lowest in the vicinity of the center portion, and is gradually increased from an area in the vicinity of the center portion toward both end portions. In both ends of the left shoulder close region and the right shoulder close region, the density of the filaments is Da2.

[0087] In the pillow cushion 200, as in the case of the first embodiment, the density of the filaments is adjusted in the back head portion support region of the region V1. In this way, in the region of the pillow which supports the back head portion of the user who sleeps on the back, the repulsive force between the pillow cushion 200 and the back head portion is unlikely to be increased in the center portion in the direction of the left and right shoulders, and is unlikely to be lowered from the center portion toward both end portions in the direction of the left and right shoulders. Hence, in the pillow cushion 200, it is possible to prevent the repulsive force received from the pillow from concentrating on the part of the back head portion to give the user a feeling of pressure and to cause the head to swing from side to side such that the angle of the head is unstable.

[0088] Furthermore, in the pillow cushion 200, even in the left shoulder close region and the right shoulder close region of the region V1, the density of the filaments is the lowest in the vicinity of the center portion, and is gradually increased from an area in the vicinity of the center portion toward both end portions. Hence, even when the user takes the sleeping posture of a supine position, for example, by turning over, by the same principle as in the back head portion support region, it is possible to prevent the repulsive force received from the pillow from concentrating on the part of the back head portion to give the user

a feeling of pressure and to cause the head to swing from side to side such that the angle of the head is unstable.

[0089] FIG. 14A shows the state of the pillow cushion 200 which supports the temporal portion and the ear portion of the user who takes the sleeping posture of a lateral position as a cross-sectional view taken along a plane S1. In the figure, arrows Ps1 schematically indicate the repulsive force of the pillow cushion 200 in the center portion of a region which supports the user, and an arrow Pc1 schematically indicates the repulsive force of the pillow cushion 200 in the peripheral portion of the region which supports the user. As described above, in the pillow cushion 200, even when the user takes the sleeping posture of a lateral position, the repulsive force Pc1 can be prevented from being remarkably increased, the repulsive force Ps1 can be prevented from being excessively lowered and thus the concentration of the repulsive force on a small part of the temporal portion is suppressed, with the result that it is possible to easily stabilize the head of the user.

[0090] In the present embodiment, the conveyer conveyance speed is controlled, and thus it is possible to adjust the density of the filaments of the pillow cushion 200 in the direction of the left and right shoulders. FIG. 14B is a graph showing an example of details of control of the conveyer conveyance speed performed by the controller CT.

[0091] In FIG. 14B, the graph for an example where the filament three-dimensional bonded member 3DF used for manufacturing a plurality of pillow cushions 200 (including pillow cushions A to C) is formed is shown. A period from Ta1 to Ta5 corresponds to a period during which the repulsive force characteristics of the pillow cushion A are adjusted, a period from Tb1 to Tb5 corresponds to a period during which the repulsive force characteristics of the pillow cushion B are adjusted and a period from Tc1 to Tc5 corresponds to a period during which the repulsive force characteristics of the pillow cushion C are adjusted.

[0092] A period from Ta1 to Ta2, a period from Tb1 to Tb2 and a period from Tc1 to Tc2 respectively correspond to periods during which the repulsive force characteristics of the left shoulder close regions (or the right shoulder close regions) of the pillow cushions 200 are adjusted. A period from Ta2 to Ta4, a period from Tb2 to Tb4 and a period from Tc2 to Tc4 respectively correspond to periods during which the repulsive force characteristics of the back head portion support regions of the pillow cushions 200 are adjusted. Ta3, Tb3 and Tc3 respectively correspond to timings at which the repulsive force characteristics of the center portions of the back head portion support regions are adjusted. A period from Ta4 to Ta5, a period from Tb4 to Tb5 and a period from Tc4 to Tc5 respectively correspond to periods during which the repulsive force characteristics of the right shoulder close regions (or the left shoulder close regions) of the pillow cushions 200 are adjusted.

3. Third embodiment

[0093] The third embodiment of the present invention will then be described. In the description of the second embodiment, attention is focused on the description of configurations different from the first embodiment, and the description of the same configurations as in the first embodiment may be omitted.

[0094] FIG. 15 is a perspective view of a pillow cushion 300 according to the third embodiment. The pillow cushion 300 is a cushion which is used for a pillow, each of a first pillow unit 301 and a second pillow unit 302 is formed with the filament three-dimensional bonded member 3DF and the first pillow unit 301 is stacked on the second pillow unit 302 in a thickness direction. The first pillow unit 301 and the second pillow unit 302 are formed to have the same shape and size, and in a state where the first pillow unit 301 is stacked on the second pillow unit 302 in the thickness direction, as with the pillow cushion 100 of the first embodiment, the first pillow unit 301 and the second pillow unit 302 serve as a cushion member which has a shape and a size suitable for a pillow.

[0095] Although the first pillow unit 301 and the second pillow unit 302 are stored into a pillow cover, and thus they can be used as the integral pillow cushion 300, an integral pillow cushion obtained by adhering or fusing the first pillow unit 301 and the second pillow unit 302 may be used as the pillow cushion 300. The first pillow unit 301 and the second pillow unit 302 may be reversed (interchanged) in the thickness direction. Although in the present embodiment, the first pillow unit 301 and the second pillow unit 302 are in the shape of a rectangular parallelepiped, projections and recesses may be provided in the surface or the shape of a side surface or a planar shape may be changed to a different shape such as an oval shape as long as the effects of the present invention are not impaired. The pillow cushion 300 is formed substantially in the shape of a rectangular parallelepiped in which both end surfaces in the height direction, both end surfaces in the direction of the left and right shoulders and both end surfaces in the thickness direction are outer surfaces.

[0096] The graph of FIG. 16A shows the distribution of the density of the filaments of the first pillow unit 301 in a region (region V1) in the vicinity of a virtual plane S1 which divides the pillow cushion 300 into two equal parts in the height direction. The graph of FIG. 16B shows the distribution of the density of the filaments of the first pillow unit 301 in a region (region V2) in the vicinity of a virtual plane S2 which divides the pillow cushion 300 into two equal parts in the direction of the left and right shoulders.

[0097] As shown in FIG. 16A, in the back head portion support region Xa, the density of the filaments in the region V1 of the first pillow unit 301 is gradually increased from a center position toward both sides in the direction of the left and right shoulders. In a region from an end portion Pa1 on the left shoulder side of the back head portion support region Xa to an end portion on the left

shoulder side of the first pillow unit 301, the density of the filaments in the region V1 is the lowest in the center position, and is gradually increased from this position toward both sides in the direction of the left and right shoulders.

[0098] In a region from an end portion Pa2 on the right shoulder side of the back head portion support region Xa to an end portion on the right shoulder side of the first pillow unit 301, the density of the filaments in the region V1 is the lowest in the center position, and is gradually increased from this position toward both sides in the direction of the left and right shoulders. As shown in FIG. 16B, the density of the filaments in the region V2 of the first pillow unit 301 is constant from an end portion on the head top side to an end portion on the leg side.

[0099] The graph of FIG. 17A shows the distribution of the density of the filaments of the second pillow unit 302 in the region V1. The graph of FIG. 17B shows the distribution of the density of the filaments of the second pillow unit 302 in the region V2.

[0100] As shown in FIG. 17B, in the back head portion support region Xb, the density of the filaments in the region V2 of the second pillow unit 302 is gradually increased from the center position toward both sides in the height direction. The density of the filaments in the region V2 is gradually decreased from an end portion Pb1 on the head top side of the back head portion support region Xb to an end portion on the head top side of the second pillow unit 302.

[0101] The density of the filaments in the region V2 is gradually decreased from an end portion Pb2 on the leg side of the back head portion support region Xb to an end portion on the leg side of the second pillow unit 302. As shown in FIG. 17A, the density of the filaments in the region V1 of the second pillow unit 302 is constant from an end portion on the left shoulder side to an end portion on the right shoulder side.

[0102] As described above, in the present embodiment, the density of the filaments in the back head portion support region Xa of the first pillow unit 301 is gradually increased from the center portion toward both end portions in the direction of the left and right shoulders, and the density of the filaments in the back head portion support region Xa of the second pillow unit 302 is gradually increased from the center portion toward both end portions in the height direction. In the pillow cushion 300, the pillow units 301 and 302 described above are stacked in the thickness direction, and thus the substantial density of the filaments in each of positions on a plane orthogonal to the thickness direction is the average value of the densities of the filaments of the pillow units 301 and 302 in the position.

[0103] Hence, the distribution of the density of the filaments in the region V1 and the distribution of the density of the filaments in the region V2 are as shown in FIGS. 18 and 19. The graph of FIG. 18 shows the distribution of the substantial density of the filaments of the filament three-dimensional bonded member 3DF of

the pillow cushion 300 in the region V1. The graph of FIG. 19 shows the distribution of the substantial density of the filaments of the pillow cushion 300 in the region V2. In a position where the substantial density of the filaments is low, the repulsive force received from the pillow cushion 300 by the user is lowered accordingly, and in a position where the substantial density of the filaments is high, the repulsive force received from the pillow cushion 300 by the user is increased accordingly.

[0104] As described above, in the pillow cushion 300 of the present embodiment, the first pillow unit 301 is stacked on the second pillow unit 302 in the thickness direction, and thus the density of the filaments in the back head portion support region is gradually increased from the center portion toward both end portions both in the direction of the left and right shoulders and in the height direction. In each of the first pillow unit 301 and the second pillow unit 302, it is preferable to adjust only one of the density of the filaments in the direction of the left and right shoulders and the density of the filaments in the height direction, with the result that the pillow cushion 300 can easily be manufactured.

[0105] In the first pillow unit 301, the direction of the left and right shoulders is aligned with the length direction of the filament three-dimensional bonded member 3DF, the conveyer conveyance speed is controlled such that the distribution of the density of the filaments in the direction of the left and right shoulders is brought into the state indicated by FIG. 16A and thus it is possible to manufacture the first pillow unit 301. On the other hand, in the second pillow unit 302, the height direction is aligned with the length direction of the filament three-dimensional bonded member 3DF, the conveyer conveyance speed is controlled such that the distribution of the density of the filaments in the height direction is brought into the state indicated by FIG. 17B and thus it is possible to manufacture the second pillow unit 302.

[0106] As described above, in the present embodiment, the direction of the left and right shoulders in the first pillow unit 301 is made to correspond to the length direction of the filament three-dimensional bonded member 3DF, and the height direction of the first pillow unit 301 is made to correspond to the width direction of the filament three-dimensional bonded member 3DF. On the other hand, the direction of the left and right shoulders in the second pillow unit 302 is made to correspond to the width direction of the filament three-dimensional bonded member 3DF, and the height direction of the second pillow unit 302 is made to correspond to the length direction of the filament three-dimensional bonded member 3DF. Even when any one of the first pillow unit 301 and the second pillow unit 302 is manufactured, the density of the nozzle holes in the nozzle portion 16 can be made uniform as illustrated in FIG. 8.

4. Fourth embodiment

[0107] The fourth embodiment of the present invention

will then be described. In the description of the fourth embodiment, attention is focused on the description of configurations different from the first embodiment, and the description of the same configurations as in the first embodiment may be omitted.

[0108] FIG. 20 is a perspective view of a pillow cushion 400 according to the fourth embodiment. The pillow cushion 400 is a cushion which is used for a pillow, and each of an outer edge pillow unit 401 and a pillow core unit 402 included in the pillow cushion 400 is formed with the filament three-dimensional bonded member 3DF. The outer edge pillow unit 401 includes a cavity portion which penetrates in the direction of the left and right shoulders and is formed tubularly, and the pillow core unit 402 is stored in the cavity portion of the outer edge pillow unit 401. In the example of the present embodiment, the outer edge shape of each of the bottom surfaces (end surfaces in the direction of the left and right shoulders) of the outer edge pillow unit 401 is a rectangle with rounded four corners, and the shape of the pillow core unit 402 is a rectangular parallelepiped.

