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R. CASAS-ROBERT ET AL

3,108,556

ZIG-ZAG SEWING MACHINES

Filed Sept. 6, 1961

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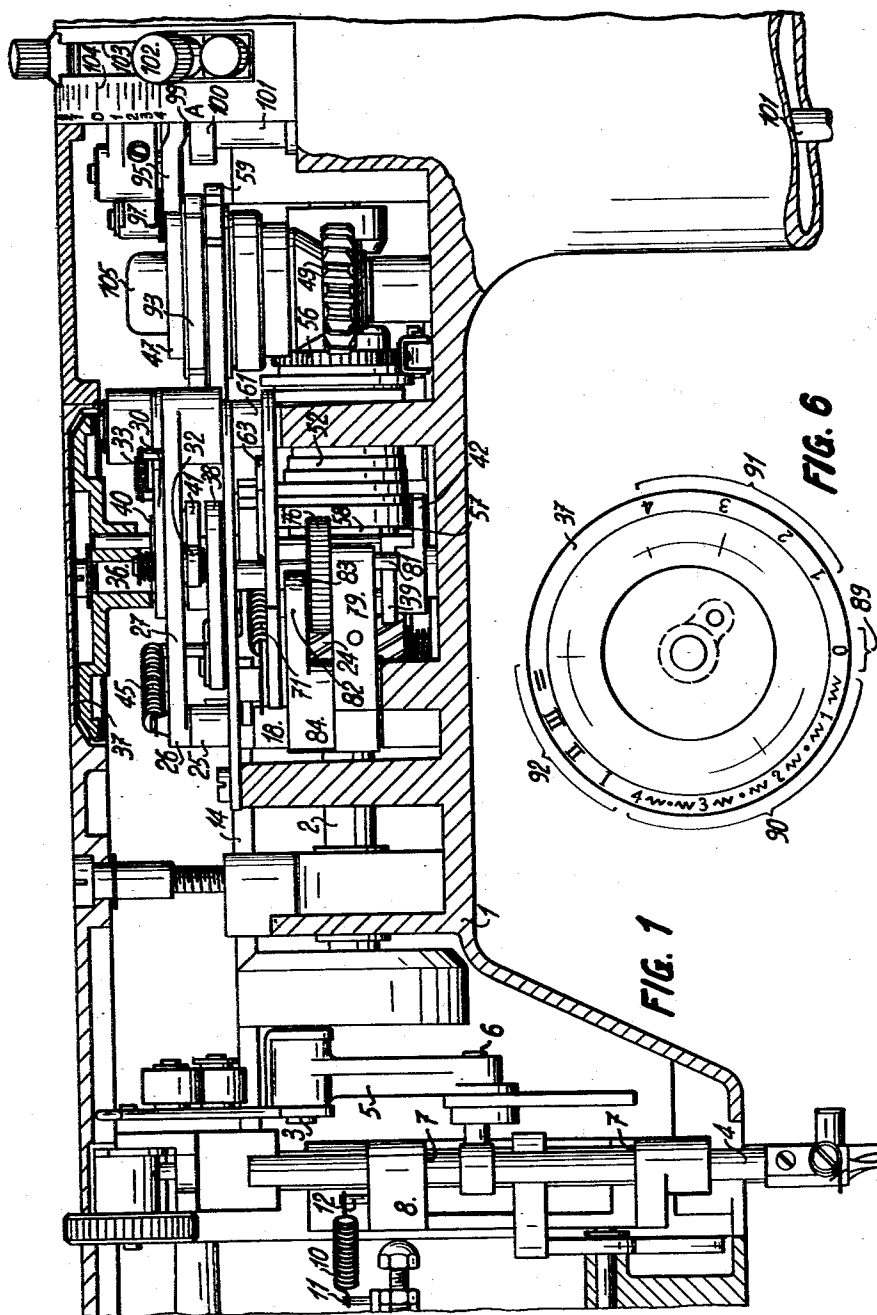


