Nov. 1, 1966 A. H. CRAWFORD 3,282,235

TUFTING APPARATUS HAVING FABRIC SHIFTING MEANS

Filed Dec. 24, 1963

2 Sheets-Sheet 1

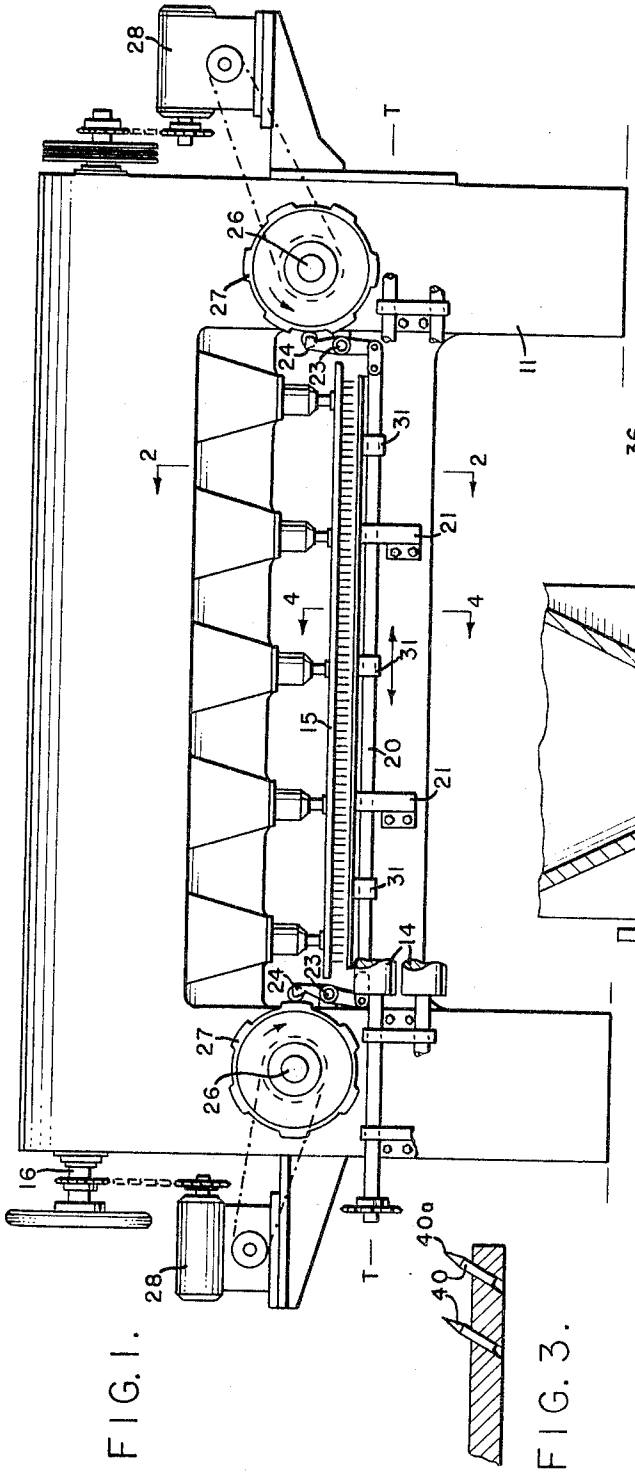


FIG. 1.

