

May 5, 1959

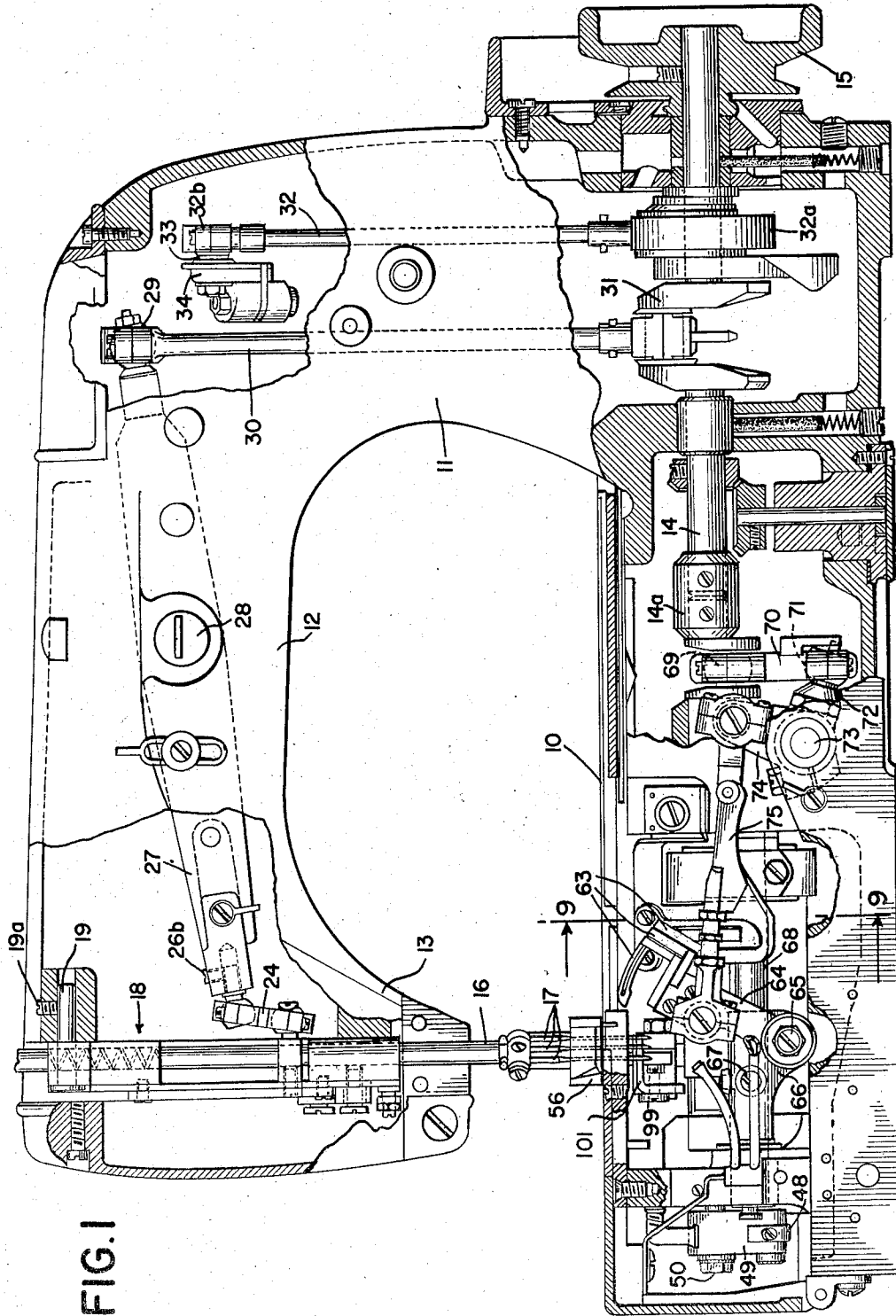
G. M. REIMER

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FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

