June 28, 1966 FUJI KOIKE 3,257,980

CAM SELECTING MECHANISM FOR SEWING MACHINES

Filed May 29, 1956 5 Sheets-Sheet 1

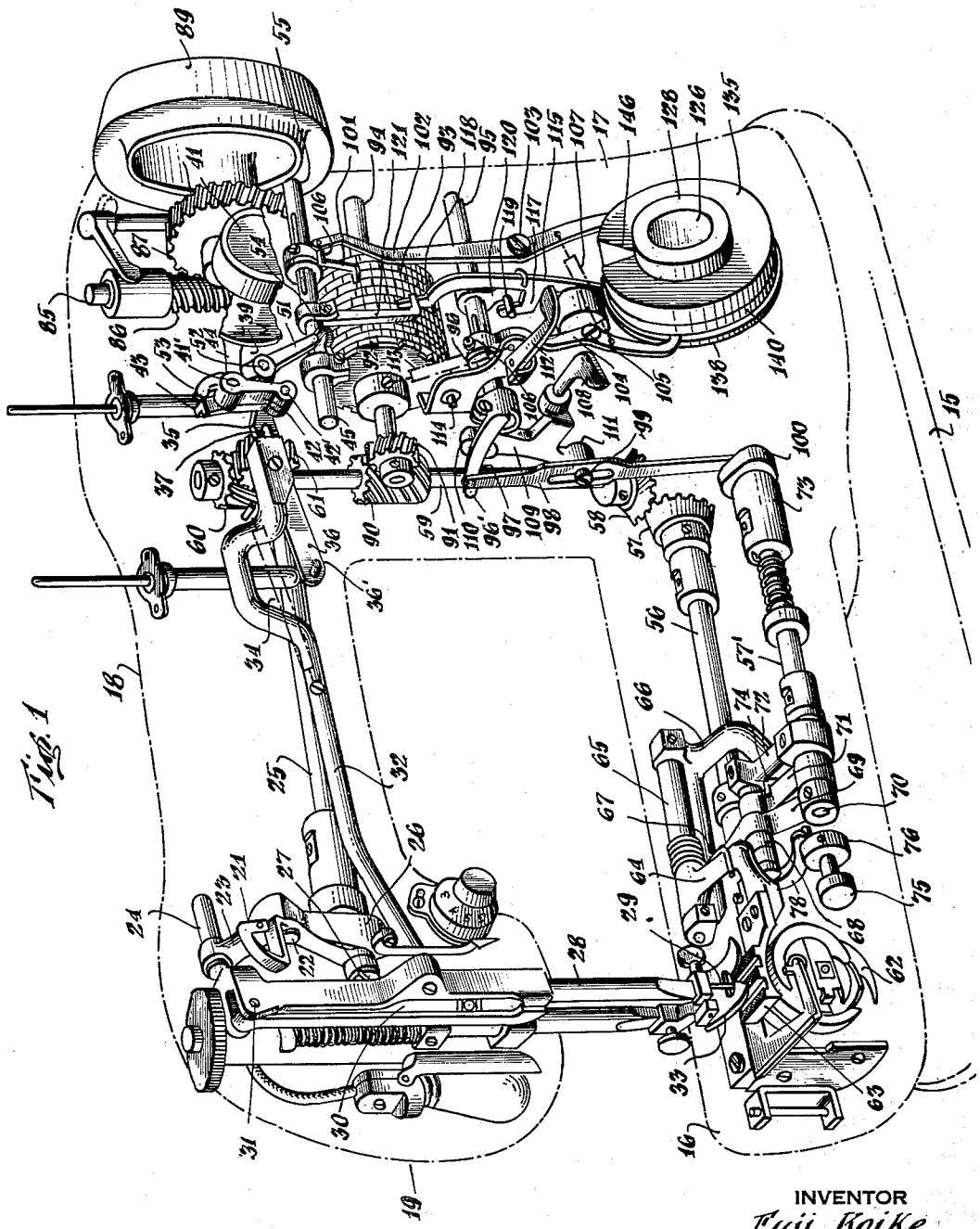


Fig. 1

INVENTOR
Fuji Koike
BY
Kane, Dalsemer & Kane
ATTORNEYS

June 28, 1966 FUJI KOIKE 3,257,980

CAM SELECTING MECHANISM FOR SEWING MACHINES

Filed May 29, 1956 5 Sheets-Sheet 2

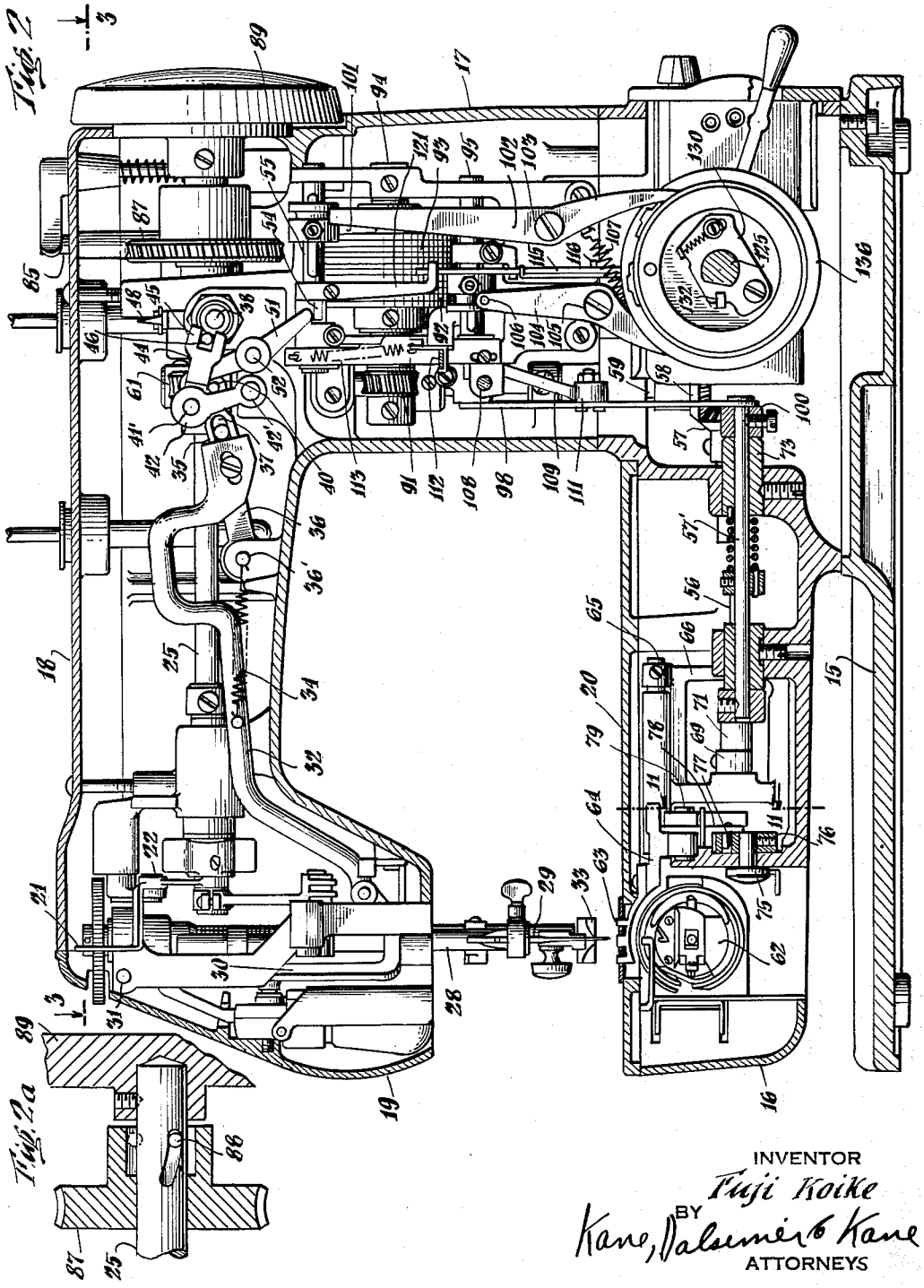


Fig. 2

Fig. 2a

INVENTOR
Fuji Koike
BY
Kane, Dalsemer & Kane
ATTORNEYS

June 28, 1966 FUJI KOIKE 3,257,980

