

Aug. 17, 1937.

H. H. BAYNTON ET AL

2,090,022

MACHINE FOR MANUFACTURING PILE FABRIC

Filed July 18, 1935

8 Sheets-Sheet 1

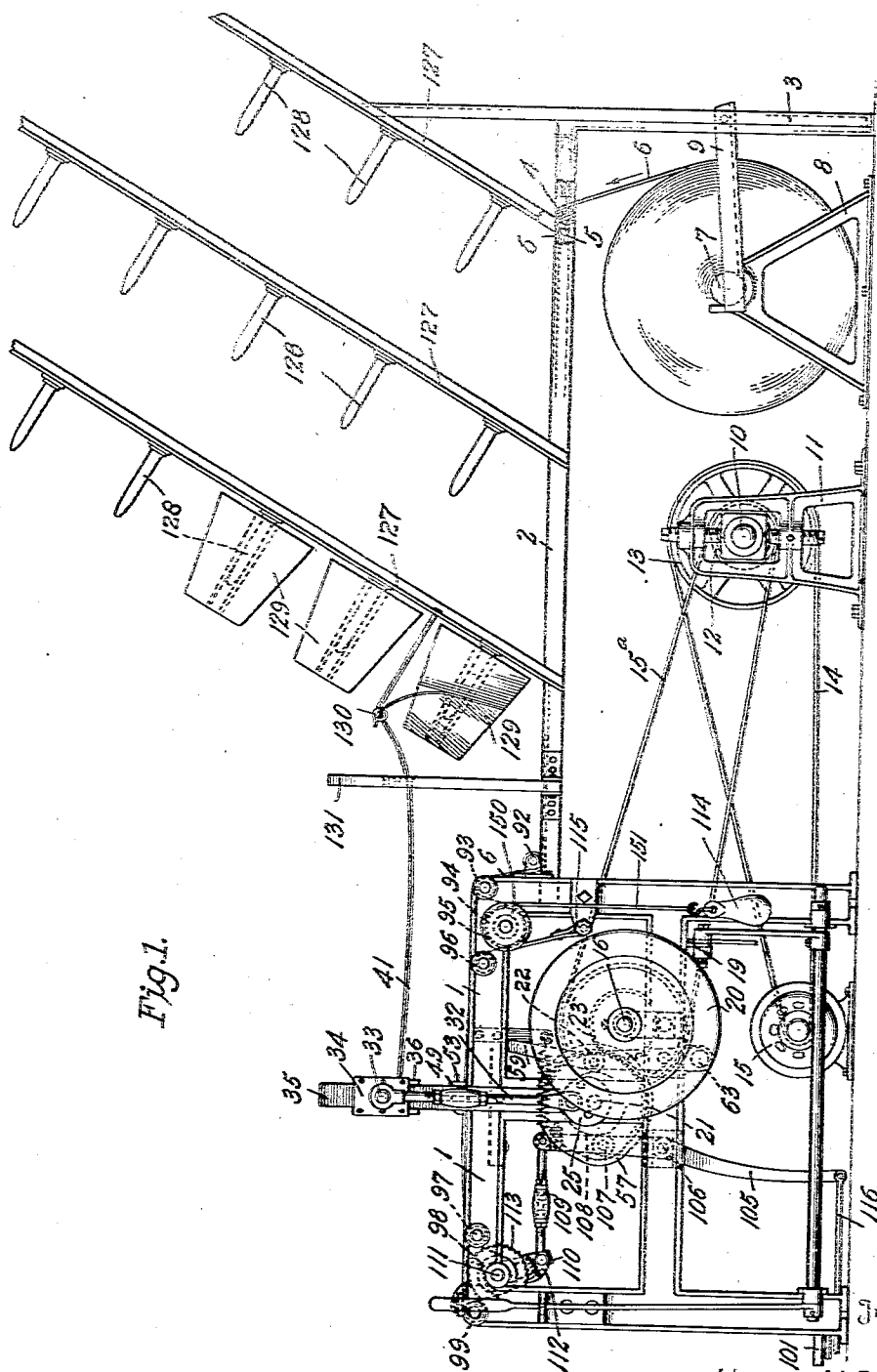


Fig. 1.

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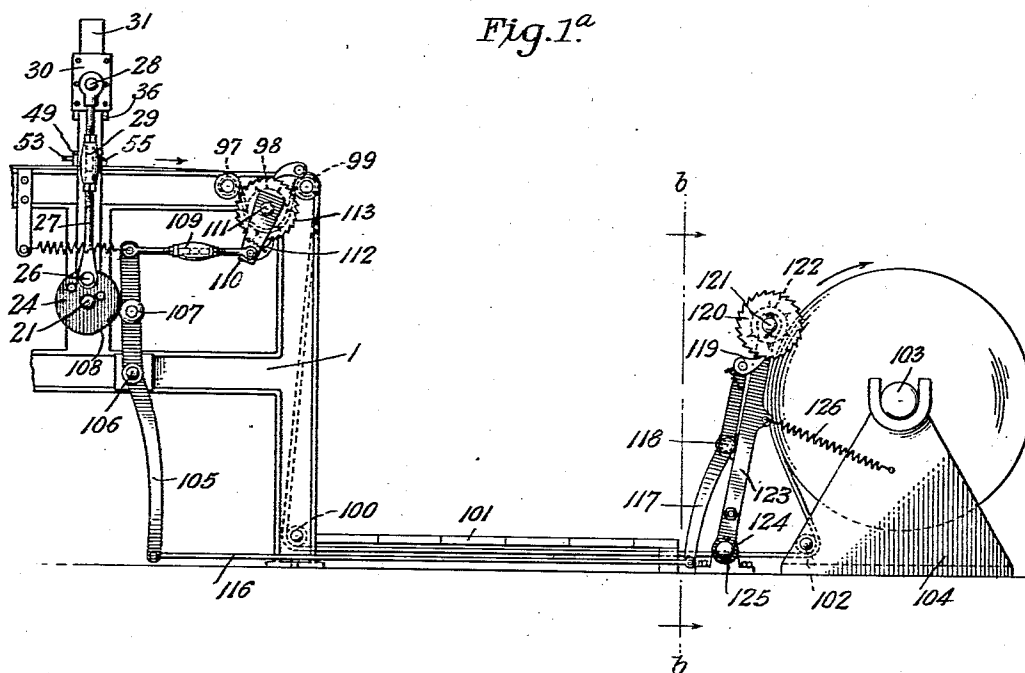
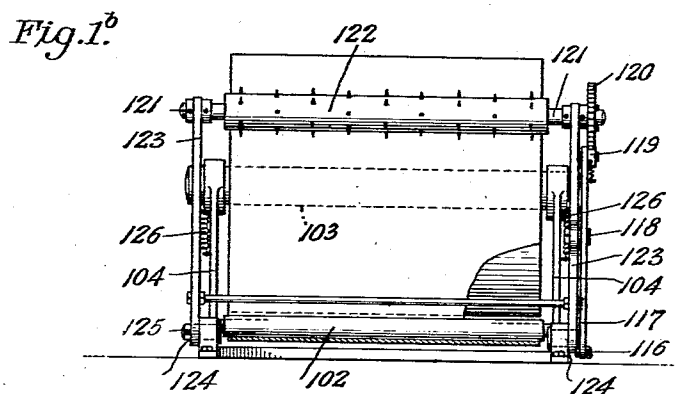
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8 Sheets-Sheet 2



