

April 24, 1934.

E. J. MOENCH

1,956,453

TUFTING APPARATUS

Filed May 3, 1929

5 Sheets-Sheet 1

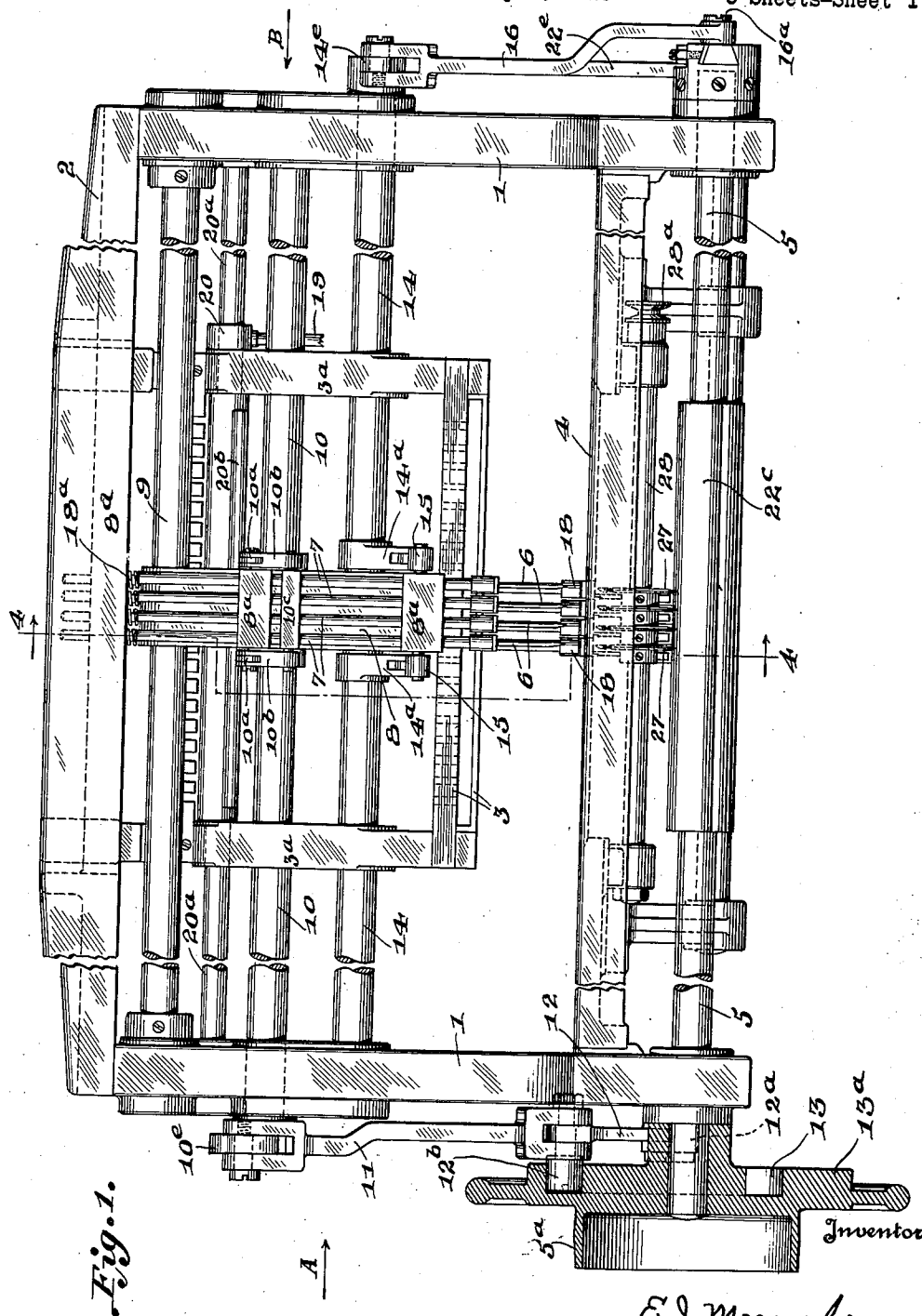


Fig. 1.

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5 Sheets-Sheet 2

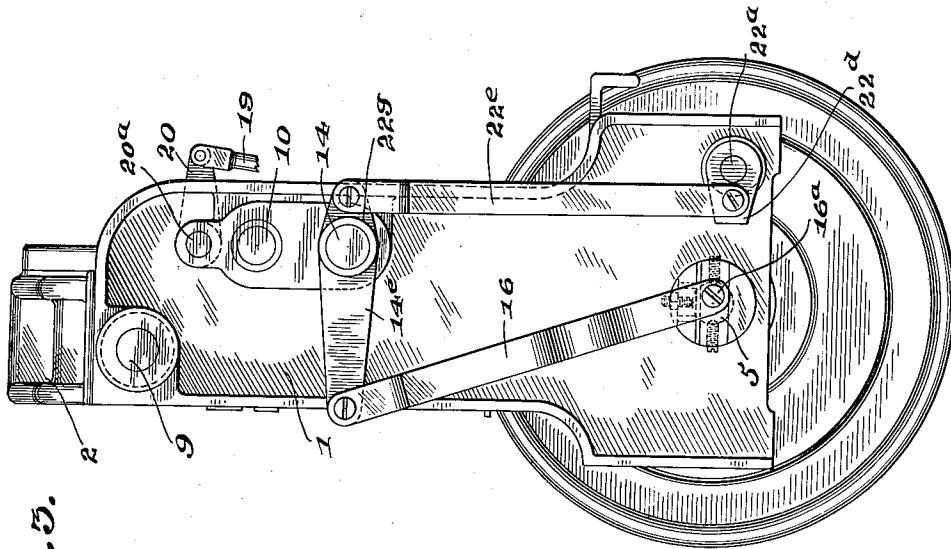


Fig. 5.

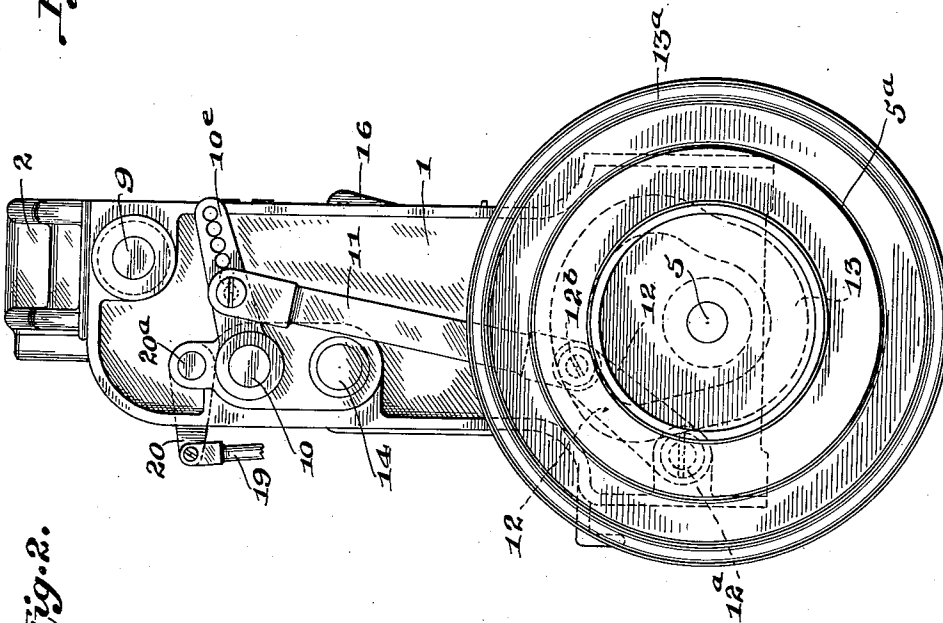


Fig. 2.

