Nov. 4, 1930. W. MYERS 1,780,309

STITCH FORMING MECHANISM FOR SEWING MACHINES

Filed July 3, 1929 3 Sheets-Sheet 1

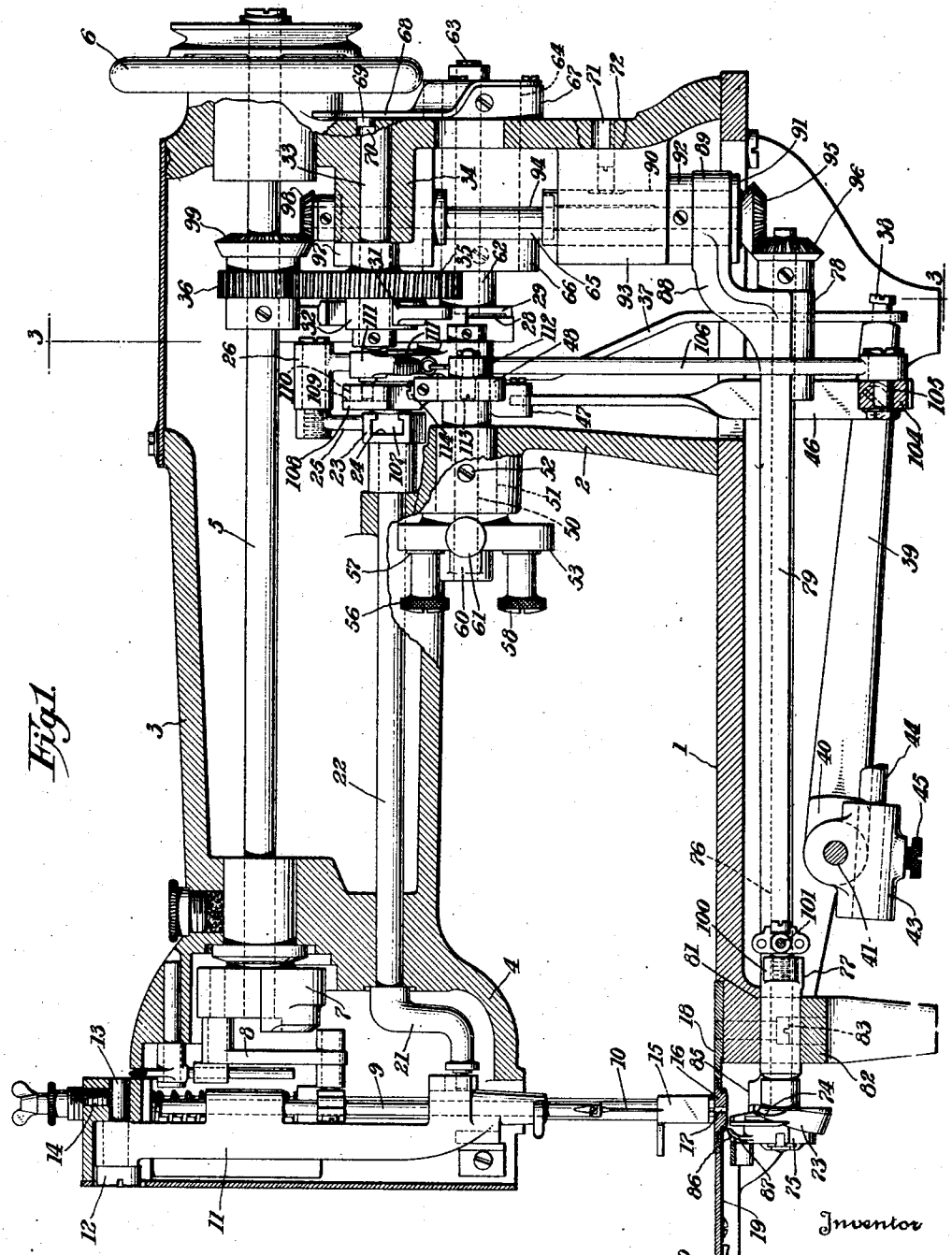


Fig. 1.

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Filed July 3, 1929 3 Sheets-Sheet 2