10 Sheets-Sheet 1



May 5, 1959

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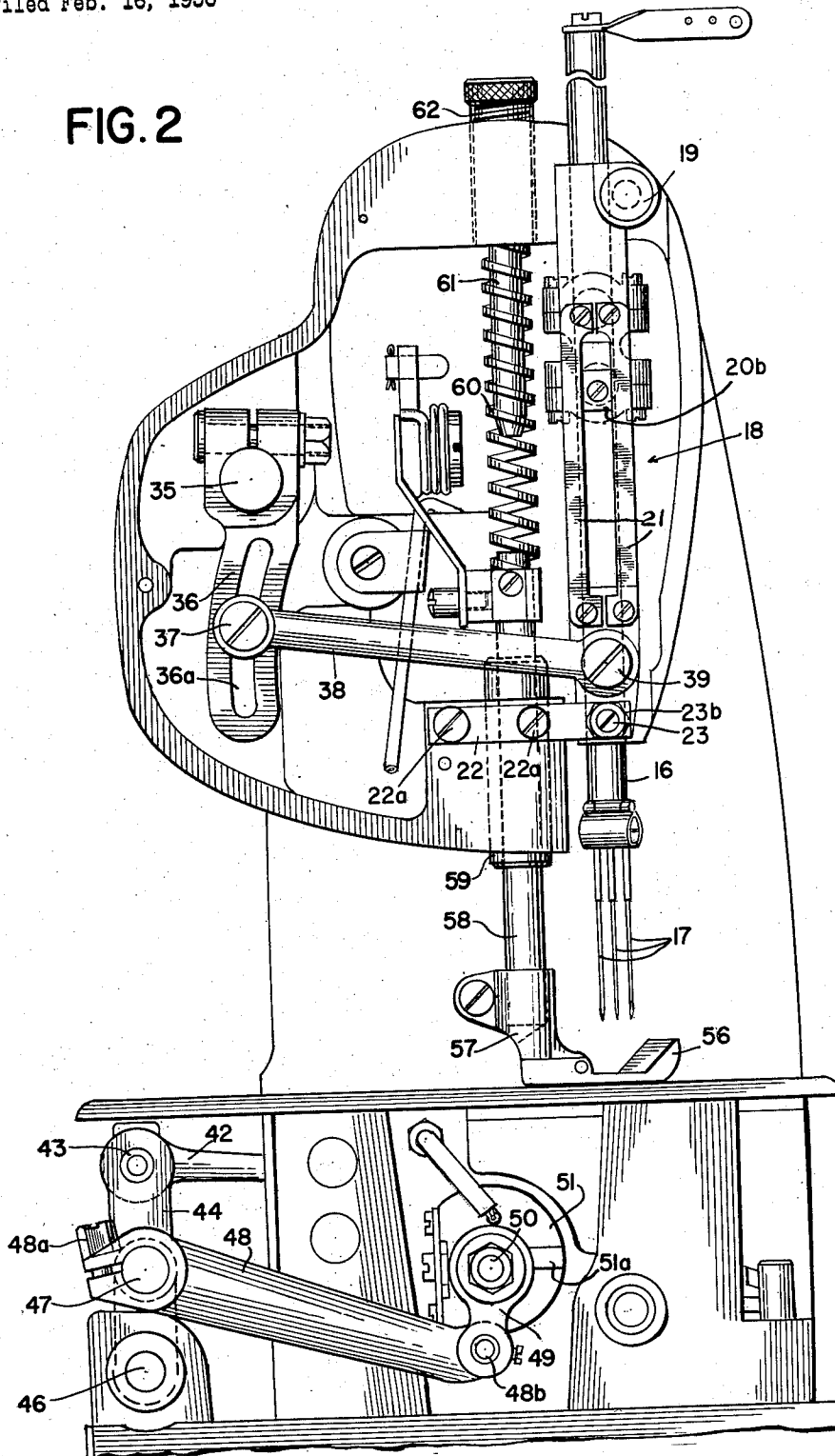
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FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

