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(54) **TANNING DRUM HAVING STRUCTURE OF SPACED HYDROPHILIC AND HYDROPHOBIC SURFACES**

GERBTROMMEL MIT EINER STRUKTUR MIT VONEINANDER BEABSTANDETEN HYDROPHILEN UND HYDROPHOBEN OBERFLÄCHEN

TAMBOUR DE TANNAGE AYANT UNE STRUCTURE DE SURFACES HYDROPHILES ET HYDROPHOBES ESPACÉES

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Description

Technical Field

[0001] The present invention relates to the technical field of leather manufacturing industry, in particular to a leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure. The invention is set out in the appended set of claims.

Background Art

[0002] Leather manufacturing is a process of tanning hides and skins into leather, in which hair and non-collagenous fibers, etc. are removed to moderately loosen, fix and strengthen collagen fibers in dermis, and then a series of chemical (including biochemical) and mechanical treatments such as finishing (trimming) are carried out. A leather manufacturing process is generally divided into four stages, that is, preparation, tanning, post-tanning and dry finishing. Since soaking, liming, dehairing, bating, pickling, tanning, dyeing, fatliquoring, and other procedures are required to be completed in a rotary drum, the rotary drum becomes an apparatus used mostly in the leather manufacturing process. A mechanical action of the rotary drum promotes uniform permeation of various chemical materials, such that a chemical action of preparations is applied on the hides and skins.

[0003] In a current leather manufacturing process, absolute processing time for leather manufacturing in a rotary drum accounts for 80% or more of the whole mechanical processing time for leather manufacturing. Existing solutions for improving a leather-manufacturing rotary drum mainly focus on an improvement of a stirring structure in the rotary drum or of an operation environment. In this way, a mechanical action is enhanced to a certain extent by increasing a rotational speed of the rotary drum or adding stirring structures, so as to improve leather manufacturing efficiency and shorten processing time. However, an over-strong mechanical action will cause excessive dispersion of leather fibers, substantial reduction of physical and mechanical properties and high energy consumption. In summary, there are two main shortcomings. On the one hand, the stirring structures do not enhance mass transfer on a surface of leather in a rising process. On the other hand, the stirring structures do not sufficiently stir a bath liquid, which results in weak mechanical action and mass transfer action in a leather manufacturing process, thereafter leads to long-time processing and high-energy consumption of leather manufacturing.

[0004] Therefore, in a current rotary drum design, it is difficult to give consideration to both effect and efficiency of leather manufacturing.

[0005] Patent document CN 211 999 784 U discloses a sheep shearing leather tanning drum based on PLC control.

[0006] Patent document EP 1 540 022 A1 discloses

improvements in drums used for the treatment of skins, leathers and like, which concern the shape and relative location of the shelves provided in such drums.

Summary

[0007] An embodiment of the present invention provides a leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure, which can realize a more efficient and greener leather manufacturing process without reducing the quality of leather, and save time and costs, so as to solve the above problems.

[0008] In order to solve the above problem, an embodiment of the present invention provides a leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure. The rotary drum comprises:

a drum body capable of rotating in its own circumferential direction;

a stirring structure arranged in the drum body; and an alternate hydrophilic and hydrophobic surface structure in which hydrophilic-material surfaces and hydrophobic-material surfaces are alternately distributed, the alternate hydrophilic and hydrophobic surface structure being distributed on a surface of an inner wall of the drum body and/or a surface of the stirring structure,

wherein, in a rotating process of the drum body, the alternate hydrophilic and hydrophobic surface structure repeatedly enters and leaves a bath liquid in the drum body.

[0009] Optionally, the alternate hydrophilic and hydrophobic surface structure is a structure in which hydrophilic coatings and hydrophobic coatings are alternately distributed, wherein:

the hydrophilic coatings are the hydrophilic-material surfaces and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body and/or the surface of the stirring structure; and the hydrophobic coatings are the hydrophobic-material surfaces and are formed by preparing hydrophobic materials on the surface of the inner wall of the drum body and/or the surface of the stirring structure.

[0010] Optionally, the alternate hydrophilic and hydrophobic surface structure is a structure in which hydrophilic coatings and polished original surfaces of the inner wall of the drum body and/or the stirring structure are alternately distributed, wherein:

the hydrophilic coatings are the hydrophilic-material surfaces and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum

body and/or the surface of the stirring structure; and the polished original surfaces of the inner wall of the drum body and/or the stirring structure are the hydrophobic-material surfaces.

[0011] Optionally, the alternate hydrophilic and hydrophobic surface structure is a structure formed by assembling a plurality of modularized hydrophilic and hydrophobic sheets, wherein:

the hydrophilic and hydrophobic material are alternately distributed to form a sheet with the hydrophilic-material and the hydrophobic-material, and the modularized hydrophilic and hydrophobic sheets are then mounted in close contact with the surface of the inner wall of the drum body and/or the surface of the stirring structure.

[0012] Optionally, the alternate hydrophilic and hydrophobic surface structure is a structure in which modularized hydrophilic sheets and hydrophobic coatings are alternately distributed, wherein:

outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces, and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body and/or the surface of the stirring structure; and

the hydrophobic coatings are the hydrophobic-material surfaces and are formed by preparing hydrophobic materials on the surface of the inner wall of the drum body and/or the surface of the stirring structure.

[0013] Optionally, the alternate hydrophilic and hydrophobic surface structure is a structure in which modularized hydrophilic sheets and polished original surfaces of the inner wall of the drum body and/or the stirring structure are alternately distributed, wherein:

outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces, and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body and/or the surface of the stirring structure; and

the polished original surfaces of the inner wall of the drum body and/or the stirring structure are the hydrophobic-material surfaces.

[0014] Optionally, the alternate hydrophilic and hydrophobic surface structure is a structure in which hydrophilic coatings and modularized hydrophobic sheets are alternately distributed, wherein:

the hydrophilic coatings are the hydrophilic-material surfaces and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body and/or the surface of the stirring structure; and outer surfaces of the hydrophobic sheets are the hydrophobic-material surfaces, and the hydrophobic sheets are mounted in close contact with the surface

of the inner wall of the drum body and/or the surface of the stirring structure.

[0015] Optionally, the alternate hydrophilic and hydrophobic surface structure is a structure in which modularized hydrophilic sheets and modularized hydrophobic sheets are alternately distributed, wherein:

outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces, and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body and/or the surface of the stirring structure; and

outer surfaces of the hydrophobic sheets are the hydrophobic-material surfaces, and the hydrophobic sheets are mounted in close contact with the surface of the inner wall of the drum body and/or the surface of the stirring structure.

[0016] Optionally, the stirring structure comprises baffles and/or protruding piles, and in the rotating process of the drum body, the baffles and/or the protruding piles repeatedly enter and leave the bath liquid in the drum body.

[0017] Optionally, when the stirring structure comprises both the baffles and the protruding piles, the baffles and the protruding piles are alternately distributed along a circumferential wall surface of the drum body.

[0018] The embodiments of the present invention have the following advantages:

the leather-manufacturing rotary drum in the embodiments of the present invention comprises a drum body capable of rotating in its own circumferential direction, a stirring structure arranged in the drum body, and an alternate hydrophilic and hydrophobic surface structure in which hydrophilic-material surfaces and hydrophobic-material surfaces are alternately distributed, the alternate hydrophilic and hydrophobic surface structure being distributed on a surface of an inner wall of the drum body and/or a surface of the stirring structure, wherein, in a rotating process of the drum body, the alternate hydrophilic and hydrophobic surface structure repeatedly enters and leaves a bath liquid in the drum body, so that a wetting behavior of the surface of the inner wall of the drum body and/or the surface of the stirring structure can be changed, so as to indirectly adjust a surface acting force between the inner wall of the drum body and/or the stirring structure and leather, thereby achieving a gain effect of optimizing a leather manufacturing process. Specifically, according to the present invention, an effective action area during leather manufacturing is enlarged and relative leather manufacturing time is prolonged without reducing the quality of the leather, thereby realizing a more efficient leather manufacturing process, and saving time and costs. Moreover, in a rotary leather manufacturing process of the drum body, along with rotation of the rotary drum, when the surface of the inner wall of the drum body and/or the surface of the stirring structure

provided with the alternate hydrophilic and hydrophobic surface structure enters and leaves the bath liquid, a stirring action of the surface of the inner wall of the drum body and/or the stirring structure on the bath liquid can be enhanced, such that flow of the bath liquid on a surface of the leather is accelerated, permeation and mass transfer of chemicals towards the interior of the leather are promoted, and acting time is shortened.

Brief Description of the Drawings

[0019] In order to more clearly describe the technical solution in the embodiments of the present invention or in the prior art, a brief introduction to the accompanying drawings required for the description of the embodiments or the prior art will be provided below. Obviously, the accompanying drawings in the following description are merely some embodiments of the present invention.

FIG. 1 is a schematic diagram of an overall structure of a leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure in an embodiment of the present invention;

FIG. 2 is a schematic structural diagram of a drum body with a circumferential inner wall provided with both baffles and protruding piles in an embodiment of the present invention;

FIG. 3 is a schematic structural diagram of an alternate hydrophilic and hydrophobic surface structure only distributed on a surface of an inner wall of a drum body in an embodiment of the present invention;

FIG. 4 is a schematic structural diagram of an alternate hydrophilic and hydrophobic surface structure distributed on both a surface of an inner wall of a drum body and a surface of a stirring structure in an embodiment of the present invention;

FIG. 5(a) is a schematic diagram of a gain principle of a baffle having an alternate hydrophilic and hydrophobic surface structure leaving a bath liquid in an embodiment of the present invention, and FIG. 5(b) is a schematic diagram of a gain principle of a protruding pile having an alternate hydrophilic and hydrophobic surface structure leaving a bath liquid in an embodiment of the present invention;

FIG. 6(a) is a schematic diagram of a gain principle of a baffle having an alternate hydrophilic and hydrophobic surface structure entering a bath liquid in an embodiment of the present invention, and FIG. 6(b) is a schematic diagram of a gain principle of a protruding pile having an alternate hydrophilic and hydrophobic surface structure entering a bath liquid in an embodiment of the present invention;

FIG. 7(a) is a schematic structural diagram of hydrophilic coatings and hydrophobic coatings alternately arranged on a surface of a protruding pile in an embodiment of the present invention, and FIG. 7(b) is a schematic structural diagram of hydrophilic

coatings and hydrophobic coatings alternately arranged on a surface of a baffle in an embodiment of the present invention;

FIGS. 8(a) to 8(g) are schematic diagrams of hydrophilic and hydrophobic sheets with hydrophilic-material surfaces and hydrophobic-material surfaces in different patterns in embodiments of the present invention respectively;

FIG. 9(a) is a schematic structural diagram of hydrophilic and hydrophobic sheets arranged on a surface of a protruding pile in an embodiment of the present invention, and FIG. 9(b) is a schematic structural diagram of hydrophilic and hydrophobic sheets arranged on a surface of a baffle in an embodiment of the present invention; and

FIGS. 10(a) to 10(g) are schematic structural diagrams of hydrophilic coatings and hydrophobic coatings alternately arranged on a surface of a baffle in different patterns and shapes in embodiments of the present invention respectively.

Description of Reference Numerals:

[0020] 1 - drum body; 2 - stirring structure, 21 - baffle, 22 - protruding pile; 3 - alternate hydrophilic and hydrophobic surface structure, 31 - hydrophilic-material surface, 32 - hydrophobic-material surface; 4 - drum hoop; 5 - connecting retaining ring; 6 - supporting frame; 7 - bearing; 8 - drum main shaft; 9 - reinforced base plate; 10 - drum base plate; and 11 - drum door.

Detailed Description of Embodiments

[0021] The technical solutions in the embodiments of the present invention will be clearly and completely described below with reference to the accompanying drawings in the embodiments of the present invention. Obviously, the embodiments described are merely some rather than all of the embodiments of the present invention.

[0022] Aiming at the technical problem of the present invention, the present invention provides a leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure. The alternate hydrophilic and hydrophobic surface structure 3 is distributed on a surface of an inner wall of a drum body 1 of the leather-manufacturing rotary drum and/or a surface of a stirring structure 2 in the drum body. Hydrophilic-material surfaces 31 in the alternate hydrophilic and hydrophobic surface structure 3 may increase an adhesive force to droplets, hydrophobic-material surfaces 32 may increase a driving force for gathering droplets and promote more droplets to move to the hydrophilic-material surfaces 31. However, according to the present invention, the hydrophilic and hydrophobic surfaces are not directly used to simply change the characteristics of fluid, but a surface acting force between the inner wall of the drum body 1 and/or the stirring structure 2 and leather is indirectly adjusted by changing a wetting behavior of the

surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2, so as to achieve a gain effect of optimizing a leather manufacturing process. In this way, according to the present invention, a leather manufacturing area is enlarged and effective leather manufacturing time is prolonged without reducing the quality of the leather, thereby realizing a more efficient leather manufacturing process, and saving time and costs. Moreover, in a rotary leather manufacturing process of the drum body, along with rotation of the rotary drum, the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 provided with the alternate hydrophilic and hydrophobic surface structure 3 may draw the leather to enter and leave the bath liquid together, so as to enhance a stirring action of the surface of the inner wall of the drum body 1 and/or the stirring structure 2 on the bath liquid, such that flow of the bath liquid on a surface of the leather is accelerated, permeation and mass transfer of chemicals towards the interior of the leather are promoted, and acting time is shortened.

[0023] Specifically, with reference to FIG. 1, a schematic diagram of an overall structure of a leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure in an embodiment of the present invention is shown. The leather-manufacturing rotary drum comprises:

- a drum body 1 capable of rotating in its own circumferential direction;
- a stirring structure 2 arranged in the drum body 1; and
- an alternate hydrophilic and hydrophobic surface structure 3 in which hydrophilic-material surfaces 31 and hydrophobic-material surfaces 32 are alternately distributed, the alternate hydrophilic and hydrophobic surface structure 3 being distributed on a surface of an inner wall of the drum body 1 and/or a surface of the stirring structure 2. In a rotating process of the drum body 1, the alternate hydrophilic and hydrophobic surface structure 3 repeatedly enters and leaves a bath liquid in the drum body 1.

[0024] In the present invention, the structure of the drum body 1 capable of rotating in its own circumferential direction and the stirring structure 2 arranged in the drum body 1 are not specifically limited in the present invention, as long as they can be used in leather manufacturing industry and can realize at least one processing procedure such as soaking, liming, dehairing, bating, pickling, tanning, dyeing and fatliquoring.