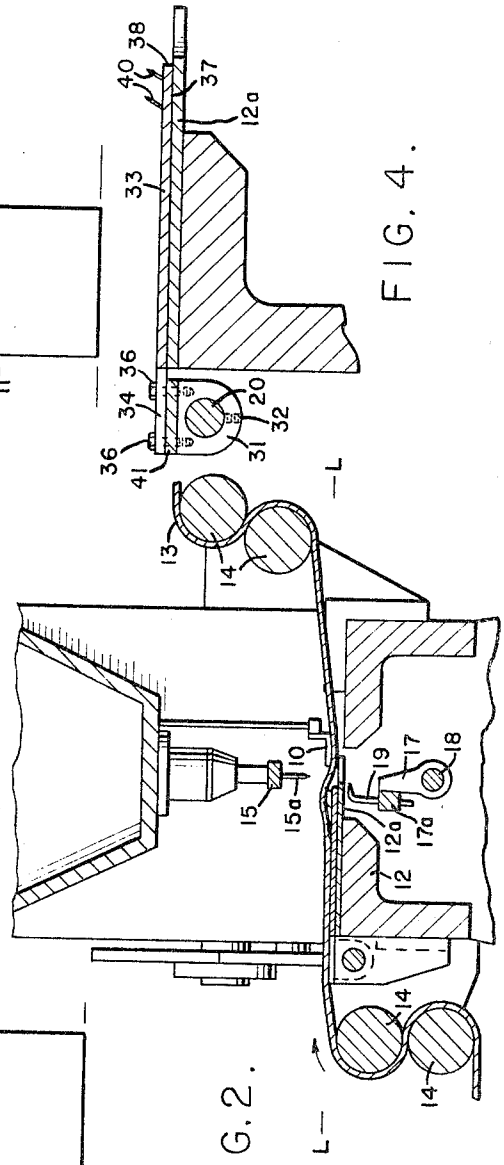


FIG. 2.

FIG. 4.

FIG. 3.

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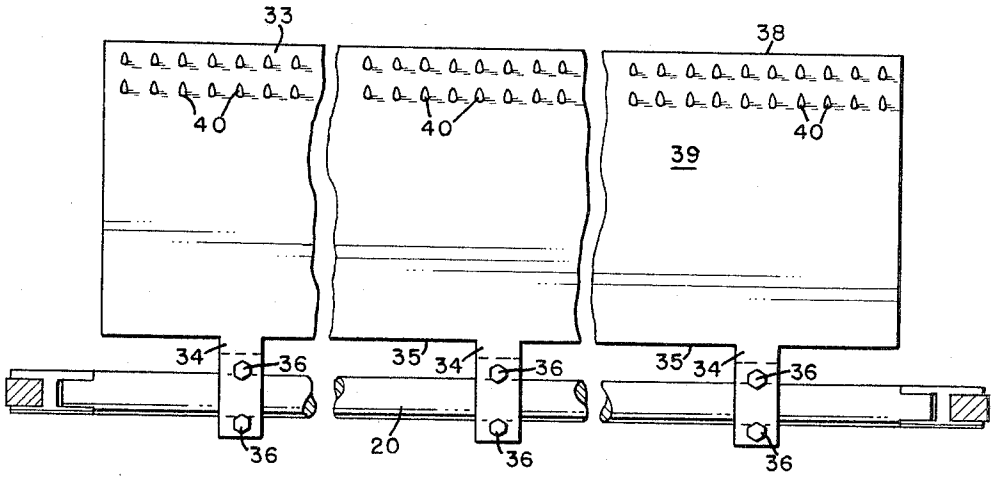


FIG. 5.

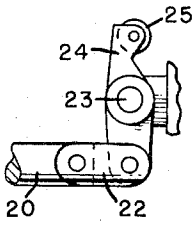


FIG. 6.

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3,282,235

Patented Nov. 1, 1966

3,282,235
TUFTING APPARATUS HAVING FABRIC SHIFTING MEANS

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Filed Dec. 24, 1963, Ser. No. 333,160
3 Claims. (Cl. 112—79)

This invention relates to apparatus for tufting pile fabrics and more particularly to a mechanism for imparting varied designs to pile fabrics produced on tufting machines. Although in the embodiment described below my improved mechanism is shown as applied to a tufting machine used in the manufacture of pile fabrics used as floor coverings or the like, I wish it to be understood that the apparatus herein disclosed is suitable for use on tufting machines employed in the manufacture of pile fabrics other than floor coverings.

