May 15, 1962 YOZO HIDA 3,034,462

ORNAMENTAL STITCH SEWING MACHINE

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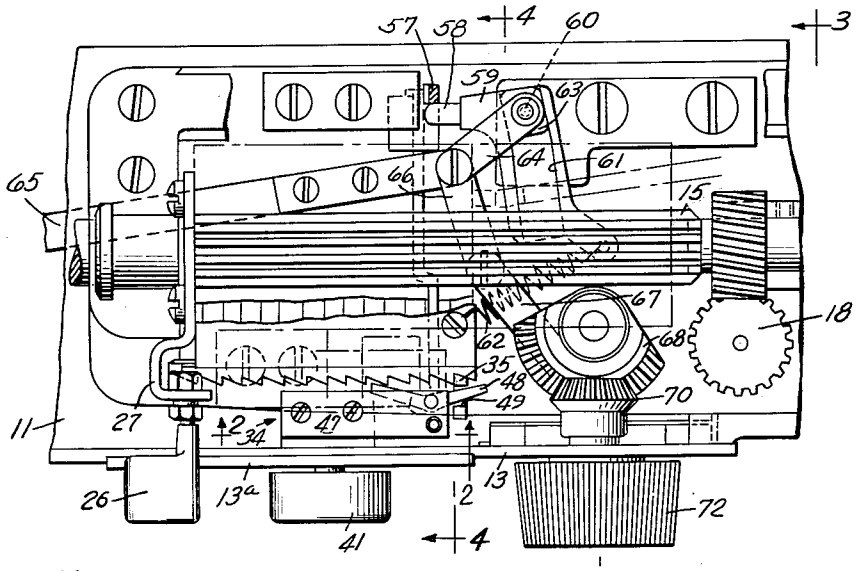


Fig. 1

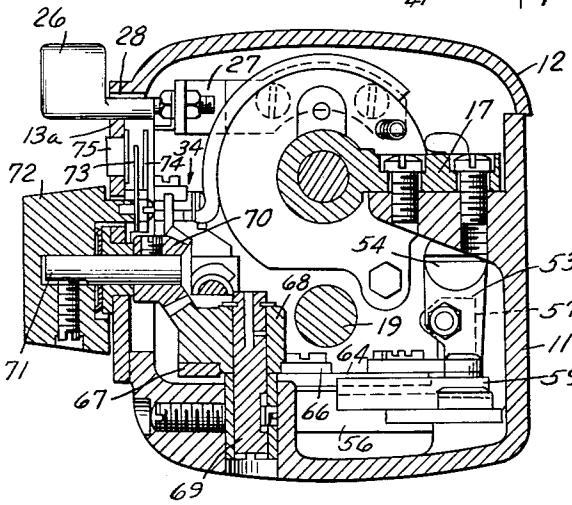


Fig. 3

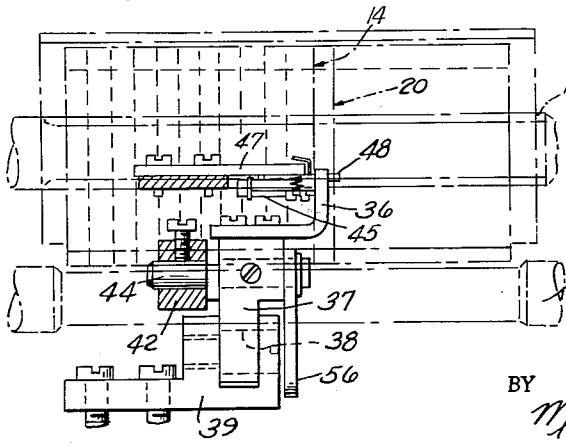


Fig. 2

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Fig. 4

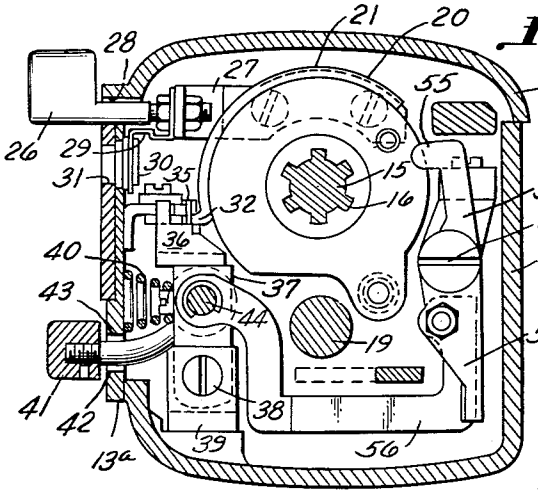
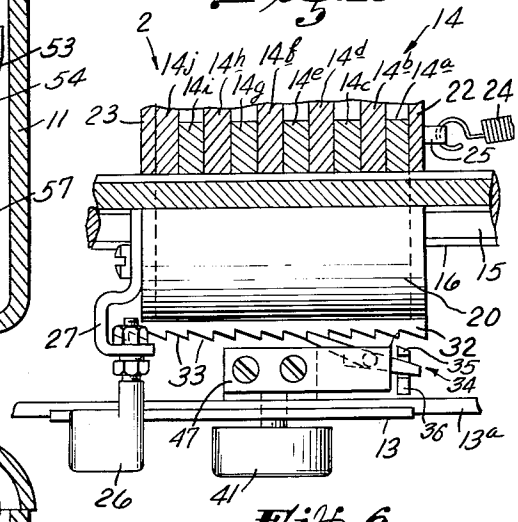


