Jan. 24, 1956 W. A. AYRES 2,731,929

SEWING MACHINE

Filed Oct. 7, 1953 3 Sheets-Sheet 1

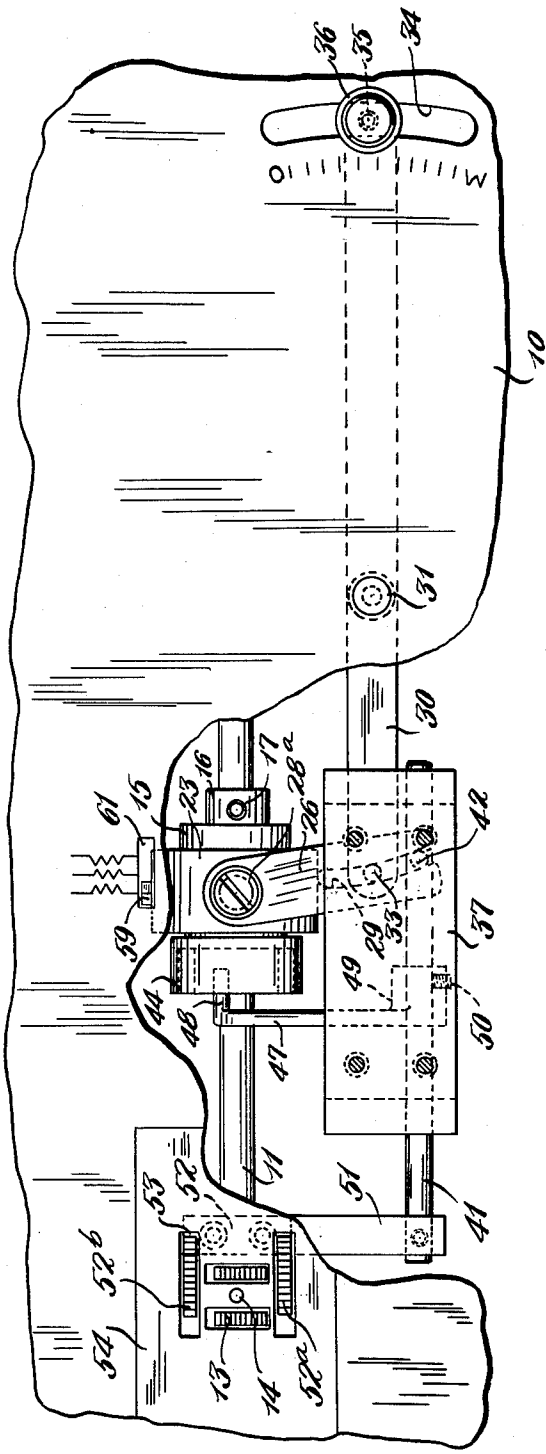


FIG. 1

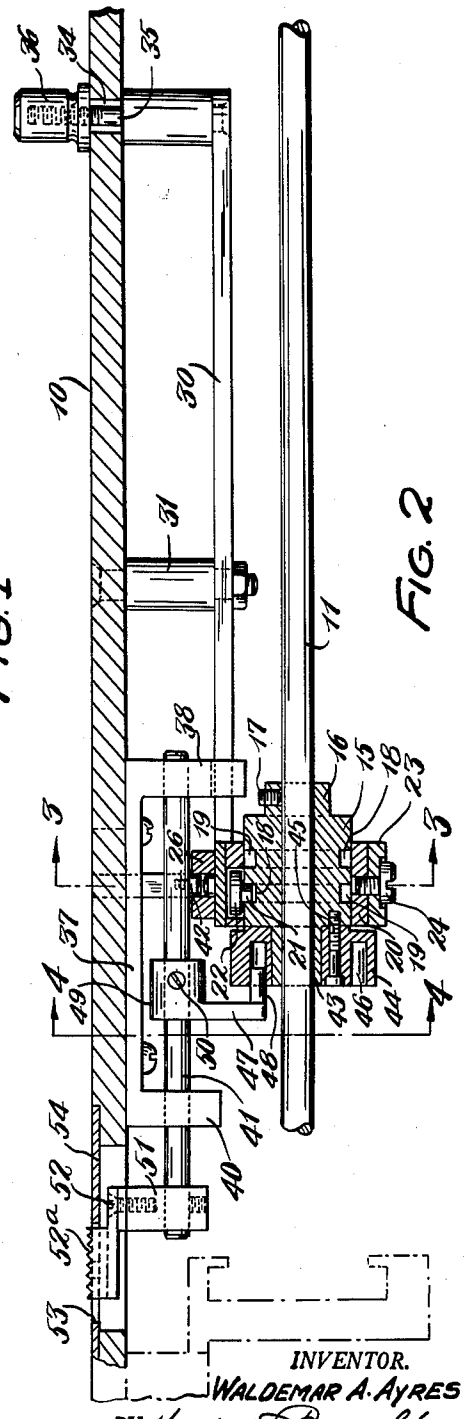


FIG. 2

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SEWING MACHINE

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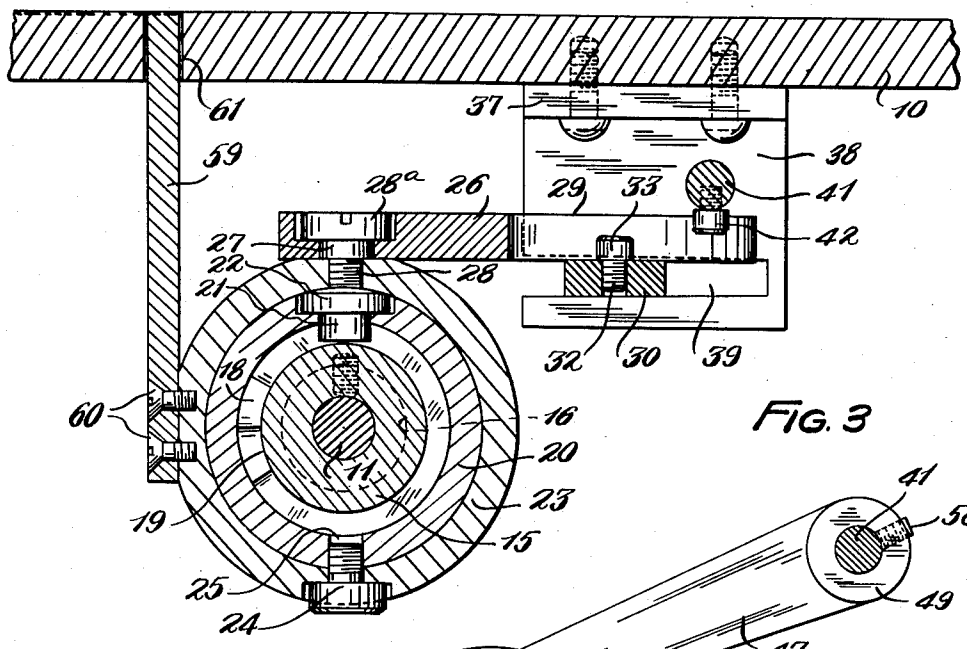


FIG. 3

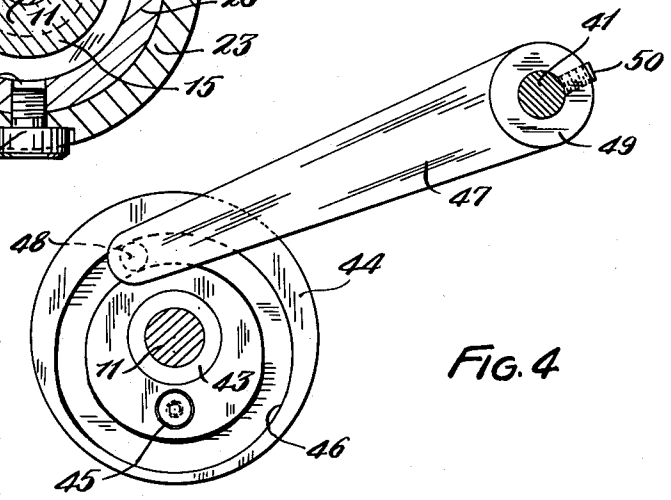


