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NEEDLE BAR DRIVES FOR ZIGZAG SEWING MACHINES

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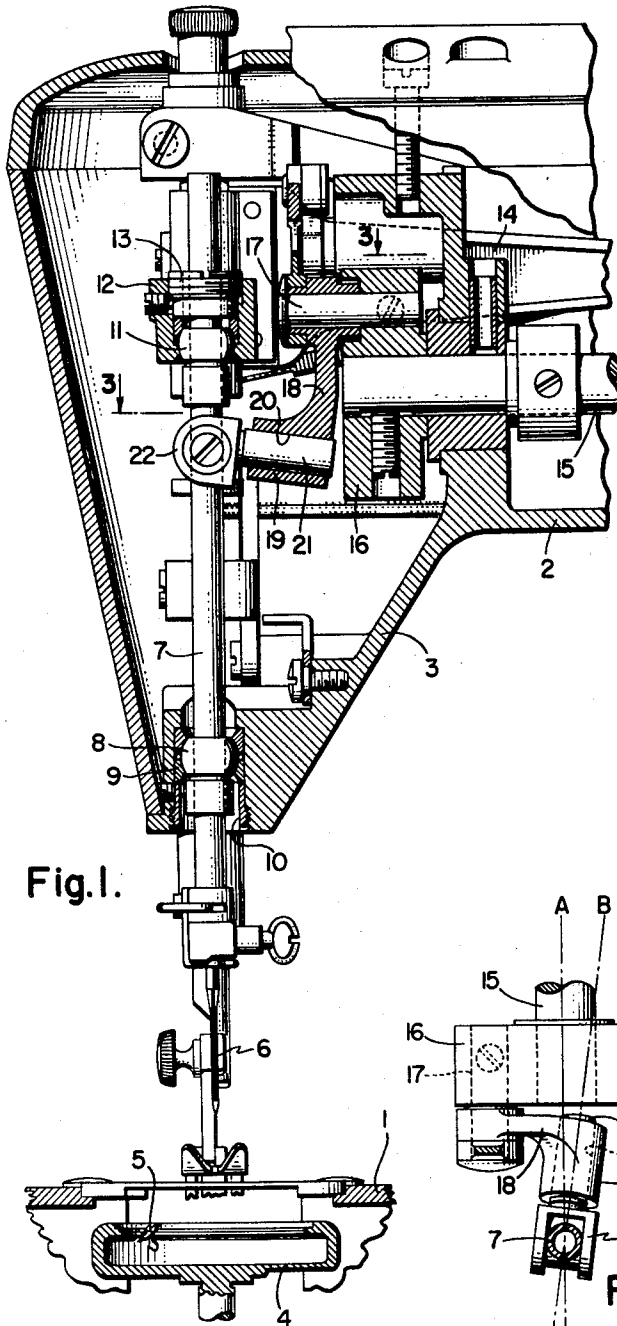


Fig. 1.

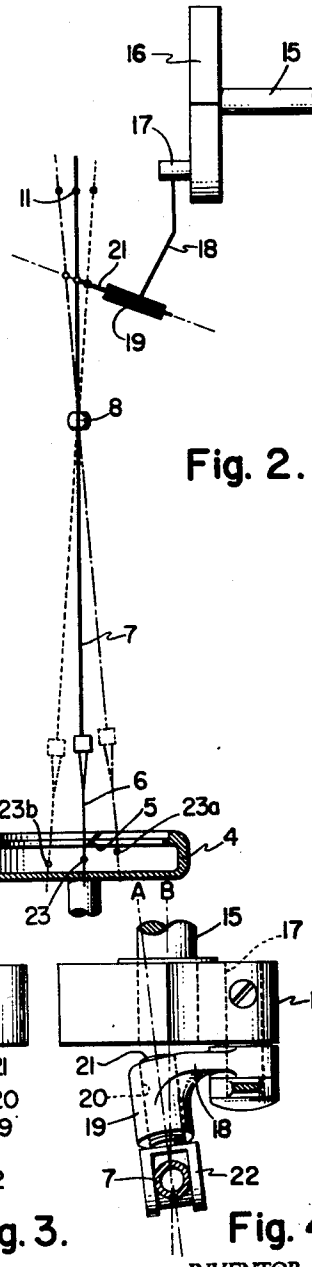


Fig. 2.

