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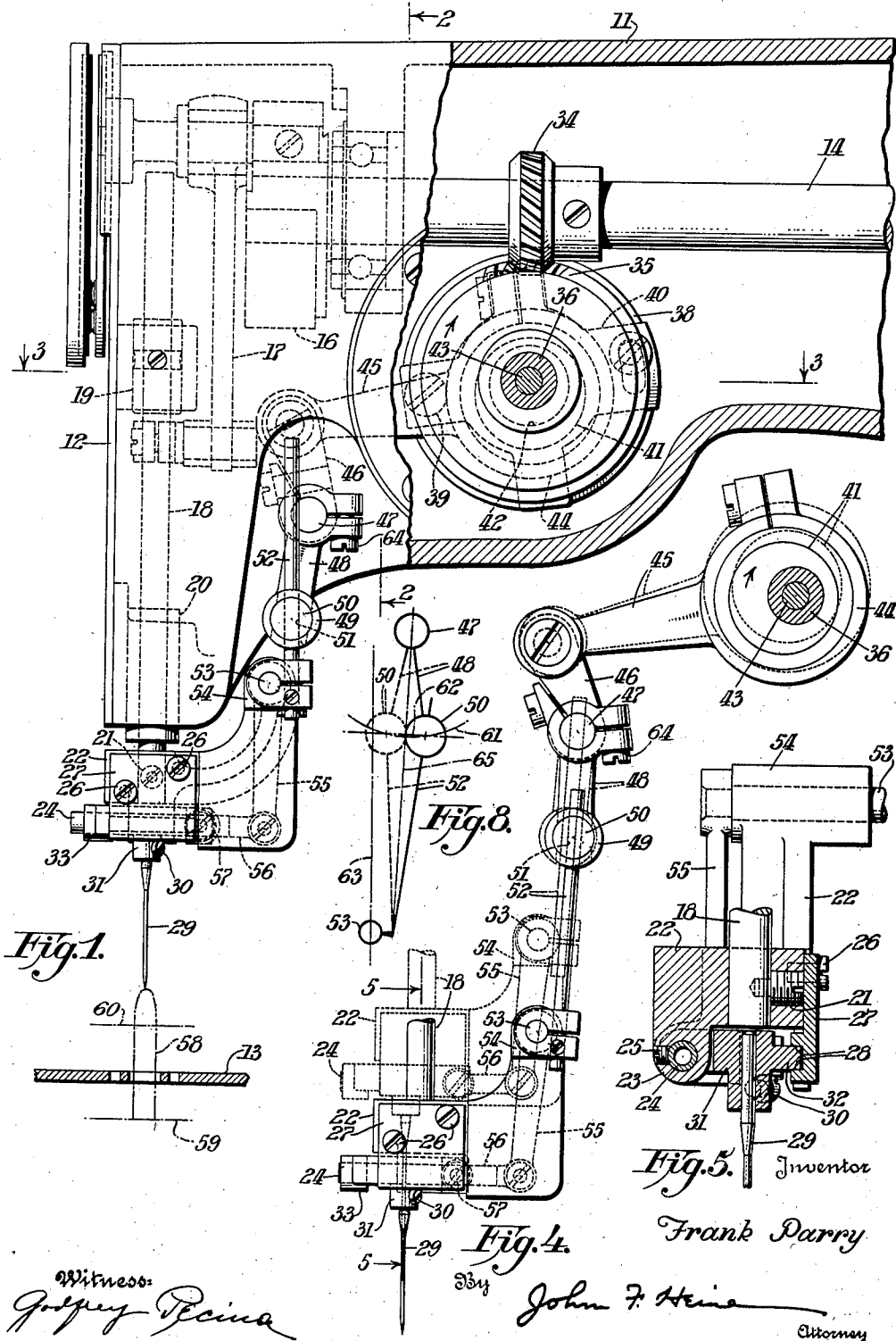
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NEEDLE-VIBRATING MECHANISM FOR SEWING MACHINES

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UNITED STATES PATENT OFFICE

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NEEDLE-VIBRATING MECHANISM FOR
SEWING MACHINES

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17 Claims. (Cl. 112-158)

This invention relates to sewing machines and more particularly to zigzag sewing machines.