FIG. 6

FIG. 1

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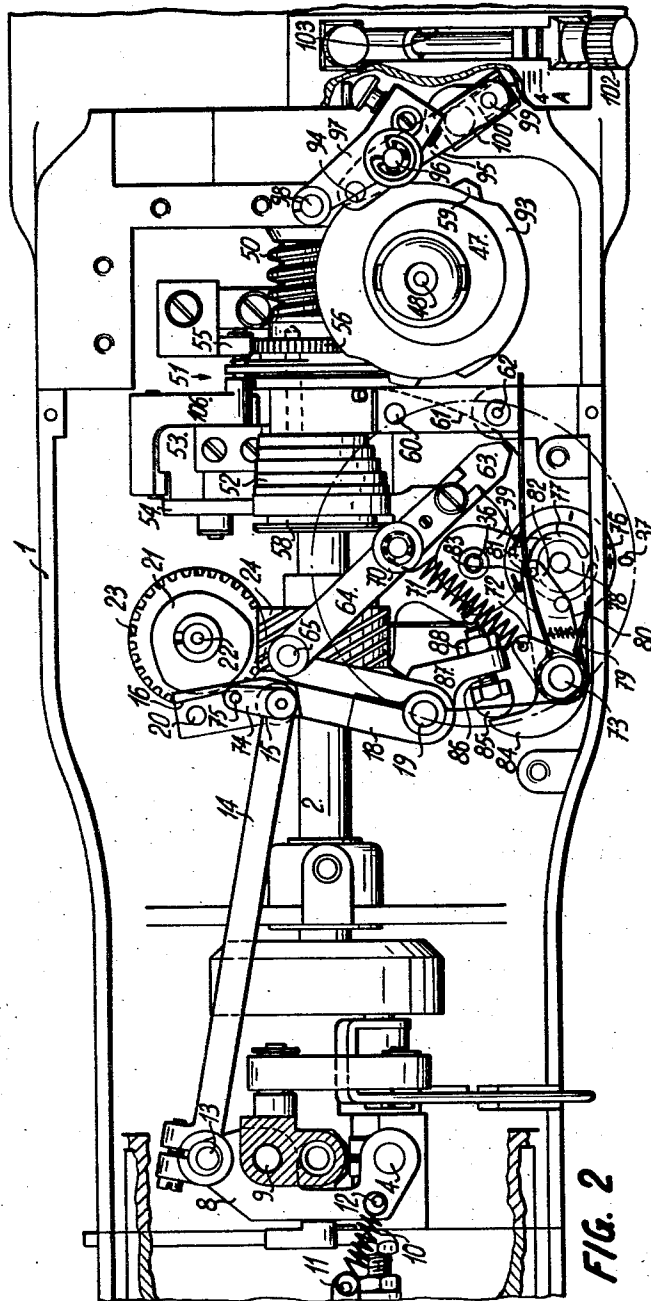
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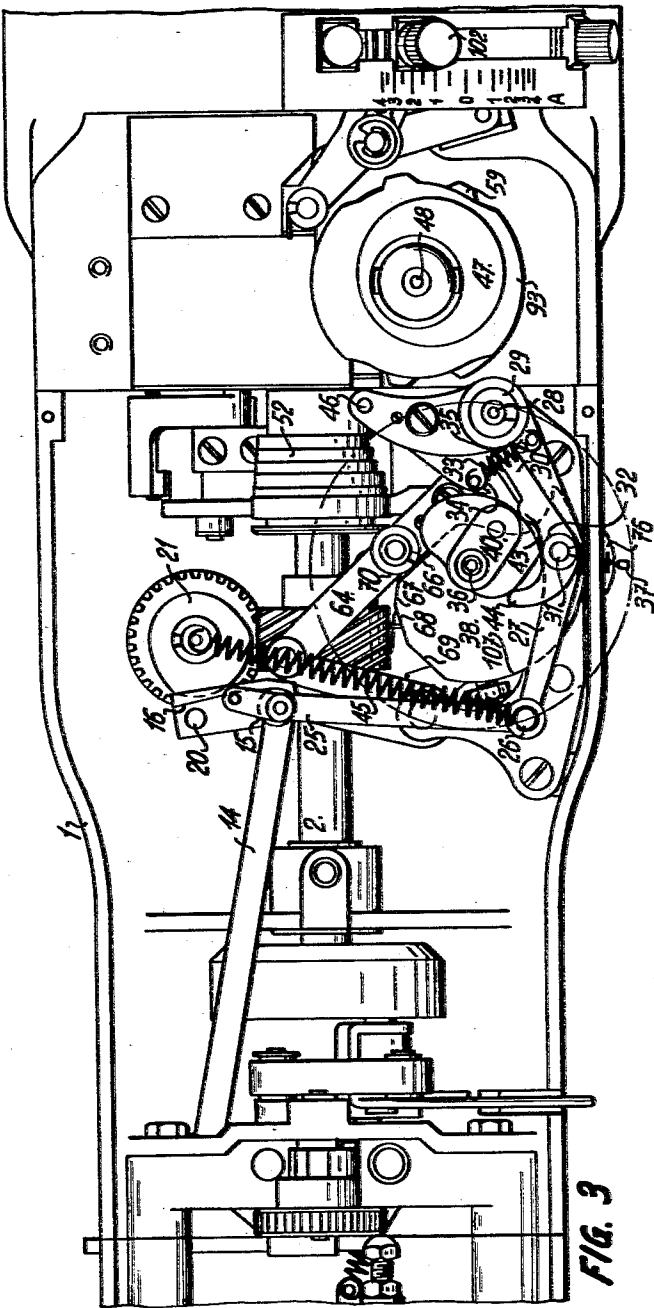


