

March 3, 1959

J. H. NIX

2,875,714

MULTIPLE NEEDLE TUFTING MACHINE

Filed Nov. 4, 1952

7 Sheets-Sheet 2

Fig. 2

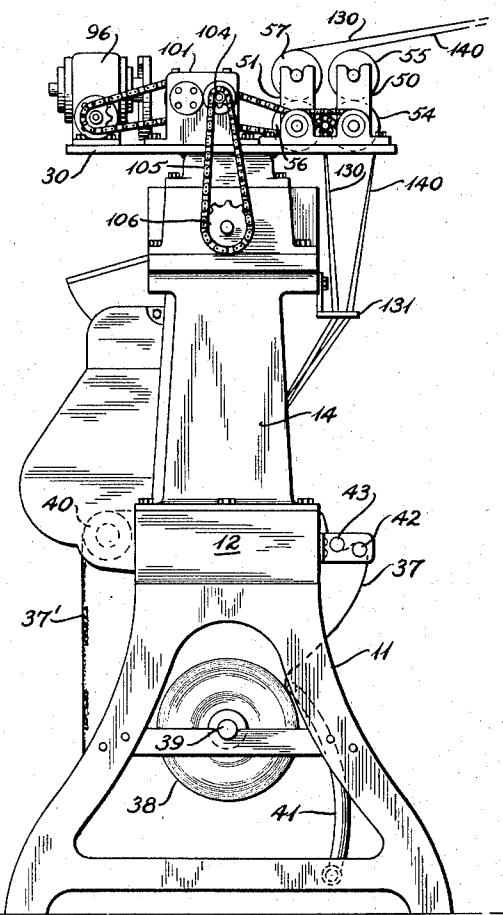


Fig. 3

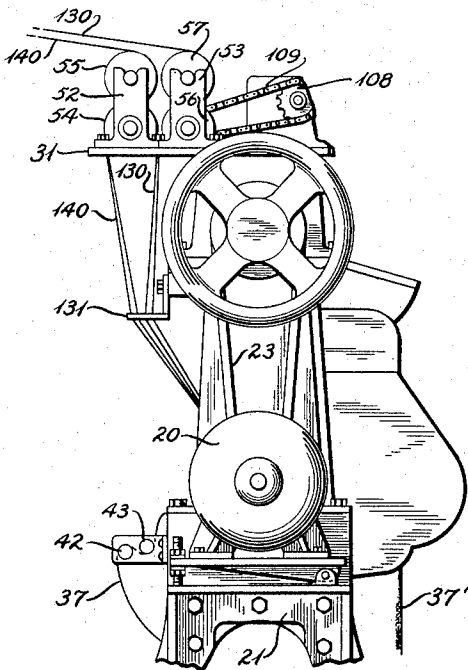


Fig. 25

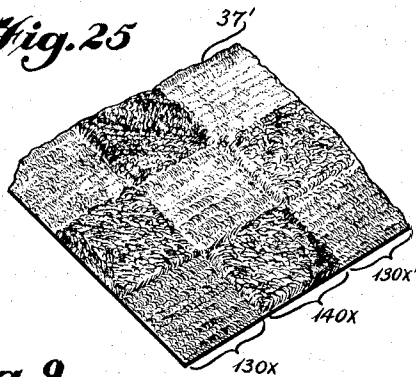
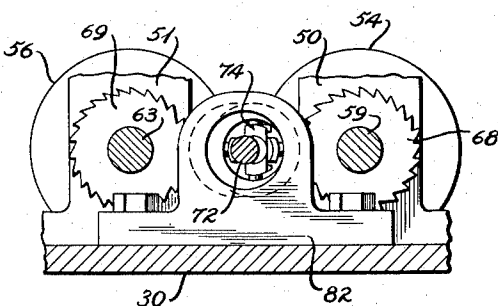


Fig. 9



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Fig. 4

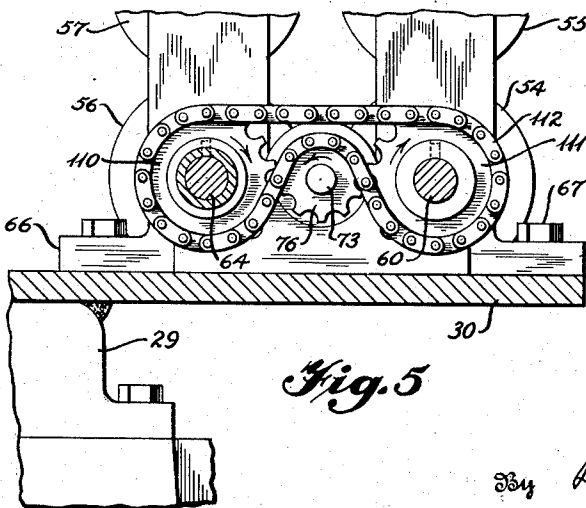
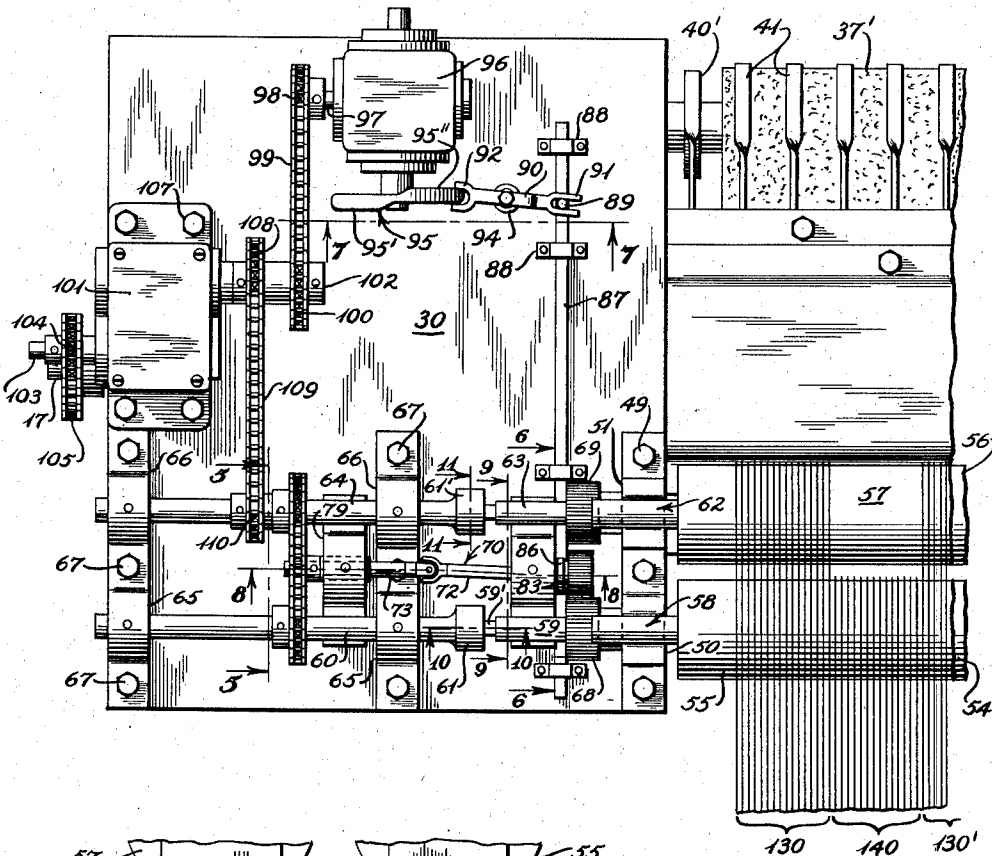


