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(54) **ARTIFICIAL GRASS TUFTED WITH
HOLLOW NEEDLE MACHINE**

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(71) Applicants: **Keith England**, Chattanooga, TN (US);
Jason Daniel Detty, Chattanooga, TN
(US); **Michael L. Kilgore**,
Chattanooga, TN (US)

(72) Inventors: **Keith England**, Chattanooga, TN (US);
Jason Daniel Detty, Chattanooga, TN
(US); **Michael L. Kilgore**,
Chattanooga, TN (US)

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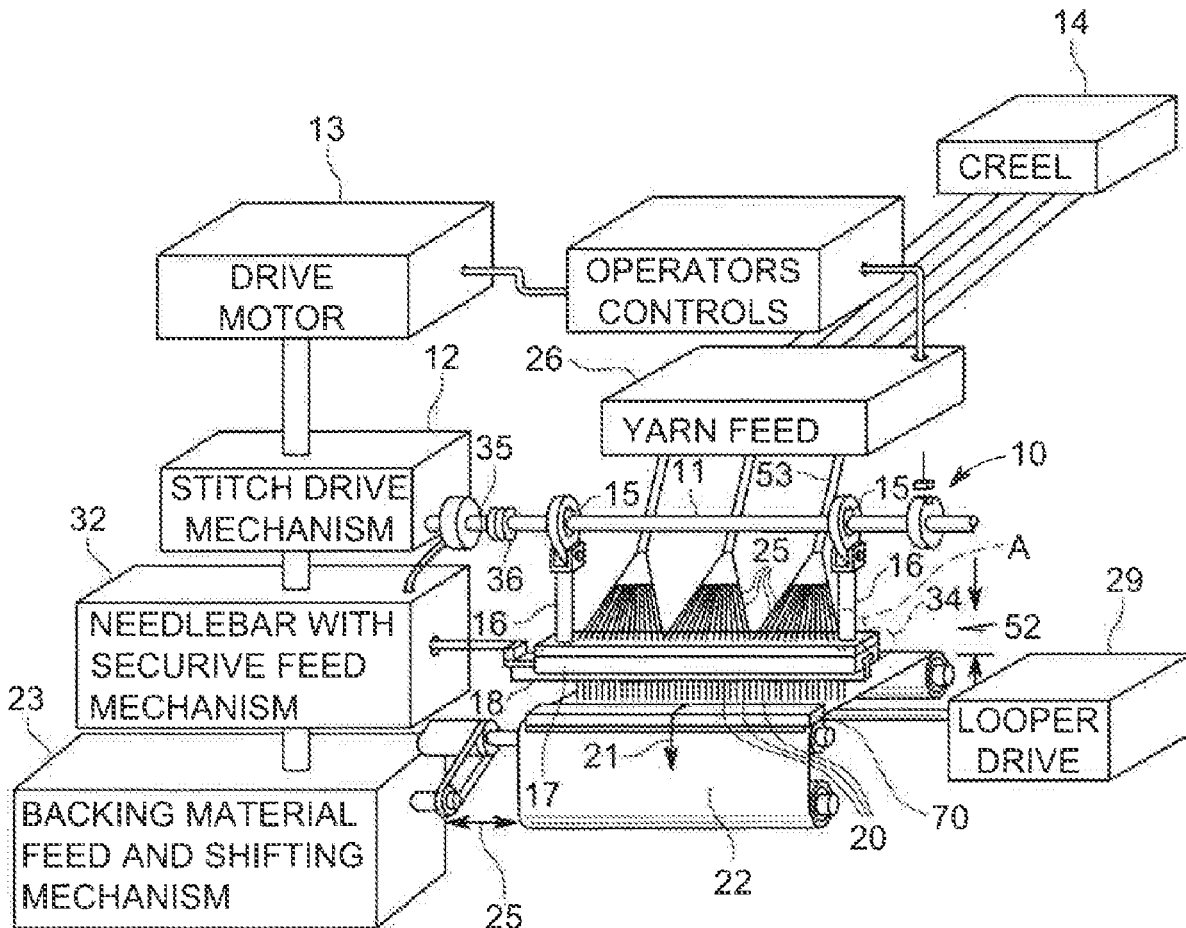
Related U.S. Application Data

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20, 2022.

(57)

ABSTRACT

A method of using an improved hollow needle tufting machine to make an artificial grass product includes features not present in prior art hollow needle tufting machines. Specifically, some embodiments have at least four inch long needles. Other embodiments have larger diameter feed rolls. Other embodiments have larger diameter guide tubes. Still other embodiments have a lowered backing support to provide an increased distance from the backing support to the needle bar.