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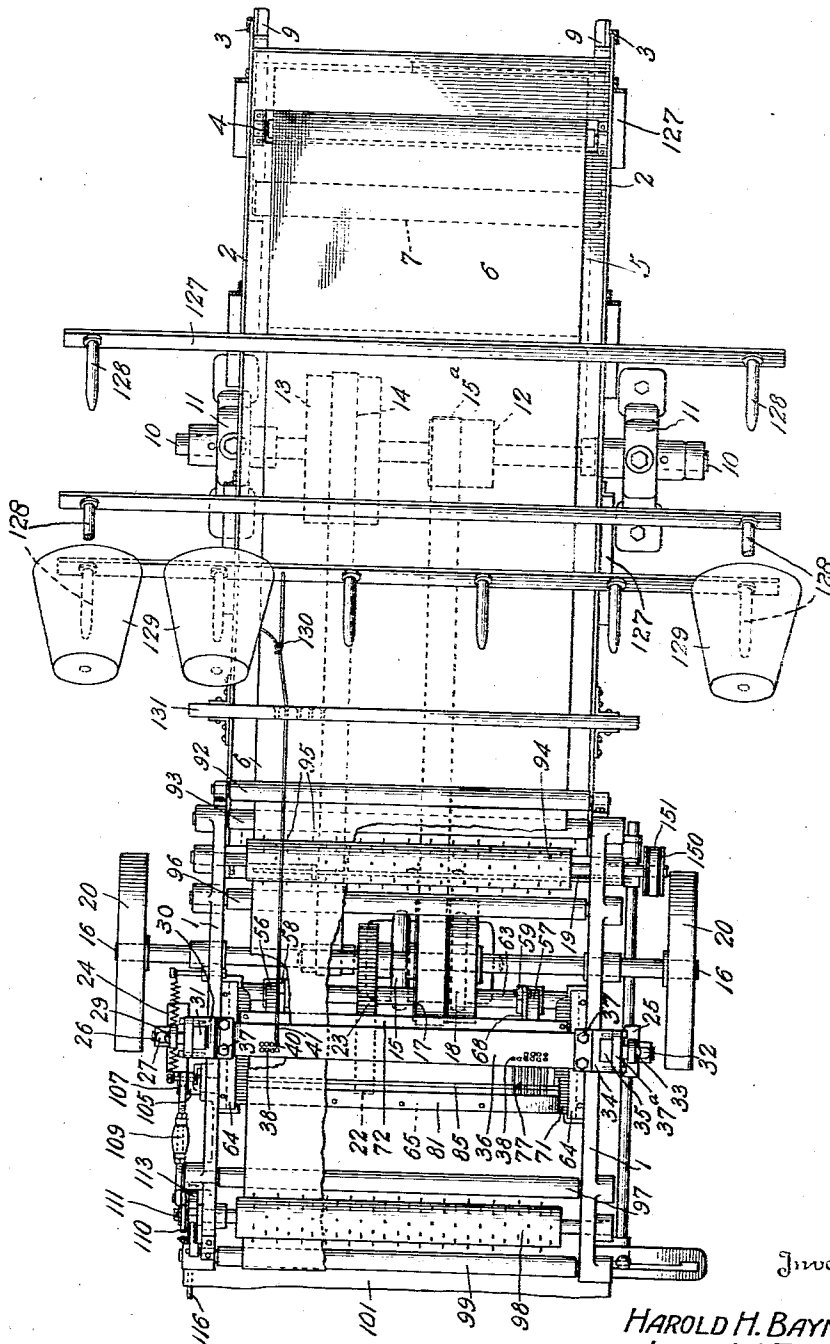
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Fig. 2.



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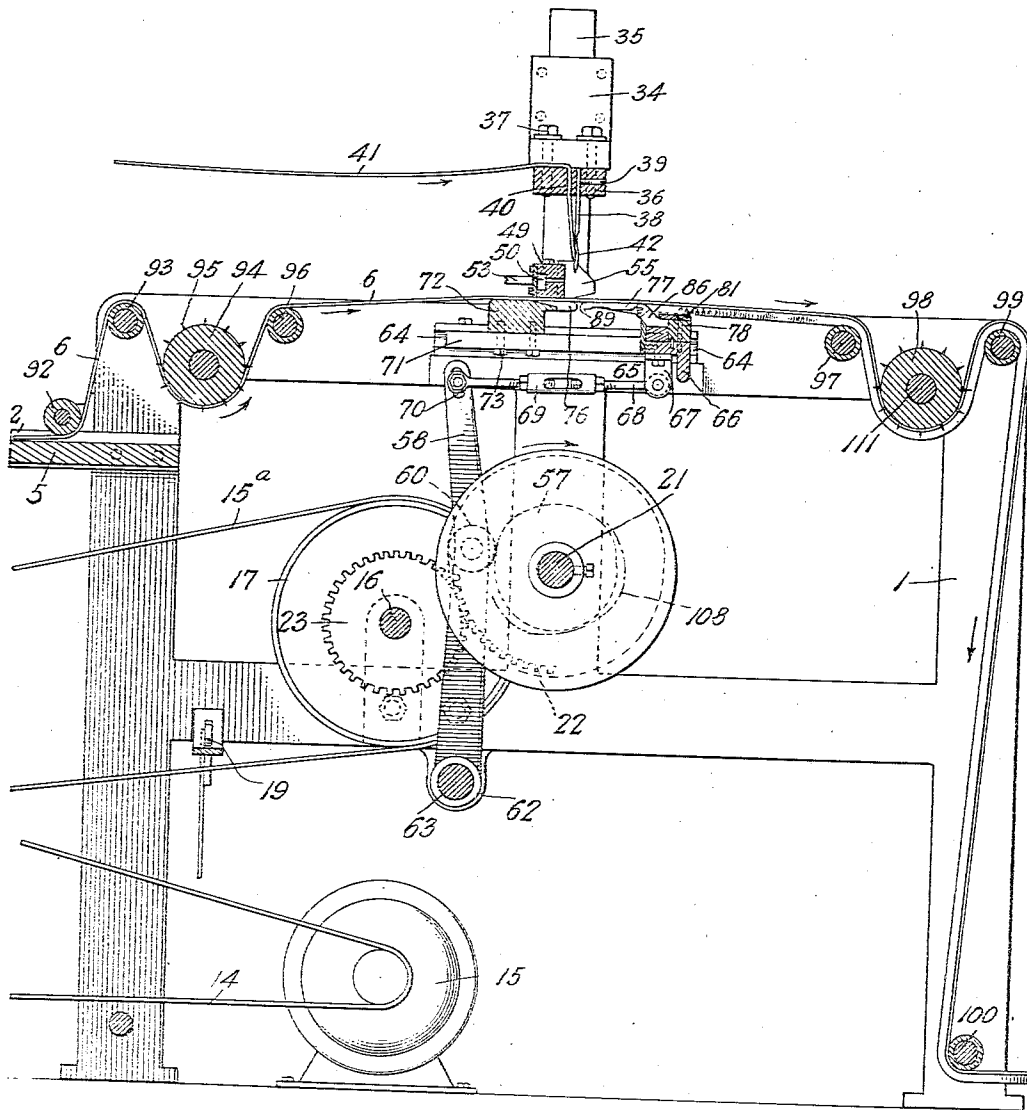
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Fig. 4.



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Fig.5.

