Dec. 15, 1953 F. PARRY 2,662,495

NEEDLE-BAR DRIVE FOR ZIG-ZAG SEWING MACHINES

Filed Oct. 5, 1950

3 Sheets-Sheet 1

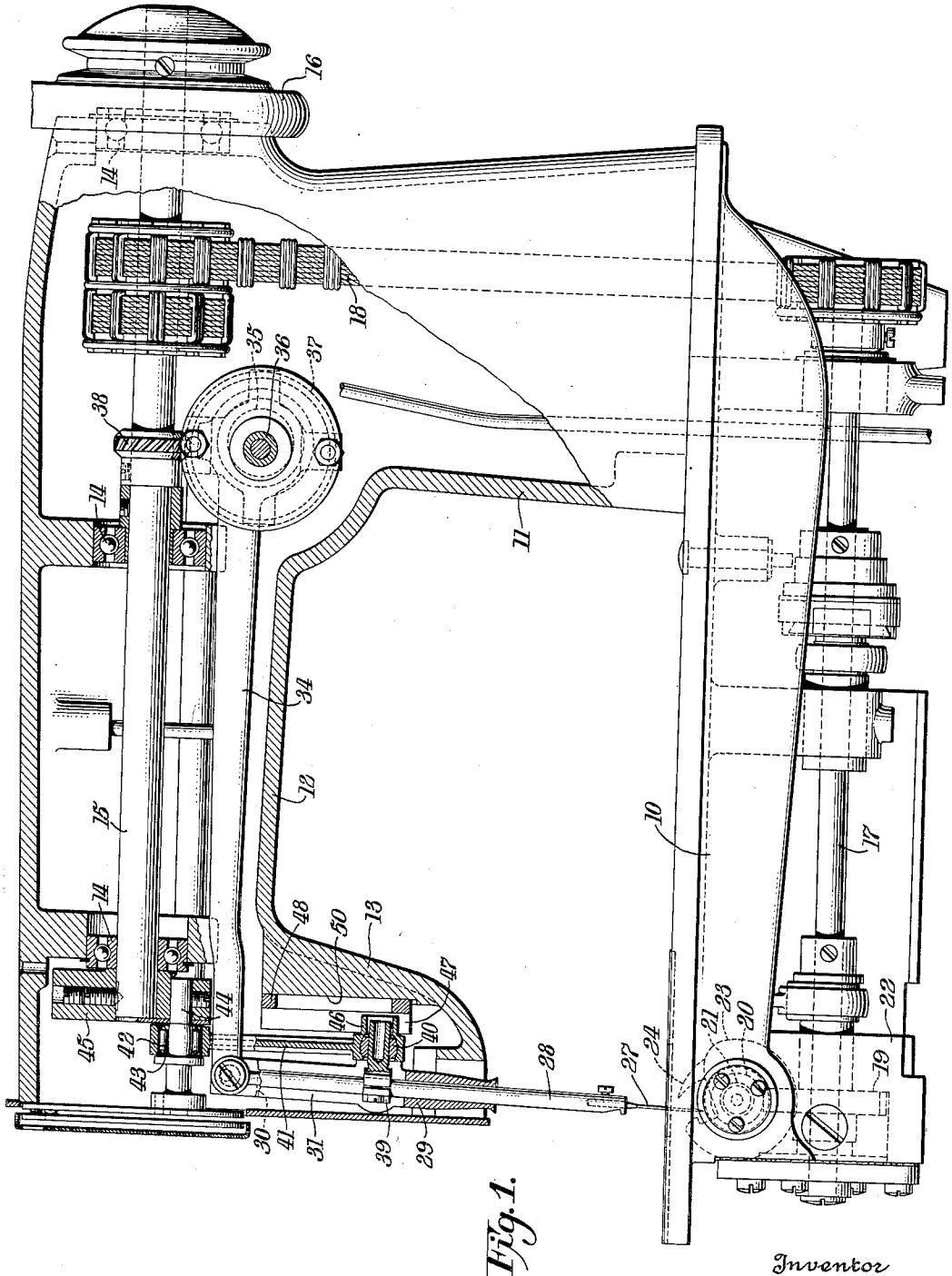

Fig. 1.

