



(19) **United States**

(12) **Patent Application Publication**
Karatzis

(10) **Pub. No.: US 2020/0385902 A1**

(43) **Pub. Date: Dec. 10, 2020**

(54) **NET HAVING A SUPPORT THREAD**

(52) **U.S. Cl.**

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CPC **D04B 21/10** (2013.01); **D10B 2507/02** (2013.01); **D10B 2505/10** (2013.01); **D10B 2403/02412** (2013.01)

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(57) **ABSTRACT**

(21) Appl. No.: **16/472,651**

The invention relates to a net (200) having a plurality of warps (110) extending in the longitudinal direction (MD) and parallel to each other and several weft threads (120), of which one weft thread extends in each case to and fro between two adjacent warps (110) and connects the adjacent warps (110) to one another. Moreover, the net comprises a first support thread (130, 131) which extends along a warp (110) and penetrates the same at several points (181).

(22) PCT Filed: **Dec. 20, 2017**

(86) PCT No.: **PCT/EP2017/083905**

§ 371 (c)(1),

(2) Date: **Oct. 21, 2019**

Ein Netz (200) weist mehrere sich in Längsrichtung (MD) parallel zueinander erstreckende Kettlen (110) und mehrere Schussfäden (120) auf, von denen jeweils einer zwischen zwei benachbarten Kellen (110) hin- und herläuft und die benachbarten Ketten (110) miteinander verbindet. Darüber hinaus weist das Netz einen ersten Unterstützungsfaden ((130, 131) auf, der entlang einer Kette verläuft (110) und diese an mehreren Stellen (181) durchstößt.

(30) **Foreign Application Priority Data**

Dec. 23, 2016 (DE) 102016125601.3

Publication Classification

(51) **Int. Cl.**

D04B 21/10 (2006.01)

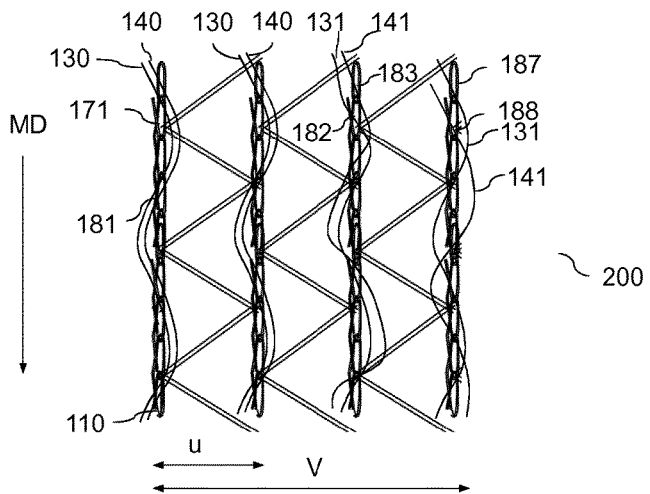
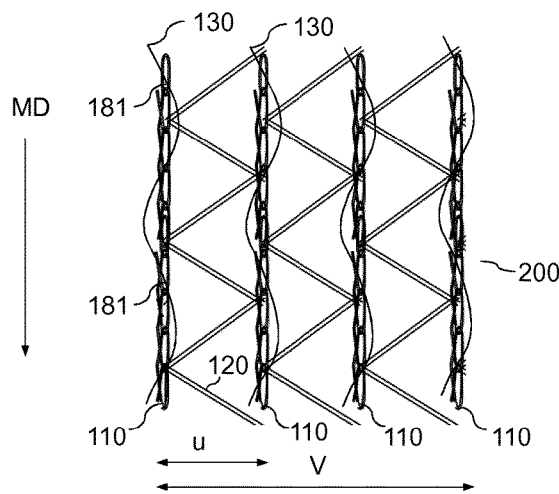


