Oct. 29, 1963 M. M. BEASLEY 3,108,553

MULTIPLE PILE HEIGHT TUFTING MACHINE

Filed Oct. 3, 1960 3 Sheets-Sheet 1

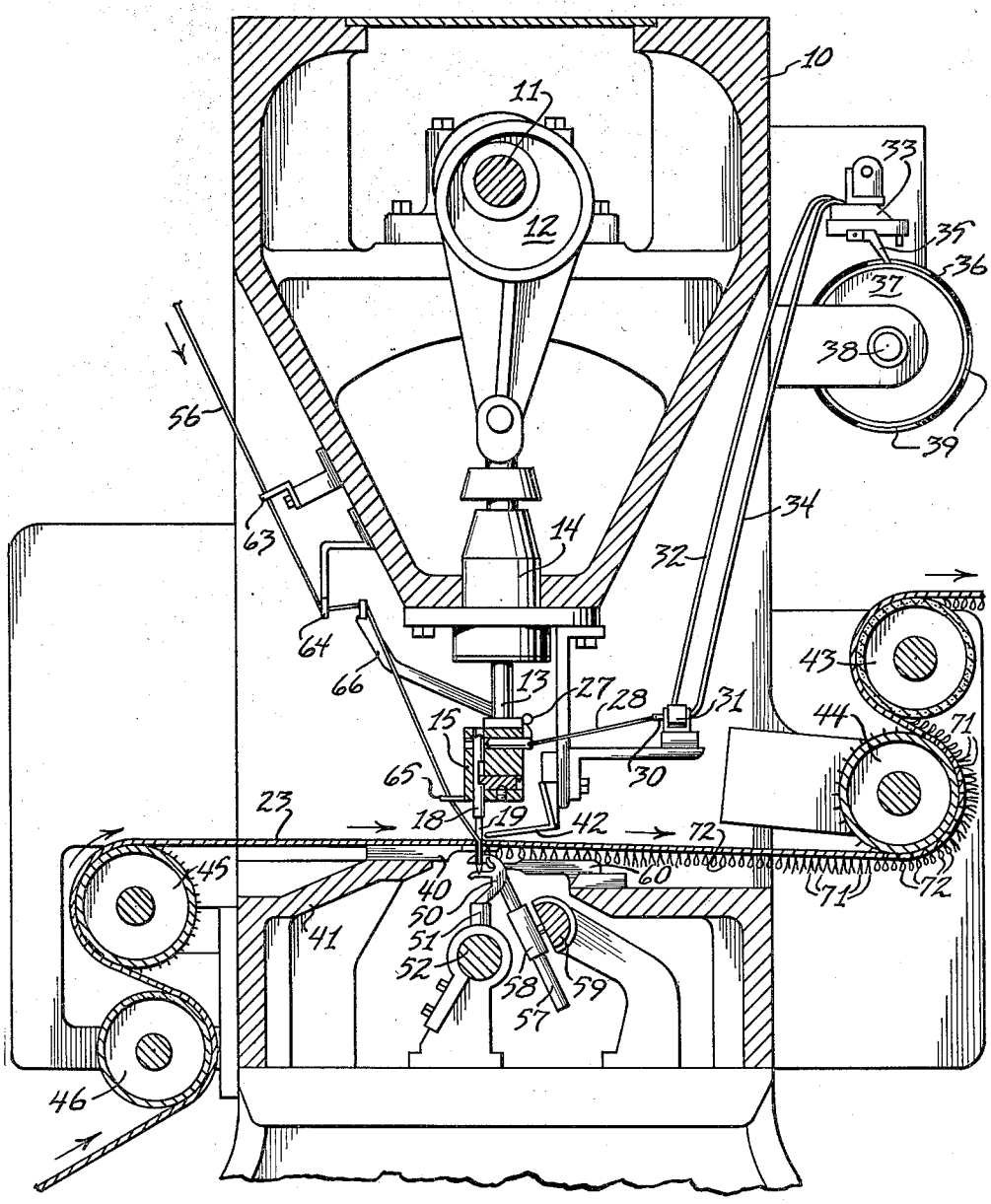


Fig. 1

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Fig. 2

