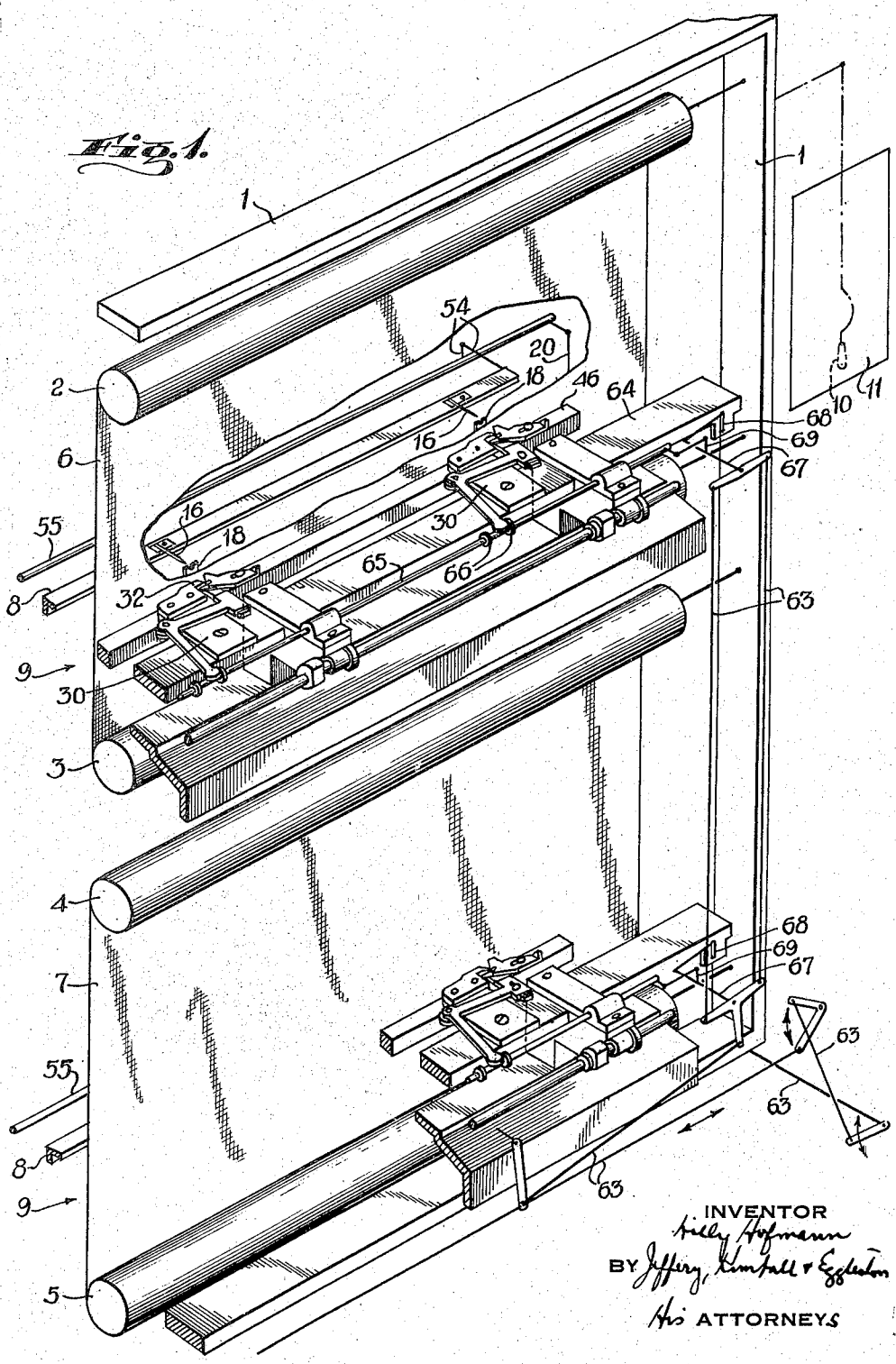
Sept. 14, 1948. W. HOFMANN 2,449,529

TUFTING MACHINE

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Fig. 1.



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TUFTING MACHINE

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Fig. 2.

