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## (54) PROCESS OF MANUFACTURING **ARTIFICIAL TURF**

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### **Related U.S. Application Data**

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#### (57)ABSTRACT

According to an embodiment of the disclosure a stitching arrangement for tufts of artificial turf includes a first stitching path along a substrate following a pattern. The pattern has at least two diagonally right stitches before two diagonally left stitches, and at least one straight stitch interspersed between each diagonally right stitch and each diagonally left stitch.





FIG. 1













FIG. 3

FIG. 4





FIG. 5B



FIG. 6B



FIG. 7B



FIG. 8A



FIG. 8B



FIG. 9B



FIG. 10B

#### PROCESS OF MANUFACTURING ARTIFICIAL TURF

#### RELATED APPLICATION

**[0001]** This application is a continuation-in-part of U.S. patent application Ser. No. 14/485,434, filed on Sep. 12, 2014, which claim foreign priority to Mexican Patent Application MX/U/2013/000622, filed on Nov. 26, 2013. The entirety of both applications are incorporated by reference herein for all purposes.

#### TECHNICAL FIELD

**[0002]** This invention pertains to carpeting of artificial turf, and more particularly to improvements in the process of manufacturing artificial turf.

### BACKGROUND

**[0003]** A variety of different techniques are used to manufacture artificial turf. The artificial industry has labored intensively to perfect the appearance of such artificial turf. For example, manufacturers have experimented with the use of different colors and materials to reflect the fact that turf in its natural state is not a homogenous single shade of green. Unfortunately, the most common weaving technique still involves using rows of stitches to create tufts of artificial turf. This, however, is not how turf appears in nature.

#### SUMMARY OF THE DISCLOSURE

**[0004]** According to an embodiment of the disclosure a stitching arrangement for tufts of artificial turf includes a first stitching path along a substrate following a predetermined pattern. The pattern has at least two diagonally right stitches before two diagonally left stitches, and at least one straight stitch interspersed between each diagonally right stitch and each diagonally left stitch.

[0005] According to another embodiment of the disclosure, a stitching arrangement for tufts of artificial turf includes a first stitching path along a substrate following a predetermined pattern. The pattern has a first portion of an oscillation from a baseline having at least one diagonally right stitch from the baseline before having at least one diagonally left stitch back towards the baseline. The pattern also includes a second portion of an oscillation from the baseline having at least one diagonally left stitch from the baseline before having at least one diagonally right stitch back towards the baseline. The pattern also includes a straight stitch between the first and second portions of the oscillation along the baseline. The pattern also includes at least one additional straight stitch between diagonal stitches on each portion of the oscillation that is not on the baseline. [0006] According to another embodiment of the disclosure, a method of stitching tufts of artificial turf include moving a first stitching needle along a substrate in a predetermined pattern. The pattern has at least two diagonally right stitches before two diagonally left stitches, and at least one straight stitch interspersed between each diagonally right stitch and each diagonally left stitch.

[0007] Although certain features have been provided above, it should be understood that other embodiments may include more, fewer, or different features.

**[0008]** Before undertaking the DETAILED DESCRIP-TION below, it may be advantageous to set forth definitions of certain words and phrases used throughout this patent document: the terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation; the term "or," is inclusive, meaning and/or; the phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like. The phrase "at least one of," when used with a list of items, means that different combinations of one or more of the listed items may be used, and only one item in the list may be needed. For example, "at least one of: A, B, and C" includes any of the following combinations: A; B; C; A and B; A and C; B and C; and A and B and C. Definitions for certain words and phrases are provided throughout this patent document, those of ordinary skill in the art should understand that in many if not most instances, such definitions apply to prior, as well as future uses of such defined words and phrases.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]** For a more complete understanding of this disclosure and its features, reference is now made to the following description, taken in conjunction with the accompanying drawings, in which:

**[0010]** FIG. **1** shows a simplified cross section of diagram of a basic tufting elements **100** through which embodiments of the disclosure may be utilized;

**[0011]** FIG. **2**A provides an illustration of the location of a particular needle as it moves in the pattern;

**[0012]** FIG. **2**B illustrate two potential ways of describing the stitch movement of FIG. **2**A with respect to a two different baselines;

[0013] FIG. 3 illustrates another pattern, according to another embodiment of the disclosure.