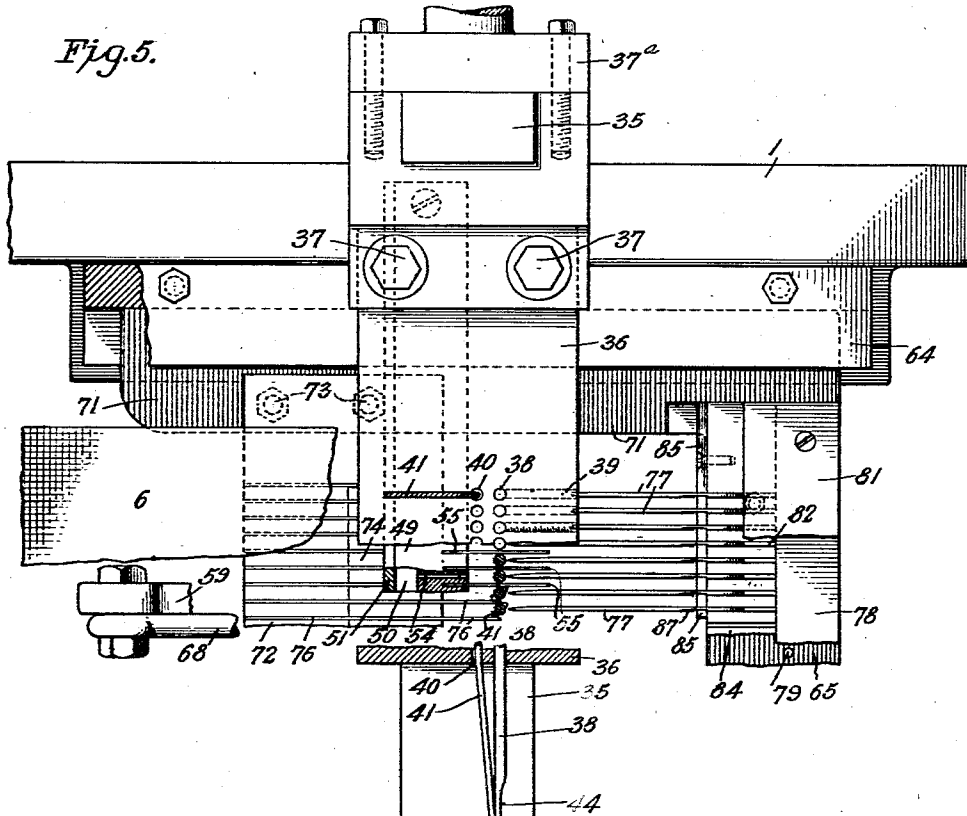
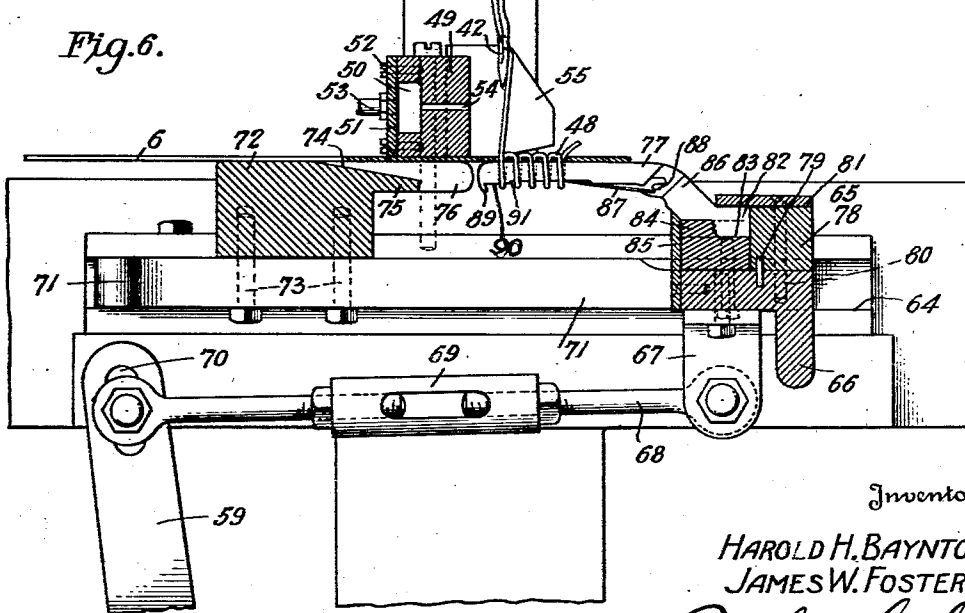


Fig. 6.



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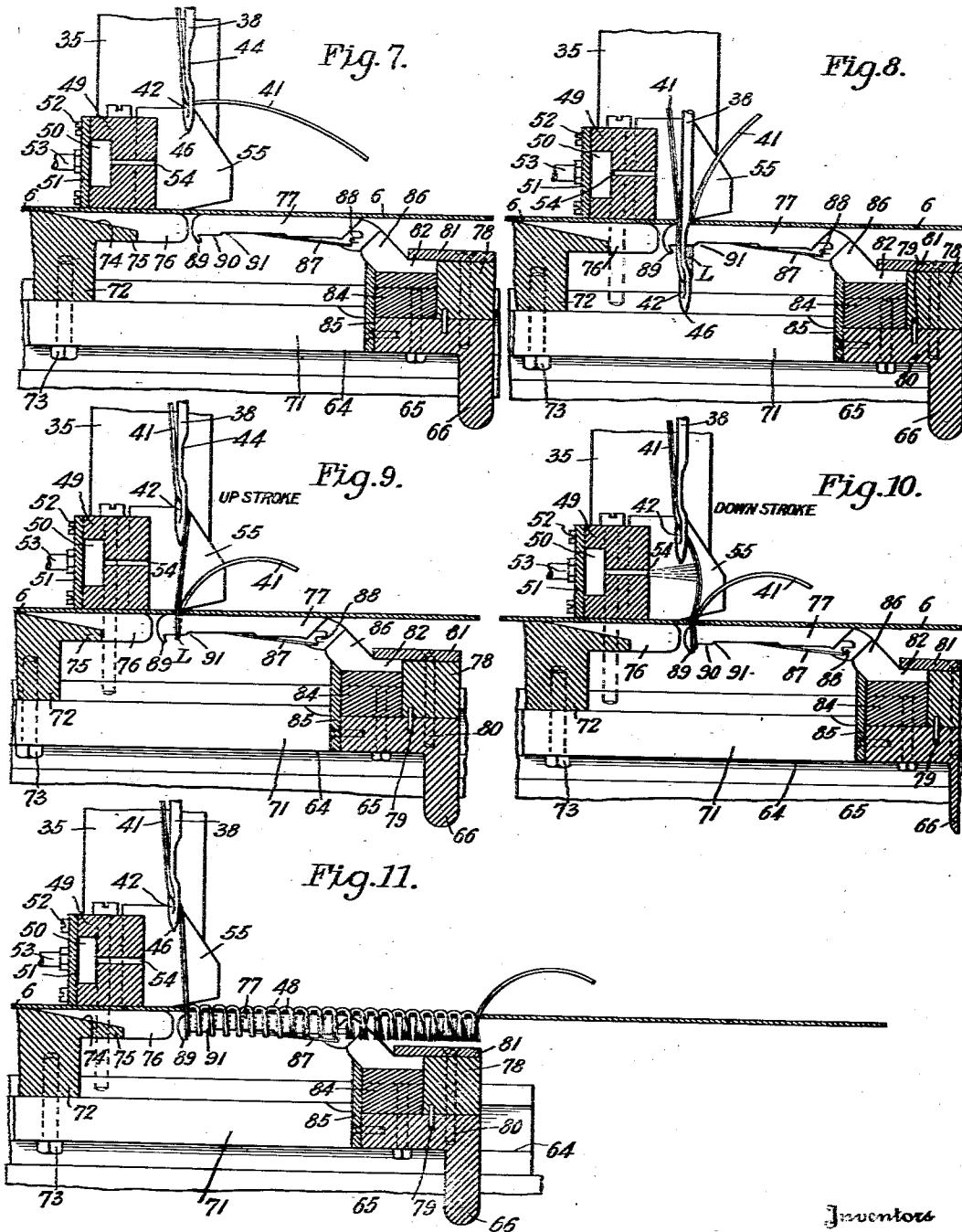
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MACHINE FOR MANUFACTURING PILE FABRIC

