Nov. 24, 1936. W. HOFMANN ET AL 2,062,027

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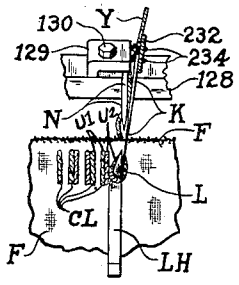


Fig. 1A. (0°, Fig. 7)

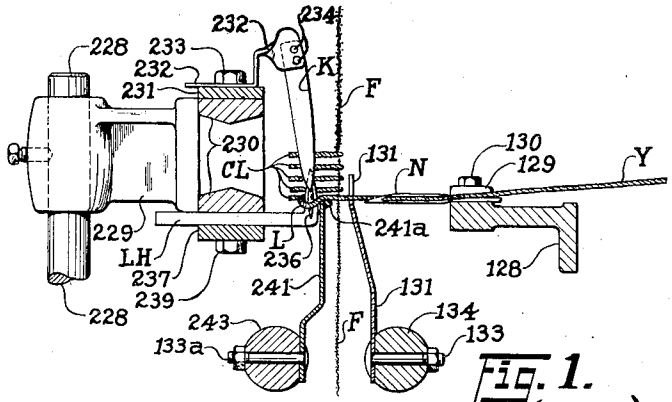


Fig. 1. (0°, Fig. 7)

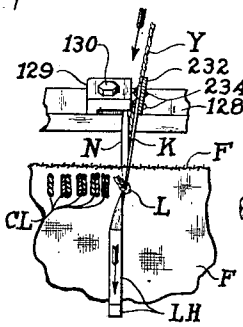


Fig. 2A. (63°, Fig. 7)

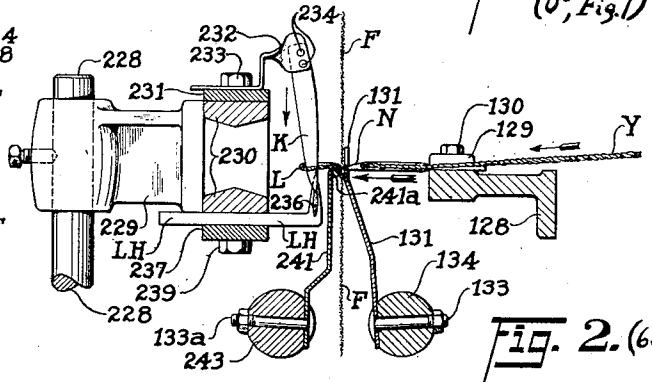


Fig. 2. (63°, Fig. 7)

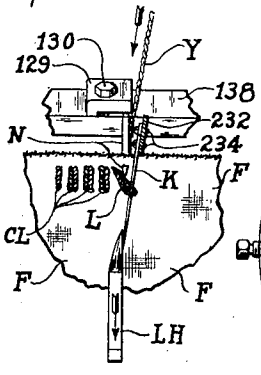


Fig. 3A. (76°, Fig. 7)

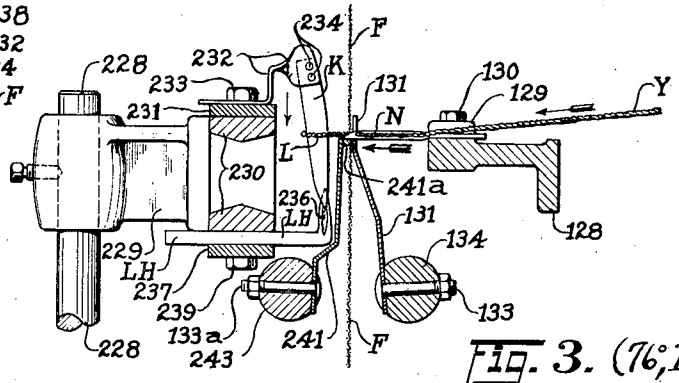


Fig. 3. (76°, Fig. 7)

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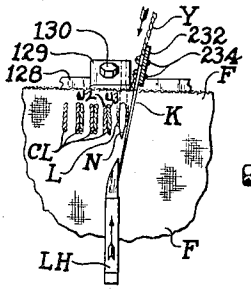


Fig. 4A. (150°, Fig. 7)

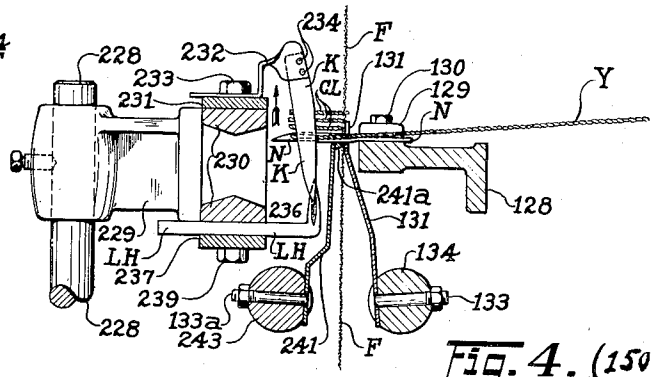


Fig. 4. (150°, Fig. 7)

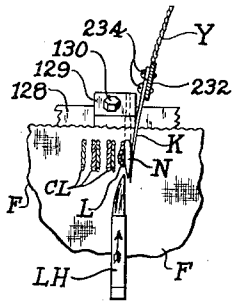


Fig. 5A. (170°, Fig. 7)

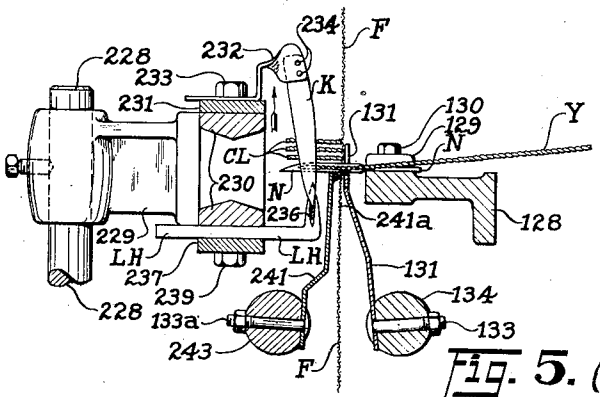


Fig. 5. (170°, Fig. 7)

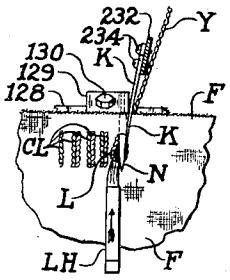


Fig. 6A. (190°, Fig. 7)

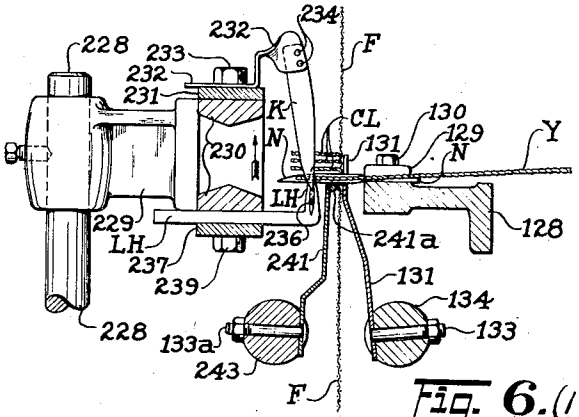


Fig. 6. (190°, Fig. 7)

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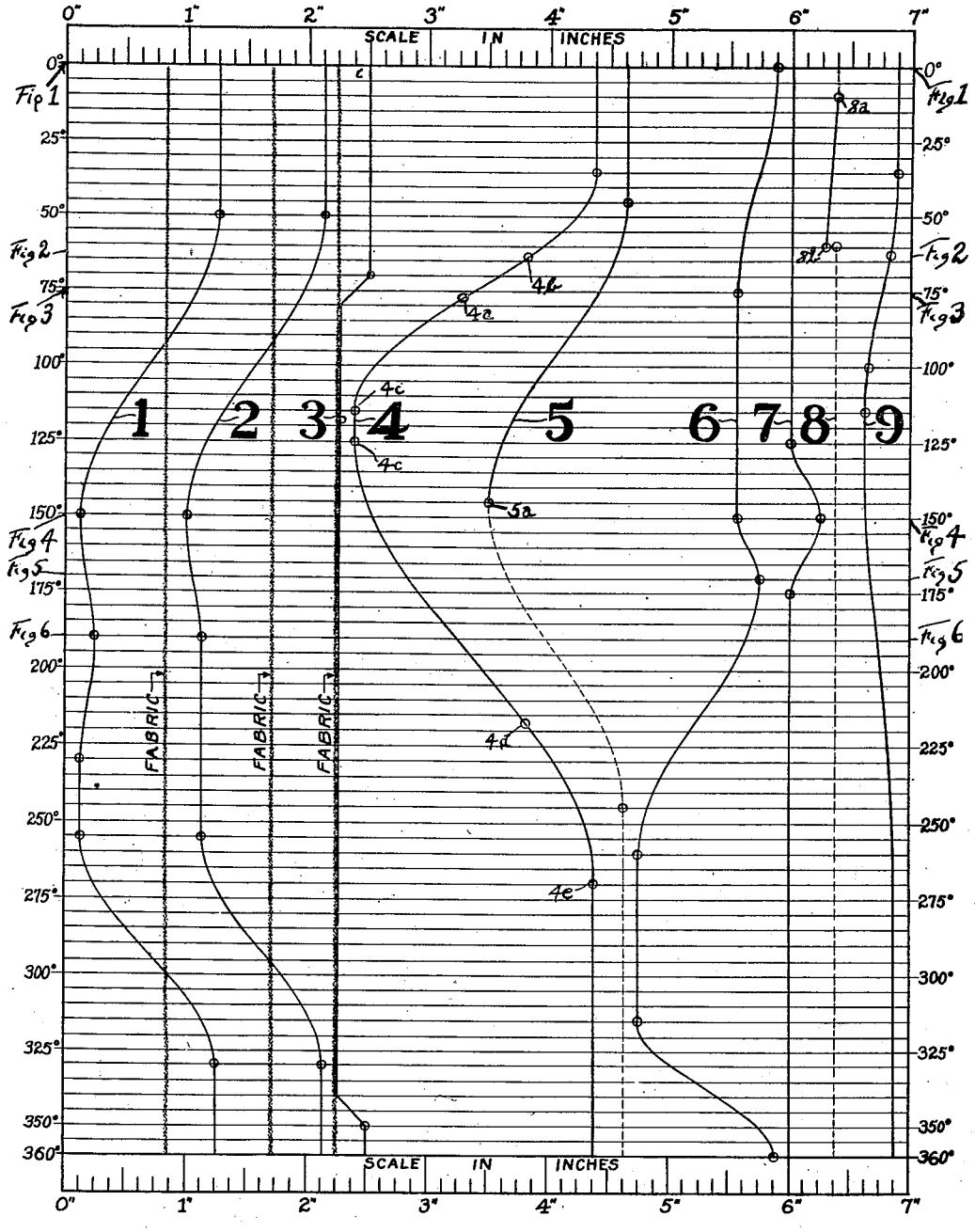


Fig. 7. (Cycle of 1/2 Second)

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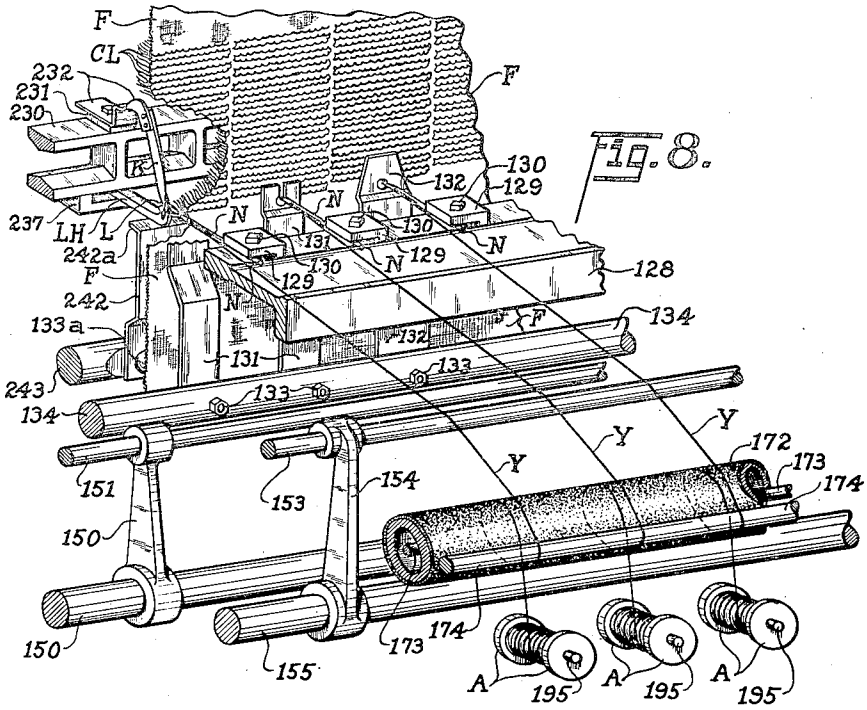


Fig. 8.

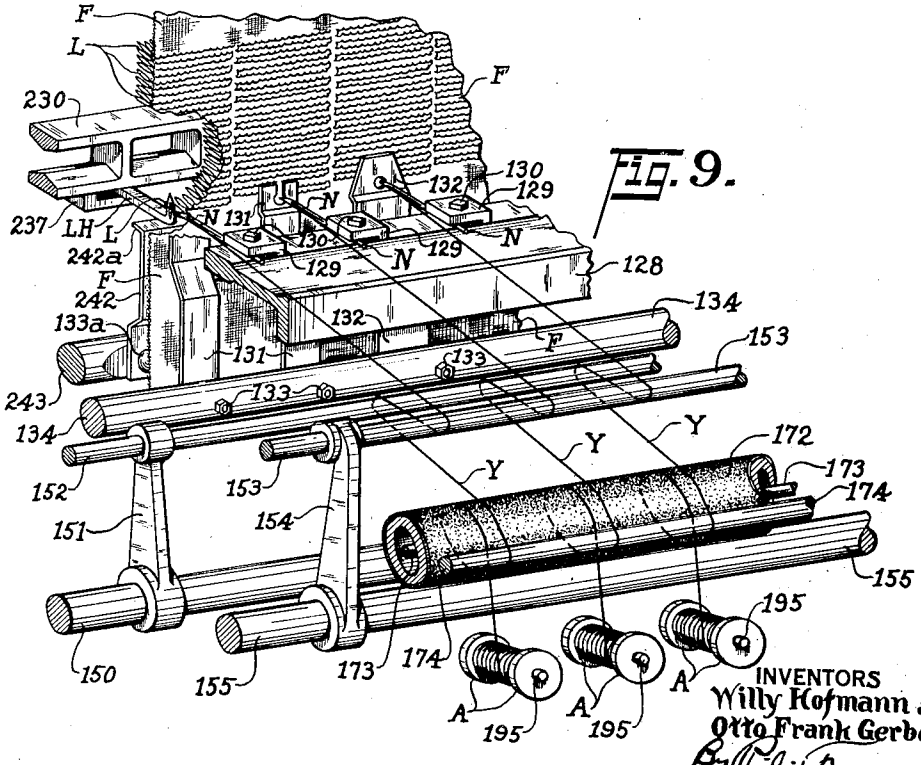


Fig. 9.

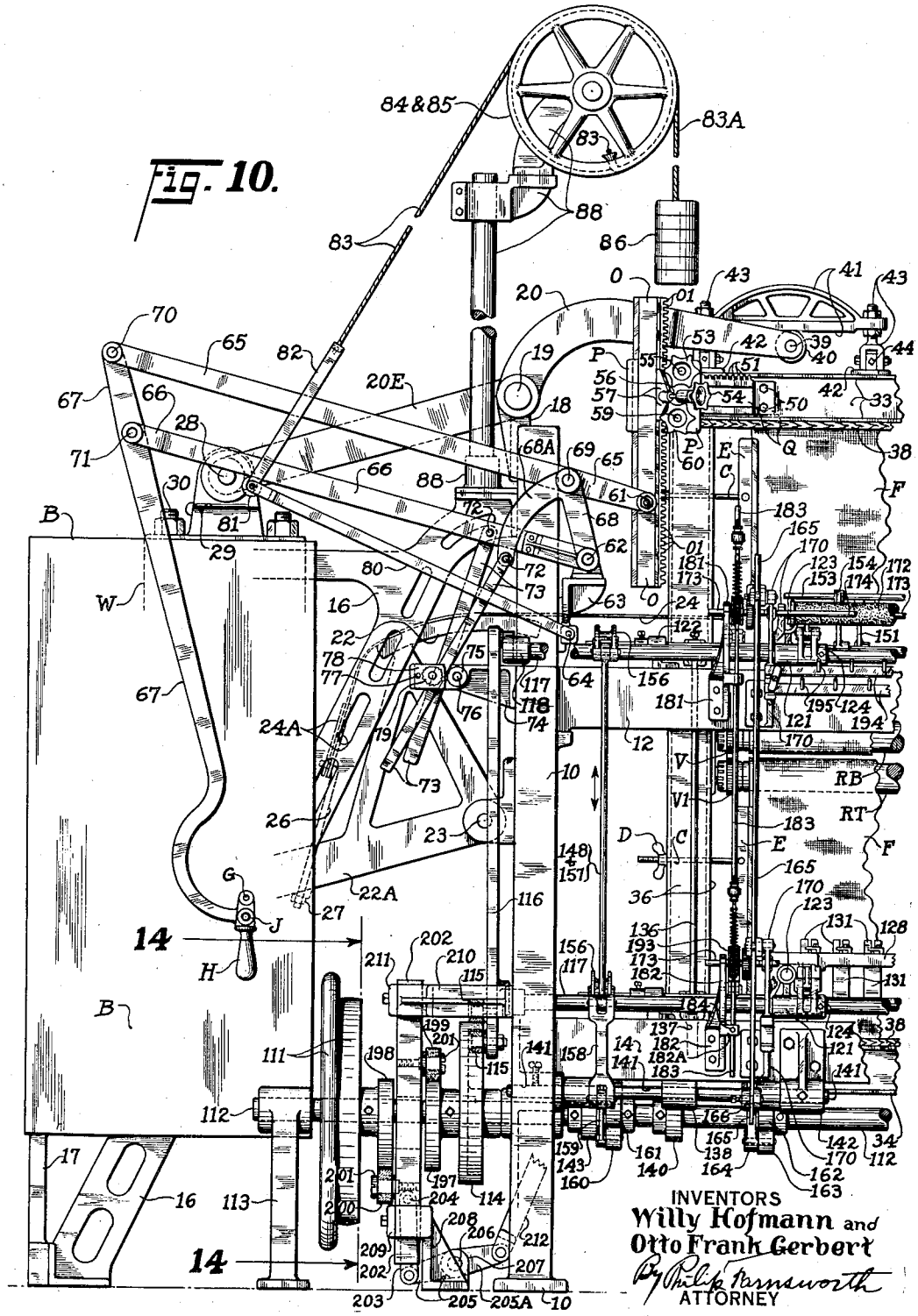
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Fig. 10.



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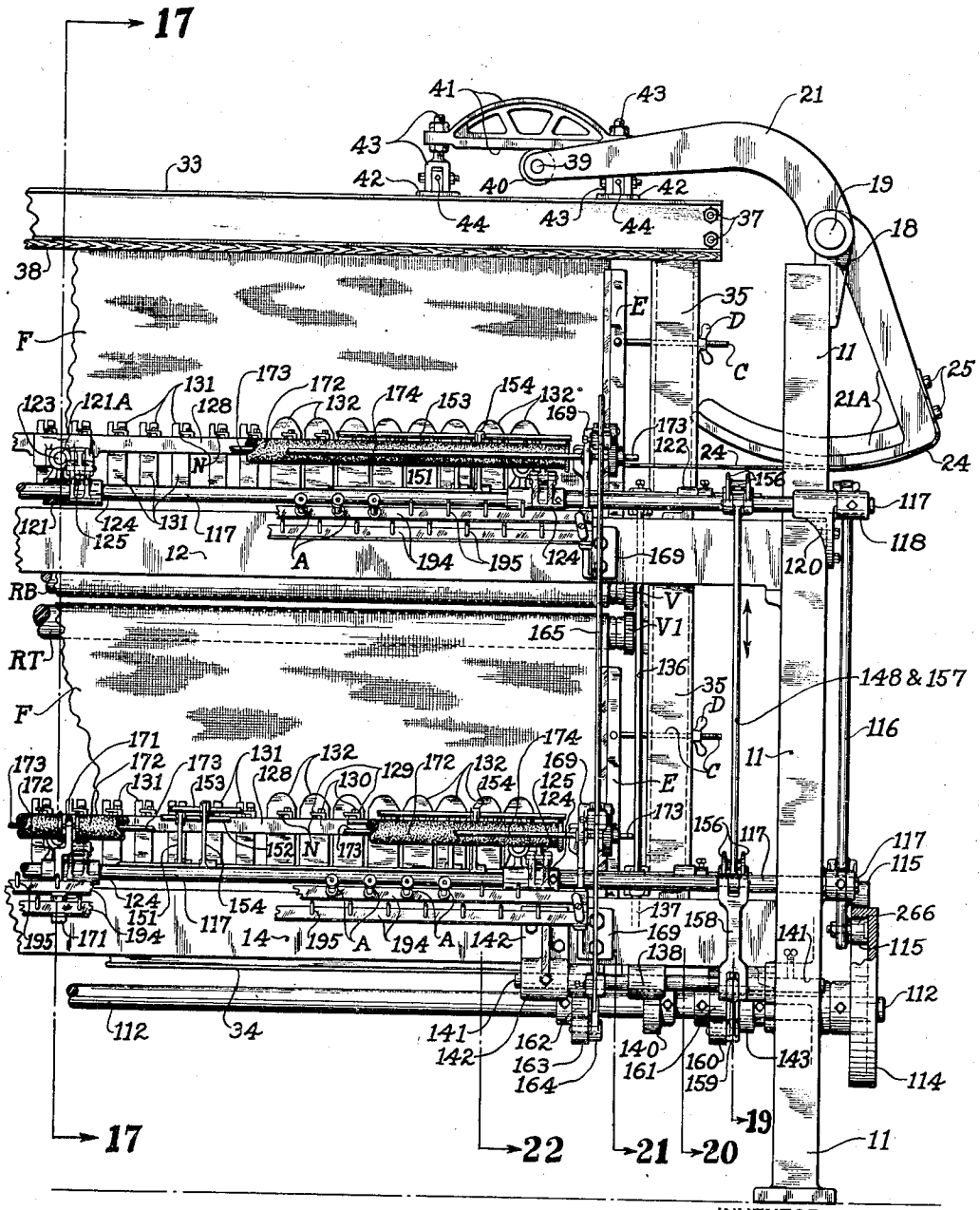


Fig. 10A.

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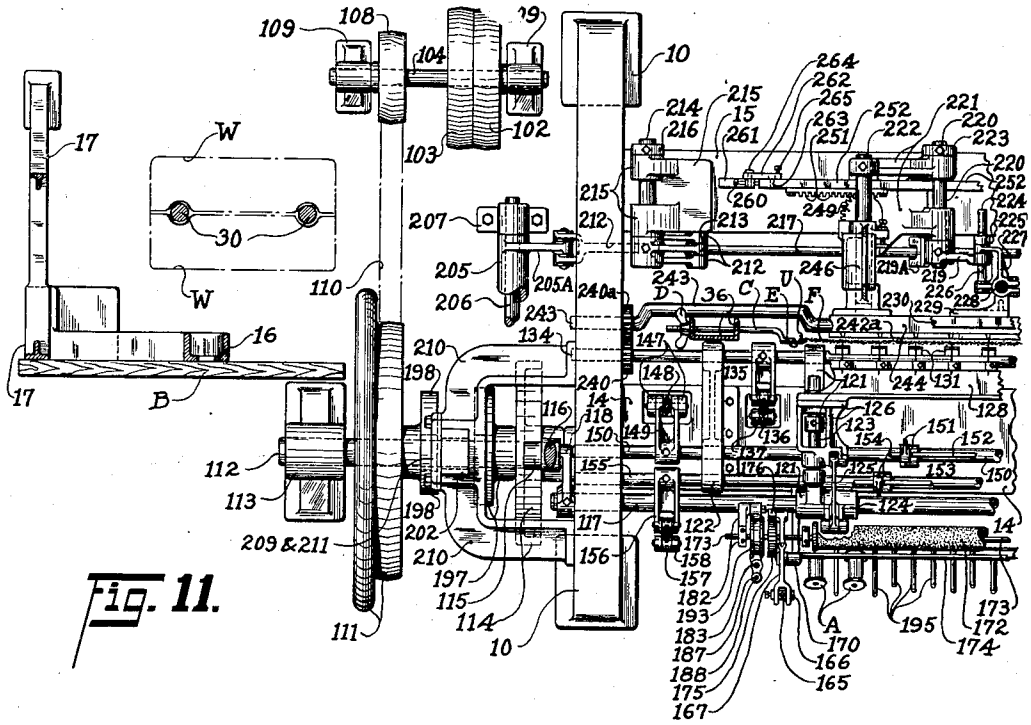


Fig. 11.

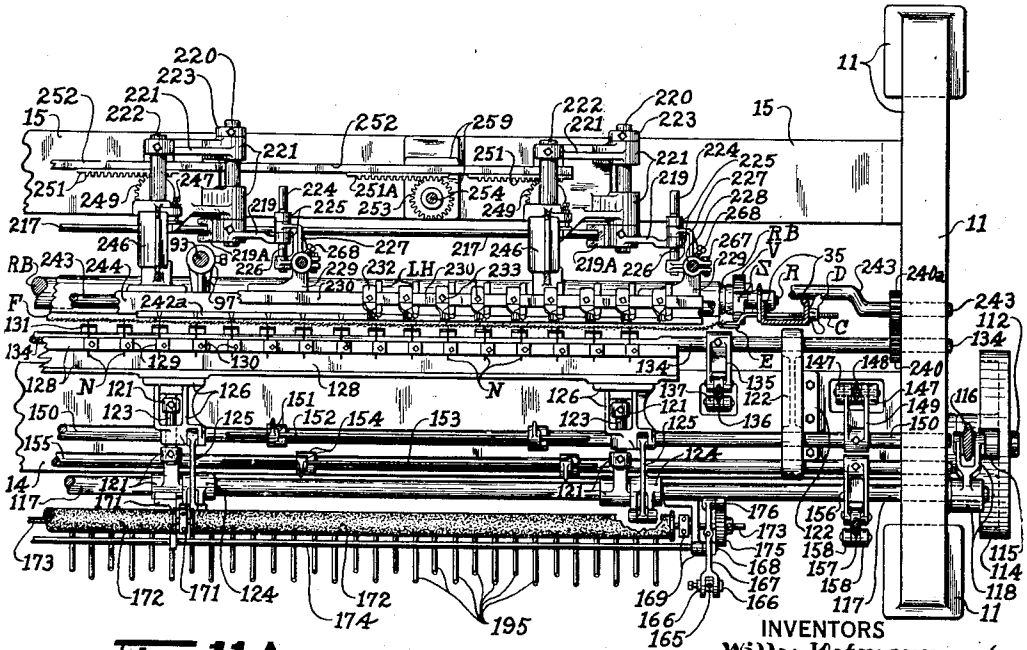


Fig. 11A.

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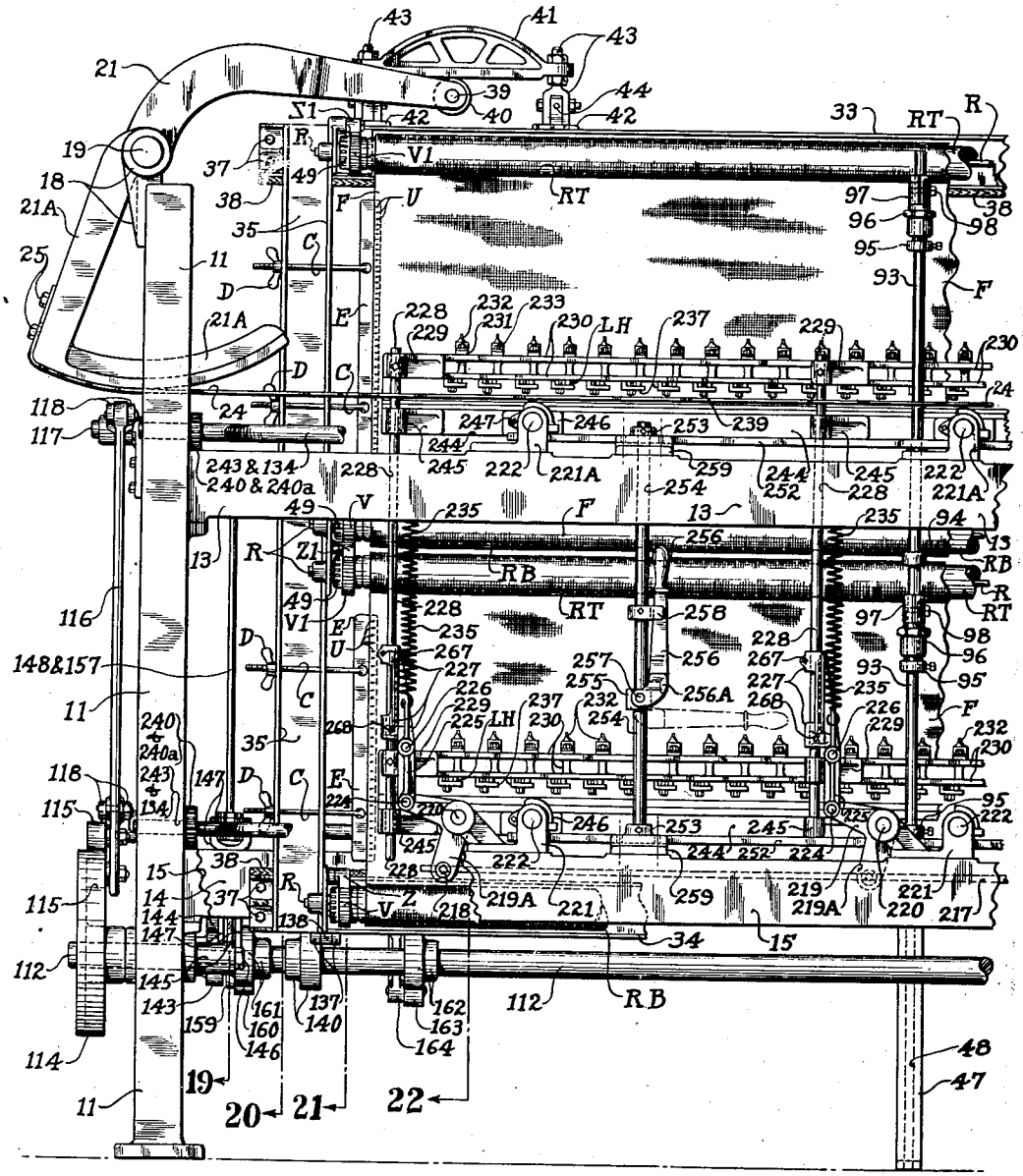


FIG 12.

