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(54) **Elastic tubular knitted fabric and process for obtaining the same**

(57) The process comprises making an elastic film, made of a thermoplastic polymer, a pigmentary dispersion and a lubricating agent, obtained in an extrusion process with certain dimensional ratios between the opening for the outlet of material, in the extruder head, and the sheet of film; cutting and stretching the film in certain conditions as to stretch and temperature ratio; and the resultant ribbons are knitted with a preferred

loop structure so that the tubular fabric preferably has an ultimate elongation and an elastic limit respectively in excess of 100% and 20%. The resultant ribbons are all knitted preferably forming a tubular loop structure which has chains of loops (1) running parallel to the longitudinal axis (5) of the tubular fabric, and ribbons (2) perpendicular to said axis interconnecting the chains of loops (figure 1).

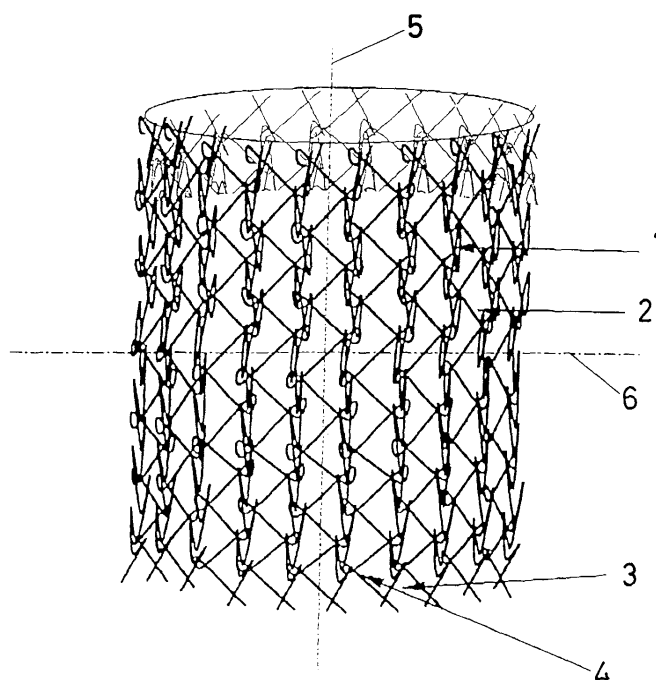


FIG. 1

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Description**OBJECT OF THE INVENTION**

5 **[0001]** The object of the present Patent application is an elastic tubular knitted fabric and a process for obtaining the same which, in addition to the function for which it was designed, contributes a number of advantages that shall be set out hereinafter, besides others inherent in the arrangement and construction thereof.

[0002] More specifically, the invention lies in an elastic tubular knitted fabric made of thermoplastic polymer and a method for making the same in order to obtain a net that is both elastic and has an ultimate elongation such as to
10 combine the compression and adaptability of the extruded net perfectly with the advantages of a flexible and scarcely rigid conventional knitted net. Furthermore, due to the characteristics of the thermoplastic with which it is made, the inventive net greatly improves such properties as the flexibility and scarce rigidity of a conventional knitted net.

[0003] Because of the above-described characteristics, the tubular net of the invention is especially suited for packing products in line, such as garlic, onions, etc., or when the net is required to adapt to the shape of the product contained,
15 for the extent of compression exerted on the packed product may be varied at will due to its elasticity. It is moreover especially suitable for packing frail products, being as it is that there is an almost negligible chance of damaging the packed product due to its great flexibility, not heretofore achieved by any net.

[0004] Furthermore, the elastic tubular net subject of the invention can be used in any of the packing machines existing in the market, be they manual, semiautomatic or automatic, without a seal, with a staple or weld seal.
20

BACKGROUND OF THE INVENTION

[0005] Plastic or paper bags, Raschel fabric sacks and either knitted or extruded tubular net bags have heretofore been used in order for such fruit and vegetable products as citrus fruits, potatoes, onions and the like to be packed.
25 Tubular net has become the most widely used material for bags weighing up to five kilograms.