[0025] In an embodiment of the present invention, the stirring structure 2 may comprise baffles 21 and/or protruding piles 22, and in the rotating process of the drum body 1, the baffles 21 and/or the protruding piles 22 repeatedly enter and leave the bath liquid in the drum body 1. That is, the stirring structure 2 may only comprise the baffles 21, or only comprise the protruding piles 22, or comprise both the baffles 21 and the protruding piles 22.

An alternate hydrophilic and hydrophobic arrangement of the baffles 21 and the protruding piles 22 can better draw the leather, so as to enhance a stirring action on the bath liquid, and enhance application of impacting, colliding, rubbing, kneading and other actions to hides and skins, thereby enhancing flow of the bath liquid on the surface of the leather, and promoting permeation and mass transfer of chemicals towards the interior of the leather. Optionally, as shown in FIGS. 1 and 2, when the stirring structure 2 comprises both the baffles 21 and the protruding piles 22, the baffles 21 and the protruding piles 22 are alternately distributed along a circumferential wall surface of the drum body 1. In this way, since the baffles 21 and the protruding piles 22 are alternately distributed along the circumferential wall surface of the drum body 1, and an interacting force exists between the baffles 21 and the protruding piles 22 and the hides and skins, in the rotating process of the drum body 1, comprehensive actions such as rubbing, kneading, rolling, bending, impacting, colliding, pressing and pulling may be performed on the hides and skins.

[0026] In the present invention, the alternate hydrophilic and hydrophobic surface structure 3 may be understood as a surface of which hydrophilic materials and hydrophobic materials are alternately distributed, a contact angle of a droplet at a three-phase intersection of the hydrophilic-material surface 31 is less than 90 degrees, a contact angle of a droplet at a three-phase intersection of the hydrophobic-material surface 32 is greater than 90 degrees, and alternate distribution of the hydrophilic and hydrophobic materials may achieve an effect that droplets are better adhered to the hydrophilic-material surfaces 31.

[0027] According to the present invention, after the alternate hydrophilic and hydrophobic surface structure 3 is arranged on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2, in the rotating process of the drum body 1, the alternate hydrophilic and hydrophobic surface structure 3 may repeatedly enter and leave the bath liquid in the drum body 1 along with the surface of the inner wall of the drum body 1 and/or the stirring structure 2. The hydrophilic-material surfaces 31 may increase an adhesive force of the surface of the inner wall of the drum body 1 and/or the stirring structure 2 to droplets of the bath liquid on the basis of hydrophilic characteristics of the hydrophilic-material surfaces, and the hydrophobic-material surfaces 32 may increase a driving force of the surface of the inner wall of the drum body 1 and/or the stirring structure 2 for gathering droplets of the bath liquid on the basis of hydrophobic characteristics of the hydrophobic-material surfaces. In this way, structural characteristics of the surface of the inner wall of the drum body 1 and/or the stirring structure 2 are optimized, thereby enhancing a mechanical action of the rotary drum on the leather in a leather manufacturing process, accelerating permeation and mass transfer processes of chemicals on the hides and skins, and improving the leather manufacturing efficiency. It should

be noted that the distribution of the alternate hydrophilic and hydrophobic surface structure 3 on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 may be divided into the following three situations: in a first situation, as shown in FIGS. 1 and 2, the alternate hydrophilic and hydrophobic surface structure 3 is only distributed on the surface of the stirring structure 2; in a second situation, as shown in FIG. 3, the alternate hydrophilic and hydrophobic surface structure 3 is only distributed on the surface of the inner wall of the drum body 1; and in a third situation, as shown in FIG. 4, the alternate hydrophilic and hydrophobic surface structure 3 is distributed on both the surface of the inner wall of the drum body 1 and the surface of the stirring structure 2. By distribution herein may be understood as that the alternate hydrophilic and hydrophobic surface structure 3 is partially or completely wrapped around the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2.

[0028] Since a principle of optimizing the surface of the stirring structure 2 by the alternate hydrophilic and hydrophobic surface structure 3 is similar to a principle of optimizing the surface of the inner wall of the drum body 1 by the alternate hydrophilic and hydrophobic surface structure 3, for the sake of brevity, the principle of optimizing the surface of the stirring structure 2 by the alternate hydrophilic and hydrophobic surface structure 3 is described below in the present invention. With reference to FIGS. 5 and 6, a gain principle of a stirring structure 2 having an alternate hydrophilic and hydrophobic surface structure 3 leaving a bath liquid is shown (as shown in FIG. 5(a), a gain principle of a baffle 21 having an alternate hydrophilic and hydrophobic surface structure 3 leaving a bath liquid is shown; and as shown in FIG. 5(b), a gain principle of a protruding pile 22 having an alternate hydrophilic and hydrophobic surface structure 3 leaving a bath liquid is shown), and a gain principle of a stirring structure 2 having an alternate hydrophilic and hydrophobic surface structure 3 entering a bath liquid is shown (as shown in FIG. 6(a), a gain principle of a baffle 21 having an alternate hydrophilic and hydrophobic surface structure 3 entering a bath liquid is shown; and as shown in FIG. 6(b), a gain principle of a protruding pile 22 having an alternate hydrophilic and hydrophobic surface structure 3 entering a bath liquid is shown).

[0029] At first, when the stirring structure 2 impacts the bath liquid, an inertial force drives the bath liquid to rapidly spread on a surface of the stirring structure, and part of kinetic energy of the bath liquid is converted into surface energy and dissipation energy. Since the alternate hydrophilic and hydrophobic surface structure 3 is arranged on the surface of the stirring structure 2, the bath liquid has a large spreading area and a long spreading time consumption on the hydrophilic-material surfaces 31, and has a small spreading area and a short time consumption on the hydrophobic-material surfaces 32. According to a physical phenomenon that the bath liquid is adhered to the hydrophilic-material surfaces 31 to form

a liquid film, adhesive characteristics of the bath liquid on the hydrophilic-material surfaces 31 can achieve two gain effects on the leather-manufacturing rotary drum without adversely affecting the quality of the leather: on the one hand, a contact area between the leather and the bath liquid in a rising process may be increased. Compared with original stainless steel metal surfaces of mechanical components, in a rising period of the stirring structure 2 to which the bath liquid is adhered, the leather will slide on a surface to which the bath liquid is adhered under the action of gravity, and an additional mass transfer exchange action occurs between the leather and the bath liquid adhered to the alternate hydrophilic and hydrophobic surface structure 3, such that under the condition that absolute leather manufacturing time is not changed, relative leather manufacturing time is prolonged. Actions of the alternate hydrophilic and hydrophobic surface structure 3 on the leather are as shown in FIGS. 5(a) and 5(b). In FIGS. 5(a) and 5(b), small bumps on the baffle 21 and the protruding pile 22 represent droplets of the bath liquid adhered to the hydrophilic-material surface 31. Moreover, the alternate hydrophilic and hydrophobic surface structure 3 to which the bath liquid is adhered enhances an interaction between the stirring structure 2 and the leather such that the leather may reach a higher drawing position in a rising process, the wrinkled leather may be fully extended, throwing kinetic energy of the leather is increased without increasing total energy loss, and a mass transfer action is enhanced. On the other hand, a flow field of the bath liquid at the bottom of the rotary drum may be caused to be more disordered, thereby enhancing a mass transfer action between the bath liquid and the leather. When the stirring structure 2 in the rotary drum draws the leather into the bath liquid, a large number of droplets are generated, and these droplets are adhered to the alternate hydrophilic and hydrophobic surface structure 3 to form a liquid film, such that a drawing force of the stirring structure 2 on the leather is enhanced. However, a surface acting force between a conventional stirring structure 2 with a metal surface and leather is weak, such that after the stirring structure 2 draws the leather into a bath liquid, the leather will rapidly fall off. For the rotary drum having the alternate hydrophilic and hydrophobic surface structure 3, the leather is more likely to be drawn into the bath liquid at the bottom of the rotary drum to generate a strong stirring action, such that the flow field in the bath liquid is more disordered at the bottom, and effects of shearing a mass transfer boundary layer of the leather and thinning the mass transfer boundary layer are achieved, thereby promoting an effect of convective mass transfer action. This process is as shown in FIGS. 6(a) and 6(b). In FIGS. 6(a) and 6(b), small bumps on the baffle 21 and the protruding pile 22 represent droplets of the bath liquid adhered to the hydrophilic-material surface 31.

[0030] Specific materials of the hydrophilic materials and the hydrophobic materials are not limited in the present invention, as long as the hydrophilic materials

can enhance an adhesive force of the surface of the inner wall of the drum body 1 and/or the stirring structure 2 on droplets of a bath liquid on the basis of hydrophilic characteristics of the hydrophilic materials, and the hydrophobic materials can increase a driving force of the bath liquid of the surface of the inner wall of the drum body 1 and/or the stirring structure 2 for gathering the droplets on the basis of hydrophobic characteristics of the hydrophobic materials. Illustratively, the hydrophilic materials may be hydrophilic metal/non-metal nanoparticles, hydrophilic resin, polyacrylic acid, silica, polyvinylpyrrolidone, and the hydrophobic materials may be alkane, oil, fluorinated polyethylene, fluorocarbon wax, or other synthetic fluoropolymer.

[0031] In an embodiment of the present invention, a representation form of the alternate hydrophilic and hydrophobic surface structure 3 is provided. The alternate hydrophilic and hydrophobic surface structure 3 is a structure in which hydrophilic coatings and hydrophobic coatings are alternately distributed. The hydrophilic coatings are the hydrophilic-material surfaces 31 and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; and the hydrophobic coatings are the hydrophobic-material surfaces 32 and are formed by preparing hydrophobic materials on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. In this embodiment, the hydrophilic-material surfaces 31 and the hydrophobic-material surfaces 32 are both coatings, which can be understood as films applied to the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. The coatings and the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 may effectively form a compact composite structure, which can change surface characteristics of the material of the inner wall of the drum body 1 and/or the material of the stirring structure 2 without affecting original structures of the surface of the inner wall of the drum body 1 and/or the stirring structure 2, thereby optimizing movement of the leather on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the leather-manufacturing rotary drum, enhancing flow of the bath liquid, and realizing a physical mechanism, principle and method for enhancing a mechanical action in a leather manufacturing process by means of the hydrophilic coatings and the hydrophobic coatings that are alternately arranged. Illustratively, a schematic structural diagram of hydrophilic coatings and hydrophobic coatings that are alternately arranged on a surface of a protruding pile 22 is as shown in FIG. 7(a), and a schematic structural diagram of hydrophilic coatings and hydrophobic coatings that are alternately arranged on a surface of a baffle 21 is as shown in FIG. 7(b).

[0032] The hydrophilic materials may be prepared on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 through a spraying technology, a physical vapor deposition technology, a

cathode electrochemical deposition technology, an electrophoretic directional deposition technology or a micro-contact printing technology. to form the hydrophilic coatings. Similarly, the hydrophobic materials may be prepared on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 through a spraying technology, a physical vapor deposition technology, a cathode electrochemical deposition technology, an electrophoretic directional deposition technology or a micro-contact printing technology. so as to form the hydrophobic coatings. It should be noted that in the case that different materials are used to prepare the coatings, coating preparation technologies used may be different. That is, in the case that different hydrophilic materials are used to prepare the hydrophilic coatings, the coating preparation technologies used may be different, and correspondingly, in the case that different hydrophobic materials are used to prepare the hydrophobic coatings, the coating preparation technologies used may be different. By "preparation" herein includes, but is not limited to, spraying, deposition and printing. Illustratively, in the case that hydrophilic pure metal or hydrophilic composite metal nanoparticles are used as the hydrophilic materials, a spraying technology may be used to spray hydrophilic coatings on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; in the case that hydrophilic resin is used as the hydrophilic materials, a micro-contact printing technology may be used to print hydrophilic coatings on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; and in the case that polyvinylpyrrolidone is used as the hydrophilic materials, a sol-gel method may be used to print hydrophilic coatings on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. It should be further emphasized that since the present invention is mainly used in a leather manufacturing process, in consideration of the use of leather in daily life, when the hydrophilic coatings and the hydrophobic coatings are prepared on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2, the hydrophilic materials and the hydrophobic materials should be selected to be non-toxic or conform to the relevant national standards.

[0033] In an embodiment of the present invention, a representation form of the alternate hydrophilic and hydrophobic surface structure 3 is provided. The alternate hydrophilic and hydrophobic surface structure 3 is a structure in which hydrophilic coatings and polished original surfaces of the inner wall of the drum body 1 and/or the stirring structure 2 are alternately distributed. The hydrophilic coatings are the hydrophilic-material surfaces 31 and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; and the polished original surfaces of the inner wall of the drum body 1 and/or the stirring structure 2 are the hydrophobic-material surfaces 32. Since the rotary drum is generally made

of a metal material such as stainless steel, and a smooth surface of a metal inner wall has hydrophobic characteristics, the use of the polished original surfaces as the hydrophobic-material surfaces 32 can effectively save the cost in this embodiment. In actual operation, the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 may be polished first, and then hydrophilic coatings are prepared at a plurality of positions of the polished surface of the inner wall of the drum body 1 and/or the polished surface of the stirring structure 2, such that the hydrophilic coatings and the polished original surfaces of the inner wall of the drum body 1 and/or the stirring structure 2 are alternately arranged, thereby obtaining the alternate hydrophilic and hydrophobic surface structure 3 in the present invention, optimizing movement of the leather on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the leather-manufacturing rotary drum, enhancing flow of the bath liquid, and realizing a physical mechanism, principle and method for enhancing a mechanical action in a leather manufacturing process by means of the hydrophilic coatings and the polished original surfaces of the inner wall of the drum body 1 and/or the stirring structure 2 serving as the hydrophobic-material surfaces 32, which are alternately arranged. For a method for preparing a hydrophilic coating, references can be made to other embodiments, which will not be repeated in this embodiment.

