April 20, 1926. 1,581,524

S. W. WARDWELL

FEED MECHANISM

Filed Dec. 29, 1920 3 Sheets-Sheet 1

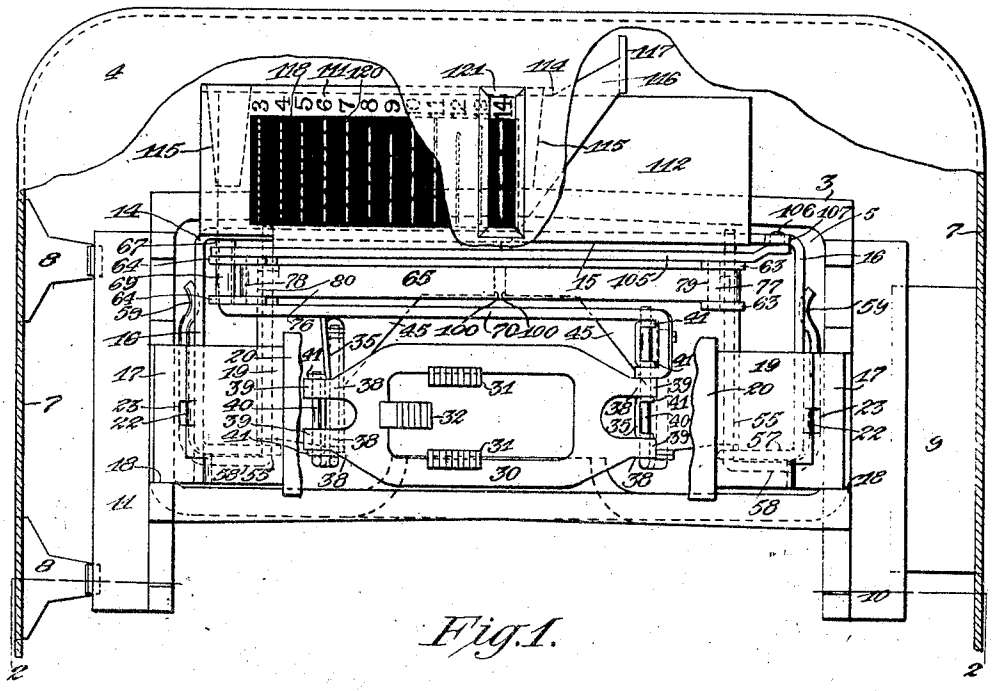


Fig. 1.

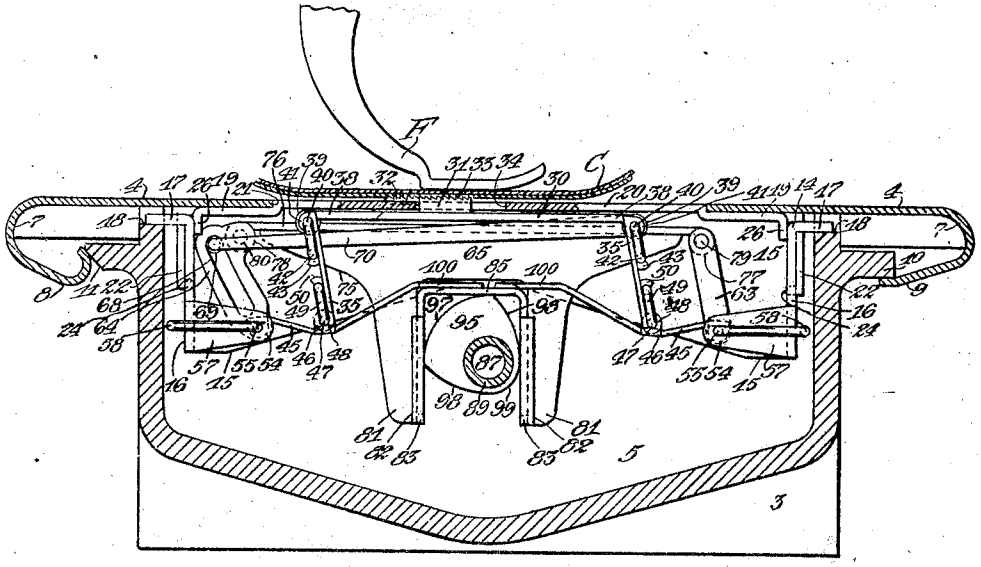


Fig. 2.

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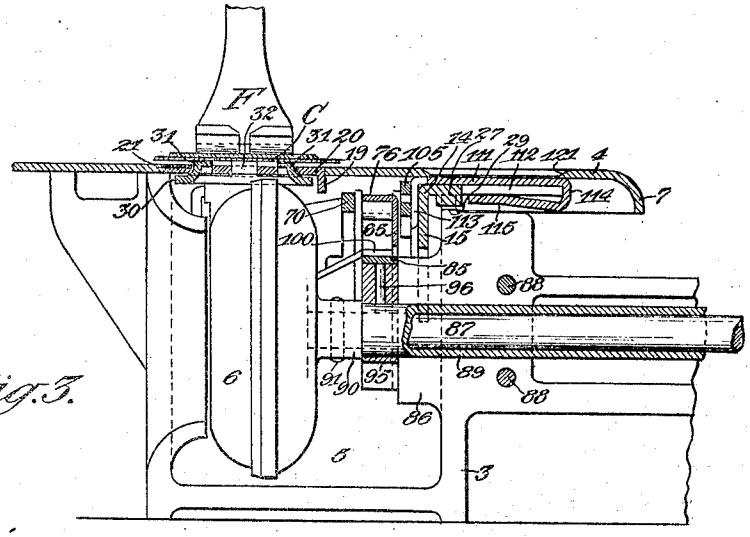


Fig. 3.

