

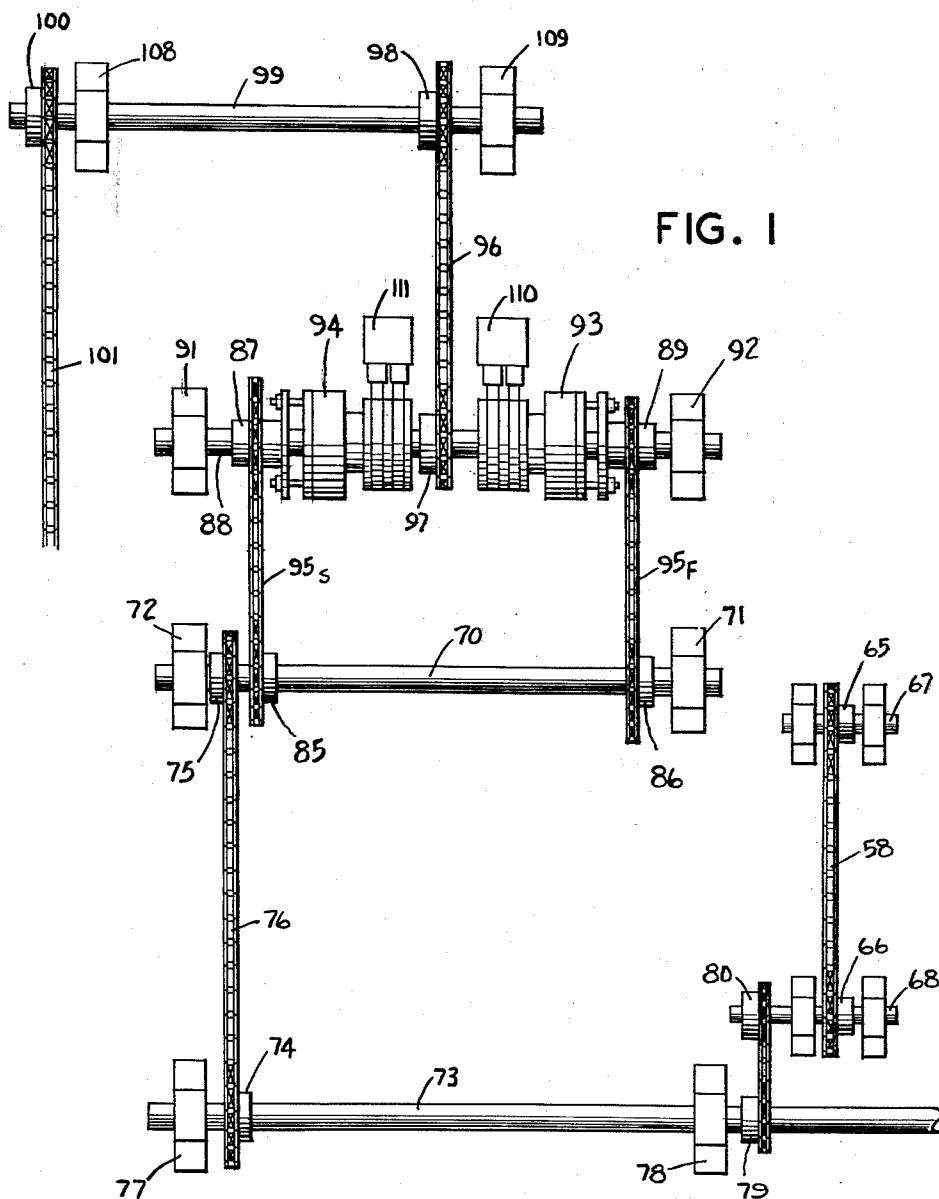
Aug. 13, 1963

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APPARATUS FOR THE PRODUCTION OF WAVE LINE
CONSTANT HEIGHT ROWS OF TUFTS