[0014] FIG. 4 illustrates another pattern, according to another embodiment of the disclosure;

**[0015]** FIGS. **5**A and **5**B show the application of a plurality of stitches from a plurality of needles following the patterns described in FIGS. **2**A-**2**B;

**[0016]** FIGS. **6**A and **6**B shows a plurality of stitches from a plurality of needles following the patterns described in FIG. **3**;

**[0017]** FIGS. 7A and 7B shows a plurality of stitches from a plurality of needles following the patterns described in FIG. 4;

**[0018]** FIGS. **8**A and **8**B show another application of a plurality of stitches from a plurality of needles following the patterns described in FIGS. **2**A-**2**B;

[0019] FIGS. 9A and 9B shows another plurality of stitches from a plurality of needles following the patterns described in FIG. 3; and

**[0020]** FIGS. **10**A and **10**B shows another application of plurality of stitches from a plurality of needles following the patterns described in FIG. **4**.

#### DETAILED DESCRIPTION

**[0021]** The FIGURES described below, and the various embodiments used to describe the principles of the present disclosure in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the disclosure. Those skilled in the art will understand that the principles of the present disclosure may be

implemented in any type of suitably arranged device or system. Additionally, the drawings are not necessarily drawn to scale.

**[0022]** This application is a continuation-in-part of U.S. patent application Ser. No. 14/485,434, filed on Sep. 12, 2014, which claim priority to Mexican Patent Application MX/u/2013/000622, filed on Nov. 26, 2013. The entirety of both applications is incorporated by reference herein for all purposes.

**[0023]** FIG. 1 shows a simplified cross section of diagram of a basic tufting elements **100** through which embodiments of the disclosure may be utilized. In particular, FIG. 1 shows tufts **110** of thread, a substrate **120**, a weave **130** for the tufts of thread, and a coating **140**. Although particular details of each will be described below, one of ordinary skill in the art will recognized that other details that artificial turf may have other elements as well.

[0024] The thread is often designed to resemble stems and leaves of grass; however, in some configurations, the threads may have a color and be configured to display particular graphics, for example, if a sports teams wants a particular logo or color for a field (e.g., blue as opposed to green or its team logo). Additionally, a threads with a plurality of colors may be used in certain configurations to display stripes or indicate boundary markings on a field (e.g., yard lines, side lines, hash marks and goal zones). The threads used may be formed from any suitable material for creating an embroidered structure, including but not limited to polyester, polypropylene, polyethylene, nylon, carbon fiber, glass, glass fiber, polvaramide, metal, copolymers, polvlactic acid, polyglycolic acid, biodegradable fibers, silk, cellulosic and polycaprolactone, including mixtures of one or more of these materials including fibers made therefrom. The substrate 120 through which the thread is weaved is often fabricated with intertwined flat polypropylene strings; however, other materials may be utilized. The coating 140, which is applied to the lower face of the substrate 120, may be made from any suitable coating material, including acrylic (including acrylic latex), polyurethane and silicone, including mixtures of one or more of these materials. In operation, a tufting machine uses an array of needles, a thread-feeding mechanism called a "creel," and a line for the finish. The tufting machine fastens, stitches, or weaves the threads upon the substrate 120, which is often stored comes in rolls. The threads are kept on bobbins or spools.

**[0025]** The substrate **120** is placed on a special accessory allowing the tufting machine to pull it as it is weaving. The spools of thread are fitted to the creel according to the number of needles used by the machine. The threads are guided by individual polyethylene tubes from the bobbin to the tufting machine. The thread enters the machine via a feeding system with rollers until it reaches the needles. The thread is strung through the eye of the needle, ready for insertion through the substrate **120**. The action of the tufting machine introduces the threads through the substrate **120** and a knife cuts them at a set length, yielding the tufts **110**.