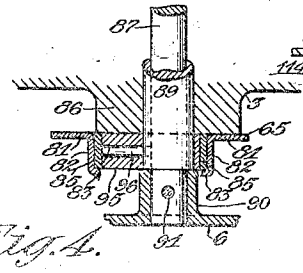


Fig. 4.

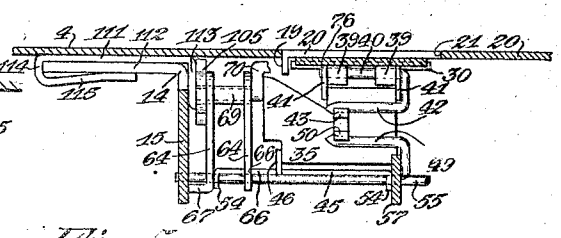


Fig. 5.

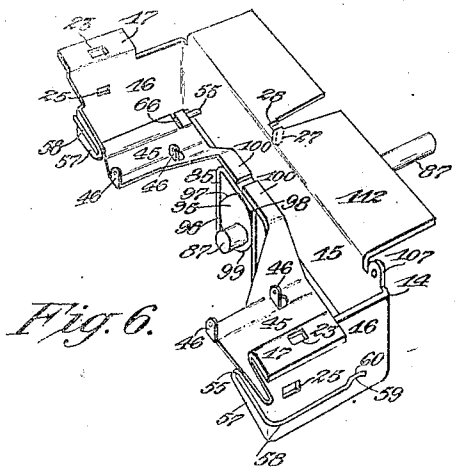


Fig. 6.

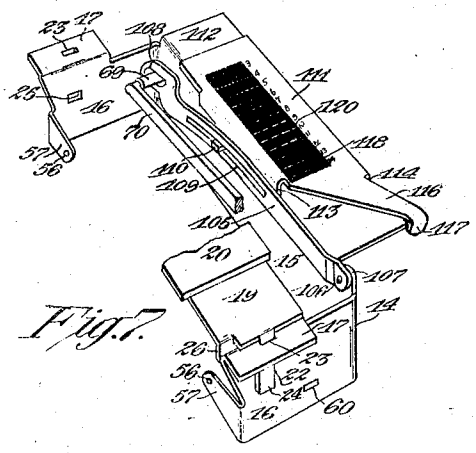


Fig. 7.

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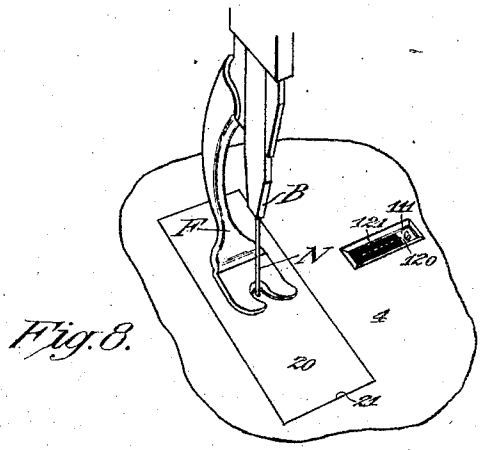


Fig. 8.

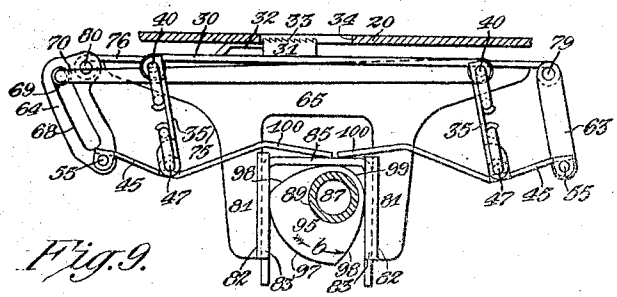


Fig. 9.

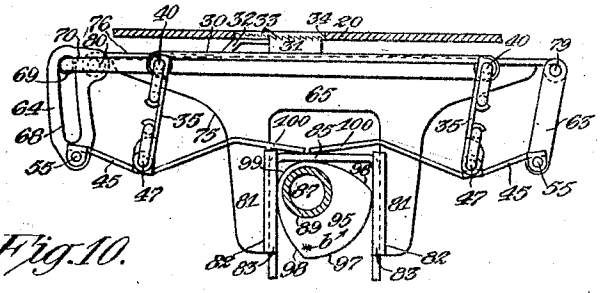


Fig. 10.

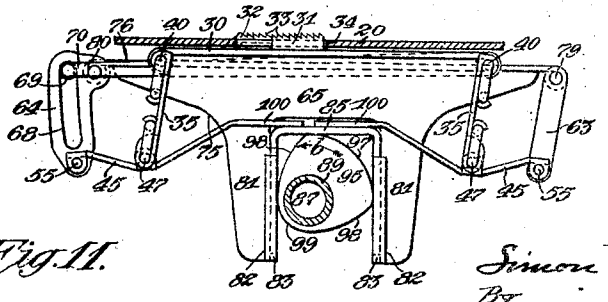


Fig. 11.