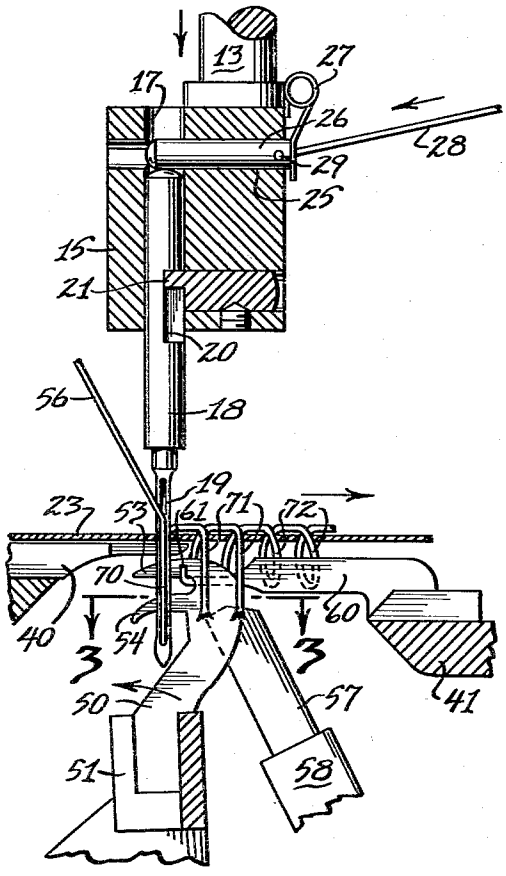


Fig. 4

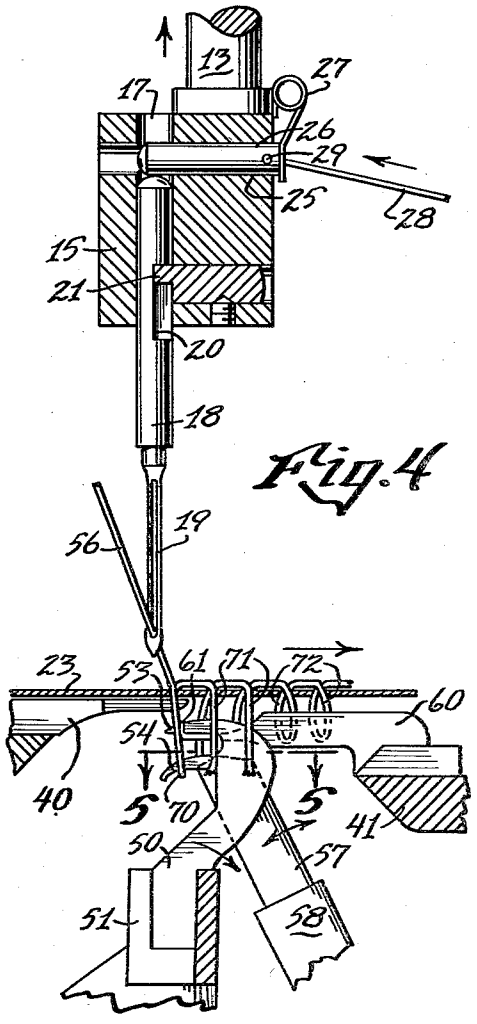


Fig. 3

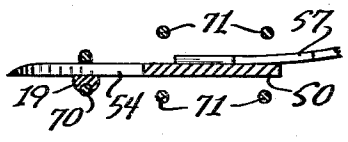
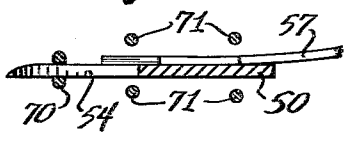


