United States Patent

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Chuo-ku, Tokyo, Japan

[32] Priority **Aug. 29, 1967**
[33] **Japan**
[31] **No. 42/55,014**

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[54] **NEEDLE PLATE DEVICE FOR A ZIGZAG SEWING MACHINE**
11 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **112/158,** 112/260
[51] **Int. Cl.** **D05b 3/02**
[50] **Field of Search** 112/158, 260, 157, 168

[56] **References Cited**

UNITED STATES PATENTS

1,290,924	1/1919	Davis	112/260
3,358,631	12/1967	Sharp	112/260

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Assistant Examiner—George V. Larkin
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ABSTRACT: The needle bar of a zigzag sewing machine is set by manual operation of a knob to a central position, and to nonoscillation so that the reciprocating needle makes a straight seam. The same operation of the knob actuates a needle plate element to reduce the slot in the needle plate to a central opening for the passage of the needle so that the stitched fabric cannot be pressed into the slot by the reciprocating needle.

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SHEET 1 OF 9

FIG. 1

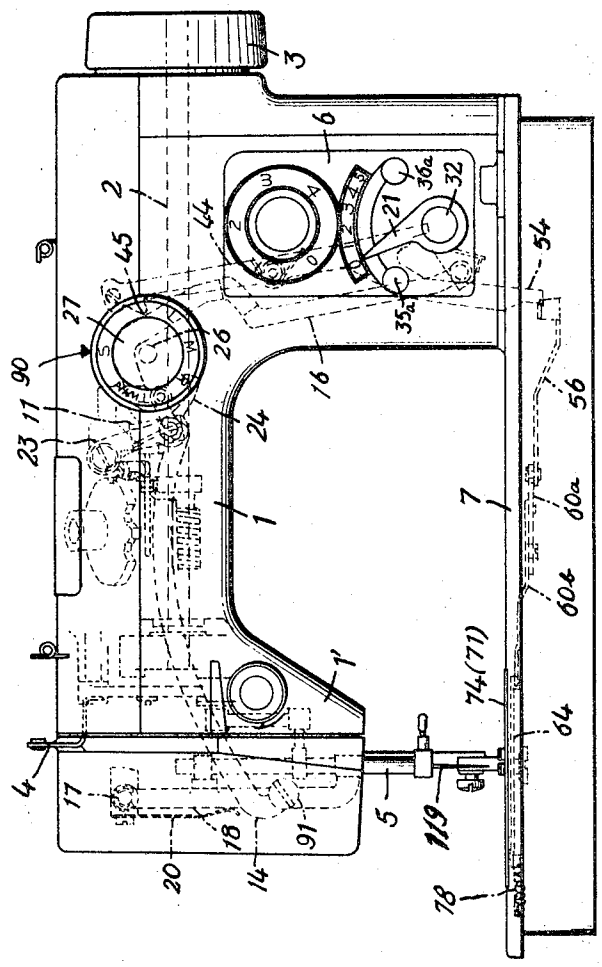

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FIG. 2

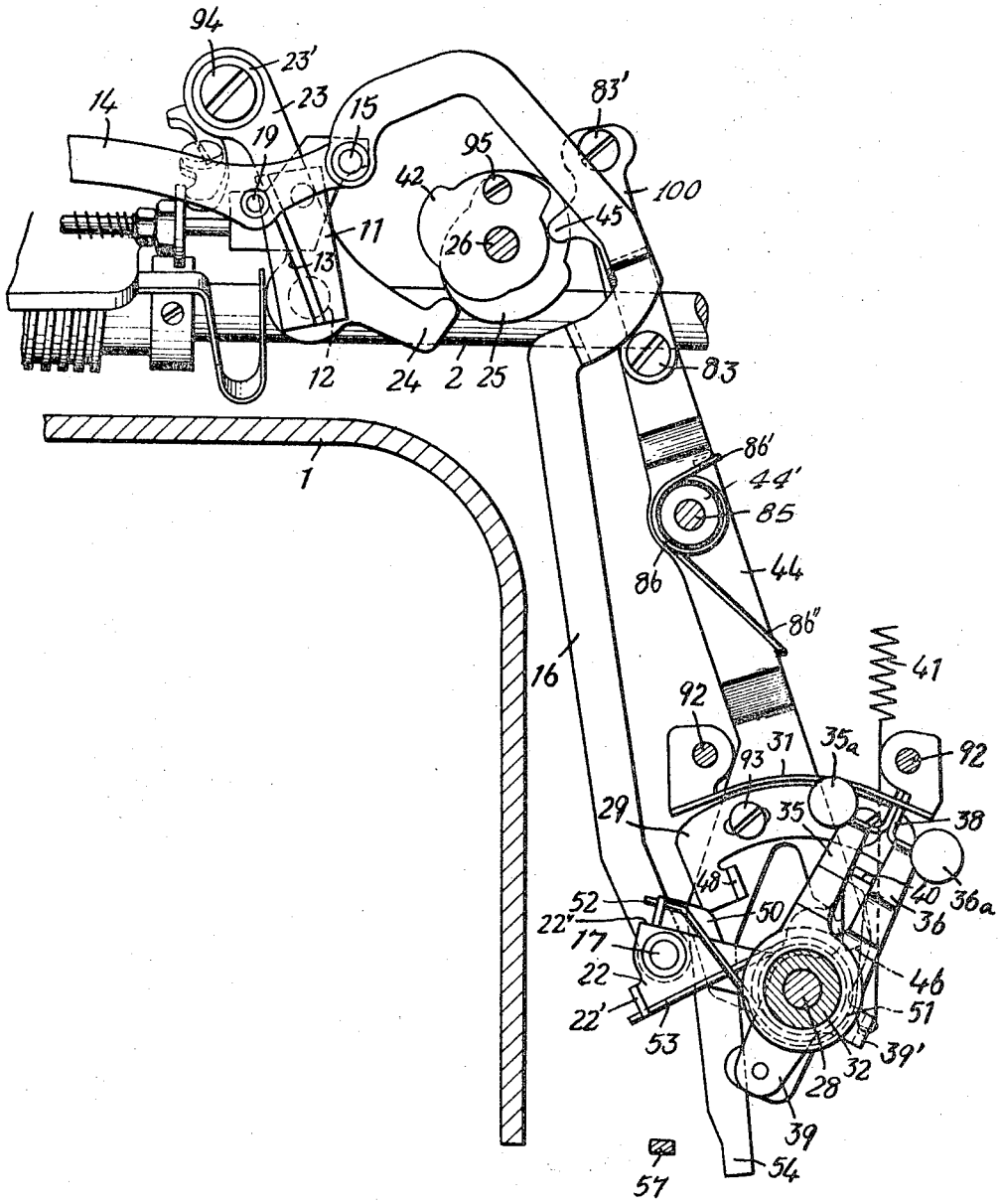

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FIG. 3

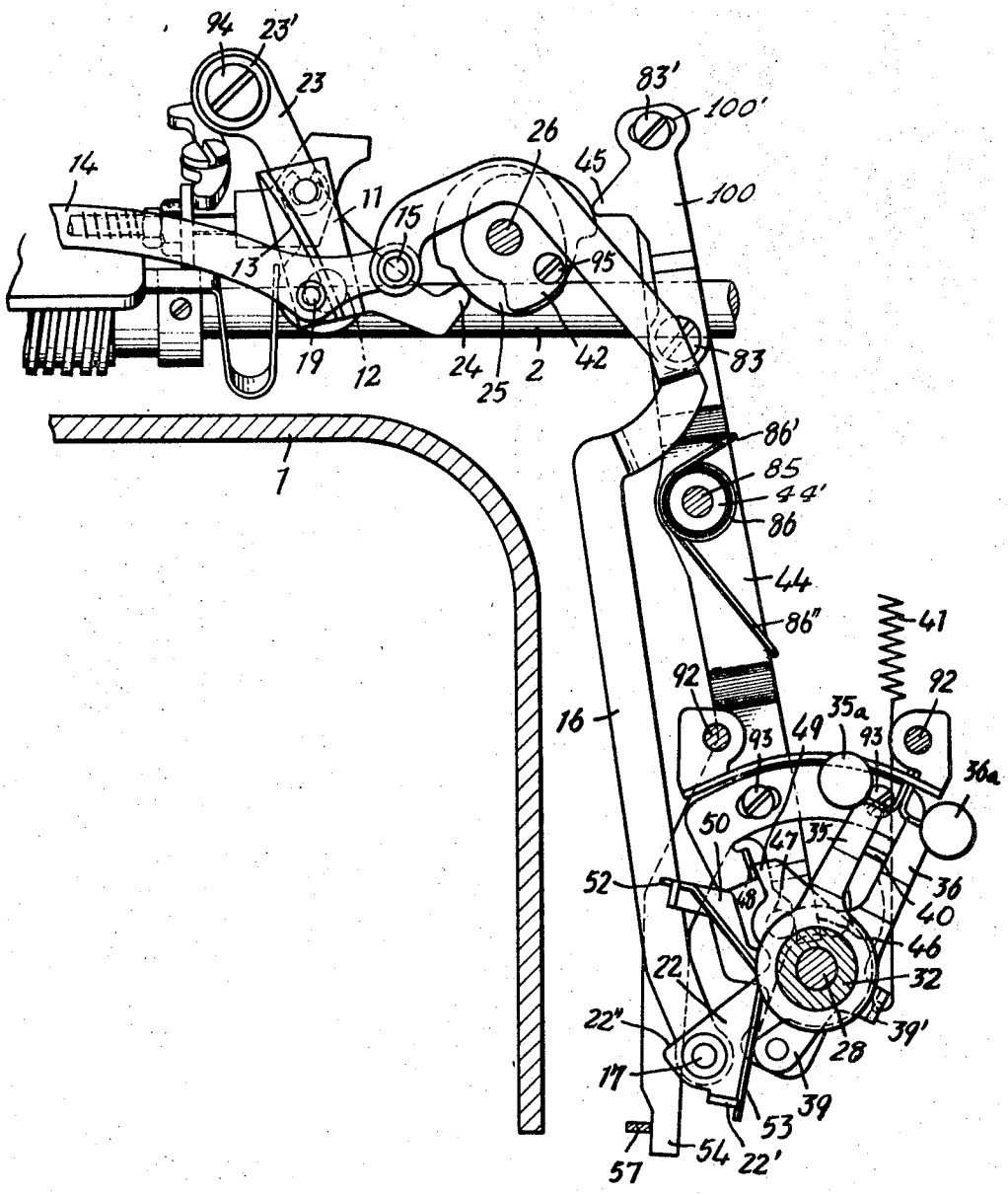

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FIG. 4