Fig. 5

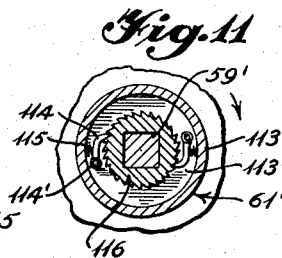


Fig. 11

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Fig. 6

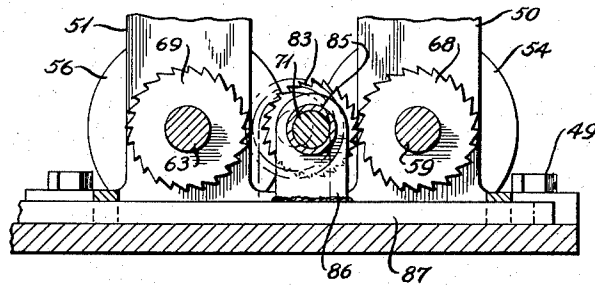


Fig. 7

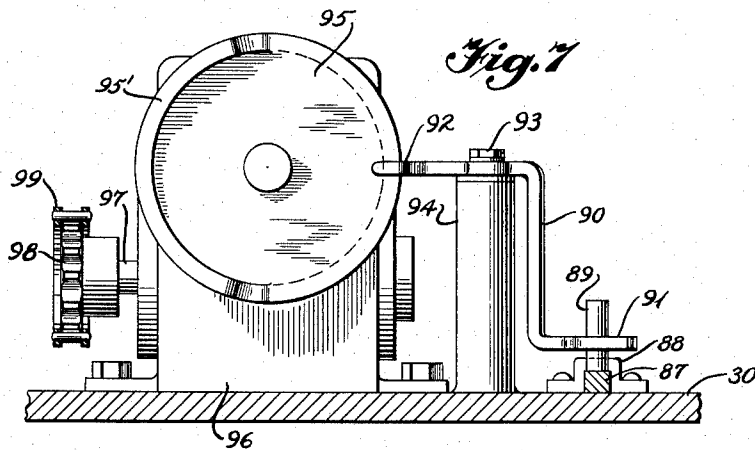


Fig. 8

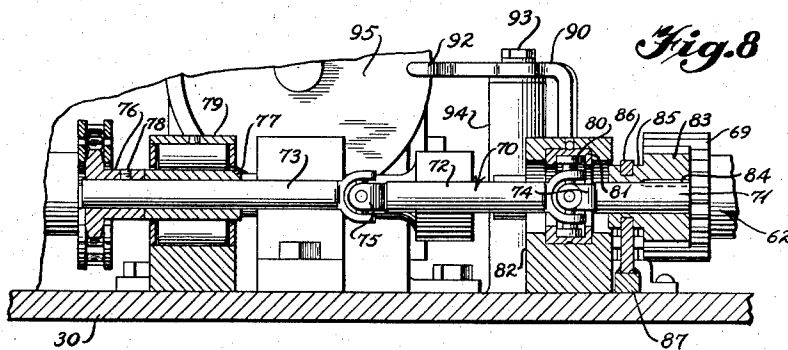
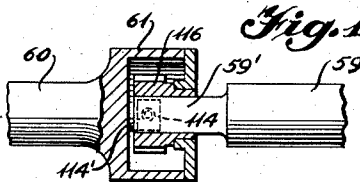


Fig. 10



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Fig. 12

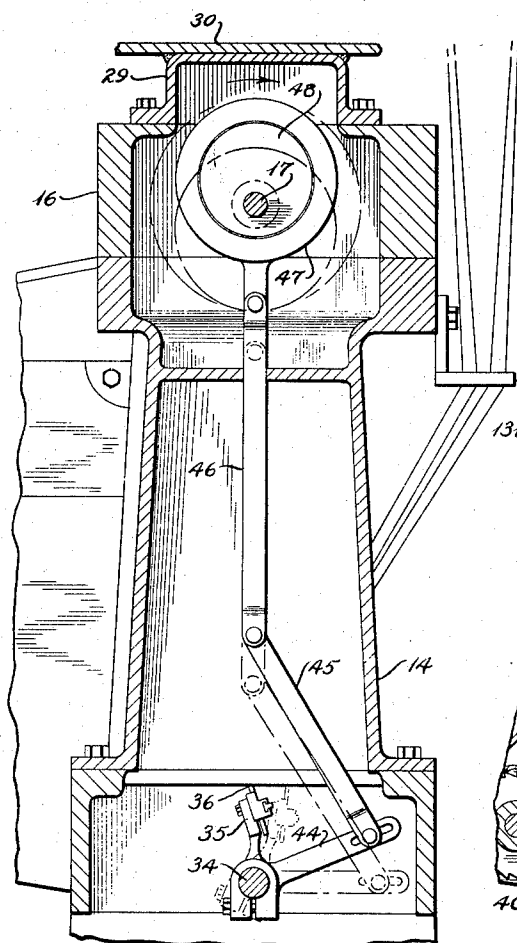


Fig. 13

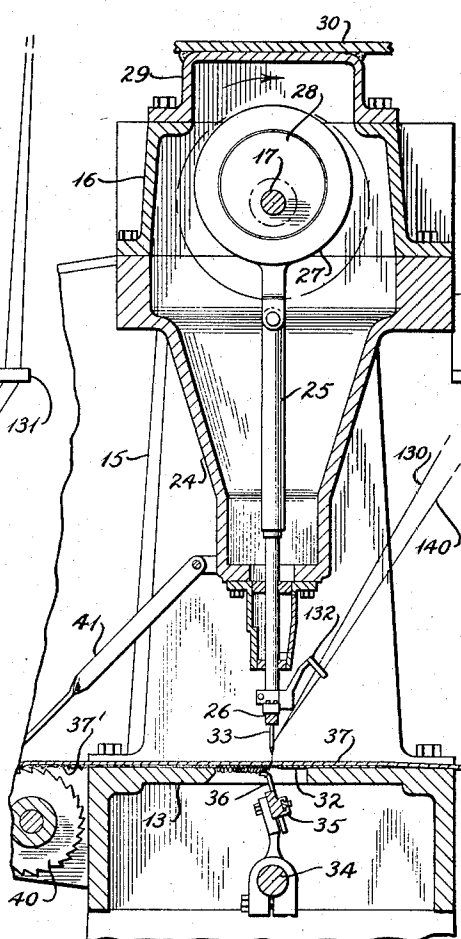


Fig. 14

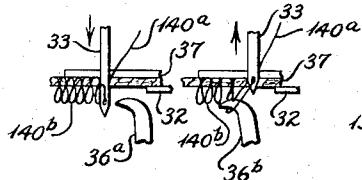


Fig. 15

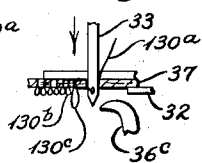


Fig. 16

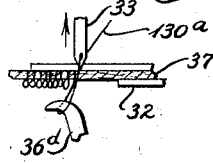


Fig. 17

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Fig. 18

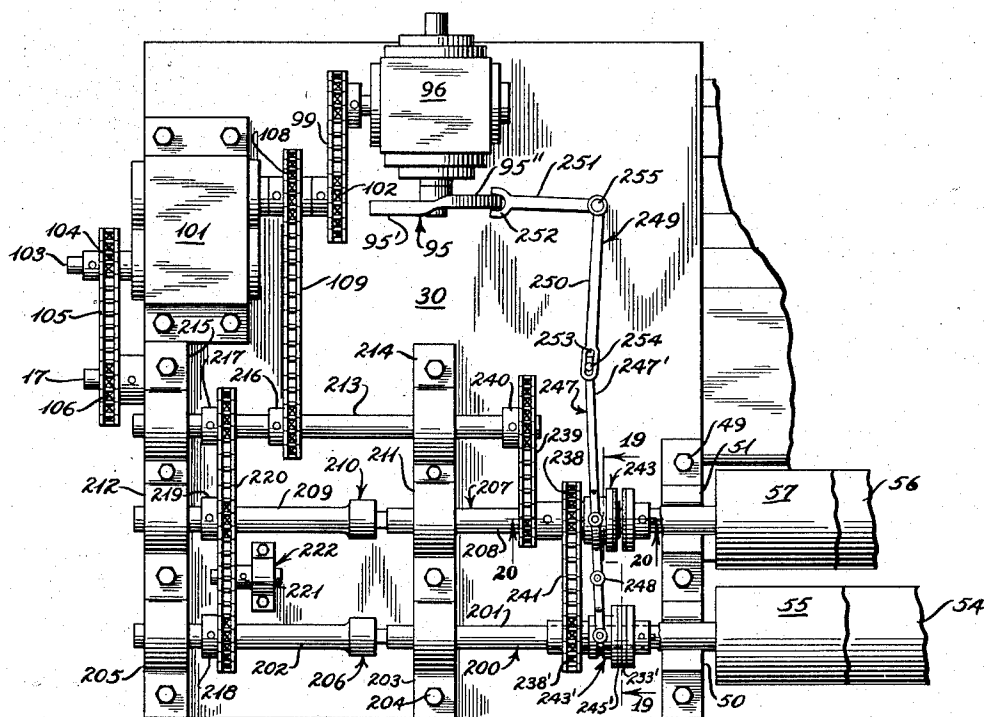


Fig. 19

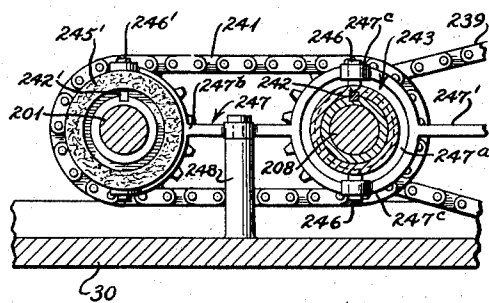
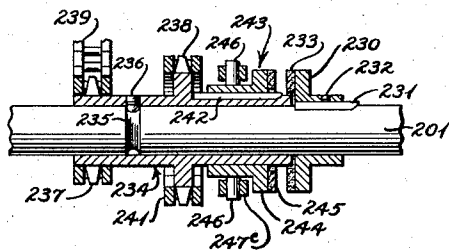