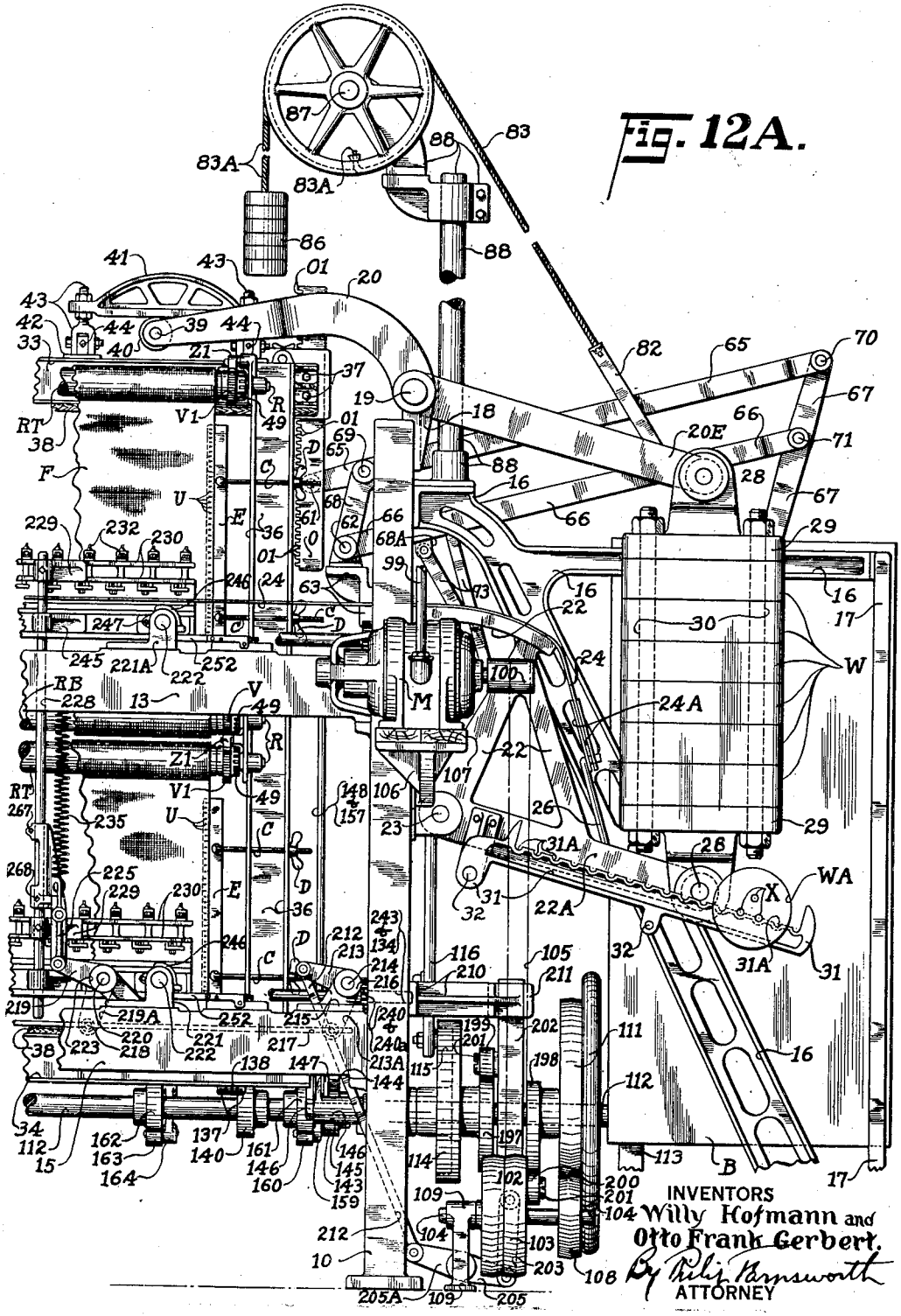
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Fig. 12A.



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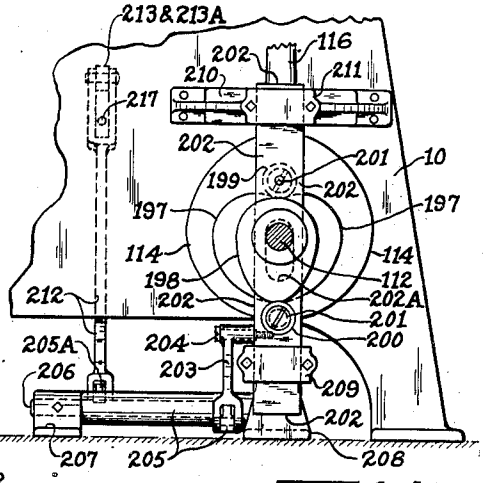


Fig. 14.

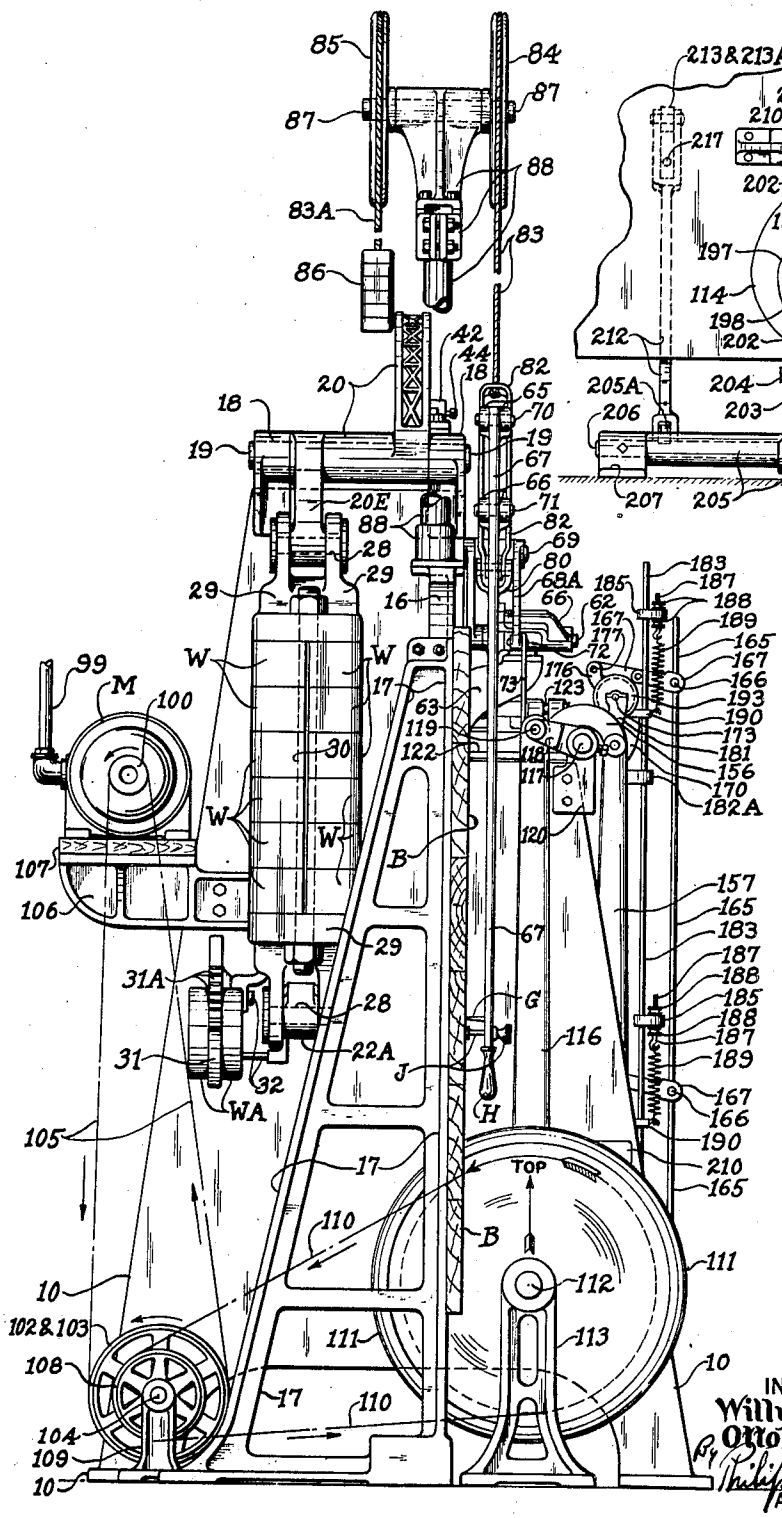


Fig. 13.

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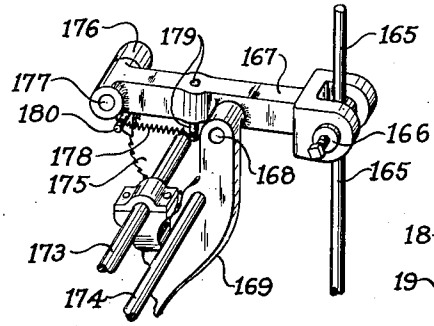


Fig. 16.

Fig. 15.

INVENTORS
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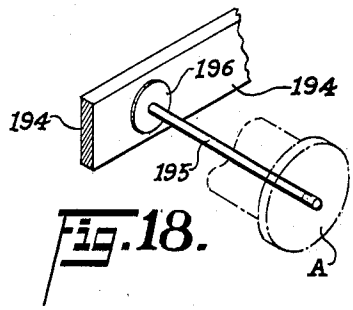


Fig. 18.

Fig. 17.

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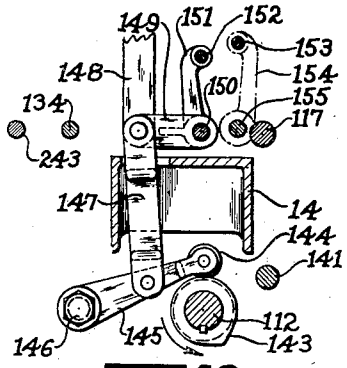


Fig. 19.

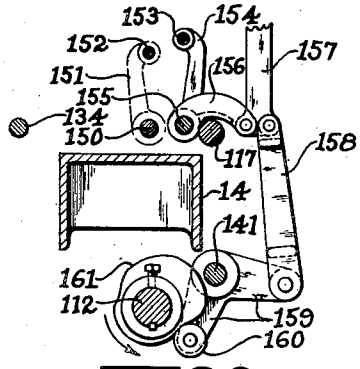


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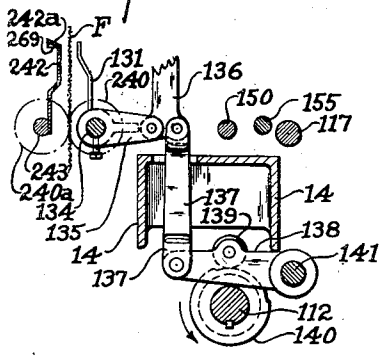


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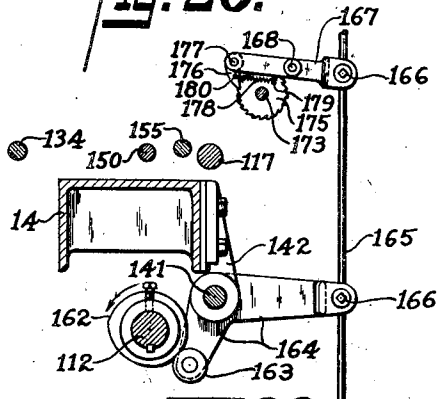


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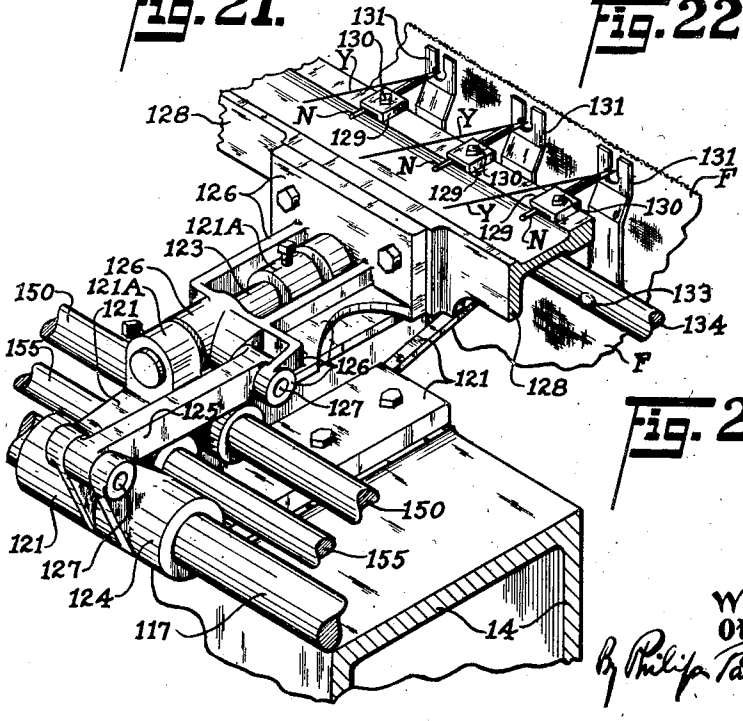


Fig. 23.

INVENTORS
Willy Hofmann and
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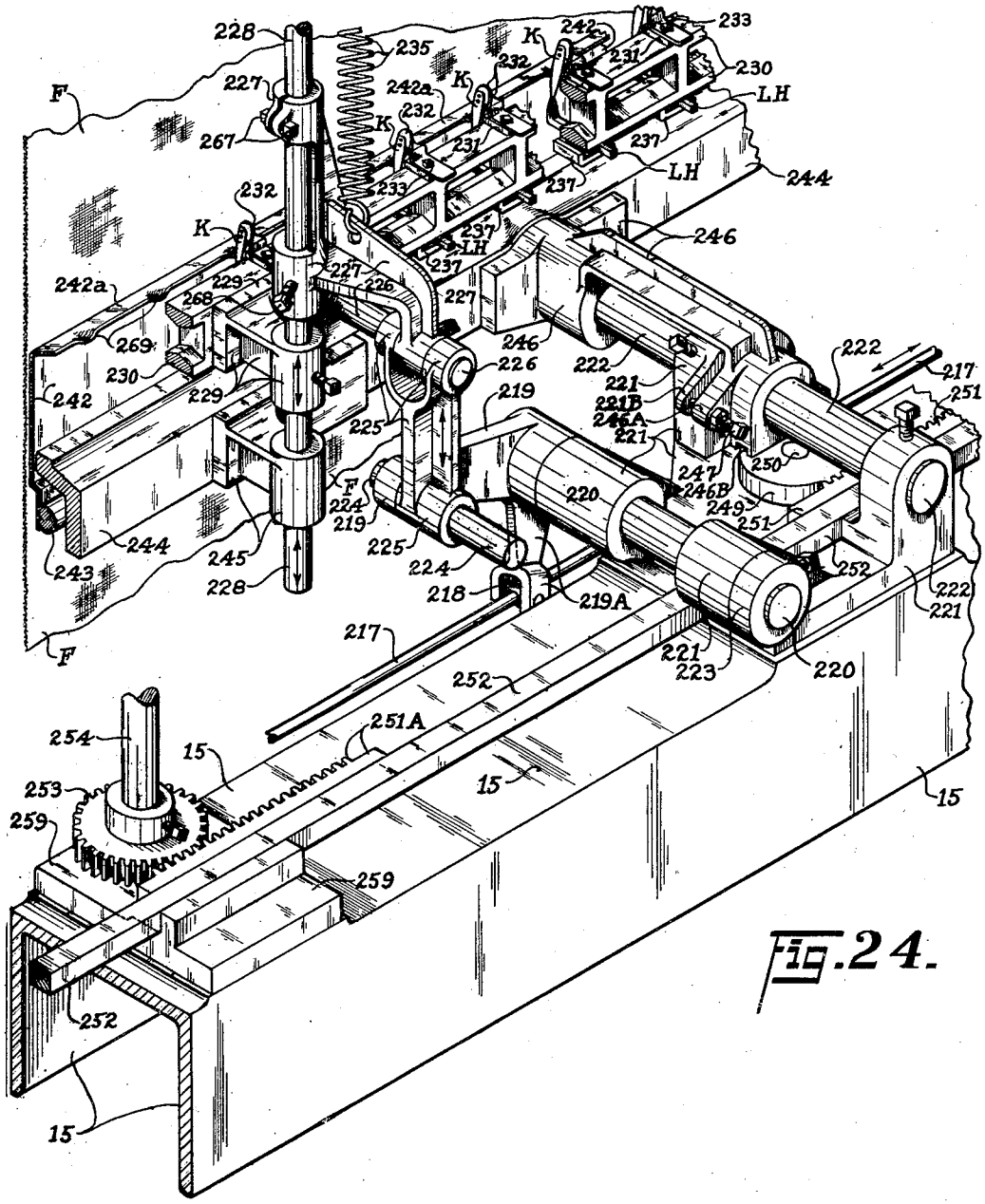


Fig. 24.

INVENTORS
Willy Hofmann and
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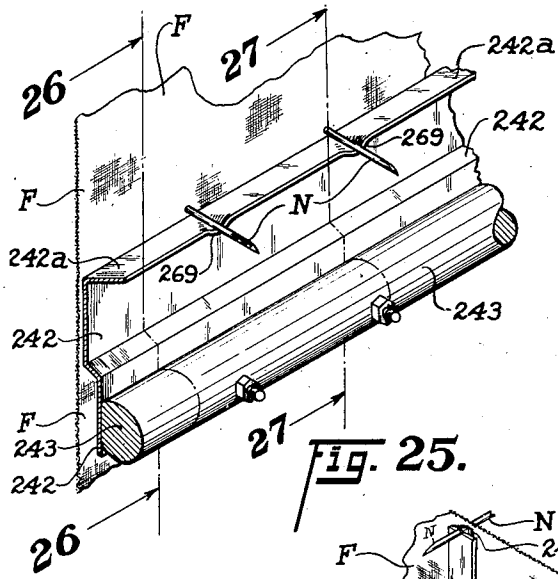


Fig. 25.

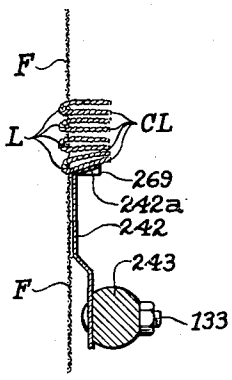


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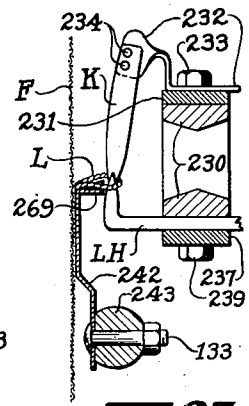
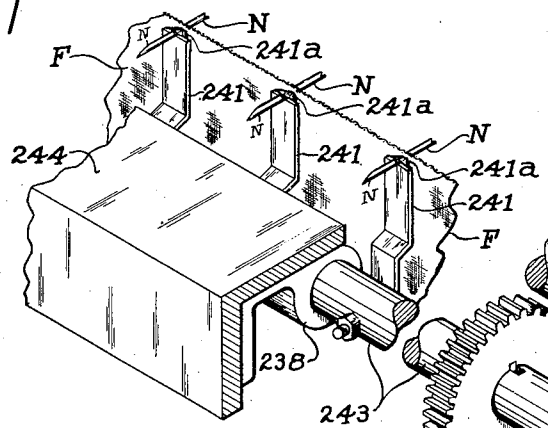


Fig. 27.



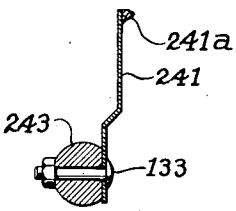


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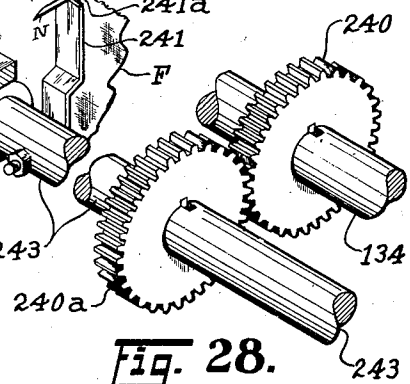


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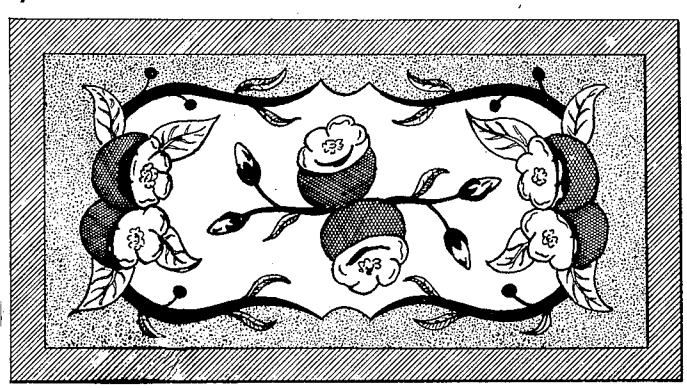


Fig. 29A.

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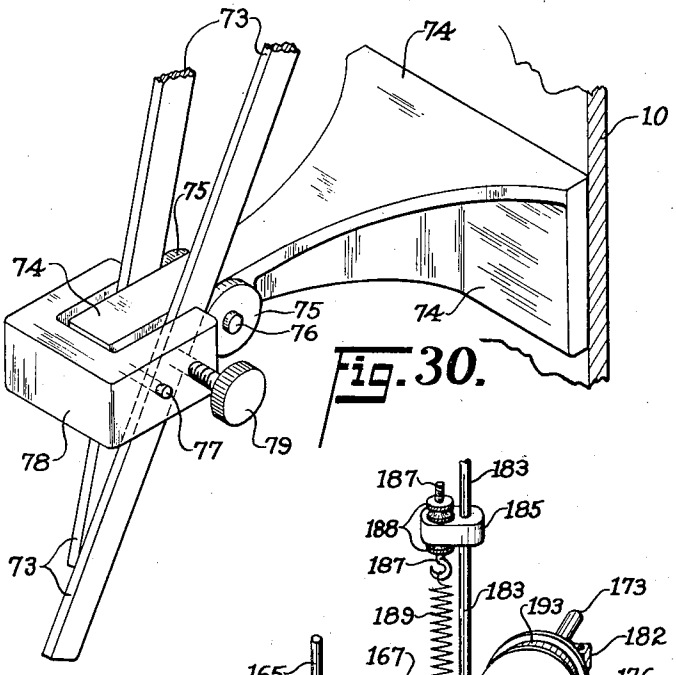


Fig. 30.

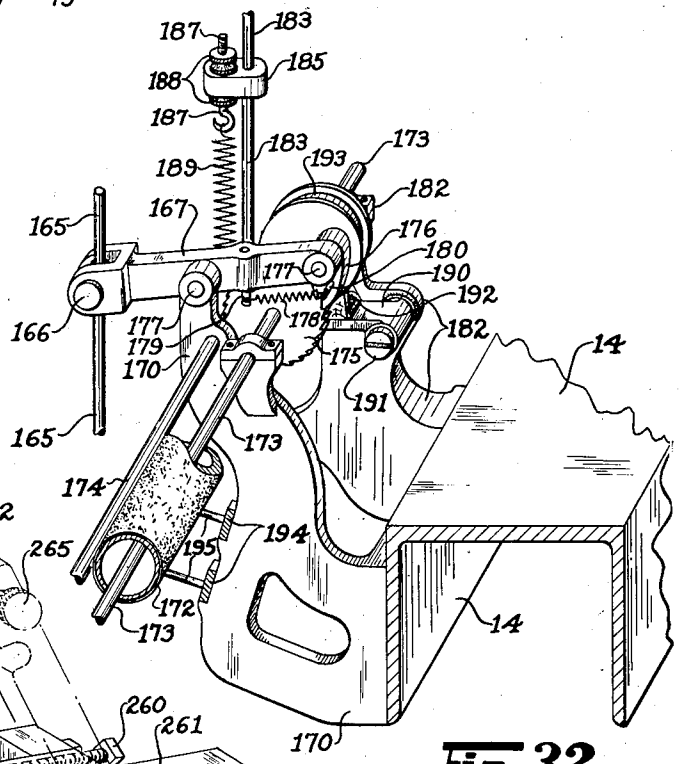


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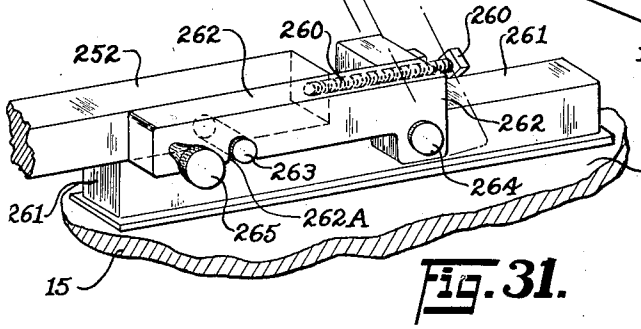


Fig. 31.

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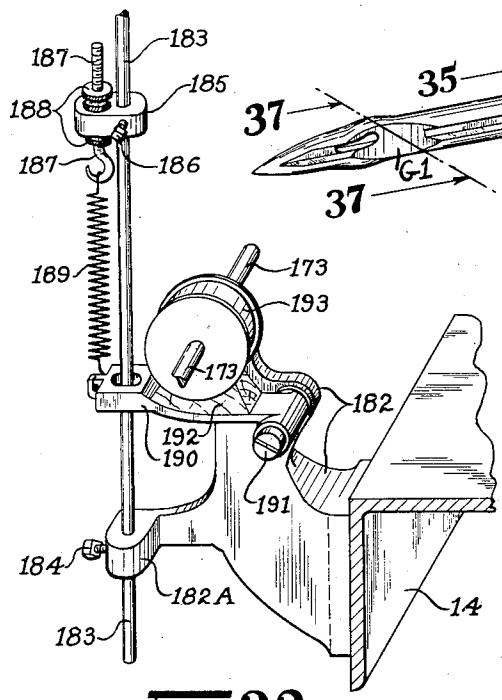


Fig. 33.

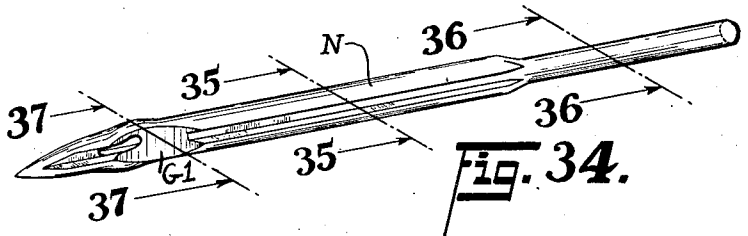


Fig. 34.



Fig. 35.



Fig. 36.

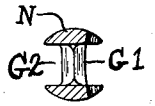


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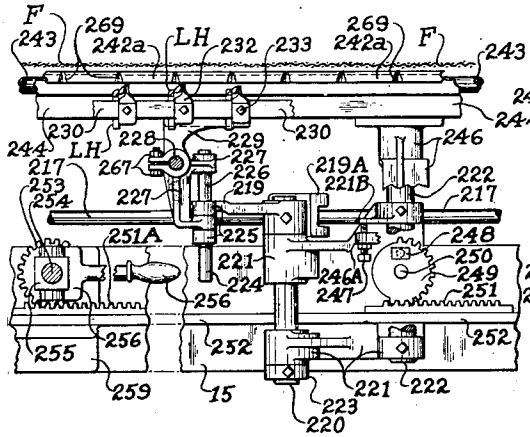


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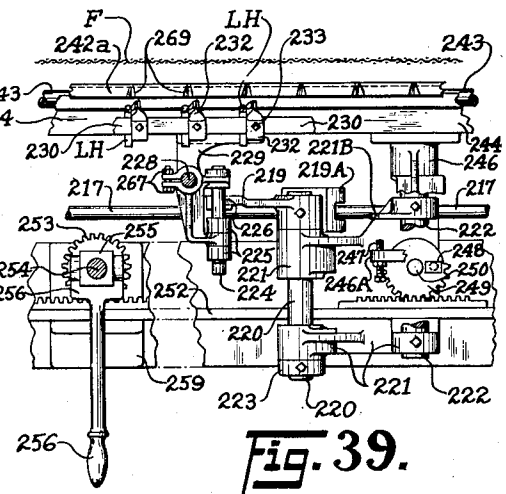


Fig. 39.

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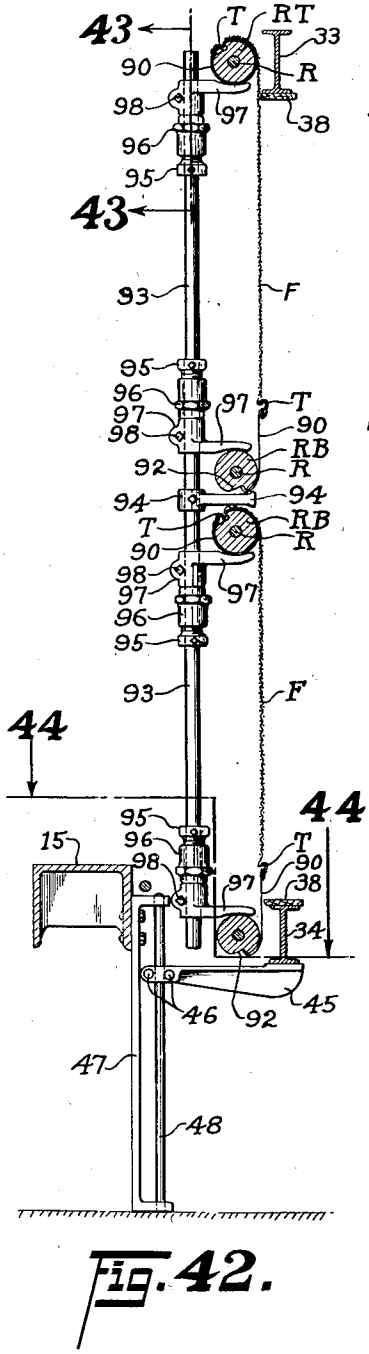


Fig. 42.

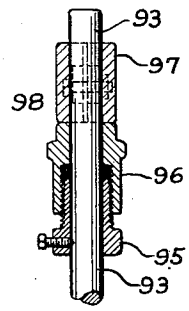


Fig. 43.

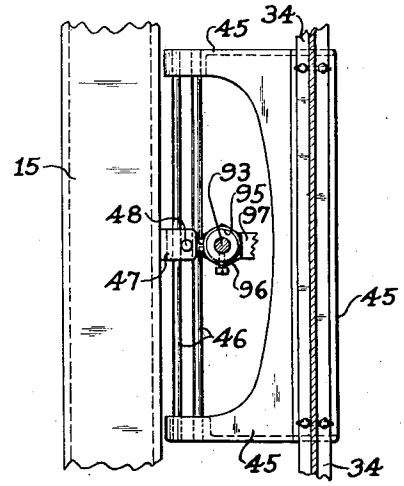


Fig. 44.

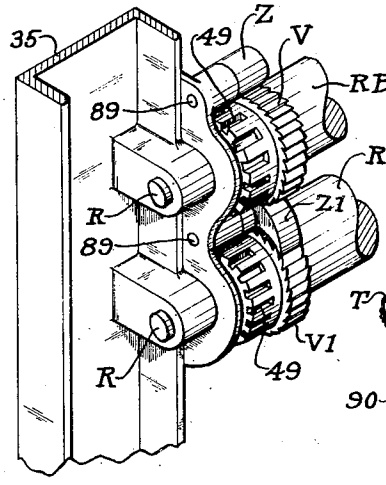


Fig. 41.

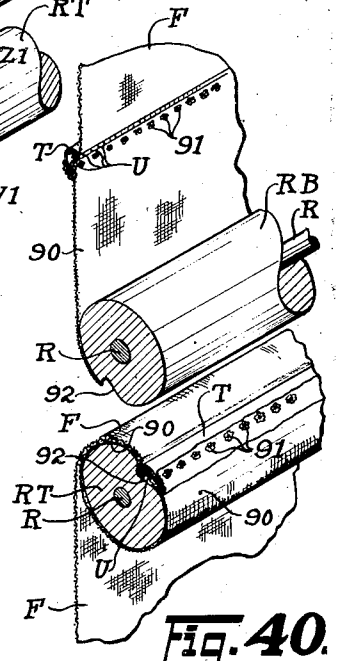


Fig. 40.

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TURFING MACHINE

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This invention relates to a turfing machine simultaneously producing a plurality of fabric articles by the projection of loops of threads of yarn or other material through the meshes of a suitable base fabric, preferably but not necessarily with a cutting of the loops to form a pile surface projecting from the base fabric; but certain of the mechanisms can be employed to produce one turfed article at a time, although an important advantage of the machine shown is the ability to reduce production costs by the simultaneous production of a considerable number of turfed articles at the expense of only one operator and one attendant for all.

The machine disclosed is designed particularly for the production of hook rugs preferably with cutting of the loops of thread to form pile threads constituting a pile surface on the base fabric. Substantially the same general design of machine, however, may be employed to produce almost any other turfed articles, with loops or pile threads of greater or less length.

An important object of the invention is to improve the quality of machine-made turfed fabric articles inclusive of hook rugs, and to reduce production costs thereof.

