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METHOD AND MEANS FOR FEEDING THREAD IN TUFTING MACHINES

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2 Sheets-Sheet 2

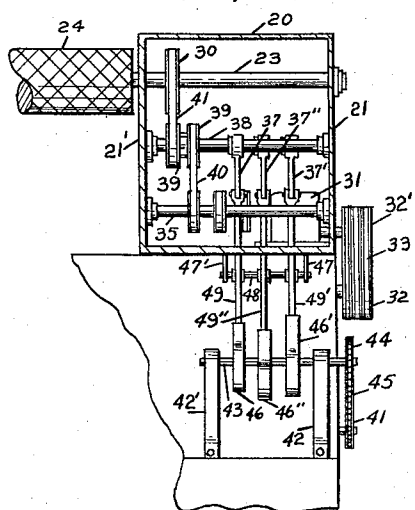


Fig 3

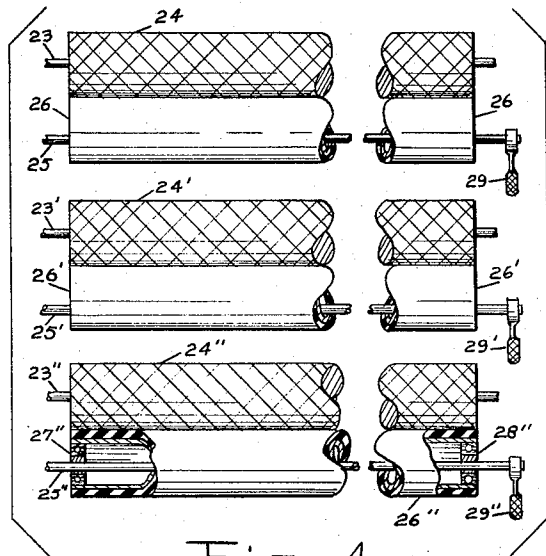


Fig 4

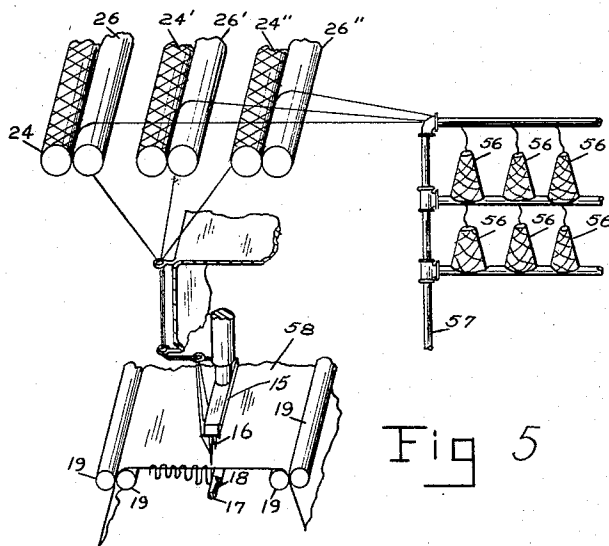


Fig 5

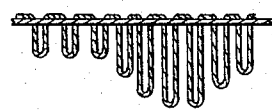


Fig 6



Fig 7

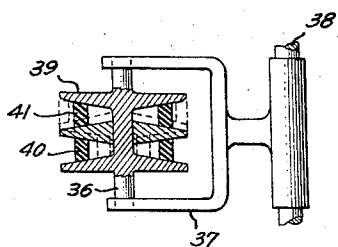


Fig 8

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METHOD AND MEANS FOR FEEDING THREAD IN TUFTING MACHINES

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6 Claims. (Cl. 112-79)

This invention relates to tufting machines and more particularly to a novel method and means of feeding thread to such machines.

