

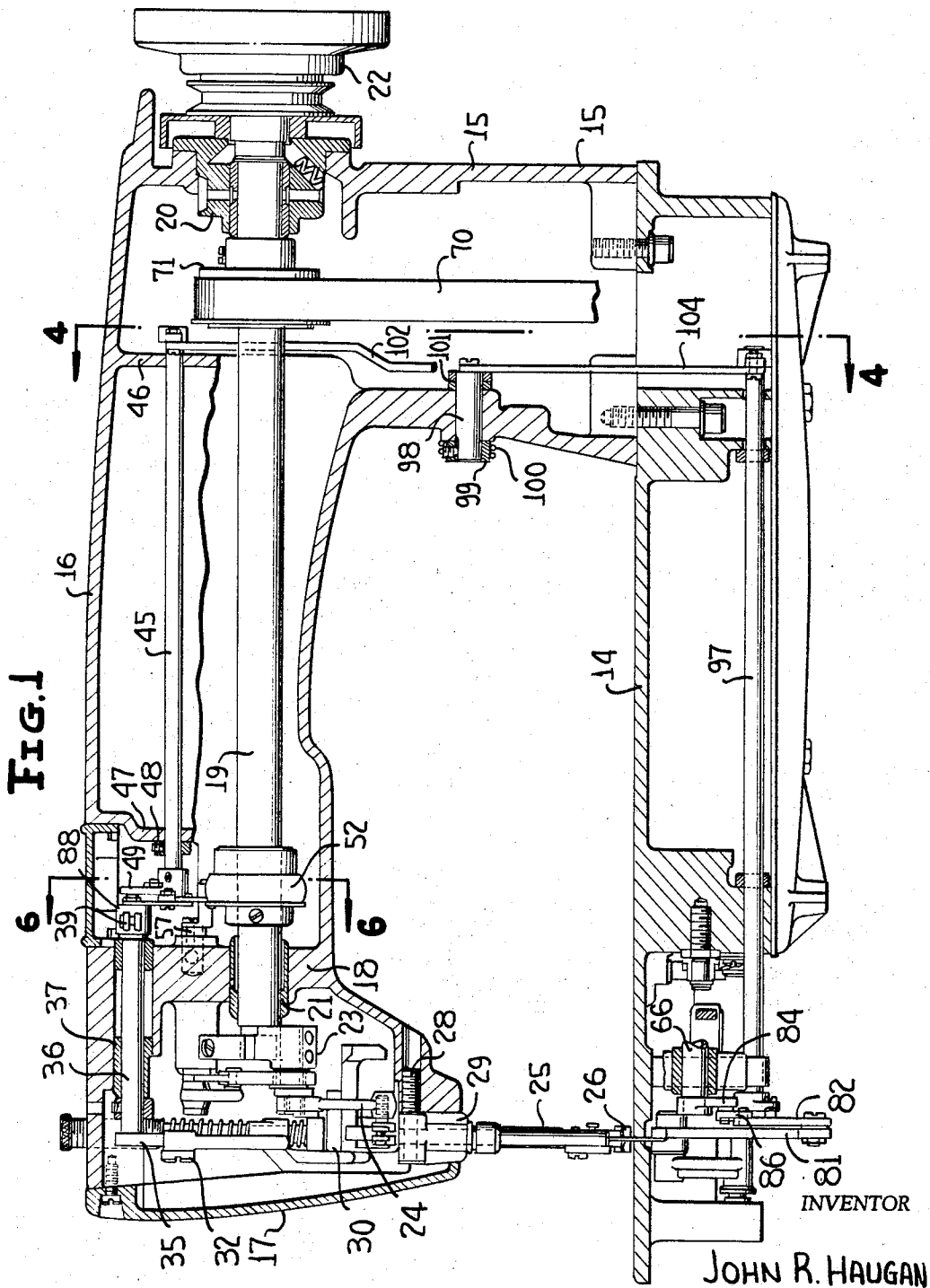
July 18, 1967

J. R. HAUGAN  
COMBINED REVERSIBLE LOWER FEED AND NEEDLE  
FEED FOR SEWING MACHINES

3,331,344

Filed Oct. 21, 1964

5 Sheets-Sheet 1



BY *Mason, Porter, Miller & Stewart*  
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July 18, 1967

