

June 21, 1960

C. W. JOHNSON

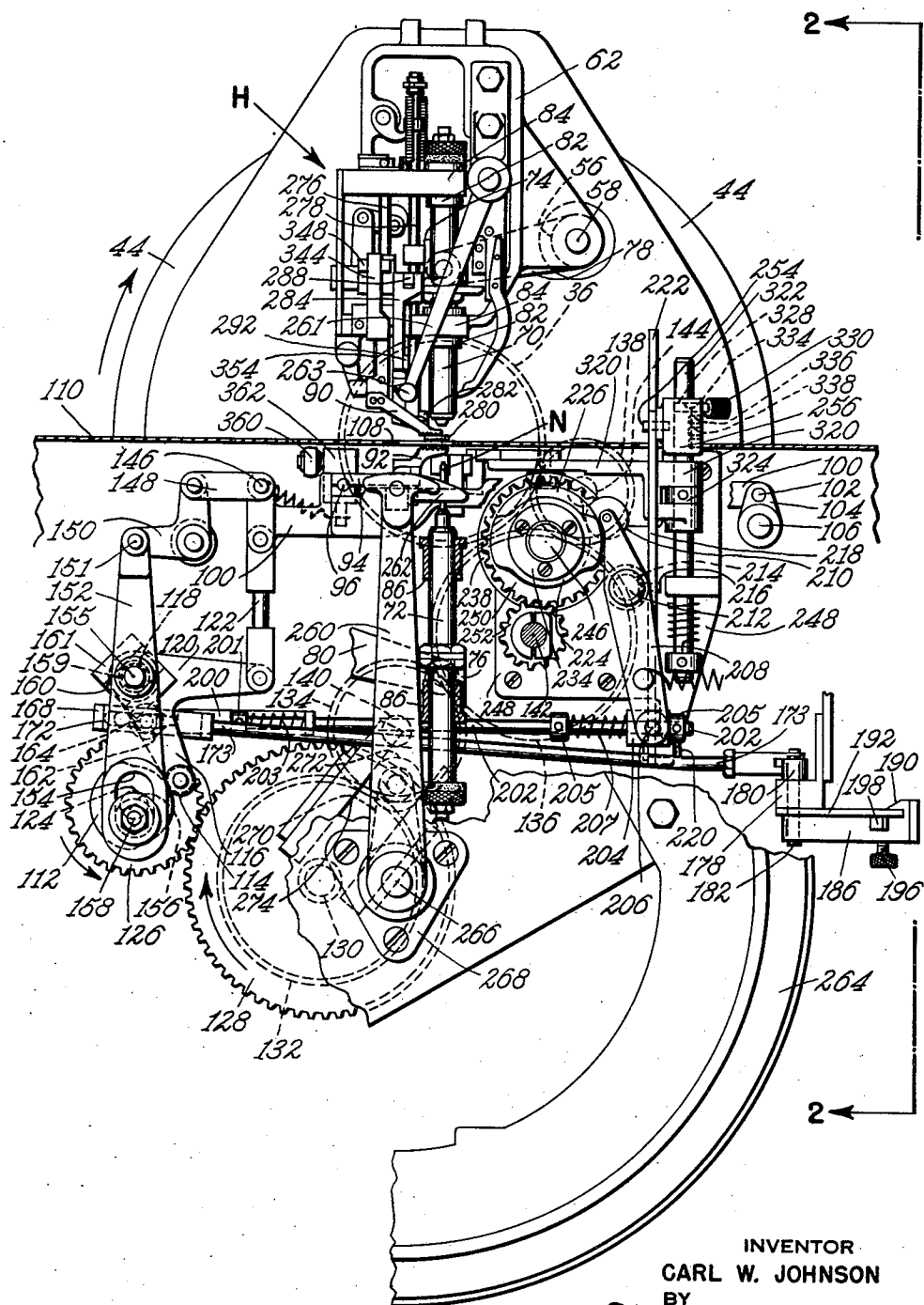
2,941,485

SPECIAL STITCH FORMING MACHINE

Filed March 15, 1956

7 Sheets-Sheet 1

FIG. 1



INVENTOR  
CARL W. JOHNSON  
BY  
*Wentworth & Clapham*  
ATTORNEY

**June 21, 1960**

C. W. JOHNSON

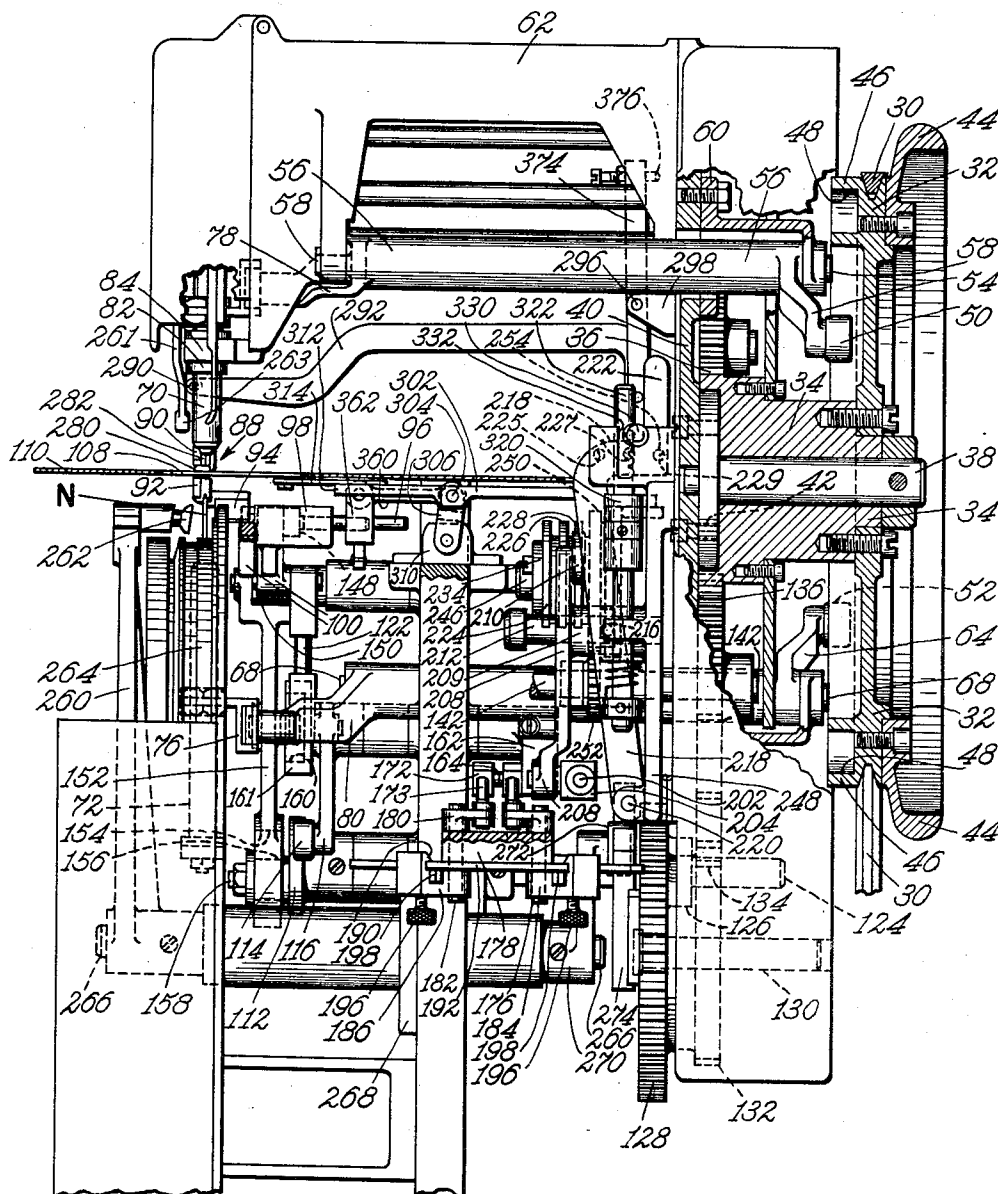
**2,941,485**

SPECIAL STITCH FORMING MACHINE

Filed March 15, 1956

7 Sheets-Sheet 2

**FIG. 2**



INVENTOR  
CARL W. JOHNSON  
BY  
*Wentworth & B. Clapham*  
ATTORNEY

**2,941,485**

7 Sheets-Sheet 3

**FIG. 4**

INVENTOR  
CARL W. JOHNSON.  
BY  
*Hentworth & Clapham*  
ATTORNEY

June 21, 1960

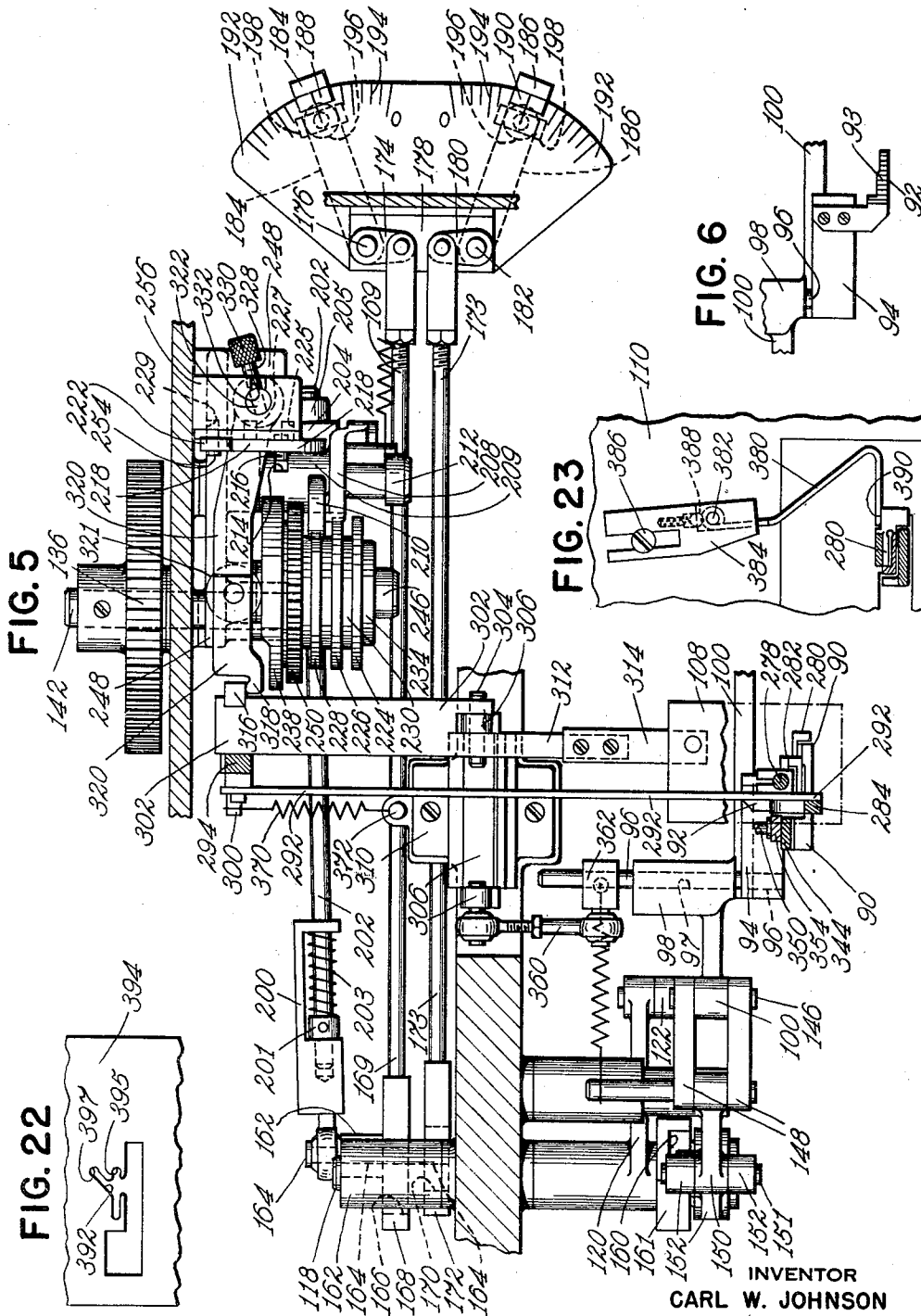