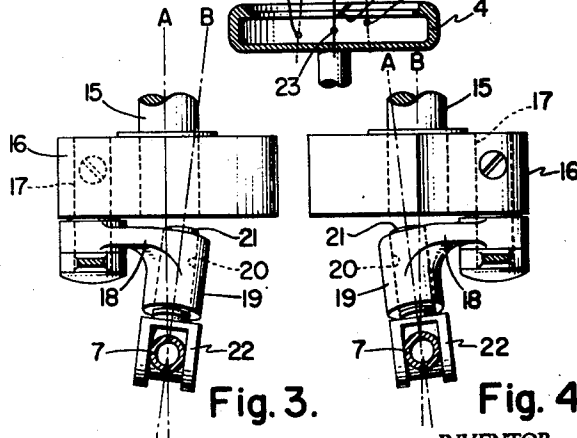


Fig. 3.

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NEEDLE BAR DRIVES FOR ZIGZAG SEWING MACHINES

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3 Claims. (Cl. 112—221)

The present invention relates to a needle bar drive for a sewing machine and has for a primary object to provide means for reducing flagging of the work, which is the tendency of the work to follow the needle as it is withdrawn from the work, and at the same time, to provide a relatively simple and economical means for compensating for the variations at loop seizure in a zigzag sewing machine in the position of the eye of the needle relatively to the path of motion of the loop seizing beak in the different positions of the needle.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

Fig. 1 is a fragmentary vertical sectional view longitudinally of a sewing machine embodying the present invention.

Fig. 2 is a schematic view illustrating the various vertical positions of the needle in the mechanism of Fig. 1 as it is moved laterally during zigzag sewing.

Figs. 3 and 4 are fragmentary sectional views taken substantially on the line 3—3 of Fig. 1 and showing the needle bar drive in different positions.

The present invention is herein disclosed as embodied in the sewing machine forming the subject matter of my pending application Serial No. 471,766, filed November 29, 1954, now Patent No. 2,862,468. The machine includes a frame having a bed 1 and a bracket arm 2 terminating in a head 3 that overhangs the bed 1. Mounted in the bed 1 is a vertical axis rotary hook 4 having a loop seizing beak 5. The hook 4 cooperates with a thread carrying needle 6 in the formation of lock stitches.

The needle 6 is secured to the lower end of a needle bar 7 that is mounted in the head 3 for endwise reciprocation and for lateral vibration. More particularly, the lower portion of the needle bar 7 is mounted for endwise sliding in a ball bearing 8 that is seated in a two-part socket element 9 arranged in a bore in the bottom of the head 3 and held therein by an externally threaded sleeve 10. At its upper end, the needle bar 7 is mounted for endwise sliding in a ball bearing 11 that is seated in a socket in a pivoted gate member 12 and held therein by an externally threaded sleeve 13. Oscillation is imparted to the gate member 12 by a pitman 14 that is driven by a needle bar vibrating mechanism. Upon oscillation of gate member 12, through the connection at the ball bearing 11, the needle bar 7 is moved laterally about the axis defined by the ball bearing 8.

Endwise reciprocation is imparted to the needle bar 7 by the main shaft 15 of the machine, which shaft is journaled longitudinally of the bracket arm 2. Mounted upon the end of the main shaft 15 is a crank 16 having a crank pin 17 upon which one end of a needle bar

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drive link 18 is pivotally mounted. At its opposite end, the link 18 is provided with a hub 19 having a bore 20 in which a stud 21 is freely mounted for turning and for endwise sliding. The stud 21 is integral with a drive member 22 mounted on the needle bar 7 for pivotal movement about an axis diametrically of the needle bar and for unitary movement endwise of the needle bar, the drive member 22 being in the form of a yoke that includes oppositely extending arms that embrace the needle bar 7 and are pivotally secured thereto by a diametrically arranged pivot pin.

