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FEED MECHANISM FOR SEWING MACHINES AND THE LIKE

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FIG. II.

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This invention relates to sewing machines, and especially to the feeding of the work past the stitching mechanism. The invention is concerned with feeding of the work effected by the needle, preferably in coaction with other feed mechanism, and is also concerned with other feed mechanism of a rotary type. Other features and advantages of the invention will appear from the following description of a species or form of embodiment thereof, and from the drawings. It is to be understood, however, that various features of this mechanism are separately useful, apart from others shown: e.g., the needle-feed apart from the other feed-mechanism, or vice versa. My novel type of needle-feed mechanism is adaptable to afford special advantages such as precision of feed, relatively unaffected by wear or looseness, delicacy of feed and stitch adjustment, etc.

In the drawings, Fig. I is a side view of a lock-stitch type of sewing machine conveniently embodying my invention, the main frame of the machine being shown in vertical mid-section, and parts unconnected with my invention being partly broken away.

Fig. II is a view from the left of Fig. I with a cover-plate removed to show the mechanism in the needle-head.

Fig. III is a fragmentary sectional view of the needle head, showing the associated mechanism, parts unconnected with my invention being partly broken away.

Fig. IV is a side view, partly in vertical axial section, of fabric-feeding and stitch-forming mechanisms, the latter comprising a rotary hook or loop-taker enclosing a bobbin-case (not shown).

Fig. V is a fragmentary plan view of the operating connection between an oscillatory needle-bar guide and its actuating crank, with an associated part in section as indicated by the line and arrows V—V in Fig. III.

Fig. VI shows a vertical axial section through an eccentric-crank mechanism for oscillating the needle-guide, and its adjusting means; Fig. VII is an "exploded" perspective view of the parts of this mechanism separated to render them individually visible; Fig. VIII is a separate perspective view of one of these parts in a different position; and Fig. IX shows a cross-section through the adjusting means; and

Fig. X is a fragmentary view illustrating the adjustment of the eccentric, taken as indicated by the line and arrows X—X in Fig. I.

Fig. XI is a bottom plan view of the work support and the associated parts and mechanisms. Fig. XII is a view similar to Fig. I showing a four-motion feed in lieu of the rotary feed shown in Fig. I, certain parts being partly broken away.

Fig. XIII is a fragmentary end view, from the left of Fig. XII, illustrating the four-motion feed, certain parts being partly broken out.

Fig. XIV is a bottom plan view of the work support shown in Figs. XII, XIII, and XV, with the associated parts and mechanisms, a bottom cover of a lower stitch mechanism being omitted.

Fig. XV shows a section taken as indicated by the line and arrows XV—XV in Fig. XIV, and illustrates parts of the feed drive.

As shown in Figs. I, II, and III the hollow frame of the sewing machine here illustrated carries a work support 10 and includes a hollow arm 11 projecting from the upright standard 12 and carrying a needle head 13. With the head 13 are associated a vertically reciprocating needle bar 15 carrying the needle 16, and a spring actuated presser bar 17 carrying a presser foot 18, here shown as of a beveled roller type. The presser bar 17 is mounted in the head 13 so as to be vertically movable, and is yieldingly urged downward by a helical compression spring 19, as usual. As shown in Fig. II, the axis of the presser foot roller 18 is in line with the path of travel of the needle 16 when the needle bar 15 is vertical.

Beneath the work support 10 are a rotary feed wheel 20, having a suitably serrated or otherwise roughened peripheral feeding surface that coacts with the presser foot 18 through an opening in the work support 10, and stitch forming mechanism 21 for coacting with the needle 16; see also Fig. IV. As here shown, the stitch forming mechanism 21 includes a rotary hook or loop-taker 22 revolving in a horizontal plane beneath the work support 10 about a vertical axis 23.

This stitch-forming mechanism 21 may be of any suitable construction, but is here shown as like that illustrated and described in the application of Norman V. Christensen and Oscar Quist, Serial No. 53,552, filed December 9, 1936, and assigned to the assignee of this application.