**[0026]** Once the turf (sometimes referred to as carpet) exits the machine, the turf is inspected and the weave is repaired as necessary. Subsequently the product is rolled up and made ready for the application of the coating **140** (or sent directly to a coating processing as opposed to being rolled). As referenced above, the coating **140** may be any suitable material such as latex or polyurethane in order to bond the threads thereby providing strength, protection, and

consistency. In the coating process, the turf is guided to a moving belt and enters an area where the material (latex or polyurethane) is applied as a liquid. Afterwards, it is sent to an oven to cure the coating **140**. The turf may continue along a moving belt and be perforated for the purpose of draining water that falls upon it when in use. Then, the turf keeps moving along the belt until the coating **140** cools completely. Finally, when the turf arrives at the inspection and packaging station where the quality is checked, the carpet is rolled up and it is wrapped inside a polyethylene plastic film. **[0027]** When the artificial turf is put in place, "in-fill" may be put thereon. Such in-fill may be natural or artificial. Non-limiting materials include silica sand, other types of sand, rubber, and the like.

**[0028]** One of the challenges in creating artificial turf is the ability to not only make it look like natural turf or grass, but also to make it operate in a similar way that natural turf or grass operates. As a non-limiting example, when an athlete runs and stops or slides on the field, one may inquire whether the artificial turf has the appropriate splash including not only in-fill splash, but possible splash of possible intermixed water retained in the in-fill. Additionally, one may inquire whether patterns appear in the artificial turf—not only in a dry state, but also when wet after the water starts to drain and push the tufts down.

[0029] A traditional weaving techniques involves stitching a plurality of parallel rows as lines across the substrate. The tuft from such a plurality of parallel rows technique yields turf that still has performance problems-not only from a natural look standpoint, but also from a performance standpoint. Stated differently, it still doesn't look or perform like real grass. One can easily see the parallel line patternespecially when water starts to drain from the artificial turf, pushing tufts in a certain direction. Given these concerns, embodiment of the disclosure provide new weaving techniques and patterns. Certain embodiments of the disclosure reduce the amount of thread required for artificial turf while simultaneously presenting the appearance of heavier, more natural turf. In addition, in certain embodiments, the pattern of stitches applied to the lower surface of the carpet (where the coating of latex or polyurethane is spread), presents a larger surface for contact with the finishing material due to the great majority of the stitches being arrayed diagonallyas will be discussed below. This causes the adhesion to the threads to be strengthened when compared to the bond obtained from a rectilinear or standard weaves (e.g., the parallel line weaves) referenced above.

**[0030]** In addition to the above, according to certain embodiments, a combined greater concentration of threads in certain areas caused by unique patterns disclosed herein provides the appearance of the turf that more closely resembles real, natural turf. This is because natural turf does not grow in furrows, but rather in a dispersed fashion. Embodiments disclosed herein also greatly reduce or eliminate the appearance in turf of the unsightly parallel green lines, yielding a more natural looking turf.

**[0031]** Yet additionally, according to certain embodiment, once the "in fill" is in place, the tufts created by the unique patterns disclosed herein allow greater in fill retention— whether during game play or when performing maintenance such as sweeping.

**[0032]** Yet additionally, according to certain embodiments, the unique weaving process maintains greater consistency when compared to the conventional parallel lines approach, thereby enhancing performance of the sport. In particular, embodiments providing a homogeneous (yet unrecognizable pattern) dispersal of the thread lines allows players to depend on a uniform distribution of the turf and in fill, yielding support for more natural running, jumping, stopping and turning. Additionally, such configurations can considerably reduce reflected light which helps to moderate vision fatigue for both players and the audience.

[0033] FIGS. 2A and 2B illustrate a novel stitching pattern, according to an embodiment of the disclosure. The disclosed patterns herein provides certain improvements over applicant's pending application, U.S. application Ser. No. 14/485,434, which is hereby incorporated by reference. [0034] As alluded to above, in a conventional artificial turf operation, a bank or array of needles spaced a distance apart from one another stitch straight line along the substrate in parallel lines. Embodiments of the disclosure improve upon such conventional weaving techniques by using one or more shifts to create diagonal stitches. Additionally, as will be disclosed below, embodiments of the disclosure utilize staggered rows of needles as opposed to all needles being located in a single row. Yet additionally, certain embodiments remove slotted location of needles-creating gaps between gaps between adjacent needles.