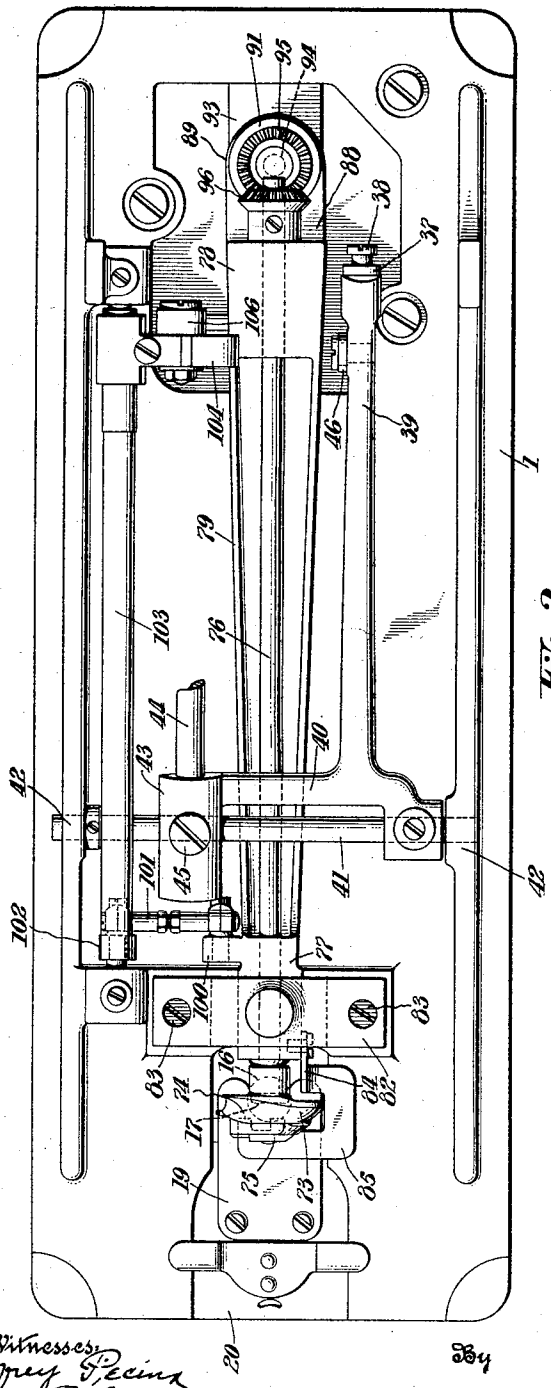


Fig. 2.

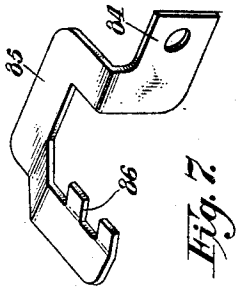


Fig. 7.

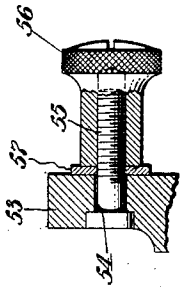


Fig. 6.

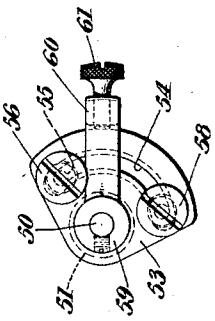


Fig. 5.

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STITCH FORMING MECHANISM FOR SEWING MACHINES

Filed July 3, 1929 3 Sheets-Sheet 3

Fig. 3.

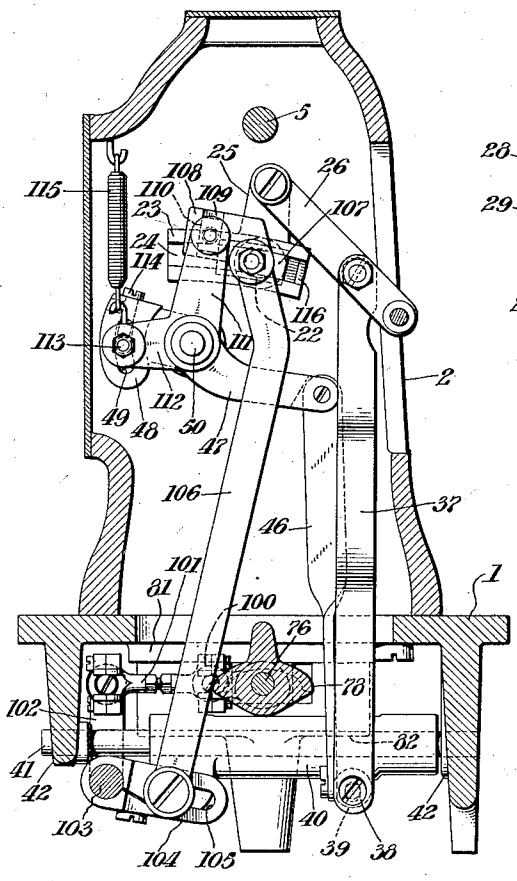
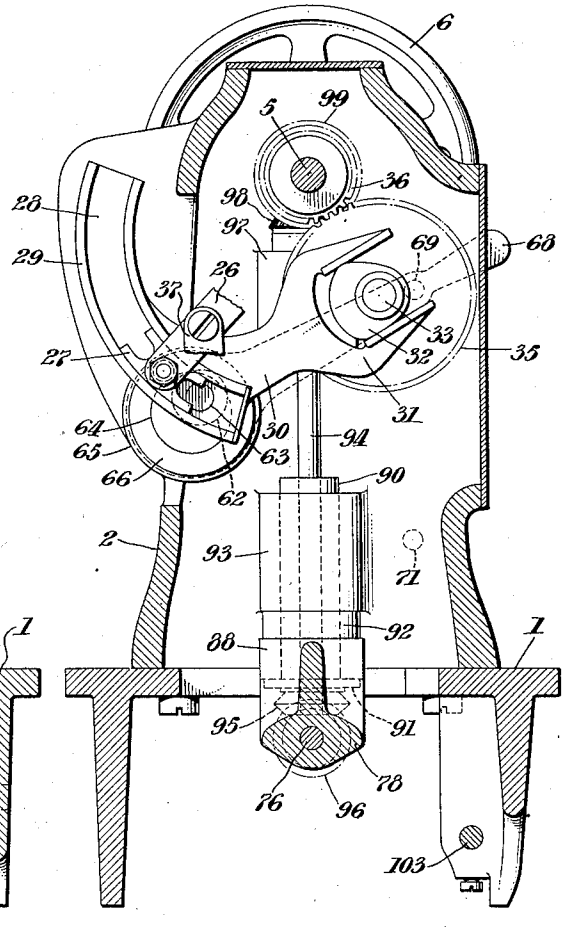


