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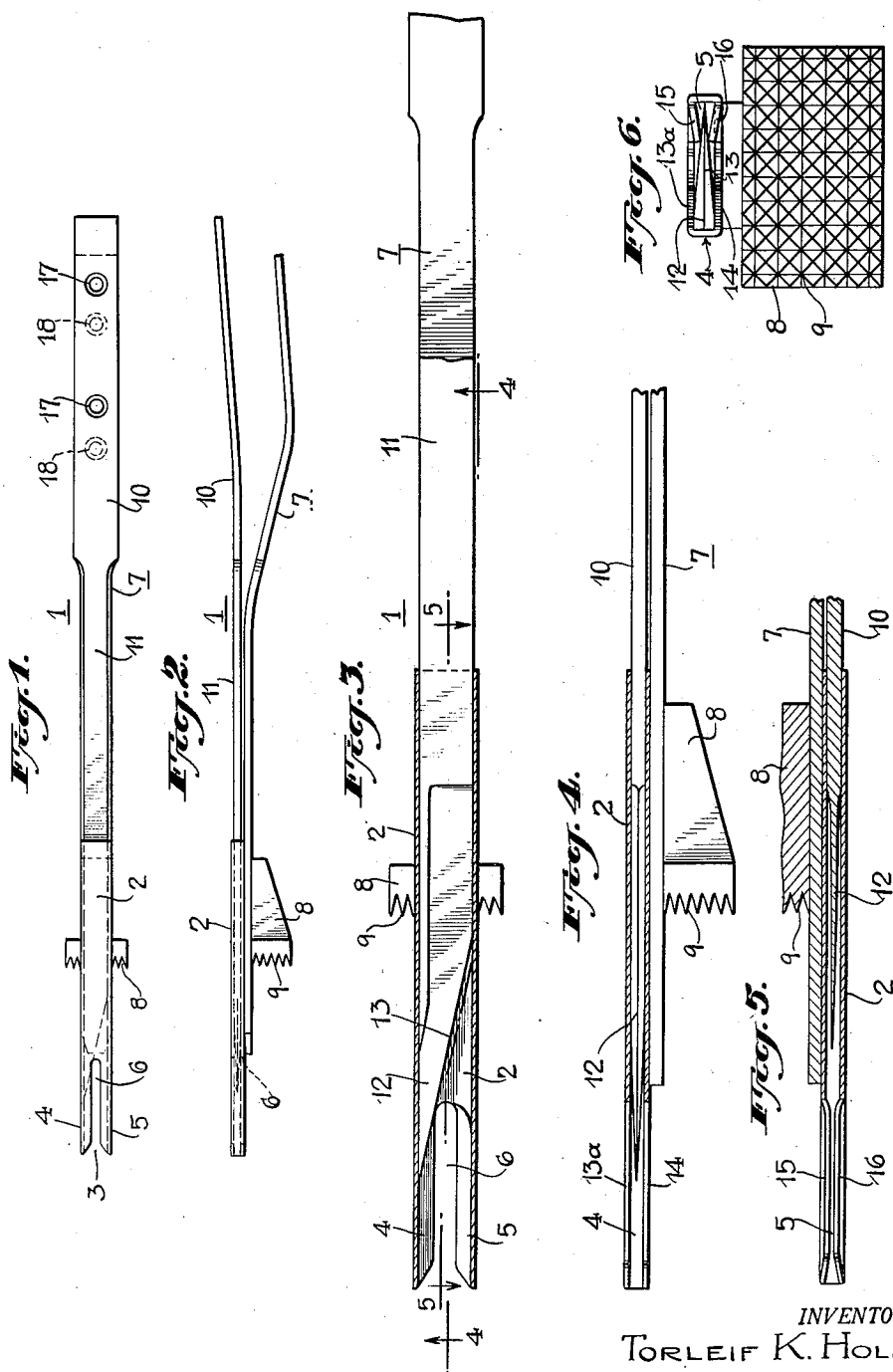
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2,591,939