**[0035]** A conventional configuration yielding parallel straight lines places needles one-half an inch apart. Embodiments of the disclosure can reduce such spacing (for example, one-quarter an inch apart or three-sixteenth and inch apart) and, also, skip certain needle placement as disclosed below (e.g., making certain needles one-quarter an inch and other one-half an inch a part or more). Although these spacing configurations and removal of certain needles will be disclosed herein can be used with any spacing configuration. Additionally, certain embodiments disclosed herein, while using the novel stitching patterns do not remove needle slots.

**[0036]** As referenced above, embodiments disclosed herein allow a forward movement for a straight stitch. Additionally, such embodiments also allow the simultaneous forward and horizontal movement, creating a diagonal stitch. Because the horizontal movement can occur in either direction, the horizontal stitch can create a right diagonal stitch when moving towards the right and a left diagonal stitch when moving toward the left.

[0037] FIG. 2A provides an illustration of the location of a particular needle as it moves in the pattern. In FIG. 2A, the circles represent the location of a needle. Thus, for example, circle 251 may be the considered the first location of a needle in the description of the pattern. As the substrate is pulled through with a simultaneously straight and horizontal movement, a diagonally right stitch 202 is created. Then, through the next stitch creation, only a straight movement occurs, yielding a straight stitch 203. Then, for the next stitch creation, there is again the simultaneously straight and horizontal movement, yielding another diagonally right stitch 204. Continuing the pattern, additional straight stitches 205, 207, and 209 occur as do diagonally left stitches 206 and 208. The pattern may then continue. Thus, following this pattern, one can see that there are two diagonally right stitches (202, 204) before there are two diagonally left stitches (206, 208) with an interspersed straight stitch (203, 205, 207, and 209) between each diagonal stitch.

**[0038]** Patterns in nature are usually unrecognizable. Similarly, this pattern, when repeated over and over, seeks to be unrecognizable—while still providing a homogeneous placement of tufts for performance. Stated differently, this pattern seeks to provide a homogenous, yet unrecognizable pattern.

[0039] FIG. 2B illustrate two potential ways of describing the stitch movement of FIG. 2A with respect to a couple of different baselines. Considering baseline 280, the pattern provides two diagonally right stitches (202, 204) away from the baseline 280 before there are two diagonally left stitches (206, 208) with an interspersed straight stitch (203, 205, 207, and 209) between each diagonal stitch. Considering baseline 290, one consider movements as portions of an oscillation. In particular, there is one diagonally stitch (204) away from the baseline 290, a straight stitch (205), and then and a diagonal stitch (206) back towards the baseline 290. After this first portion of the oscillation occurs, the second portion of the oscillation occurs, but in the opposite direction, namely one diagonally stitch (208) away from the baseline 290, a straight stitch (209), and then and a diagonal stitch (202) back towards the baseline 290. In between each respective portion of an oscillation, there is a straight line stitch (203, 207) on the baseline 290.

[0040] FIG. 3 illustrates another pattern, according to another embodiment of the disclosure. FIG. 3 is similar to the pattern of FIGS. 2A and 2B except that there are three diagonally rights stitches (302, 304, and 306) and three diagonally left stitches (308, 310, and 312). In particular, the pattern provides three diagonally right stitches (302, 304, 306) away from the baseline 380 before there are three diagonally left stitches (308, 310, and 312) with an interspersed straight (303, 305, 307, 309, 311, and 313) stitch between each diagonal stitch. A repetition of this pattern like other embodiments—seeks to provide a homogenous, yet unrecognizable pattern.

[0041] FIG. 4 illustrates another pattern, according to another embodiment of the disclosure. FIG. 4 is similar to the patterns of FIGS. 2A and 2B and FIG. 3 except that there are four diagonally rights stitches (402, 404, 406, and 408) and four diagonally left stitches (410, 412, 414, and 416). In particular, the pattern provides four diagonally right stitches (402, 404, 406, and 408) away from the baseline 480 before there are four diagonally left stitches (410, 412, 414, and 416) with an interspersed straight stitch (403, 405, 407, 409, 411, 413, 415, and 417) between each diagonal stitch. Additionally, the pattern can be viewed as two diagonal stitches (406, 408) away from the baseline 490 with a straight stitch (407) there between, a straight stitch (409), and then two diagonal stitches (410, 412) toward from the baseline 490 with a straight stitch (411) there between. After this first portion of the oscillation occurs, the second portion of the oscillation occurs, but in the opposite direction, namely two diagonal stitches (414, 416) away from the baseline 490 with a straight stitch (415) there between, a straight stitch (417\_, and then two diagonal stitches (402, 404) toward from the baseline 490 with a straight stitch (403) there between. In between each respective portion of an oscillation, there is a straight line stitch (405, 413) on the baseline. A repetition of this pattern-like other embodiments-seeks to provide a homogenous, yet unrecognizable pattern.