FIG. 3

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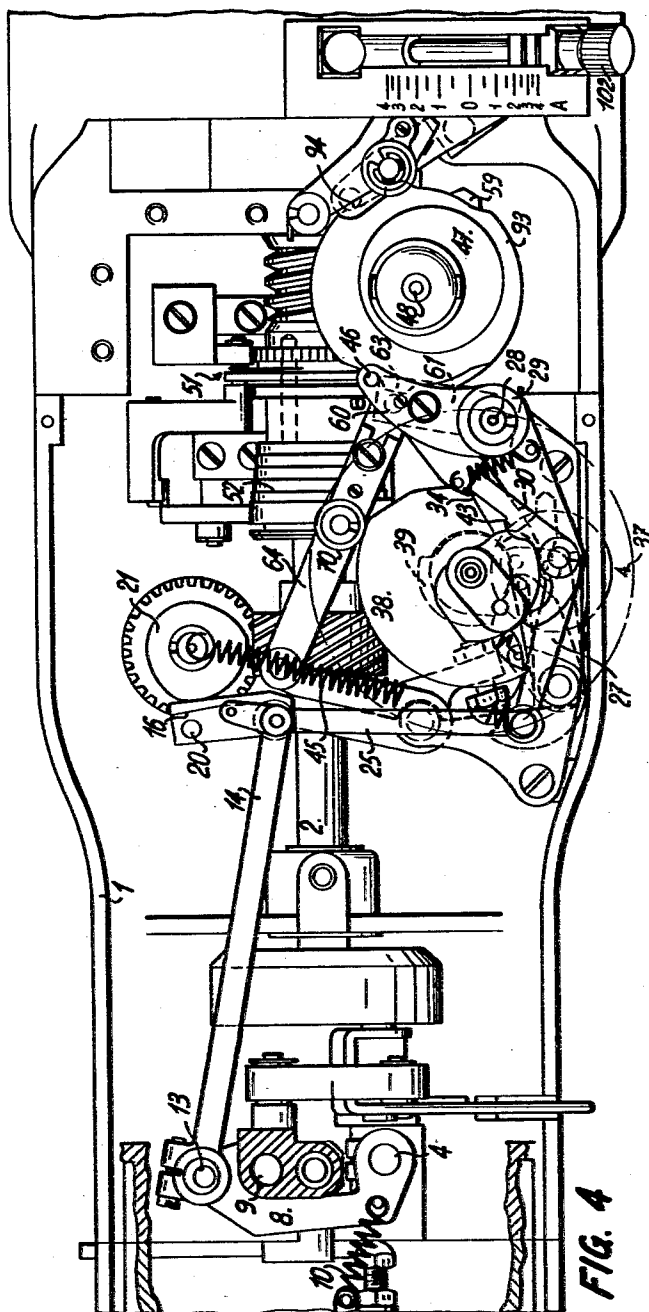


FIG. 4

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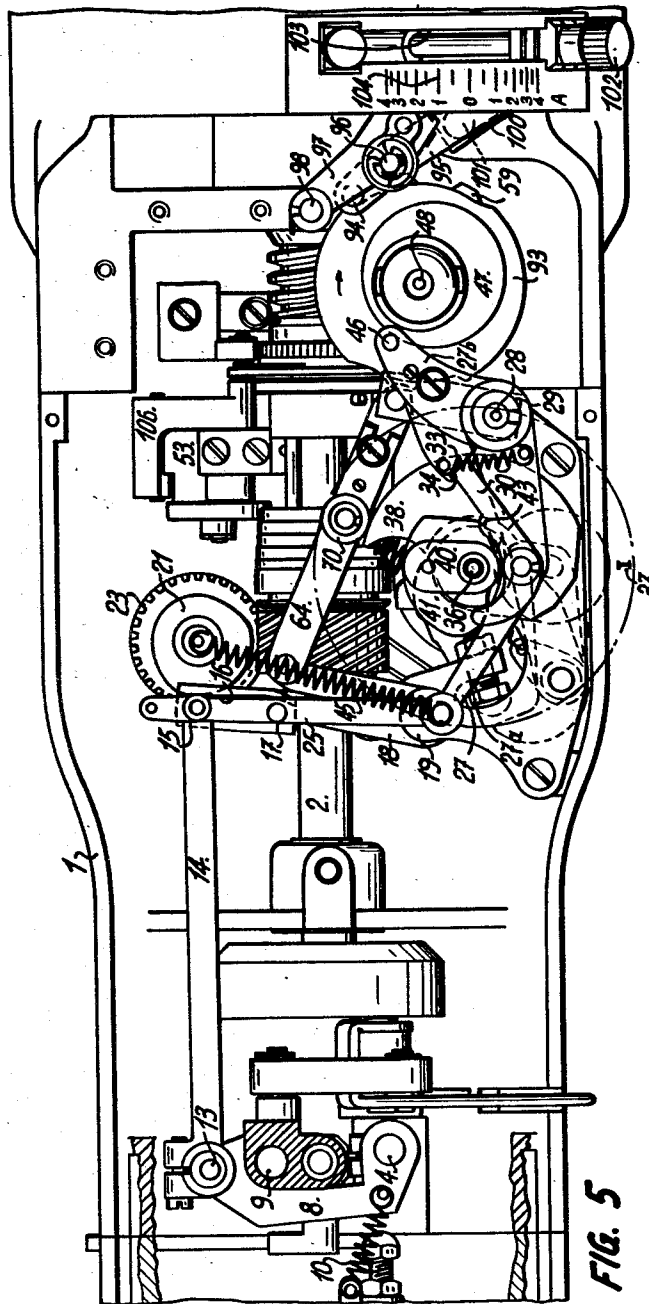
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ZIG-ZAG SEWING MACHINES

