June 20, 1961 BUNSAKU TAKETOMI 2,989,015

SEWING MACHINE EQUIPPED WITH AN AUTOMATIC DEVICE FOR EFFECTING VARIABLE PATTERN EMBROIDERY STITCHING

Filed Aug. 13, 1958 3 Sheets-Sheet 1

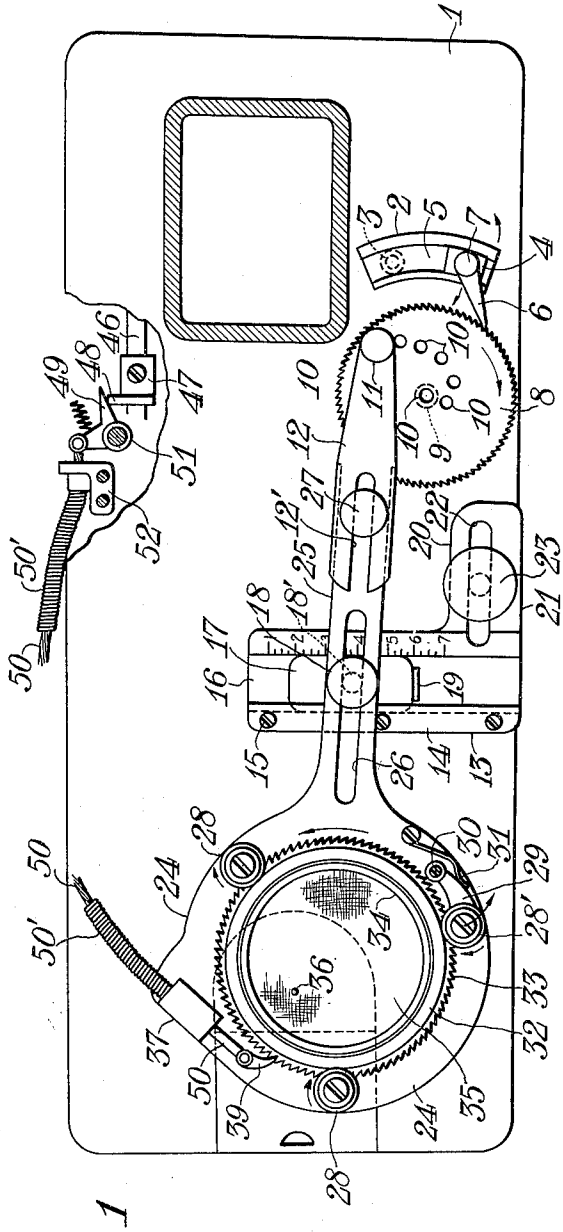


Fig. 1

