



- (51) **International Patent Classification:**  
D04B 1/10 (2006.01) D04B 1/06 (2006.01)  
D04B 1/26 (2006.01)
- (21) **International Application Number:** PCT/EP20 15/070642
- (22) **International Filing Date:** 9 September 2015 (09.09.2015)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**  
MI2014A001568 11 September 2014 (11.09.2014) IT  
102015000033270 13 July 2015 (13.07.2015) IT
- (71) **Applicant:** CALZIFICIO PINELLI S.R.L. [IT/IT]; Via Germania, 11, 46042 Castel Goffredo (IT).
- (72) **Inventors:** PINELLI, Enzo; Via Germania, 13, 1-46042 Castel Goffredo (IT). PINELLI, Michele; Via Degli Alpini, 150, 1-46042 Castel Goffredo (IT). PINELLI, Luca; Via Mazzini, 70, 1-25015 Desenzano Del Garda (IT).
- (74) **Agent:** MODIANO, Micaela; Modiano & Partners, Via Meravigli, 16, 20123 Milano (IT).
- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

[Continued on nextpage]

(54) **Title:** METHOD FOR MANUFACTURING TUBULAR ARTICLES PROVIDED WITH A GRIP REGION BY WAY OF CIRCULAR HOSIERY KNITTING MACHINES, AND TUBULAR ARTICLE OBTAINED WITH THE METHOD

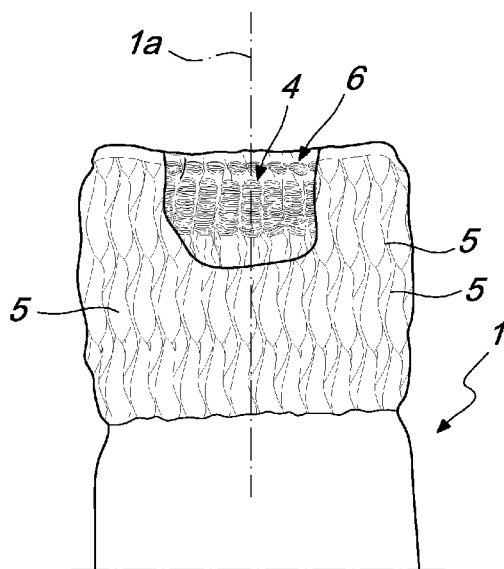


Fig. 2

(57) **Abstract:** A method for manufacturing tubular articles (1) provided with a grip region on their reverse side, particularly for providing hold-up stockings, by way of circular hosiery knitting machines, and a tubular article (1) obtained with the method, comprising the use of a circular hosiery knitting machine that has at least two feeds or drops, of which at least one first feed is capable of dispensing a bare elastomer yarn (3). According to the method of the invention, at the first feed, at least one needle of at least one group of contiguous needles is moved to a "tuck" position or to a "drop" position knit in order to pick up the bare elastomer yarn (3) while the other needles of the group of needles are held in or moved to the "miss" position and therefore excluded from picking up the bare elastomer yarn (3), and the needles of the group of needles are actuated at at least one subsequent feed in order to pick up the yarn or yarns dispensed at such subsequent feed and form knitting at least with the needles that were held in the "miss" position at the first feed.



**Published:**

— with international search report (Art. 21(3))

METHOD FOR MANUFACTURING TUBULAR ARTICLES PROVIDED WITH  
A GRIP REGION BY WAY OF CIRCULAR HOSIERY KNITTING MACHINES,  
AND TUBULAR ARTICLE OBTAINED WITH THE METHOD

5

The present invention relates to a method for manufacturing tubular articles provided with a grip region on their reverse side, particularly for providing hold-up stockings, by way of circular hosiery knitting machines, and to a tubular article obtained with the method.

10 As is known, hold-up stockings are provided, proximate to their upper end, with a band that is intended to grip the upper region of the thigh of the user in order to perform a stocking hold-up effect, thus avoiding the use of suspenders.

In some cases, the grip of the stocking on the skin of the user is  
15 obtained simply by providing, at the upper end of the article, an elastic band which is knitted as a double welt and tightens around the thigh of the user. This solution has the drawback of achieving insufficient grip, since, owing to the conical shape of the thigh, with use the elastic band tends to slip downward and roll up along the article.

20 In other cases, an elastic band, generally made of lace, is applied to the upper end of the article and a strip or multiple strips of silicone are spread on the inner side thereof, which have the effect of increasing the adhesion of such band to the skin of the user, thus contrasting the descent of the band along the thigh of the user.

25 This solution achieves a better hold-up effect than the previous solution, although often this effect is still insufficient to prevent the descent and roll-up of the article during use. Furthermore, the application of the elastic band spread with silicone significantly increases the production cost of these articles.

30 The aim of the present invention is to solve the problems described

above, by devising a method that makes it possible to manufacture tubular articles, in particular hold-up stockings, by way of circular hosiery knitting machines, by providing a grip region on the reverse side of the articles directly during the production of the article with the circular hosiery knitting  
5 machine.

Within this aim, an object of the invention is to propose a method that makes it possible to manufacture tubular articles, particularly hold-up stockings, which are provided with a greater grip effect than that obtainable with methods of known type, while also preventing the roll-up of the article  
10 along the thigh of the user.

A further object of the invention is to propose a method that makes it possible to manufacture articles, particularly hold-up stockings, with highly competitive production costs.

A still further object of the invention is to propose a method that can  
15 be carried out with circular hosiery knitting machines, preferably of the single-cylinder type, with electronic selection of known type without the need to perform structural modifications thereof but simply by performing software modifications that are simple to carry out.

Another object of the invention is to propose a method that makes it  
20 possible to manufacture comfortable articles.

