May 9, 1939. J. P. WEIS 2,157,370

FEEDING MECHANISM FOR SEWING MACHINES

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FIG. 1

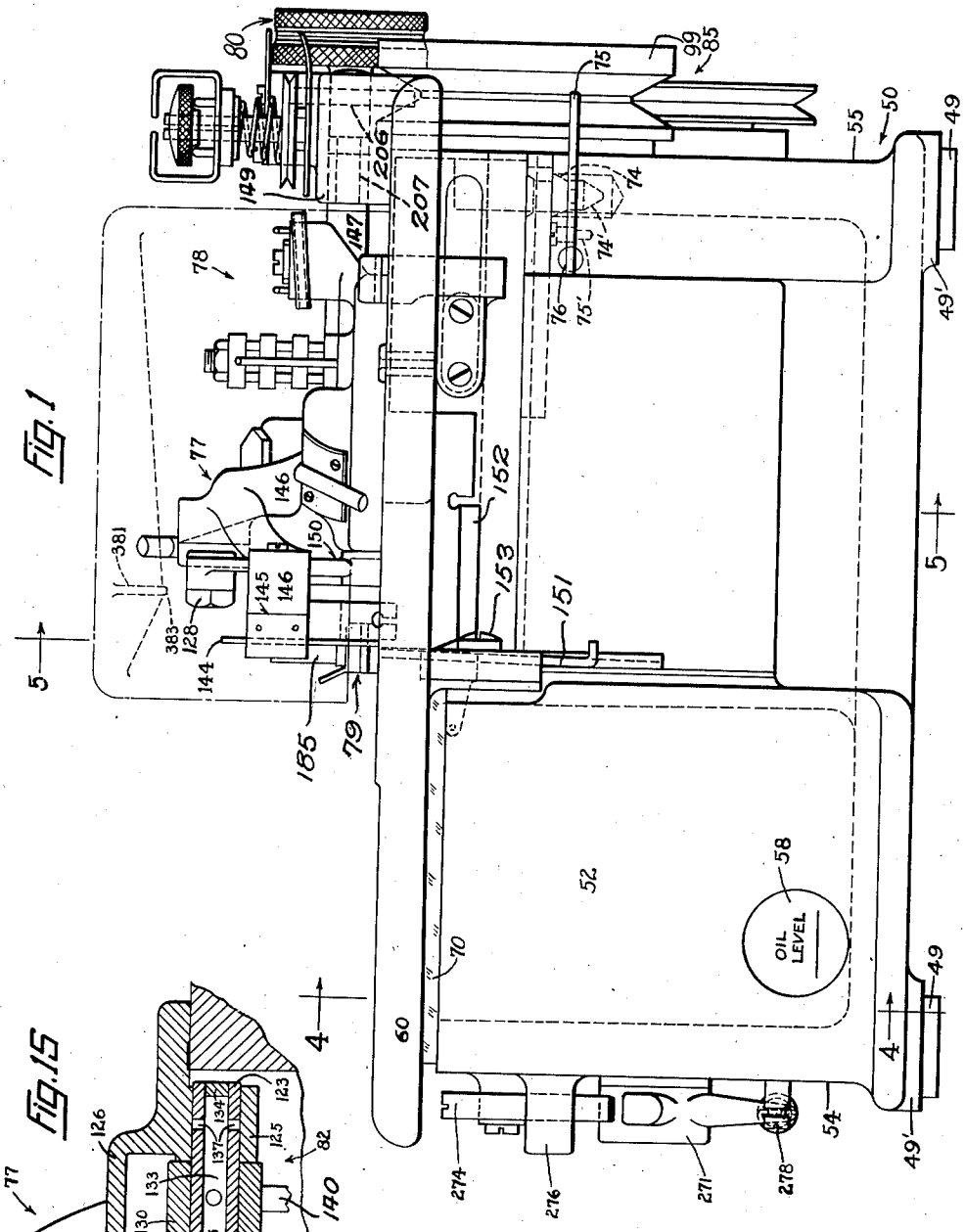
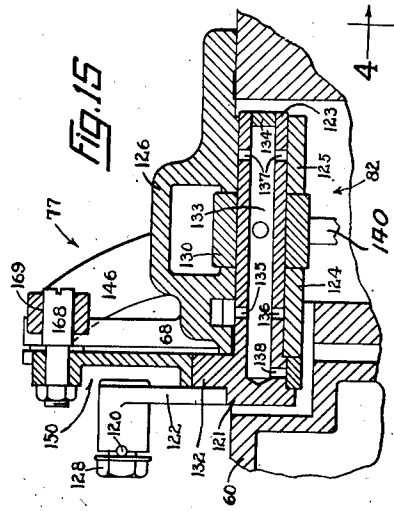


FIG. 15



INVENTOR
John P. Weis
BY William F. Feyrer
ATTORNEY

May 9, 1939. J. P. WEIS 2,157,370

FEEDING MECHANISM FOR SEWING MACHINES

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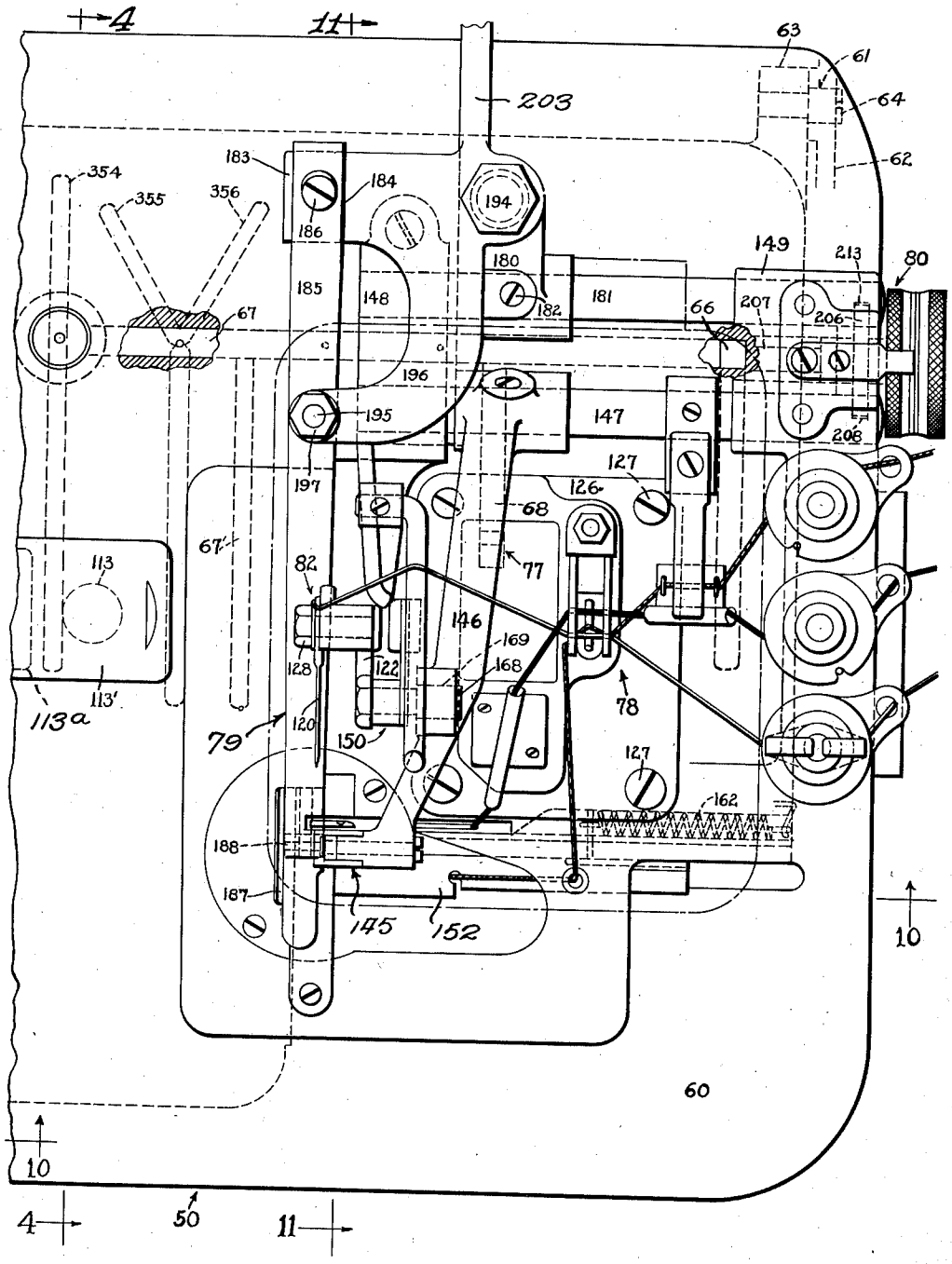


