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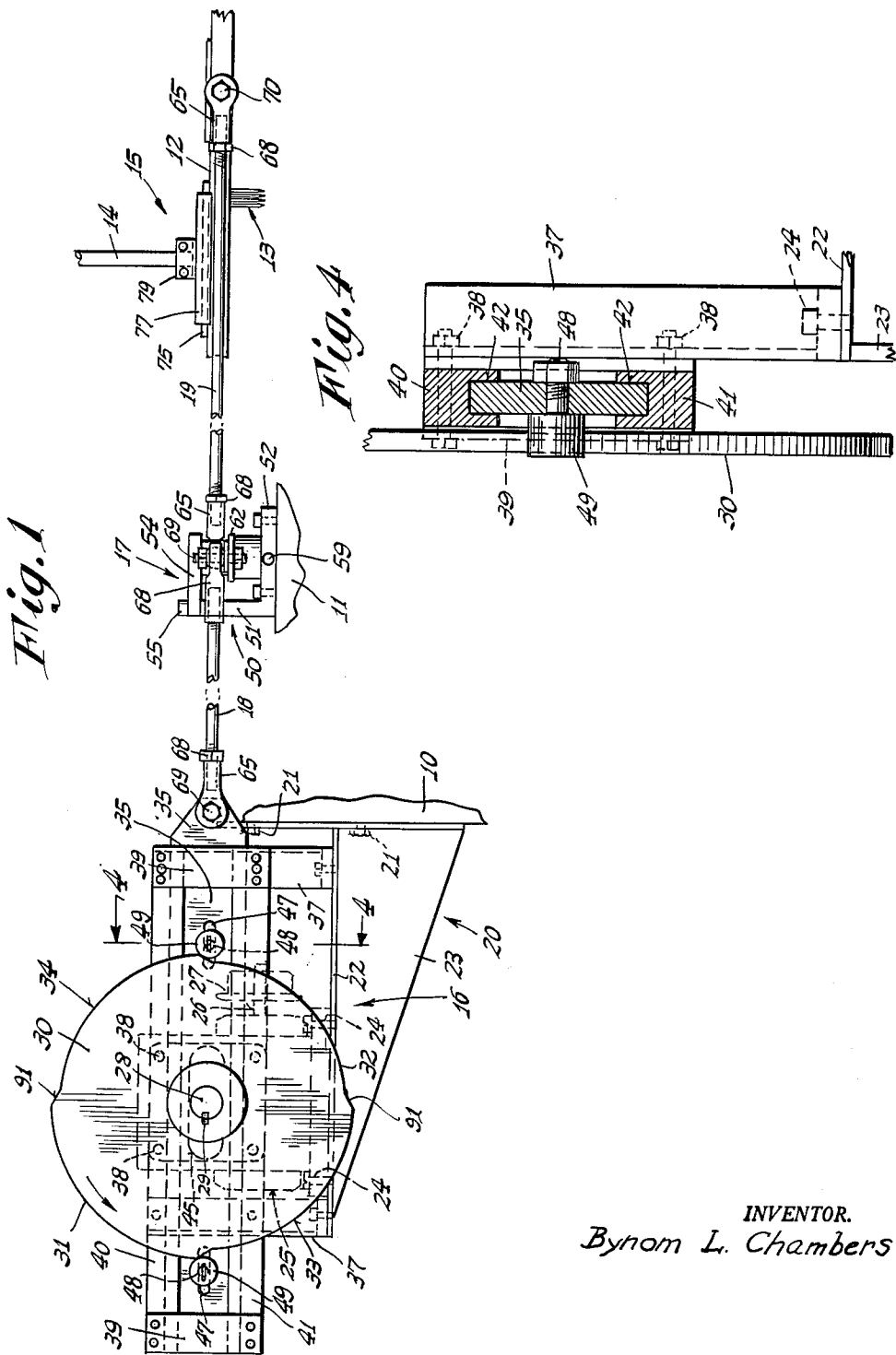
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SEWING MACHINE NEEDLE BAR STEP-OVER DEVICE