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Claims priority, application Switzerland Sept. 7, 1960

6 Claims. (Cl. 112-158)

Various sewing machines are known which, by means of cams that are either mounted permanently in the yoke of the machine or removable and interchangeable, make it possible to impart intended movements to the lateral motion of the needle bar. These so-called automatic machines make it possible, in that way, to sew practical and decorative needle-work stitches automatically, in accordance with the profile of the cams used.

Sewing machines of the aforesaid automatic type fall into two general classes which are as follows:

The first class consists of sewing machines that are called machines with indirect control, i.e., they are machines for effecting zig-zag sewing and generally have a first cam body with a triangular profile which imparts to the needle bar, when the needle is being retracted from the material to be sewn, a lateral movement which produces a zig-zag stitch. These machines are equipped, moreover, with a second arrangement of cams which are either fixed permanently or are interchangeable. This arrangement has been designed to modulate the impulses imparted by the first cam by causing variations of the amplitude of the lateral movements of the needle bar which is controlled by the first cam. In this second cam arrangement, a first profile may control the amplitude of the zig-zag motion while a second one may control the decentration of the needle bar. In the case of those machines which also possess an automatic control of the movement that feeds the textile material into it, a third profile must be provided. In the case of these sewing machines with indirect control, it becomes possible to impart to the second cam arrangement rotating speeds that vary in proportion to the number of stitches performed by the needle bar. Thus, it becomes possible to lengthen or shorten the patterns realized by the cam profiles while the same length of the stitch from one stitch of the needle to the next one is being maintained. This may offer certain advantages for the execution of special patterns, e.g., of monograms, of button-holes, etc.

The second class consists of the sewing machines that are called machines with direct control; they possess only one cam arrangement, with the cams either fixed permanently or interchangeable, and are designed to produce lateral movements of the needle bar. Due to the suppression of the triangular cam which is being used in the sewing machines with indirect control, the impulses of the lateral movements of the needle bar are imparted directly by the profile of the cam bodies of the cam arrangement of these machines with direct control. That means that just one cam profile is sufficient to control the variations of amplitude and of decentration of the needle bar. A second profile is added in the case of automatic cam control of the feeding of textile material. In order that the lateral movement of the needle bar may take place when the needle has been retracted from the piece to be sewn, the profile of the cams must be synchronized with each thrust of the needle; consequently, the rotation speed of the cam arrangement must be fixed in relation to the number of stitches of the needle bar. That excludes the possibility of lengthening or shortening the patterns realized by the cam profiles.

On these machines with direct control, the zig-zag stitch is obtained by means of a particular profile of the

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cam body in the same way as for any other practical or decorative stitch whatsoever, while on the sewing machines with indirect control, the zig-zag stitch is obtained by means of a first triangular cam body.

The primary object of this invention is to provide a sewing machine that will make it possible to combine the advantages of the two types of sewing machines referred to above, i.e., the type of sewing machine with direct control and the type of sewing machine with indirect control.

In carrying out this object, there is provided a sewing machine comprising generally a framework provided in its upper portion with a driving shaft, a crank actuating a needle bar vertically slidable in a cradle capable of oscillating movement, a triangular cam driven from said shaft and capable of actuating a first slide member in an oscillating manner. Movement of said slide causes displacement of one end of a rod in contact therewith, the other end of the rod being hinged to said cradle for controlling the transverse movements of the needle bar. The movements of the end of the rod in contact with said first slide are controlled by a cam for modulating the amplitude of said transverse movements of the needle bar. The modulation cam is driven by said shaft and is in contact with a feeler located at one end of a lever whose other end is hinged to an arm, which in turn is hinged to said rod. The hinge point of said first slide is carried by another arm, which in turn is hinged to the framework of the machine. The angular position of said last-mentioned arm is capable of being controlled by a manual centering member by means of transmission members for varying the centering position of the needle bar.