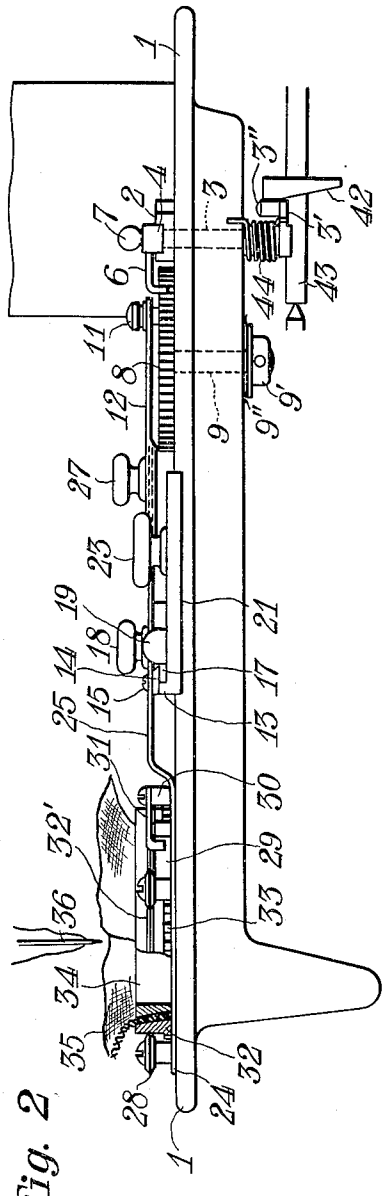


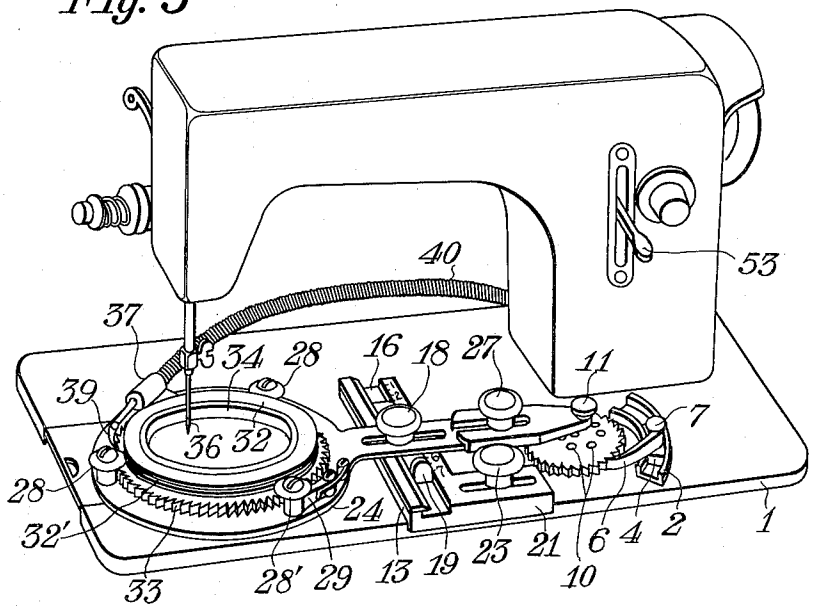
Fig. 2

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Fig. 3



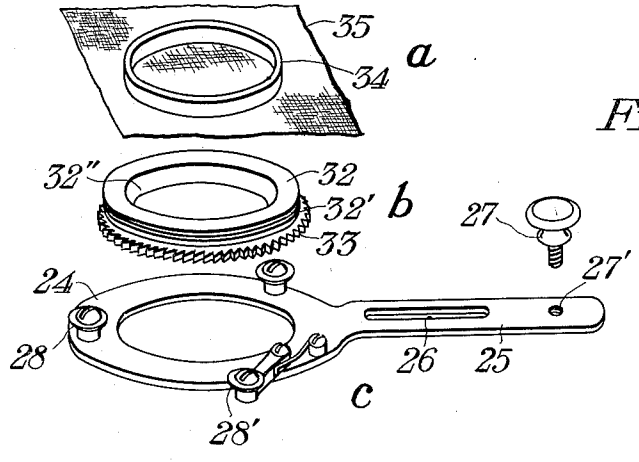
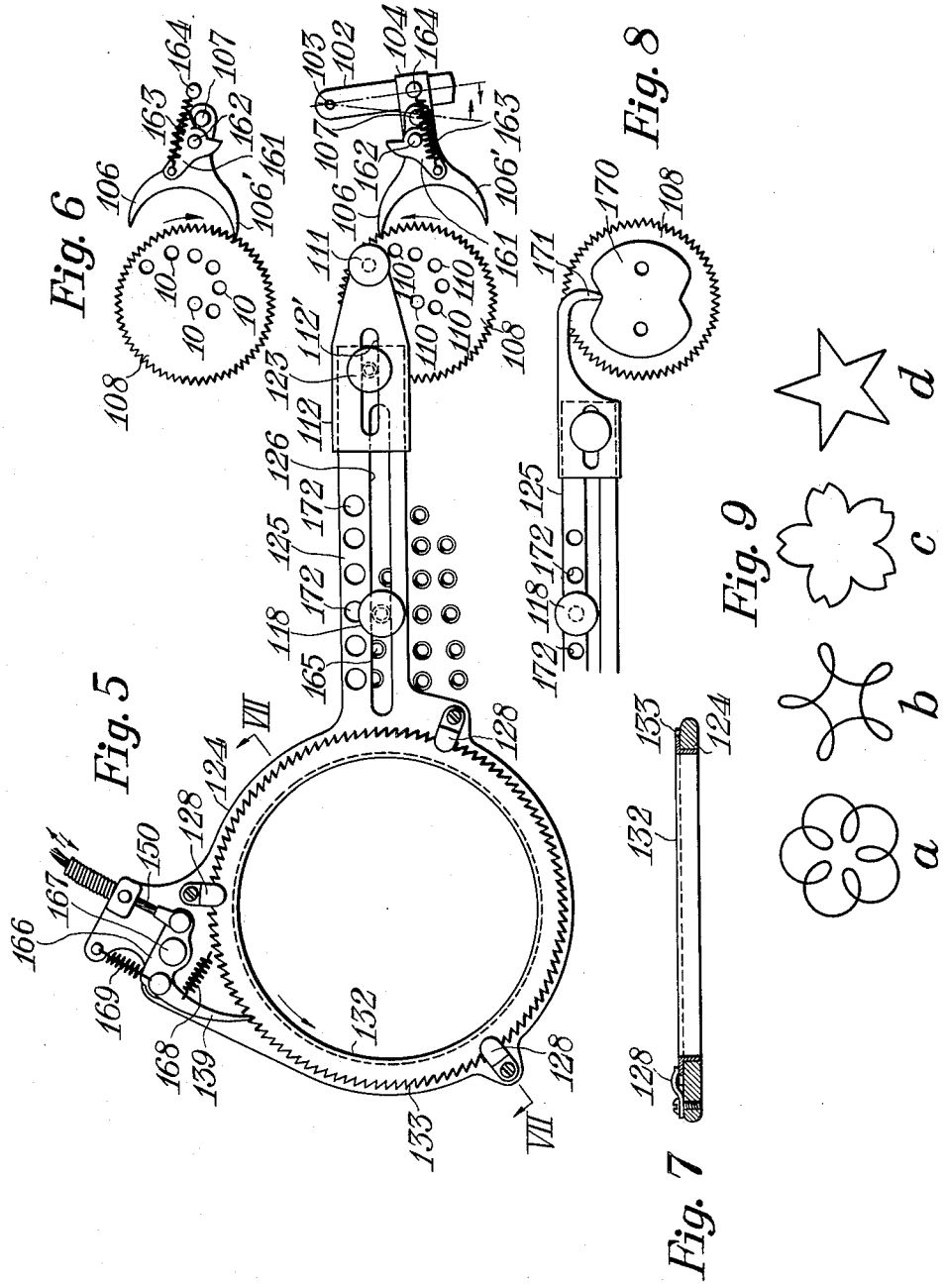


