

Fig. 4.

WITNESS

Nicholas Leozak

INVENTOR.

Thomas G. Graham

BY

Marshall J. Brien

ATTORNEY

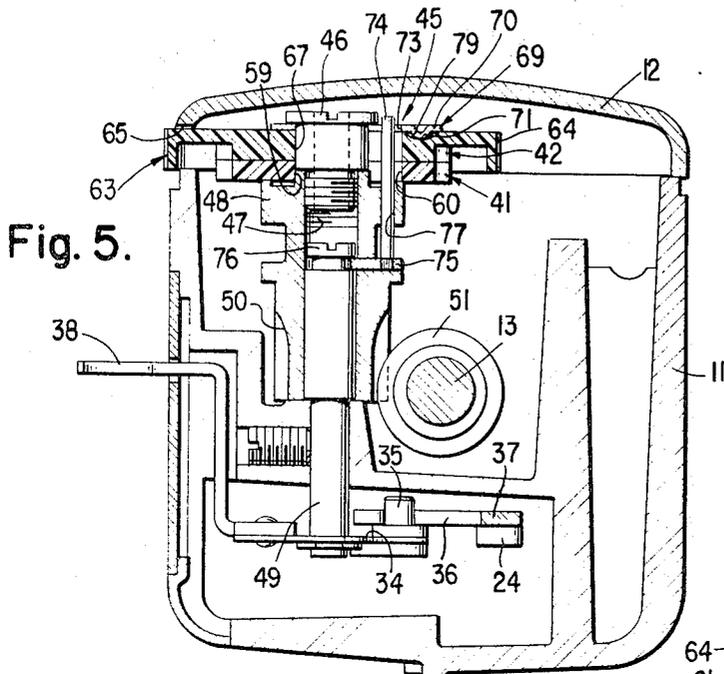


Fig. 5.

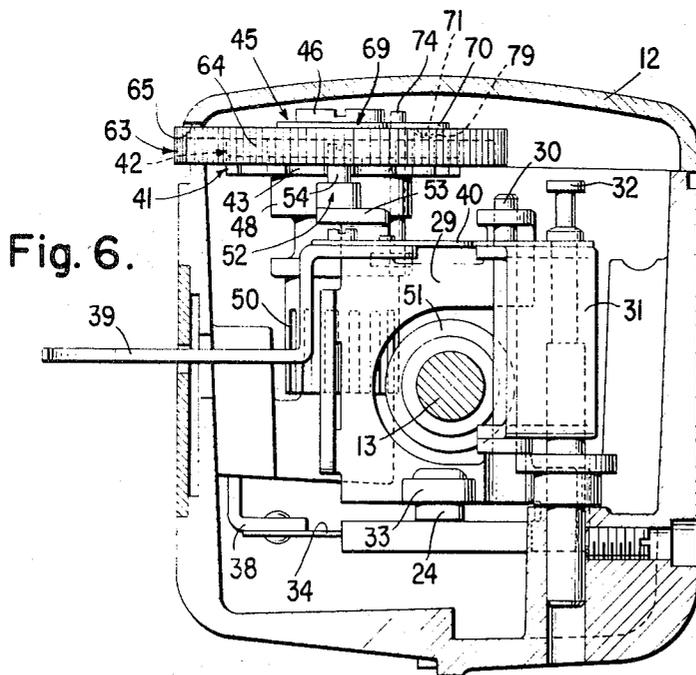


Fig. 6.

