



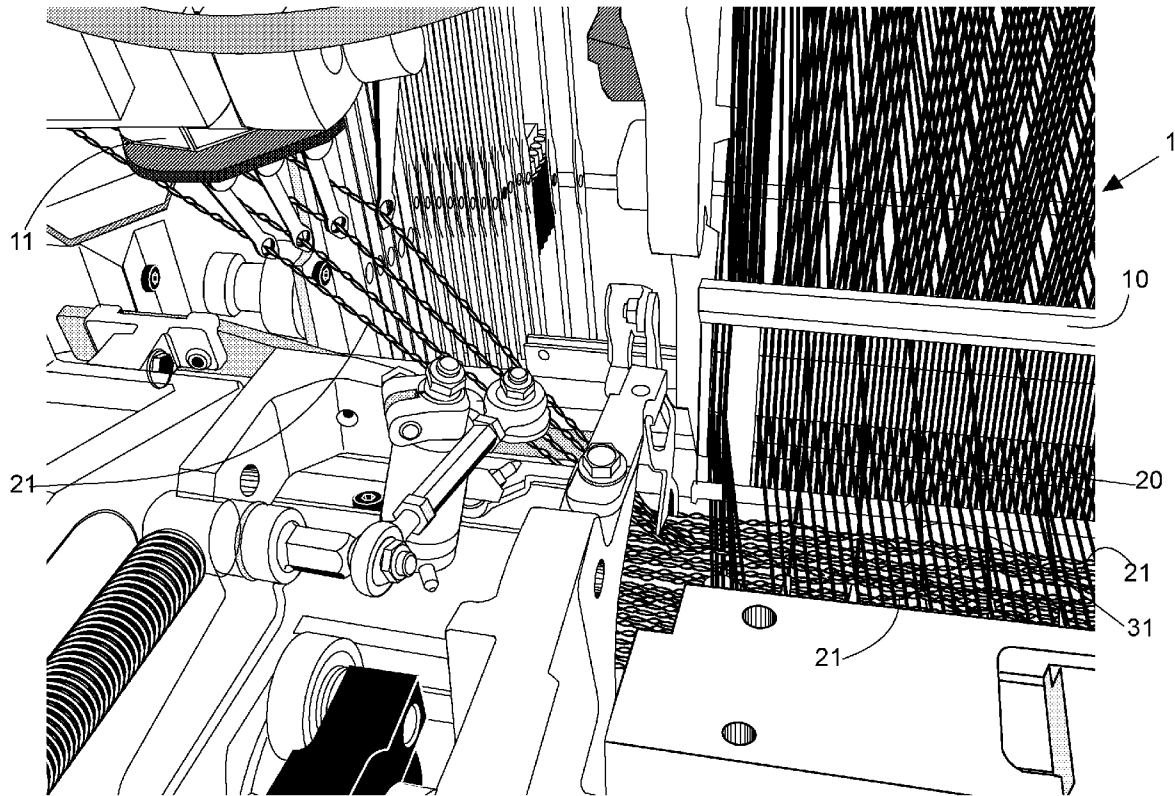
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**Frenken et al.**(10) **Pub. No.: US 2012/0125474 A1**(43) **Pub. Date: May 24, 2012**(54) **DEVICE FOR PRODUCING A FIBRE MAT BY WEAVING****Publication Classification**(75) Inventors: **Hendrikus Bernardus Frenken**,  
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(57) **ABSTRACT**

The invention relates to a device for producing a fibre mat by weaving, which fibre mat is built up of a substrate on which fibres are provided and which device is provided at least with means for forming a shed of warp yarns forming the substrate of the fibre mat, a lay as well as means disposed on one or both sides of the shed for inserting one or more weft yarns into the shed. The invention further relates to a fibre mat obtained by means of a device according to the invention.