CARPET TUFTING AND PILE CUTTING DEVICE

Filed Oct. 12, 1950

4 Sheets-Sheet 1



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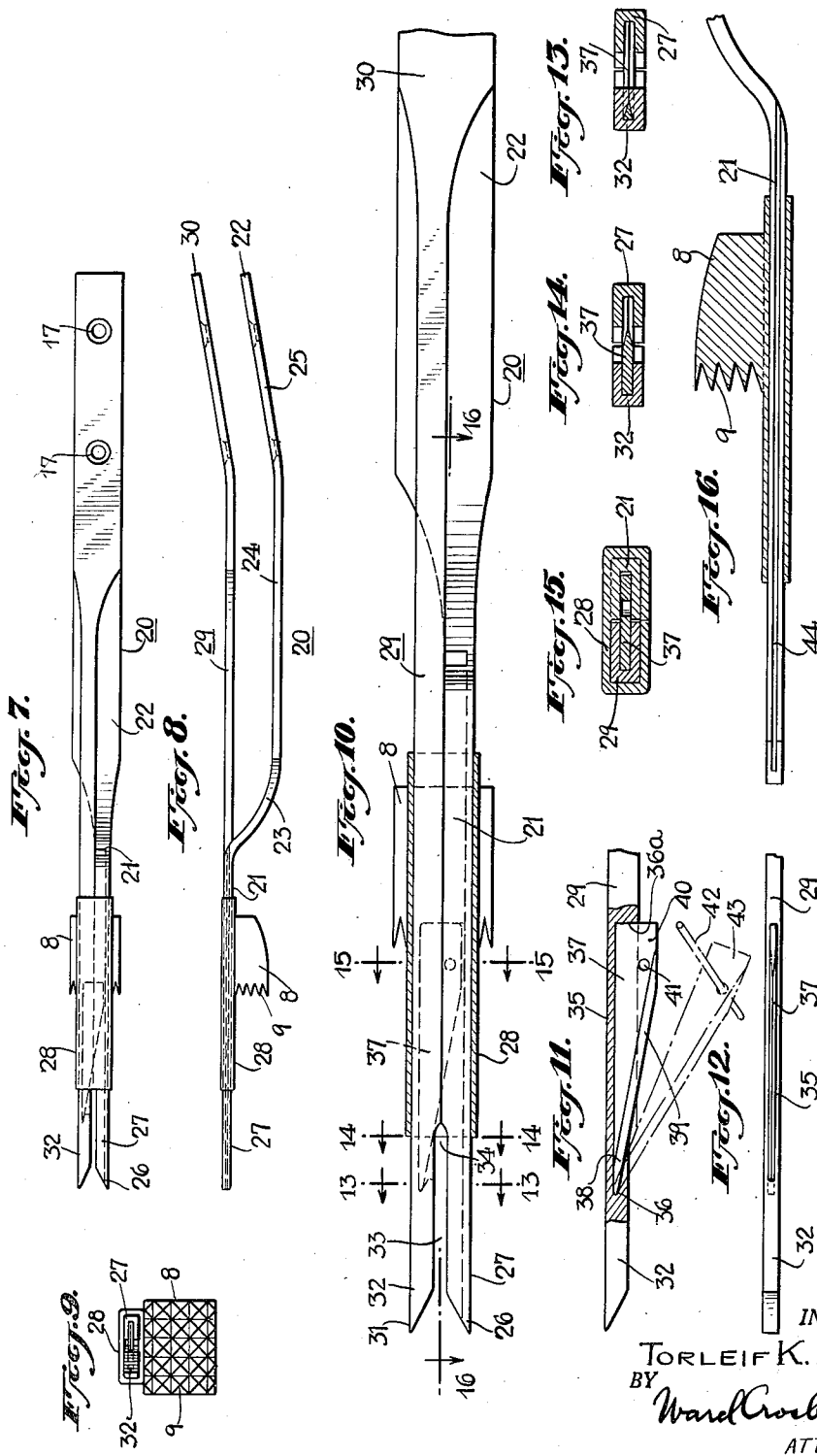
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CARPET TUFTING AND PILE CUTTING DEVICE