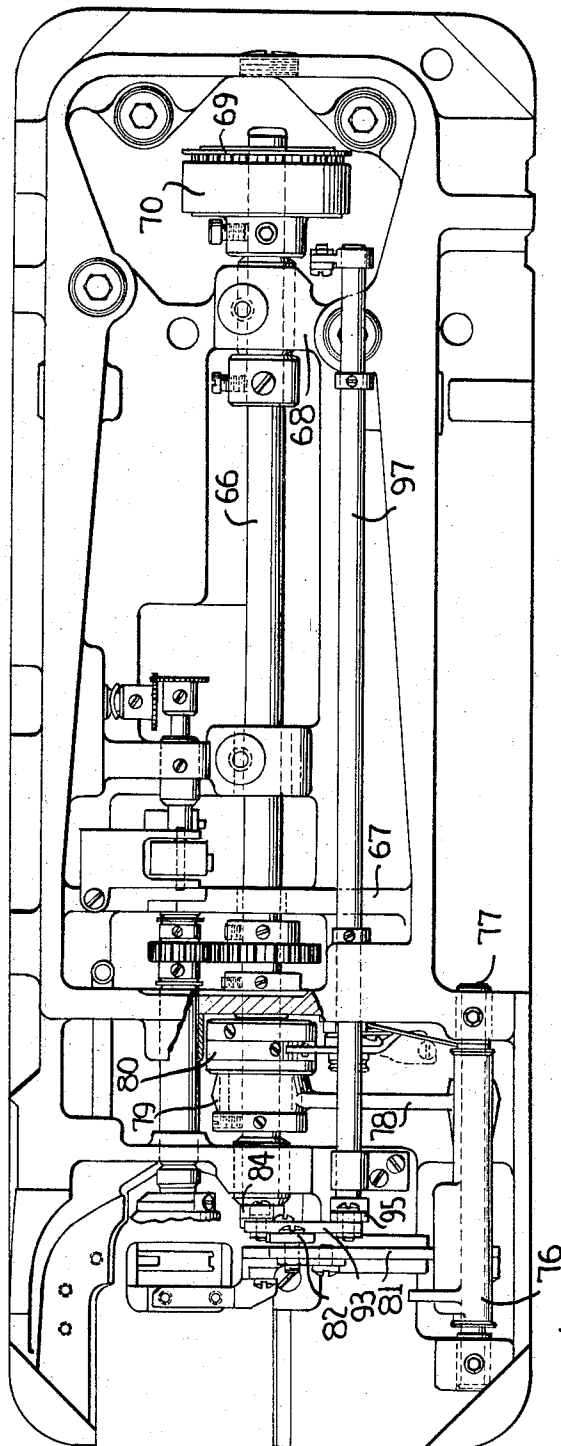
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FIG. 2



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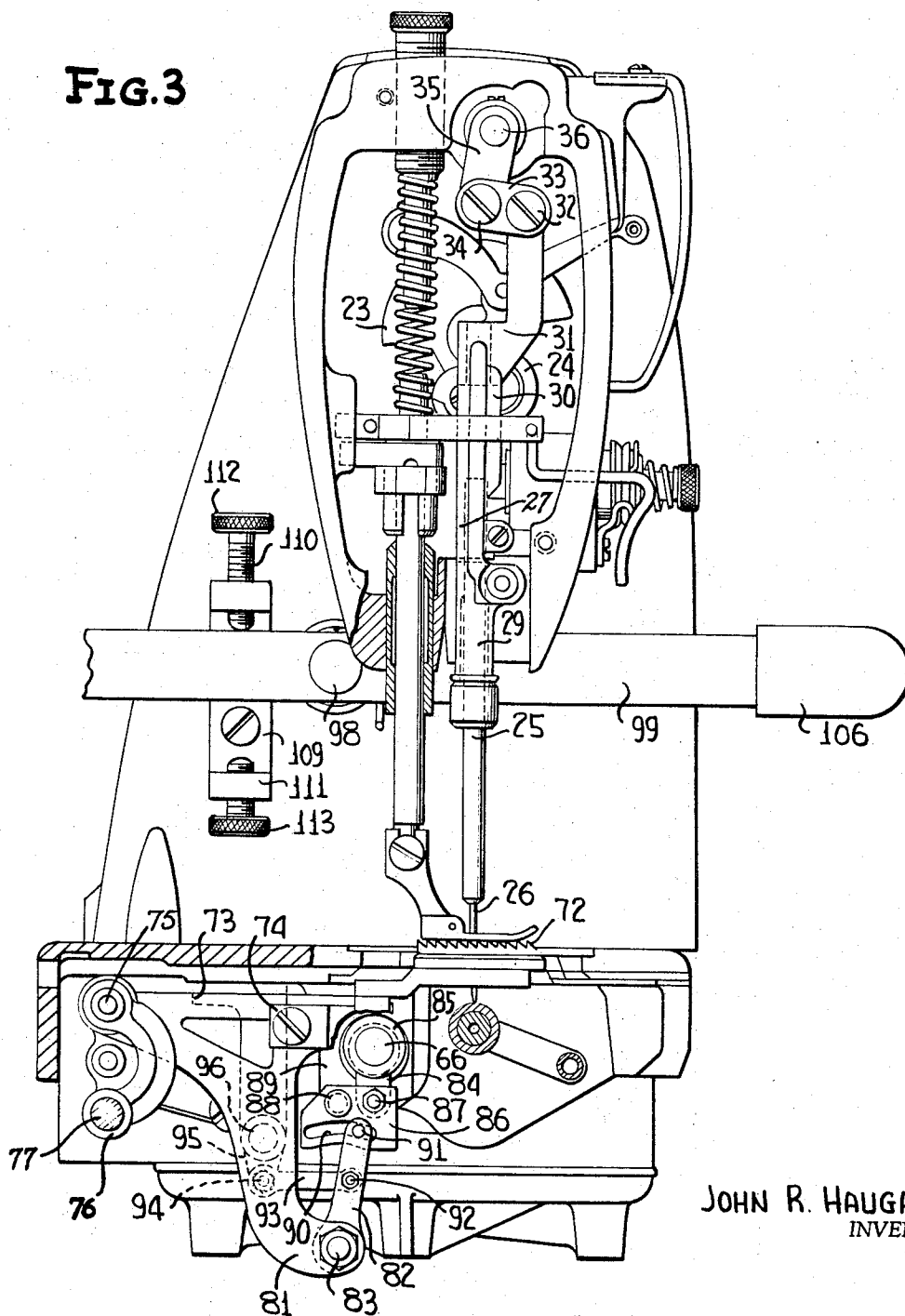
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FIG. 3



