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Mastuda et al.

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[45] **Oct. 23, 1973**

[54] **ZIG ZAG SEWING MACHINE**

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July 19, 1971 Japan 46/54072

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[51] **Int. Cl.** **D05b 3/04**
[58] **Field of Search** ..... 112/158 R, 158 A, 112/158 B, 210

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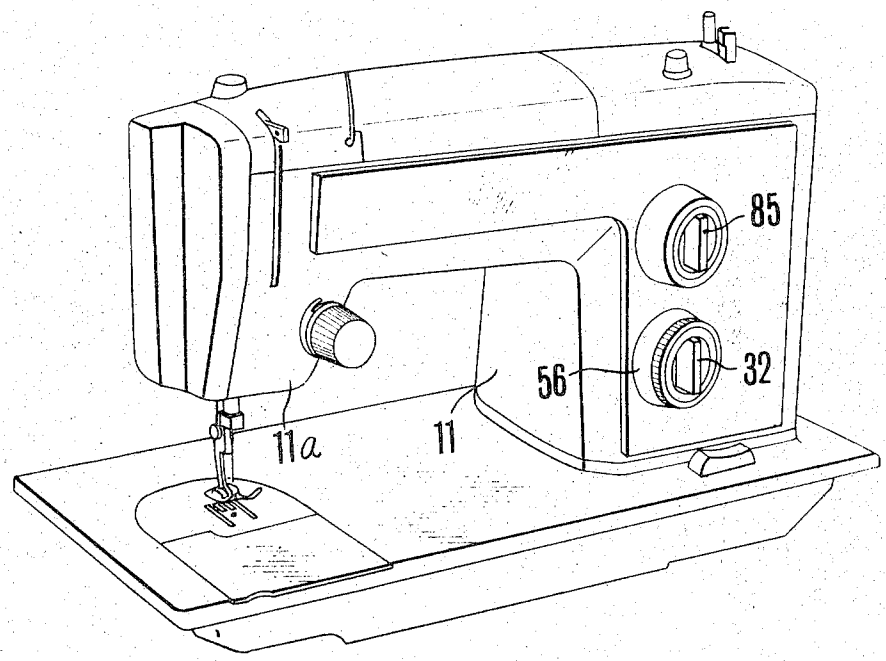
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Primary Examiner—Werner H. Schroeder
Attorney—Nathan N. Kraus et al.

[57] **ABSTRACT**

A zig zag sewing machine has a stack of built-in cams, one of which controls the stitch length while the remainder control the zig zag stitch pattern. One of a series of drop-in cams is removably mounted coaxially on said stack. A first cam follower connected with the needle bar is selectively movable into registration with each of the stacked zig zag cams and the drop-in cam. A second cam follower connected to the stitch length control mechanism of the machine is selectively movable into registration with the stitch length control cam. The means for selectively moving said followers are integrated and controlled by a single knob so that when the first cam follower is moved into registration with any one of the zig zag cams in the stack, the second cam follower is disposed in registration with the stitch length control cam and, when the first cam follower is moved into registration with the drop-in cam, the second cam follower is automatically moved out of registration with the stitch length control cam to render the operation thereof ineffective. A third cam follower connected to the second cam follower is disposed in registration with the drop-in cam and is arranged to control the stitch length when the built-in stitch length cam is rendered ineffective.