Fig. 20



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Fig. 21

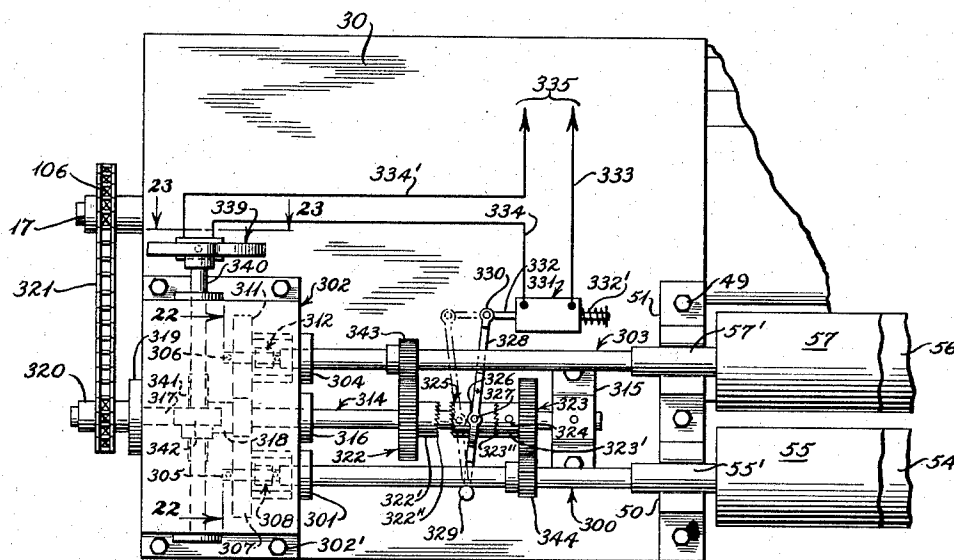


Fig. 22

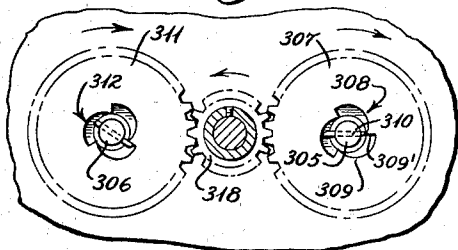


Fig. 23

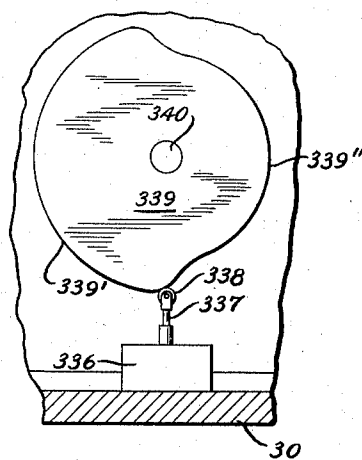
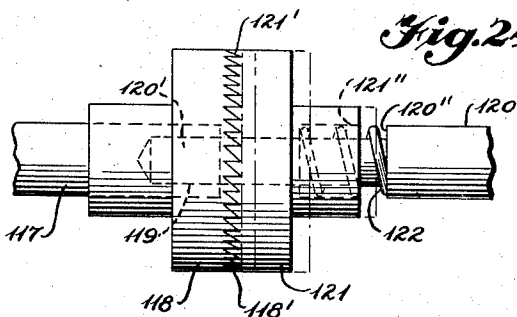


Fig. 24



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MULTIPLE NEEDLE TUFTING MACHINE

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Application November 4, 1952, Serial No. 318,641

22 Claims. (Cl. 112—79)

This invention relates to tufting machines for simultaneously forming a series of tufted rows of stitches in a fabric or backing and more particularly making long and short tufts.

It is an object of this invention to provide a multiple needle tufting machine by which a fabric or backing strip may have sewed therein a plurality of rows made up of a series of tufts that are alternately short and long in length.

A further object of my invention is to provide a multiple needle tufting machine that will sew in long and short loops in a fabric or backing so as to form a desired pattern in a carpet, rug or the like.

A still further object of my invention is to provide in a multiple needle tufting machine which simultaneously forms a series of tufted rows of stitches or loops in a fabric or backing a yarn strand feeding mechanism for varying the rate of yarn feed to the needles so that long and short loops are formed according to a pattern.

Another object of my invention is to provide in a multiple needle tufting machine a yarn strand feeding mechanism which permits an alternate full feed and starving feed to the needles such that long and short loops are formed in a fabric feed through the machine.

A still further object of my invention is to provide in a multiple needle-tufting machine that sews loops in a fabric or backing and has loop catch and holding means disposed underneath the fabric, a yarn feeding mechanism for the strands forming the loops such that at one rate of feed the yarn is supplied for a fully downward travel of the needle and a long loop is formed while the loop holding means catches and holds the loop during the upward stroke of the reciprocating needle and an alternating rate of feed for the yarn such that the feed to the needle is starved and causes the needle to pull some yarn from the precedingly formed loop into the loop being formed by the full downward travel of the needle and the loop holding means catches the loop lastly formed and holds it as a long loop during the upward stroke of the needle.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples are given by way of illustration only and, while indicating preferred embodiments of the invention, are not given by way of limitation, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

For a more complete understanding of the nature and scope of the invention, reference may be had to the drawings in which:

Fig. 1 is a side elevation of a multiple needle tufting machine showing the yarn feeding mechanism attached to the top thereof;

Fig. 2 is a left-hand end view of Fig. 1;

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Fig. 3 is a right-hand end view of Fig. 1;

Fig. 4 is a plan view of one embodiment of the yarn feeding mechanism such as shown in Fig. 1 but with a fragmentary showing of the sewing machine, the feed rolls and the take up roll for the fabric;

Fig. 5 is a sectional view along line 5—5 of Fig. 4 showing the drive for the feed roll drive shafts and the high speed drive shaft;

Fig. 6 is a sectional view along line 6—6 of Fig. 4 showing the high speed drive gears on the feed roll drive shafts and the high speed drive gear in engagement with one of the high speed drive gears;

Fig. 7 is a sectional view along lines 7—7 of Fig. 4 showing the pattern control mechanism for shifting the high speed gear of the high speed shaft;

Fig. 8 is a sectional view along line 8—8 of Fig. 4 showing the high speed drive shaft with its flexible coupling for its high speed gear and the shiftable mounting of its high speed gear;

Fig. 9 is a sectional view along line 9—9 of Fig. 4 showing the feed roll drive shafts, the high speed drive gears mounted thereon and the shiftable mounting of the high speed drive gear on the high speed shaft;

Fig. 10 is a sectional view along line 10—10 of Fig. 4 depicting a slip or ratchet coupling in one of the feed roll drive shafts;

Fig. 11 is a sectional view along line 11—11 of Fig. 4 showing a cross section of a slip or ratchet coupling in one of the feed roll drive shafts;

Fig. 12 is a sectional view along line 12—12 of Fig. 1 depicting two groups of yarn strands, the looper and its driving mechanism;

Fig. 13 is a sectional view along line 13—13 of Fig. 1 showing one of the multiple needles, a needle forming a loop with the thread, the looper holding the loop as the needle moves upward and the take up roll with the fabric or backing having loops sewed therein;

Fig. 14 is a diagrammatic view of the fabric having long loops formed therein with the needle carrying yarn on its downward stroke;

Fig. 15 is another diagrammatic view similar to Fig. 14 illustrating the formation of a long loop with the loop holder holding the loop as the needle makes its upward stroke;

Fig. 16 is a diagrammatic view of the fabric having short loops formed therein with the needle on its downward stroke, the yarn strand being fed at a slow rate thus causing the needle to pull a portion of the precedingly formed long loop into the loop it is forming in the fabric;