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MACHINE FOR MANUFACTURING PILE FABRIC

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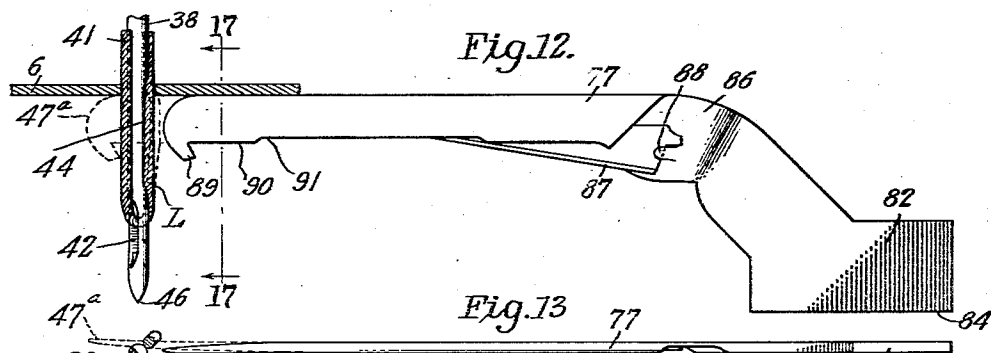
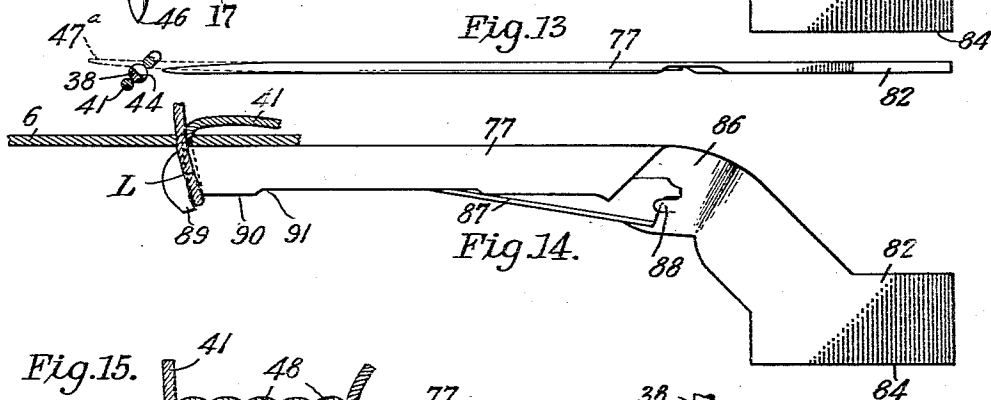
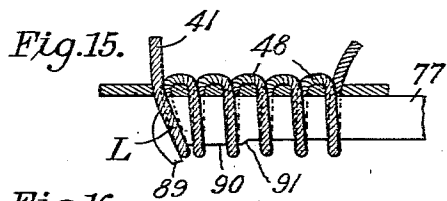
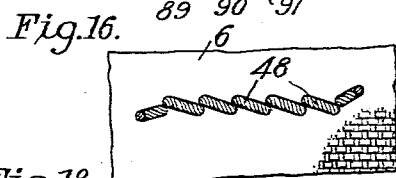
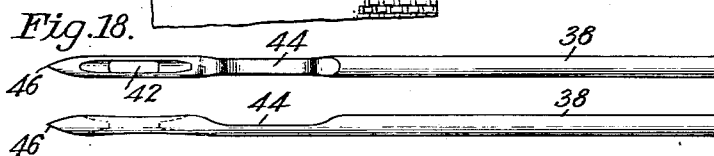
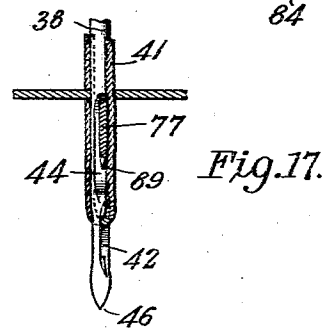
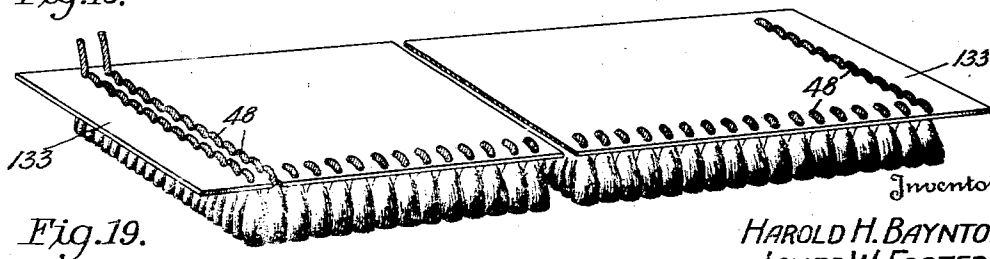


Fig. 18.^a



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Patented Aug. 17, 1937

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UNITED STATES PATENT OFFICE

2,090,022

MACHINE FOR MANUFACTURING PILE FABRIC

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gheusian, Inc., New York, N. Y., a corporation
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Application July 18, 1935, Serial No. 32,098

10 Claims. (Cl. 112—79)

Our invention relates to new and useful im-
provements in machines for manufacturing pile
fabric, and has for an object to provide a ma-
chine having a vertically reciprocating needle
bar in which there is located a plurality of yarn
carrying needles, which needles pass through a
fabric strip to form loops on the under surface
of the fabric about the pile cutters. The fabric,
in turn, advances while supported on the pile
cutters, so that the cutters, therefore, not only
engage and sever the loops but also form a work
table for the fabric as it advances beyond the
needles.

A further object of the invention is to provide
a machine for the manufacture of pile fabric or,
in other words, a turfing machine. The present
machine is so arranged as to provide overlapping
angularly positioned stitches, so that it is possible
to provide eight more or less stitches to the inch
longitudinally of the strip and six more or less
stitches to the inch transversely thereof. Thus,
the pile will be very closely associated, soft to
the tread, and rich in appearance.

Still another object of the invention is to pro-
vide a machine wherein the vertically re-
ciprocating needle bar, the feed of the fabric,
and the engagement of the loops by the pile
cutters are all synchronized. Thus, after the ma-
chine is once started, the application of the
stitches to form the loops and the cutting of the
loops to form the pile will be done in a quick and
rapid manner.

Still another object of the invention is to pro-
vide a machine wherein fabric of the desired
width is fed through the machine and the stitches
forming the loops are rapidly applied. Also, the
depth of the pile cutters determines the depth of
the loops or, in other words, the depth of the
pile.

Still another object of the invention is to pro-
vide a turfing machine wherein the stitches are
applied in an overlapping manner and wherein
the marginal side strips of the fabric are not
stitched, so that the same may be folded back
and cemented to the pile fabric, leaving non-
stitched or non-turfing marginal strips. Thus,
when several strips are sewed to each other to
form a rug or carpet, the marginal edges of these
strips may be sewed to like adjacent edges and the
seams will not be perceptible from the pile side.
This pile fabric with an added intermediate strip
and base forms the subject-matter of a separate
application filed by us on June 4, 1935, bearing
Serial Number 24,940, for Rugs and carpets.

