May 28, 1968 K. SCHLEGEL 3,385,246

QUILTING MACHINES

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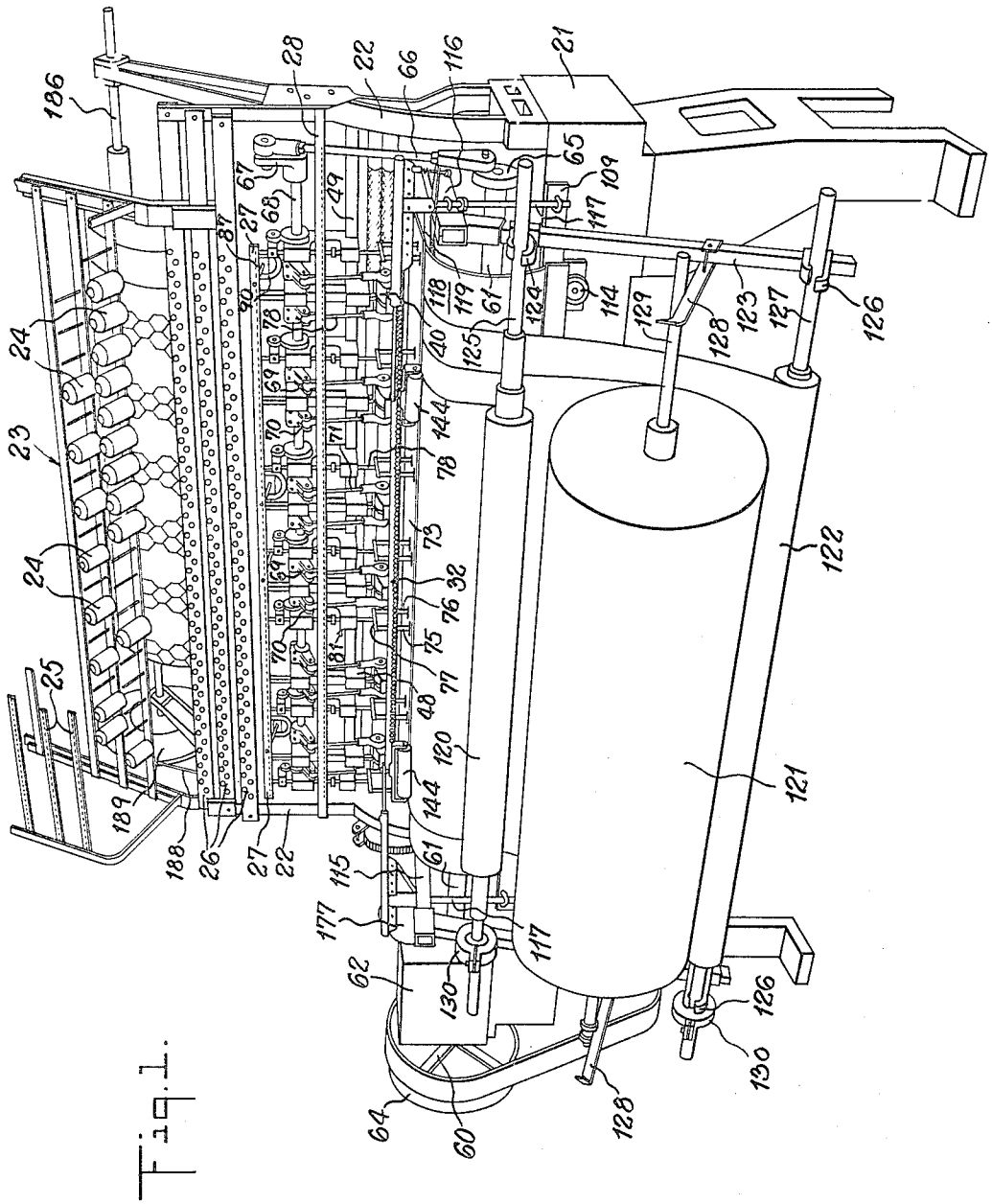

Fig. 1.

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QUILTING MACHINES

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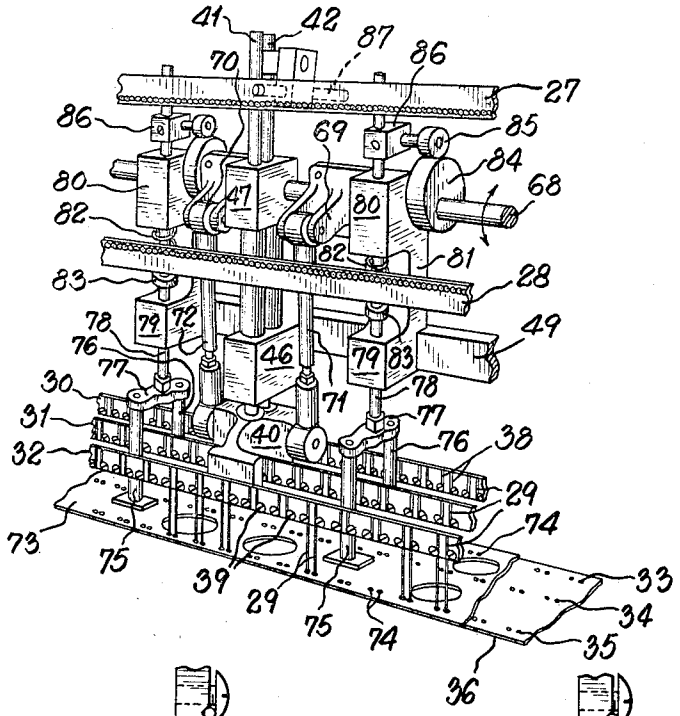
Fig. 2.



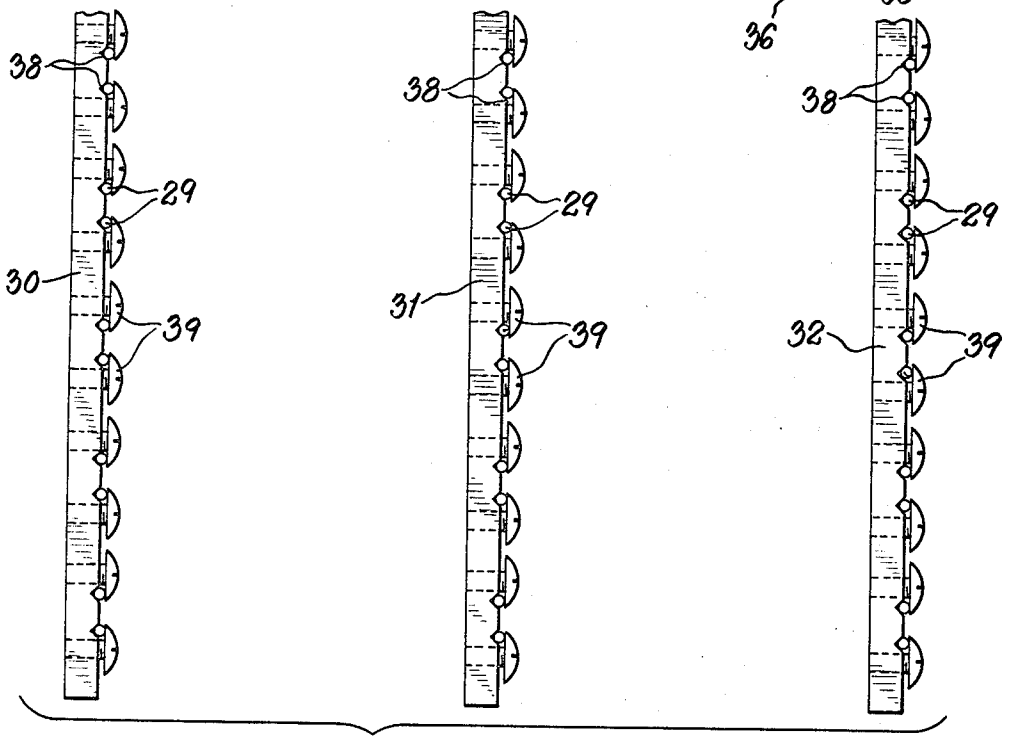


Fig. 3.

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QUILTING MACHINES

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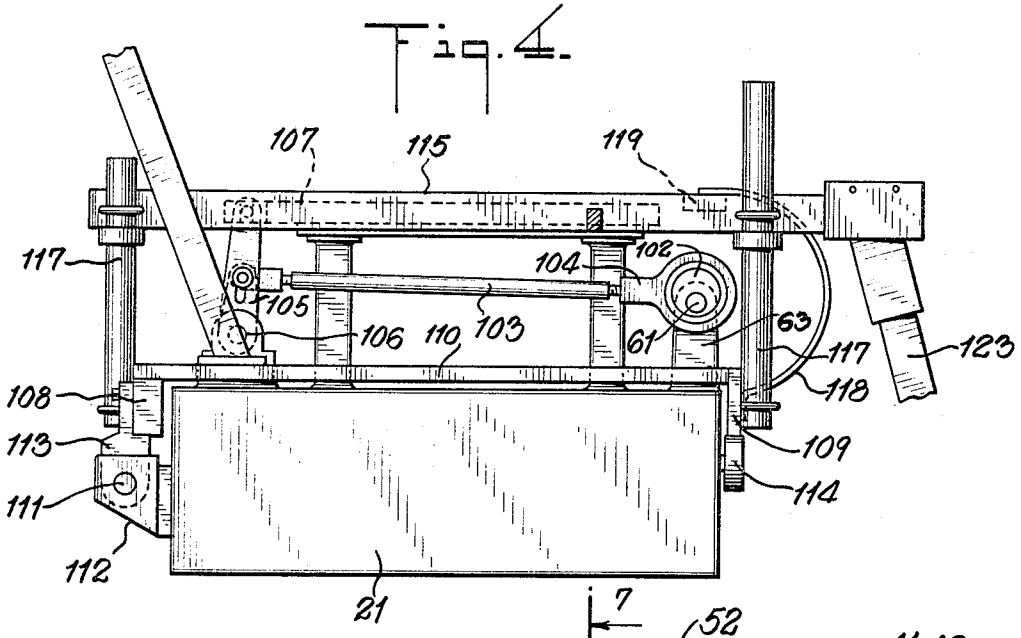
Fig. 4.