Fig. 4.



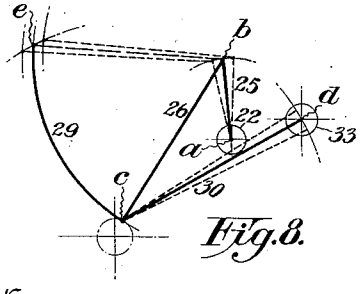


Fig. 8.

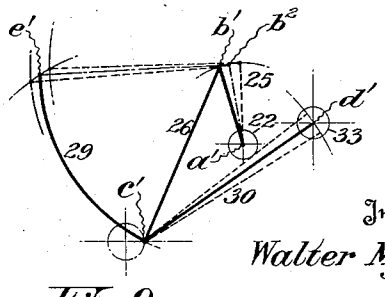


Fig. 9.

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1,780,309

UNITED STATES PATENT OFFICE

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STITCH-FORMING MECHANISM FOR SEWING MACHINES

Application filed July 3, 1929. Serial No. 375,615.

This invention relates to improvements in stitch-forming mechanisms for sewing machines and while designed more particularly for the embroidering type of sewing machines, it may be employed in any sewing machines in which the needles receive lateral movements in addition to their endwise, work-penetrating reciprocations.

The primary object of this invention is to increase the possible speed of efficient operation of a sewing machine having a laterally vibratile needle. To the attainment of this object, the present invention comprehends the provision of improved needle-vibrating mechanism; improved actuating mechanism for the loop-taker which cooperates with the needle in the formation of stitches, and improved compensating means for insuring loop-seizing relationship between the needle and the loop-taker during reciprocations of the needle in different paths.

In a preferred embodiment of the invention, the needle-carrying bar is journaled for endwise reciprocation in a vibratory frame operated from a rock-shaft having an arm connected with one end of a link of which the opposite end is shiftable, under manual control during the operation of the machine, in a segment provided on a cam-actuated rock-lever fulcrumed upon the machine frame. The fulcrum of this rock-lever is shiftable into positions in one of which the zero path of non-vibration of the needle is central of its vibratory movements, while in the other position the needle is vibratable only at one side of its zero path, although the extreme limits of throw of the needle are substantially the same in both cases. The link which is shiftable with respect to the rock-lever segment for controlling the amplitude of the needle vibration is suitably connected with a treadle or knee-shift for this purpose.

The loop-taker which cooperates with the needle in the formation of lock-stitches is of the rotary hook type, being carried by a horizontally disposed shaft beneath the cloth-plate. This shaft is gear-driven, through a vertically disposed intermediate shaft, from a main actuating shaft journaled in the machine bracket-arm. The loop-taker shaft is journaled in bearings provided in a horizontally vibratory frame pivotally supported at one end upon said vertical intermediate shaft and slidably supported adjacent to the loop-taker in a suitable guideway.

In order to insure loop-seizing relationship between the loop-taker and the needle during lateral vibrations of the latter, the loop-taker shaft supporting frame is vibrated in timed relation with the needle-vibrations. However, as the loop-taker efficiently seizes needle-thread loops up to a predetermined range of vibration of the needle, without compensating movements of the loop-taker, said vibratory movements of the loop-taker shaft supporting frame are only initiated for vibrations of the needle beyond said predetermined range. To this end, said loop-taker shaft frame is so connected with the needle-vibrating mechanism as to be inoperative for needle-vibrations within a predetermined range, but is rendered operative through lost motion connections with the needle-vibration controlling means for needle vibrations beyond said range.