The invention is embodied in the novel machine as a whole which is shown in the drawings, and includes various novel features and combinations of features constituting cooperative elements of the entire machine; and the invention particularly includes novel turfing elements and also novel combinations of turfing elements with mechanisms for operating them correlatively by power transmissions.

In attaining the desired objects by means of said constituents of the invention, especially our novel turfing elements and combinations of turfing elements, we have employed in such combinations certain features of prior machines of the multiple-needle embroidering type with various radical modifications adapted to the production of hook rugs and the like in lieu of embroidery, preferably with a cutting of the thread loops, and adapted to the production of any desired kind of turfed fabric by way of projection of loops of the thread through the meshes of a base fabric, preferably with the cutting of such loops to form pile surfaces wherein the cut ends may be of any desired uniform length.

Although the machine as a whole appears somewhat complicated, yet it is entirely practical and its construction and operation are relatively simple as compared with prior machines for doing inferior work at higher cost, for one reason on account of the omission of all operations for securing the thread-loops to the base fabric or holding them thereto by any means other than friction which in our machine is relied upon exclusively, as in the ordinary hand-made hook rug, to hold the loops or pile-threads and base-fabric together, i. e., the two threads projected as a loop thru a mesh of the base-fabric are held thereafter adjacent one another in said mesh, Fig. 1A, by friction of the two threads with the sides of the mesh and with one another, and held by the two short lengths of thread or loop-feet lying flat against the other side of the base fabric and joining the respective lengths of the threads extending thru said mesh with the two threads respectively in the two adjacent meshes on the two sides of said mesh. In other words, the operation of the machine so far as concerns the projection and cutting of the loops, is made to conform as nearly as possible to the manual production of hook rugs and the like, which heretofore have been produced almost exclusively by hand, and wherein the turfing likewise was held in the base fabric by friction alone. However, in order that such usual prior manual operations might be effectuated automatically by multiple-needle embroidery machinery, we have found it necessary to devise various cooperating mechanisms which constitute important elements of the invention.

Of the drawings, Figs. 1–6 and 1A–6A are views (about half scale) showing one of the plural sets of turfing mechanisms or elements directly involved in the projection and cutting of the loops, Figs. 1–6 being transverse sections of the same illustrating their relative positions at different portions of their cycle of operations, and Figs. 1A–6A being perspectives which pertain respectively to said sectional views; all these figures being of somewhat reduced scale but enlarged with respect to the figures showing the machine as a whole including assemblies of said turfing elements with their coordinated operating mechanisms such as in Figs. 10–17.

Fig. 7 is a chronological diagram showing the relation of various moving parts of the machine at each of all stages of one complete cycle of their operations.

Fig. 8 is a perspective in larger scale even than Figs. 1A–6A, for clearness, of a portion of the long side of the machine, looking at the front ("needle side") from which the loops of threads are projected horizontally by needles N thru the meshes of the vertical base fabric F to form loops on the other side thereof, this figure illustrating the relative spacing of the plurality of devices (such as

the needles N) which carry the thread-loops through the base-fabric, this figure also illustrating the method of feeding the threads from the reels or bobbins A when making a pile fabric as of cut loops CL shown on the other side of the base fabric F.

Fig. 9 is a perspective similar to Fig. 8 but illustrating the method of feeding the yarns from bobbins A when the projected lops L are not cut to form a pile surface; Figs. 8–9 being between one-third and one-fourth true scale.

Figs. 8–9 show a few but not all of the loop-carriers N which act to produce one turfed article; these figures showing only a small portion of the side of the long machine shown by Figs. 10–10A, the intermediate portion of the machine including hundreds of carriers or needles N of which many in a row (or two rows one above another) produce a single turfed article, and the total number of needles N producing a plurality of turfed articles simultaneously.

Fig. 10 is an elevation of the assembled machine showing its total height but only a portion of its long front side, i. e., the same (needle) side of the machine shown in Figs. 8–9. That is, Fig. 10 shows the left-hand portion of the same (needle) side of the machine and including the elements a few of which are shown in larger scale in Figs. 8–9. (The actual machine is about ten feet high.) The single operator of the machine is stationed in front at the left of Fig. 10 in position to grasp the handle H which operates the pantograph to move simultaneously the two vertical horizontally long base-fabrics F, F supported in a vertical plane above one another, in accord with a given design on the pantograph master-model, such as a design of the product shown in Fig. 29A.

Fig. 10A is an elevation of the same (needle) side of the machine shown in Fig. 10, but of a right hand portion of the needle side of which a left hand portion is shown in Fig. 10; the machine being as long as may be desired between the left and right-hand portions shown in Figs. 10–10A, for multiplexing the simultaneous operations to any desired extent, for any desired number of duplicate products, the machine economically and actually being from 45 to 60 feet long and upwards for that purpose; about five-eighths of such length being occupied by the two upper and lower lengths of base-fabrics F, and the other three-eighths being occupied at the ends by the operating and controlling mechanisms shown in Figs. 10–10A, the lengths of base-fabrics F extending intermediate such ends.

Fig. 11 is a sectional plan of the left-hand portion of the machine shown in Fig. 10, showing the left hand portion of the lower bank or horizontal row of successive groups or sets of turfing elements, which operate on the lower of the two base-fabrics F, as seen by looking down at the horizontal plane 11—11 of the vertical transverse sectional elevation of Fig. 17.

Fig. 11A is a plan similar to Fig. 11 but of the parts to the right of Fig. 11, i. e. at the right hand of an observer facing the needle side of base-fabric F as in Figs. 8–9; Fig. 11A being a sectional plan of the right hand end portion of the needle side of the machine which is shown in Fig. 10A.

Fig. 12 is an elevation of the rear of the portion of the machine shown in Fig. 10A, Fig. 12 therefore showing the loop or pile side of the machine, i. e., the side of base-fabric F from which the loops L project and to which they are projected through the base-fabric from the needle side thereof shown in Figs. 8, 9, 10 and 10A.

Fig. 12A is an elevation of the rear of Fig. 10, i. e. showing the rear or loop or pile side of the left hand portion of the machine of which the front or needle side is shown in Fig. 10.

Fig. 13 is an elevation of an end of the machine, i. e., the left hand end seen by looking from the left of the side elevation of Fig. 10, at the left of an observer facing the front or needle side of base-fabric F as in Figs. 8–9. This is the operator's end where are located the pantograph control (handle H) for moving fabrics F edgewise across the paths of carriers or needles N, and the main driving means for the several turfing elements including N.

Fig. 14 is a sectional end elevation on line 14—14 of Fig. 10, showing the shaft for the cams 114, 197, 198 (Fig. 12A, lower middle), which control the simultaneous movements of the multiple needles N for the projection of the thread-loops thru the meshes of the base-fabric F, these cams also controlling the apparatus for holding the loops so projected in place during the rest of the turfing operations on such loops; and said cams also controlling the apparatus for cutting the loops to form pile threads constituting a pile surface projecting from base-fabric F.

Fig. 15 is an elevation of the end of the machine opposite to that shown in Fig. 13, i. e., the end seen by looking from the right of Fig. 10A, at the right of an observer facing the needle side of base-fabric F as in Figs. 8–9. This is the "journal end" of the machine, i. e., the end opposite the operator's end where the pantograph and main driver are located, this journal end including the journals for the various operating rods extending longitudinally of the machine and operated at their other ends by the main driver M.

Fig. 16 is a perspective showing the ratchet-feed mechanism of thread-feed-rolls 172 duplicated at top and bottom (for the duplicate base-fabrics F and shown in Figs. 8–9), the rolls being covered with frictional material.

Fig. 17 is a sectional elevation through the entire shorter dimension of the machine as a whole, taken at 17—17 of Fig. 10A; the right-hand of Fig. 17 being the needle-side of the machine, and the left being the loop or pile side thereof.

Fig. 18 is a sectional perspective of the spindle-pin arrangement for the thread-bobbins of Figs. 8–9.

Fig. 19 is a section at 19 of each of Figs. 10A and 12, showing mechanism for oscillating the bar 152, which in Fig. 9 controls supply of threads from bobbins A to the loops projected thru the base-fabric F by carriers or needles N, the action by bar 152 being at a critical stage of the turfing method of Fig. 9.

Fig. 20 is a section at 20 of each of Figs. 10A and 12, showing mechanism for oscillating the bar 153 which in Fig. 9 cooperates with bar 152.

Fig. 21 is a section at 21 of each of Figs. 10A and 12, showing mechanism for operating the presser-fingers on the needle side of base-fabric F, as fingers 131 or 132 of Figs. 8–9.

Fig. 22 is a section at line 22 of each of Figs. 10A and 12, showing mechanism for braking feed-roll 172 of Figs. 8–9, in association with the drive for said roll shown in Fig. 16; both said drive and brake being shown also in Fig. 32 in perspective; and the brake being shown separately in Fig. 33.

Fig. 23 is a perspective from a viewpoint similar to that of Figs. 8–9, i. e., at the needle side of base-

fabric F, but showing more particularly the cam-controlled mechanism for simultaneously reciprocating the multiple needles N back and forth thru the meshes of the base-fabric F for the purpose of carrying the thread of yarn or other material thru the meshes of the base-fabric to form loops projecting from the other side of the latter.

Fig. 24 is a perspective of mechanism located at the loop or pile side of base fabric F, this mechanism being located along the long side of the machine opposite to the needle side shown in Figs. 8–9 and 23, this mechanism in Fig. 24 including particularly the common carrier **230** for the turfing mechanism LH and K ancillary to the needles N, and operating on the loops formed by the needles, and shown in Figs. 1–6 and Figs. 1A–6A; Fig. 24 also showing the mechanism for operating said turfing-mechanism carrier **230**; that is, Fig. 24 illustrates the mechanism for operating parts LH and K which act inside the loops after they have been formed by the operation of the needles N by the mechanism shown in Fig. 23.

Fig. 25 is a perspective showing the plate-like base-fabric-support or clamp **242** and associated parts all located on the loop or pile side of base-fabric F, i. e., the side to which needles N carry the thread to form the loops on that side; this support **242** cooperating with the presser-fingers **131**, Fig. 23, on the needle side of fabric F, and with the turfing elements N, LH and K.

Fig. 26 is a vertical section at **26—26** of Fig. 25.

Fig. 27 is a section at **27—27** of Fig. 25.

Fig. 28 is a perspective showing three of the plurality of certain finger-like nose-carrying supports **241** and associated operating mechanism, these being alternative with and preferable in most cases to support **242** of Figs. 25–27, and being shown in assembly in Figs. 1–6 and in the upper and lower rows in Fig. 17.

Fig. 29 is a section of one of said supports **241** and one way they may be mounted for operation by the mechanism of Fig. 28.

Fig. 29A is a view of a hook rug with cut loops (closely associated pile threads) produced by the machine, this figure illustrating the perfection of the product and the fact that in the machine there is absolute freedom for production of any desired design, upon employing the supports **241** of Figs. 28–29; this Figure 29A showing one unit of the simultaneously produced multiple units on each of the two base fabrics F, F of Figs. 17, 42, 10, 10A, 12, 12A; the completed unit of this Fig. 29A having been cut out as by hand, from a base fabric F on which the pile-fabric has been machine-fabricated in multiple.

Fig. 30 is a perspective of a locking mechanism for the pantograph control shown at the left of Fig. 10 by which a single operative controls the simultaneous production thruout almost the entire area of the base-fabric F, of a plurality of turfed articles all of the same but of any desired design, the machine duplicating the design of the master design which the operative follows with the pantograph control of the machine, analogous to the practice heretofore in multiple embroidering machines.

Fig. 31 is a perspective of mechanism for withdrawing away from the base-fabric F, the knife or loop-cutter K and loop-holder LH, of Figs. 1–6 and 1A–6A.

Fig. 32 is a perspective of the drive and brake mechanisms shown also in Fig. 22, for the thread-feed-roll **172** of Figs. 8–9.

Fig. 33 is another perspective showing particularly the braking mechanism of Figs. 32 and 22, for feed-roll **172**.

Fig. 34 is a perspective of one of the multiple loop-carriers or needles N which carry the thread through the meshes of the base fabric to form loops on the rear side thereof; this figure being triple scale.

Fig. 35 is a section at **35—35** of Fig. 34.

Fig. 36 is a section at **36—36** of Fig. 34.

Fig. 37 is a section at **37—37** of Fig. 34.

Fig. 38 is an enlarged showing of a portion of the plan of Fig. 11A, this Fig. 38 showing the turfing elements LH and K of Figs. 1–6 in normal operating position adjacent the loop-side of base fabric F, i. e., in the position which these parts occupy during operation of the machine.

Fig. 39 is a duplicate of Fig. 38 modified to show the positions of said turfing elements LH and K temporarily withdrawn manually from the operating positions shown in Fig. 38, i. e., away from base fabric F, for the purpose of permitting removal of a base fabric and the multiple productions fabricated thereon, and substitution in the machine of a fresh base fabric in readiness for fabrication in multiple thereon.

Fig. 40 is a perspective of fabric-supporting rolls RT and RB, of Figs. 10–10A, right middle, and Fig. 42, which extend longitudinally of the machine and support base fabrics F in generally taut condition in position for the multiplex loop-projection therethru, this Fig. 40 showing the method of pinning base fabrics F temporarily to permanent lead-fabrics **90** which in turn are secured permanently to the supporting rolls RT and RB.

Fig. 41 is a perspective showing the ends of said fabric-supporting rolls of Figs. 40 and 42, and showing the mechanism for adjusting and locking these rolls for the purpose of establishing and maintaining a tension on the base fabrics which tension is generally suitable to permit proper loop-fabrication thereon in accord with the invention, with the cooperation of presser-fingers **131** of Figs. 1–6 and clamps **241** of Figs. 28–29.

Fig. 42 is a vertical section of the frame for the said supporting rolls for the base-fabrics F, two of such fabrics extending in vertical planes, one above the other, longitudinally of the machine of Figs. 10–10A, this Fig. 42 illustrating the spreader arrangement for the several pairs of fabric-rolls RT and RB by which equal tension on the rolls is maintained throughout their entire long length, thereby preventing sagging or bending of the rolls by stresses caused by base-fabrics F which the rolls support in taut condition.

Fig. 43 is a vertical section on line **43—43** of Fig. 42.

Fig. 44 is a sectional plan on line **44—44** of Fig. 42, showing the guiding mechanism for the bottom of the fabric frame which includes parts **33—36**.

The above drawings have been made from a machine which is in practical operation in the production of cut-loop pile-surface hook-rugs (wherein the loops are cut as at CL, Fig. 8) embodying various designs as indicated in Fig. 29A, the patterns being marked by vari-colored yarns from bobbins A, Fig. 8. A single human operator of the exemplary machine controls the simultaneous production of many duplicate rugs or other unit turfed products by operating the pantograph handle H, Fig. 10; or, as in some types of multiple embroidery machines, automatic mechanism may be provided, including a hole-punched pattern as in automatic musical

instruments, whereby the base-fabrics F are moved edge-wise in their respective planes in accord with the master-pattern, across the paths of needles N, in order by successive movements to present fresh meshes of the base-fabric to the paths of action of N carrying additional loops thru the fabric. An attendant sees to it that bobbins A are kept supplied with threads or yarns of the colors proper for the desired design, and that if any thread is broken its ends are tied together. A plurality of needles N (loop-carriers) operate simultaneously on each rug or other unit product, being reciprocated thru the fabric and while extending therethru holding it stationary against its tendency to be moved by the pantograph. The multiplex unit products are fabricated in spaced relation to one another along the two (upper and lower) base-fabrics F, Figs. 42, 17, 10, 10A, 12 and 12A. The time occupied in completing the multiple fabrications depends on the uniform size of the unit products distributed over the base-fabrics F, and upon the nature of any given design, because the number of needles operating on a given unit design is inversely proportional to the complications of the design, and the fewer the needles are for each turfed article, the longer the time required to complete the fabrication. All the loop-carriers N (and their cooperating turfing implements of Figs. 1–6) operate simultaneously with their mates, each unit product being fabricated by a plurality of carriers or needles N, etc., the group lying in two horizontal banks or tiers, Fig. 17. Those of the needles N which lie between the spaced unit products, i. e. outside the superficies of the products, together with the turfing implements grouped with each of such needles, do not participate in such fabrication, and the bobbins A for such needles are not supplied with thread.

The turfing implements grouped in multiple and cooperating with each of the multiple loop-carriers or loop-formers N are, Figs. 1–6, the loop-holder LH, the knife or loop-cutter K, the presser-finger **131** or **132**, and the clamp **241** (Figs. 28–29 or **242**, Figs. 25–27), each of which implements is in groups with the others, each group including one of each of said implements, save for member **242**, Figs. 25–27, common to plural groups. Each loop-holder LH moves into a given loop L, after the projection of such loop by needle N thru a mesh of base fabric F, and holds such loop from retraction or shortening by the backward movement of the needle N toward its initial or "home" position, until LH moves down out of the loop, whereupon knife K, Figs. 2–3, before actually cutting the loop, acts temporarily as a loop-holding substitute for the departed principal loop-holder LH. During this time, and when the cutters K are employed, as preferred, (i. e. to produce the cut loops or pile-threads CL of Fig. 8) the multiple loop-holders LH simultaneously enter the simultaneously formed loops and hold them extended from fabric F and in position to receive knives K, this action of LH in holding the loops being assisted by the pressure-fingers **131**, Figs. 1–6, or **132**, Figs. 8–9, and by supports **242**, Figs. 25–27 for making square designs as in Figs. 8–9, or by supports **241**, Figs. 28–29, for making curved designs such as in Fig. 29A. And **241** or **242** cooperates with knives K in their temporary loop-holding action as above after LH have been moved down out of the loops.

As shown, LH and K both are fixed to a common support operated (many pairs of them extending in two banks or rows longitudinally of the machine) by rods **228** which move them up and down vertically; but such common mounting and operation of LH and K are not essentials altho a desirable and simple and far preferable arrangement.

Needles N, for each operation of forming a plurality of loops, may have either a double stroke or throw (curve **1**, Fig. 7) or single throw (curve **2**, Fig. 7); and with the mechanism shown for the double stroke, Fig. 22, the first stroke or throw is preliminary to passage of the needle and thread-loop thru fabric F, said passage occurring during the second stroke of the needle.

The operations of all the above moving parts (save fabric F when controlled by an operator at pantograph handle H, as shown), are chronologically coordinated in the construction of the machine shown, by means of the proper proportioning of the power transmissions to each of them from the electric induction motor M, Figs. 12A–13. As to the movements of base-fabric F, the operation at pantograph handle H (or alternative automatic mechanism for moving fabrics F) involves maintenance of a constant tendency on fabric F to move it edgewise in its plane to present fresh meshes to multiple needles N and their thread-loops; but fabric F is held from actually so moving by the needles while they extend thru its meshes, and by pressure-fingers **131** or **132**, and by fabric-clamping fingers **241** or plate **242**, so that fabric F does not yield to said tendency to move until N and **131** or **132** and **241** or **242** are withdrawn toward their "home" positions away from the fabric.

The above turfing elements, shown in cooperative relationship in Figs. 1–6, (and particularly LH and K in Figs. 1A–6A), are embodied in the complete machine shown in the other figures, but they may be embodied in other machines operating equivalently to operate substantially the same turfing mechanism of Figs. 1–6 operating in substantially the same manner. Conversely the machine assembly of the other figures may be combined with other turfing elements than those of Figs. 1–6 but equivalents in construction and operation. And both the turfing elements of Figs. 1–6 and the rest of the assembly of the other figures, may be modified in many respects while yet being constructed and operating substantially as shown and described.

A complete written verbal disclosure of the time-relations of the coordinated movements of the above turfing elements would be a long story which however is shown clearly in short form by the chronological chart of Fig. 7 which shows a complete cycle (360 degrees) of the operations of all said turfing elements and the relations of the positions of each of them in space relative to all of the others, at all parts of said cycle which occupies only a half second of time.

In Fig. 7, the small circles on the respective curves **1–9** indicate instants where the movements of the parts are stopped, or changed in direction, or effect some result such as loop-cutting, etc. For example as to the latter, the small circle **4a** on curve **4** of Fig. 7 indicates the instant of loop-cutting of Fig. 3.

In Fig. 7, at the left, are three curves **1–3**, each shown in relation to a separate showing of the base-fabric F as indicated. These curves **1–3** show the movements of the parts on the needle-side of the fabric F which move to and from the plane of the fabric at substantially right angles thereto, i. e., needle N (either curve **1** or curve **2**), and, curve **3**, pressure-finger **131** or **132** and sup-

port 241, or 242 when 242, Fig. 25, is arranged to be movable as is 241 in Fig. 28. The multiple pressure-fingers 131 simultaneously engage against the portions of the multiple yarn-loops L which lie flat against the needle-side of fabric F, Figs. 8–9, i. e., against the feet of the loops at their opposite ends from their curved portions or heads. Curve 1 shows the motions of the double-stroke needle the mechanism for which is shown in Fig. 23; curve 2 those of the alternative single-stroke needle; and curve 3 the motions of the pressure-finger 131 or 132 on the needle-side of fabric F, and the motions of support 241 or 242 on the opposite or loop side of fabric F, the devices on the two sides moving toward fabric F and toward one another to grip or clamp the fabric between them, Figs. 1–6, 17. All these motions are shown by curve 3 of Fig. 7 in timed relation to the needle N and in spatial relations to fabric F.

In Fig. 7, curve 4 shows the motions (in timed relation to one another) of turfing elements K and LH which do not engage the base-fabric F, so that therefore this curve is not accompanied by separate relative showings of fabric F as in the above case of curves 1—3. Curve 4 shows the vertical movements of knife K and loop-holder LH, on the loop side of fabric F and parallel to its vertical surface. Curve 5 shows the operation of thread-feed roll 172, Figs. 8–9, 32, by the movements of yarn-feed cam 162, Figs. 10, 10A, 12, 12A, and shows how roll 172, intermittently operated, commences to pull the threads from bobbins A just before needles N commence to leave home from their side of fabric F to carry a loop thru the fabric. At 5a is indicated the end of partial rotation of roll 172, and the lower dotted portion of the curve indicates the retraction of the operating pawls 176 but not of the roll itself; for the intermittent movements of the roll always are in the same direction. Curve 6 shows the movements of thread-release bar 153, Figs. 8–9, by its arms 154 on rock-shaft 155. Curve 7 shows the movements of thread-release bar 152, Figs. 8–9, operated by its arms 151 on its rock-shaft 150 over a shorter arc than above bar 153 with which 152 cooperates. Curve 8 shows the movement of base-fabric F (between the small circles at 10 degrees and 60 degrees), as by pantograph and handle H shown (or by the well-known automatic mechanism, not shown, of common multiple embroidery machines), these movements of base-fabric F being between the times when loop-carriers N lie in positions extending thru the meshes of base-fabric F, i. e., between the times when fabric F is stationary while N, (between about 92 degrees and about 300 degrees, curve 1, Fig. 7), extend thru fabric F. In this curve 8, the full line near the top, between 10 and 60 degrees, shows the movement of fabric F when needles N are in positions not projecting thru its meshes, such fabric movement edgewise in its own plane acting to present fresh meshes to the needles for projection of additional loops thru the fabric. The dotted portions of curve 8 at top and bottom indicate the time when the fabric F is stationary, with needles N extending thru it and just before they enter it and just after they leave it. The relations of the two small circles at the adjacent ends of the full and dotted lines of curve 8 indicate the length of the very short portions or feet of thread loops extending flat against the needle side of the fabric from one fabric mesh to the next succeeding mesh, i. e., the feet of the loops, the length of these feet being determined by the size of mesh of the fabric and the corresponding extent of movement of the fabric. Curve 9 shows the loop-cutting movements of knife K, relative to fabric F, i. e, the lateral sweep of its cutting edge (left edge, Figs. 1–6) away from fabric F toward the inside of the curved loop-head as K moves down to cut thru the head of the loop from a knife-position inside the loop. Altho these cutters K have a bodily movement up and down in a plane parallel to the vertical plane of fabric F, (see arrows Figs. 2–6, down in Figs. 2–3 and up in Figs. 4–6), yet the cutting action of each knife is due to the fixed inclination of its cutting edge to said vertical plane of fabric F, so that as the knife is moved vertically downward, its cutting edge sweeps pseudo-laterally away from the plane of fabric F toward the head of the loop, until finally, Fig. 3, the inside of the loop-head opposes sufficient resistance to the cutting edge sweeping toward it, to effect severance thru the loop-head. This curve 9 shows such movements of the cutting edge of knife K in timed relation to the movements of the other moving parts. As to the four small circles on curve 9, reading from top to bottom, the first circle at top shows the time (relative) when inclined knife K begins to move down (between Figs. 1–2), so that its inclined cutting edge (left edge, Fig. 1), begins to approach nearer to the loop-head. The second small circle from top (at about 63 degrees) indicates the time, Fig. 2, when the cutting edge of K has reached the inside of the loop-head but has not commenced cutting. The third and fourth small circles from top indicate lateral relations of K between Figs. 3 and 4 (i. e., after loop-cutting), the lowest small circle indicating the extreme of the sweep at the instant when K reaches the end of its downward movement, i. e., at 115 degrees. This action of knife K is a true cutting action as distinguished from a shearing, and its effective operation is due to the above cooperating turfing mechanism hereof by which the loops L and fabric F are held securely in proper positions for loop-cutting, the loops themselves being held by the clamping mechanism against undue elongation which otherwise might result from the cutting action of knife K when it tends to pull out the loop from fabric F by its pseudo-horizontal movement away from said fabric, and the loops L being held by the clamping mechanism against contraction of length by the retraction of needle N.

Figs. 1–6 (and correspondingly Figs. 1A–6A) show the above turfing mechanism at six definite stages of the complete 360 degrees (half-second) cycle illustrated by the curves 1–9 in Fig. 7, as follows. Fig. 1 shows the elements in the zero position of Fig. 7, when needles N are in "home" position, i. e., most remote from base-fabric F on their own side thereof, when loop-holder LH and knife K are at their highest vertical positions (curve 4, Fig. 7), and clamp 241 (or 242) and pressure-finger 131 (or 132) are "home", i. e., most remote from base-fabric F on their respective sides thereof (top and bottom of curve 3, Fig. 7). Figs. 2–2A show the conditions at 63 degrees, as in Fig. 7; Figs. 3–3A at 76 degrees, of Fig. 7; Figs. 4–4A at 150 degrees of Fig. 7; Figs. 5–5A at 170 degrees of Fig. 7; and Figs. 6–6A at 190 degrees of Fig. 7. That is, Figs. 1–6 show the following cycle of operations. In Figs. 1–1A, loop-holder LH has moved up (with K) and has carried a previously formed loop L about $\frac{1}{16}$ inch upward, i. e., a little above loop-support

or nose 241*a* of support 241, Figs. 28–29; and knife K, also at its highest position, is about to move down (with LH) to cut this loop L, while LH also goes down on its way out of the previously formed loop. In Figs. 2–2A, LH has moved down substantially out of loop L, and K has entered the loop L of which now a portion nearer F rests on the top of nose 241*a*, Fig. 29, and on the top surface of 241, preliminary to cutting of the loop-head by K while said head-portion of the loop is so supported in substantially horizontal position to insure cutting of equal pile-lengths; the cutting edge of K now, Fig. 2, engaging with but not yet cutting the inside of the loop-head, and acting to hold the loop away from fabric F in lieu of LH now withdrawn below the loop. In Fig. 1 the presser-finger 131 and the support 241, on opposite sides of fabric F, are out of engagement therewith while F is being moved by the pantograph to a new position, curve 8, Fig. 7, to present a fresh mesh for the next projection of needles N which in Figs. 1–2, are out of engagement with F. In Fig. 2 finger 131 and support 241 have clamped fabric F between them in anticipation of entrance of needle N into a mesh of the fabric, Figs. 3–6. In Figs. 3–3A, K, yet moving down, actually is cutting the loop, this cutting beginning (Fig. 7, curve 3) just after engagement with fabric F of pressure-finger 131 and support 241 in their fabric-clamping positions shown in Fig. 3; finger 131 now, during cutting of the loop-head, pressing the foot of the loop being cut, tightly against the needle side of fabric F so as to prevent K during cutting from pulling out and elongating the loop. The gripping of fabric F between 131 and 241 holds F firmly in position for the formation of the next loop of equal length by N which is commencing in Fig. 3 during the cutting of the previously formed loop. In the operations between Figs. 2 and 3, and in Fig. 3, the top surface of support 241, and nose 241*a* engage intermediate points of the lengths of the two legs of the previously formed loop which rest on them, holding the loop up in its horizontal position to which it has been projected thru fabric F by needles N, and preventing the loop from undue sagging by gravity before and during cutting by K, and also preventing the loop from being moved down unduly by K as the latter moves down to and thru its cutting positions. Thus the cutting is effected substantially exactly at the middle of the loop-head, producing pile-threads all of substantially equal lengths, which is a requisite of practical operations producing a commercially acceptable product. This loop-upholding by the top surface of 241, Figs. 28–29, and by nose 241*a*, effects the further important result of leaving the cut pile lengths CL, Fig. 8, (or even uncut loops L, Fig. 9) in proper final positions extending at right angles to fabric F, instead of leaving a greater or less number of the loops or of the cut pile threads more or less permanently mashed down more or less flat against the surface of fabric F. Nose 241*a* now, Figs. 2–3, as a clamp is engaging against fabric F in position opposite pressure-finger 131 on the opposite (needle) side of F, so that since fabric F itself is held between 241*a* and 131 from lateral movement, the feet of the previously formed loop are clamped tight against fabric F by finger 131 during the critical loop-cutting operation of Fig. 3, so that members 131 and 241 constitute means for clamping the loop and cut pile threads from movement thru fabric F at this time, and afterwards when there is any tendency to such thread-movement. Nose 241*a* and the top surface of 241 now, as above, also hold up the two legs of loop L being cut. The head or curved end of the loop extends horizontally slightly beyond the top edge of loop-support 241, i. e., into the downward path of K and unobjectionally may sag a little, below the parts of the loop resting on the top surface of 241 and on nose 241*a*. It is this top surface of 241 and 241*a* which supports the portions of the loop nearer fabric F, to hold the loop in substantially horizontal position just before, and during, the actual loop-cutting, as a relatively rigid reenforcement for the floppy loop-threads; the curved portion of the loop projecting beyond 241 toward K being so short and being held by 241, K, and 131 so comparatively rigidly against movement in any direction (as contrasted with a lack of 241 and a consequent longer loop having a longer sagging portion at the knife), that K is prevented from cutting the loop at any point other than substantially the middle of its curved end or head, thereby avoiding unequal lengths of pile-threads and causing production of substantially equal lengths of pile-threads and the consequent acceptable appearance of the resulting pile fabric due to lack of pile-threads projecting irregularly from the base-fabric. And after the loop-cutting in Fig. 3, the top surfaces of member 241 and 241*a* continue to hold up the cut pile-threads of the loop just cut thereby preventing them from flopping down and about into the path of the needle N and the next loop being projected by it; and also after such loop-cutting, members 241 and 131 cooperate in holding it steady from broadside movements by the members during projection of the next loops, and fingers 131 continue pressure on the loop-feet to prevent disturbance of the lengths of the cut pile-threads relative to fabric F during the operation of projecting the next loop.