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Patented Apr. 20, 1926. 1,581,524

UNITED STATES PATENT OFFICE.

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FEED MECHANISM.

Application filed December 29, 1920. Serial No. 433,795.

To all whom it may concern:

Be it known that I, SIMON W. WARDWELL, a citizen of the United States, residing at Providence, in the county of Providence, State of Rhode Island, have invented certain new and useful Improvements in Feed Mechanisms, of which the following is a specification.

My invention is an improved feed-mechanism for sewing-machines or other apparatus of a similar nature.

One object of the invention is to provide convenient means for adjusting the feed-mechanism with visual indicating-means for showing the extent of the feeding-movement by indicia corresponding to the length of stitches to be made.

Another object of the invention is to provide a light-running mechanism which may be operated with a minimum amount of power.

Another object of the invention is to provide a mechanism constructed mainly of sheet-metal stampings and particularly adapted for economical manufacture.

Another object of the invention is to provide a mechanism having its parts connected without screws, studs, bolts or nuts, whereby it may be assembled and disassembled without the use of tools.

Further objects of the invention are set forth in the following specification which describes a preferred embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is an enlarged plan view of the complete feed-mechanism and its adjustment-indicating device, showing it as applied to a sewing-machine, the table of which is illustrated as being partly broken away;

Fig. 2, a side elevation of the feed-mechanism, showing the bed and table of the sewing-machine in section on the line 2—2 of Fig. 1;

Fig. 3, an end elevation of the feed-mechanism and its adjusting-device, showing its relation to the stitch-forming or looper-mechanism of the sewing-machine;

Fig. 4, a sectional, detail view of the operating-means for the feed-mechanism, showing its relation to the shaft of the looper bowl;

Fig. 5, a detail view of the adjusting-means for the feed-mechanism;

Fig. 6, a perspective view in reduced scale of the main operating elements of the feed-mechanism;

Fig. 7, a similar view showing the connections between the feed-mechanism and the adjusting-device;

Fig. 8, a perspective view of the presser-foot and needle-bar of the sewing-machine shown in connection with the feed-indicating mechanism or length-of-stitch indicia; and

Figs. 9, 10 and 11, detail views of the feed-mechanism showing progressive steps in the operation of the feeding-element.

Referring to Figs. 1, 2 and 3 of the drawings, 3 designates the bed or lower frame-portion of a sewing-machine head and 4 is the cover-plate or work-table which overlies its top. The bed 3 is provided with a compartment or casing 5 at its forward end, see Fig. 3, within which is located the looper-bowl 6 and its associated feed-mechanism. The cover-plate or table 4 is preferably constructed of sheet-metal with a rolled-over flange 7 depending from its edges, and projecting inwardly from the flange are spring-fingers 8 and a strip 9, see Figs. 1 and 2, which hold the cover down to the bed 3. At one side the strip 9 is hooked under a horizontal rib or ledge 10 on the side of the bed 3; while at the opposite side are the fingers 8 formed with curled-over ends adapted to snap under the beveled edge of a second ledge or rib 11.

The feed-mechanism and its adjusting-device, to which the present invention more particularly relates, are assembled on a sheet-metal frame 14 which sits within the compartment or casing 5 in the bed 3. In general, the frame 14 comprises a vertical back-plate or strut 15 provided with forwardly-extending side-members or vertical arms 16. The arms 16 are formed with horizontal wings 17 bent outwardly at the top to adapt them to seat in slots 18, see Figs. 1 and 2, cut into the side walls of the casing 5. Extending across the frame between the side-arms 16 is a bridge-member 19 having a raised or upset rectangular section 20 which is received in an opening 21 in the main cover-plate or table 4 to adapt it to

constitute the needle-plate of the machine, see Figs. 2, 3 and 8. The bridge-member 19 is attached to the side-arms 16 of the frame 14 by means of downwardly-extending legs 22 inserted through apertures 23 in the wings 17, see Fig. 1. At the lower ends of the legs 22 are lugs 24 adapted to snap into openings 25 in the sides of the arms 16, see Figs. 2, 6 and 7. As a further connecting- and reinforcing-means between the bridge-member 19 and frame 14, suitable ears 26 are bent down from the top of the bridge to engage the inner sides of the arms 16. The frame 14 has a lug 27, see Fig. 3, bent down from a cut out portion 28 at the center of its back-plate 15 and adapted to seat in a slot 29 in the rear wall of the casing 5, see Fig. 6, to hold the frame laterally of the bed 3. Through this arrangement the bridge-member 19 is securely united to the frame 14, while the frame itself is held suspended from the side walls of the casing 5 and prevented from rising out of place by the cover-plate 4 which sets down against the bridge with the raised needle-plate 20 fitting its opening 21.