Preferably, the present improvement also comprehends the provision of means for conveniently adjusting the needle-vibrating mechanism, independently of the treadle-control therefor, and for maintaining the selected extent of vibration without further attention by the operator. Inasmuch as the rotary loop-taker is bodily shifted during only the wider lateral movements of the needle and then only to the extent necessary to insure loop-seizing relationship with the needle, said bodily movements of the loop-taker when initiated, may be relatively short compared with the needle-vibrations. Obviously therefore, the present construction provides for a very material increase in the possible speed of operation of the machine.

In the accompanying drawings, Fig. 1 is a longitudinal section of a sewing machine containing a preferred embodiment of the present improvement. Fig. 2 represents a

bottom plan view of the machine. Fig. 3 is a sectional view substantially on the line 3—3 of Fig. 1 looking toward the needle end of the machine. Fig. 4 is a section substantially on the same line as Fig. 3, but viewed in the opposite direction. Fig. 5 is a face view of the needle-throw adjusting device. Fig. 6 is a detail sectional view of one of the stops of said adjusting device. Fig. 7 is a perspective view of the bobbin-case stop arm. Figs. 8 and 9 are diagrammatic views illustrating the throw of the needle-actuating rock-shaft in the different positions of the axis of the rock-shaft actuating segment-lever.

Referring to the drawings, the sewing machine comprises a cloth-plate 1, from which rises the hollow standard 2 of a tubular, overhanging bracket-arm 3 terminating in a head 4. Journaled in the bracket-arm 3 is a main actuating shaft 5, carrying at one end a belt-pulley 6 and at its opposite end a crank-disk 7 connected by the usual link 8 with a needle-bar 9. The needle-bar 9 carries at its lower end a needle 10 and is journaled for endwise reciprocation in bearings provided in a vibratory frame 11 supported upon a fulcrum-pin 12 for swinging movements in directions substantially transverse to the axis of rotation of the main-shaft 5, i. e., substantially transverse to the longitudinal direction of the cloth-plate 1. The fulcrum-pin 12 preferably has a reduced extension 13 which is eccentric to the journal-axis of the frame 11 and is secured upon the head 4 by means of a screw 14, thereby providing means permitting adjustment of the needle position.

The presser-foot 15 and its supporting means employed in the present machine is substantially the same as disclosed in my prior U. S. Patent No. 1.135,959, April 13, 1915, to which reference may be had for further details of its construction. The throat-plate 16, provided with the needle-slot 17, is sustained by a supporting plate 18 suitably secured upon the cloth-plate 1, said throat-plate being latched by a bifurcated plate 19 secured upon the underside of a removable slide-plate 20.

Suitably connected with the needle-bar frame 11 is a crank-arm 21 upon the forward end of a rock-shaft 22, journaled in the machine bracket-arm below and in parallel relationship with the main-shaft 5. At its rearward end, the rock-shaft 22 fixedly carries an angle-lever of which one arm 23 is grooved to provide a segmental guideway 24 and the other arm 25 of which lever is connected by a link 26 with a slide-block 27 shiftably disposed in a segmental guideway 28 provided in an arm 29 of an actuating lever. The other arm 30 of this actuating lever terminates in a fork 31 which straddles a cam 32 upon a counter-shaft 33 journaled in a bearing lug 34 provided within the machine standard 2. The counter-shaft 33 carries a gear-wheel 35 driven by a pinion 36 upon the main shaft 5 to rotate the counter-shaft at one half the speed of the main shaft.

It will be understood that upon rotation of the counter-shaft 33, the cam 32 imparts rocking movements of constant amplitude to the actuating lever 29, 30 and that these rocking movements are transmitted to the rock-shaft 22 through the link 26 and lever-arm 25 in any position of the slide-block 27 beyond its neutral position, i. e., beyond the position in which the pivotal connection of the slide-block with the link 26 coincides with the pivotal axis of the lever 29, 30.

In order to shift the slide-block 27 in its guideway 28, under treadle control, the link 26 is pivotally connected with an intermediate link 37 of which the lower end is suitably apertured to loosely receive a stud-screw 38 upon the free end of an arm 39. The arm 39 is integral with a yoke 40 suitably secured upon a fulcrum-shaft 41 of which the opposite ends are journaled in bearing apertures provided in the parallel ribs, as 42, depending from the cloth-plate 1. The yoke 40 is formed with an apertured boss 43 receiving a rod 44 secured by a set-screw 45, said rod 44 being operable from a treadle or knee-shift in any suitable manner to impart endwise movements to the link 37.

In addition to the treadle-control of the lateral throw of the needle and in combination therewith, means are provided for adjustably limiting the extent of throw of the needle and also for selectively obtaining a uniform extent of needle-vibration during continuous operation of the machine. To this end, the arm 39 is pivotally connected with a twisted link 46 similarly joined to an arm 47 of a lever having its other arm 48 provided with an arcuate slot 49 of which the center of curvature coincides with the axis of the lever 47, 48. The lever 47, 48 is fixed upon a short shaft 50 journaled in a bushing 51 adjustably fixed in an aperture in the standard 2 by means of a screw 52.