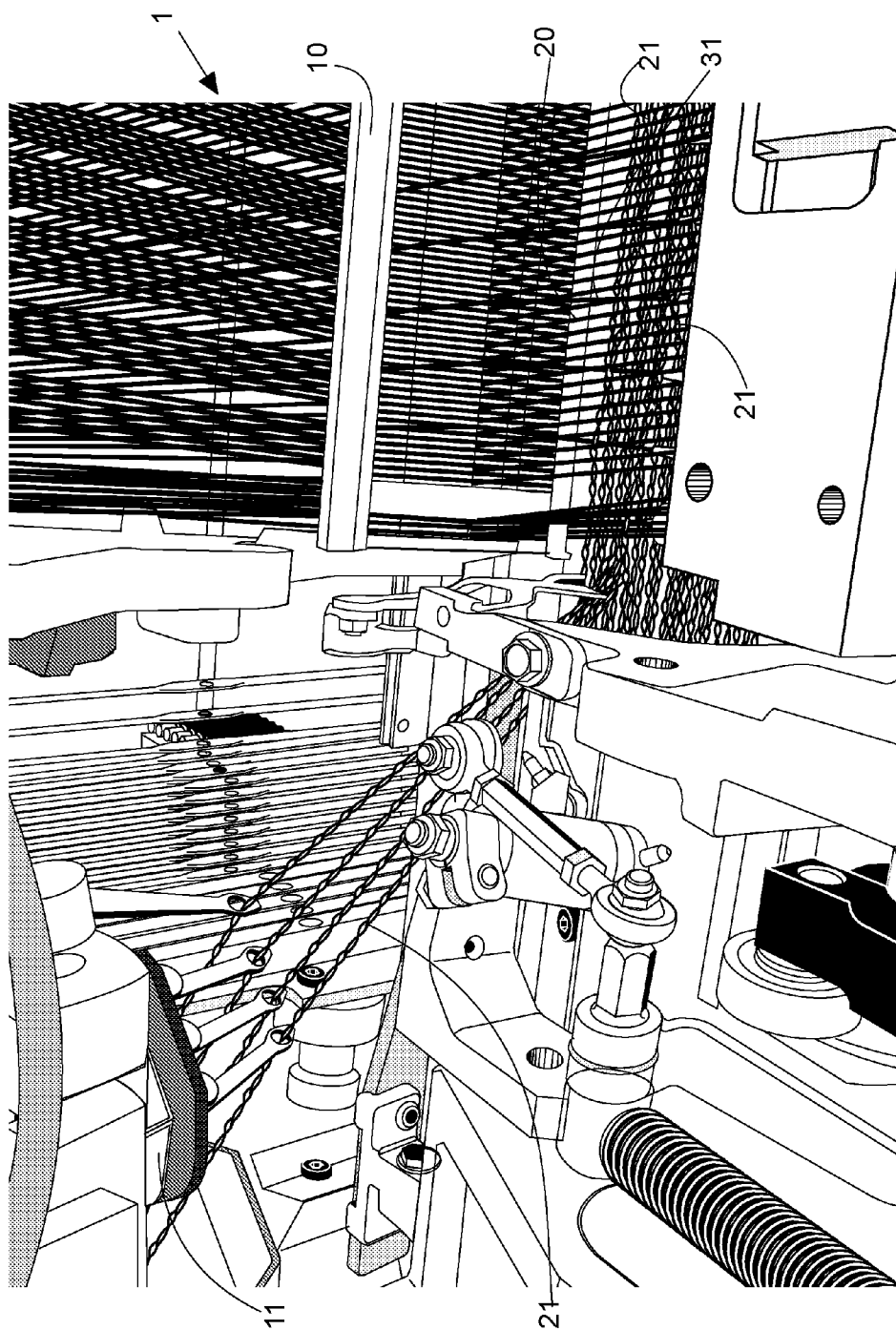


Fig. 1

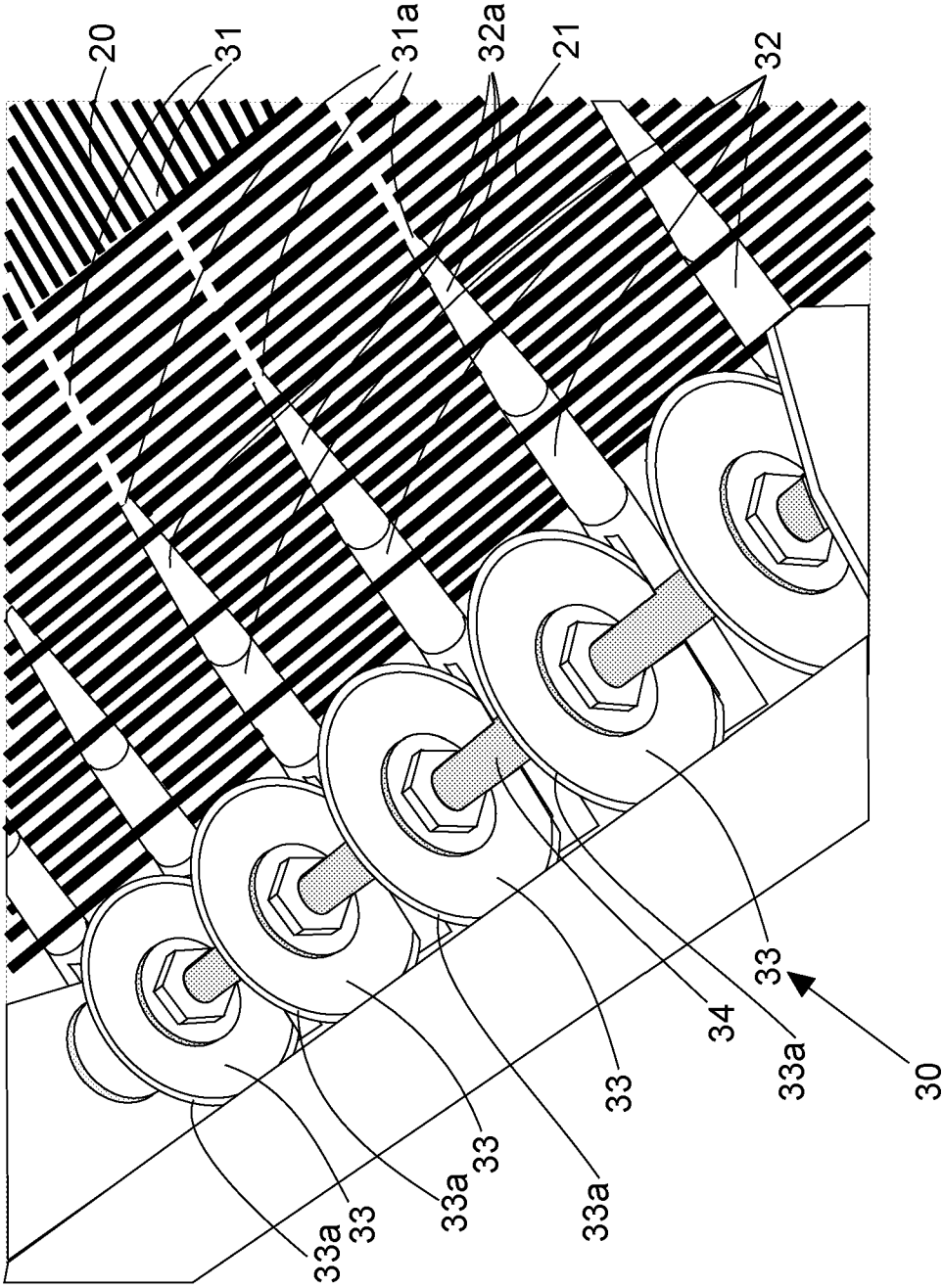


Fig. 2

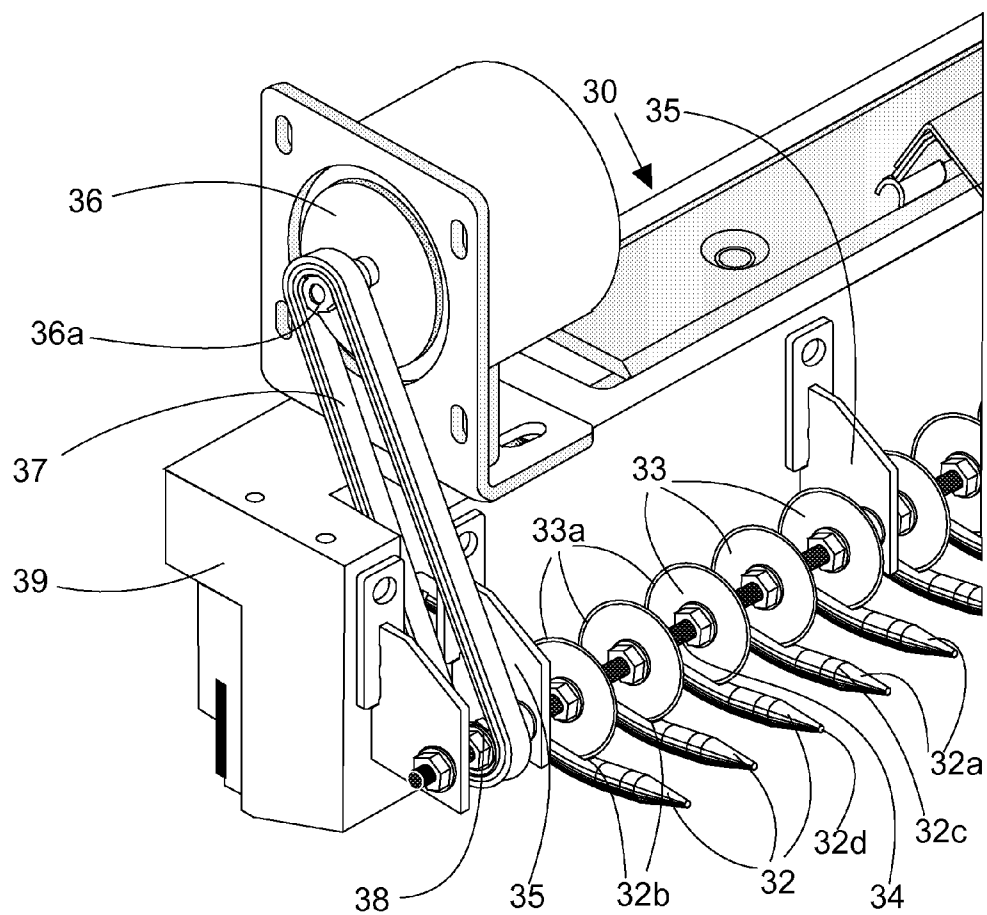


Fig. 3

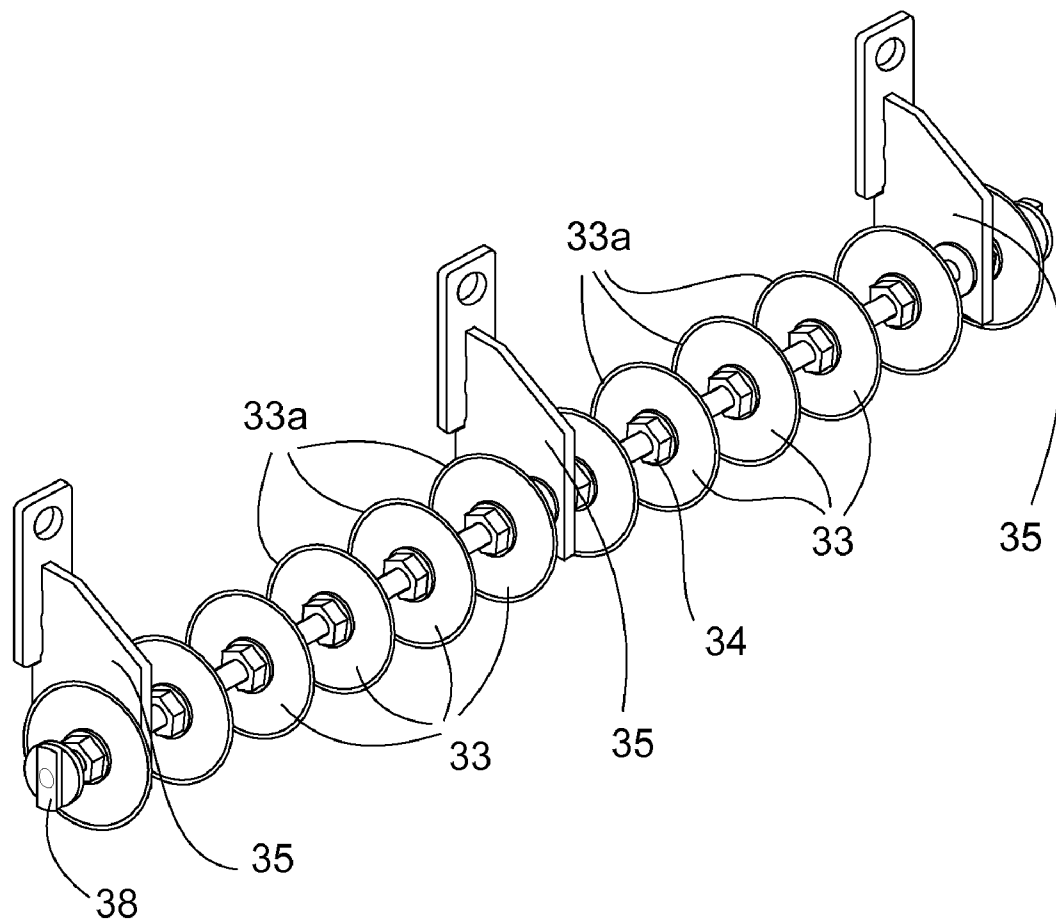


Fig. 4

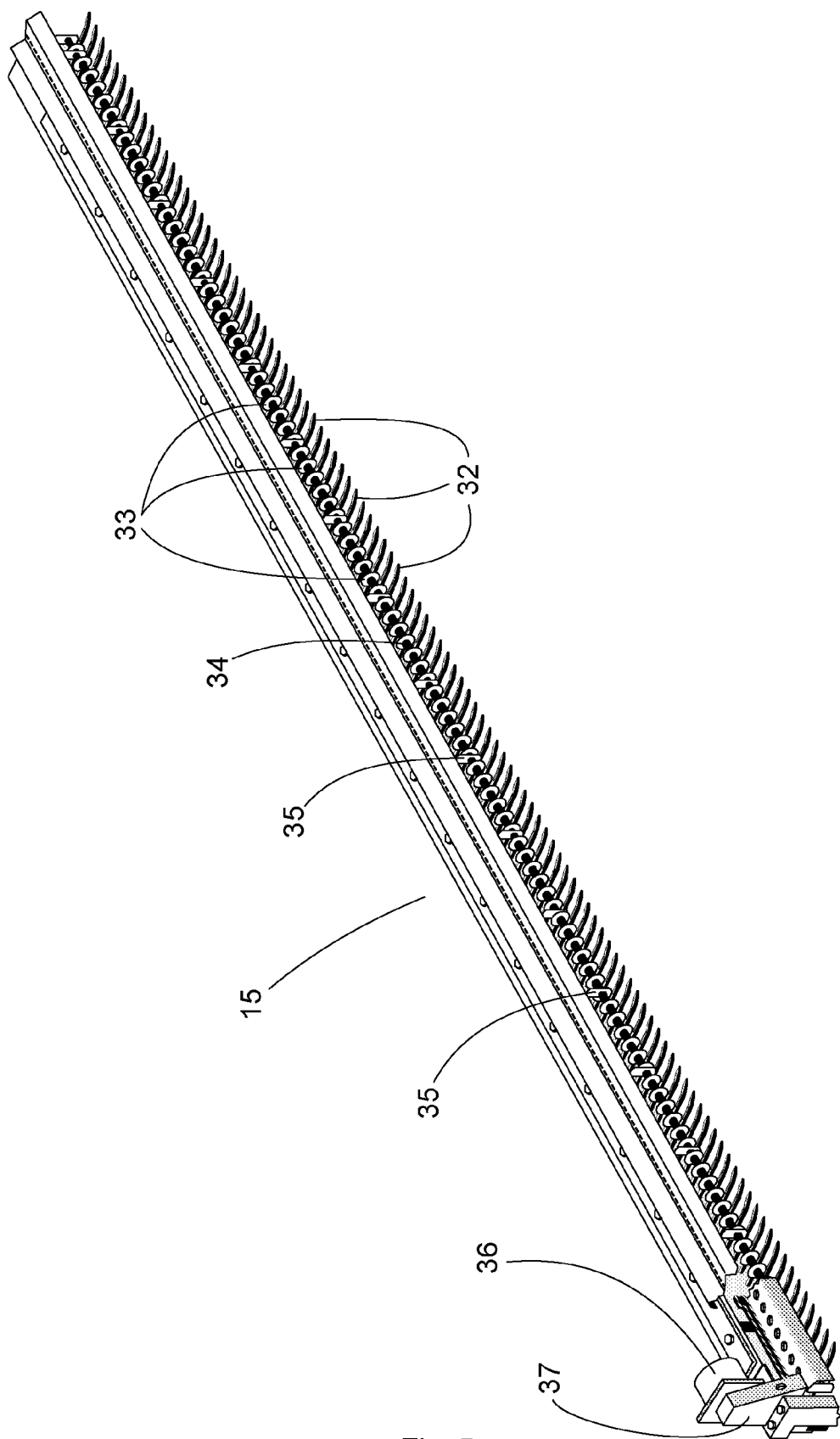


Fig. 5

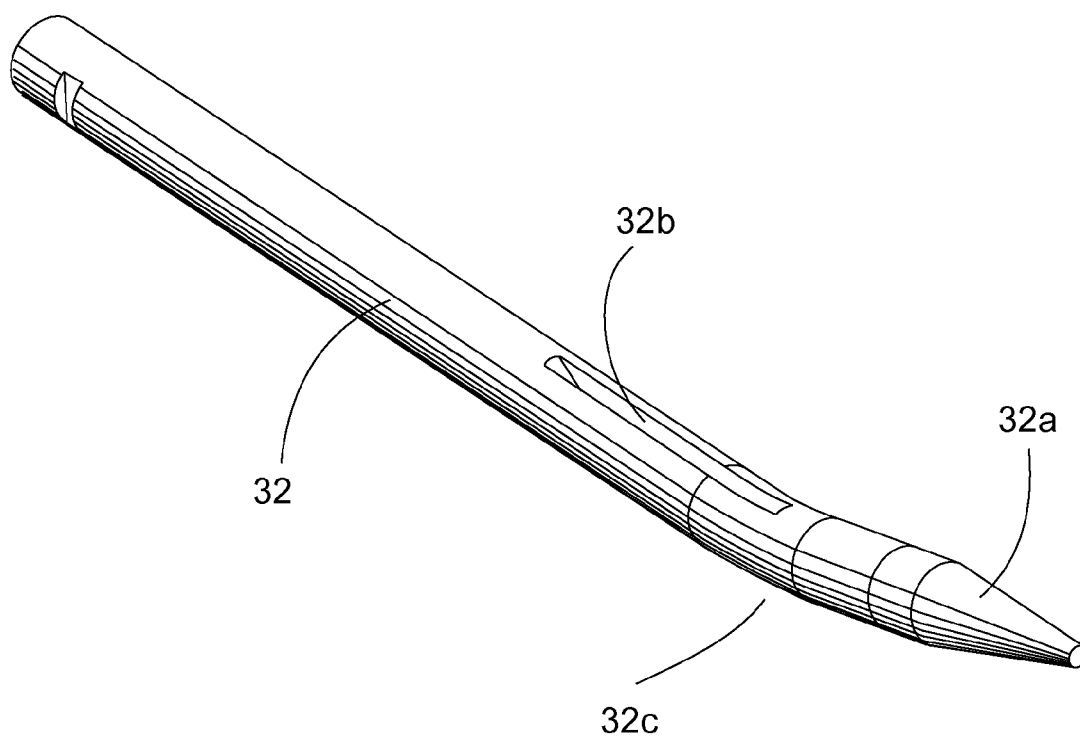


Fig. 6

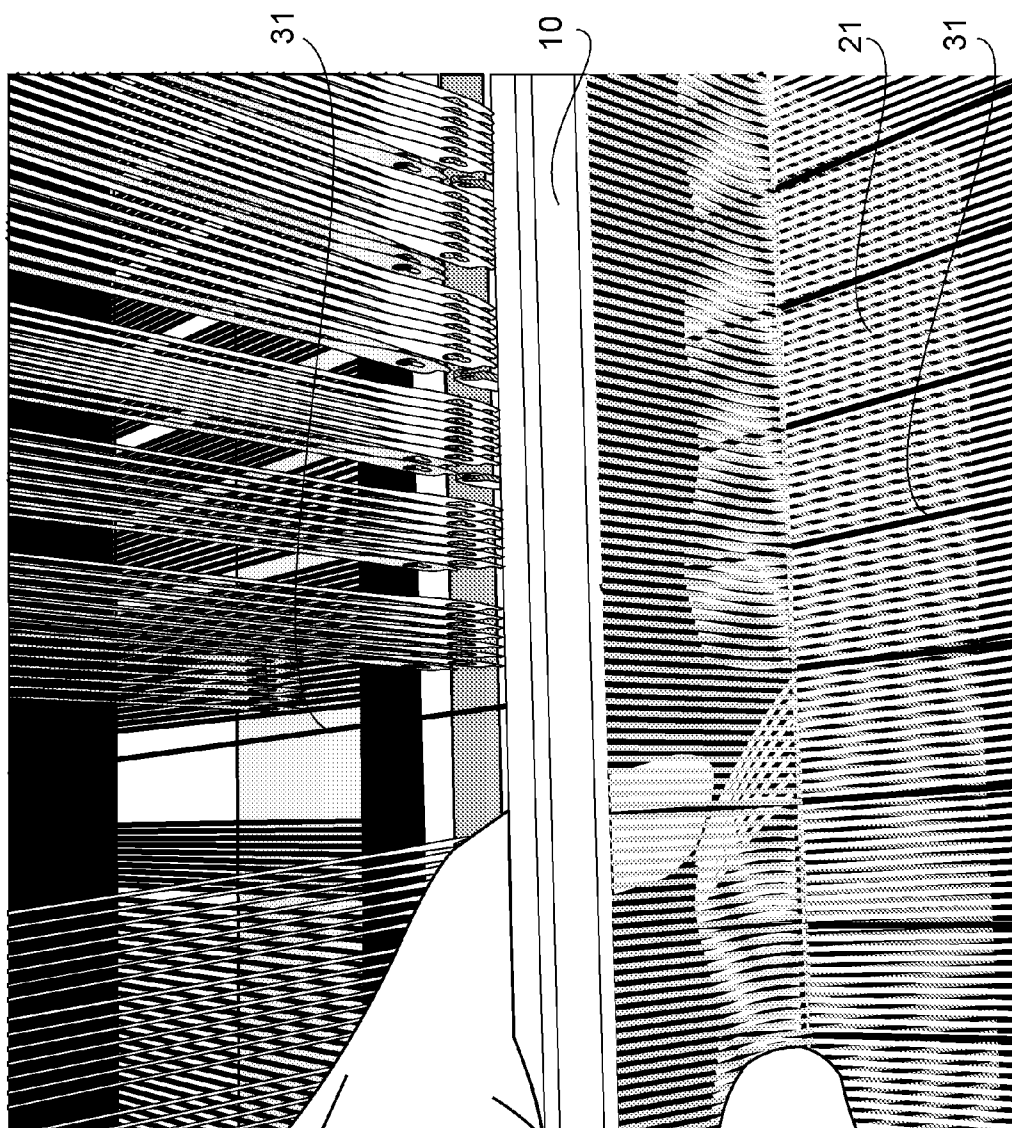


Fig. 7



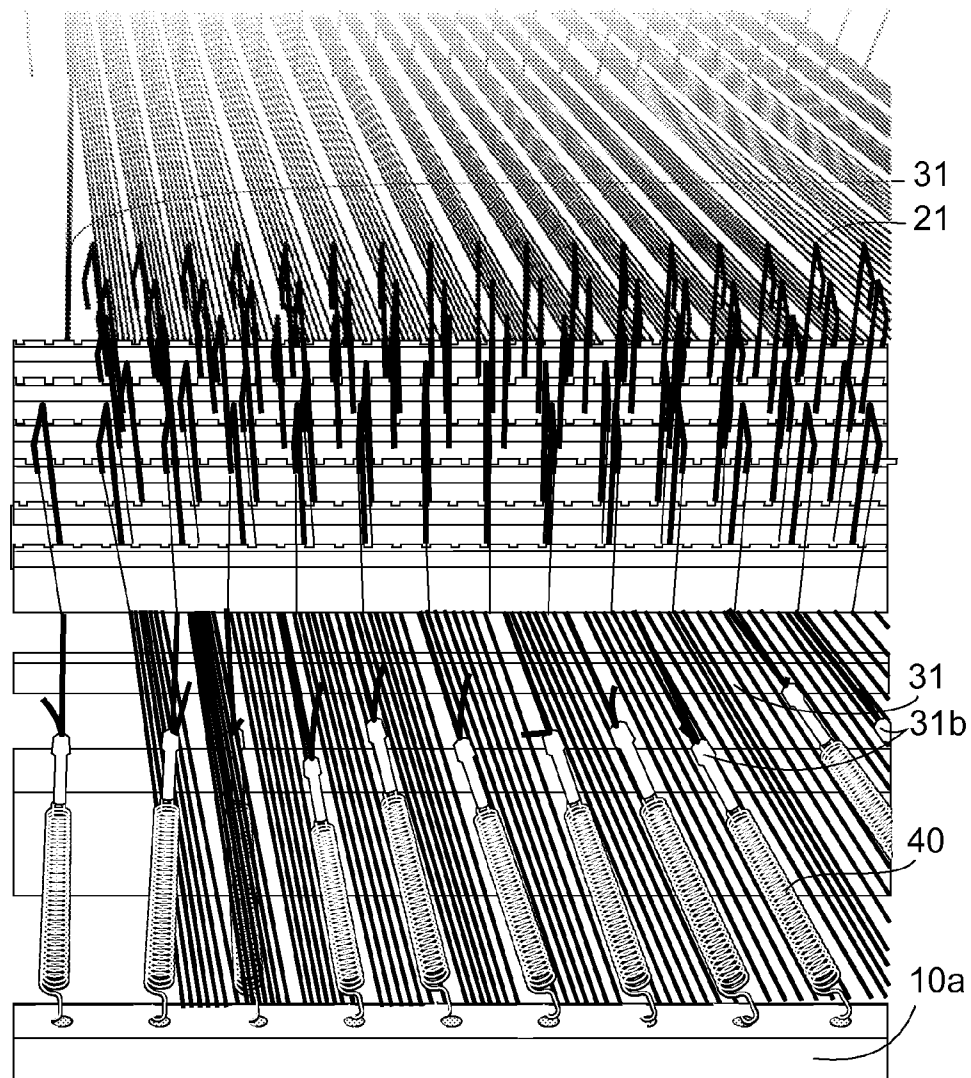


Fig. 8

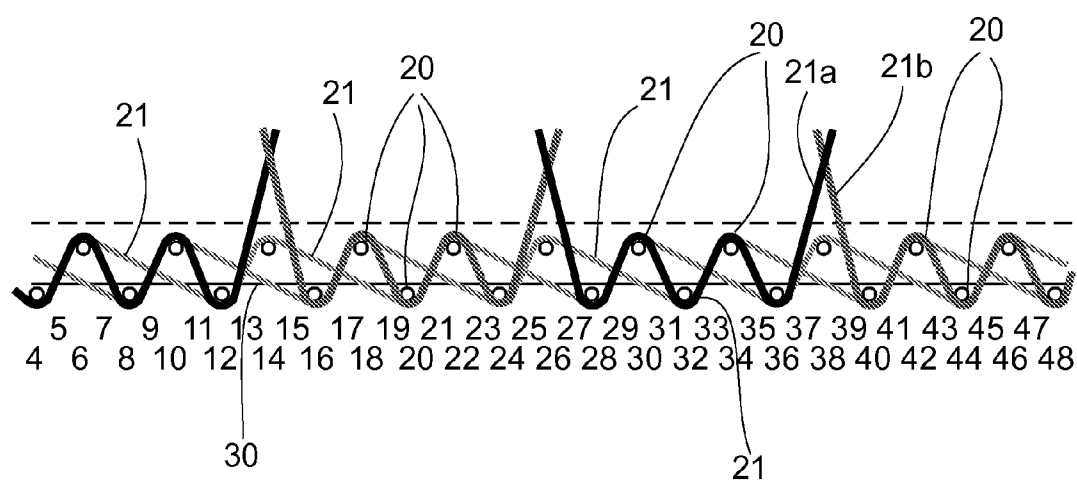
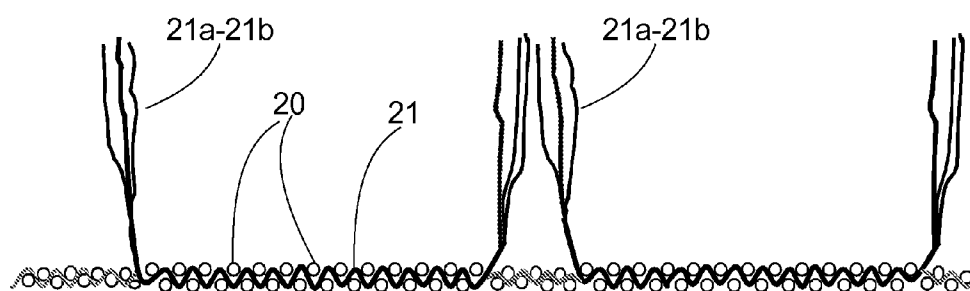
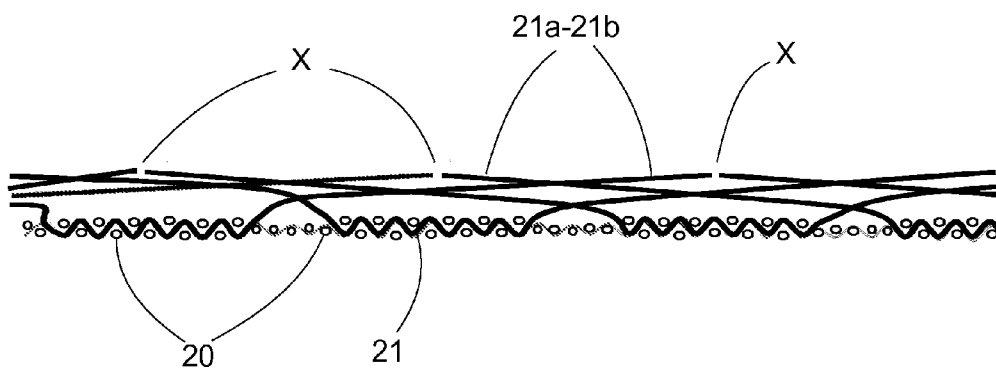


Fig. 9



(a)



(b)

Fig. 10

## DEVICE FOR PRODUCING A FIBRE MAT BY WEAVING

### FIELD OF INVENTION

**[0001]** The invention relates to a device for producing a fibre mat by weaving, which fibre mat is built up of a substrate on which fibres are provided and which device is provided at least with means for forming a shed of warp yarns forming the substrate of the fibre mat, a lay as well as means disposed on one or both sides of the shed for inserting one or more weft yarns into the shed.