Fig. 1A

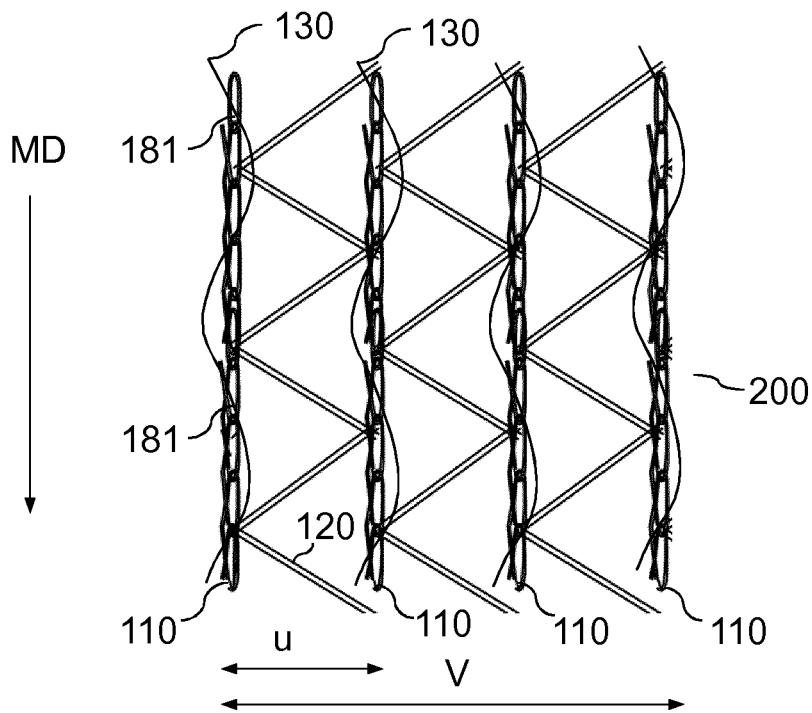


Fig. 1B

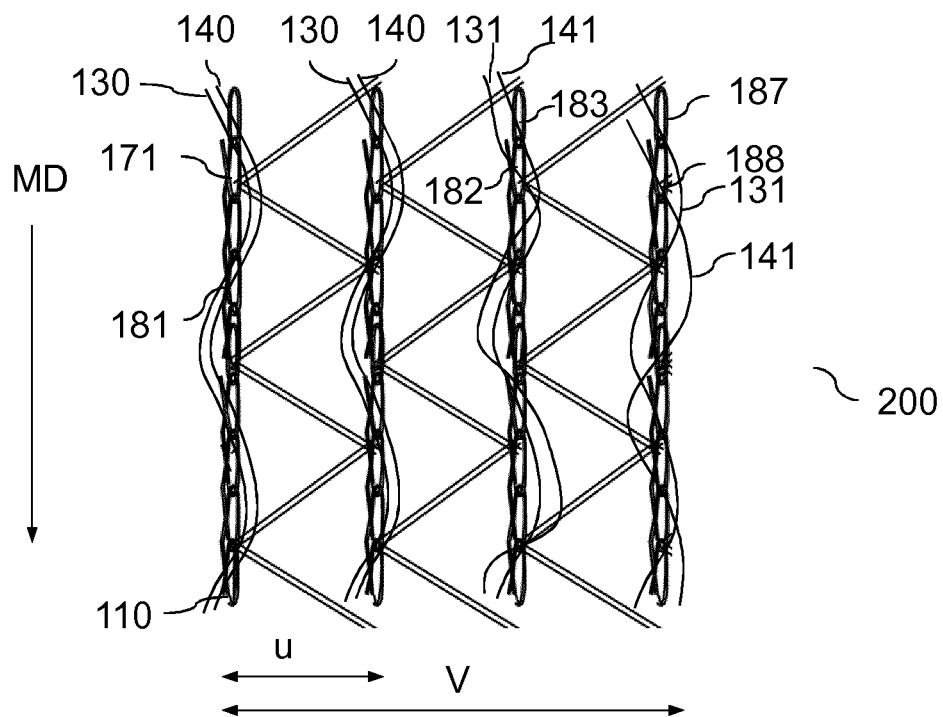


