

April 9, 1968

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3,376,835

TUFTING MACHINES AND METHODS FOR PRODUCING TERRY-LIKE
FABRICS AND FABRICS PRODUCED THEREBY

Filed Dec. 27, 1965

5 Sheets-Sheet 1

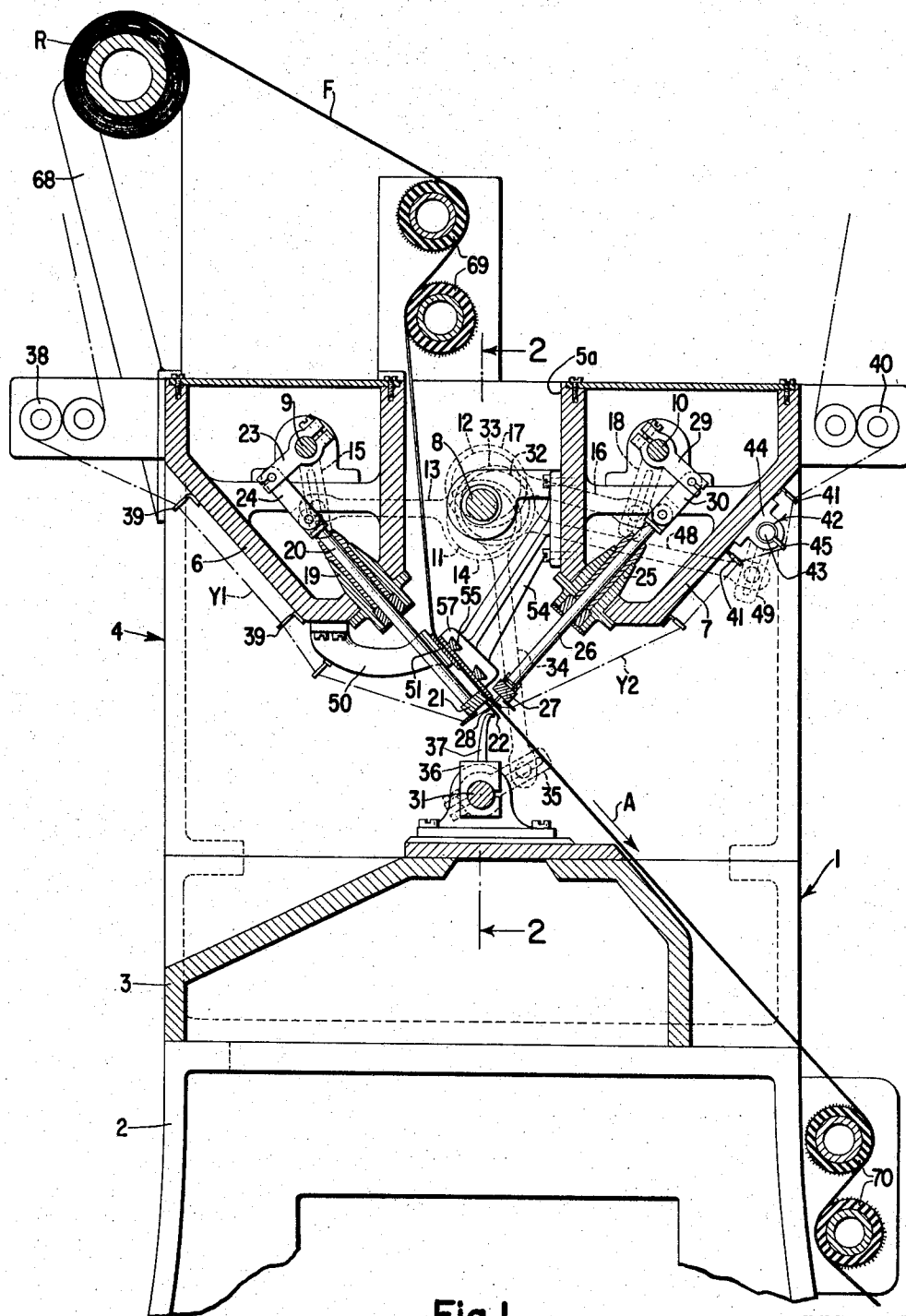