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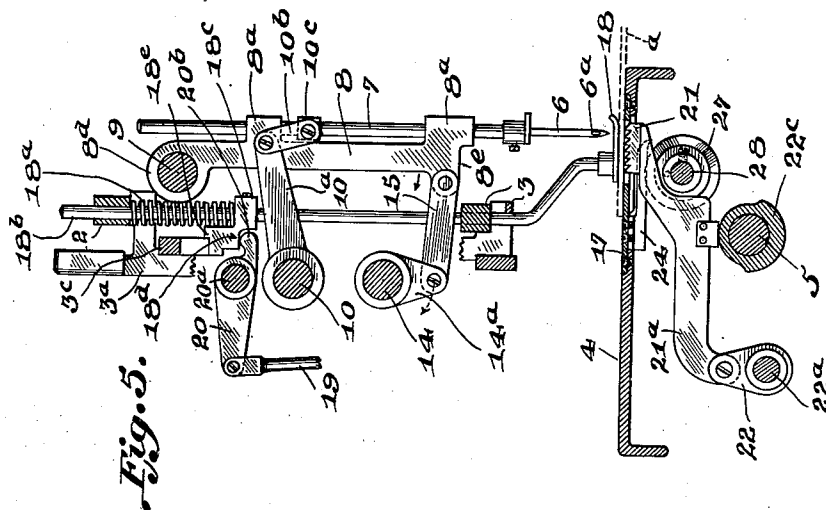
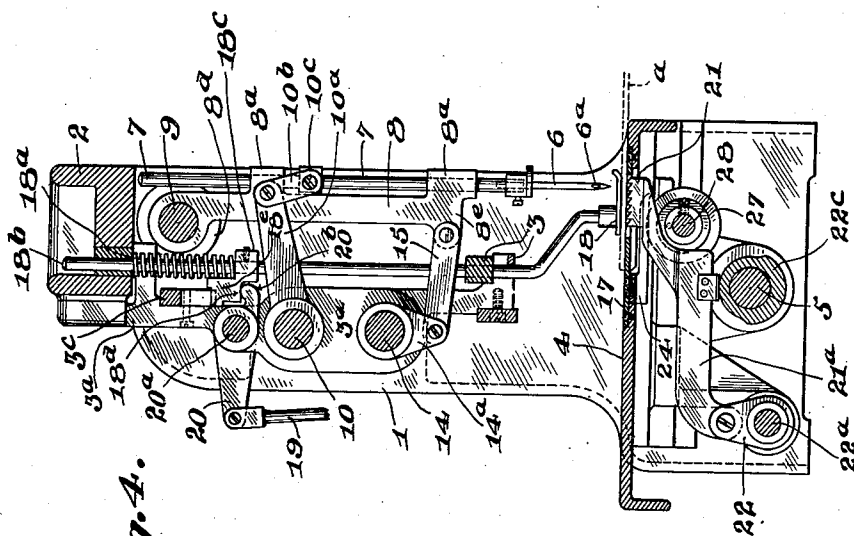


Fig. 4.



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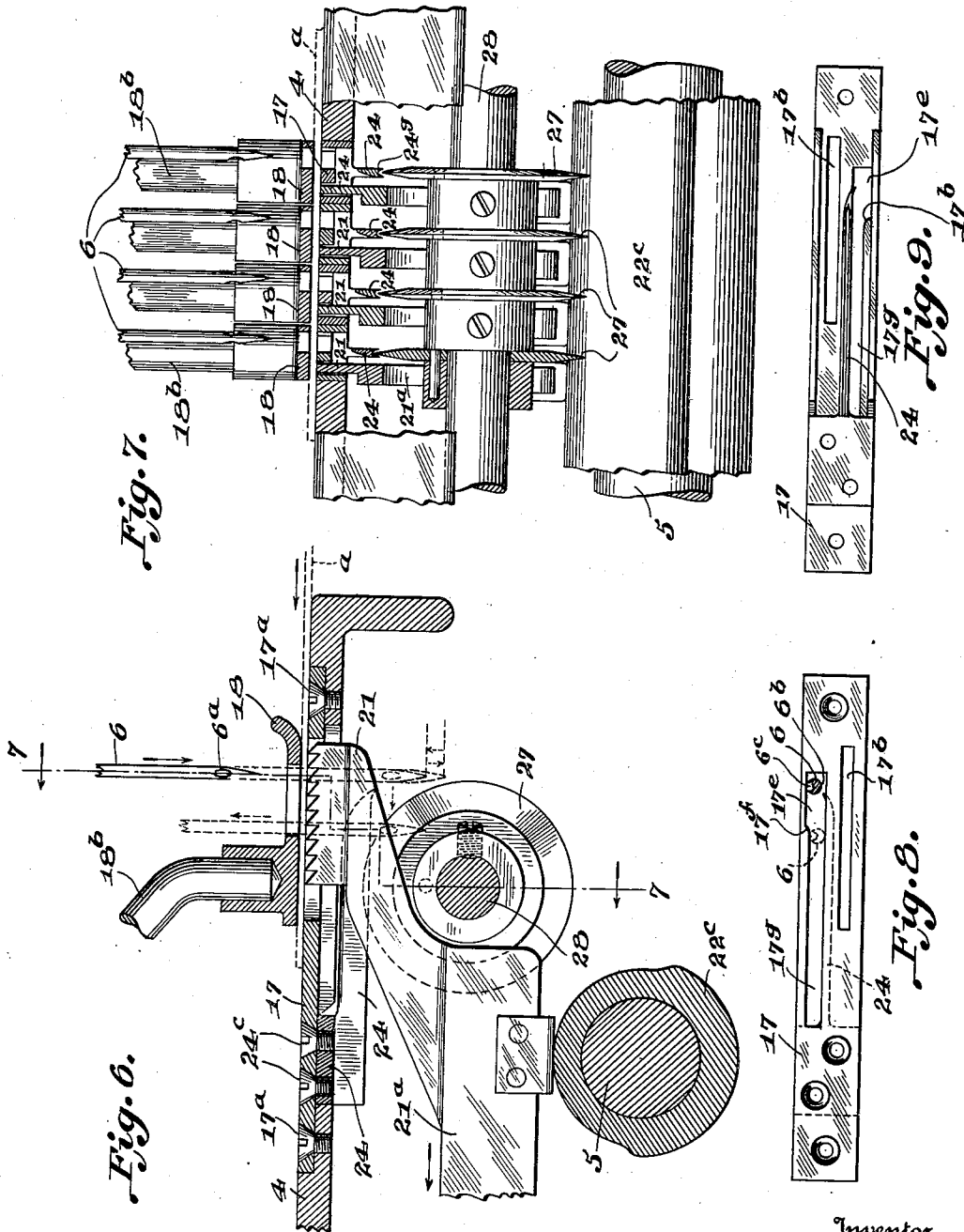
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5 Sheets-Sheet 4