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3 Sheets-Sheet 2

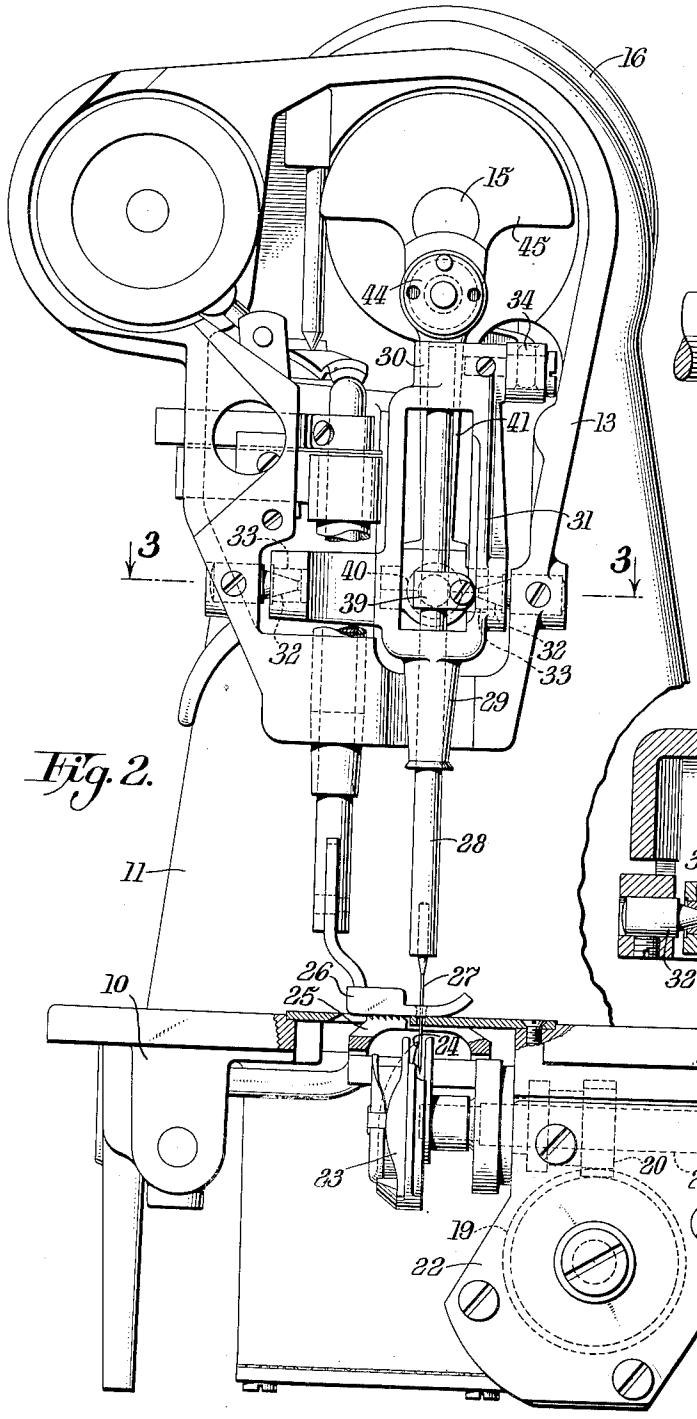

Fig. 2.

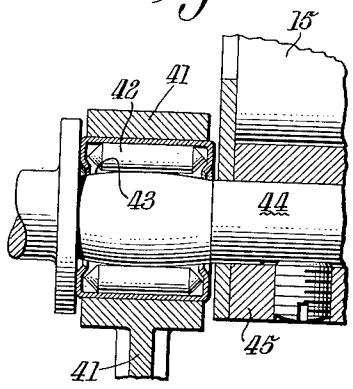

Fig. 4.