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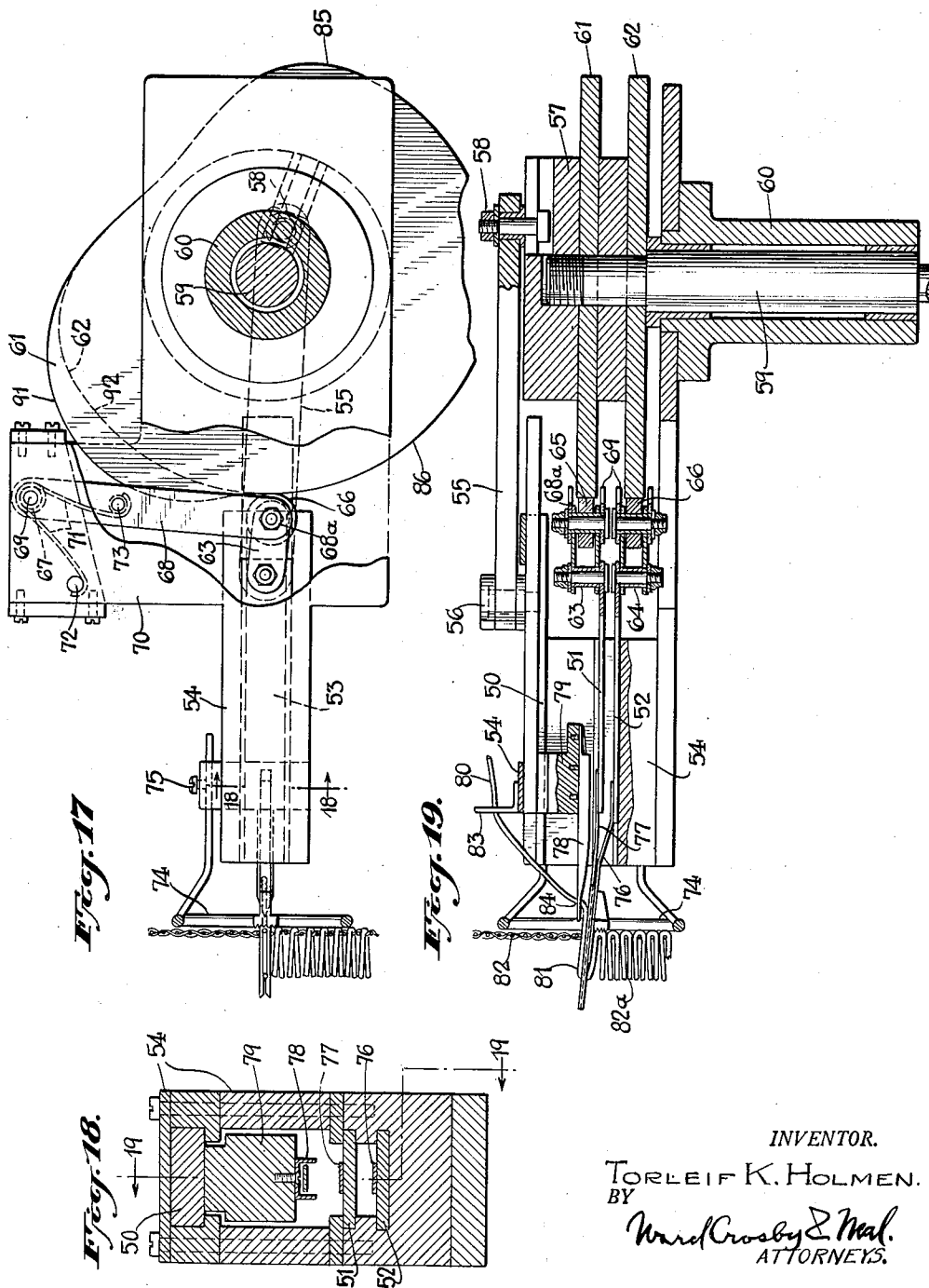
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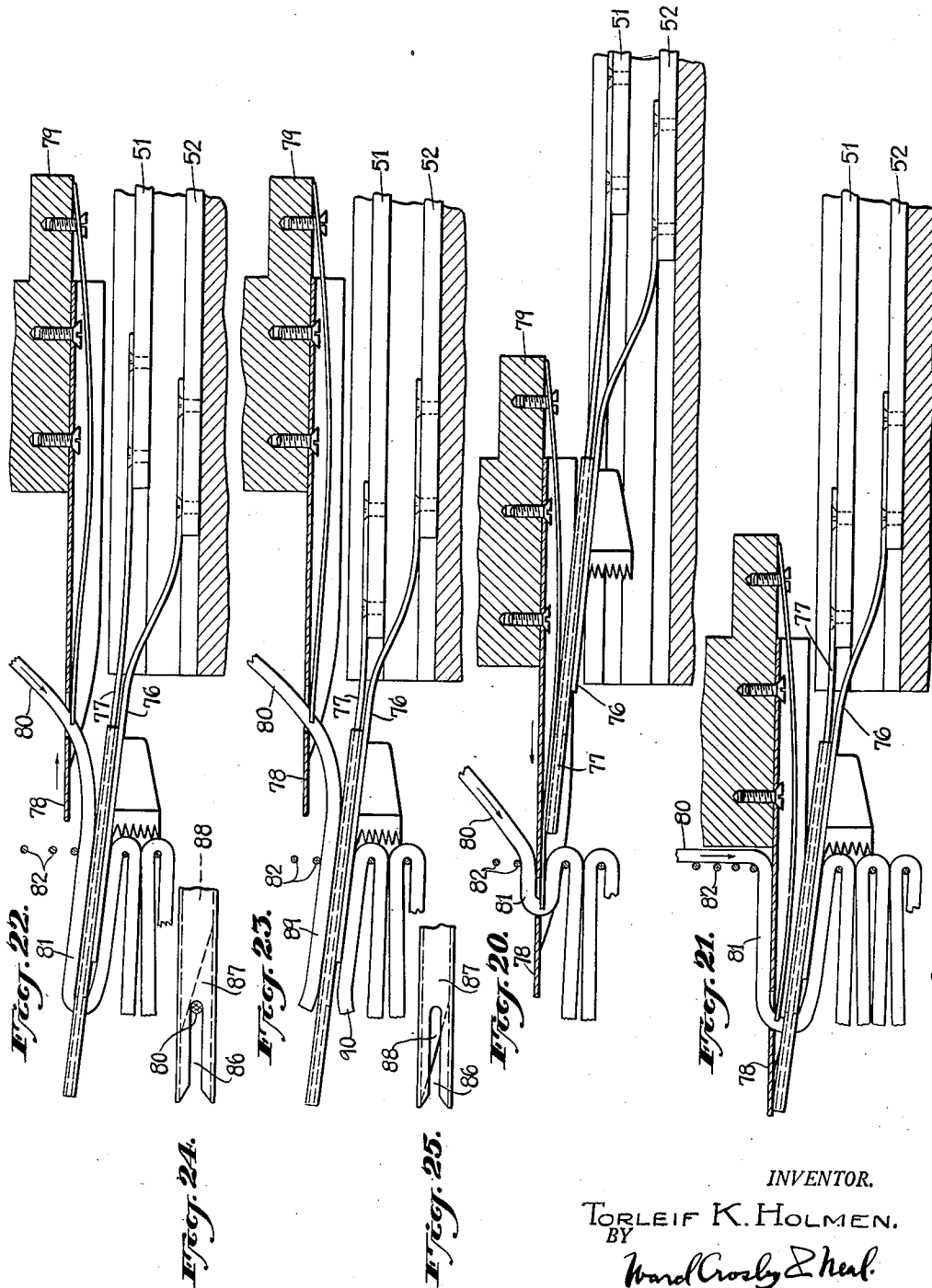
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UNITED STATES PATENT OFFICE

