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DESIGNS IN CARPETING AND THE LIKE
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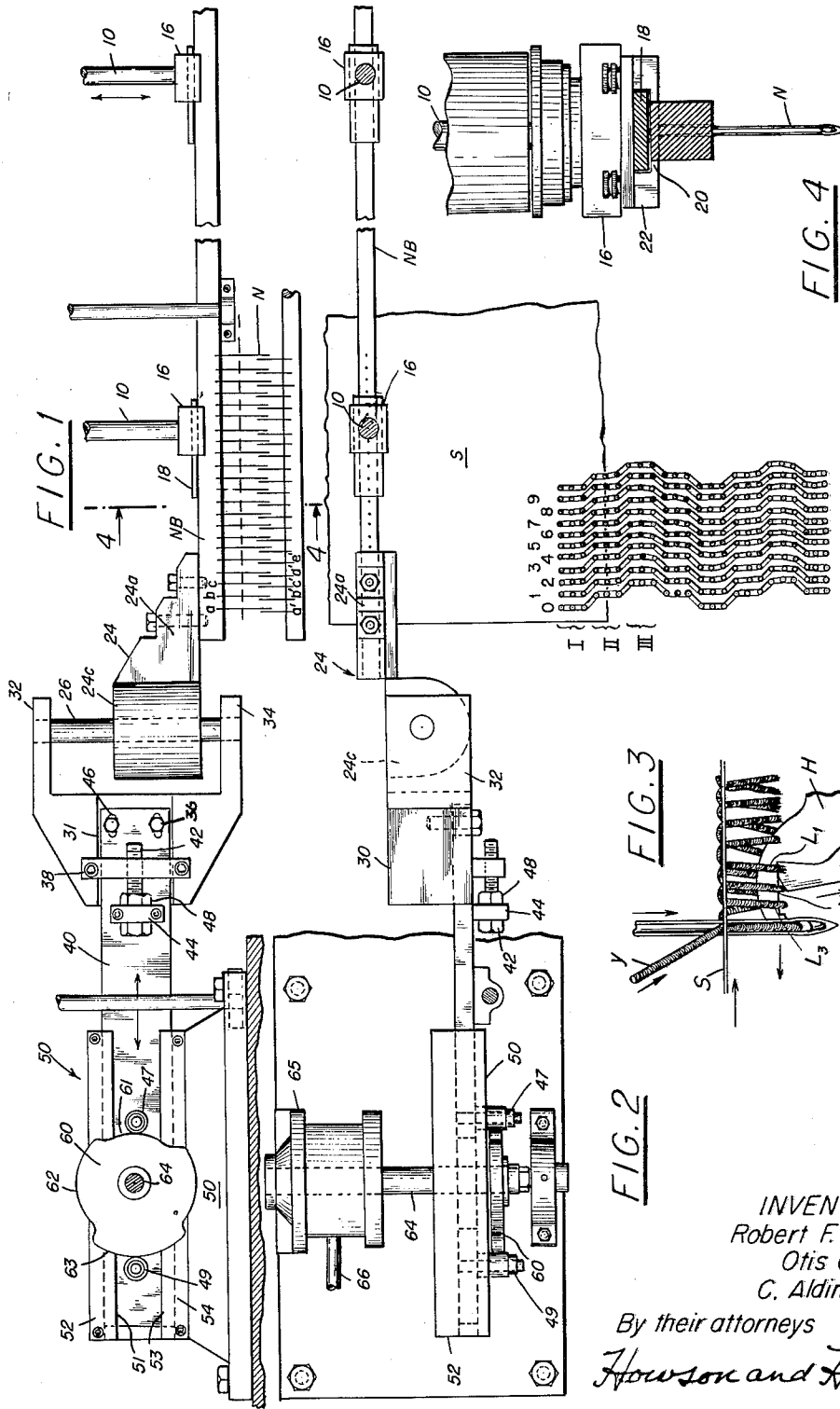


FIG. 3

FIG. 2

FIG. 4

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TUFTING MACHINE AND METHOD FOR PRODUCING MULTI-COLOR DESIGNS IN CARPETING AND THE LIKE

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This invention relates to tufting machines and methods. More particularly, it relates to tufting machines and methods for producing interesting multi-color designs in carpeting or the like by the production of cut or uncut pile loops of different colors of yarn in a backing sheet or ground fabric.

One object of this invention is to devise a new method of forming patterns in a tufted rug or similar article, such as checkered, stepped, striped or other similar patterns, while creating an article of considerable width, i.e. consisting of a large number of rows of stitches, rather than by a single row at a time—whether the row be made by hand or machine.