Fig. 2

BY

INVENTOR
John P. Weis
William T. Fryer
ATTORNEY

May 9, 1939. J. P. WEIS 2,157,370

FEEDING MECHANISM FOR SEWING MACHINES

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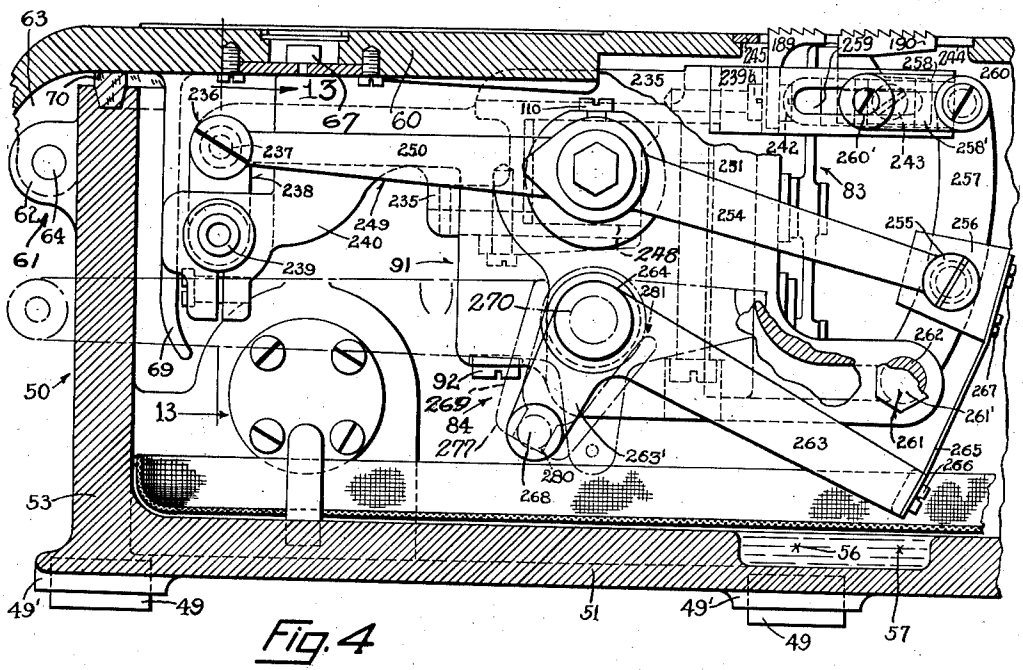
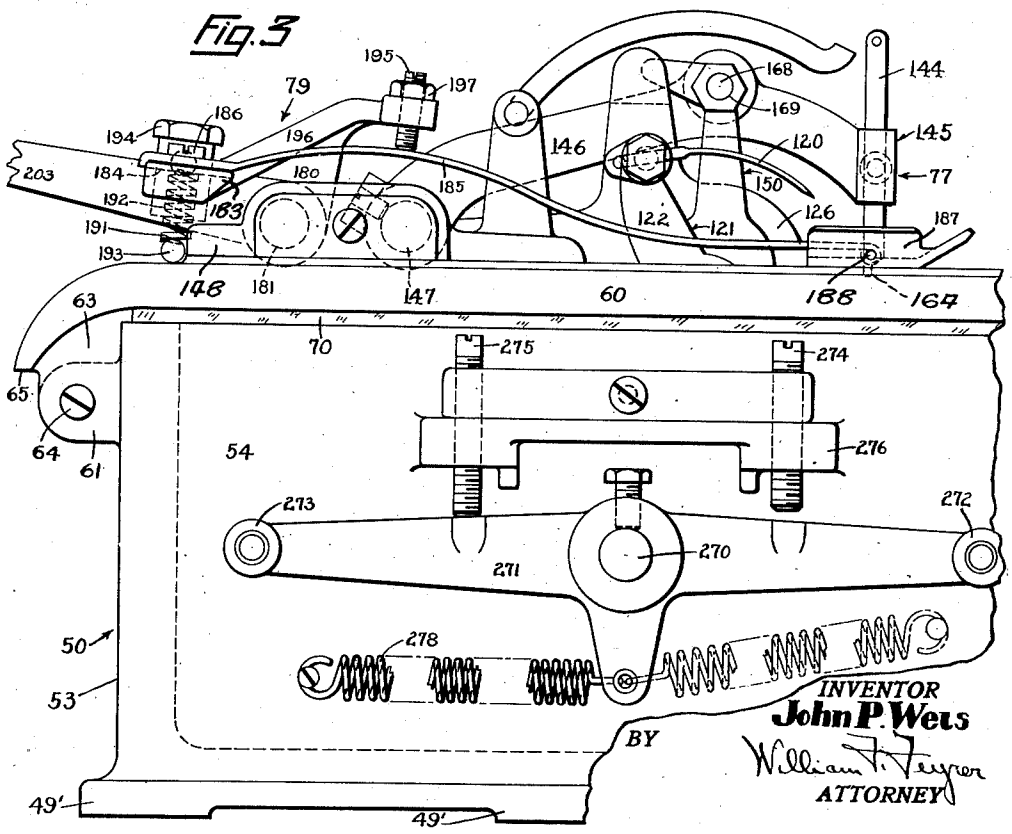


Fig. 4

Fig. 3



INVENTOR
John P. Weis
BY
William T. Fryer
ATTORNEY

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FEEDING MECHANISM FOR SEWING MACHINES

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Fig. 6

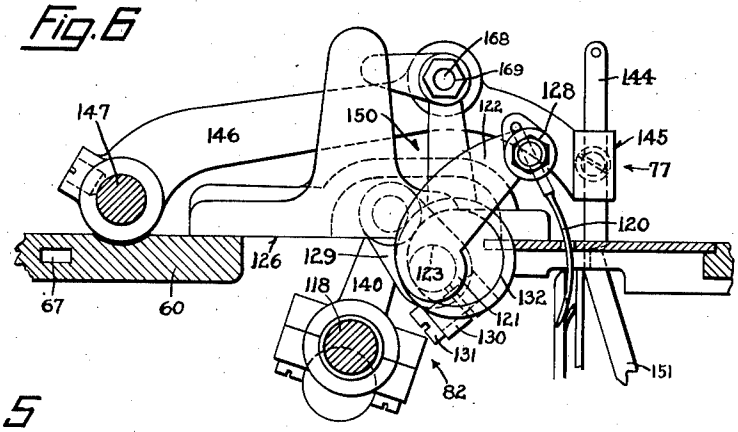
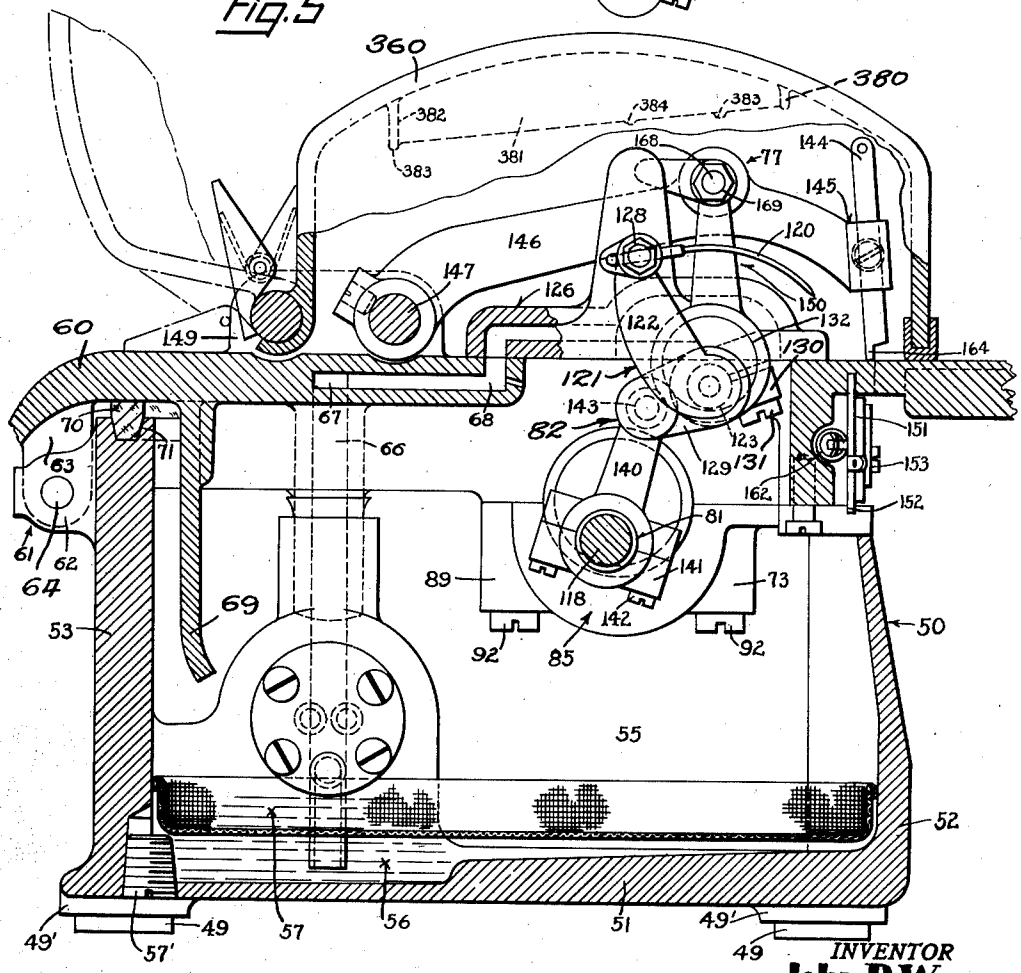


Fig. 5



INVENTOR
John P. Weis
BY
William F. Feyrer
ATTORNEY

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FEEDING MECHANISM FOR SEWING MACHINES