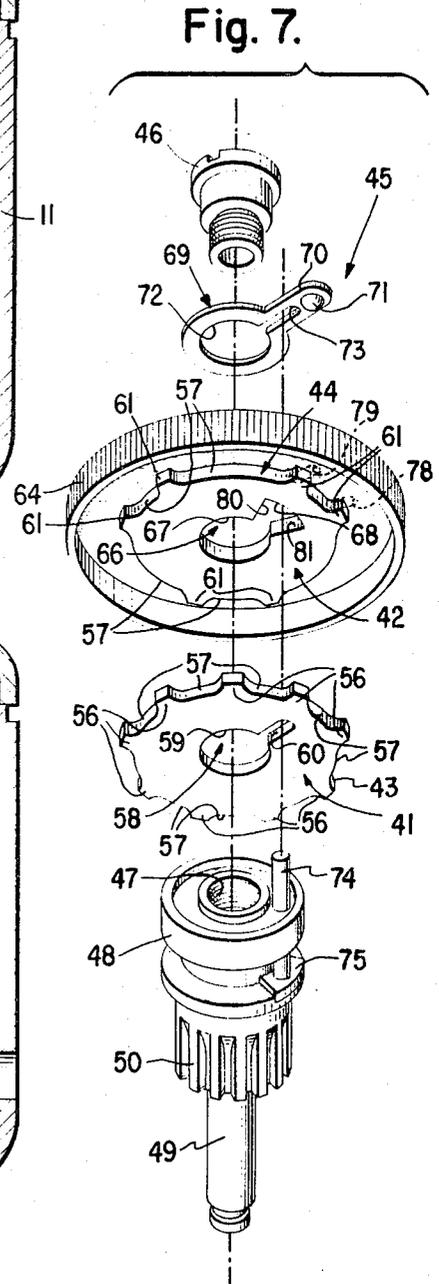


Fig. 7.

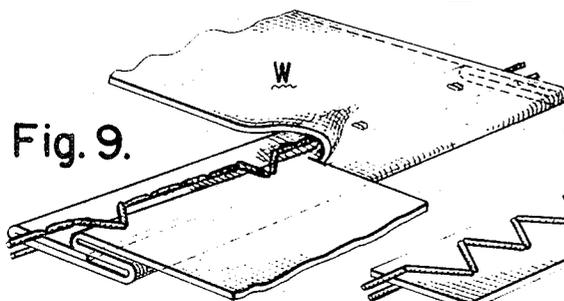


Fig. 9.

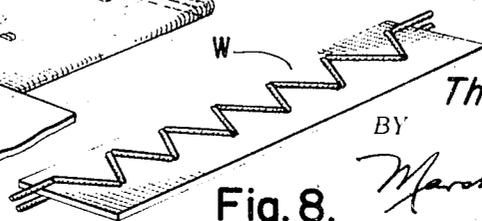


Fig. 8.

INVENTOR.
Thomas G. Graham
BY
Marshall J. Breen
ATTORNEY

CAM INDEXING MECHANISM IN AN ORNAMENTAL STITCH SEWING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to a mechanism for manually changing the relative phase relationship of cams in a sewing machine of the zigzag type in order to produce different selected stitch patterns and for accomplishing the same in a relatively simple and quiet manner.

2. Description of the Prior Art

It is generally known in the art to provide in a sewing machine means for changing the stitch pattern. An unsatisfactory arrangement which heretofore has been used to achieve this end comprises a removable cam designed so that it can be mounted on a driven cam shaft in one of two positions which are substantially 180° apart. In order to produce a stitch pattern different from the one previously formed, the operator of the machine is required to remove the replaceable cam, turn it through 180°, and replace the cam in its latter position on the cam shaft. This type of arrangement requires a substantial amount of effort on the part of the operator and brings the sewing operation to a relatively long standstill while the cam is being rearranged to produce the desired stitch pattern. Other arrangements for altering the stitch pattern are relatively inconvenient to operate and are not as readily accessible to the operator of the sewing machine as is the present invention. In addition prior art mechanisms are notorious for having a relatively noisy mode of operation which is undesirable to the operator of the machine and those nearby.

SUMMARY

This invention relates to the art of sewing machines of the zigzag type, and more particularly to a novel and improved mechanism comprising a pair of relatively phase shiftable cams whereby one of a plurality of predetermined stitch patterns may be selected manually by modifying the angular relationship of the cams in a simple and efficient manner to transmit to the needle carrying needle bar by way of a cam follower and transmission means, a needle-jogging motion in conformance with the selected pattern sensed by the cam follower. Further, the cams are so arranged relative to each other that the cam follower will sense the stitch pattern therefrom with a minimum amount of noise.