5 Claims, 10 Drawing Figures



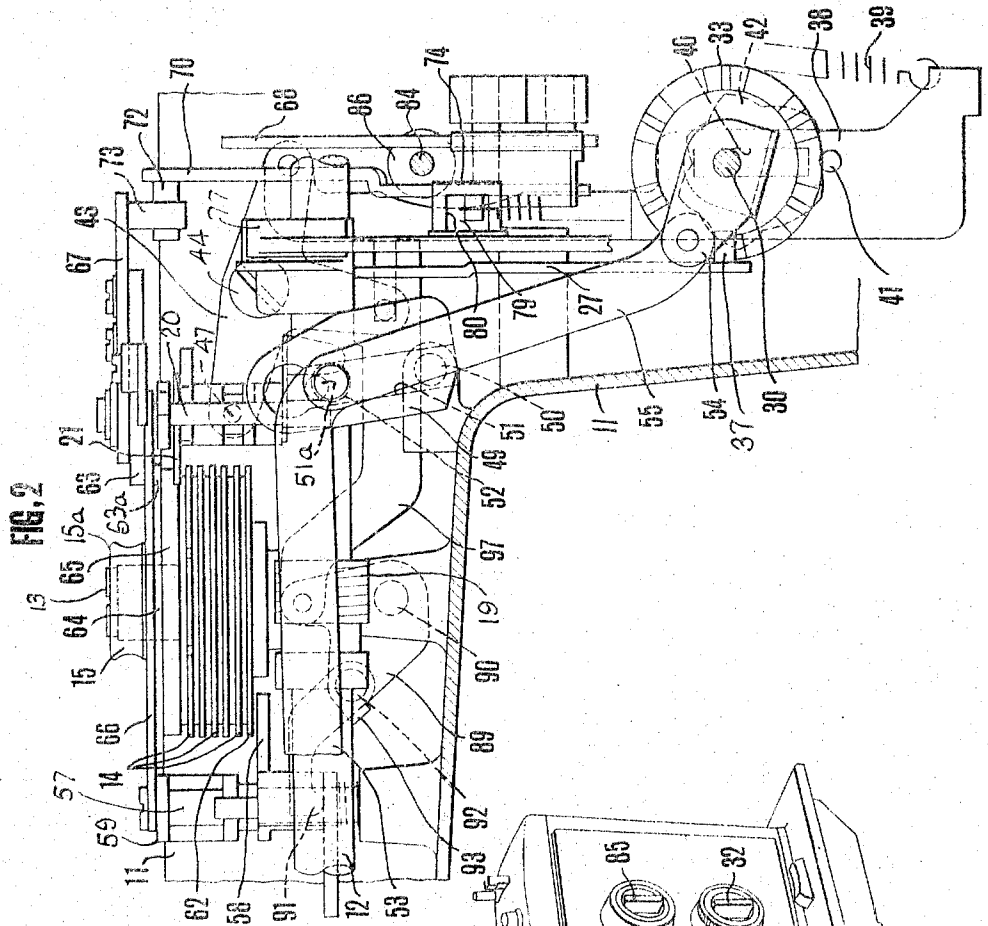

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FIG. 2

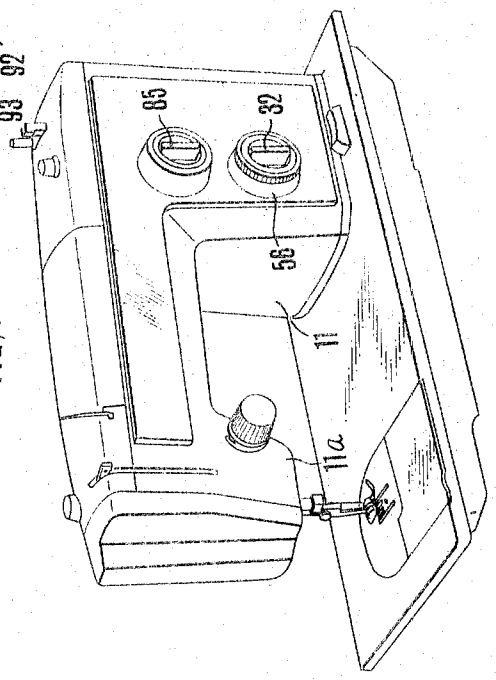