Arranged to reciprocate beneath the needle-plate 20 is a feed-plate 30 carrying the toothed feed-dogs 31 and 32. Referring to Figs. 1 and 2, the feed-plate 30 is of substantially rectangular outline in plan view, being constructed of sheet-metal and cut away at the center to reduce the weight. On the opposite sides and at one end of the cut-out section of the plate 30 the metal is left in the form of projecting tabs which are bent upwardly to provide the dogs 31 and 32. The two opposite side-dogs 31 are formed by bending the metal of the tabs upwardly from the edge of the plate 30 in a vertical plane and then bending it outwardly again in a horizontal plane, see Fig. 3; while the end tab is bent upwardly at an acute angle and then extended outwardly in the raised dog 32, see Fig. 10. The upper or gripping faces of the dogs 31 and 32 are stamped or scored to provide sharp-pointed ratchet teeth 33. As shown in Figs. 2 and 3, the feed-dogs 31 and 32 project upwardly through suitable slots or openings 34 in the needle-plate 20, the slots being of sufficient length to allow the dogs to reciprocate longitudinally therein. Referring particularly to Figs. 2 and 3, the end feed-dog 32 is arranged to oscillate back-and-forth beneath the heel of the presser-foot F, while the two opposite side-dogs 31 coact with the forwardly-extending toes of the presser-foot at either side of the needle N. As illustrated in Fig. 8, the needle N is carried by the vertically-reciprocating needle-bar B and reciprocates up and down through a small aperture in the needle-plate 20. As these last-named elements of the sewing-machine form no part of the present improvement, however, they are not herein shown and described in detail.

Referring again to Figs. 1 and 2, the feed-plate 30 is hingedly connected at its ends with a pair of rocker-arms 35 which are pivotally suspended in such a manner as to provide for a four-way motion of the feed-dogs as later more fully explained. As shown in Fig. 1, the feed-plate 30 is formed at either end with two parallel arms 38 which are curled around to provide bearings 39 for receiving pivot-pins 40 connecting them with the rocker-arms 35, see Figs. 2 and 5. The pivot-pins 40 are inserted through ears 41 bent at right-angles to the plane of the arms 35 and adapted to overlie the ends of the bearings 39. Referring particularly to Fig. 5, the pivot-pins 40 are bent into U-shape with parallel extensions 42 formed somewhat like a shepherd's crook. The extensions 42 are adapted to lie across the face of the plate-like arms 35 with their curved ends snapped into arcuate-shaped ears 43 projecting outwardly from the arms 35. The arcuate ears 43 are formed from tabs punched out from the sheet-metal of the rocker-arms 35 and serve as detents to hold the pivot-pins 40 in place while allowing for their convenient removal to disconnect the parts. Through this ingenious construction the usual rivets, screws or like threaded parts are dispensed with and considerable machine-work is eliminated.

The lower ends of the rocker-arms 35 are pivotally connected to a pair of opposite supporting-arms 45 through a similar arrangement of bearing-joints. On the arms 45 are upstanding ears 46, see Fig. 2, adapted to receive pins 47 inserted through apertured ears 48 at the lower ends of the rocker-arms 35. The pins 47 are formed with crooks 49, see Fig. 5, engaging arcuate ears 50 on the arms 35 to hold them in place. The supporting-arms 45 consist of strips of sheet-metal formed at one end with apertured ears 54, see Fig. 2, for receiving wire pivot-pins 55 which connect the arms to the frame 14. As shown in Figs. 1, 2, 5, 6 and 7, the pivot-pins 55 are inserted through holes 56 at the ends of arms 57 reaching inwardly from the vertical side-arms 16 of the frame 14. The inner ends of the pivot-pins 55 project through suitable holes in the back-plate or cross-strut 15 of the frame 14, while their outer ends are continued in the parallel extensions 58 which reach around the sides of the frame-members 16. The extensions 58 of the pins 55 are formed with crooks 59 at their ends adapted to snap into slitted openings 60, see Figs. 6 and 7, on the sides 16 of the frame 14. In this way the pivot-pins 55 are held in place in their bearings while being easily removable to disconnect the parts supported thereby.

The pins 55 also serve as pivots for two

opposite sets of links 63 and 64 on which is mounted a reciprocable crosshead 65 connected to reciprocate the feed-plate 30. The links 63 and 64 are disposed in pairs at opposite ends of the crosshead 65 as shown in Fig. 1. Viewed as in Fig. 5, the left-hand link of each pair abuts the side of the left-hand ear 54 of the arm 45, while the right-hand link is spaced apart therefrom and held in a slot 66 in the arm 45 to adapt its apertured lower end to receive the pivot-pin 55, see Fig. 6. The left-hand link of each pair is provided with a lug or toe 67, see Fig. 5, bent over from its lower end and adapted to bear against the front of the back-plate 15 of the frame 14 to space the link at a distance therefrom. Referring to Figs. 9 to 11, the links 63 of the right-hand pair are simply straight strips or bars of sheet-metal, but those of the left-hand pair 64 are of arcuate shape with a curved slot 68 extending throughout their length. The curved double-link 64 serves as the means for connecting the crosshead 65 with the feed-plate 30 in the manner of the familiar link-motion of a steam engine. For this purpose the arcuate slot 68 is adapted to receive a roller 69 mounted on the end of an arm or rod 70 which is pivoted at its opposite end on the pin 40. The pivot-pin 40, as before explained, constitutes the hinge or support for the feed-plate 30 which is mounted on the rocker-arm 35.