Fig. 2A

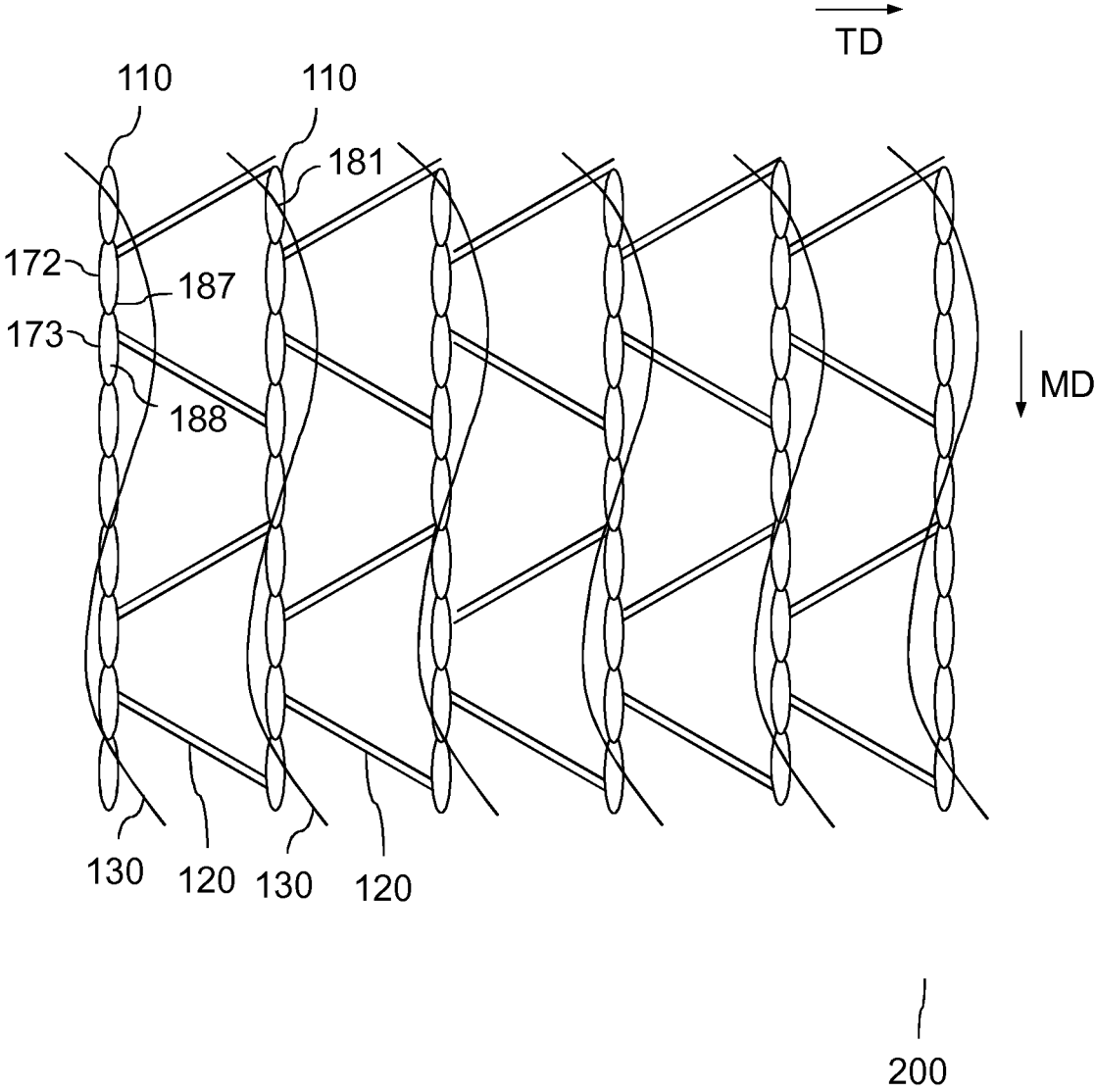
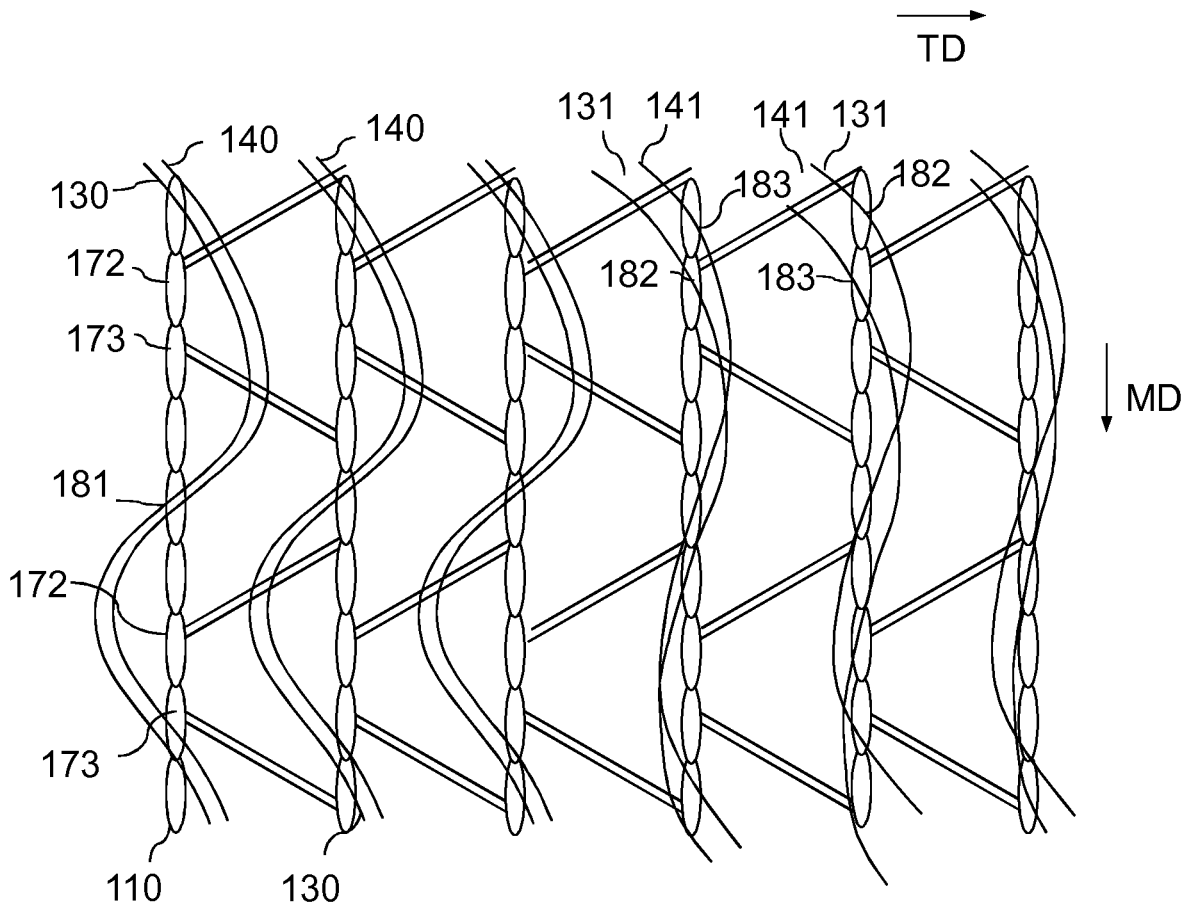


