Aug. 13, 1963 G. L. LEDFORD ETAL 3,100,466

CONTROL MEANS FOR THE BACKING FABRIC FEED IN A PILE TUFTING MACHINE

Filed April 18, 1961 4 Sheets-Sheet 1

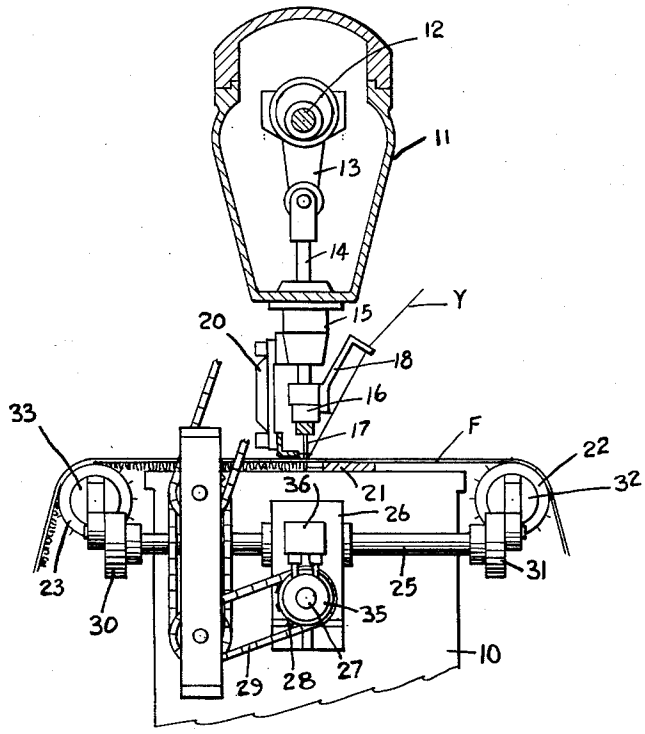

FIG. 1

INVENTORS
GLENN J. LEDFORD
HERBERT S. MC DOWELL
BY Hyde W. Ballard

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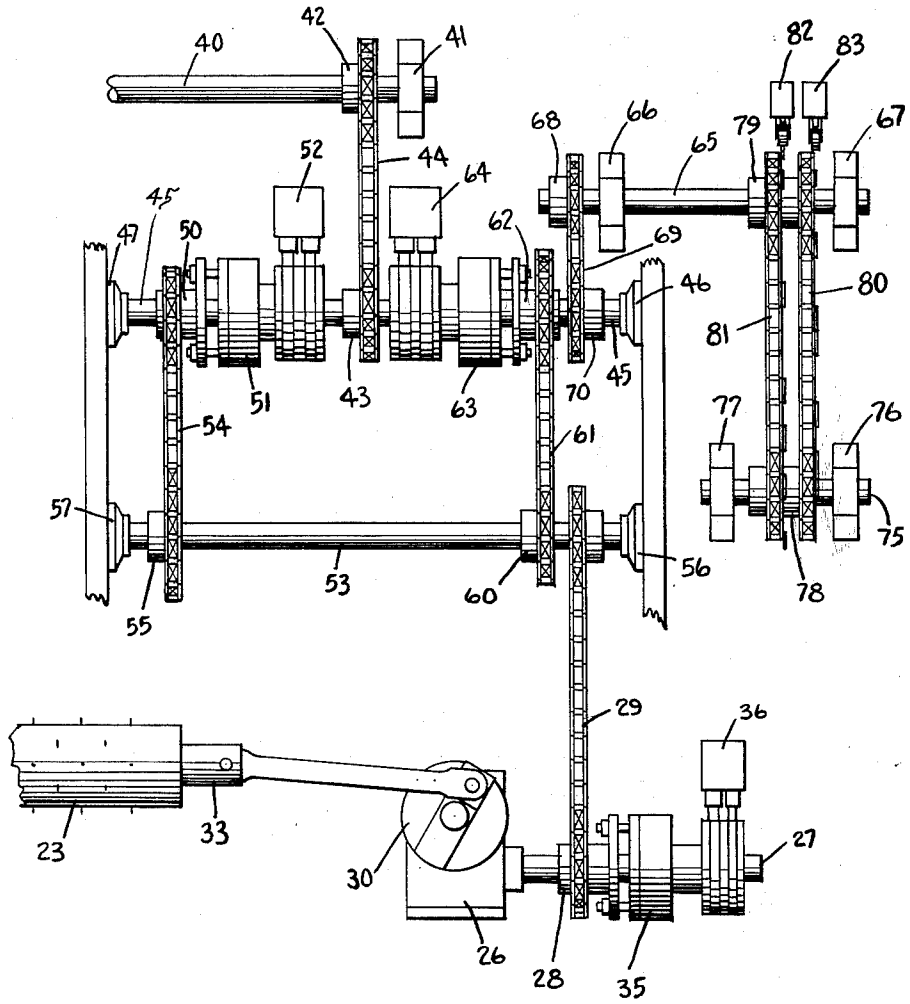