The reciprocating crosshead 65 is constructed from sheet-metal in the form of a vertical plate having a horizontal ledge or flange 76 bent forwardly from its upper edge. The flange 76 is extended at the ends to provide overhanging ears which are curled around to form circular bearings 77 and 78, see Figs. 1 and 2. The two links 63 abut the sides of the bearing 77 at one end of the crosshead 65 and are connected thereto by means of a pivot 79; while at the opposite end the bearing 78 is pivoted between suitable ears on the double-link 64 by means of a pin 80. The depending plate-portion of the crosshead 65 is cut away at its center to provide two parallel, forked arms 81. Referring particularly to Fig. 4, the inner sides of the arms 81 are provided with vertical flanges 82 bent forwardly and then inwardly at 83 to provide guideways for a slidable shoe 85. The shoe 85 is constructed from a relatively narrow strip of sheet-metal bent into inverted U-shape with its opposite, parallel legs fitted to the flanged guideways 82 on the crosshead 65.

Referring now to Figs. 2, 3 and 4, the shoe 85 is held in place in the guideways 82 with its rearward edge abutting the front face of a hub 86 on the base or frame 3. The hub 86 forms a part of the bearing for a horizontal power-shaft 87 enclosed in a tubular shaft 89 which operates the feed-mechanism. Referring particularly to Fig. 3, the base or frame of the machine is made in two halves divided on the vertical plane of the axis of the shaft 87. In this view the drawing illustrates the vertical face of one section of the frame 3 which fits against the corresponding face of its complemental section with the two halves held together by cross-pins or rivets 88. The two halves of the frame 3 are bored axially of the hub 86 and fitted to turn in the bore is the tubular shaft 89 surrounding the main shaft 87. The main shaft 87 projects beyond the end of the tubular shaft 89 to adapt it to receive the hub 90 of the spool-bowl or looper 6 which is fastened thereto by a cross-pin 91. The tubular shaft 89 extends beyond the outer end of its bearing-hub 86 and carries a cam 95 secured rotatively therewith by means of a pin 96. Referring to Figs. 2, 9, 10 and 11, the cam 95 is formed with an arcuate peripheral face 97 disposed concentric with its axis and with two opposite curved faces 98 arranged eccentric thereto. Each of the faces 97 and 98 extends through 90 degrees and the eccentric faces 98 merge in a concentric face 99 of considerably less radius extending through the remaining 90 degrees. The complete contour of the cam 95 is enclosed by the U-shaped shoe 85 with all three sides thereof bearing constantly on the several faces of the cam. The main shaft 87 is rotated to drive the bowl or looper 6 and the tubular shaft 89 is driven independently thereof at a slower rate of speed to rotate the cam 95. As the cam rotates with its several faces making contact with the three sides of the slide or shoe 85 the shoe will be oscillated laterally in relation to the axis of the cam to reciprocate the crosshead 65 in a horizontal path. The rotation of the cam 95 will also impart a vertical reciprocation to the shoe 85 to slide the latter up and down in its guideways on the crosshead 65, see Figs. 9 to 11. It will be noted from these views that the hinged arms 45 which carry the pivots for the feed-plate rocker-arms 35 are formed with extensions 100 which rest on the top of the shoe 85. Referring to Fig. 6, the supporting arms 45 are cut away at the front and bent upwardly and then outwardly in the relatively narrow fingers or extensions 100 which project across the top of the shoe 85 and rest thereon. It will thus be seen that as the shoe 85 is raised and lowered on the cross-head 65 under the action of the cam 95 it will cause a corresponding rise and fall of the arms 45. The effect of this motion is to raise and lower the feed-plate 30 at the ends of its traverse whereby to impart the desired four-way motion to the feed-dogs 31 and 32 during their reciprocation. This motion is illustrated progressively in Figs. 9 to 11 and will be explained more in detail in connection with

the method of operation of the complete device.

It has been explained above that reciprocation is imparted to the feed-plate 30 from the double-link 64 connected to the end of the crosshead 65. The oscillating motion of the link 64 is communicated to the feed-plate 30 through the connecting-rod 70 joined to the right-hand end of the plate by the pivot-pin 40, see Fig. 2. The means for adjusting the extent of movement of the feed-plate 30 consists of a device for varying the point of connection of the connecting-rod 70 on the link 64 with respect to the axis of oscillation of the latter. For this purpose manually-operable means are provided for shifting the roller 69, carried at the end of the rod 70, in the slot 68 of the link 64; it being obvious that as the roller is moved toward the lower pivot or axis of oscillation of the link 64 the motion imparted through the rod 70 will be decreased; while as the roller is moved away from the axis of the link the length of its stroke is increased.