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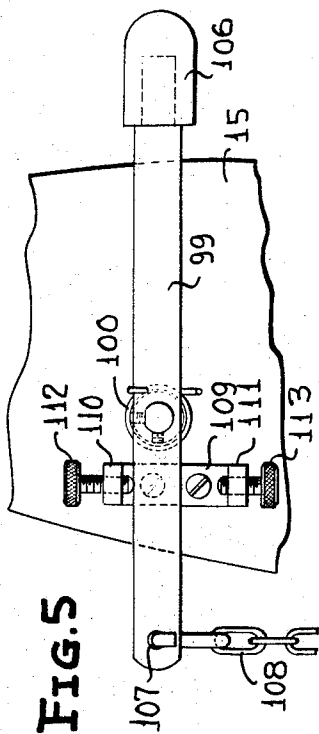


FIG. 5

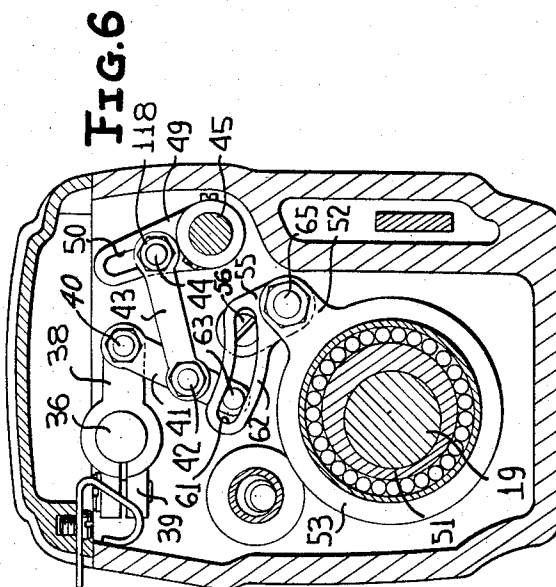


FIG. 6

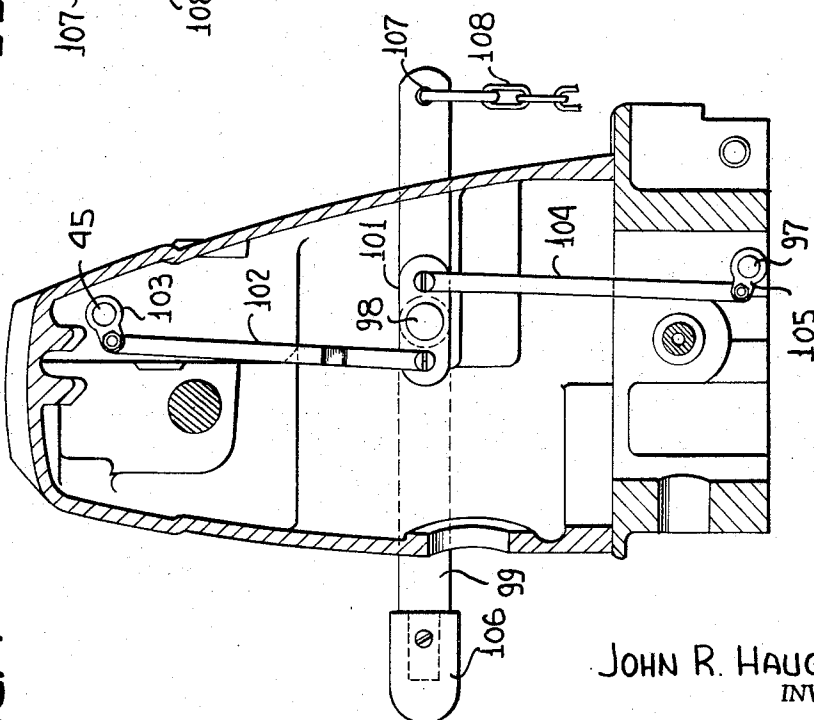


FIG. 4

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FIG. 7

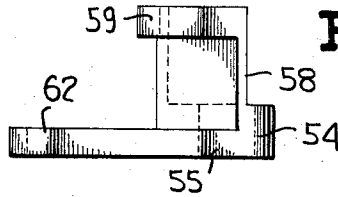
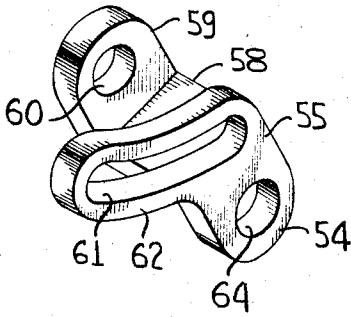


