(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 517 669 A2

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.07.2019 Bulletin 2019/31

(51) Int Cl.:
D04B 21/12 *(2006.01)*

(21) Application number: **18215521.8**

(22) Date of filing: **21.12.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **27.12.2017 ES 201731476**

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(54) **METHOD FOR MANUFACTURING A BI-ELASTIC TUBULAR KNITTED MESH AND RESULTING TUBULAR MESH**

(57) The present invention relates to a method for manufacturing, from a sheet of polymer material, a tubular woven mesh of yarns formed from said polymer material sheet, wherein said polymer material has elasticity on the two axes of the plane that forms the film sheet wherein the process begins, having a process whereby the proportion of stretching, product heating temperature and knitting speed are reduced, obtaining a bi-elastic tubular woven mesh having an elasticity of 40-50% with respect to its size once the mesh is formed and shrinking power of 20-25%, in order to be used for packaging food products such as, for example, garlic and onions.

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Description

[0001] The present invention relates to a method for manufacturing, from a sheet of polymer material, a tubular woven mesh with yarn formed from said sheet of polymer material. The present invention also relates to a tubular woven mesh obtained using this method.

Background of the invention

[0002] Extruded polymer material tubular meshes based on the extrusion of a non-elastic polyethylene material resulting in an extruded mesh exist and, therefore, are part of the state of the art.

[0003] Similarly, there exist a woven mesh resulting from the formation of a base subproduct such as a sheet of material for the subsequent cutting, stretching and knitting thereof. These subproducts have a minimum elasticity and can be even considered rigid, for this specification, since they break when stretched less than 10% and have a preferred composition based on high-density polyethylene.

[0004] Polymer film sheets are known, having a diversity of compositions used and different extrusion methods, to elaborate laminated subproducts having elastic properties with chosen directionality.

[0005] Once these sheets are taken to the cutting, stretching and knitting machines, the method followed in said machines is based on the cutting of the high-density polyethylene film sheet, without practically any associated elasticity, as indicated, in filaments that are stretched in a proportion of 1:7, corresponding to the increase in length that takes place during this process, at a temperature normally above 100 °C, in order to have filament properties that enable said stretching without breaking since, as mentioned earlier, the product is practically rigid at room temperature.

[0006] Also, during knitting, usual mesh production speeds reach approximately 35 metres/minute in order to ensure maximum production without the problem of breaking the filaments converted into yarns to be woven, since the yarns are subjected to greater tensions during knitting as knitting speed increases.

[0007] Also known in the state of the art is the product resulting from the previous process, a tubular mesh from extruded polymer material, which is used, inter alia, for packaging food products such as, for example, garlic and onions and, once introduced therein, are kept inside the mesh, allowing certain relative movement between the mesh and the product contained therein, which causes the product to suffer damage or scraping, and deficient aesthetics and detachment of residue or skin in the interior of the bag due to its internal movement and friction, as in the outer layers of garlic heads, onions, etc.

[0008] Each of these products requires producing a type of mesh having a certain diameter for each type of product, with the ensuing diversity of references produced to cater for the needs of the different types of product.

Description of the invention

[0009] The manufacturing method and product obtained from the present invention resolves the cited drawbacks and has other advantages that will be described below.

[0010] The present invention is based on a novel method for manufacturing a bi-elastic tubular woven mesh from a film sheet of polymer material having specific properties, which until now could not be adapted to cutting, stretching and knitting standard equipment. Said method is composed of various stages and steps which, at least, comprises introducing the film sheet of the polymer product to be transformed, cutting said sheet into filaments, heating and stretching said filaments, lubricating the previously formed yarns and knitting them.

[0011] The method begins with the introduction of the film sheet of polymer material in the corresponding feeding means, i.e. loading roller, wherein said polymer material may have different compositions but the sheet's critical features must include two-way elasticity, understood as longitudinal and transversal elasticity along the sheet plane, maintaining minimum stability due to its polymer-based composition which mixes high- and low-density polymers to avoid, once the yarn is formed, transversal stretching of the necessary minimum width and excessive longitudinal elongation, since both cases makes knitting impossible with guarantees of continuity and with deficiencies in the resulting product.

