Sept. 4, 1962 K. L. WHITNEY 3,052,198

APPARATUS FOR MAKING TUFTED FABRICS

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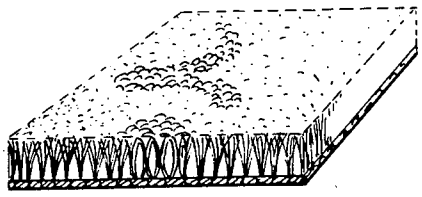


Fig. 4

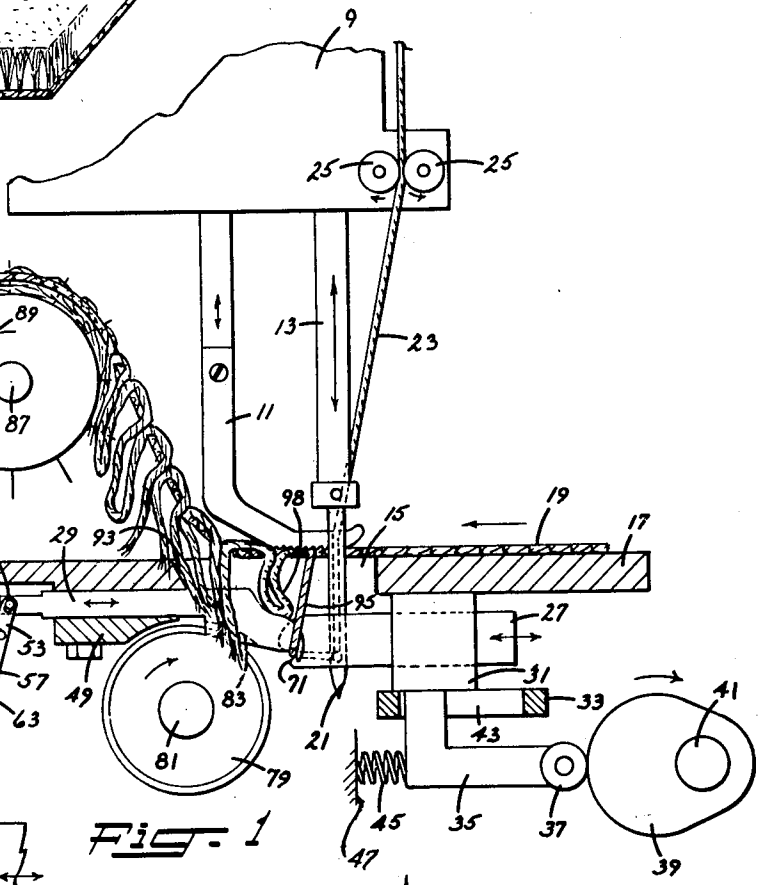


Fig. 1

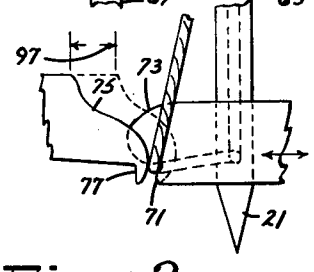


Fig. 2

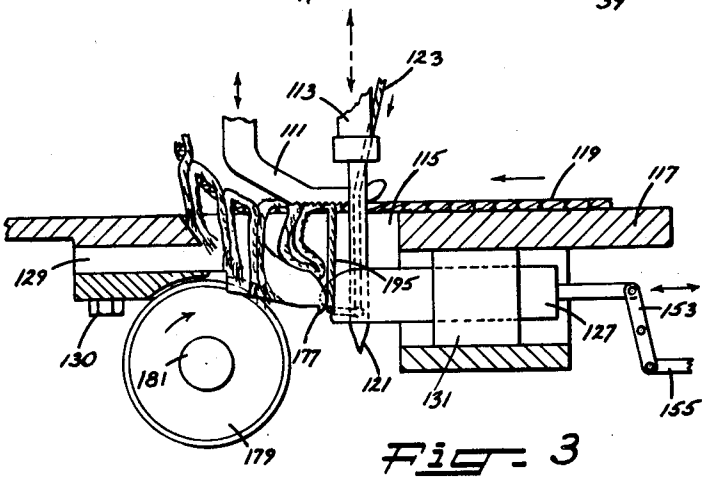


Fig. 3

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APPARATUS FOR MAKING TUFTED FABRICS

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The invention relates to the manufacture of tufted fabrics, and particularly to a tufting apparatus for providing fabrics with both cut and uncut strand loops arranged in accordance with a predetermined pattern.