3,100,465

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3 Sheets-Sheet 1



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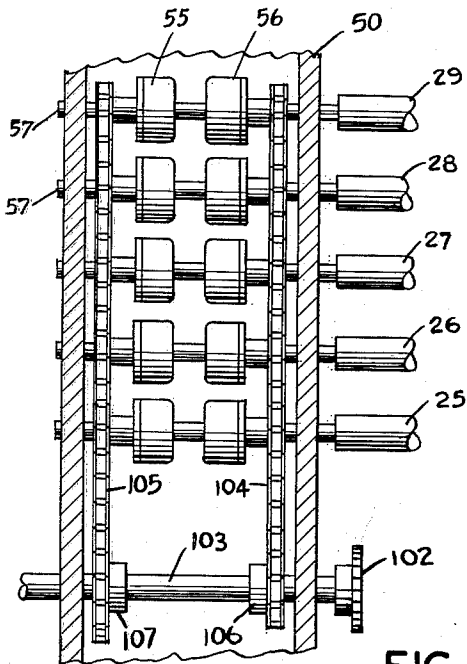


FIG. 3

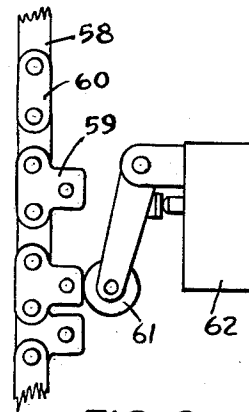


FIG. 2

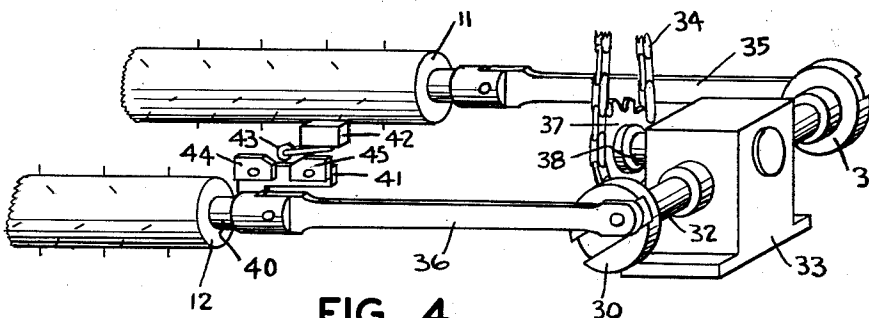


FIG. 4

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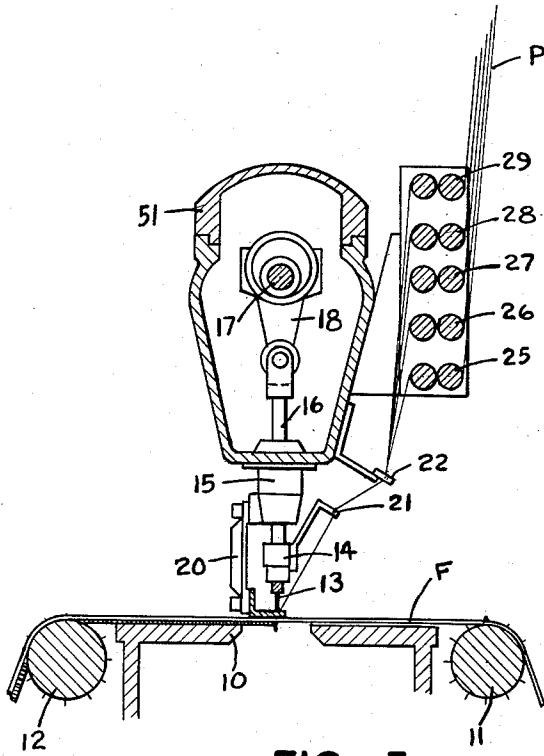


FIG. 5

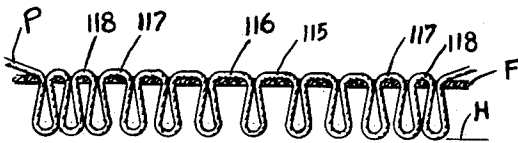


FIG. 6

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APPARATUS FOR THE PRODUCTION OF WAVE LINE CONSTANT HEIGHT ROWS OF TUFTS

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7 Claims. (Cl. 112—79)

This invention relates to tufting machinery for pile fabrics and more particularly to an improved yarn feed device whereby constant pile height can be achieved regardless of the lateral oscillation of the backing fabric.