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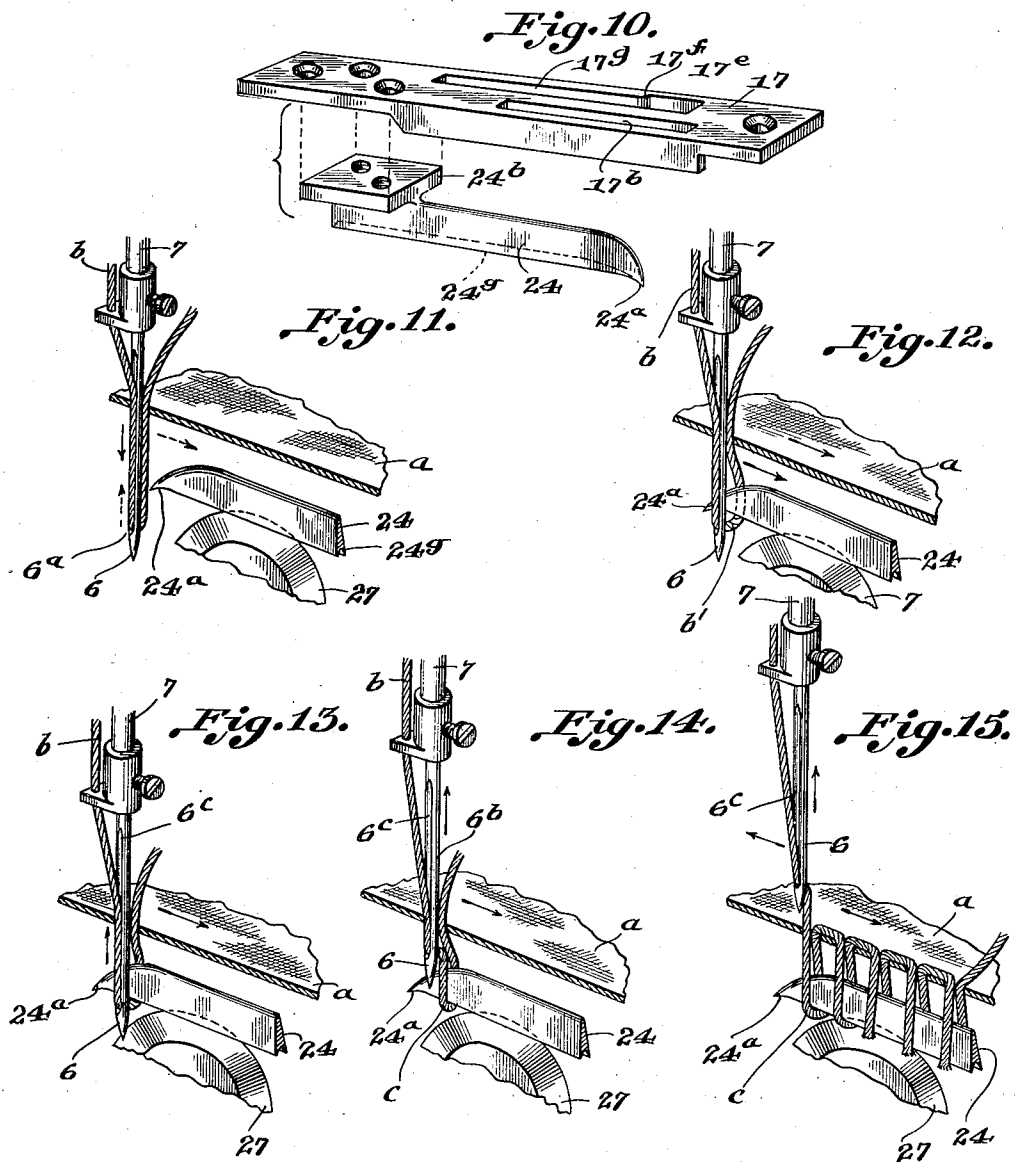
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Filed May 3, 1929

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

1,956,453

TUFTING APPARATUS

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Tennessee

Application May 3, 1929, Serial No. 360,114

30 Claims. (Cl. 112—79)

This invention relates to so-called tufting apparatus; and the objects and nature of the invention will be understood by those skilled in the art in the light of the following explanations of the accompanying drawings that illustrate what I now believe to be the preferred mechanical expression or embodiment of the invention from among other forms, constructions, arrangements, or combinations within the spirit and scope thereof.

An object of the invention is to provide improved apparatus, exceedingly simple and efficient in construction and operation, for use in applying pile loops or so-called tufts to fabric body or backing sheets, in the production of tufted fabric for various useful and ornamental purposes, such as rugs, mats, coverings, drapery, among others.

A further object of the invention is to reduce to the minimum the number of moving or driven loop-forming parts that cooperate with the puncturing needle and thread carried thereby, in apparatus for applying pile loops to fabric backs, and to produce simple apparatus that can operate at comparatively high speeds in applying comparatively tightly secured, closely-spaced and uniform pile loops or tufts to fabric backs or backing sheets.

And a further object of the invention is to provide improved pile loop forming apparatus wherein the loops are formed by cooperation between the fabric-back-puncturing needle and a stationary looper blade combined with a cutter, whereby the loops are liberated from the blade.

With the foregoing and other objects in view, the invention consists in certain novel features, structures, combinations, or arrangements, as more fully and particularly hereinafter explained and specified.

Referring to the accompanying drawings, forming a part hereof:—

Fig. 1 shows the machine in front elevation, parts being broken away.

Fig. 2 is an end elevation looking in direction of arrow A, Fig. 1, the cam groove and certain parts being shown by dotted lines.

Fig. 3 is an end elevation looking in the direction of arrow B, Fig. 1.

Fig. 4 is a cross section on the line 4—4, Fig. 1.

Fig. 5 is a fragmentary cross section on the same plane as Fig. 4, omitting various parts.

Fig. 6 is a detail vertical section on an enlarged scale with various parts broken away, dotted lines showing various needle positions.

Fig. 7 is a detail vertical section on line 7—7, Fig. 6, certain parts being broken away.

Fig. 8 shows a face plate in top plan, the needle being shown in cross section in different positions by full and dotted lines, the looper blade or arm being shown in dotted lines where hidden.

Fig. 9 is a detail bottom plan of a face plate and its looper arm or blade.

Fig. 10 shows a face plate and its looper blade separated and in perspective.

Fig. 11 is a fragmentary detail perspective view showing a portion of a fabric back, a needle carrying the loop forming thread and at its limit of downward movement through the back in starting to form a seam or line of loops in or on said back, portions of the associated looper blade and cutter also being shown, the loop forming thread or yarn being exaggerated in size.