Fig. 5



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Fig. 6

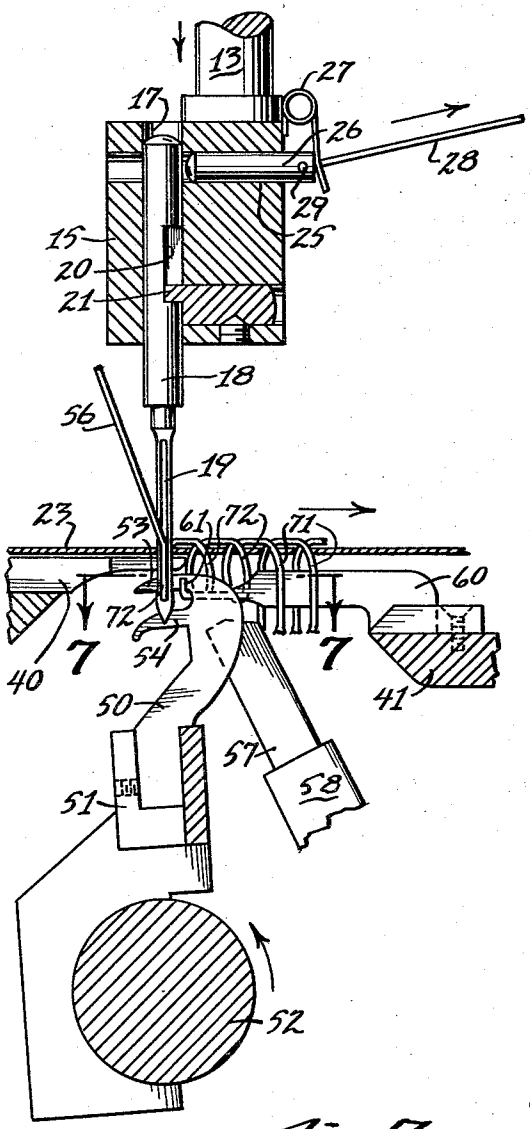


Fig. 8

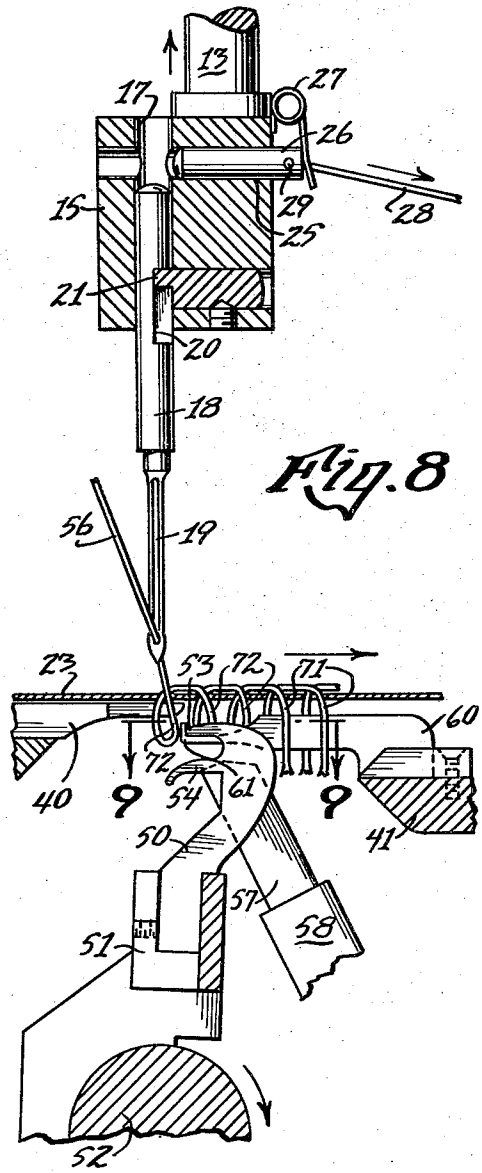


Fig. 7

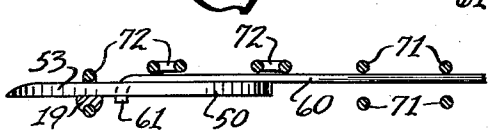
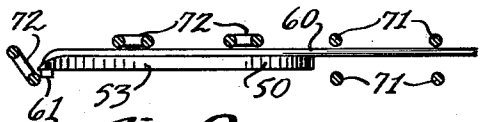


Fig. 9



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MULTIPLE PILE HEIGHT TUFTING MACHINE

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Filed Oct. 3, 1960, Ser. No. 60,190
3 Claims. (Cl. 112—79)

This invention relates to a tufting machine for selectively forming multiple pile heights in a tufted fabric, and more particularly to a tufting machine provided with means for selectively controlling the depth of penetration of the needle for forming multiple pile heights.