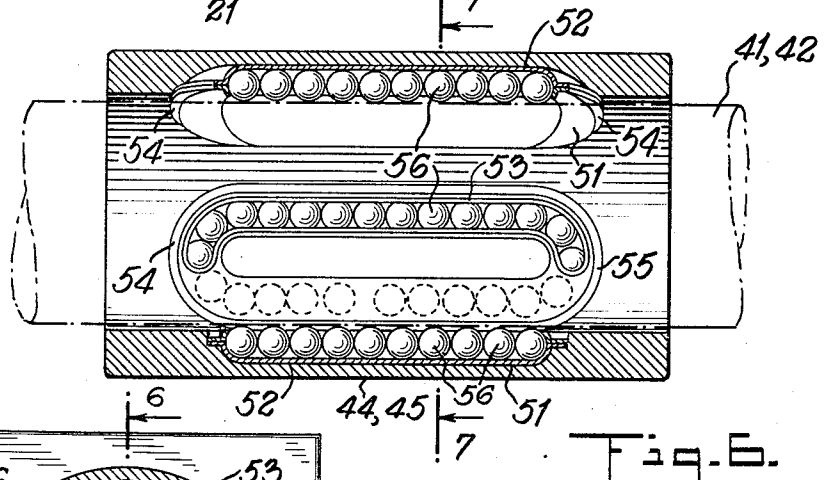


Fig. 6.

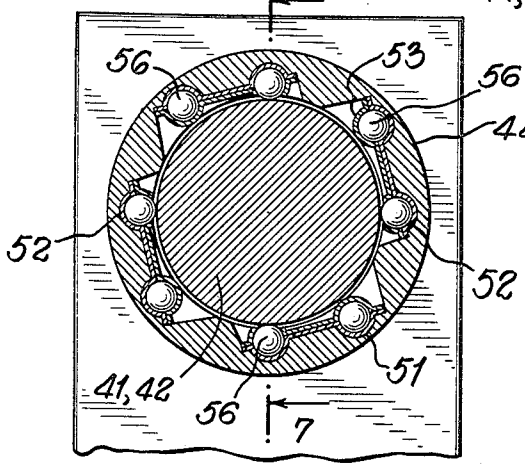


Fig. 7.

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QUILTING MACHINES

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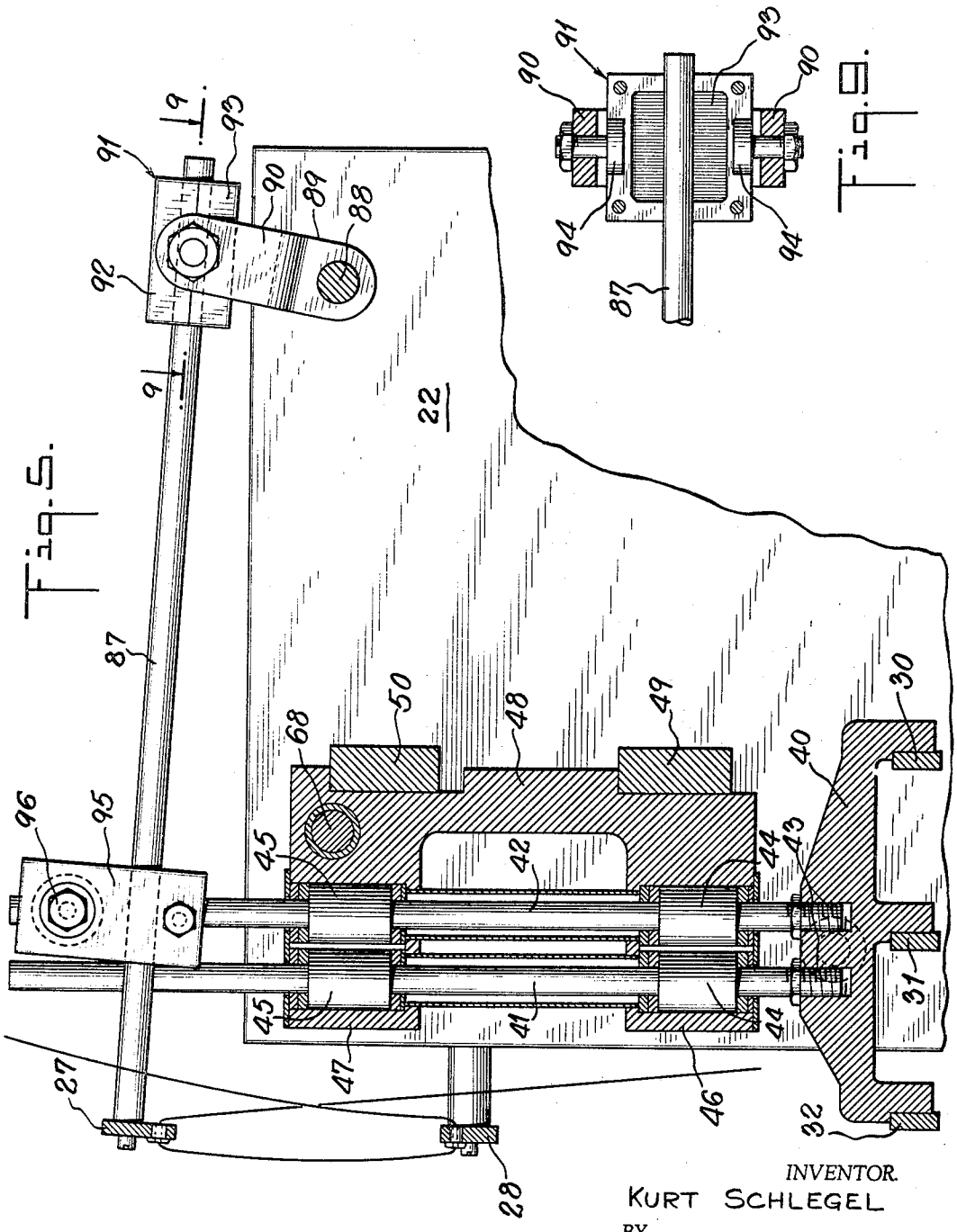

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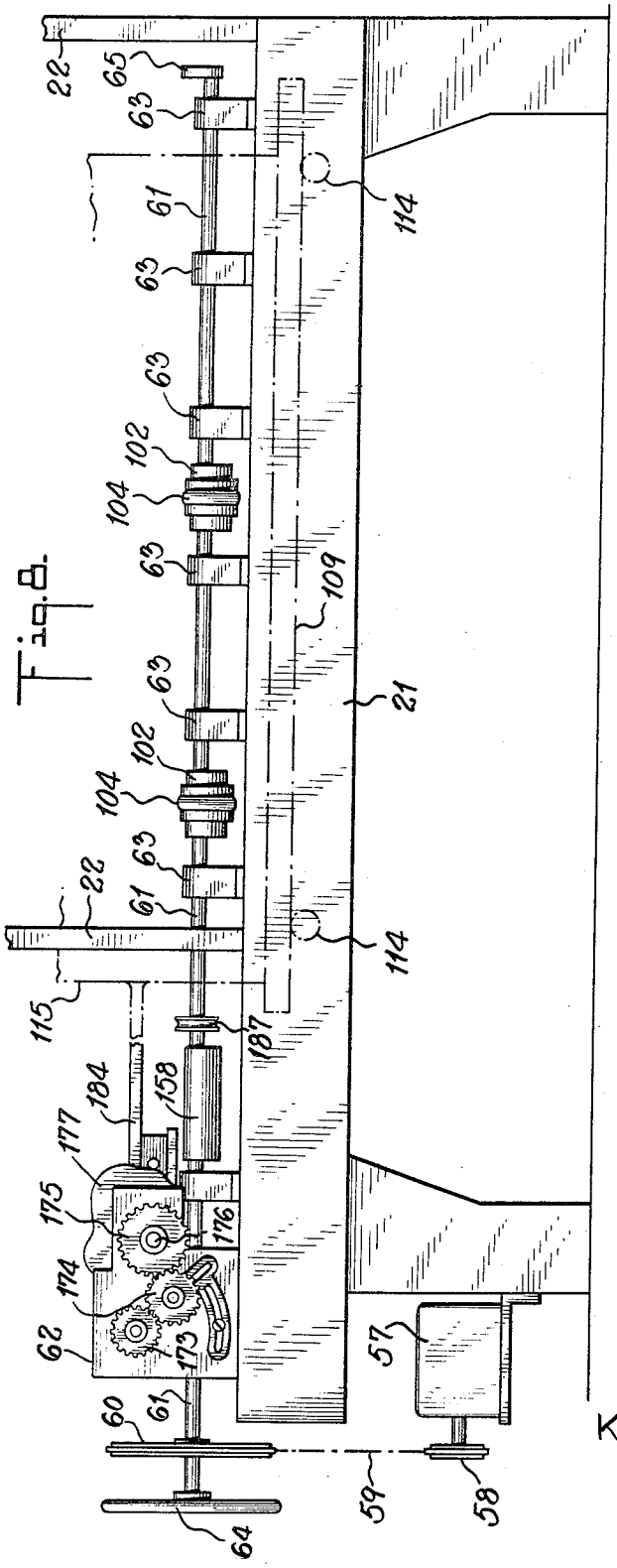

Fig. 8.

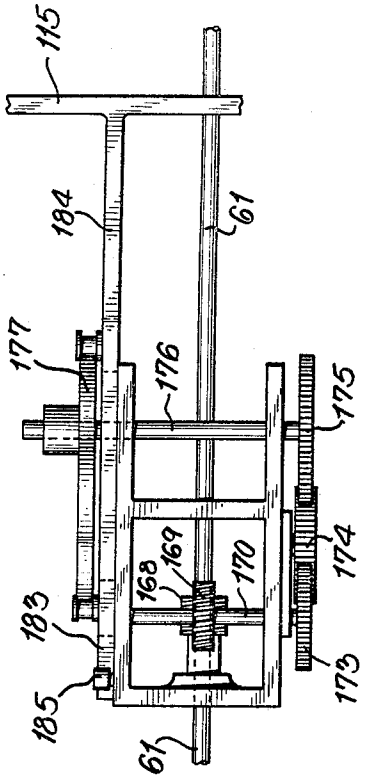

Fig. 18.