FIG. 4

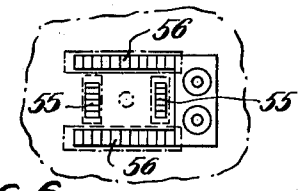


FIG. 6

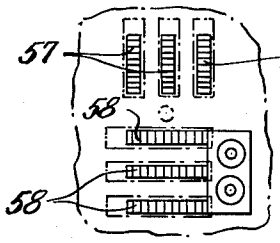


FIG. 7

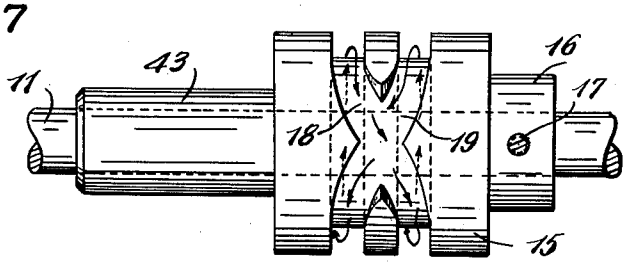


FIG. 5

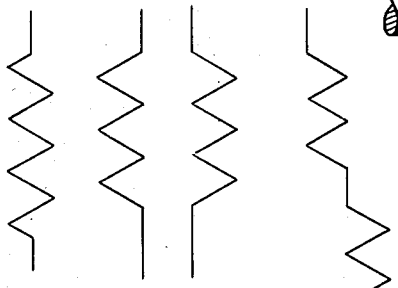


FIG. 8 FIG. 9 FIG. 10



FIG. 12

FIG. 11

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SEWING MACHINE

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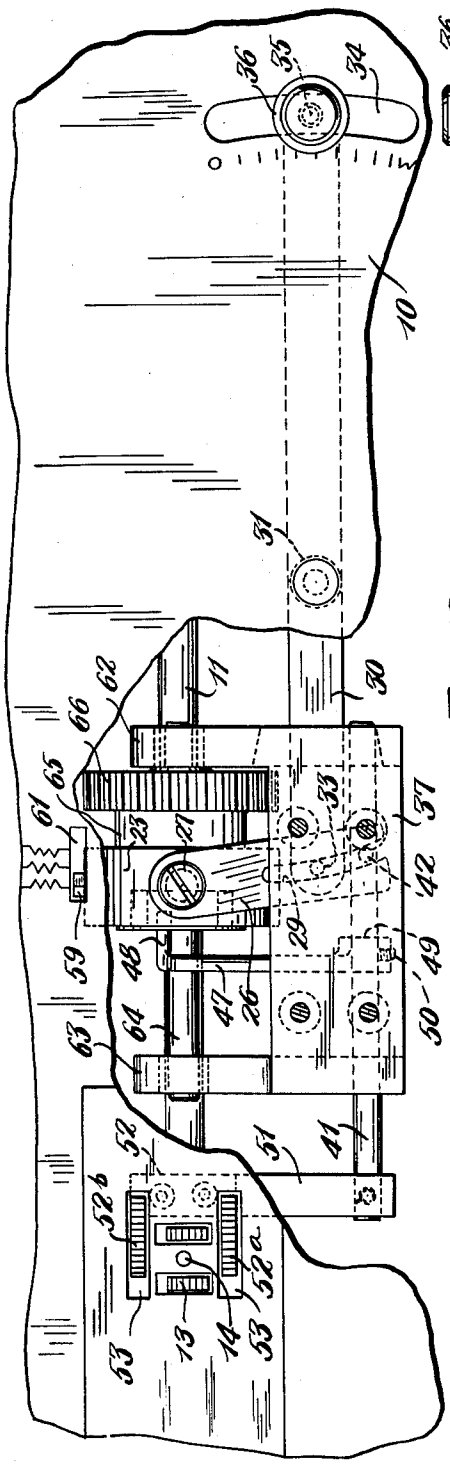