In further carrying out the object of the invention, there is provided a mechanism comprising a single selecting operating member secured to a control shaft, which carries a plurality of cams fixed angularly thereon for the distribution of the work to be formed. Rotation of the single selecting operating member serves to establish or eliminate the combined or isolated action of the manual centering member of the needle bar, of the aforesaid triangular cam, of said modulation cam and also of a first control cam secured thereto. The first control cam is adapted to actuate a feeler of a second slide hinged to the framework. This second slide provides different bearing points for a feeler finger which is secured to a rod hinged to the arm carrying the hinge point of the first slide at a point of the same radius as the distance between the hinge point of the first slide and the hinge point of said arm, in such a manner as to be able to transmit to the cradle of the needle bar, the movements imparted to said feeler finger by said control cam. A spring urges the rod against the first of the distribution cams secured to the single selecting operating member. The profile of the first distribution cam determines the position of the feeler finger along the second slide.

One form of construction of the machine according to the invention is shown diagrammatically and by way of example in the accompanying drawing:

FIG. 1 is an elevational view partly in section of a sewing machine embodying the invention.

FIG. 2 is a plan view, partly broken away, of the machine shown in FIG. 1.

FIGS. 3, 4 and 5 are views similar to FIG. 2 showing the mechanism of the machine in different positions of control.

FIG. 6 is a plan view of the single selecting operating member of this sewing machine.

The sewing machine comprises a framework 1 in the upper portion of which is supported the driving shaft 2, itself driven by a motor not shown. This shaft 2 carries a crank 3 adapted for a vertical to-and-fro movement of

a needle bar 4 through the actuation of a rod 5 hinged at 6 on the needle bar 4. This needle bar 4 slides vertically in bearings 7 provided in a cradle 8. This cradle 8 is capable of oscillating about a vertical spindle 9 carried by the framework 1. A spring 10 hooked at one end to a stud 11 of the framework 1 and at its other end to a stud 12 on said cradle 8 tends to cause the cradle to pivot in a clockwise direction relatively to FIG. 2. The cradle 8 also carries a hinge spindle 13 to which one end of a rod 14 is secured so as to transmit of the oscillation movements imparted by the control mechanism of the sewing machine to the cradle 8. The other end of rod 14 is provided with a roller 15, by which it bears against a first slide 16. As is best illustrated in FIG. 5, the slide 16 is hinged at 17 on an arm 18 which in turn is hinged at 19 on the framework 1 of the machine. This slide 16 carries a feeler 20 adapted to follow the profile of a generally triangular cam 21. This cam 21 is carried by a shaft 22 on which it turns, and is driven by a toothed wheel 23 gearing with a tangential screw 24 secured to the shaft 2. The shaft 22 is fixed in the framework 1.

An arm 25 connects the end of the rod 14 carrying the roller 15, to the end 26 of a lever 27 formed by two parts 27a and 27b (FIG. 5) connected one to the other along the pivoted axis 28 of lever 27 on the framework 1. The hinge 29 of the two parts 27a and 27b of the lever 27 is capable of being locked by a locking device. This locking device comprises a lever 30 pivoting about a hinge axis 31 (FIG. 3) on the part 27a of the lever 27. This hinge axis 31 also carries a roller 32 of which the purpose will be described hereinafter. A spring 33 connects the two parts 27a and 27b of the lever 27 and tends to urge them one towards the other in their unlocked position. The part 27b has a projection 34 which is adapted to co-operate with the end 35 of the lever 30 when the latter pivots in a counter-clockwise direction so that the end 35 abuts the projection 34 and locks the hinge 29 so that the parts 27a and 27b of the lever 27 assume the position shown in FIGS. 4 and 5.

The framework 1 of the sewing machine is provided in its upper part with a control shaft 36 located vertically, this shaft turning in bearings of the framework 1. The upper end of this shaft 36 carries an operating member 37 in the form of a disc or flywheel (see FIGS. 1 and 6), this operating member being hereinafter referred to as the single selecting operating member 37. The control shaft 36 carries a number of cams for the distribution of the operation; a first distribution cam 38, a second 39, a third 40, a fourth 41 and a fifth 42. The purpose of these different distribution cams will appear in the course of the following description.

The control of the locking and unlocking movements of the hinge 29 is effected by means of the third distribution cam 40 which is adapted to co-operate with a boss 43 and an arcuate extension 44 of the lever 30. The locking and unlocking action of the hinge 29 of the lever 27 is thus effected from the single selecting operating member 37.

