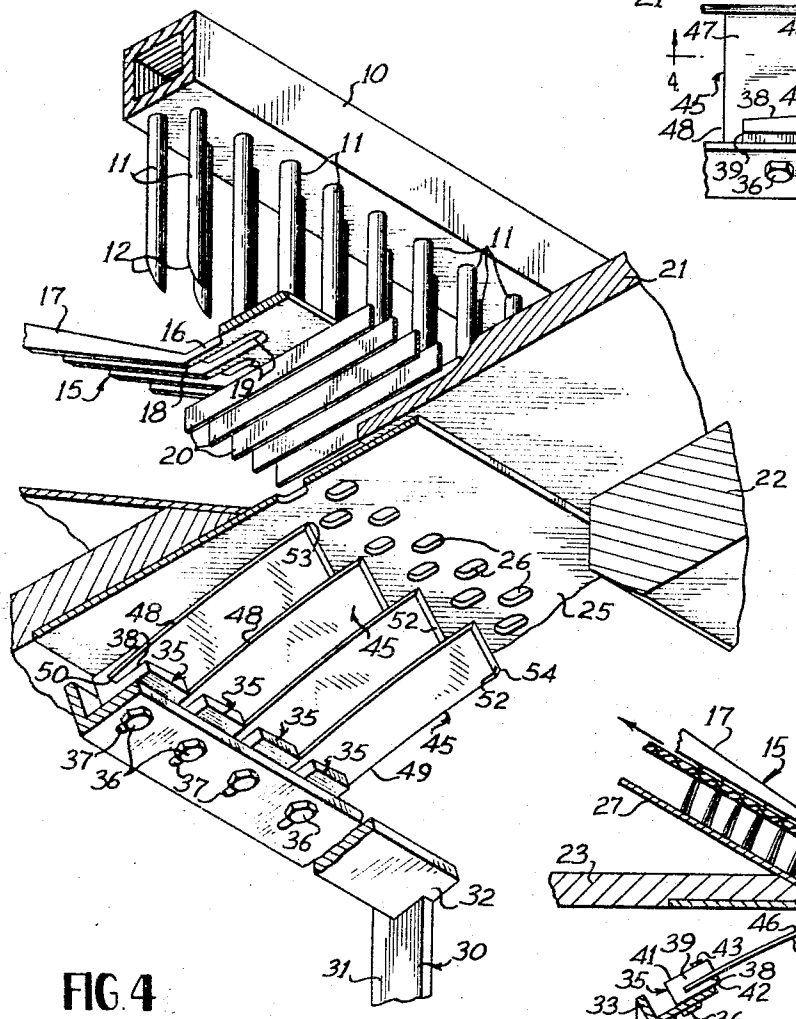
June 13, 1967 J. M. SMITH 3,324,812

SHEARING MECHANISM FOR TUFTING MACHINES

Filed Feb. 5, 1965

FIG. 1



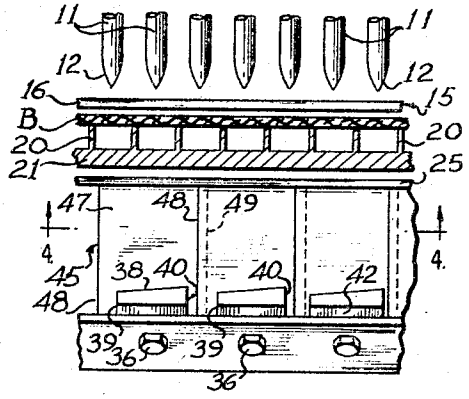


FIG. 3

FIG. 2

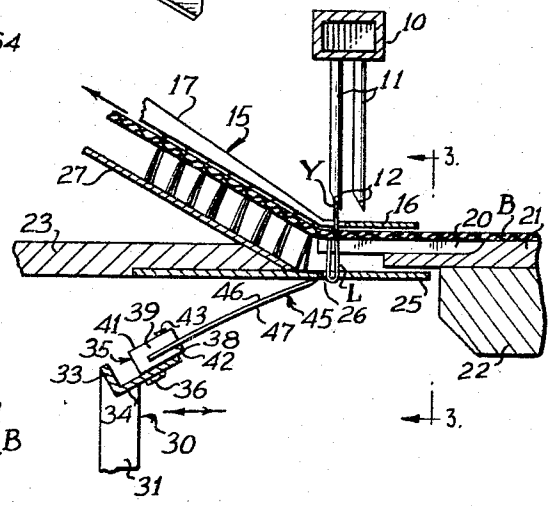
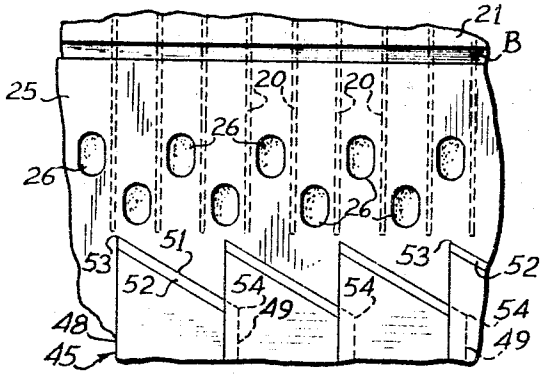


FIG. 4



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SHEARING MECHANISM FOR TUFTING MACHINES

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This invention relates to tufting machines and is more particularly concerned with a shearing mechanism for tufting machines.

In U.S. Patent No. 3,089,442 there is disclosed a pneumatic tufting machine which is suitable for producing a variety of tufted products. The present invention relates to a shearing mechanism for this pneumatic tufting machine, the shearing mechanism employing overlapping reciprocating blades which ride against a shear plate disposed beneath the backing material for shearing the backing material and through apertures in the shear plate.

It is, therefore, an object of the present invention to provide an inexpensive, durable and efficient shearing mechanism for operation in conjunction with a tufting machine for evenly and effectively shearing the ends of loops of yarn sewn in a backing material by the tufting machine.

Another object of the present invention is to provide a shearing mechanism for a tufting machine, in which the blades therefor are evenly biased, self sharpening, are capable of operating without adjustment for extended periods of time and may be individually removed, if it is found necessary to sharpen the blade.

Another object of the present invention is to provide, in a shearing mechanism, an arragement of side-by-side blades for shearing loops of yarns, wherein the danger of the yarns becoming wedged between adjacent blades is reduced to a minimum.

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 of reference designate corresponding parts throughout the several views, and in which:

FIG. 1 is a fragmentary perspective view of a portion of a tufting machine containing the shearing mechanism of the present invention;

FIG. 2 is a fragmentary side elevational view of that portion of the machine shown in FIG. 1, the machine being illustrated as in the process of producing cut pile tufts in a backing material.

FIG. 3 is a cross-sectional view taken substantially along line 3—3 in FIG. 2;