CAM SELECTING MECHANISM FOR SEWING MACHINES

Filed May 29, 1956 5 Sheets-Sheet 3

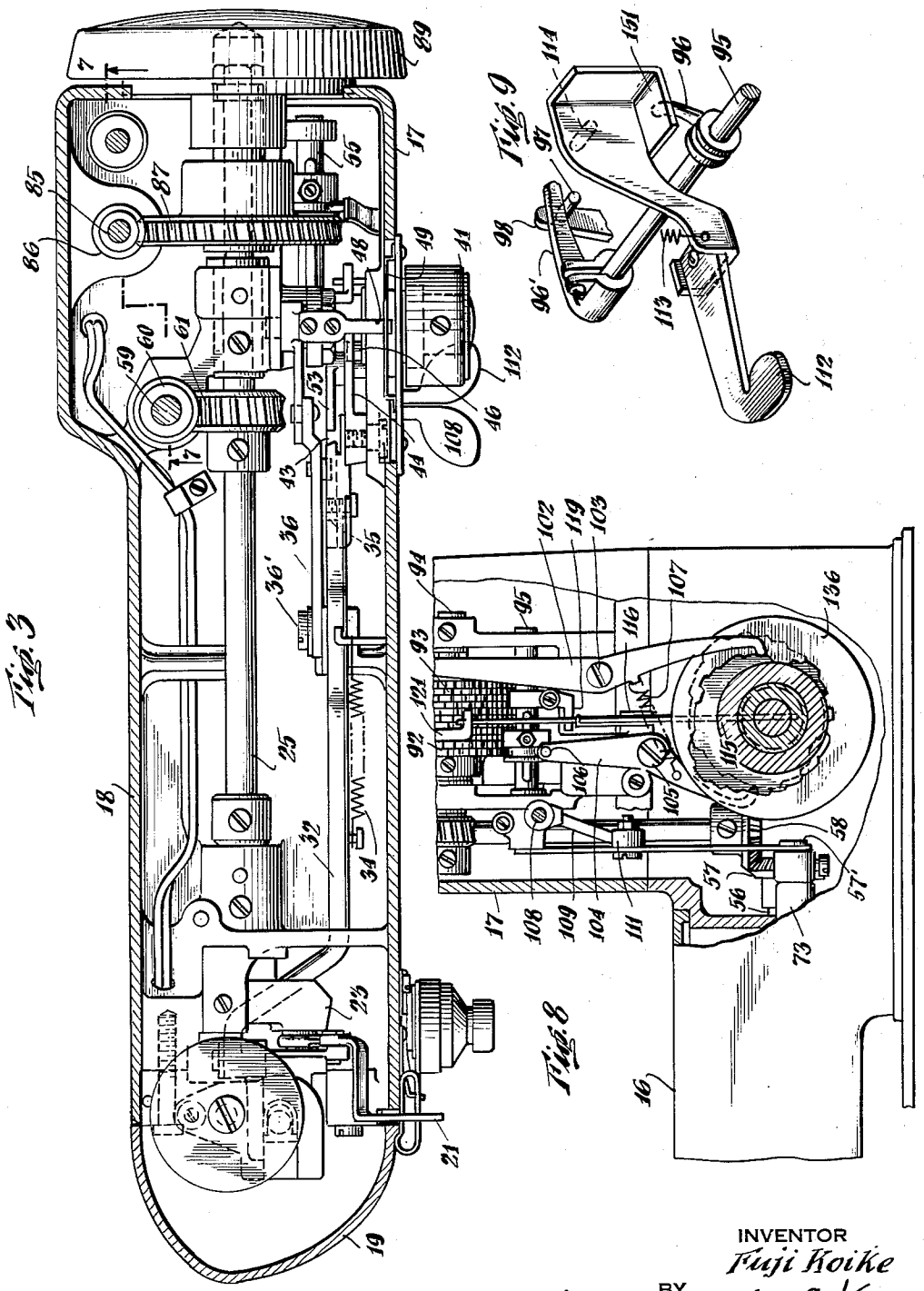


Fig. 3

Fig. 9

Fig. 8

INVENTOR
Fuji Koike
BY
Kane, Dalsimer & Kane
ATTORNEYS

June 28, 1966 FUJI KOIKE 3,257,980

CAM SELECTING MECHANISM FOR SEWING MACHINES

Filed May 29, 1956 5 Sheets-Sheet 4

Fig. 11

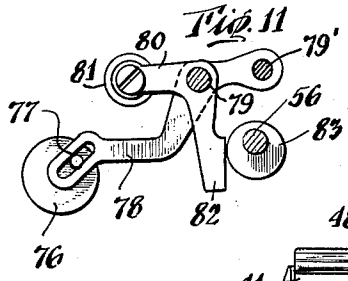


Fig. 4

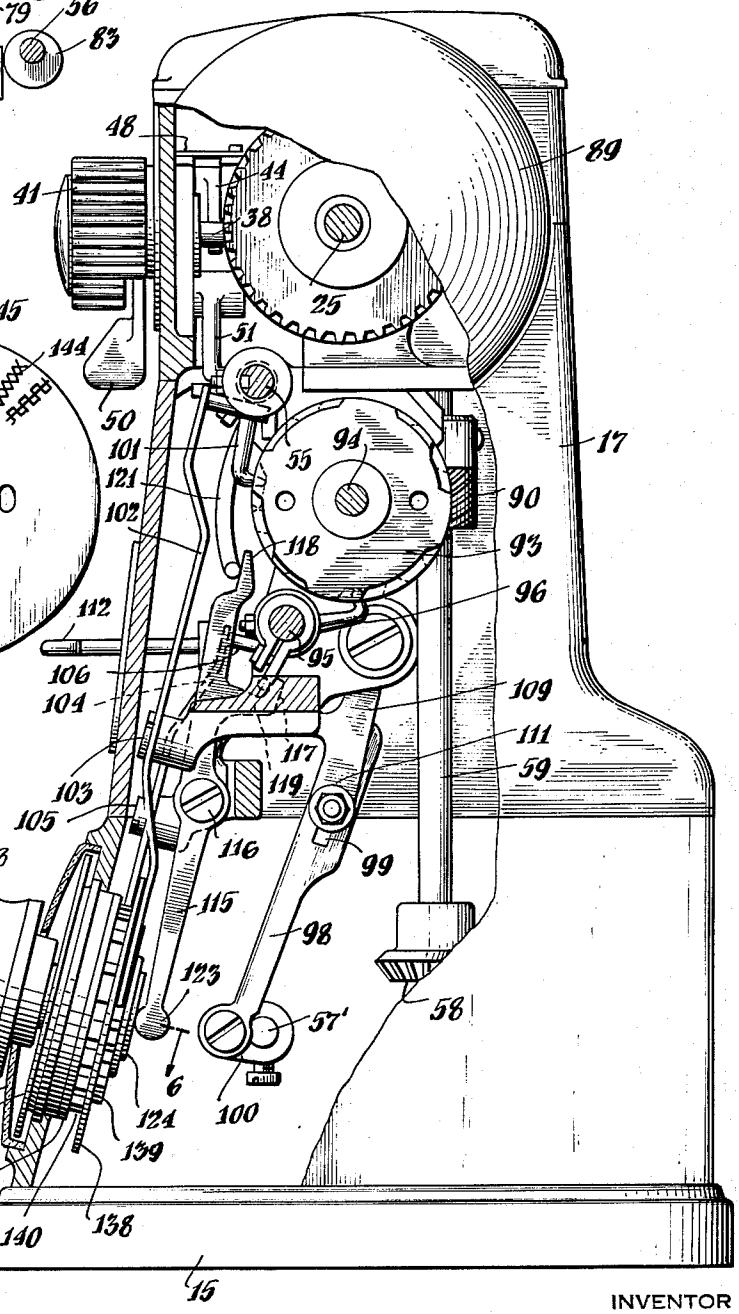
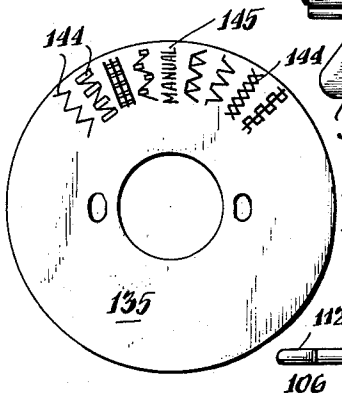