Fig. 2B



200

Fig. 3A

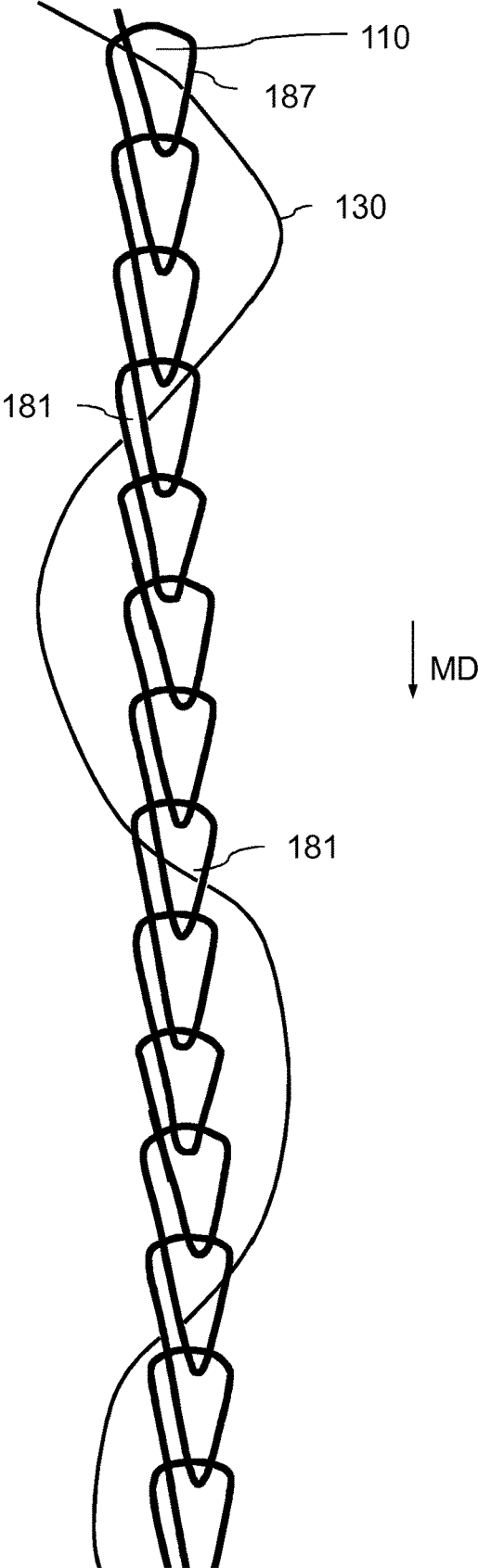


Fig. 3C

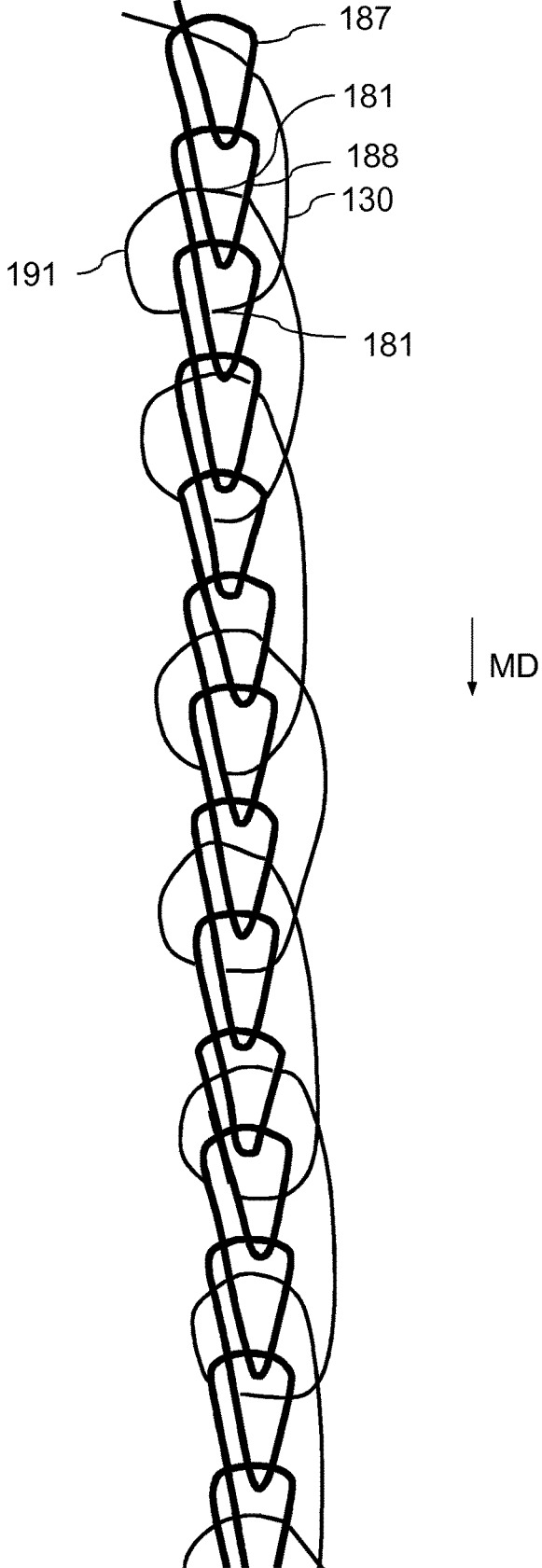
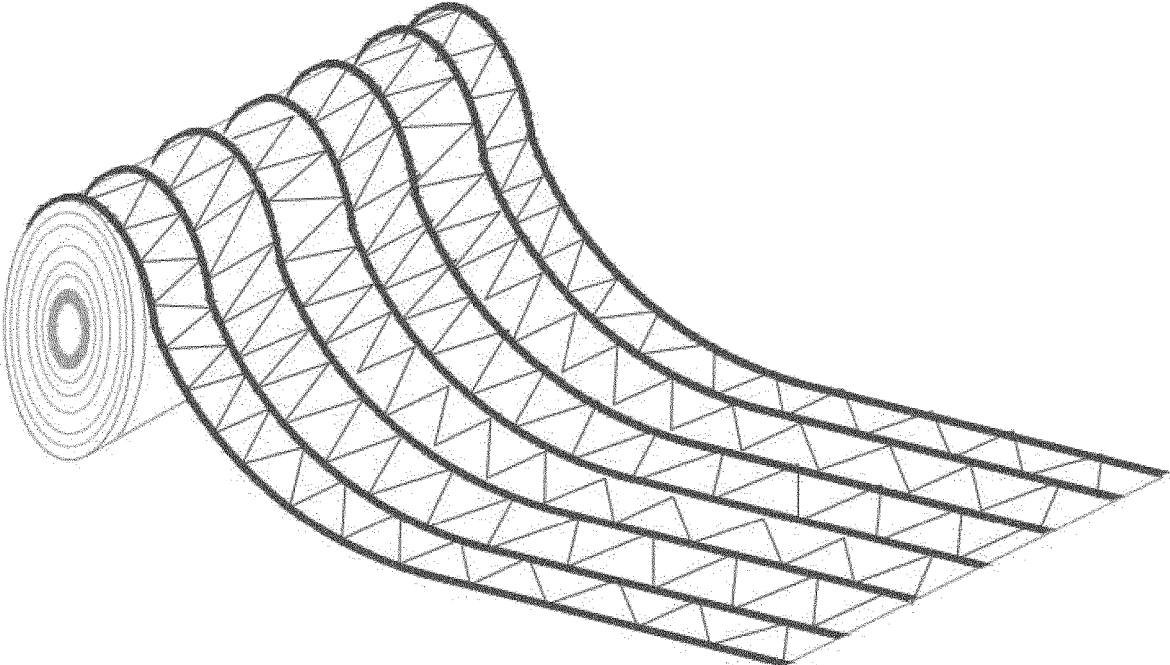


Fig. 4



NET HAVING A SUPPORT THREAD

[0001] The invention relates to a mesh, for example, a plastic mesh and, in particular, a so-called Raschel mesh.

[0002] Meshes and/or Raschel meshes are well-known. Raschel meshes serve a wide variety of intended uses and are warp knit from a plastic thread with the aid of suitable devices (Raschel machines), by entwining respective plastic threads into threads with the aid of specific needles across the entire machine width.

[0003] An example of such a Raschel mesh is known from EP 1 851 385 A1, which shows the use of a Raschel mesh for a construction site fence by way of example. Depending on the strength of the threads used, different applications are possible. For example, very light meshes can be produced, which serve to wrap loose goods such as hay bales.

[0004] For the production of such light meshes, it is, on one hand, essential that the meshes have a weight as low as possible, which goes hand in hand with a correspondingly low material expenditure and thus lower material costs. On the other hand, the meshes must also achieve sufficient strength to be capable of fulfilling their function. Hence, it is generally not possible to save material by using thinner plastic threads or plastic threads with a smaller cross section since the thin threads will then no longer have sufficient strength.

[0005] The object of the invention is to provide a mesh by which it is possible to reduce the use of material and thus the weight, without suffering losses of strength.

[0006] The object is, in accordance with the invention, solved by a mesh having the features of claim 1. Advantageous embodiments are the subject matter of the dependent claims.

[0007] In accordance with the invention, a mesh is proposed, comprising a plurality of warps extending parallel to one another in the longitudinal direction, a plurality of weft threads of which one runs to and fro between two adjacent warps and links the adjacent warps to one another, and comprising a first support thread, which runs along a warp and penetrates the same at several points.