Fig. 10



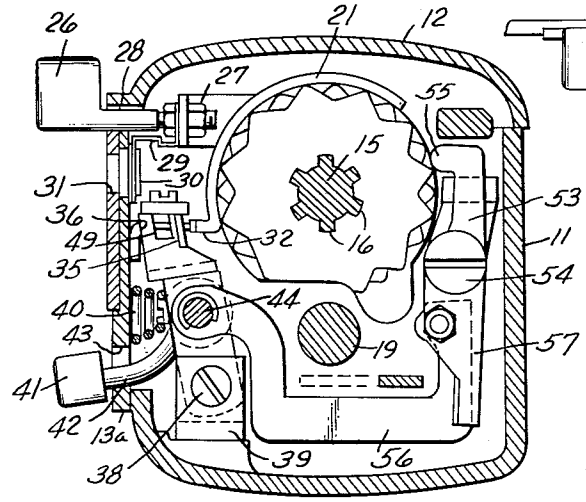


Fig. 6

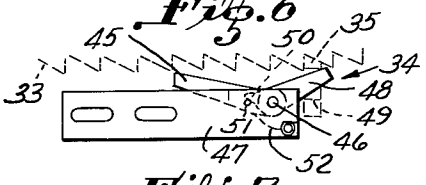


Fig. 7

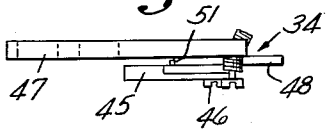
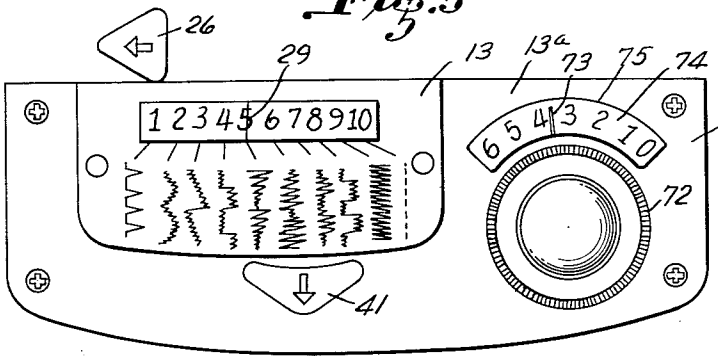


Fig. 5



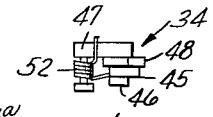


Fig. 8

Fig. 9

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ORNAMENTAL STITCH SEWING MACHINE