Preferably integral with the bushing 51 is a segment-plate 53 disposed at the outside of the standard 2 and partly under the bracket-arm 3. This segment-plate 53 is provided with an arcuate slot 54 which is T-shaped in cross-section and slidingly receives a headed stop-pin 55 secured in adjusted position in the slot 54 by means of a stop-nut 56 bearing upon a washer 57. Spaced from the stop-nut 56 and adjustably disposed in the slot 54 is the pin of another stop-nut 58 corresponding in structure to the previously described stop. Upon the outer end of the shaft 50 is secured the hub 59 of an arm 60 carrying at its overhanging free end a securing screw 61 adapted to engage the periphery of the segment-plate 53 to thereby provide for adjustably securing the shaft 50 against movement and conse-

quently maintaining a uniform amplitude of lateral vibration of the needle. When, however, the screw 61 is released the arm 60 normally engages the upper stop-nut 56, said arm 60 being thereupon manually shiftable between the stop-nuts 56, 58 or by the described treadle connections therewith to change the amplitude of needle vibration.

The segment-lever 29, 30 has a hub 62 suitably secured upon a fulcrum-shaft 63 eccentrically journaled in a bushing 64 rotatably disposed in an apertured bearing-lug 65 within the bracket-arm standard 2. The bushing 64 is held against endwise movement in the bearing-lug 65 by collars 66 and 67 fixed upon the bushing at opposite ends thereof. Secured upon the outer collar 67 is a shifting handle 68 carrying a stud 69 adapted to enter apertures, as 70 and 71, provided in the flattened face 72 of the standard 2.

When the stud 69 is disposed within the upper aperture 70, as shown in Fig. 1, the fulcrum-shaft 63 occupies a position such that the needle vibrates equal distances across its zero position of non-vibration, in correspondence with the extent of vibration selected by shifting the slide-block 27 in its guideway 28. However, when the fulcrum of the lever 29, 30 is shifted by manipulating the shifting-handle 68 so that the stud 69 enters the aperture 71, the zero position of non-vibration of the needle is disposed at one side of the vibration path thereof.

The effect of shifting the fulcrum axis of the lever 29, 30 is illustrated diagrammatically in Figs. 8 and 9 of the drawings, which respectively correspond with the positions of the parts in the upper and lower positions of the handle 68. In Fig. 8, a represents the position of the fixed axis of the rock-shaft 22; a, b the lever-arm 25 of said shaft 22; c the position of the fulcrum-axis of the lever 29, 30 when the needle is vibratable across its central zero position; d that of the axis of the counter-shaft 33, and d, c, e the lever 29, 30. It will be observed that when the center line d, c of the lever-arm 30 passes through the axis d of the counter-shaft 33, the arc c, e of the lever arm 29 has the point b as its center, with the link 26 represented by b, c as its radius. When the link b, c occupies the position represented by the full line in Fig. 8, its pivotal connection with the slide-block 27 coincides with the axis of the lever d, c, e and consequently rocking movements imparted to the lever d, c, e by the cam 32 will not effect any movement of the lever-arm a, b so that the needle reciprocates in a fixed path. When the link b, c is swung about the point b, as for instance, until the slide-block 27 coincides with the point e, the rocking movements imparted to the lever d, c, e by the cam 32 cause vibratory movements of the lever-arm a, b of equal extent upon opposite sides of the point b, as will be self-evident.

However, when the handle 68 is shifted to its lower position, the fulcrum-axis of the lever 29, 30 is shifted to the point c' in Fig. 9, thereby displacing the point b' of the lever-arm a', b' in an arc about the axis a' of the rock-shaft 22, and accordingly the zero position, i. e., the path of non-vibration of the needle is shifted correspondingly. The arc c', e' of the lever d', c', e' is now eccentric with respect to the point b' and consequently when the link b', c' is shifted, as for instance, until the slide-block 27 coincides with the point e', the point b' will be necessarily shifted to the right to coincide substantially with the point b^2, because the lever d', c', e' is held by the cam 32 against movement responsive to the shifting of the slide-block 27. Therefore, while the lever-arm a', b', i. e., lever-arm 25, vibrates an equal extent upon opposite sides of the point b^2 when the lever d', c', e', or lever 29, 30 is rocked by the cam 32, the entire movement of said lever-arm a', b' is to one side of the point b' which as before indicated is the position of the lever-arm in Fig. 9 when the needle reciprocates in a single path. It will be nevertheless noted that the point b^2 of Fig. 9 corresponds substantially with the point b of Fig. 8, so that the extreme limits of throw of the needle are substantially the same for both positions of the fulcrum-axis of the segment-lever 29, 30.