The present invention overcomes the above discussed prior art deficiencies and more by providing a mechanism for selecting a predetermined stitch pattern comprising a pair of cams coaxially mounted on a rotatable shaft journaled in the frame of the sewing machine wherein one cam is of the conventional zigzag type and has superimposed upon it in contiguous relation a similar zigzag cam modified so that every third cam lobe is removed. The modified cam is constructed and arranged so that it can be manually shifted angularly about the axis of the cam shaft to effect a change in its phase relation with respect to the standard zigzag cam. Manual adjustment of one cam relative to the other is effected by having a portion of the periphery of the disc to which the upper modified cam is attached projecting through an opening in the bracket arm cover in position to be shifted by the finger of the operator for altering the combined stitch pattern response of the cams to produce either a zigzag pattern or a blindstitch pattern. This end is accomplished by virtue of the cam design and its shiftable mounting arrangement so that in one position the cam lobes of both cams are in substantial vertical register and a regular zigzag seam is produced, and when the modified cam is indexed by means of the finger actuatable disc the lobes on the latter cam are located between the cam lobes on the lower standard zigzag cam, whereby the cam follower is allowed to drop to the low point on the lower cam only once every six needle penetrations resulting in the production of a blindstitch seam. When intelligence is added to the lower cam, as discussed above, the portion of the stitching cycle during which the follower senses the high point of the combined cam

response provides a relatively quiet mode of operation since the orientation of the cam lobes of the modified cam relative to those on the zigzag cam provide a substantially continuous response surface. Thus, there is provided by the present invention a novel and improved construction for a cam indexing mechanism which avoids the prior art deficiencies.

Accordingly, it is a primary object of the present invention to provide in a sewing machine of the ornamental stitch variety, a novel and improved cam indexing mechanism which is easily actuated and is readily accessible to the operator of the machine, and which will produce preferably either a regular zigzag seam or a blindstitch pattern.

Another object of the present invention is to provide in a zigzag sewing machine a manually actuatable mechanism for altering the angular relation of the cams to produce a desired stitch pattern.

It is a further object of this invention to provide in a sewing machine of the zigzag type a mechanism for changing the stitch pattern normally produced by the standard zigzag cam by arranging the mechanism so that it is readily accessible to the finger of the operator and need not be completely removed to alter the stitch pattern.

A further object of the present invention is to provide in a sewing machine of the zigzag type a pair of cams of different stitch pattern response producing shape adapted for relative angular movement and for being locked in a selected relative position.

Still yet another object of this invention is to provide in a zigzag sewing machine shiftable means for selection of one of a plurality of stitch patterns in combination with a single cam follower for tracking the selected pattern and transmitting it to a needle bar which is shifted laterally in response thereto.

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 functions, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the cam indexing mechanism and its related components oriented to produce a zigzag stitch pattern constructed in accordance with the present invention;

FIG. 2 is a top plan view showing the phase relation of the cams of FIG. 1 for producing a zigzag stitch pattern;

FIG. 3 is a top plan view showing the phase relation of the cams of FIG. 1 for producing a blindstitch pattern;

FIG. 4 is a partial front elevational view of the sewing machine bracket arm and cover constructed in accordance with the present invention;

FIG. 5 is a vertical sectional view taken substantially on the line 5-5 of FIG. 4;

FIG. 6 is a vertical sectional view taken substantially on the line 6-6 of FIG. 4;

FIG. 7 is an exploded perspective view of the cam indexing mechanism embodying the present invention;

FIG. 8 illustrates a zigzag stitch pattern produced by the needle with the cams oriented as shown in FIG. 2; and

FIG. 9 illustrates a blindstitch pattern produced by the needle with the cams oriented as shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the accompanying drawings wherein like reference numerals designate similar parts throughout the various views, the preferred embodiment of the present invention is herein disclosed as embodied in a sewing machine substantially similar to that forming the subject matter of U.S. Pat. No. 3,051,107, granted Aug. 28, 1962, to Ralph E. Johnson and assigned to the assignee of the present application, to which reference may be had for a more complete understand-

ing of the machine. The present application describes the parts of the sewing machine only to the extent necessary for a complete and thorough understanding of the present invention.

The sewing machine has a bed (not shown), a standard 10 rising from one end of the bed and carrying a bracket arm 11 that terminates in a head (not shown) overhanging the bed. The top of the bracket arm 11 is open and normally is closed by a cover plate 12. Rotatably journaled in suitable bearings provided in the bracket arm 11 is a horizontally disposed main shaft 13 extending lengthwise of the bracket arm and carrying at one end a drive mechanism (not shown). At its opposite end, the main shaft 13 carries a counter balanced crank 14 connected in the usual manner to a vertically disposed needle bar 15.

