AMENDED

F - F. 36918

AUSTRALIA 639610

Patents Act 1952

Form 1
Regulation 9

APPLICATION FOR A STANDARD PATENT

I/We DIATEX CO., LTD.,

of 8-6, Kaji-cho 3-chome, Kanda, Chiyoda-ku, TOKYO, JAPAN

hereby apply for the grant of a Standard Patent ~~Patent of Addition~~ for an invention entitled

"NETLIKE SHEET AND METHOD FOR PRODUCING MULTILAYER YARN FOR PRODUCING THE SAME"

which is described in the accompanying ~~provisional~~ complete specification.

For a Convention application — details of basic application(s) —

NUMBER	COUNTRY	DATE OF APPLICATION
139120/1987	JAPAN	3rd June, 1987

APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 10-1-91

Our ~~My~~ address for service is COLLISON & CO., Patent Attorneys, 117 King William Street, Adelaide, South Australia, 5000.

Dated this 14th day of September ,1988.

DIATEX CO., LTD.,
By their Patent Attorneys,
COLLISON & CO.

(Signature)

ALUN W. THOMAS

To

THE COMMISSIONER OF PATENTS

This form must be accompanied by either a provisional specification (Form 9 and true copy) or by a complete specification (Form 10 and true copy)

OP 88167 (AU)

AUSTRALIA

Form 8

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

In support of the Convention application made for a patent for an invention entitled:

NETLIKE SHEET AND METHOD FOR PRODUCING MULTILAYER YARN FOR PRODUCING THE SAME

I, Yoshinori Matsushima, President of 8-6, Kaji-cho 3-chome, Kanda, Chiyoda-ku, Tokyo, Japan

of

do solemnly and sincerely declare as follows:

~~1. I am the applicant for the patent~~

(or, in the case of an application by a body corporate)

1. I am authorized by DIATEX CO., LTD. , the applicant for the patent to make this declaration on its behalf.

2. The basic application as defined by section 141 of the Act was made in Japan on the 3rd day of June , 19 87 , by DIATEX CO., LTD.

day of , 19 , by

~~3. I am the actual inventor of the invention referred to in the basic application.~~

(or, where a person other than the inventor is the applicant)

3. KEJI SEKIGUCHI and TAKASHI FUKUSHIMA respectively of 2-7-7, Honmachi, Uozu-shi, Toyama-ken, Japan and 623, Tochiya, Unazuki-machi, Shimoniikawa-gun, Toyama-ken, Japan

of

are

~~is~~ the actual inventor of the invention and the facts upon which ~~I am entitled~~ the applicant company is entitled to make the application are as follows: The right and interest to apply for and obtain and Australian patent in this invention have been transferred from the inventors to the applicants by virtue of an Assignment dated 25th May 1988

4. The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

(or where a request is made under section 142AA of the Patents Act 1952, for an earlier application made in a Convention country to be disregarded)

~~4. (1.) The basic application referred to in paragraph 2 of this Declaration was not the first application made in a Convention country in respect of the invention the subject of the application.~~

~~(2.) An earlier application in respect of the invention the subject of the application was made in~~

~~on~~

~~(3.) A request has been made to you under section 142AA of the *Patents Act* 1952 to disregard that earlier application.~~

~~*(Here set out in succeeding sub-paragraphs the facts that show that section 142AA is applicable)*~~

~~Except as stated in this paragraph, the basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.~~

Declared at Tokyo, Japan this 25th day of May , 19 88

DIATEX CO., LTD.

Yoshinori Matsushima

(Signature of Declarant)

Yoshinori MATSUSHIMA, President

TO:

THE COMMISSIONER OF PATENTS.

(IMPORTANT – Cross out inapplicable words in above Form.)

0/4524

(12) PATENT ABRIDGMENT (11) Document No. AU-B-16976/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 608610

(54) Title
STRETCHED MULTILAYER YARN

International Patent Classification(s)
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(57) Claim

1. A netlike sheet comprising woven warp and weft yarns, either the warp yarns or the weft yarns being a five-layered yarn composed of two stretched layers of polyolefin resin and an alternating layer of polyolefin resin having a melting point lower than that of the polyolefin in the stretched layers disposed between the two stretched layers and on the outer surfaces thereof, and the other being the same five-layered yarn or a three-layered yarn composed of a central stretched layer of polyolefin resin and an alternating layer of polyolefin resin having a melting point lower than that of the polyolefin in the central stretched layer disposed on both sides of the stretched layer, the warp and weft yarns being heat bonded at their intersections.