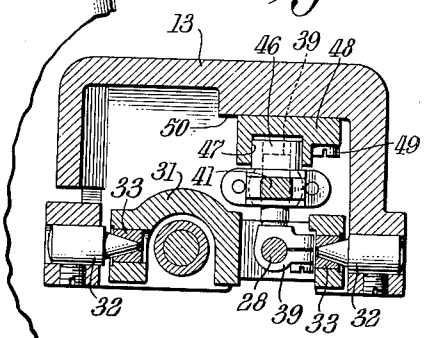

Fig. 3.

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3 Sheets-Sheet 3

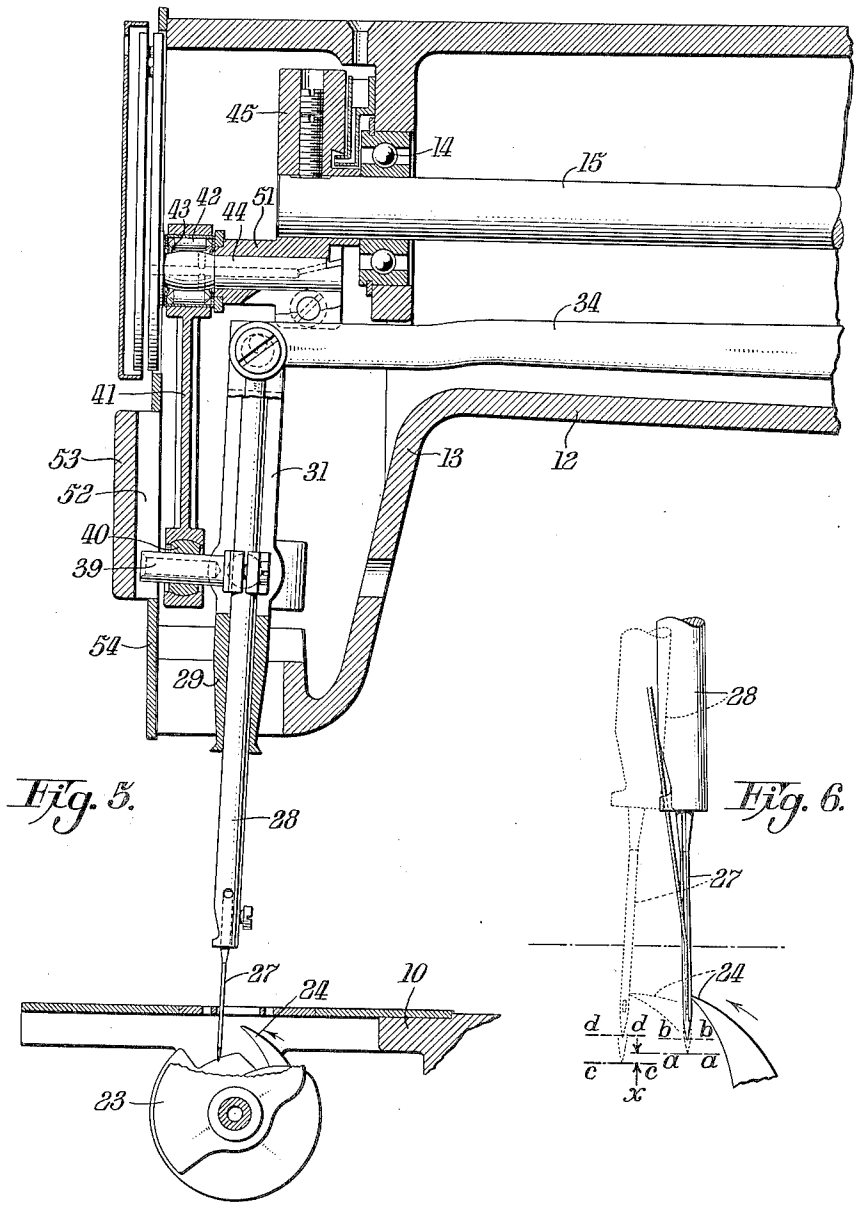

Fig. 5.