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Fig. 7

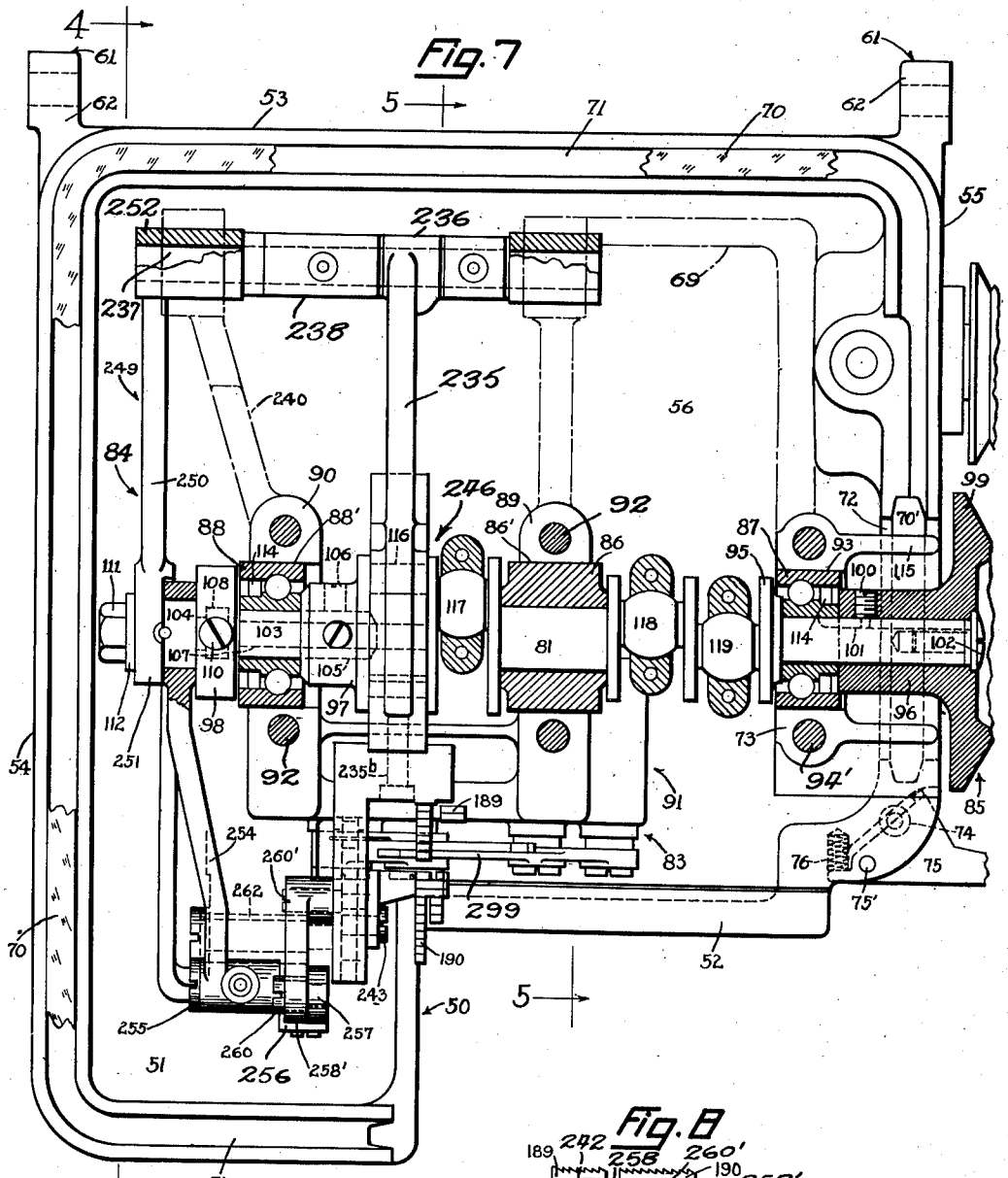
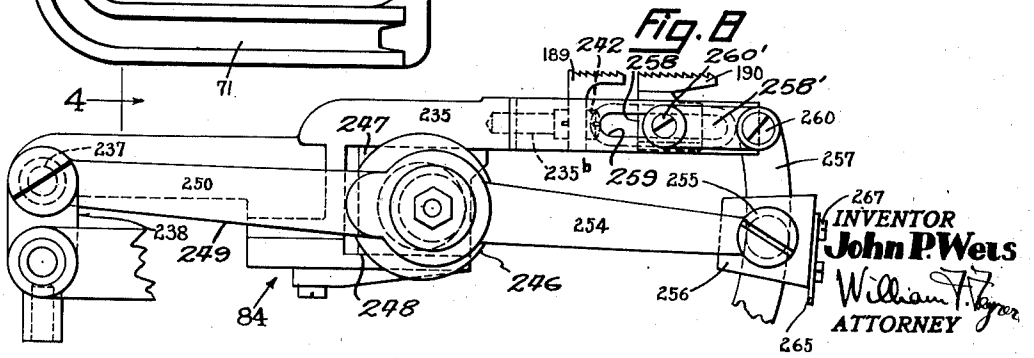


Fig. 8



INVENTOR
John P. Weis
ATTORNEY

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FEEDING MECHANISM FOR SEWING MACHINES

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Fig. 9

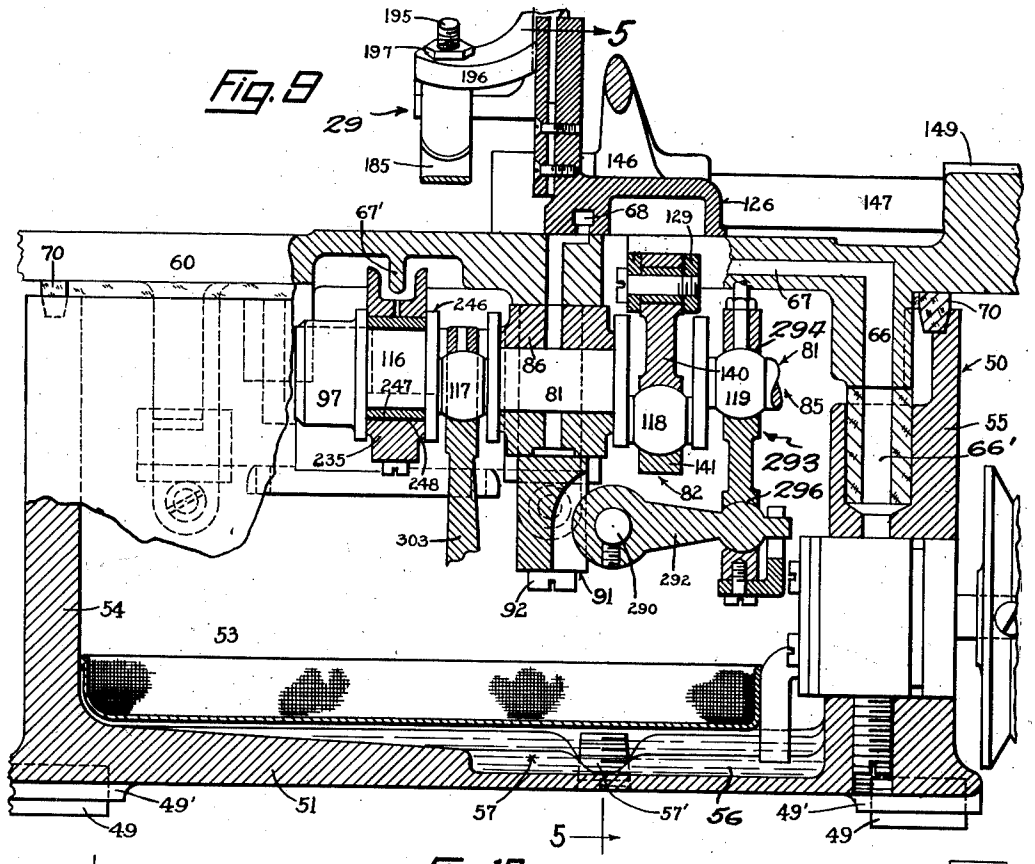
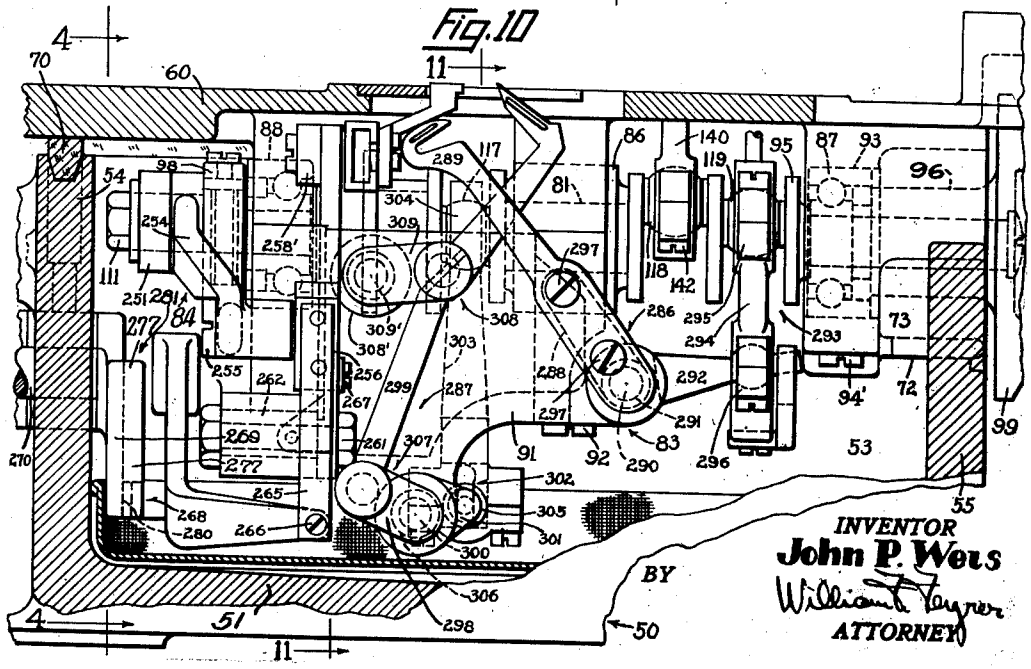


Fig. 10



INVENTOR
John P. Weis
BY
William L. Payne
ATTORNEY

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FEEDING MECHANISM FOR SEWING MACHINES

