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PATTERN MECHANISM FOR A TUFTING MACHINE AND A PROCESS FOR PRODUCING A PATTERNED TUFTED FABRIC

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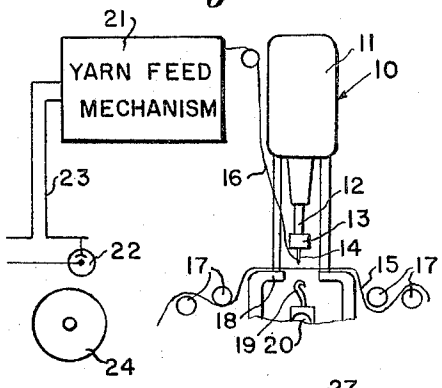
Fig 1



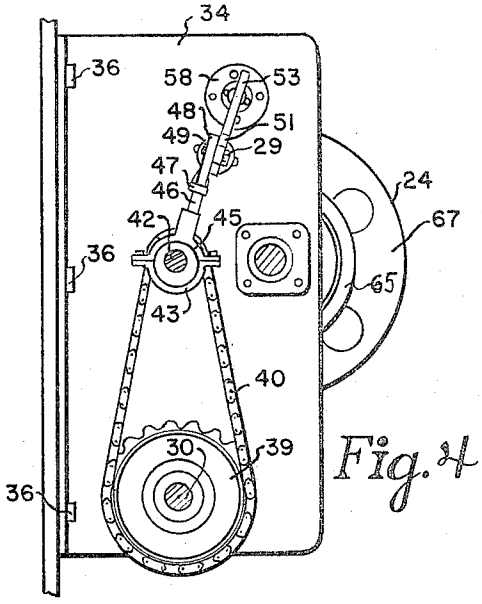
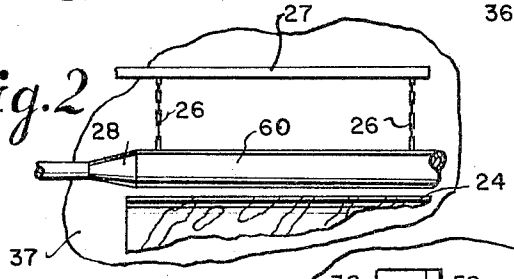