It will be understood that the machine may be provided with any usual accessories, such as a thread tension 24, take-up 25, presser foot lifting means 26 and 27, tension relieving device 28, and thread guides 29, appearing in whole or in part in Figs. I and II, and that these may be of any suitable or preferred construction, and may be operated by any suitable means. These and other accessories are more fully illustrated and
described in the aforementioned application of Norman V. Christensen and Oscar Quist. As shown in Figs. II and III, the needle bar 15 reciprocates in a guide bracket 30 which is pivoted on a stud 31 secured in the lower end of the head 13, and in the upper and lower guide bearings 32 and 33 for said needle bar. Openings in the upper and lower ends of the head 13 afford clearance for the needle bar 15 to swing or oscillate relative to the head. The needle bar 15 may be actuated from a horizontal drive shaft 35 (mounted in bearings 36, 38 in the arm 11) by any suitable means, such as a crank 37 on the end of the shaft with a pitman connection 38 from its crank pin 39 to a pivot pin 40 suitably mounted on the needle bar. As here shown, the guide bracket 30 is oscillated about its pivot 31 from a horizontal shaft 41 mounted above the shaft 35 in bearings 42, 42 in the arm 11, by means comprising a rocking arm or crank 44 fixed to the end of the shaft 41 and provided with a pivot pin 45 whose flattened end 46 is slide engaged in a vertical slot in groove 32 of the bracket 30, Fig. V. The shaft 41 may preferably be driven from the shaft 35 by means adapted to impart an adjustably variable oscillation to said shaft 41, such as hereinafter described.

In the present instance, the shaft 35 is the main drive shaft of the machine, and may be driven from any suitable source of power by any suitable means, here indicated by a grooved pulley 47 fast on the righthand end of said shaft 35, Fig. I, adjacent the hand wheel 48 also fast shaft 35. As shown, a horizontal shaft 50 mounted in bearings 51, 51 beneath the work support 10 is also driven from the shaft 35, as by means of helical gears 52, 53 of equal diameters on the shafts 35 and 50 and an interposed coacting idle gear 54 mounted on a short intermediate shaft 55. From this lower horizontal shaft 50, the stitch mechanism 21 and the feed wheel 20 may be driven by any suitable means, such as hereinafter described.

The mechanism shown in Figs. I and VI-X for actuating shaft 41 from shaft 35 includes an eccentric 56 on said shaft 35 with an eccentric rod connection 57 to a crank 58 fast on the adjacent end of shaft 41. For adjusting the amplitude of oscillation imparted to shaft 41 and through it to the needle bar guide 30, provision may be made for adjusting eccentric 56 radially or diametrically of shaft 35. For this purpose, eccentric 56 has in its lefthand side a diametral groove 60 (Figs. VI and VII) in which are engaged guide tongues or lugs 61 (Figs. VI-VIII) on a collar 52 keyed fast to shaft 35, and has in its righthand side a broad diametral groove 63 in which is engaged an eccentric 64 (Figs. VI, VII, and IX) provided with a split clamp collar 65 adapted to be clamped in frictional engagement with the shaft 35 by a screw 66. The collar 52 should be clamped on the shaft 35 tightly enough to turn with the latter and resist all stresses of ordinary operation of the machine, yet with freedom to slip for purposes of adjustment as hereinafter described.

For holding collar 65 and eccentric 64 against rotation when radial adjustment of eccentric 56 is made, an effectual holding means, as anti-turning engagement means, here shown (Figs. VII and IX) as formed by a notch 67 in its periphery, for coacting with manually operable stop means. This stop means consists of a plunger 88 mounted for vertical movement in a guide sleeve 89 on the upper wall of the arm 11, Figs. I and X, and provided with a rounded actuating head 90. Normally, the stop 88 is held elevated out of the path of the collar 85 by a 95 hole in the arm 11 of the slot 96. As shown in Fig. X, the hand wheel 98 is driven by an eccentric 99 on the lower wall of the arm 11. When the eccentric 99 is to be adjusted, however, the stop 88 is pressed down and the shaft 35 is turned by means of hand wheel 98, until said stop 88 engages in the slot 96 of the further rotation of the hand wheel 98, which will turn the eccentric 99 about the shaft 35 and shift the eccentric 56 diametrically one way or the other, to increase or decrease its eccentricity with reference to the 15 shaft. As shown in Fig. I, the hand wheel 98 is provided with a flange 23 bearing index marks for coacting with a suitable mark 74 on the adjacent portion of the frame standard 12 to indicate the lengths of stitch corresponding to various adjustments of the eccentric 56.