In multi-needle tufting machines, it is conventional practice to feed a backing fabric through a tufting zone where it is penetrated by a plurality of pile yarn carrying needles. In some such tufting machines the backing fabric is fed through the machine and over the throat plate in substantially a straight line. Feed may be constant, variable, or intermittent. The pile yarns are customarily fed to the needles from a series of feed rollers or other pattern devices which may supply the yarn at a fixed feed rate or at varying rates in order to form a high and low pile pattern. It is conventional practice and considered desirable to employ a "wave line oscillator" or attachment for the backing fabric which moves the fabric from side to side as it is being tufted by the needles. This produces a sine curve in each of the rows of stitches of pile yarn and tends to break up longitudinal streaks or striations. In addition, it is well known to utilize different yarn feeds for certain selected pile yarn ends. These may be individual ends or groups of ends. This selective pile yarn feed controls the height of the pile yarns in accordance with a predetermined pattern and may utilize either a loop robbing or a non-loop robbing technique for this purpose. When the wave line oscillating attachment moves the backing fabric from one side to the other, the longitudinal component of the backing fabric feed is, of course, substantially less than when the wave line "attachment" is operating near the dead center position of its cranks. In this case there is maximum longitudinal travel of the backing fabric per unit of time. Since the yarn feed is relatively constant across the width of the fabric and does not vary in accordance with the shifting of the backing fabric, it has been found that all of the pile projections across the fabric are effected by the movement of the wave line oscillator. Naturally at a constant rate of yarn feed for all the yarn ends the relative longitudinal acceleration and deceleration of the backing fabric feed means that there will be more pile yarn fed while the fabric is shifting from side to side than when it is traveling nearly longitudinally. It again follows that this differential in pile yarn feed affects the height of the loops and, therefore, creates transverse valleys in the form of stripes which are highly undesirable.

The present invention has for its primary object, therefore, the provision of an integrated yarn feed control mechanism and backing fabric oscillating mechanism.

A further object of the invention is to provide a sensing mechanism on the backing fabric oscillator to concurrently control the total yarn fed to the tufting machine.

A further object of the invention is to provide in a pile fabric tufting machine having a pattern attachment a jackshaft intermediate said pattern attachment, a pair of electrically actuated clutches on said jackshaft, and means for selectively disengaging said clutches in accordance with the oscillation of a wave line attachment.

Further objects will be apparent from the specification and drawings in which:

FIGURE 1 is a schematic drive diagram illustrating the application of the invention to a tufting machine of the type shown in FIGURE 5,

FIGURE 2 is a fragmentary detail of the pattern chain

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and switch controlling the pattern attachment of FIGURE 3,

FIGURE 3 is a fragmentary detail showing the multi-speed yarn feed pattern device conventionally used on a broad tufting machine,

FIGURE 4 is a perspective showing the details of the "wave line attachment,"

FIGURE 5 is a sectional detail of a multi-needle tufting machine to which the present invention is adapted, and

FIGURE 6 is a longitudinal section through an uncut tufted pile fabric showing the present invention.

Referring now more particularly to the drawings, a broad tufting machine of the type described in the present invention is provided with a throat plate 10 (FIGURE 5), a pin feed roll 11, and a pin take-up roll 12. A backing fabric F is fed across the throat 10 and through a zone where it is penetrated by a series of needles 13 mounted in a needle bar 14 of the tufting machine. The needle bar 14 oscillates vertically in guides 15 which slidably journal rods 16 connected to a crankshaft 17 by connecting rods 18. The tufting machine is also provided with the usual presser foot 20 and thread jerker 21 and yarn guide 22. Selected yarn ends are fed over pairs of yarn feed rollers 25, 26, 27, 28, and 29 in the roller pattern attachment shown in FIGURES 3 and 5. These pile yarns P are fed through pairs of rollers 25-29 thence through yarn guide 22 and to needles 13.

The fabric F is not only fed from right to left as shown in FIGURE 5, but is also given an undulating or oscillating movement over the throat plate 10. This undulating path followed by fabric F is achieved by means of a pair of cranks 30 and 31 keyed to a shaft 32 journaled in a gear reducer 33. A chain 34 serves to drive the shaft 32 and thereby oscillate or axially displace the rollers 11 and 12 through the agency of cranks 35 and 36. Chain 34 is driven from any convenient point on the tufting machine and serves to drive the reducer 33 through a sprocket 37 and in-put shaft 38. Roller shaft 40 carries a bracket 41 positioned to actuate a micro-switch 42 through cam follower 43. A pair of cams 44 and 45 on bracket 41 actuate the switch 42 as the rollers 11 and 12 reach the limit of their oscillation.