Referring particularly to Fig. 7, the means for adjusting the roller 69 in the slot 68 of the link 64 consists essentially of an arm or lever 105 pivoted at one end on a pin or rivet 106 which is secured in an ear 107 on the back-plate 15 of the frame 14. The lever 105 is offset at its opposite end and formed with a slot 108 adapted to receive the end of the roller 69 which projects through the slot 68 in the link 64, see also Fig. 5. The lever 105 is also provided with an inclined slot 109 at its center adapted to be engaged by a projection or lug 110 on a manually-adjustable slide 111, see Fig. 7. The adjusting-slide 111 consists of a flat strip of sheet-metal overlying the top of a horizontal shelf or rest 112 projecting rearwardly from the back-plate 15 of the frame 14. At its forward edge the slide 111 is formed with a depending rim or flange 113 abutting the front of the frame-member 15 and provided with the lug 110 projecting outwardly therefrom into the slot 109 in the lever 105. The rearward edge of the adjusting-plate or slide 111 is also bent downwardly in a flange 114, see Fig. 5, abutting the rear edge of the shelf 112 of the frame 14 and cooperating with the forward flange 113 to guide the movement of the slide thereon. A pair of spring fingers 115, see Figs. 1 and 3, reach forwardly from the rear flange 114 and bear at their ends on the under side of the rest 112 to hold the slide 111 down thereon while also providing a slight friction to resist its movement. The movement of the slide 111 back and forth on its rest 112 is limited at each end by the lug 110 striking against the ends of the slot 109 in the lever 105. At one end of the slide 111 is an arm 116 terminating in a finger-piece 117 bent downwardly across the rearward edge of the rest 112, see Fig. 7. As shown in Fig. 1, the finger-piece 117 is arranged just beneath the rim of the work-table 4 inside its marginal flange 7 so as to be out of the way and protected from catching in the cloth. In this way accidental or unwarranted movement of the slide 111 is prevented, but when it is required to change its position to adjust the feed the finger-piece 117 is readily accessible by reaching in under the edge of the work-table 4. Referring to Figs. 1 and 7, the top of the slide 111 bears a panel 118, preferably enameled in black, with a series of indicia brought out in relief showing the range of adjustment of the feed. As here illustrated the panel 118 is marked with rows of graduations 120 representing stitches in their varying lengths, with each line bearing a numeral indicating the length of the individual stitches, or, if preferred, the number of stitches to the inch. The several lines of graduations or stitch indicia are adapted to register individually with a slit or mortise 121 cut through the top of the table 4 as shown in Figs. 1 and 8, when the slide is pushed back and forth to adjust the extent of feed of the mechanism. The operator thus has before him a visualization of the work to be performed in accordance with the varying adjustment of the feed-mechanism.

Having now described the construction and arrangement of my improved device in detail its method of operation will next be explained. As herein shown the feed-mechanism is adapted for use in a sewing-machine and its method of functioning will therefore be explained in connection with the stitch-forming operation of the machine. As above noted, the inner shaft 87, carrying the looper 6, and the tubular shaft 89, carrying the cam 95, are rotated at different speeds through connections with the main power-shaft of the machine, not herein shown. The needle-bar B is reciprocated from means operated by the power elements to cause the needle to be inserted through the cloth C on the work-table 4 and the shaft 87 rotates the looper 6 to cause its hook, not herein shown, to take the loop from the needle N and cast it around the lower thread, in the manner as well known to those versed in the art. The presser-foot F is held down against the cloth C with a yielding pressure to hold the material and as the needle is raised the feed-dogs 31 and 32 act against this pressure to feed the cloth forward for a new insertion of the needle to complete the stitch. The rotation of the looper-shaft 87 and cam-shaft 89 are synchronized to provide for the forward operation of the feed-mechanism as the looper is casting the loop and the needle is being lifted above the cloth, and for this purpose the cam 95 operates as shown in the progressive views,

Figs. 9, 10 and 11. Fig. 9 illustrates the cam 95 as having carried the crosshead 65 to the left-hand end of its stroke and it will be noted that the cam is turned downward with the top of the yoke or shoe 85 resting on its concentric portion 99 of least radius. The cam 95 rotates in the direction indicated by the arrow *b*, Figs. 9 to 11, and hence as it turns back from the position illustrated in Fig. 9 its eccentric face 98 will act on the shoe 85 to slide the crosshead 65 to the right. During this motion of the crosshead to the right the shoe 85 remains in its lowered position with its top resting on the reduced portion 99 of the cam, and it will be noted from Figs. 9 and 10 that the fingers 100 of the supporting-arms 45 for the feed-plate 30 rest on top of the shoe with their ends lowered so that the feed-dogs 31 and 32 are depressed below the top of the work-table 4. Now, as the cam 95 turns beyond the position shown in Fig. 10 its eccentric face 98 will come into action against the top of the shoe 85 to slide the latter upwardly in its guideways. Meanwhile, the high point of the cam will have passed upwardly from the side of the shoe and the concentric face 97 will have come into engagement therewith. As the concentric face 97 of the cam 95 engages one side of the shoe 85 the opposite reduced concentric face 99 rides onto the opposite side of the shoe and consequently at this juncture there will be no lateral motion imparted to the shoe. Stated briefly, after the cam 95 has carried the crosshead 65 to the end of its throw the concentric portions 97 and 99 of the cam come into engagement with the opposite sides of the shoe 85 and the crosshead will therefore remain at rest while the cam turns through the next 90 degrees of its rotation. It will be understood, of course, that the rotation of the cam 95 is continuous and as it turns through this last 90 degrees its eccentric face 98 will act on the top of the shoe 85 to raise the latter from the position shown in Fig. 10 to that shown in Fig. 11. The elevation of the shoe 85 raises the fingers 100 at the ends of the supporting-arms 45 and as a consequence the pivots 40 of the rocker-arms 35 are lifted to displace the rocker-arms bodily in an upward direction. The lifting of the rocker-arms 35 raises the feed-plate 30 to a higher horizontal plane and the feed-dogs 31 and 32 are projected through the openings 34 in the work-table 4 to engage them with the cloth C to be fed, see Fig. 2. In this way the teeth 33 on the feed-dogs are caused to bite into the cloth which is held from raising by the presser-foot F. Now as the cam 95 continues to turn in the same direction its eccentric face 98 will ride off from the top of the shoe 85 while the concentric face 97 engages therewith, The shoe 85 will thus be supported in its raised position during the movement of the cam through the next 90 degrees of its rotation and the feed-plate 30 will consequently be maintained with its dogs 31 and 32 raised above the work-table 4 while it is traversed to the left to feed the cloth forward under the presser-foot F. The forward movement of the feed-plate 30 is effected from the motion of the crosshead 65 as the latter is carried back to the left by the action of the cam face 98 on the shoe 85, see Fig. 11. It has before been explained that the crosshead 65 is connected directly to the double-link 64 at 80, while the connecting-rod 70, in turn, is coupled to the feed-plate 30 at 40, see Figs. 1 and 2. It will thus be seen that as the double-link 64 is rocked back and forth from the crosshead 65 it will move the feed-plate 30 first in one direction and then in the other with a pause at either end of its stroke. The intervals between the strokes of the feed-plate occur while the crosshead remains at rest during the engagement of the concentric portions 97 and 99 of the cam 95 with the sides of the shoe 85. The cycle of operations of the cam is divided into four parts as defined by the several faces of 90 degrees extent on its periphery. Referring to Fig. 9, with the parts in the position as here shown the next quarter rotation of the cam carries the crosshead to the right and the depressed feed-plate 30 is traversed in the same direction from the oscillation of the double-link 64. At the next quarter rotation of the cam the crosshead 65 will remain at rest while the shoe 85 is being raised, see Figs. 10 and 11. The raising of the shoe 85 lifts the arms 45 to raise the feed-plate 30 and project its dogs through the work-table 4; and at the next quarter rotation of the cam the crosshead 65 is moved back to the left to traverse the feed-plate to feed the cloth. At the completion of this last quarter rotation the concentric faces 97 and 99 of the cam again come into engagement with the sides of the shoe 85 and the crosshead remains at rest while the shoe is lowered to first position as shown in Fig. 9. The lowering of the shoe 85 allows the arms 45 to drop to lower the feed-plate 30 to remove its feed-dogs from contact with the cloth so that at the next traverse of the plate the dogs will be carried back to take a new grip on the material. The above cycle of operations is continued to provide the intermittent or step-by-step feed and as before noted the extent of feed at each step may be adjusted by setting the slide 111.