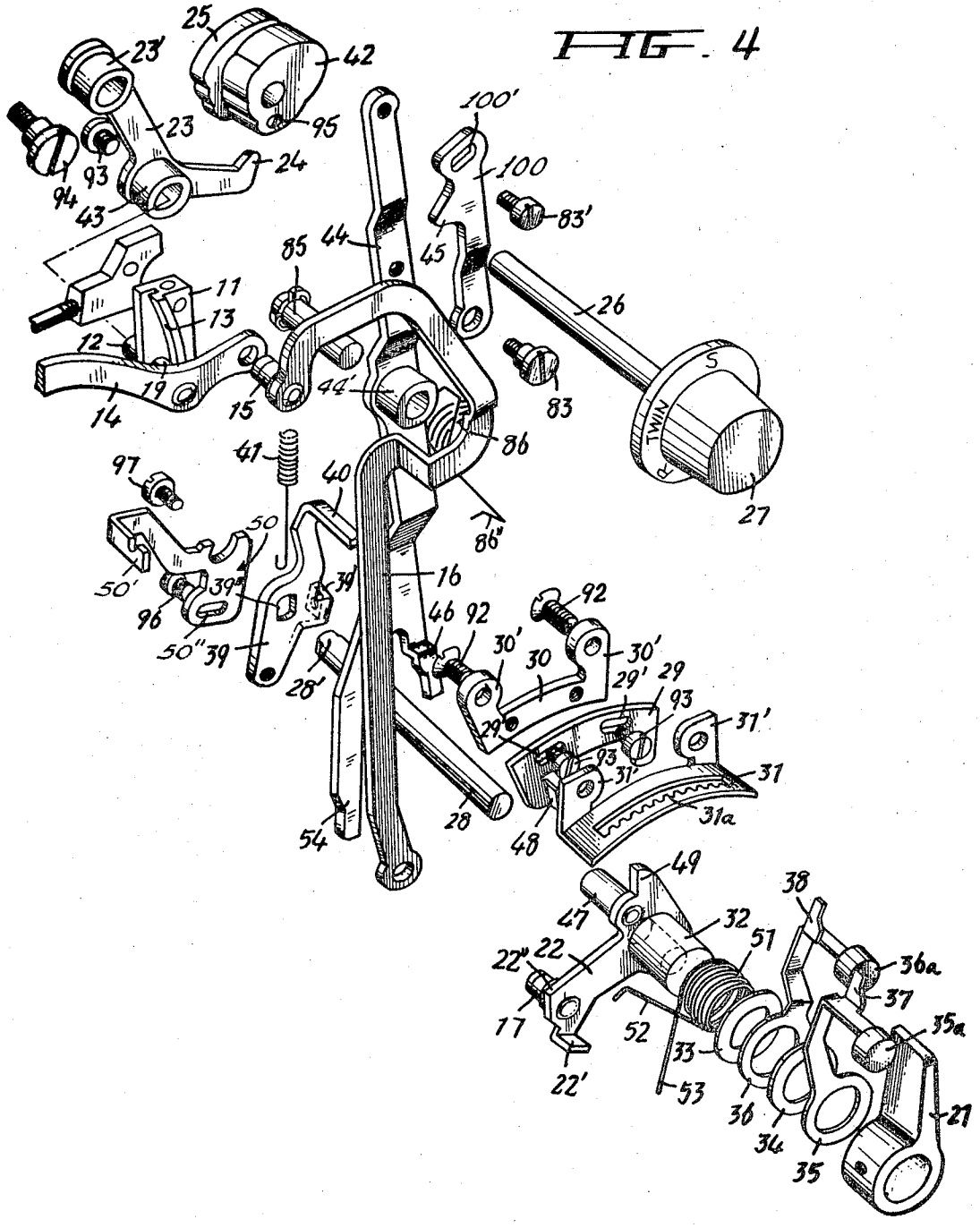

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FIG. 5

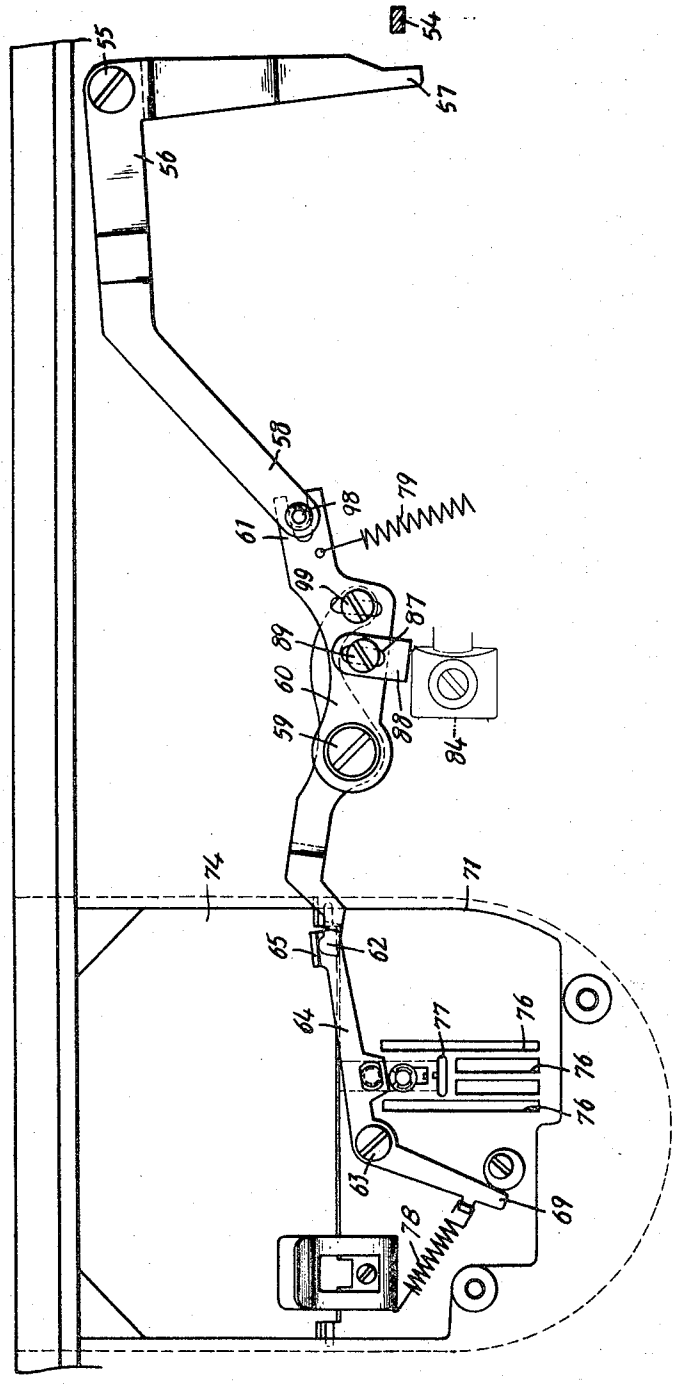

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FIG. 6

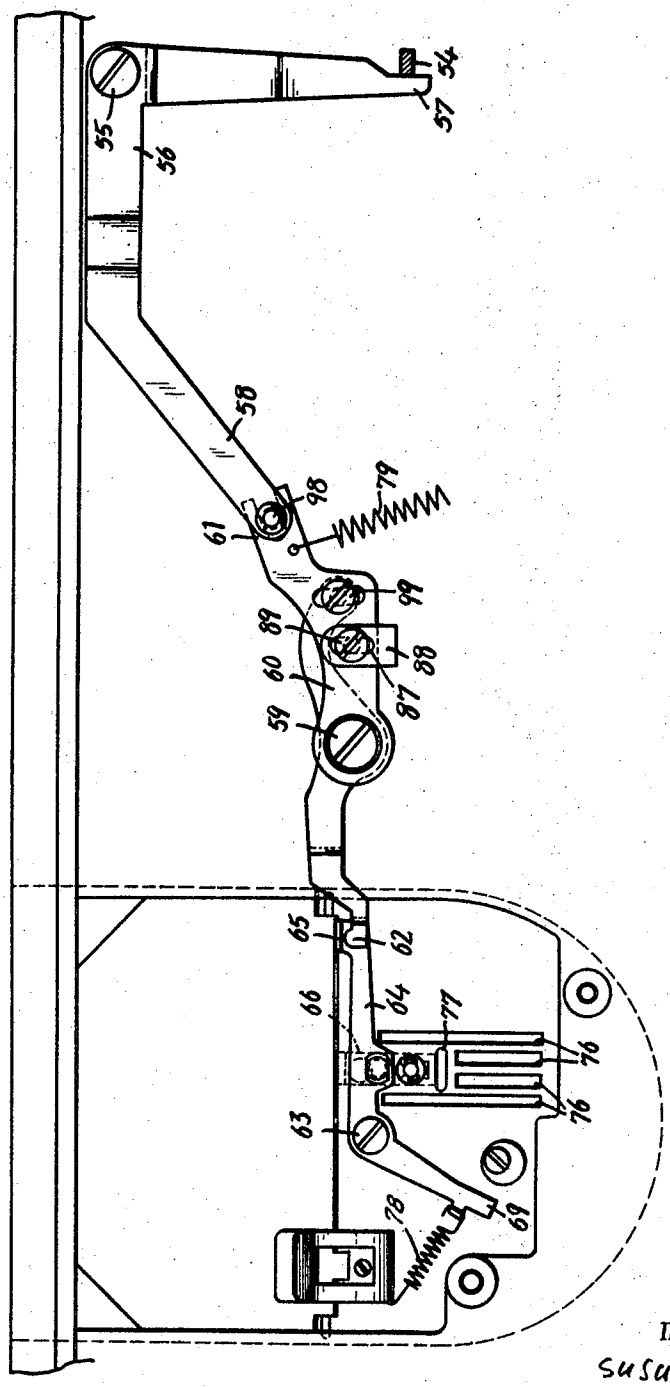

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FIG. 7

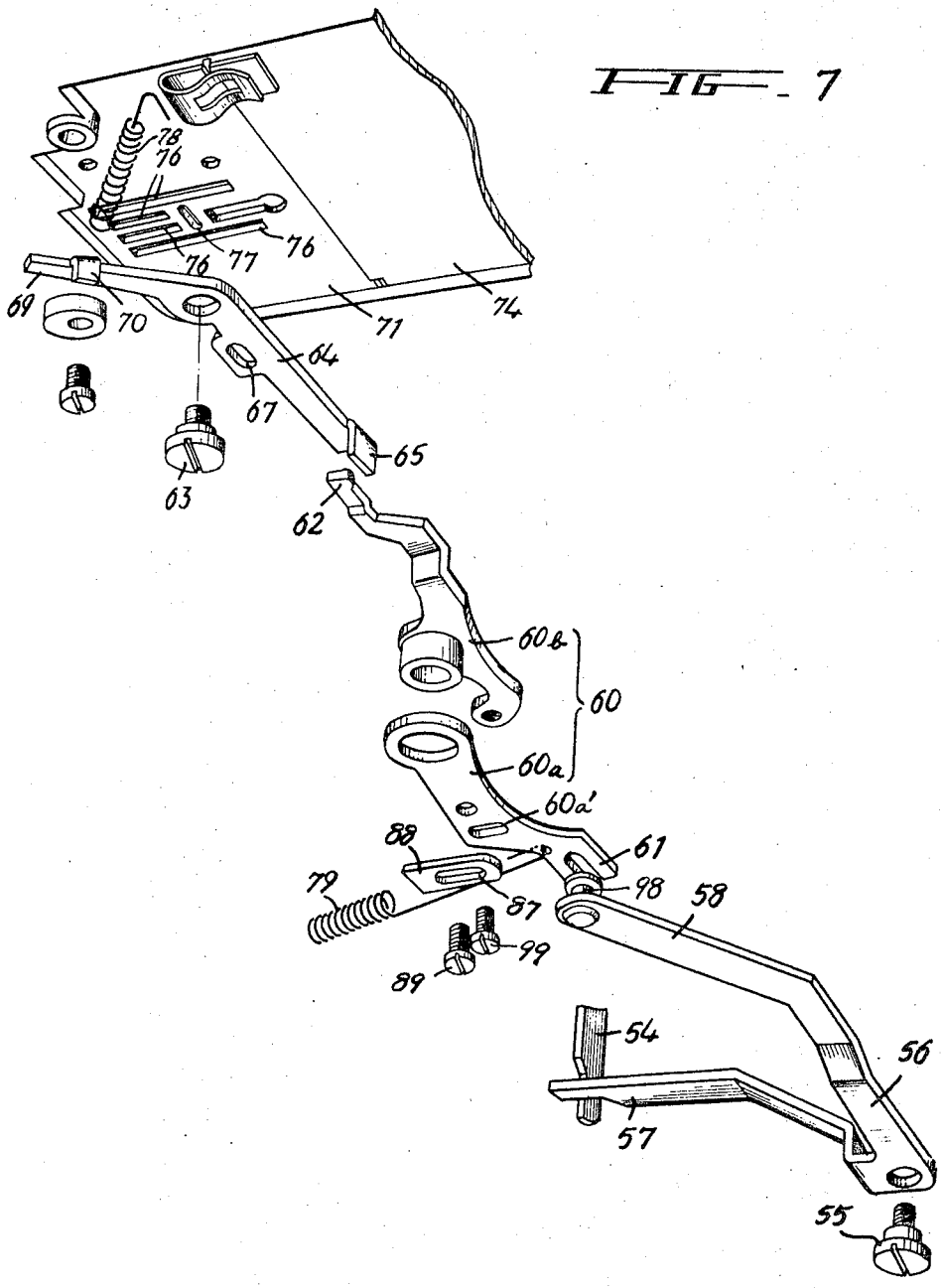

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FIG. 8

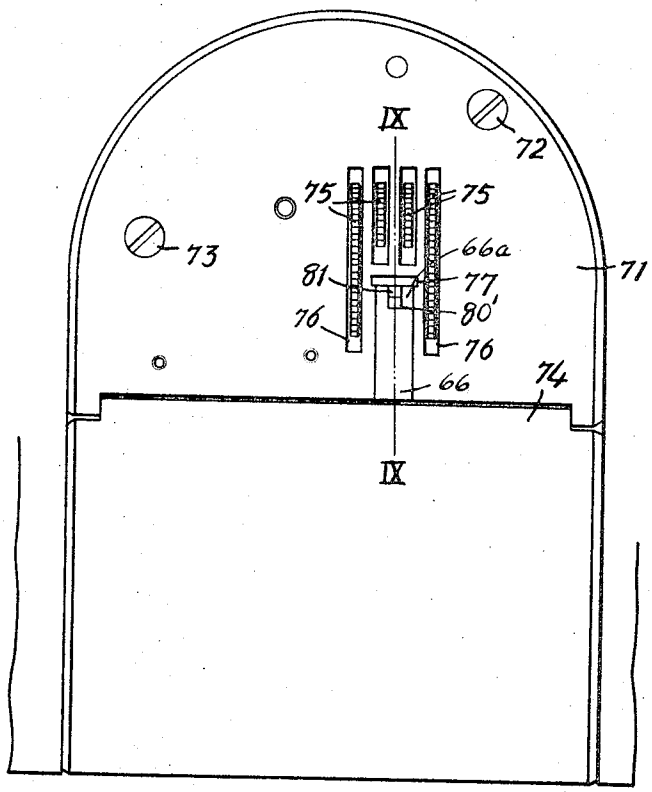

FIG. 10

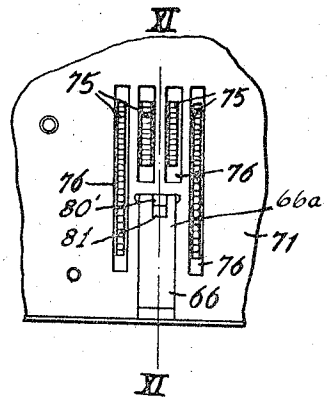

FIG. 9

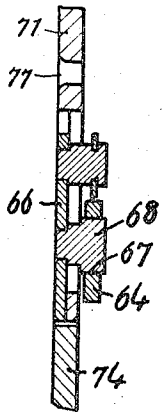

FIG. 11

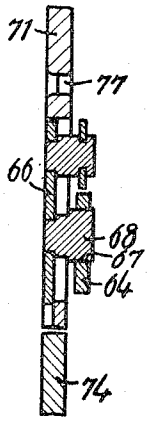

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FIG. 12

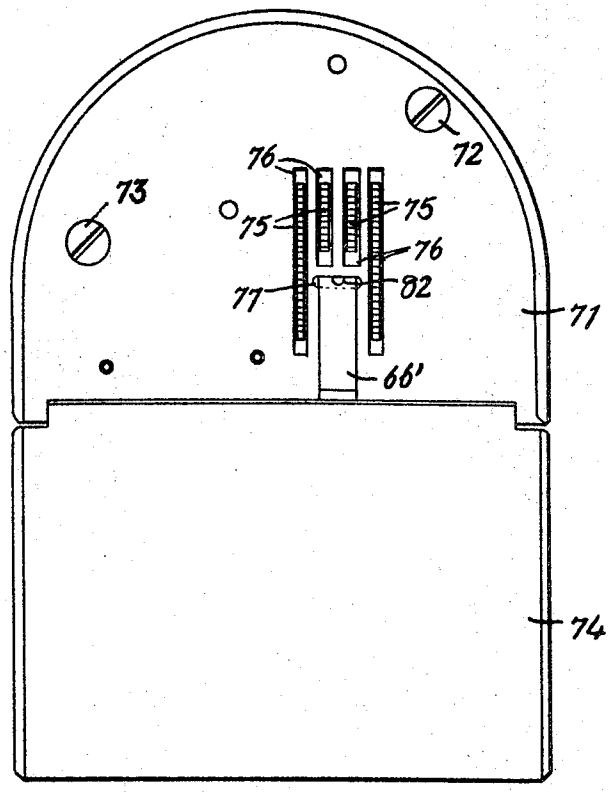


FIG. 13

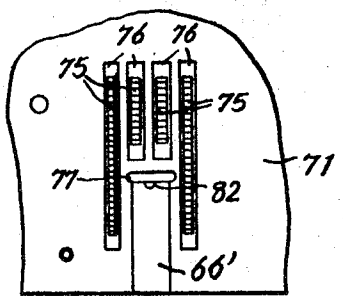
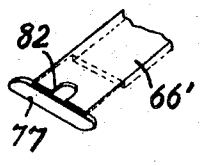


FIG. 14



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NEEDLE PLATE DEVICE FOR A ZIGZAG SEWING MACHINE

In a zigzag sewing machine, as is well known, a needle plate is provided with an elongated slot through which a needle passes when longitudinally reciprocated as well as when transversely oscillated. Although such an elongated slot is indispensable in the zigzag sewing machine, it usually tends to cause skipped stitches and also irregular seams during a sewing operation especially when straight line stitching is performed with the zigzag sewing machine, since the sewn cloth is depressed into the slot below the level of the needle plate by the needle moving down. Such depression of the cloth is most conspicuous at the central part of the slot; where straight line stitching is usually performed with the needle position being set at the center of the slot.

The primary object of this invention is to eliminate the above-mentioned disadvantages and to enable the zigzag sewing machine to produce beautiful and perfect straight line seams.

In order to achieve such an object this invention provides that, when the needle bar is located in the right or left sewing position it is shifted to a predetermined position where it is not oscillated, while the elongated slot in the needle plate is partly closed to become a hole just suitable for straight line stitching operation. A single operating member controls both operations.