2,591,939

CARPET TUFTING AND PILE CUTTING
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Application October 12, 1950, Serial No. 189,719

5 Claims. (Cl. 112—79)

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This invention pertains to improvements in the manufacture of tufted and pile cut fabrics, more specifically tufted and pile cut carpet.

The invention comprises essentially a stepper and cutter assembly, used in conjunction with a needle, for producing successive tufts of filamentary material in a base fabric, and for cutting said tufts as they are formed, to provide a resulting tufted fabric having a cut pile.

The needle and the stepper and cutter mechanism are adapted to be power actuated in appropriately timed relation by a mechanism similar to that described in a copending application of R. C. Kline, Serial No. 148,946, filed March 10, 1950, sufficient disclosure of which is included in this application to describe and illustrate operation of the present invention in conjunction therewith.

In a copending application of R. C. Kline and J. Miller, Serial No. 128,314, filed November 19, 1949, there is described a power driven carpet tufting mechanism, comprising an eccentrically driven needle, and cooperating cam actuated stepper. In this mechanism, the filamentary material to be tufted in successive loops through a base fabric, is fed through the needle, which, as stated, is eccentrically driven, successively to penetrate and be withdrawn from the base fabric in progressive stitches. The cam actuated stepper is a blade having a V notch at its advancing end, which follows up the needle on each stitch, and catches and holds the stranded material in its V notch as the needle is withdrawn, thus to form the loop or tuft on each stitch, the stepper being thereupon withdrawn from the base fabric, to similarly follow up the needle on the next stitch.

In said R. C. Kline application Serial No. 148,946, the stepper takes the form of a pair of resilient blades, mounted face-to-face, and normally terminating beneath the needle point, in oppositely beveled ends, to provide a V notch therebetween. The stepper blades are independently actuated by separate power driven cams, being slidably displaceable with respect to each other, at an appropriate portion of the tufting cycle for cutting each tuft as it is formed, the cycle of operation being as follows: The needle is eccentrically driven as before, and as it is advanced through the base fabric, it carries with it the filamentary material fed through the needle hole. The stepper follows up the needle, the two blades thereof being actuated in unison, to catch the filamentary material in the V notch between the blades, and to hold the filament and form the tuft

as the needle is withdrawn. After the tuft is thus formed, one stepper blade is slidably displaced with respect to the other, by virtue of the independent cam drives referred to, whereby the tuft is pile cut, by shearing action, due to advancement of one stepper blade relative to the other.