In the past, many types of gang needle looping machines have been developed, and they generally comprise a plurality of needles arranged to pass thread or yarn through cloth or fabric fed across the machine bed to form rows of loops thereon, mechanism being provided for severing the loops thus produced to form the nap defining piles or chenille tufts, if desired. This mechanism usually consists of a plurality of moveable units each cooperating with a needle and carrying a hook or so-called looper reciprocated by the unit across the plane of movement of the needle to engage and hold the loops. While various attempts have been made to modify such machines to sew patterns of loops of varying heights, none have been successful in producing a machine which is flexible to make various patterns and which can be adjusted while the machine is in operation.

It is an object of my invention to provide a machine of the class described above, which is completely automatic in its operation to vary the length of loops within the sewed fabric in such a way as to provide figures or patterns as desired.

Another object of my invention is to provide a tufting machine which controls or measures the amount of thread or yarn sewed by the needle, so that varying lengths of thread may be sewed at desired portions along the base fabric.

Another object of my invention is to provide a tufting machine wherein the length of the tufts or increments of thread may be varied by introducing cams into the mechanism of the tufting machine.

Another object of my invention is to provide an improvement in a tufting machine attachment which may be inexpensively and easily incorporated with conventional machines.

Other and further objects and advantages of my invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views, and wherein:

Fig. 1 is a partially broken side elevation of a machine constructed in accordance with my invention.

Fig. 2 is a partially broken end view of the machine illustrated in Fig. 1.

Fig. 3 is a view of a detail showing the speed control means for the thread feeding mechanism.

Fig. 4 is a top view of a detail showing the thread feed rollers.

Fig. 5 is a schematic view showing the threading of the yarn through the feed rollers and needles.

Fig. 6 is a side view of a base fabric wherein various length tufts are sewed in a single row by the machine illustrated in Fig. 1.

Fig. 7 is a side view of a base fabric showing the sewing of intermediate length loops of equal size in a single row by the machine illustrated in Fig. 1.

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Fig. 8 is a view of a detail partly in cross section.

Referring now in detail to the embodiment chosen for purpose of illustration, numeral 10 denotes generally a supporting table or base of a multi-needle tufting machine constructed in accordance with my invention and mounted on supporting legs 11. Base 10 is provided with an electric motor 12, driving belts 13, main drive shaft 14, reciprocating needle bars 15, needles 16, looper shaft 17, loopers 18, and base fabric feed rollers 19, all arranged in conventional manner. As shown in Fig. 1, a box-shaped housing 20 is mounted on one end of base 10 and is provided with side walls 21, 21'. Mounted at the other end of table 10 is an upstanding bracket 22. Thread feed roller shafts 23, 23', 23'' are journaled on wall 21 and bracket 22, and extend through wall 21'. Shafts 23, 23', 23'' are positioned above drive shaft 14 in parallel relation thereto and in a horizontal plane. Elongated cylindrical thread feed rollers 24, 24', 24'' are respectively mounted concentrically on shafts 23, 23', 23'', between wall 21' and bracket 22. Feeder rollers 24, 24', 24'' are steel cylinders whose periphery is knurled, as shown in Fig. 4; these rollers are fixed with relation to their respective shafts. A second group of shafts or axles 25, 25', 25'' are respectively positioned parallel to rollers 24, 24', 24'' in the same plane therewith and are journaled on bracket 22 and wall 21' so that each axle is adjacent its complementary roller. Eccentrically mounted on each respective axle 25, 25', and 25'' are hollow cylindrical presser rollers 26, 26', 26'' which are retained on axles 25, 25' and 25'' respectively by their closed ends 27, 27', 27'' and 28, 28', 28''. Ends 27'', 28'' are connected to roller 26'' through roller bearings which allow this cylinder to rotate concentrically with relation to ends 27'', 28'' and therefore independently of axle 25''. Rollers 26 and 26' are identical to roller 26'' and have identical respective ends 27 and 27' (the opposite respective ends not being shown). Rollers 26, 26' and 26'' are coated on their periphery with a rubber material, or "neoprene," or the like. Axles 25, 25' and 25'' are so spaced from each of their respective rollers as to allow the rubberized portion of pressure rollers 26, 26' and 26'' to ride against the adjacent knurled roller as shown in Figs. 2 and 4. Levers 29, 29' and 29'' are respectively fixed to the ends of axles 25, 25', 25'' adjacent bracket 22 so that upon actuation of any one of these levers the respective pressure roller may be rotated away from its adjacent knurled roller.