Filed June 30, 1964

2 Sheets-Sheet 1



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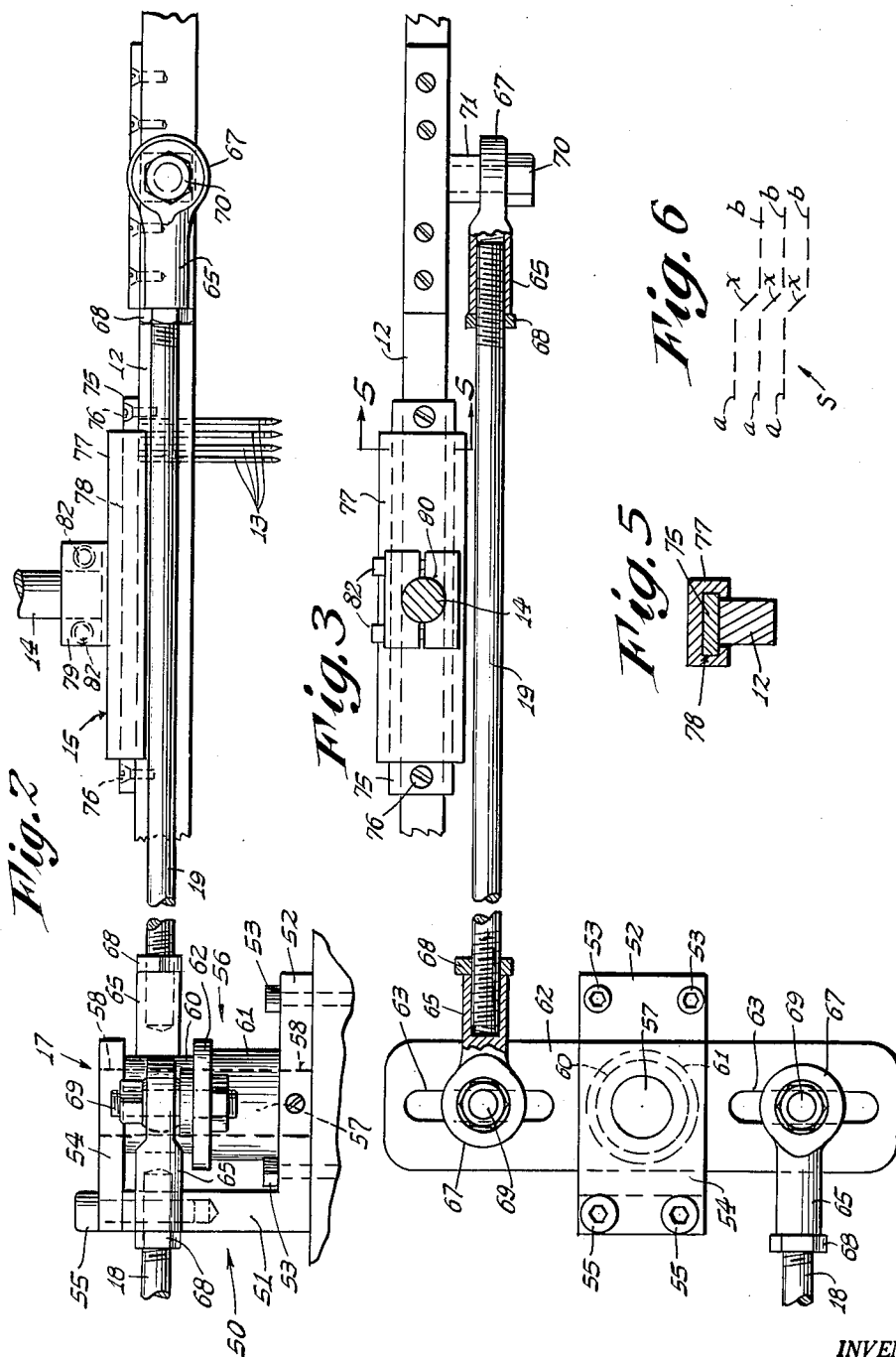
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SEWING MACHINE NEEDLE BAR STEP-OVER DEVICE

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4 Claims. (Cl. 112—79)

The present invention relates to sewing machines, and more particularly to an attachment for sewing machines for producing what may be referred to as a step-over stitch, i.e., the shifting of the needle bar of a sewing machine horizontally and laterally relative to its normal line of stitching to continue the stitching in a line parallel to but offset from the normal line of stitching. Although it is shown and referred to herein as an attachment intended for application to existing machines, it is to be understood that the invention may be adapted to and incorporated in a new machine.