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, the tufting machine on which my shearing mechanism is operative is of the type illustrated in U.S. Patent No. 3,089,442, the tufting machine including a hollow needle bar 10 which is reciprocated in the usual way and carries a plurality of hollow needles 11 .

The hollow needles 11 project downwardly from the needle bar 10 and are arranged in two or more parallel transverse rows over a backing material B. The needles 11 are staggered with respect to each other so that adjacent needles 11 are transversely spaced and offset in respective rows, as illustrated in FIG. 1.

Air, or some other fluid, under pressure supplied to the hollow needle bar 10 passes in downward paths

through all needles 11 so as to emerge, as a downwardly directed stream, out of the beveled discharge ends 12 of the needles 11. Yarns Y, supplied in prescribed amounts, by a yarn control mechanism (not shown) pass through the needles 11 and are urged by the streams of air out of ends 12 to the full extent permitted by the yarn control mechanism.

Below the needle bar 10 is a transversely extending presser foot assembly 15 which is usually supported in a stationary position from the crosshead or crank case (not shown) of the machine. The presser foot assembly 15 includes a horizontally disposed presser foot 16 and an inclined slide plate 17 integrally joined along a common edge 18 and angularly disposed with respect to each other so that the slide plate 17 projects upwardly and rearwardly from the presser foot 16.

The presser foot 16 is provided with a plurality of apertures or holes 19, aligned respectively with needles 11 and through which the needles 11 project upon downward movement of the needle bar 10. The common edge 18 is immediately rearward of the path of travel of the rear row of needles 11.

Spaced slightly below the presser foot 16 are a plurality of parallel longitudinally extending vanes 20. The spaces between the vanes 20 are aligned with the holes 19 of the pressor foot 11 so that, at the bottom dead center position of needles 11, the ends 12 of needles 11 after passing through the backing material B are disposed between adjacent vanes 20. Vanes 20 are supported in cantilever fashion by a needle plate 21, the front portions of the vanes 20 being embedded in the rear edge portion of the needle plate 21. In turn, the needle plate 21 is disposed on the upper surface of and is supported by the front flange 22 of the cross bed of the machine.