Fig. 1

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WITNESS

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5 Sheets-Sheet 2

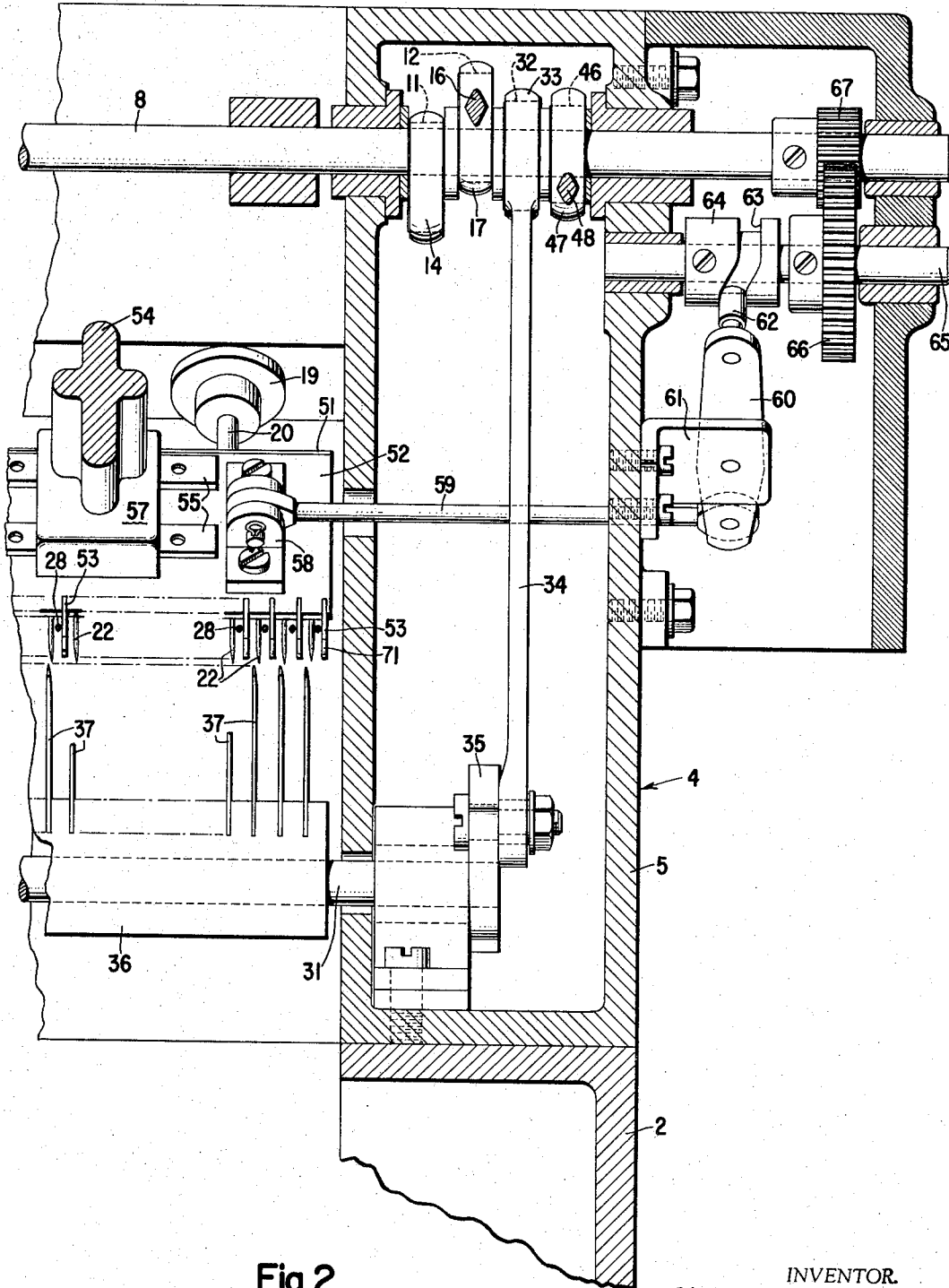


Fig.2