One of the objects of this invention is to provide improved means for vibrating the sewing machine needle laterally of the line of seam formation.

Another object of this invention is to provide a needle vibrating mechanism which will prevent the needle from moving laterally while it is in the work and which will laterally shift the needle only during the uppermost movements of the needle reciprocations.

It has been common practice in sewing machines of prior construction to employ actuating eccentrics for transmitting lateral movements to endwise reciprocating needle-bars. However, a continuously vibrating needle-bar shifts its needle laterally while entering and leaving the work. This lateral movement of the needle while in the work becomes highly objectionable in certain classes of work. A cam may of course be used in place of an eccentric for laterally vibrating the needle-bar and it has the advantage that it may be so shaped as to prevent the needle from being shifted while in the work. However, the use of cams is not consistent with high-speed mechanisms, and the present invention aims to provide a needle-vibrating mechanism that is well adapted for high-speed operation yet which will not permit the needle to shift laterally, appreciably, while in the work.

With the above and other objects in view, as will hereinafter appear, the invention comprises the combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the accompanying drawings

Fig. 1 is a side view of a portion of a sewing machine bracket-arm and bracket-arm head.

Fig. 2 is a vertical section view taken substantially along line 2-2 of Fig. 1.

Fig. 3 is a horizontal section view taken substantially along line 3-3 of Fig. 1.

Fig. 4 is a side view of the mechanism which imparts the lateral movements to the needle.

Fig. 5 is an enlarged vertical section view taken substantially along line 5-5 of Fig. 4.

Fig. 6 is a right side view of a portion of the needle-actuating mechanism shown in Fig. 2.

Fig. 7 is a horizontal section view taken substantially along line 7-7 of Fig. 2.

Fig. 8 is a diagrammatic view illustrating the paths of movement of several members of the needle-actuating mechanism.

In the embodiment of this invention selected for illustration 11 represents the bracket-arm portion of a sewing machine frame terminating in a hollow head 12. A portion of the usual needle-throat plate or work-support is represented by 13.

Journalled in suitable bearings in the bracket-arm 11 is a rotary needle-bar actuating shaft 14 and an auxiliary take-up actuating shaft 15. Mounted on one end of the needle-bar actuating shaft is a crank disk 16 to which is pivotally secured the upper end of a link 17 having its lower end pivotally connected to the usual vertically reciprocating needle-bar 18. The bearings 19 and 20 mounted in the head 12 slidably receive the needle-bar 18. For a more complete disclosure of the present sewing machine head including the take-up and, particularly, the needle-bar reciprocating mechanism, reference may be had to U. S. Patent No. 2,191,736, to Zonis, dated February 27, 1940.

Mounted upon the lower end of the needle-bar 18 by means of a set screw 21 is a crosshead 22 which is provided with an apertured boss 23 carrying therein a horizontal guide-rod 24. A set screw 25 fixes the guide-rod within the boss 23. Secured to the side of the crosshead opposite to the boss 23 by means of screws 26 is a plate 27 the lower end of which is provided with a pair of horizontal ways 28. An eye-pointed needle 29 is rigidly mounted by means of a set screw 30 in a clamp or needle carrier 31 which is movable in the crosshead in a direction transverse to the direction of feed. One side of the needle-carrier is provided with a tongue 32 which is slidably received between the ways 28, and the other side of the needle-carrier has two apertured bosses 33 which slide upon the horizontal guide-rod 24. Thus the needle-carrier is made slidable relative to the needle-bar 18, and the needle 29 will remain vertically disposed and parallel to the needle-bar at all times.

No loop taking mechanism is disclosed in conjunction with the present invention as such mechanism forms no part of this invention which may be used with any form of loop-taker common to vibratory needle machines.