The above accurate loop-cutting action is aided by a certain operation of loop-holders LH to be described, which results in maintaining a tensioned or taut condition of those short portions of the loops which project freely beyond the top surfaces of supports 241 and 241*a* toward knives K. In Figs. 2–3 the needle N, thru the eye of which the thread passes, has been moving forward from its home position at right, Fig. 1, carrying the doubled thread in the longitudinal grooves of the needle, toward base-fabric F for the projection of the next loop thru the next fabric mesh which now is presented to N as the result of the edgewise movement of F by the pantograph just after Fig. 1 and before Fig. 2. One end of the thread extends thru the thread-feeding mechanism of Figs. 8–9 to a bobbin A, and the other end of the thread, passing thru the eye of the needle, extends to the loop previously projected by N thru a mesh of fabric F, which is the loop being cut by K in Fig. 3. It is emphasized that in the products of this machine the loops L, Fig. 9, or the cut pile-threads CL, Fig. 8, are held permanently to base-fabric F exclusively by the friction of the two thicknesses of thread extending thru a single mesh of fabric F, Figs. 1A–6A. That is, the cut pile structure consists of a closely associated multiplicity of U-shaped threads, of which the two legs (which are halves of two successively formed loops) extend thru adjacent meshes of fabric F, the bottoms of the U's (feet of the loops prior to cutting) which join such two legs, lying flat against the needle side of fabric F, Figs. 8–9; and thru each mesh of F

extend, side by side, Figs. 1A–6A, the two adjacent legs, one of each of the two successive permanent U-shaped threads. In Fig. 3, while a previously formed loop L is being cut by K, the needle is about to project the next loop thru an adjacent mesh of fabric F, the needle in Fig. 3 already having entered a fabric-mesh to start the next loop during the cutting of the previously formed loop. (That is, in the complete cycle of Fig. 7 the operations of the elements which respectively effect loop-cutting of a previously formed loop and projection of the next loop, are proceeding more or less simultaneously, with resulting rapid production.) The next loop is completely projected in Fig. 6 at 190 degrees of the cycle, Fig. 7; and in Figs. 4–6 LH and K have been moving up (curve 4, Fig. 7, from 125 degrees toward 270 degrees; in preparation for the cutting of the new or succeeding loop. After Fig. 6, in Fig. 1, and between Figs. 1–2, fabric F has been moved edgewise (as by the pantograph operation) to present a fresh mesh to N to receive the projection of a third loop to be commenced in Fig. 3 at about the time of cutting of the second loop, etc., etc. The downward movement of LH and K, of Figs. 2–3, has ceased between Figs. 3 and 4, at 4c of curve 4, Fig. 7, just after N has entered fabric F at 92 degrees of the cycle, just after Fig. 3.

In Fig. 4 (comparing the 150 degree condition of the parts in this figure with the curves in Fig. 7 at 150 degrees), N has reached a limit of forward movement thru fabric F (see small circles on Fig. 7 curves 1 and 2 at 150 degrees), thereby completely forming the next or second loop to be cut after the cutting of the previous or first loop in Fig. 3; and in Figs. 5 and 6, N is being given a low rate of movement back home toward the needle side of F, while the other elements are as follows. In Fig. 4 and beginning between Figs. 3 and 4, K and LH have been moving upward, i. e., from the small circle 4c on Fig. 7 curve 4 at 125 degrees, reading down on curve 4.

As K and LH continue moving upward during the projection by N of a loop consisting of two short lengths of thread connected together at the eye of the needle, thru a mesh of fabric F, needle N passes alongside the flat face of blade K and across it, Figs. 3–4, bearing against said blade-face, the blade being a resilient steel strip of which the lower end is pointed; and in Figs. 4–5, as N is approaching toward complete projection thru fabric F, the loop-holder LH is about to move up past the lateral side of needle N which is opposite to the lateral side of the needle which is bearing against K, i. e., LH is about to move longitudinally upward across the path of the needle, Fig. 5, and as close as possible to the needle so as to pass between the two legs of the new loop carried by the needle, i. e., LH is aimed at passages thru the transverse notch or groove GI of the needle, Figs. 34, 37, said notch, in the horizontal loop-projecting movement of the needle, reaching the upward path of the top point of tapered loop-holder LH as the latter in its vertical path reaches the horizontal path of N, between Figs. 5 and 6, so that LH at this instant passes close to N thru the notch GI, Fig. 34, and between the legs of the loop, the transverse notch insuring the passage of tapered LH thru the loop of which the two threads lie in the longitudinal grooves of the needle, Figs. 34–35. Up to the instant when LH starts to pass up alongside the needle, the lower end of K, Fig. 4A, has been bearing against the upper end of LH. The knife K, being resilient, yields to needle N, Fig. 5A, as K and LH move further up on opposite sides of N, the knife being flexed broadside away from LH permitting continuation of upward movement of K and LH at their respective sides of N and notwithstanding the presence of the needle, which altho not moving vertically, passes, in effect, between the just previously contacting portions of LH and K, Figs. 5A–6A, LH thereupon entering between the legs of the loop, Figs. 6, 6A. LH moves up in a vertical line which, Fig. 6, extends up thru the new loop L, so that, in Fig. 6A, before any partial retraction of N thru F rightward back toward home has caused substantial retraction of the new loop of Figs. 6A and 6, not only has the upper point of tapered loop-holder LH entered inside the loop, Fig. 6, but after Fig. 6 and before the needle tends to retract and shorten the loop, LH has moved up so far that the larger diameter of its taper or lower enlargement has engaged directly against the inside of the loop-head so as to make it impossible for the loop to be retracted unduly by the subsequent movement of complete retraction of N back to its home position of Fig. 1 when LH is in its uppermost position in most complete engagement next the inside of the loop-head. Fig. 4A shows the conditions just before the point of contact of K and LH has risen to the plane of the needle; Fig. 5A the instant when the needle, in the upward path of K and LH is forcing the end of K away from LH to allow the continued upward movement of K and LH; and Fig. 6A when the top of LH has entered the newly formed loop, at a time prior to beginning of retracting movement of N between the ends of its path.

The engagement with fabric F of presser-fingers 131 and support 241a is particularly important in Fig. 3 while the loop is being cut by K, in that such engagement holds the foot of the loop (on the needle side of F) flat and tight against F so as to keep K, as it moves downward prior to actual cutting, from pulling the loop out longer than desired on the loop side of F. Also, engagement of 131 and 241a with opposite sides of F holding the foot of the loop tight to F as above, is important during the loop-projecting operations of Figs. 4–6 and at least a little after, (preferably to 340 degrees as in Fig. 7, and after N has been withdrawn from F, Fig. 7), for the purpose of preventing the retracting needle N from drawing back thru F that one of the two legs of the original loop which yet is connected to the thread extending thru the needle's eye and which now at the other end constitutes one of the cut pile lengths resulting from the cutting of the loop by K. Also such gripping of F between 131 and 241a holds F in much more nearly stationary condition (against broadside swinging) than it is possible to maintain it during the turfing process by means alone of the tautening means embodied in the fabric-carrying frame, of Figs. 40–42. The continued application of 131 and 241a to F includes the time before tapered loop-holder LH moves up so high as to engage closely against the inside of the head of the uncut loop and hold it at full loop length out from fabric F, as in Fig. 1.

On curve 3 of Fig. 7, the upper small circle at 70 degrees indicates the time when members 131, 241 on opposite sides of fabric F start to move toward the latter and one another, Fig. 2, just after K and LH, curve 4, Fig. 7, (top small circle) start to go down. On curve 3, the bottom small circle indicates the time when, between Figs. 6

and 1, the members 131, 241 have reached their positions of rest spaced from fabric F, i. e., after K and LH have moved at 4c, curve 4, to their top positions of Fig. 1 and N to its home position of Fig. 1.

On curve 4 of Fig. 7, the top small circle indicates the time when K and LH start to move down toward their positions of Figs. 2–3; the small circle 4b indicating their positions in Fig. 2, and 4a indicating the position of K at the instant of cutting in Fig. 3. Circle 4c indicates the lowest position of K and LH just before, Fig. 4, they start to move up. Circle 4d indicates the instant, just after Fig. 6, when K has passed up out of the loop and the interior of the loop is engaged fully by its tapered holder LH: Circle 4e indicates the instant, after Fig. 6, when K and LH have reached their highest positions and come to rest for a minute interval of time, as in Fig. 1.

As to the 170 degrees of the cycle of operations between Figs. 6 and 1, the same is shown in Fig. 7, and consists of movements subsequent to Fig. 6 including (1), curves 1 and 2, the movement of N back home, Fig. 1, after forming a loop, (2) the above withdrawal from F of 131 and 241a, curve 3 (at 340 degrees, Fig. 7) preliminary to shifting of F (at 10–60 degrees, curve 9, Fig. 7) to present a fresh mesh to N; and (3) the movement of LH and K further upward from their positions in Fig. 6 to their highest positions between Figs. 6 and 1, (see curve 4, Fig. 7).

An important feature of the construction and operation of the machine of the invention, and one which is partially shown in Fig. 7, is the fact that loop-holder LH participates in the formation of loops by carrier or needle N, i. e., LH, in the final portion of its upward movement, increases the length of a loop L extending out from fabric F after N has projected the loop initially thru and beyond F to the limit of the stroke of N. It is not this lengthening of the loop which itself is important but rather the resulting taut condition of the loop which assists in insuring mid-cutting of the loop-head and consequent cut pile threads of uniform length. In the operation, owing to the general tapered construction of LH shown, as it goes up thru the loop, Fig. 6, in its motion shown in Fig. 7 on curve 4, between the two small circles 4d and 4e (intermediate the conditions shown respectively in Figs. 6 and 1), the tapered member LH pulls the loop out from F to be slightly longer, owing to resulting greater tautness, than the loop-length caused by loop-projection by carrier N alone. This additional useful pulling out of loop L causes the desired effect of tautening the entire length of thread extending from the foot of one leg of the loop which is held tight against fabric F by presser-finger 131, to and thru that leg of the loop, thru the curved head of the loop, thru the other leg of the loop, and to the thread Y extending back to feed-bars 174 and 172. Said lengthening of the loop by the loop-holder LH establishes said tension on Y as the result of its pulling of additional yarn (sufficient for the above loop-lengthening by LH) from bobbin A; and in this operation the jerk of thread Y by LH, as above, pulls the additional thread along the frictional surface of feed-bar 172 so as to cause feed of the thread at this instant in sufficient length to supply the slight additional loop-length needed for this slight loop elongation but not in sufficient length to prevent the desired tension on Y. (The normal rate of rotation of 172 is fixed, or adjusted by the brake shown, in consideration of said temporary thread-jerk by LH.) The taut condition of the loop caused by this tensioning of the thread leading to it thru needle N, and initiated after Fig. 6 and maintained until the cutting in Fig. 3, is useful in providing for cutting at the mid-point of the curved head of the loop, so that the two cut legs will constitute equal pile-lengths, which are necessary in order to produce the desired appearance of the pile fabric product. The high rate of the operations explains the fact that the above loop tension is maintained for the above important purpose, until the cutting in Fig. 3, even if the thread be fed by friction bar 172 after the final upward movement of tapered member LH has jerked the thread and loop taut as above. For example, the time occupied by the entire 360 degree cycle of Fig. 7 is only slightly longer than half a second, and the time between the above thread-jerk by LH after Fig. 6, and the cutting in Fig. 3, is less than a tenth of a second.

In the above cycle of operations including loop-cutting, which is the method shown in Fig. 8, there is no employment of the thread-release-bars 152—153, the relative motions of which are shown in curves 6—7 of Fig. 7. But in both Figs. 8 and 9 the intermittently operated thread-feed roll 172 is employed, as follows, to feed the yarn from bobbins A to needles N to form the loops. This power-rotated feed-bar 172 preferably is surrounded with a frictional covering such as a velvet cloth or emery paper, and the thread from bobbins A is circled around it. The power transmission for intermittently rotating the feed-roll 172, including cam 162, is designed, as shown, to feed the thread Y at a rate sufficient for formation of loops L or cut pile CL, Fig. 8, of the desired lengths, as determined by the length of stroke of needles N. Alongside thread feed-bar 172, Figs. 8–9, is a stationary smaller bar 174, and the circle of thread being fed around bar 172 (curve 5, Fig. 7, full line, the feed ending at small circle 5a as N is about to complete its loop-forming stroke) is brought up around the side of smaller and stationary bar 174 which faces away from bar 172, and the thread led thence to needle N. As shown, bar 174 is located between feed-bar 172 and bobbins A and close to 172. This arrangement prevents a portion of the thread extending from feed-bar 172 to needle N from being overlaid and locked against loop-projecting movements, by portions of the thread subsequently drawn by 172 from A which otherwise would overlie its previously fed thread portions on 172.

In Fig. 9 is shown the same arrangement as in Fig. 8 save for the omission of cutter K and the employment of thread-release bars 152, 153 by leading the thread around them as shown in Fig. 9. Release bars 152, 153 are oscillated by power-operated rock-shafts 150, 155 respectively. The oscillations of these bars in timed relations to the other moving elements, are shown by curves 6 and 7 respectively of Fig. 7. The general function of bars 152, 153 is in substitution for the function of K in Fig. 8, in cases when the cutters are not employed, as in Fig. 9, in holding loop L distended from fabric F, as in the stages of operations shown in Figs. 2–3 after LH has moved down out of a loop about to be cut by K in Fig. 3. Shaft 155 for bar 153 rocks thru a greater angle than shaft 150 for bar 152. In Fig. 7, curve 6, bar 153 is started in action toward fabric F at 0 degrees, thereby beginning to slacken thread Y between 153 and N in prepa-

ration for the withdrawal of LH, Fig. 2, from a previously formed loop L by downward movement of LH, such withdrawal of LH in Fig. 8 (as in Fig. 2) being followed immediately by its replacement by knife K acting in Fig. 2 just before its cutting of the loop in Fig. 3 as a means for holding the loop distended from F or for preventing the loop from being retracted to a condition of less than desired length prior to cutting. But here, in Fig. 9, where no knife K is employed, the above slackening of the thread at the time LH leaves the loop, Fig. 2, effects, by removing tension by the thread on the loop, maintenance of the loop in proper length during the interval of time after the passing of LH out of the loop (Figs. 3–5) and as long as it is desired to maintain the above condition of slackness. The times of cooperation of bar **152** with **153** are indicated in curve **7**, Fig. 7, between 125–175 degrees. This provision of slack of thread Y at such time relieves the loop L of tension by the portion of thread Y which extends from the loop thru the needle to the bobbin, and which tension otherwise would tend to and might pull back and shorten the loop (in the lack of K acting at this time to hold the loop in lieu of loop-holder LH) if the thread Y extended back tight (under twisting tension) from loop L to feed-roll **172** and associated stationary bar **174**. Said slack of thread Y therefore at this time prevents loop L from being pulled back and thereby shortened, i. e., after LH has been withdrawn from the loop and in a case as in Fig. 9 where no knife K is provided to hold the loop in lieu of LH, Figs. 3–5.

An important factor in the proper loop cutting, for equal pile-lengths, is the construction and operation of the support **241** of Figs. 28–29 or **242** of Figs. 25–27, now to be described in further detail.

In Figs. 25–27, **242** is a plate-like support mounted as on a member **243** which may be stationary, or movable as in Fig. 29. This plate may be employed in lieu of fingers **241**, Figs. 1–6, for the square-working of Figs. 8–9 but is not adapted for the more ornamental curved work of Fig. 29A. But either of **242** or **241** in the square-working of Figs. 8–9 is suitable for co-operation with presser-fingers **131** or their equivalent in the work of holding fabric F stationary and in the pressing against F by **131** of the foot of a loop having its head cut. The right hand edge of nose portion **242***a* of **242** in Figs. 25–27 is pressed against fabric F opposite presser-finger **131** or **132**, Fig. 8, to hold this locality of F substantially stationary during the turfing operations of Fig. 7 by N, LH and K. The top surface of **242***a* (and its edge adjoining the top edge of member **242** which carries **242***a*) supports the just-formed loop L, that is, supports most of the length of loop L which extends out from F, i. e., only a short portion of the loop-end projects freely beyond **242***a* into the path of blade K,—just enough to permit entrance of the pointed lower end of K between the loop legs to effect cutting at the loop-head, the edge of K being presented away from F toward the head curvature of the loop. This limitation by **242***a* to a short length of freely projecting or unsupported loop-portion prevents undue loop-sagging and holds the loop in best condition or most nearly horizontal position for accurate loop-cutting; and this limitation acts in co-operation with the above method of stiffening the loop, just prior to and during cutting, by means of the thread-jerking by the final upward movement of LH shortly prior to loop-cutting; so that at the instant of cutting, Fig. 3, and just after, the portion of loop L to be cut, (i. e., exactly at the midpoint of its curved head) which necessarily is unsupported and exposed freely to the action of K, is both sufficiently short and stiff. In Fig. 25 are shown grooves **269** or depressions in the top surface of nose portion **242***a* of plate-support **242**, these grooves lying in the horizontal paths of needles N carrying the doubled length of thread to form a loop L; nose portion **242***a* being slightly inclined upwardly away from fabric F. Depressions **269** are large enough to receive both needle N and the doubled thread lying in the longitudinal needle-grooves; and the object and result of **242***a* and its depressions **269** are to prevent previously projected (or/and cut) loops from being bent flat to F and bound thereto by subsequently projected loops particularly when cut after being projected. The operation to effect this result is as follows, Fig. 25. After thread-carriers N have been withdrawn, leaving the loops L in depressions **269** (the loops being held by LH against retraction with the needles), the fabric-frame is moved (as by the pantograph) to move fabric F, Fig. 25, edgewise relative to support **242**, and such relative movement of F and **242** causes the loops to be forced up out of depressions **269** so as to lie across the top surface of **242***a*, the loops being pushed up (of course one row at a time) to the position shown in Fig. 26. And, since the loops then are pushed up out of depressions **269** by the time a fresh mesh of F is presented in line with needles N and depressions **269**, therefore the depressions **269** are freed of previous loops or cut piles which would conflict with the next row of loops to be formed by N in **269**. When support **242** is not moved toward F as are the alternative plurality of members **241** of Figs. 28–29, then support **242** is fixed close to fabric F so as to form a backing for F when presser-fingers **131** are moved to and against F. In the employment of single support **242** in lieu of plurality of members **241** of Figs. 28–29, (for the square-working of Figs. 8–9), it is necessary, in fabricating on the base-fabric F, to start working at the highest portion of the square-worked hook rug or other loop or pile fabric being produced, i. e., on an upper portion of fabric F as shown in Figs. 8–9, and continue the working generally downwardly on fabric F by moving it upwardly at the ends of horizontal rows of loops projected by the adjacent needles; it being impracticable to work in other directions than these straight horizontal rows of Figs. 8–9 because there is not sufficient space for the closely associated loops or cut pile-threads projected from F, to enter or lie between fabric F and vertical plate **242**. And for that reason, with the above plate-like support **242** of Figs 25–27, it is not possible to produce the curved line loop fabrication of Fig. 29A, the fabrication with such plate-like support being limited for the above reason to "square" line designs as in Figs. 8–9, i. e., to designs wherein the fresh meshes of F presented to N are in horizontal lines and short vertical lines joining the longer horizontal lines, the fabric F being moved horizontally for the long horizontal rows of loops, and upwardly for the short joining lines consisting preferably of only a single loop in order to provide for the closest practicable association of adjacent loops or cut pile-threads. In Figs. 25–27

the supporting plate **242** extends horizontally as far as the horizontal length of fabric F.

But Figs. 28–29 show an important modified form of support **242** in the form of a plurality of finger-like supports **241**, by which curved-line designs as in Fig. 29A can be produced. Here these supports **241**, (instead of being in the form of the continuous plate **242**), consist of relatively narrow fingers along the horizontal length of the machine, which need be only wide enough (Fig. 28) at their top surfaces to support the two legs of a horizontal loop projected thru F by N, altho shown wider for preference, for a shielding function to be described. These respective members **241** are disposed opposite the presser-fingers **131**, Figs. 1–6, 17, and are arranged, Fig. 28, to be moved to and from fabric F simultaneously with said presser-fingers **131**. These movements of **241** are obtained, Fig. 28, by providing rock-shaft **243** parallel to rock-shaft **134** for presser-fingers **131** and suitable bearings **238** for shaft **243**, the gear **240** on rock-shaft **134** intermeshing with a gear **240***a* on **243**. As shown in Fig. 28, the respective plural supporting members **241** are secured as in Fig. 29 to an enlarged portion **244** of rock-shaft **243**, and are located with their upper free ends just below the respective needles N, analogous in Figs. 25–27 to the locations of the top nose portion **242***a* of supporting plate **242**. In fact, members **241** are provided with nose-portions **241***a* (analogous to **242***a* of Figs. 25–27) which space the upper ends of the members **241** from fabric F even when noses **241***a* are moved toward F so that their ends engage it. The ends of noses **241***a* engage fabric F at portions which lie, Figs. 8–9, horizontally mid-way of each of presser-fingers **131** and **132**, and just below needles N as they project thru the needle-holes in **131**, **132** and over the tops of noses **241***a* and over the top surfaces of members **241** which carry noses **241***a*. When a mass of closely associated loops L, Fig. 9, has been formed, (or a mass of cut-loop-piles CL, Fig. 8) of substantial length in projection from fabric F, the arrangement of Figs. 28–29 provides for the accommodation of such masses between supports **241** as distinguished from the arrangement of the continuous plate-support **242** of Figs. 25–27. This is important in connection with the directions of the movements of fabric F carrying such loops or pile-threads fabricated into it. In Figs. 28–29, not only do noses **241***a* separate members **241** from F while F is clamped between **241***a* and **131**, **132**, Figs. 2–6, and 8–9, but when noses **241***a* are moved away from F, Fig. 1, by the mechanism of Fig. 28, additional space is provided between **241** and F for the mass of loops or pile-threads; and most important of all, the spaces between the plural fingers **241** provide much more room for the accommodation of the masses of closely assembled loops or cut loop piles, so that such masses do not interfere with the free movement of F but permit the same in any and all directions desirable in order to produce curved-line designs of which Fig. 29A is an example. But with the analogous member **242** of Figs. 25–27, the portion of fabric F previously fabricated with loops L of Fig. 9 or pile-threads CL of Fig. 8, cannot for best results be moved below top portion **242***a* of **242**, whereas in Figs. 28–29 fabric F with formed loops or pile-threads can be moved freely in any direction with reference to fingers **241**, thereby readily permitting the production of curved designs of products similar to Fig. 29A as distinguished from the square working in Figs. 8–9.

In Fig. 28, the members **241** after having been moved to positions spaced from fabric F while the latter is being moved to place succeeding meshes in the paths of needles N, said members **241** are spaced no further from F than are plates **242** of Figs. 25–27 when plate-support **242** is moved as it may be by the power transmission shown in Fig. 28; but the separation horizontally between successive members **241** of Fig. 28 (one member **241** for each needle N) is so great and the horizontal widths of the members **241** along the horizontal length of the machine are so short that as fabric F is moved the short distance corresponding with the size of its mesh, masses or groups of loops or cut pile-threads can move freely not only between successive members **241**, but, by temporary bending between the members **241** and fabric F they can move freely also thru the narrow spaces between the fabric and members **241**, so that the fabric can be moved in any direction desired to permit production of curved lines as in Fig. 29A, and therefore the work simultaneously on given plural designs can be started at any desired point of fabric F within the borders of the ultimate duplicate products. Noses **241***a* are so shaped as shown that they offer minimum opposition to masses of projecting loops or pile-threads. In Fig. 29A the various colors are indicated by various uses of black lines and white spaces representing the colors. There may be as many different colors as there are needles N and bobbins A. With the plate **242** of Figs. 25–27, however, for the square working of Figs. 8–9, the work by the needles is started at the tops of the designs, with fabric F initially in its lower position, the fabric being moved (at its successive operations each at **8***a*, **8***b* of curve **8**, Fig. 7) generally upward and, successive horizontal rows of loops or pile-threads projected by each needle, Fig. 8, are formed at successively higher portions of fabric F, the latter being moved in zigzags as in Figs. 8–9. But altho the members **241** of Figs. 28–29 permit the production of curved-line designs as in Fig. 29A, yet there are some limitations to designs which can be made even with them, because the designs must be adapted to the ability of the apparatus to produce it, and when the design is of unusual complication as to configuration or contrasting coloration, or both, it may be necessary to reduce the number of needles N operating simultaneously within the border of each turfed product thereby increasing the time of production. For example, altho an individual turfed product of large area and simple design may be made very rapidly by the employment of a very large number of needles N, yet an individual turfed product of much smaller area but of more complicated design as to lines or contrasting coloration may require the employment of only a few needles and therefore a comparatively long time for production. Noses **241***a* preferably as shown, Figs. 28–29, are not integral with fingers **241** but are supported removably thereby by being secured thereto in any desired manner thereby permitting some of them to be removed from **241** without removing **241**, for classes of work not requiring all of them, just as needles N are removable for the same purpose. Members **241** and **242** respectively of Figs. 28–29 and 25–27 are similar in function save for the above important differences in respect of the square working of Figs. 8–9 and the curve-line working of Fig. 29A, as follows. Both **241** and **242** act

by way of their respective noses 241a, 242a, to cooperate with presser-fingers 131 in gripping fabric F between them to hold it steady in its vertical plane (that is, its portions where needles N are working thru it, and near where parts LH and K are working) from movements in any direction while it is not being moved for the purpose of presenting empty meshes to the needles. Also noses 241a, 242a of fingers 241 and plate 242 serve the important function as above of acting as supports for the legs of the loops so that the latter are kept as nearly at right angles to fabric F as is desirable, not only for the cutting operation but at all times and whether or not the loops are cut, so that no loops or cut pile-threads get into matted condition more or less paralleling fabric F thereby marring the appearance of the product, but all loops or cut-pile-threads project permanently at right angles to fabric F and to equal distances therefrom constituting a greatly improved product particularly in articles such as hook rugs wherein the loops or pile-threads are comparatively short and therefore loops or pile-threads of unequal lengths are particularly prominent and unsightly. Noses 241a need not be at the top of the side of 241 and the top edges of members 241 each supports the two threads of a loop during cutting, as does the top edge of plate 242. Members 241, as shown, Fig. 28, preferably are relatively thin and wide metallic plates, and lie, Fig. 2, spaced apart at their edges from one another, and broadside between base-fabric F and the path of movements of the loop-holding and cutting means LH. K, with the opposite relatively wide surfaces of 241 respectively facing F and facing said paths of said loop-engaging means. The wide surfaces of members 241 which face F are spaced from it by distances corresponding to the extension of clamping noses 241a to F, so that, as above, room is provided for previously projected loop-threads between F and such spaced facing surfaces of members 241. Members 241 are omitted from Fig. 2A in order more clearly to show the previously projected pairs of loop-threads, which for the same reason are shown much further apart than is actually the case; but Figs. 2, 2A and 28 show that the members 241, which are relatively wide so as to extend on both sides of the respective loops being projected, intervene between the projected-thread field adjacent fabric F on the one hand, and on the other, the paths of LH and K in operating on a given projected loop, so that members 241 serve as means for shielding previously projected loop-threads (as CL, Fig. 2A) from the operations of LH and K respectively, which in operating on a given projected loop are reciprocated at high speeds in paths more or less parallel to the surface of F. Also, such high speed movements are continued while F is being moved edgewise, so that members 241 shield previously projected loop-threads which are being moved across the path of LH and K by such edgewise movement of F. The relatively thin and wide members 241 preferably extend, as shown, horizontally in both directions beyond the generally vertical paths of LH and K, so as to shield from LH and K, previously projected loop-threads close alongside LH and K on the opposite sides of the paths of LH and K. As above, these separate plural members 241, Fig. 28, spaced both from F and from one another, are particularly useful in the "curved-working" of Fig. 29A (as distinguished from the "square-working" of Figs. 8–9), and they permit such curved working because with them it is not necessary to limit the edgewise movements of F to horizontal and upward directions, (as in the case of single horizontally-long members 242 of Fig. 25, in order that 242 shall not overlie projected loop-threads), but with members 241, fabric F can be moved horizontally and downwardly so that previously projected loop-threads will lie below needles N and below the tops of 241 and between F and the relatively wide faces of members 241 spaced from F to receive such loop-threads, all the latter being shielded by 241 from the fast loop-engaging and disengaging motions of loop-holder LH and the fast loop-engaging holding and cutting movements of loop-holding cutter K. Members 241 necessarily contact with previously projected loop-threads between them and F because such threads extend from F beyond 241 and around LH; but the spacing of 241 from F by 241a locates 241 far enough from F to prevent contacts of LH or K with portions of the projected loop-threads very close to F. In curved working such as in Fig. 29A, the fabric F may be moved edgewise downwardly, Fig. 1, to project loops along those shown above the top of 241, so that the illustrated previously projected loop-threads will pass between shield 241 and F where they will be shielded by 241 from the movements of LH and K in operating on the new loops.

As to presser-fingers 131, Figs. 1–6 and 17 show their cooperation with fabric-supporting and loop-supporting fingers 241 and their fabric-engaging noses 241a, curve 3 of Fig. 7 showing the movements of both members 131 and 241 acting on opposite sides of fabric F. Presser-fingers 131 preferably as shown extend higher up than supporting fingers 241 and their noses 241a, i. e., above the needle-path. The presser-fingers may be in any suitable form including either or both of the two forms 131 and 132 of Figs. 8–9, the 132 form being wider and higher and having no slot upward from its needle-opening, but the 131 form having such slot open to and thru the top for the purpose of facilitating needle-threading. The 131 form is preferred for exclusive use in plurality as indicated in Fig. 23. In either or any form each presser-finger has a horizontal bend intermediate its lower supported portion and its free upper portion (Figs. 1–6, 8–9 and 17) so that the latter lies closer to fabric F than its lower portion, and its support lies more remote from the plane of F, the upper or fabric-engaging portion extending generally parallel to the fabric so that when moved thereto, it will lie flat against the fabric and the loop-feet. Supporting-fingers 241 are bent similarly, as in Figs. 28–29, (and 242 in Figs. 25–27), between their free upper portions and their lower supporting portions. The fabric-engaging portion of the presser-finger 131 is flat as distinguished from the nose 241a, of its cooperating fabric-support 241 of Fig. 29 because the former, 131, has a function additional to its fabric-gripping in cooperation with 241, i. e., the function of pressing the loop-feet tight and flat against fabric F. Noses 241a of 241 need to engage the fabric (for holding it steady against 131) at substantially only blunt point contacts (a modification of the line-contact with F by long continuous nose-member 242a of Figs. 25–27) because they have no function of holding any loop-foot-threads against fabric F; in fact, the parts 241a are nose-shaped in order to avoid any such large area facing fabric F as would increase unduly a flattening of the

projecting loops or cut pile-threads toward the fabric as the latter is moved across 241*a*. But in the case of the presser-fingers 131 on the opposite side of fabric F, their flat fabric-engaging portions extend sufficiently far in all directions from their openings thru which needles N reciprocate, to insure the loop-feet being held tight against fabric F no matter in which direction the latter may be moved after the formation of a given loop by a needle N. But so far as concerns this loop-holding function of fingers 131, the area of their flat fabric-engaging portions need not be extensive because it is only the foot of one loop at a time which is desirably held by a given finger 131, i. e., the foot of the first leg of the just-formed loop which lies in the direction of fabric-movement from the needle; for the other leg of this loop, whether or not its head is to be cut, and if cut, then before, during and after cutting, yet is a continuation of a portion of the thread with which the needle is working to form the next loop during the same cycle of operations, Figs. 1–7. But to the extent that the flat fabric-engaging portion of presser-fingers 131 is of greater area than necessary to hold such loop-feet (such as the upward extension of 131 or 132, Fig. 8, above nose 241*a* of supporting members 241) such larger area serves usefully in providing a broad surface for holding the fabric steady in the vicinity of the turfing operations, in cooperation with nose 241*a* which, Fig. 28, preferably is substantially circular in cross-section, tapering down to a blunt point (instead of extending toward fabric F from across the entire width of 241 and at right angles thereto, as does nose 242*a* of Figs. 25–27) for engagement in substantially point contact with a portion of fabric F which lies approximately opposite the middle of the horizontal width of presser-fingers 131, at a vertical portion of 131 just below the needle-opening therethru (or against the rim or edge of the needle-opening at a position below the path of the needle), i. e., opposite in general to a point on the lower portion of the upper or flat fabric-engaging part of 131. And 131 may be wide enough horizontally, as shown, Figs. 8–9, to hold several loop-feet on either side of its needle-opening.

As to the automatic mechanism for moving the fabric F which can be employed with the invention hereof in lieu of the pantograph shown, such automatic mechanism can be the same well-known mechanism which frequently has been employed in multiple-needle embroidering machines, such automatic fabric-moving mechanism to be combined with the supporting frame for fabrics F shown in the drawings (Fig. 42, etc.), in the same manner as such automatic fabric-moving mechanism customarily has been connected with such fabric frame.