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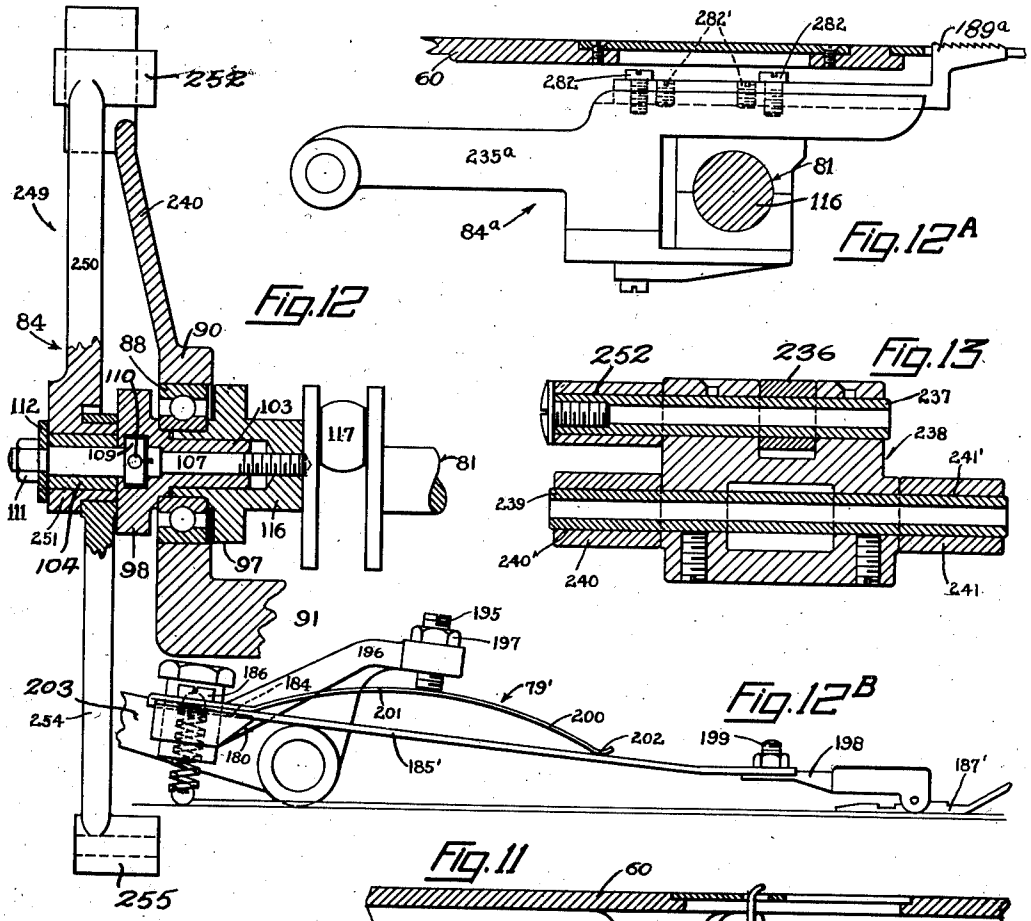


Fig. 12

Fig. 12A

Fig. 13

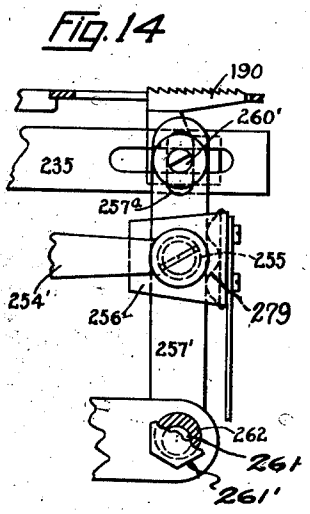


Fig. 14

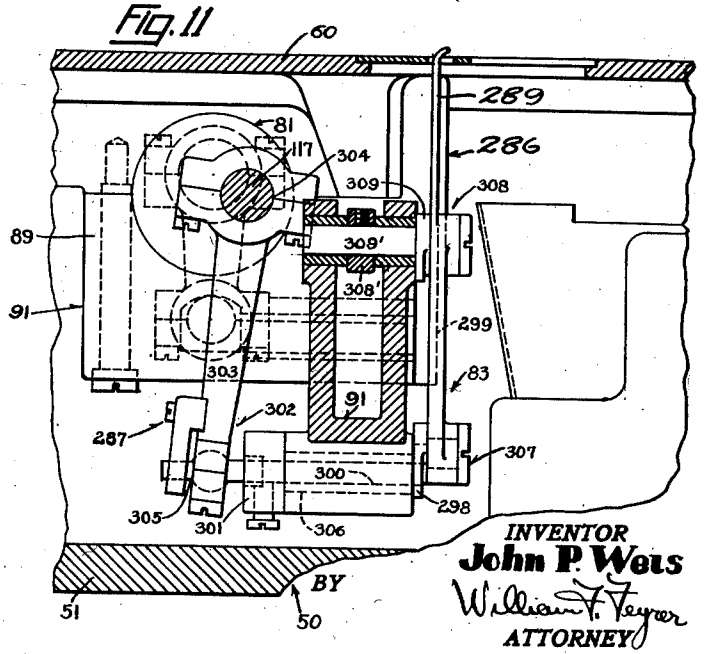


Fig. 11

INVENTOR
John P. Weis
BY
William F. Feyer
ATTORNEY

Patented May 9, 1939 2,157,370

UNITED STATES PATENT OFFICE

2,157,370

FEEDING MECHANISM FOR SEWING MACHINES

John P. Weis, Nyack, N. Y., assignor to Willcox & Gibbs Sewing Machine Company, New York, N. Y., a corporation of New York

Application June 21, 1935, Serial No. 27,773

21 Claims. (Cl. 112—209)

This invention relates to improved sewing machines and particularly to improvements in feeding mechanisms for sewing machines.

The invention relates particularly to feeding mechanisms, and especially to those of the type commonly known as a differential feed, such feeding mechanism being provided with two feed dogs or work engaging elements each actuated either wholly or partially independently of the other to effect stretching, shirring, or pleating, and the invention consists in peculiar constructions and combinations hereinafter pointed out and claimed.

Sewing machines, especially those of the overseaming type, are often provided with a differential feed when the machines are used on knit goods or other material liable to stretch or pucker at its edge. The differential feed is designed to obviate the stretching effect, and is arranged to cause one feed dog (located in advance of the needle) to feed the goods up to the needle or point of overseaming, faster than the said goods are fed away from the needle by a second feed dog (arranged to operate in rear of the needle) and thus the goods are slightly condensed or gathered at the edge, near the point of overseaming.

It is a particular object of this invention to provide a very efficient mechanism for such gathering of material, and to effectively shir and pleat materials.

With certain classes of work it is desirable to stretch the materials at the time the seam is formed, and it is an object of the present invention to provide an efficient mechanism to effect such stretching.

In meeting this object the present invention provides a differential feed mechanism having a single mechanism which may be easily and quickly changed from a one-to-one feed to a three-to-one or other greater ratios of feed, and which may be changed to less than a one-to-one feed to effect stretching of materials.

With many differential feed mechanisms it is necessary to stop the sewing machine in order to obtain a different extent of feed, thus slowing production and causing inconvenience.

It is an object of the present invention to provide a feeding mechanism which may be varied easily and quickly while the sewing machine is operating and regardless of the speed.

It is an object of the present invention to provide a machine with only one drive shaft, which may be made in substantially one piece; will be sturdy, well balanced, thoroughly lubricated; will be free of vibration, wear, and end play; has a minimum number of eccentrics so that the machine may be small.

In meeting this object the present invention provides only one main drive shaft with only one eccentric adapted to lift both a primary and a secondary feed dog, and only one other eccentric adapted to impart various extents of longitudinal or work carrying travel to both of these feed dogs.

It is another object of the present invention to provide feeding mechanism for a sewing machine which will be capable of operating at very high speeds with ease and quietness, and with minimum vibration and wear.

Special feeding problems are involved to move sweaters, underwear, blankets, and other articles made of rather elastic materials relative to the stitching mechanism. Also, in some factories, and in fact on some individual pieces of work, it is desirable to change very quickly from a fine to a coarse feed or vice versa. It is an object of the present invention to provide a feeding mechanism which meets these problems efficiently.

Controlling mechanisms for feeding means are very often in awkward, inaccessible, or work impeding places. It is an object of the present invention to provide a control which will be easily accessible at all times, yet not impede the work, and which can be adjusted easily and quickly either by hand, knee, or by foot.

Features in connection with this aspect of the invention include a control mechanism on the frame which permits the top plate to be raised without disconnecting any parts; shifting from plain to gathered, shirred, or pleated effects easily and quickly and on the same article and without stopping the machine.

In some machines it is necessary to use different feed dogs and change the same in the machine in order to obtain correct spacing between the primary and secondary feed dogs for shirring and pleating effects.

It is an object of the present invention to provide mechanism which will eliminate the need of separate, different feed dogs and the trouble of changing the same.

To this end the present invention provides an adjusting mechanism adapted to effect relative spacing between the primary and secondary feed dog.

Other objects, features, and advantages will be apparent or will appear hereinafter.

In the drawings which merely illustrate the present preferred form of the invention:

Figure 1 is a front view of the overedge sewing machine embodied in the present invention.

Fig. 2 is a top view of the sewing machine shown in Fig. 1.

Fig. 3 is a side view of the sewing machine.

Fig. 4 is a sectional view of the differential feeding mechanism and the lubricating mechanism, mainly on line 4—4 in Figs. 1, 2, 7, and 10.

Fig. 5 is a sectional view illustrating the needle and trimmer operating mechanism and the lubricating system, mainly, taken on line 5—5 in Figs. 1, 2, 7, and 9.

Fig. 6 is a fragmentary detail view of the needle and trimmer operating mechanism in the down or operative position.

Fig. 7 is a top view similar to Fig. 2 but with the work table removed.

Fig. 8 is a fragmentary detail of the differential feeding mechanism.

Fig. 9 is a sectional view through the center of the main drive shaft, looking toward the rear of the sewing machine.

Fig. 10 is a sectional view taken on line 10—10 in Fig. 2.

Fig. 11 is a fragmentary detail, partly in section, of the looper driving mechanism taken on line 11—11 in Figs. 2 and 10.

Fig. 12 is a fragmentary detail of the differential feeding mechanism.

Fig. 12A discloses a modified form of feed dog and feed dog carrier.

Fig. 12B discloses a modified form of presser foot mechanism.