Another object of the invention is to provide a multi-needle cut or uncut pile carpet tufting machine of the type in which a bank of yarn carrying needles penetrates the back sheet or ground cloth and cooperates with a bank of loopers to form yarn loops,

(a) With means to shift the needle bank laterally to the right or to the left a distance equal to the gauge or distance between adjacent needles, or a multiple of the gauge, so that a given needle will cooperate, after shifting, with a different looper than before.

(b) With needle shifting means as aforesaid which will enable yarns of different colors to appear in one row of stitches giving the appearance that the row has been tufted in a straight line by one needle.

(c) With needle shifting means to enable new and interesting designs of striped or checkered or stepped appearance or variations or combinations of the same or the like, or various geometric or other patterns to be made which have not heretofore been possible.

(d) With needle shifting means as aforesaid to produce the desired designs with rapidity and without complicated and expensive machine mechanisms.

Other objects and advantages of the invention will appear as it is described in connection with the accompanying drawing.

In the drawing:

FIG. 1 is a side elevation view of a portion of a tufting machine embodying the invention.

FIG. 2 is a plan view of the portion of the machine illustrated in FIG. 1.

FIG. 3 is a detail view showing in elevation the cooperation between the needle and looper when cut pile is to be formed.

FIG. 4 is a fragmentary section view showing in transverse section through the needle bar the cooperation between the needle bar and its reciprocating means, the section being taken along line 4-4 of FIG. 1.

This invention may be adapted to tufting machines which produce cut pile as well as to machines which produce uncut pile. Customarily, the pile is produced by reciprocation of a series of yarn-carrying needles designated generally by letter N, which penetrates a cloth backing sheet S to carry a loop of yarn Y through the sheet. Reference may now be had to FIG. 3. Customarily, when cut pile is to be produced, there is a hook or looper, designated generally by letter H, directed opposite to the direction of movement of the cloth to catch a loop of yarn. The hook depicted is

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one of a bank of hooks for producing a row of loops; and a cutter element C is associated with that looper to cut one of a certain number of loops, such as L', L², L³ that are caught and remain on the looper at all times during the operation of the machine and making of the tufted fabrics. The loop L' that is cut may be called the oldest loop on the looper, the other younger loops being pushed along the looper as a new loop is caught. Thus, each loop eventually becomes the oldest and moves into the area of the cutter action.

When uncut pile is to be produced, the looper hook is directed in the other direction or, in other words, in the same direction as the cloth movement. In this instance, only one loop is held on the looper at a time, and the holding of such loop is momentary—only until formation of the next loop is started by the downstroke of the needle.

Customarily when a continuous surface of pile is to be formed as in making a rug, a series of identical needles and loopers are provided, each looper cooperating with a single needle. The needles are all mounted on a single bar in well known fashion and are reciprocated as a unit as the needle bar is raised and lowered by well known power-operated means. Likewise, the loopers are rocked to and fro beneath a backing sheet by well known power-operated means in timed relation to the needle movement so that each loop is caught by the looper as its needle starts to ascend, i.e. is withdrawn from the cloth. The paths of the loopers are fixed; and the paths of the needles have heretofore been fixed.

Since the means to reciprocate the needles and the means to rock the loopers and also the means to synchronize the movement of the looper with the needle movement are now well known to all those who are familiar with the tufting machine art, such means need not be further described or illustrated and for clarity and ease of comprehending the invention such holding means may well be omitted.

According to the present invention, conventionally power-operated means are employed to reciprocate a plurality of parallel thrust rods 10 located at spaced points along the needle bar NB which is carried by said thrust rods. A bank of needles, a, b, c, each carrying a strand or end of yarn from the usual yarn supply is conventionally mounted on the needle bar. The number of thrust rods will depend upon the length of the needle bar which in turn may depend on the number of needles carried by the bar and the width of the fabric it is desired to produce.

Contrary to the usual mounting of the needle bar on the thrust rods, the needle bar according to this invention is mounted for lateral sliding movement relative to the thrust rods by the provision of a foot plate 16 on the end of each rod. The foot plate is rigidly secured on the lower end of the thrust rod 10 by bolts or in any other suitable fashion and slidably holds a plate 18 which is secured by bolts on the upper surface of the needle bar NB. For this purpose, flanges 20 are provided on the lower surface of the foot plate by undercutting flange bars 22 secured to the bottom surface of the foot plate on opposite sides. The flange bars and foot plate thus provide a passage in which the slide plate 18 on the needle bar can slide back and forth transverse to the axis of the thrust rods, while the needle bar NB and its needles N are elevated, with reference to the backing sheet and the foot plates 16 and thrust rods 10 are in reciprocatory motion.