In making tufted products with conventional machines, a series of needles, each carrying a strand or yarn, are passed through a fabric and are then retracted relative to both the strands and the fabric to form a series of strand loops. The loops thus formed may be retained in their uncut condition or, alternatively, may be severed to provide a cut pile fabric. It will be noted that the known tufting machines provide tufted fabrics in which either all or no strand loops are severed, with no provision being made for forming a combination of both cut and uncut loops in a desired arrangement. Shearing certain of the loops of a tufted fabric will, of course, impart a patterned effect to the fabric. This operation, however, must be effected after the fabric leaves the tufting machine, results in a considerable labor and waste of strand material, and provides cut or sheared loops which are of shorter length than the adjacent uncut loops. Accordingly, it is a primary object of this invention to provide a new or generally improved and more satisfactory apparatus for making tufted fabrics.

Another object is to provide an apparatus for making tufted fabrics having both cut and uncut strand loops arranged in a predetermined pattern.

Still another object is the provision of a fabric tufting apparatus capable of providing cut and uncut strand loops of substantially equal length and in a predetermined arrangement.

A further object is to provide a fabric tufting apparatus which permits a tufted fabric to move uniformly relative thereto without the tufts accumulating in the tufting area.

These and other objects, features, and advantages will become apparent from the following description of the invention and the drawing relating thereto in which:

FIGURE 1 is an enlarged side view of a portion of the tufting machine of the present invention, with parts thereof being broken away;

FIGURE 2 is a fragmentary view of a portion of the structure shown in FIGURE 1 on a still further enlarged scale;

FIGURE 3 is a view similar to FIGURE 2 illustrating a modified loop forming and severing arrangement; and

FIGURE 4 is a perspective view showing a tufted fabric formed in accordance with the present invention.

In general, the apparatus of the present invention is designed to provide a fabric with cut and uncut strand or yarn tufts which are of substantially the same length and arranged in a predetermined pattern. As with conventional tufting machines, the apparatus of the present invention employs a series of strand carrying needles which are reciprocated through an advancing fabric to form a plurality of strand loops.

In both embodiments of the invention, looper bars engage with the strands as the needles complete their downward movement through the fabric so as to cause the strands to assume a loop formation as the needles start and pass through the major portions of their retracting movement. During the retracting movement of the needles, the looper bars are advanced toward loop retaining bars which, when cut loops are desired, receive the loops and hold the same for severance by cutting

members. To permit all or certain loops to retain their loop formation, selected loop retaining bars are retracted away from the advancing looper bars or alternatively, the advancing movement of selected looper bars can be so controlled as to limit their degree of movement and thus prevent the transfer of loops from the looper bars to the loop retaining bars. Pattern members are utilized to control either the retracting movement of the loop retaining bars or the advancing movement of the looper bars in accordance with a predetermined sequence. If desired, the loop retaining bars may be retracted and the looper bars may be only partially advanced to prevent loop transfer to the retaining bars.

Since the formed loops on tufted fabrics trail the advancing movement of the fabric itself, there is a tendency for the loops to accumulate adjacent the loop forming and severing mechanism. Accordingly, an added aspect of the present invention is the provision of means for elevating and advancing the tufted fabric to insure that its movement is at a uniform rate.

It will be understood that the tufting apparatus of the present invention includes a series of simultaneously acting tufting needles, each having a looper bar, loop retaining bar, and related operating mechanism. However, for the sake of simplicity and clarity only a single tuft or loop forming arrangement has been illustrated and explained in the following description.

With reference to the drawing, the apparatus of the present invention includes a sewing or tufting head **9** having a presser foot **11** and a needle bar **13**, both disposed over an opening **15** formed in a platform or table **17**. The fabric to be tufted is shown at **19** and is supported by the table **17** as it is advanced relative to the tufting head. A needle **21** is fixed to the lower end of the needle bar **13** and carries a yarn or strand **23** which is drawn from a suitable supply source, not shown, by continuously actuated feed rolls **25**, as more fully described hereafter. Conventional actuating means are contained within the tufting head **9** for operating the presser foot **11** to advance the fabric **19** along the table **17**, and for reciprocating the needle bar **13** during the tufting operation.