This application is a continuation-in-part of co-pending application Serial No. 152,237, filed November 14, 1961, now abandoned, entitled Sewing Machine Needle Bar Step-Over Device.

The invention is not shown herein as applied to any particular form of sewing machine, since it is not so limited. It may be used with a single needle or a multiple needle machine, a machine employing a shuttle to knot the thread or yarn to form a stitch, or a tufting machine wherein the shuttle is replaced by a looper mechanism for creating a loop instead of a knot, or series of loops, to remain as such or to be cut at the end of each loop to form two free-end filaments. The invention may be adapted to a machine for sewing a design on a web of plain material merely to provide a stitched or embroidery design, or it may be adapted to a tufting machine for making a chenille fabric, or to a mending or finishing machine for adding a design to a web of tufted or other fabric.

An object of the present invention is to provide a step-over stitching device in or for a sewing machine which is simple and inexpensive to manufacture and easily adapted to the machine.

Another object of the invention is to provide a device of the character referred to which may be in the form of an attachment which requires a minimum of modification of a sewing machine for its attachment thereto.

Still another object of the invention is the provision of a device as aforesaid which is sturdy, accurate and efficient in its operation, which is reliable, positive and durable in its operation and is formed to require little or no attention once it is set up for a particular job.

A feature of the present invention is its versatility in operation and adjustability to accommodate itself to changes which may be made in a conventional sewing machine, as in the length of stroke, gauge, etc. of the needle bar and in the general operation of the machine.

It is also a feature of the present invention that it is readily adjustable and adaptable to produce different designs merely by the adjustment of or the interchange of one or a combination of some of its operating parts.

Other objects and features of the present invention will occur to those familiar with the art from a study of the drawings and the detailed description thereof which follows.

In the accompanying drawings, the invention has been shown merely by way of example and in preferred form and obviously many variations and modifications may be made therein and in its mode of application which will still be comprised within its spirit. It is to be understood, therefore, that the invention is not limited to any specific form or embodiment, except insofar as such limitations are set forth in the appended claims.

Referring to the drawings,

FIG. 1 is a rear elevation of a preferred embodiment of the present invention;

FIG. 2 is a similar, enlarged view of a portion of the structure shown in FIG. 1;

FIG. 3 is a top plan view of the structure shown in FIG. 2;

FIG. 4 is a transverse section, taken on the line 4—4 of FIG. 1, looking in the direction of the arrows;

FIG. 5 is a transverse section, taken on the line 5—5 of FIG. 3, looking in the direction of the arrows; and

FIG. 6 is a diagrammatic view, illustrating the form of stitch line produced by the operation of the device for the present invention.

As already stated, the invention might be adapted for incorporation in a new sewing machine. However, it has been developed and is shown in the drawings as an attachment for an existing machine which requires a minimum of modification of the machine for mounting the attachment thereon. Accordingly, the only parts of the sewing machine shown in the drawings appear as fragments of a leg 10, a base plate 11, a needle bar 12 (showing four needles 13 only) and a push bar 14 by which the needle bar 12 is actuated during the operation of the machine. It is pointed out at the outset that the only modification of the sewing machine required by the present invention is the drilling and tapping of holes in the leg 10 and base plate 11 for mounting the attachment thereon and the provision of a slide bearing connection 15 between the needle bar 12 and the push bar 14 to permit relative movement between the needle bar and its conventional operating mechanism.

Turning now to the preferred embodiment of the invention shown in the accompanying drawings, the structure comprises a drive mechanism 16, pivot adjustment mechanism 17, and connecting rods 18 and 19 respectively connected the drive mechanism 16 to the pivot adjustment mechanism 17, and the mechanism 17 to the needle bar 12.