According to the mechanism of the present invention, an entirely different principle of construction and operation is employed for the stepper and cutter mechanism and for forming the tufts and pile cutting each tuft as it is formed.

In its broader aspect, the stepper and cutter mechanism of the present invention comprises a pair of elongated and flattened metal bars or strips, preferably substantially rectangular in cross section. One of said bars has integral therewith, adjacent one end, a tubular sheath, while the second bar has a terminal portion slidable within said sheath, and has secured thereto a longitudinally beveled knife blade. A pair of spaced prongs project beyond the sheath, forming therebetween a longitudinally extending slot for catching and looping a stranded material to be cut. After the loop is thus formed, the second bar is displaceable within the sheath, whereby the knife blade secured thereto, severs the stranded material looped through the slot, by what may aptly be referred to as a "slicing-in-two" action.

More specifically, in accordance with one modification thereof, the invention comprises a stepper and a cutter element. The stepper comprises, in essence, a flattened, tubular sheath, longitudinally slotted at one end to provide opposed prongs, spaced by a substantially U-shaped slot, for catching and looping the stranded material to be tufted and cut, this sheath having integral with and projecting from the opposite end thereof, an elongated bar or metal strip, for reciprocating the same from a power driven cam. The cutter element comprises a bar or metal strip having a terminal portion which is slidable within the stepper sheath, this portion terminating in a longitudinally beveled knife edge, adapted upon displacement of the cutter bar relative to the stepper, to sever the stranded material looped through the stepper slot, the cutting action in this case comprising, as stated, a slicing in two of the tuft, in contrast to the shearing cutting action effected with the two blade stepper assembly of the copending Kline application aforesaid.

In accordance with a second modification of the invention, separate and distinct stepper and cutter elements are not employed, but two components are utilized which by their conjoint ac-

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tion, provide the stepper and cutter operations.

In accordance with a preferred embodiment of this modification of the invention, the stepper and cutter mechanism comprises a pair of elongated and flattened bars, preferably substantially rectangular in cross section. A first said bar has integral therewith a flattened, tubular sheath, surrounding the same adjacent one end; while the second said bar has a terminal portion slidable within the sheath in edgewise engagement with the first bar. The first and second bars project, respectively, beyond the sheath, in spaced prongs, forming therebetween a longitudinally extending slot for catching and looping the stranded material to be tufted and cut. The second bar is longitudinally grooved along an intermediate portion of its inner edge, this groove terminating at one end in a V notch, and having a pointed, longitudinally beveled knife blade, detachably mounted in the groove, with the point thereof engaging the V notch. The second bar is longitudinally grooved throughout its inner edge, for slidable reception of the knife blade. In this modification also the knife blade is adapted upon longitudinal displacement of the second bar with respect to the first bar, to sever stranded material looped through said slot.

The carpet tufting and pile cutting cycle of operations with the mechanism of the present invention is generally similar to that described above with reference to said Kline application Serial No. 148,946. The needle is eccentrically driven, and first advances into the base fabric carrying with it the filamentary material, fed through the needle hole. The stepper and cutter assembly is thereupon advanced, as a unit, by separate cams, mounted on the cam shaft which drives the needle eccentric. During the initial advance of the stepper and cutter assembly, the knife edge is in a retracted position within the sheath of the stepper and cutter mechanism so that as this assembly follows up the needle, the stranded material is caught in the slot thereof, and held there as the needle is withdrawn, to form the tuft. Thereupon the knife edge is advanced, relative to the slot, thus to sever the tuft, thereby to pile cut each tuft as it is formed, thus to produce a tufted and pile cut fabric. As soon as the tuft has been cut, the knife edge is again retracted by its cam within the sheath, and the stepper and cutter assemblage withdrawn as a unit, to follow up the needle, and provide the same cycle of operations on the next tufting stitch.

Referring now to the drawings:

Figure 1 is a plan view of a stepper and cutter assembly in accordance with the first modification of the invention above mentioned, while Figure 2 is a side elevation thereof. Figure 3 is an enlarged plan view, similar to Figure 1, but with a portion of the stepper sheath cut away to show the terminal construction of the cutter element disposed within the sheath. Figure 4 is a longitudinal section taken at 4—4 of Figure 3, while Figure 5 is a longitudinal section taken at 5—5 of Figure 3. Figure 6 is an enlarged end elevation of the Figure 1 assembly as viewed from the left in the drawing.