The loop forming and severing mechanism of the present apparatus is disposed below the plate **17** and includes a looper bar **27** and a loop retaining bar **29**. In the embodiment shown in FIGURE 1 of the drawing, the looper bar **27** is fixed to a carriage or block **31** which is slidably supported between the underside of the table **17** and a bearing plate **33**. An arm **35** is fixed at one end to the carriage **31** and carries, at its opposite end, a follower roll **37** which bears against the periphery of a cam **39** supported on a shaft **41** and turned by suitable means, not shown. The bearing plate **33** is provided with an elongated slot **43** which permits the arm **35** to move freely through its reciprocating motion, and a compression spring **45** is interposed between a fixed portion of the machine frame, shown at **47**, and the arm **35** to resiliently maintain the follower roll **37** in engagement with the periphery of the cam **39**.

The loop retaining bar **29** is also slidably supported between the underside of the table **17** and a bearing plate **49** for reciprocating movement in accordance with a pattern member, such as pattern chain **51** acting through the links **53** and **55** which are pivotably interconnected at **57**. The link **53** is pivotably connected to a fixed portion of the machine frame, as shown at **59**, and to the loop retaining bar **29** at **61**. The link **55** is slidably supported by a bearing **63** and has a roller **65** at its free end which is resiliently urged into engagement with the pattern member **51** by a compression spring **67** acting against a flange **68**. The pattern chain **51** is provided with projections **69** which, when engaged with the roller

65, effect a retraction of the loop retaining bar 29 to a position as best seen in FIGURE 2. It will of course be understood that other pattern members, such as a cam, may be substituted for the chain 51 without departing from the spirit and scope of the present invention.

The looper bar 27 is provided with a notch 71 adjacent to its lower edge, while its leading end 73 is of smooth arcuate construction. The looper bar 27 will thus be able to easily slide in-between the needle 21 and the strand 23, the latter of which will engage within the notch 71 as the needle starts its upward or retracting movement. The adjacent or leading end of the loop retaining bar 29 is also formed with a smooth arcuate surface 75 which permits the uncut strand loops to freely ride thereover. As hereafter explained, the strand loops to be cut are transferred to the loop retaining bar 29, which is hooked at 77 to prevent the loops from sliding therefrom. A rotary knife 79, carried by a shaft 81, cooperates with the loop retaining bar 29 to sever the strand loops moved into its path. An elongated slot 83 is formed in the lower edge of the bar 29 to accommodate the knife 79.

To assist the presser foot 11 in advancing the fabric 19, and more particularly to elevate the tufted fabric away from the table opening 15, the apparatus includes a fabric advance roller 85 which is carried on a shaft 87 and turned, as indicated by arrow 89, by any suitable means, not shown. Pins 91 are provided on the periphery of the roller 85 and serve to pull the tufted fabric along a desired path, as shown in FIGURE 1. To further eliminate any tendency for the strand loops to accumulate within the table opening 15, it will be noted that the table wall is beveled at 93.

In the operation of the apparatus described above, it will be understood that the movement of the needle bar 13, feed rolls 25, looper bar 27, and pattern member 51 are all synchronized so as to insure that the respective parts perform their intended operation at the proper time. As heretofore mentioned, the pattern member 51 may be of any suitable construction and may be actuated so as to retract the loop retaining bar 29 at the desired intervals during the tufting operation. For example, the loop retaining bar may be retracted during every other stroke of the needle bar 13 or may be held in retracted position during a series of consecutive strokes of the needle bar, depending of course upon the particular pattern of cut and uncut loops desired in the finished product.

With reference to FIGURE 1, it will be noted that the needle bar 13 is at the end of its downward movement and that the cam 39 has urged the looper bar 27 to the left, with the strand 23 being engaged within the looper bar notch 71. The roller 65 of the link 55 is at rest between spaced projections 69 on the pattern member 51 so that the loop retaining bar 29 is in its projected position adjacent to the end of the looper bar 27. With this arrangement of parts, the strand loop, shown at 95, is transferred to the retaining bar 29 during the final portion of the movement of the looper bar 27 to the left. As the needle 21 moves through approximately three-quarters of its retracting stroke, the looper bar 27 commences its motion to the right, as viewed in FIGURE 1, leaving the strand loop 95 engaged by the retaining bar hook 77. Once the needle 21 is above the fabric 19, the presser foot 11 and roller 85 advance the fabric 19 along the table 17 to position a new fabric area below the needle and to move the strand loop 95 toward the path of the knife 79.

