April 13, 1965 W. E. PASSONS 3,177,833

TUFTING MACHINE WITH PATTERN CONTROL MEANS

Filed June 18, 1962 8 Sheets-Sheet 1

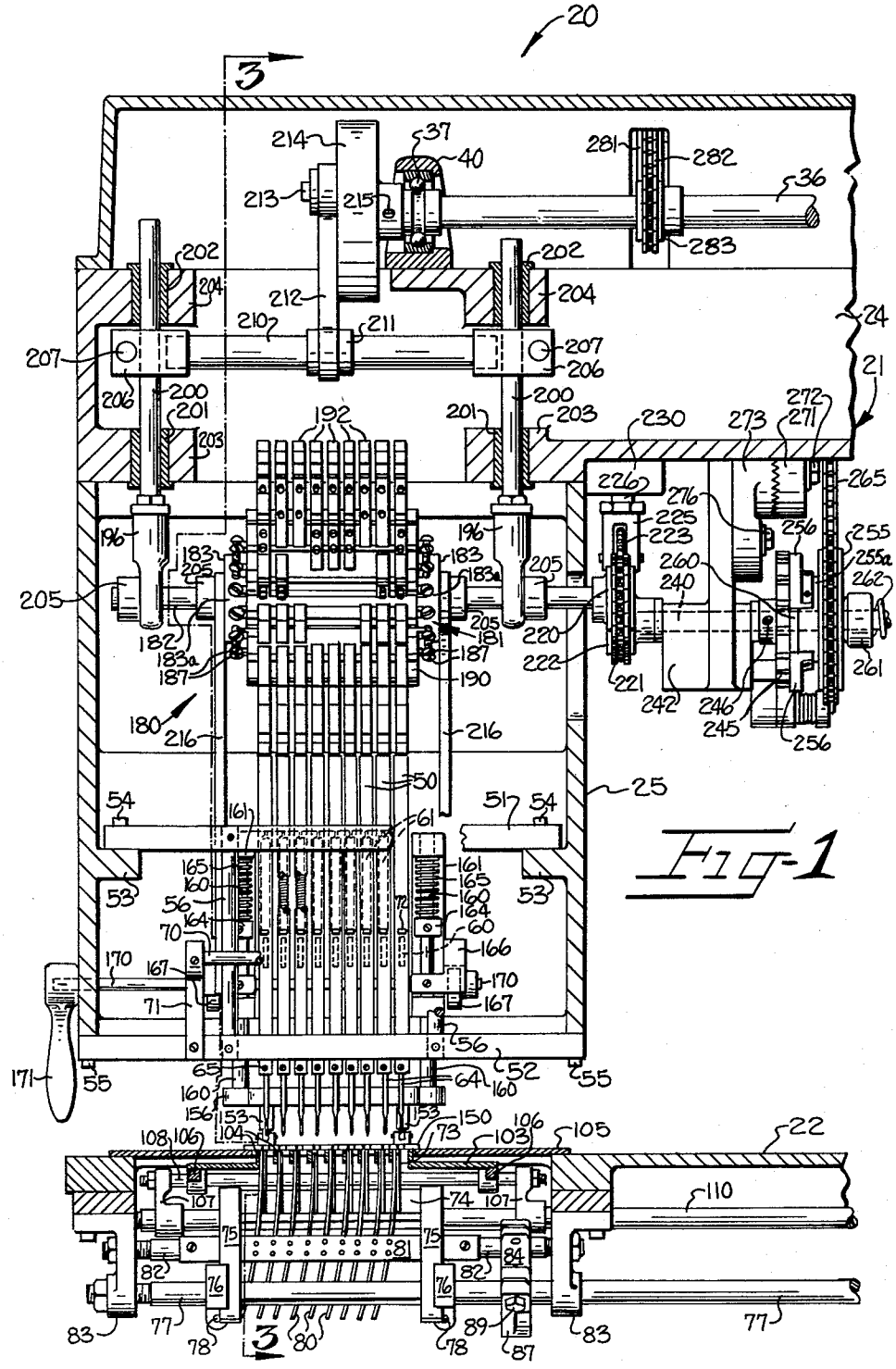


Fig-1

April 13, 1965 W. E. PASSONS 3,177,833

TUFTING MACHINE WITH PATTERN CONTROL MEANS

Filed June 18, 1962 8 Sheets-Sheet 2

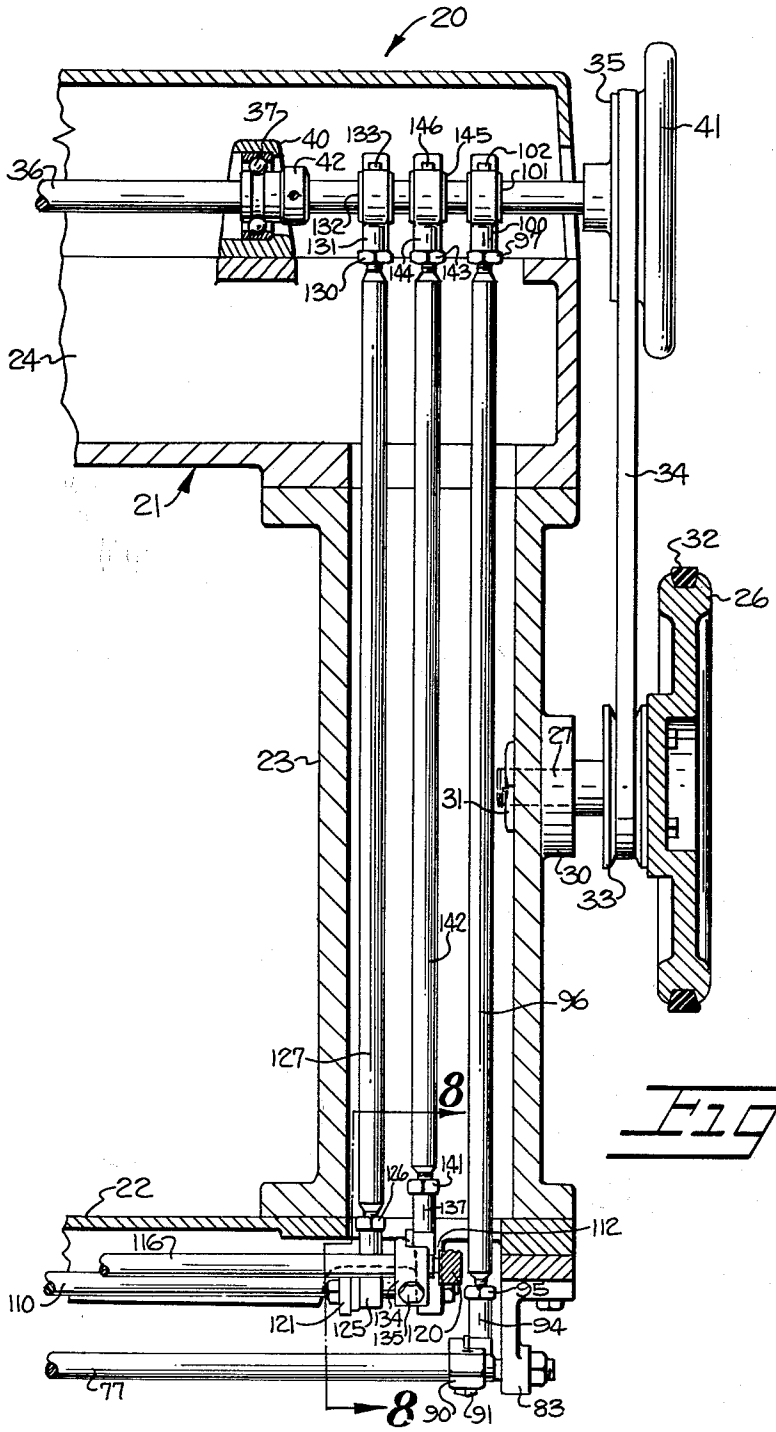


Fig-2

TUFTING MACHINE WITH PATTERN CONTROL MEANS