In the head of the machine there is mounted for endwise reciprocation and sidewise movement the needle bar 15 having a needle 16 secured to its lower end by a standard needle clamp 17. Upon actuation of the needle bar the needle penetrates the work W (see FIGS. 8 and 9) disposed below it on the work surface of the sewing machine and cooperates in the usual manner with the stitch forming mechanism (not shown) located below the head in the bed of the machine to form an ornamental stitch pattern, preferably a zigzag stitch (FIG. 8) or a blindstitch (FIG. 9). As readily can be seen from the blindstitch pattern of FIG. 9 the needle 16 is maintained fixed by the needle-jogging mechanism including the needle bar 15 at the line of feed of the work for a predetermined number, preferably four, of straight stitches and then is moved laterally of the line of feed to produce a predetermined number, preferably two, of zigzag stitches. In the preferred embodiment two zigzag stitches are formed after every four straight stitches. Upon selection of the zigzag stitch pattern, the needle bar 15 is vibrated laterally for a predetermined stitching cycle thereby causing the needle 16 to move laterally of the line of feed of work so that upon alternate stitches it will penetrate the work at laterally spaced points to define an ornamental stitch pattern, such as the zigzag seam shown in FIG. 8.

To accomplish the above the needle bar 15 is mounted for endwise reciprocation in vertically spaced bearing lugs 18 and 19 of a swinging needle bar gate 20. To provide for lateral vibration of the needle bar 15, the gate 20 also includes vertically spaced upper and lower bearing lugs 21 and 22 formed with bores (not shown) for receiving a central portion of a pivot rod 23 which mounts the gate 20 for pivotal movement about the axis of the central portion of the rod 23. Suffice it to say that the head of the sewing machine mounts the pivot rod 23 in a pair of vertically spaced bosses 82 and 83, reference being had to the above identified patent for a more complete description.

Pivotal movement of the needle bar gate 20 about the axis of the central portion of the rod 23 is imparted thereto by way of a pitman 24 adjustably connected at its one end to an L-shaped bracket 25 by means of a screw 26 extending through the bracket and threaded into the pitman. The bracket 25 is pivotally connected to the needle bar gate 20 by a pin 27 secured to the gate by a set screw (not shown) or other suitable means. The other end of the pitman 24 extends through a horizontally orientated open-ended slot 28 formed in a plate 29 that is pivotally mounted on a stud pin 30. The pin 30 is carried in a substantially U-shaped bracket 31 pivotally supported on a stud 32 secured in the bracket arm of the sewing machine. As best shown in FIG. 1, on the side of the plate 29 opposite from the needle bar 15, there is mounted on the end of the pitman 24 an upstanding portion 33 disposed in abutting relation to the adjoining surface of the plate 29. The end of the pitman 24 adjacent the plate 29 is adapted to be shifted along the slot 28 to vary the zigzag amplitude or stitch width at the needle by means of a manually shiftable lever having at one end thereof an upstanding pin 35 secured to a spring member 34 maintained in slidable register with a slot 36 provided in an offset shelf member 37 secured to the pitman 24 in

a suitable manner, and at its other end a handle 38, also carried by the member 34, which is readily accessible to the operator. To vary the field or centerline of the zigzag pattern there is provided a handle 39 carried by a plate 40 which is secured to the bracket 31, whereby the bracket pivotally may be shifted about the stud 32.

The plate 29 is oscillated by a rotary pattern cam arrangement comprising a pair of cam discs 41 and 42 having peripheral pattern surfaces 43 and 44. The cams 41 and 42 coast with other related parts, to be described in detail hereinafter, to form a cam indexing mechanism generally designated 45 for oscillating the plate 29 in a predetermined selected manner, which, in turn, operably causes the needle 16 to produce preferably either a zigzag stitch or a blindstitch pattern. The cams 41 and 42 releasably are secured by a shouldered thumb screw 46 threaded in a bore 47 formed in a disc adapter 48, which is journaled on a cam shaft 49 supported by the member 34. The disc adapter 48 has integrally formed therewith a gear wheel 50 which meshes with a worm gear 51 on the main shaft 13. A single cam follower generally designated 52 is carried on a laterally extended shelf portion 53 formed with the plate 29 and has a cam follower element 54 for tracking the peripheral surfaces 43 and 44 of the cam discs 41 and 42. Thus, as the cam follower element 54 senses the combined stitch pattern response of the cam surfaces 43 and 44, it conveys the tracked pattern to the plate 29 causing it to move in conformance therewith and resulting in a corresponding movement of the pitman 24, which vibrates the needle 16 carried by the needle bar 15 to produce the selected stitch pattern.