As the needle 21 moves through its downward stroke, the looper 27 again engages the strand 23 within its notch 71 and carries the same to a position as shown in FIGURE 1. In this case, however, it will be assumed that pattern member 51 has been advanced to engage one of its projections 69 with the link roller 65, so that the links 53 and 55 retract the retaining bar 29

to the right of its position shown in FIGURE 1. As shown in FIGURE 2, the retraction of the bar 29 from its broken line position to its solid line position must be sufficient to withdraw its hooked end a relatively small distance, such as indicated at 97, to prevent the newly formed loop from being transferred to the loop retaining bar. Thus, after the needle 21 has moved through approximately three-quarters of its retracting stroke, the looper bar 27 is urged to the right, as viewed in FIGURE 1, leaving the newly formed strand loop behind. With the advancement of the fabric 19 as heretofore described, the newly formed strand loop merely rides over the arcuate end of the retaining bar 29, as shown at 98, and retains its looped formation.

It will be noted that the looper bar 27, in the above described operation, does not start its return movement toward the right, as viewed in FIGURE 1, until the needle 21 has completed approximately three-fourths of its upward travel, and thus there is no tendency for the needle 21 to draw the strand upwardly through the fabric. Further, the feed rolls 25 are rotated so as to advance a length of strand 21 slightly in excess of that necessary to provide the desired loop thereby providing some slack in the strand between the feed rolls and the needle.

The embodiment of the invention, shown in FIGURE 3, is generally similar to that described above and includes a presser foot 111 and needle bar 113, both of which are disposed above an opening 115 in a platform or table 117. The fabric to be tufted, shown at 119, is supported on the table 117 and is advanced by the presser foot 111 and an advance roller, similar to 85, in a manner as described above. A needle 121 is fixed to the lower end of the needle bar 113 and carries a yarn or strand 123 which is supplied from a suitable source by feed rolls, such as shown at 25. As with the apparatus heretofore described, conventional actuating means are provided for operating the presser foot and needle bar.

The loop forming and severing mechanism of this embodiment includes a looper bar 127 and a loop retaining bar 129, the latter of which is fixed to the table as by bolts 130. The looper bar 127 is reciprocated relative to a bearing block 131 by a pattern member, generally similar to the pattern chain 51 heretofore described, which acts through pivotably interconnected links 153 and 155. As in the structure of FIGURE 1, a rotary knife 179 is carried by a shaft 181 for severing strand loops received on the retaining bar 129.

During the tufting operation, the looper bar 127 is reciprocated toward and away from the loop retaining bar 129 in synchronism with the movement of the needle 121. In this case, however, the stroke of the looper bar will vary as determined by the pattern member. Thus, when the free end of the link 155 engages the pattern member between spaced projections, the looper bar 127 will be advanced to its extreme position toward the loop retaining bar 129 so as to transfer a newly formed strand loop 195 over the hook portion 177 of the loop retaining bar 129. As heretofore described, strand loops transferred onto the retaining bar 129 will be severed by the knife 179. On the other hand, when a pattern chain projection causes the looper bar 127 to pass through a stroke which is reduced as by a distance equal to that indicated at 97 in FIGURE 2, the strand loop 195 will merely engage with and ride along the upper surface of the loop retaining bar 129 and will thus maintain its looped characteristics. As heretofore mentioned, the continuous movement of the strand feed rolls provides the portion of the strand between the needle and feed rolls with sufficient slack to prevent strand withdrawal during the upward movement of the needle. It will, of course, be understood that in this last described embodiment the pattern member will be continuously operated and that the spacing and length of the projections thereon will determine the

pattern of cut and uncut loops which will be imparted to the finished product.