The shaft 14 has fixed to it a gear 34 meshing with a gear 35 fixed to the auxiliary hollow shaft

36, which is arranged at right angles, to the shaft 14. The auxiliary shaft 36 has fixed to it by a set screw 37 a disk 38, and secured by the pivot screw 39 to one side of the disk is the flange 40 of an adjustable eccentric 41. The eccentric 41 has an enlarged shaft aperture 42 and is formed integral with the eccentric-flange 40 which may be adjusted with respect to the disk 38 to vary the throw of the eccentric. This adjustment may be effected by means of a screw 43 threaded in the auxiliary shaft 36 and in a manner substantially as disclosed in the patent to Dial et al., No. 718,988, dated January 27, 1903.

The gear 34 is one half the size of gear 35 and it therefore drives the larger gear at one half the speed of the shaft 14. Embracing the eccentric 41 is a strap 44 of a pitman 45 the other end of which is pivotally connected to the upper end of a crank 46 the lower end of which is fixed to a horizontal stub-shaft 47 mounted in the machine bracket-arm head 12. This stub-shaft also carries a second crank-arm or lever 48 provided at its outer end with a connection member or hollow boss 49 within which is mounted a transversely apertured swivel-pin 50.

From the above it is to be understood that the eccentric 41 actuates the pitman and, consequently, the crank 48 which is thereby oscillated through a relatively small arc, as illustrated in Fig. 8. The amplitude of oscillation of this crank 48 depends, of course, upon the adjustment of eccentric throw. Furthermore, it is to be understood that due to the two-to-one speed relation between shafts 14 and 36, the needle-bar 18 must pass through two full cycles of reciprocation for every single full cycle of oscillation of the crank 48.

Provided in the above noted swivel-pin 50 is an aperture 51 slidably receiving the upper end-portion of an upstanding needle-vibrating rod or lever 52, the lower end of which is clamped to one end of a second horizontal stub-shaft 53. The aforementioned crosshead 22 is provided with an apertured bearing portion 54 which functions as a mounting for stub-shaft 53. Fixed upon the end of the stub-shaft 53 opposite to the needle-vibrating rod 52 is a depending crank-arm 55 the lower end of which is pivotally connected to one end of a horizontal link 56 having its other end pivotally connected to a pin 57 carried by the needle-carrier 31. Oscillations of the crank 48 will oscillate the needle-vibrating rod 52 which will in turn, through the medium of crank 55 and link 56, vibrate the needle-carrier 31 back and forth within the crosshead 22.

In order to prevent the needle from moving laterally while it is in the work a motion compounding or dwell-producing arrangement of parts is provided. With reference to the mechanism shown in solid lines in Fig. 4, it is to be seen that when the needle is at the bottom of its stroke the effective lever-arm distance of the needle-vibrating rod 52, from its axis shaft 53 to the swivel-pin 50, is substantially greater than the effective lever-arm length of the crank-arm 48, from its axis shaft 47 to the swivel-pin 50. Therefore, an angular movement on the part of the crank-arm 48 will produce in the rod 52 an angular movement which will be substantially smaller than that of the crank-arm. As shown in Fig. 1, when the needle is at the upper portion of its stroke the effective lever-arm distance of the rod 52 is small as compared to that of the crank-arm 48. Consequently, any small angular

movement of the crank-arm 48 will produce a substantially greater movement of the rod 52.

To further reduce the lateral movement of the needle while it is in the work, the eccentric 41 is timed to be at one of its two dead-center points when the needle is at the bottom of its stroke, and therefore, a very slow motion is transmitted to the crank 46 and consequently to the swivel-pin 50. As shown in the solid lines of Fig. 4 the needle is at its lowest point and the eccentric 41 has moved the pitman 45 to its extreme position to the left at which position the eccentric passes through a dead-center point relative to the pitman 45. This condition is exactly reversed when the eccentric throws the pitman to its extreme right position and thereby shifts the needle to its extreme left position. From this it follows that when the eccentric passes through either of its two mid-positions, between its dead-center points, it will oscillate the crank 48 at a relatively high rate of speed and thereby rapidly shift the needle from one lateral position to the other. The needle is raised out of the work however when this shift occurs. The broken lines of Fig. 4 illustrate the needle in its raised position and the eccentric 41 in one of its two mid-positions. Further movement of the eccentric will shift the needle from the position shown to an extreme right position.