Figs. 1A–6A respectively show the stages of the cycle of operations also shown in Figs. 1–6, so far as concerns the three turfing elements which include the loop-carrier or loop-former N, the loop-holder LH and the knife K. Preferably, as shown, K and LH both are carried by the same support (as rod 228, Fig. 1) which is operated by the power transmission shown, to move them up and down in a vertical plane parallel to base-fabric F, altho it is not necessary in all cases that both LH and K be mounted on the same support or given like simultaneous movements. Figs. 1A–6A show conditions when fabric F is moved intermittently from right to left, CL indicating loops formed and cut prior to the mechanical conditions illustrated in each figure. Thus, Fig. 1A shows the conditions when the last loop, L, has been formed but not cut, and the previously formed loop at left, which has been cut to separate threads U1 and U2. U2 is a continuous thread constituting the pile-thread of the cut loop at left and the entire un-cut loop L; this thread U2 passing thru the eye of the needle to the feeding thread Y, Fig. 8. The portion of U2 which connects the right-hand pile-thread of the cut loop at left with loop L lies, hidden by fabric F, on the needle side of the latter, and constitutes the loop-foot threads F. The closely adjacent pile-threads U1, U2 are those which extend alongside one another thru the same mesh of F and are held in place by friction with one another and with the fabric-material constituting the rim of the mesh. The pile-threads U1, U1 are a continuous thread so that they, in successively adjacent meshes, are connected together by a hidden foot on the needle side of F clamped by a presser-finger 131. In Fig. 1A no loop-forming operation is going on, but LH is engaging with new loop L inside its head to be cut, holding said new loop L distended from F but is about to be moved to go down and out of the loop and to be replaced inside the loop by K also going down. In Fig. 2A, the cutting edge of K has replaced LH in its engagement with the inside of the head of loop L and in lieu of LH now K is holding the loop distended, the cutting edge of K not having gone down far enough to begin cutting the loop. In Fig. 3A, K is cutting L and at the same time needle N is starting to pass thru F, being about to project the next loop thru the next mesh of F. Since LH and K are in contact with one another at their abutting ends (spring-blade K being mounted under stress to bear with a slight pressure against LH), K has followed LH down continuously as if these two members were one. After Fig. 3A, loop L of Figs. 1A–3A no longer exists as a loop but is in the form Fig. 4A, of two adjacent pile-threads U2, U3; and in Fig. 4A a new loop L has been partially projected by N and this new loop is to replace loop L of Figs. 1A–3A as the next loop to be cut. In Fig. 4A, while the projection of new loop L is being continued toward completion, K and LH are moving back upward in preparation for holding new loop L by LH upon its completion, as in Figs. 1–1A, and then cutting it, as in Figs. 3–3A. In Fig. 5A the forming of the new loop L by N is substantially completed, LH moving up having almost reached it; and K in its upward movement has come in contact with N so that K in its upward movement is being pulled away from LH so that K can continue its upward movement along one side of N while LH continues its upward movement on the other side of N, in the transverse groove G1 in N, Fig. 34, to enter the opening between the legs of loop L and pass thru said opening, Fig. 6A, close to N, so that LH will be in position to hold loop L when, after Fig. 6A, N is retracted thru F and, Fig. 1A, LH is in its highest position holding loop L fully distended from fabric F.

In preparation for operation for making a hook rug, consider the machine at zero position, needle fully home, at zero Figs. 1 and 7. We prepare the colors of yarn on bobbins A, Fig. 8, the numbers of needles, etc. according to the desired design. The yarn, which is either on spools or cones, has been placed on spool pins 195, which are mounted on horizontal support bars 194. The thread is wound once around the feed roll 172,

Figs. 8–9, and over the feed bar **174**, which prevents twisting of the yarn. Feed roll **172** is driven by ratchet **175**. The latter is operated by feed roll ratchet pawls **176**. The thread, Fig. 8, continues to follow release bars **152** and **153** (in the Fig. 9 operation) before entering the eye of the needle, as clearly shown in Fig. 9. The purpose of **152** and **153** is to get more thread supply to the needle in the above described cycle of operations and in this way to help the looper LH in the turfing process. For operating the machine for looping and cutting, Fig. 8, the thread is laid from the roll **172** and feed bar **174** direct to the eye of the needle, because the knife K acts as a secondary loop holder after LH goes down out of the loop, and after K has moved down into the loop but before it cuts it. Release bars **152** and **153** then are not necessary, i. e., in Fig. 8 when K is employed. After completing the threading of the machine, the following action, which is called spanning, will follow.

Before placing base fabrics F in the machine, the looping and the cutting mechanism will be withdrawn by handle **256**, from Fig. 38 to Fig. 39, thereby giving ample space for spanning the fabric. A base fabric F, preferably a woven fabric, will be placed on horizontal tension bars T, Fig. 40, which are equipped with shark-teeth pins U on top, and then on the corresponding bar below. Finally the fabric F is tightened by span hook and hooked into vertical end pullers. After this action, the looping and cutting mechanism will be moved back into its proper working position, Fig. 38, by the beforementioned handle **256**.

The pattern or design which we intend to work will be placed on the pantograph board B, left, Fig. 10, and the pantograph with fabric frame will be placed at their starting position. The pantograph is connected with the fabric frame by binder handle **54**.

We now begin with the operation of the machine at zero position at the handle H. The presser-fingers **131** and **132** start to move toward fabric F a little earlier than the needles N. The needles shortly follow. The presser-fingers hold the base fabric F in stationary position before the needle point N enters the fabric F, and they hold the fabric F in the same position until the needle leaves the fabric F. While the needle N enters fabric F, loop holder LH and knife K are on their downward stroke, Figs. 2, 2A. When the needle is at its outermost point of its stroke, furtherest from home, loop holder LH, Fig. 5, is not far from the needle which has crossed the upward path of LH. While the needle is beginning retracting, Figs. 5, 6, the thread is not carried back, owing to friction of the yarn in the mesh, along the thread, while LH is entering the loop (between yarn and needle). At this time the presser-finger **131** is against the thread of the previously formed loop, i. e., is pressing against the short length of thread (loop-foot) which lies flat against the needle side of fabric F and connects the next previously formed loop with the last formed loop. As the needle moves forward to carry the loop thru the fabric-mesh, it wedges between loop holder LH and knife K. At the same moment, the loop holder LH enters between needle and thread, Fig. 6, holding the loop from thereafter being pulled back by the needle. When LH reaches its highest point, Fig. 1, the needle leaves the fabric F. LH goes back down immediately, and out of the loop, but before LH disengages the loop, the knife passes and cuts the loop-head, the point of K now bearing against LH, i. e., in a groove **236** formed in the side of LH against which K bears with its own spring pressure. While K goes through the loop in cutting action, Fig. 3, the loop rests on the top edge of fabric support **242**, Figs. 25–27, or preferably the top edge of a narrow member **241**, Figs. 28–29, thereby giving equal length to the cut threads of the loop.

The supports **241**, Fig. 28, and 242, Fig. 25, are interchangeable for different kinds of patterns in the turfing process, altho **241** can be employed for either the square working of Figs. 8–9 or for the curved working of Fig. 29A. For curved line designs, as Fig. 29A, it is preferable to employ supporting fingers **241**, Figs. 28–29. The supports **242**, **241** are removable, being removably mounted on the forward support of rock-shaft **243**. Portion **242***a* of **242**, Figs. 25–27, is inclined upwardly from fabric F toward knife K, Fig. 27. Similarly the nose **241***a*, Figs. 28–29 increases in diameter in a direction from fabric F toward knife K, likewise to hold the free end of the knife. In general, the top portion of **242** or **241** serves as a support for the loop, during the time K is moving down thru and is cutting the loop, and afterward as a support for the cut pile threads. In the case of **242***a* the latter slowly pushes cut-loop pile-threads up (from out of the notches **269** wherein they are cut) as F intermittently is moved horizontally along **242** for the working in an upper row, Figs. 8–9, said threads being supported by **242***a*; then F moves up to position a mesh in a new horizontal row, below and parallel to the first, in the path of N, such upward movement of F permitting working on a lower row by N, etc., while loops L are supported on **242***a* in position below said row and away from interference with N.

For any other design not angular, consisting of curves, as in Fig. 29A, the finger-like fabric supports **241** and noses **241***a* are preferable; the action of these being similar to that of **242** and **242***a* above.

The base fabric F may be of various kinds of material. Duck or burlap are equally good, but any other woven fabric may be employed including canvas, ticking, hessian, etc. Our best turfed products have been with duck; but the base fabric can be of a much closer weave. The size of the threads of yarns or other material will depend upon the size of the mesh of base fabric F, in order that two thicknesses of the thread (U1, U2, Fig. 1A) may be securely held by friction inside the mesh with one another and with the sides of the mesh. For turfing with a base fabric of duck, we have found the following sizes of yarn thread to be quite practicable: for turfing with uncut loops, as in Fig. 9, the size of thread may be 3/7 where the numeral **3** represents the number of strands and the numeral **7** the size of each strand; for cut-loop turfing, as at CL, Fig. 8, the threads may be either 3/10, 3/11, 3/12 or 3/13. The diameters of these threads vary from 1/6 inch to 1/8 inch. The yarns practicable (when yarn is used for threads Y) are the zephyr yarns, or yarn comprising a mixture of wool and rayon, or various other makes of wool yarns.

The respective multiple loop-projecting needles N, Fig. 9, are curved down at their pointed ends, Figs. 34–37, the eye being formed at that end as in ordinary sewing machine needles. The needle is formed with a straight longitudinal groove shown as duplicated at opposite sides, Fig. 35, for the reception respectively of both legs of the thread-loop passing thru the eye. The needle also is formed with a transverse notch, shown as dupli-

cated at opposite sides at G1, G2 near the pointed end, Figs. 34, 37, and adjacent that portion of the eye which is more remote from the point. That more remote portion of the eye is in direct communication with the transverse notches G1, G2; and said notches are in communication, Figs. 34, 37, with the straight longitudinal grooves which extend toward the needle-shank at right, Fig. 34. The special construction of the needle with the transverse notch G1, together with the special construction of loop-head holder LH, Figs. 1A–6A, and Figs. 1–6, to be described, makes it easier for the holder to enter projected loop L (without tearing the loop-thread) while its legs extend along the sides of needle N rightwardly from the eye, Fig. 34; the longitudinal grooves, by providing housings for the loop-legs, reducing friction with the fabric-meshes during loop-projection with the needle, and thereby permitting larger yarn relative to the size of the fabric-meshes and consequently greater friction between yarn-threads and meshes permanently in the product. As shown in Fig. 34, the needle-notch G1 which faces loop-head holder LH is quite deep, particularly just to right of the eye. The direct termination of the eye in notch G1 insures that the loop-yarn shall bridge across the notch; this assurance being increased by the communication between the eye and the longitudinal groove in the rear side of the needle in Fig. 34 by way of the other transverse notch G2; the result being that the deep notch G1 causes a small space to be bridged across between the notch-wall and the loop-leg which extends longitudinally of the needle across the notch rightwardly, Fig. 34. Longitudinally extending loop-head holder LH, which passes thru notch G1 while the loop-leg is bridging across the notch, is shown in Figs. 1–6, and Figs. 1A–6A. In the exemplary illustration, holder LH and head-cutter K both are operated by rod **228** which moves straight up and down. Holder LH, as shown, is formed with a pointed end for entering loop L; this point extending in line with the side of LH which faces needle N. Holder LH in this form resembles a longitudinal half of a sharpened pencil-end save for such offsetting of the pointed end from the central longitudinal axis. The portions of LH which do not face needle N, Fig. 1A, i. e., which face the inside of the loop-head, are formed blunt, rounded or curved, as shown, for holding engagement with the loop-head without injuring the thread-yarn; but the side of LH which faces N is differently shaped, straight as shown, so as to be more nearly adapted to the shape of the wall of needle-notch G1 and move straight thru the notch and closely alongside the wall of the deepest portion of the notch just to right of the needle-eye, Fig. 34, so that LH moves closely adjacent the wall of the needle at the notch G1 as LH is moved across the needle-path; and the location of the pointed end of LH, i. e., extending directly in line with said side of LH which faces N, provides for the movement of said point also closely adjacent the needle-wall at notch G1 and into the small space there bridged by the loop-leg which extends from the needle-eye directly across the notch toward the shank of N, Fig. 34. Head-holder LH is mounted, Fig. 1, so as to be spaced, as a whole, from base-fabric F, and such spacing, together with the illustrated external shape of the side of LH which faces the inside of the loop-head, determines the ultimate position of the loop-head or the length of the loop which has been projected by N thru F. Holder LH as a whole is located more remote from F than device **241**, so that the point of LH enters the portion of loop L which projects outwardly beyond **241** at the time needle-notch G1 is in the path of LH, Fig. 6, i. e., before N can pull the head of loop L back to **241** toward F. As the offset point of LH reaches the needle (between Figs. 5 and 6) the deep portion of needle-notch G1 at right of the eye, Fig. 34, is in line with said small pointed end of LH so that the latter can enter the small bridged space at the side of the needle in notch G1 and therefor enter between the two legs of loop L extending longitudinally rightward from the needle-eye. As LH moves into the loop while the latter is on and being pulled by needle N, then the curved or tapered end-portion of LH engages inside the loop-head to hold the loop from being shortened by being pulled rightward by the retraction of N; and said shape of LH, in addition to the spacing of LH as a whole from F, determines the final position of the loop-head or length of projected loop L. At the time of entrance of LH into and movement inside the loop, the loop-foot presser **131** is pressing against fabric F, the loop-foot which connects the just-projected loop with the thread, projecting thru an adjacent fabric-mesh, of the previously projected loop; presser **131** resisting to some extent, tensioning of the loop by movements of LH along the loop-head. The above portion of LH which is formed for holding engagement with the inside of the loop-head, has the shape shown, which permits the movement of LH thru the loop from pulling the loop-thread from between presser **131** and F; said external shape of LH being so related to the illustrated straight path of LH as a whole, as to avoid putting such great tension on the loop-thread as to pull the loop-foot from under presser **131**. Said presser holds the loop-foot in place also while the cutting edge of portion K of this loop-holding and cutting means LH and K is being rapidly swept along the inside of the loop-head for severance thereof to form the pile-threads. Such loop-holding by said edge is due to the longitudinal shape of the edge (relative to its path of longitudinal movement) which avoids too great tensioning on the loop-thread relative to the pressure by foot-presser **131**; altho said edge acts to hold the loop distended in cutting position at all times while the edge engages with the inside of the loop-head, as follows. As shown, the sharp edge of K is in general alinement with the longitudinally extending head-holder LH, so that as LH moves beyond its loop-head-holding position on its way out of the loop, Figs. 1, 2, it is followed by K which has an end small enough to enter the loop as it follows LH, the alinement of LH and K insuring the entrance of K into loop L. At this time (between Figs. 1 and 2) the loop, (LH and K both being inside it) rests by gravity on the top surface of **241**—**241***a*, Fig. 2 (or **242***a*, Fig. 25), i. e., said surface supports the portions of the loop-legs nearer fabric F thereby holding them up from downward sagging by gravity. As shown, the needles are mounted to project the loop-heads initially beyond **241**—**241***a*, and beyond the path of the point of LH. The edge of K, closely following LH, promptly takes over the loop-holding function of LH now leaving the loop, and said edge continues such loop-holding while the sharp cutting edge relatively slowly cuts thru the loop-head while the long edge is making a relatively rapid sweep across the yarn at the inside of the loop-head. As shown, the edge of K is far longer than the operative portion

of LH which parallels fabric F, and the effect of such long edge is to avoid such abrupt loop-cutting as would produce such high instantaneous tension on the loop-thread as would yank or pull the loop-foot from under presser **131**. That is, all the (actually short but relatively long) time the edge is cutting thru the loop-head and putting sufficient tension on the loop to hold it in cutting position, (and against any loop-shortening by any needle-movement), the long length of the edge causes sufficient distribution of the entire cutting operation progressively along the long edge, to avoid loop-tensioning high enough to pull the loop-foot from under presser **131** and cause shortening of the projected thread, in the adjacent mesh of F, of the just previously projected loop. The maintenance of loop L in cutting position during cutting is contributed to also by the loop-support **241**—**241***a*, Fig. 2, because the upper surface of said support is opposed to the direction in which K moves during its cutting movement, so that the action of the long, sharp edge in moving down below the top surface of **241**—**241***a* pulls the loop-legs down upon said support as a loop-support during cutting, and thus aids in keeping the loop in cutting position so as to produce clean-cut pile-ends. The above sufficient but not excessive loop-tensioning during cutting by the long sharp edge is provided for by the length of the edge itself and its shape as related to the path of bodily movement of portion K which in the example is straight up and down by means of rod **228** which reciprocates LH likewise. In this example, where K is reciprocated straight back and forth generally longitudinally, its long edge which faces the inside of the loop-head, is shown as slightly inclined to the surface of fabric F so that as the long edge sweeps extremely fast across the inside of the loop-head, the cutting action thru the head is relatively very gradual or slow, and not abrupt and thereby avoids putting such high tension abruptly on the loop as to pull the loop-foot from under presser **131**, as the result of the illustrated relation between the longitudinal shape of the long, sharp edge and its path of movement thru the loop. This production of uniformly moderate loop-tensioning by the distribution of the cutting operation along a long length of sharp edge is accompanied by prolongation of time of preservation of the sharpness of the edge itself, at all portions of its length employed in cutting thru the loop-head, which is of practical importance in producing pile-threads with clean-cut ends, in addition to the result of the uniformity of pile-thread lengths which is caused by the above construction and arrangement. It is advantageous not to be compelled to stop the machine during a given production, for the purpose of sharpening the plurality of cutters. Cutters K are mounted, however, Fig. 1, for convenient removal for sharpening upon completion of a given production.

As to the presser-fingers **131** and **132** of Figs. 8 and 9, all of these presser-fingers may be like either **131** or **132**, altho the form **131** is preferred, i. e., the crotched form wherein the two upwardly extending legs form a crotch and between them the needle passes, one of the crotch legs holding a portion of the thread connected to the loop, (the loop-foot), flat and tight against fabric F. In this form the top legs of **131** may be bent over to extend up and lie flat against fabric F, Fig. 1; and the portion at which the bend is made may be at a location such that when **131** is moved toward F, the inclined portion intermediate the upper and lower portions of **131** may press F over and above nose **241***a* of the opposing support **241** so that the intermediate inclined portion of **131** may overlie the nose **241***a*, the inclination of nose **241***a* and the inclined or bent top portion of **131** lying at similar angles. The needles enter the lower part of the opening between the two legs of **131**, Figs. 1, 8–9. The continuation of this opening thru to and thru the top of **131** is useful as follows. In threading a new length of thread from a bobbin A thru the needle, the free end of the thread extends beyond the needle and as soon as the loop-forming by that needle is started, the attendant with a pair of hand shears can snip off the free end of the thread. It is desirable to snip this free end off as short as possible. In the crotched form **131** the free length of thread extends thru the crotch and can be snipped off quite close. In the form of presser-finger **132**, which is broader and has only a circular perforation for the needle passage, without any crotch, the above free end of thread is liable to become caught between fabric F and the surface of the presser-finger, i. e., it does not all hang out of the small hole, and ultimately the loose end may get out at the edge at the part nearest the needle; and while the free end of thread projects out from the broad finger **132** and can be snipped off fairly close to the edge of the finger, yet that is liable to leave too long a length of thread ultimately sticking out from the back (needle side) of the fabric F.

Other timings of the elements than those shown in Figs. 1–7 may be employed, but the same are shown clearly because they are those which we have found to give commercially satisfactory results.

In lieu of the pantograph control of the simultaneous multiplex production it is quite practicable to employ wholly automatic mechanism not requiring the manipulation of handle H by an operative; but we have shown the pantograph control because we have employed it in the machine illustrated and found it to produce perfect results, and furthermore the disclosure of the automatic control referred to (which we have also in our possession in the form of operating mechanism would have made the drawings more complicated without adding anything to the disclosure of the principles of the invention. In operating the pantograph the operator exerts more or less pressure continuously on handle H, but he is skilled by experience, and he governs the pressure exerted by his muscular effort in accord with his sense of feeling in controlling the movements of the movable frame for fabrics F, the entrance of needles N thru the fabric causing a resistance at handle H to the effort of the operator so that at all times he maintains a slight pressure on handle H which is just enough to move F a distance of one mesh as soon as the needles have retracted from fabric F and the latter is freed from being gripped between presser-fingers **131** and supports **241**, to be moved by such manual pressure on the pantograph handle. Presser-fingers **131** on the needle side of fabric F, and supports **241** on the loop side (Figs. 1–6) hold the fabric F between them just before the needles enter the fabric and just after they leave it (curves **1**–**3**, Fig. 7) and thereby keep the operator from moving the fabric at such times thereby insuring that the fabric shall be stationary at such times in addition to all times when any portions of the needles extend actually thru it (dotted curve **8**, Fig. 7). The length of mo-

tion of the fabric-frame by the pantograph when the fabric meshes are free of the needles, is effected by the operator as desirable for different degrees of coarseness of the fabric mesh, and the moving of the fabric frame over short distances adapted to a fabric of a given mesh is involved with the skill of the operator and his knowledge of the size of mesh of the fabric employed, the whole depending upon the extent to which he applies his muscular effort to pantograph handle H.

The needles extend in a long horizontal row or rows (two rows in Figs. 10–11) separated from one another in the row, Figs. 8–9, by short distances such as those shown. This arrangement, which permits a large number of needles within a comparatively small unit length of the machine, i. e. within the area of a given unit hook rug, is permitted by the comparative simplicity of the machine as a whole whereby many needles can be used simultaneously, lying closely together, i. e., as closely together as is desirable for a given design and size of rug. Thus, for example, a substantially large number of needles may be used simultaneously for each unit turfed fabric, such as a hook rug, and a plurality of such turfed units can be produced simultaneously each with its plurality of needles. It is to be observed particularly that the loops or cut pile threads project from the side of fabric F which is opposite to the needle side thereof; and that the only parts of the loop threads which lie on the needle side are those short lengths of thread (loop-feet) which lie flat against the fabric and extend from one mesh thereof to the succeeding mesh and join the two thread legs (Figs. 1A, U1, U2) extending thru such adjacent meshes. Those loop-feet are the parts of the threads which are engaged by the presser-fingers **131**, **132** on the needle side of the machine as shown in Figs. 8–9. The turfed products shown in Figs. 8–9 are the square designs above referred to, and not the more ornamental curved designs illustrated for example in Fig. 29A. In Figs. 8–9 the fabric-frame, Fig. 42, is moved mesh by mesh, over a plurality of meshes in a horizontal line and then vertically one mesh, and then again in plurality of meshes in a second horizontal line, and continuously in such zigzags, a single needle N forming each of the vertical series of zigzags of loops shown. This is the kind of work which is effected by the employment of supports **242**, Figs. 25–27, on the loop side of the machine. But when supporting fingers like **241** of Figs. 28–29 are employed, then the fabric-frame can be moved not only in said zigzags, but freely in all directions in accord with a curved design on the pantograph board, with the result of producing the more ornamental turfed articles illustrated in Fig. 29A. In all our products by this machine, however, the loops or the cut pile-threads in the products are held solely by friction in base fabric F. Thus we eliminate all means such as extra needles or shuttles or both for the purpose of securing the loops or pile-threads to base fabric F, and particularly, mechanism for supporting and operating such means, and this simplifies the machine as a whole to such extent as to provide space to receive our turfing elements of Figs. 1–6 and 1A–6A constructed and operating as disclosed in a way suitable to permit practical working and fabricate a perfect product of the friction-held turfing type.

While loop-holder LH is shown as moving vertically, as preferred, yet it may be moved in other directions practicable for engagement through the loops; and the same applies to knife K. And while the true cutting action is much preferred as by a knife, as distinguished from shears, yet in some combinations of the elements disclosed it is possible to employ a shear, although that complicates the construction and operation.

In order to insure a good appearance of the product, whether or not the loops are severed to form pile-threads, it is necessary to obtain the finest accuracy of operations, and that is obtained by use of the principles of the machine shown. This is particularly true when the speed of operations is extremely high for the purpose of reducing cost of production, as in the machine disclosed, wherein the complete cycle of operations indicated in Fig. 7 is effected within the very minute interval of not substantially more than a half second of time. The construction and operation of the type of machine disclosed are particularly adapted to such high speed of operation on a single given product irrespective of whether or not a plurality of separate products are fabricated simultaneously. If this machine, thus adapted for high rate of operation, is operated at lower rates, there is liability of inferior operations of loop-forming and loop-cutting which may result in an irregular loop surface or cut-pile surface of less attractive appearance in the final product. At substantially lower rates, the loops may vary in length and the knife K may cut them non-uniformly, but with the construction and operation disclosed and at the above high rate of operation for which the same are designed, all the loops are of substantially identically the same length and the knife acts to cut substantially the exact middle of the heads of the loops and cause the resulting pile-threads to be of the same length so far as can be determined by the eye of a casual observer. The reason for this difference in results at high and at low rates is believed to be involved with the matter of friction between the thread or yarn Y and the machine elements which operate on it.

The length of the loops, in their projection on the loop side of base fabric F at right angles to the latter, varies for different products as desired according to the initial setting of the needles in their common supporting bar **128**; and the locations of LH and K, distant from the loop side of fabric F, are set to correspond with the lengths of the loops as determined by such needle settings. The respective needles are adjusted to fixed position in their holder, as by a gauge, in setting up the machine to produce a given product, so that all the needles will carry the loops L of thread Y to a uniform length of loops.

With reference to plate **242** of Figs. 25–27, and to multiple supports **241** of Figs. 28–29, it is to be noted that in each case the upward projection of these members is limited to a position below the horizontal paths of loop-carriers N, the same being important in connection with the fabrication of loops and pile-threads projecting from the vertical plane of fabric F toward the vertical plane of **241** or **242**. Also the turfing elements of the machine are constructed and arranged so that the feet of the loops always lie tight against the needle side of fabric F where said loop-feet extend from one mesh to another; the machine preventing any slack of such loop-feet, where the latter parallel the surface of the needle side of fabric F; that is, the formation of any loop-projections is limited to the side of fab-

ric F opposite to the needle side thereof. Although LH is described as a loop-holder, yet it will be understood that the other turfing elements cooperate with LH in holding the loop during fabrication in proper relations to base fabric F; for example, as above, knives K temporarily hold the loops distended before they cut them, and the presser-fingers 131 also hold the loops by pressing the loop-feet tightly against fabric F, and even the fabric-holding members 241 which cooperate with presser-fingers 131 in holding the fabric F steady, nevertheless also cooperate in holding the loops in proper relations in that said members 241 form a back for presser-fingers 131 enabling the latter to function as a contributory loop-holder. Again, although needles N are the principal loop-forming means, yet as above, loop-holders LH at one portion of the cycle of operations, may assist in loop forming by pulling the loops out slightly longer (tauter) than they are formed by needles N.

While the swinging bars 152, 153, Figs. 8–9, are useful in connection with the operations in Fig. 9 which do not involve loop-cutting, and although these bars may be employed in the operations of Fig. 8 which do involve loop-cutting, yet they are not so desirable in the case of Fig. 8 because they might pull thread Y back through fabric F, thereby shortening the cut pile-threads upon loop-cutting by knives K. The fact is also that slight differences in the lengths of adjacent uncut loops are more objectionable, in uncut loop products of Fig. 9, than slight differences in the lengths of cut pile-threads CL as in the product of the operations of Fig. 8; this being because differences in the lengths of uncut loops are more readily observable in the product than slight differences in the lengths of cut-pile threads.

It is to be noted that alternatively, each of plate 242 of Figs. 25–27 and fingers 241 of Figs. 28–29 have several functions, i. e., (1) they are fabric supports in that they cooperate with presser fingers 131 in holding steady the portions of fabric F in the vicinity of turfing operations, and (2) they are loop-supports in that their respective noses 242*a* and 241*a* support the portions of the projected loops which lie nearer to fabric F; and also, as above, these members 242 or 241 aid in holding the loops to their proper distended length in that said members cooperate with presser-fingers 131 which hold the loop-feet tightly against fabric F and prevent the loop lengths from being shortened during turfing operations.

As to the instant of loop cutting it is to be noted that this, Fig. 3, is the instant when needles N are about to project a succeeding loop, this being just as members 241 and 131 have moved into their positions, Fig. 2, pressing fabric F between them so that everything is being held taut for the cutting of the previous loop by the local steadying of fabric F between 241 and 131 and by the holding by 131 against fabric F of the foot of the loop L about to be cut.

While the rate of operations, as above, preferably is as high as a complete cycle of Fig. 7 every half second, (i. e., a production of 120 loops per minute and 240 pile-threads per minute, by each of the plurality of groups of turfing mechanisms), yet the operations may be conducted at a somewhat lower rate than this without producing an inferior product. For example, we have fabricated good products at as low a rate as 80 cycles of Fig. 7 per minute, or 160 pile-threads per minute, i. e., nearer one cycle of Fig. 7 per second instead of per half second; but of course the higher rates are preferable not only because of the resulting fabrication of better products, but on account of the reduction of factory cost consequent upon the much less total time of completely fabricating given products as the result of reducing the time of individual turfing cycles. It will be appreciated that at any of these high speeds the movements of the parts, particularly K and LH, are very rapid; and although, for example, knives K move downward one and one-half inches before the loop-cutting in Fig. 3, yet the intervals of time here are very minute indeed between successive positions of LH and K, and K is given a very rapid cutting thrust against L. It might be assumed that on account of these rapid movements, the loops would not have time, after their projection by needles N, to be altered in respect of their positions or lengths in the horizontal plane relative to the vertical movements of LH and K; but it is to be noted that the movements of needles N are at the same general high rate as those of LH and K and that to some degree the loops are yet subject to the action of N even after they have been projected by N to their furthest extent beyond base fabric F; so that if the construction and operation are not as accurate as intended, there is danger that the loops will not be in proper position or shape for cooperation by LH and K, i. e., the loops may be moved from such proper position or condition even in the extremely short interval of time after the loops have been projected and before cutting engagement therewith by knives K.

In the construction disclosed, Figs. 1–6, the horizontal bends in presser-fingers 132 near the tops thereof preferably are at such height relative to noses 241*a* on the opposite side of fabric F that when 131 and 241*a* press against fabric F toward one another, said bends in 131 move slightly over the tops of noses 241*a*, as indicated in Figs. 2–6, thereby most securely gripping fabric F to steady it and most firmly holding the loop-feet on the needle side of fabric F between the latter and presser-fingers 131 to prevent thread-slipping. Referring to the operation by the pantograph, the operator puts more pressure on handle H when a fabric F is employed which is of larger mesh, i. e., which has a greater distance between the centers of successive meshes thereby requiring longer movement of fabric F in its vertical plane in order to move a fresh mesh into the fixed horizontal paths of needles N. But even under such greater manual pressure, movement of fabric F cannot be started until after the points of needles N are withdrawn completely from its meshes, on account of the action of the many pairs of members 241 and 131.

In the cycle of operations of Fig. 7 a single stroke of the needles is sufficient for threads Y when they are of coarse yarn, but the arrangement shown, (in curve 1) for double stroke needles, is preferable for more fragile yarns or threads of other material. An advantage of the single-stroke needle is a longer pause of the needle at the extremity of its loop-projecting stroke so as to afford most assurance of the passage of the pointed end of loop-holder LH between a thread constituting one leg of a loop and the adjacent transversely notched portion of the needle. However, we employ in practical production by the machine shown, the arrangement shown of double-stroke needle and in the machine as described and as shown in these draw-

ings we have found no difficulty in this respect, i. e., the loop-holders and knives always act in a timely manner to hold and cut all the loops. In selecting a base fabric for a desired appearance of the finished turfed product in respect of close association of adjacent loops or cut pile-threads, a fabric F of smaller mesh is selected when it is desired to have a closer association of loops or pile-threads for the desired appearance of the completed turfed product; and the fabric mesh is selected also with reference to the size of thread Y employed, in order that in the product the loops or pile-threads may be held securely to the base fabric by means of friction alone without any sewing of the thread Y to the fabric F. An important feature of the invention is that in the embodiment disclosed the loops or pile-threads, and the lines or rows of individuals thereof which result from movements of fabric F in suitable directions to produce the desired designs, can be made very close together, so that there is no appearance of rows of loops or threads being spaced from one another, i. e., in our product the surface consisting of the uncut heads of loops L (Fig. 9) or of cut loops CL (Fig. 8) presents a homogeneous appearance, the fact being that each loop or thread is uniformly spaced from loops or threads lying in all directions adjacent to it, aside from the fact that the pile-threads project in pairs thru each fabric mesh.