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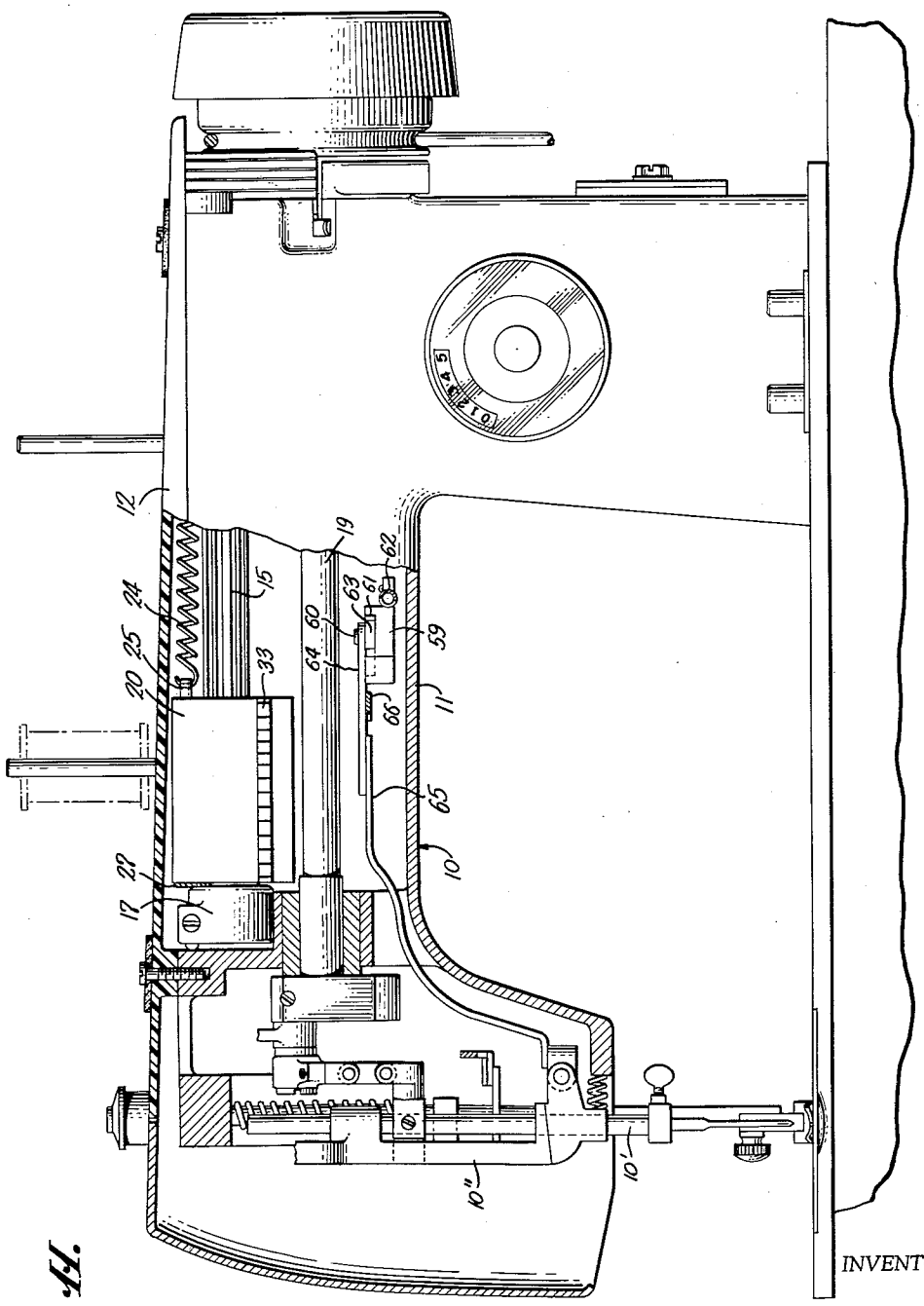


Fig. 4.

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ORNAMENTAL STITCH SEWING MACHINE

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7 Claims. (Cl. 112—158)

The present invention relates in general to ornamental stitch sewing machines and more particularly to sewing machines of the type having a mechanism permitting zigzag stitching by combined reciprocation and transverse oscillation of the needle bar under control of any one of a plurality of pattern control cams provided in the sewing machine each arranged to produce a different stitch pattern.

Zigzag sewing machines generally comprise a needle bar guide in which the needle bar is longitudinally reciprocated and which is oscillated transversely to the direction of reciprocation of the needle bar to produce zigzag patterns. In sewing machines of this kind, it has been common practice to use interchangeable pattern cams for oscillating the needle bar guide to provide various stitch patterns. These sewing machines generally had provision for only one pattern cam in a sewing machine at a time, it being necessary to remove that pattern cam and insert another and different cam to change the zigzag pattern. Obviousiy the interchanging of such pattern cams is a time-consuming operation and involves exposure of the operator to contact with oil with which the pattern cams become covered and exposes the cam members when removed to being lost or damaged. More recently, zigzag sewing machines have been provided wherein a plurality of such pattern cams are provided in the sewing machine, together with a single cam follower or a plurality of cam followers which may be freely positioned to track any one of the plurality of pattern cams. Such mechanisms introduce a practical difficulty in regard to effective use of the sewing machine by the housewife in that the precise and accurate selection of a particular one of the plurality of pattern cams to be tracked by the cam follower may be a tedious operation requiring great care and skill by the operator.

An object of the present invention is the provision of a novel cam selector mechanism for zigzag sewing machines of the type having a plurality of pattern cams therein, which facilitates accurate selection of the cam desired to be tracked by the cam follower.

Another object of the present invention is the provision of a novel zigzag sewing machine of the type having a plurality of pattern cams therein, wherein the plurality of pattern cams are shiftable as a group or block relative to a stationary cam follower in an extremely simple manner assuring precise alignment of the desired pattern cam with the cam follower.