Referring to Fig. 7, as the slide 111 is pushed forward, or to the left as viewed in Fig. 1, the lug 110 at its front will be slid along the inclined slot 109 in the arm 105 to raise the arm about its pivot 106, see Fig. 7. The lifting of the arm 105 in this manner

acts through the slot 108 at its end to raise the roller 69 in the slot 68 of the double link 64. As the roller 69 is raised away from the axis of oscillation of the link 64 it will be given a greater range of movement under the oscillation of the link and hence the connecting-rod 70 will impart a longer stroke or traverse to the feed-plate 30. Likewise, as the adjusting-plate 111 is drawn back in the opposite direction its lug 110, sliding in the slot 109, will depress the lever 105 to lower the roller 69 on the link 64. As the roller 69 is moved toward the axis of the link 64 the stroke of the link 70 is decreased in length so that the feed-plate 30 will be reciprocated with a shorter feed. In this way the range of operation of the mechanism may be easily adjusted to secure any length of feed required within the prescribed limits, the result of the adjustment or extent of feed being shown at the sight opening 121, see Fig. 8, by the indicia visible therethrough.

My improved device provides a true four-way motion for the feeding-element with the latter traveling in right lines during the operative and return strokes. That is to say, the feed-dogs are traversed in a substantially straight horizontal path from one end of the stroke to the other so as to be maintained in complete engagement with the material being fed throughout the full length of the stroke. This provision prevents slip at the ends of the feeding stroke and hence insures a much more positive and accurate feed. Furthermore, the feed-dogs are engaged with and released from the material with a right-line movement during their intervals of rest at the ends of each horizontal stroke so that they are less liable to injure delicate fabrics by abrasion or by pulling or cutting the threads.

The improved adjusting-means for the feed provides for its accurate control within wide limits; and the adjustment-indicating device is of great convenience for setting the machine for different lengths of stitches. Moreover all of the adjusting-mechanism is hidden and protected from outside interference, yet easily accessible for manual manipulation.

Particular attention is directed to the lightness and ease of operation of the parts of the device whereby power is economized and high-speed running of the machine secured. In addition, the novel and ingenious structure of the parts and the method of mounting and connecting them provides for economical manufacture while also allowing the mechanism to be assembled without the use of screws, nuts, bolts, or other threaded parts.

Various modifications in structure and arrangement of the parts of the improved device could be made without departing from the spirit or scope of the invention; therefore, without limiting myself to the precise embodiment herein shown and described,

I claim:

1. In a feed-mechanism, the combination with a feeding-element, of rocker-arms pivotally connected to the opposite ends of said feeding-element, a second set of hinged arms to which the rocker-arms are pivoted, a cam, means engaging the periphery of the cam to oscillate the feeding-element on its rocker-arms, and means reciprocated from said cam to periodically raise and lower the opposite hinged arms to bodily move the rocker-arms to effect engagement of the feeding-element with the material to be fed and to cause its withdrawal from contact therewith.

2. In a feed-mechanism, the combination with a feeding-element, of rocker-arms for supporting the opposite ends of the feeding-element to adapt it to be oscillated substantially horizontally thereon, a cam, means engaging the cam and connected to oscillate the feeding-element, a pair of hinged arms pivoted on opposite sides of the cam and pivotally connected to the rocker-arms, and means reciprocated from the cam and engaging the ends of the two hinged arms to periodically raise and lower the latter to carry the feeding-element into engagement with and remove it from contact with the material to be fed.