Filed June 18, 1962 8 Sheets-Sheet 3

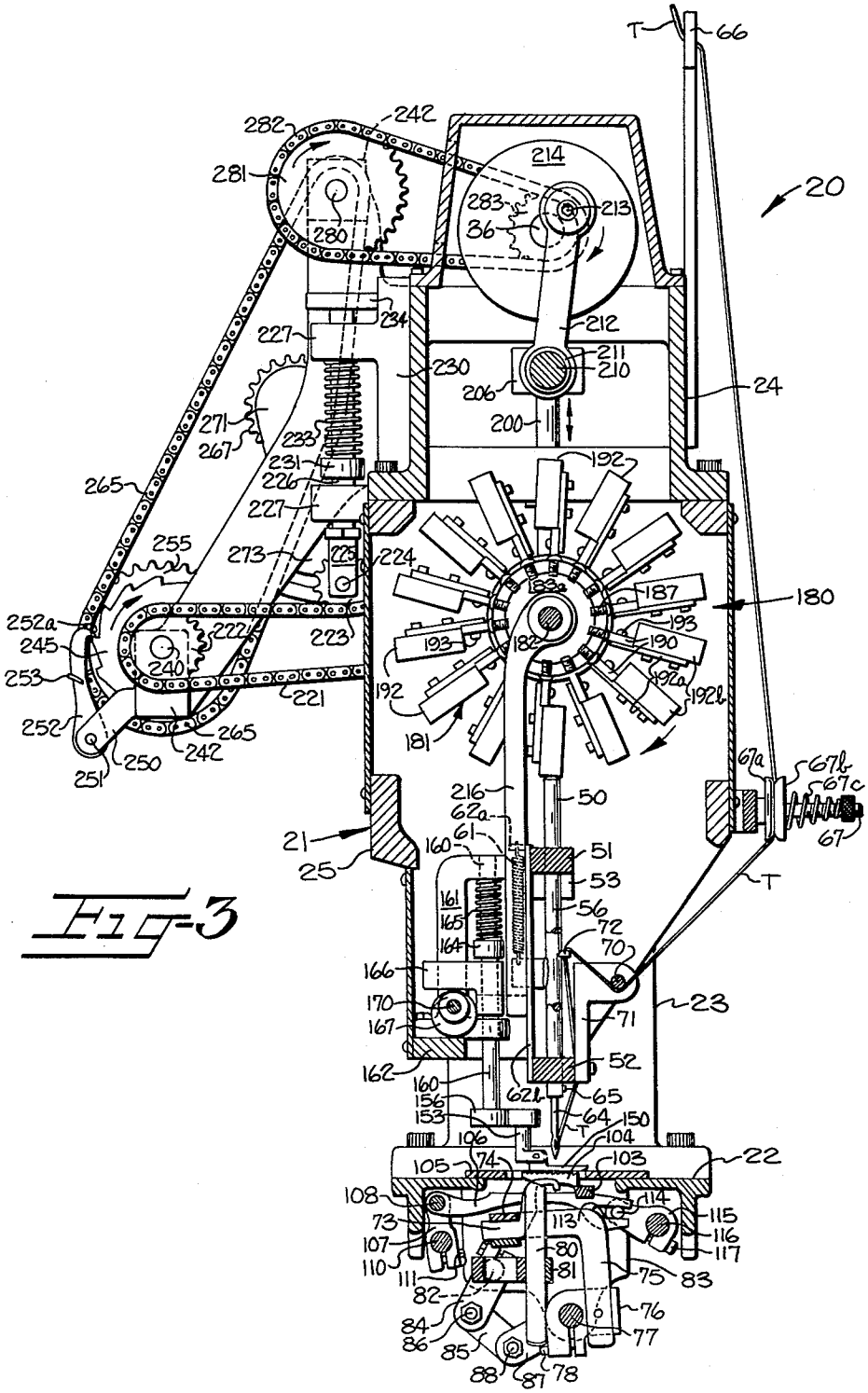


Fig-3

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TUFTING MACHINE WITH PATTERN CONTROL MEANS

Filed June 18, 1962 8 Sheets-Sheet 4

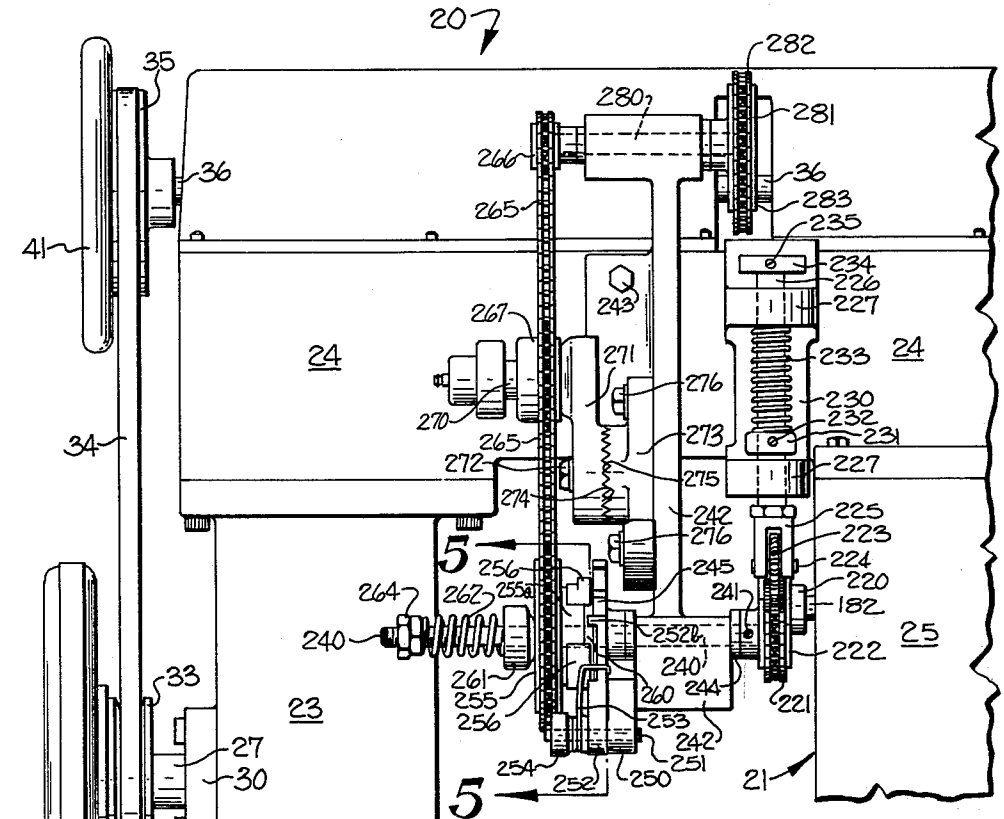


Fig-4

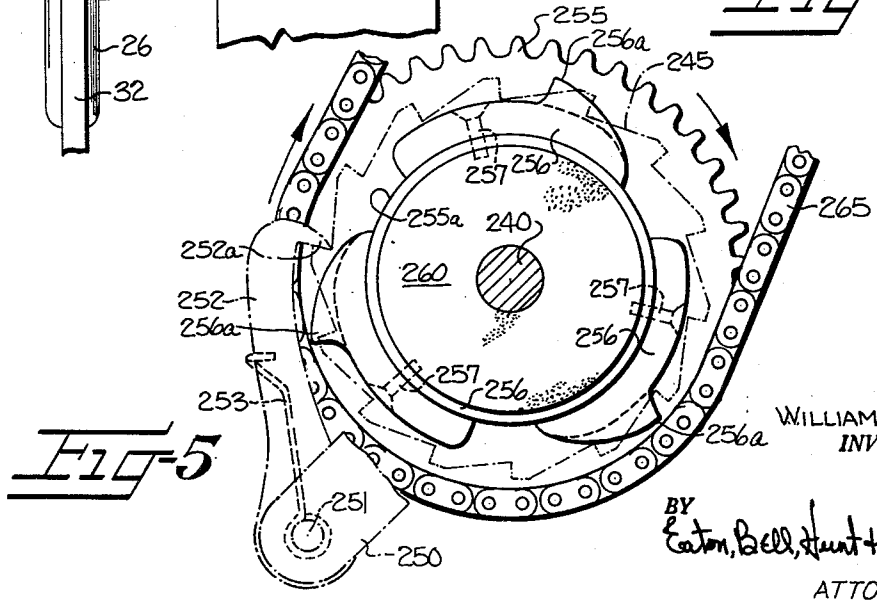


Fig-5

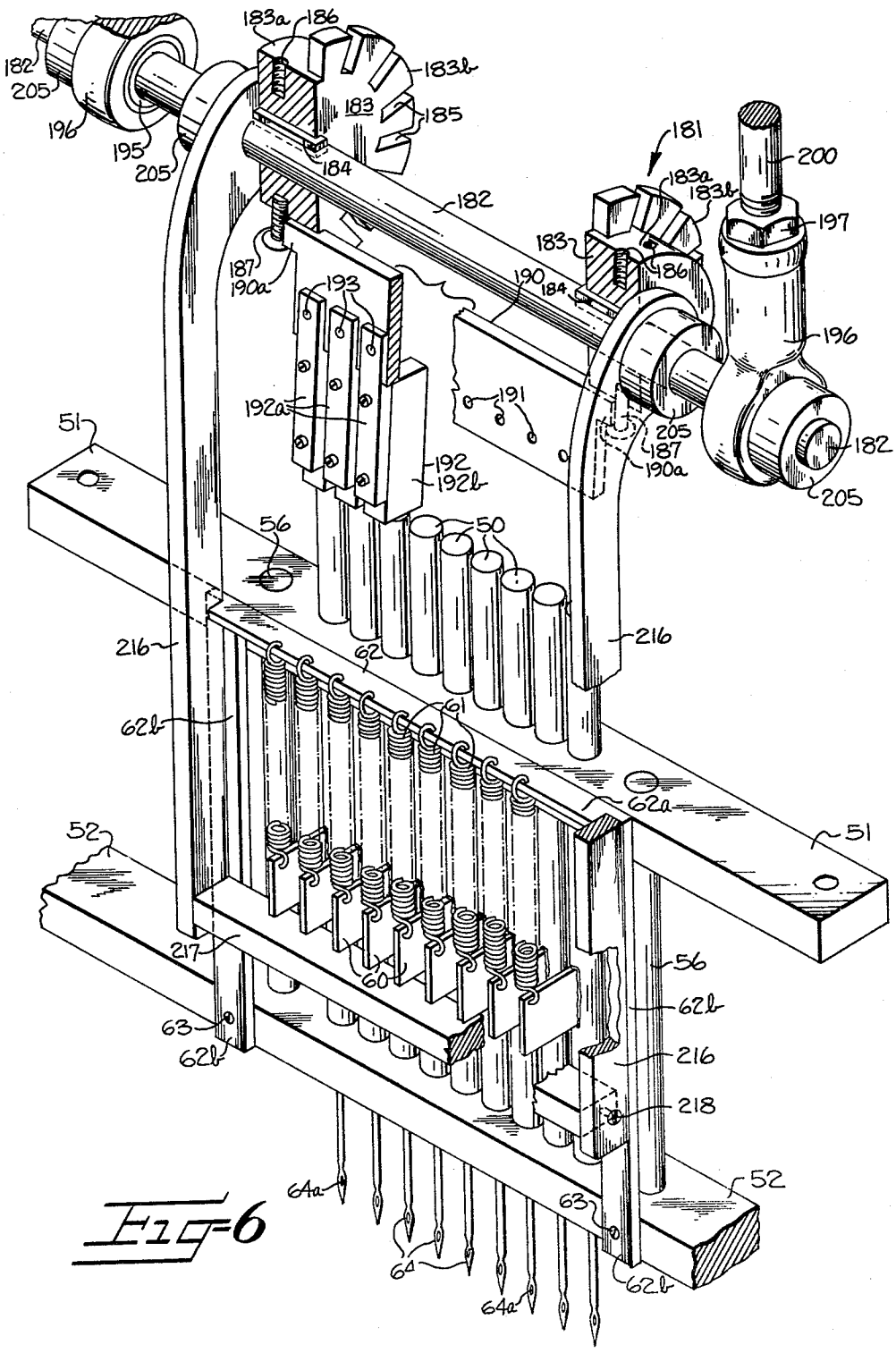
WILLIAM E. PASSONS
INVENTOR.