[0012] Once the film sheet has been obtained, it is cut into filaments of usual size, preferably 1.5 mm in width, and is heated at a temperature between 60 °C and 70 °C, preferably during cutting or subsequent thereto but always prior to stretching. This heating of the polymer makes it possible to modify the initial properties of the film sheet, going from a suitable level of stretching for forming the mesh, i.e. which allows stretching in the desired proportion without problems related to breaking or excessive stretching. It has been verified that heating said film sheet below this temperature range would cause a degree of stretching lower than that indicated, which would result in a highly irregular mesh with a concertina effect. Contrarily, heating the film sheet above said range would result in a higher level of stretching, whereupon the mesh would lose its longitudinal and transversal elasticity and shrinking properties.

[0013] The filaments created are stretched at the indicated temperature, with a configuration of the mechanical developments of the stretching means of the machine wherein said method is carried out, which make it possible to stretch said filaments at between 25% and 35% less tension than those used in known methods, since this is the optimal tension for stretching the filaments of the base material, within the indicated temperature range, to achieve an optimal stretching level of 1:5. This configuration of the mechanical developments for stretching the yarns is achieved by modifying the rollers/pinions wherethrough the cut yarns of the sheet/film pass, having a roller/pinion diameter ratio of approximately 1:5, which would initially be slightly lower, since there has been minimum stretching of the original film sheet, on creating tension in the film sheet due to the passage through the rollers prior to cutting, in the transport of said film sheet.

[0014] After this stretching, wherein the yarns that will be used in the formation of the tubular mesh have been formed, and prior to creating the mesh by knitting, the yarns are lubricated with paraffin, advantageously using a greater amount than usual in the known processes, which lubricate the yarns using 60 g every 1,000 metres of yarn in order to, and advantageously in this method, lubricate the yarns created with paraffin in a proportion of between 110 g and 140 g every 1,000 metres of yarn, having its ideal point of lubrication in a proportion of 125 g every 1,000 metres of yarn, improving the movement of the yarn and knotting thereof during knitting.

[0015] As regards the lubrication in the process, it has also been observed that, applied in different static areas of the process, such as in the static yarn transport/passage guides, the percentage of yarn breakages suffered can be reduced, due to which said areas are lubricated or non-stick means are applied, such as for example PTFE surfaces, which is regularly checked in order not to lose said property. This application of non-stick materials is performed to combat the property of the yarn surface created, which is stickier/more adherent due to the very nature of the film sheet polymer mix.

[0016] Once the plurality of yarns enter a knitting head, wherein the needles of said head knots the knitting yarns, elaborating the mesh. This elaboration is performed at a maximum speed of 10 metres/minute, which implies a speed between 60% and 80% slower than the usual knitting speed of earlier base materials in standard processes, which is usually 35 metres/minute but can be higher. Knitting is performed supervising and modifying the tensions of the yarns in the needles to prevent their shrinkability from causing dropped stitches or snags in the fabric and continuous stops. The knitted structure in which the tubular mesh is formed may be varied, but is preferably elaborated by creating a plurality of longitudinal chains in a zig-zag configuration formed by each yarn, joined at their vertices by means of a knot woven with the adjacent chains on either side, left and right, wherein the knotting is made by the yarns that form the chain, which enables elasticity both in the longitudinal axis and the transversal axis, since that part of the knotting will work the elasticity in said transversal axis together with the transversal elasticity of the yarn, wherein the continuity of the yarn that forms the chain extends longitudinally in a zig-zag configuration.

[0017] The process ends by passing the tubular mesh formed to the product packaging machine for the subsequent shipping thereof, wherein the feeder of the packaging machine makes it possible to load a larger number of metres of manufactured bi-elastic tubular mesh, since the product has an elasticity enabling compression thereof and, therefore, an input of material in the feeding tubes of said packaging machine between 2.5 or 3 times more than regular meshes, which can also be extrapolated to the storage thereof, making it possible for regular polymer material products to have 300% more material than regular extruded mesh in the same space.

[0018] The bi-elastic tubular mesh obtained using this method is formed by a plurality of elastic polymer material yarns having longitudinal and transversal elasticity, which form a tubular knitted fabric forming a structure, usually rhomboid, which makes it possible develop the elasticity of the mesh both longitudinally and transversely in an elasticity of 40-50%, having in turn shrinking properties when subjected to temperatures between 70 °C and 90 °C which cause the mesh to shrink by between 20% and 25%.