Fig. 4

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SEWING MACHINE EQUIPPED WITH AN AUTOMATIC DEVICE FOR EFFECTING VARIABLE PATTERN EMBROIDERY STITCHING

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2,989,015

SEWING MACHINE EQUIPPED WITH AN AUTOMATIC DEVICE FOR EFFECTING VARIABLE PATTERN EMBROIDERY STITCHING

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7 Claims. (Cl. 112—103)

This invention relates to a sewing machine for household use, which is improved by the equipment of an automatic device for effecting variable pattern embroidery stitching. The object of the invention is to provide an automatic device controlled and actuated through the cloth feeding mechanism and the driving or lower shaft which are usually provided in the existing type of sewing machine for household use, and adapted to obtain innumerable different patterns of embroidery stitching, without effecting any substantial change of the construction of the parts of the existing sewing machine.

The accompanying drawing will serve to illustrate specific embodiments of my invention, in order that its utility and functioning will be thoroughly appreciated. It will be understood, however, that these are by way of illustration only and are not to be taken as limiting the invention in any way. In the drawing:

FIGURE 1 is a plan view of the sewing machine bed equipped with the device for embroidery stitching according to this invention;

FIGURE 2 is a side elevation thereof;

FIGURE 3 is a perspective view of the head of the sewing machine;

FIGURE 4*a* is a perspective view of an inner ring for stretching the cloth;

FIGURE 4*b* is a perspective view of an outer ring for stretching the cloth in co-operation with said inner ring;

FIGURE 4*c* is a perspective view of an annular supporting frame for said cloth stretching ring.

FIGURE 5 is a plan view of a modified form of the device for making various patterns of embroidery stitchings;

FIGURE 6 shows the toothed wheel driving mechanism in a position reversed relative to the position shown in FIGURE 5;

FIGURE 7 is a sectional view taken along line VII—VII of FIGURE 5;

FIGURE 8 is a plan view of still modified form of the control lever used in the device shown in FIGURE 5; and

FIGURE 9 shows by way of example four different patterns of embroidery obtained in accordance with the present invention.