Fig. 6.

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2,662,495

UNITED STATES PATENT OFFICE

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NEEDLE-BAR DRIVE FOR ZIG-ZAG SEWING MACHINES

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9 Claims. (Cl. 112—158)

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This invention relates to sewing machines and more particularly to an improvement in the needle-bar drive of a sewing machine having a vibratory needle-bar; an example of such a machine being one designed to sew zigzag stitches.

The principal object of the present invention is to provide an improved driving connection for transmitting endwise reciprocation to the needle-bar while permitting vibratory motion of the needle-bar in a lateral direction.

Another object of the present invention is to provide, in a sewing machine, an improved driving connection between the rotary arm-shaft and the endwise reciprocatory and laterally vibratory needle-bar, which connection is simple in design and has incorporated in it a commercial antifriction bearing which contributes to the elimination of any binding action occuring in the needle-bar drive.

Still another object of the present invention is to provide an improved and simplified drive for a vibratory needle-bar which effects a deeper penetration of the needle on alternate thrusts of the needle-bar for the purpose of establishing the proper timing relation between the thread-loop cast out by the needle and the advancing loop-seizing beak of the loop-taker.

Other objects and advantages of the present invention will appear from the detailed description of an illustrative form of the same, which will now be given in conjunction with the accompanying drawings, in which:

Fig. 1 is a front elevational view of a lock-stitch zigzag sewing machine embodying one form of the present invention, a portion of the bracket-arm being sectioned to illustrate the details of the mechanism within said bracket-arm.

Fig. 2 is an enlarged front end view of the sewing machine with the face-plate and large needle-thread take-up disk removed, and with a portion of the bed sectioned to illustrate the feed-dog.

Fig. 3 is a horizontal sectional view of the machine-head taken substantially along the line 3—3, Fig. 2.

Fig. 4 is an enlarged view of the needle-bar crank-pin with a portion of the counterbalance and the upper end of the needle-bar link sectioned.

Fig. 5 is a front elevational view in section of a lock-stitch zigzag sewing machine embodying a modification of the needle-bar drive illustrated in Fig. 1, the needle-bar driving link in this figure being shown as positioned outside the vibratory needle-bar frame.

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Fig. 6 is an enlarged view of the needle and loop-seizing beak of the loop-taker, showing, in full lines, the relative position of the needle and loop-seizing beak at one penetration of the needle and, in dotted lines, the relative position of the needle and the loop-seizing beak on the alternate penetration of the needle.

In the sewing machine illustrated in the drawings, the needle-bar is adapted to be endwise reciprocated in a needle-bar frame which is pivotally supported within the sewing machine head so that it can be vibrated in a direction across the normal line of feed in a vertical plane parallel to the vertical plane of rotation of the cooperating horizontal-axis loop-taker. The endwise reciprocation of the needle-bar coupled with the vibratory movement of the needle-bar frame requires a needle-bar drive having capacity for universal movement between the needle-bar and the needle-bar actuating crank fast on the rotary arm-shaft. Also, for relatively wide needle-vibration, it is preferable that the needle-bar drive be such as automatically to compensate for the lateral shift of the needle relative to the axis of rotation of the loop-taker in order that the thread-loop cast out by the ascending needle will be unerringly seized by the loop-taker regardless of the position of penetration of the needle.