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FIG. 2



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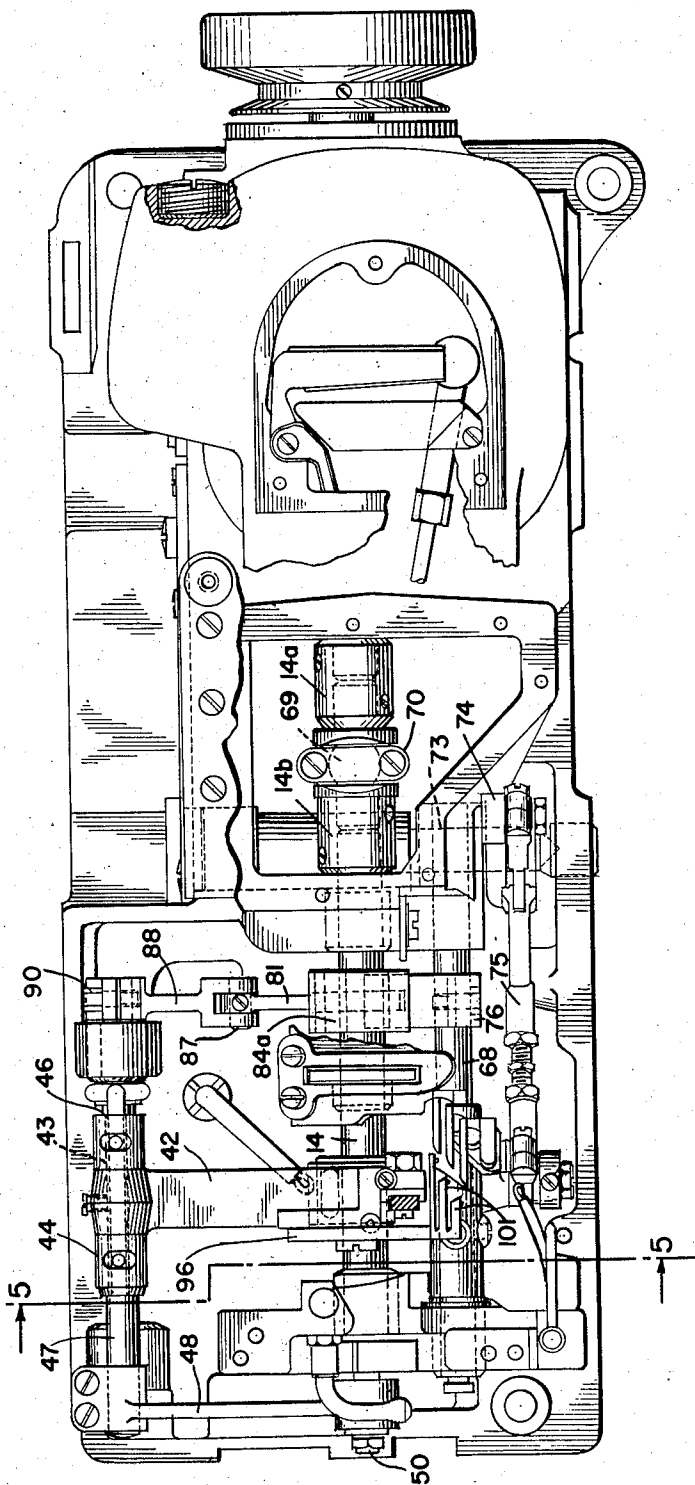
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FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