The drive mechanism 16 is supported on a plate bracket 20 secured as by bolts or cap screws 21 to the leg 10 of the machine, the bracket 20 including a horizontally disposed support plate 22 strengthened from below by one or more braces 23. Mounted on the plate 22 and secured thereto as by cap screws 24 is a conventional form of speed reducing unit 25. An input shaft 26 of the speed reducing unit 25 has a sprocket 27 mounted on and keyed thereto, the sprocket 27 being adapted to be driven by a chain (not shown) leading from the main drive shaft of the machine. A vertically disposed cam wheel 30 is mounted on an output shaft 28 of the speed reducing unit 25 and secured thereto by a set of screws 29. The periphery of the cam wheel 30 is formed with a lobe portion 31 and a diametrically opposite complementary low portion 32, and intermediate and opposite portions comprising a lobe 33 and its complement 34.

A slide bar 35 is mounted on one side of the cam wheel 30 in contiguous relation thereto in a guide bracket 36 supported above the plate 22 by a pair of uprights 37 to which the bracket 36 is secured as by bolts 38. The bracket 36 is a composite structure comprising upper and lower guide members 40 and 41, respectively, held together by end straps 39 bolted thereto and to one another. Each of the members 40 and 41 is formed with a groove 42 located in its inner surface so that the grooves oppose one another in spaced-apart relation and are adapted to accommodate opposite edges of the slide bar 35 so that the latter has a sliding fit therein. Intermediate its ends, the slide bar 35 is formed with a relatively large, horizontally extending slot 45 through which the output shaft 28 of the speed reducing unit 25 extends freely. Two smaller, horizontally extending slots 47 are formed in the slide bar 35, one spaced from each end of

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the large slot 45 and each adapted to receive a stud 48 carrying a cam follower 49, the opposite free ends of each stud being threaded to receive a nut for securing the respective follower 49 to the slide bar 35. The cam followers 49 are adjustable relative to the slide bar 35 within the limits of the slots 47 and are located to track on the periphery of the cam wheel 30. The diametrically opposite positions of the followers 49 relative to the cam wheel 30, together with the peripheral contour of the cam wheel, causes both of them to remain in constant engagement with the periphery of the cam wheel and during a complete rotation thereof the slide bar 35 has imparted to it a positive reciprocating movement comprising two successive advance strokes to the right and two successive retracting strokes to the left.

The pivot adjustment mechanism 17, best seen in FIGS. 2 and 3, comprises an L-shaped bracket 50 having a vertical leg 51 and a horizontal leg 52, the latter being fastened to the base plate of the machine, as by cap screws 53. A cover plate 54 is mounted on and secured to the upper end of the vertical leg 51 by cap screws 55. A pivot arm unit 56 is mounted between the bracket leg 52 and the cover plate 54 on a pivot pin 57 having its opposite ends journaled in apertures 58 formed in the leg 52 and the plate 54, the pin 57 being secured therein by a set screw 59 (see FIG. 1) engaged in a threaded bore extending through the side wall of the bracket leg 52. Mounted to turn on the pivot pin 57 is a sleeve 60, which extends between the horizontal bracket leg 52 and the cover plate 54. The lower half of the sleeve 60 is enlarged to form a shouldered hub 61 against the shouldered portion of which there is welded a pivot arm 62 formed to extend therefrom and project beyond opposite sides of the bracket 50. In each area of the arm 62 extending beyond the bracket 50 a slot 63 is formed along the axis of the arm and is adapted for the attachment of an end of one of the connecting rods 18 and 19 to the arm 62.

The rod 18 connects the slide bar 35 to one side of the pivot arm 62 and is threaded at each of its opposite ends to receive a form of turnbuckle or sleeve nut 65 formed with an eyelet 67 to receive a bolt 69 by which one end is fastened to the adjacent end of the slide bar 35. Similar means are employed for securing the opposite end of the connecting rod 18 to the pivot arm 62 and the ends of the connecting rod 19 to the other end of pivot arm 62 and the needle bar 12. The bolt 69 has a spherically convex outer surface at its central portion which fits into a concave inner surface in the eyelet 67. A ball joint connection is thereby established to permit pivotal movement of the connecting rod 19. In each case, a nut 68 arranged on each of the threaded ends of the rods 18 and 19 is adapted to be set up tightly against the sleeve nut 65 to lock it against turning. Thus, pivotal, lengthwise-adjustable connections are provided between the slide bar 35 and one side of the pivot arm 62 and between the opposite side of the pivot arm 62 and the needle bar 12.