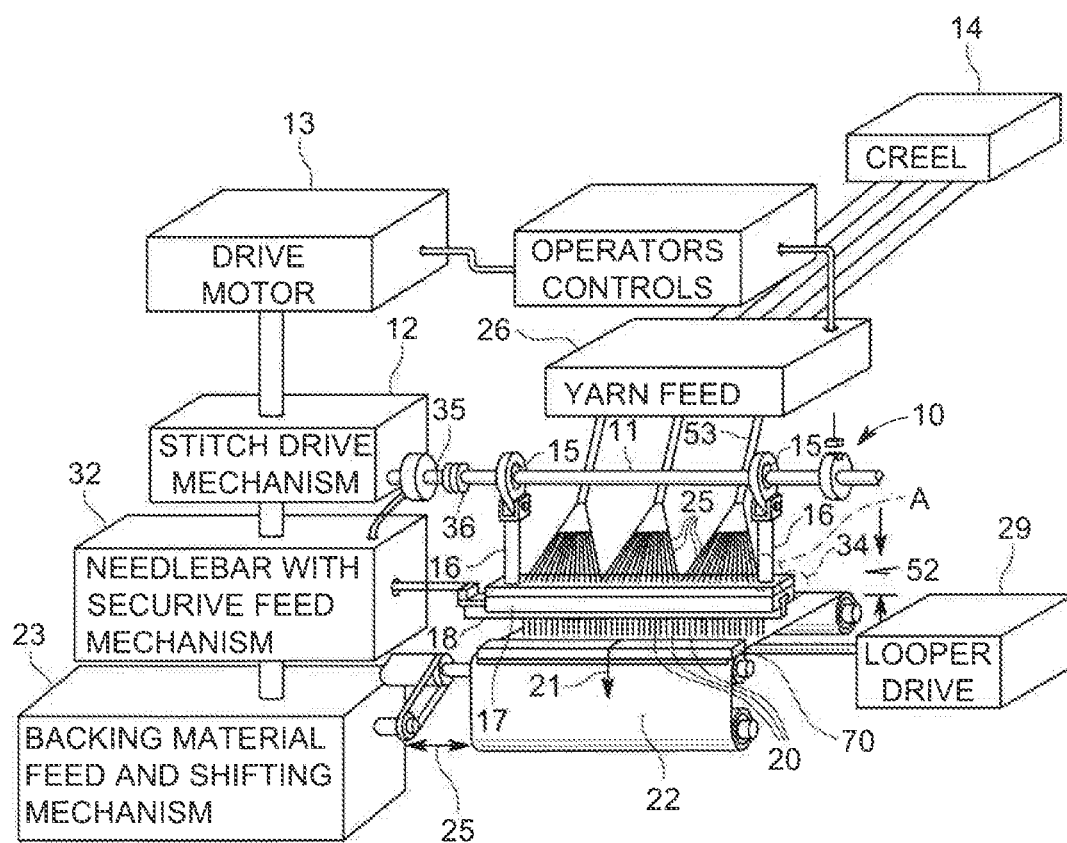


FIG. 1

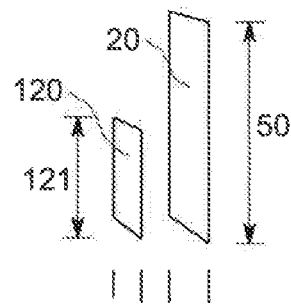


FIG. 2

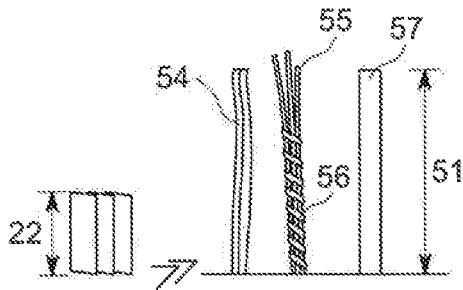


FIG. 3

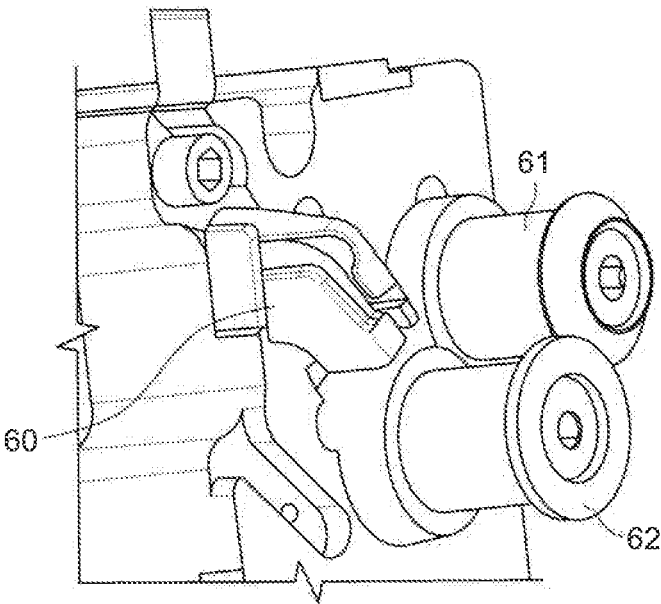


FIG. 4

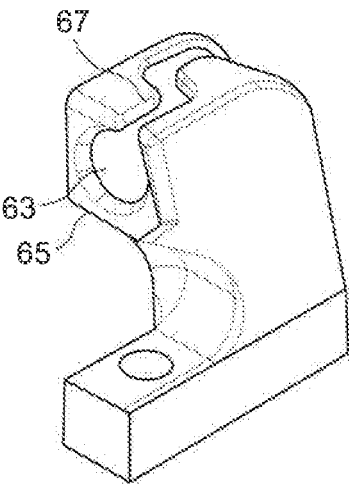


FIG. 5

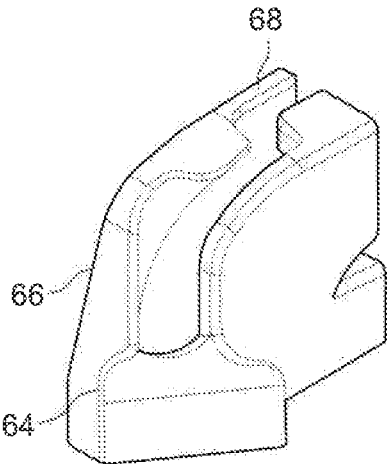


FIG. 6

ARTIFICIAL GRASS TUFTED WITH HOLLOW NEEDLE MACHINE

CLAIM OF PRIORITY

[0001] This application claims the benefit of U.S. Provisional Application No. 63/408,216 filed Sep. 20, 2022, which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to hollow needle tufting machines specifically adapted and methods of use for tufting artificial grass yarns to produce field turf, artificial lawn and/or other products.

BACKGROUND OF THE INVENTION

[0003] Hollow needle tufting was originally conceived of by Tapistron Company many years ago as U.S. Pat. No. 5,158,027 discusses an improvement which is incorporated herein by reference.

[0004] Additionally, some companies, have used independently controlled needles (ICN) tufting machines such as those having multiple tufting heads positioned in series so as to individually and sequentially tuft different colors of artificial grass yarn through a primary backing to make an artificial grass product, in particularly those having integral logos, yard markers and/or other indicia or effects on artificial grass products. For instance, one head may have white, one head may have green, etc. In those machines, the yarns only tuft where that particular color goes (all the green is tufted, then all the white is tufted, then sequentially the other colors are tufted, etc.). As one might expect, this takes a very long tufting machine to create artificial grass products. This structure used by Shaw is an improvement over prior art technology of tufting an artificial grass product and then using a waterjet or other system to cut out a particular shape and then have that same corresponding shape cut out of another product and then joined together to provide a finished product which can potentially deteriorate at seams in an undesirable fashion. For years team logos and other effects have been provided on artificial grass fields in this manner when they are not painted onto the artificial grass itself.

[0005] In spite of the prior art improvements, particularly those provided on YouTube as discussed herein, still additional improvements of these prior technologies are believed to be desirable.

SUMMARY OF THE INVENTION

[0006] It is object of many embodiments of the present invention to provide an improved artificial grass manufacturing machine and process of making artificial grass.

[0007] It is another object of many embodiments of the present invention to provide an improved hollow needle tufting machine configured to advantageously tuft, for at least some embodiments, artificial grass products and more particularly artificial grass products having logos or other multi-color effects.

[0008] Accordingly, in accordance with a presently preferred embodiment of the present invention, the applicant's technology employs a hollow needle tufting machine specifically modified to tuft artificial grass products having multiple yarns selectively provided through hollow needles.