During stitch formation, the needle bar is reciprocated endwise to penetrate the work and from the point of maximum penetration, it rises to throw a loop on the underside of the work that is then entered by the loop seizing beak. There is an optimum delay, which is approximately twenty degrees of arm shaft rotation, in the illustrated machine, between the time the needle reaches the point of maximum penetration and the time that the beak enters the loop which is calculated to produce a needle thread loop that is sufficiently large to insure loop seizure and to position the eye of the needle in a specific relationship to the loop seizing beak for the proper presentation of the loop to the loop seizing beak. In a straight-away sewing machine, timing of the needle relatively to the loop taker does not present a problem. However, in a zigzag sewing machine, the optimum timing relation is effected by the lateral vibrations of the needle. Thus, when the needle is moved in one direction, loop seizure is retarded by the amount of time required for the loop taker to travel from the previous position of loop seizure to the new position of loop seizure. Since the needle bar continues to rise during the time that the loop taker is traveling to the new position, the optimum timing relationship between them is destroyed, or more specifically, the eye of the needle is too high. Conversely, when the needle is moved in the other direction, loop seizure is advanced with the result that the eye of the needle is too low.

Heretofore, in zigzag sewing machines, the needle was timed relatively to the loop taker to obtain the optimum relationship in the zero bight position or in other words, in the position in the center of the zigzag pattern. Thus, the effects of the variations in the time of loop seizure were minimized. The resulting variations from the optimum timing relationship however, did increase the number of skipped stitches that resulted from failure of the loop taker to seize the loop and also increased the incidence of thread breakage resulting from fouling of the loop.

In accordance with the present invention, there is provided a simple and effective means for compensating for the variations in the timing of the needle relatively to the loop taker during zigzag sewing. This means comprises angling the axis of the needle bar driving stud 21 relatively to the axis of the needle bar 7. More particularly, the stud 21 is arranged at an acute angle which, in the illustrated machine, is approximately eight degrees to a line normal to the axis of the needle bar rather than normal to the axis of the needle bar or in other words, to the axis of the main shaft 15 rather than parallel to the axis of the main shaft, so that as the stud 21 moves endwise in the bore 20 it will effect an endwise displacement of the needle bar 7. The effect of this compensation is illustrated schematically in Fig. 2 in which the eye of the needle 6 is represented at 23. In the position at the center of the zigzag pattern, which is illustrated in full lines, the eye 23 of the needle is in its optimum relation relatively to the beak 5 of the loop taker at loop seizure. When the needle bar 7 is pivoted about the ball 8 to shift the needle 6 laterally to the right to the position illustrated in broken lines, the stud 21 moves

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endwise out of the bore 20, thus in effect raising the needle bar 7 and the needle 6 so that the eye 23 is closer to the path of the beak 5. With the needle shifted to the right, loop seizure will occur sooner than in the full line position since the beak 5 will arrive at the loop seizing position sooner. Normally, without means for compensating for this effect in the timing relation, the eye 23 would be too low relatively to the path of the beak 5 since it has not had sufficient time to allow for rising to the designed optimum position. In accordance with the present invention, the lateral movement of the needle bar 7, by the proper selection of the angle of inclination of the stud 21, will raise the needle bar 7 by an amount equal to the distance that the eye 23 would be below the designed optimum position that results from the earlier loop seizure. The net effect of this compensation is that the eye 23 of the needle is in the designed optimum position at loop seizure. In Fig. 2 there is illustrated only the result obtained by swinging the needle about the ball 8. Since in the right position loop seizure will occur approximately ten degrees earlier, the eye 23 of the needle 6 will actually be at loop seizure in the position illustrated at 23a, which is exactly its designed optimum position relatively to the beak 5.