[0019] These properties make it possible to adapt the tubular mesh to the products to be packaged, given their elasticity widthwise and lengthwise, adjusting the products and preventing their relative movement with respect to others, avoiding frictions that could damage the appearance of the product. Likewise, the mesh is smoother due to the polymer's properties and to the lesser stretching and lower temperature used in the process.

[0020] This adaptability avoids having to produce different tubular meshes with varying diameters, since it will enable their adaptation to slightly different diameters, given said elasticity in the transversal axis of said tubular mesh. Also, due to its heat-shrinking feature, the mesh adapts more accurately to the shape of the product once introduced in the packaging lines in heat-shrinking tunnels or heat-shrinking machines.

[0021] Therefore, we have a manufacturing method that makes it possible to work a polymer film sheet with properties that until now could not be transformed into a tubular mesh, given the difficulty of the productive industrial treatment thereof, which seeks to obtain the largest possible number of metres of tubular mesh with the lowest risk of breakage of the filaments or yarns, and that would imply an increase in costs due to downtime, obtaining said bi-elastic tubular mesh using this method, making it possible to confer properties to woven tubular mesh not known in the state of the art and which allow it to adapt perfectly to the products it contains, whether due to its elasticity or taking advantage of its heat-shrinking power in the event of a specific rise in temperature.

Brief description of the drawings

[0022] In order to better understand the description made, a set of drawings has been provided which, schematically and solely by way of non-limiting example, represents a practical case of embodiment.

Figure 1 shows a view of a section of the bi-elastic tubular mesh formed.

Figure 2 shows a partial view of two of the chains that form the mesh and their union to form the mesh.

Description of a preferred embodiment

[0023] In the present preferred embodiment of the invention, the manufacturing method of the bi-elastic tubular fabric (10) begins by introducing a film sheet of polymer material in the means for feeding the material to the process, which is composed, in this embodiment, of a multilayered mix of high-density and low-density polymers that form the film sheet used by extrusion and which has two-way elasticity along the plane of the sheet, on being manufactured with a special degree of orientation and formation of the sheet at the outlet of the corresponding extrusion head.

[0024] This coil-shaped sheet film is made to pass through different rollers that stretch it minimally to take it to the cutting stage, wherein the material is heated at the time of cutting at a temperature of 60 °C to 70 °C, which makes it possible to efficiently cut the yarns (11) in widths of 1.5 mm in order to, subsequently and working within said range of temperatures, carry out the stretching stage wherein, through the diameter ratio of the different rollers and pinions that are engaged in the usual transmission of movement of the production equipment, said yarns (11) are stretched at a ratio of 1:5 in their final part and with respect to their initial size in the roller.

[0025] The yarns (11) formed, once cut and stretched to the desired size, are lubricated with paraffin in a proportion of application of 125 g per each 1,000 metres of yarn, which makes it possible to improve the handling conditions in the process, due to the stickier/more adherent nature of the yarn (11) when in contact with other surfaces, such that in addition to this lubrication for the knitting, at various points of the process, wherein there are static points of contact wherealong the yarn (11) extends, is performed a decrease in the adherences between the machines and the yarn (11), incorporating PTFE surfaces, such as Teflon®, in said zones, such that the yarn (11) is less likely to become snagged and therefore broken.

[0026] The bi-elastic tubular mesh (10) is created in the next step, wherein each of the yarns (11) enter a knitting head wherein the needles elaborate bi-elastic tubular mesh (10) at a maximum speed of 10 metres/minute. This elaboration is performed in such a manner that the structure of said bi-elastic tubular mesh (10) is formed by the joining of yarn (11) chains (12), wherein the chains (12) have a zig-zag configuration, joined by their vertices with the adjacent chains (12') on the right and left thereof. These joints 13 on their vertices are made by means of knotting with the two yarns (11) that form each of the chains (12, 12). This configuration of the structure and properties of the film sheet confer an elasticity of 40-50% to the mesh, both along the longitudinal and transversal axis.

[0027] Lastly, the manufacturing method ends with the packaging of said bi-elastic tubular mesh (10) which can be compressed as it is produced, and compressed again a posteriori, for storage thereof and to remove the air to minimise the space thanks to the high elasticity thereof.