[0034] In an embodiment of the present invention, a representation form of the alternate hydrophilic and hydrophobic surface structure 3 is provided. The alternate hydrophilic and hydrophobic surface structure 3 is a structure formed by assembling a plurality of modularized hydrophilic and hydrophobic sheets. Outer surfaces of the hydrophilic and hydrophobic sheets are alternately distributed surfaces of the hydrophilic-material surfaces 31 and the hydrophobic-material surfaces 32, and the hydrophilic and hydrophobic sheets are mounted in close contact with the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. In this embodiment, the hydrophilic and hydrophobic sheets are modularized, and each hydrophilic and hydrophobic sheet is provided with at least one group of hydrophilic-material surface 31 and hydrophobic-material surfaces 32. In the case that there are multiple groups, the hydrophilic-material surfaces 31 and hydrophobic-material surfaces 32 are alternately distributed on the outer surface of each hydrophilic and hydrophobic sheet, which is as shown in FIGS. 8(a) to 8(g). In this embodiment, through connection means such as bonding, rivets, threads, micro-welding, the hydrophilic and hydrophobic sheets may be directly attached to or mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. In this way, the alternate hydrophilic and hydrophobic surface structure 3 assembled in a modularized manner may be formed on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2, so as to improve mechan-

ical properties of the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2, thereby optimizing movement of the leather on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the leather-manufacturing rotary drum and enhancing flow of the bath liquid. Advantages of this embodiment lie in that a sheet processing process can be directly carried out on a plane, such that technical problems caused by processing a curved surface are avoided. Moreover, the modularized hydrophilic and hydrophobic sheets are replaceable, such that the cost is lower, and a long-time gain effect of the leather-manufacturing rotary drum in a leather manufacturing process is guaranteed. Illustratively, a schematic structural diagram of modularized hydrophilic and hydrophobic sheets arranged on a surface of a protruding pile 22 is as shown in FIG. 9(a), and a schematic structural diagram of modularized hydrophilic and hydrophobic sheets arranged on a surface of a baffle 21 is as shown in FIG. 9(b).

[0035] Optionally, a method for preparing a hydrophilic and hydrophobic sheet is as follows: in a high-temperature and high-pressure environment, a hydrophobic sheet in a special shape obtained by linear cutting is embedded on a surface of hydrophilic resin, then a surface of the hydrophobic sheet is corroded by a CuCl_2 solution, and the surface of the sheet is modified by a constant-temperature water bath of an absolute ethyl alcohol solution with stearic acid, so as to finally obtain a composite surface with a hydrophilic region and a hydrophobic region coexisting, that is, the hydrophilic and hydrophobic sheet in this embodiment.

[0036] In an embodiment of the present invention, a representation form of the alternate hydrophilic and hydrophobic surface structure 3 is provided. The alternate hydrophilic and hydrophobic surface structure 3 is a structure in which modularized hydrophilic sheets and hydrophobic coatings are alternately distributed. Outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces 31, and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; and the hydrophobic coatings are the hydrophobic-material surfaces 32 and are formed by preparing hydrophobic materials on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. In this embodiment, the hydrophilic-material surfaces 31 are mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the form of hydrophilic sheets, and the hydrophobic-material surfaces 32 are presented as hydrophobic coatings. In this way, surface characteristics of the material of the inner wall of the drum body 1 and/or the material of the stirring structure 2 are changed, thereby optimizing movement of the leather on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the leather-manufacturing rotary drum, enhancing flow of the bath liquid, and realizing a physical mechanism, principle and method for enhancing a mechanical

action in a leather manufacturing process by means of the hydrophilic sheets and the hydrophobic coatings that are alternately arranged.

[0037] In an embodiment of the present invention, a representation form of an alternate hydrophilic and hydrophobic surface structure 3 is provided. The alternate hydrophilic and hydrophobic surface structure 3 is a structure in which modularized hydrophilic sheets and polished original surfaces of the inner wall of the drum body 1 and/or the stirring structure 2 are alternately distributed. Outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces 31, and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; and the polished original surfaces of the inner wall of the drum body 1 and/or the stirring structure 2 are the hydrophobic-material surfaces 32. In this embodiment, the hydrophilic-material surfaces 31 are mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the form of hydrophilic sheets, and the hydrophobic-material surfaces 32 are presented as the polished original surfaces of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. In this way, surface characteristics of the material of the inner wall of the drum body 1 and/or the material of the stirring structure 2 are changed, thereby optimizing movement of the leather on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the leather-manufacturing rotary drum, enhancing flow of the bath liquid, and realizing a physical mechanism, principle and method for enhancing a mechanical action in a leather manufacturing process by means of the hydrophilic sheets and the polished original surfaces that are alternately arranged.

[0038] In the above two embodiments, the hydrophilic sheets may be understood as sheet structures only with hydrophilic-material surfaces 31, and the hydrophilic-material surfaces 31 on the sheet structures may be prepared in the form of coatings. The hydrophilic sheets may be mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 through connection means such as bonding, rivets, threads, micro-welding, and the hydrophilic sheets and the hydrophobic-material surfaces 32 are alternately arranged. For a method for preparing the hydrophobic coatings or a preparation method in which the polished original surfaces of the inner wall of the drum body 1 and/or the stirring structure 2 can serve as the hydrophobic-material surfaces 32 and the explanation of the principles thereof, references can be made to other embodiments, which will not be repeated in this embodiment.

[0039] In an embodiment of the present invention, a representation form of the alternate hydrophilic and hydrophobic surface structure 3 is provided. The alternate hydrophilic and hydrophobic surface structure 3 is a structure in which hydrophilic coatings and modularized hydrophobic sheets are alternately distributed. The hy-

drophilic coatings are the hydrophilic-material surfaces 31 and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; and outer surfaces of the hydrophobic sheets are the hydrophobic-material surfaces 32, and the hydrophobic sheets are mounted in close contact with the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. In this embodiment, the hydrophobic-material surfaces 32 are mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the form of hydrophobic sheets, and the hydrophilic-material surfaces 31 are presented in the form of hydrophilic coatings. In this way, surface characteristics of the material of the inner wall of the drum body 1 and/or the material of the stirring structure 2 are changed, thereby optimizing movement of the leather on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the leather-manufacturing rotary drum, enhancing flow of the bath liquid, and realizing a physical mechanism, principle and method for enhancing a mechanical action in a leather manufacturing process by means of the hydrophobic sheets and the hydrophilic coatings that are alternately arranged.

[0040] The hydrophobic sheets in this embodiment may be understood as sheet structures only with hydrophobic-material surfaces 32, and the hydrophobic-material surfaces 32 on the sheet structures may be prepared in the form of coatings. The hydrophobic sheets may be mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 through connection means such as bonding, rivets, threads, micro-welding, and the hydrophobic sheets and the hydrophilic coatings are alternately arranged. For a method for preparing a hydrophilic coating, references can be made to other embodiments, which will not be repeated in this embodiment.

[0041] In an embodiment of the present invention, a representation form of the alternate hydrophilic and hydrophobic surface structure 3 is provided. The alternate hydrophilic and hydrophobic surface structure 3 is a structure in which modularized hydrophilic sheets and modularized hydrophobic sheets are alternately distributed. Outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces 31, and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2; and outer surfaces of the hydrophobic sheets are the hydrophobic-material surfaces 32, and the hydrophobic sheets are mounted in close contact with the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2. In this embodiment, the hydrophilic-material surfaces 31 are mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the form of hydrophilic sheets, and the hydrophobic-material surfaces 32 are mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the form

of hydrophobic sheets. In this way, surface characteristics of the material of the inner wall of the drum body 1 and/or the material of the stirring structure 2 are changed, thereby optimizing movement of the leather on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 in the leather-manufacturing rotary drum, enhancing flow of the bath liquid, and realizing a physical mechanism, principle and method for enhancing a mechanical action in a leather manufacturing process by means of the hydrophilic sheets and the hydrophobic sheets that are alternately distributed.

[0042] The hydrophilic sheets in the embodiment may be understood as sheet structures only with hydrophilic-material surfaces 31, and the hydrophilic-material surfaces 31 on the sheet structures may be prepared in the form of coatings. The hydrophobic sheets in this embodiment may be understood as sheet structures only with hydrophobic-material surfaces 32, and the hydrophobic-material surfaces 32 on the sheet structures may be prepared in the form of coatings. The hydrophilic sheets and the hydrophobic sheets may be both mounted on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2 through connection means such as bonding, rivets, threads, micro-welding, and the hydrophilic sheets and the hydrophobic sheets are assembled with each other, thereby forming the alternate hydrophilic and hydrophobic surface structure 3 on the surface of the inner wall of the drum body 1 and/or the surface of the stirring structure 2.

[0043] It should be noted that shapes of the hydrophilic-material surfaces 31 and the hydrophobic-material surfaces 32 are not limited in the present invention, which may be in a straight-line shape, a triangular shape, a zigzag shape or a wavy shape, or may be distributed in the form of spots, and the spot shape may include a circular shape, a triangular shape, a rectangular shape, a polygonal shape, or any other shape. Illustratively, the presentation of the hydrophilic-material surfaces 31 and the hydrophobic-material surfaces 32 that are alternately distributed on outer surfaces of the hydrophilic and hydrophobic sheets in different patterns and shapes may be as shown in FIGS. 8(a) to 8(g), and the presentation of the hydrophilic coatings and the hydrophobic coatings that are alternately distributed on the surface of the baffle 21 in different patterns and shapes may be as shown in FIGS. 10(a) to 10(g).

[0044] In an embodiment of the present invention, with reference to FIGS. 1, 2 and 5 to 7, in the alternate hydrophilic and hydrophobic surface structure 3, the hydrophilic-material surfaces 31 and the hydrophobic-material surfaces 32 are both in straight-line shapes. The reason why the hydrophilic-material surfaces 31 and the hydrophobic-material surfaces 32 are preferably in straight-line shapes is that the processing difficulty of a straight-line shape is low, and the hydrophilic-material surfaces 31 and the hydrophobic-material surfaces 32 can obtain a better area ratio, which is beneficial to implementation of the solution of the present invention.

[0045] Next, a specific structure of a leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure 3 in an embodiment of the present invention will be described with an example.

[0046] As shown in FIG. 1, for the leather-manufacturing rotary drum, two drum base plates 10 are mounted on two sides of a drum body 1 by means of drum hoops 4, four connecting retaining rings 5 distributed at 90 degrees are welded to the drum hoops 4, and each connecting retaining ring 5 is provided with two screw holes connected to the drum body 1, with the aim of enable sealing rings between the drum base plates 10 and the drum body 1 to achieve a sealing function. The other side of each drum base plate 10 is provided with a reinforced base plate 9 by means of screws, reinforced ribs are distributed on the reinforced base plate 9 at intervals of 60 degrees, and each reinforced rib is provided with three screw holes, so as to provide a radial acting force on the drum base plate 10, such that the drum base plate 10 is more tightly sealed against the drum body 1. A drum main shaft 8 is connected to the drum base plates 10 in a welded manner, and is nested with the reinforced base plates 9 by means of keys. The drum main shaft is connected to a bearing 7 on a supporting frame 6, and the drum main shaft and the bearing are mounted on a positioning support together. A drum door 11 is further arranged on a side surface of the drum body 1, and sliding rails are arranged on two sides of the drum door 11 so as to facilitate opening or closing the door when leather is added. The drum body 1 mainly comprises protruding piles 22, baffles 21 and an alternate hydrophilic and hydrophobic surface structure 3. Hydrophilic-material surfaces 31 and hydrophobic-material surfaces 32 of the alternate hydrophilic and hydrophobic surface structure 3 are distributed on surfaces of the protruding piles 22 and the baffles 21 in a stripe shape, as shown in FIGS. 1, 2, and 5 to 7.

[0047] When leather (hides and skins) is loaded into the rotary drum through the drum door 11, and the drum main shaft 8 is rotated under the action of an electric motor, the drum body 1 starts to rotate, and the stirring structure 2 (for example, the protruding piles 22 and the baffles 21) in the drum body 1 repeatedly enter and leave a bath liquid. In this process, the alternate hydrophilic and hydrophobic surface structure 3 on the surface of the stirring structure 2 repeatedly enters or leaves the bath liquid. Along with a periodic process of entering or leaving the bath liquid, droplets are continuously adhered to the hydrophilic-material surfaces 31, such that a drawing force between the hydrophilic-material surfaces and the wet leather is increased, thereby causing the following specific physical phenomena to occur between the leather and the surfaces of the baffles 21 and the protruding piles 22. A first physical phenomenon is that when the protruding piles 22 or the baffles 21 draw the leather into the bath liquid, under the action of the strong drawing force of the alternate hydrophilic and hydrophobic surface structure 3, the leather is not likely to fall off, and the bath liquid at a bottom is more easy to stir, such that

a flow field becomes disordered, and a mass transfer action is enhanced. A second physical phenomenon is that when the leather is drawn away from the bath liquid by the protruding piles 22 or the baffles 21, due to a strong adhesive force of the hydrophilic-material surfaces 31 to droplets, a large number of droplets will be adhered to the hydrophilic-material surfaces 31. During sliding of the leather on the alternate hydrophilic and hydrophobic surface structure 3 under the action of gravity, a mass transfer action will occur between the leather and the bath liquid adhered to the alternate hydrophilic and hydrophobic surface structure, such that relative leather manufacturing time is prolonged. A third physical phenomenon is that under the action of a strong drawing force of the alternate hydrophilic and hydrophobic surface structure 3, the lifting leather can move to a higher drawing position, such that extension is more sufficient; moreover, throwing kinetic energy is increased in a falling process. Therefore, the alternate hydrophilic and hydrophobic surface structure 3 can achieve gain effects, and in an actual leather manufacturing process, not only can a mass transfer effect of leather be improved and leather manufacturing time be shortened, but an adverse effect of a long-time mechanical action on physical and mechanical properties of the leather can also be avoided.

[0048] Preferably, there are four pairs of the protruding piles 22 and two pairs of the baffles 21 in the rotary drum, such that a distribution angle of the baffles 21 and the protruding piles 22 in a circumferential direction is 30 degrees. The arrangement mode of two adjacent protruding piles 22 in a direction of the drum body 1 is a staggered arrangement, with the aim of destroying a fixed form of the leather in the rotary drum, thereby enhancing a mechanical action and improving a leather manufacturing effect. Strip-type hydrophilic sheets are formed on the surfaces of the baffles 21 and the protruding piles 22, and original surfaces of the baffles and the protruding piles serve as hydrophobic-material surfaces 32, thereby achieving the function of an alternate hydrophilic and hydrophobic surface. Chemically treated gold coatings may be used as outer surfaces of the hydrophilic sheets, and the hydrophilic-material surfaces 31 are preferably in a straight-line shape, so as to enhance a leather manufacturing process at a low cost.