C. W. JOHNSON

2,941,485

SPECIAL STITCH FORMING MACHINE

Filed March 15, 1956

7 Sheets-Sheet 4



INVENTOR  
CARL W. JOHNSON

BY  
*Montgomery & Clapham*  
ATTORNEY

June 21, 1960

C. W. JOHNSON

2,941,485

SPECIAL STITCH FORMING MACHINE

Filed March 15, 1956

7 Sheets-Sheet 5

FIG. 9

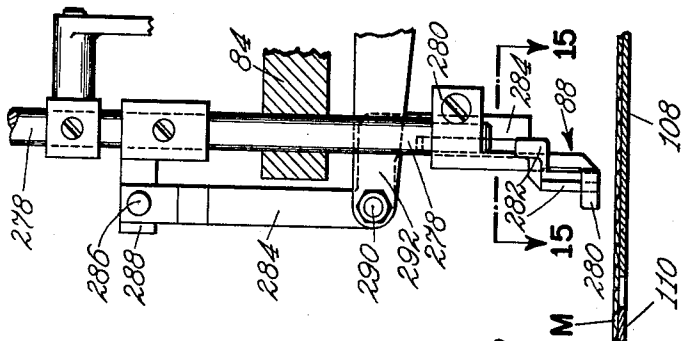


FIG. 10

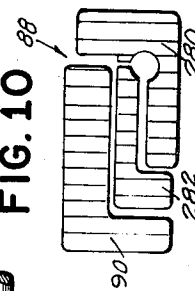
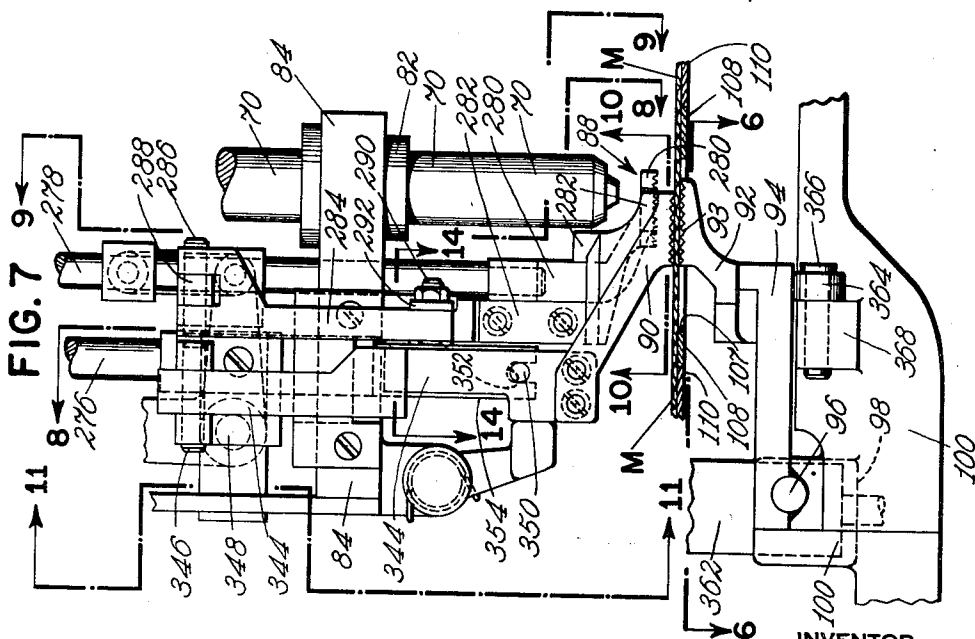
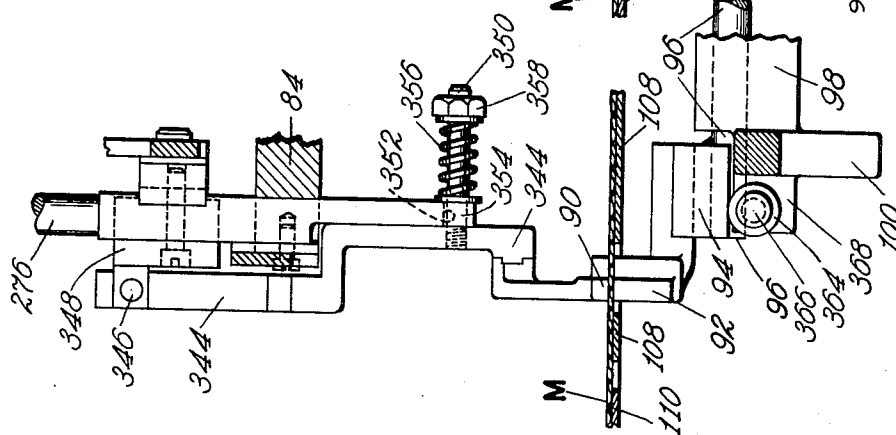


FIG. 8



INVENTOR  
CARL W. JOHNSON

BY  
*Wentworth B. Clapham*  
ATTORNEY

June 21, 1960

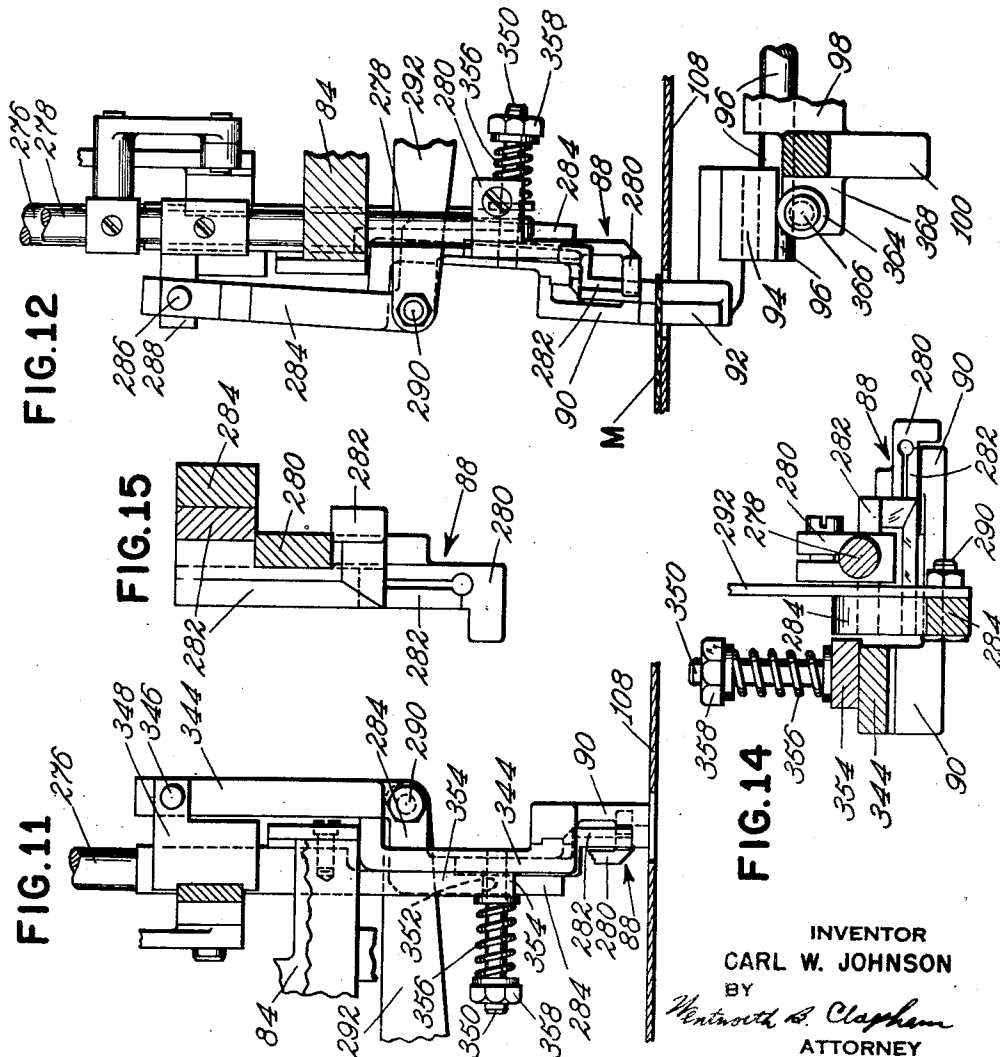
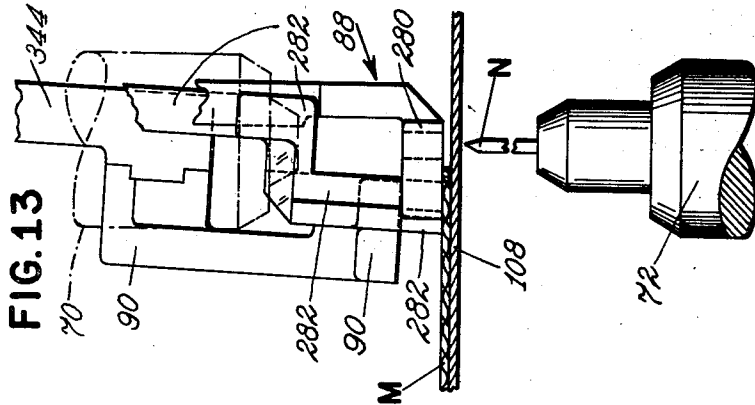
C. W. JOHNSON