For the purpose of causing the sliding of the needle bar NB a predetermined distance at a predetermined time during the reciprocation of the needle bar and at a predetermined time in relation to the progress of pro-

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ducing a tufted article, mechanism is provided as will now be described.

A bracket 24 in the form of a collar 24c with an extended arm 24a has the arm bolted to the needle bar at one end thereof. The collar slides on a connecting post 26 parallel to the thrust rods. The connecting post is carried between parallel arms 32, 34 of a bifurcated slide bracket 30 mounted adjustably on the end of a slide beam 40 which is moved in response to a needle-bar-shifting or pattern cam.

The slide bracket 30 as viewed in side elevation is generally speaking of C-shape and may have a channel 31 cut in one surface parallel to and on a center line intermediate the arms to receive the end portion of the slide beam 40. This beam is adjustably secured to the slide bracket by bolts 36 passing through slots 46. For accomplishing the adjustment of the relation of the beam and bracket, a micrometer bolt 42 has one end threaded into a bridging bar 38 bolted to the slide bracket 30 and bridging over the beam 40 and its channel 31 in the slide bracket.

The other end of the micrometer bolt passes freely through a supporting lug 44 secured to the beam. When the proper adjustment is obtained, the micrometer bolt is clamped in the position of final adjustment by tightening a nut 48 on the shank of the micrometer bolt against the lug. The other end of the slide beam 40 is slidably held in a guideway provided in one side of a frame bracket 50 mounted on the bed plate of the machine for supporting the slide beam 40 and a pattern control cam 60.

For that purpose, a pair of parallel slide-beam guiding bars 52, 54 are bolted to the frame bracket, being undercut to provide flanges 51, 53 which overlie the surface of the slide beam and provide a channel between the flange and bracket surfaces in which the beam slides.

For causing sliding of the beam to and fro, a pattern control cam 60 is mounted fixedly on a cam shaft 64 driven from a gear reduction box 65 powered by a motor driven input shaft 66 from the main drive of the machine so that the cam may be synchronized with the needle action. The cam shaft 64 is mounted in a bar located behind the slide beam 40 and supported from the bed plate. This shaft is also mounted in a bearing bracket supported from the bed plate, as shown in FIG. 2.

The cam 60 is in the form of a disc and may have a plurality of concentric cam surfaces 61, 62, 63 (three being shown for the purpose of examples) at different radii from the axis of the cam shaft. Two cam follower rollers 47, 49 diametrically oppositely faced with respect to the cam shaft are mounted on pivot pins in the slide beam.

From the foregoing, the operation of the machine may be understood. The needle bar NB is continuously reciprocated causing the needles to penetrate the cloth backing sheet S carrying the yarn Y through the sheet and forming loops L', L², L³ as the loopers oscillate in timed relation to the needle reciprocation to catch the loop on the needle when the needle is at its lowermost point. The needle bar then rises while the loop is still caught on the looper and after reaching its uppermost point, the needle bar again starts to descend. Meantime, the looper is oscillated in the opposite direction to the cloth movement (if uncut pile is to be made) releasing the just-formed loop and preparing to engage the next loop-to-be-formed when the needle again penetrates the cloth.

The yarn ends in adjacent needles may be of different colors or the yarn may be of the same color in adjacent needles and in every third needle of a different color; or any combination of colors of yarns may be threaded into the needles along the entire bank of the needle bar. The color combination will be according to predetermined desired patterns.

In order to create and vary the pattern produced in

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the pile, the needle bar is shifted laterally by the rotation of the pattern cam 60. In this way, if needles (which for the purpose of illustration and example will be called a, b and c) have yarns of red, green and yellow, they will cooperate with loopers a', b' and c' when the pattern cam is in a position such as that shown in FIGURE 1. Upon rotation of the cam to the point where the next highest cam surface 62 (which is intermediate the lowest cam surface 61 with which the cam follower roller 47 is engaged in FIGURE 1 and the highest cam surface 63 with which the cam follower 49 is engaged in FIGURE 1) engages the first-mentioned cam follower 4, the slide beam 40 will be shifted to the right, carrying with it the needle bar NB without affecting the ability for reciprocation of the needle bar (due to the slidable connection including the connecting post 26 and the needle bar bracket 30). In this next position, the needles designated as a, b and c will be in position to cooperate with loopers b', c' and d', respectively.