Fig. 12 shows the parts of Fig. 11, with the needle slightly elevated and on its backward swing to initiate the loop formation and deliver the same on the point of the looper blade.

Fig. 13 shows the parts of Fig. 12 with the needle at its limit of rearward swing and continued on its upward movement from the position thereof shown in Fig. 12.

Fig. 14 shows the parts of Fig. 13 with the needle elevated beyond its position in Fig. 13, and the loop tightened on the blade.

Fig. 15 shows the parts of Fig. 14 after the formation of a number of loops and corresponding advance of the fabric back, some of the loops having been cut, the needle being shown in an elevated position above the fabric back and still moving up on its return stroke, the size, arrangement, and spacing of the loops being somewhat exaggerated.

The machine is provided with any suitable base and supporting frame, although in the particular example illustrated for purposes of explanation, I happen to show a supporting frame that embodies strong rigid end uprights 1, at their upper ends connected by rigid horizontal top rail or bar 2, while above their base portions said end uprights carry and are connected by the fixed horizontal bed 4, on the top surface of which, the fabric back, body, or sheet *a*, slides and travels during the looping or tufting operations. The main rotary drive shaft 5, of the machine is arranged horizontally below the bed 4, and extends through and between the lower portions or bases of the end uprights 1, wherein suitable bearings for the shaft are provided. Any suitable provision, such as pulley 5*a*, is made for driving this shaft from a suitable source of power.

Each looping puncturing needle 6, operates from above the bed 4, to puncture the fabric body or back that is fed rearwardly on said bed by suitable feed mechanism, and to carry the yarn or thread b, through said fabric and form a line of loops depending therefrom. Each needle is formed with an eye 6a, above its lower end that forms the puncturing point, and this eye 6a, is transverse or at right angles to the direction in which the fabric backing is fed along the bed 4. The needle is preferably longitudinally grooved, at 6c, to receive the thread or yarn leading down to the needle eye, but is flattened or recessed, at 6b, on the opposite side so that the length of said thread leading up from the eye is accessible for looping. Each needle 6, depends from the lower end of its vertically reciprocatory needle bar 7, to which it is removably clamped or otherwise normally fixed. Each needle bar 7, is confined to and reciprocates longitudinally in and projects below a needle bar holder and guide 8. This needle bar guide is in the form of a vertically elongated bar or block having aligned spaced eyes or guide ways 8a, by which the needle bar is confined to the guide and to longitudinal straight line reciprocation longitudinally thereof. This guide 8, is supported by and hung from a fixed pivot shaft 9, extending horizontally between and supported by the end uprights 1, through the medium of a transverse eye 8d, forming the upper end of the guide 8, and surrounding and rotatable on shaft 9, as an axis. The guide 8, is thereby swingable vertically on the shaft 9, and hence its lower end and the one or more needles and needle bars carried by said guide 8, are movable or swingable back and forth in the direction of feed of the backing fabric being operated on, as is fully explained hereinafter.

Each needle bar 7, is reciprocated, in its holding guide 8, to actuate the needle 6, in any suitable manner, as by rock shaft 10, through the medium of forwardly projecting crank arms 10a, normally fixed to the shaft, and pivotal push and pull link connections 10b, between the free end of said arm and the ends of a cross head or block 10c, fixed to the needle bar if one is employed, or to all of the needle bars where several are employed. The rock shaft is mounted in end uprights 1, and is located to the rear of the needle bar holding guide. The shaft 10, is rocked to reciprocate the needle in timed relation to the movements of certain other operating parts, as hereinafter explained, by the drive shaft 5, through the medium of any suitable power transmission. For instance, from among other transmissions that might be employed, I show shaft 10, provided with fixed laterally projecting crank arm 10e, pivotally connected by pitman 11, with the free end of vertically swingable roller arm 12, having pivoted or fulcrum mounting 12a, on the adjacent end of the main frame. The arm 12, is swung vertically to actuate crank 10e, and shaft 10, by roller 12b, carried by the free end of the arm and operatively engaged in the endless cam groove 13, in rotary cam disk 13a, fixed on and driven by drive shaft 5, the cam groove being of such formation as to control the needle reciprocation as hereinafter explained.

The needle bar holding guide 8, is swung forwardly and back on shaft 9, as an axis, and consequently the angular position of the needle or needles 6, with respect to a vertical plane, is determined by suitable operating means, for instance, such as the horizontal rock shaft 14, mounted in end uprights 1, and located behind

and having operative eccentric connection with the guide 8, to swing the same. For instance, the rock shaft 14, is provided with short crank arms 14a, at their free ends having pivotal push and pull connections 15, with rearwardly projecting ear or ears 8e, rigid with the rear of the lower end of guide 8.

The shaft 14, is rocked back and forth through a partial revolution, to attain the desired back and forth oscillation of the needle bar holding guide, in timed relation to the movements of certain other parts, by suitable power transmission from the drive shaft 5. For instance, in the example shown, the desired movement is attained by pitman 16, between and pivotally joined to the crank 16a, of drive shaft 5, and the crank arm 14e, of rock shaft 14.

The fabric backing through which the needles operate to apply the pile loops thereto, is fed rearwardly on the bed 4, and over the top surface of horizontal face plates 17, one for each needle, set down in the bed to fill an opening therethrough. Each face plate 17, while removable, is normally secured in fixed position, as by machine screws 17a. Any suitable means is provided to yieldingly press the backing to and hold the same flattened out on the face plates, and to permit rearward feeding of the backing thereunder. For instance, any suitable presser foot construction and arrangement can be provided for this purpose, although, for each needle and its face plate, I show presser foot 18, vertically slotted for vertical passage and forward and back swing of the needle allotted thereto. Each presser foot is yieldingly pressed downwardly by coiled tension spring 18a, located on the upstanding shank or stem 18b, of the foot, slidably extending through and guided by the top rail 2, and the guiding rail 3, fixed to the supplemental vertical frame bars 3a, fixed to and depending from top rail 2.

Suitable means are provided whereby the presser foot 18, or the presser feet if more than one needle is employed, can be lifted from operative position and held elevated. In the example illustrated, where I happen to show four needles and four presser feet, each presser foot shank 18b, has an abutment 18c, for spring 18a, fixed to the shank and this abutment is projected rearwardly and upwardly to form a downwardly facing shoulder 18d, and an upstanding wing 18e. The wings 18e, are slidable up and down in vertical guiding slots in rail 3c, fixed to the depending frame bars 3a, (Figs. 4 and 5) to hold the presser bar shanks against axial or rotary movements. A rock shaft 20a, is mounted in the vertical frame bars behind the abutments 18c, and is provided with a forwardly projecting lifting toe 20b, rigid therewith, below and in lifting engagement with the shoulders 18d, of the presser foot shank abutments 18c, so that rocking of the shaft 20a, to lift the toe 20b, will lift each presser foot 18, from operative position, so that the fabric backing a, can be shifted, removed, or inserted under the feet.