[0028] In this manner, the bi-elastic tubular mesh (10) is formed by a plurality of yarns (11) made of polymer material composed of various layers mixing high- and low-density polymers having two-way elasticity of 40-50% which, by knitting, form chains (12, 12') in a zigzag configuration that are joined (13) by their vertices with the adjacent chains on the right and left by knotting to form said bi-elastic tubular mesh (10).

[0029] Said mesh (10) is reduced in size by shrinking by between 20% and 25% when subjected to an increase in temperature, between 70 °C and 90 °C, which makes it possible to produce a mesh (10) with a high degree of elasticity and shrinkability and, thus, suitable for packaging food products such as garlic, onions, etc., adapting to them immediately if their diameter is smaller than that of the mesh and, therefore, must be stretched in order to introduce the products, whereupon it becomes adapted to said products or is adapted by shrinking and reduction when the product packaged in said bi-elastic tubular mesh (10) passes through heating means.

[0030] Despite the fact that reference has been made to a specific embodiment of the invention, it is evident for a person skilled in the art that the method for manufacturing a bi-elastic tubular woven mesh, and the resulting tubular mesh described, is susceptible of numerous variations and modifications, and that all the aforementioned details can be replaced by other technically equivalent ones without detracting from the scope of the protection defined by the attached claims.

Claims

1. Method for manufacturing a bi-elastic tubular woven mesh wherefrom a polymer film sheet emerges which is cut, stretched and knitted to form said tubular mesh, **characterised in that** the method comprises at least the following steps:

- It begins with the introduction of a polymer film sheet in the manufacturing process.
- It is cut into filaments, which are heated before being stretched at a temperature between 60 °C and 70 °C;
- Each of the filaments is stretched at a tension in a proportion of 1:5 with respect to the initial size, forming the yarns (11) that will be woven,
- Each of the yarns (11) are lubricated such that between 110 g and 140 g are applied every 1,000 metres of yarn (11) formed;
- The yarns (11) enter a knitting head, wherein the needles make joints (13) knotting the yarns (11), forming a chain structure (12);

wherein the polymer film sheet has elasticity in the two axes of the sheet plane, longitudinally and transversely, and is composed of a multilayered mixture of high- and low-density polymers.

2. Method for manufacturing a bi-elastic tubular woven mesh, according to claim 1, wherein knitting is performed forming a plurality of longitudinal chains (12, 12') in a zig-zag configuration joined at their vertices with the adjacent chains on either side by knotting (13) with the yarns (11) that form the chains (12, 12').

3. Method for manufacturing a bi-elastic tubular woven mesh, according to claim 1, wherein the film sheet is cut to a size of 1.5 mm per filament.

4. Method for manufacturing a bi-elastic tubular woven mesh, according to claim 1, wherein heating is performed at the same time as cutting or subsequent thereto.

5. Method for manufacturing a bi-elastic tubular woven mesh, according to claim 1, wherein the lubrication of the yarns (11) are performed applying 125 g every 1,000 metres of yarn (11).

6. Method for manufacturing a bi-elastic tubular woven mesh, according to claim 1, wherein the lubrication of the process is additionally performed using lubricating or non-stick means on the static yarn transport/passage guides.

7. Method for manufacturing a bi-elastic tubular woven mesh, according to claim 1, wherein the maximum speed of elaboration by knitting is 10 metres/minute.

8. Method for manufacturing a bi-elastic tubular woven mesh, according to claim 1, wherein the product is packaged subsequent to knitting for the subsequent shipping thereof, compressing the bi-elastic tubular mesh (10).

9. Bi-elastic tubular woven mesh obtained by the method described in the preceding claims, **characterised in that** the bi-elastic tubular mesh (10) comprises a plurality of yarns (11) having longitudinal and transversal elasticity properties, which form the knitted structure of the tubular mesh, wherein the bi-elastic tubular mesh (10) has a transversal and longitudinal elasticity of between 40% and 50% and shrinks between 20% and 25% at a temperature between 70 °C and 90 °C.

10. Bi-elastic tubular woven mesh, according to claim 9, wherein the structure of the bi-elastic tubular mesh (10) is formed by chains (12, 12') in a zig-zag configuration, which are joined (13) by their vertices to the adjacent chains on the right and left by knotting.