FIG. 2

INVENTORS
GLENN J. LEDFORD
HERBERT S. MC DOWELL
BY Hyde Co. Ballard

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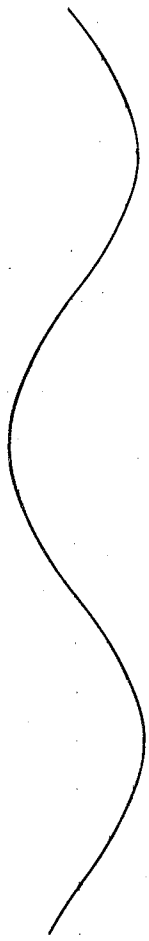

FIG. 3

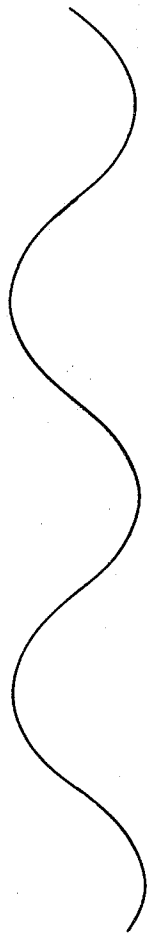

FIG. 4

FIG. 5

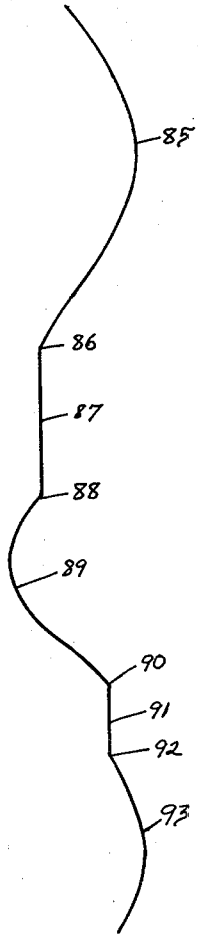

FIG. 6

INVENTORS
GLENN J. LEDFORD
HERBERT S. MC DOWELL
BY Hyde W. Ballard

Aug. 13, 1963 G. L. LEDFORD ETAL 3,100,466

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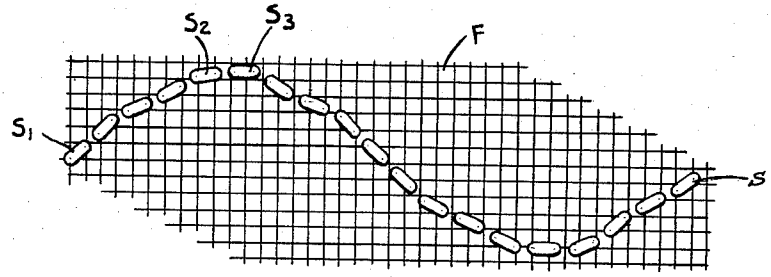