As the needle both descends into and ascends through the work the eccentric driven crank-arm 48, which carries the swivel-pin 50 turns to compensate for the rising movements of the needle-vibrating rod 52 so as not to shift the rod laterally. The needle-vibrating rod therefore, if not shifted laterally will not actuate the needle-carrier. This dwell-producing or motion compounding means is particularly useful with an eccentric driven mechanism where a longer dwell is desired than is inherent therein.

The path of the reciprocating needle 29 is illustrated in Fig. 1 by the broken line 58 and the broken line 59 illustrates the lowest point of the needle stroke. Between the lines 59 and 60 the path of needle travel is substantially vertical. In Fig. 4 the solid lines illustrate the needle, needle-carrier and cross head in their lowest positions corresponding to the line 59 in Fig. 1. The broken lines of Fig. 4 illustrate this mechanism when the needle has reached a point in its path corresponding to line 60 of Fig. 1. It is to be seen from Fig. 4 therefore, that as the needle travels between its lowest point in its stroke and a point corresponding to line 60 of Fig. 1, the crank-arm 48 moves about its pivotal axis, the shaft 47, so as to permit the needle-vibrating rod 52 to move upwardly and relative to the swivel-pin 50, but to prevent it from moving about its own pivotal axis, the shaft 53. Due to the speed ratio of two-to-one between shafts 14 and 36 the needle-vibrating rod remains inclined to the right, as shown in Fig. 4, while the needle descends through and rises back out of the work after which action the rod is shifted to the left where it remains until the needle again passes through a major portion of its reciprocatory cycle. In Fig. 1 that portion of the line 58 extending above the line 60 represents the needle path as the needle-carrier is shifted from one of its two extreme predetermined lateral positions to the other. It is to be understood that when the point of the needle has risen to the line 60 of Fig. 1, it has been withdrawn clear of any work that may be supported upon the work-support 13. It is also to be understood that the amplitude

of needle-vibration may be varied by changing the throw of the eccentric 41. As the throw of the eccentric is varied the position of the crank 48 upon the shaft 47 may also be adjusted, as by loosening the clamp-screw 64, thereby to retune the phase relation between the crank 48 and the needle-vibratory rod 52.

Fig. 8 is a diagrammatic view illustrating the stub-shaft 53 in the position it assumes when the needle is at its lowest point and showing the needle-vibrating rod 52 and the swivel-pin 50 in each of their two extreme predetermined positions. The broken line 61 represents the arc through which the swivel-pin 50 travels and the broken line 62 represents the chord of the arc 61. It is to be understood that the chord 62 is substantially perpendicular to the line 63 which represents the direction in which the shaft 53 travels. In the present form of the invention the line 63 is parallel to the needle-bar 18. Furthermore, it may be seen from Fig. 8 that the center point of the connection member or swivel-pin 50 shifts from one side to the other of a line 65 connecting the respective fulcrum axes 53 and 47 of the levers 52 and 48 to shift said needle from one to the other of its two predetermined positions. If this swivel-pin 50 did not shift through the above noted center line in the present device, the needle-vibrating rod 52 would assume a substantially vertical position while it was in one of its two laterally extreme positions with the result that it would be moved by the swivel-pin, and therefore, the needle would shift laterally while in the work.

From the above description it is to be seen that the present device prevents vibration of the needle while in the work and at the same time it permits the needle to be shifted laterally of the direction of seam formation while out of the work. As the amplitude of the needle-vibration may be varied by changing the throw of the eccentric the present invention thus provides convenient means for adapting the sewing machine for producing divers types of stitching effects.