[0009] When attempting to utilize existing hollow needle sampling machines to manufacture artificial grass products having multiple colors, the applicant ran into many difficulties. Specifically, the needles presently utilized did not offer a high enough grass extending from the primary backing when tufted. Due to this longer grass product which is significantly longer than cut loop pile or other tips sheared carpet products, the applicant discovered a need for a taller needle such as well in excess of the 2¾ inch needles utilized in the applicant's prior art tufting machines. The needle height needed to be at least 4½ inches and certainly over 4 inches to create a satisfactory height of artificial grass product. A need also existed for a larger distance between the head of the tufting machine and the backing plate or bed which required either the head to be raised, which for many embodiments would be difficult because then the machine would not fit within a container for shipment. Thus, instead of just raising the head, the applicant lowered the bed at least about an inch and a half if not two inches or more. Larger diameter bores in guide tubes were believed to be desirable over prior art carpet technology designs so as to accommodate the different types of yarns utilized in manufacturing artificial grass such as slit tapes, monofilament fiber wraps such as those having tracers and other yarn types not normally utilized in carpets. In fact, the tracer yarns would routinely get caught up in guides and hang up.

[0010] Guides that do not pinch would be particularly desirable for many artificial grass manufacturing systems.

[0011] By utilizing shifting backing systems and/or shifting needle bar systems, the gauge and density can be changed so that denser hollow needle tufting areas may "pop" to the observer.

[0012] A tip shearing apparatus integral with a tufting machine may also be desirable to prevent an extra shearing step.

[0013] Larger diameter yarn feed rolls may also be desirable to feed more yarn for each stroke of the needle tufted through the backing. While a ¾ inch diameter feed roll worked satisfactorily, less rotation would be required of a two inch diameter or three inch diameter roll. Larger diameters may prove to be easier to control and/or provide greater precision.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The particular features and advantages of the inventions with other objects will become apparent from the following description taken in connection with the accompanying drawings in which:

[0015] FIG. 1 is a simplified diagram illustration of a tufting machine showing operative components;

[0016] FIG. 2 is a side by side comparison of prior art needles with needles of a presently preferred embodiment of the present invention;

[0017] FIG. 3 is a side by side comparison of carpet as compared to artificial grass as tufted with prior art machines as compared to artificial grass tufted with the tufting machine of FIG. 1;

[0018] FIG. 4 is a perspective view of detailed area A showing the use of a new guide;

[0019] FIG. 5 is a perspective view of the guides shown in FIG. 4;

[0020] FIG. 6 is a rear perspective view of the guides shown in FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0021] A tufting machine 10 disclosed in FIG. 1 includes rotary needle shaft or main drive shaft 11 driven by stitch drive mechanism 12 from the drive motor or other conventional means. Rotary eccentric mechanism 15 mounted upon rotary needle shaft 11 adopts to reciprocally move the vertical push rod 16 for vertically and reciprocally moving the needle bar slide holder 17 and needle bar 18. The needle bar 18 supports a plurality of uniformly spaced tufting needles 20 in a longitudinal row, or staggered longitudinal rows, extending transversely of the feeding direction of the backing material 22. The backing fabric 22 is moved longitudinally and directionally 21 to the tufting machine 10 by the backing fabric feed mechanism 23 in across the backing fabric support with needle plate and needle plate fingers. The yarns 25 are fed from the creel 14 to the pattern control feed 26 with respect to needles 20 as each needle 20 carries the yarn 25 through the backing fabric 22 a hook may be reciprocally driven by the looper drive 29 to cross each corresponding needle 20 and hold the corresponding yarn end 25 to form loops. Cut pile tufts are formed by cutting loops with knives (not shown). A cut/loop or level cut loop (LCL) may also be employed and may have its own controller, just as do the yarn feed, needle bar or backing shifter and backing feed apparatus if utilized. The backing feed shifting mechanism 23 is desirable to laterally shift the backing fabric 22 relative to the needle bar holder 17 a predetermined transverse distance equal to the needle gauge or multiple of the needle gauge, in an either transverse direction 25 from its normal central position, relative to the backing fabric 22, for each stroke of the needles 20. Alternatively, a needle bar mechanism 32 may also be needle bar shifting mechanism for other embodiments.

[0022] In order to generate and put in coder signals for the backing shifting mechanism 23 corresponding stroke of the needles 20 and coder 34 or other device indicate positional information which the tufting machine controller can determine the position of the needles in the tufting cycle. Alternatively, drive motors may use commentators to indicate the motor position in which positions the associated driven components may be extrapolated by the controller. Operator controls 24 may also interface with the tufting machine controllers to provide necessary pattern information to the storage associated with the various tufting machine controllers before machine operation.