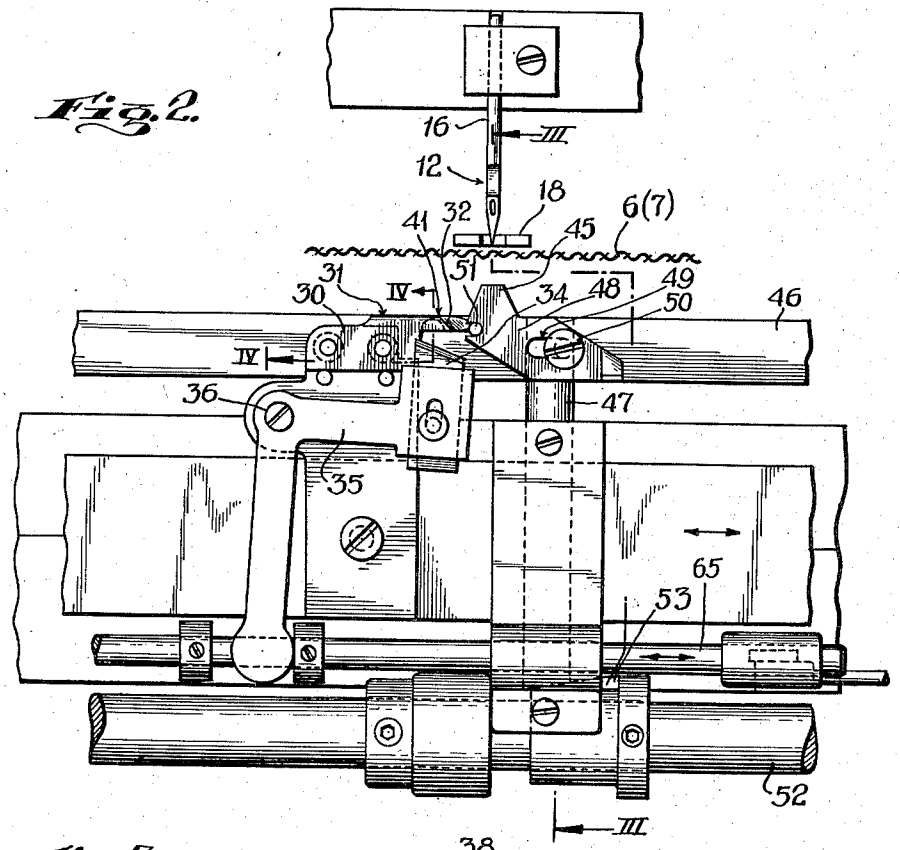


Fig. 3.

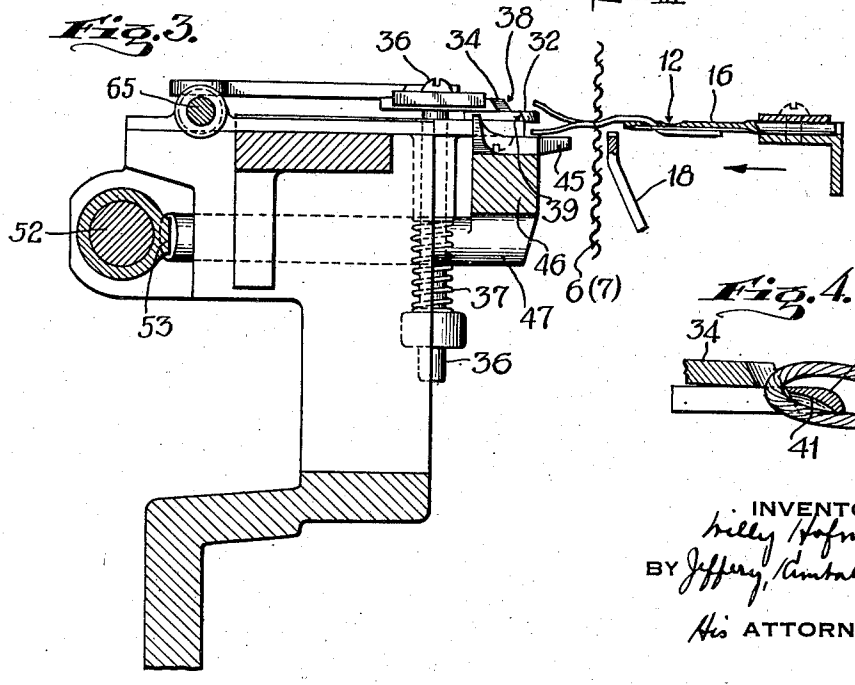


Fig. 4.

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TUFTING MACHINE

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Fig. 5.