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5 Sheets-Sheet 3

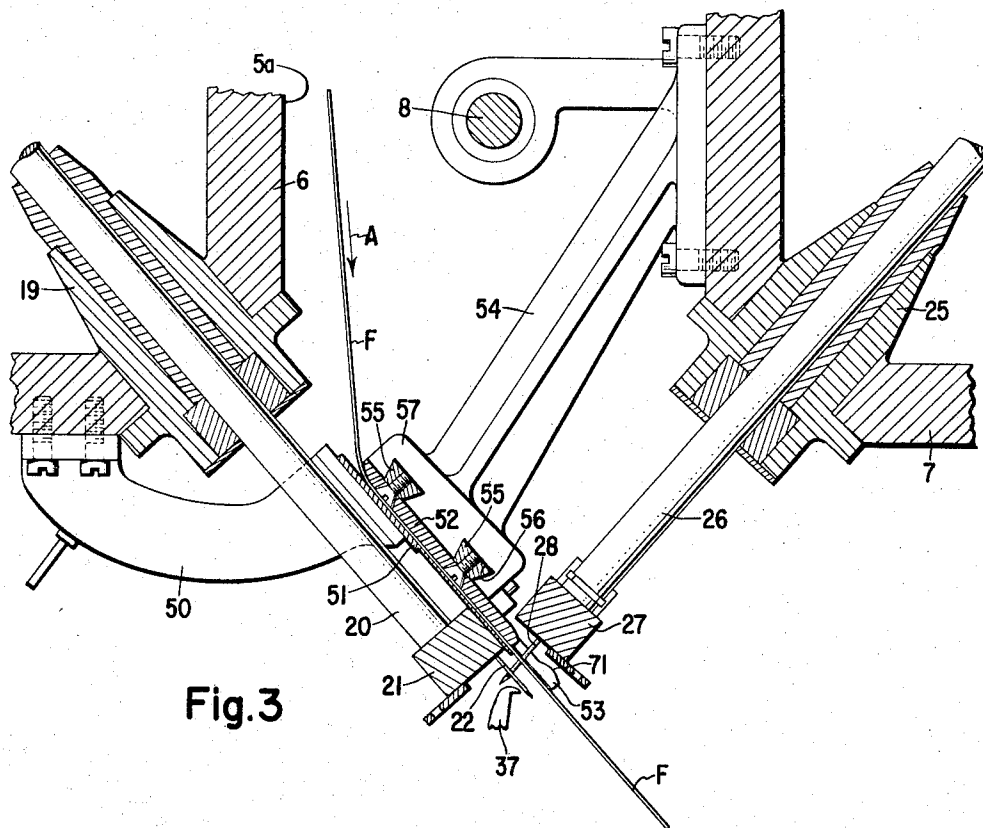


Fig. 3

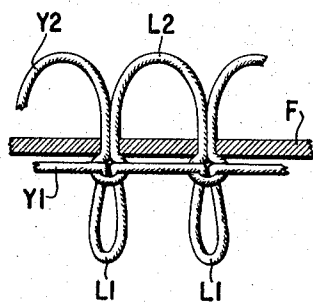


Fig. 4

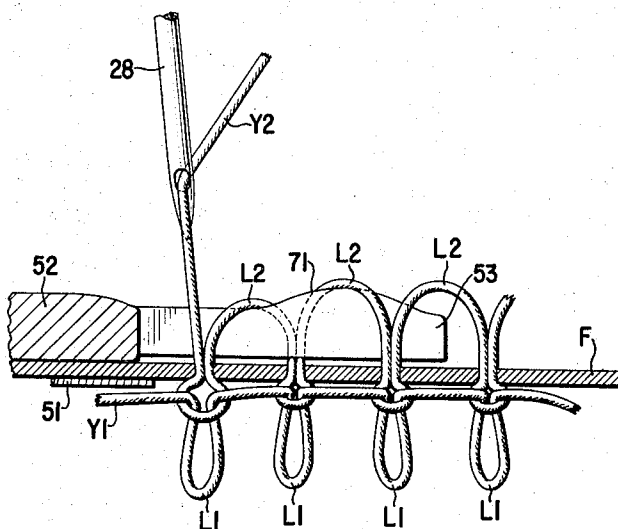


Fig. 9