Another object of the present invention is the provision of a novel zigzag sewing machine of the type having a plurality of pattern cams therein, wherein the cam follower is maintained at a uniform angular relationship with each one of the cams which are selected to be tracked.

Another object of the present invention is the provision of a novel zigzag sewing machine of the type having a plurality of pattern cams therein, wherein the cams are movable relative to a stationary cam follower as a unitary group or block of cams and are arranged in such a manner that a large number of cams can be accommodated within the sewing machine bracket arm.

Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings illustrating one preferred embodiment of the invention.

In the drawings:

FIGURE 1 is a fragmentary top plan view of the bracket arm of a sewing machine embodying the present invention, with the top cover of the bracket arm removed and certain components illustrated in broken lines only to reveal the construction of the pattern selector mechanism;

FIGURE 2 is a fragmentary vertical section view viewed from the line 2—2 of FIGURE 1 with the main drive shaft and pattern cams indicated in broken lines to show the relationship of the parts;

FIGURE 3 is a vertical transverse section view taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a vertical transverse section view taken along the line 4—4 of FIGURE 1;

FIGURE 5 is a section view similar to FIGURE 4 but illustrating the position of the components when the pattern selector key has been depressed to effect an axial stepping of the pattern cams;

FIGURE 6 is an enlarged fragmentary top plan view of the escape mechanism for controlling step-wise movement of the pattern cams;

FIGURE 7 is a front elevation of the structure illustrated in FIGURE 6;

FIGURE 8 is an end elevation of the structure illustrated in FIGURE 6;

FIGURE 9 is a front elevation of the pattern plate and components exposed to view at the front of the sewing machine frame;

FIGURE 10 is a fragmentary top plan view of the pattern cams and cam selector mechanism, illustrating the components in an intermediate position during one stepping operation of the cam; and

FIGURE 11 is a front elevation of the sewing machine with parts broken away to reveal the operative connection between the pattern cam mechanism and the needle bar.

Referring to the drawings wherein like reference characters designate corresponding parts throughout the several figures, and in particular to FIGURES 1 to 4, and 11, a sewing machine having the usual hollow sewing machine frame indicated generally by the reference character **10** and a vertically reciprocative needle bar **10'** movably guided in a swingable needle bar frame **10''**, houses the components for control of the transverse oscillations of the needle bar within the generally horizontally extending bracket arm **11** of the sewing machine which are normally covered by a cover plate **12** overlying the chamber within the bracket arm **11** within which the parts are housed. The various zigzag stitches which are to be produced by differing transverse oscillations of the needle bar frame, which are indicated diagrammatically on the pattern plate shown in FIGURE 9 and indicated by the reference character **13**, are established by a group of transversely aligned pattern cams, indicated as a group by the reference character **14** and bearing individual reference characters **14***a* to **14***j*. The pattern cams **14** are arranged in side-by-side fashion on a common axis extending parallel to the longitudinal axis of the bracket arm **11**, by which a large number of cams can be accommodated within the bracket arm of a sewing machine of standard size, and are supported for axial displacement and rotation on an elongated splined shaft **15** having ribs **16** projecting from the periphery thereof. The splined shaft **15** is journalled in suitable bearings, as indicated at **17**, anchored to the sewing machine bracket arm **11**, and is driven through a vertically extending worm gear unit **18** from the main drive shaft **19** of the sewing machine. The group of pattern cams **14** are maintained in grouped relation by a cam housing or carriage **20** having a convexly curved outer wall **21** and a pair of end plates **22, 23** which are also suitably apertured to accommodate

the splined shaft 15 and permit the housing 20 and the pattern cams 14 to be axially shifted as a group along the splined shaft 15.

The cam housing 20 is spring biased toward the right as viewed in FIGURES 1, 2 and 10 by means of a coil spring 24 secured at one end to an anchoring stud 25 on the end plate 22 and at its other end to a suitable anchor on the bracket arm 11, and a carriage return handle 26 having a stem or anchoring member 27 fixed to the opposite end plate of the cam housing 20 projects through a suitable slot 28 in the front wall of the bracket arm 11 immediately above the plate 13 to permit manual return of the cam housing 20 and cams 14 from their right-hand limit position to their left-hand limit or start position against the action of the spring 24. A pointer 29 is also affixed to the carriage return handle 26 and depends therefrom in front of a stationary number-bearing indicator strip 30 and behind a viewing window 31 in the pattern plate 13 to visually indicate by registry with members on the indicator strip 30 the position of the cams 14 and cam housing 20 axially along the splined shaft 15.