[0109] The density of the filaments in the back head portion support region of the outer edge pillow unit 401 is low in the center portion, and is gradually increased from the center portion toward both ends in the direction of the left and right shoulders. On the other hand, the density of the filaments in the back head portion support region of the pillow core unit 402 is low in the center portion, and is gradually increased from the center portion toward both ends in the height direction.

[0110] Preferably, when the outer edge pillow unit 401 is manufactured with the manufacturing device 1, a nozzle portion 116 illustrated in FIG. 21 is adopted as the nozzle portion 16, and the direction of the left and right shoulders in the outer edge pillow unit 401 is aligned with the length direction of the filament three-dimensional bonded member 3DF. In the nozzle portion 116, a plurality of nozzle holes 116h are spaced in a substantially oval first area (corresponding to the first pillow unit 301), and the nozzle holes 116h are not provided in a second area (corresponding to the cavity portion) which is rectangular center portion. The nozzle portion 116 is used, and thus it is possible to easily manufacture the outer edge pillow unit 401 which is tubular (in which the cavity portion is provided).

[0111] Furthermore, when the outer edge pillow unit 401 is manufactured with the manufacturing device 1, as the receiving plate 21, a receiving plate 121 which is illustrated in the plan view of FIG. 22 can be adopted. The receiving plate 121 is a metal plate including a bent portion which includes: inclination surfaces 121a that are inclined downward toward the inside; and substantially elliptically cylindrical vertical surfaces 121b that extend from lower ends of the inclination surfaces 121a downward in the vertical direction. In the receiving plate 121, the four corners of the inside edge of the inclination surfaces 121a are rounded when viewed from above, and thus the outer edge shape of each of the bottom

surfaces of the outer edge pillow unit 401 is easily set to a rectangle with rounded four corners.

[0112] In the first area, the density of the nozzle holes can be made uniform. When the outer edge pillow unit 401 is manufactured with the manufacturing device 1, as in the case where the first pillow unit 301 in the third embodiment is manufactured, the conveyer conveyance speed can be controlled such that the density of the filaments in the back head portion support region of the outer edge pillow unit 401 is low in the center portion, and is gradually increased from the center portion toward both ends in the direction of the left and right shoulders.

[0113] In the pillow core unit 402, the height direction is made to correspond to the length direction of the filament three-dimensional bonded member 3DF, and the direction of the left and right shoulders is made to correspond to the width direction of the filament three-dimensional bonded member 3DF. When the pillow core unit 402 is manufactured, as in the case where the second pillow unit 302 in the third embodiment is manufactured, the conveyer conveyance speed can be controlled such that the density of the filaments in the back head portion support region of the pillow core unit 402 is low in the center portion, and is gradually increased from the center portion toward both ends in the height direction.

[0114] Although the embodiments of the present invention have been described above, the configuration of the present invention is not limited to the embodiments described above, and various changes can be added without departing from the spirit of the present invention. In other words, the embodiments described above should be considered to be illustrative in all respects and not restrictive. It should be understood that the technical scope of the present invention is indicated not by the description of the above embodiments but by the scope of claims, and meanings equivalent to the scope of claims and all changes in the scope are included in the technical scope.

Industrial Applicability

[0115] The present invention can be utilized for a pillow cushion and a method for manufacturing such as pillow cushion.

Reference Signs List

[0116]

- 1 manufacturing device
- 10 molten filament supply unit
- 11 pressurization melting portion
- 11a cylinder
- 11b cylinder discharge port
- 12 filament discharge portion
- 12a guide flow path
- 13 material input portion
- 14 screw

15 screw motor
 15a screw heater
 16, 116 nozzle portion
 16h, 116h nozzle hole
 18 die heater
 20 fusing formation unit
 21, 121 receiving plate
 21a, 121a inclination surface
 21b, 121b vertical surface
 22 cooling water supply device
 23 cooling water tank
 24 conveyer
 25a to 25h conveyance roller
 100, 200, 300, 400 pillow cushion
 301 first pillow unit
 302 second pillow unit
 401 outer edge pillow unit
 402 pillow core unit

Claims

1. A pillow cushion formed with a filament three-dimensional bonded member in which, in a state where a plurality of filaments formed of a thermoplastic resin or a thermoplastic elastomer are three-dimensionally entangled, contact points of the filaments are fused, wherein a density of the filaments in a back head portion support region is higher in both end portions in a direction of left and right shoulders than in a center portion.
2. The pillow cushion according to claim 1, wherein the density of the filaments in the back head portion support region is gradually increased from the center portion toward the both end portions in the direction of left and right shoulders.
3. The pillow cushion according to claim 2, wherein the density of the filaments in the back head portion support region is gradually increased from the center portion toward both end portions in a height direction.
4. The pillow cushion according to claim 3, wherein the pillow cushion is formed by stacking a plurality of pillow units in a thickness direction, each of the pillow units includes a first pillow unit and a second pillow unit formed with the filament three-dimensional bonded member, a density of the filaments in the back head portion support region of the first pillow unit is gradually increased from the center portion toward the both end portions in the direction of left and right shoulders and a density of the filaments in the back head por-

tion support region of the second pillow unit is gradually increased from the center portion toward the both end portions in the height direction.

5. A method for manufacturing the pillow cushion according to claim 2 or 3, the method comprising:

a molten filament supply step of discharging a plurality of molten filaments formed of a thermoplastic resin or a thermoplastic elastomer downward in a vertical direction from a plurality of nozzle holes provided in a nozzle portion;
 a filament three-dimensional fused member formation step of fusing, while three-dimensionally entangling the molten filaments, contact points of the molten filaments to form a filament three-dimensional fused member; and
 a filament three-dimensional bonded member formation step of conveying the filament three-dimensional fused member and moving the filament three-dimensional fused member in cooling water to cool and solidify the filament three-dimensional fused member, wherein the pillow cushion according to claim 2 or 3 is manufactured by cutting the filament three-dimensional bonded member formed in the filament three-dimensional bonded member formation step, the direction of left and right shoulders in the pillow cushion is substantially aligned with a direction of the conveyance and a speed of the conveyance is controlled such that the density of the filaments in the back head portion support region of the pillow cushion is gradually increased from the center portion toward the both end portions in the direction of left and right shoulders.

6. The manufacturing method according to claim 5, wherein the pillow cushion that is used by a predetermined user is manufactured, and the speed of the conveyance is controlled based on back head portion horizontal shape information of the user such that the density of the filaments in the back head portion support region of the pillow cushion is gradually increased from the center portion toward the both end portions in the direction of left and right shoulders.
7. The manufacturing method according to claim 6, wherein the pillow cushion in which the density of the filaments in the back head portion support region is gradually increased from the center portion toward both end portions in a height

direction is manufactured, and
a density of the nozzle holes in the nozzle portion
is adjusted based on back head portion vertical
shape information of the user such that the
density of the filaments in the back head portion 5
support region of the pillow cushion is gradually
increased from the center portion toward the
both end portions in the height direction.

8. The manufacturing method according to claim 6 or 7, 10
wherein the speed of the conveyance is controlled
based on back head portion position information and
head weight information of the user.

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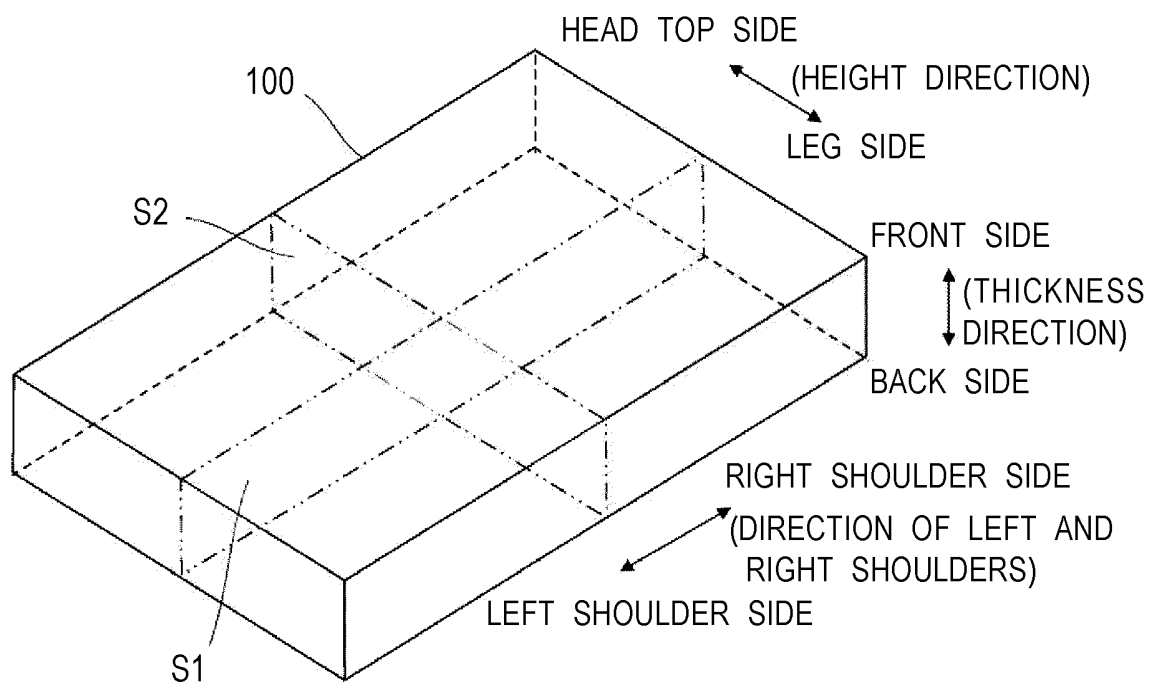