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

1. In a sewing machine having an endwise reciprocating needle-bar, a needle-carrier mounted upon and adapted to be shifted laterally of said needle-bar, a needle mounted on said needle-carrier, a needle-vibrating rod pivotally carried by said needle-bar, said needle-vibrating rod being operatively connected to said needle-carrier, and means connected to said needle-vibrating rod for shifting the needle laterally while the needle is out of the work, said means including a rotatable eccentric.

2. In a sewing machine having a frame including a work-support and a bracket-arm terminating in a head, stitching mechanism including a needle-bar reciprocable in said head, a rotary shaft journaled in said frame and adapted to actuate said needle-bar, a needle-carrier mounted upon and adapted to shift laterally of said needle-bar, a needle mounted upon said needle-carrier and disposed in parallelism with said needle-bar, a rotatable eccentric connected to and actuated by said rotary shaft, and needle shifting means operatively engaging said needle carrier and connected to be operated by said rotatable eccentric solely during the time when the needle is above said work-support.

3. A sewing machine having in combination, a vertically reciprocating needle-bar, a rotary shaft

for actuating said needle-bar, an eccentric actuated by said rotary shaft, a crosshead fixed upon said needle-bar, a needle-carrier mounted in said crosshead and adapted to be shifted laterally thereof, a needle mounted upon said needle-carrier and disposed in parallelism with said needle-bar, and a needle-vibrating rod pivotally carried by said crosshead and operatively connected to said needle-carrier, said needle-vibrating rod being connected to be operated by said eccentric solely during the period that the needle is out of the work.

4. Stitch-forming mechanism for sewing machines, including an endwise reciprocating needle-bar, a needle-carrier mounted upon said needle-bar, a needle carried by said needle-carrier and adapted to be shifted laterally of said needle-bar from one of two predetermined positions to the other during the stitch-forming cycle, a needle-vibrating rod carried by said needle-bar and operatively connected to said needle carrier, a rotary actuating eccentric, a pitman having a strap embracing said rotary actuating eccentric, a motion-compounding means connecting said pitman with said needle-vibrating rod and timed to shift said needle from one of its two predetermined positions to the other solely while the needle is out of the work.

5. A sewing machine having in combination, a vertically reciprocating needle-bar, a rotary shaft for actuating said needle-bar, a needle-carrier mounted upon and adapted to be shifted laterally of said needle-bar from one of two predetermined positions to the other, a needle mounted upon said needle-carrier, a needle-vibrating rod pivotally carried upon said needle-bar and operatively connected to said needle-carrier, a rotary actuating eccentric driven by said rotary shaft, a pitman having a strap embracing said rotary actuating eccentric, a rock-shaft, a crank-arm mounted upon said rock-shaft and connected to said pitman, and a second crank-arm being operatively connected with said needle-vibrating rod and permitting endwise movement thereof, said second crank-arm also being adapted to impart pivotal movement to said needle-vibrating rod solely while the needle is above the work, said pivotal movements of said needle-vibrating rod being effective to shift said needle-carrier from one of its predetermined positions to the other.

6. A sewing machine having, in combination, a frame including a work-support and a bracket-arm terminating in a head, stitching mechanism including a needle, a needle-bar reciprocable in said head, a carrier for said needle shiftably mounted on said needle-bar and having laterally spaced effective positions in which said needle penetrates the work in a line normal to said work, a shaft journaled in said frame, a rotary actuator mounted on said shaft, and means for shifting said carrier from one to the other of its spaced effective positions, said means including a needle-vibrating rod carried by said needle-bar and operatively connected to said needle-carrier, and a crank actuated by said rotary actuator and operatively connected with said needle-vibrating rod and permitting endwise movements of the rod, said crank also being adapted to impart sidewise swinging movements to said needle-vibrating rod solely while the needle is above the level of the work-support.