Fig. 4

Fig. 2



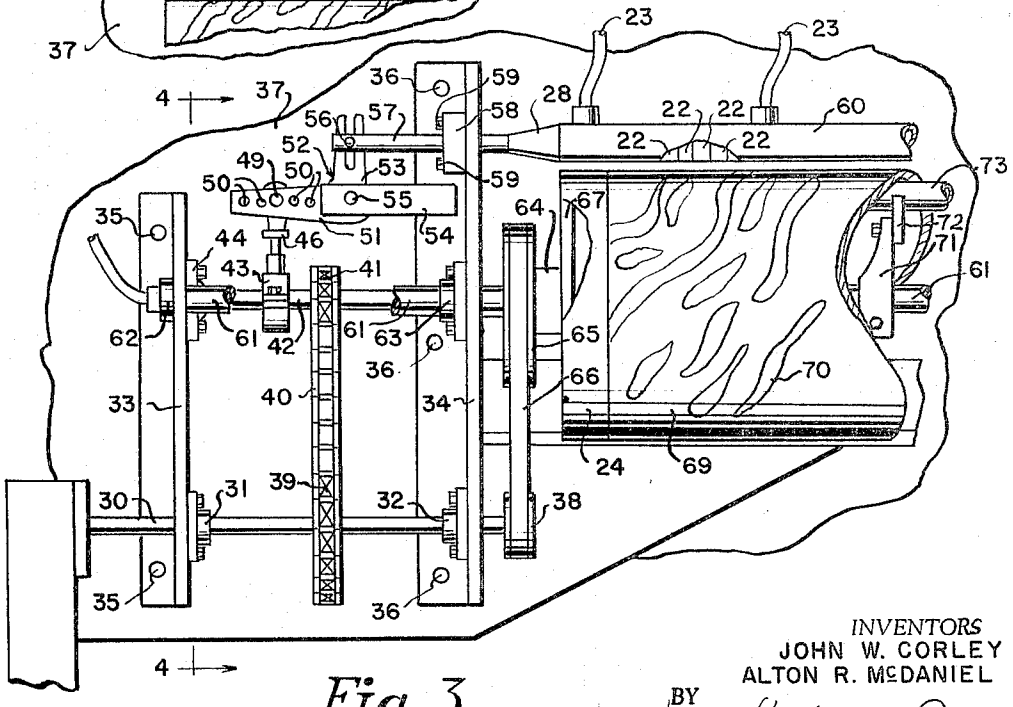


Fig. 3

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PATTERN MECHANISM FOR A TUFTING MACHINE AND A PROCESS FOR PRODUCING A PATTERNED TUFTED FABRIC

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This invention relates to a tufting machine and is more particularly concerned with a pattern mechanism for a tufting machine and a process for producing a patterned tufted fabric.

In the past, many and various devices have been produced for creating high and low loops in tufted fabrics. Among these machines is the well known Singer Cobble Scroll type pattern machine which has an illustrated pattern scanning system. The W. W. Hammel, Jr., Patent No. 3,103,187 with respect to which the present invention is an improvement, illustrates the type of apparatus referred to. This device utilizes a plurality of photoelectric cells disposed in juxtaposition over a rotatable clear plastic pattern drum. The pattern is painted on a piece of translucent acetate sheet which is disposed over the drum so that light within the drum is intermittently interrupted from shining on selected photoelectric cells as the drum is rotated. The photoelectric cells, in turn, control through a yarn feed mechanism, the amount of yarn fed to the respective needles of the tufting machine so as to feed a prescribed amount of yarn to those needles. By such an arrangement the needles on their down stroke, selectively rob the preceding loops in accordance with the continuous pattern on the acetate sheet.

In the scroll type pattern machine, the single ends of yarn are controlled; however, the pattern is repeated approximately every 36 inches transversely of the base fabric. Likewise, upon each revolution of the pattern drum, the pattern is repeated longitudinally of the base fabric. Between each repeat pattern, there is a tendency to create longitudinal pattern repeat lines, thereby making each repeat section on the base fabric stand out from the adjacent section. Likewise, there is a tendency to create transverse, streaking of the pattern on the base fabric, each revolution of the drum, as the pattern itself is repeated. The longitudinal pattern repeat lines and the transverse pattern streaking lines are very perceptible in certain quantities of goods and detract from the appearance of these goods. Indeed, in some instances, such goods must be classified as seconds.

Briefly decribed, the present invention, which overcomes the disadvantages described above, includes a mechanism for progressively altering the relative position of sensing means (photoelectric cells) and the path of movement of the pattern means (pattern drum) to thereby break up or blend the straight lines both horizontally and vertically into the overall pattern. In general terms the preferred embodiment of the present invention includes for photoelectric cell housing of the illustrated scanning system a supporting structure by means of which the position of the housing is progressively shifted transversely i.e. axially of the path of travel of the pattern drum while at times shifting the housing longitudinally i.e., circumferentially of the path of travel of the pattern drum.

Accordingly, it is an object of the present invention to provide a pattern mechanism for a tufting machine which will break up and blend into the overall pattern of the goods, any streaking and pattern repeat lines.

Another object of the present invention is to provide a pattern mechanism for tufting machine which is inexpensive to manufacture, durable in structure, and efficient in operation.

Another object of the present invention is to provide

a method of creating repeat patterns in a tufted fabric whereby the tendency to create streaking and pattern repeat lines is minimized.

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

FIG. 1 is a schematic diagram of the conventional scroll type loop pile tufting machine employing the conventional illustrated pattern scanning system.

FIG. 2 is a schematic side elevational view of the photoelectric cell housing and pattern drum of the device shown in FIG. 1 and showing the movable supporting structure for the housing, produced in accordance with the present invention.

FIG. 3 is fragmentary side elevational view of a portion of the tufting machine assembly illustrated in FIG. 1 and including the movable supporting structure for the photoelectric housing of the present invention and the mechanism by which the housing is continuously moved.

FIG. 4 is a cross sectional view taken substantially along line 4—4 in FIG. 3.