BY
Eaton, Bell, Hunt & Beltzer
ATTORNEYS

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TUFTING MACHINE WITH PATTERN CONTROL MEANS

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TUFTING MACHINE WITH PATTERN CONTROL MEANS

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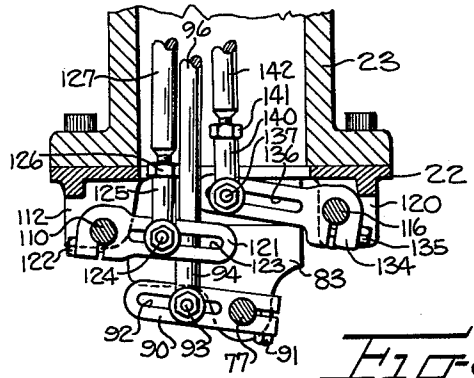


Fig-8

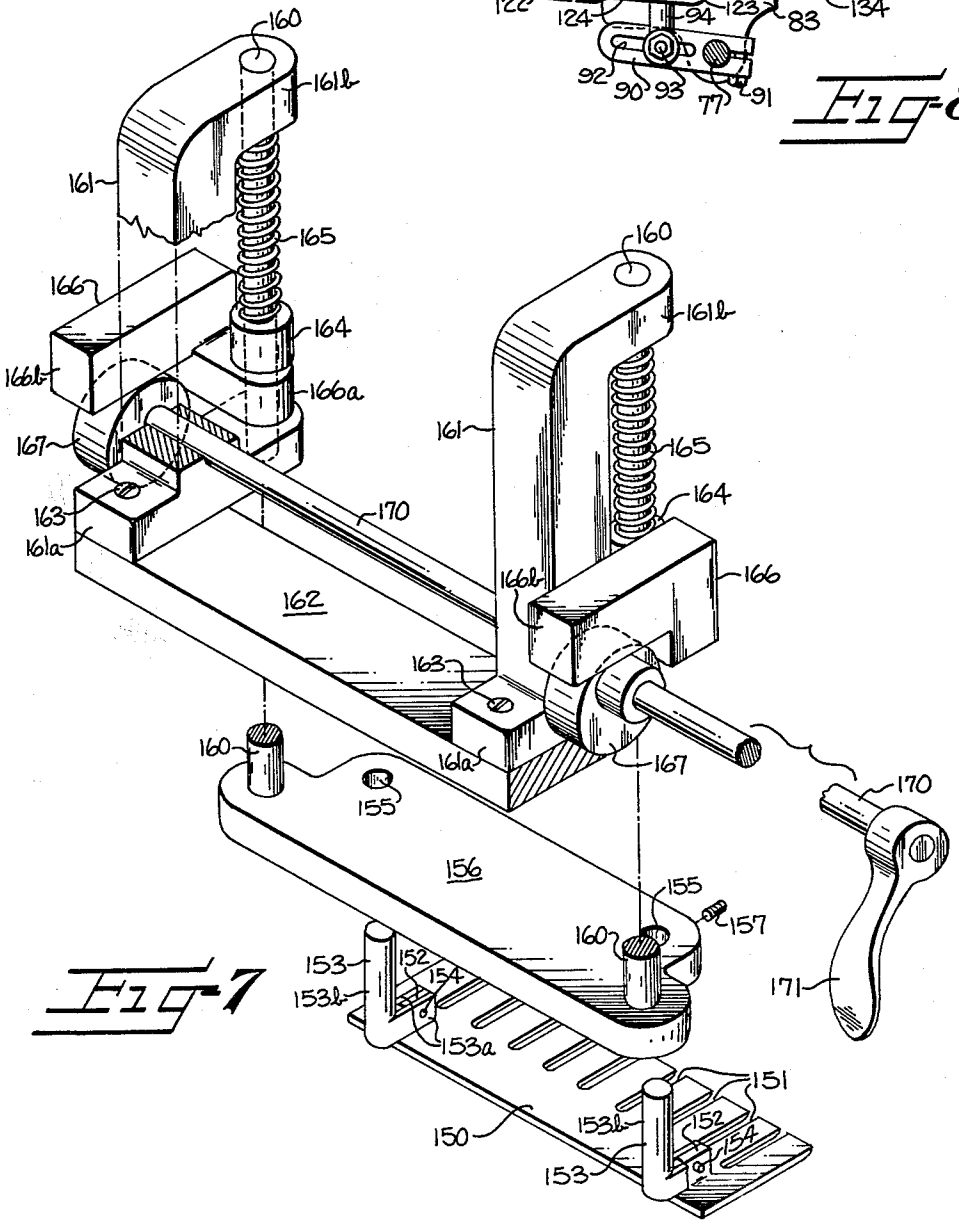


Fig-7

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TUFTING MACHINE WITH PATTERN CONTROL MEANS

Filed June 18, 1962 8 Sheets-Sheet 7

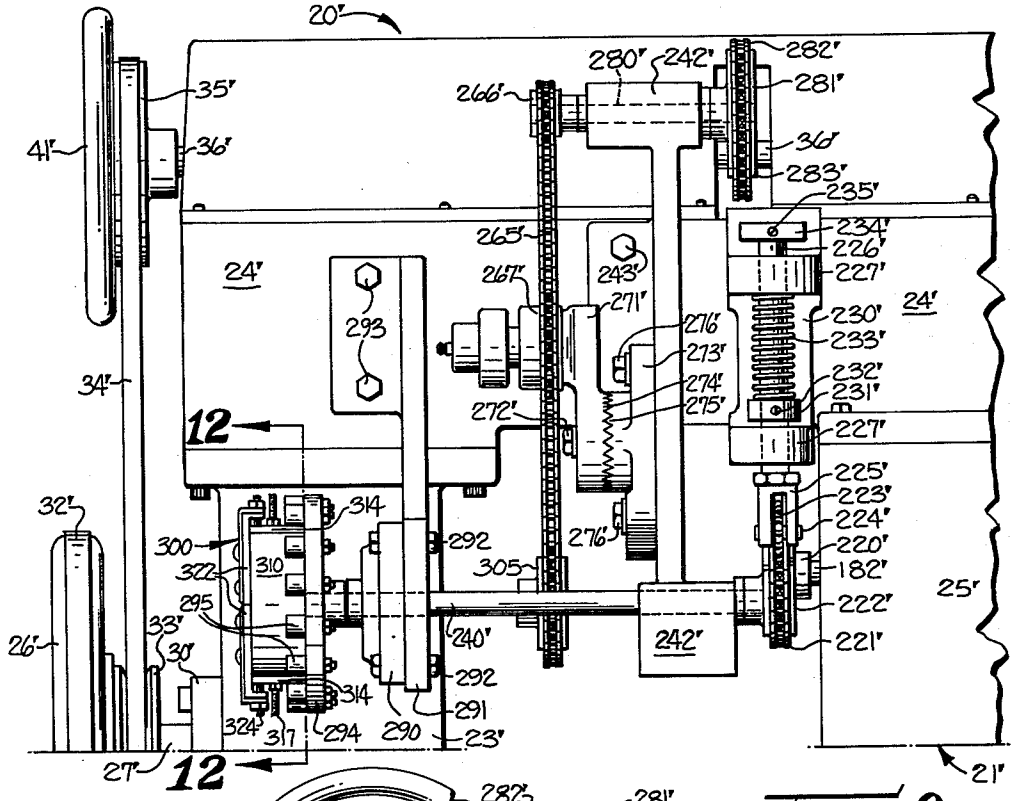


Fig-9

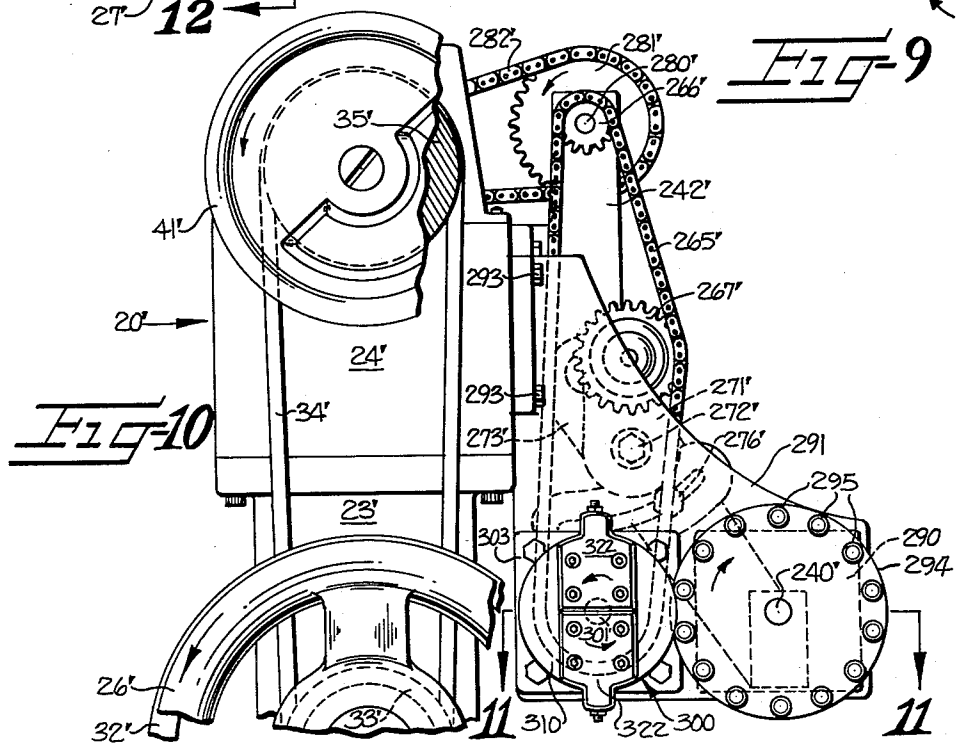


Fig-10

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TUFTING MACHINE WITH PATTERN CONTROL MEANS

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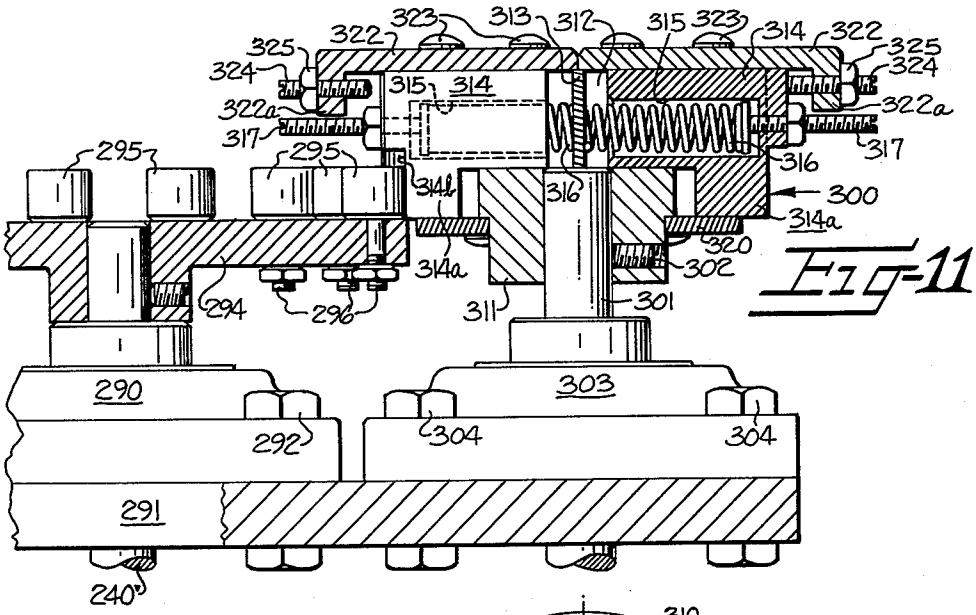