**[0042]** FIGS. **5**A and **5**B show an application of a plurality of stitches from a plurality of needles following the patterns

described in FIGS. 2A-2B. FIG. 5A show the needle arrangement whereas FIG. 5B shows the stitching paths of the needles following the pattern. For purpose of illustration, only eight needles are shown. Four of the needles are slightly staggered forward (solid) from the four other needles as illustrated by row 504 and row 506. Additionally, there is a removal of a location in which there could otherwise be a needle as can be seen from the spacing 508 between needles being seen as much shorter than spacing 510 between needles. Using this configuration, the pattern creates the overlaps shown in FIG. 5B as all eight needles move together (e.g., forward, right, or left). Although only eight needles have been shown for purposes of illustration, one of ordinary skill in the art will recognize that more than eight needles can be utilized. Additionally, although all eight needles have shown as moving together in the same direction (e.g., forward, right, or left), other embodiments may utilize independent movement of a subset of the needles. For example, an independent movement of row 504 and 506 could occur.

[0043] FIGS. 6A and 6B shows an application of plurality of stitches from a plurality of needles following the patterns described in FIG. 3. FIG. 6A show the needle arrangement whereas FIG. 6B shows the stitching paths of the needles following the pattern. For purpose of illustration, only twelve needles are shown. Eight of the needles are slightly staggered forward (solid) from the four other needles as illustrated by row 604 and 606. Additionally, there is a select removal of needles in location in which there could otherwise be a needle, namely between the slightly staggered forward pieces as can be seen from the spacing 608 between needles being seen as much shorter than spacing 610 between needles. However, spacing 612 is roughly the same as spacing 608. Using this configuration, the patterns creates overlap as all twelve needles move together (e.g., forward, right, or left). Although only twelve needles have been shown for purposes of illustration, one of ordinary skill in the art will recognize that more than twelve needles can be utilized. Additionally, although all eight needles have shown as moving together in the same direction (e.g., forward, right, or left), other embodiments may utilize independent movement of a subset of the needles. For example, an independent movement of row 604 and 606 could occur.

[0044] FIGS. 7A and 7B shows an application of a plurality of stitches from a plurality of needles following the patterns described in FIG. 4. FIG. 7A show the needle arrangement whereas FIG. 7B shows the stitching paths of the needles following the pattern. For purpose of illustration, only twelve needles are shown. Six of the needles are slightly staggered forward (solid) from the six other needles as illustrated by row 704 and row 706. Additionally, there is a removal of a location in which there could otherwise be a needle as can be seen from the spacing 708 between needles being seen as much shorter than spacing 710 between needles. As also seen, the staggering of needles alternates with there being generally two needles on one row, two needles on the next row, and so on. Additionally, although all twelve needles have shown as moving together in the same direction (e.g., forward, right, or left), other embodiments may utilize independent movement of a subset of the needles. For example, if all the needle positions for a particular row were at the same level, some could move in one direction (e.g., dotted lines) while other could move in a different direction (e.g., solid lines).

[0045] FIGS. 8A and 8B show another application of a plurality of stitches from a plurality of needles following the patterns described in FIGS. 2A-2B. FIG. 8A shows the needle arrangement whereas FIG. 8B shows the stitching paths of the needles following the pattern. For purpose of illustration, only eight needles are shown. All of the needles in this configuration are in the row 804. Additionally, there is a removal of a location in which there could otherwise be a needle as can be seen from the spacing 808 between needles being seen as much shorter than spacing 810 between needles. Although only eight needles have been shown for purposes of illustration, one of ordinary skill in the art will recognize that more than eight needles can be utilized.