[0049] It should be noted that the various embodiments in the description are described in a progressive manner, each embodiment focuses on the differences from other embodiments, and the same and similar parts of the various embodiments can be referred to each other.

[0050] It should also be noted that in the description, an orientation or positional relationship indicated by terms "center", "upper", "lower", "left", "right", "vertical", "horizontal", "inner", "outer", etc. is an orientation or positional relationship shown on the basis of the accompanying drawings, which is only for convenience of describing the present invention and simplifying the description, rather than indicating or implying that the referred device or element must have a particular orientation, and be

constructed and operated in a particular orientation, and therefore should not be construed as limiting the present invention. In addition, relational terms such as "first" and "second" are merely used to distinguish one entity or operation from another entity or operation, do not necessarily require or imply that any actual relation or sequence exists between these entities or operations, and should not be constructed as indicating or implying relative importance. Moreover, terms "include", "comprise", or any other variants thereof are intended to cover a non-exclusive inclusion, such that a process, method, article, or terminal apparatus that includes a list of elements not only includes those elements but also includes other elements that are not listed, or further includes elements inherent to such a process, method, article, or terminal apparatus. In the absence of more restrictions, an element defined by "including a..." does not exclude a further identical element in a process, method, article, or terminal apparatus that includes the element.

[0051] The technical solutions provided in the present invention are described in detail above, and in the description, the principles and implementations of the present invention are described by means of specific examples. The description of the above embodiments is only used to help understand the present invention, and the content of the description should not be construed as limiting the present invention, the scope of protection of the present invention is defined in appended claims.

Claims

1. A leather-manufacturing rotary drum having an alternate hydrophilic and hydrophobic surface structure (3), **characterized by** comprising:

a drum body (1) capable of rotating in its own circumferential direction;
a stirring structure (2) arranged in the drum body (1); and
an alternate hydrophilic and hydrophobic surface structure (3) in which hydrophilic-material surfaces (31) and hydrophobic-material surfaces (32) are alternately distributed, the alternate hydrophilic and hydrophobic surface structure (3) being distributed on a surface of an inner wall of the drum body (1) and/or a surface of the stirring structure (2),
wherein, in a rotating process of the drum body (1), the alternate hydrophilic and hydrophobic surface structure (3) repeatedly enters and leaves a bath liquid in the drum body (1).

2. The leather-manufacturing rotary drum according to claim 1, **characterized in that** the alternate hydrophilic and hydrophobic surface structure (3) is a structure in which hydrophilic coatings and hydrophobic coatings are alternately distributed, wherein:

- the hydrophilic coatings are the hydrophilic-material surfaces (31) and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2); and
the hydrophobic coatings are the hydrophobic-material surfaces (32) and are formed by preparing hydrophobic materials on the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2).
3. The leather-manufacturing rotary drum according to claim 1, **characterized in that** the alternate hydrophilic and hydrophobic surface structure (3) is a structure in which hydrophilic coatings and polished original surfaces of the inner wall of the drum body (1) and/or the stirring structure (2) are alternately distributed, wherein:
- the hydrophilic coatings are the hydrophilic-material surfaces (31) and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2); and
the polished original surfaces of the inner wall of the drum body (1) and/or the stirring structure (2) are the hydrophobic-material surfaces (32).
4. The leather-manufacturing rotary drum according to claim 1, **characterized in that** the alternate hydrophilic and hydrophobic surface structure (3) is a structure formed by assembling a plurality of modularized hydrophilic and hydrophobic sheets, wherein: outer surfaces of the hydrophilic and hydrophobic sheets are alternately distributed surfaces of the hydrophilic-material surfaces (31) and the hydrophobic-material surfaces (32), and the hydrophilic and hydrophobic sheets are mounted in close contact with the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2).
5. The leather-manufacturing rotary drum according to claim 1, **characterized in that** the alternate hydrophilic and hydrophobic surface structure (3) is a structure in which modularized hydrophilic sheets and hydrophobic coatings are alternately distributed, wherein:
- outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces (31), and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2); and
the hydrophobic coatings are the hydrophobic-material surfaces (32) and are formed by preparing hydrophobic materials on the surface of the inner wall of the drum body (1) and/or the

surface of the stirring structure (2).

6. The leather-manufacturing rotary drum according to claim 1, **characterized in that** the alternate hydrophilic and hydrophobic surface structure (3) is a structure in which modularized hydrophilic sheets and polished original surfaces of the inner wall of the drum body (1) and/or the stirring structure (2) are alternately distributed, wherein:

outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces (31), and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2); and
the polished original surfaces of the inner wall of the drum body (1) and/or the stirring structure (2) are the hydrophobic-material surfaces (32).

7. The leather-manufacturing rotary drum according to claim 1, **characterized in that** the alternate hydrophilic and hydrophobic surface structure (3) is a structure in which hydrophilic coatings and modularized hydrophobic sheets are alternately distributed, wherein:

the hydrophilic coatings are the hydrophilic-material surfaces (31) and are formed by preparing hydrophilic materials on the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2); and
outer surfaces of the hydrophobic sheets are the hydrophobic-material surfaces (32), and the hydrophobic sheets are mounted in close contact with the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2).

8. The leather-manufacturing rotary drum according to claim 1, **characterized in that** the alternate hydrophilic and hydrophobic surface structure (3) is a structure in which modularized hydrophilic sheets and modularized hydrophobic sheets are alternately distributed, wherein:

outer surfaces of the hydrophilic sheets are the hydrophilic-material surfaces (31), and the hydrophilic sheets are mounted in close contact with the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2); and
outer surfaces of the hydrophobic sheets are the hydrophobic-material surfaces (32), and the hydrophobic sheets are mounted in close contact with the surface of the inner wall of the drum body (1) and/or the surface of the stirring structure (2).

9. The leather-manufacturing rotary drum according to any one of claims 1-8, **characterized in that** the stirring structure (2) comprises baffles (21) and/or protruding piles (22), and in the rotating process of the drum body (1), the baffles (21) and/or the protruding piles (22) repeatedly enter and leave the bath liquid in the drum body (1).
10. The leather-manufacturing rotary drum according to claim 9, **characterized in that** when the stirring structure (2) comprises both the baffles (21) and the protruding piles (22), the baffles (21) and the protruding piles (22) are alternately distributed along a circumferential wall surface of the drum body (1).

Patentansprüche

1. Drehtrommel für die Lederherstellung, die eine abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) aufweist, **dadurch gekennzeichnet, dass** sie umfasst:

einen Trommelkörper (1), der in der Lage ist, in seiner eigenen Umfangsrichtung zu drehen;
eine Rührstruktur (2), die im Trommelkörper (1) eingerichtet ist; und
eine abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3), bei der Oberflächen aus hydrophilem Material (31) und Oberflächen aus hydrophobem Material (32) abwechselnd verteilt sind, wobei die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) auf einer Oberfläche einer Innenwand des Trommelkörpers (1) und/oder einer Oberfläche der Rührstruktur (2) verteilt ist,
wobei bei einem Drehprozess des Trommelkörpers (1) die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) wiederholt in eine Badflüssigkeit im Trommelkörper (1) eintritt und diese verlässt.

2. Drehtrommel für die Lederherstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) eine Struktur ist, bei der hydrophile Beschichtungen und hydrophobe Beschichtungen abwechselnd verteilt sind, wobei:

die hydrophilen Beschichtungen die Oberflächen aus hydrophilem Material (31) sind und durch Anfertigen von hydrophilen Materialien auf der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) gebildet sind; und
die hydrophoben Beschichtungen die Oberflächen aus hydrophobem Material (32) sind und durch Anfertigen von hydrophoben Materialien

auf der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) gebildet sind.

3. Drehtrommel für die Lederherstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) eine Struktur ist, bei der hydrophile Beschichtungen und polierte ursprüngliche Oberflächen der Innenwand des Trommelkörpers (1) und/oder der Rührstruktur (2) abwechselnd verteilt sind, wobei:

die hydrophilen Beschichtungen die Oberflächen aus hydrophilem Material (31) sind und durch Anfertigen von hydrophilen Materialien auf der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) gebildet sind; und
die polierten ursprünglichen Oberflächen der Innenwand des Trommelkörpers (1) und/oder der Rührstruktur (2) die Oberflächen aus hydrophobem Material (32) sind.

4. Drehtrommel für die Lederherstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) eine Struktur ist, die durch Zusammensetzen einer Vielzahl von modularisierten hydrophilen und hydrophoben Lagen gebildet ist, wobei:

Außenoberflächen der hydrophilen und hydrophoben Lagen abwechselnd verteilte Oberflächen der Oberflächen aus hydrophilem Material (31) und der Oberflächen aus hydrophobem Material (32) sind, und die hydrophilen und hydrophoben Lagen in engem Kontakt mit der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) angebracht sind.

5. Drehtrommel für die Lederherstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) eine Struktur ist, bei der modularisierte hydrophile Lagen und hydrophobe Beschichtungen abwechselnd verteilt sind, wobei:

Außenoberflächen der hydrophilen Lagen die Oberflächen aus hydrophilem Material (31) sind, und die hydrophilen Lagen in engem Kontakt mit der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) angebracht sind; und
die hydrophoben Beschichtungen die Oberflächen aus hydrophobem Material (32) sind und durch Anfertigen von hydrophoben Materialien auf der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der

Rührstruktur (2) gebildet sind.

6. Drehtrommel für die Lederherstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) eine Struktur ist, bei der modularisierte hydrophile Lagen und polierte ursprüngliche Oberflächen der Innenwand des Trommelkörpers (1) und/oder der Rührstruktur (2) abwechselnd verteilt sind, wobei:

Außenoberflächen der hydrophilen Lagen die Oberflächen aus hydrophilem Material (31) sind, und die hydrophilen Lagen in engem Kontakt mit der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) angebracht sind; und die polierten ursprünglichen Oberflächen der Innenwand des Trommelkörpers (1) und/oder der Rührstruktur (2) die Oberflächen aus hydrophobem Material (32) sind.

7. Drehtrommel für die Lederherstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) eine Struktur ist, bei der hydrophile Beschichtungen und modularisierte hydrophobe Lagen abwechselnd verteilt sind, wobei:

die hydrophilen Beschichtungen die Oberflächen aus hydrophilem Material (31) sind und durch Anfertigen von hydrophilen Materialien auf der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) gebildet sind; und Außenoberflächen der hydrophoben Lagen die Oberflächen aus hydrophobem Material (32) sind, und die hydrophoben Lagen in engem Kontakt mit der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) angebracht sind.

8. Drehtrommel für die Lederherstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** die abwechselnd hydrophile und hydrophobe Oberflächenstruktur (3) eine Struktur ist, bei der modularisierte hydrophile Lagen und modularisierte hydrophobe Lagen abwechselnd verteilt sind, wobei:

Außenoberflächen der hydrophilen Lagen die Oberflächen aus hydrophilem Material (31) sind, und die hydrophilen Lagen in engem Kontakt mit der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) angebracht sind; und Außenoberflächen der hydrophoben Lagen die Oberflächen aus hydrophobem Material (32) sind, und die hydrophoben Lagen in engem Kon-

takt mit der Oberfläche der Innenwand des Trommelkörpers (1) und/oder der Oberfläche der Rührstruktur (2) angebracht sind.

9. Drehtrommel für die Lederherstellung nach einem der Ansprüche 1-8, **dadurch gekennzeichnet, dass** die Rührstruktur (2) Leitbleche (21) und/oder vorspringende Stapel (22) umfasst, und beim Drehprozess des Trommelkörpers (1) die Leitbleche (21) und/oder die vorspringenden Stapel (22) wiederholt in die Badflüssigkeit im Trommelkörper (1) eintreten und diese verlassen.

10. Drehtrommel für die Lederherstellung nach Anspruch 9, **dadurch gekennzeichnet, dass**, wenn die Rührstruktur (2) sowohl die Leitbleche (21) als auch die vorspringenden Stapel (22) umfasst, die Leitbleche (21) und die vorspringenden Stapel (22) abwechselnd entlang einer Umfangswandoberfläche des Trommelkörpers (1) verteilt sind.

Revendications

1. Tambour rotatif de fabrication de cuir ayant une structure de surfaces hydrophiles et hydrophobes en alternance (3), **caractérisé en ce qu'il comprend :**

un corps de tambour (1) capable de tourner dans sa propre direction circonférentielle ;
une structure d'agitation (2) agencée dans le corps de tambour (1) ; et
une structure de surfaces hydrophiles et hydrophobes en alternance (3) dans laquelle des surfaces de matériaux hydrophiles (31) et des surfaces de matériaux hydrophobes (32) sont distribuées alternativement, la structure de surfaces hydrophiles et hydrophobes en alternance (3) étant distribuée sur une surface d'une paroi intérieure du corps de tambour (1) et/ou une surface de la structure d'agitation (2),
dans lequel, dans un procédé de rotation du corps de tambour (1), la structure de surfaces hydrophiles et hydrophobes en alternance (3) entre dans et quitte à plusieurs reprises un liquide pour bain dans le corps de tambour (1).