10 Sheets-Sheet 3

FIG. 3



May 5, 1959

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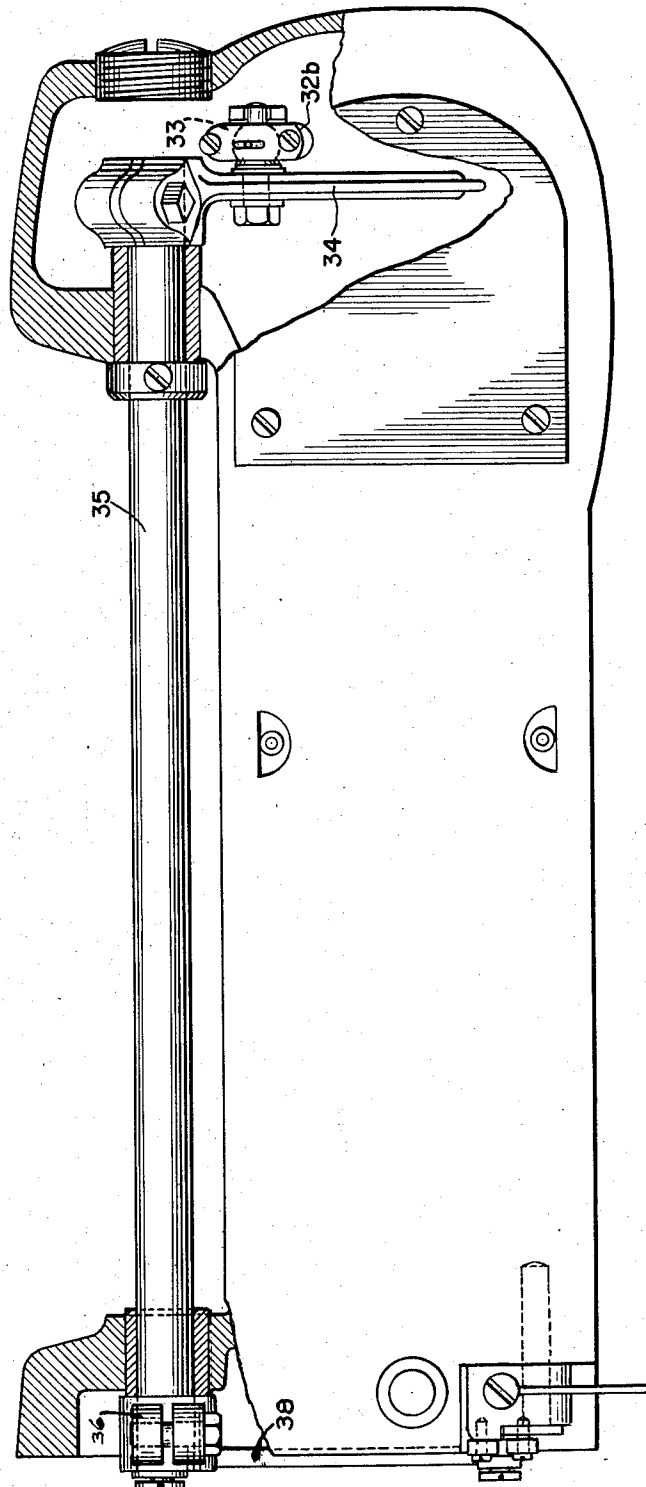
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FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