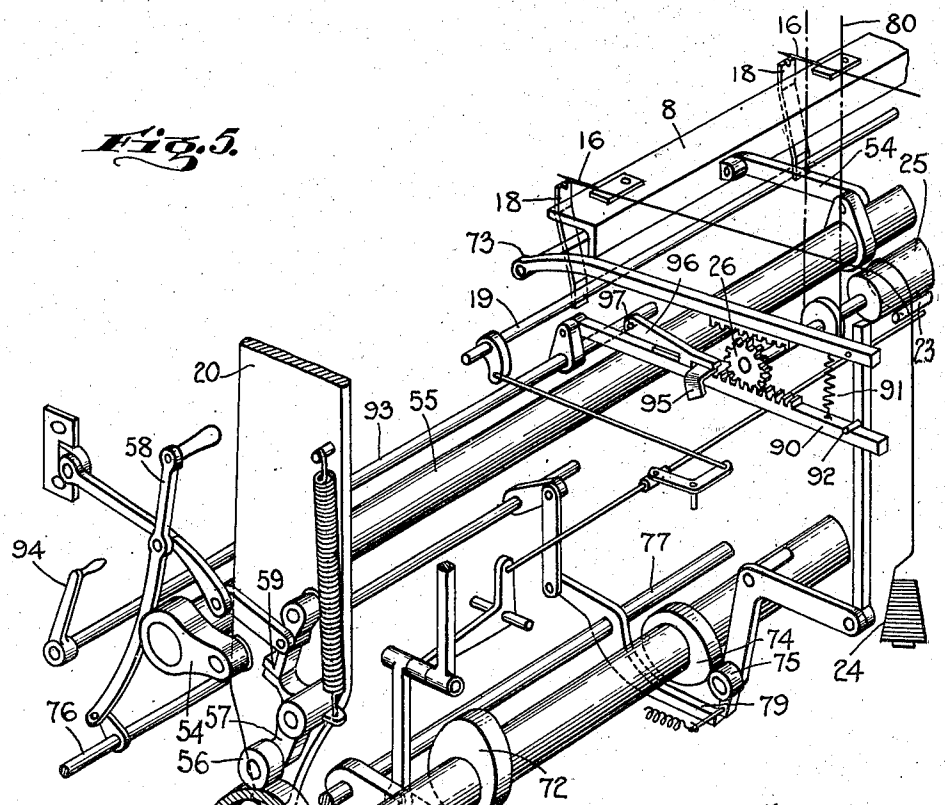
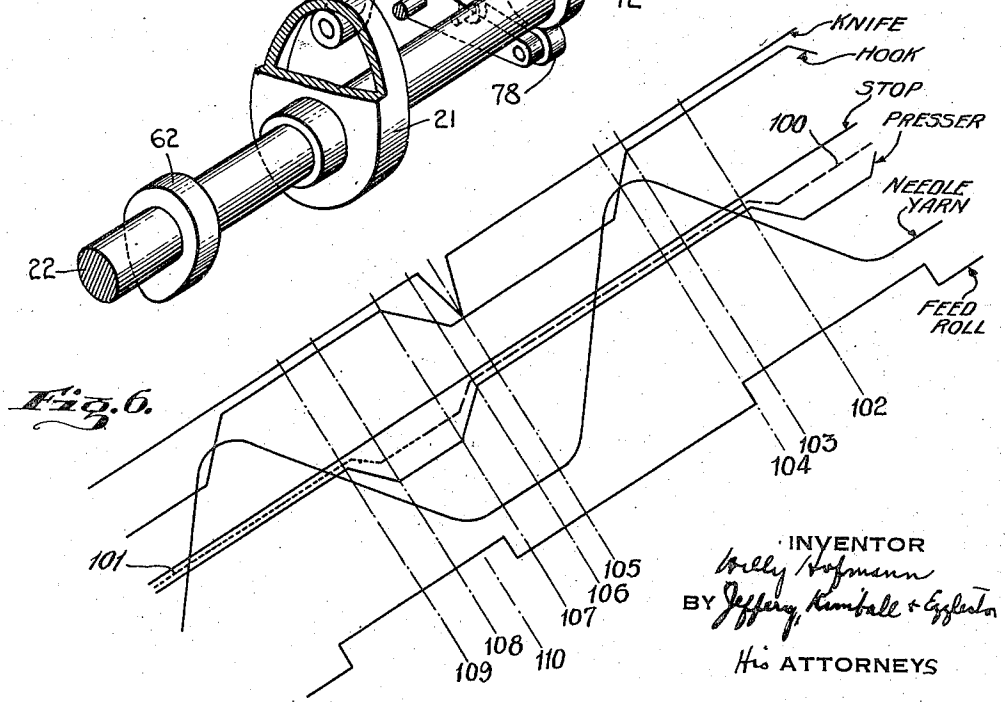


Fig. 6.



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UNITED STATES PATENT OFFICE

2,449,529

TUFTING MACHINE

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Application October 18, 1945, Serial No. 623,091

11 Claims. (Cl. 112—79)

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My invention relates to tufting machines, so called, and more particularly to that type of tufting machines in which the cloth being tufted is held more or less stretched out flat on a frame in front of (usually) a gang of needles and the frame is shifted step by step to bring successively to the needles those points on the fabric at which loops of the yarn are to be drawn. Usually the cloth is carried in the frame on two rolls, from one of which it passes to the other during the operations, usually the rolls are placed one above the other so that the cloth is extended vertically, and frequently two pairs of rolls are used in the same frame one above the other, each pair carrying a cloth to be tufted and each cooperating with a gang of needles and accessory apparatus so that two cloths are tufted at the same time and with the same relative placements of the yarn loops.

It will be understood of course that a tufting machine is not limited to the production of tufts properly speaking, i. e. clusters of yarn loops or yarn ends, but may be used to cover a large area or even a whole piece of fabric with loops or ends of yarn, more or less tightly packed together, or it may be used to place loops or yarn ends more or less in lines forming more or less complex designs, etc. Herein the words "tufts," "tufting," etc. are to be understood as including such variations.

In the operation of machines of the type indicated, each needle, at each stroke, passes yarn through the fabric thus forming a loop at the opposite face of the fabric, and a hook or "looper" then enters the loop to hold the loop extended as the needle is withdrawn to its starting position. Usually the hook is withdrawn from each loop about as this occurs, in machines of the type indicated. The loop may be left uncut, or it may be cut to form two projecting yarn ends of about equal lengths. To cut the loops heretofore it has been the practice to use knives the edges of which face away from the fabric, and which cut their loops by being thrust into loops and thereby their cutting edges drawn across the ends of the loops to sever them. The tension on the yarn in the needle eye tends to prevent additional yarn from being drawn into one side or leg of a loop during the cutting operation, and also a presser has been disposed adjacent each

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needle, and at the moment of cutting operated to press against yarn lying at the needle side of the fabric to keep such yarn from being drawn into a loop by the knife acting to elongate the loop during the cutting.