Referring now to Fig. 2, pulleys 30, 30' and 30'' are respectively fixed to thread feed roller shafts 23, 23' and 23'', within housing 20, thus providing a means of rotating thread feed rollers 24, 24' and 24''. A reduction gear 31 is fixed within the housing 20 just above the main drive shaft 14; this reduction gear is driven from the main drive shaft 14 by means of pulley 32 which is fixed to the end of main drive shaft 14, and pulley 32' which is fixed to reduction gear 31 and connected by belt 33. Intermediate shafts 34, 34' and 34'' are respectively positioned below and parallel to thread feed roller shafts 23, 23' and 23'' and are journaled for rotation between walls 21 and 21'; these intermediate shafts are connected to the reduction gear 31 so that each will be rotated at the same speed by reduction gear 31. In Figs. 2 and 3, it can be seen that the drawings illustrate this connection as a plurality of belts 35, 35' and 35'' extending from a common shaft on reduction gear 31 to drive respectively intermediate shafts 34, 34' and 34'' through pulleys mounted on the various shafts.

Between intermediate shafts 34, 34' and 34'' and their complementary thread feed roller shafts 23, 23', 23'' are respectively mounted variable speed transmissions denoted generally by numerals 36, 36' and 36''. These

variable speed transmissions are of conventional construction consisting respectively of control arms 37, 37' and 37'', shafts 38, 38', 38'' and pairs of variable diameter pulleys 39, 39', 39''. Belts 40, 40' and 40'' connect respectively the pulleys on intermediate shafts 34, 34', 34'' to one of the pairs of pulleys 39, 39', 39'' of the variable speed transmissions. Other belts 41, 41', 41'' respectively connect the other of the pairs of pulleys 39, 39', 39'' on the variable speed transmissions to pulleys 30, 30', 30''. Therefore, it is apparent that upon rotation of the main drive shaft 14, pulley 32 will be actuated to drive reduction gear 31, thus providing power to rotate shafts 34, 34' and 34'' which in turn rotate the variable speed transmissions 36, 36' and 36'' which rotate respectively the thread feed roller shafts 23, 23' and 23'', thus providing rotation for the thread feed rollers 24, 24', and 24''. As mentioned above, pressure rollers 26, 26', and 26'' are so positioned that they ride on the periphery of thread feed rollers 24, 24' and 24'' respectively; therefore, upon the actuation mentioned above, these pressure rollers will also be rotated about their ends when the pressure rollers are riding against their respective thread feed rollers. It should be apparent from the foregoing description that each individual thread feed roller may be operated at a different speed from the other thread feed rollers and these speeds can be varied as desired by varying the respective control arm since each thread feed roller is separately actuated through its own variable speed transmission.

As seen in Fig. 2, a sprocket 61 is affixed to a shaft extending from the tufting machine. This shaft is also actuated from the main drive shaft 14 and provides a means of power to rotate sprocket 61. A pair of brackets 42, 42' extend from the tufting machine at a position adjacent sprocket 61 and these brackets support a cam shaft 43 journaled therebetween for rotation in parallel relation to main drive shaft 14. This cam shaft extends outwardly of the brackets and is provided with a sprocket 44. Chain drive 45 connects sprocket 61 with sprocket 44 thus providing actuation to rotate cam shaft 43. Cams 46, 46', 46'' are fixed on cam shaft 43.