10 Sheets-Sheet 4

FIG. 4



May 5, 1959

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Filed Feb. 16, 1956

10 Sheets-Sheet 5

FIG. 5

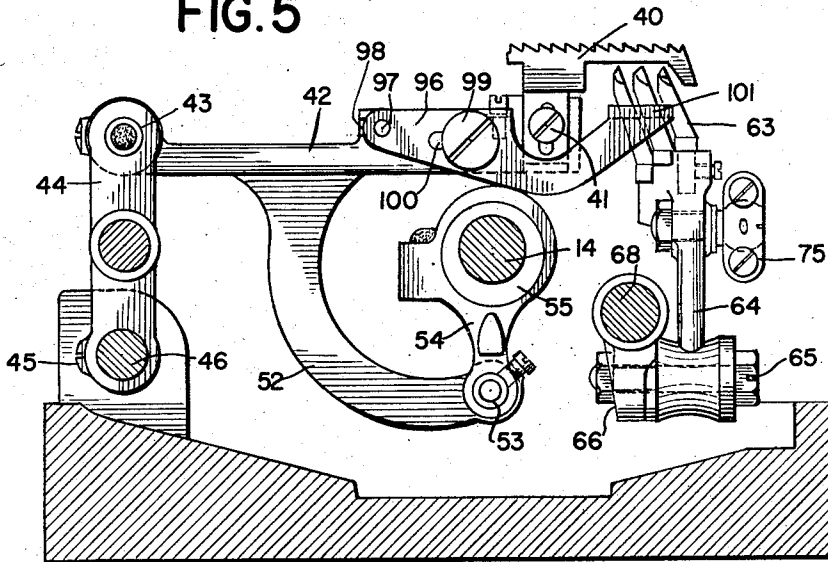


FIG. 6



FIG. 7

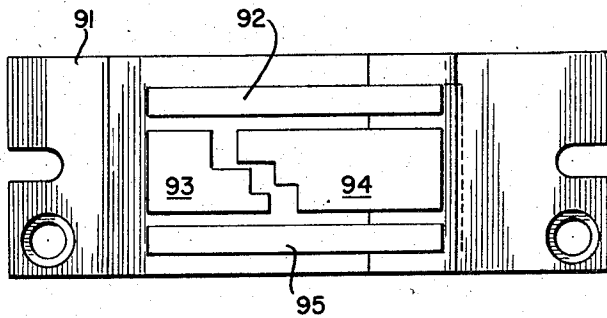
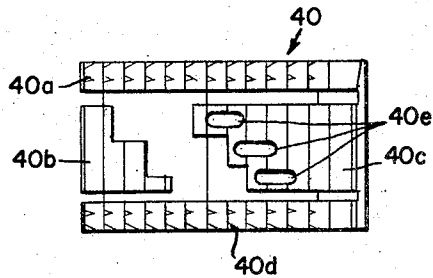


FIG. 8



May 5, 1959

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2,884,883

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Filed Feb. 16, 1956

10 Sheets-Sheet 6

FIG. 9

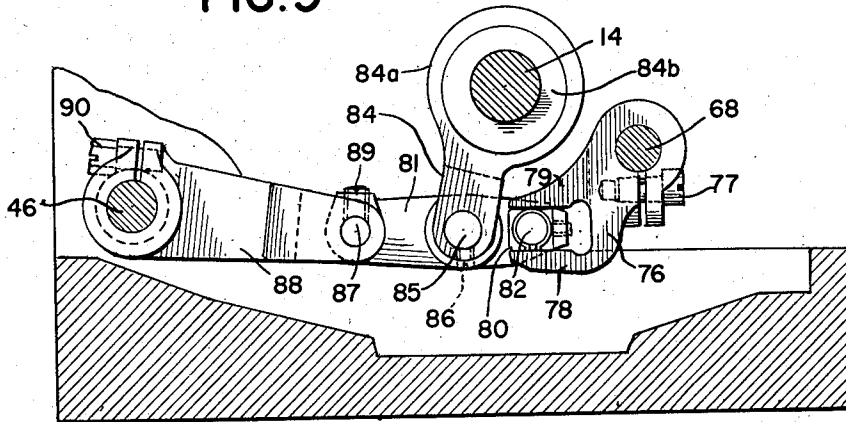
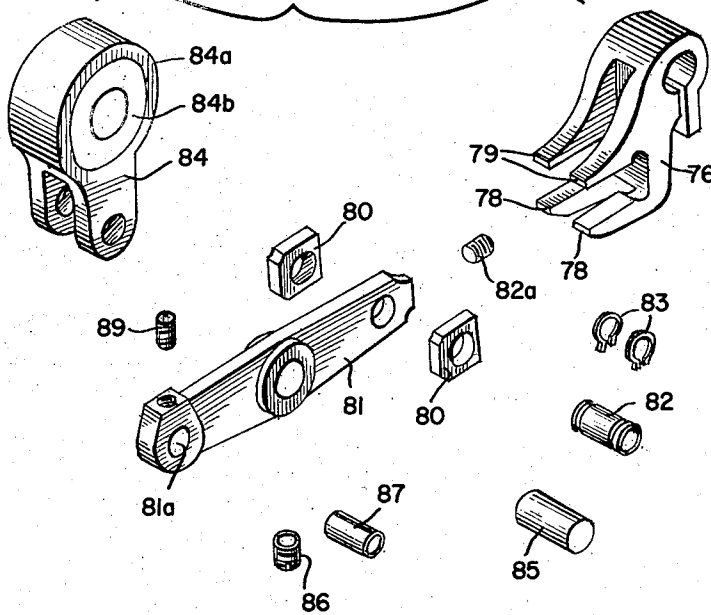