Since the advent of tufting as a major factor in the manufacture of pile fabric floor coverings, there have been numerous innovations introduced in attempts to impart to this type of floor covering design characteristics not capable of attainment with the earliest tufting machines, which were operable to produce only straight row single level goods. For example, the method disclosed in the Boyles U.S. Patent No. 2,876,441, when practiced by the use of yarn feeding apparatus such as that disclosed in Crawford U.S. Patents Nos. 2,853,033, and 2,853,034, is effective in producing multi-level tufted pile fabrics which have found wide acceptance at the consumer level and which now account for approximately seventy-five percent of all tufted pile floor coverings manufactured in the United States.

Similarly, the fabric of the Rice U.S. Patent No. 2,766,506 and the method and apparatus of Bryant et al. U.S. Patent No. 3,026,830 are inventions which have been developed to provide tufted pile fabrics improved in aesthetic characteristics over those fabrics capable of production with the earlier tufting machines.

One of the serious limitations in the use of tufting apparatus is the heretofore unsolved problem of how to satisfactorily impart, on a mass production basis, certain multicolored characteristics to tufted pile fabrics. As is well known to those skilled in that portion of the textile art to which this invention pertains, the color combinations possible in Wilton and Axminster weaving, or an approximation thereof, would be quite desirable in tufted carpets but, as above noted, no one has thus far found a satisfactory solution to this problem despite the sustained activity in this field.

An examination of the Rice patent discloses a tufted pile fabric wherein a varicolored pattern effect is achieved by using two sets of pile yarns, each set of yarns being of a different color, with the yarns of one set alternating across the fabric with those of the other. The fabric of the Rice patent, in its simplest form, has yarns tufted into the backing sheet in wavy or undulating rows, rather than conventional rectilinear rows, with the pile yarns being fed to their respective needles in such a manner that, in a given area, the loops formed of the first set will be high loops capable of hiding low loops formed of the second set. In a longitudinally adjacent area of the fabric, the yarn is then fed to the needles in amounts so that the loops formed of the first set are low loops and the loops formed of the second set are low loop hiding high loops, thus producing a fabric wherein straight lines extending lengthwise on the surface thereof will pass through loops of different colors.

Since the areas having only loops of the first set or second set visible on the surface of the fabric can be randomly located throughout the fabric, both longitudinally and transversely thereof, it will be appreciated that with the advent of the Rice fabric it then became possible to produce tufted pile fabrics having varicolored pile effects not theretofore possible, thus increasing the versatility of such fabrics.

In the manufacture of the Rice fabric, various means can be used to cause the longitudinally extending rows of pile yarns to assume their non-rectilinear shape. For example, a to and fro movement can be imparted to the spike rolls used in moving the backing sheet through the tufting machine. Alternatively, apparatus such as that disclosed in the Bryant et al. U.S. Patent No. 3,026,830 can be employed to cause the needle bar to move laterally to and fro.

In the case of the first mentioned method of deflecting the backing sheet laterally from its normal rectilinear path through the tufting machine, it is difficult to accurately control the deflection of the sheet at the point of penetration of the needles inasmuch as the spike rolls are spaced some distance from the needle bar along the longitudinal path of travel of the backing sheet through the tufting machine.

In utilizing the method and apparatus of the Bryant et al. U.S. Patent No. 3,026,830, a number of difficulties are presented in attaining, with precision, the fine cooperation required in ensuring that a proper registration of each needle with its associated looper will occur upon each downward excursion of the needle bar. Also, my experience has been that when practicing the invention of the aforementioned Bryant et al. patent, a marked reduction in the heretofore generally expected operating speed of the tufting machine is necessary, resulting in a lesser output of the fabric being manufactured.

My invention is directed to an apparatus which, when used on a tufting machine, will cause the backing sheet to move laterally to and fro in an accurately predetermined pattern. It overcomes the problems above noted in that it permits accurate control of the lateral movement of the backing sheet at the point of penetration of the yarn carrying needles and is extremely simple in operation, requiring a minimum of maintenance and adjustment. No lateral deflection of the needle bar is required in the use of my invention, thus the problem of needle and looper registration, inherent in a shiftable needle bar type apparatus, are obviated.