Fig. 5



INVENTOR
Fuji Koike

BY
Kane, Dalsimer & Kane
ATTORNEYS

June 28, 1966 FUJI KOIKE 3,257,980

CAM SELECTING MECHANISM FOR SEWING MACHINES

Filed May 29, 1956 5 Sheets-Sheet 5

Fig. 7

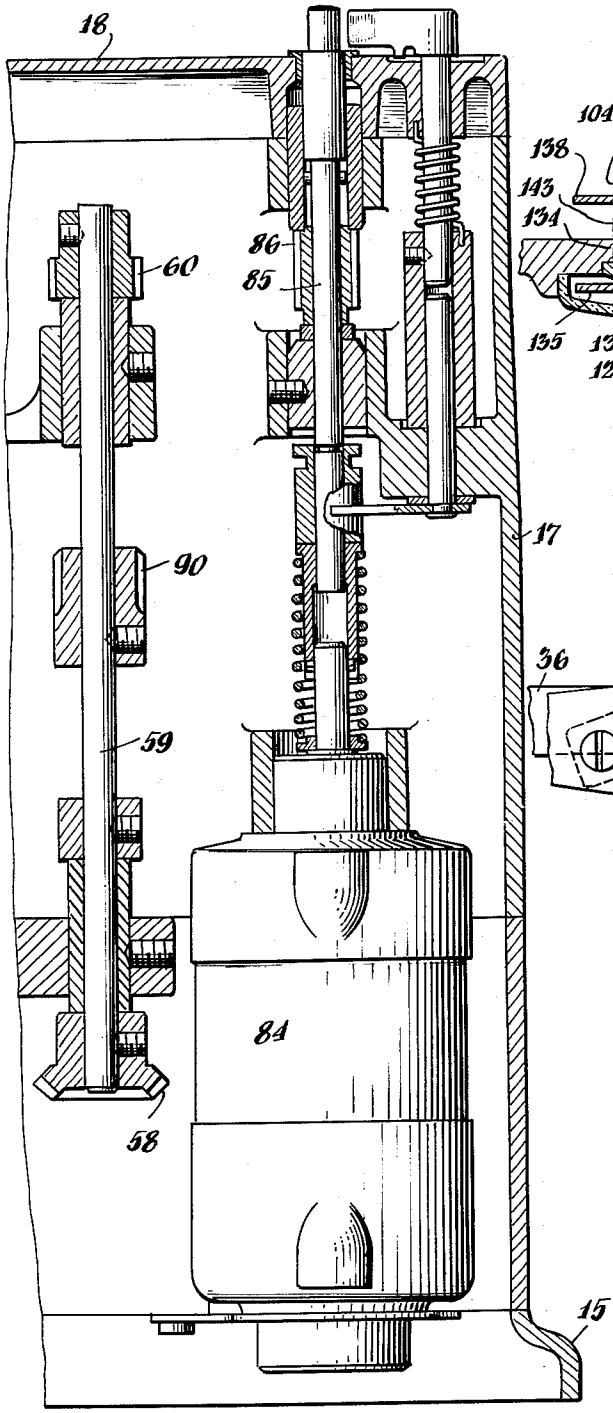


Fig. 6

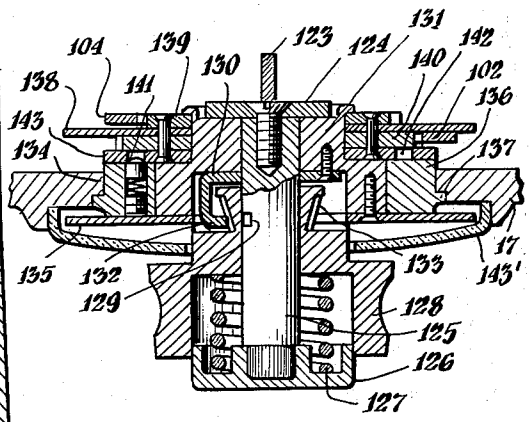


Fig. 10

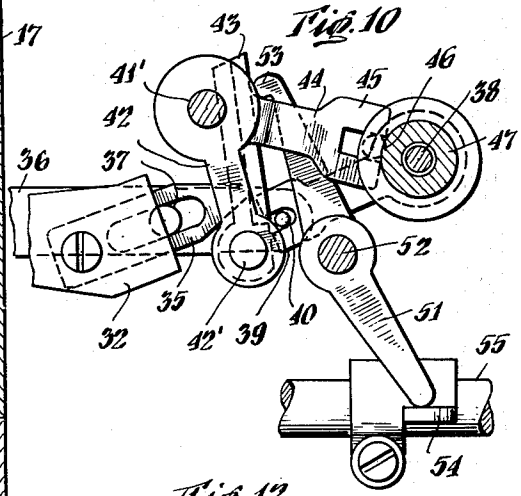
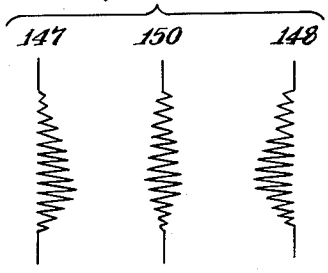


Fig. 12



INVENTOR
Fuji Koike
BY
Kane, Dalsemer & Kane
ATTORNEYS

United States Patent Office 3,257,980
Patented June 28, 1966

3,257,980

CAM SELECTING MECHANISM FOR SEWING MACHINES

Fuji Koike, Nagoya, Japan, assignor to Brother Industries, Ltd., Horita-dori, Mizuho-ku, Nagoya, Japan, a corporation of Japan

Filed May 29, 1956, Ser. No. 588,070
Claims priority, application Japan, June 2, 1955, 30/15,087; Oct. 29, 1955, 30/28,473
9 Claims. (Cl. 112—158)

This invention relates to improvements in zigzag sewing machines and especially to a cam-selecting mechanism forming part of such machines.