FIG. 9

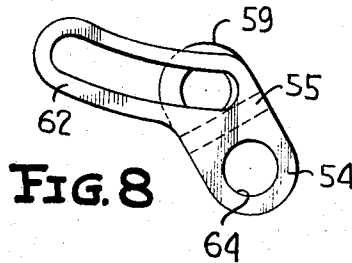


FIG. 8

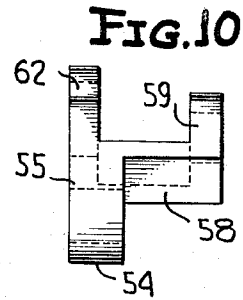


FIG. 10

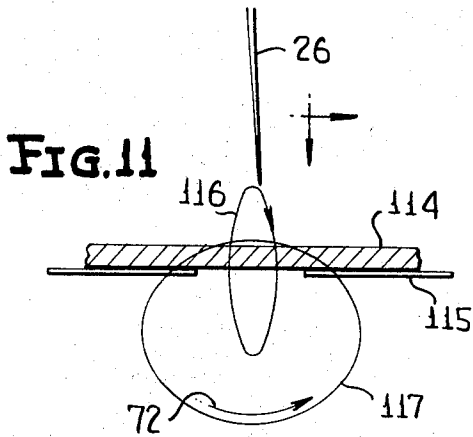


FIG. 11

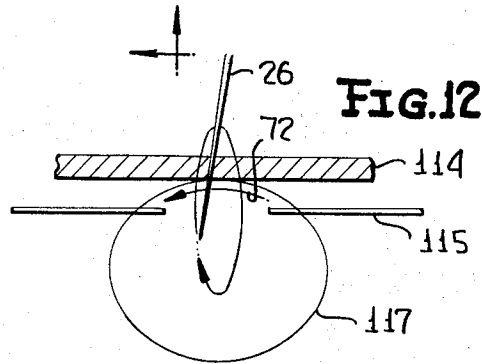


FIG. 12

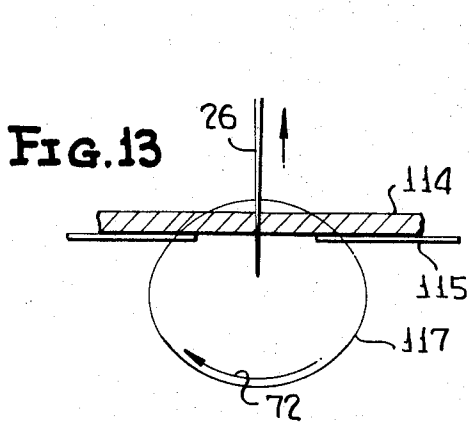


FIG. 13

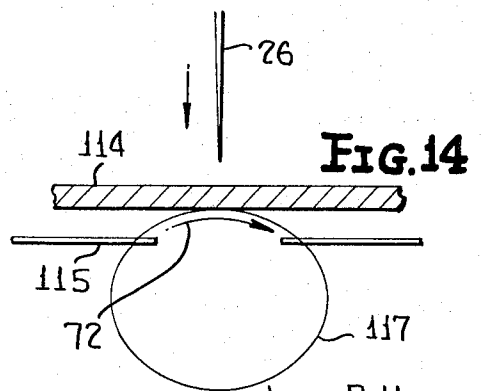


FIG. 14

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3,331,344

**COMBINED REVERSIBLE LOWER FEED AND  
NEEDLE FEED FOR SEWING MACHINES**  
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Filed Oct. 21, 1964, Ser. No. 405,388  
7 Claims. (Cl. 112-213)

## ABSTRACT OF THE DISCLOSURE

The disclosure embodies in a lockstitch sewing machine a feed-dog with a four-motion lower feed mechanism and a simultaneously operating needle feed mechanism, the four-motion feed mechanism including feed lift means and horizontal feed stroke means, means for shifting the timing of the feed lift means through 180° relative to the horizontal feed stroke for reversing the direction of feed stroke of the feed-dog, means for nullifying the feed of the needle and a single means for actuating said reversing means and for nullifying the feed of the needle.

The following specification relates to combined reversible lower feed and needle feed for sewing machines of the type in which the material is fed both by a lower feed dog and by the oscillatory advance of the sewing needle.

In machines of this type, where the material being sewed is advanced by the conjoint operation of a four-motion lower feed mechanism and an oscillatory needle feed mechanism, it is desirable under certain circumstances to reverse the direction of feed of the material. Fundamentally, this is carried out by providing a reversible lower feed mechanism. This must, however, be correlated with suitable mechanism for disengaging the feeding action of the needle during the time when the travel of the lower feed mechanism, that is, the feed dog, is in the reverse direction.

Fundamentally, this may be accomplished by temporarily stopping the forward feeding motion of the needle, as it operates in unison with the lower feed dog.

It is an object of this invention to accomplish the same result by changing the timing of the four-motion lower feed mechanism as much as 180 degrees out-of-phase with the needle feed during the reverse feeding action of the lower feed dog. Such cycling in alternation makes possible the reverse feeding by the lower feed dog without interference from the normally advancing needle.

A further object of the invention is simultaneously with the change of the feed lift timing of the lower feed dog, to completely disengage the feeding action of the needle, so that it no longer has its normal lateral feeding movement but merely reciprocates vertically in a straight path.

A still further object of the invention is by means of the alternate engagement of the needle and the lower feed dog with the work, to raise the needle completely out of the way when the lower feed dog engages the material for reverse feeding, and alternately limiting the vertical path of the needle penetrating the work to a time when the feed dog is below the throat plate and not in feeding position.

An incidental object of the invention is the provision, as part of the needle disengaging mechanism, of adjusting means for varying the amount of lateral travel of the needle.

Among the objects of the invention is to enable the operator by a single manipulation to simultaneously shift the operating mechanism from a forward to a reverse feed by a single control means, such as a treadle or a hand-operated lever.