**[0046]** FIGS. **9**A and **9**B shows another application of a plurality of stitches from a plurality of needles following the patterns described in FIG. **3**. FIG. **9**A shows the needle arrangement whereas FIG. **9**B shows the stitching paths of the needles following the pattern. For purpose of illustration, only eight needles are shown. All of the eight needles are in row **904**. Additionally, there is a select removal of needles in location in which there could otherwise be a needle as can be seen from the spacing **908** between needles being seen as much shorter than spacing **910** between needles. Although only eight needles have been shown for purposes of illustration, one of ordinary skill in the art will recognize that more than eight needles can be utilized.

[0047] FIGS. 10A and 10B shows another application for a plurality of stitches from a plurality of needles following the patterns described in FIG. 4. FIG. 10A shows the needle arrangement whereas FIG. 10B shows the stitching paths of the needles following the pattern. For purpose of illustration, only twelve needles are shown. All of the needles are in row 1004. Additionally, there is a removal of a location in which there could otherwise be a needle as can be seen from the spacing 1008 between needles being seen as much shorter than spacing 1010 between needles. Although only eight needles have been shown for purposes of illustration, one of ordinary skill in the art will recognize that more than eight needles can be utilized.

**[0048]** With reference to FIGS. **5**B, **6**B, **7**B, **8**B, **9**B, and **10**B and in with particular view to the dots (each of which may represent a tuft of turf), one can see that that the dots have patches of closeness interspersed with spaced gaps. The dots appear random—just like natural grass—although a pattern is followed for uniformity in the artificial turf design.

[0049] Although example spacing have been provided in FIGS. 5A, 6A, 7A, 8A, 9A, and 10A, other spacing configurations may also be utilized with the patterns of FIGS. 2A, 2B, 3, and 4. Additionally, although particular staggered arrangements have been provided with reference to FIGS. 5A, 6A, and 7A, other staggered arrangements may be utilized with the patterns of FIGS. 2A, 2B, 3, and 4, including staggered arrangements with more than two rows. [0050] It will be understood that well known processes have not been described in detail and have been omitted for brevity. Although specific steps, structures and materials may have been described, the present disclosure may not limited to these specifics, and others may substituted as is well understood by those skilled in the art, and various steps may not necessarily be performed in the sequences shown. [0051] While this disclosure has described certain embodiments and generally associated methods, alterations

and permutations of these embodiments and methods will be apparent to those skilled in the art. Accordingly, the above description of example embodiments does not define or constrain this disclosure. Other changes, substitutions, and alterations are also possible without departing from the spirit and scope of this disclosure, as defined by the following claims.

What is claimed is:

**1**. A stitching arrangement for tufts of artificial turf comprising:

a first stitching path along a substrate following a pattern, the pattern having at least two diagonally right stitches before two diagonally left stitches, and at least one straight stitch interspersed between each diagonally right stitch and each diagonally left stitch.

**2**. The stitching arrangement of claim **1**, further comprising:

- a second stitching path along the substrate following the pattern and closest in proximity amongst stitching paths to the first stitching path, wherein
  - the second stitching path follows the pattern from a different starting point from the first stitching path, and
  - the starting point for the first stitching path is in a first row and the starting point for the second stitching path is staggered from the substrate in a second row.
- **3**. The stitching arrangement of claim **2**, further comprising:
  - a third stitching path along a substrate following the pattern and closest in proximity to the second stitching path, wherein
    - the third stitching path follows the pattern from a different starting point from the first stitching path and the second stitching path,
    - the starting point for the third stitching path is in the first row, and
    - a spacing between the third stitching path and the second stitching path is greater than a spacing between the second stitching path and the first stitching path.

4. The stitching arrangement of claim 2, further comprising:

- a third stitching path along a substrate following the pattern and closest in proximity to the second stitching path, wherein
  - the third stitching path follows the pattern from a different starting point from the first stitching path and the second stitching path,
  - the starting point for the third stitching path is in the second row, and
  - a spacing between the third stitching path and the second stitching path is greater than a spacing between the second stitching path and the first stitching path.