2,941,485

SPECIAL STITCH FORMING MACHINE

Filed March 15, 1956

7 Sheets-Sheet 6



INVENTOR  
CARL W. JOHNSON  
BY  
*Wentworth & Clapham*  
ATTORNEY

June 21, 1960

C. W. JOHNSON

2,941,485

SPECIAL STITCH FORMING MACHINE

Filed March 15, 1956

7 Sheets-Sheet 7

FIG. 16

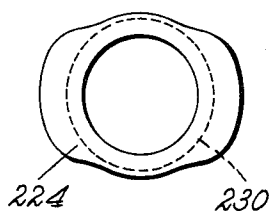


FIG. 17

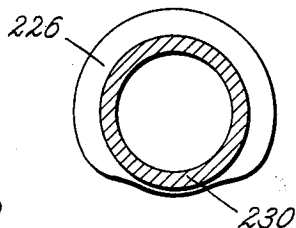


FIG. 18

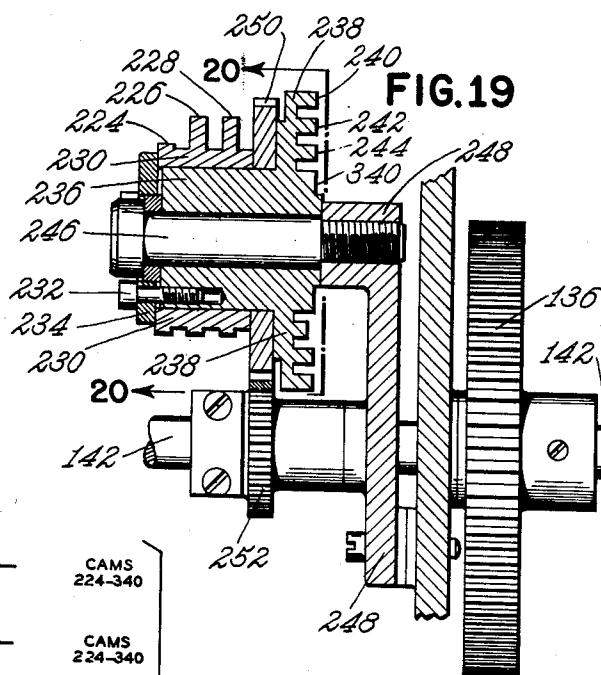
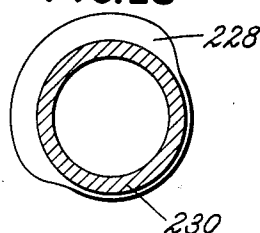


FIG. 21

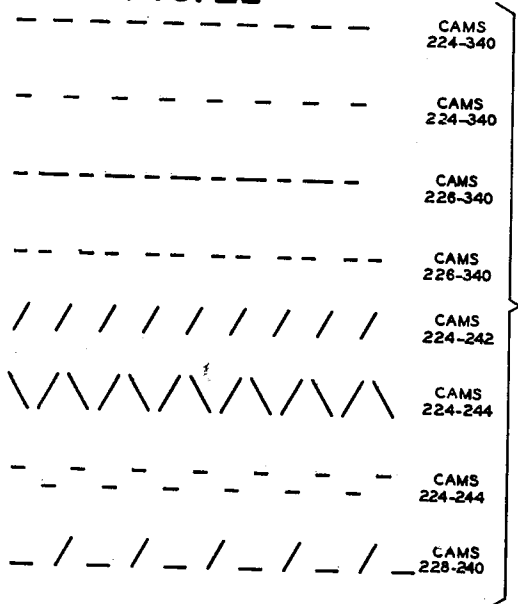
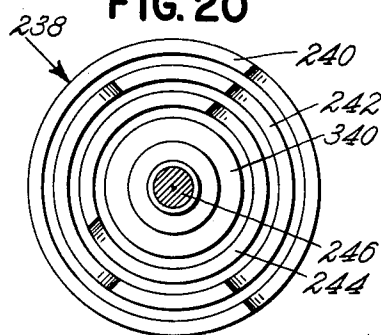


FIG. 20



INVENTOR  
CARL W. JOHNSON

BY

*Wentworth & Clapham*  
ATTORNEY

1

2,941,485

## SPECIAL STITCH FORMING MACHINE

Carl W. Johnson, Brooklyn, N.Y., assignor to American Machine & Foundry Company, a corporation of New Jersey

Filed Mar. 15, 1956, Ser. No. 571,731

44 Claims. (Cl. 112—98)

This invention relates to the art of sewing, and more particularly to improvements relating to sewing machines and sewing methods for forming various types and combination of types of stitches closely simulating hand stitching.

The invention further relates to the novel method of and apparatus for forming selected combinations of straight stitches and lateral stitches and combinations of such stitches wherein all or none of the lateral stitches may extend over the edge of the work or only a part of the lateral stitches may extend thereover. Material stitched in accordance with the invention so closely resembles hand sewing that it is difficult even to an expert to tell whether the work has been stitched by a skilled seamstress or tailor. It is believed that finished work so closely approximates "hand" sewing because as in hand sewing a single thread is pressed back and forth through the work and disposed therein in a manner approximating hand sewing.

The term "lateral stitch" as used herein, means a stitch that is positioned at an angle to the direction of feed of the work or of the line of stitches in the work, or at substantially right angles thereto.

A preferred form of apparatus for accomplishing the results of the invention comprises a sewing machine using a double pointed needle having an eye located between the points through which the length of thread may pass. The needle is moved by opposed alternately operating needle bars back and forth relative to a work support table and projected through the work with the thread which has a loose and a fixed end in timed relation to the operation of the work feeding and holding means. On alternate operations of the needle bars while a portion of the thread is held above the work by a tension device, a loop of thread formed beneath the work support table is engaged by the thread engaging head of a rotary thread puller. The thread puller pulls the loose end of the thread through the work and disposes it on a thread receiving and supporting drum.

In forming certain types of lateral stitches, over edge and combinations of such stitches, selected spaced portions of the edge of the work may be moved out of the path of travel of the needle, or if desired, the lateral stitches may be disposed wholly within the work. The work is disposed in proper position for stitch formation by means of upper and lower work feed members which grip it and locate it in the path of travel of the needle. The work feed members are moved laterally or forwardly or given combined movements in effecting the type or types of the stitch desired. A machine constructed in accordance with the invention also is provided with selective mechanism which makes it possible to adapt it rapidly for forming conventional straight slip stitches, or for making a plurality of different types of lateral stitches or combinations thereof.

It is an object of the invention to provide a novel apparatus and method of forming selected types of stitches

2

consisting of combinations of lateral and straight stitches, or lateral or straight over and under stitches, and wherein the lateral stitches may be disposed within the limits of the work or over its edge, and wherein stitches are formed from a single continuous length of thread which is disposed in the work in a manner closely approximating hand sewing.

It is a further object of the invention to provide a sewing machine utilizing a double pointed needle having a plurality of adjustable cam actuated means, wherein a specified cam may be selected in order to form a predetermined type of stitch, or a plurality of cams may be selected in forming other predetermined types of stitches, or wherein the cam means may be incapacitated and the machine can then be operated to form conventional types of over and under stitches.

The invention is further characterized by a novel method for forming selected types of stitches, or combination stitches in which the work being stitched is moved laterally, forwardly or backwardly with relation to a double pointed needle which is employed for disposing the thread inside or outside of the work in accordance with a predetermined pattern of stitching.

The invention is also characterized by the provision of novel mechanism for and the method of forming a plurality of types of slip stitches including a succession of lateral stitches which may be disposed within the limits of the work, or over the edge of the work and a succession of combination stitches. The machine is also provided with means for gripping and feeding the work according to a predetermined pattern of movement relative to the needle so that a highly desirable decorative effect can be obtained as well as a succession of stitches having great utility.

It is a further object of the invention to provide an improved length adjusting mechanism which furnishes a visual and actual indication of the length of stitch to be made.

The invention further consists in the provision of novel mechanism including a plurality of cams and adjustable means actuated thereby for producing a large number of highly decorative and pleasing as well as utilitarian stitches in work which is stitched. In accordance with the invention, a selected cam or a plurality of cams may be operated at one time in forming the desired type of stitch required.

With these and other objects not specifically mentioned in view, the invention consists in certain combinations and constructions which will be hereinafter fully described, and then set forth in the claims hereunto appended.

In the accompanying drawings which form a part of this specification, and in which like characters of reference indicate the same or like parts:

Fig. 1 is a partial sectional end elevation of a preferred embodiment of sewing machine embodying the invention.

Fig. 2 is a sectional front elevation of the machine, taken on line 2—2 of Fig. 1.

Fig. 3 is a rear view illustrating the material feed and displacement mechanism.

Fig. 4 is a view taken on line 4—4 of Fig. 3.

Fig. 5 is a plan view of the controls for the material feed and displacement mechanism.

Fig. 6 is a detailed plan view of the lower material feed foot, taken on line 6—6 of Fig. 11.

Fig. 7 is a side elevation illustrating the material feed and displacement mechanism while engaging the material being sewed during feeding operation.

Fig. 8 is an end elevation, partly in section, illustrating the upper and lower feed foot during feeding action, taken on line 8—8 of Fig. 7.



Fig. 9 is an end elevation taken on line 9—9 of Fig. 7 showing the dual presser foot in elevated position during feeding of the material.

Fig. 10 is a bottom view of the upper feed foot and dual presser foot, taken on line 10—10 of Fig. 7.