12. A method for producing a five-layered yarn comprising the steps of: extruding, into a composite die, a first polyolefin resin and a second polyolefin resin so as to form a three-layered film in which the central layer of the film consists of the first resin and the second resin is welded onto both sides of the central layer, the second resin having a melting point lower than that of the first resin; forming the

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three-layered film into a cylindrical three-layered structure by extruding the same through the composite die using an inflation molding; cutting the film into tape-like pieces having a desired width; superposing pairs of the tape-like pieces; then heating the superposed pieces to adhere the polyolefin resin layers having low melting point to each other; and stretching the resultant product.

COMMONWEALTH OF AUSTRALIA 608610 Form 10

Patents Act 1952-1969

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE:

Class Int. Class

Application Number :
Lodged :

This document contains the amendments made under Section 49 and is correct for printing.

Complete Application No. :
Specification Lodged :
Published :

Priority:

Related art:

TO BE COMPLETED BY APPLICANT

Name of Applicant: ~~DIATEX CO., LTD.~~, Diatex Co., Ltd.

AUSTRALIAN PATENT OFFICE reg 763

Address of Applicant: 8-6, Kaji-cho 3-chome,
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Actual Inventors: Keji SEKIGUCHI, and
Takashi FUKUSHIMA

Address for Service: COLLISON & CO., Patent Attorneys, 117 King William Street, Adelaide, South Australia, 5000.

Complete Specification for the invention entitled:

NETLIKE SHEET AND METHOD FOR PRODUCING MULTILAYER YARN FOR PRODUCING THE SAME

The following statement is a full description of this invention, including the best method of performing it known to ~~me~~ us

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TITLE OF THE INVENTION

Netlike Sheet and Method for Producing Multilayer Yarn for Producing the Same

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to a netlike sheet wide by utilizable as a material for making, for example, light shielding nets, sheets for civil engineering applications, sheets for fruit containers, sheets for drying cereals, and various kinds of reinforcing materials, and to a method for producing a multilayer yarn for making such netlike sheet.

(2) Prior Art

It has been known that woven fabrics can be produced from multilayer yarns composed of stretched yarns of thermoplastic synthetic resins provided thereon with layers of thermoplastic synthetic resins which have a melting point lower than that of the thermoplastic synthetic resin used in making the stretched yarn. For instance, Japanese Utility Model Publication No. 53-49902 discloses a process in which a woven fabric is woven from multilayer yarns of this type and the outer thermoplastic synthetic resin layers are heated to a temperature higher than the melting point thereof so that the multilayer yarns disposed as warp and weft are adhered to each

other in a thermocompression bonding manner to obtain woven sheets.

The warp and weft yarns used in such process are composed of multilayer yarns each of which comprises a stretched yarn disposed at the interior thereof and, therefore, the woven sheets produced therefrom are too low in stiffness for use as light shielding nets, sheets for civil engineering applications and various reinforcing materials. Moreover, the low strength creates problems concerning deforming of the woven fabrics during weaving of the yarns into fabrics and/or storing the same, which in turn results in low yield.

In order to eliminate the foregoing problems, it would seem effective to increase the thickness of the stretched yarns and low melting theremoplastic synthetic resin layers constituting the warp and weft yarns. However, such a method is not effective for imparting the desired stiffness to these yarns. This is because if thick stretched yarns should be prepared by the method, non-uniform multilayer yarns would be obtained.

SUMMARY OF THE INVENTION

Accordingly, a primary object of the present invention is to provide a netlike sheet having good stiffness and excellent retention of sheet-like shape.

Another object of the present invention is to provide a method for effectively producing multilayer yarns for use in making such a netlike sheet.