Referring to the drawings, the sewing machine illustrated has a frame including a bed 10 from one end of which rises a standard 11 merging at its upper end in a bracket-arm 12 which terminates at its free end in a hollow head 13. Rotatably journaled in ball-bearings 14 in the bracket-arm 12 is a rotary actuating or needle-reciprocating shaft 15 extending horizontally lengthwise of the bracket-arm 12 and carrying at its exposed end a belt-driven balance-wheel 16. Journaled in suitable bearings provided in the bed 10 is a rotary bed-shaft 17 connected to be driven by a belt 18 from the actuating arm-shaft 15. At the head-end of the machine, the bed-shaft 17 is connected through gears 19 and 20 to a horizontally disposed rotary loop-taker shaft 21 journaled in a suitable saddle 22 depending from the bed 10. Carried on the loop-taker shaft 21 is a loop-taker 23 preferably of the rotary hook type having a loop-seizing beak 24, the point of which rotates in a vertical plane transverse to the normal direction of feed of the work determined by the usual feed-dog 25 and opposed spring-depressed presser-foot 26.

Complemental to the loop-taker in the formation of lock-stitches is a thread-carrying needle 27 carried in the lower end of a needle-bar 28

journaled for endwise reciprocation in the spaced bearings 29 and 30 of a vibratory needle-bar frame 31. As shown in Figs. 2 and 3, the vibratory frame 31 is supported to pivot on a pair of alined pintles 32 fixed in the front and rear walls of the machine head 13. The pintles 32 extend into hardened inserts 33 pressed into the vibratory frame 31 which is preferably made of lightweight metal.

To effect vibration of the frame 31, it has connected to its upper end the outer end of a pitman 34 embracing at its inner end a conventional form of adjustable eccentric 35 mounted on a cross-shaft 36 driven by gears 37, 38 from the arm-shaft 15 at a speed equal to one-half that of the arm-shaft. From the above, it will be understood that rotation of the arm-shaft 15 will effect rotation of the cross-shaft 36 at one-half the speed of the arm-shaft and, through the eccentric 35 and pitman 34, the frame 31 is caused to vibrate on its pintles 32 in a direction to shift the needle-bar 28 crosswise of the seam line, thereby to produce zigzag stitches.

Simultaneously with the vibration of the frame 31, the needle-bar 28 is adapted to be endwise reciprocated in the spaced bearings 29 and 30 of the frame 31. This is accomplished by means comprising a pivot-stud 39 clamped upon the needle-bar 28 and slidably carrying a spherically surfaced element or ball-member 40 embraced by the spherically seated lower end of a needle-bar link 41. At its upper end, the needle-bar link is bored to receive a commercial needle-bearing 42, the cylindrical needles of which engage the crowned or spherical surface 43 of a needle-bar actuating crank-pin 44 fastened in the usual counterbalanced needle-bar actuating crank 45 secured on the arm-shaft 15. To prevent the needle-bar 28 from turning in its bearings 29 and 30, and likewise to prevent the link 41 from turning on the crank-pin 44, the pivot-stud 39 is extended and the needle-bar link 41, at its lower end, is formed with a projection 46 internally bored to snugly embrace the horizontally opposite sides of the extended pivot-stud 39 and externally sized to slidably engage the sides of a vertically disposed guideway 47 formed in the guide-block 48 attached by screws 49 (Fig. 3) to a seat 50 milled in the head 13.

From the foregoing, it will be understood that the ball-and-socket connection at the lower end of the needle-bar actuating link 41, together with the crowned surface 43 of the needle-bar crank-pin 44, permits the needle-bar link 41 limited universal movement so that the needle-bar 28, through the frame 31, can be vibrated transversely of the normal line of feed, without in any way binding or cramping the needle-bar or its driving connection. Moreover, the crowned portion 43 on the needle-bar crank-pin is a simple and effective way of obtaining a universal connection between the crank-pin 44 and the link 41, and particularly since it lends itself to the use in combination with a commercial form of antifriction needle-bearing 42. One of the advantages of using a needle-bearing in this location is that little lubrication is needed to effectively lubricate it. The requirement of only a small amount of lubricating oil for this connection reduces to a minimum the danger of excess oil collecting in the bottom of the head 13, and consequent soiling of the work being stitched.