As seen in Fig. 3, braces 47, 47' depend from housing 20 and support fixed shaft 48 therebetween. Lever arms 49, 49', 49'' are pivotally mounted on the fixed shaft 48 and extend down therefrom respectively toward the cams 46, 46' and 46'' and extend upwardly from shaft 48 into housing 20. Cam followers 50, 50'' are respectively provided on the ends of lever arms 48' and 48'' and bear respectively on cams 46', 46''. Lever arm 48 is provided with an identical cam follower, riding on cam 46 which is not shown. In a position substantially adjacent shaft 48, springs 51, 51'' depend from housing 20 substantially parallel to their respective levers 49', 49''. Linkages 52, 52'' respectively connect lever arms 49', 49'' to springs 51', 51'' so that cam followers 50, 50'' are respectively urged against their respective cams. A similar spring and linkage is provided for lever arm 49 but is not shown. Bearing plate 53 depends from housing 20 substantially adjacent these springs and a tension adjusting screw 54 threadably extends through bearing plate 53 and engages spring 51', to provide a means for adjusting the tension of the spring, a similar adjusting screw being provided for each of the springs.

The ends of lever arms 49, 49', 49'' which extend up into housing 20 are respectively connected to control arms 37, 37', 37'' through linkage members 55, 55', 55'' as shown in Fig. 2. Therefore, as these levers are rocked back and forth by the action of their respective cams they will actuate control arms 37, 37', 37'' and thus rock them back and forth also. It should be remembered that control arms 37, 37', 37'' control the speed of rotation of feeder rollers 24, 24', 24'' and therefore the speed at which these various rollers operate depends upon the shape of their respective cams.

Referring now to Fig. 5, it can be seen that spools

of yarn 56 are positioned on a supporting frame 57 at some place adjacent the tufting machine, and the yarn from these spools is fed between rollers 24 and 26, 24' and 26', and 24'' and 26''; then, through the machine and through the yarn's respective needles 16. The pressure rollers bearing against the knurled feed rollers prevent any slippage of the thread between the rollers so that an exactly controlled and measured quantity of thread is positively fed to each needle.

When a tufting machine is placed in operation, base fabric 58 is fed through fabric feed rollers 19 as illustrated in Fig. 5. The needles pass through this base fabric and loopers 18 engage the yarn held by the needles; then the needles return to their original position leaving a loop of yarn retained by the looper. As the needles approach top dead center of their stroke, the loops retained by loopers 18 are released because of the traverse of the base fabric through the machine, thus releasing loopers 18 to receive and retain the next loop sewed by the needle.

Assuming now that cams 46, 46', 46'' are of such a shape as will substantially reduce the speed of rollers 24, 24', 24''; it will be obvious that the yarn controlled by these rollers will not be fed at the same rate of speed as the downward stroke of its respective needle. Therefore, as the needles 16 pass into the base fabric, yarn will be pulled back through the needle and through the fabric, thus decreasing the height of the preceding loop by a distance proportionate to the diameter of its respective cam at that instant. Thus, it can be seen that a cam of varying diameter may cause the machine to sew a row of stitches as illustrated in Fig. 6; or, if the cam were a circular disk which would give a uniformly slow speed to the respective roller, a row of stitches as illustrated in Fig. 7 would be sewed. It will be obvious to those skilled in the art that by introducing cams of various shapes, intricate designs may be introduced in the pile fabric which will give a very pleasing appearance to the finished material. In addition to the many shapes of cams, variations of course may be introduced into the patterns by variously substituting the particular threads to be fed by the individually controlled thread feed rollers and their co-operating pressure rollers.

It will be obvious to those skilled in the art that many variations may be made in the embodiment chosen for illustration without departing from the scope of my invention, as described in the appended claims.

I claim:

1. In the method of forming patterns with pile loops in a base fabric comprising simultaneously inserting a plurality of transversely aligned loops through a base fabric to a uniform predetermined depth to form a first row of transversely aligned pile loops, furnishing thread for the successive formation of additional rows of aligned loops spaced from and generally parallel to said first row of loops, and repeating said loop-forming operation; the step of backdrawing thread in an amount corresponding to the demands of a prescribed pattern from selected pile loops in one of said rows of loops to thereby shorten the selected loops in said one of said rows of loops in an amount corresponding to the length of thread backdrawn therefrom, while avoiding backdrawing thread from the other loops in the said one of said rows.