Fig. 13 is a fragmentary and sectional view of one part of the feeding mechanism, taken on line 13—13 in Fig. 4.

Fig. 14 is a fragmentary view of a modified form of feed dog driving mechanism.

Fig. 15 is a fragmentary sectional view of the needle and trimmer operating mechanism.

The detailed description which follows is under various headings to facilitate an understanding of the various mechanisms and their mode of operation. The present invention is not limited to the details of construction and arrangement of parts illustrated and described herein, for the invention is capable of other embodiments in whole or part, in sewing machines other than those of overedge type, and the phraseology used is for the purpose of description and not of limitation.

Main frame and general structure

The sewing machine embodying the present invention comprises a main frame 50 having a bottom 51, and having front, rear, left side, and right side walls 52, 53, 54, and 55 respectively, preferably forming a reservoir 56 for lubricant 57. A plug 57' may be provided to occasionally draw off the lubricant. A glass insert 58 may be provided to indicate the level of lubricant in the reservoir. Rubber or other resilient plugs 49 in bosses 49' are provided to minimize vibration between the machine and bench.

A work plate 60 is supported on the main frame 50 by preferably spaced pivot connections 61, including suitable rearwardly projecting lugs 62 on the main frame 50 and cooperating lugs 63 on the work plate 60 with shoulder screws 64 therebetween, as may be seen best in Figs. 2 and 3. A shoulder 65 on the work plate is adapted to engage the underside of the lugs 62 (Fig. 3) to limit movement of the work plate 60 into a raised inoperative position, as when it is desired to make repairs.

It should be noted also that the work plate 60 of the present invention is provided with a plurality of channels, 66, 67, and 68, and rib 67' adapted to very efficiently lubricate the various operating instrumentalities. Preferably, the work plate is provided with a depending apron 69 to prevent oil spray from leaking out through the joint between the work plate 60 and the rear wall 53, and particularly to throw the spray between the moving parts within the machine itself.

The work plate 60 may be locked relative to the main frame 50. In its present preferred form (Figs. 1 and 7) this is accomplished by providing a pin 74 in the work table adapted to enter a cooperating aperture in the main frame 50 whereupon a beveled end 74' thereof pushes a catch 75, best seen in Figs. 1 and 7, in a clockwise direction about a pivot 75' against the pressure of a spring 76 until the work plate is fully in the down position, whereupon the catch 75 is urged into a suitable groove in the pin 74 by the spring 76. The widely spaced hinges 61, and the pin connection and catch just described, rigidly support the plate and frame relative to each other and prevent adverse rattling or vibration.

In order to provide an effective oil seal between the main frame 50 and the work plate 60 and also to provide a very effective noise and vibration absorber, the present invention provides a cork, felt or like pad 70, preferably located in a suitable channel 71 in the top edge of the various sides 52 through 55. The underside of the work plate rests upon this pad, which in the concave section 72 (Figs. 7 and 10) of the frame supports the bearing cap 73 and prevents oil leakage past it.

The work plate 60, preferably, and as shown, is adapted to advantageously support a trimming mechanism 77, thread control mechanism 78, a presser device 79, and a trimming mechanism and presser device shifter 80 on its upper side, and to support a main drive shaft 81 and associated needle operating, looper, differential feeding and main driving mechanisms, 82, 83, 84, and 85 respectively on its underside. All of these mechanisms will now be described in detail.

Main driving mechanism

The main driving mechanism 85, best seen in Figs. 2, 4, 5, 6, 7, 9, and 10, preferably comprises a substantially one-piece main drive shaft 81 having a split sleeve bearing 86 near the middle and having a ball bearing 87 at the right side and a similar ball bearing 88 on the left side. The bearings 86 and 88 are supported and clamped in suitable bores 86' and 88' between the work plate 60 and cap sections 89 and 90 of a suspended housing or bracket 91 as by screws 92, and the remaining bearing 87 is similarly supported and clamped in a coaxial bore 93 between a cap 73 and the work plate 60 by screws 94'.

Axial movement of the main drive shaft 81, (seen best in Fig. 7), may be prevented by one or more of the following: The ends of the split bearing 86 engaging flanges on the main drive shaft; the flange 95 and pulley hub 96 engaging the bearing 87; the hub 97 and head 98 at the left end of the main drive shaft 81 engaging the bearing 88.

A main drive pulley 99 is secured to the right end of the drive shaft in any suitable manner: for example, and as shown best in Fig. 7, by a set screw 100 sliding in a spline slot 101 to prevent relative rotation, and a screw 102 adapted to prevent relative axial movement.

Although it would be possible to have the coaxial section 103, head 98, and eccentric 104 integral with the remainder of the main drive shaft 81, they are preferably made separate and secured into a bore 105 in the left hand end of the main drive shaft by a screw 106 entering a suitable spline or hole for relative arcuate locating and a screw 107 to prevent relative axial movement as may be seen best in Figs. 7 and 12. The section 103 is a shank integral with the head 98; the adjustable eccentric 104 and adjusting mechanism therefor is substantially like that disclosed in the J. P. Weis Patent No. 1,118,321 and the A. H. Weis Patent No. 1,574,270.

Main feed adjustment

Occasionally it may be desirable to effect major changes in the feed. For example, it may be desirable to change the machine from 10 stitches per inch as provided by the control, to 15 stitches per inch. According to the present invention this is accomplished by a slide connection, between the eccentric 104 and the head 98, comprising a T-shaped tongue and slot connection 109.

A screw 110 associated with the tongue and slot connection 109 and held against axial movement in the large head 98 is provided to regulate the position of the eccentric 104 while a nut 111 and washer 112 at the outer end thereof are adapted to rigidly clamp the eccentric against a face on the head 98 to maintain it in the adjusted position. By tightening the nut 111 lightly a snug slidable fit is provided for the eccentric, in which a screw driver may be passed through a hole 113 in the work plate 60 to adjust the eccentric without lifting the work plate or disassembling the machine. The eccentric 104 is a sleeve adapted to be located various distances from the axis of the main drive shaft and to be snugly or rigidly maintained in the adjusted position.

Thus, the present invention provides an adjustable main driving eccentric 104 on the main drive shaft 81 adapted to impart various extents of motion to the feeding mechanism 84, as is more fully described hereinafter.

Oil retainers 114 may be provided in the ball bearings 87 and 88 to prevent oil from escaping. The bearing cap 73 is provided with a collar 115 extending from within the frame to a position overlying the side wall 55 of the main frame, as may be seen best in Fig. 7, adapted to engage with and rest upon the cork or similar pad 70' underlying it in a channel coextensive with the channel 71. In addition to the adjustable eccentric 104 just described in detail, the main drive shaft is provided with a feed lift crank 116 and an upper looper crank 117 on the left side of the bearing 86 and with a combination needle and trimmer operating crank 118 and a lower looper crank 119 on the right side as may be seen best in Figs. 5, 6, 7, 9, and 10.

Needle operating and trimming mechanisms

A needle operating and trimming mechanism 82 and 77, respectively, of the present invention are of very novel construction and are much more completely described and claimed in my copending application Serial No. 11,488 filed March 16, 1935. Suffice in the present description to state that the needle operating mechanism comprises a needle carrier 121 having a preferably integral shaft 123 pivotally supported for arcuate movement in bearings 124 and 125 on the underside of a top housing 126 secured to the work plate 60 by screws 127, as may be seen best in Figs. 1, 2, 3, 5, 6, and 9. The needle 120 may be clamped in a suitable hole of the carrier arm 122 by a nut 128. The top housing is provided with depending lugs forming the bearings 124 and 125 to pivotally support the shaft 123 of the needle carrier 121. A rearwardly extending arm 129 is secured to the shaft 123 by a yoke 130 and screw 131 to hold an eccentric 132 against the left side of the housing 126 and thereby prevent axial movement.

A duct 133, closed at the end by a plug 134, extending through the shaft 123 through a hole 135, joins with the oil groove 68 in the housing 126 and work plate 60 in order to effectively oil the bearings 124 and 125 and the eccentric 132 through suitable oil escape apertures 136 and 137, and 138 respectively. If any oil drips out of these bearings it will merely drop onto other operating mechanism or into the reservoir 56, and cannot fall on the work. By having the shaft integral with the needle carrier 121 there is no danger of relative shifting. Since the shaft 123 is, according to the present invention, disposed very close to the path of travel of the materials being sewed and close to the point of stitch formation, the carrier arm 122 may, as shown, be made very small, short, and very light.

In order to impart oscillatory movement to the needle 120 and carrier arm 122 from the raised inoperative position shown in Fig. 5 to the lowered operative position shown in Fig. 6, the present invention provides a very short crank connection comprising a crank-arm 140 secured to the crank 118 as by a conventional cap 141 and screws 142 and joined by a pivot stud 143 to the rearwardly extending arm 129 as may be seen in Figs. 5, 6, and 9 particularly, thus providing very short and substantially direct driving connections with very little inertia.

The trimmer mechanism 77 comprises an upper movable cutter 144 having an adjustable connection 145 with a cutter carrier arm 146 mounted for pivotal and axial movement on a shaft 147. A driving connection 150 on the pivot stud 168 and on the eccentric 132 of the needle carrier 121 is provided to drive a cutter 144 synchronously with the needle 120 and other operating parts. The stud 168 has an axially sliding fit with a bore 169 in the cutter carrier 146 so that the trimming mechanism may be shifted laterally relative to the needle.

The upper movable cutter 144 cooperates with the lower substantially stationary cutter 151 secured to a slide 152 by a screw 153 and normally pulled to the right as viewed in Fig. 1 by a spring 162 so that the two cutters 144 and 151 are always in cooperating engagement. A downwardly projecting finger 164 on the upper movable cutter prevents the lower cutter from moving directly under the upper cutter and thereby insures a close shearing engagement and close working relation between these two. The slide 152 which carries the lower cutter is suitably supported on the frame.