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5 Sheets-Sheet 4

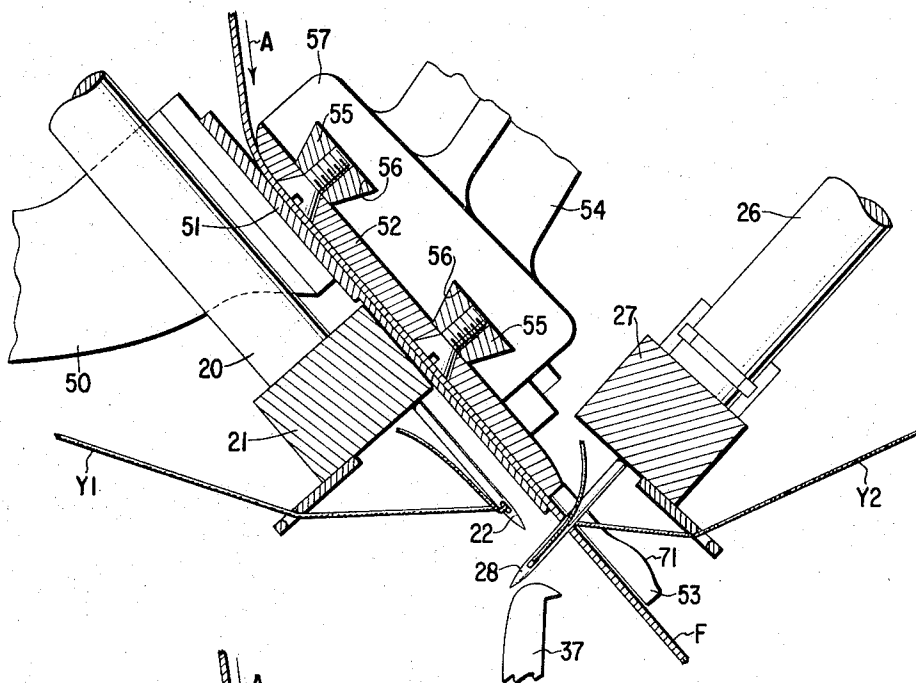


Fig. 5

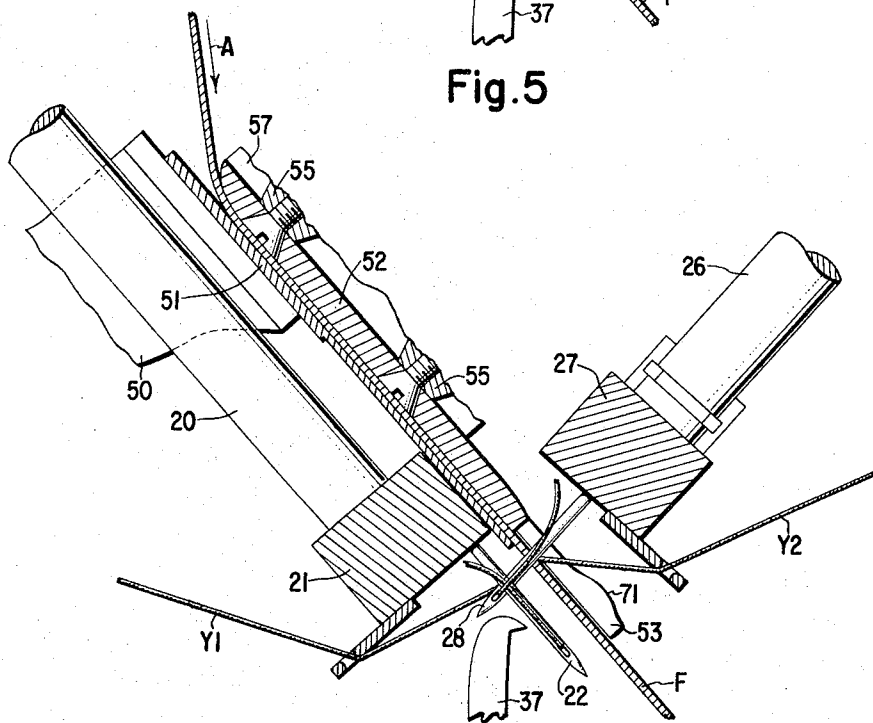


Fig. 6

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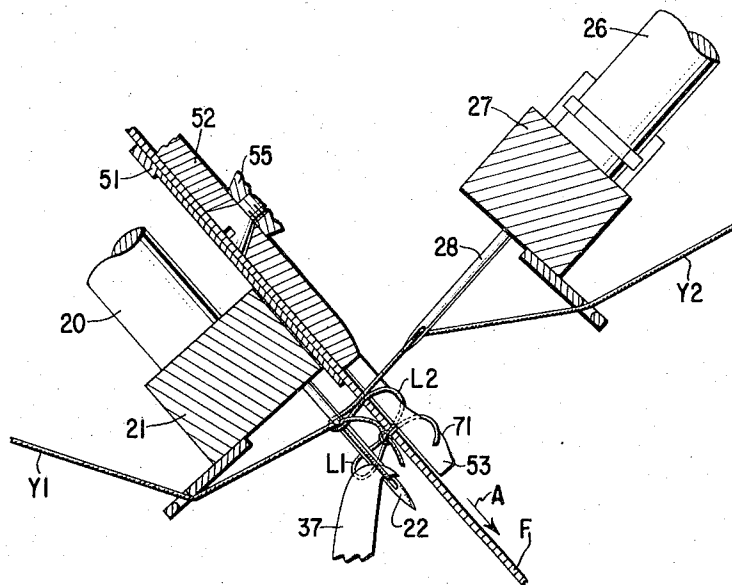