The present invention has been completed on the basis of the finding that the foregoing problems can be effectively eliminated by utilizing, as warp or weft yarns for weaving a netlike sheet, five-layered yarns composed of two stretched layers or polyolefin resin and an alternating layer of polyolefin resin having a melting point lower than that of the polyolefin in the stretched layers disposed between the two stretched layers and on the outer surfaces thereof and that such a multilayer yarn can be efficiently produced by employing an inflation molding method in which a composite die is used.

Consequently, according to one aspect of the present invention, there is provided a netlike sheet comprising woven warp and weft yarns, either the warp yarns or the weft yarns being a five-layered yarn composed of two stretched layers of polyolefin resin and an alternating layer of polyolefin resin having a melting point lower than that of the polyolefin and the stretched layers disposed between the two stretched layers and on the outer surfaces thereof, and the other being the same five-layered yarn or a three-layered yarn composed of a central stretched layer of polyolefin resin and an alternating layer of polyolefin resin having a melting point lower than that of the polyolefin in the stretched layer disposd on both sides of the stretched layer, the warp and weft yarns being heat bonded at their intersections.

According to another aspect of the present invention, there is provided a method for producing a five-layered yarn comprising the steps of: extruding, into a composite die, a first polyolefin resin and a second polyolefin resin so as to _____

form a three-layered film in which the central layer of the film consists of the first resin and the second resin is welded onto both sides of the central layer, the second resin having a melting point lower than that of the first resin; forming the three-layered film into a cylindrical three-layered structure by extruding the same through the composite die using an inflation molding; cutting the film into long tape-like pieces having a desired width; superposing pairs of the tape-like pieces; then heating the superposed pieces to adhere the polyolefin resin layers having low melting point to each other; and stretchinbg the resultant product.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will hereunder be described in more detail with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic diagram illustrating a netlike sheet according to the present invention;

Fig. 2 is a cross sectional view of the netlike sheet shown in Fig. 1, taken along the line A-A; and

Fig. 3 is a schematic cross sectional view of a multilayer yarn from which the netlike sheet of this invention is produced.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the present invention, the stretched layers forming core members of the 5-layer and 3-layer yarns and the layers

of polyolefin resin having a melting point lower than the material of core members are both formed from polyolefin resins (such as high density polyethylene, low-density polyethylene, medium-density polyethylene, polypropylene,) polyvinyl chloride, polystyrene, polyvinyl alcohol, polyacrylonitrile, polyvinylidene chloride, polyamide or polyester. In this respects, the low-melting-point thermoplastic synthetic resin layer is formed from a thermoplastic synthetic resin whose melting point is lower, by 15 to 35°C, preferably 20 to 30°C, than that of the resin as the material for the stretched core members. The material for the core members is preferably a high-density polyethylene or polypropylene and the materials for the low-melting-point thermoplastic synthetic resin layers are a low-density polyethylene or polypropylene having a low melting point.

The low-melting-point thermoplastic synthetic resin layers may contain inorganic fillers such as silicon oxide, calcium carbonate, talc, kaolin and the like. Among these, preferred are silicon oxide and calcium carbonate and particularly preferred is silicon oxide. These inorganic fillers may be incorporated into the low-melting-point thermoplastic synthetic resin layer in an amount of 0.1 to 4% by weight (hereinafter simply referred to as "%") and more preferably 0.4 to 3%. If a low-density polyethylene is used as the low-melting-point thermoplastic synthetic resin, it is preferable to add such fillers in an amount of 0.1 to 1%, more preferably 0.4 to 0.6%, while if a polypropylene having a low

melting point is used, the content thereof is preferably 1.5 to 3%. The mean particle size of the inorganic fillers is not critical, but is preferably 1 to 8 microns, more preferably 2 to 5 microns. These inorganic fillers may also be incorporated into the core members of the stretched flat yarns.

In a preferred netlike sheet of the invention, the both warp and weft yarns are multilayer yarns having 5-layer structure, which are composed of two stretched layers of polyolefin resin and three layers of low-melting-point polyolefin resin disposed between the two stretched layers and on the outer surfaces thereof. In this respect, the core members (i.e. the two stretched layers) are made from a high-density polyethylene or polypropylene while the low-melting-point resin layers are made from a low-density polyethylene, as mentioned above.

In the netlike sheet of this invention, the materials for obtaining the foregoing two stretched layers may differ from each other. However, it is desirable to form these two layers from the same material from the viewpoint of easy preparation.