A torsion spring 55 coiled about the intermediate portion of the pivot rod 23 between the bearing lugs 21 and 22 is constructed and arranged to bias the needle bar gate 20 in a counterclockwise direction thereby tending to pull the pitman 24 to the left which urges the upstanding portion 33 against the adjacent surface of the plate 29 causing the plate to pivot about the pin 30 in a clockwise direction. Thus, since the cam follower element 54 is mounted on the plate 29 it also will tend to move clockwise and will be resiliently held in tracking engagement with the cam surfaces 43 and 44. As the cam surfaces present a high point to the cam follower element 54, it will tend to move in a counterclockwise direction imparting a clockwise motion to the needle bar gate 20 against the action of the spring 55. When the follower element 54 contacts a low point on the cam surfaces the needle bar gate is pivoted in a counterclockwise direction by the spring 55.

To provide the operator with a choice of stitch patterns the cams are designed so that in one position a blindstitch will result, while in another selected position a conventional zigzag stitch pattern will be produced. As best shown in FIG. 7, the cam 41 has a conventional zigzag design with equally spaced cam lobes 56 forming the high points with the low points defined by the surfaces therebetween and designated 57. The cam 41 is preferably of the eighteen stitch variety. The zigzag cam 41 is formed with a keyhole shaped aperture generally designated 58 comprising an enlarged circular portion 59 for mounting the cam on the adapter 48 and a relatively narrow elongated opening or slot 60 depending therefrom. The upper cam 42 is illustrated as having six cam lobes 61 and is similar to the zigzag cam 41 except that it is modified so that every third cam lobe is removed. The modified cam 42 is mounted in contiguous relation with the zigzag cam 41 on the cam shaft 49 so that it can be manually shifted angularly about the axis of the cam shaft to change its phase relation with respect to the standard zigzag cam 41. As shown in FIG. 2, in one position the cam lobes 56 and 61 of the cams 41 and 42 are aligned in vertical register and produce a regular zigzag seam such as the one shown in FIG. 8. When the modified cam 42 is indexed in a manner to be described below, the lobes 61 on the cam 42 are located between the cam lobes 56 on the lower zigzag cam 41 as shown in FIG. 3. Thus, by the latter arrangement the cam follower element 54 is allowed to contact the low points 57 on the zigzag cam 41 only once every six needle

penetrations thereby resulting in the production of a blindstitch pattern as illustrated in FIG. 9.

With the cam lobes disposed as shown in FIG. 3, that is, for blindstitch operation, the outer surfaces of the adjacent lobes 56 and 61 provide a substantially continuous peripheral surface for the cam follower element 54 to track during formation of the straight stitches for the blindstitch pattern. Any spacing that may be present between the adjacent cam lobes comprising the straight stitch portion of the stitching cycle will cause a substantial amount of undesirable noise. In the preferred embodiment of the present invention the spacing 62 between adjacent cam lobes is minimized so that as the follower leaves the peripheral surface of a lobe 61, it almost immediately contacts the peripheral surface of the next lobe 56 and so on. This results in a relatively quiet mode of operation.

The modified cam 42 preferably is integrally formed with an actuating dial or disc 63 having a knurled peripheral surface 64. A portion of the periphery 64 of the dial 63 is adapted to project through a slot 65 provided in the cover plate 12 for the bracket arm 11 and is positioned, as best shown in FIG. 4, to be readily accessible to the finger of the operator. The dial 63 mounts on the disc adapter 48 in rotary fashion so that the modified cam 42 is superimposed upon the zigzag cam 41 in face-to-face relation as shown in FIGS. 1 and 5. An opening 65 comprising a circular portion 67 and a fan-tail portion 68 depending therefrom formed in both the dial 63 and the cam 42 allows the cam 42 to be mounted coaxially with the zigzag cam 41 and shifted relative thereto.