As shown in Figs. I and XI, the horizontal drive shaft 75 of the oscillating mechanism 21 is (approximately) in line with the lower shaft 50 and is driven therefrom by a flexible or universal coupling 76 which takes care of slight misalignment and permits slight adjustments. On the shaft 50 adjacent the coupling 76 is an eccentric-crank 77 which drive the feed wheel 20 by means adapted to suitably describe such means, such as hereinafter described.

Referring to Figs. I, II, IV, and XI, it will be seen that the feed wheel 20 is mounted on one end of a short shaft 80 which is journaled in a bracket 82 which can be adjusted up and down to any desired position and provided with a means for controlling the position of bracket 82, as by a notch 83 in the periphery of bracket 82, permitting said bracket 82 to move a distance sufficient to permit the shaft to be driven up and down in a suitably threaded lug or boss 88 on work support 10. A helical compression spring 89 is interposed between lug or boss 88 and arm 85. As shown in Fig. II, a ratchet action by means of a projection 91 on the lower side of arm 85. On bracket 82 may be mounted any suitable means 92 for converting reciprocatory or oscillatory motion into intermittent, step-by-step, uni-directional rotation of shaft 80, such as the clutch 55 mechanism disclosed in U. S. patent to W. B. Long et al., No. 1,692,130, November 20, 1928. As shown in Figs. II and XI, the oscillatory actuating arm 93 of the clutch mechanism 92 is connected by a link 94 to an oscillating rocker arm 95 fast to one end of a shaft 96 journaled in bearing lugs 97 depending from the work support 10. Shaft 96 may be rocked or oscillated from one end of the feed wheel 20 by means of a notch 98 on the periphery of the feed wheel 20, such as an eccentric rod 99 connected to a crank 100 fast on the corresponding end of shaft 96. The amplitude of movement thus imparted to clutch arm 93 and feed wheel 20 may be adjusted and varied by any suitable means, as by a slot and screw clamp connection between link 94 and its pivot 90. The oscillation of needle bar guide 30 as above described causes a corresponding to and from motion of needle 16 in the direction of feed. With suitable adjustment or setting of the various eccen-
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centrics and cranks, as shown, there is a movement of needle 16 in the direction of feed while engaged in the work, and a coincident and similarly corresponding movement of the rotary feed wheel 20. The contrary movement of the needle 16 takes place while it is out of the work. The amplitude of this work-feeding movement of the needle 16 and the resulting work feed and stitch length can be adjusted by adjusting the eccentric S as above described; and the work-feeding movement of the feed wheel 20 can be adjusted by adjusting the pivot 100 in the oscillatory arm 95 as described. By these adjustments, the vibratory or oscillatory movement of the needle 16 may be made to correspond accurately with that of the feed wheel 20, or may be made greater or less in any desired proportion, if preferred for any reason. As shown in Figs. II and III, the driving connection 45, 46 acts on the guide 30 further from the fulcrum pivot 31 than the latter is from the work at 10, and in such relation to said pivot that the parts 45, 46 always have a greater movement than the resulting work feed and stitch length. This gives great fineness or delicacy of stitch adjustment by adjusting the amplitude of oscillation of the guide 30, and also reduces the effects of wear or looseness in the driving connections.