Likewise, when the highest cam surface 63 engages the first-mentioned or right cam roller 47, the slide beam 40 will have moved the needle bar still further to the right placing the needles a, b and c in position to cooperate with loopers c', d' and e', respectively. These shifting movements of the needle bar will cause the yarns of different colors to move over from one row into the next as the tufts or loops are formed in the cloth, in consequence of which a variation in the color occurs in the rows as the tufting proceeds. This may be observed by reference to FIGURE 2 wherein the zero position or row is equivalent to the position of the needle bar when the right cam roller 47 is in engagement with the lowest cam surface 61. It is in this position that the needles a, b and c cooperate with the loopers a', b' and c', respectively.

The yarn in the zero position (FIGURE 2) may be considered the yarn end carried by the needle a. The yarn in the position 1 may be considered as being carried by needle b and in position 2 as being carried by needle c. On shifting of the needle bar to the right as the intermediate cam surface 62 engages the right cam roller 47, the yarn ends will be moved over to the next row. Thus, if the first three courses designated by the Roman numeral I were formed while the lowermost point 61 of the cam is in engagement with the right cam roller (the position of FIGURE 1) the rows 0, 1 and 2 would be red, green and yellow, respectively; and the series of the next three loops designated by the Roman numeral II would be formed with the red, green and yellow yarns in the next adjacent rows, i.e. the rows 1, 2 and 3, respectively, by needles a, b and c. Likewise, when the highest point 63 of the cam is in engagement with the right cam roller 47, the needle bar will have been shifted again so that the yarns carried by needles a, b and c will be shifted to the positions 2, 3 and 4 and the colors red, green and yellow will be in those rows, respectively. Row 2 would then have (for example) green in course I, yellow in course II and red in course III.

From the foregoing, it will be obvious that by varying the number and the heights and the extents of cam surfaces, a considerable variation is possible in the number of patterns which can be made by this machine according to design.

In the foregoing, description of the mechanism for reciprocating the needles from a power source or motor is omitted as well known in the art, as is also the presser foot and feeding mechanism which causes movement of the ground sheet through the machine under the needles; so also is the coordinating and synchronizing means for the needle, looper and feeding operations. Such known portions of the tufting machine may be observed by reference to prior art patents, publications and machines.

It will be understood that the motor input shaft 66 of the gear reduction box 65 will preferably be driven by the motor which drives the needle, looper and cloth feed-

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ing mechanism so that coordination and synchronization of the motions of all will be maintained regardless of starting, stopping or continuation of the run of the machine. This is important since, once the timing of the pattern cam is adjusted to cause shifting while the needles are above the cloth, that condition must continue. Equally obviously, the needles when penetrating the cloth must always be in a path for cooperating precisely with the loopers. This is true whether the needle bar is in the middle, the right or the left of the positions possible in the embodiment illustrated. Thus, the cam surfaces must be exactly machined and the follower rollers must always be in engagement therewith.

In describing the invention and in the claims, reference to a bank of needles is intended to include two or more needles mounted side-by-side on a support such as the needle bar, the spacing between adjacent needles ordinarily being equal across the bar or a multiple of the smallest of equal spaces.

The backing sheet may be of any fabric, or plastic or cloth material used as a ground or foundation in which the stitches are formed.

The term stitches may include loops as formed in the cloth whether cut or uncut to provide pile which is cut or uncut.

The designs created need not necessarily be of yarns which are identical except for color across the bank, but may be of different materials as well as different colors, or both. Also, yarns of the same or different colors, but of different thickness or texture or composition may be carried by the various needles across the bank, according to the desired design. Also, such variations in color, material, thickness, uniformity or non-uniformity along the length are included when reference is made herein to yarns of different character; and the term yarn includes threads, filaments, strands or the like.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the form illustrated and described.

What is claimed is:

1. In a tufting machine, needle-operating means reciprocating in a predetermined path, a bank of yarn-carrying needles supported by said needle-operating means and adapted to penetrate a ground sheet which moves in a certain direction to form stitches in parallel rows in the sheet, looping means operating in a fixed path beneath the plane of the ground sheet in cooperation with the needles to catch yarn loops as they are formed, and means to move said needle-bank laterally to and fro with respect to the direction of sheet movement and relative to the looping means while said needles are out of the ground sheet and causing the needles to penetrate the sheet in rows laterally spaced from the rows of previous penetration, and motor means driving said needle operating means and said lateral-moving means in synchronism to maintain the relation of the reciprocating and lateral movements of the needle.