FIG. 7

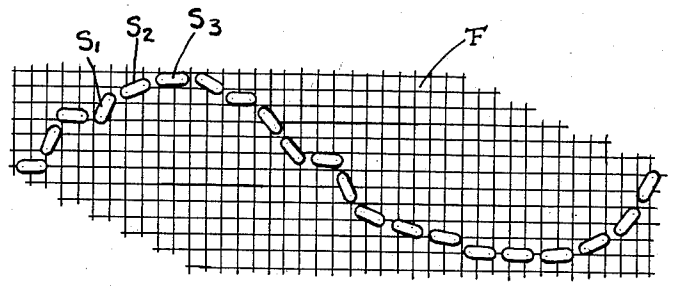

FIG. 8

INVENTORS
GLENN J. LEDFORD
HERBERT S. MC DOWELL

BY Hazel. Ballard

United States Patent Office 3,100,466 Patented Aug. 13, 1963

3,100,466

CONTROL MEANS FOR THE BACKING FABRIC FEED IN A PILE TUFTING MACHINE

Glenn J. Ledford, Clayton, and Herbert S. McDowell, Mountain City, Ga., assignors to James Lees and Sons Company, Bridgeport, Pa., a corporation of Delaware

Filed Apr. 18, 1961, Ser. No. 103,875
4 Claims. (Cl. 112—79)

This invention relates to pile tufting machines and more particularly to an improved control for the backing feed in such a pile tufting machine.

A primary object of the invention is to provide a control mechanism for the backing feed in a pile fabric tufting machine which permits a wide range of interesting effects to be achieved.

A further object of the invention is to provide a pattern chain control for the wave line attachment of a tulfting machine which completely interrupts the transverse action of the wave line attachment and controls further movement thereof in accordance with a pattern.

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

FIGURE 1 is a schematic transverse sectional view of a tufting machine incorporating the present invention,

FIGURE 2 is an enlarged drive diagram showing the control for the wave line attachment of the apparatus in FIGURE 1,

FIGURE 3 shows the path followed by a row of pile yarn stitches when controlled by the slow drive for the wave line atachment,

FIGURE 4 shows the path followed by a row of pile yarn stitches when controlled by the fast drive for the wave line attachment,

FIGURE 5 shows the path of a row of stitches when the wave line attachment is disconnected to provide linear feed of the backing fabric,

FIGURE 6 is a representative indication of the path followed by a single row of pile yarn stitches using various combinations of the paths of FIGURES 3–5, and

FIGURES 7 and 8 show the directional variation that can be achieved with individual stitches in a single row.

Referring now more particularly to the drawings, a tufting machine constructed in accordance with the present invention comprises the conventional base or frame member **10** over which the crankshaft housing **11** is mounted and which encloses the crankshaft **12** having a plurality of connecting rods **13** which reciprocate rods **14** up and down in guides **15**. The needle bar **16** is supported on the ends of rods **14** carries a plurality of tufting needles **17** and a jerker bar **18** for the pile yarns Y. The usual presser foot **20** is secured to the guides **15** and the needles **17** penetrate a backing fabric F which is fed over a throat **21**. In the conventional tufting machine a plurality of loopers are customarily employed for retaining or cutting the pile projections but in the interests of clarity these loopers have been omitted.

The fabric feed is from a conventional roll or source of supply, not shown, to a pin feed roller **22** over throat plate **21** and thence to a pin take-up roller **23**. These rollers are driven in a counterclockwise direction as seen in FIGURE 1 to feed the fabric in a longitudinal direction over the throat **21** and under the needles **17**. In addition to the longitudinal feed for the fabric F, it is well known to oscillate the fabric in a transverse direction by means of a secondary shaft **25** journaled in a reducing unit **26** mounted on a bracket **27**. Each end of shaft **25** is provided with a crank **30** and **31** each of which is adjustable to displace or oscillate the shafts **32** and **33**

for pin rolls **22** and **23** respectively. The drive for shaft **25** is through the speed reducing unit **26**, an in-put shaft **27**, sprocket **28**, chain **29**, and an electrically controlled clutch **35** actuated by means of brush assembly **36**.