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11a

FIG. 1

FIG. 3

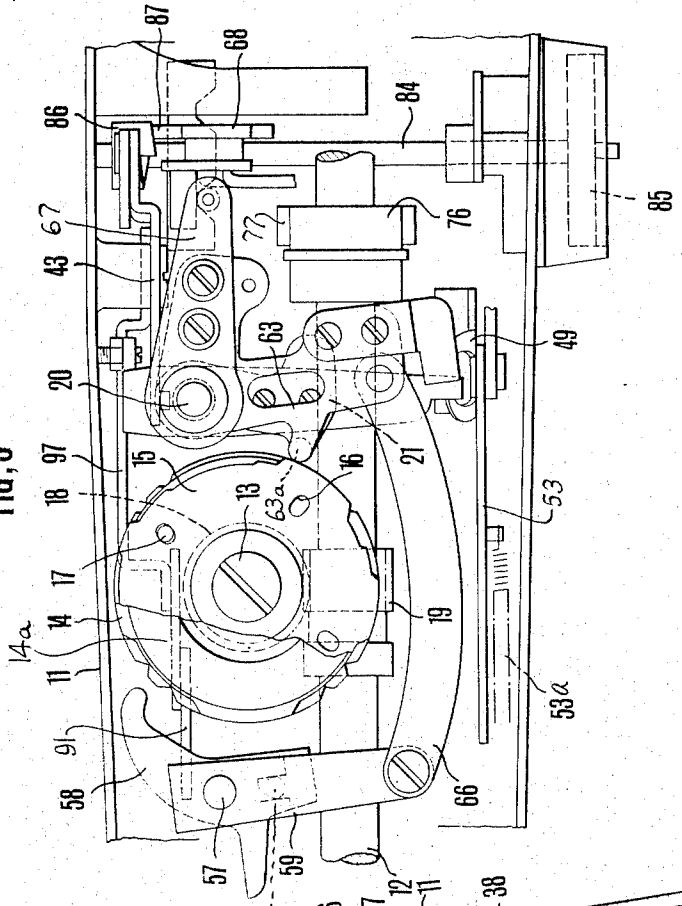
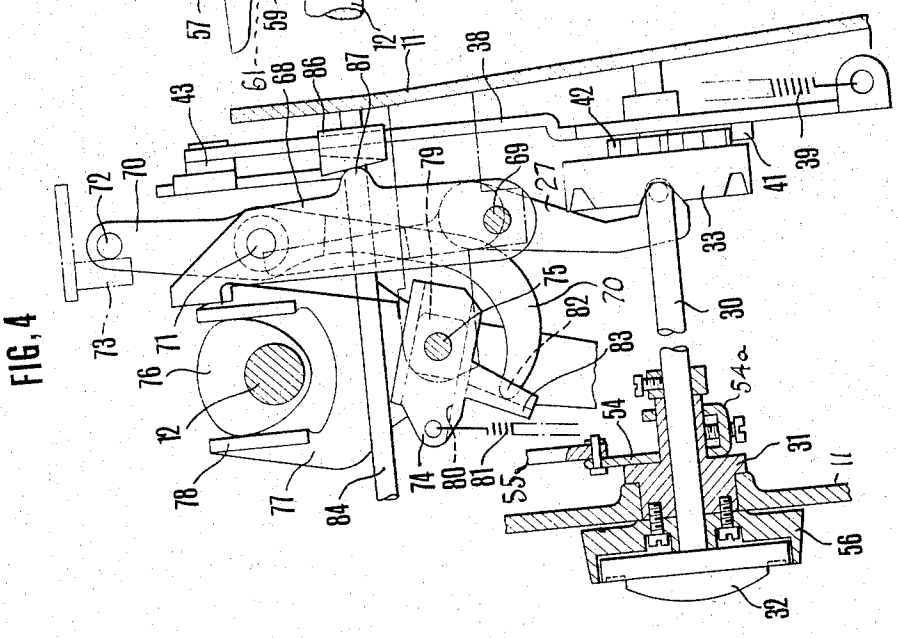
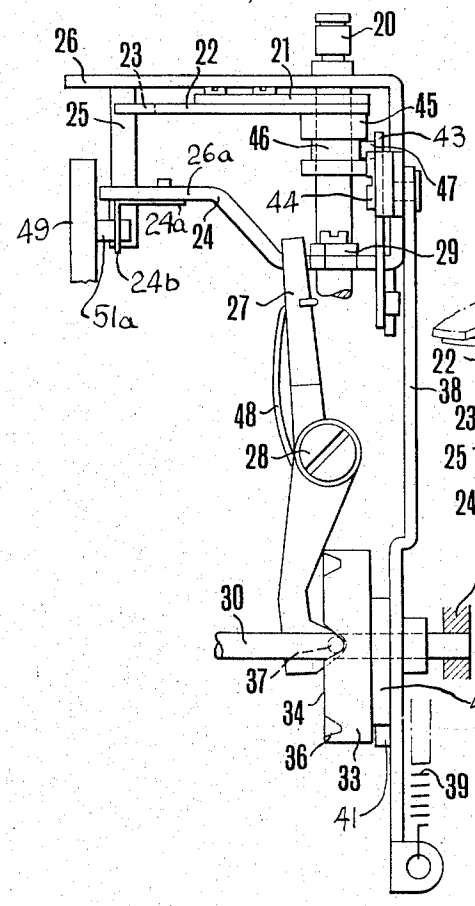