A still further object of the invention is to relieve the

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bearings and fast moving parts of the sewing machine of stress by inactivating the upper feed mechanism during the reverse operation. This has a definite and noticeable result in reducing the wear and tear on the mechanism and quieting operation.

The preferred form of this invention has been illustrated for purpose of example in the accompanying drawings in which:

FIGURE 1 is a longitudinal, vertical section of a sewing machine of the needle feeding type;

FIGURE 2 is a bottom plane view of the same with the bottom plate removed;

FIGURE 3 is a left-end elevation of the machine with the cover plate removed;

FIGURE 4 is a vertical section taken on the line 4-4 of FIGURE 1;

FIGURE 5 is a fragmentary side elevation of the reversing lever;

FIGURE 6 is vertical transverse section on the line 6-6 of FIGURE 1;

FIGURE 7 is a fragmentary perspective view of the needle feed adjustment;

FIGURE 8 is a side elevation of this adjusting element;

FIGURE 9 is a plane view of the same;

FIGURE 10 is an end view of the same;

FIGURE 11 is a diagrammatic illustration of the forward feeding motion of the needle;

FIGURE 12 is a similar showing of the completion of the forward feeding stroke;

FIGURE 13 illustrates the vertical reciprocation of the needle in advance of the reverse feeding stroke; and

FIGURE 14 is a reciprocation of the vertically reciprocating needle during the reverse feeding stroke.

Briefly described, the invention comprises the conjoint operation of the needle feed and the four-motion lower feed mechanism so related that the needle feed can be nullified and the needle withdrawn from the material during the reverse feed of the four-motion lower feed dog. The linkage for the needle is such that it is limited to a vertical reciprocation, passing through the material only when the latter is not being reversely fed by the lower four-motion feed mechanism.

As illustrated in the drawings, the invention forms part of a sewing machine of the following general features. The machine has a main frame comprising a work supporting base 14, a hollow vertical standard 15, and a hollow overhanging arm 16. The arm carries a needle head 17 at its outer end. A partition wall 18 separates the space within the overhanging arm 16 from that within the needle head.

A main drive shaft 19 extends longitudinally through the overhanging arm 16. At its right end it is journaled in a bushing 20 forming part of the end wall of the standard 15. The partition wall 18 has a bushing 21 forming a bearing for the opposite end of the drive shaft 19.

The outer end of the drive shaft 19 projects from the standard 15 and is there provided with a combined hand wheel and pulley 22, by which power for driving the sewing machine may be supplied.

Within the needle head, the shaft 19 has a crank member 23 secured thereto. This crank member is connected by means of a pitman 24 to a needle bar 25, on the lower end of which there is provided the usual machine needle 26. The needle bar 25 is mounted for substantially vertical reciprocation in a rock frame 27. The latter is pivotally supported by a stud 28 projecting from the lower wall of the needle head 17. Spaced bearing portions 29 and 30 of the rock frame 27 hold the needle bar 25 for substantially longitudinal movement and provided for the vertical reciprocation of the needle bar by the drive shaft 19.

The needle feed action of the needle bar 25 and its needle 26 is provided by suitable connections with the drive shaft 19 at the upper end of the rock frame 27. For this purpose the rock frame 27 is provided with an offset upper extension 31. This has a pivot screw 32 forming a pivotal connection from the rock frame 27 to a horizontally disposed link 33.

The opposite end of the link 33 has a screw stud 34 forming a pivotal connection with the lower end of an arm 35 fastened on a rock shaft 36. This rock shaft is journaled in a bearing sleeve 37 carried by the partition wall 18. The shaft 36 extends from the wall 18 into the needle head enclosure and also into the overhanging arm. Within the overhanging arm, the inner end of the shaft 36 has an arm 38 secured thereto by means of a split clamping portion and tightening screw as indicated at 39.

The structure so far described is similar to what is shown in the prior patent to Quist, June 12, 1956, No. 2,749,861.

The outer end of the arm 38 has a pivot 40 which carries a loose link 41. The link 41 is provided at an intermediate point with a pivot pin or screw 42, on which is mounted one end of a laterally disposed pitman 43.

The opposite end of the pitman 43 has a pivot screw 44.

A feed control shaft 45 extends longitudinally through the upper portion of the overhanging arm 16. The latter carries a vertical web 46 at the junction with the standard 15. A similar vertical web 47 depends from the upper part of the arm 16 near the partition wall 18.

The shaft 45 is loosely journaled in the webs 46 and 47. Where the shaft projects through the web 47, it carries a fixed collar 48. The opposite end of the shaft 45 is also held in place by means to be described later.

The shaft 45 has a fixed arm 49. This arm is slotted as at 50 in a radial or outward direction. The pivot screw 44 is slidably held in the slot 50.

The needle drive mechanism resembles closely that in the United States Patent No. 2,749,861 of Quist, with certain important modifications. The feeding action is imparted to the needle 26 and the needle bar 25 from the drive shaft 19 through compact linkage which is adapted to translate the rotary motion of the drive shaft 19 into a reciprocating motion for actuating the needle feed rock shaft 36. In particular, this linkage comprises an eccentric 51 which is mounted on drive shaft 19. A pitman 52 having one end in the form of a strap portion 53, is carried by the eccentric 51. The pitman 52 is pivotally connected to the shorter arm 54 of a bell crank 55. This in turn is mounted on a fulcrum screw 56. The latter is threaded into a suitable bushing or plug 57 disposed in the partition wall 18 and secured therein against turning by a suitable set screw. Said bushing 57 extends longitudinally from the partition wall 18 into the overhanging arm.