Fig. 17 is a diagrammatic view similar to Fig. 16 showing the looper moved into holding position of the loop formed lastly in Fig. 16 while the needle is in its upward stroke;

Fig. 18 is a plan view of a second embodiment of feed roll drive mechanism for driving the yarn feed rolls to alternately feed yarn strands at full feed for long loop formation and starving feed for short loop formation in the backing or fabric;

Fig. 19 is a sectional view along line 19—19 in Fig. 18 showing high speed drive couplings for alternately driving the feed rolls drive shaft at full feed speed;

Fig. 20 is a sectional view along line 20—20 of Fig. 18 showing a feed roll drive shaft and the mounting thereon of the high speed drive sleeve, gears or sprockets and clutch mechanism;

Fig. 21 is a third embodiment of yarn strand feed roll drive mechanism providing for alternate full feed and starving feed of the yarn strands to the needles to form alternately a series of long and short loops in the fabric or backing;

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Fig. 22 is a sectional view along line 22—22 of Fig. 21 showing the low speed drive gears, their slip or ratchet coupling to the feed roll drive shafts which they drive through the coupling and the high speed drive shaft with its drive from the low speed gears;

Fig. 23 is a sectional view along line 23—23 of Fig. 21 depicting the pattern control wheel and the microswitch which it operates;

Fig. 24 is an elevation view of a slip or ratchet coupling in a drive shaft; and

Fig. 25 is a fragmentary view of a carpet or rug showing a particular pattern of long and short loops of yarn strands sewn therein by the mechanism according to my invention.

Referring to Fig. 1, a typical multiple needle tufting machine 10 is built up around base end members 11 and 12 supporting a transversely extending cross bed 13. Mounted on opposite ends of bed 13 are upright end frames 14 and 15 which support a cross head member 16 within which extends the horizontal over head horizontal drive shaft 17 supported toward the ends thereof by bearings 18 and 19. Power is supplied by an electric motor 20 supported on bracket 21 attached to base end member 11 such that V-belts are led from pulley 22 on motor 21 to pulley 23 on the shaft 17.

Still referring to Fig. 1, cross head member 16 has depending support member 24, best shown in cross section in Fig. 13, through which the connecting rods 25 extend which rods support at their lower ends the transversely extending needle bar 26 above cross bed 13. Connecting rod 25 is connected at its upper end to a sleeve 27 mounted on an eccentric 28 fast to shaft 17.

Referring again to Fig. 1, a cover cap 29 is mounted on top of cross head member 16 and this has attached thereto, as by welding, a horizontally extending bed plate 30 at the left-hand end and a further horizontally extending bed plate 31 at the right-hand end. These bed plates, 30 and 31, serve to support the yarn strand feed rolls and the variable speed drive mechanism according to my invention herein described.

The bed portion 13 of the machine has mounted thereon, see Fig. 13, a needle plate 32 apertured for movement therethrough of the reciprocating needles 33 secured in the needle bar 26. Below the needle plate 32 is mounted a cross shaft 34 which carries the loopers generally indicated at 35 having hooks 36 adjustably mounted thereon. The fabric or backing material 37 is supplied from a roll 38 shown mounted in Fig. 2 on a suitable shaft 39 supported beneath bed 13. Fabric 37 is fed over bed 13 and needle plate 32 under the needles 33 to a take-up mechanism generally indicated at 40, best shown in Fig. 13. Cooperating with take-up mechanism 40 on which the finished carpet is rolled are tension bars 41 while another tension bar 42, see Figures 1 and 2, cooperates with the fabric or backing as it leaves the roll 38 and passes through guide rolls 42 and 43 to the surface of the bed 13. The take-up mechanism 40 may be a roll with a ratchet surface on the periphery thereof or a plurality of discs 40', see Fig. 4, having a ratchet periphery.

The loopers 35 are oscillated by shaft 34 on which they are mounted by a crank arm 44, a pitman lever 45 and the connecting rod 46 which is connected to a sleeve 47 mounted on the eccentric 48 fast on drive shaft 17.

Yarn strand feeding mechanism

Referring to Figures 1, 2 and 3 there is shown mounted on the bed plate 30 two spaced apart bearings 50 and 51 while bed plate 31 has two like bearings 52 and 53. The bearings are secured to the bed plates by bolts 49. Each bearing provides for mounting two rolls, one above the other, bearings 50 and 52 mounting a yarn strand feed roll 54 and a pressure roll 55 thereabove and in contact therewith. Bearings 51 and 53 have mounted therein a yarn strand feed roll 56 and a pressure roll

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57 thereabove and in contact with roll 56. Roll 54 is fixedly mounted on a feed roll drive shaft generally indicated at having a first section 59 fast to the feed roll 54 and a second section 60 remote therefrom coupled to the first section 59 by a slip or ratchet coupling 61 which permits the first section 59 with its attached feed roll 54 to be rotated at a faster speed than the first section 60 of the drive shaft 58. Feed roll 56 is mounted on a drive shaft generally indicated at 62 having a first section 63 adjacent the feed roll 54 and a second section 64 remote therefrom and coupled thereto by a slip joint or ratchet coupling 65. The second sections, 60 and 64, of the feed roll drive shafts extend parallel to each other and are spaced apart as are their respective first sections, 59 and 63, and their second sections, 60 and 64. Drive shaft sections 60, 64 are mounted respectively in two pairs of pillow block bearings 65 and 66. Bearings 65 and 66 are supported on and secured to the bed plate 30 by bolts 67.

Referring to Figures 4 and 6, each of the first sections of drive shaft 59 and 63 have fixed respectively thereto high speed drive elements, such as gears 68 and 69, which are driven and in turn drive their respective drive rolls 54 and 56 through the first sections 59 and 63 of the drive shafts.

In Figures 4 and 8 there is shown mounted intermediate drive shafts 58 and 62 a high speed drive shaft generally indicated at 70. High speed drive shaft 70 includes three sections 71, 72 and 73, shaft sections 71 and 72 of which are connected by a special universal joint 74 while shaft sections 72 and 73 are connected by a universal joint 75. Shaft section 73 has secured thereto a sprocket 76 having a sleeve 77 secured to shaft section 73 by set screw 78, sleeve 77 being rotatably mounted in a bearing 79 supported on bed plate 30. The special universal joint 74, as best shown in Figures 8 and 9, includes an outer annular shoe 80 which is rotatably supported in an annular recessed casing 81 housed in a special bearing support member 82 mounted on bed plate 30. This special universal coupling 74 may be shifted from side to side as indicated by the broken lines in Fig. 9. In Figures 4 and 8, the first high speed shaft section 71 has keyed thereto by key 84 a high speed drive gear 83 adapted to alternately mesh with and drive the high speed drive gears 68 and 69 which in turn rotate the yarn strand feed rolls 54 and 56 at high speed to provide for a full feed of yarn to the needles.

Referring to Figures 4, 6 and 8, it will be noted that shifting mechanism is provided to alternately move high speed drive gear 83 into engagement with gears 68 and 69. The shift mechanism includes a collar 85 mounted on high speed shaft section 71 which is in turn mounted in an upstanding lug 86 weldingly connected at its lower end to a horizontally extending operating bar 87 mounted on bed plate 30 as by brackets 88.

Referring to Figures 4 and 7 the operating rod 87 for the high speed gear 83 is provided with a second upstanding lug or post 89 at its outer or opposite end which is operatively connected in one of the double forked ends 91 of operating lever 90. Operating lever 90 has its forked ends 91 and 92 offset vertically from each other and is pivotally mounted by pivot screw 93 on a vertical post 94 welded to bed plate 30. The forked end 92 of lever 90 is in engagement with a pattern wheel generally indicated at 95 having a first cam surface 95' extending on one face and for a sector of 180° while the other cam surface 95'' extends oppositely also for a sector of 180°. The pattern wheel 95 is driven by a pattern control drive mechanism generally indicated at 96. Pattern control drive mechanism 96 is provided with an input shaft 97 having a sprocket 98 that is driven by a chain 99 leading to a drive sprocket 100 on the output shaft 102 of a speed reducer mechanism generally indicated at 101 and mounted on bed plate 30, as by bolts 107.

Speed reducer 101 has an input shaft 103 provided with a drive sprocket 104 over which a drive chain 105 is lead to a sprocket 106 on the end of drive shaft 17 of the multiple needle tufting machine 10.