One object of this invention is to provide a tufting machine for selectively forming pile heights in a tufted fabric without robbing or backdrawing yarn from previously formed loops.

Another object of this invention is to provide a multiple needle tufting machine provided with a pattern control mechanism for selectively positioning the needles to penetrate the base fabric to various depths in order to form corresponding pile heights in the tufted fabric.

A further object of this invention is to provide a looper mechanism of novel structure to cooperate with a needle penetrating a base fabric to different depths.

Another object of this invention is to provide a needle tufting machine for forming an infinite variety of patterns of high cut pile and low loop pile in a tufted fabric.

A further object of this invention is to provide a novel pattern controlled latching means for controlling the axial position of each needle relative to a common reciprocable needle carrier.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings, wherein:

FIG. 1 discloses a typical cross section of a multiple needle tufting machine incorporating the invention with a needle penetrating the fabric to its shallow position;

FIG. 2 is an enlarged side elevation operational view showing the needle carrier in its lowermost position and the needle in its deep position to form high cut pile;

FIG. 3 is a section taken along the line 3—3 of FIG. 2;

FIG. 4 is a view similar to FIG. 2 with the needle carrier in its uppermost position;

FIG. 5 is a section taken along the line 5—5 of FIG. 4;

FIG. 6 is a view similar to FIG. 2 with the needle in shallow position to form low loop pile;

FIG. 7 is a section taken along the line 7—7 of FIG. 6;

FIG. 8 is a view similar to FIG. 6 with the needle carrier in its uppermost position; and

FIG. 9 is a section taken along the line 9—9 of FIG. 8.

Referring now to the drawings in more detail, FIG. 1 discloses a cross section of a conventional multiple needle tufting machine having a frame or housing **10** supporting a main drive shaft **11** upon which are mounted a plurality of eccentrics **12** adapted to reciprocate the push rods **13** through bearings or housings **14** upon rotation of the the drive shaft **11**. The push rods **13** support a needle bar carrier **15** mounted transversely of the machine.

Equally spaced in transverse alignment along the needle carrier **15** are a plurality of vertical guideways **17** extending from top to bottom through the carrier. Slidably received for axial movement in each guideway **17** is a needle bar **18**. In order to retain each needle bar **18** within the carrier **15** and to permit limited reciprocation of the needle bar **18** within the guideway **17**, a keyway or slot **20** is formed in one side of the needle bar **18**. A stationary key or dog **21** is held in the carrier **15** and extends from the wall of the guideway **17** into the keyway **20**. The difference between the depth of the keyway **20** and the key **21** is equal to the length of relative movement of the needle bar **18** within its guideway **17**, and as will be shown later, is equal to the depth range of needle penetration through the base fabric **23**.

In order to lock the needle bar **18** in its extended position relative to the needle carrier **15** to permit the deepest penetration of the base fabric **23** by the needle **19**, as disclosed in FIGS. 2–5, a hole or guideway **25** is formed through the carrier **15** to intersect the needle bar guideway **17**. Adapted to reciprocate within the hole **25** is a latch pin **26**. The pin **26** is held in extended latched position, that is, extending through the guideway **17** above the top or blunt end of the needle bar **18**, by means of a spring **27**, as best disclosed in FIGS. 2 and 4. The dimensions of the needle bar **18** are such that when the needle bar is latched in extended position, it will be securely locked against axial movement by the latch pin **26** above the needle bar **18** and the key **21** abutting against the upper surface of the keyway **20**.