Fig.7

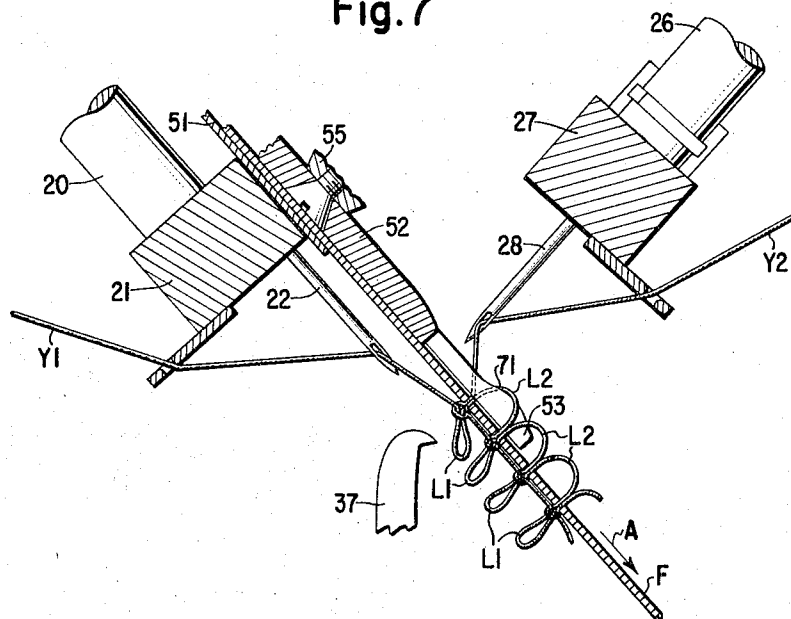


Fig.8

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TUFTING MACHINES AND METHODS FOR PRODUCING TERRY-LIKE FABRICS AND FABRICS PRODUCED THEREBY

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9 Claims. (Cl. 112-79)

ABSTRACT OF THE DISCLOSURE

This disclosure relates to textile machinery and in particular to tufting machines which through a novel method of operation is capable of producing novel pile fabrics such as terry cloth and the like. Basically, the novel machine disclosed herein includes means for projecting a loop of a first yarn to one side of a backing fabric, means for projecting a loop of a second yarn to said one side of the backing fabric and means for collapsing one of said loops around the other and for holding the other in loose pile-like disposition.

The present invention relates to tufting machines and has for an object to provide a tufting machine for forming a tufted fabric resembling terry cloth, that is, in which loose expanded loops of yarn are disposed on the surfaces of a backing fabric.

Further objects of this invention are to provide a tufting machine for forming simulated terry cloth, which tufting machine is simple, efficient and economical, and is capable of producing high quality fabric at a high rate of production.

It has heretofore been proposed to produce a simulated terry cloth by tufting, for example as disclosed in British Patent No. 962,594, corresponding to U.S. Patent No. 3,230,917. In accordance with the present invention, there has been provided a tufting machine which is faster in that it will form a loop on both sides of the fabric upon each cycle of the machine, and which at the same time will produce a fabric in which the loops will be sufficiently locked, at least after the first laundering thereof, so that they will resist being pulled out to an extent comparable to that of a woven terry cloth.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, the combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

FIG. 1 is a vertical sectional view substantially transversely of a tufting machine constructed in accordance with the present invention,

FIG. 2 is a fragmentary vertical sectional view substantially on the line 2-2 of FIG. 1,

FIG. 3 is a fragmentary sectional view on an enlarged scale of the operative elements of the machine of FIG. 1,

FIG. 4 is a sectional view of a tufted fabric made in accordance with this invention by the machine of FIG. 1 and illustrating a row of pile.

FIGS. 5, 6, 7 and 8 are fragmentary views illustrating the operation of a machine in accordance with this invention.

FIG. 9 is a detail view illustrating the fingers of the needle plate of the machine of FIG. 1.

With reference to the drawings there is illustrated a tufting machine comprising a frame 1 including a stand-

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ard 2, a bed 3 and a head 4. The head 4 comprises end housings 5 (FIG. 2) between the upper portion of which extend an opposed pair of needle housings 6 and 7 (FIG. 1) arranged longitudinally of the machine and spaced apart transversely thereof to provide a slot-like opening 5a therebetween.

Journalled longitudinally of the head 4 in the slot 5a between the needle housings 6 and 7 is a driven rotary main shaft 8. Also journalled longitudinally of the head 4 and within the needle housings 6 and 7 are a pair of oscillatory needle shafts 9 and 10 that are arranged parallel to the main shaft 8 and are adapted to be driven by the main shaft 8 by eccentrics 11 and 12. The eccentric 11 is connected to the needle shaft 9 by a pitman 13 having a strap end 14 encircling the eccentric 11 and having its opposite end pivotally and adjustably connected to the free end of a crank arm 15 which is secured to the needle shaft 9. The eccentric 12 is connected to the needle shaft 10 by a pitman 16 having a strap end 17 encircling the eccentric 12 and having its opposite end pivotally and adjustably connected to the free end of a crank arm 18 secured to the needle shaft 10.

If it is deemed necessary or desirable, the needle shafts 9 and 10 may be driven at a plurality of points spaced along the same longitudinally of the machine. However, depending upon the width of the machine, the size of the shafts, the speed of operation, and the character of the work being tufted, it may be sufficient that they be driven at each end thereof.

Mounted in the lower portion of the needle housing 6 is a bushing 19 in which is slidably mounted for endwise reciprocation a push rod 20 upon the lower end of which is mounted a needle bar 21 extending longitudinally of the machine and carrying a plurality of needles 22. Endwise reciprocation is imparted to the push rod 20 and thus to the needles 22 from the needle shaft 9 by a crank arm 23 secured to the needle shaft 9 and connected to the push rod 20 by a connecting link 24. While only a single push rod 20 is shown a plurality thereof is provided to support and actuate the needle bar 21.