Fig. 11 is an end elevation, taken on line 11—11 of Fig. 7 illustrating the upper feed foot and dual presser foot.

Fig. 12 is an end elevation of the upper and lower feed foot in conjunction with the dual presser foot during material displacement action.

Fig. 13 is an enlarged partial end elevation illustrating the upper feed and dual presser feet after displacing the material and prior to the upward movement of the needle.

Fig. 14 is a sectional plan view of the upper feed foot and presser foot mechanism, taken on line 14—14 of Fig. 7.

Fig. 15 is a sectional plan view of the dual presser foot, taken on line 15—15 of Fig. 9.

Figs. 16, 17, and 18 illustrate the configuration of each of the three vertical cams employed for the purpose of selecting various combinations of stitch lengths.

Fig. 19 is a sectional end elevation illustrating the assembly of vertical cams and the horizontal cams provided to effect various timed lateral displacement of the material and thus produce various selected combinations of ornamental stitches.

Fig. 20 is an end elevation of the horizontal cams, taken on line 20—20 of Fig. 19.

Fig. 21 illustrates a few of the several ornamental stitches which can be produced through the selection of the various stitch length control cams in combination with the various material displacement cams.

Fig. 22 is a plan view of a preferred form of throat plate.

Fig. 23 is a plan view of the material guide showing its relation to the upper presser foot.

With reference to the drawings, stitch forming mechanisms embodying the invention are shown in conjunction with an under and over stitch sewing machine, such as illustrated and described in Patent No. 2,386,800, granted to C. W. Johnson on October 16, 1945.

It will be understood by those skilled in the art that in the type of machine disclosed and described herein, needle N is grasped alternately by the jaws of each needle bar as the needle is pushed vertically downward or upward or back and forth through the work or material being sewed. In the operation of the machine, one end of the thread is held fixed and the other end is loose. This loose end of the thread is pulled through the work on each alternate movement of the needle bars by a thread puller described hereinafter.

The machine is driven by a belt 30 running on pulley 32 secured to hub 34 of gear 36 rotatably supported by stud shaft 38 mounted on the wall of frame 40 by means of suitable screws 42. Belt 30 is driven by a suitable pulley (not shown) which is integral with a suitable clutch mechanism driven from a motor (not shown) in a manner similar to that disclosed in Johnson Patent No. 2,368,066, issued January 23, 1945. Since the drive, as well as the mechanism for operating the clutch and brake of the sewing machine, form no part of the present invention, further showing and description thereof are deemed unnecessary and are omitted. A hand wheel 44 attached to pulley 32 is provided in order to permit manual turning of the machine.

Formed integrally with pulley 32 is a cam 46 having a cam track 48 in which run cam rollers 50 and 52 positioned at diagrammatically opposite points of cam 46. Cam roller 50 is pivotally supported on the free end of cam lever 54 projecting from the rearward end of an elongated hub or sleeve 56 pivotally mounted on horizontal shaft 58 held at one end by a suitable bearing bracket 60 and at the other end by a bearing lug of bridge housing 62. Cam roller 52 is pivotally mounted on the free end of cam lever 64 projecting from the rearward end of

elongated hub or sleeve 66 loosely supported on a suitably mounted horizontal shaft 68 (Fig. 2).

The machine is provided with an upper needle bar 70 and a lower needle bar 72 arranged in opposed axial alignment. Each needle bar is operatively connected to an actuating member 74 and 76, respectively. Actuating member 74 of upper needle bar 70 is pivotally connected to actuating arm 78 projecting from the forward end of hub or sleeve 56. Actuating member 76 of the lower needle bar 72 is pivotally connected to the free end of actuating arm 80 projecting from the forward end of hub or sleeve 66.

Upper needle bar 70 is guided by means of a pair of vertical bushings 82 (Fig. 1) supported by a pair of suitable lugs 84 projecting from the forward end of bridge housing 62. Lower needle bar 72 is also guided by means of a pair of suitably supported vertically spaced axial aligned bushings 86 (Fig. 1). Since the actuating members 74 and 76, respectively, of the upper and lower needle bars are of the sliding block type, oscillating motion imparted to actuating arms 78 and 80 and sleeve members 56 and 66 by means of cam 48 through cam levers 54 and 64, respectively, is converted into vertical reciprocating motion of needle bars 70 and 72.

Needle N, which is projected by needle bars 70 and 72 back and forth through the work, is a double pointed needle having a point at each end and an eye located preferably about midway between the ends thereof through which the thread passes. Since both needle bars 70 and 72 are constructed in the same manner as the needle bars shown and described in Johnson Patent 2,386,800, and their construction forms no specific part of the present invention, further detailed disclosure and description thereof are deemed unnecessary and are therefore omitted.

The machine selected for purposes of illustration is provided with a dual upper presser foot designated generally 88 which coacts with another upper feed foot 90, and a lower feed foot 92 which operate to engage, displace and feed as well as retain the work or material being sewed in proper position on work support table or plate 110. The actuating mechanism for effecting the vertical up and down motions of presser foot 88 and upper feed foot 90 of sewing head H is generally the same in construction and operation as that shown and described in Patent 2,386,800 and therefore a detailed description is deemed unnecessary to an understanding of the invention.

In order to facilitate the formation of a new series of stitches in work M, and also to enable an operator to inspect the work at any time during the operation of the machine, presser foot 88 and upper feed foot 90 are so constructed and arranged that they may be lifted upwardly whenever the operator desires. This operation is accomplished by means of a knee actuated treadle or plate mechanism (not shown) similar to that shown in the above referred to Patent 2,386,800.

Lower feed foot 92 is similar in construction and operation to that disclosed and described in Patent 2,368,066 as far as its reciprocatory movement is concerned. In accordance with the invention, however, feed foot 92 is so constructed that it may be moved laterally, as well as longitudinally up and down. In this way, the work is given either a straight forward feeding movement over work table 110, or a lateral movement thereon, or a combined lateral and longitudinal movement. By virtue of these several movements, a large number of desired types of highly decorating and pleasing, as well as utilitarian stitches, can be made.

Referring to Figures 5, 6, 7 and 8, it will be seen that lower feed foot 92 is attached to a carrier bar 94 having rigidly attached to, as by welding or other suitable means, a rod 96 slidably mounted in a bore 97 formed in a laterally projecting hub 98 of an arm 100. The extreme right end of arm 100, as viewed in Fig. 1, is pivotally attached to a stud 102 carried by a lug 104 loosely mounted on

stud shaft 106 suitably supported in the frame of the machine.

Lower feed foot 92 is provided with a corrugated or toothed work engaging and feeding surface 93 adapted to engage, and advance the work to and from the path of travel of needle N. Feeding surface 93 may be of any conventional type known in the art. Lower presser foot 92 is moved in a closed path of travel upwardly through a slot 107 in a throat plate 108 mounted in work table 110 with its upper surface lying in the plane of table 110. As illustrated, throat plate 108 is mounted for lateral movement relative to the straight line movement of work M to and from the path of travel of needle N.

As each stitch is completed, lower feed foot carrying arm 100, by means of the operating connections described hereinbelow, descends slightly below the level of throat plate 108 thereby disengaging surface 93 from work M, after which it returns along its prescribed closed path of travel to its starting position at the right of the path of travel of needle N, as viewed in Fig. 1. In the continued operation of the machine, arm 100 moves upwardly, engaging surface 93 with the under surface of work M which is then advanced by lower feed foot 92 into position awaiting the next movement of needle N therethrough. The work or material M remains in this position during each sewing operation of the needle while lower feed foot 92 returns to its starting position.

Upward and downward movement of lower feed foot 92 on arm 100 is effected by means of cam 112 which is tracked by cam follower 114 on one arm 116 of a bell crank cam lever loosely mounted on a horizontal shaft 118 (Figs. 1 and 2). The other arm 120 of this bell crank lever is pivotally connected to one end of a connecting rod 122. The other end of rod 122 is pivotally attached to the left end of arm 100, as viewed in Fig. 1.

Cam 112 is mounted on and rotated continuously by shaft 124 suitably supported in suitable bearings in the frame of the machine. Shaft 124 is driven by a gear 126 attached thereto and meshing with gear 128 mounted on shaft 130. A gear 132, preferably formed integrally with gear 128, meshes with gear 134 which in turn meshes with and is driven by gear 136. Gear 136 meshes with gear 138 which meshes with and is driven by gear 36 to which driving pulley 32 is attached. Gears 134, 136 and 138 are mounted on shafts 140, 142 and 144, respectively, all of which are suitably supported bearings in the machine frame.

Referring to Fig. 1, the left end of arm 100 carries a pin or stud 146 connected by means of a pair of parallel links 148 to one arm of a bell crank lever 150. The other arm of bell crank lever 150 is pivotally attached by pin 151 to a yoke formed on the upper end of arm 152. The lower end of arm 152 is formed with an elongated slot 154 which is engaged by a roller 156 pivotally mounted on a crank pin or stud 158 supported eccentrically on the front face of cam 112. A roller 159 rotatably mounted on stud 155 projecting from the center portion of arm 152, engages with a track 160 of the cam block formed integrally on one end of shaft 118 suitably mounted on bearings supported in the frame of the machine. An arm 162 (Figs. 1, 3 and 5) mounted on shaft 118 carries on its free end a pin 164 engaging an elongated slot 166 formed in a bar 168 and an elongated slot 170 formed in a bar 172. Bar 168 is secured to one end of a rod 169, the other end of which is pivotally connected to an arm 174 mounted on a vertical shaft 176 pivotally supported in a suitable bearing bracket 178 attached to the front frame portion of the machine. Bar 172 is attached to one end of rod 173 whose other end is pivotally connected to the free end of arm 180 mounted on a vertical shaft 182 also pivotally mounted in bearing bracket 178.

Stitch selector arms 184 and 186 are attached to the lower ends of vertical shafts 176 and 182, respectively

(Figs. 1 and 5). The free ends of arms 184 and 186 are provided with pointer or indicator heads 188 and 190, respectively, which engage with the front edge of an indicator plate 192 having formed thereon suitable spaced markings or calibrations which aid an operator in setting one or both heads 188 and 190 in a selected position according to the length of stitches to be made.

Each arm 184 and 186 is provided with a thumb screw 196 which coacts with a clamp shoe 198 operative to hold its respective stitch selector arm firmly in adjusted selected position on indicator plate 192. Indicator plate 192 is attached to the bottom portion of bearing bracket 178.