Presser device

The presser device 79 which may be seen best in Figs. 1, 2, and 3 comprises a carrier 180 secured

on a rod 181 by a screw 182, the rod having axial and rotary movement in the upstanding lugs 148 and 149 on the upper side of the work plate 60. As may be seen best in Figs. 1 and 3, the carrier block is provided with a finger 183 having a channel 184 adapted to receive a spring carrier-arm 185 and to locate it against lateral displacement while a screw 186 holds it against vertical displacement relative to the block. Divers presser feet 187 may be secured to the front end of the spring carrier-arm as by a pin connection 188. The long spring 185 enables the presser foot 187 to exert substantial pressure on the materials in their relation with the feed dogs 189 and/or 190 of the feeding mechanism 84, yet enables the presser foot to yield for cross seams, supplementary thicknesses, etc. in the work as it is fed rearwardly through the machine.

The main pressure of the presser foot toward the work plate is accomplished by a coil spring 191 located in a suitable bore 192 in the carrier block 180 as may be seen best in Figs. 2 and 3, preferably having a ball 193 at the lower end adapted to slide over the work plate 60. The bore 192 prevents the spring from tilting and cramping the carrier block, while a screw stud 194 permits various pressure adjustments.

Secondary pressure control is provided by a regulating screw 195 on a finger portion 196 of the carrier block. This screw may be made long enough to engage the spring carrier-arm 185 and may, as shown, be provided with a lock nut 197 to maintain the screw in adjusted position. This regulating structure also serves the advantageous purpose of preventing adverse strains on the screw 186, since a considerable lifting leverage might be applied thereto because of the substantial length between the screw 186 and the presser foot 187.

In the modified form of presser device 79' shown in Fig. 12B the carrier-arm 185' is in the form of a flat spring clamped in the channel 184 with the screw 186, and having an interponent 198 secured thereto by a screw 199 holding a presser foot 187'. Particularly it provides an auxiliary spring 200 in order to obtain the desirable action of a leaf spring effect between the carrier block 180 and the presser foot 187'. This secondary spring is preferably connected to the carrier-arm 185' in the channel 184 with the screw 186, and is provided with a bowed section 201 under the adjusting screw 195 and has an end 202 engaging substantially the middle of the carrier-arm 185', making it possible to use a much lighter weight material in the spring carrier-arm 185' and thereby obtaining better yielding action in the presser device.

An arm 203 extending rearwardly of the carrier block 180 is provided to lift the presser foot into an inoperative position relative to the work plate 60. Preferably, it is provided with any usual type of foot treadle connection.

The presser foot mechanism is more completely disclosed and described in my copending application, Serial No. 86,922, filed June 24, 1936.

Trimmer and presser device shifting mechanism

The trimmer and presser device shifting mechanism 80 is disclosed best in Fig. 2 and comprises a screw member 207 having a flange 206 connected to a slot 208 in the shaft 147 of the trimming mechanism 77 and also connecting with a similar slot 213 in the shaft 181 of the presser device 73. By rotating the screw member 207 in one direction, the trimmer and presser devices are shifted transversely in one direction relative to the line of feed and when rotated in the other direction are shifted transversely in the opposite direction transversely relative to the line of feed. The shafts 147 and 181 move both to the right and to the left in lugs 149 above the top plate 60, as is apparent by viewing Fig. 2.

The shifting mechanism is much more completely disclosed and described in application Serial No. 11,488 filed March 16, 1935.

Looper mechanism

The looper mechanism 83 may be seen best in Figs. 9, 10, and 11 and comprises a lower looper mechanism 286 and an overedge looper mechanism 287, the latter having a retracted position under the work table 60 (Fig. 10) and an advanced operating position above the work table and materials being sewed. The looper mechanisms are capable of forming the usual single, double, and triple thread overedge seams, and are much more completely described in the copending application Serial No. 11,488, filed March 16, 1935.

Suffice, herein to state that the lower looper mechanism 286 comprises a looper carrier arm 288, supporting a looper 289, on a shaft 290 pivotally mounted in a bearing 291 on the depending housing or bracket 91, and having an arm 292 extending laterally of the machine to a crank connection 293 with the crank 119 on the main drive shaft. Preferably, the connection comprises a crank-arm 294 with a ball and socket joint 295 at the upper end and a similar ball and socket joint 296 at its lower end. The lower looper 289 is secured to the looper carrier 288 by screws 297 and may be readily interchanged for the other slightly differently shaped loopers when the size of the thread, materials being operated upon, stitch, or other similar factors make such change desirable.

The overedge looper mechanism 287 comprises a looper carrier 298, interchangeably supporting a looper 299, on a shaft 300 shown in Figs. 10 and 11 and which has a secondary arm 301 with a crank connection 302 to the crank 117 on the main drive shaft. The crank connection preferably includes a crank-arm 303 having a ball and socket joint 304 at its upper end on the crank 117, and a similar ball and socket joint 305 to the arm 301 at its lower end. The shaft 300 is journaled in a bearing 306 of the depending housing or bracket 91. The carrier 298 supports a looper 299 on a pivot 307 which has a secondary pivotal connection 308 intermediate its length on a crank-arm portion 309 of a shaft 309' held in place as by a collar 308'. This looper mechanism imparts both a vertical and oscillatory movement to the looper 299; viz. when the crank 117 is in the uppermost position it pulls the crank-arm 303 upwardly and causes the shaft 300 to be moved into its farthest counter-clockwise position wherein the carrier 298 and the lower end of the looper 299 are moved down and wherein the crank-arm 309 is similarly moved down so that the top end of the looper is underneath the work support and is in a retracted position relative to the materials being sewed.

However, when the crank 117 is rotated toward the lower position as viewed in Fig. 10, it imparts a clockwise rotation to the shaft 300 initially lifting the looper 299 to a point above the top of the work plate 60 and then imparting a counter-clockwise movement to the looper in order to move the thread carrying point thereof over the

top of the material for well known cooperation with the needle **120**.

In general, and dependent upon the type seam desired, the lower looper mechanism **286** may carry a hook-type looper, or may be an eye-type looper **289** as shown in Fig. 10. Similarly, the overedge looper mechanism **287** may carry a hook-type overedge looper or an eye-type overedge looper **299** as shown in Fig. 10.

The novel thread tensioning and control mechanism **78** best seen in Figs. 1 and 2, is completely described and claimed in a copending application, Serial No. 118,061, filed December 29, 1936.

Feeding mechanism

The object of a differential feed in a sewing machine is to overcome stretching of elastic materials such as knit materials from which sweaters, bathing suits, underwear, and other clothing are made, and also when operating on soft material such as blankets, serges, felts, laces, open mesh, and other articles employing delicate materials that may be condensed or compressed into smaller space than they normally occupy.

This differential feed is arranged so as to have a movement approximately three and one-half times greater than the main feed and its motion may be varied during the operation of the machine by the control lever, either by hand, foot treadle, or knee shift. Regardless of the speed at which the machine is operating, this shift will change the motion of the feed on the work so as to cause it to gather if the movement of the differential feed is greater than that of the main feed.

Suitable feed teeth or surfaces and differences of feed will enable not only gathering, but shirring of the material or ruffling or pleating, within the limits and scope of the arrangement and design of the parts. That is to say, if the differential feed has but one tooth to contact with the work, it will permit the work or material to fold upon itself, forming distinct ruffles or pleats because the material will fold upon itself, especially if it be woven materials. If sufficient action be given to the differential feed, a distinct pleat can be effected.

On the other hand, if the differential feed contacts with a larger portion of the material, as for instance, several teeth are brought to bear upon the same, the effect is a shirring or gathering action, rather than a pleat or fold. The goods is pushed together, so to speak, and that is the desired function in most cases, especially on knitted and other soft fabrics.

Cooperating with the feeds must be a suitable presser foot to hold the materials against the feed, and a great variety of effects can be produced by special designs of presser feet. The length of the foot, the shape of the pattern end, the width of its bearing surface on the goods, and the amount of pressure, all must be considered and arranged to bring about the desired function and effect of the differential feed.

The differential feeding mechanism **84**, best seen in Figs. 3, 4, 7, 8, 10, 12, and 13, comprises a feed dog carrier **235** having a pivotal connection **236** with a shaft **237** on a feed rocker frame **238**. A primary feed dog **189** is secured to the front end of the main carrier **235** (Figs. 4, 7, and 8) with a screw **242**, and a differential feed dog **190** may also be slidably secured thereto by a screw **243**. Both feed dogs reciprocate in a slot **244** in a needle plate **245**. Substantially midway of its length the carrier **235** is provided with a feed-lift connection **246** (Fig. 9) including a split bearing **247** fitting upon the crank **116** of the main drive shaft **81** which in turn slides in an elongated slot **248** (Figs. 8 and 9).

A feed rocking connection **249** (Figs. 4, 7, 8 and 12) is provided to impart variable extents of movement to materials on the work plate **60** under the presser device **79** and relative to the needle **120** and primary feed dog **189**. Main feed rocking movement of the carrier **235** and primary feed dog **189** secured thereto, is effected by a rearwardly extending crank-arm **250** connected to the adjustable eccentric **104** by a bearing **251** at the front end and at the back end by bearing **252** to the sleeve **237** on the rocking frame **238** which is pivoted on the sleeve **239** in bearings **240'** and **241'** on the webs **240** and **241** of the work plate **60**. By moving the eccentric **104**, less and greater feed rocking movement is imparted to the frame **238** and carrier **235**.

In order to effect the major adjustments of the eccentric **104** on the head **98** for various extents of feed, the present invention provides a hole **113** and a slide **113'** in the work plate **60** so that it is possible to move the adjusting screw **110** with a screw driver alone, when the nut **111** is tightened only enough to insure a snug sliding fit rather than a locked fit between the eccentric **104** and head **98**. When it is desired to have a lock fit, a wrench may be passed down through an opening **113a**. Thus, it is not necessary to lift the work plate whenever major adjustments are made to the eccentric.