Figs. 5 and 6 illustrate a modification of the sewing machine shown in Figs. 1 to 4. The modification relates to the needle-bar reciprocating means and more specifically to the location of the needle-bar actuating link 41 with respect to the needle-bar 28 and its vibratory frame 31. The purpose of this relocation of the needle-bar actuating link 41 is to provide a better timing between the needle 27 and the loop-taker 23 at the opposite ends of needle vibration. It will be understood that since the needle vibrates in a vertical plane disposed crosswise of the line of feed and the plane of rotation of the horizontal axis loop-taker is disposed parallel to this plane, it follows that when the needle is vibrated inwardly toward the standard (full lines, Fig. 6) and the loop-taker is rotating in a counterclockwise direction as viewed from the front of the machine, the hook-beak 24 will pass the eye of the needle earlier in point of time than when the needle is in neutral position. Likewise, when the needle is vibrated outwardly away from the standard (dotted lines, Fig. 6), the hook will pass the eye of the needle later than when in neutral position. The needle-bar actuating mechanism disclosed in Fig. 5 compensates for this difference in timing by causing the needle 27 to descend to a lower position when it is vibrated outwardly than when vibrated inwardly. To that end, the counterbalanced crank 45 is formed with an outwardly extending projection 51 bored to receive the crank-pin 44 having the crowned surface 43 formed adjacent its outer end. Embracing the crowned surface 43 is the antifriction needle-bearing 42 carried in the upper end of the needle-bar link 41. The lower end of the needle-bar link is spherically socketed to receive the ball-element 40 mounted on the pivot-stud 39 clamped on the needle-bar 28. It will be seen in Fig. 5 that the needle-bar link 41 is arranged on the outside of the needle-bar 28 instead of on the inside, as is the case in the mechanism shown in Fig. 1. The pivot-stud 39, in this modification, is disposed to project outwardly with its free end arranged to slide in a guideway 52 formed in a block 53 suitably fastened to a cover-plate 54 which is attached to the front of the machine head.

From the above, it will be understood that the change of timing of needle-reciprocation at the opposite ends of the vibratory movements of the needle is a result of a small amount of needle-bar reciprocation caused by oscillation of the vibratory frame. Inasmuch as the connection between the needle-bar 28 and the needle-bar link 41 is positive, the angular relation of the pivot-stud 39 and the driving link 41 during pivotal movements of the vibratory frame 31 about the axis of the pintles 32 causes this relative slight endwise movement of the needle-bar in the vibratory frame. When the driving link is disposed outside the vibratory frame or, in other words, when the link is disposed on that side of the axis of vibration of the needle opposite to that of the approach to the needle of the loop-taker beak 24, in the manner shown in Fig. 5, the needle-bar reciprocations are advanced and retarded to coincide with the late and early positions of the beak of the rotary hook 23. Referring to Fig. 6, it will be seen that on the inside penetration of the needle (full line position), the lowest position of needle dip is indicated by the line *a*—*a* and that, in ascending to cast out the usual needle-thread-loop, the needle rises to the point indicated by line *b*—*b*, at which point the beak 24 of the loop-taker is in proper position to seize the cast-out needle-thread-loop. On the outside penetration of the needle (dotted line

position), the lowest position of needle dip is indicated by the line *c*—*c* and, in ascending to cast out the needle-thread-loop, the needle rises to the point indicated by the line *d*—*d*, at which point the loop-taker beak **24** is again in proper position to seize the cast-out needle-thread-loop. It will be readily observed in Fig. 6 that the needle on the outside penetration dips to a lower position than on the inside penetration, the difference in the depths of penetration being indicated by the letter *x*. This difference in depth of needle penetration results from the angular relation of the pivot-stud **39** and the driving link **41**, as fully described above. The advantage of the different depths of needle penetration is readily apparent in Fig. 6, because it will be seen that the same relationship between the eye of the needle and the beak of the loop-taker occurs at either inside or outside penetration of the needle. Since this relationship is constant, an accurate timing setting of the needle and the loop-taker can be made, with the assurance that such setting will be identical for either penetration of the needle. It will be understood that with the needle-bar link **41** located inside the vibratory frame **31**, the angular relation of the pivot-stud **39** and the driving link **41** during pivotal movements of the vibratory frame **31**, effects a lesser depth of needle penetration on the outside stroke of the needle than on the inside stroke, and that this aggravates the timing error between the needle and loop-taker.