Zigzag sewing machines are known wherein the lateral rocking movement of the needle bar is controlled by a cam selected from a group of cams. Machines of this type are also known in which a more complicated stitch pattern is produced by controlling the material feed movement as well as the needle bar lateral movement. It is also theoretically possible to control direction as well as the rate of the material-feeding movement by a further cam selected from another series of cams. Such an arrangement is impractical, however, because of the complicated mechanisms and operations involved. In addition, undesidable combinations could not be avoided, when separate cam-selecting means are provided for needle-bar-controlling cam groups and for material-feed-movement control cams.

It is therefore an object of the present invention to provide a zigzag sewing machine of improved type, which, although simple and easy to operate, is highly compact in its design, despite the fact that it is provided with two groups of cams for said dual control purposes.

Thus, according to the present invention there is provided a zigzag sewing machine including a needle bar assembly, material feed mechanism and two groups of cams. The material feed mechanism is controllable both as to direction of feed and rate of feed by a cam follower engaging a cam selected from one of these groups. The lateral rocking movement of the needle bar assembly is controllable by a cam follower engaging a cam selected from the second group of cams. A single manually and readily operable control assembly is provided which serves to select one of a predetermined number of combinations of a cam from each group. These exercise their respective controlling functions and thus produce a predetermined and desired stitch pattern.

Preferably, the control assembly includes a rotatable dial assembly and a pointer by reference to which the assembly may readily be set to select a desired predetermined stitch pattern.

The cam followers may be slidably mounted for movement relative to the groups of cams. The assembly further includes means to retract the cam followers from engagement with the cams, thus enabling the cam followers to be easily moved without interference to a newly selected position. Moreover, it is preferred that the assembly include a structure preventing the cam followers from being moved without having first been retracted from engagement with the cams. Accordingly, the cam-selecting means is rendered foolproof against manipulations such as might cause serious damage to the mechanisms.

It is also preferred to include further control means for increasing and decreasing the rate of the material-feeding movement, in order to enhance the versatility of the machine.

The selection of a predetermined combination of a cam from each group may conveniently be achieved, in accordance with the present teachings, by means of a control assembly cam.

With these and other objects in mind, reference is had to the attached sheets of drawings illustrating practical embodiments of the invention and in which:

FIG. 1 is a prespective view of the essential parts of a sewing machine mechanism and including one form of the present teachings;

FIG. 2 is a sectional front view of the assembly;

FIG. 2A is a fragmentary sectional view of one desirable form of coupling which is included in the mechanism;

FIG. 3 is a sectional plan view taken along the line 3—3 in the direction of the arrows as indicated in FIG. 2;

FIG. 4 is an end view of the apparatus with certain of the parts broken away to disclose underlying construction;

FIG. 5 is a face view of the dial or control by means of which an operator may adjust the positions of the components of the mechanism;

FIG. 6 is a transverse sectional view taken along the line 6—6 in the direction of the arrows as indicated in FIG. 4;

FIG. 7 is a similar view taken along the line 7—7 in the direction of the arrows as indicated in FIG. 3;

FIG. 8 is a fragmentary and partly sectional side view of those parts of the mechanism which are disposed adjacent the control dial;

FIG. 9 is a fragmentary perspective view of certain details of that control mechanism;

FIG. 10 is a fragmentary sectional view in enlarged scale of the components of the amplitude control;

FIG. 11 is a sectional side view of a coupling assembly embodied in the apparatus; and

FIG. 12 is a fragmentary face view of a portion of material with stitching embraced therein.

Referring primarily to FIGS. 1 and 2, there has been indicated at **15** a base portion, which is extended to provide a casing part **16**. Within and above this the usual platform or deck housing the shuttle and feed mechanisms is positioned. The usual casing **17** extends upwardly from base **15** adjacent one end of the assembly. An arm **18** of the casing extends generally parallel to and overlying the base **15** at the upper end of part **17**. This arm terminates in a casing head part **19**, from which the needle bar **28** extends downwardly. The casing portion **16** supports the plate **20** which covers its upper face. That plate is provided with the usual openings, through which the feed mechanism extends substantially in line with the path of movement of the bar and the needle carried thereby.

Adjacent the head portion **19** of the casing assembly, the thread take-up lever **21** is mounted to have its outer end move to a position beyond that casing. This lever is supported intermediate its ends by a pivot **22** extending from a link **23**, in turn supported by a shaft **24** fixed to the casing **19**. An operating shaft **25** is mounted for rotation within casing portion **18** and supports adjacent the head **19** a crank **26**. By means of a crank pin **27**, the thread take-up lever is connected to rock with respect to link **23** as shaft **25** turns. This pin is also connected to needle bar **28** which supports needle **29**. The latter is supported for vertical movement within a guide **30**. Such guide is, in turn, pivotally supported as at **31** and connected to a bar **32** extending length-wise of casing portion **18**. It is apparent that when bar **32** is reciprocated, the guide **30** will be rocked with respect to its point of support **31**. Consequently, as bar **28** reciprocates, it may simultaneously be oscillated through a limited arc extending in a lateral direction.

A presser foot **33** is disposed adjacent the station at which the needle **29** moves. That foot is formed with a laterally extending slot of sufficient length to permit

entry and withdrawal of the needle 29 within the limits of its oscillating movement as imparted to it by bar 28.

The bar or link 32 is normally maintained in retracted position to the right (as viewed in FIGS. 1 and 2) by means of a spring 34. A nosepiece 35 is secured to the end bar or link 32; attention also being invited to FIG. 10. A link 36 has one end pivotally mounted as at 36' within the casing extension 18. Its body extends adjacent the nosepiece 35 and slidably supports the latter by, for example, a pin and slot coupling 37. A shaft 38 supports a forked member 39 (FIG. 10) disposed at the end of an arm secured to that shaft. The legs of the forked portion 39 receive between them a pin 40. This pin is attached to the end of arm 36. A knob 41 (FIG. 4) is supported for rotation with shaft 38 outside the casing. When this knob is oscillated, it will turn shaft 38 and rock forked member 39. This will raise and lower the free inner end of link 32 and the nosepiece 35 carried thereby.

Pivotally supported (FIG. 10) as at 41' is a bell crank lever, one arm 42 of which extends downwardly and mounts a pivot 42'. The lower end of the latter carries the lower end of a track member 43. Nosepiece 35 bears against this track or guide 43. The second arm 44 of the bell crank lever terminates in a forked portion 45. Within the space defined between the arms of the latter, a pin 46 is disposed. That pin is carried by a hub 47 encircling shaft 38 and rotatable with respect thereto. As shown particularly in FIGS. 3 and 4, a pointer or indicating element 48 is attached to that end of member or arm 39 which is secured to shaft 38. This element in cooperation with suitable indicia displayed upon a plate 49 will register the position to which forked member 39 has been shifted by actuation of knob 41.

An actuator such as 50 (see FIG. 4) is connected to hub 47. Therefore, with the former being shifted, that hub will rotate within a limited arc. So rotating, its pin 46 will shift arm 44 around pivot 41' to correspondingly shift arm 42 and pivot 42' of track member 43. Again any suitable register or indicating structure may be provided so that an operator will be readily aware of the position assumed by the parts incident to a shifting of actuator 50.

A lever 51 (FIG. 10) is pivotally supported as at 52 by the casing. The end of this lever terminates in a contact portion 53, bearing against the rear face of the rail or guide element 43. The opposite end of this lever bears against a ledge 54 secured to and extending laterally of a shaft 55. Assuming that the latter is rocked, it will be apparent that the abutment or ledge 54 bearing against lever 51 will rock its lower end around pivot 52. Therefore, its contact portion 53 will be similarly moved. When shifted in a counter clockwise direction this contact portion 53 will cause rail or guide element 43 to be similarly rocked around its point of pivotal support 42'. Therefore, nosepiece 35 will be shifted to the left. With such shifting, link 32 will be likewise shifted against the urging of spring 34. When lever 51 is no longer urged upwardly by ledge or abutment 54, but rather shaft 55 has rocked so that the lower end of this lever may move in a clockwise direction, its upper end will move similarly. This will permit rail or guide element 43 to shift in an identical manner due to the fact that nosepiece 35 is pressed against this element because of the action of spring 34 connected to link 32.