With the above in mind, it is, accordingly, an object of this invention to provide an apparatus for use with a cut or uncut pile tufting machine of indeterminate width which is useful in the manufacture of pile fabrics having a multicolored surface effect.

A more specific object of this invention is to provide a movable plate having points located on one surface thereof which will securely grip and move, in a laterally to and fro direction, a backing sheet being fed through a tufting machine.

Another object of this invention is to provide an apparatus which is simple to construct and which may be used on a tufting machine operating at conventional operating speeds.

A still further object of this invention is the provision of a cam controlled apparatus for use in laterally moving, according to predetermined pattern, a backing sheet being fed through a tufting machine.

An additional object of this invention is the provision of a control means for use with a tufting machine which is operable to shift a longitudinally moving backing sheet, transversely, amounts such that successive pile ends, extending longitudinally of the fabric, may be spaced transversely of each other a distance less than, equal to, or greater than the needle gauge of the tufting machine.

These and other objects, and the various features and details of the operations and construction, are hereinafter more fully set forth and described with reference to the accompanying drawings, in which:

FIG. 1 is a view of a tufting machine equipped with my invention.

FIG. 2 is a sectional view along the line 2—2 of FIG. 1.

FIG. 3 is a view showing certain details of construction on my movable plate.

FIG. 4 is a sectional view along the line 4—4 of FIG. 1.

FIG. 5 is a plan view of a part of the apparatus of FIG. 1.

FIG. 6 is a view of a portion of the cam controlled apparatus of FIG. 1.

Referring to FIGS. 1 and 2, a tufting machine, with a longitudinal axis L—L and a transverse axis T—T, is somewhat diagrammatically shown having a framework **11** on which is mounted a bed **12**, supporting a throat plate **12***a*, over which a backing sheet **13** is passed from left to right as seen in FIG. 2. The backing sheet is tautly gripped and advanced over the bed **12** and throat plate **12***a* by means of a plurality of spike or feed rolls **14**, **14***a*, one or all of which may be positively driven. A needle bar **15**, having a plurality of yarn carrying needles **15***a* positioned therein, is mounted for vertical reciprocal movement by a suitable means cooperating with the main drive shaft **16**. Mounted beneath the lower surface of the bed **12**, on a plurality of arms **17** carried by a rock shaft **18** is a looper bar **17***a* supporting a plurality of looper hooks **19**, one such looper hook being provided for cooperation with each of the needles **15***a*. Fixedly mounted on the machine framework extending transversely of the tufting machine is an ...ble stripper bar **10** closely overlying the backing ...

...pparatus described thus far, as well as its normal operation, is old and well known in the art be... described for example in U.S. Patents Nos. 2,853,033, and 2,853,034 and forms no part ...sent invention. It suffices to say that as the ... **15** reciprocates it causes the yarn carrying ... to penetrate the backing sheet **13** to a point ...oper **19** associated with each needle **15***a* may ...ckwise, FIG. 2, to cause the bill **19***a* of ...oper **19** to enter a loop of ... needle 15*a*, and hold ...

thus insuring that the shaft **20** will always be positively driven in its to and fro movement along the transverse axis T—T of the tufting machine.