These prior practices have various faults, as has been recognized. For example, the knives must be very sharp since they must slice through the yarn against only so much tension as can be put on a loop to prevent it elongating; the result is that the knives must be removed from the machine frequently for resharpening. The knives do not always cut the yarns cleanly. Frequently the projecting yarn ends vary noticeably in length. The knife holders and the looper hooks as heretofore placed, tend to flatten down many previously-formed yarn ends as the cloth is shifted to bring new localities of it to the needles. Noticeably long lengths of yarn are left projecting from the needle-side of the fabric when the fabric is shifted more than a small fraction of an inch, and these, for appearance sake, must be pulled out by hand. And it has not been possible heretofore to change the lengths of loops or yarn ends readily, and accordingly not practical to change their lengths from time to time or to make adjacent loops or adjacent yarn ends of different selected lengths.

Speaking generally, my invention overcomes such recognized and persisting faults of the prior practices. It involves placing each looper hook at right angles to the general line of travel of the fabric being tufted, e. g. parallel to rolls carrying the fabric rather than at right angles to such rolls as heretofore. It involves also placing each cutter or knife and its mechanism back of the adjacent looper hook, i. e. at the opposite side of the hook from the fabric rather than at about the same distance from the fabric as the hook as heretofore, and arranging each cutter or knife to cooperate with its looper hook in making cuts so that each loop is grasped, as it were, between its knife and hook at the moment of severance. It involves also placing each looper hook and the adjacent stop (or adjacent portion of an elongated stop serving a number of needle stations), against which the fabric is pressed while loops are being drawn, at opposite sides of the path of the respective cooperating needle; also forming each stop with a rather narrow elongated fabric-

engaging face, and placing this face substantially parallel to the adjacent looper hook; also making the stops adjustable readily toward and from the normal plane of the extended fabric, i. e. toward and from the plane containing the axes of the rollers supporting the fabric. It involves also withdrawing yarn from the needles whenever the fabric is shifted a considerable distance.

The accompanying drawings illustrate a preferred form of my invention as applied to a well known form of tufting machine of the type indicated: Fig. 1 is a diagrammatic perspective view of one end of the machine; Fig. 2 is a plan view of a needle, looper, and accessory mechanism of one tufting station of the machine; Fig. 3 is a section about on the line III—III of Fig. 2; Fig. 4 is a sectional view of about on the line IV—IV of Fig. 2, a tufting loop being added however and the knife being shown somewhat nearer its loop-severing position; Fig. 5 is an elevation of so much of a mechanism suitable for driving the operating portions of the machine as is necessary for an understanding of it; Fig. 6 is a timing diagram showing the order in which the parts of the machine involving my invention operate by preference.

Speaking generally, the machine illustrated comprises a frame 1 carrying two pairs of cloth rolls 2, 3 and 4, 5, which carry fabrics 6 and 7 respectively, each in a vertical plane and between a bank of needles 8 and associated apparatus 9, together with mechanism to reciprocate the needles toward and from the fabrics and actuate the associated apparatus, and mechanism to raise and lower the frame and move it to the right and left to shift the fabrics 6 and 7 so that different parts of the fabrics are brought successively to the needles, say in accordance with a predetermined plan, and to turn the cloth rolls to transfer fabric from one to the other as the work progresses along each fabric. The frame may be shifted automatically in accordance with, say, a perforated pattern, or under manual control of a lever 10 used to follow a pattern on a board 11 for example; both these means for directing the movement of the frames and hence of the fabrics 6 and 7 are well known. Neither the particular mechanism used to shift the frame 1 nor the mechanism used to turn the cloth rolls is material to the present invention. Also the number of fabrics carried by the frame is not material. There may be only one, or more than two. Hereafter only the fabric 6 and its associated apparatus will be referred to for the most part, the fabric 7 and its associated apparatus being similar.

A bank of needles 8 may be substantially like needle banks used heretofore. It comprises a plurality of needles 16, the number of which may be varied from time to time as may best suit the particular design to be produced on the fabrics, and all the needles of the bank may be mounted fixedly on one and the same bar like that marked 8. Preferably however the needles are mounted with their eyes at right angles to the associated cloth rolls 2, 3, or to whatever may take the place of such rolls, rather than parallel to them as customary heretofore, and the notches 12 which assist the looper hooks to enter the loops are placed on sides of the needles facing one of the rolls (or its substitute) rather than at 90° from such positions as heretofore. Each needle bar 8 may be reciprocated toward and from its related fabrics 6, to thrust its needles 16 through the fabric to form loops of yarn on the opposite

face of the fabrics, by any suitable mechanism; for example, mechanism used heretofore for reciprocating needle bars can be used. At each needle 16 a presser 18 is provided to press the adjacent portions of the fabric against opposing stops described later, while the needles are piercing the fabric; as indicated in Fig. 5, these pressers 18 of a bank of needles may be mounted on a rock shaft 19 which by rocking action brings the pressers to the fabric and away from the fabric again at the appropriate moments.