Like the needle housing 6, the needle housing 7 also has mounted in the lower portion thereof a bushing 25 in which is slidably mounted for endwise reciprocation a push rod 26 upon the lower end of which is mounted a needle bar 27 that carries a plurality of needles 28. Endwise reciprocation is imparted to the push rod 26 and thus to the needles 28 by a crank arm 29 secured to the needle shaft 10 and connected to the push rod 26 by a connecting link 30. The needles 28 are slightly offset or staggered relative the needles 22 whereby the needles 22 are adapted to pass the needles 28 in loop seizing relation when the needles 28 are at the bottom of their stroke. Like the push rod 20, a plurality of push rods 26 would be provided.

The push rods 20 and 26 are inclined to converge downwardly towards each other so that the needles 22 and 28 carried thereby converge substantially at a point beneath the main shaft 8. In the illustrated embodiment of the invention, the push rods 20 and 26 are substantially at an angle of forty degrees to the vertical plane passing through the center line of the main shaft and thus are substantially at an angle of eighty degrees to each other.

Journalled longitudinally of the bed 3 is a looper shaft 31 that is adapted to be oscillated from the main shaft 8 by means of an eccentric 32 on the main shaft that is surrounded by the strap end 33 of a pitman 34, which pitman 34 at its lower end is pivotally and adjustably connected to a crank 35 secured to the looper shaft 31. Mounted on the looper shaft 31 is a looper bar 36 carrying the loopers 37 that are adapted to cooperate with the needles 22.

Yarns Y1 are fed to the needles 22 by a yarn feed

mechanism 38 which comprises a pair of cooperating yarn feed rolls journaled longitudinally of the machine at the back of the needle housing 6 and adapted to be driven at a uniform rate by means (not shown) for example from the main shaft 8 whereby a predetermined length of yarn will be fed to the needle upon each stitch. From the yarn feed mechanism 38 the yarn Y1 is led to the needle 22 by yarn guides such as those illustrated at 39.

Yarns Y2 are fed to the needles 28 by a yarn feed mechanism 40 similar to the yarn feed mechanism 38 and are directed to the needles by yarn guides including a pair of yarn guides 41.

Mounted in the needle housing 7 and adapted to act upon the yarns Y2 between the guides 41 is a yarn jerker 42 which comprises a rock shaft 43 journaled longitudinally of the machine on an axis parallel to the axis of the main shaft 8 in brackets 44 fixed to the needle housing 7. The shaft 43 carries a radially extending yarn-engaging bar 45 that is adapted upon each stitch to engage and to expand the length of yarn between the guides 41. Oscillation is imparted to the shaft 43 by an eccentric 46 (FIG. 2) on the main shaft 8, which eccentric is encircled by the strap end 47 of a pitman 48 that is pivotally and adjustably connected at its other end to a crank 49 on the shaft 43.

Mounted on the needle housing 6 by means of brackets 50 is a work supporting plate 51 that is disposed parallel to the plane of the needles 22 and between the needle bars 21 and 27. The free end of the work supporting plate 51 terminates just short of the plane of the needles 28 and may rest slidably on the needle bar 21. The plate 51 functions to support the backing fabric F against the thrust of the needles 28 as they penetrate the same.

Opposed to the work supporting plate 51 and disposed on the opposite side of the backing fabric F is a needle plate 52 having a plurality of fingers 53 extending therefrom in the direction of travel of the fabric F as indicated by the arrow A in FIGS. 1 and 3. The fingers 53 are spaced apart a distance corresponding to the gauge of the needles 28 whereby the needles 28 will penetrate between the fingers 53 as illustrated in FIG. 2. The needle plate 52 is carried by the needle housing 7 by means of brackets 54 and is adapted to be shifted longitudinally of the machine whereby, upon successive stitches, the needles 28 may descend upon opposite sides of the fingers 53. For this purpose, the needle plate 52 is provided with a pair of dove-tail ribs 55 that are adapted to be received within corresponding grooves 56 in the foot 57 of the bracket 54. For imparting lateral motion to the needle plate 52 there is provided a lug 58 (FIG. 2) secured to the needle plate and connected by a rod 59 to one end of a lever 60 that is pivoted intermediate its ends in a bracket 61 secured to the end housing 5 of the head 4. The other end of the lever 60 carries a cam follower 62 that tracks a cam groove 63 in a cam 64 secured to a countershaft 65 that is journaled on an axis parallel to the axis of the main shaft 8 and is driven therefrom in timed relation by gears 66 and 67.