Fig-11

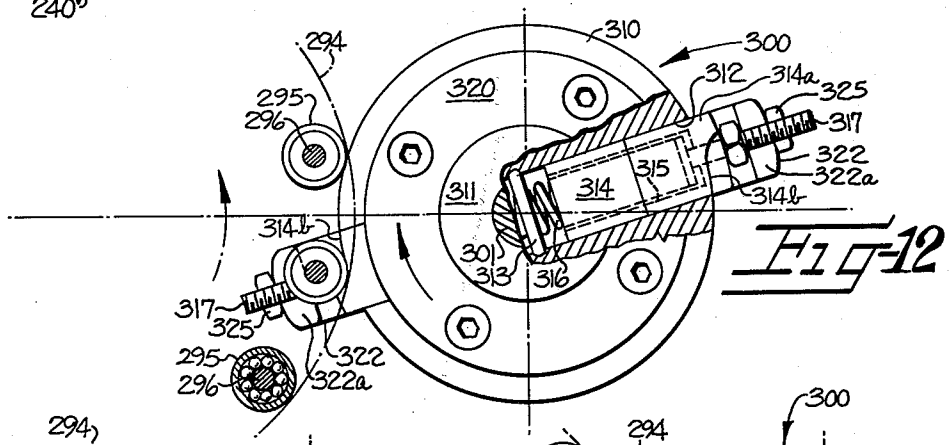


Fig-12

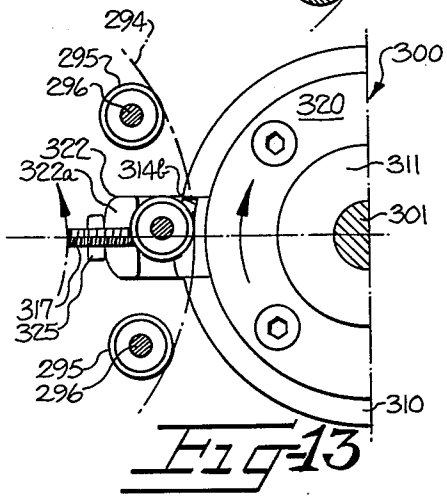


Fig-13

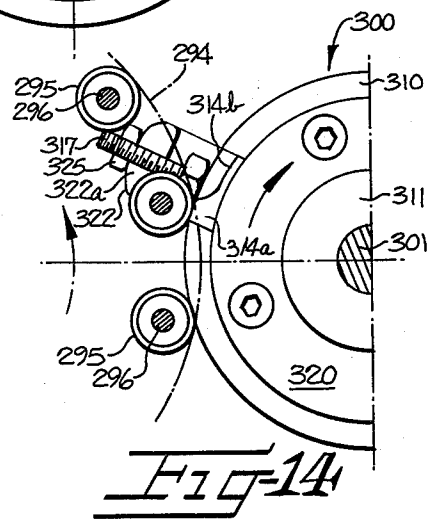


Fig-14

United States Patent Office 3,177,833 Patented Apr. 13, 1965

3,177,833

TUFTING MACHINE WITH PATTERN CONTROL MEANS

William E. Passons, Chattanooga, Tenn., assignor to Broad Street Machine Company, Inc., Chattanooga, Tenn., a corporation of Tennessee

Filed June 18, 1962, Ser. No. 203,081
13 Claims. (Cl. 112—79)

The present invention relates to tufting machines and more particularly to tufting machines of the type utilizing needles for inserting tufting stitches into a base fabric or textile web.

One of the conventional types of needle tufting machines for producing a varying pattern of tufting stitches in a base fabric utilizes a plurality of needle bars mounted on a vertically reciprocating member for vertical reciprocation therewith. These needle bars carry needles at the lower ends thereof for inserting tufting stitches in the fabric and are individually latched to the reciprocating member by spring biased latches such that the needle bars move collectively with the vertically reciprocating member. A pattern mechanism is connected to the spring biased latches by a linkage arrangement for selectively unlatching certain of the needle bars from the vertically reciprocating member such that these selected needle bars will not be reciprocated thereby. Therefore, the stitches which would have normally been inserted by the needles carried by said certain needle bars will be omitted to thereby form a pattern of tufting stitches with the active needles.

This type of tufting machine is extremely complicated due to the necessity of having the spring biased latches for each of the needle bars and the associated linkage connecting these latches to the pattern mechanism such that the same are selectively unlatched. Therefore, these machines are expensive to manufacture and hence, are expensive to purchase. Also, problems have been encountered in the use of such machines because of high maintenance costs and since the machines are frequently out of order and have to be removed from production while being repaired. Also, the latches frequently bind in their mounting and are not returned to latching position after being retracted by the pattern mechanism which results in a missing stitch or void in the pattern and, hence, seconds or poor quality goods.

Another type of conventional tufting machine utilizes a solenoid for each of the needle bars with the plungers of the solenoids connected to the needle bars for exerting downward force thereon and with springs being provided for retracting the needle bars upwardly upon the de-energization of the solenoids. The solenoids of this apparatus are selectively energized by a pattern mechanism for forming a varying pattern of stitches in the base fabric. This conventional tufting machine is also quite complicated in that an electrical system including numerous stitches and the like for energizing the solenoids is required which considerably increases the maintenance cost encountered in the operation of this machine. Also, this machine relies upon springs to retract the needle bars upwardly and therefore, if a needle bar binds in its mounting, the same interferes with the other stitch forming mechanisms resulting in damage to the fabric and, possibly, in broken needles or other parts.

The present invention obviates the aforementioned problems, and deficiencies found in conventional tufting machines by providing a simplified needle tufting machine having a plurality of individually operable needle bars, a vertically reciprocating pattern mechanism engageable with the needle bars for supplying the motive power to selective ones of the needle bars to move the same downwardly so that needles carried thereby are moved into

penetrating engagement with the base fabric, and a lifting mechanism also engageable with the needle bars for positively retracting the same upwardly to move the needles out of penetrating engagement with the base fabric. The present invention also provides novel indexing means for indexing the pattern mechanism to form a predetermined repeating pattern of tufting stitches in the base fabric.

It is therefore an object of the present invention to provide a simplified needle tufting machine wherein the motive power for reciprocating the needle bars is provided by a reciprocable pattern mechanism having a plurality of spaced rows of needle bar engaging means for engaging selective ones of the needle bars to impart reciprocation thereto and indexing means for indexing said pattern mechanism to reciprocate said needle bars in a predetermined pattern.

A more specific object of the present invention is to provide a tufting machine of the character described including lifting means movable with said pattern mechanism and engageable with said needle bars for positively retracting said needle bars upwardly to move the needles out of penetrating engagement with a base fabric.

A further more specific object of the present invention is to provide a tufting machine of the character described having a bank of individually operable needle bars mounted for reciprocation, a rotatable pattern drum also mounted for reciprocation and wherein the path of travel of the needle bars coincides with at least a portion of the path of travel of said pattern drum, said pattern drum having rows of needle bar engaging lugs spaced equidistant therearound for engaging selected ones of the needle bars upon downward reciprocation of the pattern drum for imparting downward movement to said selected needle bars and indexing means operatively connected to said pattern drum for successively positioning each of said rows in operative position relative to the needle bars to form a predetermined pattern of stitches in a base fabric.

Some of the objects of the present invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

FIGURE 1 is a fragmentary vertical section of a tufting machine incorporating the features of the present invention;

FIGURE 2 is a view similar to FIGURE 1 showing the remaining portion of the tufting machine, a portion of which is shown in FIGURE 1;

FIGURE 3 is a vertical section taken substantially along line 3—3 in FIGURE 1;

FIGURE 4 is a fragmentary rear elevational view of the apparatus shown in FIGURE 1 showing one embodiment of the indexing means of the present invention;

FIGURE 5 is an enlarged fragmentary sectional view taken substantially along line 5—5 in FIGURE 4 and showing the ratchet gear and pawl superimposed thereon in phantom lines;

FIGURE 6 is an enlarged fragmentary isometric view of the pattern mechanism and needle bars shown in the medial portion of FIGURE 3 with portions broken away and parts removed for clarity of illustration;

FIGURE 7 is a view similar to FIGURE 6 showing the presser foot mechanism shown in the lower medial portion of FIGURE 3;

FIGURE 8 is a vertical section taken substantially along line 8—8 in FIGURE 2;

FIGURE 9 is a view similar to FIGURE 4 but showing another embodiment of the indexing means of the present invention;

FIGURE 10 is a side elevational view looking from the left of FIGURE 9 with portions broken away for clarity;

FIGURE 11 is an enlarged horizontal sectional view

taken substantially along line 11—11 in FIGURE 9 with the elements turned 90° to show the same in a position corresponding to the position of subsequent figures;

FIGURE 12 is an enlarged fragmentary sectional view taken substantially along line 12—12 in FIGURE 9;

FIGURE 13 is a view similar to FIGURE 12 with the parts shown in different operational positions; and

FIGURE 14 is a view similar to FIGURES 12 and 13 showing the parts in still further different operational positions.

Referring now to the drawings and more particularly to FIGURES 1 and 2, there is shown a tufting machine generally indicated at **20** incorporating the features of the present invention. Tufting machine **20** comprises a housing **21** which includes a base **22**, a standard **23**, an overhanging arm **24** and a head **25**. Housing **21** encloses the working elements of tufting machine **20** and serves as supports therefor in a manner to be described presently.

A main pulley **26** (FIGURE 2) is drivingly mounted on one end of a shaft **27** which is journaled for rotation in a bearing boss **30** carried by standard **23**. The inner end of shaft **27** is suitably threaded and has a nut **31** positioned thereon for retaining shaft **27** in bearing boss **30**. Main pulley **26** is driven by a belt **32** which is trained therearound and which is mounted at its other end around the drive pulley (not shown) of a suitable drive means such as a motor (also not shown).