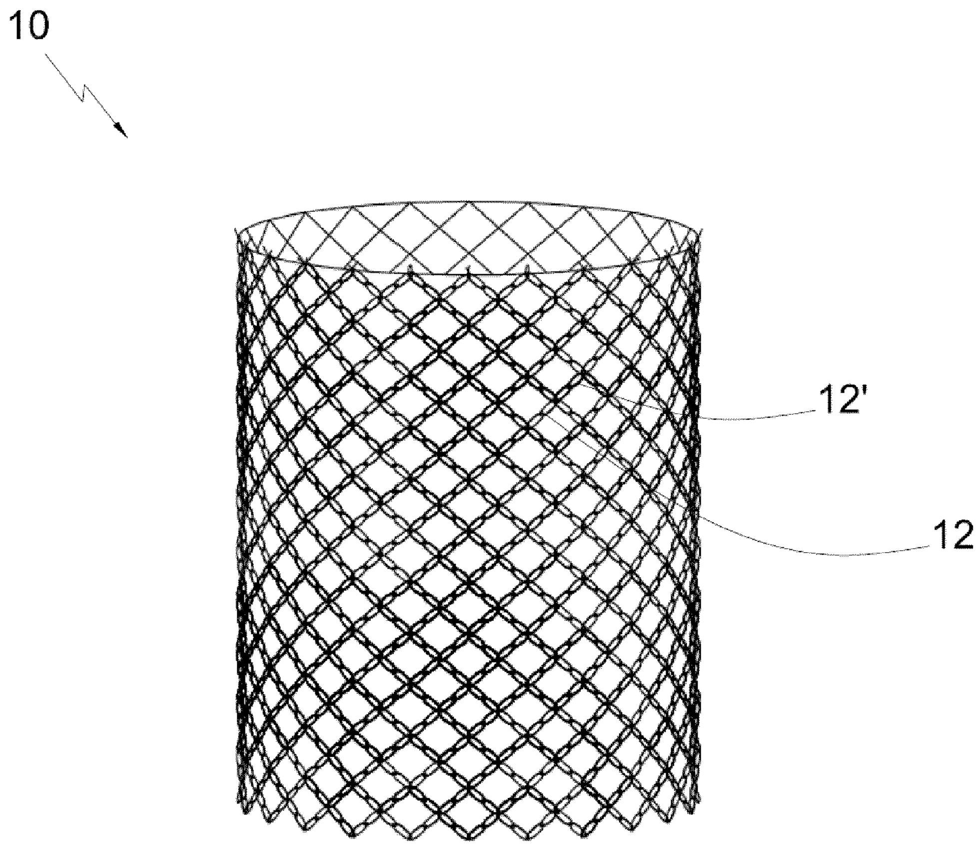

Fig. 1

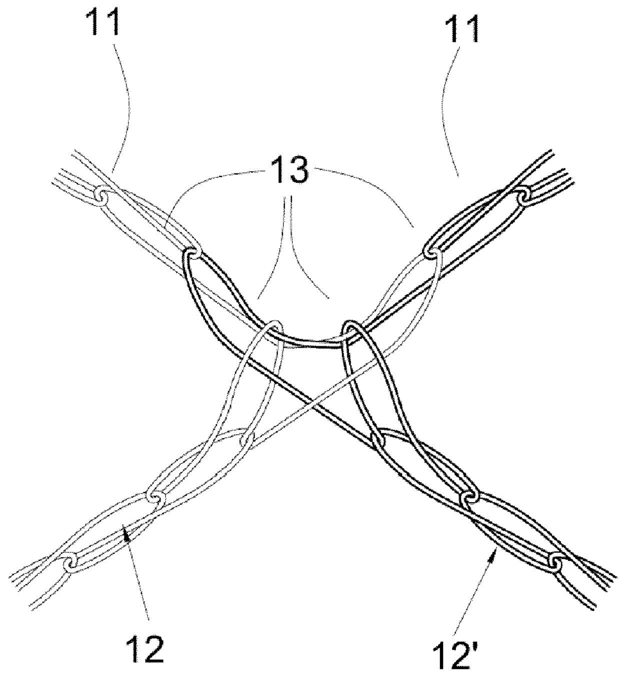

Fig. 2