**[0002]** The invention also relates to a fibre mat obtained by using a device according to the invention.

### BACKGROUND OF THE INVENTION

**[0003]** The term “fibre mat” as used in the present application is understood to refer to all kinds of substrates on which natural or synthetic fibres are provided, which fibre mats can be used for all kinds of applications, such as geotextile or, for example, as artificial grass sports fields or as so-called 3D mats or carpets.

**[0004]** Producing an artificial grass mat by means of a weaving technique is a production technique which has been developing the past few years in addition to the known production techniques such as tufting or knitting. Weaving is to be preferred over tufting, since the tufting process invariably takes place in a fixed pattern of rows or yarns. By using a weaving technique, it is possible to obtain a semi-random pattern in the shed by means of the reeds, which makes the fibre mat, for example an artificial grass mat, look better and gives it a natural appearance.

**[0005]** Furthermore, weaving is a simpler technique than tufting. In tufting, the substrate is woven first, and subsequently the fibres are tufted.

### SUMMARY OF THE INVENTION

**[0006]** The object of the invention is to provide an improved technique for producing a fibre mat and to provide a device for producing a fibre mat by using a weaving technique, which makes it possible, using one processing step, to obtain a fabric comprising free upright synthetic fibres having a semi-random, variable and adjustable pile height.

**[0007]** According to the invention, the device is characterised in that the device is provided with cutting means for cutting one or more weft yarns through in