Referring now in detail to the embodiment chosen for the purpose of illustrating the present invention, it being understood that, in its broader aspects, the present invention is not limited to the exact details herein depicted, numeral 10 denotes generally a conventional loop pile, scroll type tufting machine having a crosshead 11, within which is the main drive shaft (not shown). The main drive shaft reciprocates the push rods 12 which, in turn reciprocate the horizontal needle bar 13. The needle bar 13 carries the usual needles 14 which are evenly spaced transversely of the feed of the fabric 15 so as to insert respectively the yarns 16, simultaneously into the base fabric 15 as it is fed by the feed rollers 17 over the bed plates 18 of the machine 10. Below the needles 14 are the loop pile loopers 19 which are reciprocated by the looper shaft 20 to catch and temporarily hold the loops sewn by the needles 14.

The amounts of yarns 16 fed to the needles 14 are controlled by a yarn feed mechanism 21, which is itself controlled by a plurality of sensing means, such as electric eyes or photoelectric cells 22, the photoelectric cells 22 being electrically connected by means of appropriate cables 23 to the yarn feed mechanism 21. Adjacent the photoelectric cells 22 is the movable pattern member, such as the pattern drum 24, which is rotated in timed relationship to the reciprocation needles 14 and to the feed of the base fabric 15.

The mechanism thus far described is essentially conventional and hence no detail description of the mechanism is required. It will be understood by those skilled in the art that a single photoelectric cell 22 controls a plurality of yarns 16 which are spaced respectively from each other by approximately 36 inches while an adjacent photoelectric cell 22 controls the yarns 16 which are adjacent thereto, etc. Thus, each photoelectric cell 22 simultaneously creates that portion of the pattern which is transversely disposed every 36 inches along the width or transversely of the base fabric 15.

Referring now to FIG. 2, 3, and 4, it will be seen that, in the conventional tufting machine mechanism illustrated in drawings, a drive shaft 30, which is rotated from the main drive shaft in timed relationship to the reciprocation of needles 14 and to the feed of the base fabric 15, is carried by pair of bearings 31 and 32 mounted respectively on outwardly extending, spaced parallel, bracket plates 33 and 34. The racket plates 33 and 34 are secured by means of bolts 35 and 36 to the wall 37 of the tufting machine 10. The shaft 30 protrudes beyond the bracket

plate 34 and is provided on its ends with a pulley 38. Carried on shaft 30, between the bracket plates 33 and 34, is a sprocket 39 which drives a continuous chain 40, the chain 40 passing around a sprocket 41 carried by a cam shaft 42. The cam shaft 42 carries an eccentrically mounted circular cam 43 and is supported, at its end, by bearings, such as bearing 44 mounted bracket plates 33 and 34. The cam shaft 42 is above and parallel to the drive shaft 30.

Journalling the cam 43 is a bearing 45 having an internally threaded bore which receives an externally threaded pitman 46. A lock nut 47 is threadedly carried by the pitman 46 while the other end of the pitman 46 is threadedly received in a pivot plate 48. The pivot plate 48 is provided with a central hole through which a pivot pin 49 projects. The other end of pivot pin 49 is provided with a nut 29.

The cam 43 is provided with a set screw (not shown) for locking the cam 43 to the cam shaft 42; however upon loosening of this set screw, the position of the cam 43 may be adjusted along the axis of shaft 42. The pivot pin 49 is adapted to be received in one of a plurality of spaced holes 50 in one arm 51 of a bell crank 52. The bell crank 52 is pivotally carried at the junction of its arms 51 and 53 by means of a pivot pin 55 extending through the bifurcated end of a brace 54. The brace 54 is mounted, by its other end, to bracket plate 34, essentially above and parallel to the cam shaft 42. The length of stroke of the bell crank 52 may be adjusted by adjusting the position of the cam 43 on shaft 42 and shifting the pivot pin 49 from one hole 50 to another.

The arm 53 stands essentially upright and is itself provided with a bifurcated outer end which receives therein a pivot pin 56 carried by one end of a slide rod 57. The slide rod 57 projects inwardly through a bearing 58 and through the bracket plate 34, the bearing 58 being secured to the bracket plate 34 by means of bolts 59.