In the multilayer yarn having a 5- or 3-layer structure, the stretched layers constituting the core members and the low-melting-point polyolefin resin layers disposed on both sides thereof may have any thickness. However, it is desirable to limit the thickness thereof to 15 to 55 microns and 1 to 5 microns, respectively, and more preferably 20 to 45 microns and 2 to 4 microns. Moreover, said thicknesses in the

multilayer yarns are desirably limited to 35 to 130 microns preferably 60 to 90 microns in the yarn with 5-layer structure and to 17 to 65 microns and preferably 30 to 45 microns in the yarn with 3-layer structure. The multilayer yarn may also have any width, but is preferably between 1 and 4 mm wide.

The multilayered flat yarn having 3-layer structure used herein can be produced by welding or adhering the above-described type of low-melting-point thermoplastic synthetic resin layers to both sides of a stretched flat layer provided as a core member. However, it is preferable to form the final yarn by, in a composite die using two extruders, welding a low-melting-point thermoplastic synthetic resin (which may contain inorganic fillers) to both surfaces of a thermoplastic synthetic resin film which is not formed into a stretched film during extrusion through a composite die, and extruding the resultant welded film so as to form a laminate film (3-layer film) which is then stretched.

On the other hand, the multilayer yarn having a 5-layer structure can be obtained by welding or adhering, together, two stretched layers serving as core members and three low-melting-point polyolefin resin layers disposed on the outer surfaces of the stretched layers and therebetween. However, it is preferred to form such a multilayer yarn of 5-layer structure by extruding the foregoing multilayer yarn having a 3-layer structure through a composite die to form a laminate film, cutting the extruded multilayer film of 3-layer structure into long tape-like pieces of a desired width,

superposing pairs of the tape-like pieces on one another, heating the superposed pieces to adhere the adjacent low-melting-point polyolefin resin layers, thereby forming a flat yarn of 5-layer structure, and finally stretching the 5-layered flat yarn.

The stretching process is carried out because if the yarn is formed in this manner, the inorganic fillers included in the low-melting-point thermoplastic synthetic resin layers tend to be exposed at the outside of the final yarn and the facility with which the flat yarn can be wound is further improved. The core materials can be stretched 4 to 12 times or, preferably, 5 to 8 times the original length. Moreover, the extrusion operation in preparing the 5-layered yarn is preferably carried out by the inflation molding technique whereby multilayer yarn having a cylindrical 3-layer structure is obtained. This makes it possible to easily obtain the superposed pairs of 3-layer structure pieces by simply cutting the same.

The woven netlike sheets of the present invention can be obtained by weaving the aforementioned multilayer yarns as the warp and weft yarns into a fabric using a weaving loom and then heat-welding the warp and weft yarns at the intersections thereof. In this respect, the heat-welding should be carried out at a temperature at which the low-melting-point thermoplastic synthetic resin is molten while the stretched layers acting as the core members are not molten.

In the woven sheets of the present invention, the warp and weft yarns are arranged so that the two adjacent warp yarns and two adjacent weft yarns form square or rectangular spaces having an area of 0.002 to 1.2 cm^2, preferably 0.02 to 0.8 cm^2.

The present invention thus makes it possible to provide netlike sheets exhibiting high level of stiffness and excellent retention of sheet-like shape. Moreover, the netlike sheets of this invention exhibit an advantage in that the meshes of the net are stable during using the same since the warp and weft yarns are welded with one another at the intersections thereof.

In addition, the method of this invention makes it possible to easily produce multilayer yarns utilizing a die having a simple structure compared with the T-die used in conventional extrusion method.

The present invention will hereunder be described in more detail with reference to the following non-limitative working Examples.

Example 1

A netlike sheet of the present invention such as that shown in Fig. 1 was manufactured. In Fig. 1, a netlike sheet 1 was obtained by weaving warp yarns 2 and weft yarns 3 having 5-layer structure and heat-welding these warp and weft yarns at the intersections 4 thereof so that spaces 5 were formed between adjacent pairs of warp yarns and adjacent pairs of

weft yarns. The warp yarns 2 and weft yarns 3 were formed from the same material. As seen from Fig. 3 (a crosss sectional view), the multilayer yarn constituting the warp and weft and having 5-layer structure was composed of two stretched layers 7, 7 and layers 8, 8, 8 of low-melting-point polyolefin resin having a melting point lower than that of the polyolefin resin as the material for the stretched layers, disposed between the two stretched layers and on both outer surfaces thereof.