FIG. 13

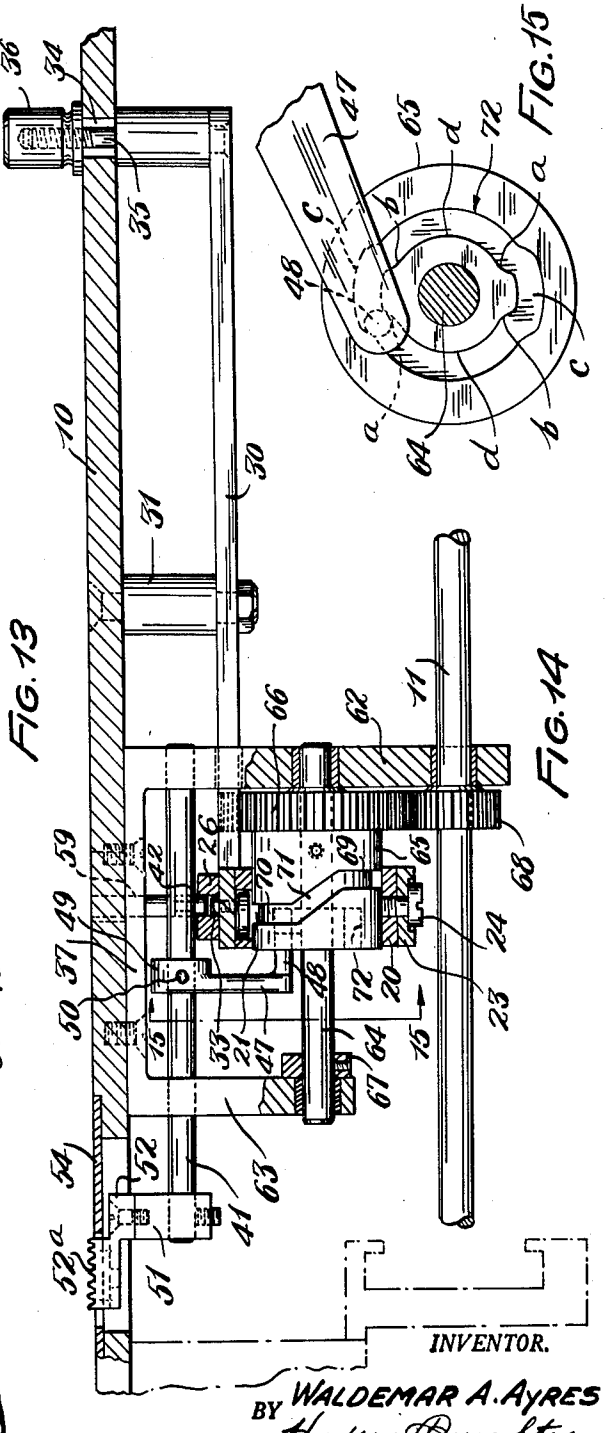


FIG. 14

FIG. 15

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United States Patent Office 2,731,929 Patented Jan. 24, 1956

2,731,929

SEWING MACHINE

Waldemar A. Ayres, Lakewood, Ohio, asisgnor to White Sewing Machine Corporation, Lakewood, Ohio, a corporation of Delaware

Application October 7, 1953, Serial No. 384,734

20 Claims. (Cl. 112—205)

This invention relates to a sewing machine and more particularly to the feeding mechanism thereof which enables zigzag stitching to be performed by the sewing machine.

An object of the invention is to provide in a sewing machine improved and novel mechanism whereby the cloth being operated on by the machine may be fed in the ordinary manner to produce straight line stitching thereon or may have movement imparted thereto laterally of the direction of ordinary feed to produce zigzag stitching thereon.

A further object of the invention is to provide in a sewing machine improved and novel mechanism such as referred to in the above object and wherein the amplitude and the relationship of the lateral movement imparted to the cloth with respect to straight line stitching and the needle may be selectively varied to produce different types, patterns and lengths of zigzag stitching.

Another object is to provide in combination with the improved and novel mechanism, an indicator whereby the operator can obtain the desired relationship between the straight line stitching and the zigzag stitching.

A further object is to provide in a sewing machine improved and novel mechanism such as referred to in the preceding objects and which is of simple construction and is efficient in operation.

A more detailed object is to provide in a sewing machine the usual feed dog and feed mechanism for imparting ordinary feeding movement to the cloth in combination with an additional feed dog or feed dogs and the operating mechanism therefor for imparting movement to the cloth laterally with respect to the direction of the ordinary feeding movement thereof.

Further and additional objects and advantages not herein before referred to will become apparent hereinafter during the detailed description of embodiments of the invention which is to follow and which embodiments of the invention are illustrated in the accompanying drawing wherein,

Fig. 1 is a fragmentary plan view of the bed plate of a sewing machine with a portion of the bed plate broken away to illustrate in top plan one form of mechanism embodying the invention for actuating the feed dog which imparts lateral movement to the cloth to produce zigzag stitching.

Fig. 2 is a partial elevational and partial longitudinal sectional view of the construction shown in Fig. 1.

Fig. 3 is a detail sectional view on a larger scale than Figs. 1 and 2 and is taken on line 3—3 of Fig. 2 looking in the direction of the arrows.

Fig. 4 is a detail sectional view also on the larger scale and is taken on line 4—4 of Fig. 2 looking in the direction of the arrows.

Fig. 5 is a fragmentary detached elevational view showing the reversing cam mounted on the feed shaft beneath the bed plate.

Figs. 6 and 7 are fragmentary plan views of the bed plate showing different arrangements of the feed dogs for

producing ordinary feeding movement and of the feed dogs for producing the lateral movement of the cloth for zigzag stitching.

Figs. 8, 9, 10, 11 and 12 illustrate examples of some of the many stitch patterns which can be produced by the mechanism embodying the invention.

Figs. 13 and 14 are views similar to Figs. 1 and 2 but showing a different form of mechanism embodying the invention, and

Fig. 15 is a fragmentary end elevation and sectional view taken substantially on line 15—15 of Fig. 14, looking in the direction of the arrows.