FIG. 10



May 5, 1959

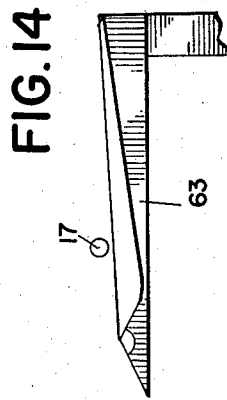
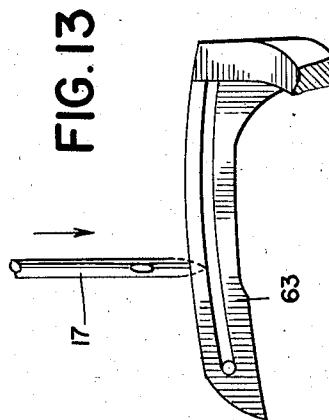
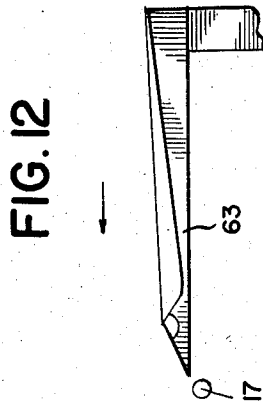
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FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

10 Sheets-Sheet 7



May 5, 1959

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2,884,883

FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

10 Sheets-Sheet 8

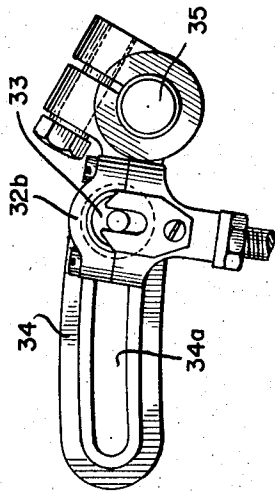