The inner end of the slide rod 57 is connected through a flexible coupling 28 to one end of a hollow tubular photoelectric cell housing 60 within which are a plurality of the juxtaposed photoelectric cells 22. The photoelectric cells 22, in turn, are electrically connected through appropriate cables 23 to the yarn feed mechanism 21, as described above. Any suitable means for movably supporting the photoelectric cell housing 60 may be employed if desired, however in the present embodiment the photoelectric cell housing 60 is supported as shown in FIG. 2 by chains 26 from a bracket 27 mounted above pattern drum 24.

It is now seen that upon rotation of shaft 30, the cam shaft 42 is rotated via sprockets 39 and 41 and chain 40. The rotation of cam shaft 42, in turn, rotates the cam 43 to reciprocate the pitman 46 and hence pivot the arm 51 of bell crank 52 inwardly and outwardly in a gradual movement of low amplitude. This oscillates the housing 60 transversely of the movement of the pattern drum 24. At the same time, the housing 60 is adapted to swing slightly, moving forwardly and rearwardly with respect to the pattern drum 24.

Disposed approximately parallel to and in front of the cam shaft 42 is a hollow tubular shaft 61 which is supported by bearings 62 and 63 on the bracket plates 33 and 34 respectively. The tubular shaft 61 projects through the bracket plate 34 and is journalled, inwardly of bracket plate 34, by a rotatable sleeve 64. The inner end of the rotatable sleeve 64 is provided with a pulley 65 over which a continuous belt 66 is disposed, the belt 66 being also disposed around the pulley 38. Hence, upon rotation of shaft 30, the sleeve 64 is rotated via the pulleys 38 and 65 and belt 66. The inner end of sleeve 64 is provided with a circular disc 67 which receives and retains one end of the hollow, clear plastic, cylindrical pattern drum 24. The drum 24 is rotated by the disc 67 and is provided, along its periphery, with the acetate sheet 69 on which the continuous pattern 70 is painted.

Inwardly of the disc 67, the tubular shaft 61 is provided with a plurality of upstanding brackets, such as bracket 71, which carry clamps, such as clamp 72. These clamps support the light source, such as the fluorescent lamp 73, adjacent the inner periphery of the pattern drum 24 and immediately below the photoelectric cell housing 60. Light emanating from the lamps 73 passes through the pattern drum 24 and through the transparent or translucent portions of the acetate sheet 69 so as to be received by the photoelectric cells. When the light is interrupted to a selected photoelectric cell 22 by the pattern 70, as the pattern 70 is moved by drum 24 between lamps 73 and the photoelectric cell 22, the photoelectric cell 22 actuates the yarn feed mechanism 21 so as to cause the yarns 16, associated with the particular photoelectric cell 22, to feed less yarn to their associated needles 14. This creates short loops every 36 inches in the base fabric 15 by robbing from preceding loops, the deficient amounts of yarn.

It will be understood that by oscillation of the photoelectric cell housing 60, the pattern repeat lines which otherwise may appear longitudinally between each repeat of the pattern are broken up so that they are not readily seen when the goods are completed. Furthermore, since the housing 60 which carries photoelectric cells 22 may be positioned at a slightly different position each time the pattern is repeated, i.e. each rotation of the drum 24, the streaks which otherwise may appear transversely on the goods are also broken up and displaced in such a manner that it cannot readily be determined from the goods where the pattern is being repeated by the pattern drum 24.

The swinging of the housing also aids in producing asymmetrical perimeter for each repeat pattern in the goods.

From actual test of the mechanism here disclosed, it has been determined that approximately 5½ oscillations of the housing 60 per revolution of the pattern drum 24, achieves the desired results, however from three to fifteen oscillations per revolution of drum 24 is suitable. It is nevertheless preferable that the oscillation of housing 60 axially be some odd function of the rotation of drum 24 whereby the housing 60 does not end up at the same place with respect to the drum 24, each revolution. The amplitude of oscillation should be sufficient to shift the photoelectric cells 22 with respect to the pattern drum 24 over a distance corresponding to approximately three needles where the needles 14 are spaced apart by 5/32 inch. This provides for a shift of the pattern sewn in fabrics 15 of 15/32 inch. Up to approximately one inch shifting of the pattern transversely achieves desirable results, however, the amplitude of the movement of the photoelectric cells 22 with respect to the pattern drum 24 is inter-related with the pattern to be produced in the goods and it may be found desirable to increase or decrease the amplitude of oscillation when the pattern 70 and sheet 69 are changed.