The end of the rod 18 connected to the slide bar 35 by the bolt 69 and the end of the rod 19 connected to the needle bar 12 by a bolt 70 and spacer 71 are rockable in offset parallel vertical planes for horizontal alignment with opposite ends of the pivot arm 62 and to maintain such alignment during operation of the apparatus. The sleeve nuts 65 on the ends of the rods 18 and 19 which are attached to the pivot arm 62 have their eyelets disposed in a horizontal plane for attachment to the top face of the arm 62, each being connected by a bolt 69 passing through the respective slot 63.

While similar provision could be made with both connecting rods 18 and 19, it is preferred for the sake of simplicity and convenience that one of the rods only be formed for periodic, working adjustability and, therefore, the rod 19 is formed at one end with a left-hand thread 72 and at the opposite end with a right-hand thread 73, 75

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whereby rotation of the rod 19 in one direction or the other will increase or decrease the length thereof between the nuts 65 by which its opposite ends are attached to the pivot arm 62 and the needle bar 12.

Instead of being connected directly to the needle bar 12, the push bar 14 in the present instance is fastened to the sliding connection 15. Accordingly (see FIGS. 2, 3 and 5), the needle bar 12 has a plate 75 fastened to the top edge thereof as by counter-sunk, flat-headed screws 76. A mount 77 formed with the rabbeted groove 78 is adapted to have a sliding fit with the plate 75 and is also formed with an upstanding fixed clamp element 79 formed with an arcuate recess 80 to conform to the periphery of the push bar 14. A similarly formed removable clamp element 81 is adapted to be secured to the fixed clamp element 79 as by cap screws 82 received in threaded bores formed in the element 79.

Assume that the attachment has already been mounted in the sewing machine with the bracket 20 fastened to the machine leg 10, the pivot adjustment mechanism fastened to the base plate 11, the needle bar 12 connected to the slide bearing 15, and the rod 19 fastened to the needle bar. It will be understood by one skilled in the art that a shutter (or looper in the case of a tufting machine) mechanism (not shown) is mounted beneath a face plate in the machine and in alignment for cooperation with the needles 13 carried by the needle bar 12. The sprocket 27 with a predetermined number of teeth is one selected to provide the desired speed of rotation of the cam wheel 30 in timed relation to the operation of the push bar 14, and the peripheral contour of the cam wheel 30 is designed to effect the production of a desired stitch pattern. With the cam wheel 30 in a position such as shown in FIG. 1, the cam followers 49 should be adjusted in the slots 46 and 47 to track on the cam wheel 30 and the connecting rod 18 should be connected to the slide bar 35 and its respective side of the pivot arm 62 approximately centered with respect to the slot 63 therein and with the pivot arm at a right angle to the plane of the slide bar. The connecting rod 19 should have one end thereof connected to its respective side of the pivot arm 62, centered with respect to the slot 63 therein, and its opposite end connected to the needle bar 12 by the stud 70. In such rough assembly of the parts the connecting rod 19, with the nuts 68 thereon loosened, may be turned in one direction or the other, as required, to shift the needle bar 12 to the left or right (FIGS. 1, 2 and 3) until the needles 13 properly align with their respective shuttles or loopers, whereupon a tightening of the nuts 68 will secure the rod 19 against accidental turning. As the needle bar 12 descends, it carries with it the outer end of the connecting rod 19 to which it is pivotally connected. The relatively short descent of the needle bar is permitted by the universal ball joint connection of the connecting rod 19. The connecting rod 19 returns to the straight position when the needle bar reascends to its elevated position illustrated. The pivotal connection between the outer end of the connecting rod 19 and the needle bar 12 prevents distortion of the needles during the movement.