Referring to the drawing, reference numeral **1** designates a bed of ordinary type sewing machine for household use. **2** is an arcuate slotted lever forming a rocking lever which is fixedly mounted on the upper end of a vertical shaft **3** which is rotatably mounted in a hole in the bed **1**. A block **4** is slidably mounted in the arcuate slot **5** formed in the lever **2**. The slide block **4** has a pin **7** having a feed pawl **6** engaging with a ratchet wheel **8**. **43** is a driving or lower shaft making oscillatory rotation, which shaft being provided in ordinary sewing machine for household use. To this lower shaft **43** is secured a cam **42** having a cam face engaging with a roller **3''** on the free end of an arm **3'** which is fixed to the lower end of the vertical shaft **3**, as shown in FIGURE 2. The roller **3''** is normally biased against the cam **42** by means of a spring **44** wound around the shaft **3**. On oscillatory rotation of the lower shaft **43**, the slotted arcuate lever **2** will be oscillated about the axis of the shaft **3**, as shown by arrows in FIGURE 1.

The ratchet wheel **8** has an axis **9** which protrudes through a vertical hole in the bed and, at the lower end, it has a head **9'**. Between said head **9'** and the under face of the bed **1**, there is inserted a leaf spring **9''**, so that the ratchet wheel **8** is normally held pressed against the top of the bed **1** under appropriate frictional engagement. Upon the oscillatory movement of the rocking lever **2**, the ratchet wheel **8** is rotated step by step by the action of the feed pawl **6**. When the slide block **4** is maintained in the position in coincidence with the axis of the shaft **3**, the pawl **6** is not operated and the ratchet wheel **8** partakes no movement. When however the slide block **4** is shifted to the position as shown in FIGURE 1 to obtain the maximum oscillatory movement of the pin **7**, five or six teeth of the ratchet wheel **8** will be fed through a single movement of the pawl **6**, thereby obtaining the maximum speed of rotation of the ratchet wheel. By such measure, the speed of rotation of the ratchet wheel **8** may be varied by changing the position of the slide block **4** relative to the axis **3**. This adjustment of speed of rotation of the ratchet wheel **8** is one of the important factors for changing the pattern of embroidery as desired.

24 is an annular frame supporting a cloth stretching ring which will be described hereinafter. This annular frame has a connecting bar **25** having at its free end a pin **11** adapted to be inserted into one of a plurality of small holes **10** formed in the ratchet wheel **8** which are arranged at different radial distances from the axis **9**, one of said holes **10** being located at the center of the ratchet wheel, i.e. at zero distance position. Said connecting bar **25** is shown as consisting of two parts, the outer extension arm **12** having a slot **12'** into which a stud **27** on the main part of the bar is inserted, so that the extension bar **12** is slidably and adjustably connected to the bar **25**, thereby the effective length of the bar **25** may be adjusted.

An L-shaped slide plate made of sheet metal having a transverse leg **13** and a longitudinal leg **20** is slidably and adjustably mounted on the bed **1**. The leg **20** is longitudinally slidably mounted by means of a slot **22** and a screw stud **23**. The outer edge of the leg **20** is bent downwardly as at **21** to be guided along the edge of the bed **1** when the longitudinal adjustment is effected. The transverse leg **13** is provided with a shallow slide way **16**, with which a slide plate **17** is held in frictional engagement by means of a thin leaf spring **14** which is secured to the leg **13** by means of set screws **15**. The slide plate **17** is adapted to be moved transversely relative to the bed **1** by manipulating a knob **19** formed by bending one end of the plate **17**. The connecting bar **25** extending from the annular frame **24** is slidably mounted on said slide plate **17**, and is connected therewith by means of a slot **26** in the bar **25**, a pin **18'** in engagement with said slot **26**, and a collar **18** pressing the upper face of the bar **25**. By such arrangement, according to the step-by-step rotation of the ratchet wheel **8**, the annular frame **24** will be oscillated about the pin **18'** in the longitudinal and transverse directions relative to the bed **1**. Referring to FIGURE 1, **46** is a feed shaft forming a part of cloth feeding mechanism found in the ordinary sewing machine for household use, which is adapted to be regulated by means of the feed adjuster lever **53** as customary in the ordinary sewing machine. To this feed shaft **46** there is secured a collar **47** having a tappet **48**. Pivotally mounted on a pivot **51** is a bell-crank lever **49**, of which one arm is in engagement with said tappet **48**. Another arm of the bell-crank lever is connected to one end of a Bowden wire **50** supported by a bracket **52**.