FIG. 1

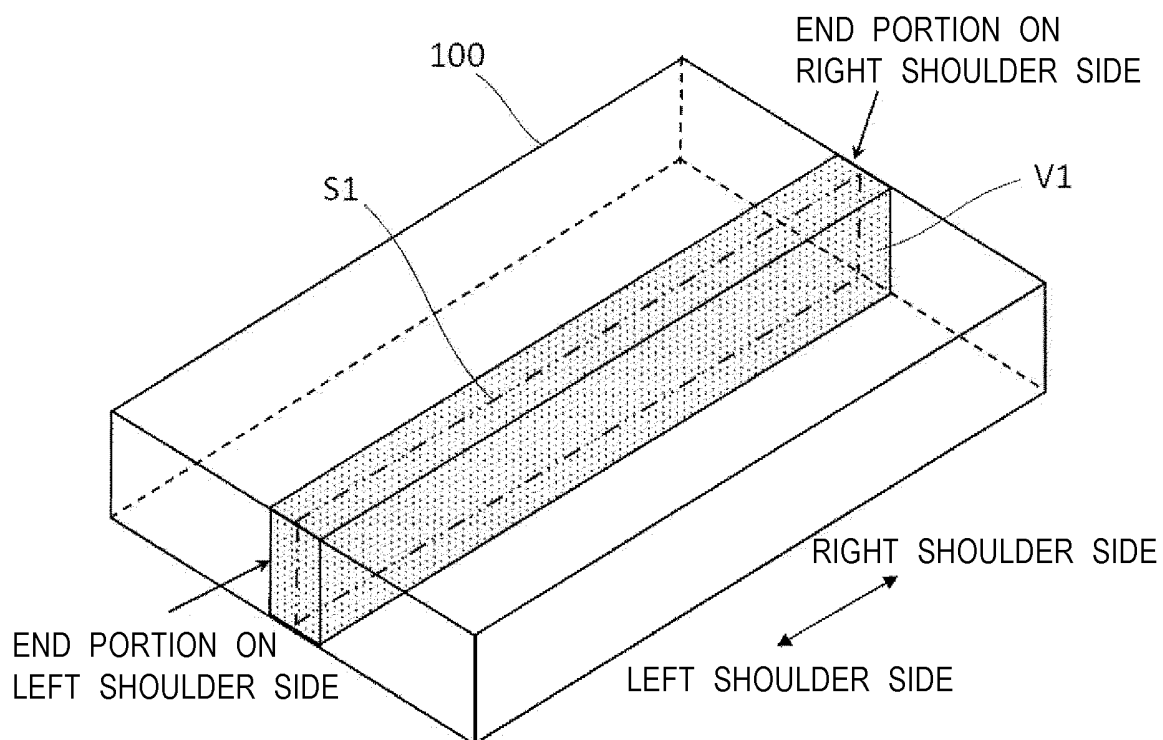


FIG. 2A

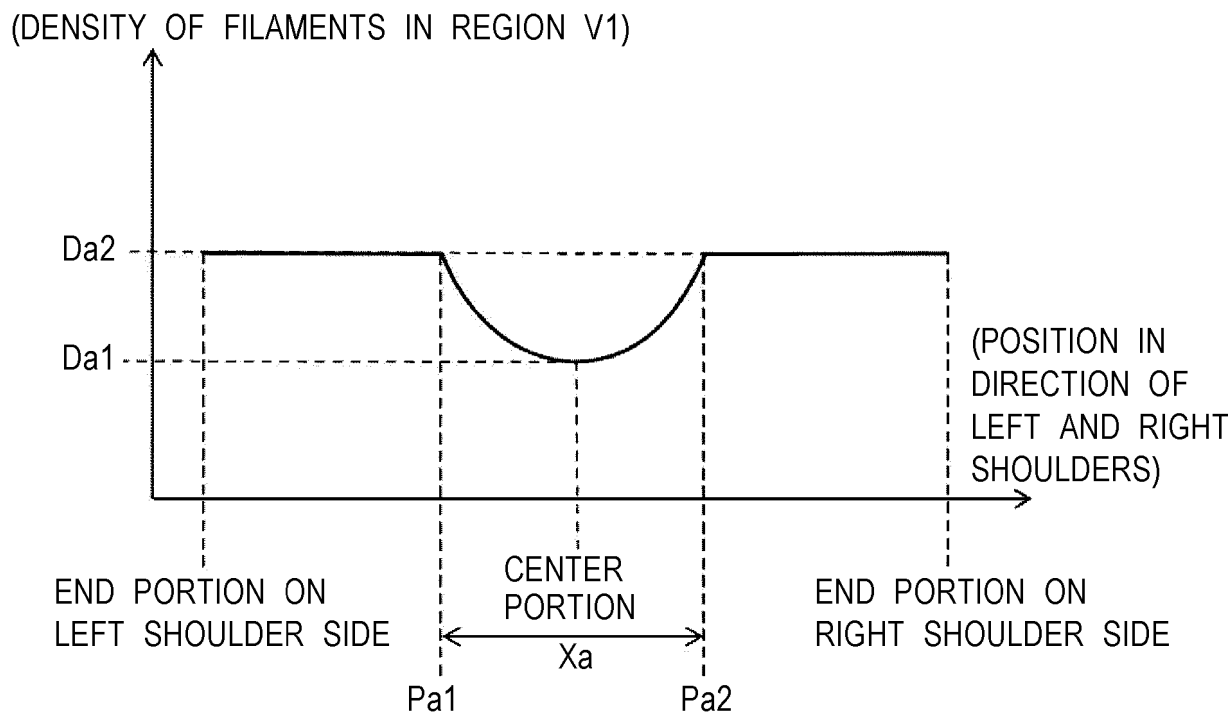


FIG. 2B

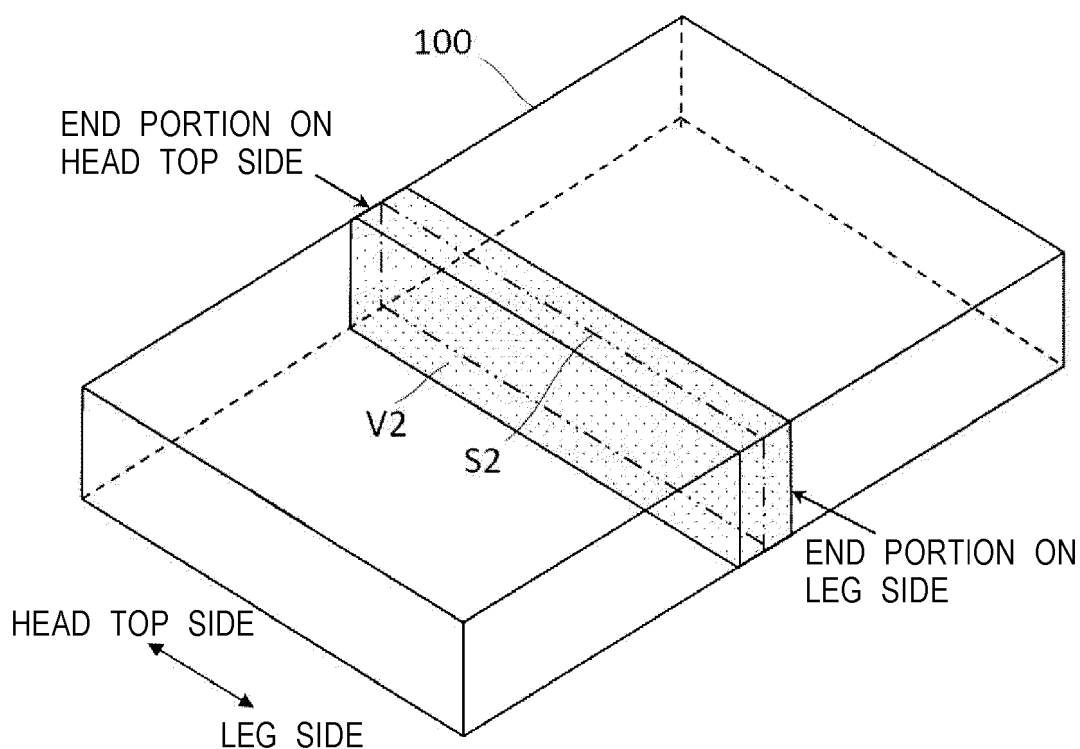


FIG. 3A

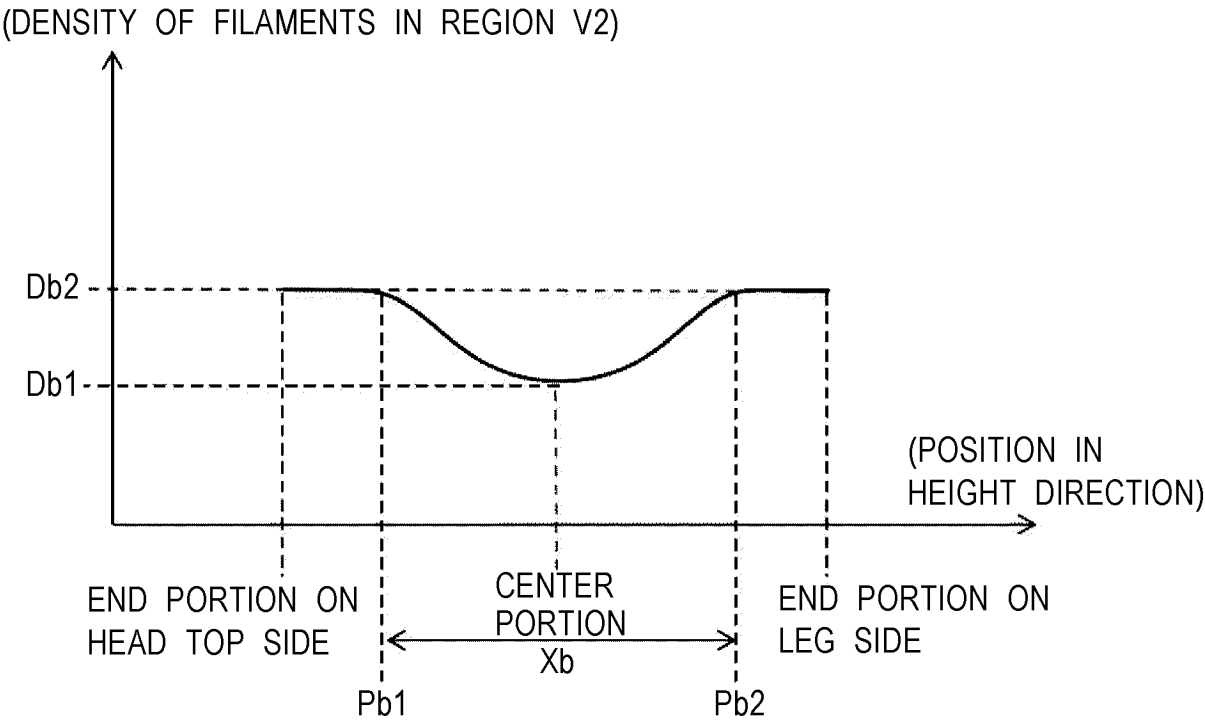


FIG. 3B

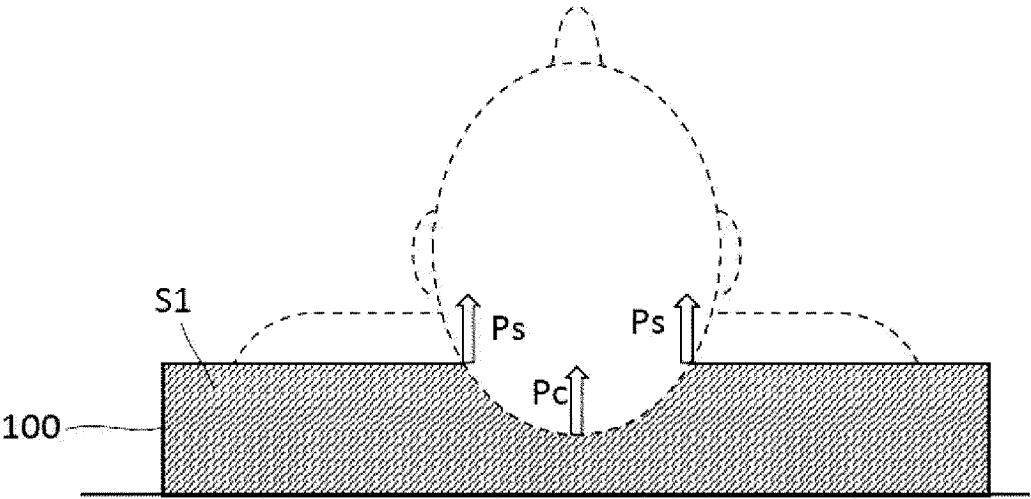


FIG. 4

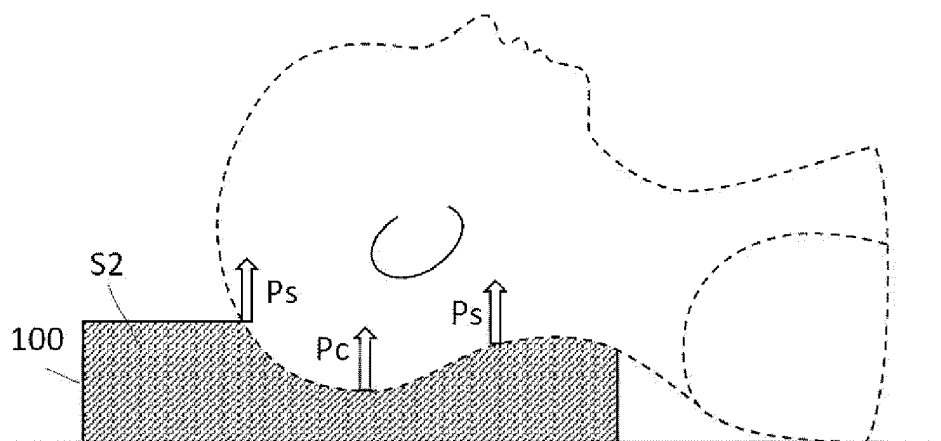