Referring to the drawings, the bed plate of a sewing machine is indicated at 10 and it will be understood that the sewing machine head (not shown) extends upwardly from the bed plate with the horizontal arm of the head overlying the bed plate in spaced relation thereto and mounting at its end or face the vertically reciprocating needle bar, the mechanism for reciprocating said needle bar including the drive shaft in the horizontal arm and the hand wheel on said shaft, and the usual presser foot mechanism, all of which parts have not been shown herein since they are well understood in the art.

The main feed shaft 11 is located beneath the bed plate 10 and extends lengthwise thereof and is supported in suitable bearings (not shown) and is operatively interconnected with the drive shaft for the needle bar as will be well understood in the art. The main feed shaft 11 is operatively connected through any suitable feeding mechanism well known in the art to the regular or straight feed dog 13 shown in Fig. 1 or it may be connected thereto by the mechanism shown in my application Serial No. 327,587, filed December 23, 1952.

It will be understood that the operative connection between the feed shaft 11 and the regular feed dog 13 may take any well known form or that it may take the form shown in said application Serial No. 327,587, and that it functions from the rotation of the shaft 11 to impart rise and fall movements to the feed dog 13 as well as linear feed movements thereto in a direction transverse to the shaft 11. A suitable arrangement for this purpose is fully illustrated, described and claimed in my said application Serial No. 327,587, and need not be explained or illustrated herein.

The usual opening 14 is provided in the bed plate 10 for the vertically reciprocating needle as is well understood in the art.

A reversing cam member 15 is mounted on the shaft 11 and has a hub portion 16 provided with a setscrew 17 whereby the reversing cam 15 can be fixed to the shaft 11 to rotate therewith. It will be understood, of course, that the reversing cam 15 might be keyed to the shaft 11 in any other desired way so long as it effects unitary rotation of the shaft and cam.

The reversing cam 15 is provided on its periphery with a continuous reversing cam track which has crossed over portions 18 and 19 shown in Fig. 5. A sleeve 20 slidably fits the periphery of the reversing cam 15 for reciprocating movement thereon in a direction axially of the cam and the shaft 11. The sleeve 20 is provided with a radially extending opening in which is rotatably mounted a cam follower 21 of oval configuration and shown as formed integral with a head 22 located in a counterbore concentric to the radial opening, with the head of such size as to be countersunk in the counterbore and thus to lie completely within the outer circumference of the sleeve 20. The oval cam follower 21 extends into the continuous reversing cam track, it being understood that the major and minor axes of the cam follower 21 and the dimensions of the crossed over portions 18 and 19 of the cam track are so proportioned that the follower will move in the cam track (see arrows in Fig. 5) to produce reciprocating

movement of the sleeve 20 axially of the reversing cam 15 and shaft 11. Thus each alternate complete rotation of the shaft 11 and cam 15 will move the sleeve 20 axially in one direction, while each intermediate complete rotation thereof will move the sleeve axially in the opposite direction. That is, a complete reciprocation of the sleeve occurs for two complete revolutions of the cam and shaft.

An outer sleeve 23 fits over the sleeve 20 and is connected thereto by a headed screw 24 mounted in a radial opening in the sleeve 23 and screwing into a threaded radial opening 25 in the sleeve 20, said radial openings being shown as diametrically opposite and aligned with the radial opening in which the cam follower 21 is mounted. It will be seen that the sleeves 20 and 23 are thus interconnected for unitary reciprocating movement axially of the reversing cam 15 which rotates within and relative to the sleeve 20.

A lever arm 26 is pivotally connected at one of its ends to the sleeve 23 by means of a pivot stud 27 and which has a reduced threaded portion 28 screwed into a threaded opening in the sleeve 23 and shown as diametrically in line with the screw 24. The pivot stud 27 is provided with an enlarged head 28A that is countersunk in a counterbore formed in the end of the lever arm 26. The opposite end of the lever arm 26 is provided with an elongated arcuate slot 29, the center of curvature of which is coincident with the pivotal axis of an adjusting arm 30 located beneath the bed plate 10 and pivoted intermediate its ends on a pivotal mounting extending downwardly from the bed plate and indicated at 31 and which pivotal mounting is the center of curvature of the arcuate slot 29 as already stated.

The pivoted adjusting arm 30 adjacent its left hand end as viewed in Figs. 1 and 2 is provided with a threaded opening located midway of the sides of the arm 30 and having a stud 32 screwed therein with the head 33 of the stud located in the slot 29 of the lever arm 26. As will later be pointed out, the head 33 of the stud 32 constitutes the fulcrum point on which the lever arm 26 turns as the sleeves 23 and 20 are reciprocated by the reversing cam axially of the shaft 11. It will be understood that if the head 33 is adjusted inwardly or outwardly of the slot 29 the fulcrum point of the lever arm 26 is thus varied as is also the amplitude of movement of the free end of the lever arm 26.

The bed plate 10 is provided with a slot 34 through which passes a vertically extending bolt 35 carried by the right hand end of the adjusting arm 30 as viewed in Figs. 1 and 2 and extending above the bed plate 10. A clamping nut 36 is mounted on the bolt 35 above the bed plate 10 and it will be understood that said nut can be loosened and the adjusting arm 30 rocked on its pivot 31 to vary the location of the head 33 in the slot 29 and then the nut can be screwed down to clamp the arm 30 in the desired adjusted position. The bed plate 10 adjacent to the slot 34 may be provided with suitable graduations and indicia calibrated in terms of length of the zigzag stitching.

A bracket 37 is screwed to the underside of the bed plate 10 and is provided at its right hand end as viewed in Figs. 1 and 2 with a depending arm 38 slotted adjacent its lower end as indicated at 39 to receive the adjusting arm 30 and accommodate its pivotal movement. The opposite end of the bracket 37 is provided with a shorter depending arm 40. The depending arms 38 and 40 of the bracket 37 are provided with aligned openings which slidably and rockably support a rod 41. The rod 41 is provided with a threaded hole into which is screwed a stud, the head 42 of which stud is located in the slot 29 of the lever arm 26, it being noted by reference to Fig. 3 that the slot 29 is of such depth that the head 33 of the stud 32 carried by the arm 30 and the head 42 of the stud carried by the rod 41 can be located in vertical alignment when the arm 30 is moved to one of its limits of adjustment.