This aim, as well as these and other objects that will become better apparent hereinafter, are achieved by a method for manufacturing tubular articles provided with a grip region on their reverse side, particularly for providing hold-up stockings, by way of circular knitting machines, which  
25 comprises the use of a circular hosiery knitting machine that has at least two feeds or drops, of which at least one first feed is capable of dispensing a bare elastomer yarn, devices for selecting needles in order to move some of the needles of the machine to pick up the yarn or yarns dispensed at said feeds, while other needles are excluded from picking up the yarn or yarns  
30 dispensed at said feeds, cams for actuating the needles in order to move said

needles to pick up the yarn or yarns dispensed by said feeds to a "tuck" position or to a "drop" position or in order to move said needles to a "miss" position for their exclusion from picking up the yarn or yarns dispensed at said feeds, said method being characterized in that, at said first feed, at least one needle of at least one group of contiguous needles is moved to knit in order to pick up the bare elastomer yarn while the other needles of said group of needles are held in or moved to the "miss" position and therefore excluded from picking up said bare elastomer yarn, and in that the needles of said at least one group of needles are actuated at at least one subsequent feed in order to pick up the yarn or yarns dispensed at said subsequent feed and form knitting at least with the needles that were held in the "miss" position at said first feed.

The article obtained with the method according to the invention has a grip region on its reverse side and is characterized in that said grip region is defined by floating portions or bridles of bare elastomer yarn which protrude on the reverse side of the article and are knitted in with the other yarns that compose the article.

Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the method according to the invention and of an article obtained with the method, which is illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a side view of an article obtained with the method according to the invention, as it is unloaded from the circular hosiery knitting machine used for its production;

Figure 2 is an enlarged-scale and partially cross-sectional view of a portion of the article obtained with the method according to the invention;

Figure 3 is an enlarged-scale view of a detail of the article turned inside out, relating to the grip region;

Figure 4 is a view of the same detail as Figure 3, tensioned at right

angles to the axis of the article.

With reference to the figures, the method according to the invention, for providing a tubular article provided with a grip region on its reverse side, in particular a hold-up stocking of the type shown in the figures, 5 comprises the use of a circular hosiery knitting machine that has at least two feeds or drops, of which at least one first feed is equipped to dispense a bare elastomer yarn to the needles of the machine that pass at this feed. The circular machine used to carry out the method according to the invention is provided with electronic needle selection devices of known type, which 10 make it possible to select the needles of the machine that must be actuated to pick up the yarn or yarns dispensed at the feeds or drops of the machine while other needles are excluded from picking up this yarn or these yarns. Furthermore, such machine is provided, in a manner known per se, with needle actuation cams in order to move the needles to pick up the yarn or 15 yarns dispensed by the feeds in a "tuck" position or in a "drop" position or in order to move the needles to a "miss" position in order to exclude them from picking up the yarn or yarns dispensed at the feeds.

It should be noted that in the present description the expression "reverse side" of the article is understood to mean the side of the article that 20 is intended to be directed toward the skin of the user.

The circular hosiery knitting machine that can be used to carry out the method according to the invention is obviously provided, in a manner known per se, with other elements and devices, such as for example sinkers, yarn feeders, etc.

25 More particularly, in the preferred hypothesis of using a single-cylinder circular hosiery knitting machine and of manufacturing the article with the needles located in the needle cylinder which is arranged with its axis vertically, the picking-up of the yarn or yarns by needles in the "tuck" position is performed by lifting, by way of the corresponding actuation 30 cams, the needles to a height level such that their tip or head is extracted

upward by the sinkers, but to a height level that is not sufficient to allow the loop or loops of knitting which were formed previously to slide below the latch of the corresponding needle. In this manner, upon the subsequent descent, caused by the corresponding actuation cams, these needles will form a new loop of knitting without knocking over the loop or loops formed previously, which remain, together with the new loop, in the head or tip of the corresponding needle.

The picking-up of the yarn or yarns by needles in the "drop" position is performed by lifting, by way of the corresponding actuation cams, the needles to a height level such that their tip or head is extracted upward by the sinkers in order to pick up the yarn or yarns at a height level that is sufficient to allow the loop or loops of knitting which were formed previously to slide below the latch of the needle. In this manner, upon the subsequent descent, caused by the corresponding actuation cams, these needles will form a new loop of knitting, knocking over or dropping the loop or loops of knitting which were formed previously.

When the needles are in the "miss" position, their head or tip is located below the knockover plane of the sinkers and holds the loop or loops of knitting which were formed previously. In this position, the needles cannot pick up the yarn or yarns dispensed at the corresponding feed and therefore cannot form knitting.

In the method according to the invention, at the first feed, at least one needle of at least one group of contiguous needles is moved to knit so that at least one needle picks up the bare elastomer yarn while the other needles of the group of needles are held or moved to the "miss" position and therefore excluded from picking up the bare elastomer yarn. The needles of the group of needles are actuated at at least one subsequent feed so as to pick up the yarn or yarns dispensed at this subsequent feed and form knitting at least with those needles which, at the first feed, had been held or moved to the "miss" position.

Preferably, at the first feed, the at least one needle, which is actuated to pick up the bare elastomer yarn, is actuated so as to pick up such yarn in the "tuck" position.

As an alternative, at the first feed, the at least one needle, which is  
5 actuated to pick up the bare elastomer yarn, is actuated in order to pick up such yarn in the "drop" position.

Preferably, at the at least one subsequent feed, the needle that picked up the bare elastomer yarn at the first feed is actuated in order to pick up the yarn or yarns, dispensed by the at least one subsequent feed, in the "tuck"  
10 position.

Conveniently, after the production of a preset number of rows of knitting by the other needles of the group of needles, i.e., by the needles that did not pick up the bare elastomer yarn at the first feed, the needle that picked up the bare elastomer yarn is actuated, at the at least one subsequent  
15 feed, so as to pick up the yarn or yarns dispensed by this feed in the "drop" position and so form a new loop of knitting, dropping the loops of knitting which were formed previously and held in its head.

Without altering the fact that it is possible to use machines with a different number of feeds or drops, the method according to the invention is  
20 preferably carried out by using a circular hosiery knitting machine with four feeds arranged in sequence around the axis of the needle cylinder of the machine along the direction of rotation of the needle cylinder with respect to the feeds or drops.

Preferably, if one wishes to provide a grip region that is extended  
25 circumferentially on the reverse side of the article, substantially all the needles of the machine are used, dividing them into multiple groups of needles, where the needles of each group are selected and actuated as explained above with reference to the at least one group of needles.

Each group of needles is preferably composed of from 7 to 16  
30 contiguous needles and, at the first feed, where the bare elastomer yarn is



dispensed, each group of needles is selected according to a first selection comprised between 1:6 and 1:15, i.e., a selection that causes the actuation of one needle to pick up the bare elastomer yarn in the "tuck" position and the retention or passage of a number of contiguous or, rather, subsequent  
5 needles (which pass subsequently at the first feed) comprised between 6 and 15 in the "miss" position.