Any suitable, preferably manually operated means, can be employed for rocking and holding shaft 20a, although for this purpose I show pull rod 19, pivotally coupled to crank arm 20, rigid with said shaft. The pull rod 19, can be operated and held by a suitably located foot treadle, operating handle, or the like, not shown.

Any suitable feed is provided for periodically advancing or feeding the fabric backing. As an example of feeding means, from among others that might be employed, I show toothed feed dogs 21, one for each presser foot and arranged there-

under to operatively engage the under side of the fabric backing below the presser feet, on its feeding strokes. Each feed dog operates through an elongated slot 17b, in its cooperating face plate 17. Each dog 21, is formed with a depending and rearwardly extending or bell crank shank 21a, at its rear extremity coupled by a transverse pivot, to an upright crank arm 22, of a horizontal rock shaft 22a, mounted in the end uprights 1, whereby the dog as an entirety is swingable vertically on said rear transverse pivot. In advance of said transverse pivot, the lower horizontal portions of said shanks of the dogs rest on a cam 22c, on and rotating with the drive shaft 5, whereby the dogs are raised during their rearward fabric feeding stroke, and permitted to drop from operative engagement with the fabric during their forward return stroke.

The shaft 22a, is rocked back and forth through a partial revolution, to carry the feed dogs forward on the return stroke while cam 22c, holds the dogs in lowered inoperative position, and to pull the dogs rearwardly on operative feed stroke while the cam 22c, elevates the dogs to operative fabric grasping position. The cam 22c, and rock shaft 22a, are hence relatively timed in their movements, and are also timed with respect to the movements of the needles.

In the example shown, the rock shaft 22a, is actuated in its rocking movements by pitman 22e, pivotally joining crank arm 22g, of rock shaft 14, and crank arm 22d, of rock shaft 22a (Fig. 3).

A horizontally-disposed forwardly projecting stationary looper blade or bar 24, is arranged longitudinally of and below each face plate 17, to cooperate with the needle movable therethrough to form the pile or tufting loops c, in and depending from the fabric back a. The longitudinal axis of each elongated blade 24, is approximately parallel with the sheet a, and the direction in which said sheet is fed, and said blade is fixed or supported from its rear end and extends forwardly to its preferably bevelled approximately pointed front free end 24a. In the example shown, this blade is secured to and carried by and removable with the face plate 17. To this end, the rear end of the blade is formed with an elevated horizontal base 24b, fitting the underside of the rear end of the face plate and normally fixedly secured thereto by one or more rivets or machine screws 24c. The longitudinal top edge of the blade in advance of base 24b, is preferably spaced downwardly from the face plate. The lower longitudinal edge of the blade is usually approximately straight, except possibly where the point 24a, is deflected down to aid in the initial loop formation and the retention of the loop on the blade.

The face plate 17, is formed with a longitudinal slot 17e, extending vertically therethrough for the passage of the needle and of a length to accommodate the rearward movement of the needle, and this slot 17e, is elongated rearwardly, see 17g, for the passage of the pile loops c, as the fabric back a, feeds rearwardly. The elongated slot 17e, 17g, is parallel with and spaced a distance laterally from the feed dog receiving slot 17b, and the looper blade 24, is preferably located in a vertical plane parallel with and between the respective vertical planes of the slots 17b, and 17e, 17g, with the blade closely adjacent to and at its point approximately lapping into the vertical plane of slot 17e, 17g, usually with the front end of the blade bevelled down to point 24a, and usually deflected laterally approximately into the path of

the cooperating needle to facilitate the action of the blade point in entering between the adjacent side of the needle and the adjacent length of the thread to assure separation to form the loop, the blade point and/or the needle being laterally resilient to yield should there be rubbing contact between these parts in operation.

The yarn or thread b, that is stitched through the fabric back a, to form the depending pile loops c, extends from a suitable bobbin, not shown, to and through any usual or suitable tension device and guide eyes, not shown, and downwardly therefrom in the grooved side of the needle 6, to and through the needle eye and upwardly at the flattened or non-grooved side of the needle, and it is this flattened or non-grooved side of the needle that in operation moves next to or beside the adjacent side of the looper blade point or free end 24a. As the needle descends from its limit of upward movement, the fabric back a, is at rest and the feed dog is making its return stroke, and during this down stroke while above the fabric back, the needle is swung toward the front of the machine, by shaft 14, and guide 8, so that when the needle starts to puncture said fabric back, the needle is at its limit of forward swing, see Fig. 6, and thus punctures the fabric back and enters the front end of the face plate slot 17e, a distance in advance of the point or front end 24a, of the looper blade, see Fig. 11, and as shown by the needle cross section in full lines Fig. 8. At this forward position, the needle descends its full down stroke through the fabric back a, and at its limit of downward movement, the needle eye is located a distance below the level of the point of the looper blade and a distance in front thereof, with the thread b, extending below the fabric back in the form of a straight loop stretched more or less tightly from the fabric a, to the needle eye, particularly on the flattened side of the needle where the thread is exposed for frictional engagement with the fabric while being carried therethrough with the needle (Fig. 11). The needle while still in advance of the free end of the looper blade, then makes a short initial return or upward movement, and again comes to rest. The purpose of this initial upward movement of the return stroke, is to open the tightly stretched thread loop above the needle eye and in front of and to ultimately receive the point of the looper blade, by loosening the upwardly extending length b', of thread on the flat side of the needle between the eye and the point where the thread is frictionally held between the fabric a, and the smooth surface of the needle. The surplus length b', of the thread when thus loosened bulges laterally or tends to separate from the adjacent flat side of the needle to receive the looper blade above the bottom of the loop. On the completion of this short upward initial movement the eye of the needle still remains below the level of the looper blade point, and thereupon the needle under the action of shaft 14, starts on its rearward swing and at the same time the feed dog 21, starts on its operative rearward feed stroke carrying the fabric back a, on a rearward feed step, so that the needle, still extending through said fabric back, moves rearwardly with the fabric without being subject to lateral strains or stresses or without performing fabric feeding or retarding work, as the fabric is positively moved by the feed dog, and the needle merely moves with the fabric under the action of shaft 14, as the operating connections for swinging the needle rearwardly are timed or synchronized to swing

the needle on this rearward stroke simultaneously with the operative feed stroke of the feed dog. This rearward movement of the needle with the fabric *a*, is designed to carry the initiated loop *b'*, onto the point of the fixed looper blade, with the point of the blade possibly yieldingly and slidably bearing against the flattened side of the needle above the needle eye and thus passing above the cross portion of the thread where it enters the needle eye and between the upwardly extending portion *b'*, of the thread and the adjacent flattened side of the needle (Fig. 12). The needle while in its advanced position punctures the fabric and enters the front end of face plate slot 17*e*, (Fig. 11), and then moves up a very short distance to start the loop for reception of the looper blade point, and thereupon the needle moves rearwardly in face plate slot 17*e*, to deposit the partially formed loop on the looper blade Fig. 12, and as the needle completes its rearward swing at the rear end of the elongated needle slot 17*e*, the grooved side of the needle engages the preferably inclined or cam edge 17*f*, of said slot and is thereby crowded or sprung laterally to approximately yieldingly engage the adjacent side of the looper blade point and push back the loop thereon and hence aid in feeding the loops threaded on the looper blade toward the rear end thereof and the cutter.