The stretched layers 7 were produced from a high-density polyethylene (melting point (m.p.) = 134°C; density = 0.960; and the stretch ratio = 7:1 i.e. 7 times the original length) measuring 35 microns in thickness and 2 mm in width, and the low-melting-point thermoplastic synthetic resin layers 8 were composed of a low-density polyethylene (m.p. = 134°C; density = 0.920), measuring 2 microns in thickness and 2 mm in width.

The multilayer yarns used above were prepared by the method described below:

A circular die having a diameter of 200 mm was connected to a core extruder which extruded the high-density polyethylene and a coating extruder which extruded the low-density polyethylene. The low-density polyethylene was introduced into the die, was then divided into two flows therein and was led to both sides of a flow passage through which the high-density polyethylene flowed. The extruded 3-layer film was formed into a cylindrical 3-layer film by the inflation molding technique. The cylindrical 3-layer film was

slit into tape-like pieces which were superposed in pairs which were then heat-welded, cooled, stretched 7 times the original length to form the multilayer yarn of 5-layer structure.

Fabrics were woven from the so-prepared yarns using a weaving loom and, the warp and weft yarns were welded to one another at the intersections thereof in a heat-welded manner. Conditions for the manufacture of the fabrics were as specified below.

(1) Weaving loom used: Water Jet Loom FW 451 manufactured and sold by Nissan Motor Co., Ltd.

(2) Speed of Machine Rotation: 400 rpm

(3) Weaving Width: 130 cm

(4) Cloth Fusion Temperature: 107°C

(5) Heat Welding Conditions:

(i) Heat welding temperature: 120°C

(ii) Pressure applied: 2 kg/cm^2

(iii) Heating time: 4 sec.

(iv) Welding width: 15 mm

Example 2

The procedures of Example 1 were repeated to form a netlike sheet except for using, as the warp yarn, multilayer yarns having 3-layer structure obtained by welding layers of a low-density polyethylene (m.p. = 109°C; density = 0.920; and

stretch ratio = 7:1) containing 0.5% silicon oxide and measuring 35 microns in thickness and 2 mm in width onto both sieds of a stretched layer of a high-density polyethylene (m.p. = 109°C; density = 0.960; and stretch ratio = 7:1) measuring 35 microns in thickness and 2 mm in width.

The netlike sheets produced in Examples 1 and 2 were found to exhibit an extremely high level of stiffness and excellent retention of sheet-like shape during the manufacture and the storage thereof.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A netlike sheet comprising woven warp and weft yarns, either the warp yarns or the weft yarns being a five-layered yarn composed of two stretched layers of polyolefin resin and an alternating layer of polyolefin resin having a melting point lower than that of the polyolefin in the stretched layers disposed between the two stretched layers and on the outer surfaces thereof, and the other being the same five-layered yarn or a three-layered yarn composed of a central stretched layer of polyolefin resin and an alternating layer of polyolefin resin having a melting point lower than that of the polyolefin in the central stretched layer disposed on both sides of the stretched layer, the warp and weft yarns being heat bonded at their intersections.

2. A netlike sheet according to claim 1 wherein the both warp and weft yarns are multilayer yarns having 5-layer structure composed of two stretched layer of polyolefin resin and three layers of polyolefin resin having a melting point lower than that of the polyolefin of the stretched yarn, disposed between the two stretched layers and on both outer surfaces thereof.

3. A netlike sheet according to claim 1 wherein the thicknesses of the stretched layer of polyolefin resin and the low-melting -point polyolefin resin layers are 15 to 55 microns and 1 to 5 microns respectively.

4. A netlike sheet according to claim 1 wherein the width of the multilayer yarn ranges from 1 to 4 mm.

5. A netlike sheet according to claim 1 wherein the stretched layer is formed from a high-density polyethylene or polypropylene, and the ~~other~~ alternating layers are formed from low-melting-point polyolefin resin selected from a low-density polyethylene and polypropylene having a low melting point.