2. Tambour rotatif de fabrication de cuir selon la revendication 1, **caractérisé en ce que** la structure de surfaces hydrophiles et hydrophobes en alternance (3) est une structure dans laquelle des revêtements hydrophiles et des revêtements hydrophobes sont distribués alternativement, dans lequel :

les revêtements hydrophiles sont les surfaces de matériaux hydrophiles (31) et sont formés en préparant des matériaux hydrophiles sur la sur-

- face de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2) ; et
 les revêtements hydrophobes sont les surfaces de matériaux hydrophobes (32) et sont formés en préparant des matériaux hydrophobes sur la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2).
3. Tambour rotatif de fabrication de cuir selon la revendication 1, **caractérisé en ce que** la structure de surfaces hydrophiles et hydrophobes en alternance (3) est une structure dans laquelle des revêtements hydrophiles et des surfaces originales polies de la paroi intérieure du corps de tambour (1) et/ou de la structure d'agitation (2) sont distribués alternativement, dans lequel :
- les revêtements hydrophiles sont les surfaces de matériaux hydrophiles (31) et sont formés en préparant des matériaux hydrophiles sur la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2) ; et
 les surfaces originales polies de la paroi intérieure du corps de tambour (1) et/ou de la structure d'agitation (2) sont les surfaces de matériaux hydrophobes (32).
4. Tambour rotatif de fabrication de cuir selon la revendication 1, **caractérisé en ce que** la structure de surfaces hydrophiles et hydrophobes en alternance (3) est une structure formée en assemblant une pluralité de feuilles hydrophiles et hydrophobes modularisées, dans lequel :
- des surfaces extérieures des feuilles hydrophiles et hydrophobes sont des surfaces distribuées alternativement des surfaces de matériaux hydrophiles (31) et des surfaces de matériaux hydrophobes (32), et les feuilles hydrophiles et hydrophobes sont montées en contact étroit avec la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2) .
5. Tambour rotatif de fabrication de cuir selon la revendication 1, **caractérisé en ce que** la structure de surfaces hydrophiles et hydrophobes en alternance (3) est une structure dans laquelle des feuilles hydrophiles modularisées et des revêtements hydrophobes sont distribués alternativement, dans lequel :
- des surfaces extérieures des feuilles hydrophiles sont les surfaces de matériaux hydrophiles (31), et les feuilles hydrophiles sont montées en contact étroit avec la surface de la paroi intérieure du corps de tambour (1) et/ou la surface
- de la structure d'agitation (2) ; et
 les revêtements hydrophobes sont les surfaces de matériaux hydrophobes (32) et sont formés en préparant des matériaux hydrophobes sur la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2).
6. Tambour rotatif de fabrication de cuir selon la revendication 1, **caractérisé en ce que** la structure de surfaces hydrophiles et hydrophobes en alternance (3) est une structure dans laquelle des feuilles hydrophiles modularisées et des surfaces originales polies de la paroi intérieure du corps de tambour (1) et/ou de la structure d'agitation (2) sont distribuées alternativement, dans lequel :
- des surfaces extérieures des feuilles hydrophiles sont les surfaces de matériaux hydrophiles (31), et les feuilles hydrophiles sont montées en contact étroit avec la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2) ; et
 les surfaces originales polies de la paroi intérieure du corps de tambour (1) et/ou de la structure d'agitation (2) sont les surfaces de matériaux hydrophobes (32).
7. Tambour rotatif de fabrication de cuir selon la revendication 1, **caractérisé en ce que** la structure de surfaces hydrophiles et hydrophobes en alternance (3) est une structure dans laquelle des revêtements hydrophiles et des feuilles hydrophobes modularisées sont distribués alternativement, dans lequel :
- les revêtements hydrophiles sont les surfaces de matériaux hydrophiles (31) et sont formés en préparant des matériaux hydrophiles sur la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2) ; et
 des surfaces extérieures des feuilles hydrophobes sont les surfaces de matériaux hydrophobes (32), et les feuilles hydrophobes sont montées en contact étroit avec la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2).
8. Tambour rotatif de fabrication de cuir selon la revendication 1, **caractérisé en ce que** la structure de surfaces hydrophiles et hydrophobes en alternance (3) est une structure dans laquelle des feuilles hydrophiles modularisées et des feuilles hydrophobes modularisées sont distribuées alternativement, dans lequel :
- des surfaces extérieures des feuilles hydrophiles sont les surfaces de matériaux hydrophiles

(31), et les feuilles hydrophiles sont montées en contact étroit avec la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2) ; et des surfaces extérieures des feuilles hydrophobes sont les surfaces de matériaux hydrophobes (32), et les feuilles hydrophobes sont montées en contact étroit avec la surface de la paroi intérieure du corps de tambour (1) et/ou la surface de la structure d'agitation (2).

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9. Tambour rotatif de fabrication de cuir selon l'une quelconque des revendications 1 à 8, **caractérisé en ce que** la structure d'agitation (2) comprend des déflecteurs (21) et/ou des pieux en saillie (22), et dans le procédé de rotation du corps de tambour (1), les déflecteurs (21) et/ou les pieux en saillie (22) entrent dans et quittent à plusieurs reprises le liquide pour bain dans le corps de tambour (1).

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10. Tambour rotatif de fabrication de cuir selon la revendication 9, **caractérisé en ce que** lorsque la structure d'agitation (2) comprend à la fois les déflecteurs (21) et les pieux en saillie (22), les déflecteurs (21) et les pieux en saillie (22) sont distribués alternativement le long d'une surface de paroi circonférentielle du corps de tambour (1).

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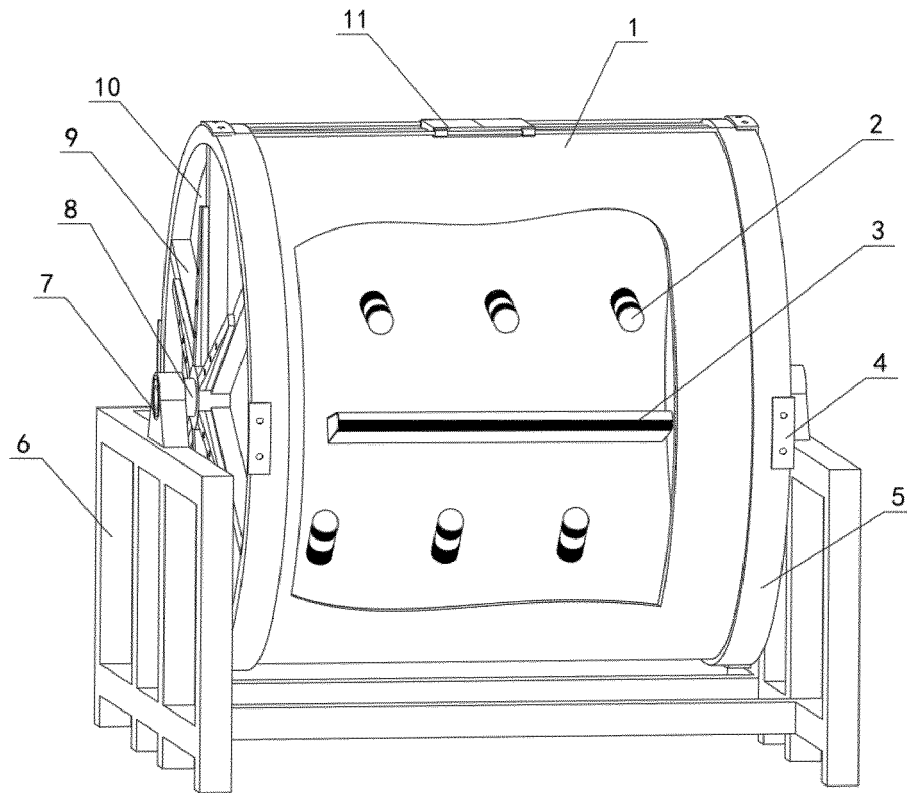


FIG. 1

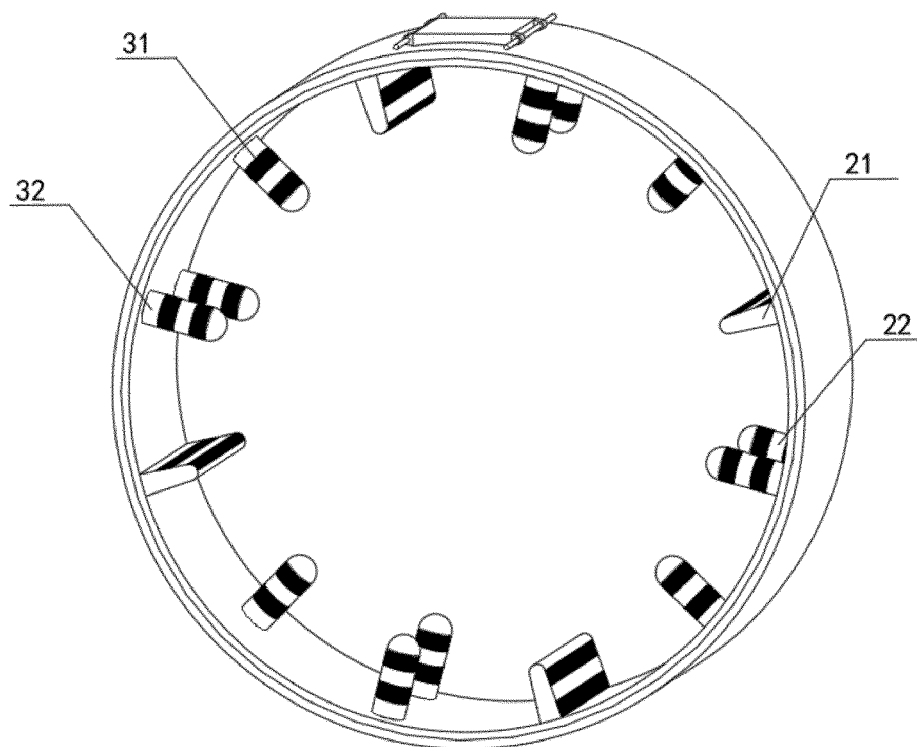


FIG. 2

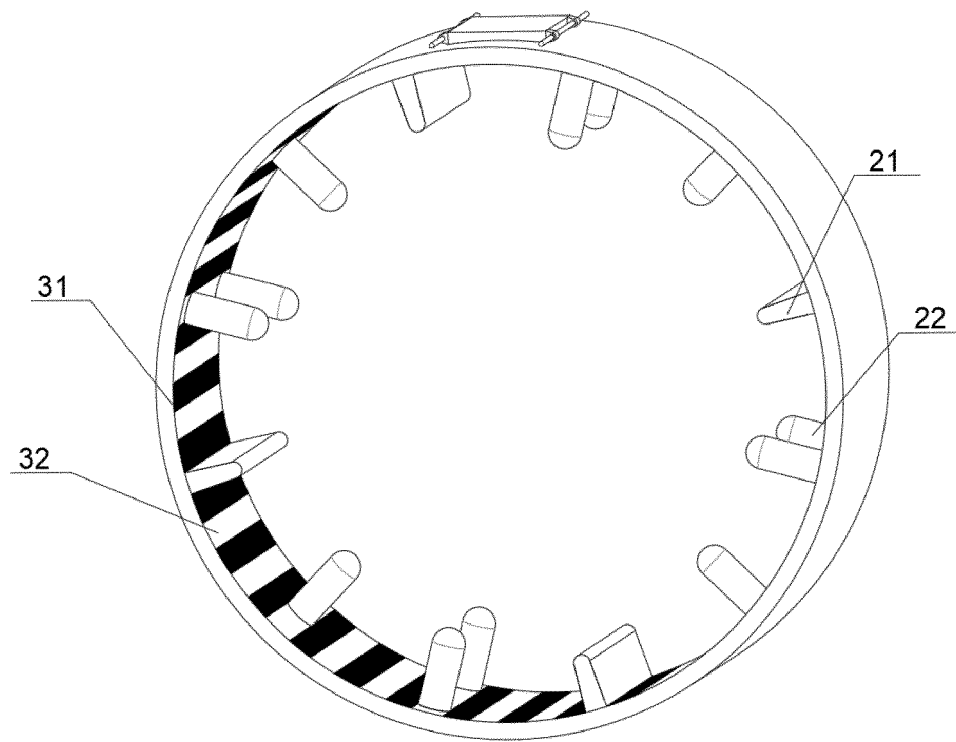


FIG. 3

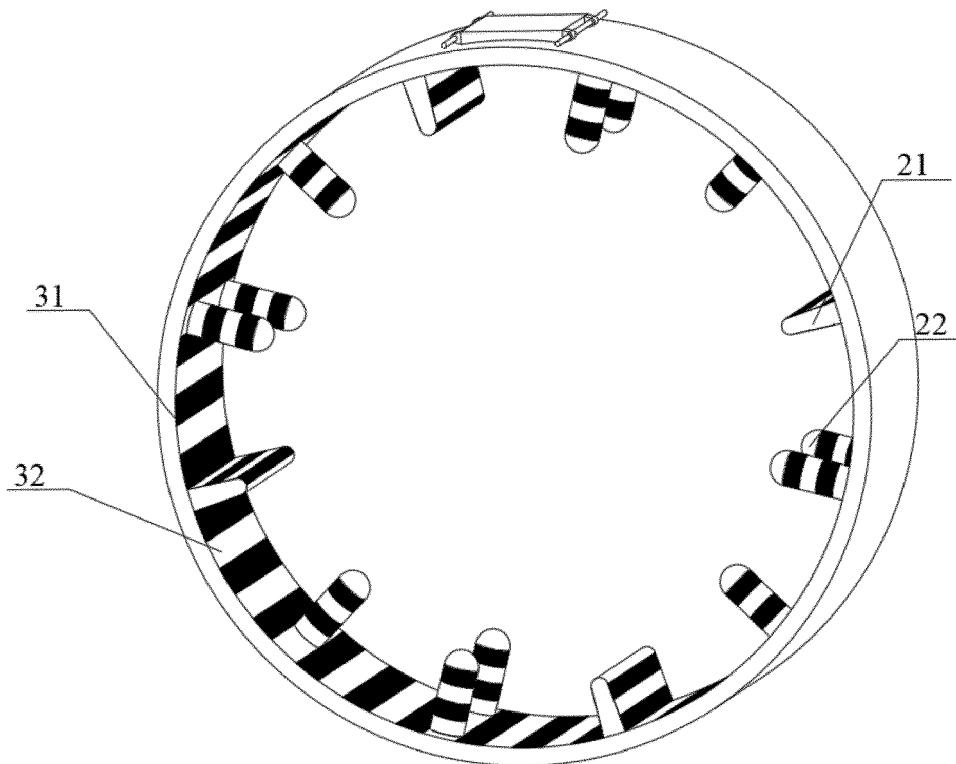


FIG. 4

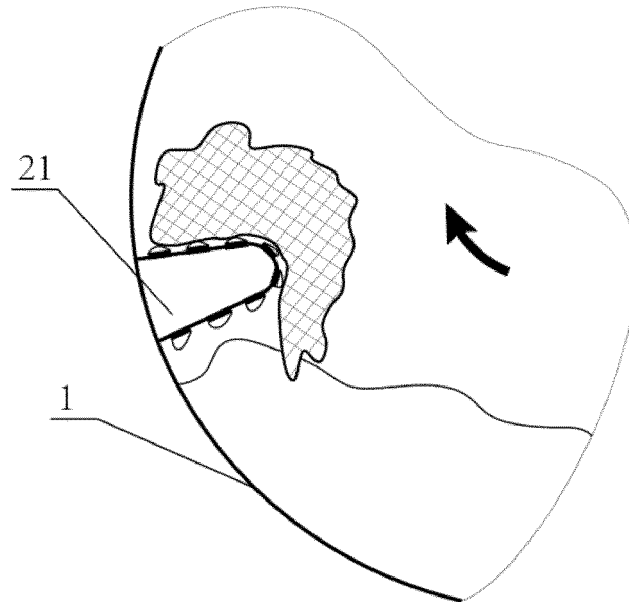


FIG. 5(a)