The other advantages and characteristics of this invention will be understood from the following explanation of actual embodiments described in reference to the attached drawings; in which

FIG. 1 is a front elevational view of the entire sewing machine equipped with an embodiment of this invention.

FIG. 2 is a front elevational view of this embodiment with some parts illustrated in section and showing a condition in which the needle bar is to be set for making the largest oscillation.

FIG. 3 is almost the same view as that of FIG. 2, however, showing a condition in which the needle bar is to be shifted to a predetermined sewing position and set for making a straight reciprocating longitudinal movement.

FIG. 4 is an exploded perspective view of this invention as illustrated in FIGS. 2 and 3.

FIG. 5 is a bottom view of this embodiment showing a plate element and other connecting members, the plate element opening the slot in the needle plate for making zigzag stitching.

FIG. 6 is almost the same view as that of FIG. 5, showing the plate element partly closing the slot ready for making straight line stitching.

FIG. 7 is an exploded perspective view of the embodiment as illustrated in FIGS. 5 and 6.

FIG. 8 is a top plan view of the needle plate according to this invention in which the slot in the needle plate is opened for zigzag stitching.

FIG. 9 is a sectional view taken along line 1X–1X of FIG. 8.

FIG. 10 is a top plan view of the needle plate according to this invention in which the slot in the needle plate is closed for straight line stitching.

FIG. 11 is a sectional view taken along line X1–X1 of FIG. 10.

FIG. 12 is a top plan view of the needle plate according to another embodiment of this invention in which the slot in the needle plate is partly closed for straight line stitching.

FIG. 13 is almost the same view as that of FIG. 12 in which, the slot is opened for zigzag stitching.

FIG. 14 is an enlarged perspective view of the needle plate and the plate element of this invention.

Now referring to FIG. 1 in the machine frame 1 of the sewing machine, as well known, a drive shaft 2 is rotatably journaled. The drive shaft 2 is at one end provided with a handwheel 3 and at the other end provided with a balance crank and other members so that it may actuate a needle bar 5. Though not illustrated there is provided an oscillation-generating mechanism which is operatively connected to the drive shaft 2 and driven by the same.

Referring to FIGS. 2 and 3 an oscillating member 11 is operatively connected to the oscillation-generating mechanism and oscillated by the same. An oscillating rod 14 is at one end pivotally supported on a needle bar support 18 by means of a pivot member 19 and at the other end portion connected to the oscillating member 11, so that the needle bar support 18 may be oscillated in accordance with the oscillation of the oscillating member 11 against a leaf spring 20 which is at one end fixedly mounted at the front end of the machine frame 1 and normally urges the needle bar support 18 to turn in one direction about a pivot 17. Thus the needle bar 5 which is reciprocably supported on the needle bar support 18 is transversely oscillated during its longitudinal reciprocating movement.

As illustrated in FIGS. 2—4 the oscillating rod 14 is at its right end connected to the upper end of an oscillation-adjusting rod 16 by means of a pivot element 15 while the oscillation-adjusting rod is at the lower end connected to one end portion of an adjusting arm 22 by means of a pivot element 17. The adjusting arm 22 with its hub 32 is turnably mounted on the shaft 28. The shaft 28 is arranged in the lower part of the casing of the sewing machine and projects at its forward end out of the casing for carrying an oscillation adjusting knob 21 thereon. The oscillating member 11 is formed with a slide surface 13 slidingly engaged by a pin 19 mounted at one end portion of the oscillating rod 14, and the oscillating member 11 is turnably supported by a pivot element 12 on a plate member 23 which is operated to change the sewing position of the needle bar 5 as more clearly described hereinafter. Usually the pin 19 is slidingly moved along the slide surface 13 of the oscillating member 11 in the direction to and from the pivot element 12 by turning the knob 21 so that the oscillating movement of the needle bar 5 may be varied by the oscillating rod 14.

A mounting plate 6 as illustrated in FIG. 1 mounts the knob 21 at its lower part outside of the casing. On the inside of the mounting plate 6, as illustrated in FIG. 4, a seat member 30 and a racked plate 31 are fixedly attached in a flatly joined condition by means of screws 92 respectively passing through the holes 30'. Just below the seat member 30 and the racked plate 31 a guide plate 29 is adjustably fixed by means of screws 93 respectively passing through the elongated holes 29' formed in the guide plate. The guide plate 29 is at its one end portion formed with a part 48 bent out of the plane of the guide plate, and adapted to be engaged by a projection part 49 of the aforementioned oscillation-adjusting arm 22. The shaft 28 is at its inner end formed with a reduced part 28' at which is fixed an oscillation regulator member 39 with a hole 39'' formed therein by means of a screw 97. On the forward part of the shaft 28, the oscillation-adjusting arm 22 with hub 32, a washer 33, a setting member 36, a washer 34, a setting member 35 and the manually operated oscillating-adjusting knob 21, which is on the outside of the mounting plate 6, are aligned and fixed. A spring member 51 surrounds hub 32 and has arms 52 and 53. The setting members 35, 36 are at their upper parts respectively formed with upstanding elements 37, 38 which are adapted in a contacting condition to engage any of the detaining places 31A' of the racked plate 31, and further the setting members 35, 36 are provided with operating members 35', 36' respectively. Such a pair of regulator set members is adapted, as illustrated in FIGS. 2 and 3, to hold a bent extension 40 of the oscillation regulator member 39 and detain it in its shifted position. The oscillation regulator member 39 is normally urged to turn in the counterclockwise direction by a spring 41 which is at one end attached to a projecting part 39' of the same member 39 and at the other end anchored to the machine frame 1. It is understood that when the bent extension 40 of the oscillation regulator member 39 is embraced by the pair of setting members 35, 36 and detained at any desired position along the racked plate 31, it will be detained there substantially by the left setting member 35 and serve to maintain constant a selected oscillating amplitude of the needle bar 5.