In FIG. 6 there is shown the stitching pattern produced in the operation of the attachment, as set up, by the form of cam wheel 30 shown. In the present case FIG. 6 could be taken as a diagram of the two step action of the track of the cam wheel 30 but it is preferred to describe it as the stitching pattern S and noting that the three stitch lines shown may be made by using a different colored thread for each of them. If, then, it is assumed that the foregoing setup is accurately made for the stitching pattern shown in FIG. 6, after its first complete reciprocation to cause the needles 13 to partake of an advancing and a retracting stroke and penetrate the web of material being stitched to make the first knot, each complete reciprocating movement of the push bar 14 thereafter will effect a corresponding movement of the needle

bar 12, and the conventional movement of the web of material will produce three lines of stitching *a*. The cam 30 is so formed and the speed ratio of the sprocket 27 and the speed reducing unit 25 to the machine drive (or operation of the needle bar 12) is such that during the period that the three lines of stitchings *a* are being made the left and right cam followers 49 ride upon the cam lobe 31 and its complement 32, respectively, to maintain the slide in its left-hand position. Through the connecting rods 18-19 and the pivot arm 62, the needle bar 12 is held in the position shown in FIGS. 2 and 3. After the third stitching *a* has been made and the needle bar 12 is at or near its uppermost position with the needles 13 out of engagement with the web of material being sewed, i.e., at the time the needle bar is completing the minor fraction of a retracting stroke and/or subsequently partaking of the initial minor fraction of an advancing stroke, the right-hand cam follower 49 will ride up the portion 90 and the left-hand cam follower 49 will ride down the portion 91 of the cam 30 causing the slide bar 35 to move to the right (FIG. 1). Such movement of the slide bar 35 will be transmitted through the rod 18 to rock the pivot arm 62 counterclockwise (FIG. 3) carrying with it the rod 19 to shift the needle bar 12 to the left a predetermined distance equal to the distance between the longitudinal axes of two of the needles 13 (in this case two adjacent needles) and the next advance and retracting stroke of the needle bar 12 will form the stitching *x*. As the cam wheel 30 continues to rotate, the cam followers 49 will ride on the cam surfaces 33 and 34 to maintain the parts in the positions to which they were moved and continued operation of the needle bar 12 will form the three stitchings *b*. Thereupon the right-hand cam follower 49 will ride up onto the cam surface 33 and the left-hand follower 49 will ride down onto the surface 34 to shift the needle bar 12 in the same direction (left) to form another of the stitchings *x*, offset in the same direction as before, and then continue a straight line of stitching until the cam wheel 30 has completed a 180° movement. During the next 180° movement of the cam wheel 30 the shifting of the slide bar 35 and corresponding shifting of the needle bar 12 will be in the reverse direction, terminating in the plane of the lines of stitching *a*. In other words, the particular cam wheel 30 shown in the drawings is designed to make a stitchline pattern comprising two successive shifts in each direction during each complete rotation of the cam. When the needles 13 are each provided with a thread or yarn of different color, an attractive pattern may thus be produced.

It has already been pointed out that the right- and left-handed threads 72 and 73 on the connecting rod 19 provide for the proper alignment of the needles 13 with their respective shuttles or loopers. Provision is also made for adjustment for a difference in gauge, i.e. the distance between the longitudinal axes of contiguous needles 13. This involves increasing or decreasing the extent to which the needle bar 12 is shifted each time and is carried out at the point of the pivot adjustment mechanism 17. Thus, for a shorter shift of the needle bar 12 the rod 19 can remain connected to the pivot arm 62 as shown and the bolt 68 holding the rod 18 to the pivot arm can be moved in its slot 63 to a point closer to the pivot pin 57; or it can be moved outward away from the pivot pin 57 for a longer shift of the needle bar 12. For still longer or shorter shifts the connections of both rods 18 and 19 to the pivot arm 62 can be moved either outward or inward, respectively, relative to the pivot pin 57. The versatility of the apparatus is further noted by pointing out that a cam wheel corresponding to 30 but formed with different peripheral contours to change the needle bar shifting pattern may be employed and the sprocket 27 may have substituted therefor other sprockets with more or fewer teeth for changing the speed ratio of the cam wheel 30 relative to the operation of the needle bar 12.