The forward edge of the curved wall 21 of the cam housing 20 is provided with a horizontal, forwardly projecting flange 32 having a group of ratchet teeth 33 extending substantially along the entire length of the cam housing 20, which cooperates with a pawl assembly 34 to establish step-wise movement of the group of cams 14 along the splined shaft 15 through increments equal to the width of one pattern cam. The pawl assembly 34 functions like an escapement mechanism and includes a primary holding pawl 35 which is formed of the rearmost leg of a bifurcated or forked vertical portion of an angle-shaped member 36, which is secured to a supporting block 37 pivoted on a fixed axis such as the pin 38 to a bearing block 39 anchored to the sewing machine bracket arm 11. The pivoted supporting block 37 and primary holding pawl 35 are continuously urged in a clockwise direction as viewed in FIGURES 4 and 5 toward the ratchet teeth 33 by means of a coil spring 40. The primary holding pawl 35 normally interfits into the ratchet teeth 33 and assumes the position shown in FIGURES 1, 4, 6 and 10 of the drawings to hold the cam housing 20 and pattern cams 14 against movement by the spring 24. A pattern selector key 41 has a stem 42 extending through a vertically elongated slot 43 in the front plate 13*a* of bracket arm 11 and is fixed to the pivoted supporting block 37, as by being keyed to a shaft or pin 44 extending through the block 37 at a position spaced radially from the pivot pin 38 whereby the pivoted supporting block 37 and primary holding pawl 35 will be rocked in a counter-clockwise direction away from the ratchet teeth 33 on depression of the pattern selector key 41.

In order to limit the movement of the cam housing 20 and pattern cams 14 to step-wise movement through the width of one cam under the influence of the spring 24 when the primary holding pawl 35 is released from the ratchet teeth 33, a secondary stop pawl 45 is provided, which is pivoted on a depending pivot pin or screw 46 to a supporting platform 47 anchored to the bracket arm 11 and is controlled by a control lever 48, also pivotally supported about on the pivot pin 46. The control lever 48 projects through the slot 49 formed in the vertical portion of the angle-shaped member 36 forming the primary holding pawl 35, whereby the control lever 48 will be pivoted in a clockwise direction as viewed in FIGURE 6 upon depression of the pattern selector key 41 and withdrawal of the primary holding pawl 35 from the ratchet teeth 33. The control lever 48 has a curved working surface 50 on the tail portion thereof overlying the secondary pawl 45, which normally engages a pin 51 projecting upwardly from the secondary pawl 45 to force the secondary pawl 45 in a counter-clockwise direction about the pivot 45 a sufficient distance to space the tip of the secondary pawl 45 out of the path of the ratchet teeth 33. However, when the primary holding pawl 35 is shifted to withdraw the pawl 35 from the ratchet teeth 33, the control level 48 extending through the slot 49 is rotated in a clockwise direction as viewed in FIGURE 6, shifting the working surface 50 thereof through a sufficient range of movement to permit the secondary stop pawl 45 to be forced by its biasing spring 52 between a pair of ratchet teeth 33 to restrain axial movement of the cam housing 20 along the splined shaft 15 to a distance less than the width of one of the cams 14. Then, upon release of the pattern selector key 41 and movement of the primary holding pawl 35 toward the ratchet teeth 33 under the influence of the coil spring 40, the counter-clockwise movement of the control lever 48 as viewed in FIGURE 6 will cause the working surface 50 thereof to shift the pin 51 and secondary stop pawl 45 in a direction to withdraw the secondary stop pawl 45 from between the ratchet teeth 33 and permit the next successive ratchet teeth 33 to the left of the primary holding pawl 35 to butt against the holding pawl 35.

A single cam follower lever 53 is pivoted at 54 to the sewing machine bracket arm 11 and is provided with a nose 55 projecting toward the peripheries of the pattern cams 14 to bear against one of the cams 14 which is aligned with the cam follower 53 transversely of the axis of the splined shaft 15, and effect oscillation of the cam follower 53 in accordance with the profile of the associated cam 14. A link 56 interconnects the tail portion 57 of the cam follower with the pivoted supporting block 37 at a point eccentric to the pivotal axis of the block 37, for example at the pin 44, so that shifting of the supporting block 37 by depression of the pattern selector key 41 to the position illustrated in FIGURE 5 rotates the cam follower 53 in a clockwise direction about its pivot 54 to withdraw the nose 55 of the cam follower lever from the path of the cams 14.