As an alternative, each group of needles can comprise from 8 to 17 contiguous needles and the selection of the needles at the first feed can be comprised between 2:6 and 2:15, i.e., a selection that causes the actuation of  
10 two contiguous needles to pick up the bare elastomer yarn in the "tuck" position and the retention or passage of a number of contiguous or, rather, subsequent needles (which pass subsequently at the first feed) comprised between 6 and 15 in the "miss" position.

At the at least one subsequent feed, preferably at the second feed,  
15 each group of needles is selected according to a second selection chosen from among 1:1, with one needle actuated to pick up the yarn or yarns in the "tuck" position and one needle actuated to pick up the yarn or yarns in the "drop" position for every two contiguous needles of the group of needles, or 2:2, with two contiguous needles actuated to pick up the yarn or yarns in the  
20 "tuck" position and two contiguous needles actuated to pick up the yarn or yarns in the "drop" position for every four contiguous needles of the group of needles, or 2:1, with two contiguous needles actuated to pick up the yarn or yarns in the "tuck" position and one needle actuated to pick up the yarn or yarns in the "drop" position for every three contiguous needles of the  
25 group of needles, or 1:2, with one needle actuated to pick up the yarn or yarns in the "tuck" position and two contiguous needles actuated to pick up the yarn or yarns in the "drop" position for every three contiguous needles of the group of needles.

At this second feed, the needles that picked up the bare elastomer  
30 yarn at the first feed belong to the needles that are moved to knit to pick up

the yarn or yarns in the "tuck" position.

It should be noted that, in the transition from the first feed to the second feed, the needles that picked up the bare elastomer yarn at the first feed in the "tuck" position are not lowered. This is achieved by deactivating  
5 the lowering cam of the needles at the first feed. Owing to the fact that these needles are not lowered, at the second feed they pick up the yarn or yarns dispensed by this feed in a position that is slightly higher than the "tuck" position and therefore drop the previously formed stitches on their stem.

At the second feed, the needles, after picking up the yarn or yarns, are  
10 lowered in order to form new loops of knitting.

At the third feed, the needles that picked up the bare elastomer yarn at the first feed are actuated again in the "tuck" position in order to pick up the yarn or yarns dispensed by this feed for a preset number of rotations of the needle cylinder, while the other needles of the group of needles are actuated  
15 in the "drop" position in order to pick up the yarn or yarns dispensed at this third feed and form knitting, knocking over the previously formed loops of knitting. After this preset number of turns, the needles that picked up the bare elastomer yarn at the first feed are actuated in order to pick up the yarn or yarns in the "drop" position so as to form new loops of knitting, dropping  
20 the loops of knitting which were formed previously and held in their head, and a needle that is contiguous to these is actuated in order to pick up the yarn or yarns in the "tuck" position. At the subsequent rotation of the needle cylinder, knitting resumes as for the previous rotations. In particular, at this third feed, the needles that picked up the bare elastomer yarn at the first feed  
25 are actuated again in the "tuck" position for another preset number of rotations of the needle cylinder.

At the third feed, the needles, after picking up the yarn or yarns, are lowered in order to form new loops of knitting.

At the fourth feed, the needles of each group of needles are selected  
30 and actuated in a manner similar to what was done at the second feed.

At the fourth feed, the needles, after picking up the yarn or yarns, are lowered in order to form new loops of knitting.

It should be noted that, in the various rotations of the needle cylinder about its own axis in order to form knitting, during the formation of the grip region, the selection of the needles at the various feeds is not changed, apart from the different actuation, at the third feed, after a preset number of rotations, of the needles that picked up the bare elastomer yarn at the first feed, as described.

The preset number of rotations of the needle cylinder after which, at the third feed, the actuation in the "drop" position of the needles that picked up the bare elastomer yarn at the first feed intervenes, is comprised substantially between 4 and 9.

It should be noted, furthermore, that, at the second and fourth feeds, the needles that picked up the bare elastomer yarn at the first feed are actuated in the "tuck" position to pick up the yarn or yarns dispensed by these feeds.

The tubular knitted article that is obtained with the method according to the invention, which is designated generally by the reference numeral 1, has, on its reverse side, a grip region 2 which is defined by floating portions or bridles of bare elastomer yarn 3 which protrude on the reverse side of the article 1 and are knitted in with the other yarns that compose the article 1. The floating portions or bridles of yarn 3 are generated by the lack of pickup of the bare elastomer yarn by the needles of the various groups of needles that are moved to or held in the "miss" position at the first feed, as explained above.

The grip region 2 is preferably defined by one or more circumferential bands 4, each one composed of multiple turns or rows of these floating portions of bare elastomer yarn 3, which are mutually side-by-side along the axis 1a of the article 1.

In the embodiment shown in the figures, which relates to a hold-up

stocking, the grip region 2 is composed of three circumferential bands 4, which are mutually spaced apart along the axis 1a of the article 1.

Figure 1 shows a hold-up stocking or, rather, a semifinished article for the production of a hold-up stocking as it is unloaded from the circular hosiery knitting machine that produced it. Such semifinished article has both ends open. One of these two ends is intended to be closed by sewing or looping in order to provide the finished product.

The grip region 2 which is obtained with the method according to the invention is located proximate to the opposite end, i.e., the end that constitutes the upper end of the hold-up stocking.

The bare elastomer yarn that defines the grip region 2 is preferably made of silicone rubber.

Conveniently, at the grip region 2, the article 1 is provided with gathered portions 5 which are produced preferably by a pre-tensioning of the bare elastomer yarn 3 during its feeding to the needles of the machine in the production of the article 1.

The knitting-in of the bare elastomer yarn 3 with the yarns that compose the remaining part of the article 1, as can be deduced from the description given above of the method for its production, is performed by way of tuck-stitch knitting and the knitting-in stitches, i.e., the stitches for joining the floating portions of bare elastomer yarn 3 to the remaining part of the article 1, are preferably mutually aligned parallel to the axis 1a of the article 1.

Preferably, each floating portion of bare elastomer yarn 3 extends for a number of rows of stitches that is substantially comprised between 6 and 15.