As shown in Figs. II and III, the presser foot 18 comprises a bracket structure 101 attached to the lower end of presser bar 17 and having laterally projecting arms 102, 103. The roller 18 revolves on a shaft 103 mounted in the lower end of a sloping arm 104 whose upper shoulder portion 105 is pivoted about a horizontal axis parallel with the line of feed. For this purpose, conical-ended pivot-screws 106, 108 in the bracket arms 102, 104 engage in corresponding sockets in arms 103, 104, these screws 106, 108 being shown as provided with lock-nut 107. For determining and adjusting the exact position of roller 18 relative to needle 16, as well as the angular relation of its periphery to the work support 18, there is a stop-screw 109 in the part 104 of arm 104, adapted to engage against bracket 101 and provided with a lock-nut 108. A double leaf-spring 110 is attached to bracket 101 at 111, and its free end has a beveled latch-ump 112 that engages against the lower edge of shoulder 115 and holds arm 104 in the position shown, with stop screw 108 against bracket 101. By forcibly swinging arm 104 to the left (Fig. XIII), its shoulder 105 can be snapped past the latch end of spring 110 and freed, so that roller 18 can be swung up out of the way for insertion or removal of work beneath the presser-foot. As shown in Fig. III, the "tread" of the beveled roller 18 makes a very acute angle with the plane of work support 18.

While the above described rotary feed is shown in combination with a roller presser foot and a needle feed it will be understood that the needle feed may be dispensed with in certain types of work, and that under certain conditions it may be desirable (either with or without a needle feed) to employ a presser foot of some character other than a roller presser foot.

Fig. XII shows a lock-stitch sewing machine with an ordinary type of rockably pivoted presser foot 182 substituted for the roller presser foot 18 of Fig. I, and with a lower four-motion feed 20a in lieu of the rotary feed of Fig. I, but in other respects substantially like the machine of Figs. I–XI, and including a like needle-feed action.

Accordingly, various parts and features shown in Figs. XII–XV are marked with the same reference numerals as the like parts and features in Figs. I–XI, as a means of dispensing with repetitious description, while other corresponding parts and features are distinguished by addition of a letter to the reference numeral, where such distinction appears necessary.

As best shown in Fig. XIII, the feed 29a comprises a feed-dog 120 coating with the presser-foot 18a through a suitable opening in the work support 10. The feed-dog 120 is mounted for up and down adjustment (as shown in connection 121) on a four-motion feed-bar 122. The feed member comprising feed-dog 120 and feed-bar 122 receives up and down motion from horizontal shaft 50 through its extension 55a (corresponding in some respects to the shaft 55 in Fig. I), by means of an eccentric 123 fast on shaft 55a and acting through an eccentric strap and rod 124 pivoted at 123 to a forward extending curved arm 126 of feed-bar 122. Shafts 50 and 55a are journaled in bearings 51, 51, and 51a, Fig. XIV, beneath the work support 10. Bracket 51a and rotary hook-stitch mechanism 50a are shown as like corresponding parts in the aforementioned Christensen and Quist application, and as similarly engaged with and adjustable along a tongue forming flange 127 on the work-support 10, to which flange they are securely bolted by bolt and slot connections 128, 129. The stitch mechanism 21a, like that in Fig. IV, is shown as revolving in a horizontal plane beneath the work support 10 about a vertical axis, and as similarly driven from shaft 55a through bevel gears 129, 130, best shown in Fig. XIV.

The feed member comprising dog 120 and feed-bar 122 may receive horizontal, to and fro, work-feeding motion from an eccentric 71a on shaft 50, Figs. XIV and XV. As shown in Fig. XIV, a forward-extending arm 132 of feed-bar 122 is pivotally connected at 133 to the upper end of a bifurcated arm 134 fast to one end of a horizontal shaft 96a that is journaled in bearing 97a depending from the work-support 10. As shown, shaft 96a is under the front edge of work support 10, instead of under its rear edge as in Fig. XI. Shaft 96a may be racked or oscillated from eccentric 71a through actuating connections including an eccentric strap and rod 98a pivoted at 136 to the joint of a toggle device 137, 138. The lazy-bar link 137 of this toggle device is pivoted at 138 to a bracket 140 depending from the work-support 10, while the more active toggle link 139 is pivotally connected to a rocker arm 99a fast to shaft 96a. The amplitude of movement thus imparted to shaft 96a and feed-dog 120 may be adjusted and varied by any suitable means, as by a slot and screw-clamp connection between link 139 and its pivot 190a on rocker 99a. By this adjustment the eccentric 55a as already described in connection with Figs. I–IX, the feeding action of dog 120 can be made to correspond accurately with that due to the vibratory or oscillatory movement of needle 16, or may be made greater or less in any desired proportion. As shown in Fig. XIV, set collars 141, 142 secured on shaft 96a control its longitudinal position in its bearings 97a.