Cooperating with the needle 10 in the formation of lock-stitches is a rotary-hook or loop-taker 73 of the horizontal axis type, having a loop-seizing beak 74 and in which loop-taker is suitably journaled a bobbin-case 75 for the under-thread around which needle-thread loops are cast by the loop-taker. The loop-taker 73 is carried by the forward end of a rotary actuating shaft 76 journaled in suitable bearing apertures provided in bearing-lugs 77 and 78 disposed at opposite ends of a vibratory frame 79. The outer surface of the forward bearing-lug 77 is rectangular to constitute a slide-block guided between the flattened lower face of a lug 81 depending from the cloth-plate 1 and a block 82 secured by screws, as 83, upon said lug 81. Suitably secured upon a side of the lug 77 is the shank 84 of an angular arm 85 provided at its free end with a notch 86 entered by a finger 87 projecting from the bobbin-case 75, whereby the latter is restrained against rotation with the loop-taker. By means of this construction, the bobbin-case stop-arm 85 partakes of any bodily lateral movements of the loop-taker and maintains a definite relationship with respect to the bobbin-case finger 87 during successive stitch-forming cycles, whether or not the needle is vibrated.

The vibratory frame 79, at its rearward end, has an upwardly and laterally bent extension 88 terminating in an apertured boss 89 fulcrumed upon a bushing 90 between a bushing flange 91 and a collar 92 secured upon

the bushing. The bushing 90 is suitably fixed in a lug 93 within the standard 2 and affords a journal for the lower end of a vertically disposed, intermediate shaft 94 carrying a bevel-gear 95 in mesh with a similar gear 96 fixed upon the rearward end of the loop-taker shaft 76. At its upper end, the shaft 94 is journaled in a bushed bearing-lug 97 within the standard 2 and carries a bevel gear 98 which is one half the size of a gear 99 upon the main shaft 5, whereby the loop-taker is rotated twice for each rotation of the main shaft.

A lateral extension 100 of the slide-block or lug 77 has a ball-joint connection with an extensible pitman 101 similarly connected with a crank-arm 102 of a rock-shaft 103 suitably journaled beneath the cloth-plate 1. Clamped upon the rearward end of the rock-shaft 103 is a crank-arm 104 having an elongated slot 105 to which crank-arm is adjustably secured the lower end of a link 106. At its upper end, the link 106 is pivotally connected with a slide-block 107 shiftably disposed in the segmental guideway 24 of the angle-lever 23, 25. A lateral extension 108 of the link 106 is provided with a transverse guide-groove 109 for a slide-block 110 pivotally carried by an arm 111 of an angle-lever fulcrumed for rocking movements upon the adjusting shaft 50. The other arm 112 of said angle-lever fixedly carries a stud 113 which freely enters the arcuate slot 49 in the lever-arm 48. The stud 113 therefore constitutes a lost-motion connection between the lever-arm 48 and the lever-arm 112, the extent of play of the stud 113 within the slot 49 being adjustably limited by the end of a screw 114 threaded into the upper side of the lever-arm 48 to extend into the slot 49 lengthwise thereof. A coil-spring 115 connects the arm 112 with the bracket-arm 3, whereby the slide-block 107 is yieldingly held against a shouldered stop 116 intersecting the guideway 24 at one end thereof.

It will be apparent from the foregoing description that the needle 10 is reciprocable in two zero positions of non-vibration, one of which is at the center and the other at one side of its path of vibratory movement. These zero positions depend upon the location of the fulcrum-axis of the segment-lever 29, 30, which location may be changed by shifting the handle 68. In either position of the fulcrum-axis of the segment-lever 29, 30, the needle may be caused to vibrate laterally while above the work by shifting the slide-block 27 to any point at one side of the segment-lever axis to an extent limited by the adjustable stop-nuts 56 and 58. The shifting of the slide-block 27 may be effected by the described connections with the treadle-actuated rod 44 or may be effected by directly shifting the arm 60 and if it is desired to uniformly maintain a definite amplitude of vibration of the needle, the arm 60 may be secured against movement by clamping the screw 61 against the periphery of the stationary segment-plate 53.

By properly timing the reciprocations of the needle 10 with the rotations of the loop-taker 73, the needle may have a substantial range of lateral vibratory movement in a fixed position of the loop-taker axis without occasioning skipping of stitches. In the present instance a safe range of lateral movement of the needle is approximately $\frac{5}{16}$ of an inch, but this range will of course vary in different constructions of the parts. In the present construction, the loop-taker axis remains fixed for any needle-vibrations within said safe range because the pivotal axis of the slide-block 107, under the influence of the spring 115, normally coincides substantially with the axis of the rock-shaft 22 and consequently the link 106 is normally unresponsive to any rocking movements imparted to the lever 23, 25 by the segment-lever 29, 30. This normal position of the slide-block 107 remains unchanged during a predetermined extent of off-center movement of the slide-block 27 in its guideway, because of the lost-motion connection between the lever-arms 48 and 112 afforded by the arcuate slot 49, it being understood that the arm 48 is moved downwardly as the slide-block 27 is shifted off center with respect to the axis of the segment-lever 29, 30, whereby the end of the screw 114 approaches the stud 113 which normally engages the lower end of the slot 49. When the slide block 27 is shifted a sufficient extent to cause the screw 114 to engage the stud 113, the manually initiated movement of the lever 47, 48 is transmitted to the lever 111, 112, consequently shifting the slide-block 107 off the axis of the rock-shaft 22 and thereby causing actuation of the link 106 to laterally vibrate the loop-taker shaft frame 79 to an extent which may be adjustably determined by means of the adjustable connection between the lower end of the link 106 and the rock-shaft crank-arm 104. The reciprocatory movements of the link 106 are however not transmitted to the lever 111, 112 because of the link-extension groove 109, as will be readily understood.