In order to lock the two superimposed cams in a selected relative position there is provided an apertured blindstitch disc detent spring generally designated 69 including a slightly downward biased integral finger 70 extending radially thereof and having a detent 71 formed on the lower surface at its free extremity. The aperture in the spring 69 is similar to that formed in the zigzag cam 41 and comprises a circular portion 72 and an elongated opening 73 formed in the finger 70. The spring 69 is mounted adjacent the upper surface of the dial 63 in coaxial relation with the cam discs 41 and 42. The cams 41, 42 and the spring 69 are vertically aligned in the proper relative position by means of a pin 74 depending from a curved member 75 which is held in place in a cutout portion (not shown) provided at the top of the gear wheel 50. The member 75 is mounted with the cam shaft 49 by means of a screw 76 (see FIG. 5) and is designed so that it is substantially complementary to the portion removed from the top surface of the wheel 50. The aligning pin 74 extends upward in sequence through a bore 77 formed in the disc adapter 48, the slot 60 of the cam 41, the fan tail-shaped opening 68 of the cam 42, and the slotted portion of the spring finger 70.

A pair of circumferentially spaced depressions 78 and 79 are formed on the upper surface of the dial 63 for receiving the detent 71 of the spring finger 70 and releasably holding the cams in their selected relative position. The depressions are spaced from the periphery of the disc 63 so that radial location is substantially equal to the radial disposition of the detent 70 relative to the axis of the cam shaft 49. Each of the depressions is substantially radially aligned with a side wall 80 and 81 defining the fan tail-shaped opening 68 in the cam disc 42 so that as the disc 42 is shifted angularly relative to the pin 74 between the side walls 80 and 81, the detent 71 will register with one of the depressions 78 and 79.

The operator manually may select either a blindstitch or a zigzag stitch pattern by shifting the projecting peripheral portion of the dial 63 either to the right or to the left as shown by the indicia on the bracket arm cover plate 12 in FIG. 4. Thus, when the dial 63 is shifted to the right for a blindstitch pattern the modified cam 42 secured to the dial 63 is indexed so that the phase relation illustrated in FIG. 3 results with the detent 71 in register with the depression 78. The detent carrying finger 70 of the spring 69 is biased downwardly to maintain the detent 71 in contact with the adjacent surface of the dial 63, but is sufficiently resilient to allow the detent to be shifted from one depression to the other. If a zigzag stitch pattern is

desired the operator merely shifts the dial to the left as indicated in FIG. 4 whereupon the cams 41 and 42 will be aligned as shown in FIG. 2 with the detent 71 in register with the depression 79. This latter arrangement is shown in FIG. 1. Thus, it is seen that the radial walls, 80 and 81 of the fan tail-shaped opening 68 in the dial 63 forms stop abutments for the pin 74 thereby defining the limits of angular shift of the upper cam 42.

Numerous alterations of the structure herein disclosed 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.

I claim:

1. In a sewing machine having a frame including a bracket arm, a needle carrying needle bar mounted in said frame for endwise reciprocation and sidewise movement, at least a first and a second stitch-pattern cam each having a different response producing shape, a shaft journaled in said frame for rotation about a single axis, means mounting said cams on said shaft for rotation therewith, at least said first cam having an indexing axis about which at least said first cam may be angularly indexed relative to said shaft, said indexing axis being substantially coincident with said single axis at all times, means for rotating said shaft in synchronism with said needle reciprocating movements, a single cam-tracking means carried by said frame for tracking and responding to at least said first and second cam during a predetermined stitching cycle, means operatively connecting said cam-tracking means to said needle bar for shifting said needle sidewise in conformance with the combined response of said cams sensed by said cam-tracking means, and means for indexing at least said first cam angularly about said indexing axis thereby to change the relative phase relation of said cams, whereby in one position the cams are so arranged as to produce a seam of predetermined stitch pattern and when in another position said cams are arranged to produce a seam of different stitch pattern.