The backing fabric F is fed from a roll R that is supported freely for rotation by a bracket 68 at the top of the machine. From the roll R the fabric passes to a pair of driven let-off rolls 69, downwardly between the needle housings 6 and 7, between the working supporting plate 51 and the needle plate 52, and then to the driven feed rolls 70.

The operation of the present machine will be described with reference to FIGS. 5, 6, 7 and 8 wherein the operation of a single pair of needles 22 and 28 and finger 53 is illustrated. As seen in FIG. 5, the needle 28 has advanced to penetrate the fabric F and to carry a loop of the yarn Y2 therethrough. As shown in FIG. 6, after the needle 28 has reached the point of maximum penetration and is in the return stroke, the needle 22 passes between the needle 28 and the limb of the yarn Y2 thereon thereby projecting a loop of the yarn Y1 through the loop of the

yarn Y2. The needle 28 continues its return stroke with the loop of the yarn Y2 being held beneath the fabric F by the needle 22. In FIG. 7, the needle 22 has completed its advance stroke and is beginning its return stroke, the looper 37 having advanced to enter the loop of yarn Y1 on the needle 22 to hold the same as the needle 22 returns. Finally, with reference to FIG. 8, the needle 28 is advancing to form the next loop with the fabric F having been advanced one stitch length while the needle 28 was out of the fabric and the needle plate 52 having been shifted laterally so that the needle 28 will descend on a side of the finger 53 opposite from the side on which it descended on the previous cycle. In this manner, the needle 28 has in effect stepped over the finger 53 thereby to form a pile loop in the yarn Y2 at the top of the fabric F.

The yarn jerker 42 functions to expand the length of the yarn Y2 between the guides 41 thereby pulling on the yarn to pull the loop of the yarn Y2 beneath the fabric F and thus to tighten it about the loop of the yarn Y1. The yarn jerker 42 is timed to operate after the loop of the yarn Y2 has been released by the needle 22, which is during the return stroke thereof and while the needle 28 is advancing, that is between the positions of FIGS. 7 and 8.

The resulting fabric is illustrated in FIG. 4, the loops L1 being the loops in the yarn Y1 and the loops L2 being the loops in the yarn Y2. As shown, the yarn Y1 is disposed entirely on the under face of the backing fabric F and is formed with loops L1 that project through and are frictionally held by loops of the yarn Y2 that project through the backing fabric. Between alternate penetrations of the fabric F, the yarn Y2 is formed on the upper face of the fabric with loops L2. Substantially in the same manner as with conventional woven terry cloth, the loops will become twisted upon themselves, particularly upon laundering, thereby locking the yarns in the fabric.

In FIG. 9 there is illustrated on an enlarged scale the details of the finger 53 on the needle plate 52. As will be seen, the finger 53 is substantially rectangular but with a rise 71 on the upper edge thereof between that portion of the finger directly beneath the needle 28 and the free end thereof. The purpose of the rise 71 is to expand the loops L2 of the yarn Y2 as the loops pass off the finger 53, thereby, further tightening the loops beneath the fabric F and through which the loops L1 of the yarn Y1 pass.

Having thus described the nature of the invention, what I claim herein is:

1. In a tufting machine, means for supporting a backing fabric and for advancing the same across said supporting means, a first needle, means mounting said first needle for endwise reciprocation on one side of the path of travel of the backing fabric and for penetrating the backing fabric upon reciprocation thereof to project a loop of yarn therethrough, a second needle, means mounting said second needle for endwise reciprocation on the opposite side of the path of travel of the backing fabric from said first needle and for entering the loop of yarn presented by said first needle and for projecting a loop of yarn therethrough and looper means for entering the loop of yarn presented by said second needle and for holding the same during the return stroke of said second needle such that after the return stroke of said first and second needles the loop of yarn presented by said second needle is disposed in loose pile-like disposition on the opposite side of the path of travel of the backing fabric and held by the loop of yarn presented by the said first needle.

2. In a tufting machine, means for supporting a backing fabric and for advancing the same across said supporting means, a first needle, means mounting said first needle for endwise reciprocation on one side of the path of travel of the backing fabric and in a plane generally normal to the backing fabric whereby said first needle

is adapted to penetrate the backing fabric upon reciprocation thereof for projecting a loop of yarn therethrough, a second needle, means mounting said second needle for endwise reciprocation on the opposite side of the path of travel of the backing fabric from said first needle and in a plane generally parallel to the backing fabric whereby said second needle is adapted to enter and to project a loop of yarn through the loop of yarn presented by said first needle, and looper means for entering the loop of yarn presented by said second needle and for holding the same during the return stroke of said second needle such that after the return stroke of said first and second needles the loop of yarn presented by said second needle is disposed in loose pile-like disposition on the opposite side of the path of travel of the backing fabric and held by the loop of yarn presented by the said first needle.