7. A sewing machine having, in combination, a frame including a work-support and a bracket-arm terminating in a head, a rotary shaft journaled in said frame, a reciprocable needle-bar car-

ried by said head and actuated by said rotary shaft, a needle-carrier mounted upon and adapted to be shifted laterally of said needle-bar from one of two predetermined positions to the other, a needle mounted in said needle-carrier, a needle-vibrating rod pivotally carried by said needle-bar and operatively connected to said needle-carrier, and means for shifting said needle-carrier, said means including an oscillating crank slidably connected with said needle-vibrating rod and permitting endwise movements thereof, and an eccentric which is rotated at one half of the speed of said rotary shaft and operatively connected to said oscillating crank, said eccentric being timed so as to be in one of its two dead-center positions when the needle is at the bottom of its stroke.

8. A sewing machine having, in combination, a rotary shaft, a reciprocatory needle-bar actuated by said rotary shaft, a needle-carrier mounted upon said needle-bar and adapted to be shifted laterally of said needle-bar from one of two predetermined positions to the other during the stitch-forming cycle, a needle carried by said needle-carrier, a needle-vibrating rod pivotally carried by said needle-bar and operatively connected with said needle-carrier so that its longitudinal axis is inclined with the needle-bar whenever said needle-carrier is in one of its two predetermined positions, an oscillating crank slidably connected to said needle-vibrating rod and permitting endwise movements thereof, and an eccentric rotated at one half of the speed of said rotary shaft and operatively connected to said oscillating crank for actuating the same, said eccentric being timed so as to be in one of its two dead-center positions when the needle is at the bottom of its stroke.

9. A sewing machine having, in combination, a frame including a work-support and a bracket-arm terminating in a head, stitching mechanism including a needle, a needle-bar reciprocable in said head, a carrier for said needle shiftably fastened on said needle-bar and having laterally spaced effective positions in which said needle penetrates the work in a line normal to said work, a shaft journaled in said frame, a rotary actuator mounted on said shaft, and means for shifting said carrier from one to the other of its spaced effective positions during the time the needle is above the level of the work, said means including a pair of interconnected levers of the first order fulcrumed upon spaced axes, and a connection member operated by said rotary actuator for oscillating said levers so that the point of interconnection between said levers shifts from one side to the other side of a line connecting the fulcrum axes of said levers to shift said needle from one to the other of its effective positions.

10. A sewing machine having in combination, a frame including a work-support and a bracket-arm terminating in a head, a rotary shaft journaled in said frame, an eccentric driven by and at one half the speed of said rotary shaft, a reciprocable needle-bar carried by said head and actuated directly by said rotary shaft, a needle-carrier mounted upon and adapted to be shifted laterally of said needle-bar from one of two predetermined positions to the other, a needle mounted in said needle-carrier, and means for shifting said needle-carrier during the time the needle is above the level of the work, said means including interconnected first and second levers fulcrumed upon spaced axes, the axis of said first

lever being given a straight line reciprocating motion by said needle-bar, said second lever being fulcrumed upon said head and being oscillated in an arcuate path by said rotary eccentric, the oscillations of said second lever covering an arc the chord of which is substantially perpendicular to the direction of the straight line motion imparted to the axis of said first lever.

11. Needle-actuating mechanism for sewing machines including an endwise reciprocating needle-bar, a crosshead fixed upon said needle-bar, a needle-carrier mounted in and movable laterally on said crosshead, a stub-shaft carried by said crosshead, a lever fastened upon said stub-shaft and operatively connected to said needle-carrier, and means including a rotatable eccentric to oscillate said stub-shaft so as to shift said needle-carrier relative to said crosshead.

12. A sewing machine having in combination, a frame including a bracket-arm terminating in a head, a needle-bar reciprocable in said head, means to actuate said needle-bar, a crosshead fixed upon said needle-bar, a needle-carrier mounted in and movable laterally of said crosshead, a stub-shaft carried by said crosshead, a first lever fastened upon said stub-shaft and operatively connected with said needle-carrier, a second lever fixed upon said stub-shaft, and means carried by said head and driven by said first mentioned means for engaging and actuating said second lever.