As will be apparent from the above description, the inventive teachings of the present invention can be incorporated into new or existing tufting machines either by providing a reciprocable loop retaining bar or by varying the stroke of the reciprocable looper bar. Alternatively, it is within the scope of the present invention to utilize an apparatus having both a reciprocating loop retaining bar and looper bar, the movements of which are so controlled as to insure that only desired strand loops are transferred onto the loop retaining bar and severed in the manner as described above.

As illustrated in FIGURE 4, tufted products having both cut and uncut loops, as produced in accordance with with the present invention, provide novel and decorative structure not heretofore possible with conventional equipment. Further, the simplicity of the described apparatus permits the tuft pattern to be varied by merely altering the arrangement and/or operation of the pattern members themselves. If desired, the parts of both embodiments of the invention may be so adjusted to form tufted fabrics having either all cut or uncut loops.

It will be seen from the above description that the objects of the invention are well fulfilled by the apparatus described. The description is intended to be illustrative only and it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A tufting machine including a reciprocating needle for penetrating a fabric and carrying a strand therethrough, first means for engaging with the strand on one side of the fabric to form a strand loop as the needle terminates its movement in one direction and reverses its travel, second means for receiving strand loops from said first means when said first and second means are in a predetermined position, cutting means cooperating with said second means for severing the strand loops thereon, and third means including a pattern member for translating at least one of said first and second means toward and away from the other of said first and second means with a stroke of varying length to effect transfer of selected strand loops from said first means to said second means.

2. A machine as defined in claim 1 wherein said third means includes means for translating said first means toward and away from said second means in accordance with a varying pattern.

3. A machine as defined in claim 1 wherein said third means includes means for traanslating said second means toward and away from said first means in accordance with a varying pattern.

4. A machine as defined in claim 1 wherein said third means includes means for translating said first and second means toward and away from each other in accordance with a varying pattern.

5. A tufting machine including a reciprocating needle for penetrating a fabric and carrying a strand therethrough, a looper bar for engaging with the strand on one side of the fabric to form a strand loop as the needle terminates its movement in one direction and reverses its travel, a retaining bar for receiving strand loops from said looper bar when said looper and retaining bars are in a predetermined position, means for translating said looper bar toward and away from said retaining bar, cutting means cooperating with said retaining bar for severing the strand loops thereon, and means for translating said retaining bar toward and away from said looper bar with a stroke of varying length to effect transfer of selected strand loops from said looper bar to said retaining bar.

6. A machine as defined in claim 5 wherein said first mentioned means translates said looper bar with a stroke of uniform length.

7. A machine as defined in claim 5 wherein said first mentioned means translates said looper bar with a predetermined stroke of varying length.

8. A tufting machine including a reciprocating needle for penetrating a fabric and carrying a strand therethrough, a looper bar for engaging with the strand on one side of the fabric to form a strand loop as the needle terminates its movement in one direction and reverses its travel, a retaining bar for receiving strand loops from said looper bar when looper and retaining bars are in a predetermined position, means for translating said looper bar toward and away from said predetermined position with a stroke of uniform length, means for translating said retaining bar toward and away from said predetermined position with a stroke of varying length to effect transfer of selected strand loops from said looper bar to said retaining bar, and cutting means for severing the strand loops received on said retaining bar.

9. A tufting machine including a reciprocating needle for penetrating a fabric and carrying a strand therethrough, a looper bar for engaging with the strand on one side of the fabric to form a strand loop as the needle terminates its movement in one direction and reverses its travel, a stationary retaining bar for receiving strand loops from said looper bar when said looper and retaining bars are in a predetermined position, means for translating said looper bar toward and away from said predetermined position with a stroke of varying length whereby only selected strand loops are transferred to said retaining bar, and cutting means cooperating with said retaining bar for severing the strand loops thereon.

10. A tufting machine including a table for supporting a fabric, an opening in said table, a reciprocating needle passing through said opening for penetrating a fabric and carrying a strand therethrough, a looper bar for engaging with the strand on one side of the fabric to form a strand loop as the needle terminates its movement in one direction and reverses its travel, a retaining bar for receiving strand loops from said looper bar when said looper and retaining bars are in a predetermined position, means for translating said looper bar toward and away from said predetermined position, means cooperating with said retaining bar for severing the loops received thereon, a roller having fabrics engaging means on its periphery, said roller concomitantly elevating and advancing the tufted fabric away from said opening to prevent an accumulation of strand tufts therein.

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