The reversing cam 15 on its end opposite to the hub 16 is illustrated as provided with an integral elongated sleeve portion 43 and a face cam member 44 interfits the sleeve portion 43 and is rigidly connected to the reversing cam 15 by a screw 45. The face cam member 44 is provided with an eccentric or cam groove 46 of substantial depth in the axial direction of the shaft 11. A rocker arm 47 mounts at one end a pin-like cam follower 48 extending into the cam groove 46. The other end of the rocker arm 47 is provided with a hub portion 49 which fits the rod 41 and is fixed thereto by a setscrew 50. It will be seen that as the reversing cam 15 and the face cam 44 rotate the eccentric cam groove 46 in the latter acting on the follower pin 48 will effect a rocking movement of the rocker arm 47 and rod 41 and that the depth of the cam groove 46 accommodates the pin 48 at all times notwithstanding the longitudinal movement imparted to the rod 41 by the reversing cam 15 and the elements operatively interconnecting the reversing cam with the rod.

The rod 41 at its left hand end as viewed in Figs. 1 and 2 has fixed thereto a bracket 51 which in turn has secured to it the zigzag feed dog 52 which includes a pair of feed dog proper portions 52*a* and 52*b* located in slots 53 in the usual removable plate 54 carried by the bed plate as will be well understood. The dog portions 52*a* and 52*b* are parallel to each other and extend transversely with respect to the dog portion of the ordinary or straight feed dog 13 and lie at opposite ends thereof as clearly indicated in Fig. 1.

It will be seen that when the knob 36 and bolt 35 are moved to one limit of movement in the slot 34, i. e., the upper end of the slot as viewed in Fig. 1, the adjusting arm 30 will have rocked counterclockwise as viewed in Fig. 1, until the head 33 is positioned directly under the head 42 carried by the rod 41. Consequently at such time the reciprocation of the sleeves 20 and 25 by the reversing cam 15 will not operate through the arm 26 to impart any reciprocating movement to the rod 41 and hence no reciprocating movement of the feed dog 52 laterally of the feed dog 13 and therefore no zigzag stitching will be effected at such time.

It will be understood that the reversing cam and the shaft 11 rotate at all times when the machine is operating but the only motion imparted to the feed dog 52 when the fulcrum head 33 is beneath the head 42 in the slot 29 is the small rocking or raising and lowering movement of the feed dog 52 occasioned by the cam groove 46 of the cam 44 and rocking arm 47.

In Figs. 6 and 7 two different patterns of regular feed dogs and zigzag feed dogs are illustrated. Referring first to Fig. 6 which is substantially the same pattern as Fig. 1, the regular feed dogs are indicated at 55 while the zigzag feed dogs are indicated at 56 and are somewhat longer than the feed dog portions 52*a* and 52*b* of Fig. 1. In Fig. 7 the regular feed dogs are indicated at 57 while three zigzag feed dogs 58 are shown to one side of the dogs 57 rather than straddling said dogs as in the previous pattern of feed dogs. It will be understood that various other patterns of regular and zigzag feed dogs can be employed.

The construction already explained is such that a wide variety of stitch patterns can be obtained in a sewing machine embodying such construction. These stitch patterns may include straight line stitched portions and zigzag stitched portions with the zigzag stitches extending outwardly on each side of the straight line stitches or being altogether on one or the other side thereof as the case may be. Also the zigzag stitching can take various forms so as to provide zigzag stitches having different configurations as, for instance, a diamond configuration, such as is shown in Fig. 12.

Figs. 8, 9, 10, 11 and 12 show illustrative stitch patterns but it will be understood that many other forms of patterns can be produced with the mechanism.

In order to facilitate the use of the machine to enable the different desired stitch patterns to be obtained

an indicating device is provided whereby the operator can visually determine and select the position of the cam follower **21** in relation hip to the continuous cam groove and the crossed over portions **18** and **19** to thus determine whether the sleeves **20** and **23** are at one or the other of the limits of their reciprocating movement or are intermediate such limits. This indicating device comprises an indicating arm **59** which is arranged vertically and tangentially with respect to the sleeve **23** and has its lower end rigidly secured thereto by suitable securing means such as by the screws **60**.

The upper end of the indicating arm **59** extends into an opening **61** in the bed plate **10** and said upper end of the indicating arm **59** is flush with the upper surface of the bed plate. The slot **61** is elongated to accommodate the movement of the arm **59** therein within the limits of the movement of the sleeve **23**. The upper end of the arm **59** may be provided with an indicating line adapted to register with one or the other of indicating markings on the bed plate to show the relationship of the zigzag stitching to the straight line stitching that can be obtained and to indicate the position of the cam follower **21** with respect to the continuous reversing cam groove of the cam **15** as will later become more apparent.