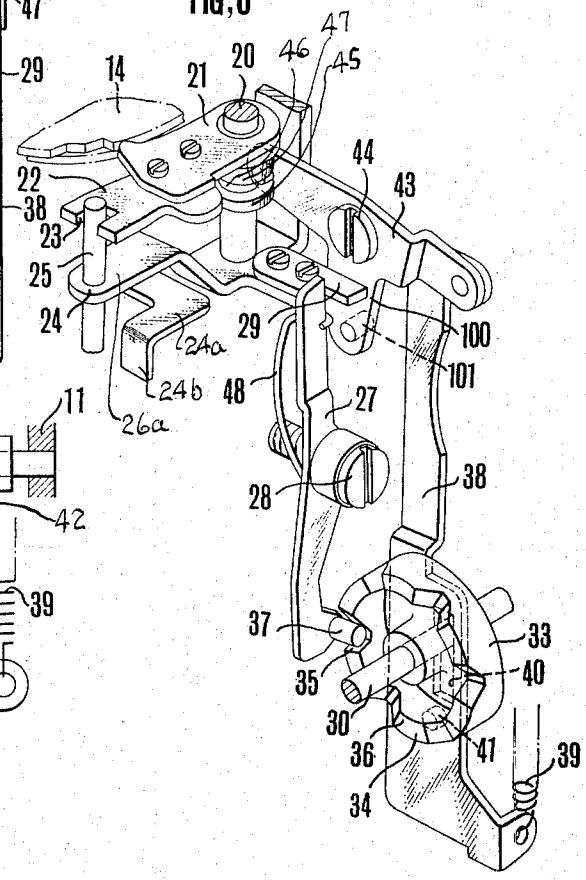
FIG. 4



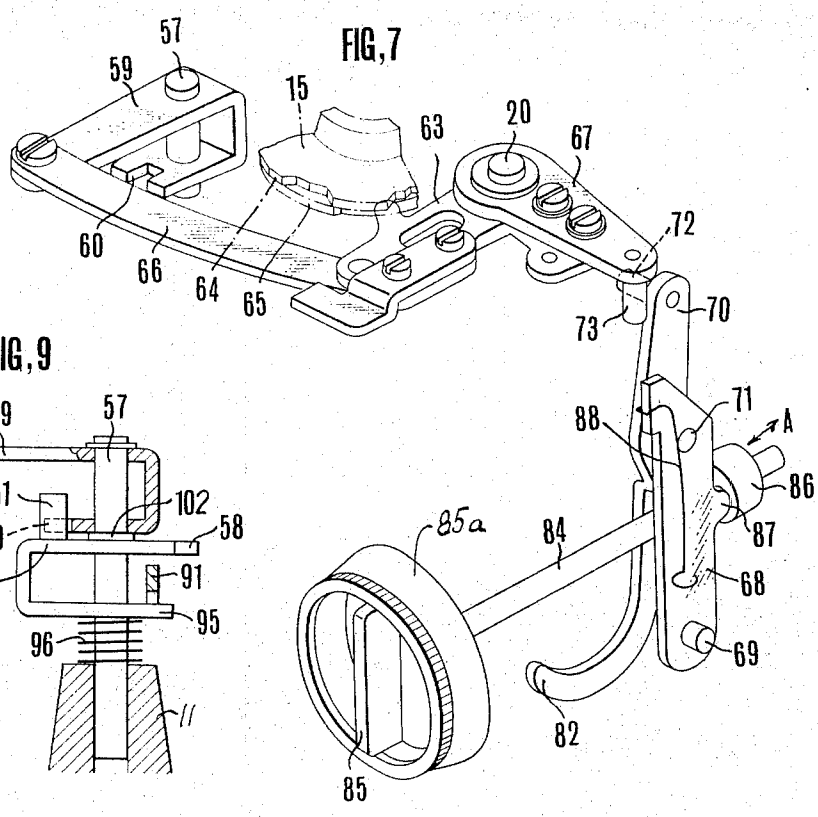
FIG,5


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FIG,6

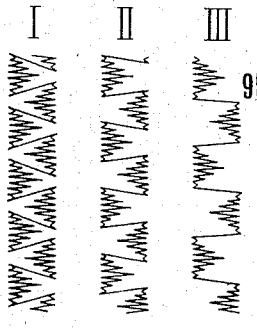

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FIG,7

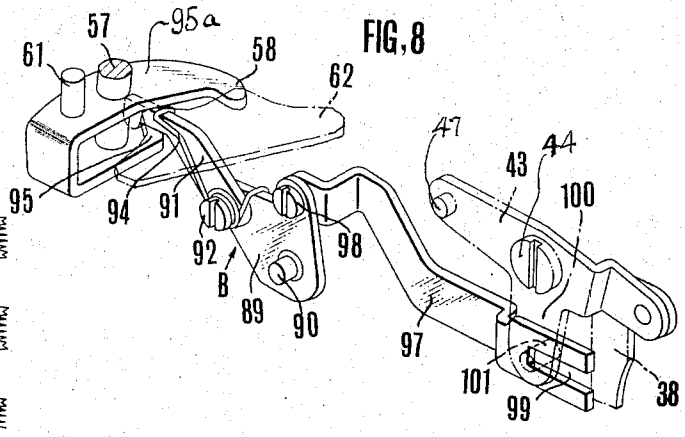


FIG,9

FIG,10



FIG,8



ZIG ZAG SEWING MACHINE

SUMMARY OF THE INVENTION

A zig zag sewing machine having a cam shaft carrying a plurality of built-in zig zag or stitch pattern cams and a fabric feed cam controlling the reverse feed and stitch length, all being in stacked relation. A drop-in cam unit having two cams, a lower one for controlling the zig zag stitch pattern and an upper one for controlling the reverse feed and stitch length is arranged to be superposed on said stack of cams. A first cam follower operatively connected to the needle bar of the machine is arranged to be moved into selective registration with each of said zig zag cams and a second cam follower operatively connected with the reverse feed and stitch length control mechanism is arranged for selective registration with said built-in fabric feed cam. A third cam follower is arranged for registration with the upper cam of the drop-in cam unit and is operatively connected to the reverse feed and stitch length control mechanism. A single control means is operative to effect movement of the first and second cam followers so that when the first cam follower is moved into registration with any one of the built-in zig zag cams, the second cam follower is disposed in registration with the built-in stitch length control cam and when the first cam follower is disposed in registration with the drop-in zig zag cam, the second cam follower is out of registration with the built-in stitch length control cam so that the third cam follower in registration with the drop-in stitch length control cam then cooperates with the drop-in zig zag stitch control to produce a desired stitch pattern.

One of the objects of this invention is the provision of a zig zag sewing machine having a series of built-in cams and arranged to receive a series of drop-in cams to provide a wider range of stitch designs than is possible with known sewing machines.