The cloth stretching ring consists of an outer ring **32** (FIG. 4*b*) and an inner ring **34** (FIG. 4*a*). The outer ring **32** has a circumferential V-shaped groove **32'** and a circumferential ratchet teeth **33**, and the inner periphery **32''** is slightly tapered as shown. The inner ring **34** has

its outer periphery similarly tapered to fit snugly the tapered inner periphery of the outer ring **32**. Placing the cloth **35** on the outer ring **32**, the inner ring **34** is pressed upon it so as to stretch and support the cloth therebetween in usual manner.

On the annular supporting frame **24**, there are provided three rollers **28**, each having V-shaped periphery engaging with the V-shaped annular groove **32'** on the outer ring **32**, as shown in FIGURES 1 and 2. While two of said rollers **28** are journalled on stationary axes, one of them, the roller **28'**, is supported by a lever **29** pivoted as at **30** and biased against the peripheral V-shaped groove **32'** by means of a spring **31**. The outer sheath **50'** of the above mentioned Bowden wire **50**, on the other end, is supported by a bracket **37** formed on the annular supporting frame **24**. The end of the Bowden wire **50** has a feed pawl **39** engaging with the ratchet teeth **33** on the outer ring **32**. By such arrangement, according to the operation of the feed shaft **46**, the cloth stretching ring (consisting of the rings **32** and **34** united together) is intermittently rotated through the action of the Bowden wire **50**.

The operation of the device according to this invention is as follows: When the sewing machine equipped with the above mentioned mechanism is put into operation, the ratchet wheel **8** as well as the cloth stretching ring **32** having the ratchet wheel **33** are rotated intermittently, the stretched cloth **35** is automatically displaced relative to the center of the needle **36** along the path produced by a combination of the above mentioned two kinds of rotation, so that a geometrical pattern of embroidery stitching may be produced. It will be noted that the pattern of stitch may be varied nearly indefinitely by varying the speed of rotation of each ratchet wheel or by varying the ratio of rotation of the ratchet wheels to each other, and/or by varying the stroke of the connecting rod **25**, and/or by varying the position of the pin **18'** by displacement in the transverse or longitudinal direction.

It is to be understood that while the present invention may be applied to the ordinary type sewing machine for straight stitching, it may similarly be applied to the existing type of zigzag sewing machines.

In the modified form of the device shown in FIGURES 5 to 7, the annular supporting frame **124** has a connecting bar **125** having an extension bar **112** adjustably connected therewith by means of a slot **112'** and a screw stud **123**. A pin **111** on the free end of said extension arm is inserted into one of a plurality of holes **110** formed in a toothed wheel **108** at different radial distances, excepting one arranged in the center of the wheel **108**. **102** is a rod oscillatably mounted around a pivot **103** adapted to be actuated by means of a cam (not shown) mounted on the upper shaft or a crank which is found in the ordinary sewing machine for household use. Slidably mounted on and secured to said oscillating rod **102**, there is a slide block **104**, on which a driving fork having two pawls **106** and **106'** is pivotably mounted as at **107**. A switching lever **161** is pivotally mounted on said fork as at **162**, and the long arm of said lever **161** is connected by means of a spring **163** to a pin **164** on the slide block **104**. While in the position shown in FIGURE 5 the upper pawl **106** is in engagement with a tooth of the toothed wheel, when the switching lever **161** is turned clockwise so as to bring the line of action of the spring **163** to the opposite side of the straight line connecting the pivot **162** and the pin **164** said pawl **106** is disengaged and the other pawl **106'** will be brought into engagement with a tooth of the toothed wheel as shown in FIGURE 6. By such arrrangement the rotation of the toothed wheel **108** will be reversed. Said reversal of the direction of rotation of the toothed wheel **108** will result in substantial change of the pattern of embroidery stitching, as will be hereinafter described.