The power in-put to the mechanism shown in FIGURE 2 is through a main power shaft **40** journaled at **41** and keyed to a sprocket **42**. Sprocket **42** drives a sprocket **43** through chain **44**. Sprocket **43** is keyed to a shaft **45** journaled at each end in the tufting machine frame at **46** and **47**. A low speed sprocket **50** is selectively engagable with shaft **45** through an electric clutch **51** controlled by brush assembly **52**. Sprocket **50** is drivingly connected to a shaft **53** through chain **54** and sprocket **55**. Shaft **53** journaled at **56** and **57** also carries the high speed sprocket **60** which is in turn driven through chain **61**, sprocket **62**, and clutch **63** from shaft **45**. Clutch **63** is selectively and drivingly connected to shaft **45** by means of a brush assembly **64** in the same manner as is clutch **51**.

The sequential operation of clutches **51** and **63** as well as clutch **35** is controlled by means of a pattern mechanism also driven from shaft **45**. This mechanism comprises a shaft **65** journaled at **66** and **67** carrying a driven sprocket **68** having a chain **69** trained over driving sprocket **70** keyed to shaft **45**. A jackshaft **75** journaled at **76** and **77** carried a dual sprocket **78** in alignment with a dual sprocket **79** on shaft **65**. Pattern chains **80** and **81** are trained over the sprockets **78** and **79** as shown clearly in FIGURE 2 and these pattern chains control microswitches **82** and **83** which in turn actuate clutches **36**, **51**, and **63** in accordance with the high and low links on the pattern chains.

Referring now to FIGURES 3 and 6, typical paths of pile fabric stitches are shown which can be produced with the controls of pattern chains **80** and **81**. When the backing backing fabric F is controlled only by the engagement of slow clutch **51** all of the stitches on the backing fabric follow a sine path such as that shown for example in FIGURE 3. When the wave line attachment and particularly shaft **25** is driven through the fast clutch **63**, the path folowed by the stitches is still a sine curve but with more closely spaced nodes. This is shown generally in FIGURE 4. With the main driving clutch **35** disengaged so that the wave line attachment is completely disconnected, the stitches naturally follow the straight line path shown in FIGURE 5. With a judicious selection of the links on the pattern chains **80** and **81**, however, it is now possible for the fabric designer to combine the fast, slow, and straight lateral movements of the backing fabric to achieve a wide variety of interesting pattern effects. FIGURE 6 shows a typical example in which the upper portion shown at **85** is controlled by the slow speed clutch **51** and corresponds to the curve of FIGURE 3. At point **86**, however, the pattern chain disengages clutch **35** so that all stitches across the fabric follow the straight line path **87** which corresponds to FIGURE 5. At point **88** clutch **35** is engaged, clutch **51** disengaged, and high speed clutch **63** engaged so that the stitches follow the high speed path **89** corresponding to the curve of FIGURE 4. At any point in the curvilinear path of the stitches the designer may interrupt the lateral travel of the backing fabric to introduce a long or a short series of linear stitches. Such is shown at **90** in FIGURE 6 at which point the clutch **35** is disengaged to provide the straight path of stitches **91** parallel to the straight path **87**. Path **91** or any subsequent path may be in line with a previous straight path. At point **92** the straight or linear path for the stitches is interrupted and the engagement of clutches **51** and **63** reversed so that a slow speed wave line motion is introduced to follow the more gradually curving path **93** of FIGURE 3. It will be apparent

that clutches **51** and **63** may be controlled by the pattern chains to disengage each one simultaneously thus automatically stopping the wave line motion of the pin feed and take-up rolls. The provision of a separate clutch **35** for this purpose has been found to produce a quicker and more positive action and eliminates precise timing of the chains to overcome any lag in the simultaneous disengagement of clutches **51** and **63**. It will be understood, however, that if desired the fast and slow clutches may be disengaged simultaneously and thereby eliminate the necessity for the third clutch **35**.