one or more places. In this way it is possible to create the free upright synthetic fibres in the fabric during the weaving step already, making it possible to obtain a fibre mat having a variable, adjustable pile height, which simulates a natural lawn, for example.

**[0008]** According to another embodiment, the device is characterised in that the cutting means are disposed downstream of the shed. This makes it possible to obtain free upright synthetic fibres already during the weaving step. In this way the need for an additional processing step of the fabric obtained after the weaving step is obviated, which simplifies the operation and which speeds up the production process considerably.

**[0009]** According to a functional aspect of the invention, the device is characterised in that the cutting means comprise at least one knife element. More in particular, the cutting surface of said at least one knife element extends perpendicularly to the insertion direction of the weft yarn. This aspect

makes it possible to cut the weft yarn through at the desired position already during the weaving process so as to obtain free upright synthetic fibres.

**[0010]** According to another functional aspect of the invention, the device is characterised in that said at least one knife element is fixedly disposed, whilst in another embodiment said at least one knife element is movably disposed. Said at least one knife element can conduct a scissor movement.

**[0011]** In another moving embodiment it is preferable if said at least one knife element is rotatable, with the cutting means more in particular comprising at least one rotatably driven shaft provided with several spaced-apart knife elements. Thus the weft yarns can be cut through in an efficient and quick manner during the weaving process so as to obtain upright synthetic fibres.