The bell crank 54 as shown in FIGURES 7, 8, 9 and 10 has a laterally extending portion 58 with an upturned flange 59. This extends parallel with the crank arm 54. The flange 59 has a transverse bearing hole 60 in which the fulcrum screw 56 is held. The hole 60 is so located that its center or axis extends perpendicularly through the center line of an elongated arcuate slot 61 in the longer crank arm 62 of the bell crank 55. Said slot 61 is adapted to receive a sliding pin 63.

The pin 63 is integrally connected to the lower end of the feed actuating link or rod 41, the upper end of which is pivotally connected at 40 with the crank arm 38. The latter is secured to the rock shaft 36 by means of a split clamping portion having a tightening screw 39.

The shorter arm 54 of the bell crank 55 has a hole 64 to receive a pin 65 on which pitman 52 is pivoted.

The arrangement of the mechanism as just described is such, that pitman 52 reciprocates once during each revolution of the drive shaft 19, thereby imparting to bell crank 55 an oscillating movement of a fixed magnitude about its fulcrum 56. Link 41 is connected to arm 62 of the bell crank 55 by a sliding pin 63. Link 41 is therefore recip-

rocated vertically, thus putting crank arm 38 into an angular, oscillating motion about the axis of rock shaft 36. This in turn transmits this motion in known manner to the needle rock frame 27.

From FIGURE 6 it will be seen that link 41 may be swung about its pivot connection 40 with crank arm 38, whereby the slide element 63 follows the arcuate slot 61 from a first position to a second position and vice versa. This movement is controlled through pitman 43 and crank arm 49 by a predetermined angular movement of shaft 45 about its axis in one or the other direction.

The first position of the sliding element 63 in slot 61 is toward the outer end of bell crank arm 62. This is the driving position for the needle feed, since the feed actuating link 41 cooperates with the bell crank 55 to oscillate the crank arm 38.

The second or opposite position of the sliding pin 63 in slot 61 aligns the axis of the pin with the axis of the bell crank fulcrum 56. Thus no motion will be imparted to the crank arm 38 by the movement of the pitman 52. The actuating link 41 of the needle feed is now in a neutral swinging position of zero amplitude.

Provision is also made by this mechanism for manually adjusting the length of the needle feed stroke. This is accomplished by the slot 50 in the crank arm 49. The slot receives the pivot screw 44, secured in place by nut 118. For the purpose of adjustment, the nut 118 is loosened and screw 44 moved along the slot 50 to the desired position, and the nut 118 then re-tightened.

By this means, the center of the angular action of pitman 43 will be relocated with respect to the link 41. Link 41 will be moved angularly about its pivot connection at 40, thus shifting its slidable element 63 along the slot 61 into a different driving position, thus either shortening or lengthening the effective lever length of the crank arm 62. Consequently, the length of the stroke of the feed actuating link 41 will be decreased or increased, thus resulting in either a longer or shorter feed stroke of the needle 26.

The lower reversible feed mechanism is housed in machine base 14. This is driven by a shaft 66 journaled in transverse webs 67 and 68 of the base. It extends longitudinally of the base. At one end it carries a pulley 69, driven by a belt 70 connected to a second pulley 71 on the shaft 19.

The feed dog 72 is mounted upon a feed bar 73 and a screw 74 permits the adjustable mounting of the feed dog on the feed bar. The rear end of the feed bar is connected by a pivot 75 to a rocker 76. The rocker in turn is rotatably mounted on a stationary shaft 77.

The feed bar receives its longitudinal movement from a pitman 78. This pitman has a strap 79 on an adjustable eccentric 80. Eccentric 80 is mounted on shaft 66 and its eccentricity may be varied readily to change the stitch length of the machine in the usual manner. This is illustrated in the prior patent of J.N. Covert, No. 2,851,976.

The feed bar 73 has a downwardly extending arm 81. A vertically disposed connecting link 82 is loosely pivoted from the arm 81 by means of the pivot pin 83.

A feed lift pitman 84 has an upper end which surrounds an eccentric 85 on the end of the shaft 66. Pitman 84 has a downwardly extending end which carries a feed segment plate 86 by means of a loose pin 87.

The plate 86 is mounted loosely by means of a fulcrum screw 88 on a depending bearing lug 89 on which shaft 66 is journaled.

A spacer sleeve is held on screw 88 for positioning the segment plate 86 with respect to both the link 82 and the pitman 84. The feed segment plate 86 is therefore free to pivot relative to both the pitman 84 and the lug 89.

The segment plate 86 has an arcuate slot 90 arranged horizontally below and equidistantly on both sides of the fulcrum screw 88. The upper end of the connecting link 82 carries a lateral pin 91. A pivot screw 92 is attached at an intermediate point on the connecting link 82. The

pivot screw 92 is attached to a transversely disposed rod 93, the opposite end of which is pivotally connected at 94 to a downwardly extending arm 95 of a crank element 96. This crank is carried on the left end of a control shaft 97.

The control shaft 97 is part of the feed direction control system.

The shaft 97 projects at its opposite end into the base below the standard 15.