Still referring to Fig. 4 the output shaft 102 of speed reducer 101 has a second drive sprocket 108 thereon which through chain 109 drives a sprocket 110 fast on the second section 64 of feed roll drive shaft 62.

In Fig. 5 it will be observed that adjacent sprocket 76 on the high speed drive shaft are sprockets 110 on shaft section 64 and 111 on shaft section 60. These sprockets 110, 76 and 111 have reeved thereover a drive chain 112 such that as sprockets 110 and 111 are rotated clockwise, sprocket 76 rotates counter-clockwise. Sprocket 76 is of a smaller diameter than sprockets 110 and 111, thus driving sprocket 76 at a relatively higher speed and the high speed drive shaft generally indicated at 70 at a relatively higher speed than the yarn strand feed roll drive shafts 58 and 62.

In the position of the pattern control mechanism shown in Fig. 4, high speed drive gear 83 is shown in driving engagement with high speed gear 68 thus driving the first section 59 of feed roll drive shaft 58 and its feed roll 54 at high speed. As this takes place the ratchet 61, see Figures 1 and 11, acts to permit the drive shaft second section 60 of feed roll drive shaft 58 to rotate at low speed through its drive sprocket 111. In Figures 10 and 11 there is depicted cross sectional views of the slip or ratchet couplings 61 and 61' each of which comprises an enlarged bell shaped end 113 on shaft section 60 or 64 having pivotally mounted therein on a vertical face 113' a pair of dogs 114 on pivot pins 114' which are spring biased by springs 115 into engagement with a ratchet gear 116 mounted on the squared end 59' of shaft sections 59 and 63. Another form that the slip coupling or ratchet coupling may take is shown in Fig. 24.

Referring to Fig. 24 there is shown another form of slip or ratchet coupling that may be used as the coupling for the drive shafts in the mechanisms shown in Figures 4, 18, and 21. This coupling, shown in Fig. 24 has a drive shaft 117 which has attached a coupling element 118 provided with ratchet teeth 118' and an axially disposed socket 119 therein which receives a reduced portion 120' on a driven shaft 120. Slidably mounted on shaft 120 and rotated thereby is a second coupling element 121 having ratchet teeth 121' on a face thereof that mesh with teeth 118' on drive element 118 when the biasing spring 122 disposed between shaft 120 and coupling element 121 urges the couplings into engagement. Drive coupling 121 is formed with a recess 121'' coaxial therewith and opposite to the toothed face 121' thereof that receives the biasing spring 122 which is mounted over the reduced portion 120' of driven shaft 120 while the other end of spring 122 rides against the shoulder 120'' formed on shaft 120 and its reduced portion 120'. Thus the driven shaft 120 may be rotated at a speed relatively higher than the drive shaft 117.

In Figures 1-4 there is also shown groups of yarn strands feed at alternately high and low speeds by their feed rolls.

A group of yarn strands 130, 130' etc. in the designated 130 group are lead from a yarn strand supply (not shown) over a pressure roll 57, thence between rolls 57 and 56, over yarn strand feed roll 56 downward through a thread guide 131, through a second thread guide 132 spaced just above and forward of the needle bar 26, see Figures 1 and 13, and thence to and through needle eyes in a group of corresponding needles such as 36. Alternately disposed to the yarn strand groups 130, 130', etc., are grouped yarn strands 140, 140', etc., which are also fed through suitable apertures in thread guides 131 and 132 to their respective groups of multiple parallel arranged needles attached to needle bar 26.

Referring to Figures 14 and 15, a typical yarn strand 140a of yarn strand group 140 is shown fed through a

typical needle 36 for its group such that full feed for the needle 36 is furnished by yarn strand feed roll 54 being driven at high speed furnishing full feed thread for the needle thereby forming a series of long loops 140b—in fabric on backing 37. In Fig. 14 the needle 36 is on its downward stroke and thread 140a is feed for a full downward stroke of the needle. In Fig. 15 the looper 36b has caught the loop just formed and holds it as the needle 36 moves upward.

In Figures 16 and 17 there is depicted the forming of a series of short loops 130b by a typical yarn strand 130a fed by its needle 33. The yarn strand 130a is fed by yarn strand feed roll 56 which is being rotated at slow speed by its drive mechanism. The loop 130c which has been formed by needle 33 has been supplied by a portion of the precedingly formed loop as the feed of strand 130a is at slow speed or at a starving feed condition to the needle 33. As the needle 33 in Fig. 16 starts downward to form a loop, it pulls yarn from the precedingly formed loop 130c since the feed of the strand 130a to the needle is not sufficient for the needle and as the needle moves to its full downward position it will form a long loop like loop 130c but as it does this loop 130c will be pulled such that it is a short loop as 130b. In Fig. 17, the looper 36d has moved to catch the long loop just joined by the needle and the needle is moving on its upward stroke as the looper holds the long loop. This action is repeated and a series of short loops are formed as depicted in Figures 16 and 17.

Referring to Fig. 25, the fabric 37 with the loops sewn therein is designated now as 37'. The area indicated at 130x has a series of short loops while the area at 140x has an area of long loops adjacent the short loops of area 130x. These areas alternate with each other affording a plurality of long loops adjacent a plurality of short loops to provide a checker board pattern as controlled by the pattern control mechanism which alternately feeds yarn strands for a full feed and a starving feed of thread to the needle as the yarn strand feed rolls are alternately driven at high and low speeds.

Yarn strand feeding mechanism second embodiment

The second embodiment of the yarn strand feeding mechanism as illustrated in Fig. 18 is hereinafter described. Similar parts and elements common to the first embodiment of yarn strand feeding mechanism as shown in Fig. 4, are used in the mechanism of this second embodiment shown in Fig. 18. The mechanism shown in Fig. 18 is similarly mounted on a bed plate 30 as are the yarn strand feed rolls 54 and 56 with their respective pressure rolls 55 and 57 mounted thereabove.

Yarn feed drive roll 54 which is mounted below its pressure roll 55 is fast to a feed roll drive shaft generally indicated at 200 which shaft comprises a first shaft section 201 and a second shaft section 202. Shaft section 201 is supported in bearings 50 and 203 supported on and affixed to bed plate 30 by bolts 204 such as secure all of the bearings to be described to the bed plate 30. The second section 202 of feed roll drive shaft 200 is supported in a bearing 205 while the two sections of drive shaft, 201 and 202, are coupled together by a slip or ratchet coupling 206 of the character described for the first embodiment as depicted in Figures 4, 10, 11 and the alternative type as shown in Fig. 24. This slip or ratchet coupling 206 permits the first section 201 of feed roll drive shaft to be driven at a relatively higher speed than the second section of shaft 202.

The other yarn strand feed roll 56 which is mounted below its cooperating pressure roll 57 is mounted fast to its drive shaft generally indicated at 207 and comprises a first section 208 mounting the feed roll 56 and a second section 209 coupled thereto by a slip or ratchet coupling 210. The first section 208 of shaft 207 is mounted in bearings 51 and 211 while the second section is supported in a

bearing 212. Feed roll drive shafts 200 and 207 are disposed in spaced relationship and parallel to each other. A counter shaft 213 is provided and mounted parallel to shafts 200 and 207 in bearings 214 and 215. Counter shaft 213 has mounted thereon a sprocket 216 which is drivingly connected to the drive sprocket 108 on the output of the speed reducer 101 by a drive chain 109. A second sprocket 217 is mounted on counter shaft 213 and fast thereon. Each of the second sections 202 and 209 of drive shafts 200 and 207 respectively have fast thereon drive sprockets respectively 218 and 219. Sprockets 217, 218 and 219 are connected by a drive chain 220 and an idler sprocket is provided at 221 intermediate shaft sections 202 and 209 by means of a mounting bearing and stub shaft generally indicated at 222. Thus the slow speed drive for drive shafts 200 and 207 for the feed rolls 54 and 56 respectively is provided through the drive chain 220 and its connected drive from the output of speed reducer 101. The alternate high speed drive for the yarn strand feed roll drive shafts 200 and 207 will now be described. Each of the high speed drive means for the shafts 200 and 207 are alike and thus only one will be described. In Fig. 20 a cross section along line 20—20 of Fig. 18 depicts the high speed clutch coupling for feed roll drive shaft 207. A high speed clutch drive element 230 is keyed at 231 to the first section of drive shaft 201 by a key way and key generally indicated at 231 and held tightly thereto by a set screw 232. Clutch drive element 230 is provided with a clutch facing 233 on the flat face thereof. Rotatably mounted but not axially movable on first section drive shaft, is a sleeve generally indicated at 234. Shaft section 201 has formed therein an annular groove 235 which receives a set screw 236 housed in sleeve 234 such that sleeve 234 is permitted to rotate freely on shaft section 201 but not move axially therealong, sleeve 234 has formed thereon two spaced sprockets 237 and 238. Sprocket 237 is connected by a drive chain 239 to a third sprocket 240 fast on counter shaft 213. Sprocket 238 is coupled by a drive chain 241 to a similar sprocket 238' on a similar sleeve 234' on shaft 200. Slidably mounted on sleeve 234 by a key way and key generally indicated at 242 is a clutch drive element 243 adjacent sprocket 238 on the side thereof remote from sprocket 237. Clutch drive element 243 is in the form of a sleeve having an annular collar 244 formed thereon to which face thereof is affixed a clutch facing 245 which when the sleeve is slid axially toward the right, see Fig. 20, engages with clutch facing 233 on driven clutch element 230. Slidable clutch element 243 has formed thereon two oppositely and outwardly extending pins 246. A common operating lever 247 is pivotally mounted by a pivot post 248 extending upward from bed plate 30 and intermediate slidably clutch driving elements 243 and 243' and has an extending arm 247' projecting integral therewith. Operating lever 247 is formed with two annular spaced portions 247a and 247b each having apertured bosses 247c disposed 180° apart which are received by the oppositely projecting pins 246 on slidable clutch drive element 243 and 243'.