Another important function of presser-fingers **131**, in the case disclosed of operation by pantograph handle H, is to prevent movement of fabric F by the pressure on handle H, just before engagement of needles N with the fabric, in order that the fabric may not be in motion at the time when the needles engage it; this purpose being effected by the movements of **131** to engage the fabric (Fig. 2), clamp it against **241***a*, and hold it against motion by the pantograph, before needles N start (Fig. 3) to enter the meshes of the fabric. It is clear that in the preferred form of machine disclosed, the presence of hundreds of pairs of members **131** and **241**, simultaneously acting on the fabric, establish frictional conditions which effectually prevent movement of the fabric by the muscular effort of the operator at pantograph handle H.

In the operation of the machine, between successive loop-projections by needles N, the movement of fabric F causes a slight movement of thread Y through the eye of the needle, because the edgewise movement of the fabric is transverse of the paths of the needles, and the thread passing through the eye of the needle is connected with its portion projected through the fabric to constitute an uncut loop or a side of a cut loop, the foot of such loop or side of cut loop being held to the fabric by loop-holder LH during the time, intermediate Figs. 1A and 2A, while the fabric is being moved (full portion of curve 8, Fig. 7), this being at a time when, Fig. 1, presser-members **131** and **241** are out of engagement with fabric F and the loop-feet of thread Y, and needles N are not moving forward to project loops so that the edgewise movement of F pulls the threads thru N to form the loop feet on the needle-side of F, which feet then, Fig. 2, are clamped by **131**.

Generally the length of the uncut loops is from one-quarter inch to somewhat more than an inch for hook or pile rugs; but with the same machine disclosed the loops may be made much longer by the above adustable positioning of needles N and of LH and K so that loops or projecting cut pile-threads may be made of greater desired lengths to produce various desired forms of products having long fringes. In this respect the noses **242***a* and **241***a* are of great value in supporting as much as desired of the lengths of the threads adjacent fabric F on the loop side thereof, leaving exposed beyond the noses toward LH and K only sufficient portions of the lengths of the loops to permit proper operation of LH and K through the loops near the curved heads thereof.

As to the closeness together of the loop-feet on the needle side of the fabric, and the rows of such feet, Figs. 8 and 9, and similarly in Fig. 29A, the machine disclosed customarily makes loops to a maximum of 90 to 100 per square inch, depending on the size of the meshes of fabric F and the size of the thread Y and the control by the pantograph.

When it is desired to produce turfed products of large superficial area extending nearer the tops and bottoms of F, the rolls of the fabric-frame, Figs. 40–42, may be turned at a desired stage of progress of the work so as to place a new portion of fabric F within the fields of operations of the multiple groups of turfing mechanisms.

The noses **242***a* (Figs. 25–27) or **241***a* (Figs. 28–29) are of particular importance when the operations involve loop-severing as in Fig. 8, because the function of such noses in holding up the loops to be cut is important in keeping the loops in best positions for cutting. But said loop-supporting function of said noses is not necessary in operations not involving loop-cutting, as in Fig. 9; although the functions of members **242** or **241**, which carry said noses, in any case are important in holding fabric F steady, in cooperation with presser-fingers **131**, in both kinds of operations in Figs. 8 and 9, i, e., whether or not the loops are cut. Likewise when the fabric-supporting devices are employed in the form of separate members **241** of Figs. 28–29, for the purpose of fabrications involving curved-line designs as in Fig. 29A, as distinguished from the square working as in Figs. 8–9, then the function of fingers **241** in steadying fabric F, in cooperation with presser-fingers **131** is important, even if uncut loops are involved in the curved line designs as in Fig. 29A, i. e., even if it is not important that the loops be supported for cutting. In any such cases the spaced members **241** may have any suitable design for engaging fabric F below needles N to press the fabric toward portions of corresponding presser-fingers **131** for the purpose of gripping and steadying fabric F during the operations of loop-projecting by needles N, so that the loops, forthwith upon their projection, will lie in the relations to fabric F which are permanent relations.

It will be understood that with the permissible large areas of the pair of long fabrics F, Fig. 42, or even of one such long fabric, it is practicable to produce simultaneously a large number of turfed products such as hook rugs or other turfed products within the large limits of our type of turfing machine shown. In this type of machine it is of material importance that reliance be placed on holding the loops or cut pile-threads in permanent assembly with base fabric F by means of friction alone and without any stitching or sewing of the thread to the base fabric; because the loops are projected beyond the side of fabric F which is opposite to the needle side thereof, and the turfing elements K and LH are located on such loop side

of the base fabric and occupy substantially all available space on that side so that it is not practicable in a machine of this multiplex type of employ any mechanism for sewing the thread to the base fabric, and in fact it is preferable to rely on friction to hold together in assembly the parts of the turfed product because the same makes it possible to simplify the entire machine so as to make it commercially practicable, i. e., of such nature as to secure the absolutely necessary extent of accuracy of the turfing operations and to effect the production in an economical manner. In this connection it is to be noted that needles N are in no sense sewing devices, i. e., they produce no stitches but act solely as the needles in prior hand machines for making hook rugs and the like, i. e., to form loops by projecting through base fabric F the loop which extends through the eye of the needle, both threads carried by each needle forming continuations or legs of such loop, which legs are dragged by the needle through a single mesh of the base fabric, against friction therewith, until the desired length of loop projects beyond the other side of said fabric, whereupon the loop thus projected is held by other mechanisms in its projected position while the needle retracts to its own side of the fabric without performing any sewing operation such as passing stitches through the loops and the base-fabric for the purpose of sewing them together, the cut pile-threads here being held satisfactorily to the base fabric, as in similar hand-made articles, solely by friction alone between themselves and the base fabric itself. The action of devices N in carrying loops through fabric F is what is called by mariners "reeving a bight" as distinguished from sewing or stitching. And as above, two other sets of devices, additional to the needles, cooperate in this loop-forming, i. e., the movement of fabric F forms the loop-feet on its needle side, prior to the initiation of loop projection by needles N, and thereafter the principal loop-holder LH causes the loop to become longer by pulling its head further from fabric F. Needles N, however, are the only devices which pass through fabric F. And our turfing elements include four loop-holding devices in each group, i. e., three loop-holding devices additional to principal loop-holder LH, i. e., K, **131**, and **241***a*, these being loop-holding devices in the sense that they hold the loops in uniform lengths beyond fabric F. Those four loop-holding devices are additional to loop-supporting devices **241** and **241***a* which act to support or sustain a substantial length of the loop in horizontal position suitable for cutting of the loop-head by K. Our turfed products are characterized not only by practically uniform lengths of loops and cut pile-threads but by the closeness of association of the loops or cut pile-threads with one another in the same row and by the closeness of adjacent rows, so that each unit loop or pile thread not only is substantially uniformly spaced from the loops or threads successively adjacent to it at all directions, but such spacing is very close indeed, with the result of furnishing a most desirable appearance to the surface of the product. (Of course, however, the pairs of threads thru each fabric-mesh are spaced from adjacent pairs by the thickness of the fabric thread).

Our machine, which produces turfed articles of the above desirable characteristics, is characterized generally by its simplicity which is great in proportion to the complicated operations which it produces with the above necessary accuracy; and it is further characterized by the fact that the only turfing devices on the needle side of the base fabric are the needles themselves located in a horizontal row in close successive relations to one another, and the presser-fingers **131**, all the other turfing elements being located on the loop side of fabric F which is opposite to the needle side. And fingers **131** need not be separate from one another, but may be combined as a single member, analogous to member **242** of Figs. 25–27, extending horizontally the entire length of fabric F.

While LH and K as shown preferably reciprocate vertically they or either of them may reciprocate at other angles suitable for their passage thru the loops projected by needle N.

The deep notch **236** in the side of the pointed end or spur of loop-holder LH, Figs. 1–6, receives the pointed end of resilient knife blade K at all times save when, Figs. 5–6, needle N while projecting a loop, is moved to a horizontal position wherein it extends, Fig. 6, thru the space between the pointed ends of LH and K and becomes wedged between them as they move up, forcing the point of K out of notch **236** of LH and away from LH. At this time LH is moving up thru a transverse notch G1 or G2 of needle N, Figs. 34, 37, and K thru the transverse notch of the needle, along the opposite side of the needle; and all these notches, **236**, G1, G2, permit the important close relations between the three pointed members LH, K and N, by which closeness, in connection with the end-to-end relations of LH and resilient knife K, LH is assured, Fig. 5, of entry between the legs of the loop lying in the longitudinal thread-grooves in needle N, and K is assured, Figs. 1–2, of entry into the loop after the needle has been retracted from the loop and while LH is being retracted from the loop, and while the loop is supported on **241***a*.

As above, the multiple-support arrangement of Figs. 28–29 when applied to the machine, may be employed for the square working shown in Figs. 8–9, these members being adapted for universal working of either square or curved-line designs.

The fabric supporting rollers RT and RB of Figs. 40–42 are operated, manually, to move base-fabric F vertically to new positions, only when the needles and the fabric clamping means associated with the needles are disengaged from the base-fabric. The above disengagement of knives K from the loops while fabric F is in motion in its plane, Fig. 1, prevents any undesirable loop cutting at such times. Said rollers are provided with a spreader or spacing-bar **93**, constructed and arranged vertically as shown best in Fig. 42, for the purpose of keeping the rollers in positions adjusted apart so as to keep the rolls from sagging or other vertical movement, so as to provide for equal tension in all parts of base-fabric F. As shown in Fig. 40 and top of Fig. 42, the spreader **93** extends vertically between the top roller RT and the lower roller RB of this pair of rollers, the top and the bottom of fabric F being connected to these two rollers. The upper portion **97** of spreader **93** holds top roller RT from downward sagging, and the lower portion **97** of the spreader holds lower roller RB down so that the fabric F is held taut under tension between the pair of rollers.

The movements of the fabric frame by the pantograph, as illustrated above, are while knives K, Fig. 1, are out of cutting relations with the loops I and while loop-holders LH are not only inside the loops but in their fullest engagement with the inside of the loop-heads so as to hold

the loops in place while the fabric F is moving at right angles to the needles carrying the threads which are connected to the loops engaged by loop-holders LH. Of course at this time of movement of fabric F by the pantograph, the fabric clamping devices are also disengaged from the fabric, Fig. 1.

The general organization of the machine, as shown in the drawings, is as follows.

Main transmission

As shown in Fig. 13 the main drive is from electric motor M, via pulley 100, belt 105, loose pulley 103 to tight pulley 102 on shaft 104 in floor-stand 109; thence via belt 110 to pulley 111 on main drive shaft 112 in bearing 113.

Mechanism operating LH and K

Fig. 10 shows the mechanism on the needle side of fabric F, (front of machine) and Fig. 12A that on the pile side of F or rear of machine.

LH and K both are mounted on bar 230, as shown most clearly in Fig. 1.

The drive is from pulley 111 respectively to cam 197 for positively lowering LH and K and indirectly aided by cam 198, and to cam 198 for positively raising LH and K indirectly aided by cam 197. Bar 230, supporting LH and K, extends horizontally along the length of the machine, supporting the numerous duplicates of LH and K. Vertical rods 228 move bar 230 up and down. Rods 228 are supported by members 224—227. Rods 228 are guided by bracket-bearings 245 secured to the member 244 which supports members 241 or 242. Member 224 is a guide-stud fixed in the end of crank-arm 219; its length being sufficient to allow the transverse withdrawal of the knife-actuating mechanism linkage, to slide toward the needle side of F, at times of replacing one fabric F with another or fresh fabric. Member 225 is a vertically-extending link pivoted on guide-stud 224 and free thereon for withdrawal toward the needle side of F at such times of replacing F. Member 226 are studs fixed to the bosses of brackets 227 which are clamped to vertical actuating rods 228 by screws 267—268. Member 199 is a cam-roll contacting with the top of lowering cam 197; and 200 is a cam-roll contacting with the bottom of raising cam 198, and held in such contact by roll 199. Cam-roll studs 201 are fixed in slide 202, and support rolls 199—200. Slide 202 reciprocates vertically and transmits such motion to rods 228 by way of linkage 203—205A, 212—213A on shaft 214. On shaft 214 is fixed collar 216. Push-pull rod 217 indirectly transmits motion from shaft 214 to rods 228, by way of pivot-blocks 218 operating bell-crank lever 219 and bell-crank arm 219A, stub-shafts 220 and vertically-extending links 225 pivoted on guide-stud 224 and vertically reciprocating rods 228 and support 230 for knives K and loop-holder LH. Lever 219 is cast integral with arm 219A and is fixed on shaft 220. Arm 219A is linked to rod 217 with blocks 218. Shafts 220 are supported in brackets 221 and carry members 219—219A. Bottom brackets 221 support shafts 220 and guide-bars 222. Bottom brackets 221A support guide-bars 222. Member 221B is a boss on brackets 221—221A against which stop-screw 247 abuts as a gage to limit movement of support 241, Fig. 25 or support 241, Fig. 29, toward fabric F. Guide-bars 222 support (at top and bottom) the knife-bar 230 and the supporting members for 241 or 242. Collars 223 are fixed to opposite ends of shafts 220 from 219—219A to keep 220 in place. Knife-bar support brackets 229 are fixed to rods 228 at one set of the ends of 229 and at their other ends are secured to horizontal bars 230. Knife-raising blocks 231 may be integral with bars 230 and serve as means to adjust the vertical position of knife-blade K. Knife-supports 232 are twisted or otherwise arranged to allow adjustment of the portions of blade K. Binder-screw 233 passes thru 231—232 and into 230 to hold K in desired proper position.

Mechanism operating the needles

Cam 114 on shaft 112 operates twin follower-cams 115 respectively operating inside and outside of cam-formed rims of cam 114, parallel rods 116 supporting said twin follower-cams 115. Rock-shafts 117 are actuated by 114—116. Actuating levers 118 tie rods 116 with rock-shafts 117 by way of pivot-studs 119. Shafts 117 actuate lever 124 connected by link 125 to member 126 which is the reciprocating support for needle-bar 128. Support 126 moves on guide-rods 123 and reciprocates needle-bar 128. Members 127 are pivot-studs for link 125, lever 124 and supports 126. End bearings 120 support upper rock-shaft 117. The ends of lower rock-shaft 117 are supported by end-frames 10—11. Members 121 are intermediate bearing brackets for shafts 117, etc. Members 121A are upwardly extending bosses of 121 in which are fixed guide-rods 123. Members 129 are needle-clamps and 130 are screws for said clamps.

Mechanism for bottom release bar 152

See also Fig. 8.

Cam-roll 144 is operated by shaft 112 by way of cam 143 thereon, and connected with lever 141 fulcrumed on stud 146 fixed in side-frames 10 or 11. Link 147 connects lever 145 with parts 148—149. Vertical dual link 148 actuates lever 149 connected to rock-shaft 150 to swing arms 151 and move bar 152 thru its movement which is short relative to that of top release bar 153.

Mechanism for top release bar 153

Cam 161 is operated by shaft 112, and roll 160 rides on the lower surface of cam 161 to actuate bar 153 thru its wider swing than bottom release bar 150. Cam-roll 160 operates bell-crank lever 159 fulcrumed on shaft 141. Link 158 connects lever 159 with vertical dual-acting link 157. Lever 156 is actuated by link 157 and is secured to rock-shaft 155 which carries arms 154 which support bar 153 and swing it.

Mechanism for presser-fingers

Cam 140 is mounted on shaft 112 and operates either form of presser-finger 131 or 132 by way of linkage 133—139. Cam-roll 139 is actuated by the top surface of cam 140 and is secured to lever 138. Lever 138 is connected by link 137 to vertical dual-acting link 136. Link 136 is connected by levers 135 to rock-shafts 134 to which fingers 131 (or 132) are connected as by bolts 133.

Mechanism for feed-roll 172 and brake 193

This roll 172 as shown is hollow with small connected interior spindle shaft 173 which supports ratchets 175 and friction brake drum 193 fixed to said shaft 173. Cam 162 is mounted on shaft 112 and operates roll 163 which operate bell-crank 164 to operate lifter-rod 165 linked by pivot-studs 166 to feed-pawl levers 167 which support and operate pawls 176 by way of pivot-

stud 177. Pawls 176 operate ratchet 175 on shaft or spindle 173 and thereby turn feed-roll 172. In addition, 168 is a fulcrum-stud for pawl-levers 167; 169 are brackets at right for successive units of feed-roll 172 longitudinally of the machine; 170 are brackets at left for the same; 171 are intermediate brackets for the same; 178 are pawl-springs anchored to pawl-levers 167 by pin 179 set vertically in levers 167; said springs being anchored to pawls 176 by pin 180 set horizontally in pawls 176; 181 is a top out-board support bearing-bracket for spindle-shaft 173; 182 a bottom bracket for the latter; 182A is a boss, cast solid with bracket 182, and thru which is anchored tension-rod 183 for the brake for feed-roll 172; 184 is a lock-screw in boss 182A, for locking tension-rod 183 in various positions of vertical adjustment; 185 are spring terminal blocks locked to tension-rod 133 by screws 186; 187 is an adjustable spring anchor hook regulated by knurled nuts 188 by varying the tension of springs 189 to regulate the friction of the braking of feed-roll 172; 190 is a brake-arm pivoted to brackets 181—182 by studs 191 and pulled upwardly by springs 189 against brake-drum 193 fixed to shaft 173; and 192 is a brake-lining as a wood block.

Mechanism for fabric-supports 241 or 242

See also Fig. 28 or Figs. 25–27.

On rock-shaft 243 are mounted supports 241 or 242 which are operated by the rocking of said shaft. This shaft 243 itself is journaled in bearing 238 in general supporting member 244 of the machine. Shaft 243 is operated by its pinion 240*a*, Fig. 28, which meshes with pinion 240 on shaft 134, which, as above, is the shaft which also operates presser-fingers 131 or 132, so that the presser-fingers and these fabric-supports 241 or 242 are operated simultaneously.

General

The driving motor M may be an electric induction motor of three-quarter horse-power, with high speed of 1135–1200 R. P. M.

The main machine includes left and right end samsons 10—11, front and rear top rail girders 12—13, front and rear bottom rail girders 14—15, angular side-brace 16 for pantograph board B and frame 10, and angular back-brace 17 for board B.

In back-brace 17 are mounted shafts 19 in bearings 18; said shafts supporting the fabric-frame by crane-members 20—21 of which left member 20 is provided with left-end extension 20E. The fabric-frame includes top and bottom I beams 33—34, right and left side-members 35—36 supporting 33—34; and wooden guide-rails secured to 33—34 to guide fabric F in its vertical plane, especially when the rolls RB and RT carry increased diameters of rolled-up fabric F.

Roll-studs 39 extend thru bifurcated ends of crane-members 20—21 and carry rolls 39 supporting the fabric-frame by way of bridge-members 41 which allow left to right movement of that frame by the pantograph; the members 41 being supported by bracket 42 and studs 43. Bracket 45 supports guide-bars 46.

The pantograph control of intermittent operation of the fabric-frame includes handle H secured to the bottom of control-link 67; the vertical adjustment-slide and rack O adjusted by way of pinion on spindle 59 of handle 60; teeth of rack O; carriage-member P; anchorage casting Q; stud anchoring pantograph leverage arrangement between handle H and operating the fabric-frame by way of parts O, P and Q; upper and lower pantograph links 65—66; control-link or operator's handle 67; anchor-link 68 and extension 68A; locking bars 73 and bracket 74; and counter-balance weight 86.

As shown, Figs. 10A, 12, 17, 42, the fabric-frame includes duplicate upper and lower mechanisms including rolls RB and RT, so that at the same time operations are conducted on two long fabrics F each extending almost the entire long length of the machine; the multiple sets or groups of turfing mechanisms being located close together along two horizontal lines each opposite the respective two base-fabrics F; and the novel elements and turfing mechanisms hereof being located in the machine in replacement of the shuttles etc. heretofore employed in such locations in multiple embroidery machines. In all respects other than the construction and operation of the turfing mechanisms hereof and their operation by power from motor M, the general construction and arrangement of the machine may be like the ordinary prior multiple embroidery machine as shown in full detail in the drawings and known to those skilled in the art of multiple embroidery machines.

We claim:

1. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a relatively movable fabric-frame supporting the base-fabric, loop-carrying means on one face of the fabric and carrying loops thru the meshes of the base-fabric into positions projecting substantially beyond the other face of the fabric; mechanism reciprocating the loop-carrying means back and forth thru the fabric; loop-holding means on the loop face of the fabric and having a loop-entering end and longitudinally reciprocable along the base-fabric for movement of its end into a loop on the loop-carrying means; mechanism reciprocating the loop-holding means into and out of the projected loops on the loop-carrying means; mechanism moving the fabric frame in accord with a master design, to move the fabric edgewise in its plane between the loop-holding means and the loop-carrying means while the loop-carrying means is disengaged from the base-fabric, whereby successive operations of both said loop-carrying means and loop-holding means fabricate a thread-loop design on the base-fabric which duplicates the master design; and clamping means mounted at the respective faces of the base-fabric opposite one another and adjacent the loop-carrying means, for holding the base-fabric from broadside movements and clamping loop-feet to it.

2. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a relatively movable fabric-frame supporting the base-fabric in a vertical plane, of plural groups of duplicate turfing elements, including needles on one face of the fabric carrying thread-loops thru the meshes thereof to positions extending substantially beyond the other side of the fabric, and including means on the loop face of the fabric and having a loop-entering end hold-

ing the projected loops; clamping means mounted at the respective faces of the base-fabric opposite one another adjacent the paths of the respective needles, for holding the base-fabric from horizontal broadside movements and clamping loop-feet to it; mechanism operating the turfing elements of the plural groups simultaneously and operating the clamping means on at least one face of the base-fabric; and mechanism moving the frame in accord with a master design, to move the fabric edgewise in its vertical plane between the groups of loop-holding means and loop-projecting needles, whereby the successive operations of plural groups of turfing elements simultaneously fabricate a plurality of projected-thread designs on the base-fabric which duplicate the master design.

3. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a relatively movable fabric-frame supporting the base-fabric, of duplicate turfing elements including needles projecting thread-loops thru the meshes of the fabric to positions extending substantially beyond the face thereof, said turfing elements being arranged in a plurality of groups within the length of one dimension of the portion of the base-fabric which is to constitute the base of the product; clamping means mounted at the respective faces of the base-fabric opposite one another adjacent the paths of the respective needles, for holding the base-fabric from broadside movements and clamping loop-feet to it; mechanism simultaneously operating the turfing elements of the plural groups duplicating the operations at corresponding portions of the base-fabric; mechanism intermittently moving the clamping means on at least one face of the base-fabric; and mechanism moving the frame in accord with a master design carrying the base-fabric edgewise presenting its open meshes to the needles for the filling of the latter with loops by the turfing elements, the frame being moved by said mechanism at least in the direction of the second dimension of the area of its portion which is to constitute the base of the product, and while said clamping means are out of clamping relation with the fabric.

4. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, which includes the combination with a relatively movable fabric-frame supporting the base-fabric, of a plurality of groups of duplicate turfing elements including needles carrying thread-loops thru the meshes of the fabric to positions extending substantially beyond the face of the fabric; clamping means mounted at the respective faces of the base-fabric opposite one another adjacent the paths of the respective needles, for holding the base-fabric from broadside movements and clamping loop-feet to it; mechanism operating the turfing elements of the plural groups simultaneously, and operating the clamping means on at least one face of the fabric; and mechanism moving the frame carrying the fabric edgewise in accord with a master design whereby successive operations of said plural groups of turfing elements simultaneously fabricate a plurality of projected-thread designs on the base-fabric which duplicate the master design.

5. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, which includes the combination with a relatively movable fabric-frame supporting the base-fabric, of a plurality of groups of duplicate turfing elements including needles projecting thread-loops thru the meshes of the fabric to positions extending substantially beyond the face of the fabric, at least one of said groups being provided for each product and the plural groups for plural products; mechanism operating the turfing elements of the plural groups simultaneously; clamping means mounted at the respective faces of the base-fabric opposite one another adjacent the paths of the respective needles, for holding the base-fabric from broadside movements and clamping loop-feet to it; mechanism moving the frame carrying the fabric edgewise in accord with a master design whereby the successive operations of said plural groups of turfing mechanisms simultaneously fabricate a plurality of products which include portions of the base-fabric and duplicate the master design, and mechanism holding the clamping means on the needle face of the fabric out of fabric-clamping relation while the frame is being moved, and moving said means into clamping relation before the needles enter the fabric.

6. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, which includes the combination with a relatively movable fabric-frame supporting the base-fabric, of a plurality of groups of duplicate turfing elements including needles carrying thread-loops thru the meshes of the fabric to positions extending substantially beyond the face of the fabric, a plurality of said groups being provided for each of the plurality of products; mechanism operating the turfing elements of the plural groups simultaneously; clamping means mounted at the respective faces of the base-fabric opposite one another adjacent the paths of the respective needles, for holding the base-fabric from broadside movements and clamping loop-feet to it; and mechanism moving the frame carrying the fabric edgewise in accord with a master design whereby the successive operations of said plural groups of turfing mechanisms simultaneously duplicate the master design at a plurality of portions of each of the plural products; and mechanism by which the base-fabric is made free of the clamping action of said clamping devices during the time the needles are out of engagement with the fabric and while said frame is being moved.

7. A turfing machine for manufacturing pile fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric, and severing the curved heads of the loops so projected to form pile-threads, said machine including the combination with a relatively movable frame supporting the base-fabric, of loop-projecting means on one face of the base-fabric, means clamping loop-feet to the same face of the fabric; and loop-holding and loop-cutting means on the other face of the base-fabric and reciprocable across said other face of the base-fabric and thru the projected loops to hold them out from the fabric and cut them in two; and mechanism moving the fabric frame edgewise causing different meshes of the fabric

to be presented to the operation of said loop-projecting means.

8. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction and severing the curved heads of the loops so projected to form pile-threads, said machine including the combination with a relatively movable frame supporting the base-fabric, of a plurality of groups of duplicate turfing elements including needles projecting the loops; movable knives in the respective groups and having loop-entering ends and having long cutting edges inclined toward the fabric in the direction of knife-cutting motion generally parallel to the fabric and engaging, holding and cutting the insides of the curved heads of the projected loops; mechanism simultaneously operating the turfing elements and knives of the several groups; and mechanism moving the frame carrying the fabric edgewise in accord with a master design.

9. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a relatively movable frame supporting the base-fabric in a vertical plane, of turfing elements on opposite faces of the base-fabric including needles carrying the thread-loops thru the fabric meshes to positions extending substantially beyond the face of the base-fabric, said turfing elements being arranged in a series of duplicate groups said series being located horizontally along the surfaces of the base-fabric; mechanism moving said fabric-frame carrying the base-fabric edgewise horizontally over limited distances between successive groups of turfing elements, and moving it edgewise vertically over limited distances; said fabric-frame including horizontal rollers for moving the base-fabric edgewise vertically bringing fresh portions of its area within the field of operations of the turfing elements; clamping means mounted at the respective faces of the base-fabric opposite one another and adjacent the paths of the respective needles, for holding the base-fabric from horizontal broadside movements and clamping loop-feet to it; and mechanism moving the clamping means on the needle-face of the base-fabric out of clamping engagement therewith and holding it out of such engagement while the base-fabric is being moved edgewise in its vertical plane.

10. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric, of plural groups of turfing elements severally including a loop-projecting needle, said groups being arranged in spaced-apart relations along the base-fabric and including elements on opposite faces of the base-fabric so supported; said frame including means for spanning the fabric in substantially taut condition generally throughout its area; mechanism for moving the frame and supported base-fabric edgewise in the plane of the fabric between the turfing elements on its opposite faces, and in accord with a master design; and fabric-clamping means on opposite faces of the base-fabric, at least one of which is movable to the base-fabric and toward the other, said means being arranged opposite one another and adjacent the paths of the needles in the several groups of turfing elements, for clamping the substantially taut fabric at its various portions adjacent the groups of turfing elements and thereby holding it from edgewise and broadside movements.

11. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric, of turfing elements including a loop-projecting needle and closely associated in spaced apart groups, each group including turfing elements on opposite faces of the base-fabric; fabric-clamping means on opposite faces of the base-fabric and opposite one another, at least one of which is movable to the base-fabric and toward the other, said clamping means at the loop face of the base-fabric including a plurality of separate loop-leg supporting members, one for and at each group of turfing elements, and extending almost to the paths of the multiple needles, thereby being in positions receiving and supporting the legs of loops projected thru the base-fabric; and mechanism moving the frame and supported base-fabric edgewise in its plane between the turfing elements and clamping mechanisms and in accord with a master design, whereby various portions of the base-fabric are subjected successively to the simultaneous operations by the various groups of turfing elements, and a plurality of said various fabric portions normally are subjected simultaneously to the operation of said fabric-clamping means.

12. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric; turfing elements including a loop-projecting needle and arranged in groups each including turfing elements on opposite faces of the base-fabric; fabric-clamping means on opposite sides of the base-fabric and opposite one another, and alongside the multiple needles, the clamping means on the needle face being movable to the fabric and toward the clamping means on the other face of the fabric, in a direction for clamping engagement against the feet of projected loops, whereby the fabric is held from broadside and edgewise movements and the loop-feet threads are held from movement thru the fabric-meshes; the clamping means on the loop face of the base-fabric being in position adjacent the legs of the loops projected thru the base-fabric; and mechanism moving the frame and supported base-fabric edgewise in its plane between the turfing and clamping mechanisms and in accord with a master design whereby various portions of the base-fabric are subjected successively to the simultaneous operations by the various groups of turfing elements, and a plurality of said various fabric-portions and loop-feet are subjected simultaneously to the clamping by said fabric-clamping means.

13. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a

movable frame supporting the base-fabric in a generally vertical plane; turfing elements arranged in groups each including turfing elements on opposite faces of the vertical base-fabric, one of the turfing elements being a horizontally reciprocably loop-projecting needle; a loop-head-severing instrument in the respective groups and having a loop-entering end; fabric-clamping means on the respective faces of the base-fabric, opposite one another alongside the paths of the multiple needles; the clamping means on the loop-face of the base-fabric lying horizontally close below the horizontal paths of the respective needles, the tops of the clamping means below the needles supporting the legs of prbjected loops at locations intermediate the fabric and the curved loop-heads thereby preventing undue sagging of such heads by gravity; the clamping means on the needle face of the fabric being located for clamping to the fabric the feet of loops on the needles and connected to the legs of loops previously projected; and mechanism moving the frame and supported vertical base-fabric edgewise between the turfing and clamping mechanisms and in accord with a master design whereby various portions of the base-fabric are subjected successively to the simultaneous operations by the various groups of turfing and severing instruments and said clamping means, and a plurality of said various fabric-portions are subjected simultaneously to the turfing and cutting operations of the multiple groups and to the clamping by said clamping means and to their multiple loop-leg supporting operations and to their multiple loop-foot clamping operations.

14. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric in a vertical plane; turfing elements arranged in groups each including turfing elements on opposite faces of the base-fabric; one of the turfing elements in the respective groups being a horizontally reciprocable loop projecting needle; fabric-clamping means on opposite faces of the base-fabric, opposite one another alongside the paths of the multiple needles; the multiple clamping means on the loop-face thereof having the form of separate members horizontally spaced apart, one for each group of turfing elements, and lying close to the vertical base-fabric and close under the horizontal paths of the respective needles, the surface of each below its needle being located horizontally for supporting the legs of the projected loop; the clamping means on the needle face of the fabric being located adjacent the needle-paths for clamping to the fabric the feet of loops on the needle and connected to the legs of loops previously projected thru the base-fabric; and mechanism moving the frame to move the supported base-fabric edgewise in its vertical plane between the turfing and clamping mechanisms and in accord with a master design whereby various portions of the base-fabric are subjected successively to the simultaneous operations of the various groups of turfing elements and a plurality of said various fabric-portions are subjected simultaneously to the turfing operations of the multiple groups, to the multiple fabric-clamping by said clamping mechanisms and to their multiple loop-leg supporting operations and to their multiple loop-foot clamping operations.

15. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric in a generally vertical plane, turfing and cutting elements arranged in groups each including elements on opposite faces of the base-fabric, one of the elements being a horizontally reciprocable loop-projecting needle and another being a loop-head severing device having a loop-entering end; fabric-clamping means on opposite faces of the base-fabric, opposite one another and alongside the paths of the multiple needles, the clamping means on the loop face having the form of separate members horizontally spaced apart, one for each needle, and having ends lying close below the horizontal paths of the respective needles, the top surface of each end below its needle being located horizontally for supporting the projected loop-legs intermediate the fabric and the curved loop-head thereby preventing undue sagging of such loop-legs by gravity; the clamping means on the needle face of the fabric clamping to the fabric the feet of loops on the needle and connected to the legs of previously projected loops; and mechanism moving the frame to move the supported base-fabric edgewise in its vertical plane between the turfing and clamping means and in accord with a master design whereby various portions of the base-fabric are subjected successively to the simultaneous operations by the various groups of turfing elements, and a plurality of said various fabric-portions are subjected simultaneously to the turfing and cutting operations of the respective groups and to the multiple fabric-clamping by said opposite clamping means and to their multiple loop-leg supporting operations and their multiple loop-foot clamping operations.

16. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric, turfing elements arranged in groups each including turfing elements on opposite faces of the base-fabric, one of the turfing elements being a reciprocable loop-projecting needle; fabric-clamping means on the respective faces of the base-fabric, opposite one another and alongside the paths of the multiple needles, the clamping means on the loop-face having the form of separate members spaced apart, one for the needle in each group, and said separate members severally including a device projecting along the needle path toward the base-fabric, and generally narrowed toward said fabric, said devices extending in directions toward the clamping means on the needle face of the base-fabric whereby the fabric is clamped between said needle-face clamping means and the free ends of the narrowed devices on the loop face of said fabric, the narrowed devices spacing the base-fabric from their members from which they project, in addition to the spacing between said spaced-apart members themselves, all said spacing providing room for previously projected loop-threads substantially free of action by said separate clamping members; and mechanism moving the frame and supported base-fabric edgewise in accord with a master design.

17. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric

meshes by friction, said machine including a movable frame supporting the base-fabric; turfing elements arranged on opposite faces of the base-fabric, one of said turfing elements being a reciprocable loop-projecting needle; fabric-clamping members on the respective faces of the base-fabric, the clamping-member on the loop-face including a device narrowed toward the base-fabric to a blunt point and extending alongside the needle path; mechanism putting the clamping members in clamping relations before the needle is moved thru the fabric; and mechanism moving the needle thru the fabric and retracting it from the fabric while the clamping members are in clamping relation with the fabric; said clamp-operating mechanism putting said clamping members out of clamping relations with the fabric after the needle has been retracted from the fabric; and mechanism moving the fabric edgewise in its plane while the needle and the clamping members are out of engagement with the fabric.

18. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric; thread-handling elements arranged on opposite faces of the base-fabric, one of said elements being a reciprocable loop-projecting needle and another being a longitudinally-extending loop-head severing instrument having a loop-entering end; fabric-clamping means on the respective faces of the base-fabric, opposite one another and alongside the path of the needle, and at least one being movable toward the base-fabric and toward the other, clamping said fabric between them, the clamping member on the loop-face being generally tapered toward the base-fabric down to a small area adjacent the fabric and having a loop-leg receiving surface alongside and facing the needle-path and a loop projected by the needle, said tapering construction preventing undue interference by the clamping member with the threads of previously projected loops; and mechanism moving said severing instrument longitudinally into the projected loop for cutting in a direction toward said leg-supporting surface which thereby holds the loop in position to be severed.

19. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a relatively movable frame supporting the base-fabric in a vertical plane; thread-handling elements arranged in groups each including elements on opposite faces of the base-fabric, one of the elements of the respective groups being a horizontally reciprocable loop-projecting needle and another being a vertically-extending loop-head severing instrument having a loop-entering end; fabric-clamping means on the respective faces of the base-fabric; opposite one another alongside the paths of the multiple needles; the clamping means on the loop-side of said fabric having the form of separate members horizontally spaced apart, one for the needle in each group and having a portion projecting horizontally along the needle-path and generally narrowing toward the base-fabric down to a small area adjacent the face thereof whereby said fabric is clamped between said needle-face clamping means and the small free ends of the narrowed portions on the loop-face of said fabric; the spaces between said spaced narrowed portions providing room for previously projected loop-threads substantially free from interference by said narrowed portions; the wider parts of said narrowed portions lying horizontally beneath the needle-paths and loops projected by the needles and constituting loop-leg supports; and mechanism simultaneously moving the vertical severing instruments into the projected loops for cutting in a direction toward said horizontal leg-supports holding the loops in positions for cutting.

20. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric in a vertical plane; turfing elements arranged on opposite sides of the base-fabric, one of the turfing elements being a horizontally reciprocable loop-projecting needle; fabric-clamping means on the respective faces of the base-fabric and opposite one another alongside the needle path; the clamping means on the loop-face being generally narrowed toward the base-fabric down to a small clamping area adjacent the fabric, and having a loop-leg-receiving surface below and adjacent the needle-path in position supporting the horizontally projecting loops; and mechanism moving the frame and supported base-fabric edgewise in the vertical plane in accord with a master design and between the turfing elements on the opposite sides of the base-fabric and between said opposite clamping means.

21. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric; turfing elements arranged on opposite sides of the base-fabric, one of said turfing elements being a reciprocable loop-projecting needle; fabric-clamping members on opposite faces of the base-fabric and opposite one another, and that on at least one face of the fabric being movable for clamping said fabric between the two; the clamping member on the needle-face extending generally around the needle but formed with a needle-opening; the clamping member on the loop-side including a portion projecting alongside the needle and generally narrowed toward the base-fabric down to a small clamping area adjacent the fabric, and having a surface alongside the needle-path in position adjacent the legs of projected loops to receive the latter; and mechanism moving the fabric frame edgewise at times when said needle and clamping means are out of holding relations with the base-fabric.

22. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric; turfing elements arranged in groups each including individual elements on opposite faces of the base-fabric, one of the elements being a reciprocable loop-projecting needle; clamping means mounted at opposite faces of the base-fabric opposite one another and holding the fabric from broadside and edgewise movement

and clamping loop-feet to it; power-operated mechanisms operating the turfing elements in each group in coordinated relations with one another and doing the same simultaneously in all the groups; and manually operated means moving the fabric frame edgewise in its plane between the turfing elements on opposite faces of the base-fabric at times when the needles have been retracted from the base-fabric by their operating mechanism and when said clamping means are out of clamping relations with the fabric and loop feet.

23. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric for edgewise movement, of turfing elements including a loop-projecting needle mounted at one face of the base-fabric, a loop-head holding device on the other face of the base-fabric and having an end adapted to enter loops; and a loop-foot presser on the needle face of the fabric and movable into engagement with loop-feet extending along the needle-face of the fabric; mechanism simultaneously operating said turfing elements in coordinated time relations moving said needle-face clamping member into clamping relations with the loop-foot before the needle enters the fabric and holding said member out of such clamping relations while the frame is moving the fabric edgewise; fabric-supporting means on the loop-face of the base-fabric opposite said loop-foot presser, and supporting the fabric against the pressure thereof; and mechanism moving the base-fabric edgewise in its plane in accord with a master design when it is out of holding engagement with the needle and with said fabric-supporting means and loop-foot presser.

24. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric, and cutting them, for permanent holding of the cut threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric, of thread-handling elements one of which is a loop-projecting needle on one face of the fabric and another of which is a loop-head severing instrument on the other face of the base-fabric; means pressing the loop-feet against the needle-face of the base-fabric, said means being located for engagement with the loop-foot alongside the path of the needle; mechanism operating the thread-handling elements in coordinated relations to one another holding said pressing means against the loop-foot while said severing instrument is being operated to sever the loop-head; and mechanism moving said fabric-frame moving the base-fabric edgewise in its plane at times when the needle is disengaged from the base-fabric and said pressing means is out of pressing relations with the loop-foot and after the cutting of the loop-head.

25. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric, of plural groups of turfing elements including loop-projecting needles on one face of the base-fabric and loop-holding devices on the other face of said fabric and having ends entering projected loops and holding them from retraction by the needles; means pressing the feet of projected loops against the needle-face of the base-fabric said means being located for engagement with the base-fabric alongside the paths of the multiple needles; fabric-supporting members on the loop-face of the base-fabric, one for each group of turfing elements, spaced apart, and also located alongside the paths of the multiple needles opposite said loop-foot pressers on the needle-face of the fabric; mechanism operating the turfing elements in each group in coordinated relation and doing the same simultaneously in all the groups; and mechanism moving said fabric-frame moving the base-fabric edgewise in its plane at times when the needles and loop-foot pressers are disengaged from the base-fabric and when the fabric is free to move between said supporting members on the loop-face of the fabric and said loop-foot-pressers on the needle-face.

26. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric, and cutting them, for permanent holding of the cut threads in the fabric meshes by friction, said machine including the combination with a relatively movable frame supporting the base-fabric, of turfing elements including a loop-projecting needle on one face of the base-fabric; a loop-head-severing device on the other side thereof having a loop-entering end, and having a cutting edge holding the loop out from the fabric; loop-foot pressing means engaging the needle-face of the base-fabric alongside the needle; a fabric-supporting member on the loop-face of the base-fabric, and opposite said loop-feet engaging means on the needle-face; mechanism operating the turfing elements and the severing instrument in coordinated relations and doing the same simultaneously for all the groups; and mechanism moving said fabric frame moving the base-fabric edgewise in its plane at times when the needles are disengaged from the base-fabric and when the latter is free to move between said supporting members on its loop-face and said loop-feet-engaging means on its needle-face.

27. A turfing machine for manufacturing fabric articles by projecting thread-loops by needles thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including, in combination, thread-bobbins, a friction-surface feed-roll feeding the thread from the bobbins to the needles, mechanism for reciprocating the needles, mechanism intermittently rotating said feed-roll, and a plurality of groups of turfing elements including the needles, said groups being arranged successively along the length of said feed-roll.

28. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric; turfing elements of which one is a loop-projecting needle, clamping means mounted at the opposite faces of the base-fabric and opposite one another and alongside the paths of the needles; mechanism feeding the thread to the needle, and oscillating thread-release rods acting on the thread between the feeding mechanism and the needle, releasing tension on the thread after a

loop has been projected by the needle thereby contributing to preservation of the loop-projection.

29. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction and cutting said loops to form pile-threads, said machine including the combination with a movable frame supporting the base-fabric, of a reciprocable loop-projecting needle, of a loop-holder, and a knife in an arrangement wherein the loop-holder and knife are located end to end and are reciprocable across the path of the needle, and the knife consists of a resilient blade of which the free end normally bears against the free end of the loop-holder, and the loop-holder and knife in one direction of their reciprocation move on opposite sides of the needle when the loop-holder enters a loop, and in their other direction they move successively thru the loop; and mechanisms operating said members in the coordinated relations for successively projecting, holding and cutting the loops to produce the pile-threads.

30. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a needle and a fabric-frame supporting the base-fabric and movable to move the fabric edgewise in its plane, of a set of devices including the following elements, namely, a loop-head holder, a loop-cutter and a clamp, all on the loop face of the fabric; and a presser-finger on the needle face of the fabric and having a portion engaging loop-feet-threads alongside the needle and pressing them against the fabric, and pressing the fabric against said clamp, thereby clamping the loop-feet threads and the base fabric together holding them in fixed relations with one another and with the operating paths of the loop-head holder and cutter, said paths being substantially parallel with the fabric-plane, and the cutter-edge facing away from it.

31. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric, of a needle, a loop-head holder, and a clamp-supporting member on the loop-face of the base-fabric; a clamp supported by the latter and generally narrowing toward the fabric down to a small clamping area therefor; said clamp-supporting member being located relatively remote from the fabric; and a presser-finger on the needle face of the fabric-frame and facing said small clamping area and having a fabric-pressing portion of relatively large area engaging loop-feet-threads alongside the needle and pressing them against the fabric and holding projected loop-threads from movement thru the fabric, and pressing the fabric against said small clamping area; and mechanisms operating said needle and head-holder in the coordinated relations for projecting loops and holding loop-heads and for effecting said clamping of fabric and loop-feet.

32. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a needle, a loop-head holder and cutter adapted to enter loops and hold and cut their heads, and a member engaging the loop-face of the base-fabric and narrowing down to a fabric-engaging end of small area from its portion nearer the cutter.

33. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, and cutting said loops to produce pile-threads, said machine including a needle and a loop-head holding cutter on opposite faces of the base-fabric, a fabric-supporting member generally narrowing down to an end of small area engaging the pile-face of the fabric; and means holding the loops projected by the needle from movements thru the fabric by the retraction of the needle.

34. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a loop-projecting needle formed with a transverse notch, a pointed loop-holder movable across the needle thru said notch, and a resilient knife-blade arranged generally end to end with the loop-holder and movable across the needle on the other side of the needle, the loop-holder in one direction of movement passing thru said needle-notch and entering the loop carried by the needle; and the knife in the other direction of movement entering the loop after the needle has been retracted from the loop; and means effecting said operations including separation of the loop-holder and knife by means of the needle.

35. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a loop-projecting needle formed with a longitudinal groove receiving one leg of a loop, a pointed loop-holder and a resilient knife-blade arranged generally end to end, said needle being formed with a transverse notch, the loop-holder and knife in one direction of movement passing respectively on opposite sides of the needle, the loop-holder in that same direction of movement passing thru said transverse notch and entering the loop carried by the needle before the retraction of the needle from the loop, and the knife in the opposite direction of movement entering the loop held by the loop-holder after the retraction of the needle from the loop; and means effecting said operations including separation of the loop-holder and knife by means of the needle.

36. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including in combination a needle, and a loop-holder including a straight bar longitudinally reciprocable in a plane paralleling the base-fabric and in a line adjacent the path of the needle, said loop-holder having a pointed end entering a projected loop after projection thereof by the loop-projecting needle, said loop-holder having a larger diameter more remote from its point; mechanism moving said loop-holder causing its point to enter the loop before the needle projecting it has been retracted from the loop-face of the fabric and moving said loop-holder further causing its larger

diameter to hold the loop at desired length beyond the fabric and against retraction by the retraction of the needle; and means clamping the base-fabric holding it against broadside movements in either direction and also simultaneously clamping to the fabric the loop-foot constituted by the portion of the thread which connects together the thread-portions of two projected loops.

37. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, and cutting the projected loops to produce pile-threads, said machine including a loop-projecting needle on one face of the base-fabric, and a pointed loop-holder and a separate knife-blade on the other face and arranged generally in line with one another, the the end of the knife normally engaging a side of the loop-holder; and means causing the following operations:—movements of the alined loop-holder and knife generally transversely of the needle-path, and separation of the loop-holder and knife from one another by means of the needle, leaving the loop-holder free of the knife for movement into the loop on the needle for holding the loop against shortening by retraction of the needle.

38. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric, a plurality of groups of turfing elements, said groups being distributed in spaced relations along the frame, the groups severally including a loop-projecting needle; means holding the heads of just-projected loops from loop-shortening by retractions of the needles; means common to the multiple needles for feeding the thread-yarns simultaneously thereto in equal lengths; loop-foot clamping means holding the threads of previously projected loops from shortening by retractions of the needles; and mechanism operating the turfing elements in all the groups and said other elements in coordinated time relations wherein the loop-foot clamping means is moved into clamping relations before the needles are projected thru the base-fabric, and are held in such clamping relations until the needles have been retracted, and wherein the means preventing loop-shortening are in holding engagement with the loop-heads and feet when the loops have been projected by the needles and while the loops are on the needles and while the needles are being retracted; and means for moving said fabric-frame edgewise in its plane while the needles are disengaged from the base-fabric and while the loop-foot clamping means is out of clamping relation with the loop-feet.

39. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric and moving it edgewise in its plane, a loop-projecting needle on one face of said fabric, a loop-head-holding device on the other side thereof, and a loop foot-pressing device on the needle face of the fabric and adjacent the needle path, said members being arranged for the formation of loop-feet flat against the needle-face of the base-fabric by the movement of the frame, and for the holding of such loop-feet against the fabric by said pressing member and for the projection of loops intermediate successive loop feet by projection thru a fabric mesh to and beyond the other side of the base-fabric by the movement of the needle, and for the holding of the head of the projected loop beyond the loop face of the base-fabric by the movement of the head-holder; and a clamping element on the loop-holder face of the fabric and adjacent the needle-path and located opposite said loop-foot-pressing device and holding the fabric from edgewise movements, and from broadside movements caused by passage thru it of the thread-carrying needle.

40. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, and cutting the projected loops to form pile-threads, said machine including the combination with a frame supporting the base-fabric and movable to move the base-fabric edgewise in its plane, of a loop-projecting needle on one face of the fabric; a loop-head holder and a loop-holding knife-edge on the other face and adjustable in directions to and from the base-fabric for different lengths of loops and cut pile-threads; said head-holder and knife-edge being movable across the path of the needle in paths paralleling the base-fabric, and the knife-edge being long and provided with means moving it to cut the interior of the heads of projected loops by a gradual slashing stroke generally paralleling the fabric; means feeding equal lengths of thread successively to the needle; and means pressing against the base-fabric, the loop-foot formed by the movement of the frame in its plane, and from which loop-foot, a loop is about to be projected by the needle from one of said successively equal lengths of the thread, said loop-head-holder, long knife-edge, feeding means, and pressing means cooperating to produce successively equal cut pile-threads.

41. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric and moving the latter edgewise in its plane, of a loop-projecting needle formed with an eye near its pointed end and also formed on one side with a longitudinal groove receiving a leg of the loop projected by the eye-end of the needle, the needle being formed also with a transverse notch on its other side; a pointed loop-holder on the loop-face of the base-fabric and reciprocable between the needle and a loop-leg bridging said transverse needle-notch, said loop-holder being formed with a recess in its thicker portion adjacent its pointed end; and a knife-blade also on the loop-face of the base-fabric and formed with an end normally housed in said recess in the loop-holder, said blade being reciprocable, and movable past said needle and past the loop-leg in said longitudinal needle-groove; said loop-holder and knife being arranged for the following, namely to receive the needle between them as the loop-holder point engages in the transverse needle-notch and passes between the legs of the loop on the needle, the needle wedging apart the loop-holder and knife blade as the loop-holder and knife move for complete engagement of the loop-holder with the loop, and the knife-blade thereby being withdrawn out of the

loop-holder recess and away from the loop-holder, and the loop-holder moving freely to its position completely engaging the loop-head while the knife moves in the same direction with the loop-holder but away from the needle and loop.

42. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable fabric-frame moving the base-fabric edgewise; a loop-projecting needle; a pointed loop-head-holder arranged for entering a loop projected by the needle and holding it against retraction by the needle; a long loop-holding knife-edge generally alined with said head-holder to enter the loop, holding and cutting it in substantially the position of the loop as held by the head-holder; a support for the head-holder and knife-edge; and mechanism reciprocating said support linearly moving the head-holder and knife successively across the path of a loop projected by the needle, moving the loop-holder and knife-edge successively thru such loop, and moving the long knife-edge in a slashing stroke gradually cutting thru the loop-head.

43. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a frame replaceably supporting the base-fabric movably in its plane; a loop-projecting needle on one face of the base-fabric and a loop-head holding device on the other face, fabric-clamping devices on the respective faces of the fabric and holding it against broadside movements by the needle, and clamping to the fabric, the loop-feet formed by movement of the frame in its plane, from which feet, a loop is about to be projected by the needle; movable means supporting the loop-holding device, and manually operable means moving said supporting means increasing the spacing between the base-fabric and the loop-holding device during replacement of the base-fabric in said frame.

44. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including turfing elements arranged in groups, and a movable fabric-frame extending adjacent the several groups of turfing elements and including a pair of rollers supporting the fabric and on which the latter can be rolled; mechanism moving the frame moving the fabric edgewise over limited distances in its plane; and mechanism rotating said rollers and moving the base-fabric in a direction from one roller to the other.

45. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including turfing elements arranged in groups, a movable frame adjacent the groups for moving the fabric edgewise and including rollers supporting the fabric, and means for adjusting and locking said rollers.

46. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including turfing elements arranged in groups, a movable frame including a pair of rollers supporting the base-fabric adjacent said groups, and a spreader located in position holding apart said rollers thereby holding the base-fabric taut under tension between the rollers and alongside said groups.

47. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a fabric frame supporting the base-fabric, groups of turfing elements of which the elements in each group are on opposite faces of the base-fabric including loop-projecting needles on one face thereof; a thread-feed roll extending along said groups for supplying threads in common to the plural needles; means intermittently turning said feed-roll successively equal distances to provide thread-lengths for the needles; and means for stopping the successive movements of the roll after it has been turned said equal distances.

48. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric, of turfing elements arranged in groups along the opposite faces of the base-fabric, each group including a device for reeving a bight thru a mesh of the base-fabric; means holding the base-fabric steady at each group, said means being located on opposite faces of the base-fabric clamping it between them; thread-bobbins in number corresponding with the number of bight-reeving devices; and common feeding means extending along the groups of turfing elements and feeding all the threads from the bobbins to the bight-reeving devices.

49. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric for edgewise movement, of turfing elements arranged in groups along the base-fabric and including loop-projecting needles; thread-bobbins corresponding in number to the number of needles; a main thread-feed bar extending along the base-fabric and supplying thread to the needles in the turfing-element groups; and an auxiliary feed-bar paralleling the main feed-bar and located generally between the bobbins and the main feed-bar in position holding threads passing from the bobbins to the needles from being thread-bound against loop-projecting operations of the needles.

50. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric for edgewise movement, said frame including mechanism temporarily securing the base-fabric in position, and adjustable mechanism generally tightening it, of groups of turfing elements distributed along the base-fabric and including loop-projecting needles; and

mechanism clamping the base-fabric adjacent its meshes operated on by each group.

51. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame including mechanism temporarily securing the base-fabric in position in generally taut condition, of groups of turfing elements distributed at different portions of the base-fabric and including loop-projecting needles on one face and loop-holding devices on the loop face and fabric clamping mechanisms on both faces; a common supporting means on the loop-side for the several loop-holding devices; and manually operable means moving said supporting means with the loop-holding devices away from the base-fabric preliminary to removing one base-fabric from the fabric-frame and substituting another.

52. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric for edgewise movement in various directions, of turfing elements lying along the respective faces of the base-fabric and including a loop-projecting needle and a loop-foot-presser both located on the needle face of the fabric, and a projected-loop holder, said foot-presser being formed with an open-ended slot thru which the needle can move in projecting the loops, the portions of the presser adjacent the slot being adapted to clamp the foot of a loop to the fabric as an anchorage against movement by needle reciprocation for loop-projection.

53. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric for edgewise movement, of turfing elements alongside the base-fabric and including a loop-projecting needle on one face of the fabric and a loop-head holding means on its other face; a feed-roll extending on the needle face along the base-fabric and the needle and supplying thread to the needle; means intermittently turning said feed-roll successively equal distances to provide equal thread-lengths for the needle; means for stopping the successive movements of the roll after it has been turned said equal distances, and means operating said head-holder to preserve the length of the projected thread fed by the roll to the needle and projected by the latter.

54. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric for edgewise movement, of turfing elements arranged in a group and including a loop-projecting needle; and fabric clamping means at the respective faces of the base-fabric, the clamping means at the needle-face having a relatively large area adjacent the needle-path for engaging the loop-feet, and the clamping means at the loop-face including a member spaced from the fabric by a portion having relatively small fabric-engaging and clamping area alongside the needle-path and extending toward the fabric and toward the clamping means on the other face of the fabric.

55. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a movable frame supporting the base-fabric, of turfing elements arranged in groups distributed along the frame and including loop-projecting needles on one face of the base-fabric, and fabric-clamping means on both faces, the clamping means on the loop-side including a main member spaced from the fabric by a fabric-clamping portion of relatively small fabric-engaging and clamping area and extending in narrowed shape from the main member toward the base-fabric, said fabric-clamping portion being pluralized for said several groups of turfing elements and spaced from one another in the groups.

56. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a frame supporting the base-fabric, turfing elements including a loop-projecting needle on one face of the base-fabric and a loop-head holding device on the other face; and clamping devices on both faces and opposite one another, at least one of said cooperating clamping devices being movable to and from the other and the base-fabric, the clamping device on the loop-holder face being adapted to engage the base-fabric at only one side of the path of the needle and close to its path, but the clamping device on the needle face being adapted to engage the base-fabric on at least two sides of and close to the needle-path, and formed with a needle-passage.

57. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric for edgewise movement thereof, a loop-projecting needle on one face of the base-fabric and a loop-head holder on the other face and adapted to enter the loop; cooperative fabric-clamping devices on the respective faces of the fabric, and means causing them to hold the fabric stationary from broadside and edgewise movements while the needle is operating thru it and while the head-holder is in the projected loop, at least one of said clamping devices being movable to occupy a position which is out of clamping relation with the fabric while said frame is being moved to move the fabric edgewise; the movement of the needle thru the stationary fabric initially projecting a loop; the entrance of the head-holder into the projected loop engaging the loop head and holding the loop from retraction with the needle; the movement of the fabric-frame causing the formation of a loop-foot on the needle-face of the fabric in preparation for the subsequent movement of the needle thru the stationary fabric in projecting a loop continuing from said loop-foot as a thread-anchorage; and said clamping devices clamping said loop-foot to the fabric while they are holding the base-fabric stationary

and while the head-holder is holding the loop from retraction.

58. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, said machine including the combination with a frame supporting the base-fabric, of a loop-projecting needle and a presser-finger at one face of the base-fabric, and a loop-head holder and a member narrowing toward a pointed end adjacent the fabric, both at the other face thereof; the presser-finger being located adjacent the needle-path and having a clamping surface for engagement with the surface of the base-fabric and with the foot of a loop being projected; and said pointed-end member being located adjacent the needle-path and extending toward the base-fabric with its pointed end opposite the clamping surface of the presser-finger, said pointed end being of sufficient area to prevent its passage thru the fabric and to clamp the fabric against the presser-finger; the narrowing of the pointed member toward the base-fabric being such as to avoid undesirable disturbance of previously projected threads in the vicinity of the clamping operation; and the wider portion of the pointed member extending away from the base-fabric and adjacent the needle-path and located within the length of a projected loop and constituting a support for such loop after retraction of the needle.

59. A machine for manufacturing a pile-fabric by successively projecting loops of a thread through and substantially beyond the meshes of a base-fabric and then severing the ends of the projecting loops to form the pile threads, said machine including a loop-projecting needle, a loop-head holder formed with an end adapted for entrance between the threads of a projected loop preliminary to cutting thereof; a knife-blade formed with an end also adapted for entering the loop and with a cutting edge facing away from the base-fabric; said head-holder and knife being arranged with adjacent overlapping ends; and mechanism operating the needle, head-holder and knife, for projecting a loop by the needle, moving the head-holder and knife in one direction for entrance of the end of the head-holder into the projected loop on the needle for loop-holding prior to cutting, said operating mechanism causing the knife to be moved by the needle away from the head-holder to provide for said entrance of the head-holder into the loop, the knife moving outside the loop as the head-holder enters the loop, and said operating mechanism moving the head-holder and knife in the opposite direction for entrance of the end of the knife into the loop adjacent the end of the head-holder for operation of the edge of the knife for continuation of head-holding and for cutting.

60. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, and cutting the projected loops to form pile-threads, said machine including a loop-projecting needle at one face of the base-fabric, and a pointed loop-head holder and a knife-blade at the other face and arranged with adjacent overlapping ends, said head-holder being formed near its end with a recess for reception of the end of the knife-blade, and the knife consisting of a resilient blade normally tending to press its end into said holder-recess and having its cutting edge facing away from the base-fabric.

61. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric for permanent holding of the threads in the fabric meshes by friction, and cutting the projected loops to form pile-threads, said machine including a loop-projecting needle at one face of the base-fabric, and a pointed loop-head holder and a knife at the other face and arranged with adjacent overlapping ends; the needle being formed with a transverse notch for the passage of the point of the head-holder between the needle and a thread of a loop on the needle; the head-holder being formed with a recessed portion protecting the loop-thread from the knife by receiving the knife-end; and the knife consisting of a resilient blade the cutting edge of which faces away from the fabric and the end of which is movable out of said recess and away from the head-holder by movement of the blade and needle against one another, leaving the point of the head-holder free of the knife for passage of said point thru the transverse notch in the needle; and means causing said movements of the elements.

62. A machine for manufacturing fabric articles by forcibly projecting loops of a thread thru and substantially beyond the meshes of a base-fabric wherein the projecting threads are held by friction after loop-projection, said machine including a fabric-carrying frame movable in the plane of the fabric to form loop-feet previous to loop-projection, and fabricating elements including a reciprocating loop-projecting needle and arranged in a group in the vicinity of the portion of the fabric thru which the loops are being projected, said elements including also a loop-foot presser at the needle-face of the fabric, means at the other face of the fabric for holding a projected loop against shortening by the needle retraction from its projection, thereby contributing to uniformity of lengths of projecting threads of successively projected loops; and a fabric-clamping member at the loop face of the fabric and extending toward the fabric in a location close along one side of the needle path and narrowing down to a point adjacent the fabric thereby providing a small end area of clamping engagement with the fabric as the result of said narrowing, said narrowing also providing a space around the clamping member avoiding interference with previously projected loop-threads; said point being sufficiently blunt to avoid penetrating the fabric and being alined with the clamping surface of said loop-foot presser to cooperate in clamping the fabric between them at the fabric-portion adjacent the needle, and thereby hold such fabric-portion from broadside movements by the movements of reciprocation of the adjacent needle, thereby further contributing to uniformity of lengths of threads of successively projected loops projecting beyond the fabric; said loop-foot presser having a surface pressing against the fabric, the foot of the previously projected loop-thread alongside the needle, which foot as a connection between successively projected loop-threads, has been formed between the fabric and said finger by edgewise movement of the fabric relative to the foot-presser from the fabric-position wherein the previous loop was projected, to the fabric-position for receiving the next loop, said presser in said position facing said foot, clamping the foot against the clamped stationary fabric while the needle is reciprocating for pro-

jection of such next loop thereby preventing such needle-movements from causing movements of said foot which would shorten the thread of the previously projected loop continuous with the foot, thereby further contributing to uniformity of lengths of threads of successively projected loops projecting beyond the fabric.

63. A machine for manufacturing fabric articles by projecting loops of a thread thru and substantially beyond the meshes of a base-fabric in which the loop-threads are held by friction after projection, said machine including a frame supporting the base-fabric and movable in the plane thereof to form loop-feet previous to loop-projection; a reciprocable loop-projecting needle; a loop-head holder at the other face of the fabric and longitudinally reciprocable in a path alongside and transversely of the loop-projecting path of the needle and having a pointed end adapted to enter a projected loop on the needle for holding the loop out from the fabric; the needle being formed with a transverse notch alongside the needle-thread on it, and in the path of the point of the reciprocable loop-holder; a fabric-clamping member at the loop-face of the fabric and alongside the needle path; and a loop-foot presser at the needle face of the fabric and alined with said first clamping member for cooperation therewith in fabric-clamping against broadside and edgewise movements, said presser lying opposite to the loop-foot connected to the previously projected loop-thread as a continuation of the thread on the reciprocating needle, and said presser clamping said foot to the clamped stationary fabric while the needle is reciprocating for the projection of its thread as a loop thru the fabric.

64. A machine for manufacturing fabric articles by projecting loops of a thread thru and substantially beyond the meshes of a base-fabric in which articles the projected loop-threads are held by friction with one another and with the mesh-threads, said machine including a fabric-supporting frame, and a loop-projecting needle at one face of the fabric; a reciprocable loop-holding knife-blade having its edge facing away from the fabric and toward the inside of the loop-head, said blade having an end entering a projected loop; means causing a slashing movement of said knife for holding out the loop-head from the fabric and severing it; a fabric-clamping device on the knife-face of the fabric, and having a loop-supporting surface located close to said path at its portion opposite to but facing the direction of slashing, holding and cutting movement of the knife, whereby said surface supports the legs of the loop against said knife-movement; and a loop-foot presser at the needle-face of the fabric and alined with said clamping device on the knife-face of the fabric for clamping the fabric between them, said presser lying opposite the loop-foot which connects the thread on the needle with the thread of the next previously projected loop, for clamping said loop-foot to the clamped stationary fabric during the loop-projecting reciprocation of the needle and during the loop-holding and loop-cutting operations of said knife.