Having thus set forth the nature of the invention, what I claim herein is:—

1. In a sewing machine, an endwise reciprocatory needle, a loop-taker cooperating with said needle in the formation of stitches, mechanism for vibrating the needle laterally, and compensating mechanism for insuring cooperative relation between the loop-taker and the needle during lateral vibrations of the latter, which compensating mechanism is ineffective during vibrations of the needle from its position of non-vibration to a predetermined extent of vibration and is ren-

dered effective for vibrations of the needle beyond said predetermined extent.

2. In a sewing machine, an endwise reciprocatory needle, a loop-taker cooperating with said needle in the formation of stitches, mechanism for vibrating the needle laterally, and loop-taker compensating mechanism which is ineffective during vibrations of the needle from its position of non-vibration to a predetermined extent of lateral vibration and is rendered effective for vibrations of the needle beyond said predetermined extent.

3. In a sewing machine, an endwise reciprocatory needle, a loop-taker cooperating with said needle in the formation of stitches, mechanism for vibrating the needle laterally, and compensating mechanism comprising means for bodily vibrating the loop-taker to insure seizure of needle-thread loops by said loop-taker during lateral vibrations of the needle, said loop-taker vibrating mechanism being ineffective during vibrations of the needle from its position of non-vibration to a predetermined extent of lateral vibration and brought into effective action for vibrations of the needle beyond said predetermined extent.

4. In a sewing machine, an endwise reciprocatory needle, mechanism for laterally vibrating said needle, a loop-taker adapted to seize needle-thread loops up to a predetermined extent of lateral vibration of the needle in the formation of stitches, compensating mechanism brought into effective action beyond said predetermined extent of needle-vibration to maintain loop-seizing relationship between the needle and the loop-taker, and means for adjustably predetermining the extent of needle-vibration at which the loop-taker compensating mechanism is brought into effective action.

5. In a sewing machine, an endwise reciprocatory needle, mechanism for laterally vibrating said needle, a loop-taker adapted to seize needle-thread loops up to a predetermined extent of lateral vibration of the needle in the formation of stitches, means for manually controlling the extent of needle vibration, and compensating mechanism brought into effective action by said manually controlled means after the needle has reached said predetermined extent of lateral vibration to maintain loop-seizing relationship between the needle and the loop-taker.

6. In a sewing machine, an endwise reciprocatory and laterally vibratory needle, means for selectively determining zero positions of non-vibration of the needle at the center and at one side of its range of lateral movement, a loop-taker cooperating with said needle in the formation of stitches, and means for laterally vibrating the loop-taker to insure loop-seizing relationship between said loop-taker and the needle in vibrations of the latter across its central zero position and at one side of its other zero position.

7. In a sewing machine, an endwise reciprocatory needle, a loop-taker cooperating with said needle in the formation of stitches, mechanism for laterally vibrating said needle, manually controlled means for determining the amplitude of lateral vibration of the needle, and mechanism having a lost motion connection with said manually controlled means for bodily shifting said loop-taker in timed relation with and at a less distance than the needle vibrations to insure seizure by the loop-taker of the thread loops presented by the needle while reciprocating in different paths.

8. In a sewing machine, an endwise reciprocatory needle, a loop-taker cooperating with said needle in the formation of stitches, mechanism for laterally vibrating said needle, means manually controllable during the operation of the machine for determining the amplitude of lateral vibration of the needle, compensating mechanism for maintaining loop-seizing relationship between the needle and the loop-taker during lateral vibrations of the needle, and a lost motion connection between said compensating mechanism and said manually controlled means for bringing said compensating mechanism into operation upon vibration of the needle beyond a predetermined extent.

9. In a sewing machine, in combintion, a work-support, a reciprocatory needle, mechanish for relatively jogging the needle and work sustained by said work-support in the formation of zigzag stitches, a loop-taker complemental to the needle in the formation of said stitches, and compensating mechanism for maintaining loop-seizing relationship between the needle and loop-taker during the relative jogging movements of the needle and work, which compensating mechanism is ineffective up to a predetermined range of said relative jogging movements and becomes effective for jogging movements beyond said predetermined range.