Also attached to pin 164 is a bridge member 200 which slidably engages and is yieldingly connected to one end of connecting rod 202 (Fig. 5). The other end of rod 202 engages with and is yieldingly connected to a block 204 which is pivotally attached by stud 206 to the lower end of cam lever 208. Cam lever 208 on its upper end carries a cam follower 210.

The yielding connection between rod 202 and bridge member 200 includes a collar 201 secured to rod 202 and a compression spring 203 encircling the rod with its ends bearing against the collar and a part of bridge member 200, as shown in Fig. 5. The resilient connection between rod 202 and block 204 includes a pair of spaced collars 205 pinned to rod 202 and a compression spring 207 encircling rod 202 with its ends bearing against opposed ends of collars 205. The resilient connections are similar in construction to those shown and described in Pedersen Patent 2,604,863, and further detailed description thereof is deemed unnecessary to an understanding of the invention, and is omitted.

Cam lever 208 at its center portion is provided with a hub 209 which is rotatably and laterally slidably supported on horizontal shaft 212 suitably mounted in the frame of the machine. Hub 209 is formed with a vertical slot 214 (Fig. 5) with which engages a pin 216 fixed to and projecting outwardly from a manually shiftable selector lever 218. This lever is pivotally mounted at its lower end on a stud 220 held in a suitable lug in the machine frame. The upper or free end of lever 218 is provided with a manually engageable handle 222 (Fig. 2).

It will be seen that when an operator wishes to select a desired operating position for lever 218, she grasps handle 222 and moves it in one direction or the other. By moving lever 218 in this manner, cam lever 208 is shifted laterally and the operator can locate cam roller 210 in position to engage and coact with any one of three vertically arranged axially spaced cams 224, 226, or 228, which preferably are formed integrally with cam sleeve 230. Cam sleeve 230 is adjustably clamped by means of screws 232 and plate 234 (Fig. 19) to hub 236 of a flange 238 which is provided with a plurality of concentric, radially spaced, edge cams 240, 242 and 244. Although three vertical cams and three edge cams have been selected to illustrate the invention, it is to be understood that more or less than three cams of each type could be used if desired. Hub 236 is rotatably supported on stud 246 which is attached to and extends outwardly from bracket 248 secured to the machine frame. A ring gear 250 attached to flange 238 and hub 236 meshes with and is driven by gear 252 adjustably secured to shaft 142 which is driven continuously by gear 136.

In order to assure proper contact and alignment of the cam roller 210 with one of the three vertical cams 224, 226 and 228, which is selected by the operator for a desired stitch pattern, hand lever 218 is provided on its upper portion with a pin 254 which can be brought into engagement with one of three properly spaced holes 225, 227 or 229 (Figs. 2 and 5) formed in a suitable bracket 256 attached to the machine frame. Pin 254, which extends outwardly from the plane of lever 218, not only serves to assure proper alignment of cam roller 210 with

a selected cam, but also to provide means for locking the cam levers 208 against lateral shifting movement during sewing operations.

The gear ratio between the main drive of the machine and that of the cams 224, 226 and 228 is 2:1. Considering that two stitches, one over and one under stitch, represent one cycle of the machine, it is evident that one revolution of the cams on shaft 246 represents two machine cycles or four stitches. In order to create a large number and variety of attractive stitch patterns, it has been found that four successive stitches may produce such desired variety. If a greater number and variety of stitch patterns were desired, the gear ratio could be increased accordingly.

In the illustrated embodiment of the invention, cams 224, 226, and 228 have been so designed that cam 224, shown in Fig. 16, produces an alternate short and long stitch; cam 226 shown in Fig. 17, produces three successive short and one long stitch, and cam 228 shown in Fig. 18, produces two successive short and two successive long stitches. It has been explained hereinabove that the angular position of track 160 in cam block 161 of shaft 118 controls the length of the stitch to be made; and that cam block 161 is rocked into different angular positions by means of vertical cams 224, 226 and 228 through cam lever 208, rod 202, bridge member 200, and arm 162. While angular movements of cam block 161 effected by the high and low portion of each of the cams 224, 226 and 228 are the same, the sequence in which such movements are effected by each of said cams is different in every two cycles of the machine depending on which cam is selected and the stitch pattern desired. It should be understood that the distance the work or material M is advanced or fed forward by the lower feed foot 92 determines and represents the length of stitch.

The production of short stitches of various lengths as well as long stitches of various lengths is accomplished by the settings of the bars 168 and 172. These bars by means of their elongated slots 166 and 170, respectively, engage with pin 164 on arm 162 oscillated by one of the cams 224, 226 and 228 described above. Bars 168 and 172 can be set in such a position that pin 164 contacts and is arrested by either of the two elongated slots 166 and 170 before the full distance effected by a selected cam is reached. The above described yieldable connection of rod 202 with the cam lever 208 and the bridge member 200 compensates for any over travel caused by a high or low portion of any of the cams 224, 226 or 228. Adjustment of either or both of heads 188 and 172 in accordance with the desired length of stitches on the top and bottom surfaces of the work and the concurrent positioning of their respective slots 166 and 170 in proper operating arrangement is effected by moving indicator heads 188 and 190 on arm 184 and 186, respectively. The machine is so arranged that indicator head 190 controls the setting for the length of stitch on the under surface of material M; indicator head 188 controls the setting for the length of stitch on the top surface thereof. By moving indicator heads 188 and 190 towards each other, shorter top and bottom stitches are effected; by moving the indicator heads away from each other, longer top and bottom stitches are formed. Separate movement of heads 188 and 190 different distances from their zero positions (Fig. 5) results in the desired lengths of top and bottom stitches.

The machine is provided with a thread puller mechanism similar to that disclosed in Patent 2,368,066, and only so much as is required to make clear its construction and operation is described and shown herein. This mechanism includes a thread puller arm 260 which on its upper free end carries a thread engaging head 262 so mounted that it may rotate around the periphery of a drum 264 (Figs. 1 and 2). The chief function of the thread puller mechanism is to engage the loop of thread formed beneath table 110 on alternate movements of the needle N, pull the loose end of the thread through the

work or material M and dispose it about the periphery of the drum 264 in such a manner that the danger of snarling, fouling or breaking the thread is practically eliminated.

As shown in Fig. 1, there is provided in upper looper arm 261 having a thread engaging and supporting head 263 which engages a loop of thread formed above work M on the downward movement of needle N by upper needle bar 70. Head 263 is provided with a roller (not shown) on which the thread is supported during the movement of looper arm 261 from left to right, as viewed in Fig. 1, when on the next upward movement of lower needle bar 72, thread engaging head 262 on thread puller arm 260 engages the loop of thread formed beneath the work and pulls the loose end of thread over the roller on head 263 and through the work in its operation of disposing the thread on drum 264. The construction and operation of upper looper arm 261 is essentially the same as that disclosed in Patent 2,386,800 and further showing and description thereof is deemed unnecessary.

Thread puller arm 260 is mounted on shaft 266 supported by a suitable bearing bracket 268 secured to the framework of the machine. Shaft 266 is rotated by means of a cam lever 270 mounted thereon and carrying on its free end a cam roller 272 engaging with a suitable cam track 274 mounted on the face of continuously driven gear 128.

Stitching head H is provided with vertical reciprocatory rods 276 and 278 which are responsible for the movement of dual presser foot 88 and upper feed or follower foot 90, respectively, to and from operative position relative to work M on table 110. The construction and operation of rods 276 and 278 are similar to those disclosed in Patent 2,386,800.

Dual presser foot 88 comprises a foot portion 280 fixed to the lower end of vertical rod 278, and a foot portion 282 secured to the lower or free end of a suitably shaped arm 284. This arm, in the illustrated embodiment, has a forked head end pivotally mounted on a stud 286 held by a lug 288 attached to vertical rod 278 (Figs. 7 and 9). Arm 284 also carries a stud 290 to which is connected one end of a link 292. The other end of link 292 is attached to lever 294 (Fig. 3) loosely mounted on stud 296 fixed in a bracket 298 secured to the machine frame.

The lower free end of lever 294 is pivotally connected to one end of link 302. The other end of link 302 is pivotally attached to one side of an H-shaped arm 306 (Fig. 3) loosely supported by a pair of pins or studs 308 in bracket 310 attached to the machine frame. On its other end, link 302 is provided with an extension lug 312 to which is secured a bar 314. The free end of bar 314 supports throat plate 108 (Figs. 3 and 5). Also attached to link 302 is a vertical bar 316 (Figs. 3, 4 and 5) which engages with a hook-shaped finger on a cam lever 320 loosely mounted on vertical cam shaft 322 and formed with a forked shaped hub adapted to engage with a collar secured to vertical shaft 322. The latter is slidably supported in a suitable bearing lug 326 projecting from bracket 248 and a suitable bearing in bracket 256.

The top end portion of vertical shaft 322 is provided with a pin 328 projecting therefrom. The free end of pin 328 is provided with a knob 330 by means of which the operator can raise or lower vertical shaft 322 in its supporting bearings. This movement of shaft 322, as described, is made possible by the provision of a vertical slot 332 formed in the bearing of bracket 256 (Fig. 2), which slot accommodates pin 328 as it is moved up or down therein. Slot 332 is formed with three vertically and equally spaced horizontal notches 334, 336 and 338. These notches allow the operator to engage and locate pin 328 in a selected notch thereby positioning cam follower 321 on cam lever 320 for coaction with a selected cam of horizontal cams 240, 242 and 244 on flange 238. These cams are employed for the purpose of effecting

lateral displacement of the work in accordance with a predetermined repetitive stitching pattern sequence. The high and low portions of each cam are constructed and arranged to cause a different repetitive stitch sequence of displacement during the course of every two cycles of the machine or four stitches, two under and two over stitches.

When the operator moves knob 330 so as to cause pin 328 to come to rest in the bottom of vertical slot 332, cam follower 321 will engage a straight annular face 340 (Figs. 19 and 20), and cam lever 320 will remain motionless, and no displacement of material M will take place.

In order to make certain that pin 328 will remain in a selected notch 334, 336 or 338, shaft 322 encircling its lower end, is provided with a suitable torque spring 342 (Fig. 1) which normally biases pin 328 into the slot and retains it in locked in position.

As shown in the drawings, it is evident that when cam follower 321 rolls onto a low portion of one of the cams 240, 242 or 244, arm 284 through the linkage described hereinabove, is moved outwardly on pivot 286. Since presser foot portion 282 is attached to the lower end of arm 284, it is also moved outwardly or displaced laterally from the position shown in Fig. 11 to that shown in Figs. 12 and 13.