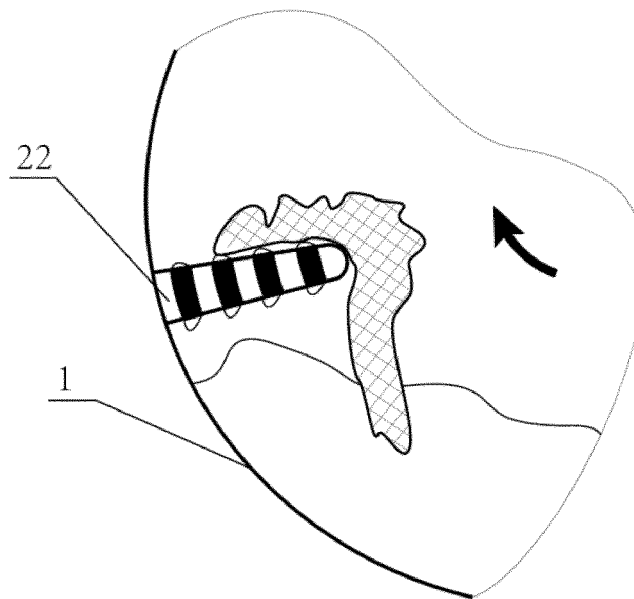


FIG. 5(b)

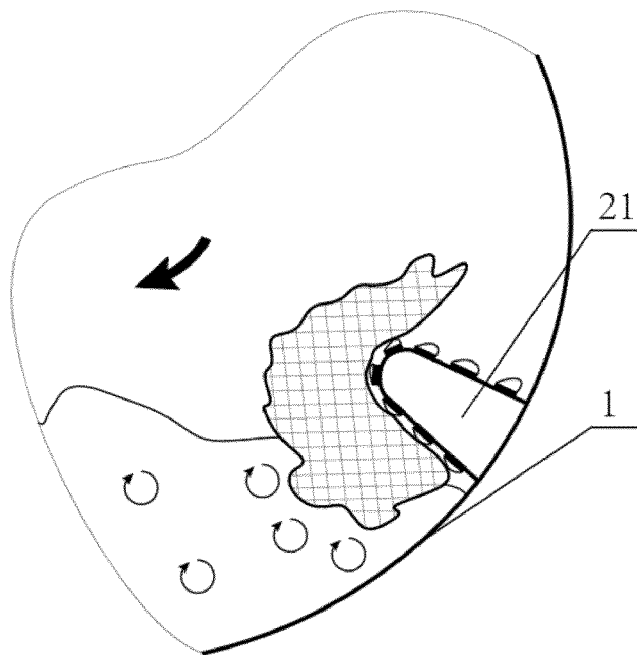


FIG. 6(a)

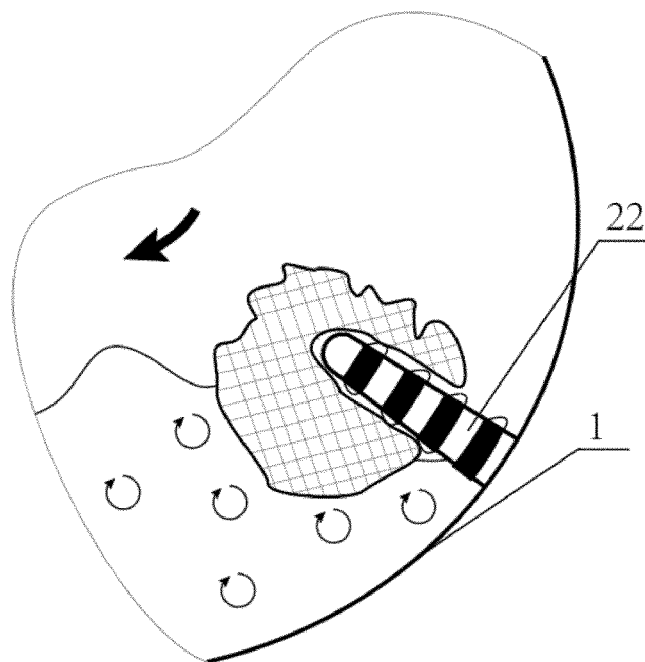


FIG. 6(b)

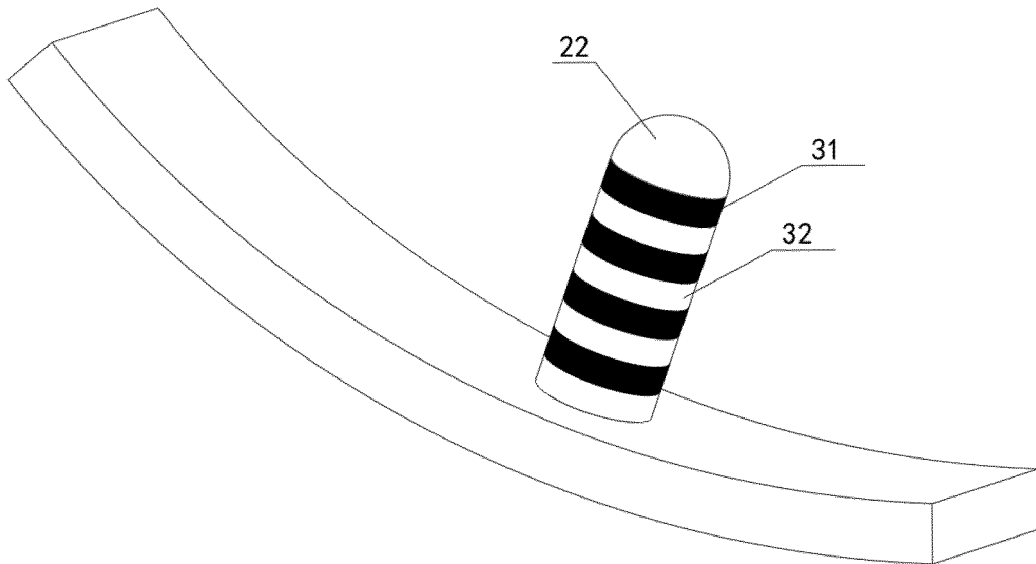


FIG. 7(a)

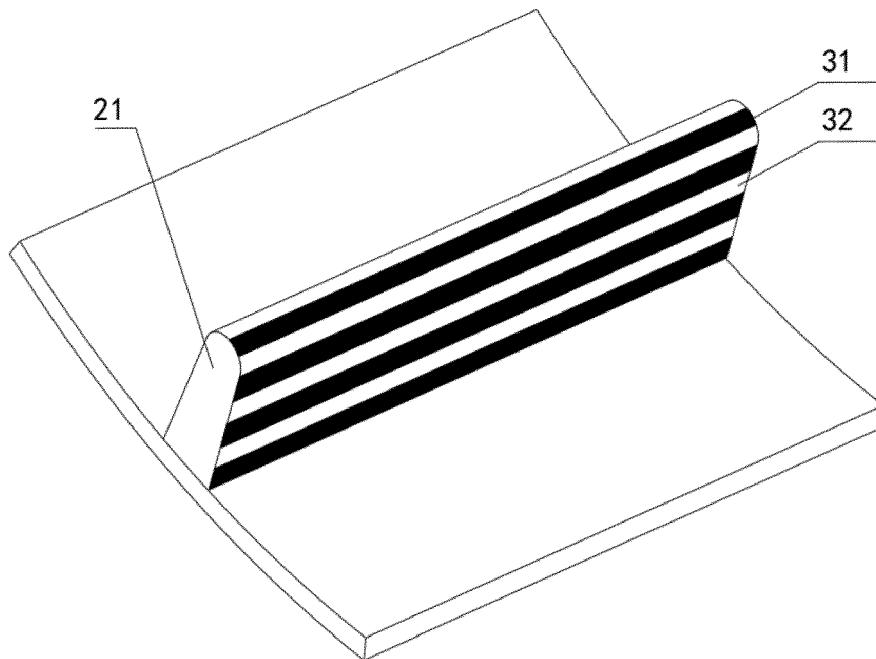


FIG. 7(b)

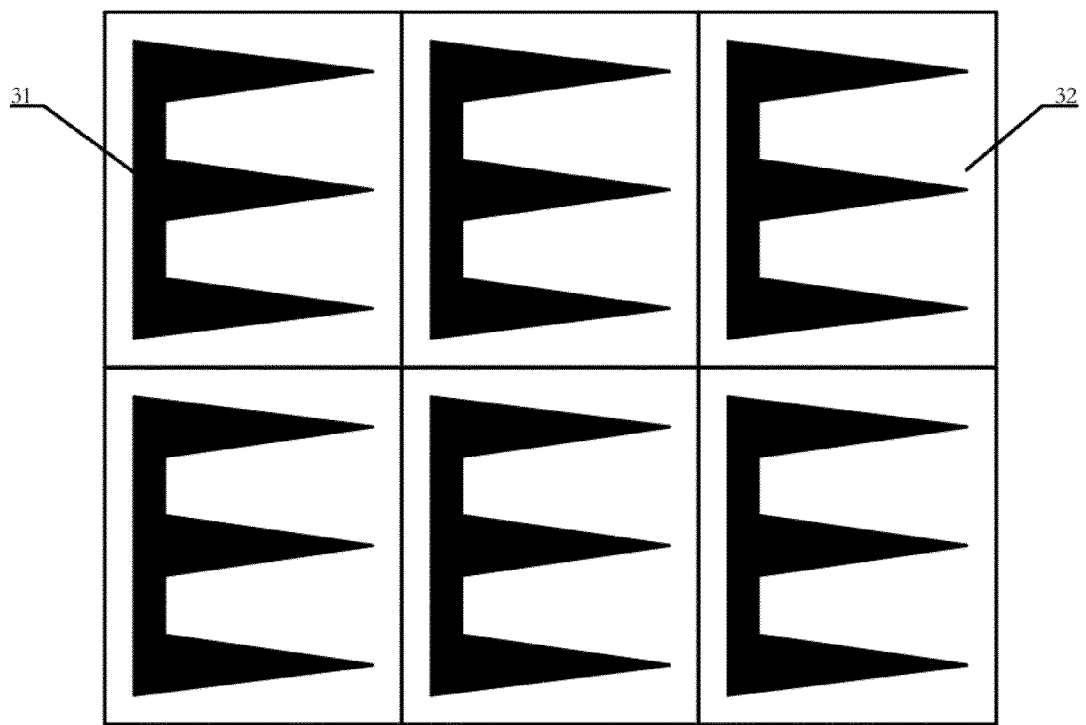


FIG. 8(a)

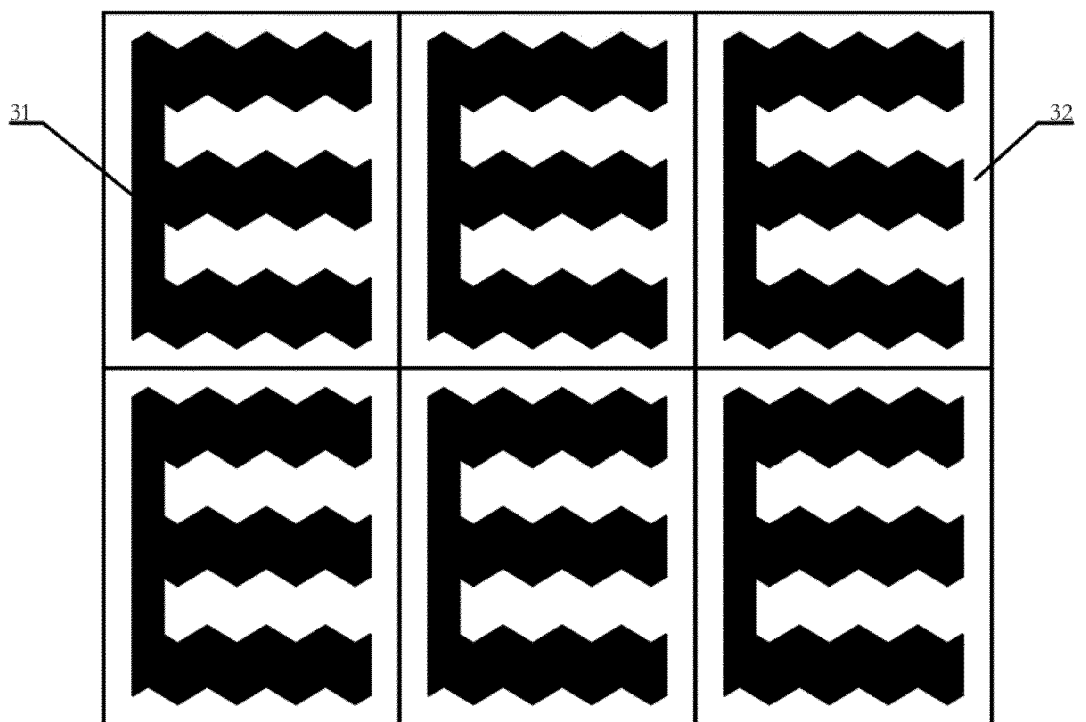


FIG. 8(b)