A bell-crank lever generally indicated at 249 is pivotally mounted on a vertical pivot post 255 projecting upwardly from bed plate 30. Bell crank lever 249 has a first arm 250 and a second arm disposed substantially 90° therefrom with arm 251 formed with a forked end 252. Arm 250 is formed with a slotted portion 253 at the end thereof which is attached by a pivot pin 254 to the outer end of operating lever portion 247'. Forked end 252 on bell-crank arm 251 engages with the pattern wheel generally indicated at 95' and 95'' as heretofore described such that bell-crank 249 is oscillated and in turn pivots operating lever 247. Operating arm 247 alternately clutches in and out the high speed clutch drive elements 243 and 243' thus driving yarn strand feed rolls 54 and 56 at high speed to provide a full feed of the yarn strands threaded thereover to their respective needles

whereby long loops are formed. As either one of the yarn strand feed rolls are driven at high speed their first drive shaft sections 201 and 208 rotate at a higher speed than the slow speed drive of their second sections 202 and 209 as the slip or ratchet couplings 206 and 210 permit these relative speeds.

Yarn strand feeding mechanism third embodiment

Referring to Figures 21-23 another embodiment of variable speed drive for the yarn strand feed rolls is shown according to my invention whereby a desired pattern of alternately long and short loops can be sewn into a backing or fabric in making a carpet.

A bed plate 30 serves as a mounting for the speed drive mechanism to be described. The yarn strand feed rolls 54 and 56 as heretofore are mounted in parallel spaced relationship in suitable bearings and have pressure rolls 55 and 57 cooperating therewith mounted above as shown in Figures 2, 3 and 21. Rolls 55 and 57 are mounted by stub shafts 55' and 57' in end bearings 50 and 51 supported on bed plate 30 as best shown for the end of the rolls in Fig. 21.

Yarn strand feed roll 54 below its pressure roll 55 is mounted on a feed roll drive shaft generally indicated at 300 and is supported at its remote end from feed roll 54 in a bearing 301 in a gear drive box generally indicated at 302 mounted on bed plate 30 by bolts 302'. The other yarn strand feed roll 56 is affixed to a yarn strand feed roll drive shaft generally indicated at 303 which is supported at its outer remote end from its feed roll 56 in a bearing 304 in drive gear box 302. The ends of drive shafts 300 and 303 are formed with a reduced diameter at their outer ends 305 on shaft 300 and 306 on shaft 303 where a drive gear 307 having a ratchet hub, generally indicated at 308, is coupled to drive the shaft 300. Shaft 300 is driven at a low speed through the gear 307 and its ratchet coupling 308 yet may be driven at a high speed whereby the shaft 300 will be rotated at a high speed relative to its low speed drive gear 307. The ratchet 308 comprises a series of internal cam surfaces 309 at the hub having radially extending drive shoulder 309' against which the slide plates 310 mounted in a slot in the end of shaft 305 drive.

Drive shaft 303 has mounted thereon a similar drive gear 311 having a ratchet hub assembly generally indicated at 312 similar to hub 308 that couples gear 311 to the outer end 306 of shaft 303.

Disposed intermediate yarn strand feed roll drive shaft 300 and 303 is a high speed drive shaft generally indicated at 314 which is mounted at its end adjacent the feed rolls in a bearing 315 attached to bed plate 30 while the other end is supported in a bearing 316 in gear box 302. High speed drive shaft 314 is coupled to an end drive shaft section 317 by a combined coupling and drive gear 318. Drive gear 318 meshes with and drives gears 307 and 311 as best shown in Fig. 22. The outer end of shaft section 317 is supported in a bearing 319 in gear box 302 while its end there adjacent projecting from the gear box 302 has fixed thereto a drive sprocket 320. Sprocket 320 is driven by a drive chain 321 which leads over the drive sprocket 106 on the end of the tufting machine drive shaft 17.

The high speed drive mechanism for the feed rolls 54 and 56 will now be described. Mounted on high speed drive shaft 314 are two spaced apart drive gears generally indicated at 322 and 323, each of which has a collar as at 322' and 323' which has a toothed face 322'' and 323'' thereof facing toward each other. The gears 322 and 323 are rotatably mounted on shaft 314 but prevented from axial displacement therealong by pins 324 which project into suitable annular grooves in the shaft 314 of similar construction to that shown in Fig. 20 at 235 and 236. Mounted on shaft 314 intermediate gears 322 and 323 is a clutch drive element generally indicated at 325 which is mounted to be rotated by shaft

314 on which it is mounted but is slidable axially therealong so that its toothed faces at each end are alternately engaged with the toothed faces 322' and 323' on drive gears 322 and 323. The central portion of element 325 is formed with an annular recess 326 in which pins 327 on operating lever 328 project. Operating lever 328 is provided with an annular portion which carries the pins 327 much like the operating lever 247 shown in Fig. 19 particularly at its annular portion 247a. Operating lever 328 is pivotally mounted at one end on a pivot post 329 projecting up from bed plate 30 while the other end 330 is pivotally connected with an armature 332 of an electric solenoid 331. The armature 332 is spring biased toward one position by a spring 332' mounted thereon. As solenoid 331 is energized, the armature 332 and operating lever 328 are moved to the left as shown by broken lines while when deenergized the spring 332 moves the armature 332 to the right and the operating lever 328 to its full line position.

Solenoid 331 is energized through electrical leads 333 and 334 connected to a source of electrical power 335. Lead 334 has connected therein an interrupting switch 336, see Fig. 23, of the micro-switch type. Micro-switch 336 has an operating rod 337 with a roller 338 thereon which rides against the surface of a cam wheel 339 which closes the switch while the cam surface 339' is in contact therewith and opens its contact when cam surface 339'' is in contact therewith.

Cam wheel 339 is driven by a counter-shaft 340 mounted in gear box 302 and driven by drive shaft 305 through suitable spur gears 341 and 342.

As the solenoid is alternately energized and deenergized the clutch drive element 325 may be shifted to drive each gear 322 or 323 which in turn mesh with gear 343 fixed to shaft 308 and gear 344 fixed to on shaft 300.

While I have shown the formation of loops in a backing fabric in a checkerboard effect other designs can equally as well be provided. By changing the number of yarn strand feed rolls and the groups of strands of yarn feed thereby to the needles other patterns may be provided. The full feed and starving feed of the yarn to the needles to alternately form long and short loops may be accomplished by the drive speed pattern for the mechanism driving the feed rolls.