6. A netlike sheet according to claim 1 wherein the melting point of the low-melting-point polyolefin resin is lower than that of the polyolefin resin of the stretched layer by 15 to 35°C.

7. A netlike sheet according to claim 1 wherein the stretch ratio of the stretched layer is 4:1 to 12:1.

8. A netlike sheet according to claim 1 wherein the low-melting-point polyolefin resin layer contains at least one inorganic filler selected from the group consisting of silicon oxide, calcium carbonate, talc and kaolin.

9. A netlike sheet according to claim 8 wherein the inorganic filler is silicon oxide.

10. A netlike sheet according to claim 8 wherein the amount of the inorganic filler ranges from 0.1 to 4% by weight.

11. A netlike sheet according to claim 8 wherein the average particle size of the inorganic filler ranges from 1 to 8 microns.

12. A method for producing a five-layered yarn comprising the steps of: extruding, into a composite die, a first polyolefin resin and a second polyolefin resin so as to form a three-layered film in which the central layer of the film consists of the first resin and the second resin is welded onto both sides of the central layer, the second resin having a melting point lower than that of the first resin; forming the three-layered film into a cylindrical three-layered structure by extruding the same through the composite die using an inflation molding; cutting the film into tape-like pieces having a desired width; superposing pairs of the tape-like pieces; then heating the superposed pieces to adhere the polyolefin resin layers having low melting point to each other; and stretching the resultant product.

13. A method according to claim 12 wherein the superposed and adhered multilayer yarn is stretched by 4 to 12 times.

14. A method according to claim 12 wherein the thickness of the central layer of polyolefin resin and the low-melting-point polyolefin resin layers are 15 to 55 microns and 1 to 5 microns respectively.

15. A method according to claim 12 wherein the width of the multilayer yarn ranges from 1 to 4 mm.

16. A method according to claim 12 wherein the central layer is formed from a high-density polyethylene or polypropylene, and the other layers are formed from low-melting-point polyolefin resin selected from a low-density polyethylene and polypropylene having a low melting point.

17. A method according to claim 12 wherein the melting point of the low-melting-point polyolefin resin is lower than that of the polyolefin resin of the central layer by 15 to 35°C.

18. A method according to claim 12 wherein the superposed pieces are heated at a temperature at which the low-melting-point thermoplastic resin is molten, but the first resin of the central layer is not molten.

19. A netlike sheet substantially as hereinbefore described with reference to the drawings.

Dated this 2nd day of June 1988

DIATEX CO., LTD.
By their Patent Attorneys,
COLLISON & CO.

FIG. 1

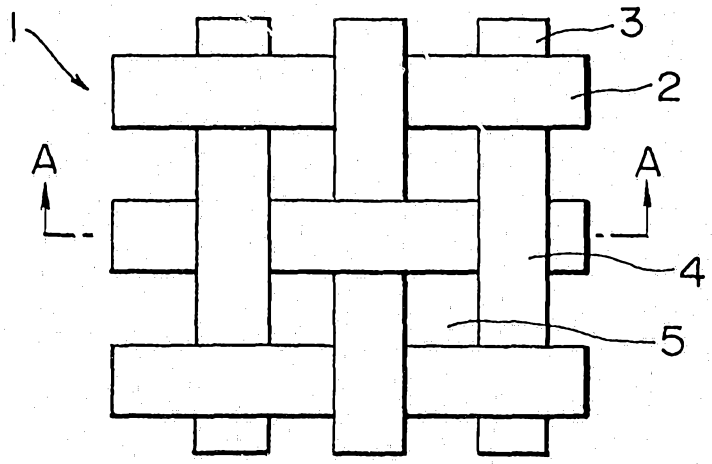

FIG. 2

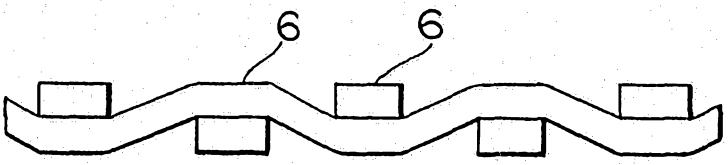

FIG. 3