A plurality of clamping members **31** spaced along and encircling the shaft **20** are each secured in place thereon by a set screw **32**. A plate **33** which has a plurality of extensions **34** spaced along one of its edges **35** is secured by bolts **36** passing through the extensions **34** and into threaded openings in bands **31**. The plate **33** is mounted so that a portion of its lower surface **37** lies atop the throat plate **12***a* and its distal edge **38** lies in close proximity to the vertical plane in which the needles **15***a* reciprocate. Although I have shown the distal end of the plate **33** extending over the opening in bed **12**, I wish it to be understood that cases will arise where the plate **33** need not extend so far, as for example, when the plane of reciprocation of needles **15***a* is closely adjacent the edge **12***c* of the bed **12**. Protruding from the upper surface **39** of plate **34** are a plurality of points or spikes **40**. The longitudinal axis A–A′ of each of these spikes **40** it will be noted, as shown in FIGS. 3 and 4, is inclined away from the vertical and in the direction of travel of the backing sheet **13**. In my preferred embodiment, the axis A–A′ of each of the spikes **40** forms an angle of approximately 45 degrees with the horizontal and the vertical distance from the surface **39** of the plate **33** to the tip **40***a* of each spike **40** is approximately one-half inch. Although I have found these particulars of construction to be efficient, they may be varied; for example when the thickness of the backing sheet varies, keeping in mind, of course, that the spikes **40** should be angled from the vertical in the direction of travel of the backing sheet **13** across the throat. Although the attachment of spikes **40** to plate **33** may be accomplished in a variety of suitable ways, I have found it to be practical to affix them as follows; ... spike, a hole is drilled through the plat... spike is inserted in the hole ... place. As an alter... could be ...

As explained above, the points **40** on plate **33** are angled away from the vertical in the direction of the travel of the backing sheet, an arrangement which permits the backing sheet **13** to move along its longitudinal path through the tufting machine uninterrupted save for the transverse to and fro movement imparted to it by the action of plate **33**.

It will be appreciated that various patterns of to and fro movement may be imparted to the backing sheet **13**, through plate **33**, by merely changing the outline of the pattern control cams **27** and, when it is desired to allow the backing sheet to travel through the tufting machine without imparting any transverse movement to it, the apparatus of my invention may be disconnected, removed from the tufting machine, or suitably shaped discs may be mounted on the studs **23** to render the plate **33** nonmovable.

It is to be understood that the means for actuating the cams **27** will preferably be driven by the same motor which drives the backing sheet feed, needle, looper, and yarn feeding mechanism to the end that any desired synchronization and coordination of any and all such motions may be maintained notwithstanding that the machine may be started, stopped, or continuously run at will.

Although it is not essential to do so, I prefer to arrange the timing of cams **27** so that any shifting movement of plate **30** and backing sheet **13** will occur when the needles **15***a* are above the backing sheet. It will, of course, be obvious that shifting motion of the plate may occur while the needles are penetrating the backing sheet. In the latter instance, that portion of the backing sheet lying in the plane in which the needles reciprocate will follow the movement of the plate **30** when the needles **15** rise out of the backing sheet **13**.

The described invention permits excellent control in shifting a longitudinally moving backing sheet to and fro in directions transverse to the longitudinal direction of movement of the backing sheet through a tufting machine. The sheet may be moved transversely distances less than, equal to, or greater than the needle gauge of the tufting machine to allow consecutive loops formed of any single yarn to be spaced transversely relative to each other in a tufted pile fabric produced on a tufting machine utilizing my invention.

Having thus described my invention, I claim:

1. In a tufting machine having a supporting framework defining a throat, a throat plate supported by said supporting framework and partially overlying said throat, feed means operable to move a backing sheet over said throat plate and across said throat, yarn carrying needle means reciprocally operable to pierce said backing sheet, and looper means supported by said framework and operable to cooperate with said needle means during tufting operations, the improvement comprising a supporting member journaled in said framework, a plate-like member supported by said supporting member and extending over said throat plate, said plate-like member having means thereon for engaging said backing sheet, means for moving said plate-like member in directions transverse to the direction of movement of said backing sheet across said throat to move said backing sheet in directions transverse to the direction of movement of said backing sheet across said throat.

2. The invention of claim **1** wherein said means for engaging said backing sheet comprises projections extending from one surface of said plate-like member said projections inclined away from the vertical in the direction of travel of said backing sheet across said throat.

3. The invention of claim **2** wherein said plate-like member is operably connected to the supporting member journaled in the machine framework, said supporting member being connected at each of its ends to cam controlled means whereby said plate is positively moved in its movement in directions transverse to the direction of movement of said backing sheet across said throat.

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