When the loop is thus established on the looper blade and the needle is at its limit of rearward swing, the feeding step of the fabric back *a*, is completed, and while the fabric back is at rest, the needle then starts on the completion of its return or upward stroke, during which the pile loop on the blade is tightened, completed and standardized as to length by more or less tightening thereof, as the needle slides up on the length of thread depending from the tension device and through the usual guide eye or eyes on the needle bar, to and through the needle eye, and down therefrom through the fabric and looped around the looper blade.

When the needle again descends, it swings forward a distance equal to the distance fabric backing *a*, is fed forward at each dog feeding stroke, which determines the length of each stitch, i. e. the spacing between the pile loops, and when the needle in its advanced position, again punctures the fabric *a*, the thread from one side of the previously formed loop will be laid on the top surface of fabric *a*, as usual in pile loop forming or so-called tufting machines.

The fabric back *a*, is impelled on its forward feeding strokes after being punctured by the needle so that the needle moves with said fabric from the forward needle position to the rearward needle position, and during this rearward movement of the needle with the fabric back, each loop is formed in the thread or yarn depending from the fabric back and such loops are thereby threaded and completed on the looper blade, and thereafter tightened thereon to standard or approximately uniform length on the upward strokes of the needle.

As the fabric backing *a*, is fed rearwardly the pile loops gather and slide rearwardly on the looper blade and travel rearwardly through and longitudinally of the longitudinal slot 17*g*, in the face plate until the loops are severed and pass upwardly from the rear end of said slot and over the rear top surface of the face plate, see Fig. 15.

Any suitable means can be provided for cutting or severing each loop at its bottom or lower end, before the successive loops sliding rearwardly on

the blade, reach the rear end of slot 17*g*, and the neck supporting the blade from its base 24*b*. For instance, as an example of cutting means that can be employed, I show a thin rapidly rotating circular disk 27, one for each looper blade, having a sharp peripheral cutting edge preferably cooperating with the longitudinal bottom edge of the looper blade to successively sever the bottom cross portions of the loops as they slide rearwardly on the blade into contact with the sharp rapidly rotating cutting edge. This cutter disk is vertically arranged, rotating on a horizontal axis 28, located below the looper blade. The cutter is approximately located in the vertical plane of the blade and the top segment of the cutter vertically laps the lower edge portion of the blade in such manner that the rearward progress of each loop is stopped by the sharp edge of the cutter until severed thereby. The cutter is preferably rotated in such a direction that the upper part thereof with which the loops contact and where the loops are severed travels forwardly and downwardly in opposition to the rearward movement of the loops on the looper blade under the rearward pull of the fabric back. This forward or downward rotation of the cutter also tends to prevent any possible piling up and accumulation of the loops and jamming thereof between the blade and cutter.

As at present advised by experience with the actual practical operation of my invention, I prefer to longitudinally groove the bottom longitudinal edge of the looper blade, see 24*g*, midway the thickness of said blade and to a suitable depth vertically to receive, guide and center the top segment of the rotary cutting disk, whereby the cutter with a forward downward action will sever the lower ends of the loops where stretched across the lower edge of the looper blade and the slot or groove 24*g*, therein.

The cutter can be readily sharpened, if need be, by application of sharpening means to the cutter as it rotates.

In the example shown, each cutter disk 27, is fixed on horizontal shaft 28, arranged under the looper blades in a vertical plane that intersects said blades. This shaft can be mounted in bearings depending from the bed 4, and the shaft 28, can be driven at the desired speed in any suitable manner, as by endless driving belt (not shown) applied to pulley 28*a*, and driven independently of shaft 5, to continue rotation of the cutters after shaft 5, has stopped whereby loops *c*, then on the looper bars can be severed by pulling the fabric backing rearwardly.

The length of the pile loops formed on the fixed looper bars, can be changed or varied by changing the limit of the upward movement of the needle bars, as the length of the thread from the fabric back to the needle eye when the needle is at its limit of upward movement, minus the distance between the loops on the fabric back, determines the length of the pile loop depending from the fabric back. The machine provides for adjustment of pitman 11 along crank 10*e*, and between said pitman and roller 12*b*, to vary the stroke of the needle.

Provision for adjustment is also provided between pitman 16, and drive shaft 5, through adjustable crank 16*a*, to vary the back and forth swing of the needles and the length of the fabric back feed strokes.

While the drawings show four spaced needles and four sets of cooperating parts to simultaneously stitch the fabric backing to form four paral-

lel closely arranged rows of tufts or pile loops, yet the machine is adapted to operate but one needle and associated parts, or a greater number of needles and cooperating parts. In fact the machine as shown, is designed to receive many more needles and associated parts than illustrated. While I happen to show a single holding guide 8, for four needles, said guide will accommodate one or more needle bars, and if so desired, one holding guide can be provided for each needle bar and all hung from shaft 9, and connected to swing together.

The machine illustrated can provide but one needle and cooperating parts to form a single line of stitching or row of pile loops in and depending from the fabric back so that the pile design on said back can be worked out by shifting the back on the bed to follow various designs, or by working said fabric back and forth under the needle to form parallel closely adjacent rows of pile loops to cover so much of the surface of the fabric as may be desired. However, the disclosure hereof is designed to receive and operate any suitable number of parallel closely adjacent simultaneously operating needles and associated looper blades, cutting disks, feed dogs, presser feet, etc. to simultaneously form series of closely adjacent parallel rows of ornamental stitching or pile loops. It is but necessary to duplicate each combination of needle bar, feed dog, face plate, looper bar, and cutter. The several cutters can be mounted on the shaft 28, to cooperate with their respective looper bars carried by their respective face plates or a common face plate, and the operating devices of the present disclosure are arranged to operate a single needle combination, and multiplications thereof.

It is evident that various changes, modifications, departures, additions, and/or omissions might be resorted to without departing from the spirit and scope of my invention and hence I do not wish to limit my invention to the disclosure hereof except where so required by the following claims construed in the light of the prior art, as the claims are designed and intended to afford as full and complete protection as it is legally possible to secure.

What I claim is:

1. In combination; a pile thread carrying and backing sheet puncturing needle; feeding means for advancing a backing sheet in operative relation to said needle; a stationary looper blade arranged below the path of said sheet; a cutter to sever the loops for release from said blade; a needle bar for said sheet puncturing pile thread carrying needle; means for reciprocating said bar to carry its thread through and from said sheet; a laterally movable holder guide for said needle bar; and mechanism other than said feeding means, and said bar reciprocating means, for moving said guide back and forth on its lateral movement to correspondingly move the needle.

2. In combination; a pile-thread-carrying and backing-sheet-puncturing needle; actuating means for said needle; a stationary looper blade to cooperate with the needle in threading the successive pile thread loops on the blade with the closed ends of the loops stretched across the under longitudinal edge of the blade and travelling rearwardly thereon as the backing sheet advances, and means for severing said closed ends of the successive loops as they move rearwardly on said blade, said loop severing means including a power driven element movable relatively of said looper.