In order to effect transmission of the motion imparted to the cam follower lever 53 by the profile of the associated pattern cams to the needle bar frame to effect transverse vibration or oscillation of the needle bar frame, the tail 57 of the cam follower also bears against a rigid pin 58 projecting from a pivoted guide block 59, which is pivoted to the bracket arm 11 for rotation about a pivot indicated at 60 and has a slightly curved guideway 61 therein. The pivoted guide block 59 is resiliently biased in a clockwise direction as viewed in FIGURE 1 by means of a coil spring 62 anchored at one end to the sewing machine bracket arm 11 and connected at the other end to the pivoted guide block 59 at a point remote from the pivot 60. A sliding element 63 fits into the guideway 61 in the top surface of the guide block 59 for movement along the path of the guideway 61 to assume different eccentric positions relative to the axis of rotation of the guide block 59. A connecting link 64 is secured at one end to the sliding element 63 and at its other end to the pitman 65 which is connected to the needle bar frame 10" in a conventional manner. Connected to the link 64 is another link 66 which is coupled to the arm 67 extending from the base of a beveled sector gear 68 supported on a suitable pivot post 69 rising from the bracket arm 11. The sector gear 68 and its associated elements comprise amplitude adjustment means for establishing the amplitude of vibration of the needle bar frame. The sector gear 68 is adjusted by means of a bevel gear 70 fixed onto a shaft 71 journalled in and extending through the front plate of the bracket arm 11 having an adjusting knob 72 keyed to the exterior end of the shaft 71. A pointer 73 is fixed to the adjusting knob 72 rearwardly of the pattern plate 13 and overlies an indicator plate 74 having numbers thereon visible through a window 75 to indicate the angular adjustment of the knob 72.

In the operation of the above-described mechanism, it will be apparent that rotation of the pattern cams 14 by the drive coupled to the splined shaft 15 from the main drive shaft 19 will effect oscillation of the cam follower 53 about its pivot 54 in accordance with the profile of

the particular pattern cam engaged by the nose 55 of the cam follower 53. The resulting oscillations of the tail 57 of the cam follower lever 53 are transmitted to the pin 58 of the guide block 59 to oscillate the guide block 59 about its pivot 60. If the sliding element 63 is disposed eccentric to the pivot 60, the link 64 and pitman 65 are reciprocated to transversely oscillate the needle bar frame through an amplitude determined by the eccentric position of the sliding element 63. It will be apparent that adjustment of the knob 72 will rotate the sector gear 68 in accordance with rotation of the bevel gear 70 to shift the arm 67 and links 66 and 64 to draw the sliding element 63 to the desired position along the guideway 61 to effect the desired amplitude adjustment.

When it is desired to select another pattern cam identified by a number of higher rank, the operator need only depress the pattern selector key 41 an appropriate number of times to step the cam housing 20 and group of cams 14 through a number of cam widths or steps to position the pointer 29 in registry with the number on the indicator strip 30 designating the particular pattern cam to be selected. The depression of the pattern selector key 41 operates to withdraw the primary holding pawl 35 from engagement with the ratchet teeth 33 and project the secondary stop pawl 45 into position to limit movement of the cam housing 20 under influence of the spring 24 to a distance less than the width of one pattern cam, and release of the pattern selector key 41 withdraws the secondary stop pawl 45 and advances the primary holding pawl 35 relative to the ratchet teeth 33, all in the manner previously described in detail.

In order to select a pattern cam designated by a number of lower numerical rank than the one on which the pointer 29 is standing, the pattern selector key 41 should be depressed, and the carriage return handle 26 grasped and shifted to the left as viewed in FIGURE 1 to draw the cam housing 20 against the action of the spring 24 fully to the start or left hand limit position. The cam housing 20 is then stepped to position the pointer 29 in registry with the desired lower rank number by successive depressions of the pattern selector key 41.

By means of this construction, precise and accurate selection of any one of a large number of pattern cams to be followed and adjustment of the amplitude of vibration of the needle bar frame are effected by means of a relatively simple mechanism which is particularly suitable to operation by unskilled persons. By means of the escapement mechanism, the device insures accurate and precise mechanical regulation of the stepping of the cam pack and can be accomplished readily by the operator with only minimum or negligible distraction from the sewing operation. Due to the stepping mechanism provided, the operator does not have to be concerned with careful regulation of the range of movement of the hand or of the external facility which must be manipulated to effect selection of the proper pattern cam. Also, by this particular arrangement of the cams and cam follower, the cam follower remains at a fixed station and the cams move relative to that station so that a uniform angular relationship between the cam follower and the cam which it is tracking is maintained.

While but one preferred example of the present invention has been particularly shown and described, it is apparent that various modifications may be made therein within the spirit and scope of the invention, and it is desired, therefore, that only such limitations be placed on the invention as are imposed by the prior art and set forth in the appended claims.