Figures 7, 8 and 9 are respectively a plan view, a side elevation, and an end elevation, the latter as viewed from the left in Figure 7, of a stepper and cutter assembly in accordance with the second modification of the invention, which includes a detachably mounted knife. Figure 10 is an enlarged plan view, similar to Figure 7, with a portion of the sheath removed, to illustrate the

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detachable mounting of the knife. Figure 11 is a plan view, partly in section, of the terminal portion of the bar on which the knife is mounted, further illustrating the detachable mounting of the knife edge therein. Figure 12 is an elevation of Figure 11 as viewed from below in Figure 11. Figures 13, 14 and 15 are transverse sections, as taken at 13—13, 14—14, and 15—15, respectively, of Figure 10. Figure 16 is a longitudinal section as taken at 16—16 of Figure 10.

Figure 17 is a side elevation, partly in section, of the above mentioned eccentric and cam actuating mechanism for driving the needle and stepper and cutter elements, as aforesaid, to produce a tufted and pile cut fabric; while Figure 18 is cross section thereof taken at 18—18 of Figure 17. Figure 19 is a plan view, partly in section and partly in elevation, as taken approximately along the line 19—19 of Figure 18.

Figures 20 to 23 inclusive are side elevations, partly in section, of the needle and stepper and cutter mechanisms, at successive intervals of the tufting and pile cutting cycle, to illustrate the relative positions of these components at various portions of said cycle; while Figures 24 and 25 are fragmentary plan views of the stepper and cutter elements showing the relative positions thereof, at the Figures 22 and 23 intervals respectively of the tufting and pile cutting cycle.

Referring to the modification of the invention illustrated in Figures 1 to 6 inclusive, there is shown a stepper and cutter assembly 1, the stepper of which comprises a flattened, substantially rectangular, tubular sheath 2, which is longitudinally slotted at one end, as at 3, to provide opposed prongs 4, 5, spaced by a substantially U-shaped slot 6, the latter for the reception of the stranded material to be tufted and cut. Integral with and extending from the opposite end of the sheath 2 is a bar or metal strip 7, for longitudinally displacing the stepper by the power actuating mechanism in the manner described below. Also mounted on the underside of the stepper bar 7 is a lug 8, preferably provided with a toothed or serrated face, as at 9, perpendicular to the plane of the bar 7, for engaging the base fabric and regulating the depth of penetration of the stepper therethrough, in the manner explained below. The cutter comprises a separate bar or metal strip 10, having a terminal portion 11 adapted to slide within the stepper sheath 2, this terminal portion having mounted thereon or formed integral therewith, a pointed blade 12, having a longitudinally beveled knife edge, as at 13.

Referring more particularly to Figures 4, 5 and 6, the opposite sidewalls 13a, 14 of the sheath prong 4, are substantially parallel, as shown, while the sidewalls 15, 16, of the opposite sheath prong 5 are inclined toward each other, to facilitate the cutting action, as the knife blade 12 is longitudinally displaced with respect to the slot 6. The terminal ends of the metal strips 7 and 10, are provided with holes as at 17, 18, for mounting on thrust bars of the cam actuated reciprocating mechanism as described hereinafter.

To describe briefly at this point the operation of this stepper and cutter mechanism, the cutter bar 10 is normally in the position shown in Figures 1 to 6, in relation to the stepper assembly 2, 7. For the tufting operation, the stepper and cutter assembly, in their relative positions shown, are advanced as a unit, whereby the stranded material to be tufted and pile cut, is caught in

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the slot 6 and looped thereover under tension. Thereupon the cutter bar 10 is advanced relative to the stepper, 2, 7 so that the beveled knife edge 13 of the knife blade 12 severs the stranded material by a slicing action, whereupon the cutter bar 10 is again retracted to the position shown in the drawing. During the cutting action the stranded material is pressed by the knife edge 13 against the inwardly inclined walls 15, 16 of the lower prong 5 thus facilitating severing of the strand by slicing action.

Referring to the modification of the invention shown in Figures 7 to 16 inclusive, the mechanism comprises a first bar or metal strip 20, one end 21 of which is relatively narrow and coplanar, while the opposite end 22 is widened and bent away from, as at 23, and thence substantially parallel, as at 24, to the plane of portion 21, and finally inclined thereto, as at 25. Portion 21 is further narrowed at its end and pointed at its extremity 26, to provide a terminal prong 27. Encasing the narrowed portion 21, commencing at the base of the prong 27, is a flattened, tubular sheath 28, secured to portion 21, as by welding, soldering, etc.