In lieu of individual pressers 18, a single bar will serve as a presser for a number or all the needles 16 of a bank, this bar extending along the positions of the heads of the pressers 18 and being operated in the same manner as 18. However it is not necessary that the pressers 18 (or bars substituted for them) extend across the paths of these needles in order to engage yarns lying on the needle-face of the respective fabric 6, as has been proposed heretofore. Further, the natures of the mechanisms for actuating the needles and pressers are immaterial to the invention.

Yarn can be supplied to the needles 16 by, for example, cones 24, one for each needle. Preferably the yarn is drawn forcefully from the source of supply, e. g. by yarn feed rollers 25, say one for each bank of needles, around which each yarn fed by it is wrapped in passing from the respective source or sources 24 to its needle 16; these rollers may be driven at 26, Fig. 5, for example, at appropriate moments to feed yarn to their needles as described in some detail later. The nature of the driving mechanism for such rolls as 25 is immaterial however. In order to permit the needles to draw a little more yarn than the rolls 25 may feed, the yarns may be looped from these rolls around one or more parallel bars 23, Fig. 5, spaced a little from the roll, as will be understood from prior practices; such bars permit the yarn to slip on the rolls a little easier than they can around the rolls alone.

This same mechanism, e. g. a feed roller, or feed rollers 25, can be used also to reduce the lengths of yarn that usually are left projecting from the needle-side of the cloths at times as referred to again.

Speaking generally, the particular constructions of the mechanisms so far mentioned, and the mechanisms for driving and otherwise actuating them, are quite or substantially immaterial to the present invention except as herein appears. Accordingly, the foregoing description and the diagrammatic illustration will suffice for the present purposes. Should any further illustration or description of such parts be needed or desired however, the U. S. patents No. 1,972,265, Sept. 4, 1934 and No. 2,062,027, Nov. 24, 1936, may be referred to.

As usual in tufting machines of the type here concerned, the loops formed by the needles on the opposite side of the fabric or fabrics are caught by loopers so called, and may be cut to produce two projecting ends of yarn from each loop. In the present instance however the looping and cutting mechanisms are quite distinctive.

In the present instance, each looper comprises a member 30 presenting to the cloth a horizontal edge 31 as it were that extends parallel to its associated cloth rolls 2, 3 (or substitutes for them), and has a similarly extending hook portion 32 that may be pointed somewhat so as to slip readily into a loop of the yarn held on the looper side of the fabric by its adjacent needles.

In operation the needles 16 of the bank are thrust through the fabric with the associated loopers in about the position illustrated in Fig. 2, and then the loopers are moved horizontally to the right in Fig. 2 to place their hook portions 32 within the loops. The notches 12 in the needles, arranged to be in the paths of the looper hooks at the moment help to direct each hook between its needle and one leg of the loop drawn by the needle. The needles then retreat, and the hooks hold the loops to prevent them being drawn back by the needles. If the loops or any of them are to be cut, they are then cut at the hooks 32. For this purpose a knife 34 is mounted entirely back of, say, each looper hook 32, together with its actuating mechanism, i. e. at the opposite side of the looper hook from the fabric as will be observed from Fig. 2. Each knife 34 may be mounted in a swinging arm 35 hinged at 36, and preferably is mounted to cooperate with its hook 32 in severing the loop and to this end preferably is mounted to ride on one surface of the looper hook as shown in Figs. 2 and 3. The arm 35 may be hinged to the body 30 of the looper, and the hinge or pivot 36 of the knife arm 35 may be drawn downward by a spring 37 and thereby the knife held yieldingly against the upper face of its hook 32. The yarn engaging edge of the knife 34 may be inclined as at 38 (Fig. 3) so as to provide a sharp cutting edge as it were, and similarly the face 39 of the looper hook 32 may be inclined as illustrated to provide a somewhat sharp edge to cooperate with the sharp edge of the knife 34, especially at that portion of the hook 32 whereat each loop rests at the moment of cutting. Each loop may be cut as it is formed, i. e. without the accumulation of uncut loops on the hook. A cut loop is illustrated in Fig. 3. In order that the two legs of a cut loop may be more nearly of the same length, the under side of the hook 32 may be recessed as at 41, Figs. 4 and 2, at the region of the hook occupied by the loops while being cut.

After a loop is cut (or at about the same time if loops are not cut) each looper 31 is returned to the left (i. e. to its position in Fig. 2), in preparation of another (righthand) movement to enter another loop drawn by its respective needle 16.