Assuming that lever 51 has a constant arc of oscillation, it will be understood that it will cause a constant rocking of guide or track member 43. However, according to the point of engagement of nosepiece 35 with that member, that nosepiece and link 32 will be reciprocated to a lesser or greater extent. Minimum movement of the link 32 will occur when the nosepiece is adjacent pivot 42' and maximum movement when it is adjacent the opposite end of member 43. When hub 47 is shifted to rock arm 44 of the bell crank lever and thus the second arm of the latter, pivot 42' will be shifted either towards pivot 52 or in the direction of link 32. As will be apparent, this provides an adjustment for the range of reciprocation of link 32. That range will be translated by shifting guide 30. Such shifting will occur under the action of track member 43 and the movement of the latter and the zone of reciprocation of link 32 will depend upon the position which bell crank lever 42–44 has assumed by the shifting of the actuator 50. The range or reciprocation of link 32 will, of course, depend upon the distance nosepiece 35 is removed from pivot 42'.

According to whether control 50 is to the left or right of its central position, needle bar 28 will be displaced to the left or right of its intermediate position, thus resulting in the stitch pattern occurring to the left or right of a central line. The function of the control 50 is illustrated in FIG. 12, wherein 150 shows the stitched formed with the control 50 in the intermediate position, while the stitch width control knob 41 is manipulated to first increase and then decrease the amplitude of the stitches. Reference numerals 147 and 148 show the result of setting the control 50 to the right and left, respectively, of its intermediate position.

Now returning to a consideration of FIG. 1, it will be seen that the numeral 56 indicates the feed-controlling shaft. This shaft is suitably supported within casing portion 16 and is rotated conveniently by having a gear 57 attached to its inner end. That gear meshes with the teeth of a gear 58 attached to a shaft 59, supported for rotation within casing portion 17. At this time, it will be noted that a gear 60 is attached to the upper end of shaft 59 and is driven by a gear 61 attached to shaft 25. Also, it will be noted that a shaft 57' which regulates the feed is disposed parallel to shaft 56 and within casing portion 16. The shuttle 62 is operatively connected by gearing (not shown) to be operated by a turning of shaft 56. This shuttle underlies the presser foot and needle station. Disposed above it is the usual feed element 63 serving to engage material disposed upon deck 20 and to shift that material as the needle bar 28 moves through its cycle of operation.

Element 63 is supported by an arm 64, fixed to or integral with a shaft 65 having its ends journalled in a bracket 66. Bracket 66 is pivotally supported in the housing at its lower end and a spring 67 bears with one end against this bracket and its opposite end against arm 64 to normally urge the latter and element 63 in a downward direction. The bracket 66 also provides an arm 68 to which there is pivotally connected a lever 69. The outer end of this lever rotatably supports a shaft 70. The opposite end of the lever bears against a horizontal feed cam (not shown) mounted by shaft 56 and acts as a follower in cooperation with the surfaces of that cam. A crank 71 is mounted at one end by shaft 70. At its opposite end, it supports a shaft connecting it with the adjacent end of a crank 72. The latter is connected to shaft 57'. A spring, one end of which is anchored in a housing portion 73 and the other end of which is adjustably fixed to shaft 57', urges said shaft to rotate in a direction such that the outer end of crank 72 is swung upward. A spring such as 74 may conveniently cooperate with the lever and crank assembly 69, 71 and 72 to urge the follower lever 69 downward onto the horizontal feed cam mounted on shaft 56. A manually rotatable knob 75 serves to elevate or retract the position of feed element 63. This is achieved (see FIGS. 1 and 11) by means of a crank disc 76 connected to that knob, which through a pin and slot connection 77 rocks the end of a lever 78. This lever, which is pivotally supported as at 79' by a wall of the housing, is pivotally connected as at 79 to a bell crank lever 80. The outer end of one arm of the latter carries a roller 81. The opposite end of that bell crank lever terminates in a contact portion 82 bearing against a vertical feed cam 83 mounted by shaft 56. It will be apparent that as the latter rotates, it will cause

similar movement on the part of cam 83 to rock bell crank lever 80 around its pivot 79.

As bell crank lever 80 is rocked by cam 83, roller 81 fixed on bell crank lever 80 moves up and down. The roller 81 is slidably engaged with the lower surface of arm 64 and supports the latter against the action of spring 67, which urges arm 64 and feed dog 63 in a downward direction. Therefore, as roller 81 moves up and down, feed dog 63 is also moved up and down independently of the horizontal reciprocating movement thereof, which will be explained in detail hereinafter.

By turning disc 76, lever 78 and thus pivot 79 are shifted, and this will alter the zone of the material feed controlled by the dog movement. In other words, feed dog 63 will be elevated or lowered according to the manner in which knob 75 is shifted to provide for "feed" or "drop" function.

The rocking motion imparted to lever 69 by the feed cam on shaft 56 results in a rocking motion of bracket 66, by displacement of the arm 68, to which the lever 69 is pivotally connected intermediate its ends. The amplitude as well as the direction of the rocking motion of the bracket 66 is determined by the position of the crank 72. The position of the crank 72 is determined by the rotation of the shaft 57'. When, however, the crank 72 is placed parallel to the lever 69 (that is, with the pivotal axis of link 71 and crank 72 coinciding with that of the lever 69 to the bracket 66), then no displacement of the arm 68 will take place upon rocking of the lever 69. Hence, only the vertical reciprocation of said feed dog, previously described, will take place, without any horizontal movement. When the crank 72 is elevated or lowered from this neutral position, the pivot point of the lever 69 to the bracket 66 is off-centered with respect to the pivot or axis of crank 72 and link 71; therefore, as the lever 69 rotates, the arm 68 is displaced and the bracket is rocked. Owing to the mounting of the feed dog on the bracket, this rocking of the bracket results in a horizontal movement of the feed dog, which combines with the vertical movement caused by cam 83. This combined movement of the feed dog will cause a forward or reverse feed movement to be imparted to the material placed between the presser foot and feed dog. The rate of feed, or the length of the feed movement, is proportional to the degree of off-centering of crank 72 from its neutral position. The direction of the feed movement will be determined accordingly as crank 72 is elevated or lowered from the neutral position.

A motor 84 as in FIG. 7 is disposed to rotate drive shaft 85. The latter supports a gear 86. The teeth of that gear mesh with a gear 87. That gear is mounted upon shaft 25 by means of a uni-directional clutch structure indicated at 88 in FIG. 2A. Attached to the outer end of shaft 25 is fly wheel 89. It follows that as the latter is turned, shaft 25 is turned. Likewise, when gear 87 is rotated in one direction, both that shaft and the fly wheel will be rotated. However, if shaft 25 is deliberately moved in an opposite direction, then clutch structure 88 will release to prevent a rearward driving of gears 87 and 86 as well as shaft 85 and the mechanism of motor 84.