2. In the method of forming patterns with pile loops in a base fabric comprising simultaneously inserting a plurality of lengths of yarn through said fabric to a predetermined depth to produce a first series of loops aligned transversely of the line of feed, furnishing an additional length of yarn to each of said lengths of yarn for use in the formation of a second series of aligned loops and simultaneously inserting the additional lengths of the yarn through said fabric to the said predetermined depth along a line spaced from the first

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series to form said second series of aligned loops, the step of furnishing according to a prescribed pattern a lesser length of yarn to at least one of the loops in the second series than to other loops in the second series, the said lesser length of yarn being insufficient to form completely its loop in the second series to the said predetermined depth, whereby the corresponding loop in the first series is robbed of a part of its yarn and the height of the loops in the first series will vary according to the length of yarn furnished to its corresponding loop in the second series.

3. In the method of forming patterns with pile loops in a base fabric comprising simultaneously inserting a plurality of lengths of yarn through said fabric to a predetermined depth to produce a first series of loops aligned transversely of the line of feed, furnishing an additional length of yarn to each of said lengths of yarn for use in the formation of a second series of aligned loops and simultaneously inserting the additional lengths of yarn through said fabric to the said predetermined depth along a line spaced from the first series to form said second series of aligned loops, the step of furnishing according to a prescribed pattern a lesser length of yarn to at least one of the loops in the second series than to the other loops in the second series, the said lesser length of yarn being insufficient to form completely its loops in the second series to the said predetermined depth, whereby the corresponding loop in the first series is robbed of a part of its yarn and the height of the loops in the first series will vary according to the length of yarn furnished to its corresponding loop in the second series, and varying the lengths of yarn furnished in subsequent rows in accordance with a prescribed pattern to produce loops of predetermined length at prescribed areas of the base fabric.

4. In the method of forming patterns with pile loops in a base fabric comprising simultaneously inserting a plurality of transversely aligned loops through a base fabric to a uniform predetermined depth to form a first row of transversely aligned pile loops, furnishing thread for the successive formation of additional rows of aligned loops spaced from and generally parallel to said first row of loops, and repeating said loop-forming operation; the step of backdrawing thread in an amount corresponding to the demands of a prescribed pattern from selected pile loops in said first formed row of loops into corresponding loops in the second row of loops during their formation to thereby shorten the selected loops in said first formed row of loops in an amount corresponding to the length of thread backdrawn therefrom, while avoiding backdrawing thread from the other loops in the said row.

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5. The method of forming patterns with pile loops in a base fabric comprising simultaneously projecting a plurality of threads from a source through a base fabric in a transverse row to a predetermined uniform depth to form a row of transversely aligned loops, feeding thread from said source for use in the formation of a second row of loops, again simultaneously projecting said threads from said source through said base fabric, along a line spaced longitudinally of the base fabric from the first row, to the same uniform depth to form a second row of loops, limiting the feed of thread to a selected group of loops in said second row of loops to an amount which is insufficient to form completely loops of said predetermined depth whereby the corresponding loops in the first row are robbed of a part of the thread forming the same to thereby shorten the length of said loops according to the amount of thread fed to the loops of the selected group of loops in said second row, and limiting the feed of thread to other loops in said second row to an amount different from the feed of thread to the loops in said selected group of loops.

6. In a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric, means for releasably holding the yarn inserted into the base fabric by the needles to form loops, a plurality of feed rolls arranged respectively to feed said yarn to groups of said needles, variable diameter pulleys forming a plurality of variable speed drive means respectively connected to actuate said feed rolls, so that each of said feed rolls is operable to feed prescribed lengths of yarn to its associated group of needles only in response to actuation by said pulleys, spring pressed linkage forming control means connected to said drive means, and pattern forming means comprising cams operably connected to said linkage to predeterminedly actuate said control means to vary the speed of each of said drive means to control the amount of yarn fed to its associated group of needles to form prescribed patterns on said base fabric.

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