2. In a tufting machine, needle-operating means reciprocating in a fixed path, needle-carrying means having a bank of needles mounted thereon adapted to penetrate a ground sheet, means supporting said needle-carrying means slidably on said needle-operating means, looping means operating in a fixed path beneath the plane of the ground sheet in cooperation with the needles to catch yarn loops as they are formed, and means to move said needle-carrying means to and fro laterally with respect to the reciprocatory path of said needle-operating means a multiple of the distance between adjacent needles while said needles are out of the ground sheet whereby the reciprocating needle-bank penetrates a ground sheet to form stitches in parallel rows and upon lateral movement of the needles to penetrate the sheet in rows laterally spaced from the rows of the previous penetration, and motor means driving said needle operating means and said lateral-moving means in synchronism to maintain the rela-

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tion of the reciprocating and lateral movements of the needle.

3. In a tufting machine, a bank of yarn-carrying needles, needle-operating means reciprocating said needles to form stitches in parallel rows in a ground sheet as the sheet moves through the machine, looping means operating in a fixed path beneath the plane of the ground sheet in cooperation with the needles to catch yarn loops as they are formed, means to mount said needle-bank shiftably on said operating means, and pattern control means to shift said needle-bank laterally with respect to the needle reciprocation and relative to the looping means while said needles are out of the ground sheet to cause the needles to penetrate the sheet in rows laterally spaced from the rows of the previous penetration, and motor means driving said needle operating means and said lateral-moving means in synchronism to maintain the relation of the reciprocating and lateral movements of the needle.

4. In a tufting machine, a bank of yarn-carrying needles, needle-operating means reciprocating said needles to form stitches in parallel rows in a ground sheet as the sheet moves through the machine, looping means operating in a fixed path beneath the plane of the ground sheet in cooperation with the needles to catch yarn loops as they are formed, means to mount said needle-bank shiftably on said operating means for shifting while the needle-operating means continues in operation, and pattern control means to shift said needle-bank laterally with respect to the needle reciprocation and relative to the looping means while said needles are out of the ground sheet to cause the needles to penetrate the sheet in rows laterally spaced from the rows of the previous penetration, and motor means driving said needle operating means and said lateral-moving means in synchronism to maintain the relation of the reciprocating and lateral movements of the needle.

5. In a tufting machine, a bank of yarn-carrying needles, needle-operating means reciprocating said needles to form stitches in parallel rows in a ground sheet as the sheet moves through the machine, looping means operating in a fixed path beneath the plane of the ground sheet in cooperation with the needles to catch yarn loops as they are formed, means to mount said needle-bank shiftably on said operating means for shifting while the needle-operating means continues in operation and while the needles are out of the ground sheet, and pattern control means to shift said needle-bank laterally with respect to the needle reciprocation and to cause the needles to penetrate the sheet in rows laterally spaced from the rows of the previous penetration and to form stitches in continuation of said laterally spaced rows, said pattern control means comprising a cam and a cam follower engaging both sides of the cam to positively shift said needle bank to and fro, said cam having surfaces to move said follower and needle-bank selectively a multiple of the distance between adjacent needles, and motor means driving said needle operating means and cam in synchronism to maintain the relation of the reciprocating and lateral movements of the needle.

6. A tufting machine as claimed in claim 3 in which the pattern control means comprises a cam and a cam follower engaging both sides of the cam to positively shift said needle-bank to and fro, said cam having surfaces to move said follower and needle-bank selectively a multiple of the distance between adjacent needles.

7. A tufting machine as claimed in claim 3 in which said pattern control means comprises slidable means connecting with said needle-bank, and cam means actuating said slidable means and having surfaces to move said slidable means and needle-bank selectively a multiple of the distance between adjacent needles.

8. The method of forming a plurality of transverse rows of stitches in a backing sheet with yarns of different characters at selected locations along said rows comprising moving the sheet and causing a plurality of yarn ends

to penetrate the sheet to form a plurality of stitches in transverse rows, progressively the character of the yarn not being the same across a transverse row, shifting said yarn ends between the formation of the stitches in one transverse row and the next or any selected succeeding row, thereby forming the succeeding stitches in a given longitudinal row or rows from yarns of different characters.

9. The method of forming a plurality of transverse rows of stitches in a backing sheet with yarns of different characters at selected locations along said rows comprising moving the sheet and simultaneously forming in the plurality of transverse rows one or more stitches progressively of yarn ends of different character, the character of the yarn ends not being the same across any one transverse row, shifting the whole group of yarn ends between the formation of one stitch and the next or any selected suc-

ceeding stitch in order to form the succeeding stitches in rows from yarn ends of different characters than the preceding stitch and which had previously been used in a neighboring transverse row.

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