[0008] The points where the support thread penetrates the warp can, in particular, be the warp links or stitches, which each form an approximately ring-shaped or elongated opening through which the support thread is threaded.

[0009] The additional support thread significantly increases the strength of the mesh and enables the reduction of the strength (thickness, width) of the threads of which the warps and weft threads are made.

[0010] In the mesh, the first support thread can extend along the warp in the longitudinal direction, wherein the first support thread forms eyes in sections, in which it runs against the longitudinal direction. The eyes can have the form of loops. Thus, the support thread extends in the longitudinal direction (machine direction) and forms slings or loops (eyes) at regular or irregular intervals.

[0011] A plurality of support threads can be provided in the mesh. For example, also in the case of one warp, a plurality of support threads, e.g., 2 to 5 support threads, can be threaded in, which extend along the warp and penetrate the same at several points.

[0012] As the mesh consists of a plurality of warps running parallel to one another, it is possible that at least one support thread or a plurality of support threads run on a portion of the warps or on all warps of the mesh. The more support threads are present, the greater the strength.

[0013] For example, a second support thread (or additional support threads) can be provided, which runs along the warp on which the first support thread is already provided. By providing a second support thread in addition to the first support thread, the strength is further increased.

[0014] In this process, the second support thread can extend along the warp in the longitudinal direction, wherein the second support thread forms slings, eyes or loops in sections, in which it runs against the longitudinal direction. Thus, similar to the first support thread, the slings can have the form of loops. Thus, also the second support thread extends in the longitudinal direction (machine direction) and forms slings or loops (eyes) at regular or irregular intervals.

[0015] The second support thread can at least partly run parallel to the first support thread.

[0016] The first support thread, as well as the other support threads, can run in such a manner that every support thread penetrates every stitch of the warp, i.e. is threaded through every stitch of the warps or every warp link, respectively.

[0017] The interval between two adjacent warps can amount to 20 mm to 80 mm.

[0018] The support thread can be a plastic film thread.

[0019] The thickness of the support thread can amount to 0.5 mm to 4 mm.

[0020] The weft thread can connect the warps allocated to it in such a manner that its course forms a zigzag pattern.

[0021] After having penetrated an associated warp, the weft thread can run, in parts, parallel to this warp.

[0022] Additional advantages and features of the invention are explained in more detail in the following text based on examples with the aid of the accompanying figures, in which:

[0023] FIG. 1A shows a mesh according to a first exemplary embodiment;

[0024] FIG. 1B shows a mesh according to another exemplary embodiment;

[0025] FIG. 2A shows a section of a mesh according to another exemplary embodiment;

[0026] FIG. 2B shows a section of a mesh according to another exemplary embodiment;

[0027] FIG. 3A shows a portion of a warp with a support thread, which forms a component of a mesh according to an exemplary embodiment;

[0028] FIG. 3B shows a portion of a warp with a support thread, which forms a component of a mesh according to another exemplary embodiment;

[0029] FIG. 3C shows a portion of a warp with a support thread, which forms a component of a mesh according to another exemplary embodiment; and

[0030] FIG. 4 shows an example of a mesh rolled into a role.

[0031] The description of the following exemplary embodiments is not restrictive. In particular, elements of the individual exemplary embodiments, which are described in the following text, can be combined with elements of various exemplary embodiments.

[0032] For a more detailed explanation of components of the produced mesh, the designations below are used in the following text:

[0033] For a more detailed explanation, the designations below are used in the following text:

[0034] Mesh or fabric: thin straps which, for example, are made from or consist of polyolefins such as LLDPE (linear low density polyethylene), LDPE (low-density polyethyl-

ene), HDPE (high-density polyethylene), PVC (polyvinyl chloride), EVA (ethylene vinyl acetate) or from a similar plastic, are processed to a mesh or fabric.

[0035] Threads: the thin straps of which the mesh is composed.

[0036] Warp threads: the stitches lined up next to one another to form a sling compound in the flow direction of the mesh.

[0037] Wefts: the threads with a zigzag linkage which link the warp threads to a mesh.

[0038] MD (machine direction): the flow direction of the mesh during the production or processing, also designated as the longitudinal direction of the mesh.

[0039] TD (transverse direction): the direction perpendicular to the flow direction or machine direction.

[0040] FIG. 1A shows a mesh according to an exemplary embodiment.

[0041] As discussed in the following text, the mesh **200** shown in FIG. 1A has a plurality of warps **110** extending parallel to one another in the longitudinal direction or machine direction MD, as well as a plurality of weft threads **120**, of which one weft thread runs to and fro between two adjacent warps **110** and connects the adjacent warps to one another. Furthermore, the mesh **200** includes a first support thread **130**, which runs along a warp **110** and penetrates the same at several points **181**.