It will be appreciated that when the supporting pintles **32** are located intermediate the ends of the vibratory frame **31**, instead of at its upper extremity, as for example, in the machine disclosed in the U. S. Patent of A. N. Hale, No. 2,310,176, February 2, 1943, the slight endwise movement of the needle-bar resulting from the vibration of the frame **31** is increased. This is especially true when the pivot-stud **39** is clamped on the needle-bar in the vicinity of the pivotal axis of the vibratory frame. This being the case, it will be understood that the need for corrective measures is greater in the machine disclosed in the drawings than when the needle-bar frame is pivoted at its upper end. It will be further understood that by arranging the pintles **32** intermediate the ends of the frame **31** and substantially at the center of mass of the frame and needle-bar, the inertia forces are reduced and a high speed mechanism results.

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

1. A sewing machine having a machine-frame including a hollow head provided with a guideway, a rotary actuating shaft journaled in said machine-frame, a vibratory frame mounted within said hollow head, operating connections with said last-named frame for imparting vibratory movements thereto, a needle-bar journaled in said vibratory frame for endwise reciprocation, a pivot-stud secured to said needle-bar, a crank-member secured to said rotary shaft and having a crank-pin provided with a portion formed with a crowned surface, and a link having one of its ends in bearing contact with the crowned surface of said crank-pin and its other end connected to said pivot-stud, said link having a projection disposed in sliding engagement with said guideway in said hollow head to confine said link against turning and having an internal bore sized to embrace snugly the opposite sides of said pivot-stud.

2. Needle actuating mechanism for sewing machines, comprising, a rotary actuating shaft, a vibratory frame, operating connections with said frame for imparting vibratory movements thereto, a needle-bar journaled in said frame for endwise reciprocation, a pivot stud secured to said needle-bar, a ball-member slidably mounted on said pivot-stud, a crank-member secured to said rotary actuating shaft and having a crank-pin provided with a portion formed with a crowned surface, a link having one end socketed to embrace said ball-member on said pivot-stud, and an antifriction bearing carried in the other end of said link and including a plurality of rollers disposed to engage the crowned surface of said crank-pin.

3. A sewing machine having a machine-frame including a standard, bracket-arm and hollow head, a rotary actuating shaft journaled in said bracket-arm and extending into said head, a circularly moving loop-taker having a loop-seizing beak movable in a vertical plane, a vibratory frame, operating connections for imparting vibratory movements to said last-named frame in a plane parallel to the vertical plane of movement of said loop-seizing beak, a needle-bar journaled in said vibratory frame for endwise reciprocation, a crank-member secured to said rotary actuating shaft, and a needle-bar actuating link connected at one end to said needle-bar and its other end to said crank-member, said needle-bar actuating link being located on that side of said vibratory frame remote from said machine-standard.

4. In a zigzag sewing machine, a machine-frame including a standard, bracket-arm and hollow head, a work-feeding mechanism, a rotary actuating shaft journaled in said bracket-arm and extending into said head, a circularly moving loop-taker having a loop-seizing beak movable in a vertical plane arranged transversely of the normal direction of feed, a vibratory frame, actuating connections for imparting vibratory movements to said last-named frame in a plane parallel to the vertical plane of movement of said loop-seizing beak, a needle-bar journaled in said vibratory frame for endwise reciprocation, a needle carried by said needle-bar, a crank-member secured to said rotary actuating shaft, and a needle-bar actuating link connected at one end to said needle-bar and at its other end to said crank-member, said needle-bar actuating link being located on that side of the needle remote from said standard of the sewing machine.