The connecting bar **125** is provided with a slot with which a stepped screw stud **118** snugly fits, and said stud **118** is screwed into one of a plurality of screw threaded holes **165** formed in the bed of the sewing machine.

Rotatably mounted upon the annular supporting frame **124**, there is a cloth stretching ring frame consisting of an outer ring **132** and an inner ring (not shown) substantially similar to that shown in FIGURE 4*a*. The outer ring **132** is provided with the rim having peripheral ratchet teeth **133** and is embraced by three ears **128** fixed to the frame **124**. A lever **166** is pivoted as at **167** in an extension of the annular supporting frame **124**. One end of the Bowden wire **150** (similar to the Bowden wire **50** shown in FIGURE 1) is connected to one arm of said lever **166**, and a feed pawl **139** is connected to the other arm of lever **166**. The pawl **139** is pulled by a spring **168** so that it is normally held in engagement with the teeth of the ratchet wheel **133**. Spring **169** tends to turn the lever **166** in the clockwise direction. It will be noted that by reciprocal movement of the Bowden wire **150** by virtue of the operation of the feed shaft of the sewing machine, the cloth stretching ring **132** is intermittently rotated in the direction of arrow.

When the sewing machine equipped with the above mentioned mechanism is put into operation, the needle partakes a stitching operation as usual. According to this invention, the toothed wheel **108** as well as the cloth stretching ring **132** are rotated intermittently. By rotation of the toothed wheel **108**, the annular supporting frame **124** is oscillated about the axis **118** and moved in the transverse and longitudinal directions relative to the bed of the sewing machine, producing thereby various movement of the cloth stretched on the ring **132** to produce a predetermined pattern of embroidery stitching, varying in accordance with the various combinations of five variable factors, i.e. predetermined speed of rotation of the ring **132**, the position of the axis **118**, the speed of rotation of the toothed wheel **108**, the distance between the axis **118** and the axis of the toothed wheel **108**. On experiments, it has been found that substantially indefinite numbers of patterns may be produced without the necessity of interchanging any part of the mechanism. It is believed that more than twenty thousand kinds of patterns may be obtained according to this invention. Four patterns *a*, *b*, *c*, and *d* are shown in FIGURE 9 by way of example. The pattern *a* having inwardly looped trace has been obtained when the toothed wheel **108** is rotated in anti-clockwise direction as shown in FIGURE 5, and the pattern *b* having outwardly looped trace has been obtained when the toothed wheel **108** is rotated in the clockwise direction as shown in FIGURE 6.

While the patterns *a* and *b* are composed solely of curved lines, other pattern composed of or containing straight lines, such as for instance patterns *c* and *d* in FIGURE 9, may also be obtained by slightly modifying the mechanism as shown in FIGURE 8. In this modification, the toothed wheel **108** is provided with an interchangeable cam **170**, against which a finger **171** formed on the free end of the connecting bar **125** engages. The stepped screw stud **118** is inserted into one of a plurality of holes **172** formed in the connecting bar **125**, so that the sliding movement of the bar in the longitudinal direction is prevented, allowing only the oscillating movement around the axis **118**.

From the foregoing, it will be seen that according to this invention the cloth stretching ring frame is intermittently rotated at varying speed utilizing the adjustable cloth feed mechanism, and that the said cloth stretching ring frame is oscillated about the axis outside of the ring by means of the adjustable toothed wheel controlled from the driving or lower shaft, both said adjustable cloth feed mechanism and the driving or lower shaft being usually provided in the existing sewing machine for household use, and that by varying the speed of rotation of said cloth stretching ring frame, and/or of the adjustable toothed wheel, and/or varying the

effective length of the connecting bar connecting the cloth stretching ring frame and the adjustable toothed wheel, and/or by varying the position of said axis of oscillation of said connecting bar, it is possible to obtain innumerable different patterns of embroidery stitch, and that the mechanism may be readily handled by those unskilled in the art.