The yarns used to produce the article, which are different from the bare elastomer yarn, can be constituted at least partially by elastically extensible yarns.

The method according to the invention makes it possible to unload

from a circular hosiery knitting machine an article 1 that is already provided with a grip region 2 on the reverse side which can be used to hold the article 1 to the skin of the user. In particular, if the article is constituted by a hold-up stocking, this grip region ensures optimum effectiveness in holding the upper end of the stocking to the thigh of the user, effectively contrasting its descent and its roll-up during use.

In particular, owing to the fact that, during the production of the grip region 2, the needles that picked up the bare elastomer yarn 3 at the first feed of the machine are moved to knit in the "tuck" position at the subsequent feeds, one achieves the effect of having rows of knitting (the ones formed by the needles that picked up the bare elastomer yarn 3) that are less elastically yielding than the other rows of knitting (produced by the needles that did not pick up the bare elastomer yarn 3). This particular method of execution of the grip region 2 achieves the effect of elastically loading this region toward the inside of the article i.e. toward the skin of the user, effectively contrasting the outward roll-up of the article.

The optional, preferred execution of the elastically extensible gathered portions 5 has the effect of further reinforcing the resistance to roll-up of the article.

Merely by way of non-limiting example, below are two examples are given of practical execution of the method according to the invention for the production of a hold-up stocking.

#### Example 1

A single-cylinder circular hosiery knitting machine provided with 400 needles and with four feeds or drops is used.

The needles of the machine are divided into groups of 12 needles.

The article 1 to be provided is a hold-up stocking of the type shown in the figures.

Production of the article 1 begins from the upper end of the article 1, i.e., the opposite end with respect to the toe of the stocking.

After a preset number of rotations of the needle cylinder, during which an initial portion of the stocking is provided in a manner known per se, the provision of the grip region 2 begins and occurs as follows.

At the first feed, the knockover cam is extracted, in the sense that it is rendered inactive so as to not actuate the needles.

At this first feed, the bare elastomer yarn 3 is dispensed and the needles of each group of needles are selected according to a 1:11 selection, so that one needle of the group is actuated in order to pick up the bare elastomer yarn 3 in the "tuck" position while the other 11 needles are moved to or held in the "miss" position. In view of the deactivation of the knockover cam, the needle of each group that picked up the bare elastomer yarn 3 passes to the second feed already in the "tuck" position or, more precisely, in a position in which it is raised only slightly more than the "tuck" position.

At the second feed, the needles of each group are selected according to a 1:1 selection so that, for every two contiguous needles, one needle is actuated to pick up the yarns dispensed by said feed, in the "tuck" position, while the other needle is actuated to pick up the yarns, dispensed by said feed, in the "drop" position. The needle that picked up the bare elastomer yarn 3 at the first feed is one of the needles which, at this second feed, pick up the yarns in the "tuck" position. At this second feed, the needles are fed with three yarns, of which two are 78/46 (with count = 78 decitex and 46 strands) and one is 44/34 (with count = 44 decitex and 34 strands). The supply of three yarns at the second feed has the function of strengthening the grip region 2, effectively preventing said region from rolling up with use.

After the pickup of the yarns dispensed by this second feed, the needles are lowered in order to form new loops of knitting.

At the third feed, for each group of needles, a 1:11 selection of the needles is performed, with one needle being raised to pick up the yarns in

the "tuck" position and 11 needles being raised in the "drop" position. The needle that is raised to the "tuck" position is the needle that picked up the bare elastomer yarn 3 at the first feed. This occurs for a preset number of rotations of the needle cylinder which is preferably equal to 4, then, at the fifth rotation and for only one rotation, this needle is raised to the "drop" position and a contiguous needle is raised to the "tuck" position. At this feed, the needles, both the ones that are raised to the "tuck" position and the ones that are raised to the "drop" position, are fed with two 78/46 yarns (with count = 78 decitex and 46 strands).

10 After the pickup of the yarns dispensed by this third feed, the needles are lowered in order to form new loops of knitting.

At the fourth feed, the needles of each group are selected, as at the second feed, according to a 1:1 selection so that for every two contiguous needles one needle is actuated to pick up the yarns dispensed by this feed in the "tuck" position, while the other needle is actuated to pick up the yarns dispensed by this feed in the "drop" position. The needle that picked up the bare elastomer yarn 3 at the first feed is one of the needles that, at this fourth feed, pick up the yarns in the "tuck" position. At this fourth feed, the needles are fed with three yarns, of which two are 78/46 (with count = 78 decitex and 46 strands) and one is 44/34 (with count = 44 decitex and 34 strands). In this case also, the provision of three yarns has the function of strengthening the grip region 2, effectively preventing such region from rolling up with use.

25 After picking up the yarns dispensed by this fourth feed, the needles are lowered in order to form new loops of knitting.

With this technique, three circumferential bands 4 are provided with portions of bare elastomer yarn 3 that float on the reverse side of the article 1. The circumferential regions located between the circumferential bands 4 provided with bare elastomer yarn 3 can be provided in a manner known per se, or as described, but omitting to feed the bare elastomer yarn 3 to the

needles.

Optionally, before beginning the provision of the grip region 2, it is possible to perform a few rotations of the needle cylinder (three rotations are performed in the example shown), during which some needles, preferably different from those which are actuated at the first feed during the provision of the grip region 2, are fed with the bare elastomer yarn 3 (optionally dispensed always at the first feed), while the other needles are excluded from picking up the bare elastomer yarn 3 so as to obtain a circumferential band 6 of reduced height, again with portions of bare elastomer yarn 3 that float on the reverse side of the article 1, optionally offset with respect to the floating portions of bare elastomer yarn 3 of the grip region 2.

After the provision of the grip region 2, the production of the article 1 continues in a manner known per se up to the provision of the toe of the article 1, after which the article 1 is unloaded from the machine.

### Example 2

A single-cylinder circular hosiery knitting machine provided with 400 needles and with four feeds or drops is used.

The needles of the machine are divided into groups of 12 needles as in example 1.

In this second example of practical embodiment of the method according to the invention, the same operations already described in example 1 are carried out, with the difference that, at the first feed of the machine, the needle of each group of needles that is actuated in order to pick up the bare elastomer yarn 3 is moved to knit in the "drop" position instead of in the "tuck" position.