65. A machine for manufacturing fabric articles by projecting successive loops from a thread thru and substantially beyond the meshes of a base-fabric in which articles said loop-threads are held by friction with one another and the mesh-threads, said machine including a fabric-supporting frame movable to form loop-feet previous to loop-projection, fabricating elements including a reciprocable needle and a loop-foot presser both at one face of the fabric, and a loop-head holding knife adapted to enter a loop and hold it out from the fabric and a clamping device, both at the other face of the fabric, said clamping device being in a position close alongside the path of the needle and having a pointed end sufficiently blunt to avoid penetrating the fabric, for small area of clamping engagement with the fabric; said clamping device and loop-foot presser being in alinement with one another close alongside the path of the needle for clamping between them in stationary position the portion of the fabric alongside the needle during the reciprocation of the needle thru the fabric and during action of the loop-holding knife on the loop; said loop-holding knife having its cutting edge facing away from the fabric and adapted to engage the inside of the loop-head, said knife being constructed and arranged and provided with operating mechanism whereby its edge is given a slashing movement in holding and cutting engagement against the inside of the loop-head; and said loop-foot presser being formed with a clamping surface which lies adjacent the loop-foot which connects the thread on the needle with the thread of the next previously projected loop, said presser thereby clamping said loop-foot to the clamped stationary fabric while the head of the last-projected loop is being cut by the knife; and said cooperating clamping device at the loop-face of the fabric having a loop-leg supporting surface widening away from the fabric and located close to the needle-path at the portion thereof opposite to but facing the direction of slashing movement of the knife whereby said slashing movement across the inside of the loop-head moves the loop-legs against said widened portion and causes the latter to support the loop against the holding and cutting movement of the knife.

66. In a machine for the purpose described, the combination with a fabric-frame, of a needle at one face of the fabric and reciprocable thru the fabric; a loop-head-holder and head-holding and cutting knife-blade adapted to enter a projected loop and located at the other face of the fabric and reciprocable across the needle-path, said head-holder and head-holding knife being generally alined with one another for successive head-holding of the loop out from the fabric, and the cutting-edge of the knife facing away from the fabric and toward the inside of the loop-head, the head-holder being formed with a recess receiving the end of the knife, the needle being formed with a longitudinal groove in one side receiving one leg of a loop being projected and the needle being formed also with a transverse notch on its opposite side and bridged by the other leg of a loop in process of projection; said head-holder and knife being arranged relative to the needle-path, for the movement of the head-holder thru the transverse needle-notch and for the simultaneous movement of the knife across the oppositely grooved side of the needle, whereupon said movements of parts including the needle cause withdrawal of the knife-end from said recess in the head-holder leaving the latter free to enter the loop on the needle.

67. In a machine for the purpose described, the combination with a fabric-frame, of a needle at one face of the fabric and reciprocable thru the fabric; a loop-head holder and head-holding and cutting knife-blade at the other face of the fabric and reciprocable across the needle-path, said head-holder and knife being generally alined with

one another for successive head-holding of the loop out from the fabric, and the cutting-edge of the knife facing away from the fabric and toward the inside of the loop-head; the head-holder being formed with a recess housing the end of the knife; the needle being formed with a transverse notch on its side and bridged by the leg of a loop in process of projection; said head-holder and knife being arranged relative to the needle-path, for the movement of the head-holder thru the transverse needle-notch and for the simultaneous movement of the knife across the opposite side of the needle, whereupon said movements of parts including the needle cause withdrawal of the knife from said recess in the head-holder leaving the latter free to enter the loop on the needle.

68. In a machine for the purpose substantially as described, the combination with a frame for supporting the base-fabric, of a plurality of groups of turfing elements respectively mounted in positions adjacent the base-fabric, the groups severally including at least four turfing elements, respectively a loop-projecting needle and a loop-foot presser mounted at one face of the base-fabric, and a loop-head holder and a fabric-clamping member mounted at the opposite face; the needle being reciprocable thru the base-fabric; the foot-presser being supported at one side of the needle-path for movement to and from the fabric and having a pressing surface located adjacent the needle-path and adapted to engage the base-fabric and the loop-foot which lies against said fabric in the vicinity of the needle-path; said fabric-clamping member being in clamping alinement with said surface of the foot-presser for fabric-clamping cooperation therewith; the head-holder being mounted for longitudinal reciprocation in a path crossing the path of a loop on the needle and having a small end adapted to enter such loop while on the needle and hold it out from the fabric; mechanism moving the plurality of foot-pressers simultaneously into engagement with the fabric and the loop-feet and into fabric-clamping relations with said fabric-clamping members; mechanism reciprocating the plurality of needles simultaneously thru the base-fabric to project loops; mechanism reciprocating the plurality of head-holders simultaneously thru the projected loops on the needles; and means coordinating the timing of the operations of said three mechanisms causing the foot-pressers to be in positions engaging the base-fabric and loop-feet and in fabric-clamping relations with said fabric-clamping members while the needles are being moved thru the fabric, and causing said entrances of the head-holder ends into the projected loops while the loops yet remain on the needles.

69. In a machine for the purpose described, the combination with the base-fabric frame, of the needle movable back and forth thru the base-fabric, and the loop-head holder having a point directed toward the needle-path and movable back and forth across said path; the needle being formed near its point with a transverse notch which is shallower at its portion nearer the needle point; the needle-eye being formed in a direction extending transversely of the direction of extent of said transverse notch and in a location between the sides of the notch and wherein said eye leads directly into such shallower portion of the notch, whereby a loop-thread extending along the two sides of the length of the needle and thru the eye enters the notch from the eye directly in said shallower notch-portion but then bridges across the deeper portion of the notch located more remote from the needle-point thereby forming a small space between such thread and the deeper portion of the notch; and the needle operatively occupying a position in the machine wherein its eye-hole extends in a direction transversely of the path of the head-holder-point across the needle-path, whereby the notch extends in the same general direction as the path of said holder-point across the needle-path, and said small thread-bridged space at the deeper portion of the notch is presented to the point of the head-holder.

70. In a machine for the purpose described, the combination with a base-fabric frame, of turfing elements including a loop-projecting needle and a loop-foot presser mounted at one face of the base-fabric, and a fabric-clamping member and a loop-head holdng knife mounted at the other face and having its cutting edge facing away from the fabric in position for holding the loop out from the fabric and cutting thru the inside of the loop-head; the fabric-clamping member being located adjacent the needle-path and having a pointed end directed toward the foot presser in fabric-clamping relation therewith, said clamping member being widened in a direction away from the presser and in a location between the knife edge and the fabric, said widened portion cooperating with the knife-edge in holding the loop out from the fabric just previous to and during cutting, in position for clean cutting.

71. In a machine for the purpose described, the combination with the base-fabric frame, of a group of turfing elements respectively mounted in positions adjacent the base-fabric, and including at least four turfing elements, namely, a needle and a loop-foot presser at one face of the base-fabric, and a fabric-clamping member and a loop-head holding knife at the other face; the knife having its cutting edge facing away from the fabric and being constructed and arranged and provided with operating mechanism whereby said edge is given a slashing movement in holding and cutting engagement against the inside of the head of a loop projected by the needle; said fabric-clamping member operatively lying in alinement with said foot presser for fabric-clamping cooperation therewith; and the presser being mounted for movement back and forth against the base-fabric into and out of fabric-clamping relation with the clamping member.

72. In a machine for the purpose described, the combination with the base-fabric frame, of a group of turfing elements respectively mounted in positions adjacent the base-fabric, and including at least four turfing elements, namely, a needle and a loop-foot presser at one face of the base-fabric, and a loop-head holder and a fabric-clamping member at the other face; the needle and head-holder being mounted for reciprocation substantially at right angles across the paths of one another; the fabric-clamping member operatively lying in alinement with the foot presser for fabric-clamping cooperation therewith; and the presser being mounted for movement back and forth against the base-fabric into and out of clamping relation with the fabric-clamping member.

73. In a turfing machine, the combination with a fabric-frame movably mounted for edgewise movement of the base-fabric in a vertical plane, of a horizontally mounted loop-projecting needle;

mechanism moving the frame to move the base-fabric edgewise in its vertical plane, means supporting a loop horizontally projected thru the vertical fabric in horizontal position, and at a portion of the length of the loop adjacent the fabric, said means including a member having a horizontal top loop-receiving surface below and alongside the needle-path preventing loop-sagging from the fabric; mechanism horizontally reciprocating the needle above and across and beyond said loop-supporting member and projecting the needle and the looped head of its thread thru the fabric-mesh horizontally beyond said horizontal loop-supporting member; and means positively holding the head of the projected loop from being drawn back to said loop-support toward the fabric during and by needle-movement after its loop-projection, said loop-head holding means including a small-ended longitudinally extending head-holder for the needle-loop and located in rear of the fabric but more remote therefrom than said horizontal loop-support and mounted for longitudinal movement generally paralleling the fabric to extend generally vertically thru and hold the portion of the projected loop on the needle which extends beyond said horizontal loop-support away from the fabric; said loop-head holder having a loop-length-determining spacing from the fabric; the needle being mounted at the front of the vertical fabric and in position for reciprocation above and generally parallel with said horizontal loop-support and beyond the latter across the path of the loop-holder beyond the loop-support; and means reciprocating the loop-head holder linearly and moving its small end toward and across the needle-path while the needle and the loop thereon extend horizontally beyond the horizontal loop-support; the needle for that purpose having a construction involving a transverse notch in its vertical side adjacent the loop-holder path which notch at the time the loop-holder is moved across the needle lies in the generally vertical path of the loop-holder more remote from the fabric than said horizontal loop-support; the needle being formed on its opposite vertical side with a thread-groove extending straight along the needle horizontally and communicating with the needle-eye and receiving a loop-leg within the general external configuration of the needle; the needle-eye extending from said straight thread-groove on one vertical side of the needle to the notch in the other vertical side of the needle whereby the thread extends from the eye directly into the notch; the needle-notch having a portion at one side of the eye of sufficient depth relative to the termination of the needle-eye in the notch, to cause the loop-leg extending along the needle to bridge across a small space in the notch alongside the needle, the termination of the needle-eye in the notch assuring the movement of the loop-thread across said deep notch-portion to bridge said space; and said small end of the loop-head holder being sufficiently small to enter said small bridged space without injuring the loop-thread and thereby enter the loop between its legs extending along the needle whereby the loop-holder can engage the inside of the loop-head and preserve the loop from being drawn back over the horizontal loop-support toward the fabric during and by needle-retraction after loop-projection, and a presser-finger mounted in front of the fabric and in position alongside the needle and opposite the loop-support for clamping the loop-foot, after edgewise fabric-movement, against the horizontal loop-support in rear of the fabric, holding the loop-thread from movement thru the fabric-mesh before and after retraction of the loop-holder from the loop and during and against the needle-pull in projecting the loop.

74. In a turfing machine, the combination with a fabric-frame movably mounted for edgewise movement of the base-fabric, of a loop-projecting needle, mechanism moving the frame to move the base-fabric edgewise; a loop-supporting member mounted on the loop-side of the fabric and lying alongside the path of the needle; mechanism reciprocating the needle along and across and beyond said loop-support and projecting the needle and the looped head of its thread beyond the loop-support; a longitudinally extending small-ended holder for the head of the needle-loop movable longitudinally thru the portion of the projected loop which extends beyond the loop-support away from the fabric; the needle being mounted in position for reciprocation alongside and generally parallel with the loop-support across the path of the loop-holder beyond the loop-support to the distance corresponding generally to the desired length of threads projecting beyond the fabric in the product; said loop-head holder having loop-length-determining spacing from the fabric; and mechanism reciprocating the loop-holder and moving its small end toward and across the needle-path while the needle and the loop alongside it extend beyond the loop-support; the needle for that purpose having a construction involving a transverse notch in its side adjacent the loop-holder path which notch at the time the loop-holder is moved across the needle is in the path of the loop-holder which is more remote from the fabric than said loop-support; the needle-notch having a portion at one side of the eye of sufficient depth to cause a loop-leg on the needle to bridge across a small space alongside the needle; and the loop-holder having its said small end sufficiently small to enter said small bridged space without injuring the loop-thread and thereby enter the loop between its legs whereby the loop-holder can engage the inside of the loop-head and preserve the loop from being drawn back along the loop-support toward the fabric during and by needle-retraction after loop-projection, and a presser-finger in position alongside the needle and opposite the loop-support for clamping the loop-foot, after edgewise fabric-movement, against the loop-support on the other side of the fabric, holding projected loop-threads from shortening by needle movements.

75. In a turfing machine, the combination with a fabric-frame movably mounted for edgewise movement of the base-fabric, of a loop-projecting needle and mechanism reciprocating it thru the base-fabric; mechanism for moving the frame to move the base-fabric edgewise; a longitudinally extending pointed member for holding the projected loop-head from being drawn back toward the fabric by needle-retraction after loop-projection; the needle-reciprocating mechanism moving the head of the thread-loop in the needle eye beyond the path of the loop-holder point to the distance corresponding generally to desired thread-lengths projecting beyond the fabric in the product; the loop-holder having a loop-length determining spacing from the base-fabric; loop-holder reciprocating mechanism moving the loop-holder point longitudinally toward and across the needle path and into the

loop while the needle and the loop alongside it are in the path of the loop-holder, all whereby the loop is preserved from being shortened by being drawn back toward the base-fabric; a movable presser-finger mounted in position alongside the needle-path for pressing the foot of the loop against the base-fabric, resisting tensioning of the thread of the loop; and mechanism for operating said presser-finger and moving it away from the loop-foot and base-fabric for the edgewise movement of the fabric after needle-retraction.

76. In a turfing machine, the combination with a fabric-frame movably mounted for edgewise movement of the base-fabric, of a loop-projecting needle and mechanism reciprocating it thru the fabric-meshes; mechanism for moving the fabric-frame to move the base-fabric edgewise; a longitudinally extending, small-ended holder for the thread-loop and movable longitudinally across the path of the needle; the needle-reciprocating mechanism moving the head of the thread-loop alongside the needle beyond the path of the loop-holder; the loop-holder having a loop-length-determining spacing from the base-fabric; loop-holder reciprocating mechanism moving the loop-holder toward and across the needle-path while the needle and the loop alongside it are in the path of the loop-holder; the needle having a construction involving a notch in its side toward the loop-holder path, which notch at the time the loop-holder is moved across the needle-path and while the needle is in the path of the loop-holder, is in the path of the small end of the loop-holder; said needle-notch having a portion extending sufficiently deep into the needle to cause the leg of the loop alongside the needle to bridge across a small space alongside the needle; and the small end of the loop-holder being sufficiently small to enter said small bridged space, and presser-means mounted in position alongside the needle-path for pressing the foot of the loop against the base-fabric, resisting tensionings on the loop-thread.

77. In a turfing machine, the combination with a fabric frame for supporting the meshed base-fabric for edgewise mobility and a loop-projecting needle; of means preventing retraction of the projected loop-threads back toward the fabric by needle-pulls, said means including a loop-foot presser, a loop-head holder, and a needle-construction involving a transverse notch causing formation of a small space between the needle and the leg of a loop alongside it and extending longitudinally across and bridging the needle-notch, said loop-foot presser being mounted at the needle side of the base-fabric and holding the loop-foot to the fabric against movement by needle-movement; said loop-head holder preventing shortening of the loop by needle-movement, the loop-head holder for that purpose including a member having a small end and mounted at the loop-side of the base-fabric for reciprocation in general parallelism with the base-fabric and across the needle-path for entry of its small end into the needle-notch and between the legs of a loop alongside the needle, the holder being positioned for definite loop-length-determining spacing from the base-fabric and positioned and shaped for engagement with the inside of the head of the loop; said loop-foot presser cooperating with the loop-head holder in preventing shortening of the loop by needle-movement, and the loop-foot presser holding the loop-foot from shortening, by needle-movement, of the projecting thread of the previously projected loop; and mechanisms operating the needle to project the loop, operating the fabric-frame to move the fabric edgewise across the needle-path and form the loop-foot, operating the loop-head holder to pass thru the needle-notch and enter between the legs of the loop alongside the needle, and operating the loop-foot presser to press the loop-foot against the base-fabric and alternately to withdraw it from the fabric for the edgewise movement thereof.

78. In a turfing machine, the combination with a fabric frame movably mounted for edgewise movement of the meshed base-fabric, and a loop-projecting needle, of means pre-determining uniformity of lengths of projected loop-threads projecting from out of and beyond the base-fabric, said means including a loop-foot presser, a loop-head holder, a needle-construction involving a transverse notch causing formation of a small space between the needle and a loop-leg thereon extending longitudinally along the needle and bridging across the notch, and a support for the base-fabric holding it from broadside movement by the loop-projecting needle and loop being projected thru one of its meshes, said fabric-support for that purpose including a blunt-pointed member mounted for engagement with the loop-side of the base-fabric in the vicinity of the path of the needle and loop thru the fabric-mesh, said member being sufficiently narrow to avoid injurious conflict with the threads of previously projected loop-threads in its vicinity, but sufficiently blunt-ended to stop broadside movement of the fabric by the loop-projecting needle and loop being projected, thereby preventing shortening of the distance between the projected loop-head and the base-fabric; said loop-foot presser and fabric-support preventing movement of the needle in projecting a given loop from shortening the thread of the previously projected loop, the foot-presser for that purpose being positioned operatively at the needle-side of the fabric adjacent the needle-path and opposite the blunt point of the fabric-support on the other side of the fabric, pressing the fabric against said fabric-support and pressing the loop-foot against the base-fabric; said loop-head holder preventing shortening of the distance between a given projected loop-head and the fabric held by said fabric-support, by means of movement of the head of the given loop toward the fabric by needle-movement, the loop-head holder for that purpose including a member having a small end and mounted at the loop-side of the base-fabric for movement across the needle-path for entry of its small end thru the needle-notch and between the legs of the given loop alongside the needle, the loop-head holder having a form adapted for holding engagement with the inside of the loop-head; the operative blunt-pointed end of the fabric-support being located between the base-fabric and the path of the loop-head holder, and the small holder-end having a path extending across the needle-path which is more remote from the base-fabric than the operative blunt-pointed end of the fabric-support and thereby having a loop-length-determining spacing from the base-fabric; and coordinated mechanisms for operating the needle to project the loop, the fabric-frame to move edgewise across the needle-path and form the loop-foot, and the loop-head holder to pass thru the needle notch and enter between the legs of a loop alongside the needle and engage the

inside of the loop-head to keep the loop distended against needle-movement.

79. In a turfing and pile-forming machine, the combination with a fabric-frame movably mounted for edgewise movement of the base-fabric, and a loop-projecting needle, of a loop-head holding and cutting member narrow enough to be moved longitudinally thru a loop and having an end sufficiently small to enter the loop and formed on its side facing the inside of the loop-head with a long, sharp cutting edge; and mechanism moving said holding and cutting member longitudinally into the loop and into holding and cutting engagement with the inside of the loop-head; said long, sharp edge having a linear shape which has a relation to its path across the loop-head causing cutting progressively during a relatively fast sweep of a long length of the sharp edge across the loop-head, at a relatively slow rate of cutting thru the loop-head thread, with corresponding uniform, moderate tension of the loop outwardly from the base-fabric which tension holds the loop-yarn in uniform relation with the long cutting edge during the linear sweep of the latter, against any tendency of the yarn to move longitudinally across the sharp edge, with accompanying distribution of the head-severing operation along the length of the long edge thereby preserving the sharpness of all portions of the length of the edge; and all the same contributing to production of cut yarn pile-threads of equal lengths and clean-cut ends.

80. In a turfing machine, the combination with a fabric-frame movably mounted for edgewise movement of the base-fabric, and a loop-projecting needle, of fabric-clamping devices at the respective faces of the base-fabric and alongside the needle-path for clamping together the base-fabric and a loop-foot extending along the needle-side thereof, at least one of said clamping devices being movable from the base-fabric for freedom of edgewise movement thereof; and a long holding and cutting member having a small end shaped for entrance into a projected loop and movable along the inside of the loop-head for holding and cutting it, said long member being formed with a sharp cutting edge on its side which faces the inside of the loop-head, said edge having a long length and a linear shape which has a relation to the path of movement of its long length along the loop-head which causes relatively slow cutting progressively thru the loop-head during a relatively fast sweep of the long edge across the inside of the loop-head, with a corresponding distribution of the outward tension on the loop during the cutting operation by a long length of the edge, such distribution tending to cause substantially uniform loop-tension so low as to be insufficient at any time to pull the loop-foot from between said clamping devices thereby preventing shortening of the projecting thread of the previously projected loop connected with the clamped foot and causing actual production of substantially uniform loop-tension throughout the cutting operation; said distribution of outward loop-tension along the long length of the sharp edge during the cutting thereby also preserving the sharpness of all portions of the edge length; all the same contributing to production of pile-threads having equal lengths and clean-cut ends.

81. In a turfing machine, the combination with a fabric-frame movably mounted for edgewise movement of the base-fabric, and the loop-projecting needle, of fabric-clamping devices at the respective faces of the base-fabric and alongside the needle path for clamping together the base-fabric and a loop-foot extending along the needle-side thereof, at least one of said clamping devices being movable from the base-fabric for freedom of edgewise movement thereof; and a longitudinally extending loop-head holder mounted for linear movement into a loop extending along the sides of the needle while the foot of the loop is clamped between said clamping devices, said head-holder having its side which faces the needle shaped in conformity with the facing side of the needle to pass closely adjacent the needle in crossing its path, and said head-holder being formed with a pointed end extending in line with its said conformed side, all whereby the holder can the more assuredly enter the loop extending along the sides of the needle; the lateral portion of said head-holder which faces the inside of the loop-head having a linear shape in relation to its path of linear movement thru the loop, which holds the loop against shortening by needle-retraction while applying outward tension to the loop insufficient to pull the loop-foot from between said clamping devices, thereby also preventing shortening of the projecting thread of the previously projected loop which is connected with the clamped foot.

82. A turfing and pile-forming machine including a movable frame supporting a base-fabric for edgewise movement, and a plurality of spaced groups of turfing elements distributed adjacent the base-fabric, the respective groups including a loop-projecting needle at one face of the base-fabric, and loop-holding means movable transversely of the needle-path, along the other face of the base-fabric, into projected loops, holding them from shortening by needle-retraction after loop-projection; and a plurality of spaced-apart shielding members also respectively in said respective groups and consisting of relatively wide and thin members arranged in a plane between the base-fabric and the paths of movements of the loop-holding means and facing and spaced from the base-fabric and in positions shielding from the movements of the loop-holding means, the previously projected loop-threads in the vicinity of said holding means.

83. A turfing and pile-forming machine including a movable frame supporting a base-fabric for edgewise movement, a loop-projecting needle; longitudinally-extending loop-holding and cutting means longitudinally movable transversely of the needle path and into projected loops holding them against the needle pull, and consisting of a blunt portion engaging the inside of the projected loop-head to hold the loop from shortening by needle-retraction after loop-projection, and a holding and cutting portion formed with a sharp edge facing the inside of the projected loop-head; a relatively wide and thin shielding member arranged in a plane between the base-fabric and the path of movement of said holding and cutting means and facing and spaced from the base-fabric; and a nose extending toward the base-fabric beyond said shielding member for engagement with the base-fabric at a portion thereof adjacent the needle-path; said shielding member being located in a position shielding from the movements of the holding and cutting means, the previously projected loop-threads in the vicinity of said nose, while engaged in operating on a given projected loop alongside the nose.

84. A turfing machine including a movable frame for the base-fabric, a loop-projecting nee-

dle and a loop-foot presser adjacent the needle, on one side of the base-fabric, and at the other side a fabric-clamping nose opposite said loop-foot presser, a loop-holding knife arranged for sweeping movement of its edge in holding and cutting engagements against the inside of the head of the loop projected by the needle, and a shield spaced from the base-fabric and located between said fabric and the path of said knife; said nose being arranged adjacent the needle-path; and the cutting movement of the knife being in a direction relative to the surface of the nose facing the needle-path which causes the knife in its direction of cutting movement to move the loop-legs against said nose-surface thereby causing said surface to support the loop-legs against the cutting movement of the knife.

85. The combination with a reciprocable loop-projecting needle formed with a transverse notch, of means supporting a base-fabric and movably mounted for edgewise movement of the fabric presenting its different meshes successively to the needle; loop-foot-pressing means pressing against the needle side of the fabric, the thread extending from the fabric to the needle-eye; means reciprocating the needle thru the fabric projecting therethru as a loop the thread extending from said pressing means to the needle-eye, said pressing means holding the previously projected portion of the length of the thread from retraction thru the fabric by the retraction of the needle; fabric-holding means supporting the fabric against loop-projecting movements of the needle and thread frictionally thru it thereby determining the lengths of projected loops beyond the fabric; and an end-pointed loop-head-holding device mounted for movement thru said transverse needle-notch and thereby thru the projected loop between the legs and against the head thereof, holding it in loop-form against collapse by retraction of the needle, and causing the needle to slide along said thread extending thru its eye and held at the foot of the loop by said pressing means and at the head of the loop by said loop-holding means.

86. The combination with a reciprocable loop-carrying needle projecting loops thru the meshes and beyond the surface of a base-fabric held therewith by friction, of a longitudinally extending and longitudinally movable device entering the projected loop and holding its head from retraction toward the fabric by the return movement of the needle, said device having a pointed end offset from the longitudinal center of the device and at the side of the device facing the path of the needle; the needle having a transverse notch in its side toward the path of said holding device and at the end of the needle-eye, said eye-end terminating in the notch and the notch having a deep bottom close to the notch-terminating eye-end and said eye-end termination in the notch guiding the loop-thread emerging from the needle into position bridging across the notch-bottom longitudinally of the needle as the needle-eye and notch are moved along the loop-thread by the loop-projecting movement of the needle; and coordinated mechanisms operating the needle and the loop-holding device and moving the offset point of the latter into and across the path of the needle carrying the loop while the needle-notch is in the path of the point; said offset point being mounted to lie closely adjacent the path of the deep notch-bottom and closely adjacent the path of the eye-end in the notch; and said operating mechanisms being further coordinated to cause the offset point while it is being moved thru the notch, to move actually opposite the notch-bottom itself, and the loop-holder also being moved closely adjacent the notch-bottom and the eye-end terminating in the notch, avoiding injury to the thread of the adjacent loop-leg and entering the loop near its head at the needle-eye.

87. The combination with a reciprocable loop-carrying needle projecting loops thru the meshes and beyond the surface of a base-fabric held with the fabric by friction, said needle having a transverse notch in its side at an end of its eye and said eye-end terminating in the notch and the notch having a deep bottom close to the end of the notch-terminating eye-end and said eye-end termination in the notch guiding the loop-thread emerging from the needle into position bridging across the notch-bottom longitudinally of the needle as the needle-eye and notch are moved along the loop-thread by the loop-projecting movement of the needle; of a longitudinally extending longitudinally movable device holding the head of the projected loop from retraction by the needle in its return movement, said device having a sharp-pointed end; and coordinated mechanisms operating the needle and said loop-holding device and moving the sharp point of the latter into and across the path of the needle carrying the loop while the needle-notch is in the path of the point; said point being mounted to lie closely adjacent the path of the deep notch-bottom and closely adjacent the path of the eye-end in the notch; and said operating mechanisms being further coordinated to cause the point while it is being moved thru the notch to move actually opposite the notch-bottom itself, the point of the loop-holder also being moved closely adjacent the notch-bottom and the eye-end terminating in the notch, avoiding injury to the thread of the adjacent loop-leg and entering the loop near its head at the needle-eye.

88. The combination with a reciprocable loop-carrying needle projecting loops thru the meshes and beyond the surface of a base-fabric, of means pressing the foot of a projected loop against the fabric, and a longitudinally extending longitudinally movable loop-holding device engaging the inside of the head of the projected loop and cooperating with said foot-pressing means in keeping the loop-head from retraction toward the fabric by the return of the needle, said loop-holding device having a pointed end; said needle having a transverse notch having a deep bottom and bridgeable by the thread of the projected loop extending from said pressing means to the eye of the needle; and coordinated mechanisms operating the needle and the loop-holding device while said pressing means is pressing the loop-foot against the fabric, and in such operation longitudinally moving said point thru said notch close to its deep bottom avoiding injury to the thread of the adjacent loop-leg.

89. The combination with a reciprocable loop-carrying needle projecting loops thru the meshes of and beyond the surface of a base-fabric, of means pressing the foot of a projected loop alongside and against the fabric, and a longitudinally extending longitudinally movable loop-head-holding device holding the head of the projected loop and cooperating with said foot-pressing means in keeping the loop-head from retraction toward the fabric by return movement of the needle, and having a pointed end offset from the longitudinal center of the device and

at the side of the device facing the needle-path; said needle having a transverse notch in its side facing the path of said head holding device, said notch having a deep bottom bridgeable by the thread of the projected loop extending from the eye of the needle to said loop-foot-pressing means; the side of said head-holding device opposite its offset point being tapered longitudinally away from the point for engagement with the inside of the loop-head after the point enters the loop, and said tapered side being transversely curved in substantial conformity with the curvature of the loop-head at the eye of the needle, said transversely curved portion, without injury to the inside of the loop-head, holding the head away from said loop-foot-pressing means and against the retracting pull on the loop by the needle.

90. The combination with a reciprocable loop-carrying needle projecting loops thru the meshes and beyond the surface of a base-fabric, of means holding projected loop-threads at head and foot thereof and including a loop-foot-pressing device pressing the loop-feet alongside and against the surface of the fabric and including a loop-head-holding cutting member engaging the inside of the projected loop-heads and formed with a sharp cutting and head-holding edge facing the loop-head which sharp edge is very long relative to the thickness of the loop-thread; and means rapidly moving said loop-holding member in a direction causing slashing of its long cutting edge across the loop-head and cutting thru the thread rapidly but gradually and progressively, reducing tendencies to pull the loop-thread from under said pressing device or from the needle; said slashing cut holding the loop during cutting gently pulled out away from the foot-pressing device in cutting position with its head centralized to the long cutting edge during the slashing movement of the latter.

91. The combination with a reciprocable loop-carrying needle projecting loops thru the meshes and beyond the surface of a base-fabric, of means holding loops at desired length beyond the fabric surface after projection, said means including a loop-foot pressing device holding projected loops in position by pressing their feet against the fabric, and said means including loop-head holding means including two portions, the first having a pointed end adapted to pass between the needle and a loop-leg thereon and engage the inside of the loop-head, holding it away from said foot-pressing device, and the second portion having a sharp cutting and head-holding edge facing the inside of the loop-head and very long relative to the thickness of the loop-thread, and means moving said loop-head holding portions thru the loop simultaneously in the same general direction, moving said second portion rapidly in a direction causing slashing of its long cutting edge across the loop-head and cutting thru the thread rapidly but gradually and progressively, reducing tendencies to pull the loop-thread from under said foot-pressing means or from the needle.

92. A machine for manufacturing fabric articles by projecting thread-loops thru and substantially beyond the meshes of a base-fabric, and cutting them, for permanent holding of the cut threads in the fabric meshes by friction, said machine including a movable frame supporting the base-fabric, thread-handling elements including a loop-projecting needle, loop-holding and cutting means adapted to engage against the inside of the loop-head to hold and cut it and fabric-clamping means; and mechanisms operating said elements in coordinated time relations wherein the clamping means are moved into clamping relations with the base-fabric before the needle is projected therethru, and remain in such clamping relations until after the needle has been retracted, and wherein the loop-holding and cutting means are in holding engagement against the inside of the loop-head while the needle is being retracted and while the loop-head is being cut; and means for moving said fabric frame to move the fabric edgewise in its plane while the needle is disengaged from the base-fabric and while the fabric-clamping means is out of clamping relations with the base-fabric.

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