It will be noted that shaft 59 mounts a gear 90. This gear meshes with teeth of gear 91. By means of the latter, an assembly of cams involving groups 92 and 93 are rotated incident to the fact that they are mounted upon a shaft 94 to which the gear 91 is secured. A shaft 95 is supported for rotational movement at a point adjacent and preferably below the series of cams 92 and 93. This shaft 95 has mounted upon it a follower arm 96 which, by means of a key-way or otherwise, is secured against rotation with respect to it. That follower 96 is capable of movement axially of shaft 95 and cooperates with one of the series of cams 92 which control the feed action of element 63. To obtain this result, shaft 95 has attached to it an actuating arm 96', as shown in FIG. 9. This arm engages a pin 97 secured to a lever 98, guided by means of a pin and slot coupling 99 at a point intermediate its extremities and connected to a crank 100 secured to shaft 57'. It will be remembered that a spring is provided to act on shaft 57' and thus urge the outer end of crank 100 upward. The action of this spring urges lever 98 and actuator 96' upward through pin 97, and finally urges follower 96 toward cam 93 through the connection provided by shaft 95 and the key thereof. It is apparent, with follower 96 cooperating with the surfaces of one of the cams of group 92, that when the operative portions of that cam traverse the end of the follower, the latter will rock to correspondingly oscillate shaft 95. This will result in arm 96 being rocked to cause lever 98 to be similarly moved. Accordingly, crank 100 will be shifted to rotate shaft 57' within a range of movement limited by the characteristics of the particular cam involved. As shaft 57' shifts, it will cause a corresponding movement on the part of cranks 72 and 71 to accordingly move lever 69 as aforedescribed, and thus control the eventual movements of the feeding element 63.

Extending generally parallel to shaft 95, at a point preferably adjacent and above the axis of the cam group 92–93 (FIG. 4), is the shaft 55 which is mounted for rotation. Slidably keyed on this shaft, in a manner similar to the support of follower 96, is a follower 101. The latter operatively engages the cam and dwell surfaces of the group of cams indicated at 93. It will be remembered that this shaft 55 supports the ledge or actuator 54. It therefore follows that when shaft 55 is oscillated, lever 51 will be rocked. This will control the reciprocation of link or bar 32 which, in turn, controls the arcuate movement of the needle-supporting assembly. A lever 102 is pivotally supported as at 103 for movement at its upper end substantially parallel to shaft 55. A similar lever 104 is pivotally supported as at 105 to have its upper end traverse a limited zone of shaft 95. Both of these levers carry, for example, pins 106 which engage within grooves or are otherwise suitably coupled to followers 96 and 101 respectively. As these levers are rocked, those followers will be shifted along the axes of shafts 55 and 95 to selectively overlie one of the groups of cams generally identified at 92–93. According to the characteristics of each cam, shafts 55 and 95 may be rocked. So shifted, they will cause desired movements on the part of link 32 and shaft 57' respectively.

Conveniently, a spring 107 extends between the lower ends of levers 102 and 104 below their pivot points 103 and 105. This will serve to draw those lower ends towards each other and, therefore, move the upper ends of levers 102 and 104 towards positions in the direction of the outer ends of shafts 55 and 95.

A lever 115 (especially shown in FIG. 4) is pivotally supported as at 116. The upper end of this lever terminates in a pair of arms 117 and 118. The first of these arms is engageable with a pin 119 secured to a crank 120 attached to shaft 95. The second arm 118 is engageable with the lower projecting portion of a lever or crank 121 secured to shaft 55. Therefore, if the lower end of lever 115 is moved inwardly (in a counterclockwise direction as viewed in FIG. 4), its arms will cause both shafts 95 and 55 to be rotated, thereby causing the operative ends of followers 96 and 102 to clear the peripheral portions of the individual cams embraced in groups 92 and 93.

The lower end of lever 115 terminates in a contact portion 123. Referring to FIG. 6, this portion is disposed in line with a plate 124. The latter is attached to a shaft 125 mounting on its outer end a knob 126. This knob extends into the recess of a dial member 128. A spring 127 has one end bearing against the base of this recess with its opposite end bearing against the knob 126 to normally maintain the latter in projected position. Shaft 125 is formed with a notch 129 and is encircled by a spring plate 130 secured at one end by a bolt or otherwise to the

base element 131 of a dial assembly. The opposite end of spring plate 130 is preferably hook-shaped as at 132. The base of dial 128 presents rearwardly flared side edges 133 which extend adjacent the hook-shaped end portion 132.

It is apparent that when knob 126 is projected inwardly, it will shift plate 124 to correspondingly move the actuating portion 123 of lever 115. So shifted, the detent structure provided by the spring plate or element 130 in association with notch or groove 129 will retain the shaft 125 in the position to which it has been shifted. Under these circumstances, knob 126 will be almost completely housed within dial or actuator 128. The latter is slidable on shaft 125 and normally retained in retracted position as a consequence of the spring 127. Therefore, if it is desired to again cause knob 126 to shift to the position shown in FIG. 6, then an operator by simply grasping dial 128 and moving it outwardly will cause the cam surfaces 133 to engage with the end portion 132 of spring 130. This will result in that spring flexing and riding out of notch or groove 129, thereby releasing shaft 125 and knob 126.

As shown, casing portion 17 is formed with an opening in line with the pattern dial assembly shown in FIG. 6. This opening is formed with its edges embracing a flange 134. A plate 135 overlies the opening and is secured to a hub 131 which is journaled in a hub 136. The latter is formed with a flange 137 mating with flange 134 to prevent an inward movement of the assembly. Within casing portion 17, the collar or hub 131 conveniently supports a separator disc 138. Upon the inner side of this disc, a cam 139 is mounted. A similar control cam 140 is mounted on the opposite disc face.

As especially shown in FIG. 8, the ends of levers 102 and 104 terminate in follower or contact portions riding against the peripheries of cams 140 and 139 respectively. A cam type spring-pressed detent 141 is carried by hub 136 and may engage within one of a number of recesses or openings 142 formed in a plate 143 interposed between cam 140 and hub 136. Plate 135 is conveniently enclosed by a plate 143' extending in sealing engagement with a suitable edge portion of casing 17. As particularly illustrated in FIG. 5, the outer face of plate 135 bears thereon data conveniently in the form of representations of stitches 144. Also it bears upon its face a legend 145 such as "Manual." The cover 143' which is transparent may conveniently bear upon it a framing portion 146. Within the latter, there may be registered the legend 145 or the representations 144 by rotation of the dial assembly. The plate 135 is fixedly secured to hub 131 to which cams 139 and 140 are also secured. Therefore, plate 135 will always signify by its displayed indicia 144 and 145, the relationship of cams 139 and 140 which serve to traverse levers 102 and 104. Those levers in turn shift the followers 96 and 102 axially of their shafts so that these followers are in registry with predetermined cams of the 92–93 series. Accordingly, the movements of links 32 and shaft 57' will be controlled in a correlated manner such that needle bar 28, in cooperation with feed element 63 will cause relative aggregate movements resulting in the desired stitch pattern.

As will be appreciated, when knob 126 is pressed inwardly and shaft 125 is retained in position by the detent structure 129–130, the latter additionally assures that a turning of knob 128 will result in a turning of plate 135, hub 136 and the cams attached thereto. With the inward pressing of shaft 125, lever 115 has shifted shafts 55 and 95 so that the followers carried thereby clear the edge portions of cams 92–93. With such clearance, the turning of the dial assembly permits levers 102 and 104 to freely shift the followers without the latter being obstructed by the raised portions of the cams. Therefore, the followers may be brought to predetermined positions precisely overlying the peripheries of desired cams and only thereupon, with the release of shaft 125, will lever 123 return to its normal position. In that position, it is apparent that shafts 55 and 95 are axially rotated so the followers carried thereby engage the peripheries of the cams.