The opposed rear flange 23 of the cross bed of the machine supports a forwardly extending flat shear plate 25 parallel to the presser foot 16 and the plane of vanes 20. The forward portion of shear plate 25 extends beyond the forward edge of flange 23 and is disposed below the vanes 20. Shear plate 25 is below the extremity of penetration of needles 11 and is provided with a plurality of apertures 26 which are respectively aligned with needles 11 so that yarns Y, discharged from the ends 12 of the needles 11, will be directed toward apertures 26 and be received therethrough, provided the loops L of yarns Y are sufficiently long.

Rearwardly of apertures 26, the flange 23 carries an upwardly and rearwardly inclined deflector plate 27 which is disposed approximately parallel to the slide plate 17 of the presser foot assembly 15. It will be understood that backing material B, seen in FIG. 2, is fed by feed rollers (not shown) in a rearward direction longitudinally over the needle plate 21 and the vanes 20, passing beneath the presser foot 16 and thence up the inclined passageway, defined by the slide plate 17 and the deflector plate 27, to the discharge rollers (not shown).

Below the shear plate 25, a knife reciprocating mechanism 30 is provided. The reciprocating mechanism 30 includes a plurality of upstanding rocker arms, such as arm 31, which carry, at their upper ends, a transversely extending angle iron. All rocker arms 31 are moved back and forth, forwardly and rearwardly, in timed relationship to the reciprocation of the needles 11. The angle iron carried by the rocker arms 31 immediately below the shear plate 25 has an upwardly and forwardly inclined block carrying base flange 32 and an upwardly and rearwardly inclined stop flange 33. The flanges 32 and 33 are joined along a common edge 34.

Carried by the base flange 32 are a plurality of spaced side-by-side juxtaposed rectangular knife carrying blocks 35 which are secured in place on the upper surface of

the base flange 32 by bolts 36 which pass upwardly through slots 37 in flange 32 and are respectively threadedly received in blocks 35. The slots 37 are elongated perpendicular to the common edge 34 for permitting limited individual adjustment of the blocks 35 toward or away from stop or flange 33.

According to the present invention, each block 35 is provided with a forwardly opening slot 38 extending from one side 39 to the other, 40, of block 35 through the central and forward portions of the block 35, the slot 38 being inclined with respect to the parallel upper and lower surfaces 41 and 42 of the block 35. A set screw 43, seen in FIG. 2, passes from the top or upper surface 41 of each block 35 for removably retaining in place, by its rear portion, a knife or blade 45.

Each knife or blade 45 is formed from an initially rectangular strip of spring steel. Thus, each blade or knife 45 has a flat upper or top surface 46; a flat lower or bottom surface 47 parallel to the upper surface 46; straight side edges 48 and 49, which are parallel to each other, and a straight rear edge 50 perpendicular to and extending between the ends of the side edges 48 and 49.

The front or cutting edge 51 of each knife or blade 45 is a straight edge, angling across the forward end of blade 45. Thus, side edge 48 of each blade 45 is longer than the side edge 49 thereof so that the cutting edge 51 intersects side edge 48 at an acute angle or point 53 and intersects side edge 49 at an obtuse angle or point 54. Furthermore, the front or cutting edge 51 is formed by bevelling the front portion of knife or blade 45 to provide an inclined front of beveled surface 52 disposed at an obtuse angle with respect to the bottom surface 47 while being disposed at an acute angle with respect to the upper surface 46. Thus, the cutting portion of the cutting edge 51 is adjacent the upper or top surface 46 of each blade 35.

When a knife or blade 45 is received in its associated block 35, i.e., when the end portion of blade 45 which is adjacent the rear edge of 50, is inserted into the slot 38 of its associated block 35, the blade 45 is slightly canted about its longitudinal axis to define an acute tilt angle with respect to the base flange 32, so that the shorter side edge 49 is slightly higher than the longer side edge 48 and therefore closer to the shear plate 25. The distance from the block 35 to the flat bottom surface of the shear plate 25 is substantially shorter than the length of the blade 45. Furthermore, the blade 45 is carried generally flatwise with respect to the shear plate 25 and so that it extends upwardly and forwardly toward the outer or bottom surface of shear plate 25 with its front or cutting edge 51 engaging and riding upon the outer or bottom surface of the shear plate 25 throughout the length of cutting edge 51.