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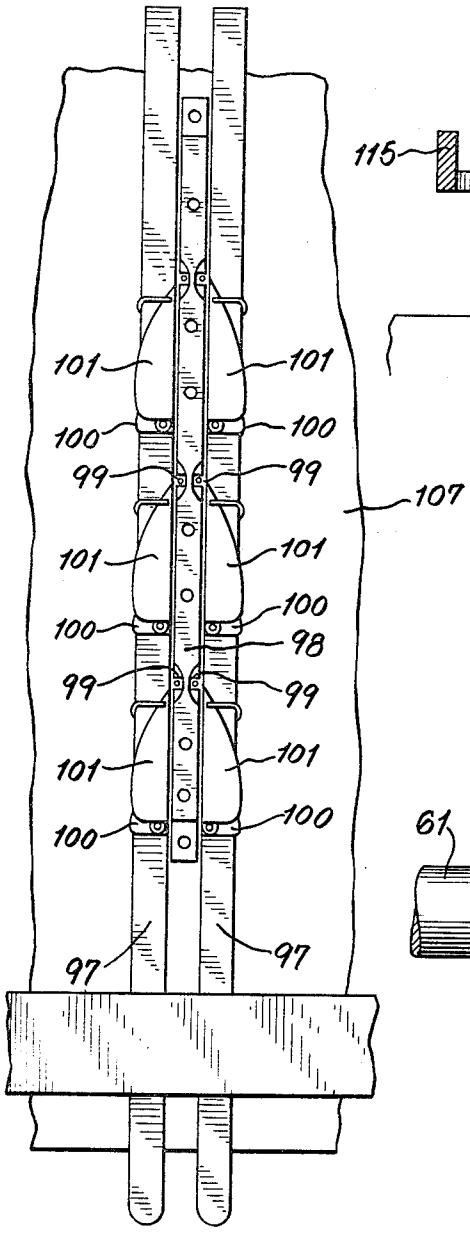
Fig. 10.



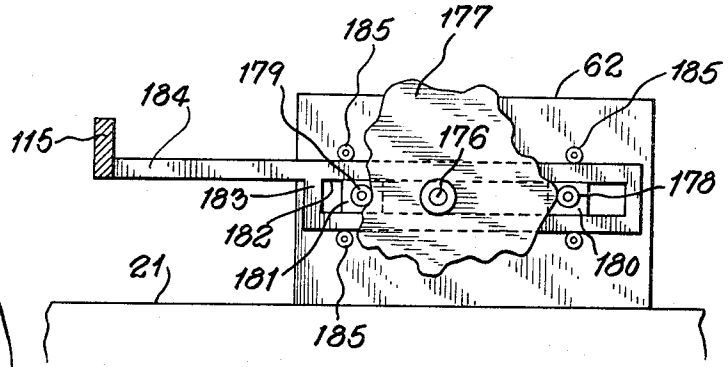


Fig. 20.

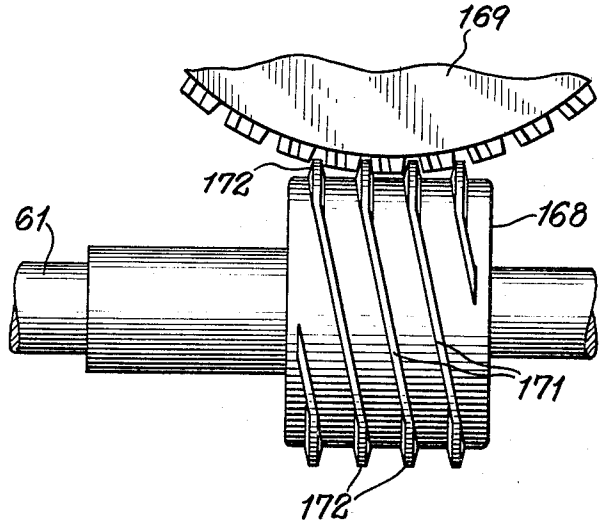


Fig. 18.

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QUILTING MACHINES

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Fig. 11.

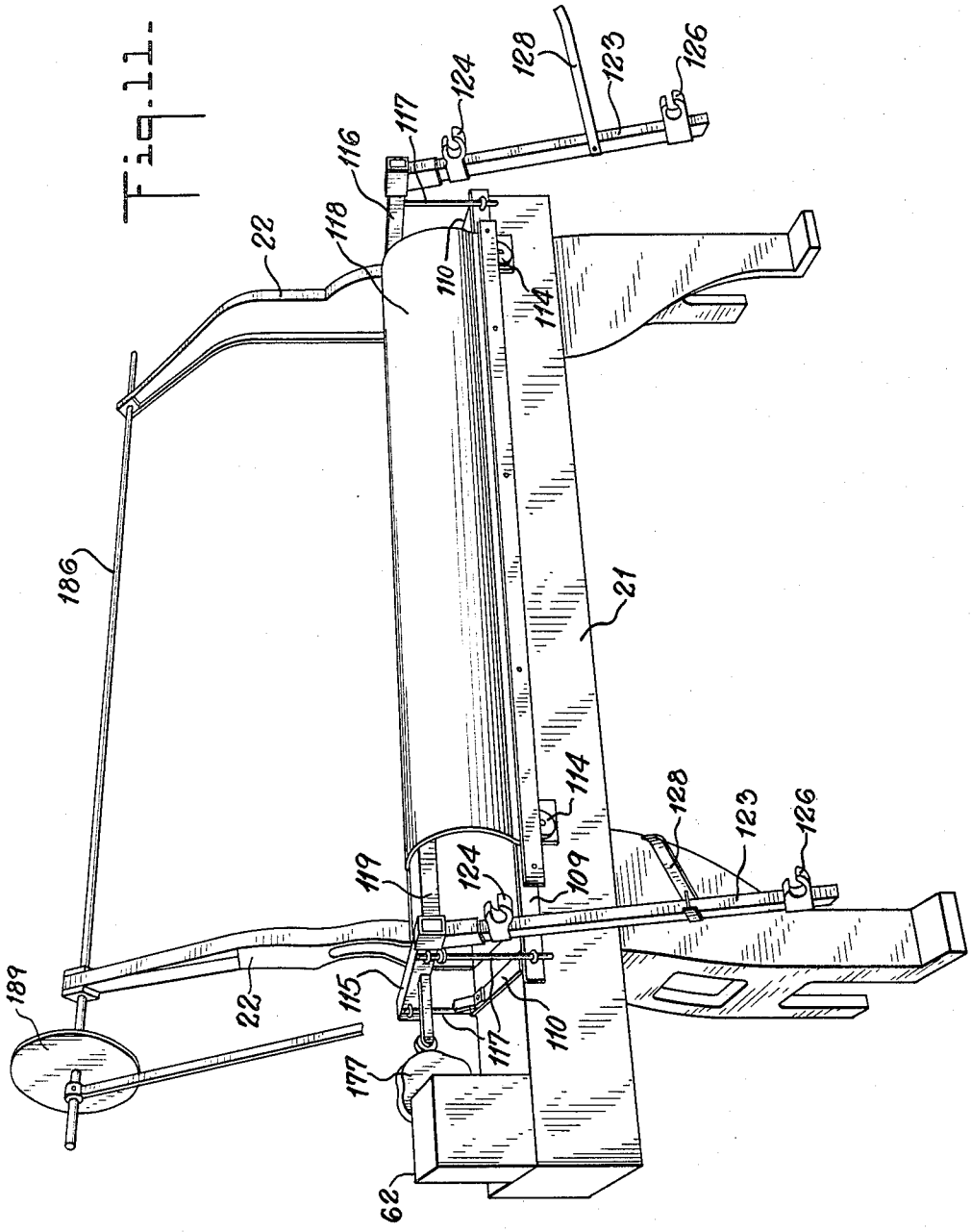

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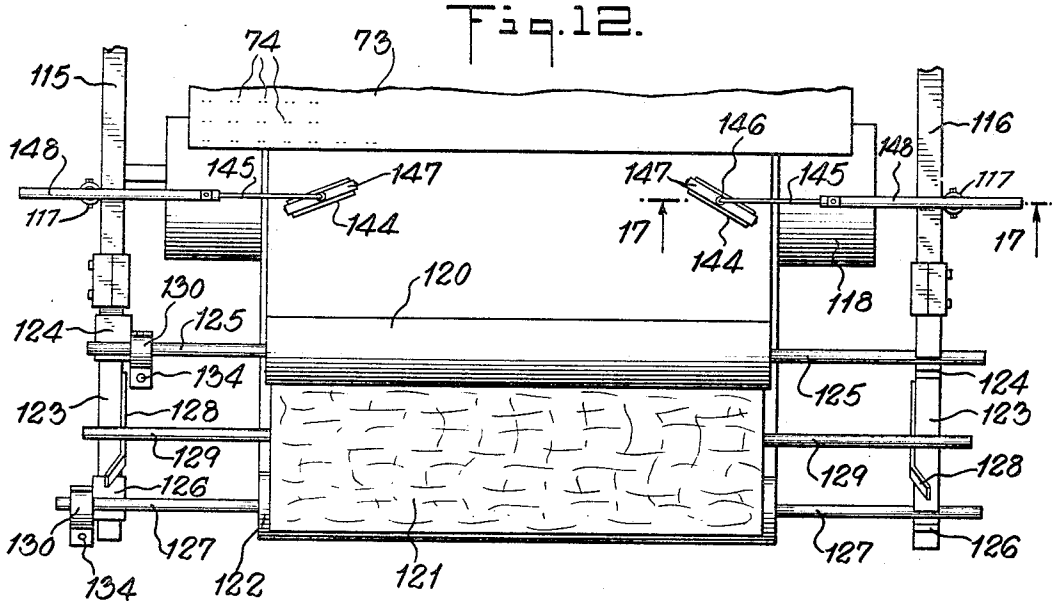
Fig. 12.



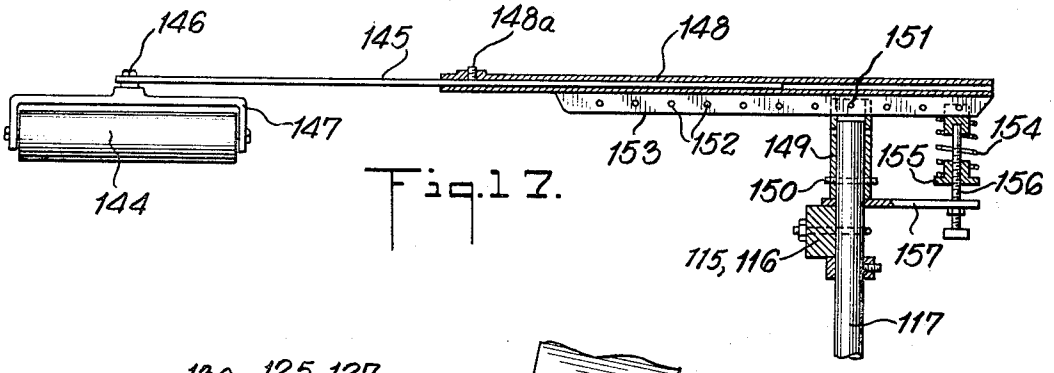


Fig. 17.