FIG. 2 shows a condition of the apparatus in which the oscillation amplitude of the needle bar 5 is set to the maximum amplitude. The pivot element 12 for the oscillating member 11 is inserted into the central hub 43 of the aforementioned plate member 23 and turnably held there by means of a setscrew 93 which is threaded into the pivot element 12 on the rear side of the plate member 23. As best seen in FIG. 4, the plate member 23 is at one end turnably supported on the frame 1 by means of a stepped screw 94 and at the other end engages a largest radius track portion of a cam 25 which is fixedly mounted on a shaft 26. The shaft 26 is provided with an operating knob 27 on its forward end which projects out of the frame 1. The bent extension 40 of the oscillation regulator member 39 is brought to the right side end of the racked plate 31 by the oscillation-adjusting knob 21 manually turned in one direction, and held there by the setting members 35, 36. Consequently the pin 19 provided on the oscillating rod 14 is slidingly moved to the position furthest from the pivot element along the slide surface 13 of the oscillating member 11. Thus the largest oscillating movement of the member about the pivot element 12 is transmitted to the needle bar 5 through the oscillating rod 14.

FIG. 3 shows a condition of this invention in which the needle bar 5 is shifted to a predetermined position and the oscillating movement eliminated, although the extension 40 of the oscillation regulator member 39 is detained at the right side position of the racked plate 31 just as illustrated in FIG. 2. According to the illustration of FIG. 3 the pin 19 is shifted to the pivot element 12 from the position at which it is located as in FIG. 2 by rotating the cam 25 and a cam 42 which are fixedly mounted on the shaft 26 and fixedly connected by means of a screw 95 so that the two cams 25 and 42 may be rotated together by operating knob 27 which is fixed on the forward end of the shaft 26 protruded out of the machine frame 1. The end part 24 of the plate member 23 engages the smaller radius track portion of the cam 25 while the projecting part 45 of an adjusting plate 100 engages the largest radius track portion of the cam 42. The adjusting plate 100 is adjustably fixed on a forked lever 44 by means of a stepped screw 83 and a screw 83' so that the position of the projecting part 45 of the adjusting plate 100 may be properly adjusted with respect to the cam 42. The forked lever 44 has a hub portion 44' turnably mounted on the frame 1 by means of a pivot element 85, and is biassed by a spring member 86. The spring member 86 is mounted around the hub 44' the forked lever 44 and at its one end abutting the forked lever 44 and at the other end anchored to the machine frame 1, so that the forked lever 44 is normally urged to turn clockwise and the projecting part 45 of the adjusting plate 100 is engaged with the cam 42. The forked lever 44 is at its lower portion provided with an oscillation control arm 46 and an actuating arm 54, the former being adapted to engage a pin 47 which is fixed on the rear side of the oscillation-adjusting arm 22 and the latter adapted to engage one end of a first layer which will be described hereinafter.

As illustrated in FIG. 4 a U-shaped member 50 is adjustably attached to the oscillation regulator member 39 by means of a screw 96 which passes through a slot 50'' formed in the same member 50 and is threaded into the threaded hole of the oscillation regulator member 39. The spring member 51 is at its one end attached to a part 50' of the U-shaped member 50 and at the other end attached to the pivot element of the oscillation regulator arm 22. Since the part 50' of the U-shaped member 50 is located on the upper edge 22'' of the oscillation regulator arm 22, the member 50 and the arm 22 are normally held together by the spring member 51 as illustrated in FIG. 2.

When the knob 27 is rotated and the symbol "S" marked on the same knob coincides with an index mark 90 on the frame 1 thereby to set the device as illustrated in FIG. 3, the forked lever 44 is turned clockwise against the spring member 86 by the cam 42, and consequently the oscillation-control arm 46 of the forked lever 44 turns the oscillation regulator arm 22 in the counterclockwise direction against the action of spring member 51 until the projecting part 49 of the oscillation regulator arm 22 engages the bent out part 48 of the guide plate 29 and is stopped by the same. Accordingly the pin 19 mounted on the oscillating rod 14 is slidingly moved along the slide surface 13 of the oscillating member 11 to the pivot element 12 from the position shown in FIG. 2 by the oscillation-adjusting rod 16 and the needle bar 5 will not be oscillated. Simultaneously the plate member 23 is turned to a predetermined position about the pivot element 94 due to the engaging relation between the end part 24 of the plate member 23 and the corresponding cam 25. Consequently the oscillation center 12 of the oscillating member 11 is shifted together with the plate member 23. Thus the needle bar 5 is shifted to the center sewing position even if it was located in the right or left sewing or field position, since the oscillating rod 14 is always subjected to the biasing force of spring member 20 so that it may at its pin 19 engage the slide surface 13 of the oscillating member 11. In this manner, the central sewing field position of needle bar 5 with the needle is set by the device 23, 24, 25, 94, while oscillation of the needle bar is stopped by the device 44, 42, 46, 22, 51, 29, 19, 13, 11, 12. Knob 27 controls both operations.