The swing forwardly and rearwardly of the housing 60 due to vibration of the machine 10, may be eliminated altogether; however, the swing of the housing 60 may be found desirable for breaking up the transverse streaking.

While, in the preferred embodiment in the invention as illustrated by the drawings, we have disclosed the oscillation of the photoelectric cells 22, in order to break up the pattern repeat lines created on the fabric, it will readily be understood by those skilled in the art the present invention is applicable to any sensing means which operates in conjunction with the pattern means of a tufting machine.

For example, the oscillation mechanism here disclosed may also be utilized on a rack of brushes which ride in electrical contact with the periphery of a drum and wherein a pattern is created by insulated portions of the

pattern drum. Indeed, the present invention is not limited to any particular form of pattern drum and may include pattern means which actuate a variety of Jacquard mechanism or the like.

Therefore, by the term "sensing means" as used herein, it is intended that the term be given a broad interpretation to include various types of mechanisms which detect a prescribed pattern which is moved with respect to the sensing means and by the term "pattern means" it is intended to include various pattern drums, belts or the like. It will be obvious therefore that many variations may be made in the embodiment here chosen for the purpose of illustrating the present invention without departing from the scope thereof as defined by the appended claims.

We claim:

1. In a tufting machine of the type including a plurality of tufting needles and a yarn feed mechanism for feeding prescribed amounts of yarn toward said needles, the combination therewith of a pile pattern control mechanism comprising:

a pattern including predetermined features,

sensing means operatively connected to said yarn feed mechanism for sensing said predetermined features and controlling said yarn feed mechanism in a manner corresponding to said features,

means for moving said pattern and said sensing means with respect to each other in a predetermined direction, and

means for moving said pattern and said sensing means with respect to each other in a direction generally normal to said predetermined direction, said tufting machine thereby being adapted to tuft a fabric which has no definite line between longitudinal and transverse repeats of the predetermined features of said pattern reproduced thereon.

2. In a tufting machine of the type including a plurality of tufting needles and a yarn feed mechanism for feeding prescribed amounts of yarn toward said needles, the combination therewith of a pile pattern control mechanism comprising:

a pattern,

sensing means operatively connected to said yarn feed mechanism for sensing the features of said pattern,

first means for moving said pattern and said sensing means with respect to each other in a predetermined direction, and

second means for moving said pattern and said sensing means with respect to each other in a second predetermined direction, said tufting machine thereby being adapted to tuft a fabric which has no definite line between longitudinal and transverse repeats of the predetermined features of said pattern reproduced thereon.

3. The invention of claim 2 wherein said first means in constructed and arranged to move said pattern past said sensing means along predetermined path and said second means is constructed and arranged to move said sensing means back and forth across said path.

4. In a process of producing a tufted fabric wherein a varying pattern of tufts is produced in successive transverse rows in a base fabric, the steps of:

rotating a pattern drum about its longitudinal axis whereby its exterior surface moves in a given direction past a sensing means,

oscillating said sensing means in a path disposed at an angle with said given direction,

determining at least some of the characteristics of said pattern drum with said sensing means, and

inserting tufts of yarn through a base fabric in a pattern corresponding to the characteristics of said pattern drum as determined by said sensing means to thereby produce a fabric which has no definite line between the longitudinal and transverse repeats of the characteristics of said pattern reproduced thereon.

5. In a process of producing a tufted fabric wherein a varying pattern of tufts produced in successive transverse rows in a base fabric, the steps of:

moving a pattern of predetermined characteristics over a path past a sensing means located at a predetermined position along said path,

moving said sensing means in a path disposed generally transverse to the path of movement of said pattern,

determining at least some of the characteristics of said pattern with said sensing means, and

inserting tufts of yarn through a base fabric in a pattern corresponding to the characteristics determined by said sensing means to thereby produce a fabric which has no definite line between the longitudinal and transverse repeats of the characteristics of said pattern reproduced thereon.

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