**[0012]** In order to be able to set the pile height of the separate upright synthetic fibres, the spacing between the knife elements is according to the invention adjustable.

**[0013]** According to the invention, in order to realize a reliable cutting through of the weft yarns at the desired positions, the device comprises support means for the weft yarns, which support means cooperate with the cutting means.

**[0014]** More in particular, in a specific embodiment the support means comprise at least one rod member, over which the weft yarns to be cut through can be passed. Said rod member may be provided with a recess which is capable of receiving at least part of the cutting element.

**[0015]** In order to realise an effective insertion of the weft yarns in the direction of the cutting means, the device is according to a specific aspect of the invention characterised in that the support means comprise at least one wire-like support guide supporting the weft yarns, which wire-like support guide is connected to the free end of a rod member with a first end and to the device with another end. The free end of the rod member may furthermore be screw-connected to the rod member, enabling easy mounting of the wire-like support guide.

**[0016]** In this way only the weft yarns that are to be cut through are led in the direction of the cutting means, whilst the weft yarns not to be cut through by the knife element in question can be guided past the cutting means in question without being cut.

**[0017]** In a functional embodiment, the device is characterised in that the wire-like support guide is connected to the device with its other end by means of a spring element. By having the wire-like support guide form part of the moving shed, a weft yarn to be cut through by the respective corresponding cutting element can thus be guided over the wire-like support guide device of the knife element.

**[0018]** Furthermore, the support means may be tiltable relative to the shed, which prevents the weft yarns from undesirable jamming or getting caught on the free end of the rod member. This also increases the tension on the weft yarns and thus facilitating the cutting action of the weft yarns through the cutting elements.

**[0019]** According to a functional aspect of the device according to the invention, the wire-like support guide is made of a plastic or a metal.

**[0020]** In two other functional embodiments, the cutting means can cut said one or more weft yarns through in one or more places using ultrasound or heat.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0021]** The invention will now be explained in more detail in the description of the figures below, in which reference is made to a drawing, in which:

[0022] FIG. 1 shows a first view of a device according to the invention;

[0023] FIGS. 2-8 show further views of the device according to FIG. 1;

[0024] FIGS. 9, 10a-10b show examples of a layout of a fibre mat obtained by means of the device according to the invention.

[0025] For a better understanding of the invention, like parts will be indicated by identical numerals in the description of the figures below.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0026] It should be noted that the fibre mat as described in the present patent application may be embodied in various ways, for example as a fibre mat for use in landscaping (for example for supporting dike bodies) or as fibre mats purely having a sports function, such as an artificial grass mat for soccer fields or hockey fields. Such a weaving device is provided with means 10 forming a shed or reed for warp yarns 20 being fed to the shed from behind the weaving device.

[0027] A fibre mat as described in the present application may comprise natural fibres as well as synthetic fibres.

[0028] The lay 10 functions to keep the warp yarns some distance apart and also to weave weft yarns 21 alternately between the various weft yarns. The warp yarns 20 thus form the substrate of the fibre mat.

[0029] To insert the weft yarns 21, insertion means 11 are disposed on one side of the shed, which insertion means unwind the weft yarns 21 from a supply bobbin (not shown) and weave them between the various warp yarns 20 in the shed 10 by means of a projectile reciprocating through the shed, for example a gripper, or by means of air or water.

[0030] A fibre mat consists of a substrate on which synthetic fibres are provided. The synthetic fibres have a certain pile height and extend upwards from the substrate so as to make the fibre mat look more like natural grass in those cases in which the fibre mat is intended for use as a geotextile mat or an artificial grass mat. Usually, an infill material, for example consisting of said and/or small particles of a synthetic material (for example rubber), is provided between the upright fibres. During the process of weaving, the weft yarns of the fibre mat, which eventually are to form also the upright fibres in the final fibre mat, have been fully inserted between the warp yarns 20.

[0031] According to the invention, in order to realise a fibre mat with free upright synthetic fibres, cutting means 30 (see FIG. 2) are provided, which cut the various weft yarns 21 through in one or more places in the shed 10.

[0032] As is clearly shown in FIG. 2 (and FIGS. 3-4-5), the cutting means 30 consist of a shaft 34, which is mounted to a frame 39 forming part of the weaving device by means of support flanges 35. The support shaft 34 can be rotatably driven by a drive unit 36 (for example an electric motor) which rotatably drives the support shaft 34 via a gear 36a, a transmission carrier 37 and a gear 38. Also other ways of driving the shaft by means of a chain or another type of endless carrier are possible, however.

[0033] According to the invention, cutting elements 33 are provided some distance apart on the support shaft 34, said cutting elements in this embodiment being embodied as rotatably driven knives 33. The knife elements 33 can be rotatably driven by means of the support shaft 34, to be true, but they are further fixedly disposed relative to the frame 39 (and the

weaving device 10). During the weaving process, the fibre mat (substrate of warp yarns 20 with inserted weft yarns 21) thus woven moves from the shed in the direction of the frame 39 and the cutting means 30.

[0034] The rotating cutting elements cut the weft yarns 21 through at predetermined positions, so that a free upright end can function as a artificial grass fibre. The rest of the weft yarn thus remains present in the substrate 20 as a part woven into said substrate, so that the artificial grass fibre cannot undesirably become detached from the substrate 20 without a force (for example a pulling force) being exerted.

[0035] It should be noted that the cutting means can also be realised in other embodiments, for example in the form of non-moving, rigidly disposed knife elements, past which the weft yarn is carried. In another embodiment, the knife elements may be configured as small scissors which are driven in a suitable manner.

[0036] The cutting means may also be oriented perpendicularly to the insertion direction of the weft yarn, as is shown in the figures. An improved cutting action can be realised, however, if the cutting means are disposed at an angle to the insertion direction of the weft yarn 21.

[0037] To achieve a correct cutting of the weft yarns 21 so as to obtain synthetic fibres having a desired pile height, the weaving device according to the invention is provided with support means which cooperate with the various cutting elements 23. The support means are indicated at 23, being configured as rod members 32 which are rigidly connected to the frame 39.

[0038] The function of the rod members 32 is a passive one performed by the free ends 32a, which lift the weft yarns to be cut through and guide said weft yarns over the rod member 32 in the direction of the cutting elements 33. Weft yarns 21 not to be cut through are passed under the rod member 32 and are thus not cut through by the corresponding cutting element 33 but remain unaffected, being woven in between the warp yarns 20. Thus a suitable fixation in the warp yarns 20 of the separate weft yarns functioning as artificial grass fibres is guaranteed.