In its cutting position, each blade 45 is held at an inclined upward and forward angle, so that the blade 45 is flexed toward the shear plate 25 with its upper surface 46 convexed and its lower surface is concaved. The blade 45 is so angled by the slot 38 that an upward biasing pressure is exerted by the blade 45 on its cutting edge 51 for biasing the cutting edge 51 at all times against the outer or lower surface of the shear plate 25, throughout the length of the cutting edge 51.

As best seen in FIG. 3, the transverse width of each knife or blade 45, is, from edge 48 to edge 49, greater than the width of block 35. Therefore, the edge portions of knife or blade 45 protrude outwardly beyond sides 39 and 40 of its associated block 35. Furthermore, the distance between centers of adjacent blocks 35 is less than the width of a blade 45. Also, the tilt angle of adjacent blades 45 is sufficient for the side edge 48 of one blade 45 to overlap the side edge 49 of an adjacent blade 45.

When all blades 45 are in place in their blocks 35, the blades 45 extend transversely across the shear plate 25 so as to present a continuity of cutting edges 51 slightly wider than the width of the row or rows of apertures 26 and generally transversely parallel to the rows of apertures 26.

The blade reciprocating mechanism 30 is so arranged and constructed that it moves the base flange 32 backward and forward in timed relationship to the reciprocation of the needle bar 10 and needles 11. This action slides the cutting edges 51 of all blades 45 along the bottom surface of shear plate 25 simultaneously across the apertures 26 in a back and forth movement so as to dispose the cutting edges 51 first on one side of the rows of apertures 26 during a portion of one cycle of the machine and then on the other side of the rows of apertures 26 during another portion of the cycle.

Preferably, the blades 45 complete their cutting or shearing action after the loops L have been extended to the full extent of their formation. In this way, a smooth cut transverse to the legs of the loops is provided so that a bight portion of each loop is severed, provided the loop is sufficiently long that the bight portion protrudes through its associated aperture 26.

It is now seen that the angling of the blade or knife 45 about its longitudinal axis so as to tilt it with respect to the line of blades 45, as described above, serves a triple function of: (1) disposing the angled cutting edge 51 of each blade 45 for slicing action with respect to the loops L as opposed to merely a chopping action, as when the cutting edge is perpendicular to its line of movement; (2) permitting an overlapping of the cutting edges 51, to thereby prevent the inadvertent wedging of yarns Y between the adjacent blades 45; and, (3) applying uniform pressure to the angled cutting edge 51 of each blade 45, throughout the length of cutting edge 51.

Still a further advantage is derived from my overlapped blade arrangement in that the biasing of the cutting edges 51 against the shear plate 25 permits a self sharpening action to take place on the edges 51 as they are reciprocated; while, at the same time, providing for a self equalizing action in that, if one portion or increment of a cutting edge 51 is biased more than another portion or increment thereof, the more biased portion will wear more quickly thereby tending to equalize the pressure on each increment of the edge 51.

It will be obvious to those skilled in the art that many variations may be made in the embodiments chosen for the purpose of illustrating the present invention without departing from the scope thereof as defined by the appended claims.

I claim:

1. In a tufting machine of the type having needles which insert yarns carried thereby through a backing material for forming loops in the backing material and having a shear plate provided with apertures through which the loops project, the combination therewith of a plurality of blades, each of said blades having a cutting edge at one end thereof and lateral sides extending away from said cutting edge, means supporting said blades adjacent said shear plate with the cutting edges of said blades facing in a common direction toward said apertures and the sides of said blades in mutually overlapping relation, and means for moving said blades endwise in said common direction across said apertures in contact with said shear plate for severing a portion of said loops.

2. In a tufting machine of the type having needles which insert yarns carried thereby through a backing material from one side thereof for forming loops in the other side of the backing material and having a shear plate provided with apertures through which the loops of a prescribed length project, the combination therewith of a plurality of blades, means supporting said blades adjacent said shear plate in overlapping fashion and means for moving said blades across said apertures for severing a portion of said loops, said blades having angled cutting edges with the leading portion of the cutting edge of one blade overlapping the trailing portion of an adjacent cutting edge, each of said blades being generally flatwise

with respect to and flexed against said shear plate for slideably biasing said cutting edges against the outer surface of said shear plate, each of said cutting edges being beveled so that the cutting portion of each cutting edge is defined by the junction of the surface of the blade which is adjacent said shear plate and the beveled portion of said cutting edge.