It will, of course, be understood that any suitably actuated four-motion or other lower feed mechanism (different from those hereinbefore described) may be employed, and may derive its motion in any preferred way from any suitable part(s) of the sewing machine.
Having thus described my invention, I claim:

1. The combination with a reciprocating needle bar and a rockable guide therefor, of a drive shaft; means actuated by said drive shaft for reciprocating said needle bar; another shaft with means actuated thereby for oscillating said guide; an eccentric on said drive shaft mounted for radial adjustment relative thereto; an eccentric crank on said drive shaft, for holding said eccentric in fixed radial position relative thereto, frictionally secured to the drive shaft to turn therewith but capable of slipping thereabout; means engageable with said eccentric crank to cause it to slip when the shaft is turned and thus adjust said eccentric radially relative to the shaft merely by preventing the eccentric crank from turning with the shaft, without need to loosen said eccentric crank thereon; and means operated by said eccentric for actuating the afore-said other shaft to oscillate said guide.

2. In a sewing machine, the combination with a work support and a presser-foot at one side thereof, of a rotary feed member at the other side of said work support coating therethrough with said presser foot, a needle and a reciprocating needle bar at the same side of said work support as said presser foot, a rockable guide for said needle-bar, a drive shaft with means actuated thereby for reciprocating said needle-bar, a shaft driven by said drive shaft and means actuated thereby for imparting step-by-step rotary work-feeding movements to said rotary feed member and for adjusting the extent of such movements, a shaft with means actuated thereby for oscillating said guide, and means for actuating said last-mentioned shaft from said drive shaft so as to feed the work by the engagement of the needle in the work as well as by the action of said feed member.

3. In a sewing machine, the combination with a work support and a presser-foot at one side thereof, of a feed member at the other side of said work support coating therethrough with said presser foot, a needle and a reciprocating needle bar at the same side of said work support as said presser foot, a rockable guide for said needle-bar, a drive shaft with means actuated thereby for reciprocating said needle bar, a shaft driven by said drive shaft and means actuated thereby for imparting up and down movements and to and fro work-feeding movements to said feed member, with means for adjusting the extent of such movements, a shaft above said drive shaft with means actuated thereby for oscillating said guide, and means for actuating said last-mentioned shaft from said drive shaft so as to feed the work by the engagement of the needle in the work as well as by the action of said feed member.

4. In a sewing machine, the combination with a frame carrying a work support and including an arm with a needle-head thereon over said work support, of a drive shaft in said arm, a rockable needle-bar guide pivoted on said head, a reciprocating needle-bar guide, means actuated by said drive shaft for reciprocating said needle bar, a shaft in said arm above said drive shaft with means actuated thereby for oscillating said guide, a shaft beneath said work support, a feed member and a stitch mechanism beneath said work support actuated from said last-mentioned shaft, and means for actuating both of the other shafts aforementioned from said drive shaft.

5. In a needle-feed sewing machine, the combination with a frame carrying a work support and including an arm overhanging said work support; of a reciprocating needle bar, and a guide therefor fulcrumed on said arm for rocking movement in the direction of the line of feed of the work; a lower shaft mounted in bearings on said arm and operatively connected to said needle bar at a point above said guide fulcrum, to reciprocate the needle bar up and down in the guide; and an upper shaft above said lower shaft mounted in bearings on said arm and operatively connected to the guide, to rock the same, at a point above the connection of said first-mentioned shaft to the needle bar, and further from said guide fulcrum than said guide fulcrum is from the work.

6. In a sewing machine, the combination with a frame carrying a work support and including an arm overhanging said work support, a guide rockably mounted on said arm, and a bar movable up and down in said guide and active in feeding the work, of a drive shaft above the axis of rocking of said guide mounted in bearings on said arm and having an eccentric crank thereon at its driven end directly adjacent a corresponding bearing on the arm, and operatively connected to said bar at its distal end, to impart up and down movement thereto, and an oscillatory shaft above said drive shaft mounted in bearings on said arm and actuated by said eccentric, and having actuating connection from its distal end to said guide for rocking said guide and said bar.

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