The pile yarn feed mechanism represented by rollers 25-29 is positioned in a housing 50 generally mounted adjacent the crankshaft housing 51 of the tufting machine. There are several well-known types of pattern attachments or yarn feed mechanism in current use and the attachment illustrated herein is shown by way of example only. Other attachments may be seen in Crawford Patents 2,853,033-34, Rice 2,842,079 and Smith 2,782,905. Each pair of rollers 25-29 is controlled by a pair of clutches 55, 56 on each of the roller shafts 57, 57. The actuation of these clutches is controlled by means of a pattern chain or other comparable device 58 (FIGURE 2) which has high links 59 and low links 60 controlling a suitable follower or feeler 61 which actuates a series of micro switches 62 that control the clutches 55 and 56. There is a pattern chain 58 for each pair of clutches 55 and 56, for example, the five pairs of clutches and rollers shown in FIGURES 3 and 5. As chain 58 turns on its associated sprockets 65 and 66 which are in turn keyed to shafts 67 and 68, a series of high and low links 59 and 60 successively energize and de-energize clutches 55 and 56 to control the height of the pile yarns in accordance with the pattern of chains 58.

In order to co-relate the feed of all pile yarns with the wave line rollers 11 and 12, I provide interconnecting mechanism shown in FIGURE 1 which consists of a jackshaft 70 journaled at 71 and 72 on the tufting machine frame and in turn driven from the main shaft 73 through sprockets 74, 75 and chain 76. Shaft 73 is journaled at 77 and 78 and carries a sprocket 79 which

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drives shaft 68 on the pattern chain device through a sprocket 80. Jackshaft 70 is provided with a relatively small sprocket 85 and a larger sprocket 86 which respectively drive large sprocket 87 on shaft 88 and a small sprocket 89 on shaft 88 which is journaled at 91 and 92. The fast electric clutch assembly 93 is electrically responsive to the cams on bracket 41 as shown in FIGURE 4 to selectively increase the yarn feed by speeding up all of the rollers 25-29. During the mid-portion (FIGURE 4) of the sine curve caused by oscillation of shaft 32, the finger 43 of switch 42 actuates this high speed or fast clutch 93 to accelerate the feed of all pile yarns to provide longer stitches but with no concurrent decrease in pile height. This result is seen in FIGURE 6.

Alternatively when the cranks 30 and 31 on shaft 32 are near their back and forward dead centers, the fabric feed in the longitudinal direction through the tufting machine will be at its maximum and therefore the yarn feed is correspondingly decelerated to provide shorter stitches and to maintain the constant pile height as is also shown in FIGURE 6. This is accomplished by actuation of the roller or cam follower 43 by either of the cams 41 or 44 to disengage the high speed clutch 93 and simultaneously engage the low speed clutch 94. This transfers the power drive from chain 95f to chain 95s and concurrently from sprocket 86 to sprocket 85. The drive from either of the clutches 93 or 94 is in turn transmitted to chain 96 through sprocket 97 keyed to shaft 88. It is understood that sprockets 87 and 89 turn freely on shaft 88 when their respective clutches are disengage. This drive is then traced through sprocket 98 on shaft 99, sprocket 100, chain 101, sprocket 102 keyed to shaft 103 of the pattern attachment (FIGURE 3). The pairs of rollers in the pattern attachment are driven through slow chain 104 and fast chain 105 from sprockets 106 and 107 respectively. It will be understood that the drive from chain 96 may be through any convenient power connection to the pile yarn feed attachment so long as all of the pile yarns are thereby accelerated or decelerated in response to the actuation of switch 42. Shaft 99 is shown journaled in bearings 108 and 109 in FIGURE 1. The clutches 93 and 94 are engaged and disengaged through the conventional brushes and connections shown schematically at 110 and 111 respectively.

It will thus be seen that the yarn feed for all of the yarns is accelerated and decelerated in timed relation with the movement of the backing fabric oscillator. In this way the lateral movement of the backing fabric which in turn produces long and short stitches can be controlled to maintain the predetermined variable yarn feed of the pattern attachment. It will be understood that the pattern attachment shown in FIGURES 3 and 5 produces pile projections of different height in accordance with a pattern on chain 58 or some comparable pattern device. The relative high and low projections of the pattern device when used with the present invention it not thereby effected due to the undulating longitudinal rate of feed of the backing fabric.