13. A sewing machine having, in combination, a frame including a work-support and a bracket-arm terminating in a head, stitching mechanism including a needle, a needle-bar reciprocable in said head, a carrier for said needle shiftably carried by said needle-bar and having laterally spaced effective positions in which said needle penetrates the work in a line normal to said work, a shaft journaled in said frame, and means for shifting said carrier from one to the other of its spaced effective positions during the time the needle is above the level of the work, said means including a pair of interconnected levers fulcrumed upon spaced axes, and means connecting said shaft to said levers for oscillating the same, the axes of said levers being movable relative to each other so that the ratio of the effective lever lengths of said levers is constantly changing during the operation of the machine.

14. In a sewing machine having a frame including a work-support and a bracket-arm terminating in a head, stitching mechanism including a needle-bar reciprocable in said head, an actuating shaft journaled in said frame and adapted to actuate said needle-bar, a needle-carrier mounted upon and adapted to be shifted laterally of said needle-bar, a first pivotal lever operatively connected with said needle-carrier and fulcrumed upon an axis carried by said needle-bar, a second pivotal lever operatively connected with said first lever, and an eccentric driven by said actuating shaft and operatively connected to said second lever for oscillating the same, said levers being movable relative to each other so as to change the ratio of the effective lever lengths therebetween, said eccentric being timed to pass through its dead-center points whenever the effective lever length of said first lever is at its greatest extent.

15. A sewing machine having, in combination, a frame including a work-support and a bracket-arm terminating in a head, stitching mechanism

including a needle, a needle-bar reciprocable in said head, a carrier for said needle shiftably carried by said needle-bar and having two laterally spaced effective positions in which said needle penetrates the work in a line normal to said work, a shaft journaled in said frame, a rotary eccentric actuated by said shaft, and means for shifting said carrier from one to the other of its spaced effective positions during the time the needle is above the level of the work, said means including a pair of interconnected levers of the first order fulcrumed upon spaced axes, and a connection member operated by said rotary eccentric for oscillating said levers so that the point of interconnection between said levers shifts from one side to the other side of a line connecting the fulcrum axes of said levers to shift said needle from one to the other of its effective positions, said rotary eccentric being timed to pass through its dead-center points whenever the needle is in either of its spaced effective positions and at the lower portion of its stroke.

16. In a sewing machine having a frame including a bracket-arm terminating in a head, stitching mechanism including a needle-bar reciprocable in said head, an actuating shaft journaled in said frame and adapted to actuate said needle-bar, a needle carried by said needle-bar and adapted to be shifted in a line normal to the work, a rotary eccentric actuated by said shaft in a two-to-one speed ratio, and means connecting said needle and said rotary eccentric for shifting the needle, said means including a pair

of interconnected and oscillatory levers fulcrumed upon spaced axes, said levers being movable relative to each other so as to change the effective lever lengths therebetween, said eccentric being timed to pass through its dead-center points whenever the needle is at the lower portion of its stroke.

17. A sewing machine having, in combination, a frame including a work-support and a bracket-arm terminating in a head, stitching mechanism including a needle-bar reciprocable in said head, a needle carried by said needle-bar and adapted to be shifted from one to another of two laterally spaced effective positions in which said needle penetrates the work in a line normal to said work, a shaft journaled in said frame, a rotary eccentric actuated by said shaft, and means connecting said needle and said rotary eccentric for shifting said needle from one to the other of its spaced effective positions during the time the needle is above the level of the work-support, said means including a first pivotal lever operatively connected to the needle, a second pivotal lever operatively connected with said first lever and said eccentric, said levers being movable relative to each other so as to change the ratio of the effective lever lengths therebetween, said eccentric being timed to pass through a position intermediate its dead-center positions whenever the effective lever length of said first lever is at its shortest length.

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