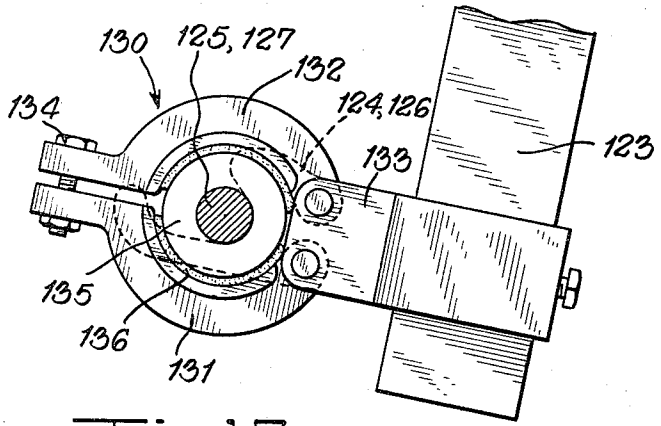


Fig. 13.

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Fig. 14.

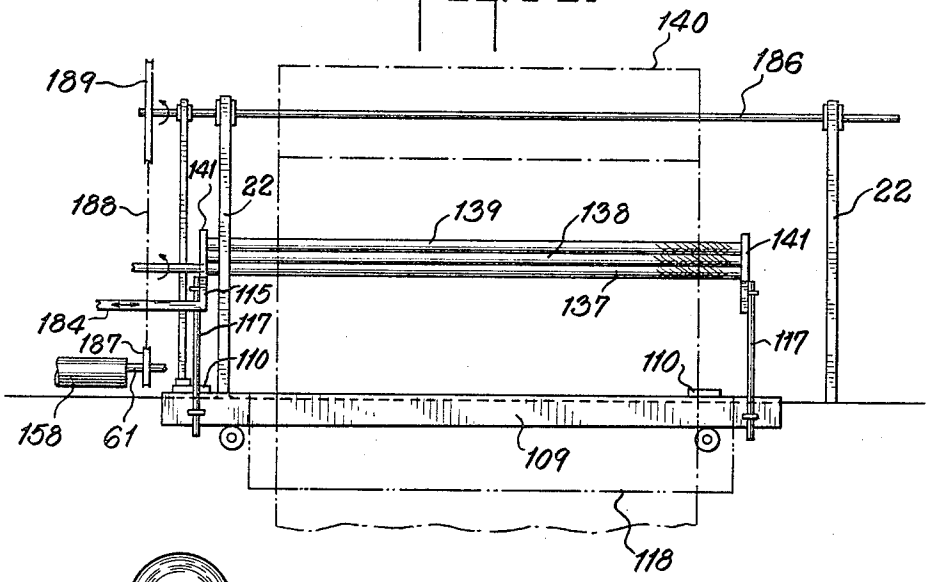


Fig. 15.

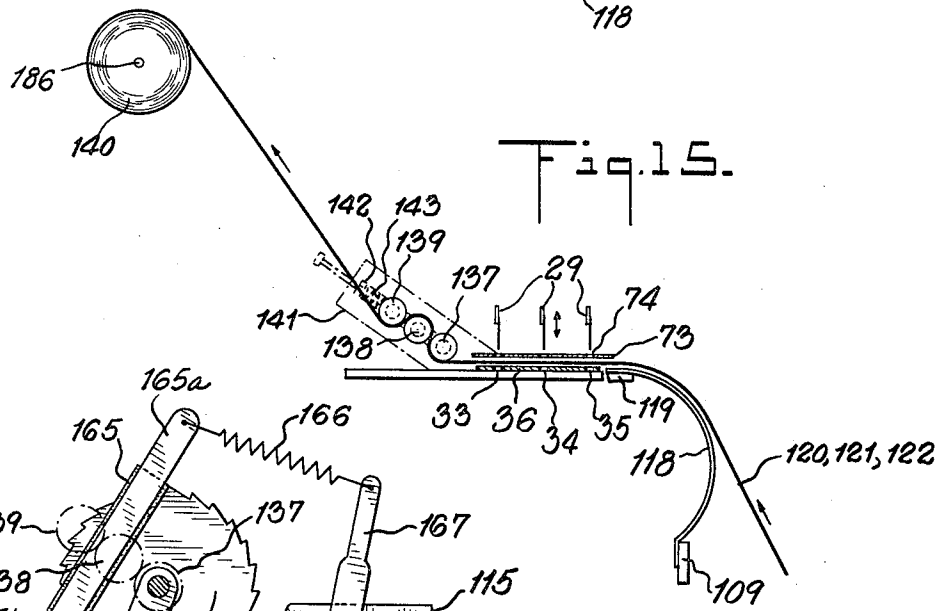
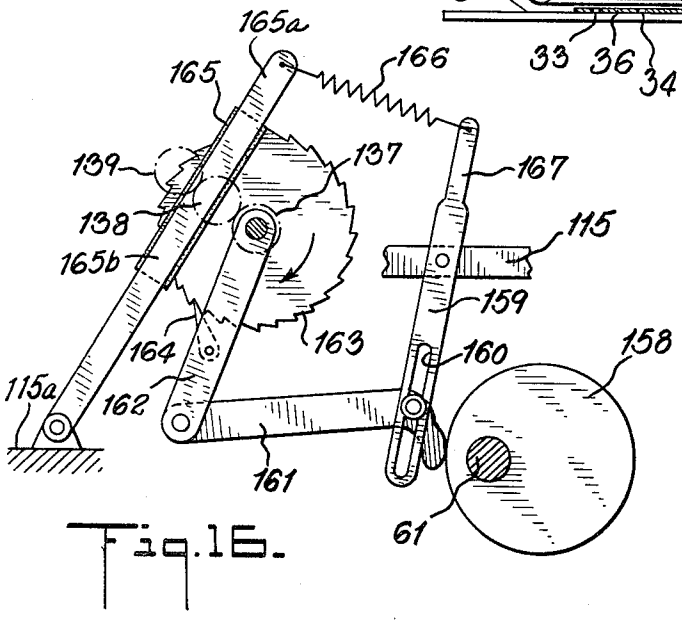


Fig. 16.



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United States Patent Office 3,385,246
Patented May 28, 1968

3,385,246

QUILTING MACHINES

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(% Edgewater Machine Co., College Point, N.Y. 11356)

Filed Aug. 19, 1963, Ser. No. 302,801
25 Claims. (Cl. 112—118)

My present invention relates to quilting machines to stitch together an assembly of quilting fabrics and a filler in a pattern of stitches distributed throughout the area of the assembly. The assembly of quilting elements comprises a filler or mat of loosely assembled fibres or similar resilient material and a sheet of woven fabric on each face of the filler. The filler is generally of loosely matted fibres, or in some cases may be a flat mass of down or feathers, which would shift if not confined to small areas of the assembly by the stitching. One purpose of the stitching is to produce such areas between lines of stitching. Another purpose is to produce a pleasing pattern in the quilted product.

In the quilting operation the woven fabrics are drawn from supply rolls while the filler is drawn from a supply roll between the fabrics to form an assembly of filler sandwiched between an upper and a lower fabric. The assembly is then passed through the stitching mechanism by means of drawing rolls and then passes to a take-up roll.

The stitching mechanism is a stationary unit comprising a stitching plate over which the fabric is drawn and having a series of holes spaced transversely of the direction of movement of the fabric through which the needles may pass downwardly to shuttles, one for each hole and needle, placed beneath the needle plate. A series of needles is positioned vertically above each needle hole and is supported as a unit by means of a needle bar extending transversely of the direction of movement of the quilting assembly. Stitches are made by a downward movement of the needle bar to thrust the pointed ends of the needles below the needle plate and by an upward movement of the needle bar to withdraw them sufficiently to form loops in the thread below the needle plate, through which the shuttles pass and the needles are then further withdrawn to form the stitches. During the stitching operation a presser plate is lowered onto the fabric on the needle plate to hold it in place and a length of thread is drawn through a tensioning means to form a slack length for the next stitch. During the making of each set of stitches the quilting assembly is held stationary and after the completion of each stitching is advanced for the next stitching operation.

In stitching machines heretofore known it was possible to have a single line only of stitching for each path of the stitching and the number of paths of the stitching was limited.

In my present invention I provide means to mount a pair of needles closely spaced to form a double line of stitching for each stitching path or line in the design, thus providing a much stronger stitching of the assembly as well as enabling much more effective designs to be obtained on the finished quilting.

To accomplish this I provide mountings for pairs of twin needles on the needle bar and provide twin shuttles in the space normally required for one.

My invention also provides for three parallel needle bars and for replaceable cams to provide a wider range of transverse movement of the fabric holding and feed unit so that a greater variety of patterns may be obtained.

These improvements are made possible by novel mounting means and novel cam and other elements and a novel mode of action between these elements as will be shown in connection with the accompanying drawings.

In these drawings:

FIG. 1 is a perspective front view of a quilting machine embodying my invention,

FIG. 2 is a perspective front view of the needle bars and presser plate and the mechanisms for operating them,

FIG. 3 is a plan view of an assembly of needle bars,

FIG. 4 is a vertical section through the shuttle operating mechanism,

FIG. 5 is a vertical section through the mounting and operating mechanism for the needle bars,

FIG. 6 is a longitudinal section of a bearing for the needle bar supporting rods,

FIG. 7 is a cross section through the bearing shown in FIG. 6 taken on the line 7—7 of FIG. 6,

FIG. 8 is an elevation of the driving means for the stitching and fabric moving means,

FIG. 9 is a detail section of a part of the means for supplying thread from the tensioning means to the needles,

FIG. 10 is a plan view of the shuttle mounting means and shuttles,

FIG. 11 is a perspective front view of the supporting means for the fabric moving elements,

FIG. 12 is a plan view of a portion of the fabric moving means,

FIG. 13 is a detail of an element of the fabric moving means,

FIG. 14 is an elevation of elements of the fabric moving means,

FIG. 15 is a vertical section of elements of the fabric moving unit,

FIG. 16 is an end elevation of the driving means for the fabric,

FIG. 17 is a front elevation of means for holding taut the quilting assembly as it passes to the needles,

FIG. 18 is a plan view of a cam and associated elements for shifting the fabric moving unit,

FIG. 19 is a view of a worm drive for providing an intermittent advance of the quilting assembly,

FIG. 20 is an elevation of a cam and cam follower for shifting the fabric moving unit.