In practice it has been found that the method according to the invention fully achieves the intended aim, since it makes it possible to manufacture articles provided with a grip region on their reverse side, particularly hold-up stockings, which is provided directly during the



formation of the article with a hosiery knitting machine, without requiring the execution of a double welt and/or additional knitting in order to provide such grip region.

Another advantage of the method according to the invention is that it  
5 allows the provision of articles in which roll-up of the grip region during use does not occur.

The method thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other, technically equivalent  
10 elements. Thus, for example, the manufacture of the article can begin from one axial end thereof or from the opposite axial end, i.e., in hosiery, from the toe or from the top.

Although the invention has been conceived in particular for the production of hold-up stockings, it can also be used to manufacture other  
15 types of hosiery, such as for example knee-highs, or for other types of finished or semifinished tubular articles.

In practice, the materials used, unless otherwise specified above, as well as the dimensions, may be any according to the requirements and the state of the art.

20 The disclosures in Italian Patent Applications No. MI2014A001568 (102014902292281) and No. 102015000033270 from which this application claims priority are incorporated herein by reference.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole  
25 purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

### CLAIMS

1. A method for manufacturing tubular articles provided with a grip region on their reverse side, particularly for providing hold-up stockings, by way of circular knitting machines, which comprises the use of a circular hosiery knitting machine that has at least two feeds or drops, of which at least one first feed is capable of dispensing a bare elastomer yarn, devices for selecting needles in order to move some of the needles of the machine to pick up the yarn or yarns dispensed at said feeds, while other needles are excluded from picking up the yarn or yarns dispensed at said feeds, cams for actuating the needles in order to move said needles to pick up the yarn or yarns dispensed by said feeds to a "tuck" position or to a "drop" position or in order to move said needles to a "miss" position for their exclusion from picking up the yarn or yarns dispensed at said feeds, said method being characterized in that, at said first feed, at least one needle of at least one group of contiguous needles is moved to knit in order to pick up the bare elastomer yarn while the other needles of said at least one group of needles are held in or moved to the "miss" position and therefore excluded from picking up said bare elastomer yarn, and in that the needles of said at least one group of needles are actuated at at least one subsequent feed in order to pick up the yarn or yarns dispensed at said subsequent feed and form knitting at least with the needles that were held in the "miss" position at said first feed.

2. The method according to claim 1, characterized in that, at said first feed, said at least one needle is actuated in order to pick up said bare elastomer yarn in the "tuck" position.

3. The method according to claim 1, characterized in that, at said first feed, said at least one needle is actuated to pick up said bare elastomer yarn in the "drop" position.

4. The method according to one or more of the preceding claims, characterized in that, at said at least one subsequent feed, the at least one

needle, which picked up the bare elastomer yarn at said first feed, is actuated to pick up the yarn or yarns dispensed by said at least one subsequent feed in the "tuck" position.

5 5. The method according to one or more of the preceding claims, characterized in that said bare elastomer yarn is fed to said at least one needle in a pre-tensioned condition.

10 6. The method according to one or more of the preceding claims, characterized in that, after the production of a preset number of rows of knitting by said other needles of the at least one group of needles, at said at least one subsequent feed, said at least one needle is actuated to pick up the yarn or yarns in the "drop" position in order to form new loops of knitting, knocking over the loops of knitting formed previously and held in the head of said at least one needle.

15 7. The method according to one or more of the preceding claims, characterized in that it uses a circular hosiery knitting machine with four feeds or drops arranged in sequence around the axis of the needle cylinder of the machine along the direction of rotation of the needle cylinder with respect to said feeds or drops, and in that, for each one of said groups of needles:

20 - at said first feed, said at least one needle is moved to knit in order to pick up the bare elastomer yarn dispensed by said first feed while the other needles of said at least one group of needles are moved to or held in the "miss" position and therefore excluded from picking up said bare elastomer yarn;

25 - at said second feed, the needles of said at least one group of needles are actuated in order to pick up the yarn or yarns dispensed at said second feed and form knitting at least with the needles that were previously held in the "miss" position at said first feed, the needles that picked up the bare elastomer yarn at said first feed being moved to knit at said second feed in  
30 the "tuck" position;

- at said third feed, said at least one needle is moved to knit in the "tuck" position, for a preset number of rotations of the needle cylinder about its own axis, in order to pick up the yarn or yarns dispensed at said third feed, while the other needles of said at least one group of needles are moved  
5 to knit in the "drop" position in order to pick up the yarn or yarns dispensed by said third feed;

- at said fourth feed, the needles of said at least one group of needles are actuated in order to pick up the yarn or yarns dispensed at said fourth feed, the needles that picked up the bare elastomer yarn at said first feed  
10 being moved to knit at said fourth feed in the "tuck" position.

8. The method according to claim 7, characterized in that said preset number of rotations of the needle cylinder about its own axis is comprised between 4 and 9.

9. The method according to one or more of the preceding claims,  
15 characterized in that, after said preset number of rotations of the needle cylinder about its own axis, said at least one needle, at said third feed, is actuated in order to pick up the yarn or yarns in the "drop" position in order to form new loops of knitting, knocking over the loops of knitting formed previously and held in the head of said at least one needle.

20 10. The method according to one or more of the preceding claims, characterized in that the needles of the needle cylinder of the machine are composed of a preset number of groups of needles, each one composed of a preset number of contiguous needles, which are selected and actuated at the feeds or drops of the machine like said at least one group of needles.

25 11. The method according to one or more of the preceding claims, characterized in that each one of said groups of needles comprises from 7 to 16 contiguous needles and in that, at said first feed, each group of needles is selected according to a first selection comprised between 1:6 and 1:15, i.e., with one needle actuated to pick up said bare elastomer yarn in the "tuck"  
30 position and with from 6 to 15 contiguous needles in the "miss" position.

12. The method according to one or more of claims 1 to 10, characterized in that each one of said groups of needles comprises from 8 to 17 contiguous needles and in that, at said first feed, each group of needles is selected according to a first selection comprised between 2:6 and 2:15, i.e.,  
5 with two contiguous needles actuated to pick up said bare elastomer yarn in the "tuck" position and with from 6 to 15 contiguous needles in the "miss" position.