What is claimed is:

1. In an ornamental stitch sewing machine for selectively producing a plurality of stitch patterns including a hollow frame, a needle mounted on said frame for endwise reciprocation and for lateral movements transversely of the direction of reciprocation, an elongated cam shaft supported within said frame, a cam follower pivotally supported at a fixed station within said frame alongside said cam shaft, a plurality of rotary pattern cams mounted in side-by-side coaxial relation on said cam shaft, means for rotating said cams simultaneously about the axis of said cam shaft, and means for communicating movements of said cam follower to the needle to impart lateral swinging movements to the needle in response to movement of the cam follower by the pattern cam engaged thereby; the improvement comprising operator controlled means for shifting the plurality of cams as a group axially in one direction along said cam shaft in stepwise increments corresponding to the width of one cam to dispose one cam after another in radial alignment with the cam follower to enable a selected cam to be engaged by the cam follower, said operator controlled means including a reciprocative stepping key extending externally of said frame to effect axial movement of said cams through one of said increments upon one depression and release of said stepping key, means for returning the cams axially along said cam shaft in the opposite direction to dispose the leading cam relative to said first-mentioned direction in radial alignment with the cam follower, means responsive to actuation of said stepping key for withdrawing said cam follower radially from said cams during axial movement of the cams along said cam shaft.

2. In an ornamental stitch sewing machine for selectively producing a plurality of stitch patterns including a hollow frame, a needle mounted on said frame for endwise reciprocation and for lateral movements transversely of the direction of reciprocation, an elongated cam shaft supported within said frame, a cam follower pivotally supported at a fixed station within said frame alongside said cam shaft, a plurality of rotary pattern cams mounted in side-by-side coaxial relation on said cam shaft, means for rotating said cam simultaneously about the axis of said cam shaft, and means communicating movements of the cam follower responsive to the pattern cam periphery to the needle to impart lateral swinging movements to said needle; the improvement comprising operator-controlled means for shifting said plurality of pattern cams as a group axially along said cam shaft axis in an advance direction and a return direction between limit positions disposing the endmost cams of the group of pattern cams in radial alignment with said cam follower, said operator-controlled means including means limiting movement of said plurality of cams in the advance direction to stepwise increments corresponding to the width of one cam to dispose one cam after another in precise radial alignment with the cam follower comprising means for resiliently urging the group of cams axially along said cam shaft in said one direction, an escapement mechanism coacting with said group of cams including a pawl to normally restrain movement of said cams by the resilient means and maintain the cams in selected conditions of radial alignment with the cam follower, said pawl being shiftable responsive to movement of said operator-controlled means to withdraw the pawl from holding relation with the cams and return the pawl into said holding relation, and means coacting with said pawl to restrict axial movement of the cams by the resilient means to a fraction of one of said increments while the pawl is released from the cams, means for releasably locking the group of cams against axial displacement to maintain selected adjustments of said pattern cams in alignment with said cam follower, and means for withdrawing said cam follower radially from the cam peripheries during axial movement of the cams along the cam shaft.

3. In an ornamental stitch sewing machine, the combination recited in claim 1 wherein said means for shifting the cams in stepwise increments in one direction includes spring means for resiliently urging the group of cams axially along said cam shaft in said one direction, an elongated series of ratchet teeth for controlling the position of said cams axially along said cam shaft, and an escapement mechanism coacting with said ratchet teeth

including a primary pawl normally interfitted with said ratchet teeth to restrain movement of said cams by said spring and maintain the cams in selected conditions of radial alignment with the cam follower, said primary pawl being shiftable responsive to reciprocation of said stepping key to withdraw the primary pawl from engagement with said ratchet teeth and return the primary pawl into holding relation with the ratchet teeth, and a secondary pawl responsive to movement of said primary pawl to project into the path of the ratchet teeth when the primary pawl is withdrawn therefrom and restrain axial movement of the cams under influence of the spring to a distance less than one of said stepwise increments and to withdraw from the ratchet teeth upon return of the primary pawl into holding relation to the ratchet teeth.