The inner wall of the standard 15 carries a horizontally disposed shaft 98. The shaft 98 extends through the wall of the standard beneath the arm 16. A lever 99 is keyed to the left end of the shaft 98. As best shown in FIGURES 3 and 5 a spiral spring 100 is adapted to bias said lever 99 in a clockwise direction about the axis of the shaft 98.

Within the standard, the shaft 98 carries a fixed horizontal bar 101. This bar has a hub fitting tightly on the end of the shaft 98.

A rod 102 is pivoted to one end of the bar and extends upwardly. At its upper end, the rod has a pivotal connection to a crank 103. This crank is fixed to the inner end of the shaft 45 and confines the latter against longitudinal movement.

The opposite side of the bar 101 carries a pivotal rod 104. This extends downwardly into the base adjacent the control shaft 97 to which it is connected by crank 105.

The lever 99 extends forwardly and ends in a handle 106. The rod also extends to the rear, where it is provided with an eyelet 107. A chain 108 attached to the eyelet 107 extends downwardly to a foot treadle (not shown).

The inner wall of the standard 15 carries a bracket 109. Flanges 110 and 111 extend outwardly from the upper and lower ends of the bracket. The flanges carry screw-threaded adjustment bolts 112, 113. The bolts are capable of adjustment to limit the vertical movement of the lever 99, as circumstances may require.

For reversing the direction of feed, the operator may either step on a foot treadle of the usual type, or push the handle 106 of the lever 99 upwards and hold it in this position during the reverse feeding period. Upon releasing the lever 99, the machine returns to its forward feeding cycle as the spring 100 returns the lever to its original position.

Upon actuating lever 99 as above described, rods 102 and 104 will be shifted upward and downward respectively, thereby imparting a simultaneous angular movement to both control shafts 45 and 97 about their axes.

The upper control shaft 45 will rotate clockwise, as seen from the hand wheel end of the machine. FIGURE 6. Thus the crank 49 will be swung toward the rear wall of the overhanging arm, thereby shifting link 41 around its pivot connection by means of a pitman 43. As pointed out above, the pin 63 will be shifted into its extreme right-hand position, inactivating the needle feed.

Referring to FIGURE 4, the lower control shaft 97 will be rotated counterclockwise. In the forward feeding position, crank 96 on the left end of control shaft 97 will extend substantially downward. In this position, the slide 91 of the connecting link 82 is shifted to the right side of the segmental slot 90, FIGURE 3. Since its point of effective force is thus located on the same side of the fulcrum screw 88 as the pivot connection of segmental plate 86 with the pitman 84, the segmental plate itself acts as a second class lever, transmitting the reciprocating motion of feed lift pitman 84 directly to the feed bar. Upon the counterclockwise rotation of the control shaft 97, the crank 96 will be swung toward the rear of the machine, thereby shifting pin 91 into a position at the left side of segmental slot 90. It will now be noted that segmental plate 86 is no longer a second class lever, but assumes the role of a first class lever, reversing the reciprocating motion of the feed lift pitman 84. This results in a 180° change in the time relation of the lower feed lift motion with respect to the reciprocation of the vertical

needle, thus bringing about a change in the direction of feed.

On FIGURES 11 and 12, the normal forward feeding motion has been illustrated for comparison. On FIGURE 11, the feed dog 72 is schematically indicated in a position below the throat plate 115 while on its return stroke during the forward feeding cycle. The feed dog is not at that moment in contact with the two or more plies of material forming the work 114. Needle 26 is raised and swinging backward, that is toward the operator, as shown by the horizontal arrow. In this forward motion, the needle 26 and the feed dog 72 engage the work 114 simultaneously. The orbit of the needle is shown at 116, and the orbit of the feed dog at 117.

The conclusion of the simultaneous forward feeding movements of the needle 26 and the feed dog 72, is schematically indicated on FIGURE 12. Here the feed dog has raised the work 114 from the throat plate 115 and joins with the needle 26 in advancing the work.

FIGURE 13 shows the positions when the work is being fed in reverse. In this instance, the orbit 117 of the feed dog is in the reverse direction. The needle 26 no longer has a feeding function, but is limited to a vertical reciprocation, as shown by the arrow.

Due to the 180° change in relative phases, the needle 26 is completely withdrawn from the work 114 at the time when the feed dog lifts the work 114 and gives it a reverse movement.

The reciprocation of the needle 26 is without effect, since the work 114 is not at the moment of engagement being moved by the feed dog.

The relation of parts thus described provides the combination of simultaneous needle feed and a four-motion lower feed mechanism in which the timing of the lower feed mechanism has been shifted approximately 180° from normal, so that the lower feed dog accomplishes a reverse feeding action. Simultaneously with this change, the feeding action of the needle is completely disengaged, so that it has no longer any lateral feeding movement, but merely reciprocates up and down in a straight vertical path.

It is significant that this 180° change in the timed relation between the needle and the lower feed dog causes them to engage the work alternately, the needle being up and out of the path of the material when it is engaged by the lower feed mechanism and retracted toward the operator. At the same time, the feed dog is below the throat plate and not engaged in feeding when the needle penetrates the work in a vertical path.

In substance, the invention affords conjoint action between the reversal of the lower four-motion feed mechanism and the needle feeding action. The lower feed mechanism is caused to operate in the reverse direction by appropriate selection of linkage with its drive shaft.