The mechanism for moving the differential feed dog **190** (Figs. 4, 7, and 10) comprises the mechanism just described and a forwardly extending crank **254** connected to the eccentric **104** at one end, and at its other end having a pivot connection **255** with a block **256** slidably mounted on a link **257**. The link is, by a stud **260**, link **258'**, and screw **260'** at its upper end connected to a differential feed dog carrier **258**, which is slidable in a slot **259** in the main carrier **235**. The carrier may be made of two pieces with interchangeable sections held together by screws **235b** if preferred. At its lower end the link **257** is pivoted on a stud **261**. Divers differential feed dogs **190** may be connected to the differential feed dog carrier **258**.

Viewing Fig. 4, it will be seen that the crank connection **254** extending from the eccentric **104**, and the slide block **256** can be shifted up and down on the curved arm **257**. When the block is shifted to the highest position on the curved arm, the angular relation of the crank connection **254** is changed a number of degrees from the position shown. This effects a slight change in timed relation. Instead of the two feeds working in unison or as one feed, when the parts are shifted to the highest position, there is a slight retarded movement to the feed dog **190**. The movement is slower than the movement of feed dog **189** because the crank is operating in a direction towards the top or working surface of the machine.

This lifting motion of the bearing end of the crank connection **254** causes this retarded movement, which has a slight stretching effect on loose and sleazy materials. On the other hand, when the crank connection is shifted down to its lowest position, there is an advanced timed relation and movement to the differential feed dog **190** in relation to the main feed dog **189**. This is important to bring about the wide range of effects desired in stitching different kinds of

materials. All of these effects are instantaneously produced during the operation of the machine by shifting the lever 271.

Since it is important to accurately position the differential feed dog 190 with respect to the main feed dog 189, an eccentric bushing is provided that fits over the screw 261. This bushing operates in the bearing and is clamped in fixed relation by nut 261' tapped into the curved arm 257. This eccentric bushing is indicated by 262 in Fig. 4.

By loosening the nut 261' and turning this bushing, the arced relation of the arm 257 is changed so that as the slide block 256 is shifted up and down, the feed dog 190 may be brought to a position very close to the main feed dog 189, while in another position, the adjustment of this eccentric bushing will cause a considerable space to be maintained between the back left hand edge of the differential feed dog 190 and the front right hand edge of the feed dog 189, leaving a space between the two, and this space is useful for goods to expand or enter therebetween as it is carried past the stitching position. Then too, this adjustment is very important when the machine is arranged for making 20 stitches to the inch under certain requirements, or on the other hand, making a long stitch, 5 or 6 to the inch depending upon the requirements. Were it not for this eccentric bushing, the differential feed dog 190 would require shifting or an endwise adjustment to meet the requirements, or replacement of feed dogs.

Shifting of the slide block 256 into various stations in order to effect a differential feed is preferably accomplished instantaneously, without direct manual adjustment of slide block 256, and without the necessity of lifting the work plate 60 from the main frame 50 by the provision of a control arm 263, which as shown may be advantageously formed as a bell crank, pivotally mounted on a stud 264, having a novel spring strip connection 265 under screws 266 and 267 to the slide block and having a pin 268 at the end of the shorter arm 263' of the bell crank. An arm 269 is secured to a stud 270 which is pivotally mounted on the left side wall 54 and is substantially coaxial with the stud 264 when the work plate is in a lowered position and resting on the pad 70. As clearly shown in Figs. 4 and 10, the arm 269 has a guiding rim 277 projecting from its sides toward the inside of the frame, and a slot 280 at the lower end of the rim 277 of a width to accommodate and receive the pin 268.

A lever 271 is secured to the stud 270 at the outside of wall 54 and may be provided with any suitable foot treadle or knee shifting mechanism, and is also conveniently located for hand shifting, connected to the front and rear ends 272 and 273, respectively. Regulating screws 274 and 275 in a lug 276 limit the extent of clockwise or counter-clockwise movement of the outer lever and associated slide block 256. A spring 278 may be provided to normally urge the lever and slide block 256 into the maximum feed position when positioned as shown by solid lines, or into minimum feed position when in dot and dash position shown in Fig. 3, dependent on whether the work is mostly plain or mostly gathered, pleated, or the like. The slide block 256 may be provided with a slightly bowed flat spring 279 (Fig. 14) adapted to press against the link 257 and frictionally maintain the slide in any position on the link that it is moved to. As clearly shown in Fig. 4, the rim 277 of the arm 269 only projects from the sides thereof leaving an interruption or opening 281 at the upper end of arm 269 for the insertion of the pin 268 on arm 263. This special pin and slot connection 268, 280 enables the operator to raise the work plate without the use of special tools and without disturbing the adjustment of the regulating screws 274 and 275. Upon lowering the work plate, the pin 268 enters the opening 281 in the rim 277 and is guided by the rim into the slot 280.

Fig. 12A discloses a modified form of feeding mechanism 84a including a main carrier 235a to which only divers primary feed dogs 189a may be secured by screws 282. The crank 250 and frame 238 actuated by the adjustable eccentric 104 form a feed rocking drive. This is a much more economical feed mechanism to manufacture, for those machines wherein the secondary feed dog 190 and its controls are not needed, as in sewing materials which do not stretch unduly. Jack-screws 282' are provided to tilt the feed dog relative to the presser foot.

The feed dog 189 is shown as a separate element secured to a separate carrier 235 by screws 242, and is preferably so made in order to facilitate changing from one type of feed dog to another. However, the feed dog 189 and carrier 235 may be made in one piece and thereby dispense with screws for economy in manufacturing cost and rigidity in use, if preferred.

If preferred, a single link 257' and shorter crank 254', as shown in Fig. 14, may be provided in place of the double link 257 and 258 hereinbefore described in which event a slot 257a engaging the stud 260' is used to permit the upper end of the link to travel relative to the stud and to drive the dog 190 relative to the carrier 235. However, the double link construction is preferred for a smoother action and less wear.

By having the feeding mechanism compact and fully enclosed within the casing comprising the main case 50 and the top plate 60, it is possible to thoroughly lubricate the feed mechanism parts without danger of oil spray reaching the work. Also, it is possible to effect a gravity feed of oil to various moving parts of the feed mechanism, as will be apparent by viewing Figs. 2 and 9 wherein there is disclosed web 67' extending from the channel 67 down which oil runs and drips onto the bearing parts between the carrier 235 and eccentric 116, see Fig. 9. Similar webs 354, 355, and 356 may be extended from the main channel 67 in order to oil other parts of the feeding mechanism. The complete lubricating means are disclosed and claimed in the copending application Serial No. 50,460 filed November 18, 1935 which also describes and claims the drip webs 380, 381, 382, and 383 of the cover 360 and the contact between channels 66 and 66' of the top plate 60 and frame 50.

Operation

Briefly, operation of the sewing machine may be described as follows: As the pulley 99 and associated drive shaft 81 are rotated, the needle operating mechanism 82, looper mechanism 83, and driving mechanism 85 are driven coordinately to sew the desired form of seam, and if the work is to be trimmed, the trimming mechanism 77 is through the driving connections hereinbefore described, also operated coordinately.

Of particular importance in the present case, the feeding mechanism 84 is operated by the crank shaft 81 coordinately with the stitch forming mechanism. The plain form of feeding mech-

anism 84a shown in Fig. 12A, with only one feed dog may be used for the ordinary run of work, and various extents of horizontal movement to obtain 10, 12, and other quantities of stitches per inch may be imparted to the feed dog 189a upon each rotation of the crank shaft 81 by merely setting the adjustable eccentric 104 with the tongue and slot connection 109.

Differential feeding by the mechanism 84 is accomplished in a somewhat similar manner. The primary feed dog 189 thereof is driven and adjusted in the same manner as the feed dog 189a just described. The secondary feed dog 190 is operated synchronously with the primary feed dog 189 by the crank 254 extending from the eccentric 104 to the slide block 256 oscillating the link 257 about its pivot, and through the link 258 reciprocating the secondary feed dog 190 in the feed dog carrier 235. By shifting the slide block 256 upwardly on the link 257, shorter travel is imparted to the secondary feed dog, even to the point of obtaining less travel for the secondary feed dog than the primary feed dog, and by moving the block down on the link, as through the pin and slot connection 268, 280, the secondary feed dog can be made to travel just the same extent as the primary feed dog to form a supplemental feed, or can be made to travel a much greater extent in order to gather, shir, or pleat materials.

In order to pleat materials it is preferable to have a considerable space longitudinally between the two feed dogs, and in order to effect this spacing without changing the feed dogs, the present invention provides the eccentric bushing 262. When the eccentric is turned in a clockwise direction as viewed in Fig. 2, the space between the two feed dogs is increased, and when it is moved in a clockwise direction, the feed dogs are brought closer together which is a preferred condition when plain feeding is desired.

Because of the particular pin and slot connection 268, 280 between the control arm 263, 263' and the arm 269 on the stud 270, a considerable advantage is obtained, for the top plate 60 can be moved relative to the main frame 50 without disturbing the setting of any of the feeding mechanism parts. The lever 271 with the screws 274 and 275 makes it possible to effect quick movement of the secondary feed dog 190 into predetermined ratio of feed relative to the primary feed dog 189, and the spring 278 serves to normally maintain the secondary feed dog in the minimum or maximum feed position as preferred.

In some classes of work it may be desirable to have just one feed dog, which however may be quickly changed from a slow feed, to form 20 stitches per inch for example, to a high speed to form only 8 or 10 stitches per inch, in which event the present invention makes it possible to remove the feed dog 189 and use only the feed dog 190 with the associated controlling mechanism 268.

Other variations and modifications may be made within the scope of the present invention, and portions of the improvements may be used without others.