A spring 45 hooked at one of its ends to the shaft 22 and at its other end to the end 27a of the lever 27 tends to cause said lever to turn in a clockwise direction relative to FIG. 3. The part 27b of the lever 27 carries a feeler 46 adapted to follow the profile of a modulation cam 47 carried by a driving shaft 48. This driving shaft 48 is disposed vertically and is fixed in the framework 1 of the machine. This shaft also carries a toothed wheel 49 gearing with tangential screw 50 engaged around the driving shaft 2. Thus tangential screw 50 is not keyed to the shaft 2, but is capable of being connected thereto according to different ratios of transmission, through the medium of a speed changing device 51 which is described in greater detail in Swiss Patent 366,720. To a larger extent, this change speed device comprises a series of eccentrics 52 of different eccentricities relatively to the shaft 2, these eccentrics being angularly secured to the

shaft 2 but capable of sliding thereon. A lever 53 hinged relative to the framework of the machine carries a roller 54 adapted to bear elastically against one of the eccentrics 52. The to-and-fro movements imparted to this roller 54 by one or other of the eccentrics 52 are transmitted by the lever 53 and the lever 106 to a pawl 55 carried by the latter and co-operating with a ratchet wheel 56 secured to the tangential screw 50. The pawl 55 thus drives the tangential screw 50 in jerks in angular movements of which the amplitude depends on the selection of the eccentric 52 co-operating with the roller 54.

The axial movement of the eccentrics 52 on the shaft 2, whose displacement determines the selection of the ratio of transmission, is controlled from the single selecting operating member 37 through the medium of the fifth distribution cam 42 which acts by a nipple 57 in a groove 58 of the eccentric block 52 for displacing this axially.

The shaft 48 carries a first control cam 59 driven simultaneously with the modulation cam 47. This control cam 59 acts on a stud or feeler 60 carried by a second slide 61 hinged at 62 to the framework 1 of the machine. Against this second slide 61 is adapted to bear a feeler finger 63 forming the extremity of a rod 64. This rod is hinged at 65 to an arm 18, the hinge axis 65 being spaced from the pivotal point 19 of the arm 18 by a radius equal to the distance separating the hinge axis 17 of the first slide 16 from the same pivotal point 19. The guiding of this rod 64 is effected by means of the first distribution cam 38. As will be seen from FIGURE 3, cam 38 is provided on its profile with planar portions 66, 67, 68 and 69 located at different radii from the control shaft 36. The rod 64 is adapted to bear against said planar portions through the medium of a roller 70 carried thereby. It will be understood that the different angular positions imparted to the distribution cam 38 by the single selecting operating member 37 permits moving the feeler 63 in various positions along the slide 61. When the roller 70 bears against the part 66 of the cam 38, the feeler 63 bears against the slide 61 beyond its hinging point 62, which causes the spacing of the feeler 60 from the control cam 59. However, when the distribution cam 38 is moved into an angular position for which the roller 70 bears against its parts 67, 68, 69 and on the circular part 107, the feeler bears against different points of the slide 61 and transmits movements of different amplitudes to the arm 18 and thus to the rod 14 actuating the cradle 8. However, the direct actuation of the rod 14 from the control cam 59 through the medium of the rod 64 only takes place when the extremity 15 of the rod 14 has been placed on the slide 16, beyond its hinge point 17, the triangular cam 21 being then inoperative on the slide 16. The rod 64 is maintained pressed by its roller 70 against the distribution cam 38, by reason of a spring 71 hooked, at one end, to the spindle of the roller 70 and on the other hand to a stationary point of the machine represented in the particular case by a plate 72 fixed to a spindle 73 carried by the framework 1. In order to prevent the first slide 16 from moving too far from the triangular cam 21 when the extremity 15 of the rod 14 bears beyond the hinge point 17, this rod 14 is provided with an extension 74 carrying a finger 75 adapted to serve as a stop for the first slide 16 (see FIG. 2).

In order that it may be possible to adjust the centering position of the needle bar 4 when the transverse movements of this are transmitted thereto from the triangular cam 21, the sewing machine is provided with a manual centering member 76 comprising a wheel having a groove 77 constituting a cam in the form of a spiral. The spindle 78 of the wheel 76 is carried by a plate 79 hinged about the spindle 73 on the framework of the machine. This plate 79 is subjected to the action of a spring 80 tending to urge it into the interior of the framework until it comes into abutment with the second distribution cam 39

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through means of a finger 81 carried by said plate 79. An intermediate lever 82 carries a finger 83 engaged in the groove forming a spiral cam 77. The other extremity 84 of the intermediate lever 82 is adapted to serve as stop for the rounded head 85 of a screw 86 screwed into an extension 87 of the arm 18. A nut 88 ensures the locking of the screw 86 in position in the extension 87.

It will be readily understood by the examination of FIG. 2, that when the control members of the sewing machine are in this position, the manual operation of the wheel 76 permits varying through means of the lever 82, the angular position of the arm 18 carrying the hinge axis 17 of the first slide 16. This variation of the position of the hinge axis 17 permits varying the centering position of the needle bar 4 either when the single operation selecting member 37 is in position "0," that is to say in the first zone 89 of the member 37, or when this member 37 is moved into another one of its positions comprising a second operating zone 90 (see FIG. 6) so that the transverse movements of the needle bar 4 are controlled from the triangular cam 21.