[0023] On a broadloom tufting machine, these components can be operated in a fashion to provide pixel-addressed yarn placement as described in various prior patents such as U.S. Pat. Nos. 6,439,141; 7,426,895; and 8,359,989 and continuations thereof. Pixel controlled yarn placement in connection with ICN machines is described in U.S. Pat. Nos. 5,382,723 and 5,143,003; while pixel controlled placement of yarns utilizing hollow needle tufting machines is described in U.S. Pat. Nos. 4,549,496 and 5,738,030. All these patents are incorporated herein by reference. Software to facilitate such pixel mapped designs has been available from NedGraphics since at least about 2004 in the form of its Texcelle and Tuft programs, from Tuftco Corp. in the form of its Tuftco Design System, and from Yamaguchi in the form of its design system for similar lengths of time.

[0024] Improved hollow needle tufting machines 10, as discussed herein, are particularly well adapted to manufacture artificial grass products. Using a prior art carpet sam-

pling machine, the applicant attempted to use hollow needle tufting machines to manufacture artificial grass products but quickly realized improvements were necessary whether it be to make fields or artificial lawns, landscape products, etc. One principal reason of this is a hollow needle machine set up for carpet is not well adapted for use with artificial grass. Accordingly, the applicant realized that many changes were desirable in order to make a hollow needle artificial grass machine.

[0025] For hollow needle tufting machines which are typically capable of selectively tufting at least two color yarns to the same needle 20, the applicant discovered that not only can traditional artificial grass for landscape or turf products be tufted, but also those which integrate specific field lines or logos or other effects for fields or even different patterns of different colorations and/or patterns of grass products for artificial lawns. At least two yarns can be provided per needle. Three or more can certainly be provided as well which is particularly helpful when tufting logos such as at the middle of the field or school names in end zones and/or other effects.

[0026] FIG. 2 shows the difference between a current needle 20 and a prior art needle 120 with the preferred needle 20 having a height of at least 4½ inch height 50 as compared to a maximum height 121 of the prior art needle 120 being roughly no greater than ¾ inches. Providing a tuft height 122 of any more than an inch would be an inch to an inch and a half would be very high in the carpeting community, whereas the applicant desires to have at least some yarn heights 51 at least two inches if not greater for artificial grass products. Accordingly, not only does the needle height 50 need to be greater than prior art needle height 121 but also the spacing between the needle head 17 and the backing 22 needs to be greater with spacing 52 being roughly at least one and a half to two inches greater than prior art spacing so as to accommodate the longer needles 20. While certainly one option might be to move the needle bar 17 upwardly away from the backing 22, another option would be to lower the bed and thus the backing 22 relative to the bar 17 so that the machine can still fit within a container when being shipped.

[0027] Tube such as tubes 53 can advantageously take advantage of a larger diameter such as changing from a quarter inch inner diameter to five-sixteenths or other inner diameter to accommodate yarn constructions than prior art yarns used to manufacture carpet. Specifically, when manufacturing artificial grass products, not only are flat yarns utilized for at least some embodiments but also slit tape products which may tend to roll or fold, as well as multiple monofilament fibers such as up to six, or more, monofilament fibers with a tracer yarn wrap 56, etc. Of course, that yarn 56 flat yarns 57, etc., may be utilized and/or various combination of these and/or other yarns or yarn types that are utilized in the manufacture of artificial grass products whether it be landscape products, field based products, etc.

[0028] While certainly artificial grass products are tufted with prior art tufting machines with a single yarn fed to a single needle, the applicant is unaware of any attempts to manufacture artificial grass products with tufting machines having hollow needles 20 fed by multiple yarns or selectively fed through the needles 20 depending on the pattern and/or design designed at any particular location of tuft of the needle 20.

[0029] When tufting these, the applicant discovered a number of issues when attempting to utilize prior art technology. Specifically, the guide 60 feeding with yarn feed rolls 61,62 tended to pinch and bind tracer yarns on mono-filament wrapped yarns, thus creating a tangle and relatively quickly requiring machine to be stopped. Accordingly, improved guide 60 could replace the prior art guides 60 having a smooth inner bore 63 extending from rear 64 to front 65 along a channel 66, guides 60 may have a slot 67 preferably with a jog 68 so as to retain yarns within the channel 66 but allow for easy insertion through the slot 67. A channel 66 may have a radius of curvature along the inner surface 63 but preferably no sharp edges or interface faces where one part meets with another in a sharp angle or along a pivot so as to potentially catch or retain a tracer yarn or other portion of a yarn. For the preferred embodiment, the guides 60 can be molded, 3D printed or driven or manufactured by other techniques.