Another object of this invention is the provision, in a sewing machine of the type described, of single control means for selectively and easily conditioning the mechanism to operate either with the built-in cams or with the drop-in cams.

A further object of this invention is the provision in a sewing machine of the foregoing character of integrated means operated by single control means for selectively rendering certain parts of the operating mechanism operatively effective while automatically rendering other of said parts of said machine operatively ineffective.

Still another object of this invention is the provision of means for adjustably varying the stitch length control means further to vary the stitch designs capable of being produced by the machine.

Other and further objects and advantages of this invention will become apparent from the following description when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a zig zag sewing machine in accordance with this invention.

FIG. 2 is a fragmentary longitudinal vertical cross-sectional view, on an enlarged scale, through the bracket arm and standard of the sewing machine, showing the mechanism thereof in elevation.

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

FIG. 4 is a fragmentary end elevational view, partly in cross-section, taken through the standard of the machine and illustrating the cam selection and stitch adjustment mechanisms.

FIG. 5 is a fragmentary end elevational view, showing additional cam selection and stitch adjustment mechanisms.

FIG. 6 is a fragmentary perspective view of the mechanism illustrated in FIG. 5.

FIG. 7 is a fragmentary perspective view of certain structural details shown in FIG. 3.

FIG. 8 is a fragmentary perspective view of certain structural details shown in FIG. 3.

FIG. 9 is a fragmentary vertical cross-sectional view of a structural detail, and

FIG. 10 is a plan view of stitch designs capable of being produced by the machine of this invention.

BRIEF DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to the drawings, the numeral 11 indicates, generally, a hollow standard and bracket arm terminating in a head 11*a*. A main drive shaft 12 is suitably journalled in the standard and bracket arm and is driven through a belt by an electric motor, not shown, in a conventional manner. A cam shaft 13 carries a plurality of cams 14 in vertically stacked relation, the uppermost cam 14 being surmounted by an annular member 14*a* carrying an upstanding pin 17. A drop-in cam 15, hereinafter to be described, is provided with a plurality of elongated apertures 16 in one of which the pin 17 is received to lock the cam 15 to the cams 14. The series of cams 14 and the drop-in cams 15 are caused to be simultaneously rotated by the cam shaft 13 which is suitably journalled in the arm 11. The lower end of the shaft 13 is provided with a worm wheel 18 in operative engagement with a worm 19 fixed on the main shaft 12, thus, causing the cams 14 and 15 to be rotated at a reduced rate of speed.

Referring to FIGS. 5 and 6, a vertical shaft 20 is fixed at its lower end in the arm 11 and rockably supports at its upper end a cam follower 21, shaped substantially as illustrated. The cam follower 21 is attached to an arm 22 provided with a bifurcated end 23 which embraces a vertical rod 25 fixed in the arms of a generally U-shaped member 24. The member 24 is rockably supported on the shaft 20 and the distal end of its lower leg 26*a* is upwardly offset to clear the main shaft 12. The upper leg 26 of the member 24 is substantially in vertical registration with the lower leg 26*a* and the rod 25 is anchored in both legs, with the lower portion of the rod 25 depending from the lower leg, as illustrated in FIG. 5.

The cam follower 21 is disposed between the upper and lower legs 26 and 26*a* of the U-shaped member 24 and is slidable axially of the shaft 20 between said legs. The arm 22 is provided with an integral depending boss 45 which has a peripheral groove 46 in which is received a pin 47 of a cam selection lever 43, hereinafter to be described. Secured to the offset portion of the lower leg 26*a* is a generally L-shaped lug 24*a* having a depending leg portion 24*b* arranged in spaced relation to the depending portion of rod 25. A laterally extending arm 29 is secured as with screws to the member 24. Said arm is adapted to be engaged by the upper end of a lever 27 pivotally supported on a shaft 28 mounted in the arm 11. The lower end of the lever 27 is provided

with a laterally extending pin 37 which engages a face cam 33 fixed on a selector shaft 30 extending transversely across the standard 11. A knob 32 is fixed on the end of shaft 30 and is received in the recess of a knob 56 in concentric relation therewith, the knob 56 being secured to a bushing 31 received in an opening in the forward wall of the standard 11. A crank 54 is secured to the bushing 31 and is pivotally connected to a connecting link 55, hereinafter to be described. It will be understood that the knobs 32 and 56 are relatively rotatable to effect selective rotation of associated mechanisms.

The face cam 33 has on its forward face 34 a series of valley portions 35 intermediate a series of ridge portions 36, all corresponding portions being uniformly spaced. The cam face 34 is engaged by a follower pin 37 secured in the end of lever 27. A torsion spring 48 normally biases the lever 27 in a direction so that the pin 37 normally is caused to be in engagement with the face 34.