Simultaneously the needle feed mechanism is reduced to a vertical reciprocation thus nullifying the action of the normal needle feed.

Furthermore, while the needle is restricted to a vertical reciprocation which passes through the work, this operation is timed in alternation with the engagement of the lower feed mechanism with the work. The needle is therefore not relied upon in the reverse feeding.

An important feature of nullifying or reducing to zero the range of reverse feeding by the needle is, that this eliminates vibratory movement of the several small parts. In this way the wear on the machine is greatly reduced.

In the course of disengaging the needle feeding mechanism, provision is also made for changing the amount of lateral feed of the needle.

It will of course be readily understood that disengagement of the needle feed during the reverse feeding cycle does not produce any detrimental effects in the formula of the seam, as the plies of the work are already stitched together when the cycle is shifted from forward to reverse

feeding. This precludes any relative slippage between individual plies of fabric material.

Numerous changes are possible in the specific embodiment of the invention as to proportions and minor details of structure without departing from the scope of the invention as defined in the following claims.

What I claim is:

1. In combination with a lockstitch sewing machine having both a feed-dog with a four-motion lower feed mechanism and a needle feed mechanism, said four-motion lower feed mechanism including feed lift means and horizontal feed stroke means, means for shifting the timing of the feed lift means through 180° relative to the horizontal feed stroke for reversing the direction of feed stroke of the feed-dog, means for nullifying the feed of the needle and a single means for actuating said reversing means and for nullifying the feed of the needle.

2. In combination with a lockstitch sewing machine having both a feed-dog with a four-motion lower feed mechanism and a simultaneously operating needle feed mechanism, said four-motion lower feed mechanism including feed lift means and horizontal feed stroke means, means for shifting the timing of the feed lift means through 180° relative to the horizontal feed stroke for reversing the direction of feed stroke of the feed-dog and means nullifying the feed of the needle and for withdrawing the needle from the work when the lower feed-dog is engaged with the work.

3. In combination with a lockstitch sewing machine having both a feed-dog with a four-motion lower feed mechanism and a simultaneously operating needle feed mechanism, said four-motion lower feed mechanism including feed lift means and horizontal feed stroke means, means for shifting the timing of the feed lift means through 180° relative to the horizontal feed stroke for reversing the direction of feed stroke of the feed-dog, and means for reciprocating the needle in a vertical direction through the work when the lower feed dog is disengaged from the work.

4. In combination with a lockstitch sewing machine having both a feed-dog with a four-motion lower feed mechanism and a simultaneously operating needle feed mechanism, said four-motion lower feed mechanism including feed lift means and horizontal feed stroke means, means for shifting the timing of the feed lift means through 180° relative to the horizontal feed stroke for reversing the direction of feed stroke of the feed-dog, and means for reciprocating the needle in a vertical direction through the work alternately with the engagement of the feed-dog with the work.

5. In combination with a lockstitch sewing machine having a frame including a base and a feed dog with a four-motion lower feed mechanism, an operating shaft therefor, an eccentric on the shaft, a lift pitman encompassing the eccentric with one of its ends, said pitman

being pivotally connected at its other end to a feed segment plate fulcrumed to the frame of the sewing machine, said segment plate having an arcuate slot extending in opposite directions from the fulcrum point, a depending arm on the feed mechanism, a link pivotally connected at one of its ends to the depending arm, said link having its other end slidably held in said slot in the segment plate, and a rod pivotally connected with the link, a control shaft journaled in the machine base, and a crank on said control shaft in connection with the rod for shifting the link in the slot in the segment plate to opposite sides of the fulcrum point.

6. In combination with a lockstitch sewing machine having a feed dog with a four-motion lower feed mechanism, an operating shaft therefor, means connecting the shaft in the feed mechanism for operation of the latter in either the forward or reverse direction at will, a needle feed mechanism comprising a main drive shaft, an eccentric on the shaft, a pitman on the eccentric, a bell crank lever pivotally mounted on the machine frame, a pivotal connection between the bell crank lever and the pitman, said bell crank lever having an arm with a longitudinal slot, a needle feed rock frame, a rock shaft, an arm on the rock shaft, a link between the arm and the rock frame, a second arm on the rock shaft, a link pivoted at one of its ends to that second arm, a pin carried in the other end of said link, said pin being in slidable engagement with the slot in the arm of the bell crank lever, a feed control shaft, an arm on said feed control shaft having a longitudinal slot, a link pivoted at one of its ends to the link extending between the bell crank and the second arm on the rock shaft and, at its other end, to means adjustable along said longitudinal slot in said arm on the feed control shaft, and means for operating the feed control shaft.

7. In combination with a lockstitch sewing machine including a frame and standard and having a feed dog with a reversible four-motion lower feed mechanism and a needle feed mechanism, means for reversing the direction of the feed stroke of the feed dog, a control shaft therefor with crank means on each of its opposite ends, means for nullifying the feed of the needle including a control shaft therefor with crank means on each of its opposite ends, a rock shaft journaled in the machine standard, a transverse bar on one end of said rock shaft, a rod connecting one of said crank means on each control shaft with an end of the transverse bar on opposite sides of said rock shaft, and a lever on the opposite end of the rock shaft.

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JORDAN FRANKLIN, *Primary Examiner*.

R. J. SCANLAN, JR., *Examiner*.