Stitching unit

Referring to FIG. 1 of the drawings, the elements of the stitching unit are mounted on a table **21**. A pair of supports **22**, one at each end of the table, extend upwardly from the top of the table and carry a rack **23** for a number of spools **24** of thread. Above this rack a frame **25** having thread guiding eyelets and below the spools a tensioning unit **26** for tensioning the thread passing to the needles are mounted. In the specific example shown there are three banks of spool holding elements and correspondingly three banks of guiding eyelets and three banks of tensioning elements. In addition, a vertically movable eyelet bar **27** is provided and also a fixed eyelet bar **28** to guide the threads from moving parts of the unit and direct them to their respective needles, these additional eyelet bars being secured to the supports **22** or to elements secured thereto, such as one of the tensioning banks.

As shown in FIGS. 2 and 3 of the drawings, needles **29** are mounted vertically in pairs spaced along three needle bars **30**, **31** and **32** immediately above holes **33**, **34**, and **35** in a horizontal needle plate **36** mounted above the upper surface of the table by a supporting structure, not shown. The needle plate may be continuous or made in sections with the needle holes aligned with the needles.

As shown in FIG. 3, a vertical face of each needle bar **30**, **31**, **32**, is provided with spaced vertical grooves **38** each to receive and hold a needle **29** vertically and screws **39** are provided to clamp the needles in their respective grooves. The grooves are spaced in closely spaced pairs with wider spaces between the pairs.

As shown in FIGS. 1, 2 and 5, the three needle bars **30**, **31** and **32** are mounted in a series of yokes **40** spaced at intervals along the needle bars. In the operation of the apparatus an imbalance may be imposed on the yokes due to forces acting on the needles of the several bars which may act to deflect needles out of alignment with the respective holes in the needle plate and thereby injure the needles thus affected and cause a shut-down of the apparatus. To insure against this, the several yokes are supported in their vertical movements by a pair of vertical guiding and supporting rods **41** and **42**, FIG. 5, which are rigidly secured at their lower ends in the yokes by a screw-thread engagement shown at **43**, and extend upwardly parallel to each other in a plane at right angles to the needle bars. These rods **41** and **42** extend through, and are slidable vertically in bearings **44** and **45** spaced vertically and rigidly mounted in arms **46** and **47** of a bracket **48** which is rigidly secured to vertically spaced, horizontal bars **49** and **50** rigidly secured to the uprights **22**.

The bearings **44** and **45** are of the frictionless type shown in FIGS. 6 and 7. In this type of bearing a number of raceways **51**, four in the example shown in FIGS. 6 and 7 are mounted in the bearings **44**, **45** symmetrically about the rods **37** and **38**. Each raceway has a channel **52** extending lengthwise of the rod **41** or **42** and open to the rod, a channel **53** closed to the rod and semicircular ends **54** connecting the channels **52** and **53**. Balls **56** fill these channels so that they may run in a circuit through channel **52** between the rod **41** or **42** about the ends **54** and **55** and through the channel **53** in one direction or the other as the rods **41** and **42** move up or down. Thereby friction between the rods and the bearings is reduced to an insignificant amount and binding of the rods in the bearings is eliminated. By means of the double guide rods, aided by the sliding ball bearings, the needles in all of the bars are held in their correct positions with the greatest precision, thus avoiding injury to or breaking of the needles and resultant shut-downs.

The needles, as well as the other elements of the machine, are driven from a common power source through transmission elements which synchronize the movements of the elements of the stitching and fabric feed units. As shown at the left in FIG. 8, the power source is a motor **57** mounted on the table which is connected by means of a pulley **58** on the shaft of the motor and a belt **59** to a pulley **60** fixed on a shaft **61** extending through a gear box **62** to the right hand end of the table **21**. The shaft **61** is supported above the top of the table by bearings, six bearings **63** being used in the present machine. The shaft and bearings are below the needle plate as shown in FIGS. 1 and 4. A hand wheel **64**, shown in FIG. 8, is mounted on the shaft **61** so that the shaft may be rotated by hand in setting up the machine for a specific quilting pattern to observe the operation of the machine in slow motion before the motor is set into operation.

Fixed on the right hand end of the shaft **61** as viewed in FIGS. 1 and 8, is a crank arm **65** from which is taken power to operate the needles and associated elements. As shown in FIG. 1, the crank arm **65** is connected by a link **66** to a crank arm **67** fixed on a rock shaft **68** extending lengthwise of the table **21** above the needle bars **30–32** and yokes **40** and journaled in bearings in the brackets **48** as shown in FIG. 5. The effective lengths of the crank arms **65** and **67** are so proportioned that for each revolution of the shaft **61** and crank arm **65**, the crank arm **67** and rock shaft **68** are rotated through an arc and returned. The speed of rocking of the crank arm **67** and rock shaft **68** is not uniform throughout the arc but is most rapid between the ends of the arc to move the needle bars and needles quickly down and up through the fabric. As described later there is a dwell period at the upper and lower end points of the needle movement during which the fabric is advanced and shifted. During the return of the needles from their lowermost position loops are formed below the quilting assembly and the needle plate and the shuttles pass through the loops to complete the stitches.

As shown more particularly in FIGS. 1 and 2, a pair of crank arms **69** and **70** are fixed on the rock shaft **68** one on each side of each bracket **48**. Each pair of these crank arms is connected by links **71** and **72**, respectively, to one of the yokes **40** which carry the needle bars **30–32**. Inasmuch as the crank arms of each pair are attached at opposite ends of the yoke, the thrust and pull of the rods on the yoke are balanced, thus avoiding any stress that might tend to bend or tilt the yokes.

As shown in FIGS. 1 and 2, a presser plate **73** is provided to hold the quilting assembly firmly on the needle plate while the needles pierce the assembly of quilting elements and return to a position above the assembly and to rise from the assembly when the needles are withdrawn to permit the assembly to be shifted to a new position. The presser plate **73** is provided with holes **74**, one for each needle, through which the needles project during the stitching operation. The presser plate is preferably continuous from one end of the machine to the other.

As shown in FIGS. 1 and 2, the presser plate **73** is suspended at intervals spaced throughout its length by pairs of vertical rods **75** and **76** in planes at right angles to the needle bars secured at their lower ends to the presser plate and extending upwardly to a cross bar **77** which is, in turn, secured to the lower end of a vertical rod **78** which extends vertically upwardly through bearings in vertically spaced, horizontal, arms **79** and **80** of a bracket **81** mounted and secured on the horizontal bars **49** and **50** which as mentioned above and as shown in FIG. 5 also support the brackets **48**. Each rod **78** and the presser plate **73** is pressed downwardly onto the fabric assembly during the stitching operation by means of helical springs **82**, one for each rod **78** encircling its respective rod and confined between a collar **83** fixed on the rod and the upper arm **80** of the bracket. During the periods between two successive stitches, the rods **78** and presser plate **73** are lifted to permit shifting of the quilting assembly. This is accomplished for each rod by a cam **84**, FIG. 2, fixed on the rock shaft **68**, and a roller **85** resting on the cam surface and fixed by means of a block **86** to the rod **78**. The cam **84** is so positioned on the rock shaft **68** that it lifts the rods **78** at the time the needles are lifted free of the fabric, the presser, plate holding the fabric until this is done, and releases the rods to be pressed down by the springs **82** just before the needles pierce the quilting assembly. A series of single rods only is sufficient as the rods are not pressed down under power but only by the springs which exert only a relatively small downward pressure. There is no force to be overcome other than that of the springs on the upward movement of the rods.

With the formation of each stitch a small length of thread must be drawn through the individual tensioning elements of the tensioning unit **26**. After each needle has reached its lowermost point in forming a stitch and returns upwardly it must form a loop below the needle plate through which a shuttle may pass and after the shuttle has passed the thread must again be drawn taut to close the stitch and to permit the shuttle to return outside the loop. These thread control operations can not be accomplished by the needles and are accomplished by the movable eyelet bar **27**. As each needle bar moves downwardly the eyelet bar moves with it to provide a length of untensioned thread sufficient to extend with the point of the needle to its lowest point. Relieving the thread of tension at this time avoids any stress that might bend the needle. As the needle is withdrawn the eyelet bar **27** pauses until a loop of thread is formed below the needle plate through which the shuttle may pass and then, after the shuttle has passed through the loop, lifts to close the loop to lock the stitch and permit the shuttle to return outside the closed loop and also to take up any slack in the thread.

As shown in FIGS. 5 and 9, the horizontal eyelet bar **27** is mounted on the forward ends of rods **87** which extend rearwardly past and closely adjacent to the vertical guiding and supporting rods **41** and **42** of the needle bar yokes to a pivoting means. This pivoting means comprises a fixed supporting shaft **88** extending from the support **22** at one end of the table to the support at the other end and parallel to the rock shaft **68**. Rotatably mounted on the shaft **88** are yokes **89**, one for each rod **87**, each having a pair of arms **90** between which the rear end of a rod **87** extends and in which the rods are pivoted by means of a pivot block **91**. The block **91** is formed of an upper half **92** and a lower half **93** which are bolted together onto the rod **87** extending through it and which also form bearings for trunnions **94**, FIG. 9, extending inwardly from the yoke arms **90**. The rod thus pivots on the trunnions and on the shaft **88**. Each rod is also pivotally connected to the guide rod **42** by a pivot box **95** through which the rod extends and which, in turn, is pivoted on the rod **42** by a pivot pin **96** or other pivoting means.

In operation, threads taken from the tensioning elements of the unit **26** pass through eyelets in the fixed lower eyelet bar **28** and thence upwardly to the movable eyelet bar **27** and thence downwardly to the needles. In its upward movement, the bar **27** draws thread from the supply spools to make up the small amount used in a stitch, the tension imposed on the needle in its upward position being slight and causing no disadvantage at this point. Inasmuch as the length of the arm from the shaft **88** to the bar **27** is greater than that to the pivot box **95**, the eyelet bar moves at a greater speed and through a greater distance than the needle yoke and needle and therefore provides a slack in the thread at the needle point sufficient to cause a loop to be formed when the needle starts to rise from its lowermost position through which the shuttle may pass later to be closed as the needle and eyelet bar reach their uppermost positions.