As the needle enters the fabric 6 at any time, the fabric should be rather exactly positioned and confined locally; otherwise the contemplated design may be undesirably irregular, etc. To this end the pressers 18 (or the equivalent of multiple pressers, namely, say a horizontal bar positioned at the line of the heads of 18) press the fabric adjacent the needle paths from the position in Figs. 2 and 3 to against a corresponding series of stops 45 at the opposite side of the fabric (or against, say, a horizontal bar substituted for the row of stops 45). Preferably each stop 45 is placed at the opposite side of the path of its needle from its adjacent looper hook 32, and may be held in a (temporarily) fixed relation to its adjacent looper hook 32. The stops 45 determine the lengths of loop that are formed by the needles and hooks 32; i. e. if a stop 45 projects a considerable distance from a looper hook 32 toward the plane containing the axes of the rolls 2, 3, the fabric 6 will be held a corresponding distance from the hook 32 when the retreating needle again comes to rest (and when the loop is cut if cut) and hence the projecting loop (or projecting yarn ends if the loop is cut) will be long; reversely, if a stop 45 projects only a little distance beyond its adjacent looper hook 32, the fabric will be correspondingly closer to the hook when the loop is completed (and perhaps cut), and the projecting loop (or yarn ends) left will be correspondingly short. In order to vary the lengths of the loops and/or cut yarn ends, the stops 45 may be made adjustable toward and from the plane of the axes of the rolls 2, 3 (or their substitutes) and to this end they may be mounted on a common horizontal bar 46, and this in turn carried by slides 47 so that all the stops 45 of a bank can be adjusted in position as a unit. An adjacent slidable bar 52 having a wedge or wedges 53 operating against one or more of the slides 47, will serve to adjust the positions of the stops 45, manually or automatically, at desired intervals. If desired however, each stop 45 can be made independently adjustable. On occasion it is desirable to remove one or more of the stops 45 entirely from action; for example, when one or more corresponding needles are taken off the needle bar. To this end, I usually mount each stop 45 on a body member 48 through which a screw bolt 50 is passed to fasten the body to the supporting bar 46. By loosening the bolt 50 the member 48 can be swung to place the stop 45 substantially at the fabric-edge of the bar 46 of course; and thus out of action. If desired a pin 51 and a corresponding notch in one end of the stop 45—48 can be used to hold the stop from turning under the thrust of its adjacent presser 18, while a slot 49 will permit the stop being slipped away from the pin in being put out of action.

As will be appreciated, the devices so far described can be operated by various forms of mechanism and the particular form of mechanism employed is not material to my invention, at least for the most part. By way of example, however, Fig. 5 indicates a mechanism that I have found suitable. In this mechanism a cam shaft 22 is driven continuously by some suitable source of power. A cam 21 on this shaft reciprocates the vertical link 20 and from this cranks and links 54 and shafts 55 operate the needle bars as before described. In order to stop the operation of the needle bars when necessary, one of its follower rolls 56 can be mounted on a pivoted link 57 that normally is held in such position that the cam 21, acting through the roller 56, can raise the link 20; but by means of a hand lever 58 a supporting hinged arm 59 can be withdrawn from 57, and when this happens the coaction of the follower 56 with the cam 21 will simply swing the link 57 without moving link 20. Another cam 62 on the cam shaft may act through appropriate linkage 63, Fig. 1, to reciprocate a horizontal bar 64 extending along each bank of loopers 30 and on which the looper bodies are mounted, and also reciprocate parallel bars 65 having collars 66 at each needle station to actuate the cranks 35 carrying the knives 34. In the particular mechanism illustrated rock shafts 67 have links running in pin slots 68 of the looper bars 64 and cranks 69 linked to the knife bars 65; by appropriate shaping of the slot 68 and spacing of the collars 66 that will be understood, the loopers can be shifted parallel with the fabric and the knives moved to and retreated from their severing positions at appropriate moments. Each presser bar 19 may be rocked by a cam 72, for example, on the cam shaft 22, as will be recognized from Fig. 5. To operate each yarn feed roll 25, preferably I provide a rack member 73 that is reciprocated lengthwise by a connection to the respective needle bar, and a

cooperating gear wheel 26 on the shaft of the feed roll, together with a cam 74 on the cam shaft 22 which acts through a follower 75 to hold the rack bar 76 raised from the gear 26 at times when no feeding of the yarn is required. The manual stop handle is arranged to stop the feed of the yarns by the yarn drums 25, by a connection from this lever 58 to a rock shaft 76 arranged to rock a lever 79 into the path of the arm carrying the follower 75 of the rack 73, to thereby hold the follower out of the path of the yarn feed cam 74 and thereby, for the time being, hold the rack bar 73 out of engagement with the gear 26. If desired a rack bar 73 and gear 26 may be provided for only one of, say, two yarn drums 25, the other yarn drum being driven from the shaft of the first as through a belt 80.