Attention is next invited to FIG. 9, in which manually shiftable actuator 112 is shown as pivotally supported as at 114. This actuator may also have coupled to it a plate 151. The latter overlies shaft 95 at a point immediately beyond the last of cams 92. When the dial 135 is adjusted to have the "Manual" indication 145 in registry with the framing aperture 146, then the cam 139 will have thrown the end of lever 104 to a position at which the follower 96 underlies the obstruction provided by plate 151. Under those circumstances, the follower arm 96 can be regulated manually by depression of the actuator 112. Simultaneously, the follower 101 will be shifted into cooperating engagement with the periphery of a cam of the series 93, which establishes a zigzag pattern on the part of needle 28. By adjusting the amplitude control 41, as especially described heretofore in connection with FIG. 10, this oscillation of the needle bar may be nullified. Accordingly, a straight line of stitching results, since shaft 57' will be maintained in a fixed position determined by the follower 96 engaging the underside of the plate 151 under the influence of the spring surrounding shaft 57'. Moreover, by depressing actuator 112, shaft 95 may be moved to cause lever 98 to rock shaft 57' to a position at which a reverse feed takes place. The rate of the reverse feeding movement may be controlled by means of the actuator 108.

From the foregoing, it will be appreciated in the present assembly that two series of cams are provided. One of these controls the oscillating movement of the needle bar which, in cooperation with straight feeding of the material, results in a basic stitch of the zigzag type. The other series of cams controls the feed mechanism which shifts the material. These cams are, according to the present teachings, arranged in a compact group and by means of a single control assembly and dial, it is feasible to have the followers cooperate with various cams of the different series to permutate the motions of the mechanisms and thus produce precisely the desired stitch. The amplitude of that stitch may be varied by a further control and, in the case of certain types of stitches, nullified entirely so that a straight line of stitching becomes feasible. The desired stitch pattern may be variously disposed within a given zone of the material underlying the presser foot. Of course, in lieu of a single needle 29, two or more needles may be employed and if necessary the shuttle assembly might be modified to further amplify the number of permutations and stitch patterns capable of production. As aforedescribed, the feed may be reversed in action. Accordingly, an operator will be able to produce effects without resorting to numerous different controls which have to be correlated with respect to each other.

Thus among others, the several objects as specifically aforenoted are achieved. Obviously, numerous changes in construction and rearrangements of the parts may be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. In a sewing machine having a frame, a needle bar mounted in said frame for lateral oscillation and for endwise reciprocation, a main shaft journaled in said frame for rotation, operative connections between said main shaft and needle bar for imparting endwise reciprocation to said needle bar upon rotation of said shaft, a pitman operatively connected to said needle bar for imparting vibration thereto upon actuation of said pitman, and means for actuating said pitman during operation of the sewing machine comprising a plurality of axially aligned stitch-pattern cams rotatably carried by said frame with the axis thereof extending in the same direction as the axis of the main shaft, drive connections between said

main shaft and said cams for rotating said cams upon rotation of said main shaft, a pivot shaft journaled in said frame on an axis parallel to the axis of said cams, a cam follower mounted on and slidable along said pivot shaft for operatively engaging said cam follower with a selected one of said cams, said cam follower being keyed to said pivot shaft for unitary turning, means for biasing said cam follower into operative engagement with the periphery of a selected one of said cams, said cams imparting a pattern of oscillation to said cam follower and said pivot shaft upon rotation of said cams, and operative connections between said pivot shaft and said pitman for actuating said pitman upon oscillation of said pivot shaft.

2. In a sewing machine having a frame, a needle bar mounted in said frame for lateral oscillation and endwise reciprocation, a main shaft journaled in said frame for rotation, operative connections between said main shaft and said needle bar for imparting endwise reciprocation to said needle bar upon rotation of said shaft, a pitman operatively connected to said needle bar for imparting vibration thereto upon actuation of said pitman, and means for actuating said pitman during operation of said sewing machine comprising a cam shaft journaled for rotation in said frame and arranged parallel to said main shaft, drive connections between said main shaft and said cam shaft for rotating said cam shaft upon rotation of said main shaft, a plurality of stitch-pattern cams carried by said cam shaft, a pivot shaft journaled in said frame on an axis parallel to the axis of said main shaft, a cam follower mounted on and slidable along said pivot shaft for operatively engaging said cam follower with a selected one of said cams, said cam follower being keyed to said pivot shaft for unitary turning and operative connections between said pivot shaft and said pitman for actuating said pitman upon actuation of said pivot shaft.

3. In a sewing machine having a frame, a needle-bar mounted in said frame for lateral movements and endwise reciprocation, a main shaft journaled in said frame for rotation, operative connections between said mainshaft and said needle-bar for imparting endwise reciprocation to said needle-bar upon rotation of said shaft, a pitman operatively connected to said needle-bar for imparting lateral movements thereto upon actuation of said pitman, and means for actuating said pitman during operation of the sewing machine comprising a plurality of axially aligned stitch-pattern cams rotatably carried by said frame with the axis thereof extending in the same direction as the axis of the main shaft, drive connections between said main shaft and said cams for rotating said cams upon rotation of said main shaft, a pivot shaft journaled in said frame on an axis parallel to the axis of said cams, a cam follower mounted by and slidable along said pivot shaft for operatively engaging said cam follower with a selected one of said cams, said cam follower being keyed to said pivot shaft for unitary turning, means for biasing said cam follower into operative engagement with the periphery of a selected one of said cams, said cams imparting a pattern of oscillation to said cam follower and said pivot shaft upon rotation of said cams, operative connections between said pivot shaft and said pitman for actuating said pitman upon oscillation of said pivot shaft, a manually operable actuator rotatably supported by said frame, a selector cam carried by said actuator for unitary turning, and a lever engaging said selector cam with one end thereof and the other end connected to said cam follower, whereby said cam follower is shifted in response to movements of the surface of said selector cam to operatively engage a selected cam of said stitch-pattern cams for producing desired patterns upon manual rotation of said actuator.

4. In a sewing machine having a frame, a needle-bar mounted in said frame for lateral movements and endwise reciprocation, a main shaft journaled in said frame for rotation, operative connections between said mainshaft and said needle-bar for imparting endwise reciprocation to said needle-bar upon rotation of said shaft, a pitman operatively connected to said needle-bar for imparting lateral movements thereto upon actuation of said pitman, and means for actuating said pitman during operation of the sewing machine comprising a plurality of axially aligned stitch-pattern cams rotatably carried by said frame with the axis thereof extending in the same direction as the axis of the main shaft, drive connections between said main shaft and said cams for rotating said cams upon rotation of said main shaft, a pivot shaft journaled in said frame on an axis parallel to the axis of said cams, a cam follower mounted by and slidable along said pivot shaft for operatively engaging said cam follower with a selected one of said cams, said cam follower being keyed to said pivot shaft for unitary turning, means for biasing said cam follower into operative engagement with the periphery of a selected one of said cams, said cams imparting a pattern of oscillation to said cam follower and said pivot shaft upon rotation of said cams, operative connections between said pivot shaft and said pitman for actuating said pitman upon oscillation of said pivot shaft, a manually operable actuator supported by said frame for rotation and axial movements with respect thereto, a selector cam carried by said actuator for unitary turning, a lever engaging said selector cam with one end thereof and the other end connected to said cam follower, and connecting means between said pivot shaft and said actuator for rotating said pivot shaft by the axial movement of said actuator, whereby said cam follower is withdrawn from the surface of said one cam by axial movement of said actuator prior to the axial shifting of the cam follower for selecting of stitch patterns by rotation of said actuator.