A drive pulley **33** is mounted on shaft **27** for rotation therewith between pulley **26** and bearing boss **30**. A belt **34** is trained around pulley **33** and at its other end is trained around a drive pulley **35** which is drivingly mounted on a main shaft **36**. Shaft **36** is journaled for rotation in a pair of bearings **37** which are disposed at spaced points therealong and which are in turn mounted in brackets **40**. Brackets **40** are mounted on overhanging arm **24** in any suitable manner. A hand wheel **41** is formed integral with pulley **35** for manual rotation of shaft **36**. A collar **42** is mounted on shaft **36** in abutting relation to the side of the bearing **37** adjacent to pulley **35** to prevent longitudinal movement of shaft **36** toward head **25**.

Stitch forming instrumentalities

A plurality of needle bars **50** are vertically disposed and are individually mounted for vertical reciprocatory movement in vertically alined openings formed in a pair of spaced apart needle bar mounting members **51** and **52**. Needle bar mounting member **51** is mounted at opposite ends on a pair of bosses **53** (FIGURE 1) extending inwardly from head **25** by suitable bolts **54**. Needle bar mounting member **52** is mounted on the lower end of the head **25** by bolts **55** and is connected to needle bar mounting member **51** by spaced vertically disposed rods **56** (FIGURE 6) which are fixedly connected at opposite ends thereto.

Each of the needle bars **50** has a finger **60** mounted thereon by any suitable means such as welding or the like and extending laterally outwardly therefrom at a point between needle bar mounting members **51** and **52**. It is noted that fingers **60** are positioned a distance above needle bar mounting member **52** greater than the length of reciprocation of needle bars **50** from the inoperative position to the operative position so that the same will not interfere with such movement. Needle bars **50** are biased upwardly toward the inoperative position by springs **61** which are connected at one end to projecting fingers **60** and at their other end to the web portion **62***a* of a generally inverted U-shaped bracket **62**. The leg portions **62***b* of inverted U-shaped bracket **62** extend downwardly from web portion **62***a* and are connected to needle bar mounting member **52** by suitable screws **63**.

Needle bars **50** have needle mounting means at the lower ends thereof which receive needles **64** which are releasably secured therein by suitable set screws **65** (FIGURE 1). Needles **64** have eyes **64***a* (FIGURE 3) which receive threads T therein to form tufting stitches in a base fabric. Threads T are supplied to needles **64** from suitable sources of supply (not shown) and pass through a plurality of eyelets formed in a thread guide member **66**. Thread guide member **66** is mounted on overhanging arm **24** by any suitable means and extends upwardly therefrom.

The threads T then pass through suitable tension mechanisms **67** mounted on head **25**. Tension mechanisms **67** are of conventional construction comprising two wheels **67***a*, **67***b* between which threads T pass. Wheel **67***b* is biased toward wheel **67***a* by springs **67***c* for placing a frictional retarding force on threads T. From tension mechanisms **67**, the threads T pass downwardly beneath a thread guide bar **70** mounted at opposite ends on a pair of upstanding brackets **71** which in turn are mounted at their lower ends on needle bar mounting member **52** by any suitable means.

Threads T then pass through eyelets **72** mounted on needle bars **50** at a point spaced slightly upwardly from projecting fingers **60** and on the opposite side of needle bars **50** therefrom. From eyelets **72**, the threads pass to the eyes **64***a* of the needles **64**. It is noted that when the needle bars **50** move to the upper or inoperative position, the same pull upwardly on the threads T and sets the stitches in conventional manner and at the same time act as thread pull-off mechanisms for providing the necessary length of thread for the insertion of the next stitches. It is to be understood that separate thread pull-off and take-up mechanisms may be provided within the scope of the present invention.

A bank of loopers **73** (FIGURES 1 and 3) is disposed in base **22** and the loopers **73** are equal in number to the number of needles **64**. Loopers **73** engage and hold the stitch loops inserted by the needles as the needles move upwardly out of penetrating engagement with the fabric. Loopers **73** are mounted for individual adjustment in suitable horizontal openings in a looper mounting bar **74**. Looper mounting bar **74** is mounted at its opposite ends on one leg of a pair of generally L-shaped members **75**, the other legs of which are connected to a pair of crank arms **76**. Crank arms **76** are mounted on a rock shaft **77** for oscillatory movement therewith by bolts **78**.

A bank of knives **80** (FIGURES 1 and 3) is also disposed in base **22** and the knives are equal in number to loopers **73** and cooperate therewith to sever the stitch loops to form cut pile. Knives **80** are mounted in a knife mounting bar **81** for individual vertical adjustment so that the upper end or cutting surface thereof is disposed at the same height as the upper or hook portion of loopers **73**. Knife mounting bar **81** is mounted at its opposite ends on a carrier portion of a rock shaft **82** in off-set relation to the axis thereof for oscillatory movement therewith. Rock shaft **82** in turn is journaled at its opposite ends in a pair of spaced bearing brackets **83** for oscillatory movement therein. One end of a crank arm **84** (FIGURE 3) is drivingly connected to rock shaft **82** and is pivotally connected at its other end to a link **85** by a bolt **86**. Link **85** is pivotally connected at its other end to one end of a crank arm **87** by a bolt **88**. The other end of crank arm **87** is mounted on rock shaft **77** by a bolt **89** for oscillatory movement therewith. It is noted that rock shaft **77** is journaled for rotation in the spaced bearing brackets **83** and is also journaled for rotation in another bearing bracket **83** mounted on base **22** beneath standard **23**.

A crank arm **90** is drivingly mounted on rock shaft **77** (FIGURE 8) by a bolt **91** and has a generally elongate horizontally extending opening **92** formed therein. A bolt **93** penetrates through elongate opening **92** and is threadably received in a suitably internally threaded opening in a connecting nipple **94**. The other end of connecting nipple **94** has a nut **95** mounted thereon (FIGURE 2) in which is disposed an externally threaded end portion of a connecting rod **96**. Connecting rod **96** extends up-

wardly from connecting nipple 94 and is connected at its other end to a nut 97 which is mounted on the lower end of a strap member 100. Strap member 100 encircles an eccentric 101 which is mounted on main shaft 36 for rotation therewith. Strap 100 is maintained in encircling relation to eccentric 101 by a bolt 102.

Therefore, when main shaft 36 rotates, eccentric 101 will impart vertical reciprocatory movement to connecting rod 96 through strap 100 which will oscillate crank member 90 through connecting nipple 94. As crank 90 oscillates, the same will drive rock shaft 77 in like manner which in turn will oscillate cranks 76 to impart the conventional pick up and drawing motion to loopers 73 through the L-shaped members 75 and looper mounting bar 74. At the same time, rock shaft 77 imparts oscillatory movement to crank 87 which imparts like oscillatory movement to rock shaft 82 through connecting link 85 and crank arm 84. Due to the off-set nature of the knife mounting bar 81 relative to rock shaft 82, knives 80 are thereby moved both upwardly and forwardly to cut the loops of threads T held by loopers 73.

Fabric feeding mechanism

The fabric feeding mechanism of tufting machine 20 comprises a feed dog mechanism and a presser foot mechanism which cooperate in conventional manner to feed the fabric through the machines. The feed dog mechanism comprises a feed dog mounting plate 103 (FIGURE 1) which has a plurality of upstanding feed dogs 104 (FIGURE 3) formed integrally therewith or suitably mounted thereon, which feed dogs have serrated edges for engaging and gripping the fabric. The upstanding feed dogs 104 are equal in number to the needles 64 and loopers 73 and are disposed in elongate openings formed in a throat plate 105 over which the fabric is to be fed.

Feed dog mounting plate 103 is mounted at its opposite ends on a pair of feed dog operating members 106 for movement therewith. Feed dog operating members 106 are connected to a pair of crank arms 107 by a shaft 108 extending through suitable openings formed in the feed dog mounting members 106 and in one end of crank arms 107. Crank arms 107 are mounted on a rock shaft 110 by suitable bolts 111 (FIGURE 3). Rock shaft 110 is journaled at opposite ends for oscillatory movement in suitable bosses 112 (FIGURE 8) formed on base 22.

The other end of each of the feed dog mounting members 106 has a laterally opening, generally horizontally extending elongate opening 113 (FIGURE 3) which has a pin 114 disposed therein. Pins 114 are connected to a pair of crank arms 115 mounted at spaced points along a rock shaft 116 by bolts 117. Rock shaft 116 is journaled for oscillatory movement in bosses 120 (FIGURE 8) formed integral with base 22.

Shaft 110 has a crank arm 121 (FIGURE 8) drivingly mounted thereon by a bolt 122 at a point underlying standard 23. Crank arm 121 has a horizontally extending elongate opening 123 formed therein which receives a bolt 124 therein. Bolt 124 extends into a suitably internally threaded opening formed in a connecting nipple 125 to adjustably and pivotally connect nipple 125 to crank arm 121. A nut member 126 is mounted on the upper end of connecting nipple 125 and matingly receives the externally threaded lower end portion of a connecting rod 127. Connecting rod 127 extends upwardly from connecting nipple 125 and is connected at its upper end to a nut 130 (FIGURE 2) mounted on the lower end of a strap 131. Strap 131 is disposed in encircling relation to an eccentric 132 mounted on main shaft 36 for rotation therewith and is maintained in such encircling relation by a bolt 133.

Shaft 116 has a crank arm 134 (FIGURE 8) drivingly mounted thereon by a bolt 135 at a point underlying standard 23. Crank arm 134 has a horizontally extending elongate opening 136 formed therein with a bolt 137 penetrating therethrough and into an internally threaded opening in a connecting nipple 140. A nut member 141 is mounted on the upper end of connecting nipple 140 and receives the threaded lower end portion of a connecting rod 142. Connecting rod 142 extends upwardly from connecting nipple 140 and is connected at its upper end to a nut member 143 (FIGURE 2) which is mounted on the lower end of a strap 144. Strap 144 is disposed in encircling relation to an eccentric 145 mounted on main shaft 36 for rotation therewith and is maintained in such encircling relation by a bolt 146.

A presser foot 150 (FIGURES 1, 3 and 7) is mounted on head 25 for cooperating engagement with feed dogs 104 and operates to clamp the fabric against throat plate 105 to insure good frictional gripping engagement of feed dogs 104 with the fabric so that the same may properly feed the fabric. Presser foot 150 is preferably of a greater length than the combined width of the bank of needles 64 and is of a width at least as large as the length of the fabric engaging portion of feed dogs 104. Presser foot 150 has suitable slots or elongate openings 151 formed therein to allow needles 64 to penetrate therethrough. Presser foot 150 has a pair of spaced bosses 152 formed integrally therewith and extending upwardly therefrom with alined horizontal openings therein. Presser foot 150 is mounted for vertical movement between an operative position wherein the same is in engagement with throat plate 105 and an inoperative position wherein the same is spaced above throat plate 105 by a pair of generally L-shaped mounting members 153 (FIGURE 7) having horizontal leg portions 153*a* and vertical leg portions 153*b*. The horizontal leg portions 153*a* of members 153 are bifurcated and receive the bosses 152 therein. Members 153 are connected to bosses 152 for limited pivotal movement by pins 154.