13. The method according to one or more of the preceding claims, characterized in that, at said second feed and/or said fourth feed, each one of  
10 said groups of needles is selected according to a second selection chosen from among 1:1, with one needle actuated to pick up the yarn or yarns in the "tuck" position and one needle actuated to pick up the yarn or yarns in the "drop" position for every two contiguous needles of the group of needles, or  
15 2:2, with two contiguous needles actuated to pick up the yarn or yarns in the "tuck" position and two contiguous needles actuated to pick up the yarn or yarns in the "drop" position for every four contiguous needles of the group of needles, or 2:1, with two contiguous needles actuated to pick up the yarn or yarns in the "tuck" position and one needle actuated to pick up the yarn or yarns in the "drop" position for every three contiguous needles of the  
20 group of needles, or 1:2, with one needle actuated to pick up the yarn or yarns in the "tuck" position and two contiguous needles actuated to pick up the yarn or yarns in the "drop" position for every three contiguous needles of the group of needles.

14. A knitted tubular article, particularly of the type of a hold-up  
25 stocking, provided with a grip region (2) on its reverse side, characterized in that said grip region (2) is defined by floating portions or bridles of bare elastomer yarn (3) which protrude on the reverse side of the article (1), which is intended to be directed toward the skin of the user, and are knitted in with the other yarns that compose the article (1).

30 15. The knitted tubular article according to claim 14, characterized in

that said grip region (2) is defined by at least one circumferential band (4) composed of multiple turns or rows of said floating portions of bare elastomer yarn (3) arranged mutually side by side along the axis (1a) of the article (1).

5           16. The knitted tubular article according to claim 15, characterized in that said grip region (2) is defined by multiple circumferential bands (4), each one composed of multiple turns or rows of said floating portions of bare elastomer yarn (3) arranged mutually side by side along the axis (1a) of the article (1), said circumferential bands (4) being mutually spaced apart  
10 along the axis (1a) of the article (1).

17. The knitted tubular article according to one or more of the preceding claims, characterized in that said bare elastomer yarn (3) is made of silicone rubber.

15           18. The knitted tubular article according to one or more of the preceding claims, characterized in that it has, at said grip region (2), elastically extensible gathered portions (5).

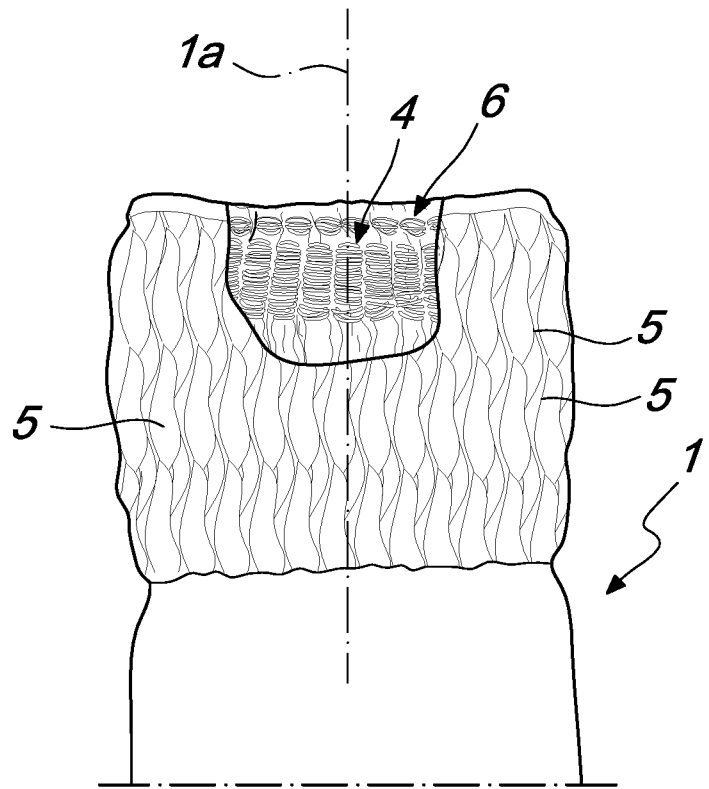
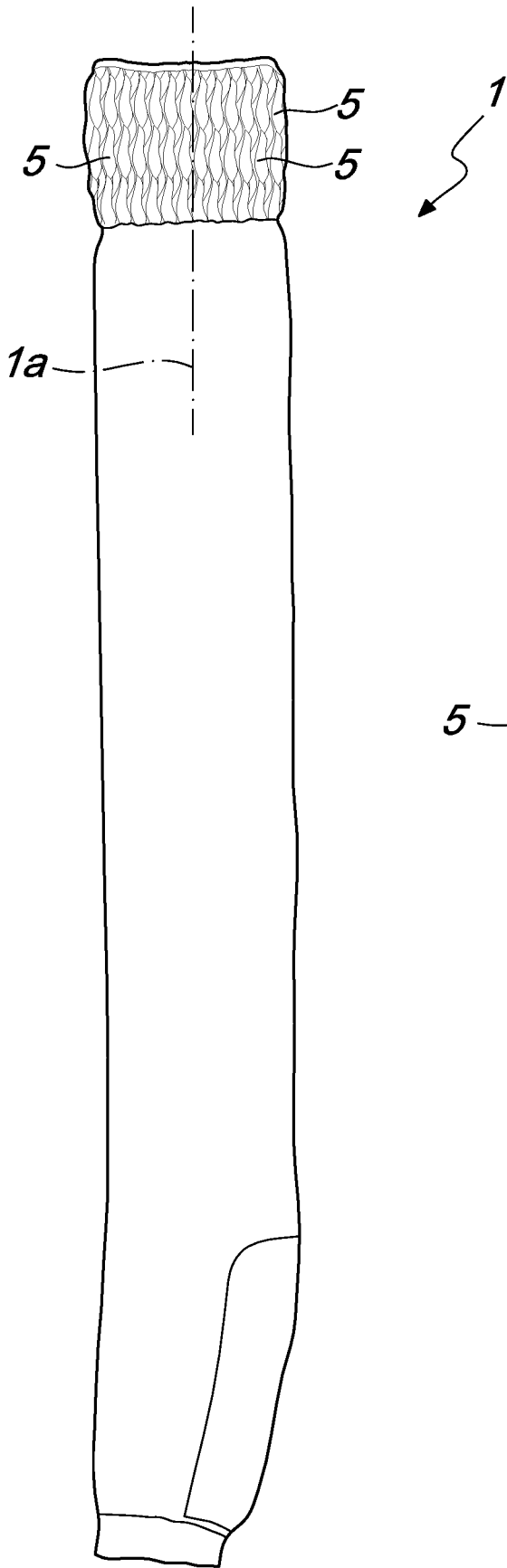
19. The knitted tubular article according to claim 18, characterized in that said gathered portions (5) are produced by a pre-tensioning of said bare elastomer yarn (3).