To more clearly illustrate the application of the invention, it will be seen in FIGURE 6 that a pile yarn P stitched through the backing fabric F at a constant rate of yarn feed will produce a given pile height indicated as H in FIGURE 6. If however instead of the backing fabric F being fed at a constant forward rate as would be the case if no oscillator or wave line attachment is used, the forward component of the backing fabric feed varies because of the installation of the oscillator, then at a constant rate of pile yarn feed there will be less yarn to produce the desired pile height H in areas such as 115 and 116 where the length of the stitches is substantially greater than the length of the stitches 117 and 118. Ordinarily then the height of the pile projections in the area of stitches 115 and 116 would be decreased by the added increment of yarn necessary to make the longer stitches 115 and 116. At this point the increased

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feed of the yarn produced by the present invention and specifically the high speed clutch assembly 93 adds sufficient yarn to compensate for the added pile yarn required to make the longer stitches 115 and 116. This, as shown in FIGURE 6, insures that all pile projections are at the desired height regardless of the length of stitches on the backing fabric. While the pile loops or projections shown in FIGURE 6 are all substantially equal in height, it will be understood that the same result takes place even though the pattern attachment may be calling for relatively high and low loops. In other words, the present yarn feed control has no effect in the relative height of the pile as produced by the conventional pattern attachment. It compensates for the overall reduced or increased pile height caused solely by the oscillation of the backing fabric produced by rollers 11 and 12.

The present invention overcomes a serious objection to the provision of pattern tufted goods and particularly where the wave line oscillator is used. It is now possible to eliminate or break up any streaks or striations which are considered to be defects in the goods.

Having thus described my invention, I claim:

1. A pile fabric tufting machine comprising a throat plate, a series of vertically oscillating needles for introducing pile yarns into and through a backing fabric carried over the throat plate, means for transversely shifting the backing fabric across the throat plate, and means for selectively accelerating and decelerating the rate of feed of pile yarns to the needles in timed relation with the shifting means.

2. A pile fabric tufting machine comprising a throat plate, a series of vertical oscillating needles for introducing pile yarns into and through a backing fabric carried over said throat plate, a feed roller for said backing fabric, a take-up roller for said backing fabric, means for transversely oscillating said feed and take-up backing fabric rollers in unison across the throat plate, a switch responsive to oscillations of said backing feed and take-up rollers, a pattern attachment for feeding pile yarns to said needles, drive means for said pattern attachment and a pair of clutches operatively connected to said drive means and responsive to actuation of said switch for selectively accelerating and decelerating the drive means for the pattern attachment.

3. Apparatus in accordance with claim 2 in which the drive means comprises a shaft, a large sprocket on said shaft, a small sprocket on said shaft, a clutch selectively engaging the large sprocket with a second shaft and a clutch for selectively engaging the small sprocket with said second shaft.

4. A pile fabric tufting machine comprising a throat plate, a series of vertical oscillating needles for introducing pile yarns into and through a backing fabric carried over said throat plate, a feed roller for said backing fabric, a take-up roller for said backing fabric, means for transversely oscillating said feed and take-up backing fabric rollers in unison across the throat plate, a switch responsive to oscillations of said backing feed and take-up rollers, a yarn feed mechanism for feeding pile yarns to said needles, drive means for said yarn feed mechanism and a pair of clutches operatively connected to said drive means and responsive to actuation of said switch for selectively accelerating and decelerating the drive means for the yarn feed mechanism.

5. In a pile fabric tufting machine having a plurality of oscillating pile yarn carrying needles, roller means for feeding a backing fabric into a tufting zone where the fabric is penetrated by said needles, and variable speed pile yarn feed means, the improvement which comprises a pair of cranks each connected to an axis of the backing fabric roller feed means for laterally oscillating the backing fabric feed, a jackshaft journaled on the tufting machine, at least two separate driving connections between said jackshaft and the pile yarn feed mechanism, and a

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clutch in each of said driving connections for selectively driving the pile yarn feed means in accordance with the angular position of the cranks.

6. Apparatus in accordance with claim 5 in which one of the driving connections between the jackshaft and the yarn feed means comprises a chain and a pair of high speed sprockets and the other connection comprises a chain and a pair of low speed sprockets.

7. Apparatus in accordance with claim 6 having electrically actuated clutches for engaging and disengaging said

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driving connections, and a switch associated with one of the cranks for actuating the clutches.

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