Assuming that it is desired to produce a stitch pattern such as is indicated in Fig. 8, the operator moves the knob **36** to its uppermost position in the slot **34** as viewed in Fig. 1, i. e., the zero position of Fig. 1, to move through the adjusting arm **30**, the fulcrum head **33** beneath the head **42** and then clamps the knob **36** in such position. This adjustment means that no zigzag movement will be imparted to the zigzag feed dog **52** when the machine is operated. The operator now operates the machine in the usual manner to provide on the material a length of straight line stitching and when this has proceeded the desired distance the operation of the machine is stopped. The operator without releasing the presser foot turns the hand wheel of the machine slowly to rotate shaft **11** and reversing cam **15** and until the upper end of the indicating arm **59** in the slot **61** is in middle position which indicates that the sleeve **23** is midway of its limits of reciprocating movement. The operator now loosens the knob **36** and moves the same in the slot **34** away from the zero position and into a position correlated to the length of zigzag stitch desired as will be indicated by the graduation marks on the bed plate adjacent to the slot **34**. This movement of the knob **36** rocks the arm **30** to move the fulcrum head **33** in the slot **29** from beneath the head **42** and into a position wherein reciprocation of the sleeve **23** will cause the lever arm **26** to rock about the head **33** as a fulcrum and impart reciprocating movement to the rod **41** and to the zigzag feed dog **52**. The operator clamps the knob **36** in the desired position and then starts the operation of the machine, with the result that the feed dog **52** will be moved laterally of the straight line stitching an equal distance on each side of the straight line stitching to produce zigzag stitching that extends equal distances to each side of the straight line stitching as indicated in Fig. 8. The operator observes the zigzag stitches and when the desired number thereof have been formed and the stitch is coincident with the projected line of straight line stitching, the operation of the machine is stopped. The operator then loosens the knob **36** and moves the same relative to the slot **34** to zero position to locate the fulcrum head **33** beneath the head **42** so that further zigzag movement will not be given to the feed dog **52**. The machine is then again operated to provide a line of straight line stitching. The foregoing procedure may be repeated as many times as desired.

Now assuming that it is desired to produce the stitch pattern shown in Fig. 9 wherein the zigzag stitching is located all to the left hand side of the straight line stitching as viewed in Fig. 9, the operator after performing the desired length of straight line stitching stops the operation of the machine and then without releasing the presser foot slowly by hand rotates the hand wheel to rotate the shaft **11**, reversing cam **15** and move the sleeve **23** until the indicator arm **59** in the slot **61** is in its most right hand position as viewed in Fig. 1, at which time the sleeve **23** is also at its right hand limit of movement. The operator then moves the knob **36** from zero position to the position for the desired length of zigzag stitch and clamps the knob in the latter position. This movement of the knob **36** has shifted the fulcrum head **33** to the desired position. The operator then starts the operation of the machine, whereupon the initial movement of the zigzag feed dog **52** is to the right and first shifts the material or cloth laterally and to the right of the path of movement of the needle and the zigzag stitches will be all to the left of the straight line stitching since the needle has movement relative to the cloth that is toward the left.

If it is desired to produce the pattern shown in Fig. 10 the same procedure is followed, except that in rotating the hand wheel the operator does so until the indicating arm **59** is at its most left hand position in the slot **61** and the sleeve **23** is at the left end limit of its movement. Then upon moving the knob **36** from zero position to the desired position for the required length of zigzag stitch the fulcrum head **33** is shifted the desired distance from beneath the head **42**. Thus when the machine is operated again the zigzag stitching will start at the end of the straight line stitching and be located all to the right of the straight line stitching.

In connection with the description of the stitch patterns given above, it will be appreciated that when the sleeve **23** is positioned by the rotation of the hand wheel in its most right hand position to obtain the pattern of Fig. 9 then its reciprocation will start from such position and go to its most left hand limit and then back to its right hand limit. This reciprocation of the sleeve **23** will cause through the arm **26** a reverse reciprocation of the rod **41** and feed dog **52**, that is a reciprocation first from left to right and then back to left. However, the path of movement of the needle being fixed, the reciprocation of the feed dog **52** starting from left to right first will shift the material or cloth transversely of the path of movement of the needle so that the zigzag stitching will be all to the left of the straight line stitching. Similarly when the sleeve **23** is set by the regular rotation of the hand wheel at its most left hand limit of movement to obtain the pattern of Fig. 10 the start of the reciprocation of the sleeve will be from left to right and the start of the reciprocation of the rod **41** and feed dog **52** will be from right to left which will cause the material to be shifted from right to left relative to the path of movement of the needle so as to produce zigzag stitching lying all to the right of the straight line stitching. From the explanation already given as to the obtainance of the stitch pattern shown in Figs. 8, 9 and 10, it will be clear how the stitch pattern of Fig. 11 can be obtained.

In order to obtain the zigzag stitch pattern of diamond configuration shown in Fig. 12, the operator will stop the machine at the end of the straight line stitching and rotate the hand wheel to position the indicator **59** midway of the slot **61**. Then the operator will start the operation of the machine and simultaneously therewith will move the knob **36** from zero position to maximum position and then back to zero position to progressively vary the position of the fulcrum head **33** in the slot **29** to gradually increase the length of the zigzag stitches from minimum to maximum and then decrease the length thereof from maximum to minimum.

One complete rotation of shaft **11** and cams **15** and **44** causes the zigzag feed dogs to rise, move linearly in one direction and then fall. These movements occur during 90° of the 360° of the one complete revolution of the shaft and cam, it being understood that the needle will be in the cloth during 180° of the complete revolu-

tion and the rise and fall and linear movements will be imparted to the regular or straight line feed dogs 13 during the remaining 90° thereof.

Similarly, during the next complete rotation of the shaft 11 and cams 15 and 44 the zigzag feed dogs rise, move linearly in the opposite direction and then fall. During the operation of the machine for zigzag stitching the sequence of movements of the zigzag feed dogs, as above explained, occurs for each two successive complete rotations of the shaft 11 and cams 15 and 44.

A modified form of construction embodying the invention from that hereinbefore described is illustrated in Figs. 13, 14 and 15. This modified form of construction in certain respects may be considered as the preferred one as compared to the previously described form. In so far as the parts of the modified form of construction are identical with the corresponding parts of the first form they will be described and identified herein by the same reference numerals.

Referring to Figs. 13, 14 and 15 the bed plate of the sewing machine is indicated at 10 and below the bed plate the main feed shaft at 11. The regular or straight stitching feed dog 13 and needle opening 14 are located in the removable plate 54 carried by the bed plate 10. Also located in suitable openings 53 in the plate 54 are the zigzag feed dogs proper 52*a* and 52*b* forming part of the feed dog 52.

The bracket 37 secured to the underside of the bed plate 10 is provided at its opposite ends with depending arms 62 and 63 which, in this instance, are longer vertically and are extended laterally as compared to the arms 38 and 40 in the previously described form for a purpose latter to become apparent.