Ordinarily after a needle has drawn a loop at one point on the fabric and retreated from the fabric, the fabric is shifted only sufficiently to place the next point of needle penetration and loop a short distance away. Such an operation need not shorten materially a previously made loop or yarn end. On occasion, however, as before indicated, the fabric must be shifted to bring a rather remote point to the needle for its next loop. In such an operation the needle pulls back out of the fabric one leg of the last loop formed (assuming that loop to have been cut), since that leg is a part of the yarn standing in the needle eye. When the needle makes its next stroke at the remote point, accordingly, an end of yarn, of noticeable length, is left projecting from the needle-face of the fabric. This is not fatal but is somewhat unsightly and heretofore it has been customary to have these projecting ends pulled out by hand. I substantially prevent these projecting ends on the needle-face of the fabric by causing the yarn feed roll 25 to reverse slightly whenever the fabric is shifted a considerable distance. The fabric makes these long shifts while otherwise the machine is at rest and while the rack bar 73, which normally advances the feed roll 25, is held out of engagement with its gear 26, so that the feed roll can be rotated in reverse at such times. I thereby withdraw sufficient yarn from the needle to allow only a short stub-end of yarn to project from the needle-face of the fabric on the next draft of a loop by the needle. This reversing of the feed roll may be done wholly automatically (e. g. as an incident to automatic control of the machine as before suggested), or it may be done manually at the proper times. To reverse the roll 25 at this time I prefer to add a second rack bar 90 to also engage with the gear 26 of the feed roll, provide it with a spring 91 to bring this bar into engagement with the gear, and, say, a pin 92 on the linkage to hold the rack 90 from the gear 26 while the rack 37 engages that gear. The second rack bar may then be connected to a rock shaft 93 provided with some means for rocking it, for example, a manual handle 94. A stop 95 may be mounted on the rack bar 90 and a cooperating stop 96 hinged at 97 to some fixed point on the machine, to limit the roll-reversing movement of the second rack bar 90 to the desired amount of reverse movement.

The preferred order of operations is illustrated in Fig. 6.

It will be understood that this Fig. 6 illustrates the operation at one needle (any one) on the machine. The length of the figure indicates the passage of time and the various lines marked

"knife," "hook," etc. served to indicate the operation of those devices in forming and cutting the loops. The broken line 100 serves to indicate the position of the fabric with respect to the needle, presser and stop during and subsequent to one shift of the fabric and its continuation 101 serves to indicate another part of the fabric brought to the same needle.

At the time represented by 102, the fabric has been shifted to bring a new point 100 on it to opposite the needle, the presser 18 adjacent that needle is pressing that portion of the fabric against the opposing stop 45, and the needle 16 has advanced and is just about to pass into the fabric. The feed roll 25 feeding the yarn for this needle is turning to supply yarn to the needle, the respective looper hook 32 is at rest slightly away from the path of the needle, and the knife 40 is in its retracted position of Fig. 2. As the needle continues to advance it penetrates the fabric, and ultimately, at the time 103, when the needle is at or almost at its furtherest point of projection, its looper hook 32 passes into the loop near the needle end, as indicated by the change in position of the line representing the "hook" movement.

As the needle reaches its most advanced position through the fabric, i. e. at time 104, the feed roll becomes stationary, and when the hook 32 is well within the loop the needle starts to retreat as indicated by the change of direction of its line in Fig. 6, and when about this time the hook 32 has fully entered the new loop, the movement of the hook (to the right in Fig. 2) stops. The needle retraction continues, the hook within the loop preventing the needle drawing the loop out of the cloth until just about as the needle comes to rest in its initial, Fig. 2, position, i. e. at time 105, the knife quickly advances to cut the loop against the loop hook 32 as indicated by the change in direction of the knife line in Fig. 6. The knife can be restored immediately to its initial, Fig. 2, position as indicated also by the "knife" line.

About as soon as the cut is made, at time 106, the presser 18 may be retracted and the hook may be withdrawn to its initial Fig. 2 position, as indicated by the line directions. As soon as the presser is retracted and thus allows the tension on the fabric to pull the fabric from the adjacent stop 45, the frame of the machine is shifted to bring another point 101 on it to opposite the respective needle 16; the shift takes place in the interval from about 107 to about 108. The needle remains out of the fabric during this shift, but can be started toward the fabric as indicated by the change in direction of the needle line, between time 107 and 108, and about simultaneously the yarn feeding roll 25 starts turning again to feed yarn toward the needle. As soon as the fabric shift has been completed at 108, the presser 18 may be advanced again to press the new point 101 on the fabric to the stop 45, and this movement is completed at 109 shortly before the needle again enters the fabric. At 109 accordingly, the cycle described is completed, and a new and similar cycle begins.

The reversing of the feed roll 25 for any needle or bank of needles when the fabric is shifted a considerable distance, as described above, may take place at about the time 110.

As compared with prior devices, the new constructions described above reduce materially the amount of flattening of loops and yarn ends which arises from dragging loops and yarn ends

over the apparatus as can be seen readily. Preferably however I reduce the flattening effect still further by so operating the machine that, so far as practical, and in at least the major number of instances, each shift of the fabric between the formation of two successive loops is made in directions parallel to cloth rolls 2, 3 etc. (or their substitutes), or in directions moving each latest-formed loop directly away from both the looper hooks 32 and the stops 45 (i. e. in the upward direction in arrangements such as Fig. 1), or intermediate such directions. Such a method of operation tends to keep formed loops and yarn ends away from active apparatus such as the loopers and the stops.

It will be understood of course that my invention is not limited to the details of construction and the operation described above and illustrated in the drawings except as appears hereafter in the claims.