In Fig. 11, it will be seen that normally presser foot portion 282 is located adjacent upper feed foot 90. Thus any lateral movement of presser foot portion 282 results in a similar movement of feed foot 90 (Fig. 12). In order to obtain this lateral movement, upper feed foot 90 is attached to the lower free end of a suitably shaped arm 344, the upper end of which is secured to pin 346 mounted in a forked lug 348 adjustably secured to vertical actuating rod 276 (Figs. 7 and 8).

The lower end of arm 344 carries a stud 350 extending through a slot 352 of a guide and aligning lug 354 fixed to the lower end of vertical reciprocating rod 276. Compression spring 356 encircling stud 350 and having its ends bearing against nut 358 and lug 354 normally maintains upper feed foot 90 in vertical position. When, however, upper feed foot 90 is displaced laterally, by presser foot portion 282, as just described, spring 356 is operative to return it to its normal position.

Since it is desirable to grip the work or material M firmly when it is displaced by the upper feed foot 90 and lower feed dog or foot 92, the latter is moved laterally at the same time and by the same mechanism that moves presser foot portion 282 and upper feed foot 90. The lateral movement of these parts can be a right angular movement or a compound lateral and forward movement constituting a substantially diagonal path of travel depending upon which of the vertical and horizontal cam combinations is selected to produce the desired repetitive sequence stitching pattern.

This operation is effected by H-shaped arm 306 which is connected by adjustable connecting rod 360 to lug 362 adjustably attached to rod 96 which is integral with lower feed foot carrier bar 94. It will be recalled that rod 96 is slidably supported in hub 98 of arm 100. In this way, lower feed foot 92 is mounted for movement in two directions at right angles one to the other. That is it can be moved back and forth as well as sideways.

In order to prevent undue friction and make possible a smooth sidewise motion, a roller 364 is provided for supporting the front end of carrier bar 94 (Figs. 7 and 8). Roller 364 is loosely mounted on stud 366 held by lug 368 forming a part of arm 100.

As described hereinabove, the displacement of upper feed foot 90 and lower feed foot or dog 92, as well as presser foot portion 282 and throat plate 108, is effected by cams 240, 242 and 244 through cam lever 320 and associated linkages. Cam follower 321 on cam lever 320 is maintained in contact with any of the selected cams 240, 242 and 244 by means of tension spring 370

(Figs. 3, 4, and 5) having one end attached to stud 300 on link 302 and its other end anchored to a post 372 mounted in a suitable lug on the machine frame.

When cam follower 321 moves off a high spot of the selected cam with which it coacts to a low spot thereon, a displacement action of the work displacing mechanism occurs. Since the distance between the high and low spots or portions of a selected cam of any of the cams 240, 242 and 244 is the same for all cams, the amount of lateral displacement of the work in response to this operation is the same regardless of which of the three cams 240, 242, or 244 cam roller 321 is engaged. However, since it is possible to obtain a greater variety of stitches by varying the amount of lateral displacement of the work engaged by the above described displacing mechanism, lever 294 (Fig. 3) is provided on its upper free end with an adjustable stop screw 376. This screw may be so adjusted by turning in one direction of the other, that the lateral displacement of the work may be made less than it would have been if cam follower 321 were permitted to reach the bottom of a low spot on any of the selected cams 240, 242 or 244 with which it is engaged. Therefore, the extent of movement of the displacing mechanism may be regulated by screw 376 from a maximum of the full throw provided by each low spot on one of the cams 240, 242 and 244 to a minimum as desired by the operator.

In order to provide means for insuring that the work will at all times be fed properly with respect to the path of movement of needle N, there is provided a detachably mounted, suitably shaped material guide finger 380 (Fig. 23) pivotally supported on a stud 382 in bracket 384. The latter is adjustably and detachably secured by screw 386 to work supporting table 110. Guide finger 380 is maintained in operative position on bracket 384, as shown in Fig. 23, by means of a conventional type of spring urged ball lock or detent 388. When it is desired to move finger 380 out of operative position, the operator merely grasps it and pulls it towards her and in so doing, the lock connection is broken. Presser foot 280 is provided with a cut-out 390 adapted to accommodate the end of guide finger 380 and in this manner allows guide finger 380 to be located closely adjacent the presser finger mechanism.

Since it is desirable, especially when sewing thin and delicate materials to provide as much support as possible therefor during the stitching operations, the cut-out in throat plate 108 is held to a minimum. This may be effected by providing a cut-out 392 such as shown in the modified form of throat plate 394 illustrated in Fig. 22. It will be noted that this throat plate has two laterally spaced needle holes 395 and 397 which provide for unobstructed movement of needle N at all times during the formation of straight line and also lateral stitches.

With the banks of cams shown in Fig. 19, many different selected repetitive type of stitch patterns can be formed. Fig. 21 for purposes of illustration shows several types of repetitive stitch patterns which can be formed. In the last stitch pattern shown in this figure, the machine forms a stitch which is commonly known in the glove trade as a "Creed" stitch. In the formation of this stitch, selected cams of each bank of vertical and edge cams are used. The motions imparted by selected cams 228 and 240 of these banks of cams imparts not only a forward or straight line path of movement to the work, but also a diagonal movement by means described hereinabove so that in forming the stitches which extend in a straight line path of movement, cam 228 is responsible for this movement, and the diagonal or lateral stitch is effected by cam 240. The exact sequential operation of other combinations of selected vertical and horizontal cams is not described herein since it is considered that the invention can be understood without a description of the operation of each selected set of cams, and is therefore omitted in the interest of brevity.

A sewing machine of the type described equipped with

the cams and coacting mechanisms which result in the many types of selected stitch patterns, makes possible the formation of stitches which not only have a highly pleasing decorative effect, but also stitches which are utilitarian in purpose and function.

What I claim is:

1. The mechanical method of forming a succession of over and under stitches, and lateral stitches in accordance with a desired repetitive stitching pattern, comprising feeding work to be stitched over a support surface into and out of the path of a needle, moving a double pointed needle having an eye located between its points and thread having a loose end back and forth through said work to form a straight line series of one or more over and under stitches, then gripping said work adjacent the path of travel of said needle and moving said work laterally to dispose it for the next movement of said needle therethrough in a line parallel to but spaced laterally from the line of over and under stitches, again gripping said work and moving it in the reverse direction laterally to dispose it in the path of said needle and in line with said line of over and under stitches, and pulling the loose end of said thread through said work on each alternate movement of said needle.

2. The mechanical method of forming a succession of over and under stitches, and lateral stitches in accordance with a desired repetitive stitching pattern, comprising feeding work to be stitched over a support surface into and out of the path of a needle, moving a double pointed needle having an eye located between its points and threaded with a thread having a loose end back and forth through said work to form a straight line series of one or more over and under stitches, gripping the work adjacent the path of movement of said needle after the formation of said one or more over and under stitches and laterally displacing said gripped work to position it for movement of said needle therethrough in a path of travel lying along a line parallel to the line of over and under stitches, and shifting said work back and forth relative to said needle in forming each stitching sequence of said repetitive stitching pattern.

3. The mechanical method of forming a succession of over and under stitches, and lateral stitches in accordance with a desired repetitive stitching pattern, comprising feeding work to be stitched over a support surface into and out of the path of a needle, moving a double pointed needle having an eye located between its points and threaded with a thread having a loose end back and forth through said work to form a straight line series of one or more over and under stitches, gripping said work adjacent the path of movement of said needle after the formation of said one or more over and under stitches and laterally displacing said gripped work to position it for movement of said needle therethrough at a point located at one side of the line of stitches first-named, pulling the loose end of said thread through the work on each alternate movement of said needle through said work, and selectively shifting said work relative to said needle in forming each stitching sequence of said repetitive stitching pattern.

4. The mechanical method of forming a succession of over and under stitches, and lateral stitches in accordance with a desired repetitive stitching pattern, comprising feeding work to be stitched over a support surface into and out of the path of a needle, moving a double pointed needle having an eye located between its points and threaded with a thread having a loose end back and forth through said work to form a straight line series of one or more over and under stitches, gripping said work adjacent the path of movement of said needle after the formation of said one or more over and under stitches and substantially simultaneously laterally and forwardly displacing said gripped work to position it for movement of said needle therethrough at a point located at one side of said straight line series of stitches, pulling the loose end of said thread through the work on each alternate move-

ment of said needle through said work, and selectively shifting said work relative to said needle in forming each stitching sequence of said repetitive stitching pattern.

5. The mechanical method of forming a succession of lateral stitches according to a desired repetitive stitching pattern, said pattern having a succession of stitching sequences, comprising feeding said work along a guide and over a work supporting surface into and out of the path of travel of a double pointed needle having an eye between its ends and threaded with a thread having a loose end, forming one or more over and under stitches according to a sequence of said stitching pattern, then gripping said work after the last over and under stitch of said sequence is completed and moving it laterally relative to said guide and the path of travel of said needle to dispose it so that on the next movement of said needle therethrough, said needle may move therethrough at a point laterally spaced from the line of stitching formed by said over and under stitches, and pulling the loose end of said thread through said work on the completion of each stitch.

6. The mechanical method of forming a succession of lateral stitches in work being stitched comprising feeding said work past a guide over a work support into the path of movement of a double pointed needle having an eye between its ends and threaded with a thread having a loose end, gripping said work adjacent the path of travel of said needle, passing said needle and thread through said work, moving said gripped work forwardly and substantially simultaneously, also moving said work laterally, and then passing said needle through said work in the opposite direction to form a lateral stitch therein, and pulling the loose end of said thread through said work on alternate movements of said needle.

7. The mechanical method of forming a succession of one or more over and under stitches and lateral stitches in accordance with a desired repetitive stitching pattern closely simulating hand stitching comprising feeding work to be stitched over a work support into the path of travel of a double pointed needle having an eye between its ends threaded with a thread having a loose end, and forming one or more over and under stitches according to said pattern sequence, then gripping the work after the final over and under stitch of each repetitive sequence has been completed and moving said work laterally so as to locate it for the passage of said needle therethrough in a line parallel to the line of over and under stitches, and pulling the loose end of said thread through said work after alternate movements of said needle.