20           20. The knitted tubular article according to one or more of the preceding claims, characterized in that said bare elastomer yarn (3) is knitted in with the yarns that compose the remaining part of the article (1) by way of tuck-stitch knitting (1).

25           21. The knitted tubular article according to one or more of the preceding claims, characterized in that the stitches for knitting-in said bare elastomer yarn (3) with the yarns that compose the remaining part of the article (1), row by row, are mutually aligned parallel to the axis (1a) of the article (1).

30           22. The knitted tubular article according to one or more of the preceding claims, characterized in that said floating portions of the bare

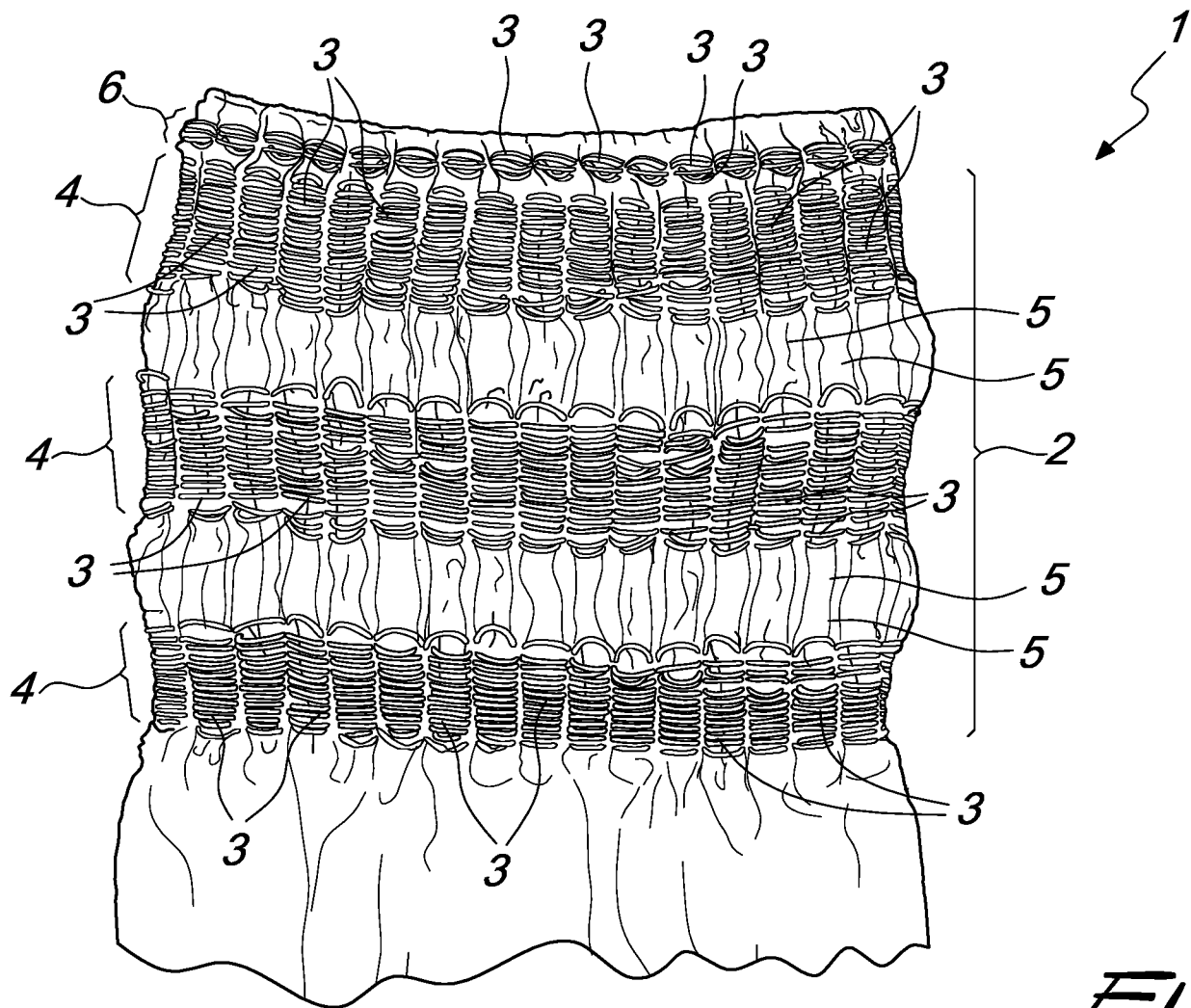
elastomer yarn (3) are extended for a number of rows of stitches that is comprised substantially between 6 and 15.