The main feed shaft 11 extends through and is rotatable in a bushing carried by the lower end of the arm 62 of the bracket 37. Directly above and parallel to the shaft 11 is a short cam shaft 64 rotatably supported in bearing bushings carried by the arms 62 and 63 of the bracket 37. A cam member 65 is fixed to the shaft 64 to rotate therewith and at one end of the cam member 65 is a gear 66 on and rotatable with the shaft 64 and either secured to or formed integral with the cam member. The gear 66 and a collar 67 secured to the shaft 64 act to prevent axial displacement of the shaft.

The gear 66 meshes with a smaller gear 68 fixed on the main feed shaft 11, wherefore the main shaft rotatably drives the gear 66, cam member 65 and cam shaft 64 at a reduced speed compared to the speed of the main shaft. The ratio of the gears 66 and 68 is two to one and hence the cam member 65 and cam shaft 64 rotate at one half the speed of the main shaft 11.

The cam member 65 is provided on its circumference and intermediate its ends with a continuous cam groove track which in each 180° of the circumference has two circularly extending portions 69 and 70 interconnected by a diagonal portion 71, it being understood that the diagonal portion 71 in the one 180° of circumference is oppositely disposed compared to the diagonal portion 71 of the other 180° of circumference.

As in the first described form, a sleeve 20 slides on the cam member 65 and is provided with a cam follower 21 located in the continuous cam groove track of the cam member 65. An outer sleeve 23 fits over the sleeve 20 and is connected thereto to move as a unit therewith by a headed screw 24 as already described for the first form of construction. Thus the cam member 65 rotates within the sleeves 20 and 23 and for each complete rotation of the cam member (two complete rotations of the main feed shaft 11) the sleeves 20 and 23 are reciprocated as a unit axially of the cam member with their movements in opposite directions equal to each other and to the axial displacement of the circular portions 69 and 70 of the continuous cam track groove.

A lever arm 26 is pivotally connected at one of its ends to the sleeve 23 by means of a pivot stud 27 as in the first described form. Also as previously described, the opposite or free end of the lever arm 26 is provided with an elongated arcuate slot 29 into which extend the stud head 33 carried by the pivoted adjusting arm 30 and the stud head 42 carried by the rod 41. The purpose and function of the parts just referred to are identical with those of the previously described form. Also the rod 41 of the second form is connected to the zigzag feed dog 52 by the bracket 51 fixed to the rod 41.

The cam member 65 on its end or face remote from the gear 66 is provided with continuous cam track groove 72 of substantial depth. As in the other form of construction a pin-like cam follower 48 extends into the groove 72 and is carried by one end of a rocker arm 47 having at its other end a hub portion 49 fitting the rod 41 and secured thereto by a set screw 50. It will be seen that rotation of the cam member 65 effects a rocking movement of the rocker arm 47 and rod 41 to produce rise and fall movements of the zigzag feed dog 52.

The cam groove 72 is so laid out that for each complete rotation of the shaft 64 and cam member 65 two complete rise and fall movements are imparted to the zigzag feed dog. Since the shaft 64 rotates at half the speed of the main shaft 11 there will be one complete rise and fall movement of the zigzag feed dog for each rotation of the main shaft 11. The cam groove 72 has two rise portions *a*, two fall portions *b*, two high dwell portions *c*, and two low dwell portions *d*.

Therefore, as in the first form the zigzag feed dogs proper 52*a* and 52*b* rise, move linearly in one direction, and fall during one complete rotation of the main feed shaft 11 and then during the next rotation thereof they rise, move linearly in the opposite direction, and fall.

Also, the second form of construction includes the indicating device constituted of the indicating arm 59 secured to the sleeve 23 and having its upper end located in the slot 61 in the bed plate 10.

The mode of operation, the adjustment of the length of the zigzag stitching and the manner in which different stitch patterns may be obtained are the same for both forms of construction and have been fully explained previously and, hence, need not be repeated for the second form.

Although embodiments of the invention have been illustrated and described herein, it will be understood that the invention is susceptible of various modifications and adaptations within the scope of the appended claims.

Having thus described my invention, I claim:

1. In a sewing machine having in the bed plate thereof a feed dog arrangement for feeding the material being sewed to produce straight line stitching therein and mechanism for actuating said feed dog arrangement including a feed shaft beneath the bed plate; a second feed dog arrangement in the bed plate and arranged in predetermined relationship to the first feed dog arrangement, and means operatively interconnecting said second feed dog arrangement with said feed shaft for imparting to it independently of the movement of the first feed dog arrangement reciprocating feeding movement in a direction transverse to the straight line feeding movement produced by the latter to produce zigzag stitching in the material.

2. In a sewing machine as defined in claim 1 and wherein the means operatively interconnecting said second feed dog arrangement with said feed shaft includes means for varying the amplitude of the feeding movement imparted to the second feed dog arrangement to vary the length of the zigzag stitches.

3. In a sewing machine as defined in claim 1 and wherein a visual indicating means is operatively associated with the means that operatively interconnects the second feed dog arrangement with the feed shaft and visually enables the operator to select the relationship between the straight line stitching and the zigzag stitching to provide for the obtainance of different stitch patterns.

4. In a sewing machine as defined in claim 1 and where-

in the means operatively interconnecting said second feed dog arrangement with said feed shaft includes means for varying the amplitude of the feeding movement imparted to said second feed dog arrangement to produce different lengths of zigzag stitching, in combination with means for selectively actuating said last named means and including a movable element having a portion extending through an elongated slot in the bed plate and provided with an operating knob which can be clamped in adjusted position against the bed plate.

5. In a sewing machine as defined in claim 1 and wherein the means operatively interconnecting the second feed dog arrangement with the feed shaft includes a cam driven by said feed shaft, a reciprocating rod connected to said second feed dog arrangement, and operative connections between said cam and said reciprocating rod.

6. In a sewing machine as defined in claim 5 and wherein said operative connections between said cam and said rod include a sleeve reciprocating on said cam, a lever arm pivoted on the circumference of said sleeve and operatively connected with said rod, and fulcrum means intermediate the pivotal connection of said lever arm to said sleeve and the operative connection of said lever arm to said rod and about which fulcrum means said arm is oscillated by the reciprocating movement of said sleeve to effect reciprocating movement of said rod and said second feed dog arrangement.