5. The stitching arrangement of claim 1, further comprising:

- a plurality of first stitching paths along the substrate following the pattern, the plurality of first stitching paths having a point in a first stitching path row corresponding to a same point for each respective first stitching paths in the pattern, the first stitching path one of the plurality of first stitching paths; and
- a plurality of second stitching paths along the substrate following the pattern, the plurality of second stitching

paths having a point in a second stitching path row corresponding to a same point for each respective second stitching path in the pattern; and

- wherein the second stitching path row is staggered forward from the first stitching path row.
- 6. The stitching arrangement of claim 5, wherein:
- moving along the second stitching path row and the first stitching path row, there are approximately two points in the second stitching path row for every point in the first stitching path row.
- 7. The stitching arrangement of claim 5, wherein:
- moving along the second stitching path row and the first stitching path row, there is an alternating two points in the second stitching path row and the first stitching path row.

8. The stitching arrangement of claim 1, wherein

- the at least two diagonally right stitches in the pattern are at least three diagonally right stitches; and
- the at least two diagonally left stitches in the pattern are at least three diagonally left stitches.
- 9. The stitching arrangement of claim 1, wherein:
- the at least two diagonally right stitches in the pattern are at least four diagonally right stitches; and
- the at least two diagonally left stitches in the pattern are at least four diagonally left stitches.

**10**. A stitching arrangement for tufts of artificial turf comprising:

- a first stitching path along a substrate following a pattern, the pattern having:
  - a first portion of an oscillation from a baseline having at least one diagonally right stitch from the baseline before having at least one diagonally left stitch back towards the baseline;
  - a second portion of an oscillation from the baseline having at least one diagonally left stitch from the baseline before having at least one diagonally right stitch back towards the baseline;
  - a straight stitch between the first and second portions of the oscillation along the baseline; and
  - at least one additional straight stitch between diagonal stitches on each portion of the oscillation that is not on the baseline.

11. The stitching arrangement of claim 10, further comprising:

- a second stitching path along the substrate following the pattern and closest in proximity amongst stitching paths to the first stitching path, wherein
  - the second stitching path follows the pattern from a different starting point from the first stitching path, and
  - the starting point for the first stitching path is in a first row and the starting point for the second stitching path is staggered from the substrate in a second row.
- 12. The stitching arrangement of claim 10, wherein:
- the first portion of the oscillation from baseline has at least two diagonally right stitches from the baseline before having at least two diagonally left stitch back towards the baseline.
- 13. The stitching arrangement of claim 10, wherein:
- the second portion of an oscillation from the baseline has at least two diagonally left stitch from the baseline before having at least two diagonally right stitch back towards the baseline.

**14**. A method of stitching tufts of artificial turf comprising:

moving a first stitching needle along a substrate in a pattern having at least two diagonally right stitches before two diagonally left stitches, and at least one straight stitch interspersed between each diagonally right stitch and each diagonally left stitch.

15. The method of claim 14, further comprising:

- moving a second stitching needle along the substrate in the pattern and closest in proximity amongst needles to the first stitching needle, wherein
  - the second stitching needle follows the pattern from a different starting point from the first stitching needle,
  - the starting point for the first stitching needle is in a first row and the starting point for the second stitching needle is staggered from the substrate in a second row.

16. The method of claim 15, further comprising:

- moving a third stitching needle along the substrate following the pattern, wherein
  - the third stitching needle follows the pattern from a different starting point from the first stitching needle and the second stitching needle,
  - the starting point for the third stitching needle is in the first row, and
  - a spacing between the third stitching needle and the second stitching needle is greater than a spacing between the second stitching needle and the first stitching needle.

- 17. The method of claim 15, further comprising:
- moving a third stitching needle along the substrate following the pattern, wherein

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- the third stitching needle follows the pattern from a different starting point from the first stitching needle and the second stitching needle,
- the starting point for the third stitching needle is in the second row, and
- a spacing between the third stitching needle and the second stitching needle is greater than a spacing between the second stitching needle and the first stitching needle.
- 18. The method of claim 14, further comprising:
- moving a plurality of first stitching needles along the substrate following the pattern, the plurality of first stitching needles being in a first row, the first stitching needle one of the plurality of first stitching needles,
- moving a plurality of second stitching needles along the substrate following the pattern, the plurality of second stitching needles in a second row that is staggered forward from the first row.

19. The method of claim 18, wherein:

there are approximately two stitching needles in the second row for every needle in the first row.

20. The method of claim 18, wherein:

moving along the second row and the first row, there is an alternating two stitching needles in the second row and the first row.

\* \* \* \* \*