The vertical leg portions 113*b* of members 153 are preferably cylindrical and are vertically adjustably mounted in vertical openings 155 formed in a bracket member 156 and are retained therein by set screws 157 (FIGURE 7). Bracket member 156 is mounted on the lower end of a pair of vertical rods 160 for vertical reciprocation therewith. Vertical rods 160 are slidably mounted in a pair of brackets 161 mounted on a plate 162 by suitable screws 163. Plate 162 is mounted on head 25 of housing 21 by any suitable means (not shown). Brackets 161 include base portions 161*a* projecting outwardly from plate 162 and generally L-shaped standard portions 161*b* having vertical legs extending upwardly from base portions 161*a* and horizontal legs overlying base portions 161*a*. Base portions 161*a* and the horizontal legs of standard portions 161*b* have vertically alined openings slidably receiving rods 160 therein.

A collar 164 is fixedly mounted on each of the rods 160 in spaced relation to the bracket portions 161*a* and 161*b*. A compression spring 165 is disposed in surrounding relation to each of the rods 160 between collar 164 and the horizontal leg of bracket portion 161*b* to bias the respective rods 160 downwardly and hence presser foot 150 toward the operative position. A pair of generally L-shaped followers 166 have vertically extending openings formed in one leg 166*a* thereof through which rods 160 penetrate. It is noted that the legs 166*a* are disposed between collars 164 and bracket portions 161*a*. The other legs 166*b* of followers 166 extend rearwardly from legs 166*a* in overlying relation to a pair of cams 167 mounted on a shaft 170 for rotation therewith. Shaft 170 is journaled for oscillatory movement in suitable openings formed in the vertical leg of standard portions 161*b* of brackets 161. Shaft 170 projects outwardly from brackets 161 through a suitable opening formed in head 25 and has a handle 171 mounted on the end thereof for manual oscillation of shaft 170 to cam followers 166 upwardly and thereby to raise rods 160 and presser foot 150.

Pattern mechanism

A pattern mechanism generally indicated at 180 (FIGURES 1, 3 and 6) is mounted in head 25 of housing 21

in overlying relation to the bank of needle bars **50**. Pattern mechanism **180** comprises a pattern drum **181** which is mounted on a shaft **182** for rotation therewith. Pattern drum **181** comprises a hub which comprises a pair of spaced apart hub members **183** (FIGURE 6) which are mounted on shaft **182** for rotation therewith by keys **184** positioned in cooperating keysways in the members **183** and shaft **182**.

Hub members **183** are substantially identical in construction except that the same are allochirally arranged. These hub members **183** comprise a base portion **183***a* which is substantially cylindrical and a flange portion **183***b* extending radially outwardly from base portion **183***a* and disposed adjacent the innermost end thereof. Flange member **183***b* has a plurality of radially extending, outwardly opening grooves **185** cut therein to a depth generally equal to the height of flange portion **183***b* such that the bottom of grooves **185** is substantially alined with the outer surface of base portion **183***a*. The number of the outwardly opening grooves **185** corresponds to the number of pattern stations or needle bar engaging stations on pattern drum **181** which may be of any desired number with the preferred number, as shown in the drawings, being fourteen. It should be understood that the number of stations on the pattern drum **181** may be varied as desired without departing from the scope of the present invention.

Hub base portion **183***a* has a plurality of internally threaded openings **186** formed therein in lateral alinement with grooves **185**. Openings **186** matingly receive headed bolts **187** therein which have enlarged head portions for reasons to be presently described.

A plurality of lug mounting members **190** are mounted at their opposite ends on hub members **183** and have reduced end portions **190***a* disposed in grooves **185**. End portions **190***a* are clamped between the head portions of bolts **187** and the bottom of grooves **185** and hub base portion **183***a* to removably mount the same on the hub members **183**. Lug mounting members **190** have a plurality of spaced openings **191** (FIGURE 6) formed therein, which openings are equal in number to the number of needle bars **50** and are disposed in vertical alinement therewith. A plurality of lugs **192** are mounted on each of lug mounting members **190** by screws **193** penetrating through a mounting portion **192***a* thereof and into the openings **191**. Lug mounting portion **192***a* is preferably formed of metal and has a needle bar engaging portion **192***b* mounted thereon by screws **194**. Needle bar engaging portion **192***b* is preferably formed of a resin impregnated fibrous material having good wear resistant characteristics while being capable of dampening noise. It is noted that the number of lugs **192** mounted on each lug mounting member **190** and the position thereof along mounting member **190** will vary in accordance with the number and selected ones of the needle bars **50** which are desired to be reciprocated by the respective lugs **192** and mounting member **190** to form the predetermined pattern of tufting stitches.

Shaft **182** is journaled for rotation in spaced bearings **195** (FIGURE 6) which are mounted in openings formed in a pair of spaced hanger members **196**. Hanger members **196** have nuts **197** mounted on the upper end thereof which receive the threaded lower ends of drive rods **200**. Each of the rods **200** is mounted for vertical reciprocation in a pair of vertically alined sleeve bearings **201, 202** (FIGURE 1). Bearings **201, 202** are mounted in openings formed in bosses **203, 204** formed integral with overhanging arm **24** of housing **21**. Pairs of collars **205** are mounted on shaft **182** on opposite sides of pattern drum **181** and on the opposite side of hanger members **196** from pattern drum **181** to prevent longitudinal movement of pattern drum **181** relative to shaft **182** and shaft **182** relative to hanger members **196**.

A pair of blocks **206** are fixedly mounted on rods **200** between sleeve bearings **201** and **202** by bolts **207**. Blocks **206** have horizontal openings formed in the sides thereof facing toward each other. A connecting rod **210** has opposite ends thereof disposed in the openings in blocks **206** and connects blocks **206**, and hence the rods **200**, together. A bearing **211** is mounted on rod **210** intermediate its ends and is disposed in an opening formed in a connecting link **212**. Bearing **211** allows oscillation of link **212** relative to rod **210** without binding or undue wear.

The opposite end of connecting link **212** has a similar opening formed therein through which penetrates a bolt **213** which has its inner end matingly received in an internally threaded opening (not shown) formed in a crank member **214**. The suitably internally threaded opening in crank member **214** is off-set laterally from the axis of rotation of crank member **214** (FIGURE 3) and therefore connecting link **212** is connected to crank member **214** at a point off-set from the axis thereof. Crank member **214** is mounted on the end of main shaft **36** for rotation therewith by a set screw **215** (FIGURE 1) which penetrates through the hub portion of crank member **214** and engages shaft **36**. It is noted that the hub portion of crank member **214** cooperates with collar **42** to prevent longitudinal movement of main shaft **36** relative to bearings **37**.

A pair of lifter arms **216** (FIGURE 6) is freely mounted on shaft **182** at their upper ends and extend downwardly and slightly rearwardly therefrom to a point below projecting fingers **60** on needle bars **50**. It is noted that lifter arms **216** are disposed in cut out portions in web portion **62***a* of U-shaped bracket member **62**. Therefore, the cut out portion and leg portions of bracket member **62** serve to guide lifter arms **216** in their vertical reciprocatory movement as shaft **182** reciprocates. A lifter bar **217** is mounted on the lower end portions of lifter arms **216** by suitable screws **218** and extends therebetween in underlying relation to projecting fingers **60** on needle bars **50**.

Therefore, on the upward stroke of the vertical reciprocation of shaft **182**, lifter bar **217** will move into engagement with the lower surface of projecting fingers **60** on needle bars **50** and will exert a positive lifting action on needle bars **50** to positively move the same to the upper or inoperative position. This will effectively insure that needle bars **50** will be moved upwardly from the operative position to the inoperative position thereby moving needles **64** out of penetrating engagement with the fabric.

Indexing mechanism

Referring now to FIGURES 1, 3, 4 and 5 wherein there is shown one embodiment of an indexing mechanism for pattern drum **181** to successively move the rows of lugs **192** carried by lug mounting members **190** into operative position overlying the bank of needle bars **50**. A sprocket **220** is drivingly mounted on the end of shaft **182** and has a sprocket chain **221** trained therearound. Sprocket chain **221** is trained around a drive sprocket **222** at its other end and has an idler sprocket **223** engaging the upper reach thereof for maintaining proper tension therein. It is noted that sprockets **220** and **222** are of the same size so that the same rotate at the same rotational speed.

Sprocket **223** is mounted on a shaft **224** which in turn is mounted at opposite ends in the bifurcated leg portion of a suspension bracket **225**. Bracket **225** is mounted on the lower end of a vertically disposed rod **226** (FIGURE 4). Rod **226** is mounted for vertical reciprocatory movement in a pair of spaced bosses **227** formed integral with a bracket **230** which is mounted on the side of overhanging arm **24**. A collar **231** is mounted on rod **226** by a set screw **232** in spaced relation to upper boss **227**. A compression spring **233** is disposed in surrounding relation to rod **226** between collar **231** and upper boss **227** to bias rod **226**, and hence idler sprocket **223** carried thereby, downward

ly toward engagement with sprocket chain 221. It is noted that idler sprocket 223 is maintained in contact with sprocket chain 221 during the vertical reciprocation of sprocket 220 with shaft 182. A guide member 234 is mounted on the upper end of rod 226 by a set screw 235 and has one side thereof disposed in engagement with bracket 230 to guide rod 226 in its vertical reciprocation and to prevent rotation of rod 226 in bearing bosses 227.

Sprocket 222 is mounted on a shaft 240 (FIGURE 4) for rotation therewith by a set screw 241 extending through the hub portion thereof. Shaft 240 is journaled for rotation in the lower end of a bracket 242 which is mounted on the side of overhanging arm 24 by suitable bolts 243, only one of which is shown.

A washer 244 is disposed between the hub portion of sprocket 222 and bracket 242 to reduce friction between sprocket 222 and bracket 242. A ratchet gear 245 is drivingly mounted on shaft 240 by a set screw 246 and has teeth thereon which are equal in number to the number of rows of lugs 192 on pattern drum 181. There is also a washer 247 disposed between the hub portion of ratchet gear 245 and bracket 242 for the same reason as set forth above.