7. In a sewing machine as defined in claim 5 and wherein the operative connections between said cam and said rod include a sleeve slidable on and reciprocated by said cam, a lever arm pivoted at one of its ends to the circumference of said sleeve and having its opposite end operatively connected to said rod, an adjustable fulcrum means for said lever arm intermediate the ends thereof, and means for adjusting said fulcrum point to vary the amplitude of reciprocating movement imparted to said rod and said second feed dog arrangement and including an operating portion located above the bed plate.

8. In a sewing machine having in the bed plate thereof a feed dog arrangement for feeding the material being sewed to produce regular straight line stitching therein and mechanism for actuating said feed dog arrangement including a rotatable feed shaft beneath the bed plate; a second feed dog arrangement in the bed plate and arranged in predetermined relationship to the first named feed dog arrangement, a cam driven by said feed shaft, a sleeve slidable on and reciprocated by said cam, a lever arm pivoted at one end to the circumference of said sleeve and having an arcuate slot extending longitudinally of the lever arm from the other end of said arm, a reciprocating rod connected to said second feed dog arrangement and provided with a headed member extending into said slot and adjacent the other end of said lever arm, an adjusting arm pivoted beneath said bed plate on an axis coincident with the center of curvature of said slot and provided at one end with a headed element extending into said slot and movable when said adjusting member is moved from beneath the headed element carried by said rod inwardly of said slot to provide an infinitely variable fulcrum point about which said lever arm is turned when said sleeve is reciprocated by said cam to infinitely vary the amplitude of reciprocating movement imparted to said rod and second named feed dog arrangement, said bed plate being provided with an elongated slot and said adjusting member having means extending through said slot and including a threaded portion projecting above said slot, and an actuating knob screwed on said threaded portion.

9. In a sewing machine as defined in claim 8 and wherein a second cam is driven by said feed shaft while said reciprocating rod is also rockable and a rocker arm is fixed to said rod and has a cam follower engaging said second cam whereby rotation of the latter imparts rocking movement to said rod and rise and fall movements to said second feed dog arrangement.

10. In a sewing machine as defined in claim 8 and wherein said first cam is provided in its periphery with a continuous cam groove having portions spaced apart in the direction of its axis while a cam follower extends into said groove and is operatively connected to said sleeve.

11. In a sewing machine as defined in claim 10 and wherein said bed plate is provided with a slot extending in the longitudinal direction of said feed shaft and of a length equal to the maximum movement imparted to said sleeve by said first cam, an indicating arm connected to and extending tangentially of the circumference of said sleeve and having its free end located in said slot in the bed plate, said bed plate being provided adjacent said slot with indicia indicating the relationship of the zigzag stitching to the straight line stitching whereby the operator may adjust the position of the cam follower with respect to the cam groove and visually observe the free end of said indicating arm to obtain different stitch patterns.

12. In a sewing machine having in the bed plate thereof a feed dog arrangement for feeding the material being sewed to produce straight line stitching therein and mechanism for actuating said feed dog arrangement including a feed shaft beneath the bed plate; a second feed dog arrangement in the bed plate and arranged in predetermined relationship to the first feed dog arrangement, a reciprocating and rockable element supported beneath the bed plate and connected with said second feed dog arrangement and independent of the actuating mechanism for the first named feed dog arrangement, a first cam driven by said feed shaft, operative connections between said first cam and said element for reciprocating the latter and said second feed dog arrangement, a second cam driven by said feed shaft and independent of the actuating mechanism for the first named feed dog arrangement, and operative connections between said second cam and said element to rock the latter and said second feed dog arrangement to produce rise and fall movements of the latter.

13. In a sewing machine as defined in claim 12 and wherein the operative connections between said first cam and said element include means for varying the amplitude of the reciprocating movement imparted to said element and second feed dog arrangement from zero to maximum within the capacity of the mechanism.

14. In a sewing machine as defined in claim 12 and wherein the operative connections between said first cam and said element include a sleeve slidable on and reciprocated by said first cam, a lever arm pivoted at one end to the circumference of said sleeve and having an arcuate slot extending longitudinally of the lever arm from the other end thereof, said element being provided with a headed member extending into said slot adjacent the other end of said lever arm, and adjustable fulcrum means for said lever arm located in said slot for movement therein from alignment with said headed member to positions in said slot intermediate said member and said one end of said lever arm.

15. In a sewing machine as defined in claim 12 and wherein the operative connections between said second cam and said element include a rocker arm connected with said element and having a cam follower engaging said second cam and rocked thereby to rock said element and produce rise and fall movements of said second feed dog arrangement.

16. In a sewing machine as defined in claim 12 and wherein said first and second cams are coaxially disposed with said first cam designed to impart movement to a cam follower in the axial direction and said second cam designed to impart movement to its follower in a direction transverse to the cam's axis.

17. In a sewing machine as defined in claim 12 and wherein said first and second cams are both mounted on and fixed to said feed shaft.

18. In a sewing machine as defined in claim 12 and wherein said first and second cams are mounted on and

fixed to a countershaft parallel to said feed shaft, while a gear reduction drive is provided between said feed shaft and said countershaft.

19. In a sewing machine as defined in claim 12 and wherein said first and second cams are driven by said feed shaft at one to one, while said first cam has on its periphery a continuous cam groove including circular portions spaced axially of the cam and crossed over reversing portions intermediate and interconnecting said circular portions with said second cam including a continuous cam groove of 360° extent having one high and one low portion.

20. In a sewing machine as defined in claim 12 and wherein said first and second cams are driven by said feed

shaft at one half the speed of the latter, while said first cam includes on its periphery a continuous cam groove having axially spaced circular portions and two diagonal portions interconnecting the circular portions and spaced 180° apart, with said second cam including a continuous cam groove of 360° extent having two high portions spaced 180° apart and two low portions spaced 180° apart.

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