3. In combination; feeding means for advancing a backing sheet step by step; a needle bar for a pile thread carrying sheet puncturing needle having a thread eye near its puncturing point; means for reciprocating said bar to carry its needle through said sheet and back therefrom; mechanism to move said needle bar laterally with said sheet while the sheet advances on a feeding stroke and while the needle extends through the sheet and to move the needle laterally on its return stroke while withdrawn from said sheet, said needle bar reciprocating means cooperating with the needle bar to start the needle withdrawing movement and thereby initiate the opening of the thread before said mechanism initiates said lateral movement of the needle bar and to then come to rest while said mechanism actuates said bar on its lateral movement with said sheet; actuating connections for said sheet feeding means timed in its movements with respect to the operating movements of said needle bar reciprocating means and said mechanism to maintain the sheet at rest while the needle performs its said loop-opening movement; and a looper for cooperating with the needle in the formation of pile thread loops depending from said sheet.

4. In combination; a bed on which a backing sheet to be stitched is movable rearwardly; a face plate having an elongated needle slot continued rearwardly for rearward passage of the pile loops depending from said sheet; a stationary looper blade extending forwardly below and adjacent to said slot with its front free end terminating in rear of the front end of said needle slot, said blade at its rear end secured to and depending from said plate; a cutter for severing the pile loops on said blade; an under feed dog below and operating on the sheet through said face plate for rearwardly feeding said sheet on the face plate; a cooperating presser foot above the sheet and independent of said dog; a needle bar holding guide movable forwardly and rearwardly; actuating means for said guide; a needle bar held and guided by said guide; and means for reciprocating said needle bar in said guide; said bar adapted to carry and actuate the pile thread-carrying sheet-puncturing needle in cooperation with said looper blade to thread and form the pile thread loops on said blade.

5. In combination; a looper blade having a free end and a longitudinally grooved longitudinal edge across which the closed ends of the pile loops depending from a backing sheet are stretched as the loops slide rearwardly on the blade; a rotary cutter disk projecting into said groove to successively sever said closed ends; and needle actuating means to cause the needle to carry the pile thread loops through the backing sheet and cooperate with said blade in forming and threading the pile loops thereon.

6. In a tufting machine, a looper member having a free end to cooperate with a backing-sheet-puncturing and pile-thread-carrying needle in forming pile loops stitched in and depending from the sheet and in threading said loops onto said member; a circular cutter disk having a cutting periphery to successively sever the loops on said member; and means for rotating said disk with its edge portion that severs the loops travelling in a direction in opposition to the advance of the loops toward said disk.

7. In apparatus for applying pile loops to a backing sheet, a reciprocatory thread carrying and sheet puncturing needle, in combination with a stationary looper blade below the sheet for co-

operation with said needle in forming, tightening, retaining and determining the length of said loops, relative movement between the needle and blade being provided for to thread loops on the
5 blade, and relatively-movable positively-actuated loop cutting means associated with said blade.

8. In combination; a reciprocatory needle bar; a holding guide for said bar and in which the bar reciprocates; means independent of said guide
10 for periodically advancing a fabric backing step by step; means for periodically moving said guide forwardly simultaneously with each advancing step of said backing and for moving said guide on its return strokes while said backing is at rest;
15 means for reciprocating said needle bar on its puncturing and return strokes to carry its needle through and from said backing while said backing is at rest; and relatively fixed means below said backing to cooperate with the needle in
20 forming pile loops stitched in said backing.

9. Apparatus for applying tufts to a fabric or other backing, including feed means to advance the backing step by step; a holder for a needle having a tufting thread eye near its point, said
25 holder being reciprocatory to carry the needle through said backing on its backing puncturing and return strokes; a looper on the opposite side of the path traveled by said backing to cooperate with said needle in receiving and forming the
30 tuft loops; and actuating and timing mechanisms for said feed means and for said holder whereby said needle punctures and returns from said backing while said backing is at rest and whereby on each return stroke the needle first initiates the
35 thread loop formation while the backing is held at rest, and then moves forwardly with the backing to deposit the initiated loop on the looper.

10. Apparatus for the production of tufted fabric including under feed dog means for advancing the fabric backing step by step; an under looper; a top needle having a tuft thread eye near its
40 puncturing point; and means whereby said needle is reciprocated on its backing puncturing and return strokes and is moved to deposit each initiated loop on said looper and to force loops longitudinally thereof and on its return strokes to
45 tighten the loops on said looper, said means including timing and actuating mechanisms for said under feed means and for said needle whereby said needle punctures and returns from said
50 backing and starts on its loop initiating return stroke while said backing is at rest.

11. Apparatus for the production of tufted fabrics and the like; including feed means to advance the backing; a frame above the path of
55 travel of said backing arranged transversely of said path and movable back and forth in the direction of said travel; actuating and controlling mechanism for moving said frame back and forth, said mechanism being adjustable to vary
60 said back and forth movement; a gang of parallel simultaneously movable backing puncturing needles for carrying tufting threads through said backing for cooperation with loopers to form loops
65 on the under side of the backing, said needles reciprocating with respect to said frame and carried laterally on the back and forth movements of said frame; independent actuating and
70 timing mechanism for reciprocating said gang of needles, said last mentioned mechanism being adjustable to vary the length of reciprocation of said gang, and loopers below said backing relatively stationary with respect to said needles to receive the threads therefrom and to cooperate
75 therewith in the formation of loops.

12. The combination in a sewing machine with a needle having reciprocatory movement to form loops from yarn incident to passage through fabric being worked upon, and also having lateral
80 forward and return movements; of tufting means including a stationary element to receive and hold loops presented to it by the needle as the same moves laterally as aforesaid, and rotary cutting means to sever the loops held by said element.
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13. In tufting apparatus, in combination, means to advance a backing sheet; a reciprocatory needle for carrying the tufting thread
90 through the sheet; an elongated looper having a free end to cooperate with said needle in the formation of loops; an independent rotary cutter disk arranged with respect to said looper to successively sever loops brought into contact with said disk; and means for constantly rotating said
95 disk.

14. Apparatus for the production of tufted fabric and the like, including a puncturing needle having a tufting thread eye to carry the thread
100 through the fabric backing sheet and to cooperate with a looper on the opposite side of the backing to form loops on said side of the backing, a looper at said side of the backing, a carrier for said needle, and actuating and controlling mechanisms to reciprocate said needle on its
105 backing puncturing and return strokes and to cause said needle to begin each return stroke with a loop-initiating movement and followed by a lateral movement to deposit the initiated loop on the looper.

15. Apparatus for the production of tufted fabric and the like including a needle to carry the
110 tufting thread through the fabric backing and cooperate with a looper in the formation of loops on said backing, a looper on which the loops are formed, said looper having a free end to successively receive initiated loops from the needle, carrying means for said needle, and associated
115 actuating mechanisms for feeding the backing, and for in timed relation operating said needle on its backing puncturing and return strokes and for moving said needle with respect to said looper to deposit the initiated loops on the free end
120 of said looper after the needle has started on each return stroke to initiate said loop, and for maintaining the backing at rest while said needle is moving up on said loop-initiating portion of
125 its return stroke.