Conversely, when the needle is swung about the pivot defined by the ball 8 to the left hand position, which is illustrated in dotted lines in Fig. 2, the movement of the stud 21 into the bore 20 lowers the needle bar 7. In this position, the time of loop seizure occurs later so that the eye 23 of the needle 6 would normally be too high by an amount defined by the continued needle bar rise as the beak 5 moves the additional distance to the new position of loop seizure. The additional rise of the needle bar coupled with the lowering of the needle bar as it is swung laterally that results from the fact that the stud 21 is angled downwardly, has the net effect of positioning the eye of the needle at the position 23b at loop seizure, which again is the designed optimum relation relatively to the beak 5.

Another important advantage derived from the present construction is that the needle bar 7 is turned slightly about its longitudinal axis by the action of the angled stud 21, which action breaks the frictional resistance between the needle and the work and thereby reduces flagging, which is the tendency of the work to follow the needle. As illustrated in Figs. 3 and 4, as the crank pin 17 is rotated from the one side of the needle bar 7 to the other side, the angle of approach of the link 18 is shifted with the result that in horizontal plan as shown in Figs. 3 and 4 the angle of the stud 19 relatively to the axis A of the main shaft 15 shifted between a position in which the axis B of the stud 21 is on opposite sides of the axis A of the main shaft. The maximum angles between the axes A and B of course occurs when the crank pin 17 is ninety degrees in front of and ninety degrees beyond its top dead center position. The greatest amount of the turning motion occurs around the top and bottom dead center positions with the rate of the turning motion approaching zero and then reversing in a sinusoidal manner at the ninety degree positions. Thus, about the bottom dead center position of the crank pin 17 which is when the needle reaches its point of maximum penetration and begins to rise, there is a maximum amount of turning motion which acts to break the frictional engagement between the needle and the work and reduces the tendency of the work to follow the needle as it is withdrawn.

Numerous alterations of the structure herein disclosed

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will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of my invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus described the nature of my invention, what I claim herein is:

1. In a sewing machine having a frame, a loop taker journaled in said frame, a needle bar mounted in said frame for endwise reciprocation and for turning about its longitudinal axis, a needle carried by said needle bar and adapted to cooperate with said loop taker in the formation of stitches, means for imparting endwise reciprocation to said needle bar, and means for imparting a cycle of turning to said needle bar upon each reciprocation thereof and including a turning movement at the time that the needle bar begins to rise from the point of maximum penetration and a reverse turning movement at the time that the needle bar begins to descend from the point of maximum rise.

2. In a sewing machine having a frame including a head, a needle bar mounted in said head for endwise reciprocation and for turning about its longitudinal axis, a drive member mounted on said needle bar for pivotal movement about an axis diametrically of said needle bar and for unitary motion with said needle bar in a direction longitudinally of and angularly about the axis of said needle bar, a drive stud extending laterally from said drive member, means for imparting endwise reciprocation and turning to said needle bar comprising a crank mounted in said frame for rotation about an axis substantially normal to the axis of said needle bar and having a crank pin on an axis parallel to the axis of said crank, a link connected at one end to said crank pin and at its other end having a bore on an axis inclined at an acute angle to a line parallel to the axis of said crank, said drive stud being mounted in said bore for turning and for endwise sliding.

3. In a zigzag sewing machine having a frame including a head, a needle bar mounted in said head for endwise reciprocation, for lateral vibration and for turning about its longitudinal axis, a drive member mounted on said needle bar for pivotal movement about an axis diametrically of said needle bar and perpendicular to the plane defined by the lateral vibration of the needle bar and for unitary motion with said needle bar in a direction longitudinally of and angularly about the axis of said needle bar, a drive stud extending laterally from said drive member, means for imparting lateral vibration to said needle bar and means for imparting endwise reciprocation and turning to said needle bar comprising a crank mounted in said frame for rotation about an axis substantially normal to the axis of said needle bar and having a crank pin on an axis parallel to the axis of said crank, a link connected at one end to said crank pin and at its other end having a bore on an axis inclined at an acute angle to a line parallel to the axis of said crank, said drive stud being mounted in said bore for turning and for endwise sliding movement.

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