As best disclosed in FIGS. 6 and 8, the rear end of the latch pin **26** is pivotally connected at **29** to a connecting rod **28**. When the rod **28** is pulled toward the rear of the machine (toward the right of the drawing) to overcome the spring **27**, the latch pin **26** will be withdrawn from the guideway **17** to permit the free axial movement of the needle bar **18** within the guideway **17** to the limits permitted by the engagement of the key **21** within the keyway **20**.

In order to control the movements of each latch pin **26**, the connecting rod **28** is pivotally linked to the armature **30** of a solenoid **31**. Each solenoid **31** is controlled through an electrical circuit including a lead **32**, a switch **33**, and a ground lead **34**. The switch **33** is closed and opened by means of a finger **35** which is adapted to be pivoted by engagement or disengagement with grooves **39** in the pattern sheet **36** mounted on a pattern drum **37** which is continuously rotated on the shaft **38** by means such as a motor, not shown, in a manner well known to the art.

The base fabric **23** is supported beneath and for penetration by the needles **19** by means of a conventional needle plate **40** supported on the bed plate **41**. A conventional presser foot **42** is employed to hold the base fabric **23** down upon the needle plate **40**. The base fabric **23** is fed in the direction of the arrows by conventional fabric feed rolls **43**, **44**, **45** and **46**.

A loop hook **50** of novel construction is mounted in a hook bar **51** to reciprocate in a conventional manner on a hook shaft **52** in order that the hook **50** may cooperate with the needle **19** to form loop pile of selectively different heights. The loop hook **50** is provided with an upper bill **53** and a lower bill **54** vertically spaced from each other a sufficient distance that only the upper bill **53** will cross the needle **19** to engage and hold a loop of yarn **56** when the needle **19** penetrates to its shallowest depth, as disclosed in FIG. 6. Although both bills **53** and **54** may cross the needle **19** at its deepest penetration (FIG. 2) to engage the yarn **56**, only the lower bill **54** will hold the end of the loop to form pile of the greater depth.

Since both the upper bill **53** and the lower bill **54** point in a direction opposite to the direction of fabric feed, means must be provided to remove the loops from the bills as the fabric **23** carries the loops toward the rear of the machine. In a preferred form of this invention, a conventional tufting knife **57** is carried in a knife holder **58**, which is mounted on a knife shaft **59** adapted to reciprocate in a conventional manner to cooperate with the lower bill **54** to form cut pile upon the rearward reciprocation of the loop hook **50**, as best disclosed in FIG. 4.

In order to remove the loops formed on the bill **53** to

form low or short uncut loops, a loop stripping finger 60 is fixedly attached to a rear portion of the bed plate 41 and extends forward along and adjacent the loop hook bill 53. The extremity 61 of the loop stripping finger 60 extends laterally beneath the bill 53 and then upward along the opposite side of the bill 53 in order to effectively engage the loop formed on the bill 53 and remove the loop from the free end of the bill 53, as best disclosed in FIGS. 8 and 9.

The yarn 56 may be fed to each needle by any convenient means such as the fixed yarn guides 63, 64 and 65 and the yarn jerker 66 mounted on the needle carrier 15 to reciprocate therewith in a conventional manner. Although the needle 19 may supply its own yarn demand by merely pulling the yarn 56 through the yarn guides from a creel, not shown, regardless of the depth of penetration of the needle 19, a controlled yarn feed means may be provided for supplying the selectively different increments of yarn required for each depth of penetration and synchronously operated from the pattern control drum 37.

The operation of the invention is as follows:

A preferred method of operating the machine is to synchronously drive from a single motor the main shaft 11, the pattern drum shaft 38, the fabric feed roll 44, the hook shaft 52 and the knife shaft 59. When the main shaft 11 is continuously rotated to reciprocate the needle carrier 15 above the continuously fed base fabric 23, each needle bar 18 will be locked in its extended position when the pivoted finger 35 rides over the smooth surface of the pattern sheet 36 to open the switch 33 and thereby deactivate the solenoid 31. With the needle bar 18 in this locked position and with the carrier 15 in its lowermost position, as disclosed in FIG. 2, the needle 19 will penetrate through the fabric 23 to its deepest position, and the loop hook 50 will be reciprocated forward so that the lower bill 54 will cross the needle 19 to engage and hold a long loop 70. After the carrier 15 reciprocates upward, the loop hook 50 will reciprocate toward the rear with the bill 54 carrying the long loop 70 toward cutting engagement with the cooperating knife 57 to form high cut pile 71.