As shown in FIG. 10, the shuttles are mounted on bars **97** in spaced parallel position immediately beneath the needle plate **36**. The bars **97** extend in the direction of travel of the quilting assembly and therefore at right angles to the main drive shaft. The bars are arranged in pairs and between each pair is a guide bar **98** having a pair of recesses **99** adjacent to the pointed ends of the needles to guide the loops formed by the thread as the needles begin their return stroke so that the loops will extend over the adjacent edge of the shuttle bars and beyond the pointed ends of the shuttles. On each bar are three pairs of shuttle baskets **100**, each to receive and hold a shuttle **101** so that its pointed end is just short of the loop to be thrown into its path. As soon as the loop begins to form, the bars are moved forwardly so that the point of the shuttle enters the loop and upon further movement, the shuttle passes through the loop, the thread slipping between the basket and the shuttle until the shuttle is clear of the loop whereupon the further upward movement of the needle draws the thread to close the loop and lock the stitch. Thereupon the shuttle bars and shuttles return to their original position in readiness for another stitch.

As shown in FIG. 10, the shuttles are arranged in pairs in complementary or mirror-image relation with a flat side face adjacent a needle. This special arrangement is necessary because of the close spacing of the twin needles and makes possible their close spacing for forming a double stitch.

The shuttle bars are moved longitudinally in timing with the other elements of the stitching unit. As shown in FIGS. 4 and 8, the shuttle bars and shuttles are driven from a pair of eccentrics **102** on the main drive shaft **61**, a pair of links **103** each having at one end a strap or collar **104** enclosing the eccentric and pivotally connected at its other end to a lever **105** which, in turn, is pivoted in a bearing **106** on the upper surface of the table and is connected at its other end to a sliding frame **107** carrying the shuttle bars.

As the shaft **61** and the eccentrics fixed thereon rotate, a reciprocating motion is transmitted to the frame and, with it, to the shuttle bars, there being one complete cycle of forward and reverse shifting of the shuttle bars for each rotation of the shaft. This movement of the cams and shuttle bars is in closely timed sequence with the other elements of the stitching unit and for this purpose the eccentric may be adjusted on the shaft to the angular position for proper timing. The shaft **61** extends unbroken through the eccentric.

Fabric feed unit

The fabric feed and shifting unit comprises means to feed the quilting assembly from supply rolls at the front of the machine rearwardly over the needle plate in a succession of interrupted advance movements between each stitch formation and to hold the fabric stationary during each stitch formation. This unit is also shifted transversely of the direction of feed during the forward feed of the quilting assembly in steps of variable length to produce a quilting pattern. For this transverse shifting, the unit comprises a carriage slidably mounted on the table and reciprocated transversely by an eccentric. The slidable carriage comprises a base frame shown in end view in FIG. 4 and in perspective in FIG. 11. This frame comprises a rear beam **108**, FIG. 4, extending lengthwise of the table at its rear, a front beam or rail **109**, FIG. 11, at the front side of the table parallel to the rear beam and connecting transverse bars **110**. The rear beam is slidably supported on the table by a rod **111** shown in end view in FIG. 4 secured to the table by a pair of brackets **112**, one at each end of the rod, and by a pair of brackets **113** secured to and depending from the beam **108** and slidable on the rod **111**. One of the brackets **113** as shown in FIG. 4 is at one end of the beam **108**, the other being at the opposite end of the beam. Instead of one rod extending from one end of the beam **108** to the other end, two short rods similarly secured to the beam near the opposite ends and of a length equal to the travel of the carriage may be employed. The front beam or rail **109**, FIGS. 4 and 11, is supported on a pair of wheels **114** of which one is shown in FIG. 4 and two in FIG. 11 each journaled on the front of the table.

As shown in FIGS. 1, 4 and 11, a superstructure for the fabric feed and shifting unit is mounted on the beams **108** and **109**. This superstructure comprises a pair of transverse beams **115** and **116**, one beam near each end of the table **21** and supported on the front and rear beams **109** and **108**, respectively, by means of four upright rods **117**, one near each end of the bars **110** and beams **115** and **116**, and extending vertically from the front and rear beams **109** and **108**. Towards the front of the machine as shown in FIGS. 1 and 11, an apron **118** over which the quilting assembly passes is supported at its upper edge on a beam **119** extending from one of the transverse beams **115** and **116** to the other and supported at its lower edge on the longitudinal rail **109**. The upper edge of the apron is spaced slightly from the needle plate so that the fabric assembly may slide freely relatively to the needle plate as the fabric assembly is shifted between stitches.

As shown in FIG. 1, an upper fabric roll **120**, an intermediate filler roll **121** and a lower fabric roll **122** are supported in front of the table on a supporting structure projecting forwardly and downwardly from the front ends of the transverse beams **115** and **116**. This supporting structure comprises a pair of spaced brackets **123**, FIG. 11, each mounted at its upper end on the front end of one of the transverse beams **115** and **116** and sloping downwardly and forwardly therefrom. As shown in FIGS. 1, 11 and 12, each bracket has an upper, open, bearing **124**

to carry a shaft **125** on which the upper fabric roll **120** is fixed, a lower open bearing **126** to carry a shaft **127** on which the lower fabric roll **122** is fixed and between these bearings an arm **128** projecting upwardly and forwardly on which rests a shaft **129** carrying the filler roll **121**. Secured to one of each pair of upper and lower bearings **124** and **126**, as shown at the left in FIGS. 1 and 12 is a tensioning element **130**, respectively, to brake the rotation of the respective fabric roll carrying shafts **125** and **127**. The construction of these tensioning elements is shown in side elevation in FIG. 13. Each tensioning element comprises a pair of semi-cylindrical braking members **131** and **132** pivoted at adjacent ends on pivot stubs **133** on the bracket **124** or **126** and clamped by a bolt **134** at their opposite ends about a brake drum **135** fixed on the shaft **125** or **127** to press a brake lining **136** onto the drum. The brake pressure on the drum, and consequently the tension on the fabric, is controlled by tightening or loosening the bolt **134**. As the quilting assembly is drawn onto the apron **118**, the resistance of the tensioning elements tensions the assembly to hold it taut.

No tensioning is applied to the filler roll as this material is of a loose construction and would be pulled apart by tension. It is kept flat by the downwardly sloping arms **128** which causes it to rest against the tensioned fabric coming from the lower roll **122** and it is rotated with the movement of this fabric.

The assembly of fabrics and filler is drawn over the apron **188** and the needle plate **36** by a series of cylindrical rollers **137**, **138**, and **139** arranged beyond the stitching elements as shown in FIGS. 14 and 15. As shown in end view in FIG. 15, the quilting assembly passes underneath the lowermost roller **137**, thence upwardly over the roller **138** and around and under the uppermost roller **139**, from which it passes to a wind-up roll **140**. The three rollers have knurled surfaces to engage the outer surfaces of the quilted assembly and are slidably held in tangential assembly by a pair of guide elements, one at each end of the roll assembly as indicated at **141** in FIG. 15 having an inclined slot **142** to receive the end portions of the rolls and a coil spring **143** to press the rolls resiliently against each other. The lowermost roll **137** is rotated intermittently to draw the fabric between stitches. The take-up roll **140** is rotated as the fabric is released, being driven from a continuously rotating element under a slight frictional engagement.

As the quilting assembly advances over the apron onto the needle plate it is necessary that it be held sufficiently taut and flat not only in the direction of its travel but also transversely thereof. For this purpose, as shown in FIGS. 1, 12 and 17, a pair of rollers **144** is arranged over the upper part of the apron in the positions shown and pressed down resiliently onto the quilting assembly by the mounting means shown in FIG. 17. This mounting means for each roller comprises a horizontal rod comprising a rod element **145** telescoping into, and adjustable in, a tubular support **148** pivotally mounted on the upper end of the rod **117** mounted on one of the cross beams **115** or **116** immediately above the beam **116** and extending over the apron **118** adjacent the needle plate. The roller **144** is pivotally supported from the free end of the rod **145** so that its axis may be adjusted to any desired angle to the direction of movement of the quilting assembly. Such adjustment is accomplished by means of a screw **146** which attaches to the rod a bracket **147** in which the ends of the axle of the roller are supported. The screw may be loosened to permit the bracket to be turned to any angle to the direction of passage of the quilting assembly and then tightened, and the roller is freely rotatable in the bracket. The position of the roller is approximately as shown in FIG. 12 so that, as it rotates in contact with the quilting assembly, it tends to pull the edges of the assembly outwardly from the center line of the assembly thus holding the assembly taut and flat as it passes onto the needle plate.

To enable the positions of the rollers **144** to be adjusted to various widths of quilting, each of the two rods is telescopically adjustable in its tubular support **148** to move its roller to any position whereupon it is held rigidly in any required position of adjustment by a screw **148***a*, FIG. 17. The support **148** is pivotally mounted on a vertical collar **149** encircling the rod **117** and pinned in position thereon by a pin **150**. The tubular support is pivotally mounted on a portion of the collar projecting above the rod **117** by means of a pivot pin **151** passing through one of a succession of holes **152** in a flange **153** rigidly secured to the tubular support **148**. The spacing of the holes **152** permits an adjustment of the distance of the roller **144** from the rod **117**.

To permit an adjustment of the pressure of the rollers **144** on the quilting assembly, a spring **154** is confined between the supporting member **148** and a nut **155** threaded on a screw **156** mounted on an arm **157** extending horizontally from the collar **149**. By adjusting the vertical position of the nut **155** on the screw, the pressure of the spring **154** on the supporting member **148** and thereby on the roller **144** may be adjusted.

The feed of the quilting assembly from the supply rolls **120–122** to the take-up roll **140** and the shifting of the assembly take place in that interval when the needles are raised free from the fabric.

For the feeding of the fabric, as shown in FIG. 8, a cam **158** is fixed on and rotates with the shaft **61**. As shown in FIG. 16, which is a view transverse to the shaft, a lever **159** is pivoted on the cross beam **115** at the left of the fabric supporting carriage and extends downwardly into contact with the surface of the cam **158** so that, with each rotation of the cam, this lever is rocked back and forth. The lower arm of the lever is slotted as at **160** and slidably secured in this slot is one end of a link **161** the other end of which is attached to a ratchet arm **162** pivoted on a projecting end of the shaft of the fabric drawing roller **137**. Fixed on this roller **137** or on its shaft is a ratchet wheel **163** having teeth engaged by a pawl **164** on the ratchet arm **162** spring pressed into engagement with the ratchet wheel so that as the arm **162** swings clockwise, viewed as in FIG. 16, the ratchet wheel is engaged by the pawl and rotates clockwise through a small angle together with the roller **137** thereby advancing the quilting assembly a short distance between successive stitches. The distance advanced may be controlled by the position of the end of the link **161** in the slot **160** as the movement of the link **161** and ratchet arm may thereby be adjusted to include a selected number of teeth on the ratchet wheel. A brake **165** comprising a pair of bars **165***a* having friction pads **165***b* bearing against the sides of the ratchet wheel is mounted on a part **115***a* of the frame to prevent overrunning or reverse rotation of the ratchet wheel. The bars **165***a* may be tightened against the surfaces of the ratchet wheel by known means, not shown.