[0030] Additionally, inline shear 70 may be useful with the tufting machine 10 for many preferred embodiments to selectively tip shear at least some ends.

[0031] When utilizing the hollow needles 20 and selecting which color yarn is fed and selectively tufted through the backing 22, not only can logos be tufted into carpets but also the density of individual stitches at a specific location can also be selected or varied so that logos and/or other portions or the field are artificial tuft can “pop” relative to other portions. As improved tufting machines 10 become commercially available in the marketplace, still further improvements may be developed and/or recognized as the machines implement the improvements described herein and/or possibly others.

[0032] Numerous alterations of the structure herein disclosed will present themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to the preferred embodiment of the invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having set forth the nature of the invention, what is claimed herein is:

1. A method of manufacturing artificial grass comprising: providing a hollow needle tufting machine having a plurality of at least four-inch hollow needles reciprocally driven from a needle head; feeding a backing material through the tufting machine across a backing support; selectively feeding artificial grass yarns of at least two different colors through each of the plurality of the hollow needles and the backing material while tufting to form an artificial grass product having multiple colors therein while tufting to provide a tuft height of at least two inches.
2. The method of claim 1 wherein the needle head and the backing are initially spaced at least four and a quarter inch apart.
3. The method of claim 2 wherein the backing support is lowered to achieve the desired spacing of the backing support and the needle head.
4. The method of claim 1 wherein the at least two different colors provide at least one of field lines relative to a background, a logo, and text on the artificial grass product while tufting.

5. The method of claim 1 having a guide tube diameter of at least $\frac{5}{16}$ inch selectively feeding the yarns to the hollow needles.

6. The method of claim 1 having an improved guide resisting pinching of yarn as selectively fed to the hollow needles.

7. The method of claim 6 wherein the improved guide has a smooth inner bore extending from a rear to a front along a channel.

8. The method of claim 7 wherein the improved guide has a slot with a jog permitting yarns to be inserted through the slot while the job assists in maintaining an inserted yarn within the channel.

9. The method of claim 1 further comprising the step of providing a shear inline with the hollow needle tufting machine and tip shearing the artificial grass product continuously as the artificial grass product is fed from the hollow needle tufting machine.

10. The method of claim 1 further comprising a shifting system, and further comprising the step of shifting at least one of the backing relative to the needle bar and the needle bar relative to the backing during the tufting step to provide at least one of increased gauge and stitch density.

11. The method of claim 1 further comprising the step of providing a feed roll having at least a two-inch diameter and using the feed roll to selectively feed the artificial grass yarns to the selected needle during the tufting step.

12. A method of manufacturing artificial grass comprising:

providing a hollow needle tufting machine having a plurality hollow needles reciprocally driven from a needle head;

feeding a backing material through the tufting machine across a backing support;

selectively feeding artificial grass yarns of at least two different colors with at least a two-inch diameter through each of the plurality of the hollow needles and the backing material while tufting to form an artificial grass product having multiple colors therein while tufting to provide a tuft height of at least two inches.

13. The method of claim 12 wherein the hollow needles are at least four inches long.

14. The method of claim 12 wherein the needle head and the backing are initially spaced at least four and a quarter inch apart.

15. The method of claim 14 wherein the backing support is lowered to achieve the desired spacing of the backing support and the needle head.

16. The method of claim 12 wherein the at least two different colors provide at least one of field lines relative to a background, a logo, and text on the artificial grass product while tufting.

17. The method of claim 12 having a guide tube diameter of at least $\frac{5}{16}$ inch selectively feeding the yarns to the hollow needles.

18. The method of claim 12 having an improved guide with a smooth inner bore extending from a rear to a front along a channel, resisting pinching of the yarn as selectively fed to the hollow needles.

19. The method of claim 12 further comprising a shifting system, and further comprising the step of shifting at least one of the backing relative to the needle bar and the needle bar relative to the backing during the tufting step to provide at least one of increased gauge and stitch density 20.

The method of claim 1 further comprising the step of providing a feed roll having at least a two-inch diameter and using the feed roll to selectively feed the artificial grass yarns to the selected needle during the tufting step.

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