A pawl mounting member 250 is mounted at one end on the lower end of bracket 242 and extends downwardly and rearwardly therefrom. The outer end portion of member 250 has a horizontally extending opening therethrough in which a shaft 251 is mounted. A pawl 252 is pivotally mounted on shaft 251 and has a hook 252*a* at its upper end which is normally disposed in holding engagement with one of the teeth of ratchet gear 245 to prevent the same from rotating. A cam follower portion 252*b* is formed integral with pawl 252 and extends laterally outwardly from hook 252*a*. A spring 253 has one end formed in suitable coils which are disposed in surrounding relation to shaft 251 and is fixed at this end to a collar 254 mounted on shaft 251. The other end of spring 253 engages pawl 252 and serves to bias the hook 252*a* thereof toward engagement with the teeth of ratchet gear 245. It is noted that the tension in spring 253 may be varied by rotating collar 254 in the appropriate direction.

A drive sprocket 255 is freely mounted on shaft 240 for rotation relative thereto and includes a hub 255*a* which is disposed adjacent ratchet gear 245. Hub 255*a* has a plurality of internally threaded openings (not shown) formed at spaced points there around. A plurality of cams 256 are mounted on hub 255*a* by suitable screws 257 which penetrate through openings formed therein and into the internally threaded openings in hub 255*a*. Cams 256 have cam portions 256*a* which project radially outwardly from hub 255*a* a distance greater than the distance that cam follower portion 252*b* on pawl 252 is disposed from hub 255*a*. Therefore, cam follower portion 252*b* is disposed in the path of travel of cams 256 as the same rotate with hub 255*a* of drive sprocket 255. Therefore, when a cam portion 256*a* moves into underlying relation to cam follower portion 252*b*, the hook 252*a* of pawl 252 will be moved out of engagement with the tooth of ratchet gear 245.

A friction disc 260 is positioned between the face of hub 255*a* of drive sprocket 255 and the face of ratchet gear 245. Friction disc 260 defines a friction clutch connecting ratchet gear 245 to drive sprocket 255 when hook 252*a* of pawl 252 is out of engagement with the teeth of ratchet gear 245. It is noted that cam portions 256*a* are of such a width that hook 252*a* is moved out of engagement with the teeth of ratchet gear 245 only long enough to allow one tooth to pass thereby with hook 252*a* catching the next successive tooth.

A thrust member 261 is freely mounted on shaft 240 and is disposed in engagement with the opposite side of drive sprocket 255 from hub 255*a*. A compression spring 262 is also disposed in surrounding relation to shaft 240 and engages the opposite side of thrust member 261 to bias thrust member 261 into engagement with drive sprocket 255 to urge the same against ratchet gear 245. A collar 263 is mounted on shaft 240 and engages the opposite end of compression spring 262 and is locked in position by a nut 264. The tension in spring 262 may therefore be adjusted by varying the position of collar 263 along shaft 240.

A sprocket chain 265 (FIGURE 3) is trained around drive sprocket 255 at one end and around a sprocket 266 (FIGURE 4) at its other end. It is noted that sprocket 255 is three times the size of sprocket 266 such that a three-to-one speed reduction is effected therebetween. An idler sprocket 267 is mounted for rotation on a shaft 270 which in turn is mounted in a generally L-shaped bracket 271 and normally engages chain 265 for maintaining uniform tension therein. L-shaped bracket 271 is mounted for limited rotation on a shaft 272 which in turn is threadably mounted in an internally threaded opening in a bracket 273. Bracket 273 has a portion thereof abutting against bracket 271 and the abutting faces of brackets 271 and 273 have cooperating teeth 274, 275 respectively. Therefore, the angular position of bracket 271 may be changed by loosening shaft 272 and moving teeth 274 out of cooperating engagement with teeth 275 and then rotating bracket 271 around shaft 272 to thereby vary the tension in sprocket chain 265. Bracket 273 is mounted on bracket 242 by suitable bolts 276.

Sprocket 266 is mounted on a shaft 280 (FIGURE 3) for rotation therewith which is journaled for rotation in the upper end of bracket 242. A sprocket 281 is drivingly mounted on the opposite end of shaft 280 and has a sprocket chain 282 trained therearound. The opposite end of sprocket chain 282 is trained around a drive sprocket 283 mounted on main shaft 36 for rotation therewith. It is noted that sprocket 281 is twice as large as sprocket 283 such that a two-to-one speed reduction is effected therebetween. Therefore, there is a six-to-one speed reduction between main shaft 36 and drive sprocket 255, i.e., drive sprocket 255 makes one revolution for each six revolutions of main shaft 36.

Since there are the same number of teeth on the ratchet gear 245 as there are rows of lugs 192 on pattern drum 181, and since the cam portions 256*a* on cams 256 are only in engagement with cam follower portion 252*b* on pawl 252 to move the same out of engagement with one tooth on ratchet gear 245, shaft 182 will be rotated one-fourteenth (1/14) of a revolution for each cam 256 disposed on hub 255*a* of drive sprocket 255. It is noted that the number of cams 256 mounted on the drive sprocket 255 may be varied to vary the number of stitches inserted in the base fabric between indexing movements of pattern drum 181.

As shown in the drawings, there are three cams 256 mounted on hub 255*a* of sprocket 255 and therefore, for each revolution of sprocket 255, the pawl 252 will be moved out of engagement with the teeth of ratchet gear 245 three times. Consequently, ratchet gear 245 will rotate one-fourteenth (1/14) of a revolution three times during a single revolution of sprocket 255. Pattern drum 181 will thereby be indexed three times for each revolution of sprocket 255 and since there is a six-to-one speed reduction between main shaft 36 and sprocket 255, pattern drum 181 will index upon every two revolutions of main shaft 36. Therefore, there will be two stitches inserted between each indexing movement of pattern drum 181.

It should be readily understood that if there is a single cam 256 on hub 255*a* of sprocket 255 there would be six stitches inserted between indexing movements of pattern drum 181. If there were two cams 256 thereon, there would be three stitches inserted between each indexing movement of pattern drum 181 and, if there were six cams 256, the pattern drum 181 would be indexed

into the end opening of groove 312. As the plate 294 rotates under force of cam surface 314b on the roller 295, the rotation continues until the next trailing roller 295 comes in contact with the outer surface of body portion 310 (FIGURE 14). When this occurs, further rotation of indexing plate 294 is prevented and the roller 295 being engaged cooperates with cam surface 314b to cam the actuator block 314 inwardly sufficiently to let the same pass by the roller 295. A positive indexing of plate 294 is thereby achieved with further indexing being prevented and with no possibility of a backward indexing of plate 294 and with no possibility of the actuating block 314 moving past the roller 295 without indexing plate 294.

As the plate 294 indexes, shaft 240' is rotated thereby which rotates pattern drum 181 one-fourteenth (1/14) of a revolution to move the next successive row of lugs 192 thereon into overlying relation to the bank of needle bars 50 in like manner to the previously described indexing mechanism.

Operation

In operation, main shaft 36 is rotated by main driving pulley 26 (FIGURE 2) through pulleys 33, 35 and belt 34. As main shaft 36 rotates, crank member 214 (FIGURE 1) is rotated therewith which vertically reciprocates connecting link 212 which in turn vertically reciprocates connecting rod 210. As rod 210 reciprocates, it reciprocates drive rods 200 in bearings 201, 202 which reciprocates shaft 182 through hanger members 196.

On the downward stroke, shaft 182 moves pattern drum 181 including any lugs 192 carried by the respective lug mounting member 190 disposed in overlying relation to needle bars 50 into engagement with the upper ends of needle bars 50 disposed therebeneath to move needles 64 into penetrating engagement with the base fabric. Needles 64 carry threads T downwardly through the fabric and loopers 73 catch the stitch loops and hold the same as needles 64 are moved upwardly by lifter bar 217. To effect this upward movement of needles 64, lifter bar 217 is moved upwardly into engagement with projecting fingers 60 on needle bars 50 by lifter arms 216 as shaft 182 moves upwardly in the upward stroke of its reciprocation. Loopers 73 are moved into position to catch the stitch loops and are then moved to draw the stitch loops and to position the same for severing upon rotation of main shaft 36 by eccentric 101 and strap 102 through connecting rod 96, crank 90, rock shaft 77 and spaced cranks 76. Knives 80 cooperate with loopers 73 to sever the stitch loops held thereby and are moved into severing position in timed relation to the movement of loopers 73 by crank 87, connecting link 85 and shaft 82 on which knife mounting member 81 is mounted.

The base fabric is fed beneath needles 65 and above loopers 73 and knives 80 in a step by step manner by feed dogs 104 (FIGURE 3). The positive feeding and retracting strokes are imparted to feed dogs 104 upon rotation of main shaft 36 by eccentric 132 (FIGURE 2) and strap 131 through connecting rod 127, crank 121, rock shaft 110, crank 107 and shaft 108 (FIGURE 3). Feed dogs 104 are lifted upwardly into engagement with the fabric and moved downwardly out of engagement therewith by eccentric 145 and strap 144 through connecting rod 142, crank 134, rock shaft 116 and cranks 115.

Indexing drive sprocket 255 is driven from main shaft 36 by sprocket 283, chain 282 and sprocket 281 which drives shaft 280 which in turn drives sprocket 265 and chain 265. As stated above, sprocket 255 rotates one time for each six revolutions of main shaft 36. As the same rotates, cams 256 rotate therewith and cam portions 256a engage cam follower portion 252b on pawl 252 and move the hook 252a thereon out of holding engagement to the tooth on ratchet gear 245. Ratchet gear 245 is then rotated one-fourteenth (1/14) of a revolution by sprocket 255 through friction disc 260. It is noted that each cam portion 256a only remains in engagement with cam follower portion 252b of pawl 252 for a length of time required for one tooth to move past hook 252a and then spring 253 moves pawl 252 into catching engagement with the next successive tooth of ratchet gear 245.

As ratchet gear 245 rotates, the same rotates shaft 240 which in turn rotates sprocket 222. Sprocket 222 drives chain 221 which rotates sprocket 220 mounted on shaft 182. As stated above, sprockets 220 and 222 are of the same size and therefore, shaft 182 rotates the same increment of rotation as shaft 240. Therefore, pattern drum 181 is rotated one-fourteenth (1/14) of a revolution for each cam 256. The next successive lug mounting member 190 and lugs 192 carried thereby is thereby moved into operative position in overlying relation to the upper ends of needle bars 50.