5. In a zigzag sewing machine, a machine-frame, work-feeding mechanism, a rotary actuating shaft journaled in said machine-frame, a rotary loop-taker having a loop-seizing beak movable in a vertical plane arranged transversely of the normal direction of feed, a vibratory frame, actuating connections for imparting vibratory movements to said last-named frame in a plane parallel to the vertical plane of movement of said loop-seizing beak, a needle-bar journaled in said vibratory frame for endwise reciprocation, a needle carried by said needle-bar, a crank-member secured to said rotary actuating shaft, and a needle-bar actuating link connected at one end to said needle-bar and at its other end to said crank-member, said needle-bar actuating link being located on that side of the needle-bar opposite to that of the approach of the loop-seizing beak to the needle.

6. In a zigzag sewing machine, a machine-frame, work-feeding mechanism, a rotary actuating shaft journaled in said machine-frame, a

rotary loop-taker movable in a vertical plane arranged transversely of the normal direction of feed, a vibratory frame supported to swing on a fixed pivotal axis, actuating connections for imparting vibratory movements to said last-named frame in a plane parallel to the vertical plane of movement of said loop-seizing beak, a needle-bar journaled in said vibratory frame for endwise reciprocation, a needle carried by said needle-bar, a crank-member secured to said rotary actuating shaft, and a needle-bar actuating link connected at one end to said needle-bar and at its other end to said crank-member, said needle-bar actuating link being located on the side of the pivotal axis of vibration of said frame opposite to the side of the needle approached by the beak of the loop-taker.

7. In a zigzag sewing machine, a machine-frame, work-feeding mechanism, a rotary actuating shaft journaled in said machine-frame, a rotary loop-taker movable in a vertical plane arranged transversely of the normal direction of feed, a vibratory frame supported to swing on a fixed pivotal axis disposed intermediate the ends of said vibratory frame, actuating connections for imparting vibratory movements to said last-named frame in a plane parallel to the vertical plane of movement of said loop-seizing beak, said actuating connections being connected to said vibratory frame at a point above its pivotal axis of support, a needle-bar journaled in said vibratory frame for endwise reciprocation, a needle carried by said needle-bar, a crank-member secured to said rotary actuating shaft, and a needle-bar actuating link connected at one end to said needle-bar and at its other end to said crank-member, said needle-bar actuating link being located on the side of the pivotal axis of vibration of said frame opposite to the side of the needle approached by the beak of the loop-taker.

8. A sewing machine having a machine-frame, a rotary actuating shaft journaled in said machine-frame, a vibratory needle-bar frame, operative connections for imparting lateral vibratory movements to said needle-bar frame, a needle-bar journaled in said vibratory frame for endwise reciprocation, a needle carried by said needle-bar, a circularly moving loop-taker complemental to said needle in the formation of stitches and having a needle-thread loop seizing beak, a crank-member carried by said rotary actuating shaft, and a needle-bar reciprocating link connected at one end to said needle-bar and at its other end to said crank member, said needle-bar reciprocating link being disposed at the side of said needle-bar opposite to that of the approach of the loop-seizing beak to the needle.

9. A sewing machine having a machine-frame including a standard, a rotary actuating shaft journaled in said machine-frame, a vibratory needle-bar frame, operative connections for imparting lateral vibratory movements to said needle-bar frame, a needle-bar journaled in said vibratory frame for endwise reciprocation, a needle carried by said needle-bar, a circularly moving loop-taker complemental to said needle in the formation of stitches and having a needle-thread loop-seizing beak, a crank-member carried by said rotary actuating shaft, and a needle-bar reciprocating link connected at one end to said needle-bar and at its other end to said crank-member, said needle-bar actuating link being located on that side of said needle-bar remote from said machine-standard.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,584,697	Bernhard	May 11, 1926
1,899,189	Fink	Feb. 28, 1933
2,308,707	Myers	Jan. 19, 1943
2,329,160	Hale	Sept. 7, 1943