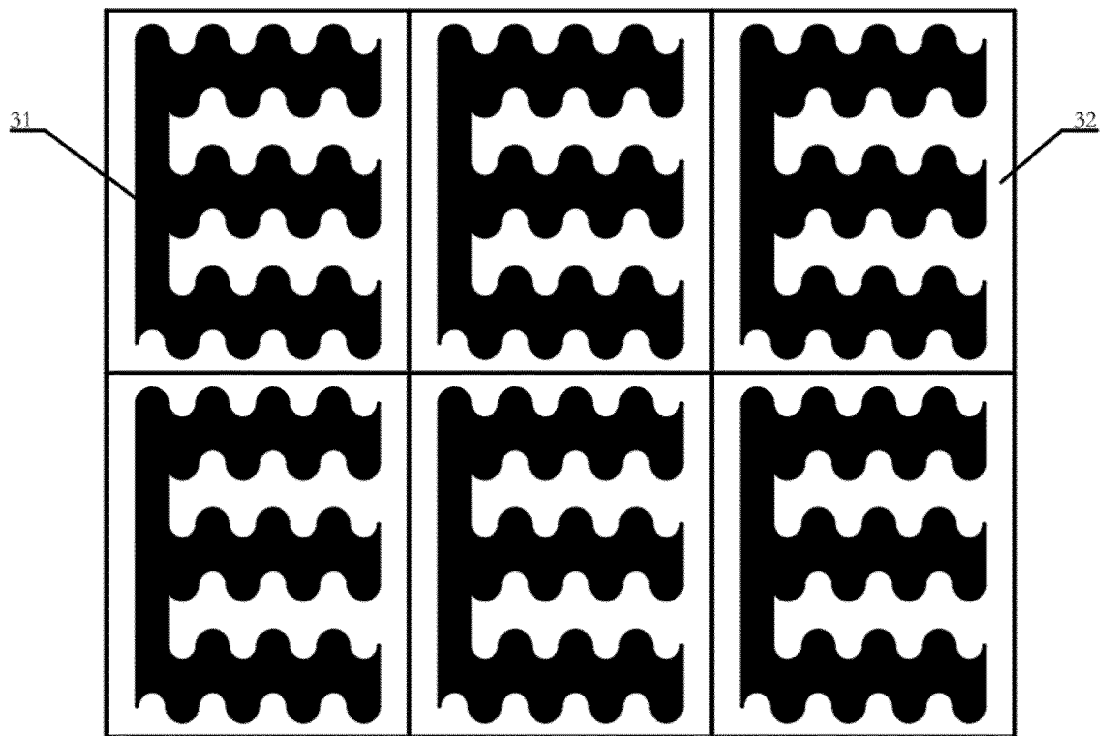


FIG. 8(c)

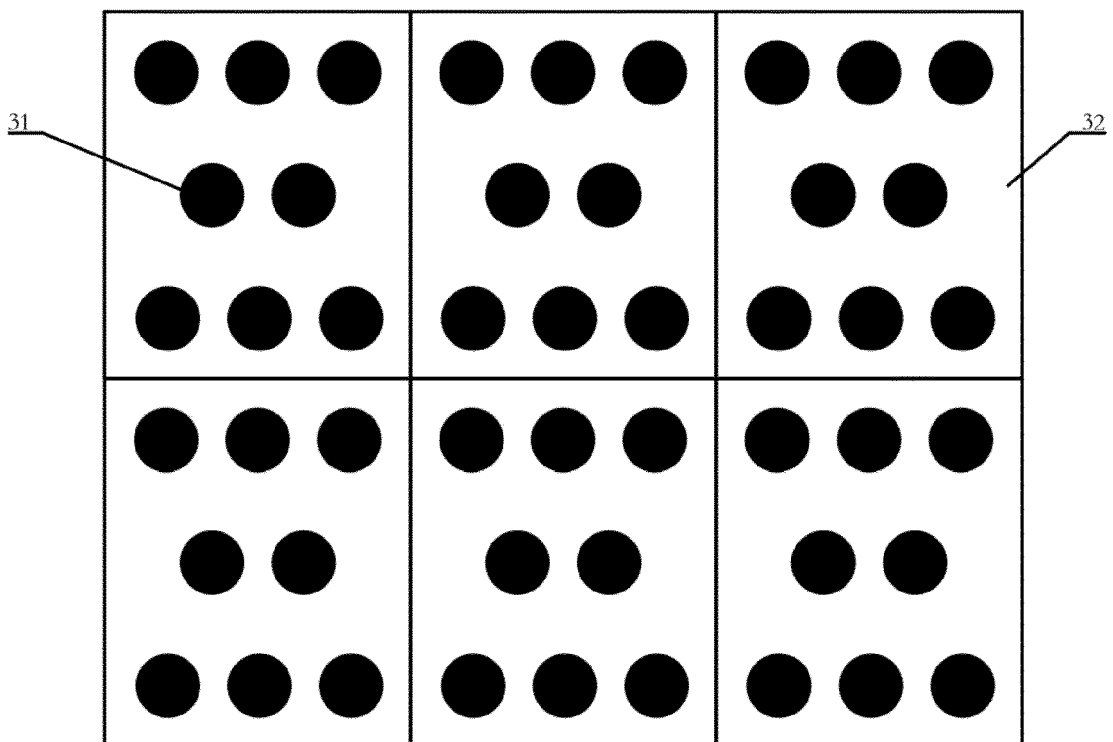


FIG. 8(d)

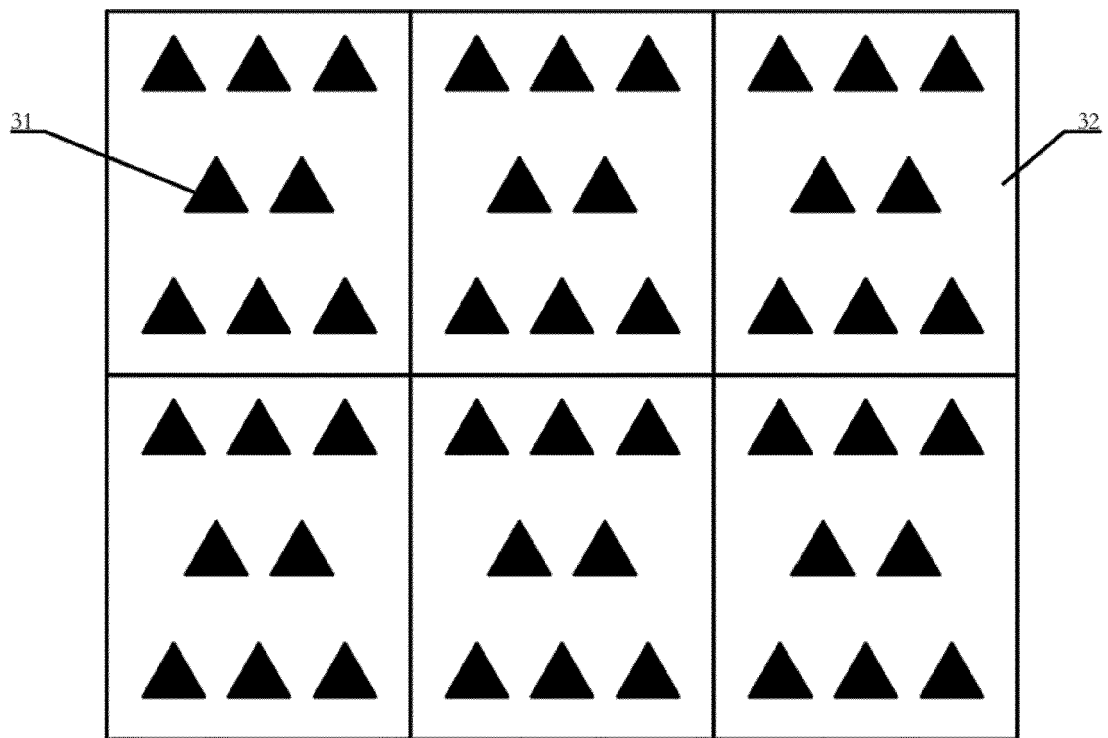


FIG. 8(e)

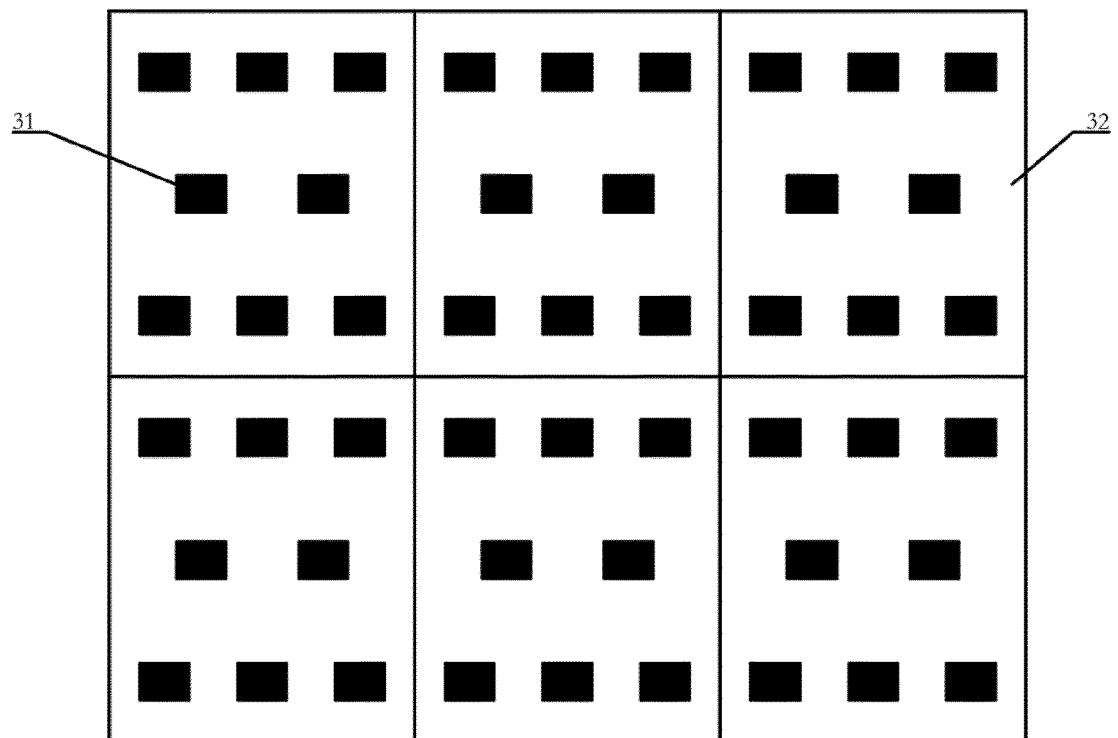


FIG. 8(f)

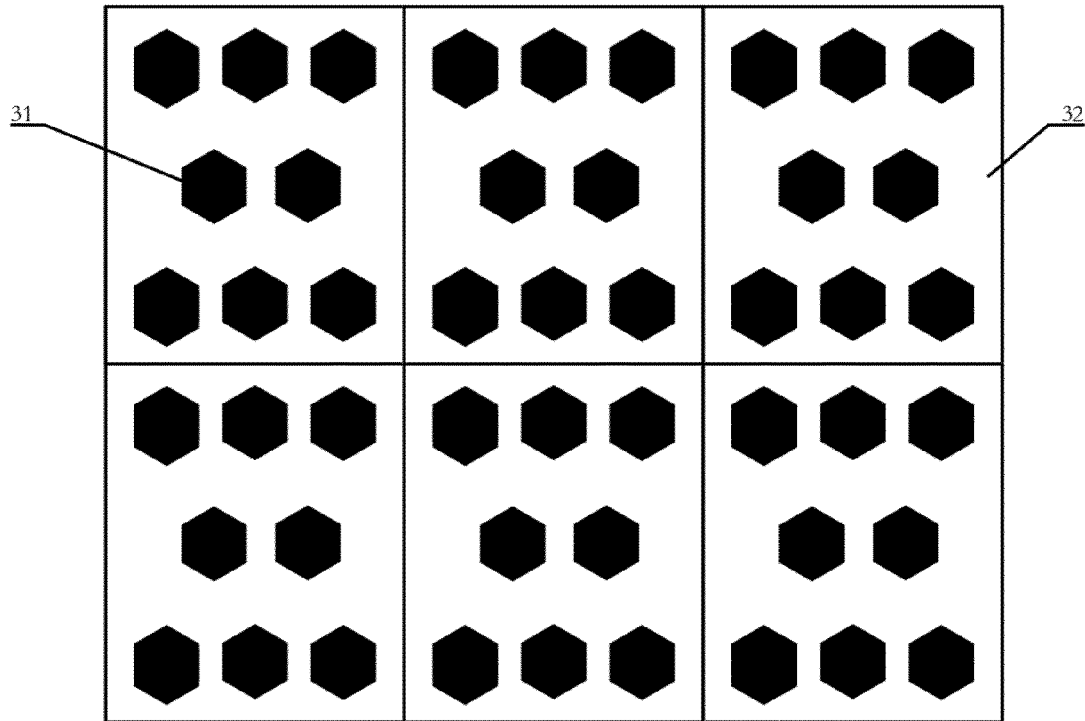


FIG. 8(g)

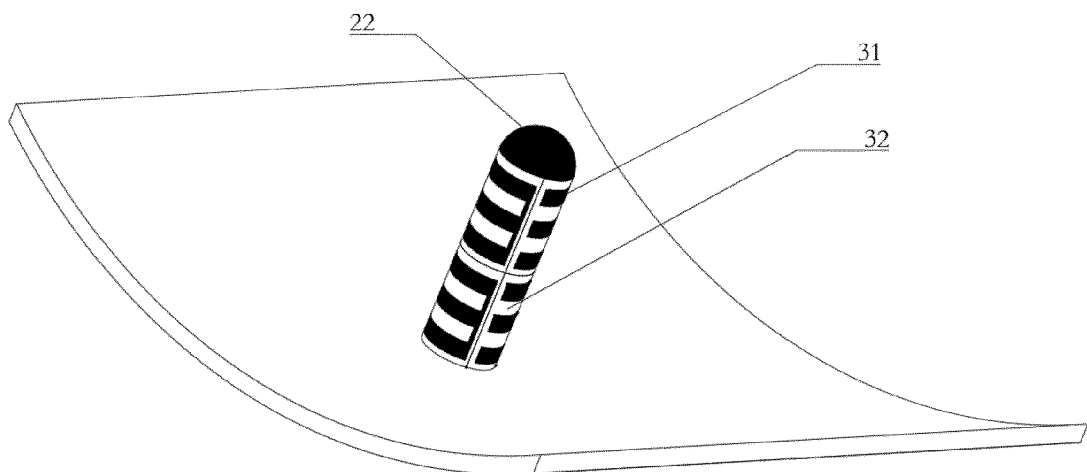


FIG. 9(a)