What I claim is:

1. In a sewing machine having a reciprocably driven needle, a bed and a rotatably driven shaft, an attachment for automatically effecting variable embroidery stitching comprising, a cloth-stretching ring disposed for movement substantially transversely to a path of travel of the needle, said ring having peripheral angularly spaced ratchet teeth, an annular support frame rotatably supporting said ring and movable relative to the bed, means to impart intermittent rotation to said ring comprising a pawl operable to intermittently engage said ratchet teeth to rotate said ring stepwise, and attachable means cooperative with said driven shaft for intermittently actuating said pawl thereby to impart periodic, stepwise rotation to said cloth-stretching ring, means operable in cooperation with said rotation imparting means to vary the position of said ring relative to the path of travel of said needle to position the cloth in position for embroidering a predetermined pattern thereon comprising, means to impart periodic oscillatory motion to said support frame in timed relationship with rotation of said ring, a ratchet wheel mounted on said bed spaced from said frame, an extension on said frame eccentrically, operably connected to said ratchet wheel, means providing a pivot selectively positionable in different positions on said bed about which said extension pivots in operation, and means to impart periodic, stepwise rotation to said ratchet wheel.

2. In a sewing machine having a reciprocably driven needle, a bed and a rotatably driven shaft, an attachment for automatically effecting variable embroidery stitching comprising, a cloth-stretching ring disposed for movement substantially transversely to a path of travel of the needle, said ring having peripheral angularly spaced ratchet teeth, an annular support frame rotatably supporting said ring and movable relative to the bed, means to impart intermittent rotation to said ring comprising a pawl operable to intermittently engage said ratchet teeth to rotate said ring stepwise, and attachable means cooperative with said driven shaft for intermittently actuating said pawl thereby to impart periodic, stepwise rotation to said cloth-stretching ring, means operable in cooperation with said rotation imparting means to vary the position of said ring relative to the path of travel of said needle to position the cloth in position for embroidering a predetermined pattern thereon comprising, means to impart periodic motion to said support frame in timed relationship with rotation of said ring, a ratchet wheel mounted on said bed spaced from said frame, an extension on said frame eccentrically, operably connected to said ratchet wheel, a stationary pivot on said bed about which said extension pivots, means to impart periodic, step-wise rotation to said ratchet wheel and means to connect the extension to the ratchet wheel at different radial distances from the center of the wheel.

3. In a sewing machine having a reciprocably driven needle, a bed and a rotatably driven shaft, an attachment for automatically effecting variable embroidery stitching comprising, a cloth-stretching ring disposed for movement substantially transversely to a path of travel of the needle, said ring having peripheral angularly spaced ratchet teeth, an annular support frame rotatably supporting said ring and movable relative to the bed, means to impart intermittent rotation to said ring comprising a pawl operable to intermittently engage said ratchet teeth to rotate said ring step-wise, and attachable means cooperative with said driven shaft for intermittently actuating said pawl thereby to impart periodic, stepwise rotation to said cloth-stretching ring, means operable

in cooperation with said rotation imparting means to vary the position of said ring relative to the path of travel of said needle to position the cloth in position for embroidering a predetermined pattern thereon comprising, means to impart oscillatory periodic motion to said support frame in timed relationship with rotation of said ring, a ratchet wheel mounted on said bed spaced from said frame, an extension on said frame eccentrically, operably connected to said ratchet wheel, a stationary pivot on said bed about which said extension pivots, means to impart periodic, step-wise rotation to said ratchet wheel, and a cam on said wheel operably engaged by said extension for imparting periodic oscillatory motion to said frame.

4. In a sewing machine having a reciprocably driven needle, a bed and a rotatably driven shaft, an attachment for automatically effecting variable embroidery stitching comprising, a cloth-stretching ring disposed for movement substantially transversely to a path of travel of the needle, said ring having peripheral angularly spaced ratchet teeth, an annular support frame rotatably supporting said ring and movable relative to the bed, means to impart intermittent rotation to said ring comprising a pawl operable to intermittently engage said ratchet teeth to rotate said ring step-wise, and attachable means cooperative with said driven shaft for intermittently actuating said pawl thereby to impart periodic, step-wise rotation to said cloth-stretching ring, means operable in cooperation with said rotation imparting means to vary the position of said ring relative to the path of travel of said needle to position the cloth in position for embroidering a predetermined pattern thereon comprising, means to impart periodic oscillatory motion to said support frame in timed relationship with rotation of said ring, a ratchet wheel mounted on said bed spaced from said frame, an extension on said frame eccentrically connected to said ratchet wheel, a stationary pivot on said bed about which said extension pivots, means to impart periodic, stepwise rotation to said ratchet wheel, and said extension having means to vary the length thereof.