It will be understood that carpet designers are given a new tool as a result of the present invention which can be used to produce very interesting color effects in fabrics since the direction of differently colored yarns and their travel may be interrupted, changed, or combined in a wide variety of ways. By using contrasting colored yarns in every other needle, or in every other pair of needles, it is possible to shift the backing fabric to produce an appearance of color changes in the same row. This, of course, can be achieved by parallel, laterally spaced runs such as **87** and **91** in FIGURE 6. By means of shifting the yarn in certain needles so that the straight runs of different yarns are in alignment, it is possible to simulate yarn color change in the same row of stitches. The yarn in the row of FIGURE 6 may be of a given color but the yarns in either or both of the adjacent rows may be of a contrasting color so that the continuation of a row of stitches can give the appearance of color changes both in a linear or a curvilinear pattern throughout the length of the fabric.

A particularly sharp change effect due to higher frequency actuation of the clutches **35**, **51**, and **63** is shown in FIGURES 7 and 8. This may be used to break up parallelism or alignment of the individual stitches in each row. In FIGURE 7, it will be seen that stitches S_1, S_2, and S_3 generally follow the overall sine curve of the row S. In FIGURE 8, however, the placing of stitches S_1, S_2, and S_3 in the backing fabric F due to sudden shifts is broken up so that there is an absence of an overall directional pattern in each row.

The present invention provides a wide range of pattern control for the formation of pile yarn stitches in a backing fabric and permits the fabric designer to achieve new and unexpected design effects simply by means of a judicious and pre-determined selection of the links in the pattern chains.

Having thus described our invention, we claim:

1. In a pile fabric tufting machine having a housing, a vertically reciprocating needle bar mounted in said housing, a throat defining a tufting zone over which a backing fabric is fed underneath the needle bar, a pin feed roll for the backing fabric, a pin take-up roll for the backing fabric, a shaft journaled on the tufting machine at right angles to the said rolls, a pair of cranks on said shaft, a connecting rod between one of said cranks and the pin feed roll, a connecting rod between the other of said cranks and the pin take-up roll, drive means for the shaft, a secondary shaft in said drive means, a high speed clutch on said secondary shaft, a low speed clutch on said secondary shaft, and pattern means for selectively actuating each of said clutches in accordance with a pre-determined pattern to intermingle a fast lateral oscillation of the backing fabric across the throat, a slow lateral oscillation of the backing fabric across the throat, and a straight travel of backing fabric across the throat.

2. Apparatus in accordance with claim 1 in which the pattern means comprises a pair of chains having high and low pattern links.

3. In a pile fabric tufting machine having a housing, a vertically reciprocating needle bar mounted in said housing, a throat defining a tufting zone over which a backing fabric is fed underneath the needle, bar, a pin feed roll for the backing fabric, a pin take-up roll for the backing fabric, a shaft journaled on the tufting machine at right angles to the said rolls, a pair of cranks on said shaft, a connecting rod between one of said cranks and the pin feed roll, a connecting rod between the other of said cranks and the pin take-up roll, drive means for the shaft, an electrically actuated clutch in said drive means, a secondary shaft in said drive means, a high speed clutch on said secondary shaft, a low speed clutch on said secondary shaft, and pattern means for selectively actuating each of said clutches in accordance with a pre-determined pattern to intermingle a fast lateral oscillation of the backing fabric across the throat, a slow lateral oscillation of the backing fabric across the throat, and a straight travel of backing fabric across the throat.

4. Apparatus in accordance with claim 3 in which the pattern means comprises a pair of chains having high and low pattern links.

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