[0006] Knitted tubular net has a number of advantages over extruded tubular net, such as offering a better ratio between strength and weight of the net, less quantity and volume of plastic material per bag, lowering the cost of recycling, greater flexibility which allows a greater length to be loaded on the tube of the packing machine, less thickness and rigidity which makes it more suitable for frail products, and allowing a wide range of openwork shapes to be provided, such as diamonds, hexagons, rectangles, etc., whereas extruded net may only have a diamond-shaped openwork.
30

[0007] However, a major advantage of extruded over knitted tubular net is its greater capacity to be compressed and hence to be adapted to the shape of the product contained. This is due to the fact that its various filaments are joined by spot welds and the connections are thus rigid, which means that upon the loop being opened, the same always
35 tends to retrieve its original diameter. This exclusive property has resulted in extruded net being preferred by packers when bags are to be made with products in lines, such as garlic, onions, etc., or when the net is required to adapt to the shape of the product contained.

[0008] Now, it would therefore be desirable to combine the advantages of knitted and extruded tubular net as a single net, and moreover improve the flexibility of both nets, in order to be able to provide an alternative to plastic bags for packing such frail products as tomatoes, apples, peppers, etc. Such properties as compression, adaptability and good flexibility have however never been successfully combined in the past in a single net because when a more compressive net was to be obtained, this resulted in a more rigid net, therefore detracting from its flexibility, and where a more flexible net was obtained, it was barely compressible.
40

DESCRIPTION OF THE INVENTION

[0009] The elastic tubular knitted fabric of the present invention is obtained by means of a process comprising making an elastic film, essentially made of a thermoplastic polymer, a pigmentary dispersion and a lubricating agent, obtained in an extrusion process with certain dimensional ratios between the opening for the outlet of material, in the extruder
50 head, and the sheet of film; cutting and stretching the film in certain conditions as to stretch and temperature ratio; and knitting the resultant ribbons with a preferred loop structure so that the tubular fabric has an ultimate elongation and an elastic limit respectively in excess of 100% and 20%.

[0010] The thermoplastic polymer is an ethyleneoctene copolymer; the pigmentary dispersion is a pigment dispersion devoid of such extenders as titanium dioxide in low density polyethylene; and the lubricating agent is a fatty amide lubricant. The mixture of these materials in the ideal proportions confer the film with the property of being elastic and properly processable in all the production process steps.
55

[0011] The dimensional ratios between the opening for the outlet of material, in the extruder head, and the sheet of film consist of a value of approximately 17 for the ratio between the thickness of the opening for the outlet of material

and the thickness of the film, and a value of approximately 0.7 for the ratio between the perimeter for the outlet of material and the width of the sheet of film.

[0012] Said film is cut and stretched to form ribbons suitable to be knitted, with a stretch ratio of less than 1:4 and a temperature not in excess of 50 degrees centigrade.

[0013] The resultant ribbons are all knitted preferably forming a tubular loop structure, with chains of loops running parallel to the longitudinal axis of the tubular fabric, and ribbons perpendicular to said axis interconnecting the chains of loops.

[0014] The chains of loops running parallel to the longitudinal axis are formed by two types of ribbons, one type being knitted only into said chains, and others which are perpendicular to the longitudinal axis and interconnect the chains of loops, preferably in a sequence of one loop consisting of one type of ribbon and the adjacent loop consisting of the other type of ribbon. Both types of ribbons can have different dimensions and their use in the loop structure may be unequal.

[0015] The fabric has an ultimate elongation in excess of 100% and an elastic limit in excess of 20%, and a tensile stress elastic rebound in excess of 25% when stretched beyond 40%; the loop structure being preferably one in which the ribbons forming the structure are cut and stretched in certain conditions as to stretch and temperature ratio.

[0016] An outstanding property of the inventive tubular knitted fabric is that a high elasticity and ultimate elongation are successfully achieved, the tensile strength of the net being in excess of 6.5 kg of strength per gram of weight of the linear metre, which renders the net suitable as concerns its strength to make the most usual bags, i.e. weighing up to 4 kg.