8. In a sewing machine, the combination with a double pointed needle and means for projecting the entire needle and a thread back and forth through work to be stitched to simulate hand stitching, of means for feeding said work into and out of the path of travel of said needle, along a straight line path of travel to form over and under stitches, and mechanism for selectively gripping opposite faces of selected portions of said work, and displacing said work laterally out of said straight line path of travel of said work relative to said needle, whereby said needle on its next complete movement disposes said thread laterally in said work.

9. The invention defined in claim 8, wherein said mechanism includes opposed work gripping and shifting members, and means operating in timed relationship with the movement of said needle projecting means for moving said members into engagement with said work adjacent the path of travel of said needle to displace said work laterally relative to the normal straight line path of movement of said work.

10. In a sewing machine, the combination with alternately operating opposed needle bars, of a double pointed needle having an eye formed between its points and a length of thread threaded through said eye, means for alternately connecting said needle with said bars for projection of the entire needle threaded with said thread through work to be sewed, feeding means for normally



moving said work along a straight line path of movement into the path of travel of said needle, and mechanism including means engaging opposite faces of selected limited portions of said work and cam means operative in accordance with a desired stitching pattern for positively holding and displacing said work laterally out of said normal path of travel to a selected stitching position and for holding said displaced work at said position during the next movement of said needle completely through said displaced work to form a lateral stitch therein.

11. In a short thread sewing machine, a pair of alternately operating needle bars, a double pointed needle, means for alternately connecting said needle with said bars to project the entire needle threaded with a thread having a loose end back and forth through the work, means coaxing with one of said bars for tensioning the thread, a drum, a thread puller operating while said thread is tensioned for pulling the loose end thereof through said work and disposing it on said drum, a work displacing unit movably mounted adjacent said needle for engaging opposite faces of said work and displacing said work laterally out of the path of said needle, a movable throat plate, and means for simultaneously moving said unit and said throat plate to displace said work and locate selected portions thereof in predetermined positions for the formation of lateral stitches therein.

12. The invention defined in claim 11 including a plurality of radially spaced cams, a cam lever, a cam follower on said lever adapted to coact with a selected one of said cams, each of said cams being operative to effect a lateral shifting of said work in accordance with a predetermined stitching pattern sequence, and means for effecting relative movement between said lever and a selected one of said cams to dispose said cam follower in position to engage said selected cam and effect the formation of a selected stitch pattern.

13. In a sewing machine of the class described, the combination with a pair of opposed alternately operating needle bars, a double pointed needle, a work support, work guide means adjustably mounted on said support, means for feeding work along said guide means on said work support, of means alternately connecting said needle with each bar for projection of the entire needle threaded with a thread having a loose end through said work, a drum located adjacent said support, a thread puller movable about the periphery of said drum for pulling the free end of said thread through said work and disposing it about said drum, mechanism normally operative to feed said work along said guide means in a straight line path of movement, mechanism for gripping and moving said work laterally out of said normal path of travel, and selective control means for effecting sequential operations of said mechanisms to produce a desired repetitive stitching pattern stitch sequence in said work.

14. The machine defined in claim 13 wherein said first-named mechanism comprises a first bank of cams, and said second-named mechanism comprises a second bank of cams, means operatively engaging a selected cam of each of said banks of cams, and manually operated means for selecting a cam on each of said banks to control the resulting movements of said work in a straight line path of movement and laterally relative thereto in accordance with the stitching pattern prescribed by said selected cams.

15. The invention defined in claim 9 including a work support table over which said work is fed, a throat plate provided with a slot, and wherein said work feeding means includes a feed dog located beneath said work support table having a work engaging surface movable upwardly through said slot into engagement with the under surface of said work, and wherein said work displacing mechanism includes means for moving said throat plate and said feed dog sidewise relative to a normal straight line movement of said work into and out of the range of operation of said needle.

16. In a sewing machine, the combination with a double pointed needle and means for projecting the entire needle and a thread back and forth through work to be stitched, of means for feeding said work into and out of the path of travel of said needle along a straight line path of travel to form over and under stitches, and mechanism for forming a plurality of types of repetitive stitching pattern sequences in said work as it is fed along a straight line path of travel to and from said needle, including a plurality of operating means, and means for selecting one of said operating means for forming a selected type of stitching pattern.

17. The invention defined in claim 16 wherein said mechanism includes opposed work gripping and shifting members, and means operating in timed relationship with the movement of said needle projecting means for moving said members into and out of engagement with said work adjacent the path of travel of said needle to feed said work in accordance with the stitching pattern prescribed by said selected operating means.

18. The invention defined in claim 16 including mechanism for controlling the length of said stitches, comprising an oscillatable shaft, a control device for said work feeding means on said shaft, a lever attached to said shaft, an operating link connected to said lever, a cam actuated link attached to said lever, a cam actuated lever secured to one end of said link, a cam follower on said lever, an elongated pin mounted on the free end of said first-named lever, an adjusting rod having a slot through which said pin extends, a second adjusting rod having a slot through which said pin also extends, means for adjusting the position of said slots in said rods relative to said pin to control the limits of oscillation of said control device, and wherein said plurality of operating means includes a plurality of axially spaced cams, and means for effecting relative movement between said cam follower and a selected cam for effecting the desired movement of said work feeding means.

19. In a sewing machine, the combination with a double pointed needle and means for projecting the entire needle and a thread back and forth through work to be stitched, of mechanism for feeding said work into and out of the path of travel of said needle, said mechanism including means for gripping opposite surfaces of selected portions of said work adjacent said path of travel of said needle and selectively moving said work with a straight line path of movement, laterally or with a compound movement relative to said needle, said needle being operative in response to its projection back and forth through said work and the movement of said work relative to the path of travel of said needle to form in said work a plurality of repetitive stitch sequences in accordance with a predetermined stitching pattern.

20. In a sewing machine, the combination with a double pointed needle and means for projecting the entire needle and a thread back and forth through work to be stitched, of means for feeding said work into and out of the path of travel of said needle along a straight line path of travel to form over and under stitches, mechanism for selectively gripping opposite surfaces of said work and displacing said work laterally out of said straight line path of travel of said work relative to said needle, whereby said needle on its next complete movement disposes said thread laterally in said work, and means for controlling the frequency of operation of said mechanism in accordance with a selected repetitive stitching pattern.

21. In a sewing machine of the class described, the combination with a pair of opposed alternately operating needle bars, a double pointed needle, a work support, work guide means adjustably mounted on said support, means for feeding work along said guide means on said work support, of means alternately connecting said needle with each bar for projection of the entire needle threaded with a thread having a loose end back and forth through said work and dispose each stitch formed flat against

the surface of said work, a drum located adjacent said support, a thread puller movable about the periphery of said drum for pulling the free end of said thread through said work and disposing it about said drum, mechanism normally operative to feed said work along said guide means in a straight line path of movement in accordance with a predetermined stitching pattern, mechanism for moving said work laterally out of said normal path of travel in accordance with said stitching pattern, and selective means for controlling the frequency of operations of said mechanisms to vary the angular disposition of stitches disposed flat against the surfaces of said work in accordance with said repetitive stitching pattern.

22. In a short thread sewing machine, a pair of alternately operating needle bars, a double pointed needle, means for alternately connecting said needle with said bars to project the entire needle threaded with a thread having a loose end back and forth through the work, means coacting with one of said bars for tensioning the thread, a drum, a thread puller operating while said thread is tensioned for pulling the loose end thereof through said work and disposing it on said drum, a work displacing unit including a work feeding dog operative to engage the under surface of said work and an upper feed foot movably mounted adjacent said needle for feeding and also displacing said work laterally out of the path of said needle, a movable throat plate having a slot accommodating said work feeding dog and two laterally spaced needle holes, and means for simultaneously moving said upper feed foot, said dog and said throat plate to displace said work and locate selected portions thereon in predetermined positions for the passage of said needle through one of said needle holes.

23. Sewing machine presser foot mechanism comprising a supporting surface and work feeding means for feeding work over said surface, a first presser foot, support means mounting said first presser foot for movement into and out of engagement with the upper surface of work to be stitched being fed by said work feeding means into and out of the path of a needle, a second presser foot coacting with said first presser foot, means mounting said second presser foot for movement into and out of engagement with said work, and for independent lateral movement relative to said first presser foot, said work feeding means including means co-acting with said second presser foot during the lateral movement thereof to displace work engaged thereby laterally out of its path of movement to and from said needle.

24. The mechanism defined in claim 23 including means mounting said second presser foot on said support means, means for raising said first presser foot out of engagement with said work, and means operative when said first presser foot is raised for moving said second presser foot and said co-acting means laterally relative to the path of feed of said work to said needle.

25. The mechanism defined in claim 23 including an upper feed foot and a lower feed means coacting with said presser feet, and means operative in response to the lateral movement of said second presser foot for effecting concurrent lateral movement of said upper feed foot.

26. Work handling and feeding mechanism for a sewing machine comprising an upper presser foot, operating means for said presser foot, an upper feed foot, a lower feed means, means for moving said feed foot and said feed means into co-acting feeding relationship with work being fed along a work support table, operating means for moving said presser foot into and out of engagement with said work, and means operative while said presser foot is out of engagement with said work for moving said feed foot and said feed means laterally relative to said presser foot to displace said work sideways on said work support table.

27. Work handling and feeding mechanism for a sewing machine comprising a first upper presser foot and a second upper presser foot coacting therewith, a com-

mon reciprocating support for said presser feet and operating means for moving said presser feet into and out of operative engagement with work being fed over a work support table to and from a reciprocatory needle, an upper feed foot and lower work feeding means co-acting with said presser feet, support means mounting said feed foot and said work feeding means for movement into and out of feeding engagement with said work, operating means for said feed foot and said work feeding means, said first upper presser foot and said feed foot and work feeding means, operating means being operative normally to maintain said work on said work support table and effect the straight line feeding movement thereof over said table, and means for moving said second upper presser foot and said feed foot and said work feeding means laterally relative to the normal path of movement of said work to displace said work sideways on said work support table.

28. The mechanism defined in claim 27 including selective devices for controlling the actuation of said operating means to effect the normal straight line feed of work over said support table and the lateral displacement thereof in accordance with a predetermined repetitive stitching pattern.