The third operating zone 91 of the member 37 corresponds with the control of the transverse movements of the needle bar 4 directly from the control cam 59 through means of the second slide 61 and the bar 64. The disposition of the control members of the machine, when the single selecting operating member 37 is placed in third zone 91 of operation, is shown in FIG. 4. It will be seen that in this third zone of operation, the second distribution cam 39 causes the withdrawal of the plate 79 and thus of the wheel 76 into the interior of the framework 1 (see FIG. 4). By reason of this angular movement of the plate 79, the extremity 84 of the intermediate lever 82 moves away from the head 85 of the screw 86. Thus the manual centering device is out of service.

In the fourth operating zone 92 of the member 37, the manual control of the centering wheel 76 is also out of service (see FIG. 5). In this fourth zone of operation, the first distribution cam 38 moves the bar 64 into its position of maximum spacing from the control shaft 36 and the de-centering movements of the needle bar 4 are controlled automatically and directly from the control cam 59.

The lever 27, whose hinge 29 is locked, imparts to the modulation cam 47 variations from the amplitude of the transverse movements transmitted to the needle bar 4 by the triangular cam 21.

In this fourth zone, the single selecting operating member 37 permits of a stopping (mark "=") of the rotation of the driving shaft 48 or the selection of different ratios of the speed of rotation of this driving shaft 48 according to the mark I, II or III which is placed opposite the stationary mark on the framework of the machine. In a model of a sewing machine already constructed, the mark I engages the ratio of speed yielding one hundred and eight sewing points for a completed revolution of the driving shaft 48 and of cams 47, 59 and 93. The mark II corresponds with one hundred and sixty two sewing points and the mark III to two hundred and sixteen sewing points for one revolution of the shaft 48. By way of comparison, when the member 37 is brought into its third zone of operation 91, the constructed machine pricks 18 sewing points for one revolution of the shaft 48.

The driving shaft 48 also carries a second control cam 93 for imparting automatically variations of the direction and of the amplitude of the movements of the feeder of the fabric on the sewing machine. This second control cam 93 acts on the actuating mechanism of the feeder (not shown in the drawing). It suffices to indicate that this second control cam 93 acts on a feeler 94 carried by one extremity of a lever 95 hinged about the axis 98 on the framework 1 of the machine. The other extremity 99 of the lever 95 carries a finger engaged in a slide 100 secured radially to the upper end of a control shaft 101 of the variations in amplitude and direction of the feed-

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er. A manual control member 102, movable in a guide groove 103 relatively to a graduation 104 permits of manual adjustment of the length of the point and of the direction of movement of the feeder. The engagement of the automatic control of the movements of variations of the amplitude and the direction of the feeder is effected by bringing the control member 102 opposite the mark indicated by A on the graduation 104. The movement of the control member 102 relative to the mark A causes a movement of the arm 97 which brings the feeler 94 into contact with the second control cam 93.

The operation of the control member 102 of the feeder may be effected in all the zones of operation of the single selecting operating member 37. Thus, even in the first and second zones of operation 89 and 90, it is also possible to engage the automatic control of the variations of the direction and of amplitude of the feeder.

The triangular cam 21 is a cam mounted on a shaft 22 which is fixed in the sewing machine. On the contrary, the modulation cam 47, as also the control cams 59 and 93, are interchangeable cams which may be replaced by other cams of different profile according to the ornamental design which it is desired to obtain by means of the sewing machine. These three cams, 47, 59 and 93 are easily interchangeable by pressure on a control knob 105 which actuates a device for fixing the cams on the driving shaft 48. This fixing device will not be described in further detail here, as it forms the subject of an earlier patent of the patentee namely, Patent No. 2,729,732.

The machine hereinbefore described with reference to the accompanying drawing combines in a unit the advantages of the two types of machines with cams, that is to say the type of machine with direct control and the type of machine with indirect control of the transverse movements of the needle bar. This machine presents the advantage of the simplicity by reason of the fact that the manipulation is effected essentially by a single selecting operating member, particularly with regard to the control of the transverse movement of the needle bar. The use of this machine is also simplified by the fact that all the distribution cams, particularly, have been arranged in such a manner as to permit operation of the single selecting member 37 at any desired moment and without any undue precaution.