5. In a sewing machine having a reciprocably driven needle, a bed and a rotatably driven shaft, an attachment for automatically effecting variable embroidery stitching comprising, a cloth-stretching ring disposed for movement substantially transversely to a path of travel of the needle, said ring having peripheral angularly spaced ratchet teeth, an annular support frame rotatably supporting said ring and movable relative to the bed, means to impart intermittent rotation to said ring comprising a pawl operable to intermittently engage said ratchet teeth to rotate said ring step-wise, and attachable means cooperative with said driven shaft for intermittently actuating said pawl thereby to impart periodic, step-wise rotation to said cloth-stretching ring, means operable in cooperation with said rotation imparting means to vary the position of said ring relative to the path of travel of said needle to position the cloth in position for embroidering a predetermined pattern thereon comprising means to impart periodic oscillatory motion to said support frame in timed relationship with rotation of said ring, a ratchet wheel mounted on said bed spaced from said frame, an extension on said frame eccentrically connected to said ratchet wheel, a stationary pivot on said bed about which said extension pivots, means to impart periodic, step-wise rotation to said ratchet wheel, and including means operable to impart rotation to said ratchet wheel alternatively in opposite directions.

6. In a sewing machine having a reciprocably driven needle, a bed provided with a plurality of holes and a rotatably driven shaft, an attachment for automatically effecting variable embroidering stitching comprising, a cloth-stretching ring disposed for movement substantially transversely to a path of travel of the needle, said ring having peripheral angularly spaced ratchet teeth, an annular support frame rotatably supporting said ring and

movable relative to the bed, means to impart intermittent rotation to said ring comprising a pawl operable to intermittently engage said ratchet teeth to rotate said ring stepwise, and attachable means cooperative with said driven shaft for intermittently actuating said pawl thereby to impart periodic, stepwise rotation to said cloth-stretching ring, means operable in cooperation with said rotation imparting means to vary the position of said ring relative to the path of travel of said needle to position the cloth in position for embroidering a predetermined pattern thereon comprising, means to impart periodic oscillatory motion to said support frame in timed relationship with rotation of said ring, a ratchet wheel mounted on said bed spaced from said frame, an extension on said frame eccentrically connected to said ratchet wheel and having a plurality of spaced holes, a stationary pivot on said bed about which said extension pivots, insertable in the extension holes individually and in selected individual holes in the bed and, means to impart periodic, stepwise rotation to said ratchet wheel.

7. In a sewing machine having a reciprocably driven needle, a bed, and a rotatably driven shaft, an attachment for automatically effecting variable embroidery stitching comprising, a cloth-stretching ring disposed for movement substantially transversely to a path of travel of the needle, said ring having peripheral angularly spaced ratchet teeth, an annular support frame rotatably supporting said ring and movable relative to the bed, means to

impart intermittent rotation to said ring comprising a pawl operable to intermittently engage said ratchet teeth to rotate said ring step-wise, and attachable means cooperative with said driven shaft for intermittently actuating said pawl thereby to impart periodic step-wise rotation to said cloth-stretching ring, means operable in cooperation with said rotation imparting means to vary the position of said ring relative to the path of travel of said needle to position the cloth in position for embroidering a predetermined pattern thereon comprising, means to impart periodic oscillatory motion to said support frame in timed relationship with rotation of said ring, a ratchet wheel mounted on said bed spaced from said frame, an extension on said frame eccentrically, operably connected to said ratchet wheel, means providing a pivot stationary in operation on said bed about which said extension pivots, means for selectively moving the position of said pivot, and means to impart periodic, stepwise rotation to said ratchet wheel.

References Cited in the file of this patent

UNITED STATES PATENTS

206,239	House	July 23, 1878
693,666	Parks	Feb. 18, 1902
906,311	Sefton et al.	Dec. 8, 1908
1,027,064	Parkes	May 21, 1912
2,652,796	Russell	Sept. 22, 1953