FIG. 5

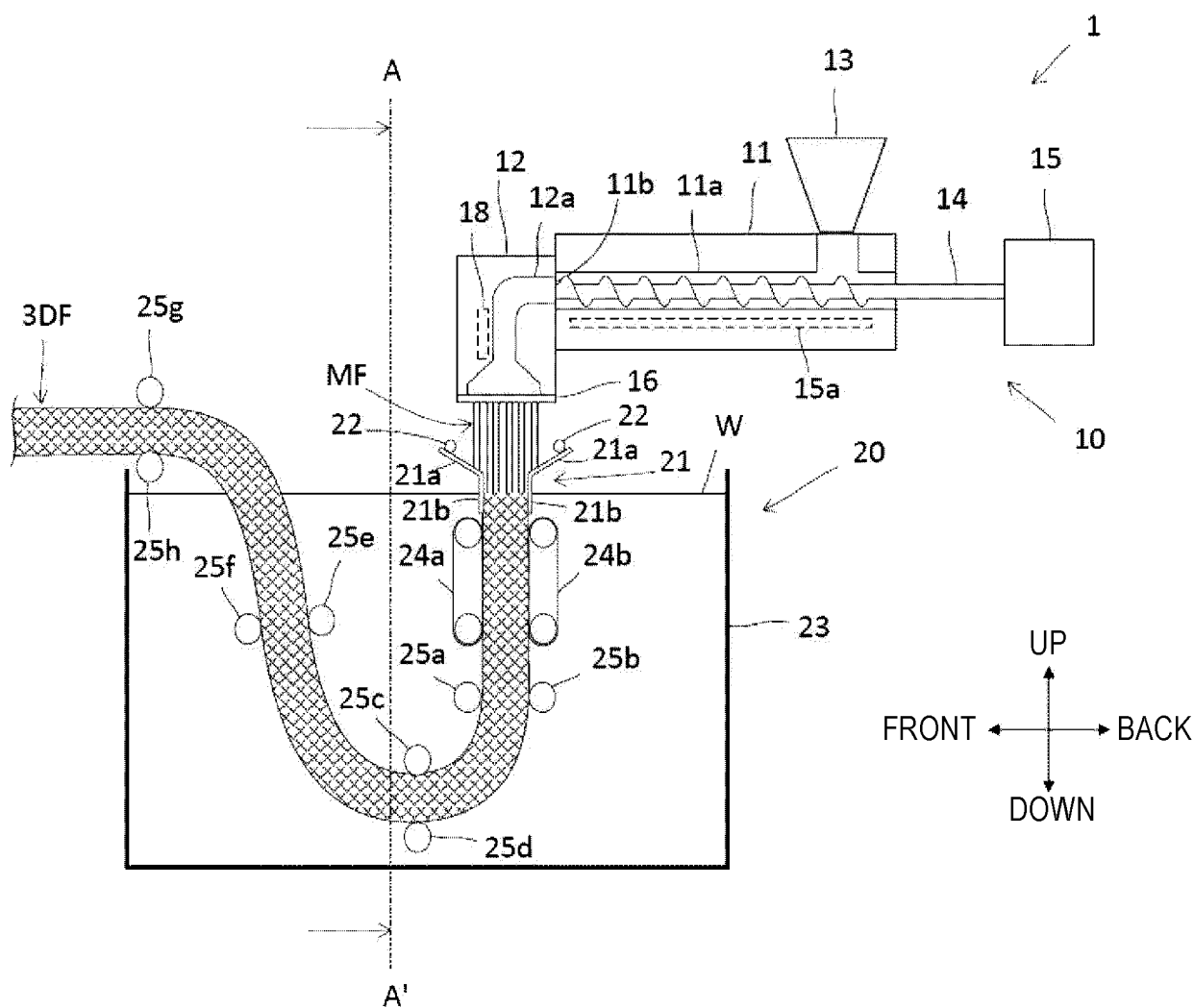


FIG. 6

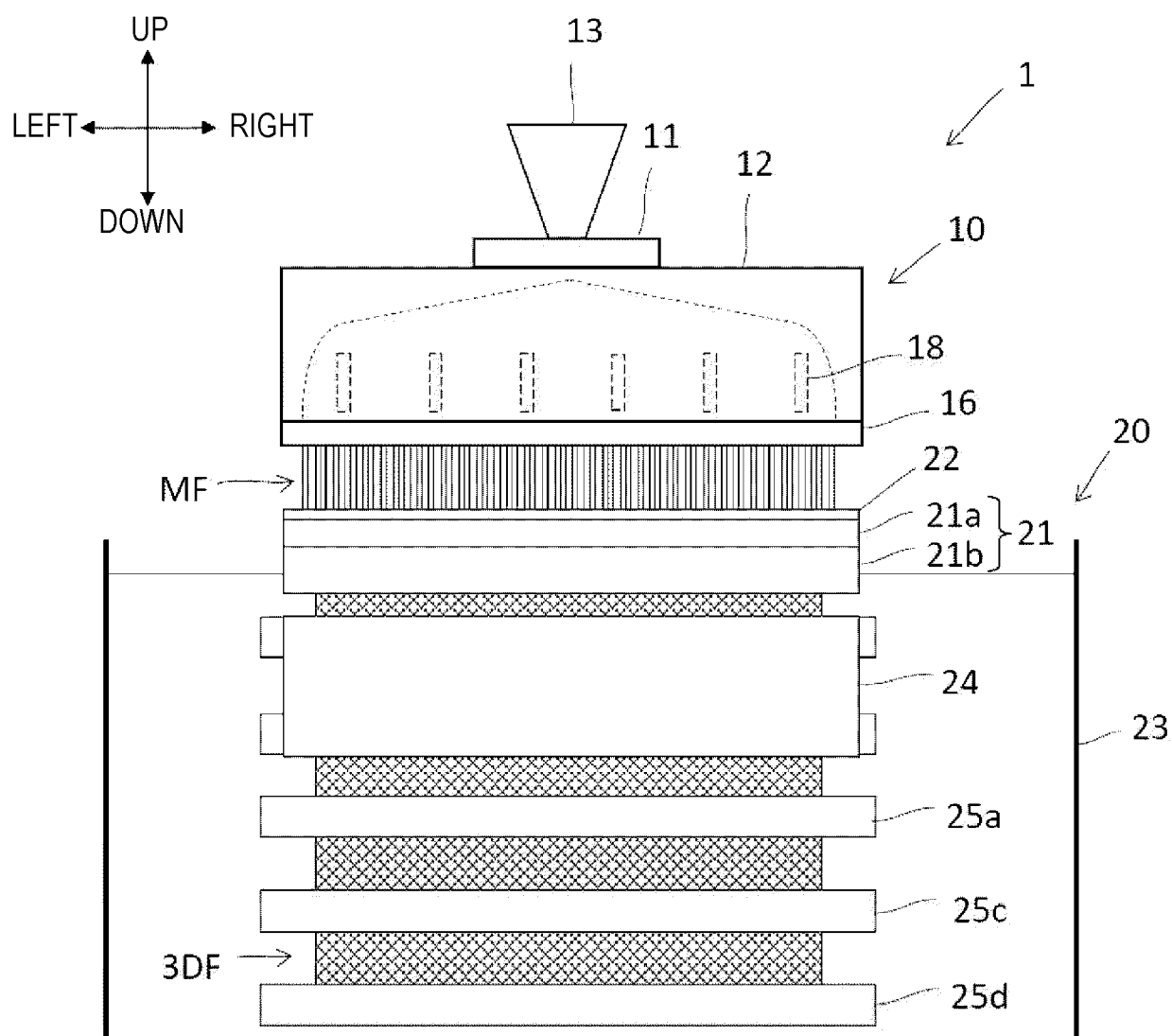


FIG. 7

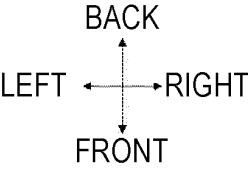
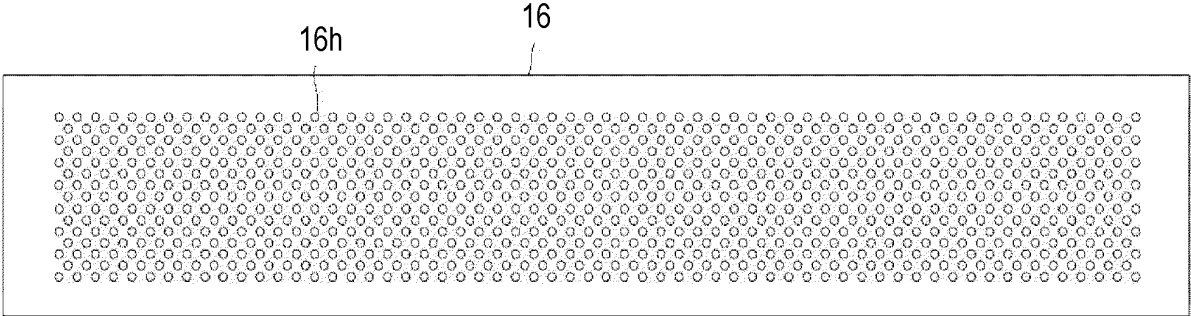


FIG. 8

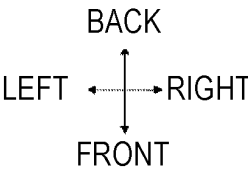
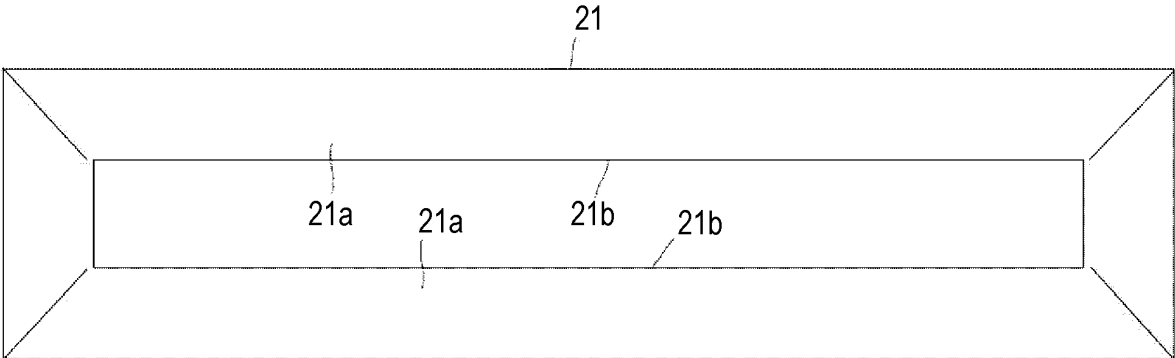