Also, the machine for turning over these mar-
ginal side strips and applying the intermediate
strip and base forms the subject-matter of a
further companion application filed by us on
July 2, 1935, bearing Serial Number 29,546, for

Machine for applying an intermediate strip and
base to pile fabrics.

And lastly, the pile cutters per se used in the
machine also form the subject-matter of a com-
panion application filed by us on June 18, 1935, 5
bearing Serial Number 27,243, for Pile cutters.

Still another object of the invention is to pro-
vide a machine wherein a rolled strip of fabric,
preferably burlap, is fed through the machine
and the stitches applied to form loops on the 10
pile cutters, the feeding of the fabric being
timed with the travel of the needles and with the
movement of the pile cutters.

Still another object of the invention is to pro-
vide a machine for the rapid and efficient man- 15
ufacture of pile fabric wherein the pile cutters
are mounted in a cutter bar, which bar, in turn,
is mounted in a reciprocating cutter head, so that
the pile cutters in their reciprocation respective-
ly pass between the needle and the yarn to form 20
loops in the fabric and about the respective pile
cutters.

The pile cutters also serve as a work support
for the advancing fabric and engage and hold
the built-up loops which are severed by a for- 25
ward movement of the pile cutters and at a time
when the fabric is stationary.

Still another object of the invention is to pro-
vide a turfing machine wherein the loops are
formed on the under side of the fabric and about 30
the pile cutters, the loops, in turn, being severed
by the knife blades on the under edge of the pile
cutters. These pile cutters also have hooks at
their forward ends to engage and hold the loops
on the pile cutters, and as the loops are formed 35
about the forward end of these pile cutters, like-
wise the depth of the pile will be determined by
the height of the pile cutters at their forward
ends.

Still another object of the invention is to pro- 40
vide a simple and relatively inexpensive turfing
machine wherein the fabric, after passing
through the machine, is in condition to then be
subjected to a further machine for either ap-
plying a fabric backing, which is impregnated 45
with a rubber in liquid form to seal the stitches
in place, or a fabric intermediate strip is to be
applied and a felt base, all as set forth in the
heretofore mentioned companion applications, to
wit: Rugs and carpets, Serial No. 24,940, filed 50
June 4, 1935, and Machine for applying an inter-
mediate strip and base to pile fabrics, Serial No.
29,546, filed July 2, 1935.

With these and other objects in view, the in-
vention consists in certain new and novel fea- 55
tures and combination of parts, as will be here-
inafter more fully explained and pointed out in
the claims.

Referring now to the drawings showing a pre- 60
ferred embodiment,

Fig. 1 is a side elevation of what we term the forward portion of the machine;

Fig. 1^a is an elevation from the other side of the rear portion of the machine;

5 Fig. 1^b is a sectional view taken on the line b—b of Fig. 1^a;

Fig. 2 is a top plan view of the forward part of the machine;

Fig. 3 is an end view, on an enlarged scale, of the forward part of the machine, as shown in Fig. 1, the needle bar being in its raised position;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3, illustrating the manner of reciprocating the cutter head;

15 Fig. 5 is an enlarged fragmentary top plan view of the needle bar, the comb, the cutter head, and associated parts;

Fig. 6 is an enlarged sectional view of the same;

20 Fig. 7 is a fragmentary sectional view showing the relationship of the needle and the cutter head when the needle is in its uppermost position;

Fig. 8 is a similar view of the lowered needle and the pile cutter mounted in the cutter bar 25 of the cutter head, the pile cutter having passed between the needle and yarn to form a loop about the pile cutter;

Fig. 9 is a similar view showing the needle in its upstroke and the loop now formed in the 30 fabric and about the pile cutter;

Fig. 10 shows the start of the second descent of the needle, the cutter head and its pile cutter having returned and the fabric having advanced;

Fig. 11 is a similar view showing both the un- 35 cut and severed loops in the fabric and the manner in which these loops are built up on the pile cutter;

Fig. 12 is an enlarged view of a pile cutter and the needle with its yarn after having passed 40 through the fabric, the dotted lines showing the loop engaged by the pile cutter and the extent of travel of the pile cutter;

Fig. 13 is an enlarged top plan view of the pile cutter, the needle and loop being shown in sec- 45 tion and the dotted lines showing how the pile cutter will be slightly deflected after engaging or swiping the needle;

Fig. 14 is an enlarged view showing the pile cutter as having engaged and hooked the loop 50 and returned;

Fig. 15 is an enlarged fragmentary view of the pile cutter showing the built-up loops thereon;

Fig. 16 is an enlarged fragmentary view of the fabric showing how the stitches are overlapped;

55 Fig. 17 is an enlarged fragmentary sectional view taken on the line 17—17 of Fig. 12 and showing the needle with its eye being set at an angle of 45° to the path of movement of the fabric;

60 Fig. 18 is a plan view of the needle, on an enlarged scale, showing the cut-out portion above the eye;

Fig. 18^a is another detail side view of the needle; and

65 Fig. 19 is a perspective of a fragmentary strip of the pile fabric with its applied stitches, the loops having been cut to form the pile and showing the marginal side strips that are not stitched.

70 Referring now more particularly to the drawings showing a preferred embodiment, and for the moment to Figs. 1 and 2, there will be seen a rectangular main cast iron or steel frame 1, forwardly from which extends the angle iron 75 frame 2 with its uprights 3. Located on this lat-

ter frame may be seen the small guide roll 4 and the fabric supporting board 5, over both of which pass the fabric 6, which is in roll form on the shaft 7, which latter is supported by the standards 8.

Beneath the angular frame 2 there may also be seen the shaft 10 mounted in the frames 1 while also mounted on the shaft 10 are the pulleys 12 and 13, the pulley 13 being driven by the belt 14 from a motor 15 mounted under the cast frame 1 and the pulley 12 with its belt 15 operates the main drive shaft 16 of this tufting machine. There is also a drive pulley 17 and an idler pulley 18 on the shaft 16 of the machine, so that the latter can be started or stopped by a movement of the belt shifter 19, as will be readily apparent from Fig. 3.

On the outer ends of the shaft 16 may also be seen the balance or fly wheels 20, so that the rotation of this shaft will be in an even and steady manner.

Referring now for the moment to Fig. 3, there will also be seen the main timing shaft 21, having the gear 22 meshing with a pinion 23, that is mounted on the aforementioned drive shaft 16. This shaft 21 is mounted in suitable standards and from this timing shaft are operated the needle bar, the feeding of the fabric, and the reciprocating cutter head with its pile cutter, as will all be shortly explained.

Description of needles, needle bar, and its associated parts

Still referring to Fig. 3, and to the shaft 2 it will be noticed that there are mounted on the opposite ends thereof the two eccentrics, the one 24 to the left of Fig. 3 and the other 25 to the right thereof. The eccentric 24 also has an outer peripheral cam face, which will be later mentioned. Mounted in the eccentric 24 is the crank pin 26, to which, in turn, is secured the crank arm 27, which latter is fastened at its upper end to the trunnion 28. As will be noticed there is a turn-buckle 29 interposed in the crank arm, so that its length may be changed to more accurately regulate the stroke or movement of the needle bar. The trunnion 28 is mounted in the head 30 which, in turn, vertically slides on the standard 31. In a like manner, there is a crank arm 32 on the eccentric 25 connected with the trunnion 33 on a like oppositely located head 34, which also slides on its standard 35.

Supported by the two heads is the needle bar 36, which is held to the respective heads by the bolts 37. Each of the heads 30 and 34 has the respective plates 37a to form the outer confining walls of the head.