As already stated, a preferred embodiment of the invention has been shown merely by way of example and obviously many variations and modifications thereof may be made which will still be comprised within its spirit. It is to be understood, therefore, that the appended claims are not to be construed as limited to any particular form or embodiment of the invention except to the extent that limitations may be expressly recited therein.

I claim:

1. An attachment for multiple needle tufting machines for producing a step-over stitch comprising

- (a) a needle bar, means for effecting movement of said needle bar to partake successively of an advancing stroke and a retracting stroke,
- (b) a drive mechanism,
- (c) said drive mechanism including a speed reducing unit having an input and output shaft, said input shaft being adapted to be connected in driving relationship to the main drive of a sewing machine,
- (d) a lobe cam wheel connected to the said output shaft,
- (e) a slide bar reciprocally mounted adjacent said cam wheel,
- (f) a pair of cam followers carried on said slide bars, said cam followers being disposed on opposite sides of said cam wheel in tracking position therewith,
- (g) means for adjusting the position of said cam followers relative to said slide bar so as to track on the periphery of said cam wheel,
- (h) said cam wheel having complementary lobes defined on the periphery thereof so as to impart to said slide bar positive successive advance strokes and positive successive retracting strokes,
- (i) and a pivot adjustment mechanism interconnecting said slide bar to said needle bar,
- (j) said pivot mechanism including a pivot,
- (k) a pivot arm pivotally journaled intermediate the ends thereof on said pivot,
- (l) a connecting rod connecting said slide bar to one end of said pivot bar,
- (m) and a second connecting rod connecting the other end of said pivot bar to said needle bar, said second rod having one end pivotally connected to said needle bar and having its other end swivelly connected to said pivot arm,
- (n) and means on said pivot adjusting mechanism for adjusting the gauge of said attachment.

2. The invention as defined in claim 1 wherein said means for adjusting the position of said cam followers relative to said slide bar includes a pair of elongated slots formed in said slide bar, whereby said cam followers are rendered adjustable within its respective slot.

3. An attachment for multiple needle tufting machines for producing a step-over stitch comprising

- (a) a needle bar mounted for movement to partake successively of an advancing stroke and a retracting stroke,
- (b) a drive mechanism,
- (c) said drive mechanism including a speed reducing unit having an input and output shaft, said input shaft being adapted to be connected in driving relationship to the main drive of a sewing machine,
- (d) a lobe cam wheel connected to the said output shaft,
- (e) a slide bar reciprocally mounted adjacent said cam wheel,
- (f) a pair of cam followers carried on said slide bars, said cam followers being disposed on opposite sides of said cam wheel in tracking position therewith,
- (g) means for adjusting the position of said cam followers relative to said slide bar so as to track on the periphery of said cam wheel,
- (h) said cam wheel having two pairs of complementary lobes defined on the periphery thereof so as to impart to said slide bar two positive successive ad-

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- vance strokes and two positive successive retracting strokes,
- (i) and a pivot adjustment mechanism interconnecting said slide bar to said needle bar,
- (j) said pivot mechanism including a pivot,
- (k) a pivot arm pivotally journaled on said pivot, said pivot arm being journaled on said pivot intermediate the ends thereof,
- (l) a connecting rod connecting said slide bar to one end of said pivot bar,
- (m) and a second connecting rod having one end connected to the other end of said pivot bar and having its other end connected to said needle bar, said one end connection to said pivot bar including a ball joint,
- (n) means for adjusting the gauge of said attachment,
- (o) and said latter means including a pin and slot connection between the pivot arm and the respective connecting rods connected thereto whereby the rela-

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tive position of the pin connections of the respective rods in their respective slots determines the resulting shift of said needle bar with respect to the throw of said slide bar.

4. The invention as defined in claim 3 wherein at least one of said connecting rods is threadedly connected at its opposite ends with opposite hand threads so as to effect adjustment of said rod.

References Cited by the Examiner

UNITED STATES PATENTS

3,026,830	3/62	Bryant	-----	112—79
3,109,395	11/63	Batty	-----	112—79

FOREIGN PATENTS

31,005	2/04	Switzerland.
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