Referring to FIGS. 5, 6 and 7, as is already described, the actuating arm 54 of the forked lever 44 normally engages one end 57 of the first lever 56 which is at its central portion turnably supported on the rear surface of the machine bed 7 by means of a pivot element 55. The other end 58 of the first lever 56 is connected to a connecting part 61 formed at one end of a second lever 60 by means of a stud 98. The second lever 60 is composed of members 60*a* and 60*b*, and turnably supported on the rear surface of the machine bed 7. The members 60*a* and 60*b* are adjustably connected to each other by the above mentioned pivot element 59 and a screw 99 so that both members may be together actuated. A stop 88 is adjustably attached to the second lever 60 by means of a screw 89 and adapted to engage the projection 84 of the machine bed 7 so that it may serve to prevent the second lever 60 from being displaced too far. The other end 62 of the second lever 60 engages one end portion 65 of a third lever 64 which is turnably supported on the rear surface of the needle plate 71 by means of a pivot element 63. Since the second lever 60 is biassed to turn clockwise about the pivot element 59 by a spring 79 which is at one end attached to the end portion 61 of the lever 60 and at the other end anchored to the machine bed 7, the second lever 60 engages at its end 62 the end 65 of the third lever 64. The third lever 64 is provided with a transversely elongated hole 67 between the pivot element 63 and the end portion 65 thereof. The hole 67 fittedly receives a projection 68 from a plate element 66 as illustrated in FIGS. 9 and 11. The third lever 64 is biassed to turn clockwise about the pivot element 63 by a spring 70 which is at one end attached to the other end portion 69 of lever 64 and at the other end anchored to the machine bed 7. Thus the plate element 66 is biassed forward toward the elongated slot 77 formed in the needle plate 71. However the action of the spring 78 is normally nullified by the opposing action of spring 79 which is of stronger tension. As shown in FIGS. 8 and 10 the needle plate 71 is mounted in the top surface of the machine bed 7 by means of screws 72, 73, and is at its central part formed with elongated cutouts 76 in which feed dogs 75 are located so that they may perform the movements required for feeding the cloth or any other material to be sewn, and further the needle plate 71 is formed with the above-mentioned elongated slot 77 for allowing the passage of the reciprocating as well as oscillating needle 119. Adjacent the needle plate 71 a slide plate 74 is slidingly fitted in the machine bed 7. The plate element 66 is slidably fitted into a groove of the needle plate 71 and has a top surface flush with the top surface of the same. Plate element 66 has two fingers 66*a* forming a rectangular cutout 80 in which a projection 81 of the needle plate 71 is located whose top surface is also flush with the top surface of the needle plate 71. Projection 81 is located directly adjacent one lateral edge of slot 77 and forms the central part of the same. When plate element 66 is in the retracted position shown in

FIG. 8, the end faces of fingers 66a extend along the outer portions of the same lateral edge of slot 77. When plate element 66 is shifted to the position of FIG. 10, fingers 66a close the outer portions of slot 77 so that only a small opening 80' at the center of slot 77 remains open for the passage of the longitudinally reciprocating needle. Plate element 66 can be moved until the bottom of cutout 80 abuts projection 81 which bounds central opening 80' together with fingers 66a. When the plate element 66 is retracted to the position of FIG. 8, faces of projection 81 and of fingers 66a bound the lateral edge of slot 77 which is now again free for the transversely operating and longitudinally reciprocating needle. Another embodiment of this invention is shown in FIGS. 12—14. According to this embodiment the plate element 66' is made as thin as possible, and the cutout 82 is made as small as possible with an arc-shaped edge only to allow the passage of the needle. When the plate element 66' slides forward the slot 77 is closed by it and changed to a central opening 82, and when the plate element 66' is retracted the slot 77 is none the less suitable for zigzag stitching since the cutout 82 is as stated above very small and shallow and will not permit depression of the cloth.

As understood from the foregoing description, this invention provides simultaneous cooperation of a device for controlling the sewing position of the needle bar, a device for controlling the oscillating movement of the needle bar and a slot for controlling the needle plate device, so that a zigzag sewing machine may perform a perfect straight line stitching.

We claim:

1. In a zigzag sewing machine comprising a machine bed, a needle bar having a needle, a first device for controlling the oscillating movement of said needle bar and needle, and a second device for controlling the sewing field position of said needle bar, in combination, a needle plate device comprising a needle plate formed with an elongated slot for the passage of said needle during zigzag stitching and mounted on said machine bed, a plate element slidably mounted on said needle plate for movement to and from a position partly closing said slot so that only an opening for the passage of said needle during straight stitching remains open, operating means controlling said first and second devices and including a manually operated dial and first and second cams, and lever means connecting said operating means with said plate element and including a forked lever and first, second, and third levers.

2. Needle plate device as set forth in claim 1 comprising a follower member connected with said second device and cooperating with said first cam, and an adjusting plate connected with said first device and adjustably mounted on said forked lever, and cooperating with said second cam.

3. A needle plate device as set forth in claim 2 wherein said forked lever is formed with an oscillation control arm and an actuating arm, the former being adapted to control the oscillating movement of the needle bar and the latter adapted to actuate said first, second and third levers.

4. A needle plate device as set forth in claim 1 wherein a projection is formed on said needle plate adjacent to said elongated slot, and a cutout is formed at one end of said plate element so that said cutout may slidably engage said projection and said plate element may be guided by said projection during its sliding movement.

5. A needle plate device as set forth in claim 4 wherein said plate element is at its one end formed with a hole just for straight line stitching.

6. A needle plate device as set forth in claim 3 wherein said forked lever operatively actuates said first, second and third levers to slidingly move said plate element.

7. A needle plate device as set forth in claim 6 wherein said second lever is composed of two members for adjustably obtaining a correct predetermined movement of said plate element.

8. In a zigzag sewing machine including a needle bar and a needle reciprocable in longitudinal direction for making stitches forming a straight seam, and oscillatable in a transverse direction for making zigzag stitches, in combination, a device for controlling the oscillating movement of said needle bar and needle; a needle plate formed with a transverse slot for the passage of said needle during oscillation and zigzag stitching; a plate element mounted on said needle plate for movement between an inoperative position in which said slot is open, and an operative position partly closing said slot so that only an opening for the passage of said needle during straight stitching remains open; and manually operated means connected with said device for controlling the oscillating movement and with said plate element to simultaneously effect nonoscillation and straight stitching of said needle bar and needle, and positioning of said plate element in said operative position whereby a fabric on said needle plate and needle element cannot be pressed into said slot during straight stitching.

9. In a zigzag sewing machine as claimed in claim 8, in combination, another device for controlling the sewing field position of said needle bar and needle; wherein said manually operated means is connected with said other device for setting said needle bar and needle to a central field position simultaneously with the placing of said plate element in said operative position and with the setting of said needle bar to straight stitching; and wherein said plate element in said operative position covers the ends of said slot and has a central cutout registering with said slot in said operative position and forming said opening in the center portion of said slot.

10. A zigzag sewing machine as claimed in claim 9 wherein said needle plate has a projection located in said cutout of said plate element adjacent a transverse edge of said slot, said projection guiding said plate element for movement between said inoperative and operative positions and stopping the same in said operative position.

11. A zigzag sewing machine as claimed in claim 9 wherein said manually operated means includes a dial knob, and linkage means connecting the same with said devices and said plate element.