I claim:

1. In a tufting machine, the combination with a needle reciprocable through the fabric to form loops of yarn at the opposite face of the fabric, a presser, a stop to cooperate with the presser to confine the fabric, a looper having a hook to enter successive yarn loops drawn by the needle, and a frame remote from said looper to hold the fabric to be tufted positioned before the needle, and with at least a portion of it extended, and to shift the fabric parallel to its extent, of a knife to cut the loops and means to operate said knife, said knife and knife-operating means being located entirely at the opposite side of said hook from the fabric, the knife being mounted to move its cutting edge substantially into contact with the looper to sever the loops between them, and said knife-operating means actuating the knife to make cutting strokes while the loops to be cut are, respectively, on the looper.

2. The combination of claim 1 characterized by the fact that the cutting edge of the knife substantially faces the fabric, and the knife is mounted to move its cutting edge over an edge of the hook which engages the ends of the loops to sever the loops between them.

3. The combination of claim 1 characterized by the fact that the cutting edge of the knife substantially faces the fabric, the knife is mounted to move its cutting edge over an edge of the hook which engages the ends of the loops to sever the loops between them, and adjacent said edge of the hook, a loop-receiving recess is provided in the face of the hook opposite the knife.

4. In a tufting machine, the combination with a frame having a pair of fabric-carrying rolls from one of which to the other the fabric is carried in an extended condition, a needle to reciprocate through the extended portion of the fabric to form loops of yarn at the opposite face of the fabric, means to shift the frame parallel to the extent of the fabric and to turn the rolls to bring selected points on the fabric to the needle successively, and a presser and a cooperating stop to confine the fabric while the needle is piercing the fabric and releasing the fabric while said means is operating, of a looper having a hook extending substantially parallel to said rolls to enter successive loops drawn by the needle, a knife to cut loops held by said hook, and means to operate said knife, said knife and knife-operating means being located more remote from the fabric than said hook.

5. The subject matter of claim 4, characterized by the fact that means are provided to reciprocate the looper to cause said hook to pass into loops drawn by the needle.

6. The subject matter of claim 4 characterized by the fact that said hook and stop are located at opposite sides of the path of the needle.

7. In a tufting machine, the combination with a frame having a pair of fabric-carrying rolls from one of which to the other the fabric is carried in an extended condition, a needle to reciprocate through the extended portion of the fabric to form loops of yarn at the opposite face of the fabric, means to shift the frame parallel to the extent of the fabric and to turn the rolls to bring selected points on the fabric to the needle successively, and a presser and a cooperating stop to confine the fabric while the needle is piercing the fabric and releasing the fabric while said means is operating, of a looper having a hook extending substantially parallel to said rolls to enter successive loops drawn by the needle, said hook and stop being located at opposite sides of the path of the needle, and the fabric-engaging portion of said stop having greater length than width and its length being substantially parallel to said rolls, a knife to cut loops held by said hook, and means to operate said knife, said knife and knife-operating means being located more remote from the fabric than said hook.

8. In a tufting machine, the combination with a frame having a pair of fabric-carrying rolls from one of which to the other the fabric is carried in an extended condition, a needle to reciprocate through the extended portion of the fabric to form loops of yarn at the opposite face of the fabric, means to shift the frame parallel to the extent of the fabric and to turn the rolls to bring selected points on the fabric to the needle successively, and a presser and a cooperating stop to confine the fabric while the needle is piercing the fabric and releasing the fabric while said means is operating, said stop being adjustable to place its fabric-engaging portion, closer to or farther from the plane containing the axes of the rolls, to change the lengths of the loops drawn by the needle, of a looper having a hook extending substantially parallel to said rolls to enter successive loops drawn by the needle, a knife to cut loops held by said hook, and means to operate said knife, said knife and knife-operating means being located more remote from the fabric than said hook.

9. In a tufting machine, the combination with a frame having a pair of fabric-carrying rolls from one of which to the other the fabric is carried in an extended condition, a needle to reciprocate through the extended portion of the fabric to form loops of yarn at the opposite face of the fabric, means to shift the frame parallel to the extent of the fabric and to turn the rolls to bring selected points on the fabric to the needle successively, and a presser and a cooperating stop to confine the fabric while the needle is piercing the fabric and releasing the fabric while said means is operating, of a looper having a loop-engaging hook extending substantially parallel to said rolls, means to reciprocate said looper substantially parallel to said rolls to place the hook within loops and restore it to inactive position, a knife movably mounted on said looper back of said hook, and means to move said knife on the looper to bring the cutting edge of the knife into loop-severing cooperation with said hook while the hook is within a loop.

10. In a tufting machine, the combination with

a needle reciprocable through the fabric to form loops of yarn at the opposite face of the fabric, a presser, a stop to cooperate with the presser to confine the fabric, a looper having a hook to enter successive yarn loops drawn by the needle, and means to hold the fabric to be tufted with at least a portion of it extended and to shift the fabric parallel to its extent, of a device over which the yarn passes on its way to the needle, and means to actuate said device and therewith the yarn to withdraw from the needle some of the yarn previously fed to it.

11. The combination of claim 10, characterized by the fact that said device over which the yarn passes is a roller to feed yarn to the needle, and said means to actuate said device rotates said roller in the direction reverse to its yarn-feeding rotation.

WILLY HOFMANN.

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