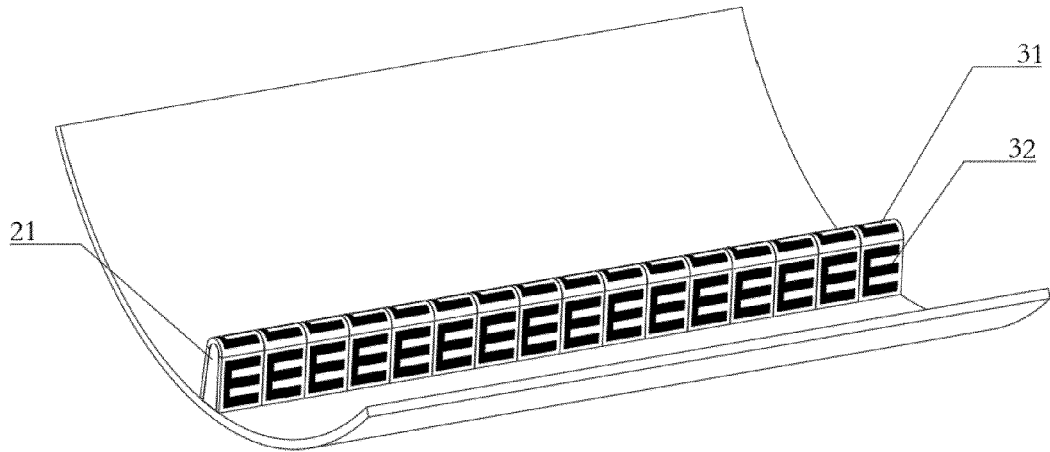


FIG. 9(b)

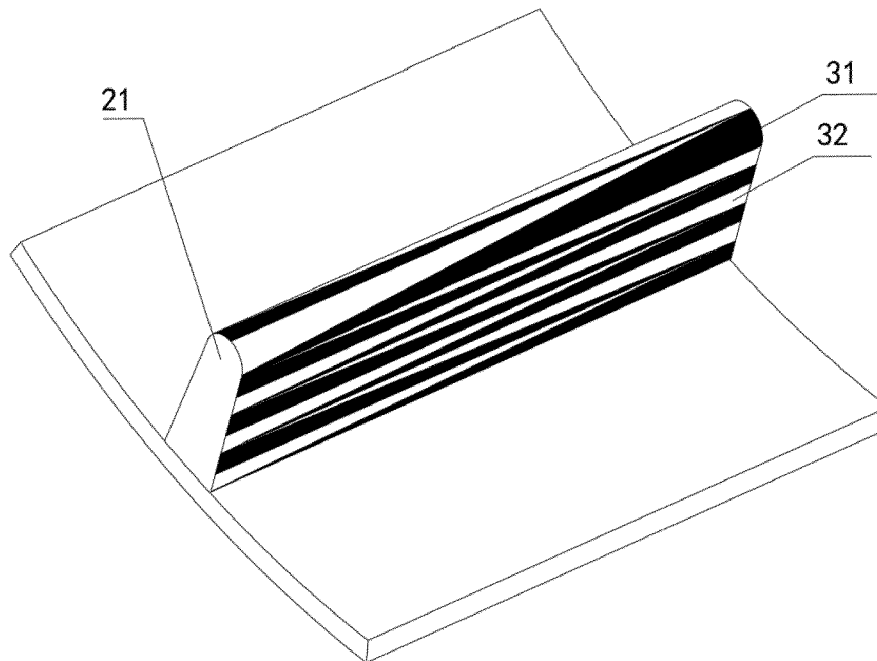


FIG. 10(a)

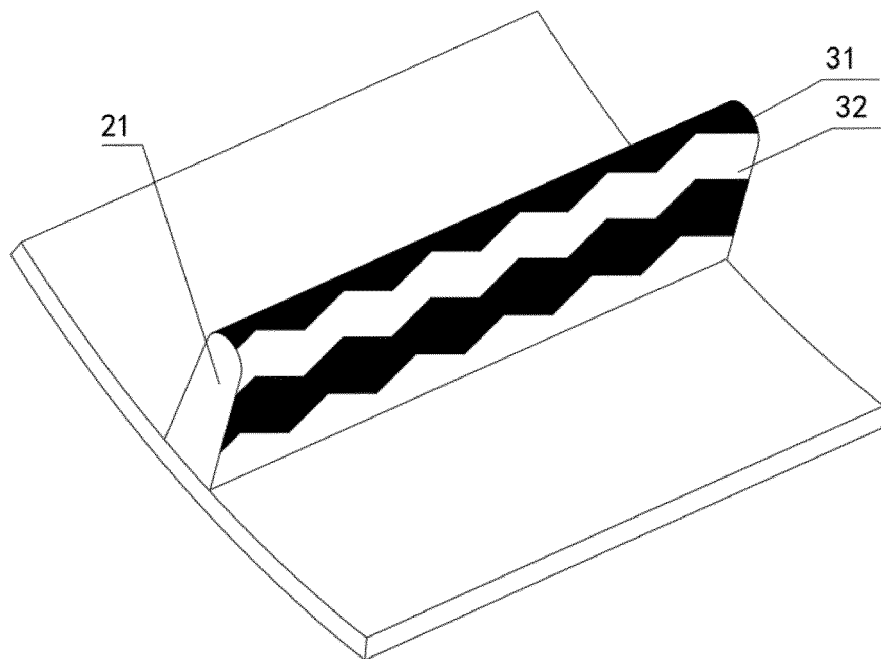


FIG. 10(b)

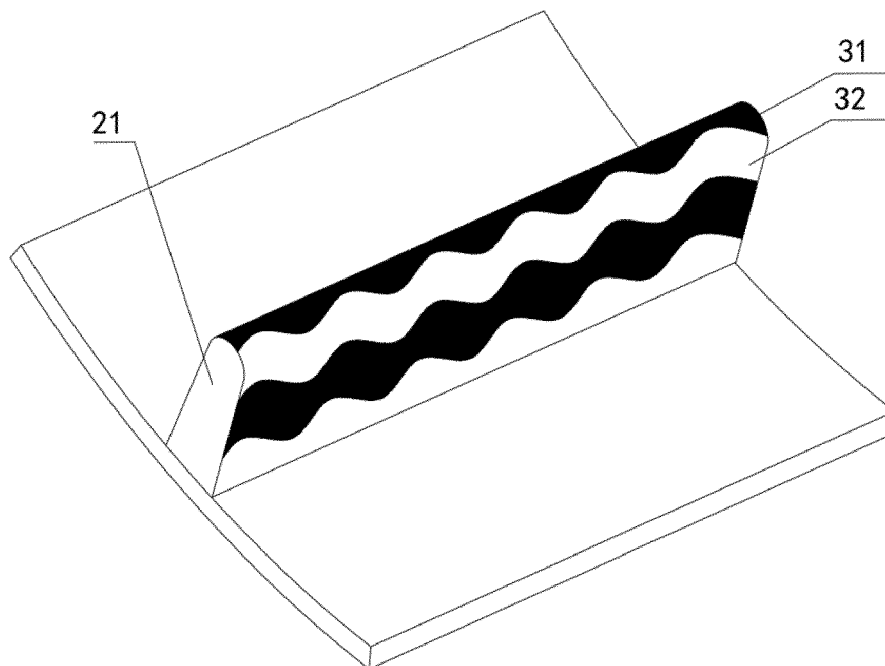


FIG. 10(c)

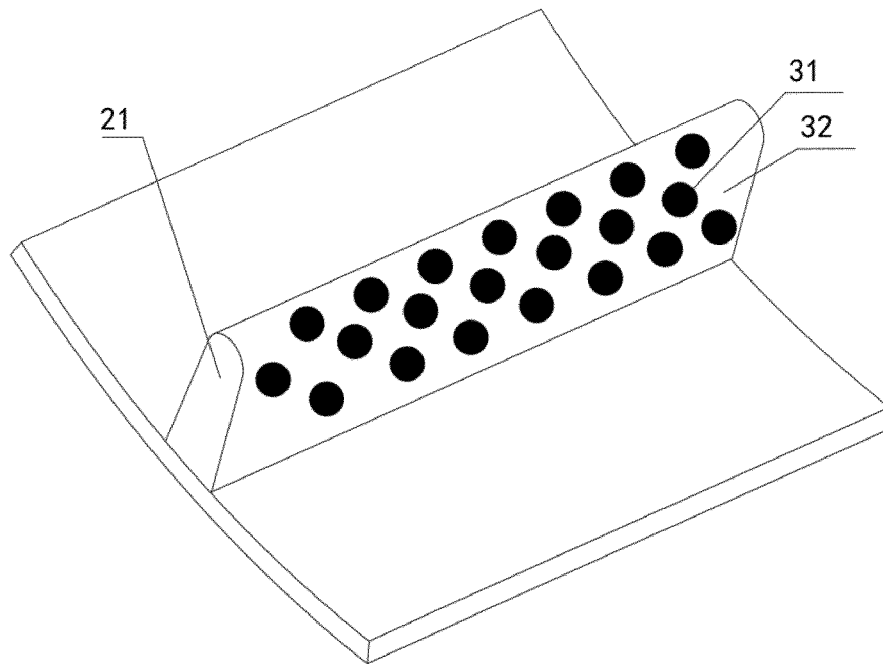


FIG. 10(d)

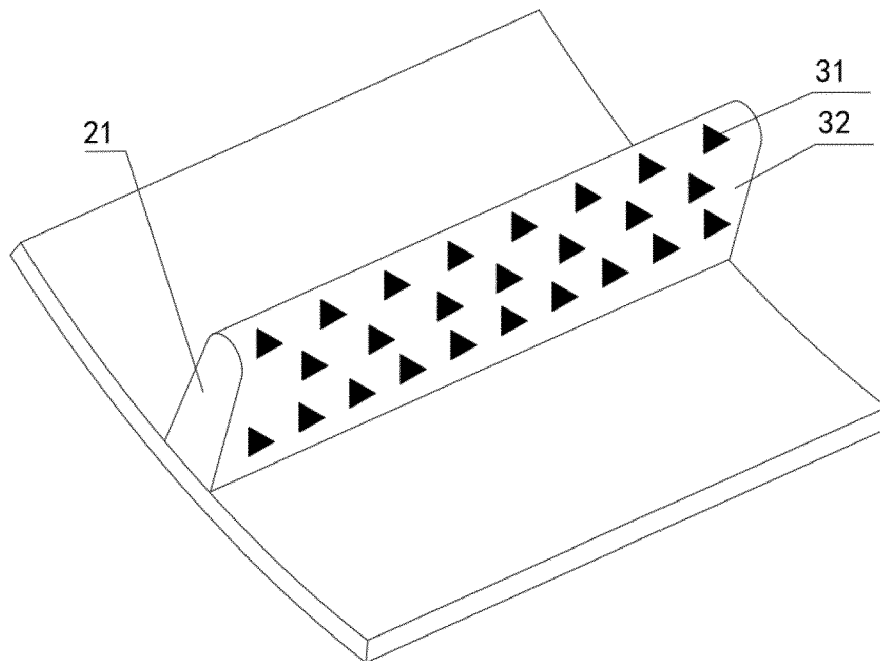


FIG. 10(e)

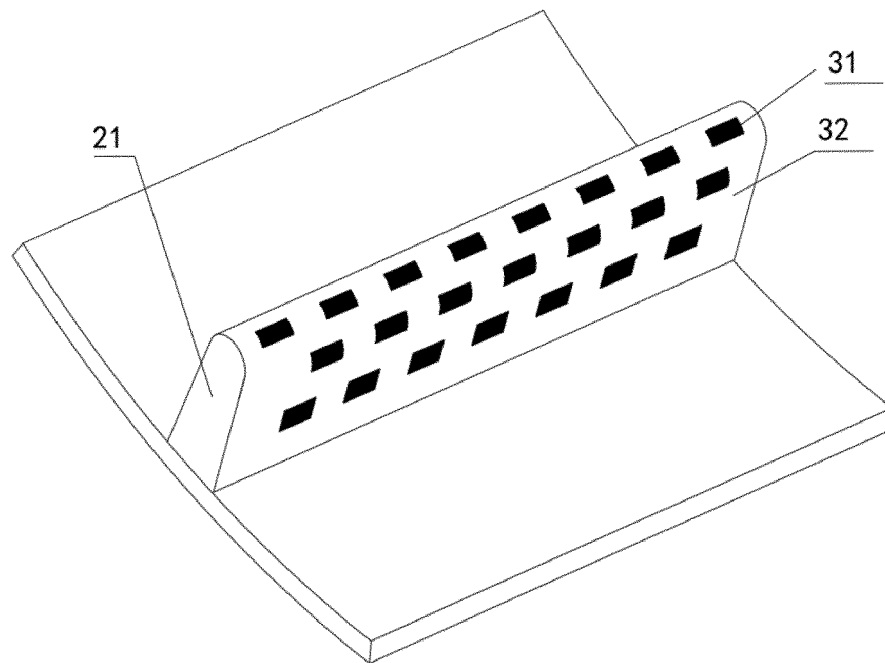


FIG. 10(f)

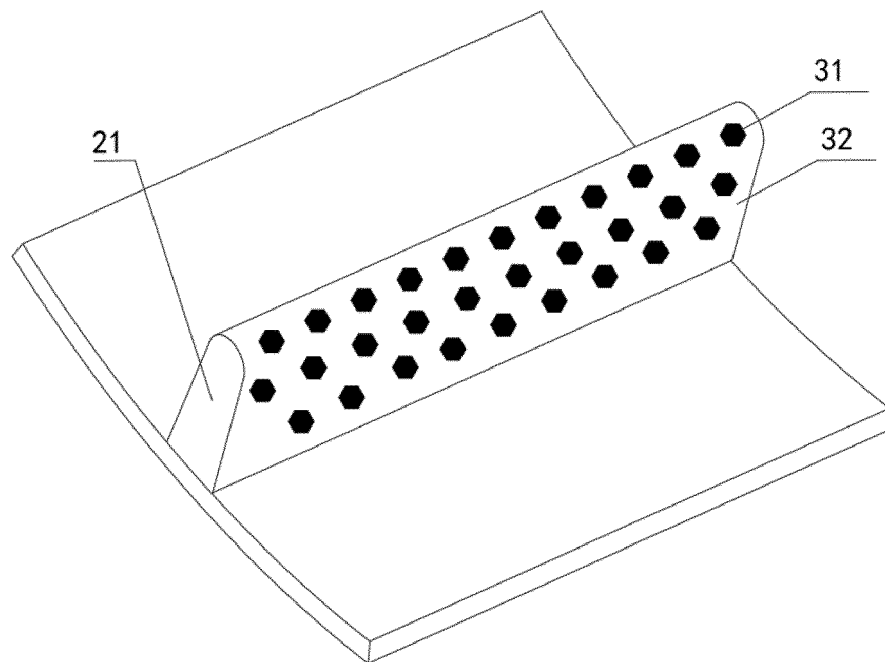


FIG. 10(g)

REFERENCES CITED IN THE DESCRIPTION

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- EP 1540022 A1 [0006]