16. Apparatus for the formation of tufted fabric and the like including a support on which the fabric backing travels, feed means to advance
130 said backing step by step, a needle to carry the tufting thread through the backing and cooperate with a looper in forming thread loops on the backing, a looper below the path of travel of the backing, actuating and timing mechanism
135 to actuate said needle on its backing, puncturing and return strokes, actuating and timing mechanism to move said needle to deposit the initiated loop on said looper after the needle has started on each return stroke to open each loop,
140 and actuating and timing mechanism for said feed means for maintaining said backing at rest while said needle is puncturing the fabric and on the loop-opening portion of the needle return stroke and for advancing the fabric after each
145 needle loop-initiating movement and while the needle is below the fabric.

17. Apparatus for the production of tufted fabric including feed dog means for advancing the fabric backing step by step, an under looper, a
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top needle having a tuft thread eye near its puncturing point, and means whereby said needle is reciprocated on its backing puncturing and return strokes, and is moved to deposit each initiated loop on said looper, and on the first portion of its return stroke is moved up to initiate or open the loop, said means including timing and actuating mechanisms for said feed means and for said needle whereby said needle punctures and returns from said backing and starts on its loop-initiating return stroke while said backing is at rest.

18. Apparatus for the production of tufted fabric and the like including a needle having a tufting thread eye, a looper below the plane in which the fabric backing travels to cooperate with said needle in the formation of thread loops depending from said backing, feed means to advance said backing, carrying means for said needle, and timing and actuating mechanisms for reciprocating said needle from above the plane in which the backing travels on its backing puncturing and return strokes and to initiate the thread loop at the beginning of each return stroke and then to move the needle with respect to said looper to deposit the initiated loop on said looper and then to complete its return stroke from the backing to complete the formation of the loop.

19. Apparatus for the production of tufted fabric; including feed means for advancing a backing sheet; a frame above said sheet swingable back and forth on its forward and return movements; actuating and controlling mechanism for swinging said frame forwardly with the backing sheet advance and on its return swing, said mechanism being adjustable to vary said swing of said frame; a needle for carrying tufting thread through said backing sheet for cooperation with a looper to form a succession of loops on the under side of said sheet, said needle being carried laterally with said frame on its back and forth swinging movements and reciprocating with respect to said frame; independent actuating and timing mechanism for reciprocating said needle, said last mentioned mechanism being adjustable to vary the length of reciprocation of said needle, and a relatively stationary looper below said backing sheet to cooperate with the needle in receiving the thread and in forming loops, and cutting means for releasing the loops from the looper.

20. In tufting apparatus; in combination; a bill-shaped looping device presenting its free end toward the line of reciprocation of the needle through the backing sheet to be tufted to enter between the thread at one side of the needle and to cooperate with the needle in forming loops; means to feed the backing sheet to carry the loops forwardly along said device; and a cutter disk for severing said loops to free them from said device.

21. Tufting apparatus including means for feeding the backing sheet; a reciprocatory needle for carrying the thread through said backing sheet for the formation of a succession of loops thereon; looping means including a finger, the needle and looping means cooperating to provide successive loops on said finger; a rotary cutter for severing said loops to free them from the finger and to form tufts; and means for driving said cutter at high speed.

22. In combination; means for advancing a backing sheet; cooperating devices for forming a succession of loops stitched through and depending from said sheet, including a finger ex-

tending through said loops and on which they travel forward; and a driven rotary cutting disk for severing said loops to form tufts.

23. In combination, in tufting apparatus, a support on which the backing sheet progresses; a top presser foot; an under feed dog independent of said foot and working upwardly through said support below said foot; and tufting mechanism including a reciprocatory needle to carry the tufting thread through the backing sheet for the formation of successive loops depending therefrom, and a free end looper finger arranged below the path of said sheet and beside said dog, said finger and said needle cooperating to locate successive loops on said finger, and means for severing said loops to free them from the finger and to form tufts.

24. In tufting apparatus, in combination, a needle to carry the tufting yarn through the fabric to provide the fabric with depending loops; means to cut the loops to form tufts; a removable face or throat plate having a slot for the passage of the needle, said plate arranged beneath the plane of travel of the fabric; and a looper finger normally fixed to and arranged below said plate and carried thereby and removable therewith and having a free end arranged longitudinally of said slot to receive the successive loops from said needle.

25. In tufting apparatus, in combination, a yarn-carrying needle reciprocatory to carry the yarn back and forth through fabric incidental to the formation of loops depending therefrom, and movable laterally with the advancing fabric to deposit the loops on the free end of a cooperating looper located below the fabric; means above the looper to press the laterally moving needle after it has deposited each loop on the looper, to an intermediate portion of the length of the looper to force the loops on the looper toward cutting means; and means for then successively severing the loops stretched on the looper.

26. Tufting apparatus including a reciprocatory needle to carry the thread or yarn back and forth through a backing sheet; looping means below said sheet; mechanism whereby the needle and looping means cooperate in providing said sheet with a succession of loops; and a driven rotary disk having a peripheral cutting edge, said disk being operatively associated with said means to sever successive formed loops.

27. Tufting apparatus including a reciprocatory needle to carry the yarn back and forth through the backing sheet; looping means below the sheet cooperating with the needle in providing the sheet with a succession of loops, said looping means including a finger having a free end to enter the successive loops; a rotary driven cutter disk supported independently of said finger and entering the same at its cutting edge portion; and means whereby the cutting edge of the disk and successive loops are brought together for severing the loops to form tufts.

28. Tufting apparatus including a needle to carry the yarn back and forth through a backing sheet; looping means associated with the needle in providing said sheet with a succession of loops, including a finger receiving successive loops; a rotary driven cutter disk revolving about a normally fixedly-located axis with its cutting edge operatively associated with said finger; and means whereby the cutting edge of the revolving disk and successive loops are brought together for severing the loops to form tufts.

29. Tufting apparatus including a needle to

carry the yarn back and forth through a backing sheet; looping means associated with said needle to provide said sheet with a succession of loops, including a finger to successively receive
 5 the loops; a cutter disk mounted to rotate on a normally fixedly-located axis and having a peripheral loop cutting edge; and means whereby the cutting edge of said disk and successive loops on said finger are brought together for severing
 10 the loops on the finger at their end cross portions to form tufts.

30. Apparatus for applying pile loops to backing sheets, embodying feeding means to positively advance the sheet; a stationary pile thread loop-

er and retainer longitudinally arranged under the path travelled by said sheet and having a free end; loop cutting means associated with said looper and including a relatively movable member supported independently of said looper;
 80 and a needle having an eye near its point and reciprocatory for puncturing said sheet and carrying a loop of the thread therethrough, said needle being relatively movable and cooperating
 85 with the free end of said looper to thread successive loops on and under said end and to tighten loops on said looper, as the sheet advances.

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