FIG. 9

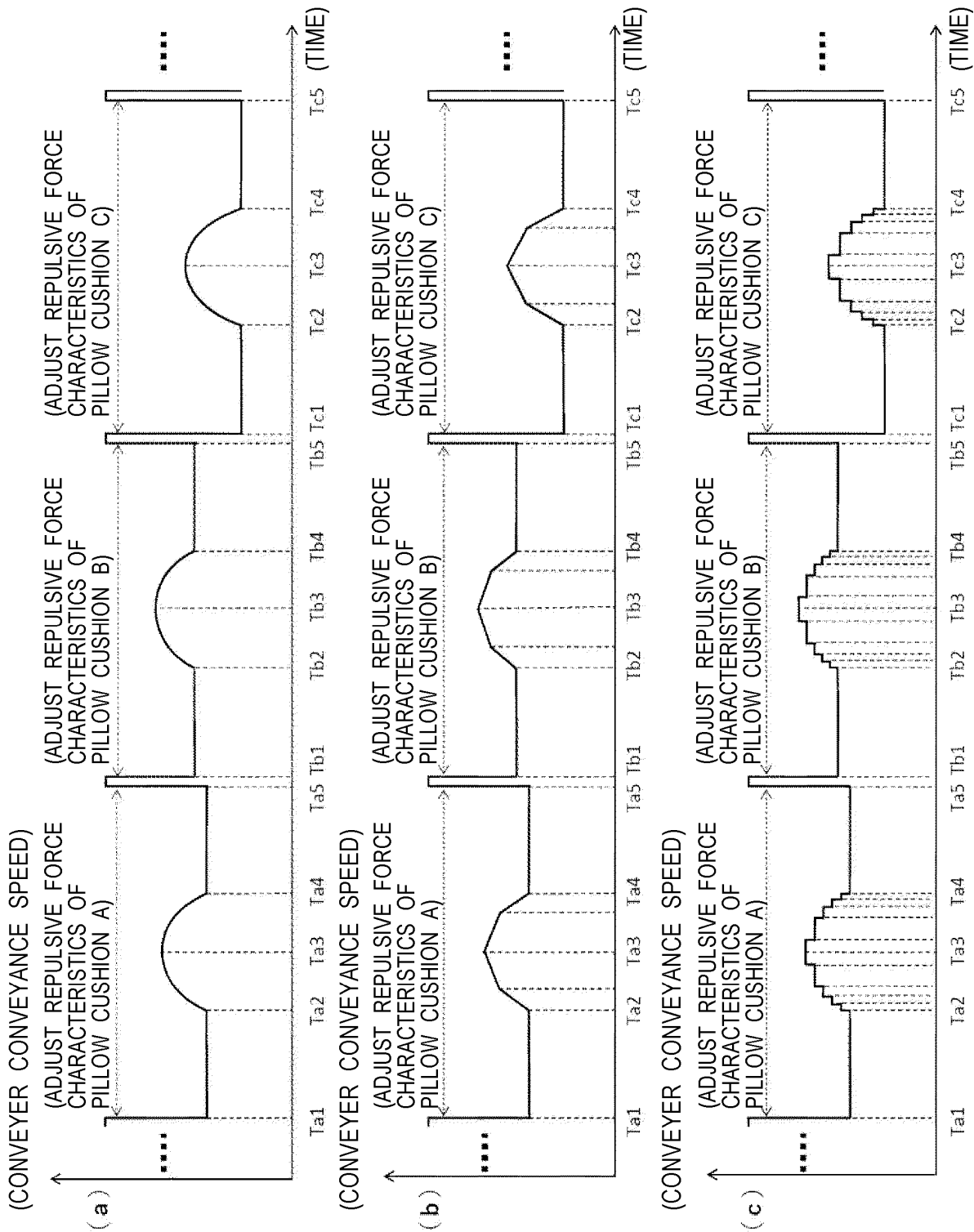


FIG. 10A

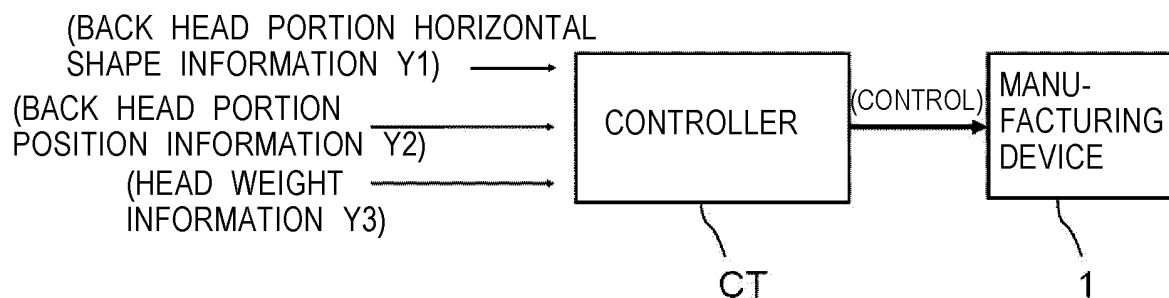


FIG. 10B

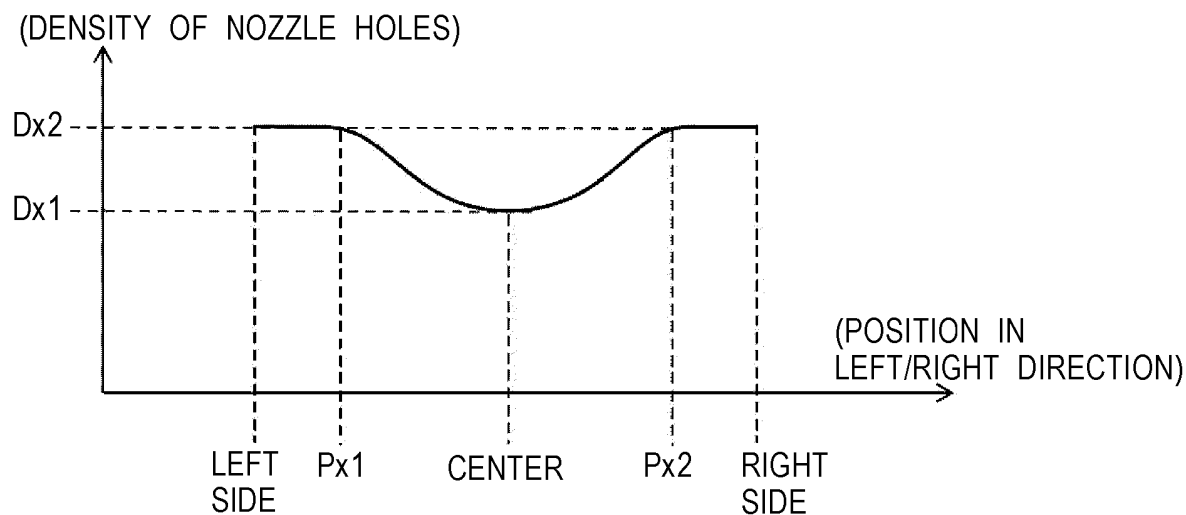


FIG. 11

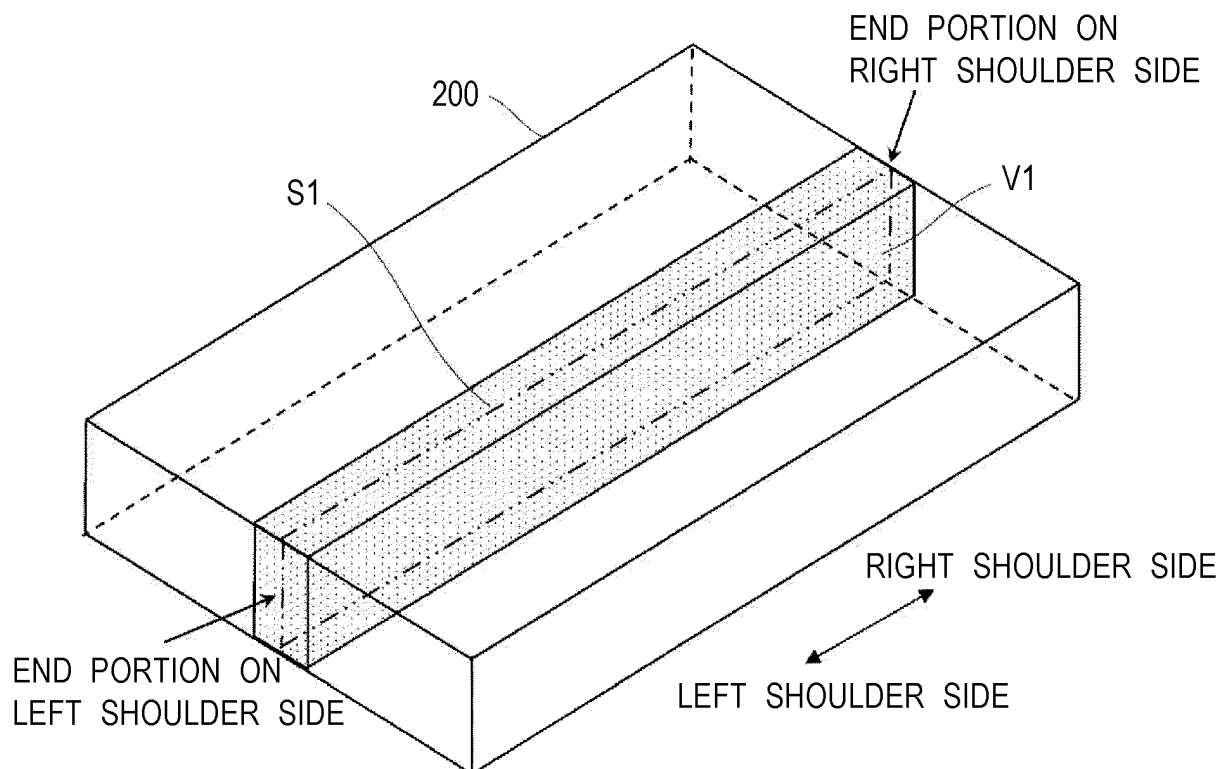


FIG. 12

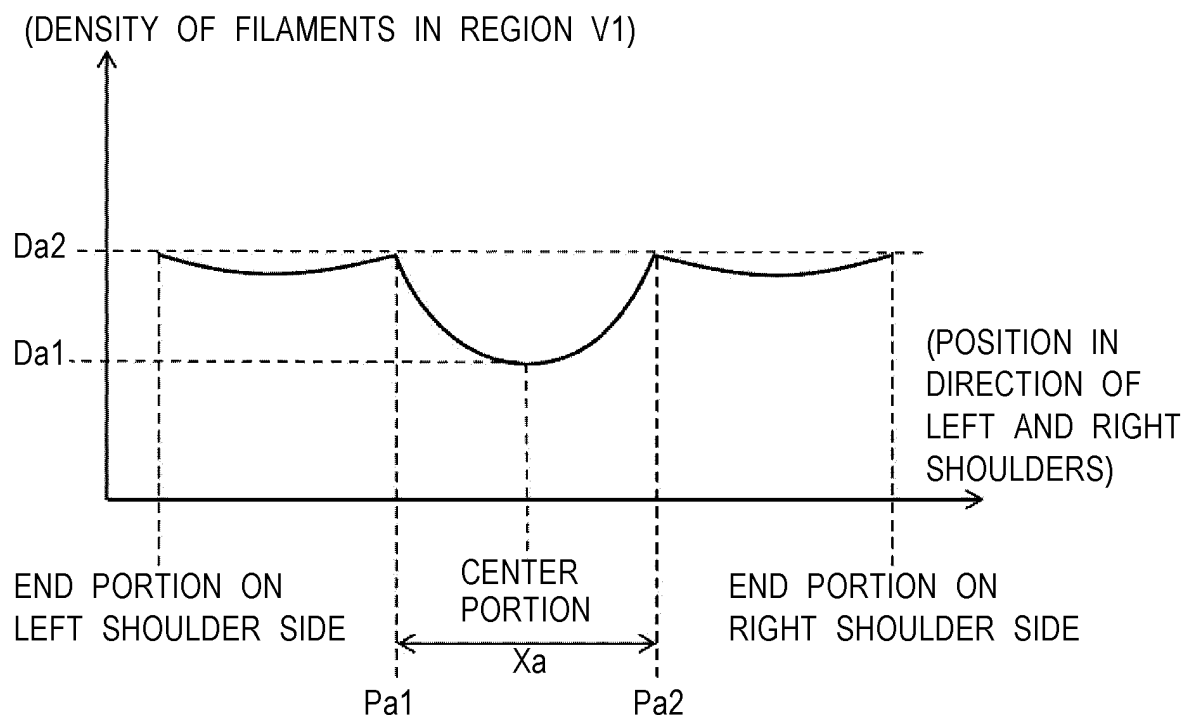


FIG. 13

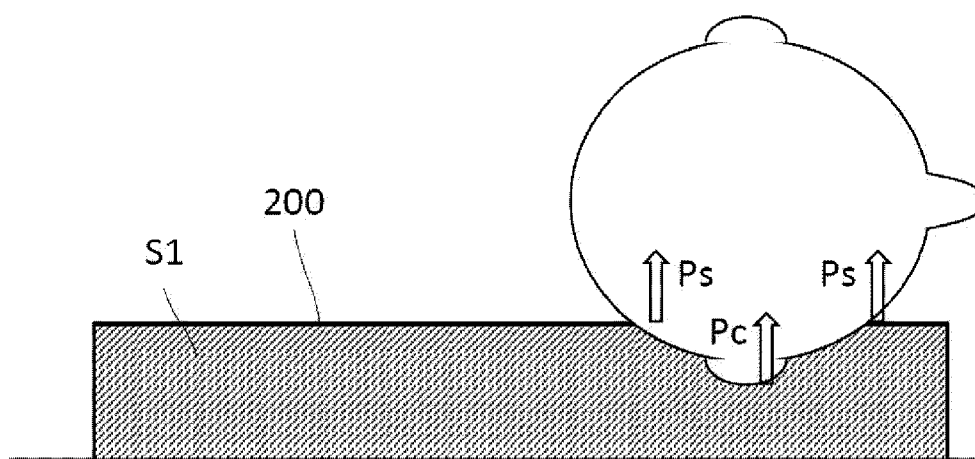


FIG. 14A

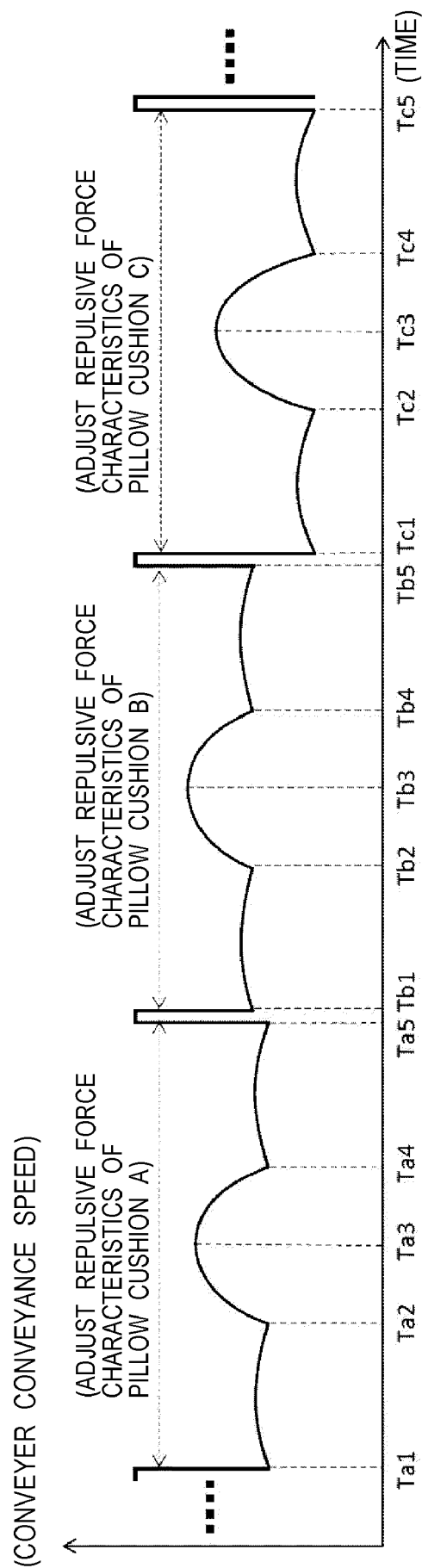


FIG. 14B

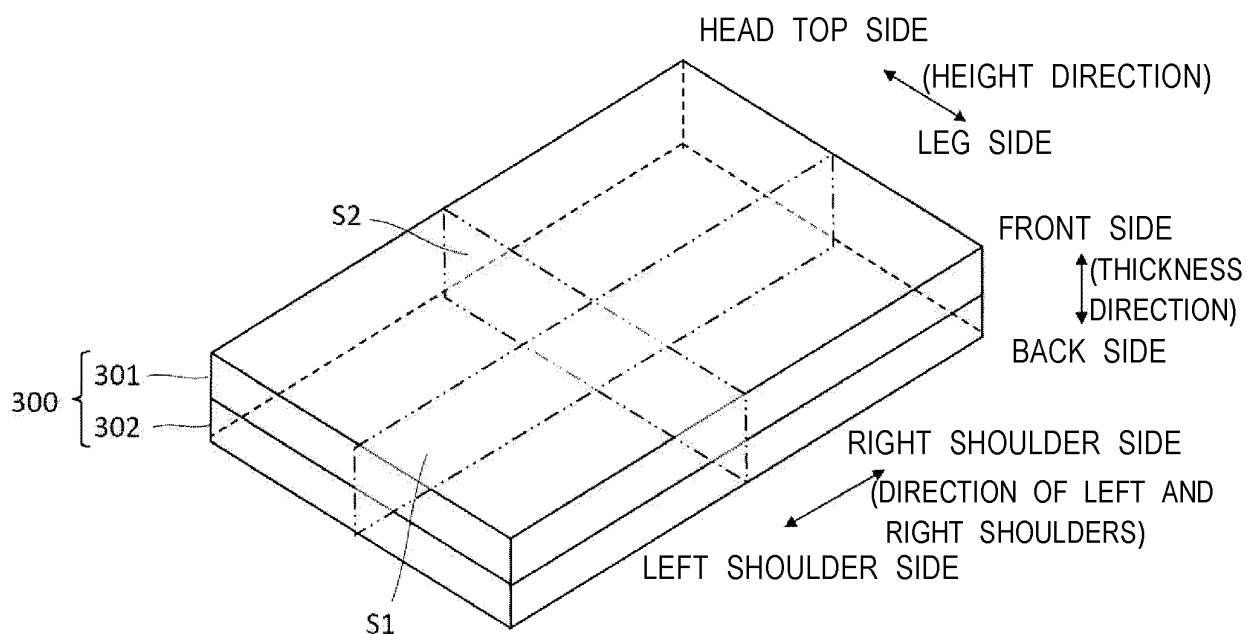


FIG. 15

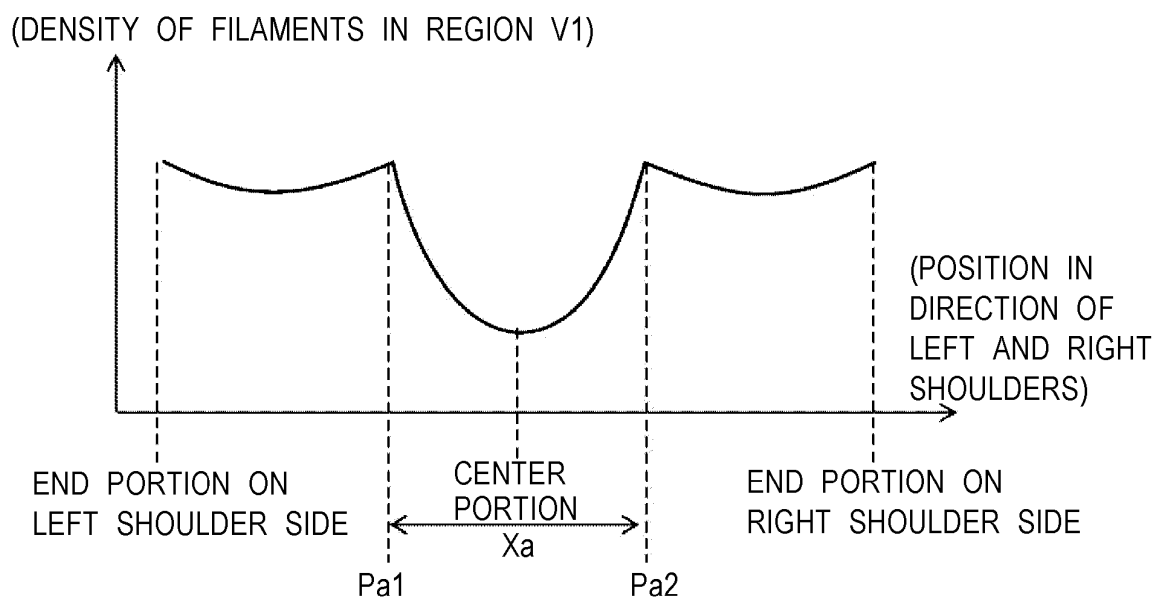


FIG. 16A

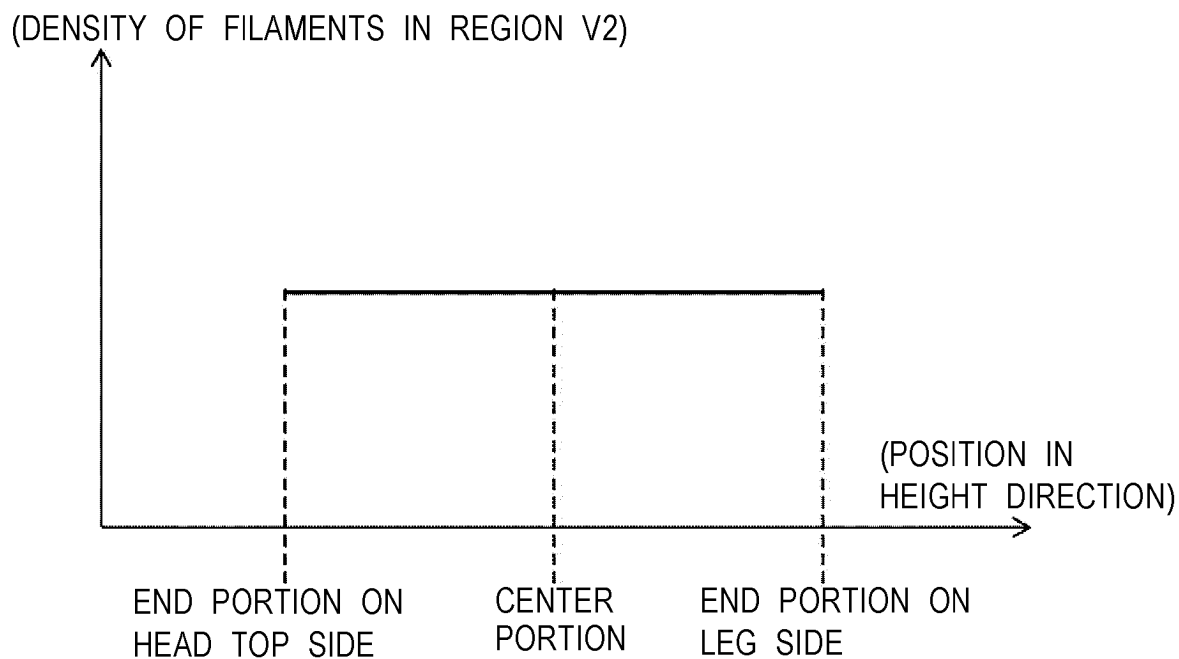


FIG. 16B

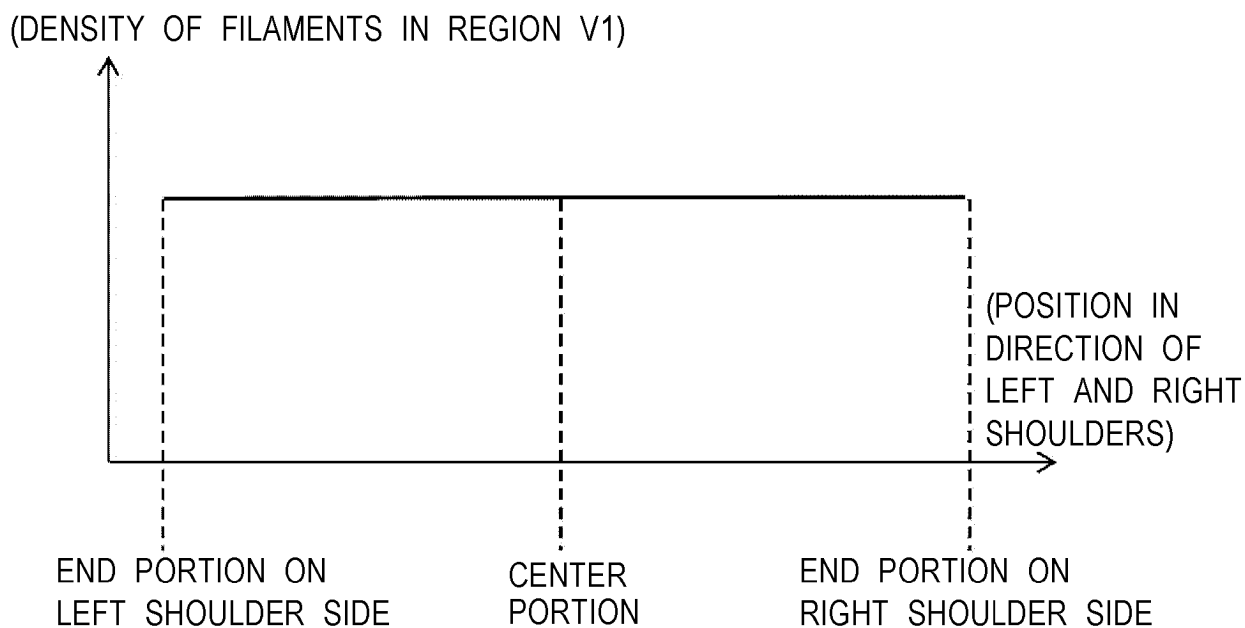


FIG. 17A

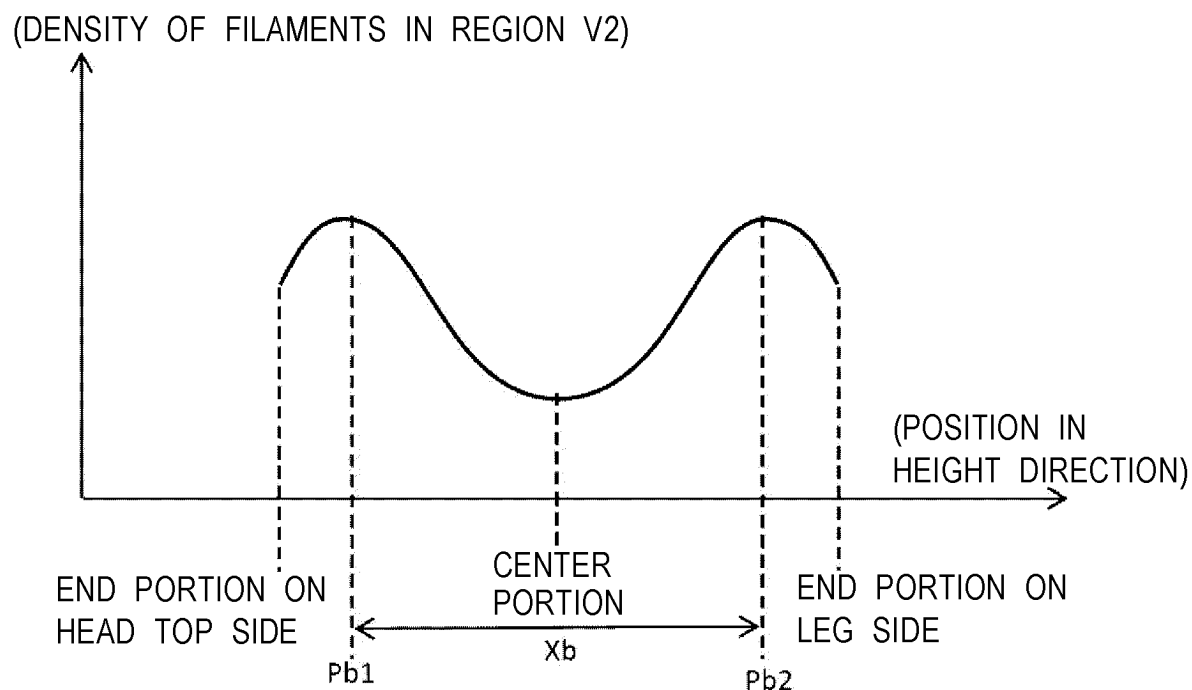


FIG. 17B

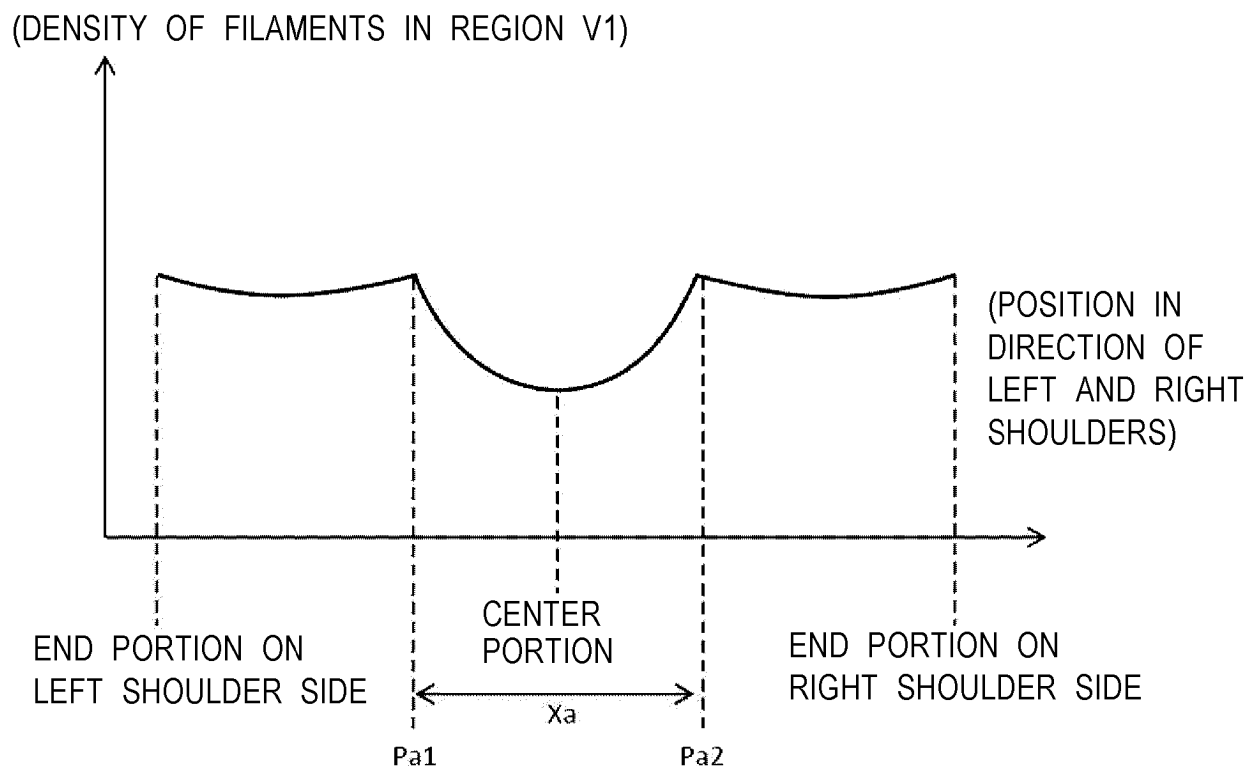


FIG. 18

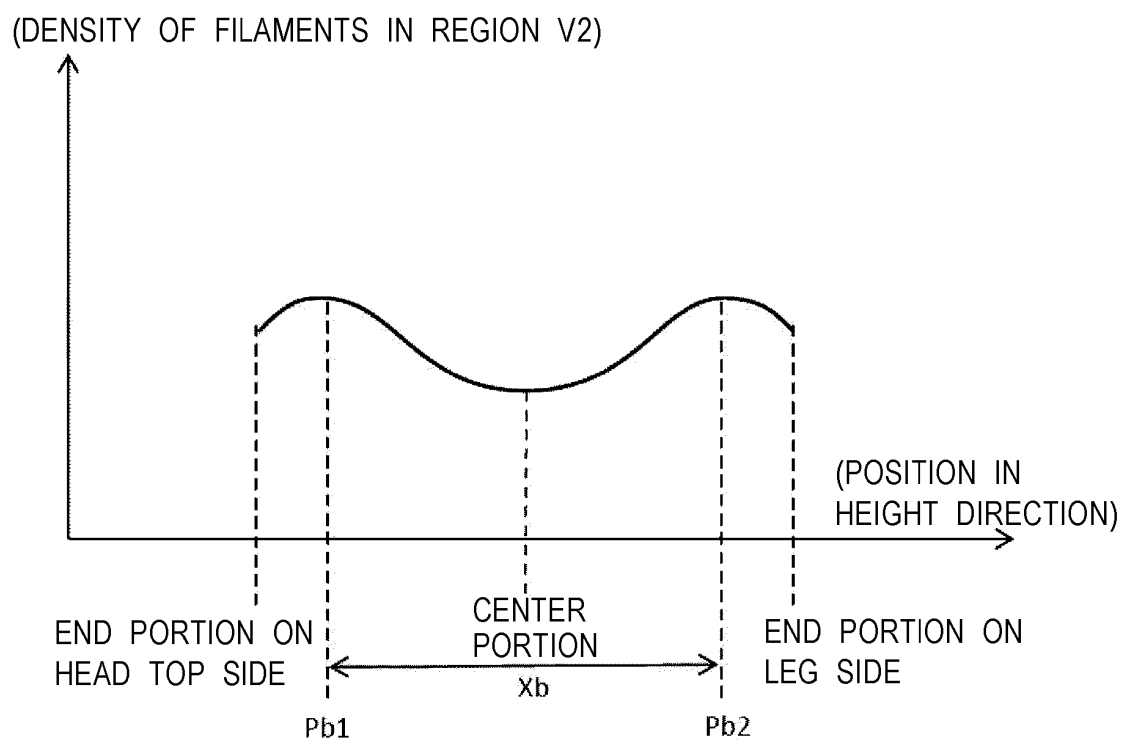


FIG. 19

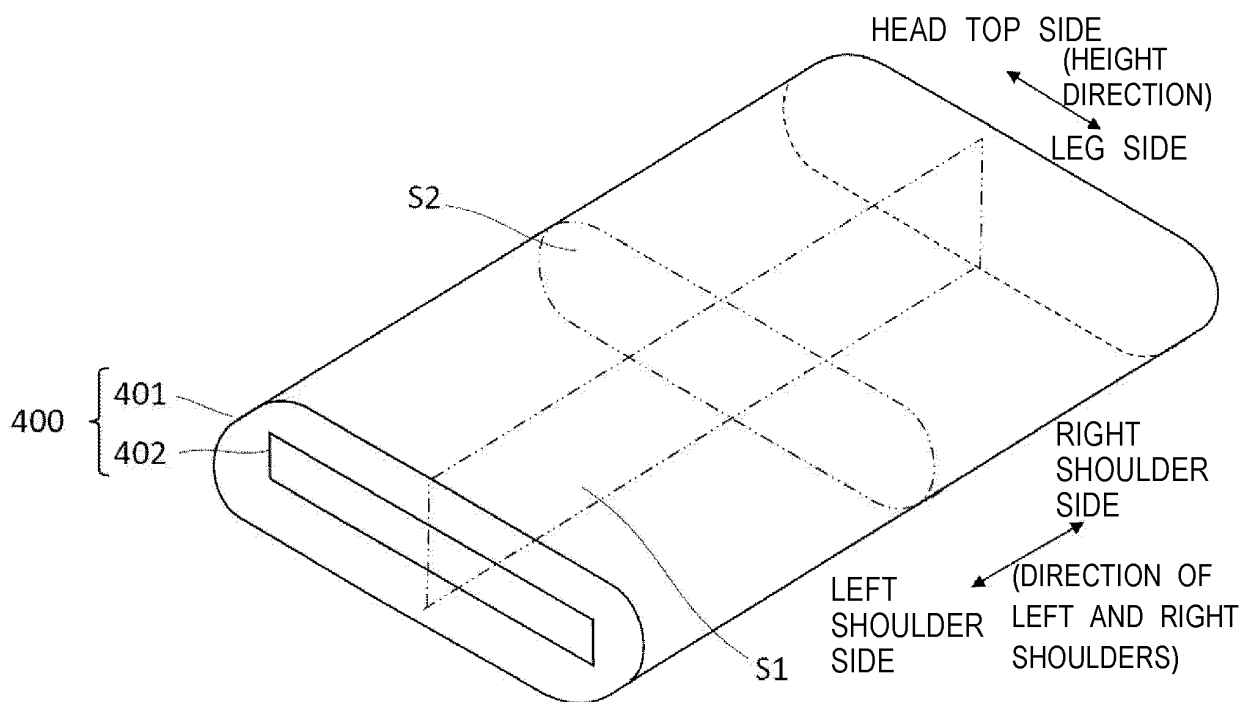


FIG. 20

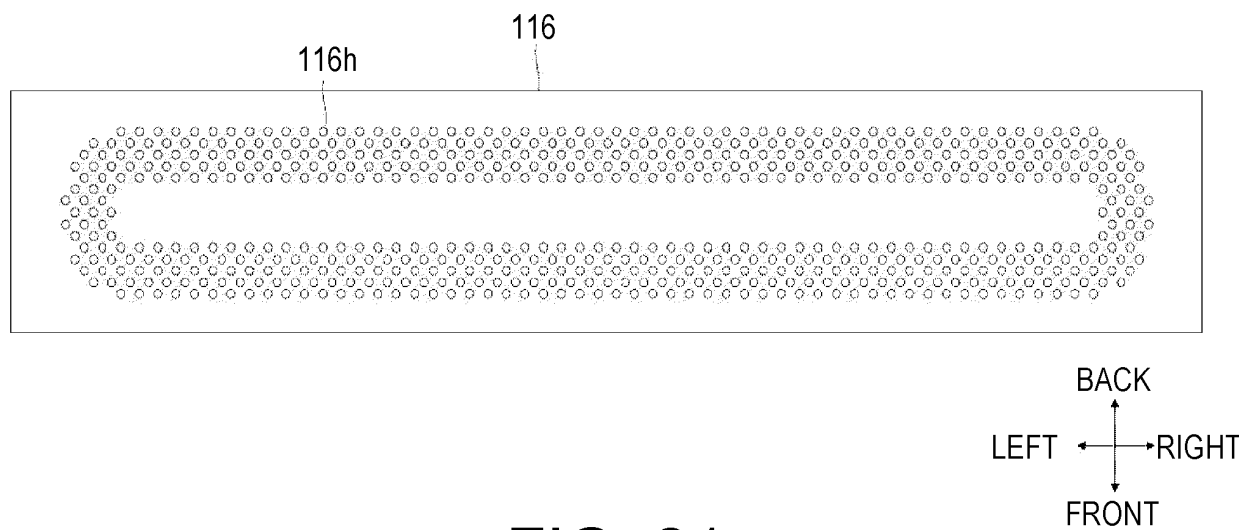


FIG. 21

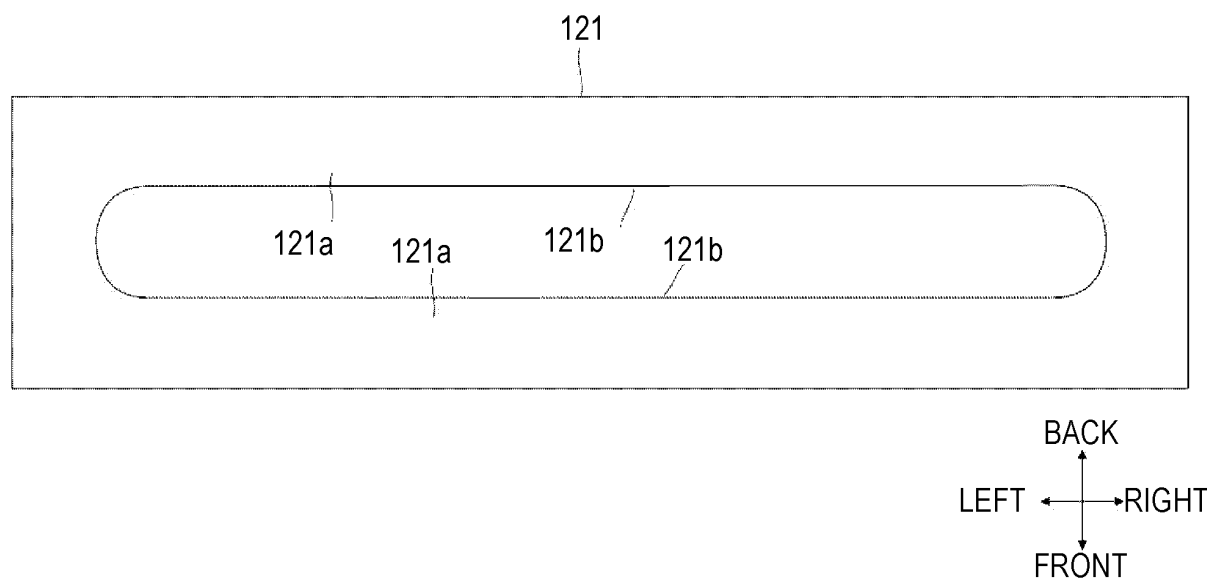


FIG. 22

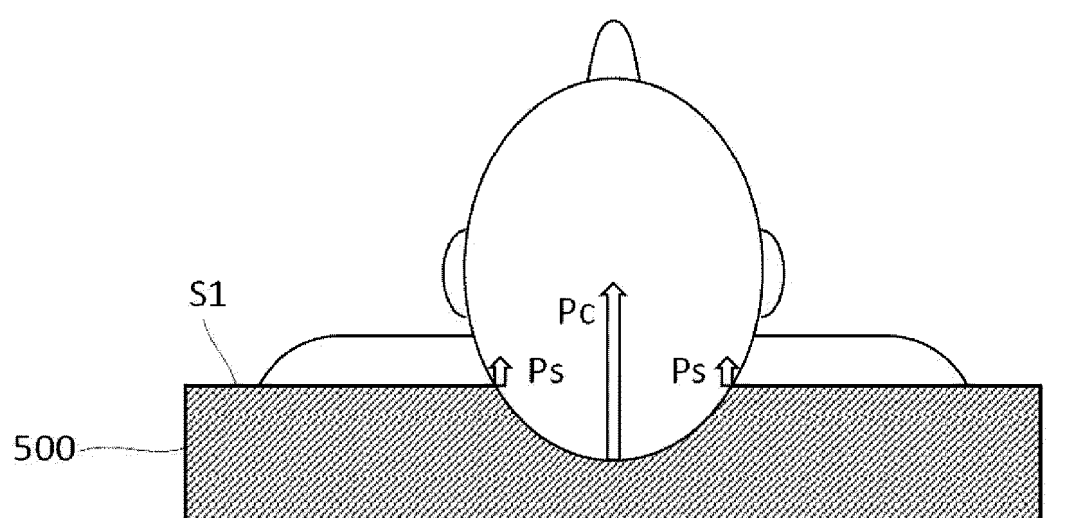


FIG. 23