10. In a sewing machine, an endwise reciprocatory needle, mechanism for laterally vibrating said needle, a loop-taker cooperating with said needle in the formation of stitches, compensating mechanism brought into effective action beyond a predetermined amplitude of needle-vibration for maintaining loop-seizing relationship between the needle and the loop-taker, and means for adjustably determining the degree of action of said compensating mechanism with respect to the amplitude of needle-vibration.

11. In a sewing machine, an endwise reciprocatory needle, mechanism for laterally vibrating said needle, a loop-taker cooperating with said needle in the formation of stitches, compensating mechanism brought into effective action beyond a predetrmined amplitude

of needle-vibration for maintaining loop-seizing relationship between the needle and the loop-taker, means for adjustably predetermining the amplitude of needle-vibration at which said compensating mechanism is brought into effective action, and means for adjustably determining the degree of action of said compensating mechanism with respect to the amplitude of needle-vibration.

12. In a sewing machine, an endwise reciprocatory and laterally vibratory needle, means for selectively determining zero positions of non-vibration of the needle at the center and at one side of its range of lateral movement, a loop-taker cooperating with said needle in the formation of stitches, and compensating mechanism brought into effective action beyond a predetermined amplitude of needle-vibration for maintaining loop-seizing relationship between the needle and the loop-taker in vibrations of the needle across its central zero position and at one side of its other zero position.

13. In a sewing machine, a needle-bar, a needle carried by said needle-bar, a laterally movable frame in which said needle-bar is journaled for endwise reciprocation, a rock-shaft operatively connected with said frame for imparting lateral movements thereto, means for actuating said rock-shaft, controlling mechanism for determining the extent of lateral movement imparted to said frame, a loop-taker cooperating with said needle in the formation of stitches, a guideway fixed upon and intersecting the axis of said rock-shaft, a guide-block shiftable in said guideway from a position normally in substantial alinement with the axis of said rock-shaft, a slide-block shifting lever, a lost-motion connection between said needle-bar vibrating controlling mechanism and said shifting lever, and a member connected with said slide-block for imparting compensating movements to said loop-taker in positions of said slide-block out of alinement with the axis of said rock-shaft.

14. In a sewing machine having a cloth-plate and an arm overhanging the cloth-plate, a reciprocatory needle, a loop-taker cooperating with said needle in the formation of stitches, a rotary loop-taker actuating shaft beneath the cloth-plate, a rotary shaft journaled in said arm, an intermediate shaft operatively connecting said shafts, a loop-taker actuating shaft supporting frame journaled for vibratory movements about the axis of said intermediate shaft, and means for vibrating said frame.

15. In a sewing machine having a cloth-plate and an arm overhanging the cloth-plate, a main-shaft journaled in said arm, a needle deriving endwise reciprocations from said main-shaft, a loop-taker cooperating with said needle in the formation of stitches, a rotary loop-taker carrying shaft, an intermediate shaft having gear connections with said main- and loop-taker shafts, a loop-taker shaft supporting frame journaled for vibratory movements about the axis of said intermediate shaft, a support for said frame adjacent the loop-taker, and means for vibrating said frame.

16. In a sewing machine, an endwise reciprocatory and laterally vibratory needle, a loop-taker cooperating with said needle in the formation of stitches, a rotary loop-taker carrying shaft, a supporting frame for said shaft journaled for vibratory movements about an axis transversely intersecting said shaft, and means for vibrating said frame a less distance than the amplitude of needle-vibration to insure seizure of the thread-loops presented by the needle while reciprocating in different paths.

17. In a sewing machine, an endwise reciprocatory and laterally vibratory needle, a loop-taker cooperating with said needle in the formation of stitches, a rotary loop-taker actuating shaft, a supporting frame for said shaft, a driving shaft disposed transversely of said actuating shaft, gear connections between said shafts, means for supporting said frame for vibratory movements about the axis of said driving shaft, a rock-shaft, an operative connection between said rock-shaft and the supporting frame, and means for actuating said rock-shaft to impart bodily lateral movements to said loop-taker.

18. In a sewing machine having a cloth-plate and an arm overhanging the cloth-plate, a rotary actuating shaft journaled lengthwise of said arm, a needle-carrying bar deriving endwise reciprocation from said actuating shaft, a laterally movable frame having a journal for said needle-bar, a rock-shaft journaled in said arm substantially parallel with said actuating shaft, operative connections between said rock-shaft and the needle-bar frame for imparting lateral movements to said frame, a segment-lever fulcrumed upon said overhanging arm to rock about an axis substantially parallel with said actuating shaft, means for rocking said segment-lever, an operative connection between said segment-lever and said rock-shaft, and means for shifting the fulcrum-axis of said segment-lever.

In testimony whereof, I have signed my name to this specification.

WALTER MYERS.