5. In a sewing machine having a frame, a needle-bar mounted in said frame for lateral movements and endwise reciprocation, a main shaft journaled in said frame for rotation, operative connections between said main shaft and said needle-bar for imparting endwise reciprocation to said needle-bar upon rotation of said shaft, a pitman operatively connected to said needle-bar for imparting lateral movements thereto upon actuation of said pitman, and means for actuating said pitman during operation of said sewing machine comprising a cam shaft journaled for rotation in said frame and arranged parallel to said main shaft, drive connections between said main shaft and said cam shaft for rotating said cam shaft upon rotation of said main shaft, a plurality of stitch-pattern cams carried by said cam shaft, a pivot shaft journaled in said frame on an axis parallel to the axis of said main shaft, a cam follower mounted on and slidable along said pivot shaft for operatively engaging said cam follower with a selected one of said cams, said cam follower being keyed to said pivot shaft for unitary turning and operative connections between said pivot shaft and said pitman for actuation of said pivot shaft, a manually operable actuator rotatably supported by said frame, a selector cam carried by said actuator for unitary turning, and a lever engaging said selector cam with one end thereof and the other end connected to said cam follower, whereby said cam follower is shifted in response to the surface of said selector cam to select one cam from said cams for producing desired patterns upon manual rotation of said actuator.

6. In a sewing machine having a frame, a needle-bar mounted in said frame for lateral oscillation and endwise reciprocation, a main shaft journaled in said frame for rotation, operative connections between said main shaft and said needle-bar for imparting endwise reciprocation to said needle-bar upon rotation of said shaft, a pitman operatively connected to said needle-bar for imparting lateral movements thereto upon actuation of said pitman, and means for actuating said pitman during operation of said sewing machine comprising a cam shaft journaled for rotation in said frame and arranged parallel to said

main shaft, drive connections between said main shaft and said cam shaft for rotating said cam shaft upon rotation of said main shaft, a plurality of stitch-pattern cams carried by said cam shaft, a pivot shaft journaled in said frame on an axis parallel to the axis of said main shaft, a cam follower mounted on and slidable along said pivot shaft for operatively engaging said cam follower with a selected one of said cams, said cam follower being keyed to said pivot shaft for unitary turning and operative connections between said pivot shaft and said pitman for actuation of said pivot shaft, a manually operable actuator supported by said frame for rotation and axial movements with respect thereto, a selector cam carried by said actuator for unitary turning, a lever engaging said selector cam with one end thereof and the other end connected to said cam follower, and connecting means between said pivot shaft and said actuator for rotating said pivot shaft by the axial movement of said actuator, whereby said cam follower is withdrawn from the surface of said one cam by axial movement of said actuator prior to the axial shifting of the cam follower for selecting a desired stitch pattern by rotation of said actuator.

7. In a sewing machine having a frame, a needle-bar mounted in said frame for lateral movements and for reciprocation, a main shaft journaled in said frame for rotation, operative connections between said main shaft and said needle-bar for imparting endwise reciprocation to said needle-bar upon rotation of said shaft, a pitman operatively connected to said needle-bar for imparting lateral movements thereto upon actuation of said pitman, a feed mechanism actuated by said main shaft for shifting material under said needle-bar, said feed mechanism having a feed adjusting mechanism for adjusting the feed direction and the scope of said feed mechanism, and means actuating said pitman and said feed adjusting mechanism during operation of the sewing machine comprising a cam shaft journaled for rotation in said frame and arranged parallel to said main shaft, drive connections between said main shaft and said cam shaft for rotating said cam shaft upon rotation of said main shaft, a plurality of stitch-pattern cams carried by said cam shaft, two pivot shafts journaled in said frame on spaced axes parallel to the axis of said main shaft, two cam followers mounted on and slidable along said each pivot shaft for operatively engaging said each cam follower with a separately selected one of said cams, said cam followers being keyed to said pivot shafts for unitary turning, and one of said pivot shafts being connected to said pitman and the other connected to said feed adjusting mechanism for actuating said pitman and said feed adjusting mechanism upon actuation of said each pivot shaft.

8. In a sewing machine having a frame, a needle-bar mounted in said frame for lateral movements and for reciprocation, a main shaft journaled in said frame for rotation, operative connections between said main shaft and said needle-bar for imparting endwise reciprocation to said needle-bar upon rotation of said shaft, a pitman operatively connected to said needle-bar for imparting vibration thereto upon actuation of said pitman, a feed mechanism actuated by said main shaft for shifting material under said needle-bar, said feed mechanism having a feed adjusting mechanism for adjusting the feed direction and the scope of said feed mechanism, and means actuating said pitman and said feed adjusting mechanism during operation of the sewing machine comprising a cam shaft journalled for rotation in said frame and arranged parallel to said main shaft, drive connections between said main shaft and said cam shaft for rotating said cam shaft upon rotation of said main shaft, a plurality of stitch-pattern cams carried by said cam shaft, two pivot shafts journaled in said frame on spaced axes parallel to the axis of said main shaft, two cam followers mounted on and slidable along said each pivot shaft for operatively engaging said each cam follower with a separately selected one of said cams, said cam followers being keyed to said pivot shafts for unitary turning, a manually operable actuator rotatably supported by said frame, two selector cams carried by said actuator for unitary turning, and two levers, said each lever being engaged by one of said selector cams with one end thereof and the other end connected to one of said cam followers, whereby said cam followers are shifted in response to the surface of said each selector cam to select a set of cams from said cams for producing desired patterns upon manual rotation of said actuator.

9. In a sewing machine having a frame, a needle-bar mounted in said frame for lateral movements and for reciprocation, a main shaft journaled in said frame for rotation, operative connections between said main shaft and said needle-bar for imparting reciprocation to said needle-bar upon rotation of said shaft, a pitman operatively connected to said needle-bar for imparting vibration thereto upon actuation of said pitman, a feed mechanism actuated by said main shaft for shifting material under said needle-bar, said feed mechanism having a feed adjusting mechanism for adjusting the feed direction and the scope of said feed mechanism, and means actuating said pitman and said feed adjusting mechanism during operation of the sewing machine comprising a cam shaft journaled for rotation in said frame and arranged parallel to said main shaft, drive connections between said main shaft and said cam shaft for rotating said cam shaft upon rotation of said main shaft, a plurality of stitch-pattern cams carried by said cam shaft, two pivot shafts journaled in said frame on spaced axes parallel to the axis of said main shaft, two cam followers mounted on and slidable along said each pivot shaft for operatively engaging said each cam follower with a separately selected one of said cams said cam followers being keyed to said pivot shafts for unitary turning, a manually operable actuator supported by said frame for rotation and axial movements with respect thereto, two selector cams carried by said actuator for unitary turning, two levers, said each lever being engaged by one cam of said selector cams with one end thereof and the other end connected to one of said cam followers, and connecting means between said each pivot shaft and said actuator for rotating said pivot shafts by the axial movement of said actuator, whereby said cam followers are withdrawn from the surface of said each one cam by axial movement of said actuator prior to the axial shifting of the cam followers for selecting a desired stitch pattern by rotation of said actuator.

References Cited by the Examiner

UNITED STATES PATENTS

2,653,557	9/1953	Casas-Robert et al.	112—98
2,755,754	7/1956	Urscheler	112—158
2,854,935	10/1958	Benink et al.	112—158
2,862,468	12/1958	Johnson	112—158
2,905,119	9/1959	Bono	112—158

FOREIGN PATENTS

300,900	11/1954	Switzerland.

JORDAN FRANKLIN, *Primary Examiner.*

SAMUEL KOREN, THOMAS J. HICKEY, *Examiners.*

G. MYSLIWIEC, H. D. COOPER, R. J. SCANLAN, *Assistant Examiners.*