3. In a tufting machine of the type having needles which insert yarns carried thereby through successive portions of a backing material for forming loops of yarns in the backing material and wherein a shear plate is provided with aperture means through which certain of the loops protrude as such loops are formed, and wherein an actuating mechanism is provided adjacent said shear plate for movement toward and away from said aperture means, the combination therewith of a plurality of flat generally rectangular blades carried by said actuating mechanism, said flat blades protruding from said actuating mechanisms toward said aperture means, each of said blades having an angled cutting edge remote from said actuating mechanism and a relatively short side edge and a relatively long side edge, the edges of said blades being overlapped with the relatively short side edge of one blade being closer to said shear plate than its relatively long side edge.

4. In a tufting machine of the type having needles which insert yarns carried thereby through successive portions of a backing material for forming loops of yarn in the backing material and wherein a shear plate is provided with aperture means through which certain of the loops protrude as such loops are formed, and wherein an actuating mechanism is provided adjacent said shear plate for movement toward and away from said aperture means, the combination therewith a plurality of flat generally rectangular blades carried by said actuating mechanism, said flat blades protruding from said actuating mechanisms toward said aperture means, each of said blades having an angled cutting edge remote from said actuating mechanism and a relatively short side edge and a relatively long side edge, the edges of said blades being overlapped with the relatively short side edge of one blade being closer to said shear plate than its relatively long side edge, the relatively short side edge of one of said blades being closer to the shear plate than the relatively long side edge of an adjacent blade, said cutting edge of each blade being biased against said shear plate so that the surface of the blade adjacent said shear plate is in a convexed condition and the surface of said blade remote from said shear plate is in a concaved condition, the cutting edges of said blades being simultaneously movable by said actuating mechanism across said aperture means for severing the bights of said loops as said loops protrude through said aperture means.

5. In a tufting machine of the type having needles which insert yarns carried thereby through successive portions of a backing material for forming loops of yarn in the backing material and wherein a shear plate is provided with aperture means through which certain of the loops protrude as such loops are formed, and wherein an actuating mechanism is provided adjacent said shear plate for movement toward and away from said aperture means, the combination therewith of a plurality of flat

generally rectangular blades carried by said actuating mechanism, said flat blades protruding from said actuating mechanisms toward said aperture means, each of said blades having an angled cutting edge remote from said actuating mechanisms and a relatively short side edge and a relatively long side edge, the edges of said blades being overlapped with the relatively short side edge of one blade being closer to said shear plate than its relatively long side edge, the relatively short side edge of one of said blades being closer to the shear plate than the relatively long side edge of an adjacent blade, said cutting edge of each blade being biased against said shear plate so that the surface of the blade adjacent said shear plate is in a convexed condition and the surface of said blade remote from said shear plate is in a concaved condition, said cutting edge of each blade being beveled to provide a cutting portion defined by the beveled surface of said cutting edge and the surface of said blade adjacent said shear plate, the cutting edges of said blades being simultaneously movable by said actuating mechanism across said aperture means for severing the bights of said loops as said loops protrude through said aperture means.

6. In a tufting machine of the type having needles which insert yarns carried thereby through successive portions of a backing material for forming loops of yarn in the backing material and wherein a shear plate is provided with aperture means through which certain of the loops protrude as such loops are formed, and wherein an actuating mechanism is provided adjacent said shear plate for movement toward and away from said aperture means, the combination therewith of a plurality of blades carried by said actuating mechanism, said blades biased against said shear plate so that the surface of the blade adjacent said shear plate is in a convexed condition and the surface of said blade remote from said shear plate is in a concaved condition, said blades each having a cutting edge beveled to provide a cutting portion defined by the beveled surface of said cutting edge and the surface of said blade adjacent said shear plate, the cutting edges of said blades being simultaneously movable by said actuating mechanism across said aperture means for severing the bights of said loops as said loops protrude through said aperture means.

7. A tufting machine according to claim 1 wherein said cutting edges are inclined relative to the direction of movement of said blades with the leading portion of the cutting edge of one blade overlapping the trailing portion of an adjacent cutting edge.

8. A tufting machine according to claim 1 wherein said blades are made of resilient spring material and said blade supporting means retains said blades flexed against said shear plate.

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