We claim:

1. A sewing machine comprising in combination, a framework 1, a driving shaft 2 mounted in said framework in its upper portion, a crank 3 driven by said driving shaft, a cradle 8 oscillatively mounted in said framework, a needle bar 4 vertically slidable in said cradle, a cam 21 of generally triangular profile driven by said shaft, a first slide 16 actuated by said cam to impart an oscillating movement thereto, a first rod 14 having one end in contact with said slide and its other end hinged to said cradle, so as to permit control of the transverse movements of said needle bar, a cam 47 for modulating the amplitude of said transverse movements, said modulation cam 47 driven by said driving shaft 2, a first arm 25 having one end connected to said first rod 14, a lever 27, a feeler 46 at one end 27b of said lever in contact with said modulation cam 47, the other end 27a of said lever connected to the opposite end of said first arm 25, a second arm 18 on which the hinge point 17 of said first slide 16 is located, said second arm hinged to said framework, manual centering means 76+ controlling the angular position of said second arm 18 to vary the centering position of said needle bar, a control shaft 36 mounted in said framework, a single selecting operating member 37 secured to said control shaft, a group of work distribution cams 38, 39, 40, 41, 42 angularly fixed on said control shaft and adapted to activate or deactivate by rotation of said single selecting operating member 37, the combined or individual action of (a) said manual centering means 76+ of said needle bar 4, (b) of said

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triangular profile cam 21, (c) of said modulation cam 47 and (d) of a first control cam 59 secured to said modulation cam, a second slide 61 hinged to said framework, a stud 60 on said second slide, said stud engaged by said first control cam 59, a second rod 64 hinged at one end to said second arm 18, a feeler finger 63 on the other end of said second rod 64, said second slide 61 providing various points of support for said feeler finger 63 whereby movements imparted to said feeler finger 63 by said control cam 59 are transmitted to the cradle 8 of said needle bar, a spring 71 holding said second rod 64 in position against the first cam 38 of said group of distribution cams 38, 39, 40, 41, 42 secured to said single selecting operating member 37, the profile of said first cam 38 determining the position of the feeler finger 63 along the second slide 61.

2. A sewing machine according to claim 1, wherein said manual centering member 76 includes a spirally grooved cam 77 mounted on a plate 79, an intermediate lever 82 acting on said cam and also acting on said second arm 18, said plate 79 hinged on the hinge axis of said intermediate lever 82 and controlled by a second distribution cam 39 secured to said control shaft 36 of said selecting operating member 37, whereby said plate may be moved into said framework 1 by rendering the manual control of said centering device inactive when the transverse movements of said needle bar are controlled by said first control cam 59, said plate 79 being brought into an active position by said second distribution cam 39 when the transverse movements of said needle bar 4 are controlled by said triangular cam 21.

3. A sewing machine according to claim 2, wherein said lever 27 comprises two parts 27a and 27b hinged one to the other and provided with means 30-35 for locking said lever in active position, a third distribution cam 40 secured to said control shaft 36 and actuating said locking device so as to set it in and out of operation in order to permit both the changing of said modulation 47 and control 59 cams and the free actuation of the other end of said lever in the unlocked position.

4. A sewing machine according to claim 3, including a fourth distribution cam 41 on said control shaft and adapted to cooperate with the end 27a of said hinged lever 27 which is connected to said first arm 25 for effecting displacements of said first rod 14 along said first slide 16 in order to permit manual control, by said selecting operating member 37, of the amplitude of the transverse movements of said needle bar 4 imparted by said triangular cam 21 when said hinge member 29 is in unlocked position.

5. A sewing machine according to claim 4, including a fifth distribution cam 42 on said control shaft for controlling in synchronism with the other distribution cams on said shaft, a change speed gear 51+ for said modula-

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tion 47 and control 59 cams, to permit the sewing of variations of decorative motifs and to effect a change in the density of the number of points.

6. A sewing machine according to claim 1, wherein said selecting operating member 37 which is secured to said control shaft 36 carrying said distribution cams 38, 39, 40, 41, 42, is successively and rotatably movable in four zones of operation, the first zone 89 permitting straight sewing with the option of changing the centering of the needle bar by means of said manual centering member 76, permitting the changing of the modulation cam 47 and first control cam 59, and operation of a second control cam 93 for control of the amplitude and direction of movement of the feeder; a second zone 90 setting into service said triangular cam 21 imparting the necessary movement to the needle bar 4 for zig-zag movement, the amplitude of movement being selected by the angular position of the selecting operating member 37, the variation of the centering of said needle bar being effected by operation of said manual centering member 76; the third zone 91 connecting said first control cam 59 to said needle bar 4 by means of said second slide 61, thereby permitting its feeler finger 60 to assume different positions for different amplitudes of movement of said needle bar, said feeler 20 of said triangular cam 21 remaining spaced from said triangular cam, said centering member 76 being out of action; the fourth zone 92 maintaining the connection of said first control cam 59 to the needle bar 4 by means of said second slide 61 and said first slide 16, the latter operating with said triangular cam, said feeler 46 of said modulation cam 47 actuating said hinged lever 27 and said first arm 25 controlling said first rod 14, said first arm 25 positioning the end 15 of said rod 14 on said first slide 16, said rod hinged at its other end to said cradle of the needle bar 4, said centering member 76 being out of action in said fourth zone; said selecting operating member 37 permitting the stopping of the rotation and ratios of different speeds of rotation of said modulation cam 47 and first control cam 59 and of the second cam 93 for control of the feeder.

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