An actuating member 38, shaped substantially as illustrated in FIGS. 5 and 6, is pivotally connected at one end to lever 43 pivoted as at 44 to the arm 11. The lower end of the member 38 is provided with a substantially rectangular cut-out 40 through which the shaft 30 passes. The rearward face of the cam 33 opposite the cam face 34 is provided with an eccentric cam 42 which is engaged by a follower pin 41 carried on the lower end of member 38. A spring 39 normally biases the member 38 in a direction so that the pin 41 is caused to engage the peripheral surface of cam 42. It will be seen that rotation of cam 42 by shaft 30 will effect vertical movement of the member 38 with a corresponding rocking of the lever 43. The distal end of said lever 43 is provided with a pin 47 which engages in the annular recess 46 thus, the rocking of lever 43 about its axis 44 will effect vertical movement of the member 22 and follower 21 axially of shaft 20 within the limits of the legs 26 and 26*a* of the U-shaped member 24.

It will be noted that the cam 42, when rotated, will effect a change in the vertical position of the follower 21 in relation to a specific one of the cams 14 for operative engagement therewith. The valley portions 35 of the face cam 34 also are related to specific cams 14 and serve as detents to hold the follower 21 in a position of adjustment. When the cam 33 is caused to be rotated, the follower pin 37 in engagement with a ridge portion 36 of the cam face 34 will effect movement of the follower 21 about shaft 20 away from the cams 14, a sufficient distance to provide clearance so that the follower 21 may be shifted axially of shaft 20 from one cam to another, as desired. The knob 32 carries on its forward annular face a series of indicia identifying different stitch formations which are capable of being produced by each of the cams 14. Thus, as a result of rotation of cam 33 by knob 32 the follower 21 is caused to be moved away from the stack of cams 14 as it is selectively moved into consecutive registration with one of the cams 14.

The zig zag stitch regulator means comprises a block 49 pivotally supported on a shaft 50 fixed in the standard 11. The block 49 has a groove 51 in its forward face and a pin 51*a* on its rearward face which extends in the space between the rod 25 and leg 24*b*, as clearly shown in FIG. 5. Thus, rocking movement of the member 24 about the axis of shaft 20 will effect rocking of the block 49 about the axis of shaft 50. A slide element 52 is received within the guide groove 51 for freely sliding movement. Connected to the slide element 52 are a pitman 53 and a connecting link 55. The opposite end of the connecting link 55 is connected to an arm 54 of a clamping element 54*a* fixed on a reduced neck portion of the bushing 31. As will be apparent, rotation of the knob 56 which is secured to the bushing will effect rocking movement of the arm 54 which through the connecting link 55 will effect movement of the slide element 52 within the guide groove 51. The relative position of the slide element 50 within the guide groove 51 determines the zig zag movement imparted by the pitman 53 to the needle bar, not shown, to which the pitman is connected. The knob 56 bears a series of indicia which indicate a variety of stitch width or zig zag settings. The movement of the pitman 53, of course, is influenced by the movement of the block 49 which in turn is caused to be rocked by the cam follower 21 through members 22 and 24. A spring 53*a* connected to the pitman 53 and to a suitable anchoring point in the arm 11 normally biases the pitman and associated parts in a direction to cause the follower 21 to engage one of the cams 14.

Referring to FIG. 3, a vertical shaft 57 is fixed within the arm 11 to the left of the stack of cams 14. Freely supported on said shaft for pivotal and axial movement is a follower 58. Said follower is generally U-shaped (FIGS. 3 and 9) and includes a pair of parallel legs 95 and 95*a* connected by a bight portion. A pin 61 extends upwardly from the upper leg 95*a* of the follower 58. A member 59, shaped substantially as illustrated in FIG. 9, is pivotally supported on the shaft 57 in superposed relation to the follower 58 with a washer 102 interposed between the parts. The member 59 includes an upper arm which is pivotally connected to a link 66 and a lower arm which is bifurcated at its end and embraces the pin 61 so that the members 58 and 59 are interlocked for simultaneous rocking movement. However, follower 58 may move vertically relative to member 59. The follower 58, under certain conditions of operation, is arranged to engage the lowermost cam 62 of the stack 14 or to be axially shifted on shaft 57 so as to be disposed below the plane of cam 62 out of operative engagement therewith as illustrated in FIG. 2. The cam 62 controls the reverse feed and stitch length.

A follower 63 is pivotally supported on shaft 20 and is pivotally connected to link 66. The follower 63 includes a lateral extension to which is secured, as with screws, an arm 67 having a rigid depending pin 73 at its distal end. The follower 63 has a depending pin 63*a* and is arranged to rock in a horizontal plane to operatively engage only the upper cam portion 64 of a drop-in cam, hereinafter to be more fully described. As will be seen by reference to FIG. 3, member 59 and follower 63 are connected by means of link 66 so that followers 58 and 63 are caused to be rocked simultaneously about their respective axes. Thus, arm 67 may be rocked either by the engagement of the cam follower 58 with cam 62 or the follower 63 in engagement with the upper cam 64 of the drop-in cam unit 15. The lower cam 65 of the drop-in cam unit 15 is caused to be engaged by the cam follower 21 when the follower is disposed in its uppermost position.