[0017] The following are the most outstanding physical characteristics of the tubular knitted fabric of the invention, compared with those of standard tubular knitted fabrics made with high density polyethylene (HDPE).

	Inventive Fabric	Standard Fabric (HDPE)
Ultimate elongation	160%	20%
Elastic limit	30%	Negligible
Relative elongation	3.2 %/kg	0.3 %/kg
Tensile strength	7.5 kg/g	19.0 kg/g

[0018] The values listed in this table correspond to standard nets made, which are only some of the many embodiments which may be made following the same method.

[0019] The ultimate elongation is the deformation the net suffers, as a percentage of the initial length, when it is applied sufficient tensile stress to be broken.

[0020] The elastic limit is the percentage elongation, with reference to the initial length, which the net may suffer when it is applied a tensile stress, so as to retrieve its initial length when said stress stops acting.

[0021] Relative elongation is the deformation the net suffers, as a percentage over the initial length, for every kilogram of tensile stress exerted.

[0022] Tensile strength is the maximum tensile stress the net can stand until it breaks divided by the weight in grams of a linear metre.

[0023] In order to complete the description made hereinafter and for an easier understanding of its characteristics, attached to this specification is a set of drawings whose figures show the most significant details of the invention for illustrative and non-limiting purposes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Figure 1. Is a partial perspective view of an elastic tubular knitted fabric obtained by means of the process according to the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0025] With reference to the above figure and in accordance with the numbering used, the same shows a preferred embodiment, which does not however limit the invention, consisting of an elastic tubular knitted fabric made with the process described above, wherein the resultant ribbons are knitted so as to form a tubular loop structure as shown in figure 1, and may be seen therein to have chains of loops -1- running parallel to the longitudinal axis -5- of the fabric, and ribbons -2- perpendicular to said axis -5- and parallel to the cross axis -6- of the fabric, interconnecting the chains of loops.

[0026] The chains of loops -1- running parallel to the longitudinal axis also comprise two types of ribbons, some -3-

knitted only into said chains and others -4- perpendicular to the longitudinal axis, interconnecting the chains of loops -1- in a sequence of one loop comprising one type of ribbon, whereas the adjacent loop is made of the other type of ribbon.

Claims

1. AN ELASTIC TUBULAR KNITTED FABRIC AND A PROCESS FOR OBTAINING THE SAME, **characterised** in that said process comprises making an elastic film, essentially made of a thermoplastic polymer, a pigmentary dispersion and a lubricating agent, obtained in an extrusion process with certain dimensional ratios between the opening for the outlet of material, in the extruder head, and the sheet of film; cutting and stretching the film in certain conditions as to stretch and temperature ratio; the resultant ribbons being provided to be knitted with a preferred loop structure so that the tubular fabric has an ultimate elongation and an elastic limit respectively in excess of 100% and 20%.
2. AN ELASTIC TUBULAR KNITTED FABRIC AND A PROCESS FOR OBTAINING THE SAME, in accordance with claim 1, **characterised** in that the thermoplastic polymer is an ethyleneoctene copolymer; whereas the pigmentary dispersion is a pigment dispersion devoid of such extenders as titanium dioxide in low density polyethylene; the lubricating agent being provided to be a fatty amide.
3. AN ELASTIC TUBULAR KNITTED FABRIC AND A PROCESS FOR OBTAINING THE SAME, in accordance with claim 1, **characterised** in that the dimensional ratios between the opening for the outlet of material, in the extruder head, and the sheet of film consist of a value of approximately 17 for the ratio between the thickness of the opening for the outlet of material and the thickness of the film, and a value of approximately 0.7 for the ratio between the perimeter for the outlet of material and the width of the sheet of film.
4. AN ELASTIC TUBULAR KNITTED FABRIC AND A PROCESS FOR OBTAINING THE SAME, in accordance with claims 1 to 3, **characterised** in that said film is cut and stretched to form ribbons suitable to be knitted, with a stretch ratio of less than 1:4 and a temperature not in excess of 50 degrees centigrade.
5. AN ELASTIC TUBULAR KNITTED FABRIC AND A PROCESS FOR OBTAINING THE SAME, in accordance with claims 1 and 4, **characterised** in that the resultant ribbons are all knitted preferably forming a tubular loop structure, with chains of loops (1) running parallel to the longitudinal axis (5) of the tubular fabric, and ribbons (2) perpendicular to said axis interconnecting the chains of loops.
6. AN ELASTIC TUBULAR KNITTED FABRIC AND A PROCESS FOR OBTAINING THE SAME, in accordance with claims 1 and 5, **characterised** in that the chains of loops (1) running parallel to the longitudinal axis (5) are formed by two types of ribbons, one type (3) being knitted only into said chains, and others (4) which are perpendicular to the longitudinal axis and interconnect the chains of loops, preferably in a sequence of one loop consisting of one type of ribbon and the adjacent loop consisting of the other type of ribbon.
7. AN ELASTIC TUBULAR KNITTED FABRIC AND A PROCESS FOR OBTAINING THE SAME, in accordance with claims 1 and 5, **characterised** in that said fabric has an ultimate elongation in excess of 100% and an elastic limit in excess of 20%, and a tensile stress elastic rebound in excess of 25% when stretched beyond 40%; the loop structure being preferably one in which the ribbons forming the structure are cut and stretched in certain conditions as to stretch and temperature ratio.