*Fig. 2*

*Fig. 1*





*Fig. 3*

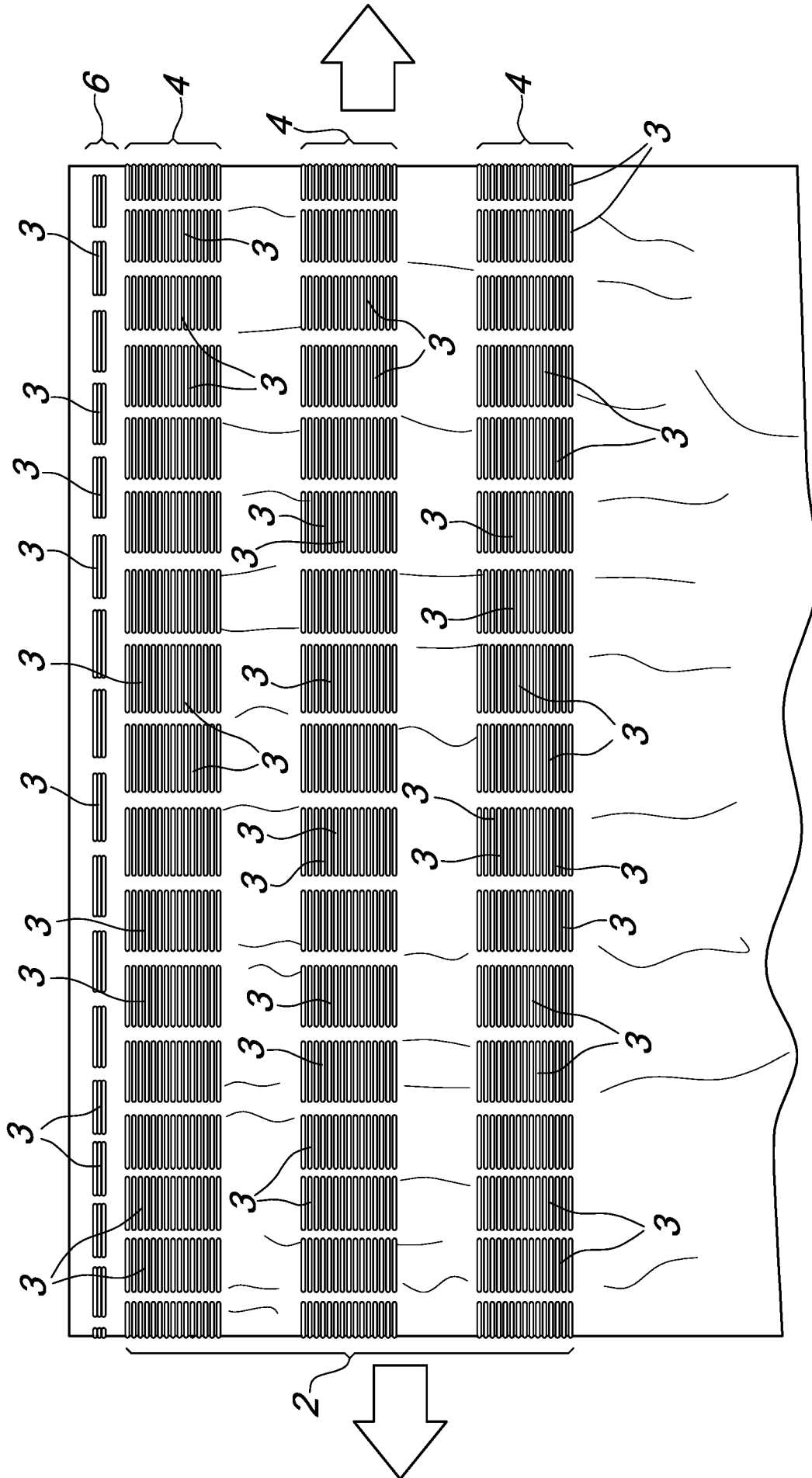


Fig. 4

# INTERNATIONAL SEARCH REPORT

International application No <b>PCT/EP2015/070642</b>
--

A. CLASSIFICATION OF SUBJECT MATTER  
**INV. D04B1/10                      D04B1/26                      D04B1/06**  
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
**D04B**

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
**EPO-Internal , WPI Data**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	wo 03/008685 AI (CALZI FICIO LEONE GALLI S R L [IT] ; GALLI ANGELO [IT] ; GALLI LORENZO [I] 30 January 2003 (2003-01-30)	14-19 ,21
Y	page 4, lines 14-18; claims 1,8, 19; figures 1-3 page 4, line 19 - page 5, line 3	1-13
X	US 2012/324961 AI (CLEMENDOT OLIVIER [FR] ) 27 December 2012 (2012-12-27)	14, 15 , 21,22
A	paragraphs [0024] , [0052] , [0063] - [0065] ; claims 17,29; figures 1,2,4B,4C	1-13
X	US 2003/213269 AI (PEELER DONALD HOOVER [US] ET AL) 20 November 2003 (2003-11-20)	14, 15 , 20,21
Y	paragraphs [0014] , [0026] ; claims 10-12 ,22-24; figures 3,5,6	1-13
	----- -/- .	

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>
---	---

Date of the actual completion of the international search <b>23 November 2015</b>	Date of mailing of the international search report <b>01/12/2015</b>
--	---

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  <b>Ki rner, Kathari na</b>
--	--

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2015/070642

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2 311 166 A (OSCAR FREGEOLLE) 16 February 1943 (1943-02-16)	1-13
A	page 1, col umn 1, line 6; claims 1,4-7 , 13; figures 1,3,4 page 2, col umn 2, lines 57-69 ,70-75 page 3, col umn 1, lines 11-26 -----	14-22
A	US 2 986 025 A (CORMI ER ALCIDE O) 30 May 1961 (1961-05-30) cl aims 1-5 ; f i g u r e s 1,3,6,8 -----	13 , 18, 19

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No <b>PCT/EP2015/070642</b>
--

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
<b>WO</b> 03008685	<b>A1</b>	30-01-2003		<b>IT</b> MI20011539 <b>A1</b>		20-01-2003
				<b>WO</b> 03008685 <b>A1</b>		30-01-2003
-----						
<b>US</b> 2012324961	<b>A1</b>	27-12-2012		<b>AU</b> 2011231976 <b>A1</b>		09-08-2012
				<b>CA</b> 2793247 <b>A1</b>		29-09-2011
				<b>EP</b> 2549967 <b>A1</b>		30-01-2013
				<b>FR</b> 2957783 <b>A1</b>		30-09-2011
				<b>JP</b> 2013521415 <b>A</b>		10-06-2013
				<b>NZ</b> 601421 <b>A</b>		30-08-2013
				<b>US</b> 2012324961 <b>A1</b>		27-12-2012
				<b>WO</b> 2011116952 <b>A1</b>		29-09-2011
-----						
<b>US</b> 2003213269	<b>A1</b>	20-11-2003		<b>AU</b> 2003269992 <b>A1</b>		02-12-2003
				<b>US</b> 2003213269 <b>A1</b>		20-11-2003
				<b>WO</b> 03096945 <b>A1</b>		27-11-2003
-----						
us 2311166	<b>A</b>	16-02-1943		<b>NONE</b>		
-----						
us 2986025	<b>A</b>	30-05-1961		<b>NONE</b>		
-----						