It will be understood that a plurality of drop-in cam units 15 will be provided, each unit related to a different stitch pattern. Each cam unit preferably is formed of molded plastic material and includes two adjacent

cams 64 and 65, one above the other, and a finger engaging handle portion 15a. The lower cam 65, like cams 14 controls the stitch width or zig zag movement whihe the upper cam 64 like cam 62 controls the reverse feed and stitch length. It will also be understood that the drop-in cam unit may include only the cam 65 with the cam 64 being eliminated. Under such conditions the conventional stitch length control means of the machine are utilized.

A support lever 68 is pivoted on shaft 69 within the arm 11 below the arm 67. A stitch length control member 70 shaped substantially as illustrated in FIGS. 4 and 7 is pivotally supported on the lever 68 as at 71. At the upper end of member 70 is fixed a pin 72 which extends laterally in the path of movement of the pin 73 so as to be engaged thereby.

The reverse feed and stitch length are controlled by means of a conventional block member 74 pivoted on shaft 75 anchored in the arm 11 (FIG. 4). The block member 74 is biased by a spring 81 in a counter-clockwise direction, as viewed in FIG. 4 and is provided with a guide groove 80 in which is slidably received a slide element 79 pivotally secured to one side of a lever 77 having bifurcated jaws 78 embracing a feed cam 76 fixed on main shaft 12. Conventional means, not shown, are associated with the dial knob 85a which when rotated effects rocking of the block member 74 to change its inclination and thereby correspondingly to change the vertical movement of the lever 77 which controls the reverse feed and stitch length.

The block member 74 includes a depending arm 83 having a recess engaged by the lower end 82 of control member 70. As the followers 58 and 63 are influenced by their respective cams 62 and 64, the arm 67 is caused to rock about its shaft 20 so that pin 73 engages 72 and effects simultaneous rocking of the member 70 which thereby effects a change in the angular position of the block 74 to cause a variation in stitch length or reverse feed, in accordance with the contours of the cams. However, between the extreme positions, the stitch design of a particular cam may be varied to obtain different stitch lengths, as illustrated in FIG. 10, I, II and III.

Referring to FIG. 8, the letter B indicates, generally, the mechanism for effecting disengagement of the follower 58 from the cam 62. An actuating member 89 is pivotally supported on shaft 90 anchored in the arm 11 and supports a finger 91, pivotable as at 92. A torsion spring 94 biases the finger 91 in a counter-clockwise direction, as viewed in FIG. 8. Movement of the finger 91 in such direction is limited by its engagement with a lug 93 extending laterally of the plane of member 89. As seen clearly in FIGS. 8 and 9, the distal end of finger 91 resiliently engages the lower leg 95 of follower 58. Said follower is urged upwardly by a compression spring 96 so that the leg 95 is normally maintained in engagement with the finger 91. A link 97 is connected, as at 98, to the member 89 and is provided at the opposite end with an elongated slot 99 in which is received a pin 101 anchored in the depending leg 100 of lever 43. Rotation of shaft 30 by means of the knob 32 through cam 42 and follower 39 will effect vertical movement of the lever 38 to rock the lever 43 and shift the follower 21 vertically into registration with a selected cam 14. In such movement the pin 101 will slide within the slot 99 without effecting any movement of link 97. However, at one position when the pin 101 engages the end of slot 99, as viewed in FIG. 8, the member 89 and finger 91 are rocked in a counter-clockwise direction to move the follower 58 downwardly out of registration with the cam 62 thus, rendering the cam ineffective. In such position of the lever 43, the follower 21 is disposed in its uppermost position, above the topmost cam 14 of the stack, but in registration with the cam 65 of the drop-in cam unit 15. Hence, the movement of follower 21 will be influenced by the cam 65 and the stitch length controlled thereby. In all other positions of the knob 32, the follower 58 is in registration with the cam 62 and the stitch length and reverse movement are controlled thereby.

The knob 32 includes an annular face carrying a series of indicia designating stitch designs, each design being related to a specific one of the cams 14. It will also be understood that the cam 42 is related to a specific indicium on the knob 32 and to a specific one of the cams 14. Thus, by rotating the knob 32 to align a particular indicium with a reference point on the standard 11, the follower 21 is caused to be moved axially of shaft 20 into alignment with a particular selected one of the cams 14. Correspondingly, the face cam 33 is rotated with the shaft 30 and as the pin 37 rides over the ridges 36 of the cam 33, the lever 27 is caused to be rocked in a clockwise direction, as viewed in FIG. 6. This effects rocking of the U-shaped member 24 in a counter-clockwise direction and correspondingly, rocks the cam follower 21 away from engagement with the cams 14. Thus, as the cam follower 21 is moved from one cam 14 to another, it is rocked away from the stack of cams 14 so that clearance is afforded between the follower 21 and the cams 14 for easy shifting movement within the limit of its travel, that is, between the lowermost cam 14 and the drop-in cam 65 which is positioned above the uppermost cam 14. In each of the five positions of registration of the follower 21 with a cam 14, the follower 58 is disposed in registration with the cam 62 because the pin 101 may move freely within slot 99. However, in the position wherein the follower 21 is in registration with the drop-in cam 65, the pin 101 engages the end of slot 99 and effects movement of the finger 94, in the manner hereinabove explained, to dispose follower 58 in a position below and out of registration with cam 62, as illustrated in FIG. 2 thereby rendering the follower 58 inoperative. When a drop-in cam 15 is in position, the follower 63 which is connected to the follower 58 assumes the function of controlling the stitch length and reverse feed by effecting changes in the angular position of the block 74 to effect variations in stitch length as determined by the contours of the cam 64. When the cam follower 58 is deactivated, as hereinabove described, the stitch length and reverse feed are then controlled entirely by the drop-in zig zag cam 65.