As shown in Figure 10, sheath 28 is approximately double the width of portion 21, of bar 20, and slidably mounted in the remaining portion of the sheath, is a second bar or metal strip 29, which is of substantially constant width and coplanar throughout its length, except for its end 30 which is widened and inclined substantially parallel to the end 22 of bar 20. Also the opposite end of bar 29 is further narrowed and pointed at its extremity as at 31, to provide a terminal prong 32, similar to and spaced from prong 27 of bar 20, and forming therebetween a slot 33, which is terminated by the outer edge 34 of sheath 28. The bars 20, 29, are normally in the relative positions shown in the drawings, with their pronged ends projecting from the sheath to the same extent, prong 27 being as explained fixed relative to the sheath, while prong 32 is displaceable relative thereto, due to the fact that bar 29 is slidably displaceable in the sheath in edgewise engagement with portion 21 of bar 20.

As shown more particularly in Figures 11 and 12, the inner edge of bar 29 is longitudinally slotted for an intermediate extent adjacent its pronged end, as at 35, the slot terminating at its forward end in a V notch, as at 36, and having a substantially right angled terminus at its opposite end, as at 36a.

Detachably mounted in this slot is a knife blade 37, having a pointed end 38 seated in the V notch 36, and having a longitudinally beveled cutting edge 39, ending in a right angled terminus 40, which abuttingly engages the slot end 36a. The end 40 is provided with a small bore, as at 41 for insertion of a bar, as at 42, for removing and replacing the blade in the manner illustrated by the dashed line position 43 of the blade.

It will be observed that the blade 37 projects beyond the bar 29 in which it is mounted, and to permit of slidably displacing the bar 29 and blade 37 with respect to bar 20, the latter is longitudinally grooved along its inner edge, as at 44, throughout the length of the narrow portion 21 thereof, as shown most clearly in Figure 16. The projecting portion of blade 37 slides within this groove, and the arrangement permits of completely withdrawing bar 29 and blade 37 assem-

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bled thereon from engagement with the sheath 28 and bar 20, for purposes of disassembly.

Figures 17 to 19 inclusive show a power driven carpet tufting and pile cutting mechanism embodying the invention. Since this mechanism is generally similar to that fully described and claimed in said Kline application Serial No. 148,946, except for the requisite modification to incorporate the stepper and cutter mechanism of the present invention, its construction and operation will be described only in sufficient detail to describe its operation in relation to the present invention.

The mechanism comprises three thrust bars 50, 51 and 52, mounted for slidable displacement along parallel paths in a housing 54, and in the manner clearly shown in the sectional view, Figure 18. Bar 50 is reciprocally driven by means of an eccentric arm 55, pivoted thereto, as at 56, and an eccentric 57, to which arm 55 is in turn pivoted, as at 58. The eccentric is keyed to a power driven shaft 59, journaled in bearings 60. Also keyed to shaft 59, are a pair of cams 61, 62, having the configurations shown in Figure 17, which respectively reciprocate the thrust bars, 51, 52, through link connections 63, 64, to which are journaled cam rolls 65, 66, respectively engaging the peripheral faces of cams 61, 62. The cam rolls are maintained in resilient engagement with the cam faces, by means of coiled springs, such as 67, and link members, such as 68, pivotally mounted, as at 69, in a housing 70. The link members 68, are pivoted to the link members 63, 64, as at 68a, while the springs 67 are provided with lever arms 71, operating between studs 72, 73, fixed to the housing 70 and link members 68 respectively. Mounted on housing 54, is a ring guard 74, adjustably spaced therefrom by a nut 75.

With the modification of the invention shown in Figures 1 to 6 inclusive, the stepper and cutter bars 7 and 10, are respectively mounted by screws passing through the screw-holes 17, 18, on the thrust bars 52, 51, and in the manner shown at 76, 77, of Figure 18. Cooperating with these stepper and cutter elements, is a needle 78, mounted on a lug 79, secured to the underside of thrust bar 50. Yarn 80, to be tufted, as at 81, into a base fabric 82, and thereupon pile cut, as at 82a, is fed through an eyelet 83, mounted on frame 54, and thence through the needle hole, as at 84.