[0042] FIG. 1A shows that the points **181** have a specific interval, and that the support thread **130** penetrates only about one in three warp links or one in three stitches of the warp **110** at a corresponding point **181**. However, in a not shown variant it is possible that the support thread **130** is threaded through every stitch or every warp link, i.e. the points **181** coincide with the respective openings of the warp links.

[0043] The mesh **200** shown in FIG. 1A can be a so-called Raschel mesh, which includes warps **110** warp knit from threads. The threads can, for example, be plastic threads. In this process, every individual warp **110** is produced by entwining one or more threads. A plurality of warps **110** can be warp knit parallel at the same time on suitable machines, in particular, on so-called Raschel machines.

[0044] In this process, the warps **110** run in the machine direction (MD), as illustrated in FIG. 1A. Two adjacent warps **110** are, as explained in the following text, each cross-connected by weft threads **120** running to and fro between two adjacent warps **110**, whereby the particular weft thread **120** takes a zigzag course, and the mesh is formed. Usually, a plurality of parallel warp groups are formed by a Raschel machine and the needles present in the Raschel machine, with the plurality of parallel warp groups then being connected to one another by the weft threads **120**.

[0045] As shown in FIG. 1A, the first support thread **130** runs, on each of the warps **110**, in the machine direction (MD) along the allocated warp **110** and penetrates the same at several points (penetration points **181**) or—in the variant not shown—at all stitches or openings of the warp links.

[0046] The interval u between two adjacent warps **110** can, for example, amount to 20 mm to 80 mm. For example, adjacent warps **110** can be formed at an interval of 25.4 mm (1 inch) to 3 inches (76.2 mm), in particular, with 30.5 mm (1.2 inches) and 50.8 mm (2 inches). Here the interval is regarded as the interval between the virtual (imagined) centerlines from two adjacent warps **110**. The total width v

of the mesh or plastic mesh can amount to 30 to 200 cm, in particular, to 50 to 170 cm. In this process, even wider meshes are easily possible.

[0047] According to the embodiment shown in FIG. 1B, the mesh contains a second support thread **140**, **141**, which, additionally to the first support thread **130**, also runs along a warp **110**. In this process, as shown in the left-hand portion of FIG. 1B, the second support thread **140** can run parallel to the first support thread **130**. More specifically, the first and second support threads **130**, **140** penetrate both the warp **110** at the same penetration point **181**.

[0048] As shown in the right-hand side of FIG. 1B, the second support thread **140** can run in an offset manner. For example, the penetration points **182**, **183** of the first and of the second support threads **131**, **141** may not match. In this connection, the term “the same penetration point **181**” designates the same stitch **187** along the longitudinal direction or machine direction MD.

[0049] According to the embodiment where the first and second support threads **130**, **140** do not run parallel to one another, the different penetration points **182**, **183** each correspond to the stitches **187**, **188** of the warp **110** offset to one another in the longitudinal direction.

[0050] Additionally to the first support thread **130** and to the second support thread **140**, additional support threads can be provided, which are also connected to the associated warps **110** correspondingly.

[0051] In a variant not shown, a plurality of support threads (e.g. 2 to 5, preferably three support threads) are provided on every warp **110** and penetrate all stitches or openings of the warp links.

[0052] According to the embodiment shown in FIGS. 1A and 1B, the weft thread **120** forms a zigzag pattern between two adjacent warps **110** in each case. That means that the penetration point **171** of the weft thread **120** through the warp **110** corresponds to the reversal point of the weft thread.

[0053] According to the embodiments shown in FIGS. 2A and 2B, the weft thread **120** can be guided in such a manner that it, having penetrated the associated warp **110**, runs, in sections, parallel to the particular warp **110**. More specifically, the weft thread **120** penetrates the warp **110** at a first penetration point **172**. Thereupon, it runs, in sections, along the machine direction MD parallel to the warp **110** and penetrates the warp **110** at a second penetration point **173** and thereupon runs in the diagonal direction to subsequently penetrate an adjacent warp **110**. A stretched zigzag pattern is thereby created. For example, the second penetration point **173** can be located in a stitch **188**, which is offset in respect of the stitch **187** of the first penetration point **172** in the machine direction MD by one or more stitches.

[0054] According to the embodiment shown in FIG. 2A, a support thread **130** is provided again, which runs along the particular warp **110** and penetrates the same at several penetration points **181**. Here too it is possible that the support thread **130** penetrates all stitches or openings of the individual warp links of the warp **110**.

[0055] According to the embodiment shown in FIG. 2B, the mesh can further include a second support thread **140**, **141** (or additional support threads). This support thread can, as depicted on the left-hand side of FIG. 2B, run parallel to the first support thread **130** and penetrate the warp **110** at the same penetration points **181** as the first support thread **130**.

[0056] According to the embodiment shown in the right-hand side of FIG. 2B, a first support thread 131 and a second support thread 141 can each penetrate the warp 110 at different penetration points 182, 183.

[0057] The support threads 130, 140 shown in FIGS. 1A to 2B are threaded into the particular warp 110 in such a manner that they run substantially straight along the warp 110.