Having thus described the invention, what is claimed as new is:

1. In a sewing machine the combination of a frame; stitch forming mechanism; a drive shaft; a presser foot; a feed dog; a feed dog carrier; a swing frame supporting one end of said carrier; an eccentric on the drive shaft for lifting said feed dog; a sliding connection between the feed dog and the carrier; a pair of links associated with the feed dog; a second eccentric on the drive shaft; a crank extending from said second eccentric to one of said links to effect minimum and maximum extents of feed; and resilient friction means to maintain said crank in predetermined positions on the link.

2. In a sewing machine the combination with a frame; of a top plate pivotally movable to raised and lowered positions relative to the frame; a drive shaft; a stitch forming mechanism operatively connected to the drive shaft; a presser foot; a feed dog; a feed dog carrier; means for operating the feed dog synchronously with the stitch forming mechanism; and control mechanism for adjusting the extent of feeding movement of the feed dog including relatively movable control members on the top plate and on the frame, automatically separable upon movement of said top to the raised position.

3. In a sewing machine the combination with a frame; of a top plate pivotally movable relative to the frame; a drive shaft; a stitch forming mechanism operatively connected to the drive shaft; a presser foot; a feed dog; a feed dog carrier; means for operating the feed dog synchronously with the stitch forming mechanism; control mechanism for adjusting the extent of feeding movement of the feed dog including relatively movable control members on the top plate and on the frame; and means to maintain said control members in predetermined positions.

4. In a sewing machine the combination of a frame; a top plate; a suspended bracket on the top plate; a stitch forming mechanism; a presser device; driving means; a feed dog carrier; a primary feed dog secured to said carrier; a secondary feed dog; a link connection between said bracket and carrier; a link connection between said bracket and the secondary feed dog; an adjustable eccentric; and at least one crank extending from said eccentric to at least one of said link connections.

5. In a sewing machine the combination of a frame; a top plate; a suspended bracket on the top plate; a stitch forming mechanism; a presser device; driving means; a feed dog carrier; a primary feed dog secured to said carrier; a secondary feed dog; a link connection between said bracket and carrier; a second link connection between said bracket and the secondary feed dog; an adjustable eccentric; a crank extending from said eccentric to the second link connection; and a shiftable connection between said crank and the second link connection.

6. In a sewing machine the combination of a frame; a top plate; a suspended bracket on the top plate; a stitch forming mechanism; a presser device; driving means; a feed dog carrier; a primary feed dog secured to said carrier; a secondary feed dog; a link connection between said bracket and carrier; a second link connection between said bracket and the secondary feed dog; an adjustable eccentric; a crank extending from said eccentric to the second link connection; a shiftable connection between said crank and the second link connection; and means for operatively locating said secondary feed dog both closely and remotely relative to said primary feed dog.

7. In a sewing machine the combination of a frame; a top plate; a suspended bracket on the top plate; a stitch forming mechanism; a presser device; driving means; a feed dog carrier; a pri-

mary feed dog secured to said carrier; a secondary feed dog; a link connection between said bracket and carrier; a second link connection between said bracket and the secondary feed dog; an adjustable eccentric; a crank extending from said eccentric to the second link connection; a shiftable connection between said crank and the second link connection; and means exteriorly of the machine for quickly moving said shiftable connection to predetermined positions.

8. In a feeding mechanism for sewing machines; a primary feed dog; a secondary feed dog; an eccentric to lift said feed dogs; means for imparting horizontal movement to said feed dogs; and means for locating the uniform back-and-forth travel of said secondary feed dog in divers positions, both closely and remotely, relative to the primary feed dog.

9. In a sewing machine the combination of a frame; a main drive shaft on said frame; a primary feed dog; a feed dog carrier; a secondary feed dog slidably supported on the carrier; one eccentric on the main drive shaft adapted to lift said feed dogs; mechanism for imparting horizontal movement to said primary feed dog; a double link connection between said frame and said secondary feed dog; a slide block on one of said links; a crank extending from said main drive shaft to said slide block; and means for shifting said slide block on said link.

10. In a sewing machine the combination of a frame; a main drive shaft on said frame; a primary feed dog; a feed dog carrier; a secondary feed dog slidably supported on the feed dog carrier; one eccentric on the main drive shaft adapted to lift said feed dogs; mechanism for imparting horizontal movement to said primary feed dog; a double link connection between said frame and said secondary feed dog; a slide block on one of said links; a crank extending from said main drive shaft to said slide block; means for shifting said slide block on said link; and an eccentric forming the main pivotal mounting for the link which carries the slide block adapted to locate the secondary feed dog relative to the primary feed dog.

11. In a sewing machine the combination of a frame; a top plate; a suspended bracket on the top plate; a main drive shaft; only one feed dog carrier; a primary feed dog; a secondary feed dog slidably mounted on the carrier; only one eccentric on the drive shaft adapted to lift both the primary and secondary feed dogs; mechanism for imparting horizontal movement to said primary feed dog and carrier; a link connection between said suspended bracket and the secondary feed dog; a crank for operating the secondary feed dog; a slide block connection between the crank and the link; and means for quickly shifting said block on said link to effect different extents of horizontal travel of said secondary feed dog relative to the primary feed dog.

12. In a sewing machine the combination of a frame; a top plate; a suspended bracket on the top plate; a main drive shaft; only one feed dog carrier; a primary feed dog; a secondary feed dog slidably mounted on the carrier; only one eccentric on the drive shaft adapted to lift both the primary and secondary feed dogs; mechanism for imparting horizontal movement to said primary feed dog and carrier; a link connection between said bracket and the secondary feed dog; a crank for operating the secondary feed dog; a slide block connection between the crank and the link; means for quickly shifting said block on said link to effect different extents of horizontal travel of said secondary feed dog relative to the primary feed dog; and a flat spring connection between said last named means and the slide block.

13. In a sewing machine the combination of a frame; a top plate; a suspended bracket on the top plate; a main drive shaft; only one feed dog carrier; a primary feed dog; a secondary feed dog slidably mounted on the feed dog carrier; only one eccentric on the drive shaft adapted to lift both the primary and secondary feed dogs; mechanism for imparting horizontal movement to said primary feed dog and carrier; a link connection between said bracket and the secondary feed dog; a crank for operating the secondary feed dog; a slide block connection between the crank and the link; a bell crank pivotally mounted on said suspended bracket and having a connection with the slide block; and means mounted on the frame adapted to cooperate with the bell crank to variously adjust the extent of travel imparted to the secondary feed dog while the extent of travel of the primary feed dog remains unchanged.

14. In a sewing machine the combination of a closed frame; a top plate; a suspended bracket on the top plate; a main drive shaft; only one feed dog carrier; a primary feed dog; a secondary feed dog slidably mounted on the feed dog carrier; only one eccentric on the drive shaft adapted to lift both the primary and secondary feed dogs; mechanism for imparting horizontal movement to said primary feed dog and carrier; a link connection between said bracket and the secondary feed dog; a crank for operating the secondary feed dog; a slide block connection between the crank and the link; and means between said slide block and the exterior of the frame adapted to shift the slide block on the link to effect various extents of secondary feed dog travel relative to the primary feed dog and to permit the top plate with the suspended bracket and associated mechanism to be automatically disconnected and moved relative to the main frame.

15. In a sewing machine the combination of a frame; a stitching mechanism; a presser device; a feeding mechanism including a feed dog movable into minimum and maximum feed positions; controlling mechanism; a lever of the first class in said controlling mechanism; adjustable means at opposite ends of said lever to obtain and limit movement of said feed mechanism into various minimum and maximum feeding positions.

16. In a sewing machine the combination of a frame; a stitching mechanism; a presser device; a feeding mechanism including a feed dog movable into minimum and maximum feed positions; controlling mechanism; a lever of the first class in said controlling mechanism; adjustable means at opposite ends of said lever to obtain and limit movement of said feed mechanism into various minimum and maximum feeding positions; and means for selectively and yieldingly maintaining said lever in its minimum and its maximum feed position.

17. In a sewing machine the combination of a frame; a drive shaft; a primary feed dog; a secondary feed dog; a carrier supporting both of said feed dogs; an integral eccentric on the drive shaft adapted to lift said carrier and said feed dogs; mechanism for imparting rocking movement to said feed dogs; a head on the end of said drive shaft having a channel; and an

adjustable eccentric movable and lockable in said channel adapted to impart various extents of movement to the feed rocking mechanism.

18. In a sewing machine the combination of a frame; a main drive shaft; a primary feed dog; a secondary feed dog; a carrier for said feed dog; an integral eccentric on the drive shaft adapted to lift said carrier and feed dogs; a link for imparting rocking movement to the carrier and primary feed dog; mechanism including a link for imparting rocking movement to the secondary feed dog; a head on the main drive shaft having a channel; and only one eccentric having a slidable and rockable connection with the channel, and upon which both of said links are connected, to impart said rocking movement to both the primary and secondary feed dogs.

19. In a sewing machine, the combination of a frame; a top plate movably associated with said frame; feeding mechanism; and control means for said feeding mechanisms, including movable members carried by said frame and said top plate, separable upon movement of said top plate away from said frame.

20. In a sewing machine, the combination of a frame; a top plate movably associated with said frame; feeding mechanism carried by the top plate; and control means for said feeding mechanism including movable members carried by said frame and said top plate, operatively associated with each other by a pin and slot connection to enable a separation thereof upon movement of said top plate away from said frame.

21. In a sewing machine, the combination of a frame; a stitch forming mechanism; a main drive shaft; a primary feed dog; a feed dog carrier; a secondary feed dog slidably supported on said carrier; a swing frame supporting one end of said carrier; an eccentric for lifting said feed dogs; a pivotally mounted link connected to said secondary feed dog; a slide block on said link; a crank connecting said main drive shaft and said slide block; and an eccentric forming the main pivotal mounting for said link adapted to locate said secondary feed dog in divers positions relative to the primary feed dog.

JOHN P. WEIS.