29. Sewing machine presser foot mechanism provided with a first presser foot, support means mounting said first presser foot for normal operative movement in a substantially vertical plane into and out of engagement with the upper surface of work to be stitched being fed into and out of the path of a needle, a second presser foot coacting with said first presser foot, means mounting said second presser foot for normal operative movement in a substantially vertical plane into and out of engagement with said work, and for independent lateral movement relative to said plane of movement, means mounting said second presser foot on said support means, means for raising said first presser foot out of engagement with said work, means operative when said first presser foot is raised for moving said second presser foot laterally relative to its normal plane of movement, means co-acting with said second presser foot during the lateral movement thereof to displace work engaged thereby laterally out of its normal path of movement to and from said needle, and selective devices for controlling the frequency of operation of said last-named means in accordance with a preselected repetitive stitching pattern.

30. The mechanism defined in claim 29 including an upper feed foot coacting with said presser feet, a lower feed foot coacting with said upper feed foot means operative in response to the lateral movement of said second presser foot for effecting concurrent lateral movement of said upper feed foot and said lower feed foot, and means for returning said second presser foot and said feed feet to their normal operative positions.

31. The mechanism defined in claim 27 wherein said lower work feeding means includes a work feeding dog, means mounting said dog for normal operation in a substantially vertical plane of movement into and out of feeding engagement with the under side of work to be fed over said table, a throat plate movably mounted in said table and provided with a slot accommodating said dog, and means operating substantially concurrently with the means for moving said upper presser foot for moving said throat plate and said feed dog laterally to shift said work on said table laterally for the next movement of the needle therethrough at a point laterally spaced from a normal straight line sequence of stitches.

32. In a short thread sewing machine, a pair of alternately operating needle bars, a double pointed needle, means for alternately connecting said needle with said bars to project the entire needle threaded with a thread having a loose end back and forth through the work, means coacting with one of said bars for tensioning the thread, a drum, a thread puller operating while said thread is tensioned for pulling the loose end thereof

17

through said work and disposing it on said drum, a work displacing unit including a work feeding dog operative to engage the under surface of said work and an upper feed foot movably mounted adjacent said needle for feeding and also displacing said work laterally out of the path of said needle, a movable throat plate having a slot accommodating said work feeding dog, means for simultaneously moving said upper feed foot, said dog and said throat plate to displace said work and locate selected portions thereon in predetermined positions for the passage of said needle through said slot, said last-named means comprising a plurality of selective cams, a first and a second cam lever, a cam follower on each of said cams, means for effecting relative movement between one of said cams and said cam follower on said first cam lever, means for effecting relative movement between another of said cams and said cam follower on said second lever, and means for rotating said cams.

33. The mechanism defined in claim 26, wherein said last-named means comprises a cam lever having a cam follower, cam means adapted to be engaged by said cam follower, a rotating shaft supporting said cam means, a pivotal mount for said presser foot, an operating lever, a link connecting said presser foot and said operating lever, a spring means operative in response to the rotation of said cam means for rocking said operating lever to move said presser foot laterally, and means operative in response to the continued rotation of said cam means for returning said presser foot to its original position.

34. The mechanism defined in claim 29, wherein said selective devices include a plurality of axially spaced cams, a first displaceable cam lever having a cam follower operatively engageable with a selected cam of said axially spaced cams, a plurality of concentric radially spaced cams, a second displaceable cam lever having a cam follower operatively engageable with a selected cam of said concentric cams, manually operated means for effecting relative movement between said concentric cams and said cam followers to locate said levers in selected operating positions, and means for securing said last-named means in said selected operating positions.

35. The sewing machine defined in claim 13 wherein said mechanisms include a compound cam unit, said cam unit having one bank of axially spaced cams, and a second bank of concentric radially spaced cams, and manually operable means for each of said banks of cams for selectively effecting the operation of a selected cam of said banks of cams to produce said selected repetitive stitch pattern.

36. Work handling and feeding apparatus for a sewing machine comprising an upper presser foot, an upper feed foot, a lower feed dog, means mounting said upper feed foot and said lower feed dog for normal longitudinal movement in a straight line path of movement, or for lateral movement, or combined longitudinal and lateral movement, a movable throat plate provided with a slot accommodating said feed dog on its upward and feeding stroke, and mechanism for operating said upper feed foot and said feed dog in their normal path of movement and selective means for interrupting the operation of said upper feed foot and feed dog and moving said feed foot, and said dog and throat plate with a lateral or compound longitudinal-lateral movement, said mechanism including a plurality of groups of cams, and operating means for said upper feed foot and said feed dog selectively engageable with selected cams of said groups of cams for imparting the desired movement to said upper feed foot and said feed dog.

37. The apparatus defined in claim 36 wherein said operating means for said feed foot, feed dog and throat plate include an adjustable cam lever provided with a cam follower engageable with a selected cam of one of said groups of cams, an operating finger on the free end of said cam lever, a shifting member engaged by said finger, a lever connected to said shifting member, means

18

for moving said shifting member to move said feed foot, said dog and said throat plate and rocking said lever, and adjustable means on said lever to limit the extent of movement of said feed foot, feed dog and throat plate.

38. A presser foot for a sewing machine comprising a first substantially vertically reciprocating rod, a first presser foot member mounted on said rod, a bracket attached to said rod, a second presser foot member pivotally mounted on said bracket, a second substantially vertically movable rod, a work feed foot pivotally mounted on said rod, means coacting with said work feed foot for moving work beneath said presser feet, means normally maintaining said presser foot members, said work feed foot and said last-named means in operative relationship for permitting work to be moved over a work supporting surface in a straight line path of movement, means for raising said rod to lift both of said presser foot members, and means for moving said second presser foot member laterally relative to said first presser foot member to engage and move said work feed foot and said first named means laterally whereby work engaged by said feed foot and said first-named means is displaced laterally on said work supporting surface.

39. The invention defined in claim 38, including a cam actuated, lever, a link connecting said lever to said second presser foot member, and means on said lever for controlling the extent of movement of said second presser foot member.

40. In a sewing machine, the combination with alternately operating opposed needle bars, a double pointed needle having an eye formed between its points and a length of thread threaded through said eye, means for alternately connecting said needle with said bars for projection with said thread through work to be sewed, feeding means for normally moving said work along a straight line path of movement into the path of travel of said needle, and mechanism including cam means operative in accordance with a desired stitching pattern for displacing said work laterally out of said normal path of travel to a selected stitching position and for holding said displaced work at said position during the next movement of said needle through said displaced work to form a lateral stitch therein, said mechanism further including a dual presser foot and an upper feed foot, means for engaging said presser foot and said upper feed foot with the upper surface of said work, a work feeding dog operative to engage the under side of said work, and coact with said upper feed foot and said dual presser foot and move said work past said needle, and means for moving said upper feed foot and said work feeding dog laterally to shift said work out of said normal path of movement of said work to said needle.

41. In a sewing machine, the combination with alternately operating opposed needle bars, of a double pointed needle having an eye formed between its points and a length of thread threaded through said eye, means for alternately connecting said needle with said bars for projection with said thread through work to be sewed, feeding means for normally moving said work along a straight line path of movement into the path of travel of said needle, and mechanism including cam means operative in accordance with a desired stitching pattern for displacing said work laterally out of said normal path of travel to a selected stitching position and for holding said displaced work at said position during the next movement of said needle through said displaced work to form a lateral stitch therein, said mechanism further including a dual presser foot and an upper feed foot, means for engaging said presser foot and said upper feed foot with the upper surface of said work, a work feeding dog operative to engage the under side of said work, and coact with said upper feed foot and said dual presser foot and move said work past said needle, a throat plate having a slot accommodating said feed dog for movement therein, and means for moving said upper feed foot and said work



19

feeding dog laterally to shift said work out of said normal path of movement of said work to said needle.

42. Work feeding mechanism for a sewing machine comprising a lower feed dog, means mounting said dog for normal movement in a substantially vertical plane into and out of engagement with work to be fed over a work support table to and from a reciprocating needle, operating means for moving said dog along its normal path of travel into and out of feeding engagement with said work, support means mounting said dog for movement laterally relative to said normal path of movement, and selectively actuated operating means for interrupting the normal travel of said dog and for moving said dog laterally on said support means to shift said work laterally and dispose laterally spaced points thereof for passage of said needle therethrough, said first named operating means including a bank of spaced cams, and said second named operating means including a second bank of spaced cams, and manually operable means for selecting combinations of cams of said banks of cams to control the operation of said operating means in accordance with a selected repetitive stitching pattern.

43. The mechanism defined in claim 42 wherein said manually operable means includes a first pivotally mounted cam lever having a cam follower for engaging a selected cam of said first bank of cams, a handle on the free end of said first cam lever, a pin projecting outwardly from said lever, a member having a plurality of laterally spaced openings for accommodating said pin when said handle is grasped by the operator and moved to position said first lever with its cam follower in position to engage said selected cam of said first-named bank of cams, a second pivotally mounted cam lever having a cam follower, an axially movable shift supporting said second cam lever, a bearing having a slot slidably supporting said shaft and a plurality of vertically spaced notches corresponding to the positions of cams of said second bank of cams, and manual means on said shaft whereby said shaft may be raised or lowered to engage

20

a selected cam with said cam follower on said second lever.

44. In a sewing machine, the combination with a needle and means for projecting said needle and a thread back and forth through work to be stitched, of means for feeding said work into and out of the path of travel of said needle along a straight line path of travel to form over and under stitches, and mechanism for forming a plurality of types of repetitive stitching pattern sequences in said work as said work is fed longitudinally to and from said needle, and means for controlling the frequency of longitudinal movement of said work relative to said needle in accordance with a predetermined stitching pattern, said last-named mechanism and means including a plurality of selective cam means, a pivotally mounted cam lever, a cam follower on said cam lever, a member having a plurality of locating openings, each corresponding to the operating position of one of said cams, manual means for shifting said cam lever to a selected operating position opening and means on said lever engaging said selected opening for locking said lever in said selected position, whereby said cam follower engages said selected cam.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

540,675	Marrow	June 11, 1895
855,286	Dantzig et al.	May 28, 1907
1,575,285	Sibbald et al.	Mar. 2, 1926
1,823,911	Muentener et al.	Sept. 22, 1931
2,007,863	Jenni	July 9, 1935
2,152,766	Lewin	Apr. 4, 1939
2,386,800	Johnson	Oct. 16, 1945
2,420,480	Ivandick	May 13, 1947
2,604,863	Pederson	July 29, 1952
2,648,303	Gerber	Aug. 11, 1953
2,682,845	Robert et al.	July 6, 1954
2,731,929	Ayres	Jan. 24, 1956