When the pivoted finger 35 engages a groove 39 on the rotating pattern sheet 36, the switch 33 will close to actuate the solenoid 31 and pull the connecting rod 28 toward the rear to overcome the spring 27 and withdraw the latch pin 26 from the needle bar guideway 17. With the needle bar 18 unlatched and the needle carrier 15 reciprocating downward, as best disclosed in FIG. 6, both the inertia of the needle bar 18 and the needle 19 and the resistance of the base fabric 23 to needle penetration will cause the needle bar 18 to withdraw upward into the needle carrier 15. Thus, when the needle carrier 15 has reached its lowermost position, the withdrawn needle 19 will have penetrated through the base fabric 23 to its shallow position, as disclosed in FIG. 6. The loop hook 50 will then be reciprocated forward in the usual manner across the path of the needle 19 in its shallow position. However, in the shallow needle position, only the hook bill 53 will cross the needle 19 to engage the yarn 56 and form a short loop 72. With the needle bar 18 still unlatched, and the needle carrier 15 reciprocated to its upward position, the needle 19 is withdrawn from the base fabric 23 and the needle bar 18 will descend by gravity to hang in its extended position relative to the needle carrier 15 to permit the latch pin 26 to slide into its locked position if the solenoid becomes deactuated on that particular stroke. After the carrier 15 has risen to its position disclosed in FIG. 8, the loop hook 50 will be reciprocated toward the rear with the bill 53 carrying the loop 72 toward the extremity 61 of the loop stripping finger 60. Continued rearward movement of the bill 53 causes the loop stripping finger 60 to move the low loop 72 from the free end of the bill 53 until it is finally free of the hook and is carried beyond the hook by the movement of the fabric 23.

It will be understood that in multiple needle machine, each needle is operated independently of any other needle in accordance with the design on the pattern sheet 36 and that an infinite variety of designs of high cut pile and low loop pile can be formed in a tufted fabric made in accordance with this machine.

It is also within the scope of this invention to provide a hook having more than two bills spaced vertically on a loop hook and with additional means for latching each needle in a corresponding number of different vertical positions relative to the needle carrier 15.

It is also within the scope of this invention to provide means for cutting or stripping loops from any or all of the hook bills.

It will be apparent to those skilled in the art that various changes may be made in the invention, without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A tufting machine for sewing pile yarn at selectively different heights in a base fabric comprising, a needle plate for supporting said base fabric, a needle having a longitudinal axis, a blunt end and a pointed end, means for feeding yarn to said needle, a needle carrier having a guideway therein for axially and slidably receiving said needle, a keyway formed along the longitudinal surface of said needle, a key in said needle carrier extending into said guideway to engage said keyway, said keyway being longer than said key by an amount equal to the limit of axial movement of said needle between a first position and a second position relative to said guideway, a locking pin, means for slidably carrying said locking pin in said needle carrier for movement across the blunt end of said needle in said first position, said key being adapted to engage the end of said keyway toward said blunt end to lock said needle in said first position, means for actuating said locking pin selectively to move across said blunt end and to withdraw said locking pin completely from said guideway to disengage said needle, said key being adapted to engage the end of said keyway remote from said blunt end in said second position, means for reciprocating said needle carrier toward and away from said needle plate to reciprocate said pointed end through said base fabric in said first or second position, and looper means for receiving yarn carried by said needle through said base fabric in either said first or second position to form loop pile of two different heights.

2. The invention according to claim 1 in which said means for actuating said locking pin comprises spring means for biasing said locking pin across said blunt end, a solenoid for withdrawing said locking pin from said guideway against said spring means, and pattern control means for energizing said solenoid.

3. The invention according to claim 1 further providing means for feeding said base fabric across said needle plate.

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