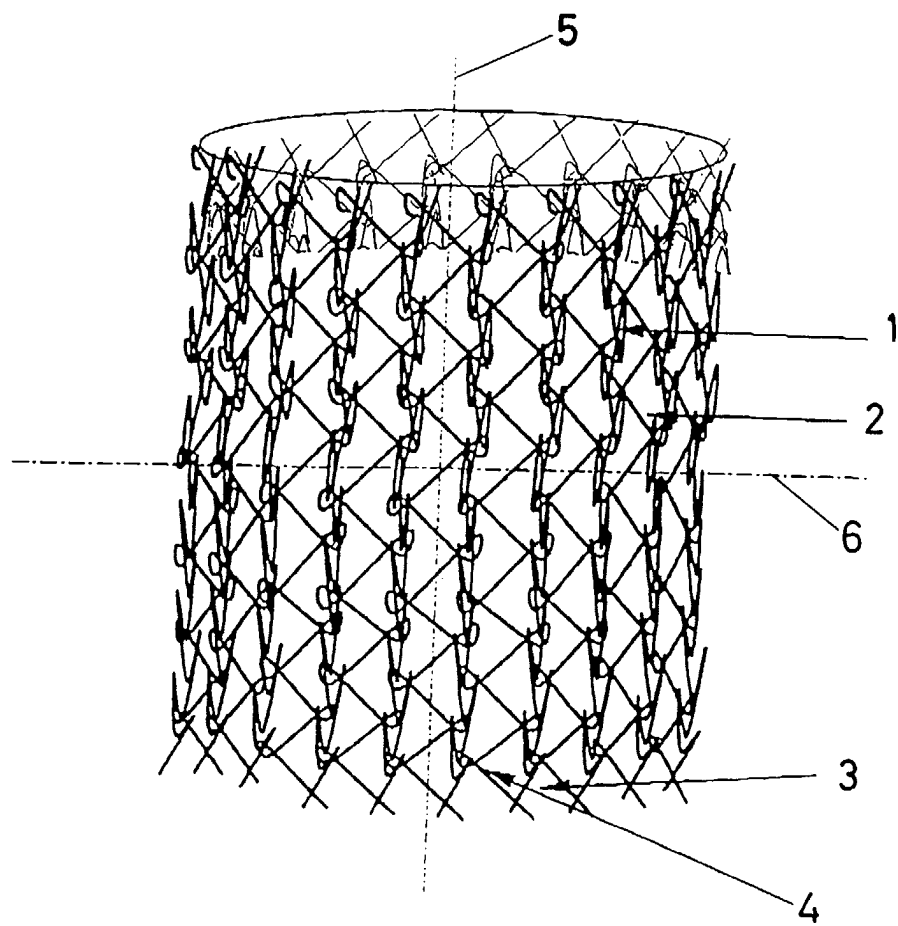


FIG. 1