3. In a tufting machine, means for supporting a backing fabric and for advancing the same across said supporting means, a first needle, means mounting said first needle for endwise reciprocation on one side of the path of travel of the backing fabric for penetrating the backing fabric upon reciprocation thereof to project a loop of yarn therethrough, a second needle, means mounting said second needle for endwise reciprocation on the opposite side of the path of travel of the backing fabric from said first needle and for entering the loop of yarn presented by said first needle and for projecting a loop of yarn therethrough, looper means for entering the loop of yarn presented by said second needle and for holding the same during the return stroke of said second needle, and means for withdrawing yarn from the loop presented by said first needle after said second needle has withdrawn therefrom for reducing the same on that side of the backing fabric opposite from said first needle and for tightening the same about the loop of yarn presented by said second needle such that after the return stroke of said first and second needles the loop of yarns presented by said second needle is disposed in loose pile-like disposition on the opposite side of the path of travel of the backing fabric and held by the loop of yarn presented by said first needle.

4. In a tufting machine, means for supporting a backing fabric and for advancing the same across said supporting means, a first needle, means mounting said first needle for endwise reciprocation on one side of the path of travel of the backing fabric for penetrating the backing fabric upon reciprocation thereof to project a loop of yarn therethrough, a second needle, means mounting said second needle for endwise reciprocation on the opposite side of the path of travel of the backing fabric from said first needle and for entering the loop of yarn presented by said first needle and for projecting a loop of yarn therethrough, looper means for entering the loop of yarn presented by said second needle and for holding the same during the return stroke of said second needle, means for withdrawing yarn from the loop presented by said first needle after said second needle has been withdrawn therefrom for reducing the same on that side of the backing fabric opposite from said first needle and for tightening the same about the loop of yarn presented by said second needle such that after the return stroke of said first and second needles the loop of yarn presented by said second needle is disposed in loose pile-like disposition on the opposite side of the path of travel of the backing fabric and held by the loop of yarn presented by said first needle, and means for forming loops from the yarn presented by said first needle between successive penetrations of the backing fabric.

5. In a tufting machine in accordance with claim 4 in which said means for forming loops from the yarn presented by said first needle between successive penetrations of the backing fabric comprises a needle plate disposed on the same side of the backing fabric as said first needle and having fingers extending therefrom in the direction of feed of the backing fabric and on opposite

sides of said needle, and means for shifting said needle plate laterally between successive penetrations of said first needle whereby the yarn between the successive penetrations extends over said fingers.

6. In a tufting machine in accordance with claim 5 in which said fingers have a rise on the edge thereof between the portion over which the yarn is laid and the free end thereof whereby the loop extending over said finger will be expanded as it moves toward the free end thereof and the corresponding loop on the opposite side of the backing fabric will be reduced to tighten the same about the loop of yarn presented by said second needle.

7. In a tufting machine, means for supporting a backing fabric and for advancing the same across said supporting means, means for projecting a loop of a first yarn through the backing fabric from a first side to a second side thereof, means for projecting a loop of a second yarn through the loop of said first yarn on the second side of said backing fabric, and means for forming a loop of the first yarn on the first side of the backing fabric and for tightening the loop of the first yarn on the second side of the backing fabric comprising a finger, means for mounting said finger on said first side of and adjacent to the backing fabric and arranged in the direction of advance of the backing fabric and for movement thereof laterally whereby a limb of the first yarn between successive loops thereof will be arranged over said finger, said finger having an enlarged portion adjacent to the free end thereof whereby as said limb of the first yarn is moved over the same by the advance of the backing fabric, it will be expanded to tighten the loop thereof on the second side of the backing fabric.

8. A method of forming a tufted fabric simulating terry cloth comprising the steps of advancing a backing fabric past a point of loop formation, projecting a loop of a first yarn through said backing fabric from a first side thereof to the second side, projecting a loop of a second yarn through the loop of the first yarn on said second side of the backing fabric, maintaining the loop of the second yarn expanded to form a free loop, withdrawing yarn from the loop of the first yarn to reduce and to tighten the same about the loop of the second yarn such that after withdrawing yarn from the loop of the first yarn the second loop is disposed in loose pile-like disposition and held by the loop of the first yarn, repeating said steps, and forming a loop of the first yarn between successive penetrations of the backing fabric.

9. A tufted fabric comprising a backing fabric, having a plurality of laterally spaced rows of loops, each of which row consists of a first yarn having loops thereof projecting through said backing fabric at spaced intervals, a second yarn disposed entirely on one side of the backing fabric and having loops thereof projecting through loops of the first yarn and in loose pile-like disposition, the loops of the first yarn being drawn tightly about the loops of the second yarn to grip the same frictionally, and pile loops formed in the first yarn on the opposite side of the backing fabric from the second yarn and between successive penetrations of the backing fabric by the second yarn.

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