Referring now for the moment to Fig. 4, the needle bar 36 is shown in cross section, and there will be noticed the needle 38 held in position by a set-screw 39. There may also be seen the opening 40 in the bar, so that the yarn 41 may pass therethrough and then through the eye 42 of the needle 38. Of course, these yarn thread openings will extend across the bar, so that each needle will be supplied with its yarn, but both the needles and these yarn openings terminate at points slightly remote from the respective end of the bar. The reason for this is that the pile fabric is not stitched or tufted across its entire width, as there are to be marginal side strips which are to be folded back and cemented to the pile fabric, as heretofore mentioned. However it will be understood that the machine may be made of any desired width to accommodate any

length needle bar with its needles, so that the pile fabric itself may be of any required width.

Reference might be made at this time to Figs. 18 and 18^a, which show the needles 38 on an enlarged scale. It will be noticed that the shank is cut-away, as at 44, just above the eye 42, which eye, of course, is located slightly above the point 46 of the needle. These needles are set in the needle bar 36 with their eyes 42 at substantially an angle of 45° with relation to the path of travel of the fabric, as may be seen from Fig. 17, so that the pile cutters 77 (see Fig. 13) will just strike or swipe the walls of the cut-out portions 44 of the needles and the pile cutters be deflected slightly, as shown by the dotted lines 47a. This setting of the needles with their eyes and the wall of the cut-out portion at substantially 45° to the path of travel of the fabric permits the pile cutter to accurately and successfully pass through the resultant angularly positioned loop of yarn L, as may be seen from Figs. 12 and 13.

As mentioned, by positioning the needles 38 at the angle described, the stitches 48, as seen in the fragmentary piece of pile fabric 6, in Fig. 16, will be arranged in an angular manner, and by regulating the step by step feed of the cloth or fabric, later to be described, these stitches 48 will slightly overlap, that is, the forward end of one stitch will extend in a plane beyond the rear portion of the preceding stitch. This allows more stitches to the running foot and also more transversely of the fabric and, of course, the greater the number of loops, the closer and thicker the pile.

Description of the comb

Referring now to Figs. 4 and 5, there will be seen extending across the machine and mounted on top of the cast iron frame what we term the loop separator comb 49. This is in the form of a bar cut out on its rear face to form a manifold 50, the manifold being sealed on its rear face by the plate 51 held in place by the screws 52. We have shown, fragmentarily, an inlet pipe 53 for this manifold, which may be connected to a suitable air supply (not shown). Leading from this manifold is a plurality of small air passageways 54, while in vertically arranged slots, there is positioned a plurality of metal needle guide plates 55. These passageways 54 extending between the plates permit the air to be blown from the manifold into each space or compartment formed by these needle guide plates 55.

In Fig. 10 is shown how the yarn 41 will be blown by its air jet, so that the yarn is kept in a uniform position and on the proper side of the needle.

In Fig. 5 (in the broken-away portion below the needle bar) may be seen several of the metal needle guide plates 55 to illustrate the manner in which they provide the respective spaces for each of the respective needles and these plates are so positioned that they will just contact with the respective needles as the latter reciprocate, to thus prevent any lateral bending or misalignment of the needles in their travel.

With the comb formed in this manner, therefore, it will be seen that the needles are always prevented from bending out of alignment and, at the same time, the yarn, due to the air manifold, is always kept on the proper side of the needles, so that there is no chance of false stitches or tangled loops.

Description of the reciprocating cutter head

Referring now for the moment to Figs. 1, 3, 4, and 6, there is shown the mechanism for reciprocating the cutter head which, in turn, it will be remembered, includes the work rest and needle guide and the cutter bar wherein the pile cutters are mounted. It will also be noticed that the main timing shaft 21 (driven from the shaft 16) besides having eccentrics at its opposite ends is provided with the two cams, 56 to the left of Fig. 3 and 57 to the right thereof. There will also be noticed the two arms 58 and 59, which cooperate with these cams. Mounted on the arm 58 is the roller 60, which latter engages the cam 56, and in a like manner, there is a roller 61 mounted on the arm 59, which cooperates with its cam 57. These two arms 58 and 59 are pivotally mounted at their lower ends, as at 62, on the shaft 63.

Now secured to the main frame are the horizontally grooved tracks 64 in which slides the reciprocating cutter head 65 with its front webbed cross piece 66, as may be seen in Fig. 3. Positioned just behind the web may be seen two brackets 67.

Glancing at Fig. 6, there will be seen fastened to one of these brackets a connecting link 68 with its turn-buckle 69, the link being pivoted at its rear end in the slot 70 to the arm 59. It will be understood that both of the arms 58 and 59 are connected in the same manner to the brackets 67 on the cutter head 65, so that as the timing shaft 21 revolves with its cams 56 and 57, the cutter head will be reciprocated under the needle bar in its aforementioned tracks 64.

Referring to Fig. 5 for the moment, which is a fragmentary top plan view showing the needle bar, a portion of the comb, and the reciprocating cutter head, it will be understood that the side bar 71 of the cutter head 65 is duplicated to slide in the oppositely positioned track while the webbed cross piece 66 extends to these two side bars. Also extending parallel with this webbed cross piece 66 and mounted on and near the opposite end of the cutter head 65 is the cloth or fabric rest and needle guide bar 72. Thus, it will be seen that as the cutter head reciprocates, not only does the cutter bar with its pile cutters thereon reciprocate, as will be shortly explained, but the cloth rest and needle guide bar 72 also reciprocates.

The cloth rest and needle guide bar 72 may be clearly seen in Fig. 6 and is bolted to the cutter head by the bolts 73. It has its upper surface slightly tapered, as at 74, while along its forward edge 75 are placed the small metal fingers or plates 76, which may also be seen in top plan in Fig. 5. It is on top of this bar 72 and on top of the plurality of properly spaced plates or fingers 76 that the fabric is supported as it is passed under the needles and to the top of the pile cutters, as may be seen in the various views.

As may be seen in Fig. 5, these fingers 76 are positioned directly beneath the aforementioned plates 55 of the comb and when the cutter head is in its normal position, that is, to the right in Figs. 5 and 6, and the needles have descended, the said fingers 76 will be in the position shown in Fig. 5, that is, just about opposite the center of the needles (looking down on the machine). It is these fingers 76 that take up the strain on the fabric as the needles are penetrating the same, and they also tend to keep the needles in

their proper vertical alignment after the needles have pierced the fabric or cloth.

Referring again for the moment to the cutter head, Fig. 6, it will be seen that above the webbed cross piece 66, there is provided the one portion 78 of the cutter bar having the dowel pins 79 therein that register with properly spaced holes in the front cross piece 66, this cutter bar being secured in position by the bolts 80. There is also a top plate 81 which overlies the upper edges of what we term the heel plates 82 of the pile cutters 77. The lower edges 83 of these heel plates, which are part of the pile cutters, rest in slots in the other portion 84 of the cutter bar. Likewise, there is a plate 85 held in position on the portion 84 of the cutter bar after the pile cutters 77 are in their set position, so that the heel plates of the pile cutters are held substantially on all four sides and thus braced against any undesired bending or twisting action.

Now these pile cutters 77 form the subject-matter of a separate application filed by us on June 18, 1935, bearing Serial Number 27,243, for Pile cutters.

For the purpose of this invention, therefore, it is simply necessary to say that each pile cutter consists of the heel plate 82, which merges with the body 86 of the cutter. There may also be noticed the knife blade 87 held at its rear by the tongue 88, while the forward end of the blade fits into the folded-over sides of the fingers of the pile cutters, as will be readily understood. At the forward end or nose of the pile cutter, there may be seen the hook 89, and it will also be noticed that extending from a point slightly to the rear of the nose, the pile cutter is greater in height than at the point 91. This is because the pile cutter is reduced or cut-away slightly, as at 91, to permit a freer movement of the pile cutter through the loops after the loops have passed from the front portion 90 to the reduced portion 91.