2. A sewing machine in accordance claim 1 including a cover for said bracket arm, said cover having at least one aperture formed therein, said indexing means including a manually operative member operably associated with said first cam for indexing said cams relative to each other, at least a portion of said manually operative member being disposed in register with said aperture thereby to facilitate access by the operator to said manually operative member.

3. In a sewing machine in accordance with claim 1 wherein the response producing shape of each of said cams has a predetermined number of spaced cam lobes on the surface thereof, at least said first of said cams comprising a first number of lobes of predetermined configuration, the second of said cams comprising a second number of lobes of same configuration as the lobes of said first cam, said second number being greater than said first number so that in one position the lobes of at least said first cam are in substantial alignment with certain of the lobes of said second cam for producing a first stitch pattern, and when at least said first cam is angularly indexed to change the relative phase relation of said cams the lobes of said first cam are disposed between the cam lobes on the second cam to produce a second stitch pattern.

4. A sewing machine in accordance with claim 3 wherein said first cam is superimposed upon said other cam in contiguous relationship.

5. A sewing machine in accordance with claim 1 wherein said indexing means includes a manually operative member disposed in operable relation with said first cam, said member having a manually engageable portion that extends through said frame thereby giving the operator of said sewing machine direct access thereto for selecting the desired stitch pattern.

6. A sewing machine in accordance with claim 1 wherein said indexing means includes a manually operable member disposed for coaction with said first cam for locating said cams in a selected one of said positions for producing the desired stitch pattern, said cams and said manually operable member being commonly mounted on said shaft, a plurality of depressions formed in said manually operable member, and means for locking said cams in a selected one of said positions comprising a detent for releasably engaging one of said depressions.

7. A sewing machine in accordance with claim 6 wherein each of said cams is provided with an aperture of predetermined size and shape, said manually operable member being disposed adjacent said first cam and being provided with an aperture similar to that provided in at least the first cam, said locking means comprising a ring member having an integral portion extending therefrom and having the detent formed at its free extremity, said integral portion being provided with an aperture similar to that provided on the second cam, said shaft having a pin depending therefrom for register with all of said apertures, said apertures of said manually operable member and said first cam being constructed to allow for circumferential movement thereof relative to said pin, whereby indexing of said manually operable member by said operator will cause said cams to shift their phase relative to each other and produce the desired selected stitch pattern.

8. In a sewing machine having a frame including a bracket arm, a needle carrying needle bar mounted in said frame for endwise reciprocation and sidewise movement relative to the direction of reciprocation, a main shaft journaled in said frame, a pair of stitch-pattern cams each having a different response producing cam surface, a second shaft rotatably driven from said main shaft, said cams being mounted adjacent each other on said second shaft for rotation therewith, cam tracking means carried by said frame for tracking the combined stitch-pattern response of said cams sensed thereby, said cam tracking means including a member disposed for

contact with said different response producing surfaces, disc means disposed adjacent one of said cams being so constructed and arranged to enable at least one of said cams to be shifted angularly relative to the other of said cams thereby to alter the combined stitch-pattern response of said cam surface, said disc means and each of said cams being provided with openings, pin means provided on said shaft for interengaging said openings provided in said cams and said disc means for allowing said cams to be shifted into a selected relative position, said disc means having at least a pair of spaced recesses formed thereon, detent means operably associated with said pin means for registering with one of said recesses and releasably locking said cams in their selected relative position when said disc means manually is shifted to the desired stitch pattern.

9. In a sewing machine having a frame, a needle carrying needle bar mounted in said frame for endwise reciprocation and lateral movement relative to the direction of reciprocation, a shaft journaled for rotation in said frame, means for rotating said shaft in timed relation with said needle reciprocation, a first cam, a second cam, means mounting said first and second cams in abutting relation on said shaft for rotation therewith, said first cam having a first number of lobes on the surface thereof, said second cam having a second number of lobes on the surface thereof, said second number being different from said first number, a single cam follower carried by said frame and engageable with both said cams for tracking and responding to the lobes on said cams, means operatively connecting said follower to said needle bar for jogging said needle laterally in response to the tracking of said lobes, and manually engageable means for displacing the lobes of at least one of said cams relative to said follower from a first position to a second position, said first position being such that a zigzag stitch pattern is produced while said second position being such that a blindstitch pattern is produced.

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