In the operation of this mechanism, rotation of shaft 59, reciprocates the thrust bars 50-52 inclusive in appropriately timed relation through the intermediary of the eccentric and cam drives referred to, the sequence of operation being as illustrated in Figures 20 to 25 inclusive. Figure 20 shows the first step with the needle 78 penetrating the base fabric 82, carrying with it the yarn 80 to form the loop or tuft, the stepper and cutter element 76, 77 being in the retracted position shown. In Figure 21, the needle has penetrated the fabric to the full extent, and the stepper and cutter elements have likewise followed up the stepper to the full extent, being advanced as a unit by the confluent face portions 85, Figure 17, of cams 61, 62. The loop 81 is then caught and held in the slot 86, Figure 24, of the stepper 87, the knife 88, being in the retracted position shown. In Figure 22 the needle 78 has been withdrawn while the stepper 87 remains stationary and holds the loop, due to the fact that the cam rolls 65, 66, are now resting upon the arc portion 86 of constant radius of the cam

rolls 61, 62, Figure 17. In Figure 23, the knife 88 is being advanced relative to the stepper, in the manner shown in Figure 25, to sever the yarn looped, as in Figure 24, over the base of slot 86, thus to pile cut the yarn as at 89, 90, Figure 23. This relative displacement of the cutter and stepper elements is effected by the non-confluent cam face portions 91, 92, Figure 17, of the cams 61, 62, on which the cam rolls 65, 66 are riding at this stage. The cycle of operations is now complete and repeats itself for each successive stitch in the manner above outlined.

With the modification of the invention illustrated in Figures 7 to 16 inclusive the same sequence occurs except that now bars 20 and 29 of this modification are respectively mounted as at 76, 77 in the thrust bars 52, 51.

What is claimed is:

1. In combination a stepper and cutter for producing a tufted and pile cut fabric, said stepper comprising a flattened, tubular sheath, longitudinally slotted at one end to provide opposed prongs, each of substantially U-shape in transverse section for reception of a stranded material to be tufted and cut, and a bar integral with and projecting from the opposite end of said sheath, said cutter comprising a bar having a terminal portion slidable within said sheath, said terminal portion including a beveled knife edge, adapted upon displacement thereof relative to said sheath, to sever stranded material held in said slot.

2. In combination a stepper and cutter for producing a tufted and pile cut fabric, said stepper comprising a flattened, tubular sheath, longitudinally slotted at one end to provide opposed prongs, each of substantially U-shape in transverse section for reception of a stranded material to be tufted and cut, and a bar integral with and projecting from the opposite end of said sheath, said cutter comprising a bar having a terminal portion slidable within said sheath, said terminal portion including a beveled knife edge, adapted upon displacement thereof relative to said sheath, to sever stranded material held in said slot, said stepper also having integral with said sheath a fabric engaging lug, for regulating the depth of penetration of said stepper through the fabric.

3. In combination a stepper and cutter assembly for producing a tufted and pile cut fabric, said stepper comprising a flattened, tubular sheath, longitudinally slotted at one end to provide opposed prongs for catching and looping a stranded material to be tufted and cut, each of said prongs being substantially U-shaped in transverse section, the opposed legs of one of which are inclined toward each other, and a bar integral with and projecting from the opposite end of said sheath, and said cutter comprising a bar having a terminal portion slidable

within said sheath, said terminal portion including a pointed knife edge, of longitudinally beveled configuration, adapted upon longitudinal displacement thereof relative to said sheath, to sever stranded material looped through said stepper slot, the aforesaid inwardly inclined legs of said stepper prong forming a two point support for the stranded material between which supports said knife edge severs said stranded material without engaging said inwardly inclined prong legs.

4. A combined cutter and stepper mechanism for producing a tufted and pile cut fabric, comprising: a pair of elongated and flattened bars, a first said bar having integral therewith, adjacent one end, a flattened, tubular sheath, the second said bar having a terminal portion slidable within said sheath and having secured thereto a longitudinally beveled knife blade, a pair of prongs projecting beyond said sheath and forming therebetween a longitudinally extending slot for catching and looping a stranded material to be tufted and cut, at least one of said prongs being integral with said sheath, and being of substantially U-shape in transverse section for slidable reception of said knife blade, and said second bar being displaceable in said sheath for severing said stranded material so caught and looped.

5. A combined cutter and stepper mechanism for producing a tufted and pile cut fabric, comprising: a pair of elongated and flattened bars, a first said bar having integral therewith a flattened, tubular sheath, surrounding the same adjacent one end, the second said bar having a terminal portion slidable within said sheath, said first and second bars terminating respectively, beyond said sheath, in spaced prongs, forming therebetween a longitudinally extending slot for catching and looping a stranded material to be tufted and cut, the second said bar having secured to the inner face thereof, adjacent said pronged end, and normally disposed within said sheath, a longitudinally beveled knife blade, and the pronged end of the first said bar being of substantially U-shape in transverse section for slidable reception of said knife blade, and said second bar being displaceable in said sheath for severing said stranded material so caught and looped.

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