As the cam **158** rotates through a complete revolution, the lever arm **159** is swung counter-clockwise by a tension spring **166** connected between the brake **165** and an upper extension **167** of the arm **159**, the spring also acting to keep the lever in contact with the cam. As the lever **159** and associated elements shift back and forth relatively to the shaft **61** and the cam **158** is fixed on the shaft, the length of the cam along the shaft is sufficient to enable the lever arm **159** to slide lengthwise on the surface of the cam.

To obtain a selected stitching design on the quilted material, the superstructure for the fabric feed is shifted between stitches back and forth in successive steps synchronized with the fabric feed whereby the combination of the fabric advance and the shifting of the superstructure enables the direction of the stitching to change in accordance with the design of the stitching. This is accomplished by means of a cam **177**, FIG. 20, driven

intermittently in successive steps from the main drive shaft 61.

To obtain the intermittent rotation of the cam, a length of the shaft 61 within the gear box 62 is provided, as shown in FIG. 19, with stepped screw threads 168 which form a worm which engages a worm gear 169 fixed on a shaft 170, FIG. 18. The screw threads 168 as shown in FIG. 19, comprise portions 171 which have a pitch or inclination so that when the worm wheel is in mesh with this portion it rotates through a small angle and portions 172 having no pitch so that during the time the worm wheel is in mesh with these portions it does not rotate but is held stationary. The worm threads are so positioned relative to the stitching cams 102 and crank arm 65 that the worm wheel will be rotated through a small arc between each successive stitch and held stationary during each stitching step.

The successive rotation steps of the worm wheel 169 and shaft 170 are transmitted through a train of gears 173, 174 and 175, FIGS. 8 and 18, to a shaft 176 on which is fixed a cam 177, such as shown in FIG. 20. The cam has a contour designed to shift the quilting carrying superstructure back and forth transversely in a succession of intermittent motions in co-operation with the feed elements to trace out the design.

This transverse movement is taken from the cam by a pair of cam followers 178 and 179 mounted on blocks 180 and 181 adjustably secured in a slot 182 in a reciprocating carriage 183 having an arm 184 secured at one end to the cross beam 115 of the superstructure. The carriage 183 is supported and guided between rollers 185 mounted on the gear box 62.

The cam 177 is replaceable to permit the use of cams of different sizes and contours. The quilting machine may be used with one, two or three needle bars in operation and the cam selected in any given case may accordingly be one appropriate to the size and shape of the design. Using three needle bars the travel of the carriage may be wider to accommodate a design in which the stitchings of the needles may cross and therefore extend over a wider range transversely to the length of the fabric design and thus require a cam having a wider distance diametrically from one edge to the other. The spacing of the cam followers in the slot 182 may be adjusted to the size of the cam.

As stated above the quilted assembly is taken up on a wind-up roll 140, shown in end view in FIG. 15 and indicated in plan view in FIG. 14. The roll is slidably mounted on a shaft 186, FIGS. 1, 11 and 14 supported on the stationary supports 22 extending upwardly from the ends of the table 21. The shaft 186 is driven continuously from the drive shaft 61 by a pulley 187, FIGS. 14 and 8, a belt 188 and a pulley 189 fixed on the shaft 186. The shaft 186 is in fixed position axially relative to the table 21 and the standards 22. When the roll 137 rotates, the friction of the wind-up roll on the shaft 186 causes the wind-up roll to rotate to wind up the quilting. When the roll 137 is stationary, the wind-up roll is held stationary, slipping on the shaft 186. The wind-up roll slides axially on the shaft 186.

Operation of the apparatus

The operation of the apparatus is briefly as follows:

The assembly of quilting elements is passed at successive intervals through a stationary unit which stitches the assembly together at each interval in which a bank of needles passes through the quilting assembly to form a loop in the thread of each needle through which a shuttle passes and which is then drawn closed to complete the stitch. The needles are then drawn upwardly clear of the quilting assembly. Thereupon the shiftable feed unit, driven from a power source common to both units, advances the quilting assembly in successive intervals between each stitching interval and may shift transversely to the direction of assembly feed so that a stitching pattern is created by a combination of these movements.

The stitching unit is driven directly from the drive shaft 61, FIG. 8, extending above a table 21 and below the needle plate 36 spaced above the table 21. The drive shaft is driven from a motor 57 mounted at the left end of the table, as viewed in FIG. 8, through pulleys 58 and 60 and belt 59. At the right end of the shaft 61 is fixed a crank arm 65 from which the needles are driven. As shown in FIG. 1, this crank arm is connected by the connecting rod 66 to the crank arm 67 on the rock shaft 68 extending above and parallel to the shaft 61 so that, with each revolution of the shaft 61 the rock shaft 68 rocks back and forth through an arc. This rocking movement moves the needles and associated elements up and down to form successive stitches.

The needles, driven by the rock shaft, are mounted in three rows each having pairs of closely spaced needles mounted on three parallel needle bars 30, 31 and 32 extending parallel to and below the rock shaft 68. These needle bars are carried by yokes 40, FIGS. 2 and 5, at spaced intervals along the bars and each yoke is, in turn, carried and guided in vertical movement by a pair of vertical rods 41 and 42 in a plane transverse to the rock shaft 68 and are slidable vertically in bearings 44 and 45 in a bracket 48 mounted on fixed bars 49 and 50 extending lengthwise above the table and needle plate. The bearings are of the frictionless construction shown in FIGS. 6 and 7 so that binding and wear are eliminated, and the yokes are thus held with precision during their vertical movements free from deviation regardless of unbalanced forces or resistances whether all of the bars are in use or not.

Each yoke is driven vertically up and down through a pair of links 71 and 72, one on each side of the yoke, connecting the yoke to crank arms 69 and 70 fixed on the rock shaft 68. Two crank arms and links are used on each yoke so that the driving force to raise and lower the yoke is balanced, thereby avoiding unbalanced stresses on the yokes in a plane transverse to the rods 41 and 42.

Immediately prior to the penetration of the needles into the quilting assembly, the presser plate 73 is pressed downwardly onto the assembly and held in position thereon until the needles are lifted free. The presser plate has holes 74, one for each needle. It is carried by a number of yokes 77 to each of which it is connected by a pair of rods 75 and 76 and which, in turn, is carried by a vertical rod 78 extending through vertically aligned bearings in arms 79 and 80 of a bracket 81 mounted on the bars 49 and 50. The rod 78 is pressed downwardly onto the quilting assembly by a spring 82 between the upper bracket arm 80 and a collar 83 fixed on the rod. Each rod and the presser plate are lifted at the proper time interval by a cam 84 fixed on the shaft 68 and engaging a roller 85 secured on an adjacent rod 78. Only a single rod 78 is required for each yoke 77 as the yokes are moved downwardly only by the force of the spring 82 and great precision is not required for the operation of the presser plate.

Thread is fed to the several needles from individual spools 24 on rack 23 above the needle operating mechanism to tensioning elements of tensioning unit 26 fixed in position, thence through eyelets in bar 28, FIG. 5, thence through eyelets in the vertically movable horizontal bar 27 from which the thread are delivered to their respective needles. With each upward movement of the needles the bar 27 is lifted to close the loops in the thread and with each downward movement of the needles the bar is lowered to relieve the tension on the threads and to enable loops to be formed through which shuttles may pass. The bar 27 is raised and lowered by levers 87 pivoted on yokes 88 pivoted on the shaft 88 and connected to the rods 42 by the pivot boxes 95.

The shuttles for supplying thread to the loops are carried on the frame 107 beneath the shuttle plate as shown

in FIG. 4. The frame **107** is reciprocated transversely of the table and parallel to the direction of movement of the quilting assembly by eccentric **102** on the main drive shaft **61** through connecting rod **103**.

The shuttles are mounted on spaced parallel bars **97** which, as shown in FIG. 10, are arranged in pairs, one on each side of guide bar **98**, each bar having three shuttle-holding baskets **100**, each of which may hold a shuttle **101**. The shuttles are mounted symmetrically, in mirror image relation, with closely spaced flat sides to slide on opposite sides of a pair of needles closely spaced for forming double stitches.

The supply and advancing unit for the quilting assembly, as shown in FIGS. 1, 4 and 11, comprises a lower frame formed of the rear beam **108**, front beam **109**, connecting transverse rails **107**, connecting transverse beams **110**, one at each end of the unit, and an upper frame comprising a pair of transverse beams **115** and **116** supported above the lower frame by uprights **117** and a front beam or rail **119** on which the guide apron **118** is mounted to guide the quilting assembly onto the needle plate of the stitching unit. The transverse beams **115** and **116** carry bracket extensions **123** for carrying upper and lower fabric rolls and the filler roll of the quilting assembly, the supporting rods **145**, **148** for the spreading rollers **144**, and the feed rolls feed rolls **137**, **138** and **139** shown in FIG. 5.

The unit is mounted to reciprocate longitudinally of the table **21** on rollers **114**, shown in FIGS. 4, 11 and 14, on which the front beam **109** rides and, as shown in FIG. 4, by means of brackets **113** sliding on bars **111** supported on the table **21**.

The feeding mechanism for the quilting assembly is reciprocated lengthwise of the table **21** by the cam mechanism shown in FIGS. 8, 18, 19 and 20. Power is transmitted from the main drive shaft **61** by the worm **168**, FIG. 19, meshing with the worm gear **169**, the worm having stepped threads **171** to rotate the worm gear **169** in steps, one step for each rotation of the shaft **61** and accordingly for each stitch. A cam **177**, FIG. 20, is driven step-wise from the worm gear **169** through the gearing **173–175** shown in FIGS. 8 and 18. The cam **177**, in turn, drives a pair of cam followers **178**, **179** connected by the rod **184** to the transverse beam **115** of the quilting moving unit to shift the unit and the quilting assembly mounted thereon in accordance with the profile of the cam to produce a quilting design. By substitution of cams, different designs may be produced and for this purpose different sizes of cams may be used. The adjustment of the cam followers **178** and **179** enables cams of different sizes to be used.