[0039] To achieve an expert, trouble-free cutting of the weft yarns 21 by the cutting elements 33, each rod member 32 may be provided with a recess 32b capable of receiving at least part of the cutting surface 33a of each cutting element.

[0040] Preferably, the free end 32a of each rod member 32 can be screwed onto the rod member 32 by means of a screw thread 32c. The free end 32 may be hollow and be provided with an opening 32d, through which a wire-like support guide 31 (see FIGS. 2, 7 and 8) extends, which wire-like support guide is connected to the free end of the rod member 32 with one end and to the device with the other end.

[0041] As FIGS. 1, 2, 7 and 8 clearly show, the wire-like support guides 31 are guided through the shed and the reed 10 to the side of the weaving device where the weft yarns 21 are inserted into the weaving device. The wire-like support guides 31 are reciprocated through the shed by the insertion means of the weaving device, so that, depending on the weaving action, weft yarns 21 are inserted into the shed below and above the wire-like support guides.

[0042] The support guides are preferably tiltably mounted in the device, thus preventing the weft yarns from undesirable jamming or getting caught on the free end thereof. The support beam 39 is to that end tiltably relative to the shed. The

support beam 39 may for example be connected to an eccentric transmission, which transmission can be driven from the weaving device.

[0043] Since each wire-like support guide 31 is connected to a rod member 32, the weft yarns 21 inserted over the wire-like support guide 31 in question will irrevocably be carried in the direction of the associated cutting element 33 to be cut through there.

[0044] Weft yarns 21 that have been locally inserted under a wire-like support guide 31 will thus not be cut through at the location of said wire-like support guide (and the rod member 32 and the knife element 33, respectively).

[0045] As FIG. 8 clearly shows, the various wire-like support guides 31 are connected to a support beam 10a of the weaving device with their other end 31b, preferably by means of a spring element 40, so that movements and stresses in the wire-like support guide 31, which stresses can develop during the weaving process, can be absorbed in a simple manner.

[0046] By tilting the support guides, as stated above, not only an undesirable jamming of the weft yarns is prevented. In combination with the spring elements 40, the tilting of the rods 32 immediately lifts the wire like support guides 31, hence lifting the weft yarns guided by these wires to the rods increasing the tension on the weft yarns and thus facilitating the cutting action of the weft yarns through the cutting elements.

[0047] Below, the parameters of a fibre mat obtained by means of a device according to the invention will be described by way of example. Such a fibre mat is shown in FIG. 9, in which the numerals in the row of numerals beside the shed (or reed) 10 refer to the weft yarns 20. The figure clearly shows the freely projecting artificial grass fibres 21a-21b obtained by locally cutting through the weft yarns 21 in the fibre mat, using the cutting means 30. The fibre mat (or fibre carpet) has a surface density of 1265 g/m<sup>2</sup>, consisting of a yarn of 8300 DTEX. The number of picks per centimetre is 14.5, whilst the pile height of the synthetic fibres 21a-21b cut free is about 60 mm.

[0048] In FIGS. 10a-10b a different layout of a fibre mat is disclosed, with reference X indicating the position where the weft yarn is cut through by the cutting means 30 for obtaining individual synthetic fibres.

[0049] The mat has been woven in accordance with the following construction: 20 weft yarns flat+10 warp yarns tied off with at least one double W-knot. However, the weaving device may also be configured to weave with 2-25 weft yarns flat+2-50 warp yarns tied off with at least one double W-knot.

[0050] The fibre mats that can be produced by means of the device according to the invention are in particular suitable for use as a geotextile in landscaping, but they can also be used for (soccer) sports fields. Characteristic of such fibre mats is the fact that use is made of a two-dimensional weaving technique, by means of which a functional 3D (artificial grass) construction is realised.

1. A device for producing a fibre mat by weaving, which fibre mat is built up of a substrate on which fibres are provided and which device is provided at least with means for forming a shed of warp yarns forming the substrate of the fibre mat, a lay as well as means disposed on one or both sides of the shed for inserting one or more weft yarns into the shed, wherein the

device is provided with cutting means for cutting one or more weft yarns through in one or more places.

2. A device according to claim 1, wherein the cutting means are disposed downstream of the shed.

3. A device according to claim 1, wherein the cutting means comprise at least one knife element.

4. A device according to claim 3, wherein the cutting surface of said at least one knife element extends perpendicularly to the insertion direction of the weft yarn.

5. A device according to claim 3, wherein the cutting surface of said at least one knife element extends at an angle to the insertion direction of the weft yarn.

6. A device according to claim 3, wherein said at least one knife element is fixedly disposed.

7. A device according to claim 3, wherein said at least one knife element is movably disposed.

8. A device according to claim 7, wherein said at least one knife element conducts a scissor movement.

9. A device according to claim 7, wherein said at least one knife element is rotatable.

10. A device according to claim 9, wherein the cutting means comprise at least one rotatably driven shaft provided with several spaced-apart knife elements.

11. A device according to claim 10, wherein the spacing between said knife elements is adjustable.

12. A device according to claim 1, wherein the device comprises support means for the weft yarns, which support means cooperate with the cutting means.

13. A device according to claim 12, wherein the support means comprise at least one rod member, over which the weft yarns to be cut through can be passed.

14. A device according to claim 13, wherein said rod member is provided with a recess which is capable of receiving at least part of the cutting element.

15. A device according to claim 12, wherein the support means comprise at least one wire-like support guide supporting the weft yarns, which wire-like support guide is connected to the free end of a rod member with a first end and to the lay with another end.

16. A device according to claim 15, wherein the free end of said rod member is screw-connected to said rod member.

17. A device according to claim 15, wherein said wire-like support guide is connected to the device with its other end by means of a spring element.

18. A device according to claim 12, wherein said support means are tiltable relative to the shed.

19. A device according to claim 15, wherein said wire-like support guide is made of a plastic material.

20. A device according to claim 15, wherein said wire-like support guide is made of a metal.

21. A device according to claim 1, wherein said cutting means cut said one or more weft yarns through in one or more places using ultrasound.

22. A device according to claim 1, wherein said cutting means cut said one or more weft yarns through in one or more places using heat.

23. A fibre mat obtained by means of the device according to one or more of the preceding claims.

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