[0058] According to the invention, the mesh can include more than two support threads, for example, three or four or more support threads. In particular, it is possible that at least one support thread is provided on each of the warps 110. Similarly, a support thread can be fastened to only a portion of the warps 110.

[0059] FIGS. 3A to 3C show different manners in which the support thread or the support threads 130, 140 can be interwoven with the warp 110, which is a component of the mesh 200.

[0060] As illustrated in FIG. 3A in more detail, the first support thread 130 can run along the warp 110 as in FIG. 1A or 2A and penetrate it at several penetration points 181, which correspond to different stitches 187, 188 in each case. In this process, as shown in FIG. 3A, the support thread 130 can exclusively run in the machine direction (MD).

[0061] According to the embodiment illustrated in FIG. 3B, the one support thread 130 or the two support threads 130, 140 can form a plurality of slings or loops or eyes 191, where the corresponding support thread runs, in sections, against the longitudinal direction or machine direction. In this process, the first and the second support threads 130, 140 can run parallel to one another, so that they penetrate the warp 110 in the same stitch 187. Alternatively, they can be offset, so that they do not have matching penetration points with the warp 110. Similarly, it is possible that only one of the support threads 130, 140 forms eyes 191 or slings or loops, while the other support thread runs straight, as shown in FIG. 3A.

[0062] According to the embodiment illustrated in FIG. 3C, the support thread 130 forms slings or eyes 191, which are densely spaced in such a manner that the support thread 130 penetrates every stitch 187, 188 of the warp. This means that each stitch 187, 188 of the warp 110 forms a penetration point 181 of the support thread 130. In this embodiment, the strength of the mesh can be further improved.

[0063] Due to the support thread, it is possible to achieve increased strength of the mesh. In other words, it is possible to use thinner threads for the different components, in particular, for the warps 110 and the weft threads 120, while the mesh retains the same strength, so that the weight of the mesh produced can be further reduced.

[0064] FIG. 4 shows an example of a rolled-up mesh. As the mesh, while retaining the same tensile strength, has a lower weight, more meters of the mesh according to the invention can be rolled into a role, while the weight of the overall role remains the same.

[0065] In the exemplary embodiments described, one of the warps can be produced from a plastic film thread. In this process, such a thread is cut or extruded from a plastic film and then processed with the aid of the Raschel machine. Due to corresponding entwining, a warp is warp knit or knit from a thread. In this process, it is also possible to knit an individual warp not only from one, but from two or more

threads. The plastic film of a plastic film thread can have a thickness of 100 μm or less, in particular, of 80 μm or less, in particular, of 60 μm or less, in particular, of 40 μm or less. The width of the support thread can, for example, amount to 0.5 to 4 mm. The support thread as well as the weft thread can, analogue to the thread, be cut or extruded from a plastic film for the production of at least one of the warps.

[0066] Due to its low mass and its high strength, the mesh according to the invention can be used to pack loose goods, such as hay, straw, vegetables, raw cotton, or other parts of plants.

1-14. (canceled)

15. A Raschel mesh, comprising:

a plurality of warps composed of stitches lined up next to one another, and which extend parallel to one another in a longitudinal direction;

a plurality of weft threads, of which a first weft thread runs to and fro between two adjacent warps and connects the two adjacent warps to one another;

a first support thread which runs along the stitches of a first warp and penetrates the first warp at a plurality of points; and

a second support thread which runs along the first warp, wherein the second support thread extends along the first warp in the longitudinal direction,

wherein the second support thread forms eyes in sections, in which the second support thread runs against the longitudinal direction.

16. The Raschel mesh of claim 15, wherein the first support thread extends along the first warp in the longitudinal direction, and wherein the first support thread forms eyes in sections, in which the first support thread runs against the longitudinal direction.

17. The Raschel mesh of claim 15, wherein the second support thread runs, at least partially, parallel to the first support thread.

18. The Raschel mesh of claim 15, wherein the first support thread penetrates every stitch of the first warp.

19. The Raschel mesh of claim 15, wherein the first support thread and the second support thread are threaded into the first warp in such a manner that the first support thread and the second support thread penetrate the first warp at all warp links.

20. The Raschel mesh of claim 15, wherein the first support thread runs along the plurality of warps and penetrates the plurality of warps at a plurality of stitches.

21. The Raschel mesh of claim 15, wherein the first support thread is a plastic film thread.

22. The Raschel mesh of claim 15, wherein the second support thread is a plastic film thread.

23. The Raschel mesh of claim 15, wherein a thickness of the first support thread is in a range of 0.5 mm to 4 mm.

24. The Raschel mesh of claim 15, wherein a thickness of the second support thread is in a range of 0.5 mm to 4 mm.

25. The Raschel mesh of claim 15, wherein the first weft thread forms a zigzag pattern.

26. The Raschel mesh of claim 15, wherein the first weft thread runs, in parts, parallel to a warp penetrated by the first weft thread.

27. The Raschel mesh of claim 15, wherein the Raschel mesh is configured to pack loose goods.

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