The quilting assembly is moved progressively from the supply rolls over the apron **118** and needle plate **36** by the feed mechanism illustrated in FIGS. 15 and 16. As shown in FIG. 15, the assembly is drawn onto the past the needle plate **36**, FIGS. 2 and 15, by the driven roll **137**, being gripped between this roll and roll **138** and between rolls **138** and **139** and the quilting then passes to the wind-up roll **140**. The roll **137** is driven from the main drive shaft **61** by cam **158**, FIGS 8 and 16, secured on the shaft and cam follower **161** adjustably pivoted in slot **160** on the lever **159** and connected to the arm **162** carrying pawl **164** spring pressed to engage ratchet wheel **163** fixed on the roll **137** or an extension thereof. With each half or part of a revolution of the shaft **61** from the position shown in FIG. 16, the cam moves the cam follower forwardly to engage the pawl **164** with a tooth of the ratched wheel **163** and rotate the wheel and the roll **137** through a small arc. The length of the arc of movement may be increased or decreased by an adjustment in the slot **160** to increase or decrease the movement of the arm **162**. In the second half of the rotation the cam follower returns, the pawl moving back one or more teeth of the ratchet wheel for the next movement.

The movement of the quilting assembly relative to the needles is the resultant of the movement of the assembly forwardly by the roll **137** and sidewise by the cam, and the direction of movement of the stitching relative to the assembly at any time is thus determined by the contour or profile of the cam and the position of the cam follower in the slot **160**.

Through the co-operation of the improved elements of the quilting machine not only is it possible to obtain double stitching but also a larger selection of designs and a wider amplitude of the designs transversely of the length of the quilting.

Having described my invention, I claim:

1. A quilting machine which comprises a stitching unit comprising at least three spaced parallel needle bars, each needle bar having needle mounting elements mounting a plurality of needles, said needles being arranged on each of said needle bars in pairs of needles closely spaced to form a double line of stitches, said pairs of needles being widely spaced along each needle bar, a needle plate below said needle bars having openings for the passage of said needles therethrough, shuttle bars below said needle plate, one pair for each pair of needles reciprocable transversely of said needle bars, a shuttle basket for each needle bar on each shuttle bar, the shuttle baskets on each side of each pair of needles being positioned to pass on opposite sides of the needles of said pair, yokes supporting said three needle bars, a pair of guide bars for each yoke, each of said guide rods being rigidly secured to its respective yoke and extending upwardly from said yoke and spaced in a plane transverse to the length of said needle bars, pairs of brackets, one for each pair of guide rods, positioned one above the other to guide said guide rods, and means to reciprocate said yokes upwardly and downwardly to reciprocate the needles at successive intervals downwardly through said openings in said needle plate and reversely, a fabric feed unit positioned to pass an assembly of quilting elements over said needle plate, said fabric feed unit comprising fabric supply rolls for said quilting elements having shafts journaled to relate with said rolls, an apron between said supply rolls and said needle plate, draw-off rolls positioned to draw quilted fabric from said needle plate, means to drive said draw-off rolls to advance said quilting assembly between each reciprocation of said needles and to shift said unit to pass said assembly of quilting elements transversely of its direction of passage to said needles between reciprocations of said needles and a common drive shaft for said means to reciprocate said yokes and for said means to advance said quilting assembly and to shift said fabric feed unit.

2. The quilting machine of claim **1** in which said means to shift said unit comprises a replaceable cam rotatable on an axis transverse to said common drive shaft, means driven by said common drive shaft to rotate said cam intermittently and a pair of cam followers in driving engagement with said fabric feed unit to shift said unit and engaging said cam on diametrically opposite sides of the perimeter of said cam, and means to adjust the spacing of said cam followers for engagement with cams of different diameters.

3. The quilting machine of claim **1** in which said means to reciprocate said needle yokes comprises a rock shaft, means on said rock shaft to reciprocate said yokes, and a crank arm on said drive shaft connected to said rock shaft to rock said rock shaft with each revolution of said drive shaft.

4. The quilting machine of claim **3** in which said means on said rock shaft to reciprocate said yokes comprises a pair of arms fixed on said rock shaft, one on each side of each of said yokes and means to connect said arms on each side of said yokes to said yokes.

5. The quilting machine of claim **2** in which said means to rotate said cam intermittently comprises a worm on said drive shaft having stepped threads and a worm

wheel engaging said threads and in driving engagement with said cam.

6. The quilting machine of claim 2 which comprises a ratchet wheel in driving connection with said take-up rolls, a pawl mounted to rock on the axis of said ratchet to advance said ratchet step by step, a cam fixed on said drive shaft and means slidable axially of and in engagement with said cam to rock said pawl with each rotation of said cam.

7. The quilting machine of claim 6 in which said means to rock said ratchet comprises a link connected to said pawl, a lever connected to said link and a spring biasing said lever into engagement with said cam, said lever having a sliding engagement with said link to permit said engagement of said link with said cam to be shifted to adjust the angle of rocking of said pawl in engagement with said ratchet.

8. The quilting machine of claim 1 in which said fabric feed unit comprises a pair of brackets spaced to receive the shafts of said supply rolls and inclined downwardly and away from said apron, a lower bearing on each bracket to receive the shaft of an under fabric roll, an upper bearing on each bracket to receive the shaft of an upper fabric roll and an arm mounted on each of said brackets between said upper and lower bearings and extending upwardly and forwardly from said bracket to support a filler roll with a gravity pressure against fabric drawn from said lower fabric roll.

9. The quilting machine of claim 8 comprising at least one tensioning member for each fabric roll, each said tensioning member comprising a pair of complementary braking members pivotally supported on one of said brackets in position to grip the shaft of its said fabric roll and means to adjust the grip of said braking members on their respective shaft.

10. The quilting machine of claim 1 comprising a pair of spreading rollers, one adjacent each end of said apron and means supporting said rollers at an angle inclined to the direction of travel of a quilting assembly over said apron and bearing on said assembly.

11. The quilting machine of claim 10 comprising means for adjusting the angles of said rollers to the direction of travel of the quilting assembly.

12. The quilting machine of claim 10 comprising means for adjusting the pressure of said rollers on said apron.

13. The quilting machine of claim 10 comprising means for adjusting the positions of said rollers transversely of the direction of travel of said quilting assembly.

14. The quilting machine of claim 1 comprising a presser plate above said needle plate, yokes for said presser plate each connected to said presser plate at points spaced in the direction of travel of the fabric assembly, a vertical rod secured to and extending upwardly from each said yoke, a guide bracket for each of said rods having a pair of arms through which said rod slides vertically, a cam follower secured on each rod, a spring pressing said rod and presser plate downwardly on the quilting assembly on said needle plate and a cam on said rock shaft engaging said cam follower to lift said rod and presser plate with each rocking cycle of said rock shaft.

15. The quilting machine of claim 1 which comprises a pair of eccentrics spaced lengthwise of said drive shaft, eccentric straps, one encircling each of said eccentrics, and links, one for each eccentric strap, connecting said eccentric straps to said shuttle bars to reciprocate said shuttle bars with each revolution of said drive shaft.

16. The quilting machine of claim 15 comprising a sliding frame reciprocable in the direction of travel of said quilting assembly and carrying said shuttle bars and connected to said links connected to said eccentric straps.

17. A stitching unit for a quilting machine which comprises a needle plate having holes for the passage of needles therethrough, said holes being positioned in three rows transverse to the direction of passage of a quilting assembly over said needle plate, said holes in each row being arranged in pairs of two closely spaced holes, said pairs being spaced more widely than the spacing of said holes of each pair, a needle bar for each row of said holes and having means to hold needles, one for each said hole in position to pass downwardly into its respective hole, yokes connecting said needle bars at intervals spaced lengthwise of said needle bars, pairs of supporting rods secured rigidly to each yoke extending upwardly from said yokes in planes transverse to the length of said needle bars, a pair of bearings, one above the other for each of said rods, a bracket supporting said bearings, and means for reciprocating said rods, yokes and needle bars vertically.

18. The stitching unit of claim 17 in which each of said bearings comprises vertical raceways spaced about the circumference of its respective rod and bearing balls in said raceways.

19. The stitching unit of claim 18 in which each said raceway comprises a pair of recesses extending lengthwise of the direction of reciprocation of said rod and connected at their ends, one of said lengths of raceway being open to said rod and the other raceway being closed from said rod.

20. The stitching unit of claim 17 in which said means for reciprocating said rods comprises a rock shaft extending horizontally adjacent said rods and a pair of crank arms for each pair of rods secured on said rock shaft and connected to opposite sides of said yoke.

21. The stitching unit of claim 17 having a presser plate above said needle plate and having holes above the holes of said needle plate, springs to press said presser plate downwardly to hold a quilting assembly, cams mounted on said rock shaft and means actuated by said cams to lift said presser plate with each complete rocking cycle of said rock shaft.

22. The stitching machine of claim 21 having shuttle bars beneath said needle plate, one on each side of each pair of needle holes, shuttle baskets on each shuttle bar positioned to slide adjacent one of said needle holes, the baskets on opposite sides of said pairs of holes being mounted in complementary relation, and means to reciprocate said shuttle bars longitudinally in the direction of travel of a quilting assembly over said needle plate in synchronism with said rock shaft.

23. The stitching machine of claim 22 in which said means to reciprocate said shuttle bars comprises a drive shaft, eccentrics fixed on said drive shaft in positions spaced lengthwise thereof, eccentric straps encircling said eccentrics and means connecting said eccentric straps to said shuttle bars.

24. A stitching unit for a quilting machine which comprises a needle plate having holes for the passage of needles therethrough, said holes being positioned in three rows transverse to the direction of passage of a quilting assembly over said needle plate, a needle bar for each row of said holes and having means to hold needles, one for each said hole in position to pass downwardly into its respective hole, yokes connecting said needle bars at intervals spaced lengthwise of said needle bars, pairs of supporting rods secured rigidly to each yoke extending upwardly from said yokes in planes transverse to the length of said needle bars, a pair of bearings, one above the other for each of said rods, a bracket supporting said bearings, and means for reciprocating said rods, yokes and needle bars vertically.

25. The stitching unit of claim 24 in which said means for reciprocating said rods, yokes and needle bars vertically comprises a horizontal rock shaft at a height above said yokes, pairs of arms fixed on said rock shaft, one pair for each yoke, the arms of each pair of arms extending sidewise from said rock shaft, one at each side of a bracket, and a pair of connecting links, one pair for each yoke, extending downwardly from said arms and con-

nected at opposite sides to the yoke below said bracket to reciprocate said yokes vertically by the rocking of said rock shaft.

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