By forming the pile cutters in this manner, therefore, there is no distortion or downward pull on the fabric as the loops build up on the pile cutters. In other words, there is no possibility of the loops choking or being strangled on the pile cutters before they reach the knife blade 87. This is also clearly set forth in the companion application just mentioned, namely, the application filed by us on June 18, 1935, bearing Serial Number 27,243, for Pile cutters.

In Fig. 12, there is shown in dotted lines the forward limit of travel of the pile cutter, while in Fig. 13, the dotted lines 47a show how the pile cutter will engage the cut-out surface 44 of the needle 38 and be deflected slightly. By positioning the pile cutters in this manner with relation to the needle, there is no possibility that the pile cutter will not pass between the yarn and the needle which, of course, would prevent the loop from being hooked and later severed.

In Figs. 14 and 15, there is shown how the hooked nose 89 of the pile cutter has engaged the loop L of the yarn and also how the loops build up on the pile cutter, so that they may be severed by a forward movement of the reciprocating cutter head and the knife blade 87 of the pile cutter after the loops have built up on the pile cutter.

It will be noticed that the depth of the loop will be the same as the distance from the lower to the top edges at the portion 90 of the pile cutter, so that if greater depth of pile is desired, pile cutters 77 of different size will be used.

In Fig. 5, the spacing of these pile cutters in the cutter bar is shown, and it will, of course, be understood that each pile cutter 77 will pass beneath the spaces between the respective plates 55 of the comb to strike the reduced portion of the respective needles which, it will be remembered, are set at an angle. The pile cutters will pass between the respective yarn strands and the needles, so that when the needles ascend, the loops, in turn, will be built up on the pile cutters. Also, it will be seen from Fig. 5 that when the cutter head is to the right, as shown in this figure, the fingers 76 of the work rest 72 will straddle the respective needles with their yarn.

By providing the turn-buckles 69 that connect the cutter head with the arms 58 and 59 which are, in turn, operated by the cams 56 and 57, accurate adjustment may be made, so that the reciprocating cutter head will be properly positioned with respect to the needles.

The length of travel of the cutter head with its pile cutters in actual practice is $\frac{3}{8}$ " while the step by step movement of the cloth or fabric is generally $\frac{1}{8}$ ". Of course, the distance the cloth or fabric moves each time will regulate the size or length of the stitches.

Mechanism for feeding the fabric

Referring now for the moment to Figs. 1, 1a, 2, and 6, there will be seen an idler roller 92 so that the fabric in passing over the board 5 will pass under this roller and over and along an idler roller 93 and then under the large roller 94 which is provided with the usual small spikes 95.

The fabric then passes over the further roller 96, where it travels across the cloth rest and needle guide 72, under the comb and needle bar 36, where the stitches are applied. The cloth or fabric, in continuing, then passes along the upper edges of the pile cutters 77, where it again passes over a small roller 97 to a second spike roller 98, which is power-driven in a step by step movement. After passing under this spike roller, the fabric 6 moves up over the idler roller 99 and then downwardly, as shown in Fig. 1a, under the roller 100 (Fig. 4), and then beneath the floor boards 101, on which the operator will stand. It then continues to the roller 102 (see Fig. 1a), where it is wound on a shaft 103 mounted in a support 104.

Glancing at Figs. 1, 1a, and 3, there will be seen the lever 105, which is pivoted, as at 106, and provided with a roller 107 to, in turn, engage the periphery 108 of the eccentric 24, which eccentric has its periphery in the shape of a cam, as heretofore mentioned. It will be remembered that this eccentric is mounted on one end of the timing shaft 21.

Still glancing at Fig. 1a, there will be seen a turn-buckle 109 fastened to the upper end of the lever arm 105 and at its other end to the plate or arm 110, which is oscillatably mounted on the shaft 111, there being a spring pawl 112 to engage the feeding ratchet 113 mounted on the shaft 111. This shaft 111, it will be remembered, supports the spike roller 98.

Also, there will be noticed on the end of the shaft supporting the spike roller 94 a small belt wheel 150 over which fits a strap 151, which is weighted, as at 114, the other end of the strap being secured to the bracket 115, so that there will always be a tension on the fabric where it extends between the two spike rollers, that is, beneath the needle bar. In other words, to prevent the roller 94 from slippage or loose move-

ment, this usual weighted means is employed. Ratchets 113 with a greater or lesser number of teeth thereon may be utilized when it is desired to increase or decrease the amount of step by step movement of the cloth or fabric which, in turn, will, of course, affect the length of the stitches.

Still referring to Fig. 1^a, it will be noticed that at the bottom of the lever 105, there is a rod 116 that connects also to the lever 117, which is pivoted, as at 118, to one of two arms 123, which lever is provided with a pawl 119 at its end to engage a further ratchet 120, which will have, of course, the same number of teeth as the ratchet 113. This latter ratchet is mounted on the shaft 121, which also supports a spike roller 122. The lever 117, as before mentioned, is pivoted at 118 to one of the arms 123, the arms, in turn, being pivotally mounted, as at 124 to the stub shafts 125 (see Fig. 1^b). It will be understood that these two arms 123 support the shaft 121 with the spike roller 122 extending therebetween. Springs 126 are fastened to the arms 123 and to the base 104 to hold the spike roller in contact with the roll of pile fabric.

This pivotal arrangement permits the spike roller to move outwardly from the roll as it increases. It will be seen that inasmuch as the lever 117 is connected with the lever 105 and the ratchets are of the same size, the turfed fabric will be wound on its roll at the same rate of speed that it is drawn through the machine.

As far as the specification has proceeded, it will be seen that the movement of the needle bar, movement of the cutter head, and the ratchet mechanism for drawing the fabric through the machine and for winding it on a roll at the end of the machine are all timed and operated from the one main timing shaft 21. The ratchets employed in the present machine, in turning, advance the cloth substantially $\frac{1}{8}$ " at a time, so that the stitches will be of this length.

Before briefly describing the operation of the machine, it might be mentioned that built up from the frame 2, there will be noticed the racks 127 with the spindles 128, on which will be mounted the yarn bobbins 129. Also, there will be a pig-tail 130 for each bobbin, from which the yarn will travel through the aligning board 131 to the respective needles.

Operation

Glancing for the moment at Figs. 7 to 11, inclusive, which show a series of positions for the needles with respect to the cutter head, it will be understood that in Fig. 7, the needle 38 in the needle bar 36 (not shown in these figures) is about to descend. The cutter head 65 will also be in the position shown, that is, at the right. The fabric 6 has passed under the comb and is in a position ready to be turfed and have the loops formed thereunder. Then, as the needle bar descends, the needle 38 (Fig. 8) will pierce the fabric 6, carrying, of course, its yarn with it. Now while the needle is in its lowermost position, as shown in Fig. 8, the cutter head 65 will move to the left, so that the pile cutter 77 will advance, that is, move to the left, and pass between the needle and the yarn strands. The pile cutter in advancing, it will be remembered, will strike the cut-out portion of the needle, as heretofore mentioned, and diverge slightly to one side.