I claim as my invention:

1. In a multiple needle tufting machine for making carpets, rugs and the like wherein a series of reciprocating needles pass strands of yarn down through the fabric to form a series of loops and means are positioned beneath the fabric to catch and hold the loops on the upward pass of the needles as said loops are formed, at least two yarn strand feed rolls, each roll feeding yarn strands to a group of needles, drive mechanism for driving said rolls at alternately high and low speed such that as the first roll is being driven at high speed the second roll is being driven at low speed, said drive mechanism including a drive shaft for each feed roll, low speed drive means connected to each drive shaft, a ratchet coupling in each drive shaft permitting each roll to be driven at high speed apart from the low speed drive means, high speed drive mechanism alternately connectable to and for driving the feed rolls at high speed and pattern control mechanism connected to said high speed drive mechanism for periodically shifting the coupling of the high speed drive mechanism from the first feed roll to the second feed roll, whereby yarn fed to a first group of needles by the first roll at high speed permits each needle of the first group to form a full loop to the extent of the downward travel of each needle, said loop holding means catching the loop formed and holding it during the upward travel of the needle, yarn fed to a second group of needles by the second feed roll at low speed starves the feed yarn to each needle of the second group causing a part of the yarn in the preceding formed loop by that needle

to be pulled into the formation of the loop being formed by the second group needle as it passes to its full downward stroke and said loop holding means for each needle of the second group catching the loop and holding same while the needle of the second group moves upward, said groups of needles alternately forming a series of long and short loops as the feed rolls are alternately driven at high and low speeds.

2. In a multiple needle tufting machine for making carpets, rugs and the like wherein a series of reciprocating needles pass strands of yarn down through the fabric to form a series of loops and means are positioned beneath the fabric to catch and hold the loops on the upward pass of the needles as said loops are formed, yarn strand feeding mechanism for simultaneously feeding yarn strands for the full travel of a first group of needles and starving the feed of yarn strands to an adjacent second group of needles and alternating the strand feed of the first group to a starving feed and the second group of needles to a full feed for the travel of the needles, said loop catch and holding means positioned below the fabric holding each loop as the needles reciprocate upward, said yarn strand feeding mechanism comprising a continuously rotated first feed roll over which yarn strands for said first group of needles is fed, a second continuously rotated feed roll over which yarn strands for said second group of needles is fed, a slow speed drive mechanism for the yarn strand feed rolls, a high speed drive mechanism for the yarn strand feed rolls, a pattern control mechanism operatively connected to said slow and high speed drive mechanisms for continuously alternately shifting the slow speed drive mechanism to drive the first feed roll while shifting the high speed drive mechanism to drive the second feed roll whereby the first feed roll while driven at slow speed starvantly feeds yarn strands passing thereover to the first group of needles thereby causing some yarn from the preceding formed loop in the series of loops formed by the first group of needles to be pulled into the loop being formed by each needle of the first group to provide a series of short loops while the second feed roll is driven at high speed so as to freely feed yarn thereover to the second group of needles to supply yarn for the full downward travel of each needle in the second group to provide a series of long loops and whereby the pattern control mechanism alters the drive of the first feed roll to high speed and the second feed roll to low speed so that the first group of needles make a series of long loops and the second group of needles make a series of short loops.

3. In a multiple needle tufting machine for making carpets, rugs and the like wherein a series of reciprocating needles pass strands of yarn down through the fabric to form a series of loops and means are positioned beneath the fabric to catch and hold the loops on the upward pass of the needles as said loops are formed, yarn strand feeding mechanism for simultaneously feeding yarn strands for the full travel of a first group of needles and starving the feed of yarn strands to an adjacent second group of needles and alternating the strand feed of the first group to a starving feed and the second group of needles to a full feed for the travel of the needles, said loop catch and holding means positioned below the fabric holding each loop as the needles reciprocate upward, said yarn strand feeding mechanism comprising a first feed roll over which yarn strands for said first group of needles is fed, a second feed roll mounted in parallel relationship to said first feed roll and over which yarn strands for said second group of needles is fed, each of said feed rolls being mounted on a drive shaft having a first section on which the feed roll is drivingly mounted and a second section remote from its feed roll, a ratchet coupling connecting the first and second sections of each drive shaft whereby the first section may be driven at a relatively higher speed than the second section, slow speed drive means for driving at slow speed

each second section of drive shaft and in turn the first section of each drive shaft through said ratchet coupling, a high speed drive element mounted on the first section of each drive shaft, a high speed drive means disposed intermediate said drive shafts for the feed rolls, a shift-able high speed drive element mounted intermediate and for alternate driving contact with said high speed drive elements on the first section of each drive shaft whereby the first section of drive shaft is driven at a higher speed than said second section with which it is connected by the ratchet coupling, flexible drive coupling means connecting said high speed drive means and said shiftable high speed drive element, pattern control mechanism, coupling means connecting said pattern control mechanism with said shiftable high speed driving element for alternately shifting said shiftable high speed driving element into driving contact with said high speed drive element on the first section of the drive shaft of each yarn strand feed roll, whereby said yarn strand feed rolls are alternately driven by said low speed drive means and said shiftable high speed drive element acting in response to said pattern control mechanism so that alternately the first group of needles make a series of long loops and the second group of needles make a series of short loops.

4. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 3 wherein said high speed drive elements on the first sections of the drive shafts for the yarn strand feed rolls and the shiftable high speed drive element for alternately contacting and driving said high speed drive elements and the shafts on which they are mounted include gears having teeth extending outwardly from the circumference thereof.

5. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 3 wherein said slow speed drive means for said second sections of the drive shafts comprises gears fixed thereto; said high speed drive means disposed intermediate said drive shafts for the feed rolls comprises a high speed shaft mounted intermediate said second sections of said drive shafts and a high speed gear mounted on said high speed shaft intermediate said gears on said second sections of drive shafts and driven thereby, said shiftable high speed driving element is mounted on a shaft coupled to said high speed drive shaft by said flexible drive coupling means; and power drive means connected to one of said second sections of the drive shafts to drive same and thereby drive the other of said second section drive shafts and said high speed drive shaft.

6. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 3 wherein low speed drive means for said second sections of the drive shafts comprises sprockets fixed thereto and a chain led over said sprockets; and said high speed drive means disposed intermediate said drive shafts for the feed rolls comprises a drive shaft having a high speed sprocket thereon disposed intermediate said first named sprockets and driven by said chain led over said sprockets on said second sections of the drive shafts; said shiftable high speed drive element is mounted on a shaft coupled to said high speed drive shaft by said flexible drive coupling means; and drive means connected to one of said second sections of the drive shaft to drive same and thereby drive the other of said second section drive shafts and said high speed drive shaft.

7. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 6 including a speed reducer mechanism having an output means, drive means connecting the output means of said speed reducer and one of said second sections of the drive shafts and drive means connecting the output means of said speed reducer and said pattern control mechanism.

8. In a multiple needle tufting machine for making carpets, rugs and the like wherein a series of recipro-

cating needles pass strands of yarn down through the fabric to form a series of loops and means are positioned beneath the fabric to catch and hold the loops on the upward pass of the needles as said loops are formed, yarn strand feeding mechanism for simultaneously feeding yarn strands for full travel of a first group of needles and starving the feed of yarn strands to an adjacent second group of needles and alternating the strand feed of the first group to a starving feed and the second group of needles to a full feed for the travel of the needles, said loop holding means positioned below the fabric catching and holding each loop as the needles reciprocate upwards, said yarn strand feeding mechanism comprising a first feed roll over which strands for the first group of needles is fed, a second feed roll over which strands for said second group of needles is fed positioned in parallel spaced relation to said first feed roll, a drive shaft fixed to each feed roll and having a first section fixed to the feed roll and a second section, a ratchet coupling connecting the sections of each feed roll drive shaft whereby one section may be rotated relative to the other section, slow speed drive means connected to and driving each second section of said drive shafts to drive said rolls for starving the strand feed to the needles, a clutch face attached to each of the first sections of the drive shafts, a sleeve rotatably mounted on each first section of the drive shafts, high speed drive means driving said sleeves, a clutch element slidably mounted on each of said sleeves and rotatably driven thereby adapted to engage and rotate said clutch faces attached to said first sections of drive shaft whereby said strand feed rolls are driven at high speed to supply full feed of the strands to the needles, coupling means attached to said slidably mounted clutch elements for alternately engaging one clutch element with a clutch face while disengaging the other clutch element from the other clutch face and a pattern control mechanism connected with said coupling means for alternately shifting said coupling means attached to said slidably mounted clutch elements.

9. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 8 wherein said high speed means for said sleeves mounted on each first section of the drive shafts comprises a sprocket fixed to each of said sleeves, a chain led over said sprockets and a driven sprocket on at least one of said sleeves rotatably mounted on a first section of the drive shafts; and said low speed drive means for each of said second sections of said drive shafts comprises sprockets fixed to each of the second sections of drive shaft and a drive chain led over said latter sprockets.

10. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 8 wherein said slow and high speed drive means includes a counter shaft extending parallel to said drive shafts, drive means for said counter shaft, drive means toward one end of said counter shaft drivingly connected to one of said sleeves on said first sections of the drive shafts, and drive means connecting said counter shaft and at least one of said second sections of the drive shafts.

11. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 10 including a speed reducer mechanism, drive means connecting an output means of said speed reducer with said counter shaft to drive same, and drive means connecting the output means of said speed reducer with said pattern control mechanism for driving the pattern control means.

12. In a multiple needle tufting machine for making carpets, rugs and the like wherein a series of reciprocating needles pass strands of yarn down through the fabric to form a series of loops and means are positioned beneath the fabric to catch and hold the loops on the upward pass of the needles as said loops are formed, yarn strand feeding mechanism for simultaneously feeding yarn strands for full travel of a first group

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of needles and starving the feed of yarn strands to an adjacent second group of needles and alternating the strand feed of the first group to a starving feed and the second group of needles to a full feed for the travel of the needles, said loop holding means positioned below the fabric catching and holding each loop as the needles reciprocate upward, said yarn strand feeding mechanism comprising a first feed roll over which strands for the first group of needles is fed, a second feed roll over which strands for said second group of needles is fed positioned in spaced relation to said first feed roll, a drive shaft fixed to each feed roll, slow speed drive means connected to each drive shaft whereby yarn strands are fed thereover to groups of needles in a starving feed manner causing a portion of the preceding loop formed by such starving feed needle to be pulled into the loop being formed by the needle to provide a series of short loops, ratchet coupling means coupling said slow speed drive means to said drive shafts permitting said drive shafts and the attached feed rolls to be driven at a speed higher than by said slow speed drive means, high speed drive elements attached to each of said drive shafts, high speed drive means alternately connectable to said high speed drive elements for driving said drive shafts and feed rolls attached thereto at high speed whereby yarn strands are fed thereover to groups of needles to supply a full feed of yarn strands for the travel of the needles to provide a series of long loops, and a pattern control mechanism for alternately connecting said high speed drive means to said high speed drive elements on the drive shafts.

13. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 12 wherein said high speed drive means comprises a high speed drive shaft having a clutch element shiftable therealong and rotated therewith and drive elements rotatably mounted on the high speed drive shaft and having clutch faces thereon alternately engageable by said shiftable clutch element and driven thereby, said rotatably mounted drive elements on the high speed drive shaft being drivingly connected to said high speed drive elements on said drive shafts on which said feed rolls are mounted, said pattern control mechanism being connected to said shiftable clutch element on said high speed drive shaft so as to alternately engage said shiftable clutch element with the clutch faces on said rotatably mounted drive elements to thereby drive said feed rolls at high speed.

14. In a multiple needle tufting machine for making carpets, rugs and the like according to claim 13 wherein said feed roll drive shafts are disposed in spaced parallel relation, said high speed drive shaft is disposed intermediate said feed roll drive shafts, said low speed drive means for each drive shaft comprises a low speed drive gear having said ratchet means connected thereto and coupling it with its drive shaft whereby the drive shaft may be driven at a higher speed than by said low speed drive gears thereon, said high speed drive elements on said drive shafts are gears fixed thereto, said rotatably mounted drive elements on the high speed drive shaft are gears which are each respectively in driving engagement with said high speed drive elements on said drive shafts, said pattern control mechanism comprises a periodic switch means, drive means connecting said high speed drive shaft and said periodic switch means, and a solenoid operatively connected to said slidable clutch element on said high speed drive shaft and electrically connected to said periodic switch means whereby said yarn feed rolls are alternately driven at high speed.

15. In a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric, means for releasably holding the yarn inserted into the base fabric by the needles to form loops, a plurality of feed means arranged respectively to feed said yarn to groups of said needles, a plurality of variable speed drive means respectively connected to actuate said feed means,

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so that each of said feed means is operable to feed prescribed lengths of yarn to its associated group of needles only in response to actuation by said drive means, control means connected to said drive means and pattern forming means connected to said control means to predetermine actuate said control means to vary the speed of each of said drive means to control the amount of yarn fed to its associated group of needles to form prescribed patterns on said base fabric.

16. In a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric, means for releasably holding the yarn inserted into the base fabric by the needles to form loops, a plurality of feed means arranged respectively to feed said yarn to groups of said needles, drive means to actuate each of said feed means, one or more of said drive means including variable speed drive mechanism, each of said feed means being operable to feed prescribed lengths of yarn to its associated group of needles only in response to actuation of its drive means, control means connected to said variable speed drive means and pattern forming means connected to said control means to vary the speed of said drive means controlled thereby to control the amount of yarn fed to its associated group of needles, whereby prescribed patterns may be formed on said base fabric.

17. In a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric, means for releasably holding the yarn inserted into the base fabric by the needles to form loops, a plurality of feed means arranged respectively to feed said yarn to groups of said needles, drive means to actuate each of said feed means, said drive means including means for driving some of said feed means at constant speed and including one or more variable speed drive means to actuate one or more of the other of said feed means, so that each of said feed means is operable to feed prescribed lengths of yarn to its associated group of needles only in response to actuation of its drive means, control means connected to said variable speed drive means and pattern forming means connected to said control means to vary the speed of said drive means controlled thereby to control the amount of yarn fed to its associated group of needles, whereby prescribed patterns may be formed on said base fabric.

18. In a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric, means for releasably holding the yarn inserted into the base fabric by the needles to form loops, a plurality of feed means arranged respectively to feed yarn to groups of said needles, drive means for said feed means, said drive means including variable speed drive means operably connected to actuate at least one of said feed means so that each of said feed means is operable to feed prescribed lengths of yarn only to its associated group of needles in response to actuation by said drive means, control means operably connected to said variable speed drive means, and pattern forming means connected to said control means to predetermine actuate said control means to independently control the amount of yarn fed to each said group of needles by its associated feed means in the formation of successive loops so that the length of the loops may be varied to form prescribed patterns on said base fabric.

19. Apparatus adapted to be attached to a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric and means for releasably holding the yarn inserted into the base fabric by the needles to form loops, comprising a plurality of feed means arranged respectively to feed said yarn to groups of said needles, a plurality of variable speed drive means respectively connected to actuate said feed means, so that each of said feed means is operable to feed prescribed lengths of yarn to its associated group of needles only in response to actuation by said drive means, con-

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trol means connected to said drive means and pattern forming means connected to said control means to predeterminedly actuate said control means to vary the speed of each of said drive means to control the amount of yarn fed to its associated group of needles to form prescribed patterns on said base fabric.

20. Apparatus adapted to be attached to a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric and means for releasably holding the yarn inserted into the base fabric by the needles to form loops, comprising a plurality of feed means arranged respectively to feed said yarn to groups of said needles, drive means to actuate each of said feed means, one or more of said drive means including variable speed drive mechanism, each of said feed means being operable to feed prescribed lengths of yarn to its associated group of needles only in response to actuation of its drive means, control means connected to said variable speed drive means and pattern forming means connected to said control means to vary the speed of said drive means controlled thereby to control the amount of yarn fed to its associated group of needles, whereby prescribed patterns may be formed on said base fabric.

21. Apparatus adapted to be attached to a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric and means for releasably holding the yarn inserted into the base fabric by the needles to form loops, comprising a plurality of feed means arranged respectively to feed said yarn to groups of said needles, drive means to actuate each of said feed means, said drive means including means for driving some of said feed means at constant speed and including one or more variable speed drive means to actuate one or more of the other of said feed means, so that each of said feed means is operable to feed prescribed lengths of yarn to its associated group of needles only in response to actuation of its drive means, control means

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connected to said variable speed drive means and pattern forming means connected to said control means to vary the speed of said drive means controlled thereby to control the amount of yarn fed to its associated group of needles, whereby prescribed patterns may be formed on said base fabric.

22. Apparatus adapted to be attached to a tufting machine having a plurality of reciprocating needles for inserting yarn threads into a base fabric and means for releasably holding the yarn inserted into the base fabric by the needles to form loops, comprising a plurality of feed means arranged respectively to feed yarn to groups of said needles, drive means for each of said feed means, said drive means including variable speed drive means operably connected to actuate at least one of said feed means so that each of said feed means is operable to feed prescribed lengths of yarn only to its associated group of needles in response to actuation by said drive means, control means operably connected to said variable speed drive means, and pattern forming means connected to said control means to predeterminedly actuate said control means to independently control the amount of yarn fed to each of said groups of needles by its associated feed means in the formation of successive loops so that the length of the loops may be varied to form prescribed patterns on said base fabric.

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