The operation of the indexing mechanism shown in FIGURES 9–14 will now be described. Indexing drive member 300 is rotated in a four-to-one speed reduction from main shaft 36 through chain 282', sprocket 281', shaft 380', sprocket 266, chain 265' and sprocket 305 mounted on shaft 301. As indexing drive member 300 rotates, actuating blocks 314 rotate therewith and successively engage one of the rollers 295 on indexing plate 294. Rollers 295 engaged by actuating blocks 314 cam the respective actuating blocks 314 inwardly against the action of spring 316 which allows the roller 295 to move partially into the end opening of groove 312 to allow indexing plate 294 to rotate. When the roller 295 is not positioned in the mouth of groove 312, plate 294 is held against rotation by two rollers 295 thereon disposed in engagement with the convex outer surface of body portion 310 of member 300.

Upon continued rotation of drive member 300, the cam surface 314b on actuating block 314 exerts a force on the roller 295 tangentially to indexing plate 294 to rotate the plate until the next successive roller 295 thereon engages the outer surface of body portion 310. Further rotation of indexing plate 294 is thereby prevented and the roller 295 being engaged by actuating block 314 cams the actuating block further inwardly against the action of spring 316 to allow the actuating block to pass thereby.

As plate 294 is circularly indexed, shaft 240' is likewise circularly indexed which rotates sprocket 222' a fraction of a revolution. Sprocket 222' circularly indexes pattern drum 181 a corresponding fraction of a revolution to move the next successive lug mounting member 190 and lugs 192 carried thereby into overlying relation to needle bars 50.

It will therefore be apparent that a novel tufting machine is provided wherein a vertically reciprocable pattern mechanism is movable into engagement with individually operable needle bars for reciprocating the needle bars downwardly to move the needles carried thereby into penetrating engagement with the fabric. There is also provided a positive lifting mechanism carried by the pattern mechanism which positively lifts the needle bars upwardly moving the needles out of penetrating engagement with the fabric. Still further, there is provided a novel indexing mechanism for indexing circularly the pattern mechanism to effect a predetermined pattern of tufting stitches upon the base fabric which indexing mechanism is positively driven and is held against further indexing or backward indexing.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only, and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. A machine for tufting a textile web comprising

(a) a bank of independently operable, elongate needle

bars mounted for longitudinal reciprocatory movement between operative and inoperative positions,

(*b*) a needle carried by one end of each of said needle bars for movement therewith and being adapted to penetrate a textile web to insert tufting stitches therein as said needle bars move to the operative position,

(*c*) a rotatable pattern drum positioned adjacent said bank of needle bars and having its axis disposed parallel to said bank of needle bars and being mounted for reciprocation in the same direction as said needle bars, said pattern drum having a plurality of rows of needle bar engaging means spaced equidistantly around the periphery thereof and each being of a length corresponding to the length of said bank of needle bars for engaging selected ones of said needle bars to impart movement thereto toward the operative position at said pattern means reciprocates in one direction,

(*d*) means operatively connected to said pattern drum for indexing the same to successively position said rows of needle bar engaging means relative to said needle bars for movement of the needle bars thereby.

2. The structure set forth in claim 1 wherein each of said rows of needle bar engaging means comprises radially arranged lugs corresponding in number to the selected needle bars to be reciprocated thereby.

3. A machine for tufting a textile web, said tufting machine comprising

(*a*) a bank of independently operable, vertically disposed needle bars mounted for vertical reciprocatory movement between an upper, inoperative position and a lower, operative position,

(*b*) a needle carried by the lower end of each of said needle bars for movement therewith and being adapted to penetrate the textile web to insert tufting stitches therein as said needle bars move downwardly,

(*c*) a rotatable pattern drum mounted adjacent said needle bars for vertical reciprocation and having a plurality of equidistantly spaced rows of varyingly arranged needle bar engaging means for engaging selected ones of said needle bars as said pattern drum moves downwardly, to thus impart downward movement to said selected needle bars to form the desired pattern, and

(*d*) means operatively connected to said pattern drum for indexing said pattern drum to successively position said rows of needle bar engaging means relative to said needle bars for movement of the needle bars thereby.

4. The structure set forth in claim 3 wherein said pattern drum comprises a hub, a plurality of elongate bars removably mounted on said hub at points spaced equidistant therearound and each having a length corresponding to the length of said bank of needle bars, and lugs removably mounted on said bars and extending laterally outwardly therefrom, said lugs on each bar corresponding in number to the selected needle bars to be moved thereby.

5. The structure set forth in claim 4 wherein said lugs include needle bar engaging portions constructed of a wear resistant and noise dampening resin impregnated fibrous material.

6. A machine for tufting a textile web, said tufting machine comprising

(*a*) a bank of independently operable, vertically disposed needle bars mounted for vertical reciprocatory movement between an upper, inoperative position and a lower, operative position,

(*b*) a needle carried by the lower end of each of said needle bars for movement therewith and adapted to penetrate the textile web to insert tufting stitches therein as said needle bars move downwardly to the lower position,

(*c*) a rotatable pattern drum mounted for vertical reciprocation between a first position wherein the same is disposed above the upper ends of said needle bars and a second position spaced downwardly from said first position, said pattern drum having a plurality of elongate bars spaced equidistant therearound and a plurality of elongate lugs mounted on each of said bars and extending laterally outwardly therefrom such that the same are radially disposed relative to the pattern drum axis, said lugs on each of said bars corresponding in number to selected ones of said needle bars to be reciprocated thereby,

(*d*) lifting means connected to and movable with said pattern drum and engagable with said needle bars as said pattern drum moves upwardly for positively moving said needle bars upwardly to the upper, inoperative position, and

(*e*) indexing means operatively connected to said pattern drum for indexing said pattern drum to successively position said bars and lugs carried thereby in overlying relation to the upper ends of said needle bars.

7. A machine for tufting a textile web, said tufting machine comprising

(*a*) a bank of vertically disposed needle bars,

(*b*) means mounting said needle bars for independent vertical reciprocatory movement between an upper, inoperative position and a lower, operative position,

(*c*) a needle carried by the lower end of each of said needle bars for movement therewith and being adapted to penetrate the textile web to insert tufting stitches therein as said needle bars move downwardly,

(*d*) a rotatable pattern drum mounted in overlying relation to said needle bars for vertical reciprocation and having a plurality of equidistantly spaced rows of varyingly arranged needle bar engaging means for engaging selected ones of said needle bars as said pattern drum moves downwardly to thus impart downward movement to the selected needle bars to form the desired pattern,

(*e*) resilient means operatively connected to each of said needle bars for normally maintaining the needle bars in the upper, inoperative position, and

(*f*) means operatively connected to said pattern drum for indexing said pattern drum to successively position said rows or needle bar engaging means relative to said needle bars for movement of said needle bars thereby.

8. The structure set forth in claim 7 wherein each of said needle bars has a finger projecting laterally outwardly therefrom and each of said resilient means comprises a spring connected at its lower end to said projecting finger and at its upper end to said needle bar mounting means for biasing each of said needle bars toward the upper, inoperative position.

9. The structure set forth in claim 8 including lifting means carried by and movable with said pattern drum and engageable with said projecting fingers on said needle bars as said pattern drum moves upwardly to positively move said needle bars from the lower, operative position to the upper, inoperative position.

10. A machine for tufting a textile web, said tufting machine comprising

(*a*) a bank of independently operable, vertically disposed needle bars mounted for vertical reciprocatory movement between an upper inoperative position and a lower operative position,

(*b*) a needle carried by the lower end of each of said needle bars for movement therewith and being adapted to penetrate the textile web to insert tufting

stitches therein as said needle bars move downwardly to the lower position,

(*c*) a rotatable pattern drum mounted adjacent said needle bars for vertical reciprocation and having a plurality of rows of needle bar engaging means spaced equidistant around the periphery thereof such that the rows are spaced the same angular distance apart around the axis of said pattern drum, said needle bar engaging means being engageable with selected ones of said needle bars as said pattern drum moves downwardly to thus impart downward movement to the selected needle bars,

(*d*) means operatively connected to said pattern drum for indexing the same to successively position said rows of needle bar engaging means relative to said needle bars, and

(*e*) main drive means operatively connected to said pattern drum for vertically reciprocating the same and being operatively connected to said indexing means for operating the same in timed relation to the reciprocation of said pattern drum.

11. The structure set forth in claim 10 wherein said indexing means comprises second drive means operatively connected to said main drive means for rotation thereby, rotatable means operatively connected to said pattern drum, and means carried by said second drive means and engageable with said rotatable means for intermittently rotating said rotatable means for a fraction of a revolution corresponding to the angular distance between said rows of needle bar engaging means on said pattern drum to thereby rotate said pattern drum in a step-by-step manner to successively position the rows of needle bar engaging means relative to said needle bars.

12. The structure set forth in claim 10, wherein said indexing means comprises a rotatable drive sprocket operatively connected to said main drive means for rotation in timed relation to the reciprocation of said pattern means, a ratchet gear rotatably mounted adjacent to said drive sprocket and having teeth thereon corresponding in number to the number of rows of needle bar engaging means on said pattern drum, a pawl pivotally mounted adjacent said ratchet gear and including a hook normally disposed in holding relation to one of the teeth of said ratchet gear to prevent rotation of said ratchet gear, cam means carried by said drive sprocket and engageable with said pawl for moving the hook thereof out of holding engagement with the tooth of said ratchet gear, said cam means moving out of engagement with said pawl to permit said pawl to return into holding engagement with the next successive tooth on said ratchet gear, frictional means positioned between and in engagement with said drive sprocket and said ratchet gear for intermittently rotating said ratchet gear when said pawl is moved out of holding engagement with the teeth of said ratchet gear, and means connecting said ratchet gear to said pattern drum to thereby rotate said pattern drum in a step-by-step manner to successively position the rows of needle bar engaging means relative to said needle bars.

13. The structure set forth in claim 10 wherein said indexing means comprises a rotatably mounted drive member, means connecting said drive member to said main drive means for rotating said drive member in timed relation to the reciprocation of said pattern means, a plate mounted adjacent said drive member for rotation in a plane parallel to the plane of rotation of said drive member, a plurality of rollers mounted on said plate parallel to and spaced radially outwardly from the axis of rotation of said plate and extending laterally outwardly from one face of said plate toward the plane of rotation of said drive member, means carried by said drive member and successively engageable with said rollers for intermittently rotating said plate a fraction of a revolution corresponding to the angular distance between said rows of needle bar engaging means on said pattern drum, and means connecting said plate to said pattern drum to thereby rotate said pattern drum in a step-by-step manner to successively position the rows of needle bar engaging means relative to said needle bars.

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JORDAN FRANKLIN, *Primary Examiner.*

DAVID J. WILLIAMOWSKY, *Examiner.*