3. In a feed-mechanism, the combination with a feeding-element, of rocker-arms pivotally connected to the opposite ends of said feeding-element, a cam, arms hinged at opposite sides of the cam and pivotally connected to the rocker-arms, means engaging the cam and connected to oscillate the feeding-element, and means operated from the cam and engaging with the ends of both of the hinged arms to raise and lower the latter to cause the feeding-element to be periodically displaced to engage it with and disengage it from the material to be fed.

4. In a feed-mechanism, the combination with a feeding-element, of rocker-arms pivotally connected to the opposite ends of said feeding-element, a cam, a crosshead reciprocated horizontally from said cam, means connecting the crosshead to oscillate the feeding-element, arms hinged at opposite sides of the cam and pivotally connected with the rocker-arms, and means reciprocated vertically from said cam and engaging beneath the opposite ends of the hinged arms to periodically raise and lower the feeding-element to engage it with and disengage it from the material being fed.

5. In a feed-mechanism, the combination with a feeding-element, of opposite rocker-arms connected to the ends of said feeding-element, a slidable crosshead connected with

the feeding-element, a cam for reciprocating the crosshead, arms hinged on opposite sides of the cam and pivotally connected to the rocker-arms, and means reciprocated vertically from the cam and arranged beneath the ends of the hinged arms to periodically raise and lower the latter to displace the feeding-element to engage it with and disengage it from the material to be fed.

6. In a feed-mechanism, the combination with a feeding-element, of rocker-arms for supporting the feeding-element, hinged arms pivotally supporting the rocker-arms on opposite sides of the cam, a reciprocable crosshead for oscillating the feeding-element, a cam for reciprocating the crosshead, and a shoe slidable on the crosshead and operated from the cam to raise and lower the hinged arms carrying the rocker-arms for the feeding-element.

7. In a feed-mechanism, the combination with a rotatable cam, of a reciprocable crosshead adapted to be reciprocated from the cam, a U-shaped shoe slidably mounted on the crosshead in engagement with the cam, hinged arms arranged on opposite sides of the cam with their free ends resting on the shoe, rocker-arms pivoted to said hinged arms, a horizontal feed-plate connected to the upper ends of the rocker-arms, and means connecting said feed-plate to be oscillated from the crosshead.

8. In a feed-mechanism, the combination of a feeding-element, of means to oscillate the feeding-element, means for adjusting the extent of oscillation of the feeding-element, a slide for operating the adjusting-means, a series of indicia on the slide for indicating the extent of feed of the feeding-element, and a cover overlying the slide and provided with a sight-opening with which the various indicia register as the slide is shifted to operate the adjusting-means.

9. In a feed-mechanism, the combination with a feeding-element, of means to oscillate the feeding-element, means to adjust the extent of oscillation of the feeding-element, means for setting the adjusting-means, a panel on the setting-means bearing a series of broken lines representing rows of stitches of varying lengths corresponding to the different lengths of stroke of the feeding-element as provided by the different degrees of adjustment, and means overlying the panel and provided with a sight-opening through which the various representations of the stitches are made visible one at a time as the panel is shifted during the adjustment of the setting-means.

10. In a feed-mechanism, the combination with a feeding-element, of means to oscillate the feeding-element, means to adjust the length of stroke of the feeding-element, means for setting the adjusting-means, a series of indicia consisting of broken lines representing rows of stitches of different lengths corresponding to the various lengths of stroke of the feeding-means, and means adapted to register with the different indicia under the adjustment of the setting-means to display one line at a time in accordance with the adjustment while concealing the other indicia.

11. In a sewing-machine, the combination with the feed-mechanism thereof, of means to adjust the extent of the feed, means bearing indicia consisting of broken lines representing rows of stitches of different lengths to indicate the effect of the adjustment of the feed-mechanism, and means overlying the indicia-bearing means and provided with a sight-opening through which a single line of the indicia is exhibited while the other lines are concealed from view.

12. In a sewing-machine, the combination with a work-table having a sight-opening therein, of a feed-mechanism beneath the work-table, means to actuate the feed-mechanism, means to adjust the extent of feed of the feed-mechanism, a plate slidable beneath the table and connected to operate the feed-adjusting means, and indicia on the plate consisting of broken lines representing a series of stitches of varying lengths, said indicia adapted to register individually with the sight-opening in the table as the plate is shifted to effect the adjustment of the feed.

13. In a feed-mechanism, the combination with a feeding-element, of rocker-arms for supporting the feeding-element to adapt it to oscillate thereon, apertured bearings on the feeding-element and rocker-arms, pivot-pins inserted through said bearings, said pins formed with shepherd-crooks overlying the sides of the arms, and means on the arms for releasably grasping the ends of the crooks to hold the pins in place in their bearings.

14. In a feed-mechanism, the combination with a feeding-element, of rocker-arms for supporting the feeding-element to adapt it to oscillate thereon, apertured bearings on the feeding-element and rocker-arms, pivot-pins inserted through said bearings, said pins bent back to overlie the arms and provided with crooks at their ends, and arcuate lugs projecting from the sides of the arms to adapt the crooks on the pins to be sprung into engagement therewith to retain the pins in place.

In testimony whereof I affix my signature.

SIMON W. WARDWELL.