Then, as the needle 38 (Fig. 9) rises, the loop will be drawn tightly about the pile cutter 77, that is, about the portion 90, which is not re-

duced. The timed relation between the movement of the needle bar and the movement of the cloth or fabric is such that by the time the needle bar approximates its upper end of travel or perhaps $\frac{1}{4}$ " from its upper limit of travel, the cloth or fabric will have been drawn toward the operator by the step by step operation of the spike roller 98 which, it will be remembered, is operated by the cam 107 driven by the timing shaft 21 and, in turn, operating the lever 105 which operates the spike roller through its pawl and ratchet.

The timing of the cutter head with relation to the needle bar is also as above-mentioned, that is, as the cloth or fabric moves toward the operator, the cutter head moves in the same direction or, in other words, the pile cutters and fabric move toward the operator in unison.

In Fig. 10, the draft from the manifold may be seen blowing a strand of yarn to the proper side of the downwardly coming needle and the loop now hooked by the pile cutter.

Fig. 11 shows a multiplicity of loops about the pile cutter and the manner in which they are severed when they engage the knife blade 87.

From the movements set forth in these Figs. 7 to 11, it will be readily apparent that when the needle is at its lowermost point, the yarn and needle are engaged by the forward movement of the pile cutter, and while the needle is nearing the limit of its upward stroke the cutter head is returned, the cloth also moving at this time. The loops are severed on a forward movement of the cutter head and its pile cutter, as will be readily understood.

It will be noted in Fig. 19 that the two marginal side edges 133 of the fabric are not stitched, as these are to be gummed and folded back on the fabric, as set forth in the companion application, to wit, filed by us on July 2, 1935, bearing Serial Number 29,546, for Machine for applying an intermediate strip and base to pile fabrics.

To start the machine, the handle 17 will be operated to slide the belt from the idler pulley to the work pulley on the shaft 16 to, in turn, drive the main timing shaft 21 which, through the eccentrics 24 and 25, will operate the needle bar 36 and through the cams 56 and 57 will operate the reciprocating cutter head with its plurality of pile cutters 77 therein. The feeding of the cloth or fabric has been described and will not be reiterated.

From the foregoing, it will be seen that the machine is a relatively simple one and there are only two eccentrics for operating the needle bar, two cams for operating the cutter head, and one cam for operating the feed of the fabric or cloth through the machine. It will also be noticed that one of the ordinary work tables is dispensed with, as the pile cutter forms a support for the fabric as it passes from its opposite work table to the pile cutters.

Also, by positioning the needles at an angle and cutting out the needles, as shown, and by forming the pile cutters with the hooked nose and the knife blades on their under surface, and mounting them in the reciprocating cutter head, it is possible to have the machine operate in a rapid manner to catch and build up the loops on the pile cutters and have the advanced loops severed as they move on the reciprocating pile cutters.

We have found in actual service that a machine designed and constructed as above will neatly arrange the stitches in the fabric and at the same time the fabric may be kept in a taut

condition while under the needles and the needles, in turn, prevented from any bending or misalignment during their operation.

Furthermore, there is no unnecessary downward thrust or pull on the pile fabric, as the pile cutters being undercut may slide freely through the previously formed loops. The pile may be arranged in this relatively close position to thus provide a rich looking pile fabric and one that is extremely soft to the tread.

As heretofore mentioned, after the material has been tufted, as herein set forth, it may be placed in the machine shown in the companion application, to wit, filed by us on July 2, 1935, bearing Serial Number 29,546, for Machine for applying an intermediate strip and base to pile fabrics, and a backing and felt base secured thereto.

Many slight changes are possible in the construction hereinbefore set forth without departing from the spirit of the invention.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. A machine for manufacturing pile fabric including fabric feeding mechanism, loop stitching mechanism, means for severing the loops, and the means for severing the loops acting as a support for the fabric as it passes along from the stitching mechanism.

2. A machine for manufacturing pile fabric including means for forming loops in a fabric, means for feeding the fabric in a step by step movement in the same plane, horizontally movable means for hookedly engaging the loops and for severing the same, and the means last referred to supporting the pile fabric, and timing mechanism for synchronizing the movement of the loop forming means, fabric feeding means, and hookedly engaging and severing means.

3. A machine for manufacturing pile fabric including fabric feeding means, a vertically reciprocating needle bar with needles therein, a horizontally reciprocating cutter head mounted under the needle bar having a work rest thereon and positioned to one side of the needle bar, pile cutters also on the cutter head and positioned to the other side of the needle bar, the said needles stitching loops on the under surface of the fabric, means for reciprocating the cutter head to pass the pile cutters into said loops, the fabric supported and moving on the work rest and on the said pile cutters, and timing means for synchronizing the movement of the cutter head, the fabric, and the needle bar.

4. A machine for manufacturing pile fabric including a main timing shaft, ratchet means connected with the timing shaft for feeding the fabric through the machine, a vertically reciprocating needle bar with needles therein, means connecting the needle bar to said timing shaft, a reciprocating cutter head having pile cutters mounted thereon, means operated by the said timing shaft for reciprocating said cutter head, the needles adapted to form loops in the pile fabric, the pile cutters adapted to pass through said loops to sever the same, and the pile cutters acting as a work support for the fabric after the needles have formed the loops in said pile fabric.

5. A machine for manufacturing pile fabric including a reciprocating needle bar having loop forming needles therein, a comb positioned beneath the needle bar, an air manifold in the comb

and having outlets therefrom directed toward the needles and adapted to prevent the yarn in the needles from getting in the path of the said needles, a reciprocating cutter head having a pile cutter therein for each needle, means for moving the cutter head in timed relation with the movement of the needles whereby the pile cutters will engage the yarn in the needles to form a loop on the under surface of the fabric, the pile cutters also severing the loops on the forward movement of the pile cutters, and means for feeding the fabric under the needles in certain timed relation with the movement of the cutter head.

6. A machine for manufacturing pile fabric including yarn carrying reciprocating needles, pile cutters adapted to move forwardly and pass between respective strands of yarn and the needles after the latter have pierced the fabric to thus form loops on said pile cutters, means for moving the fabric, means for retracting the pile cutters in unison with the movement of the fabric, the forward movement of the pile cutters severing the advanced loops built up on the pile cutters, and the pile cutters forming a work support for the fabric.

7. A machine for manufacturing pile fabric including reciprocating yarn-carrying needles, reciprocating pile cutters synchronized with the movement of the needles whereby the yarn will be looped through the fabric and about the pile cutters, means for feeding the pile fabric in unison with a rearward movement of the pile cutters, the built-up loops on the pile cutters being severed by a forward movement of the pile cutters, and means connected with the fabric feeding means for also rolling up the pile fabric as it leaves the machine.

8. A machine for manufacturing pile fabric including yarn carrying needles, hook-nosed pile cutters adapted to extend through the yarn loops beneath the fabric, the pile cutters having blades in their under edges and adapted to sever the bottoms of the loops, and the pile cutters also acting as a support for the fabric as it passes under the needles and along the pile cutters.

9. A tufting machine including a reciprocating needle bar having yarn carrying needles mounted therein, the eyes of the needles set at an angle to the longitudinal axis of the machine, a comb located under the needle bar and having guide plates therein between which guide plates the needles reciprocate, a reciprocating cutter head located beneath the comb and said cutter head provided with a work support and needle guide, said work support and needle guide including spaced metal fingers adapted to support the fabric when pierced by the needles and also preventing a lateral bending of said needles.

10. A tufting machine including a reciprocating needle bar having yarn carrying needles, a comb located beneath the needle bar having plates therein, said plates forming respective compartments for the needles and preventing the needles from axial displacement, a reciprocating cutter head having a work support and needle guide also located under the comb, and said work support and needle guide including fingers extending directly beneath the plates of the comb and adapted to also straddle the needles when the needles are in their lowermost position.

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