4. In an ornamental stitch sewing machine, the combination recited in claim 1 wherein said means for shifting the cams in stepwise increments in one direction includes spring means for resiliently urging the group of cams axially along said cam shaft in said one direction, a cam housing for said pattern cams slidably supported on said cam shaft for axial movement thereon including a pair of end plates maintaining said plurality of cams as a group therebetween and a flange member extending between said end plates and spaced radially from said cams having an elongated series of ratchet teeth thereon for controlling the position of said cams axially along said cam shaft, and an escapement mechanism supported at a fixed station in said frame to engage said ratchet teeth including a primary pawl normally interfitted with said ratchet teeth to restrain movement of said cam housing and cams by said spring and maintain the cams in selected conditions of radial alignment with the cam follower, said primary pawl being shiftable responsive to reciprocation of said stepping key to withdraw the primary pawl from engagement with said ratchet teeth and return the primary pawl into holding relation with the ratchet teeth, and a secondary pawl responsive to movement of said primary pawl to project into the path of the ratchet teeth when the primary pawl is withdrawn therefrom and restrain axial movement of the cams under influence of the spring to a distance less than one of said stepwise increments and to withdraw from the ratchet teeth upon return of the primary pawl into holding relation to the ratchet teeth.

5. In an ornamental stitch sewing machine for selectively producing a plurality of stitch patterns including a hollow frame having an elongated horizontal bracket arm, a needle mounted on said frame for endwise reciprocation and for lateral movements transversely of the direction of reciprocation, a rotary drive shaft mounted in said frame for reciprocating said needle, means for rotating said drive shaft, an elongated cam shaft supported for rotation within said bracket arm and extending in parallelism with the longitudinal axis of said bracket arm, means interconnecting said cam shaft with said main shaft for rotating said cam shaft, a cam pack comprising a plurality of pattern cams mounted in side-by-side coaxial relation on said cam shaft for sliding movement as a group along the axis of said cam shaft, means interconnecting said plurality of cams with said cam shaft to be rotated in unison by said cam shaft, the periphery of each of said cams being configurated to produce a different stitch pattern, a cam follower pivotally supported at a fixed station in said bracket arm, said cam follower having a single cam engaging head adapted to engage and respond to the peripheral surface of any one of said plurality of cams, means normally urging said cam engaging head toward the peripheral surface of the cam in radial alignment therewith to track the associated cam surface, and means connecting said cam follower with the needle to impart lateral swinging movements to said needle in response to movement of the cam follower by the pattern cam engaged thereby; the improvement comprising spring means for urging said plurality of cams as a group axially along said cam shaft in a first direction, escapement means restricting movement of said cams in said first direction to stepwise increments equal to the width of one cam, a stepping key extending externally of the frame and movable to activate said escapement means to position one pattern cam after the other in radial alignment with said cam follower, means for returning said plurality of cams as a group in the opposite direction along said cam shaft to a limit position disposing the leading cam relative to said first direction in radial alignment with said cam follower, means releasably locking said cam pack against movement from any of the positions of axial adjustment thereof disposing any selected one of said pattern cams in radial alignment with said cam follower, and means interconnected with said stepping key for withdrawing said cam engaging head from and radially of the cam periphery aligned therewith upon actuation of said stepping key during axial shifting of the cams.

6. In an ornamental stitch sewing machine, the combination recited in claim 5, including an elongated series of ratchet teeth extending alongside said cam pack and interconnected with the cam pack to regulate the position thereof along said cam shaft, said escapement mechanism comprising a pawl pivotally supported at a fixed station in said bracket arm to normally interfit with said ratchet teeth and restrain movement of the ratchet teeth and cam pack by said spring to maintain the pattern cams in selected conditions of radial alignment with the cam follower, means intercoupling said pawl with said stepping key to withdraw said pawl from holding relation with said ratchet teeth in response to depression of said stepping key and to return said pawl into holding relation with the ratchet teeth upon release of said stepping key, and means coacting with said pawl to restrict axial movement of the cam pack by said spring to a fraction of one of said increments while the pawl is released from the cams.

7. In an ornamental stitch sewing machine, the combination recited in claim 5, including an elongated series of ratchet teeth extending alongside said cam pack and interconnected with the cam pack to regulate the position thereof along said cam shaft, said escapement mechanism comprising a primary pawl pivotally supported at a fixed station in said bracket arm to normally interfit with said ratchet teeth and restrain movement of said ratchet teeth and cam pack by said spring for maintaining the pattern cams in selected conditions of radial alignment with the cam follower, means intercoupling said primary pawl with said stepping key to shift the primary pawl in response to reciprocation of the stepping key to withdraw the primary pawl from engagement with said ratchet teeth and return the primary pawl into holding relation with the ratchet teeth, and a secondary pawl intercoupled with said primary pawl to respond to movements thereof to project into the path of the ratchet teeth when the primary pawl is withdrawn therefrom and restrict axial movement of the ratchet teeth and cams under influence of the spring to a fraction of one of said stepwise increments and to withdraw from the ratchet teeth upon return of the primary pawl into holding relation to the ratchet teeth.

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