Upon adjustment of the knob 85, the position of the arm 70 is adjusted so that when the arm 67 is actuated by the drop-in cam 64, variations in the stitch pattern produced by the drop-in cam 64 may be obtained.

As will be apparent from the foregoing, the invention resides in the control of three cam followers by the use of one selection knob 32 which is adjusted by the sewing machine operator. Thus, when any of the built-in zig zag cams 14 is utilized, that is, when the follower 21 is moved into registration with any of said cams, the follower 58 is in registration with stick length control cam 62. However, when the follower 21 is moved into regis-

tration with the drop-in cam **65**, the follower **58** is automatically moved out of registration with the cam **62** to render the cam ineffective to control the stitch length and control of the stitch length is transferred to the drop-in cam. When any of the cams **14** is engaged by the follower **21**, the follower **58** is automatically moved into registration with the cam **62** to again render this cam effective for controlling stitch length.

Various changes coming within the spirit of my invention may suggest themselves to those skilled in the art; hence, I do not wish to be limited to the specific embodiment shown and described or uses mentioned, but intend the same to be merely exemplary, the scope of my invention being limited only by the appended claims.

We claim:

1. In a sewing machine having stitch width regulating mechanism and stitch length regulating and reversing mechanism, a plurality of built-in rotatable cams arranged coaxially in stacked relation, the lowermost cam controlling the stitch length and reverse feed and the remaining cams superposed thereon and controlling the stitch pattern, a removable cam having upper and lower cams and superposed on said stack of cams, the lower cam controlling the stitch pattern and the upper cam controlling the stitch length and reverse feed, a first cam follower arranged to cooperate with said cams and mounted for pivotal and axial movement on a shaft disposed in parallel relation to said cams, said follower being connected to said stitch width regulating mechanism, means for selectively shifting said first cam follower axially of said shaft to align said follower in registration with one of said cams in said stack except the lowermost cam and also with the lower cam of said removable cam, first means for rocking said first cam follower momentarily out of engagement with said cams as said follower is axially shifted from one cam to an adjacent cam, a second cam follower mounted for pivotal and axial movement on another shaft disposed in parallel relation to said cams, said second cam follower being connected to said stitch length regulating and reversing mechanism, said second cam follower arranged to cooperate with the lowermost cam in the stack, a third cam follower operatively connected to said second cam follower for conjoint movement and arranged to cooperate with the upper cam of the removable cam, second means for moving said second cam follower out of cooperative engagement with said lowermost cam and rendering the same ineffective when said first cam follower is moved into cooperative registration with the lower cam of said removable cam, a single control means operatively connected to each of said first and second means for selectively moving said first follower into registration with any one of the cams in said stack or with the lower cam of said removable cam, said second follower when said first follower is in registration with the lower cam being disposed out of registration with the lowermost cam and rendering the same ineffective.

2. The invention as defined in claim **1** including means for selectively varying the stitch length and stitch width independently of said cams and followers.

3. The invention as defined in claim **1** in which the means for selectively axially shifting said first cam follower includes a first fulcrumed lever having one end operatively engaged with said follower and having a member depending from the other end, and in which the control means includes a rotatable shaft carrying an eccentric cam, the depending member being in engagement with said cam and arranged to be moved by the rotation of said cam thereby to rock said first lever.

4. The invention as defined in claim **3** in which the means for rocking said first cam follower includes an extension arm and a second fulcrumed lever having one end engaging said arm and in which the rotatable shaft carries a face cam having uniformly spaced valleys and ridges engaged by the other end of said second lever, the movement of said first and second levers being in timed relation.

5. The invention as defined in claim **3** in which the second cam follower is spring biased normally to cooperatively engage with said lowermost cam and the means for moving said follower includes the first fulcrumed lever having an extension carrying a pin, an actuating member having a finger operatively engaging said second cam follower and a link connected at one end to said actuating member, the opposite end of said link having an elongated slot in which the pin is slidably received, said pin when engaged with the end of said slot effecting rocking of said actuating member to cause the finger to shift said second cam follower out of registration with said lowermost cam.

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