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/048304

A. CLASSIFICATION OF SUBJECT MATTER

A47G 9/10(2006.01)i; **D04H 3/033**(2012.01)i; **D04H 3/14**(2012.01)i; **D04H 3/16**(2006.01)i
 FI: A47G9/10 B; D04H3/033; D04H3/16; D04H3/14

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)

A47G9/00-9/10; D04H3/00-3/16

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

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2023
 Registered utility model specifications of Japan 1996-2023
 Published registered utility model applications of Japan 1994-2023

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.
Y	WO 2017/199474 A1 (AIRWEAVE INC.) 23 November 2017 (2017-11-23) paragraphs [0020]-[0089], fig. 1-7	1-8
Y	JP 2005-334418 A (DOCTOR L KK) 08 December 2005 (2005-12-08) paragraphs [0016]-[0035], fig. 1-7	1-8
Y	JP 2013-233192 A (USHIDA, Shuji) 21 November 2013 (2013-11-21) paragraphs [0050]-[0076], fig. 1-6	1-8
Y	JP 3131886 U (NIHON BED MANUFACTURING CO., LTD.) 24 May 2007 (2007-05-24) paragraph [0018]	1-8
Y	JP 2018-149216 A (ROFUTEE KK) 27 September 2018 (2018-09-27) paragraph [0105]	8
P, X	JP 2022-142379 A (ECO WORLD CO., LTD.) 30 September 2022 (2022-09-30) paragraphs [0012]-[0026], fig. 1-6	1-2, 5
A	US 2018/0256387 A1 (PATNEY LTD.) 13 September 2018 (2018-09-13) abstract, fig. 6	1-8

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

* Special categories of cited documents:

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 “E” earlier application or patent but published on or after the international filing date
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 “O” document referring to an oral disclosure, use, exhibition or other means
 “P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
 “&” document member of the same patent family

Date of the actual completion of the international search

03 March 2023

Date of mailing of the international search report

14 March 2023

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915
 Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/048304

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2002-339328 A (SHIENJI KK) 27 November 2002 (2002-11-27) abstract, fig. 3	1-8

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2022/048304

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
WO 2017/199474 A1	23 November 2017	(Family: none)	
JP 2005-334418 A	08 December 2005	US 2005/0262637 A1 paragraphs [0039]-[0058], fig. 1-4, 9-11	
JP 2013-233192 A	21 November 2013	(Family: none)	
JP 3131886 U	24 May 2007	(Family: none)	
JP 2018-149216 A	27 September 2018	(Family: none)	
JP 2022-142379 A	30 September 2022	(Family: none)	
US 2018/0256387 A1	13 September 2018	WO 2017/034421 A1 EP 3340839 A1 AU 2016312849 A1 CA 2996109 A1 CN 107920676 A	
JP 2002-339328 A	27 November 2002	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 6892293 B [0004]