FIG. 15

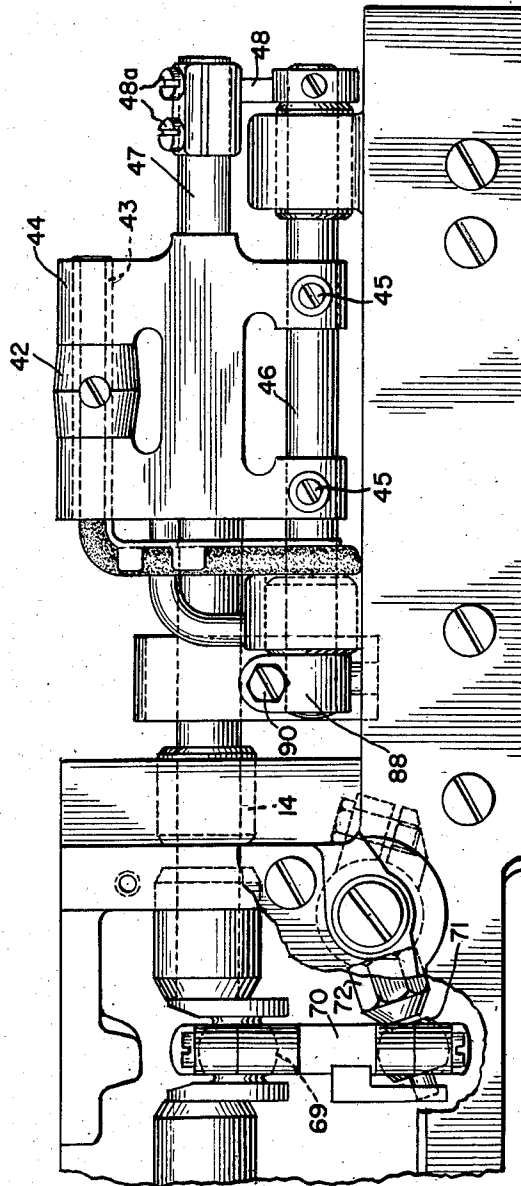


FIG. 16



May 5, 1959

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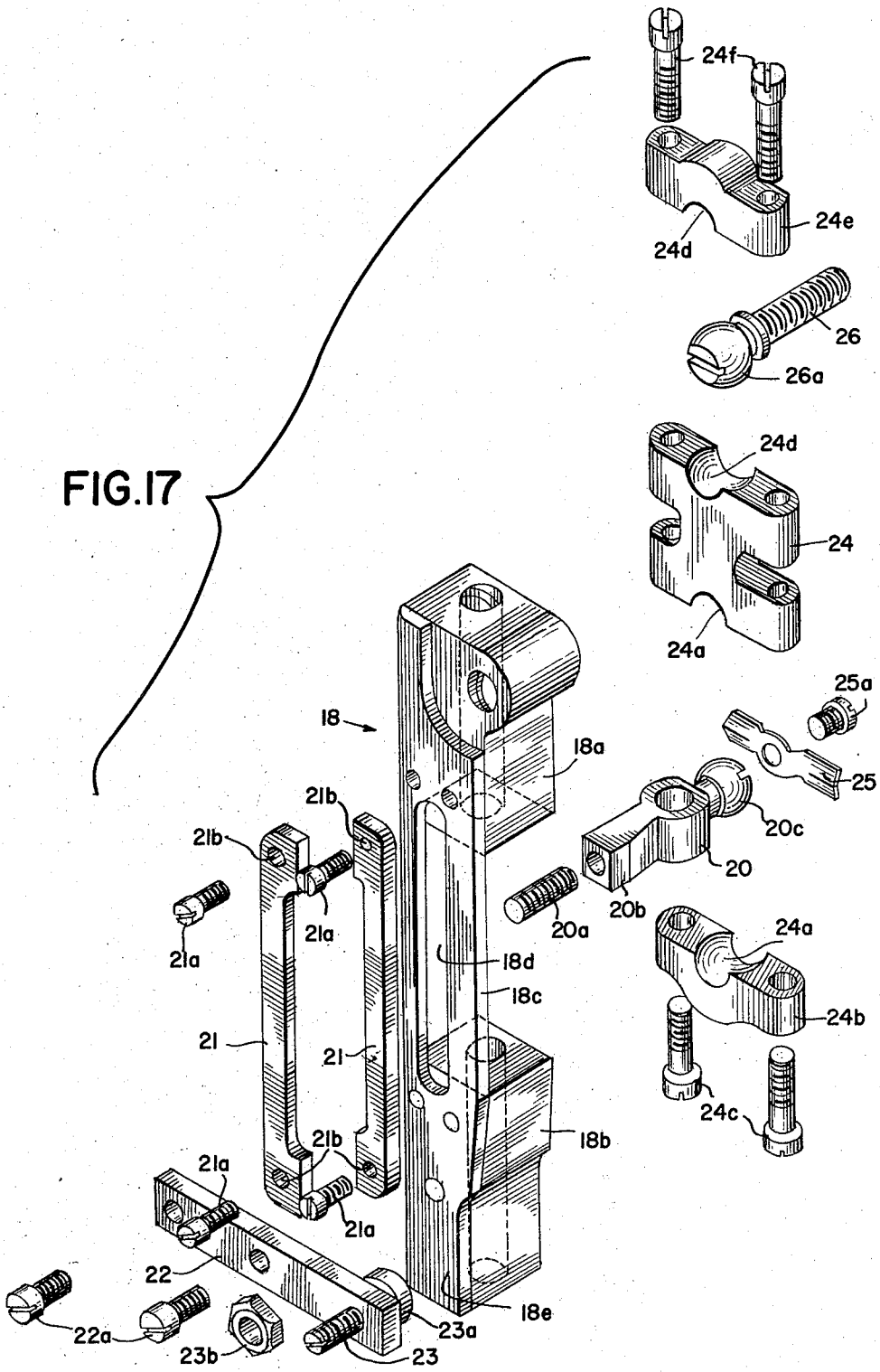
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FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

10 Sheets-Sheet 9

FIG.17



May 5, 1959

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2,884,883

FOUR MOTION LOOPER FOR SEWING MACHINES

Filed Feb. 16, 1956

10 Sheets-Sheet 10

FIG. 18

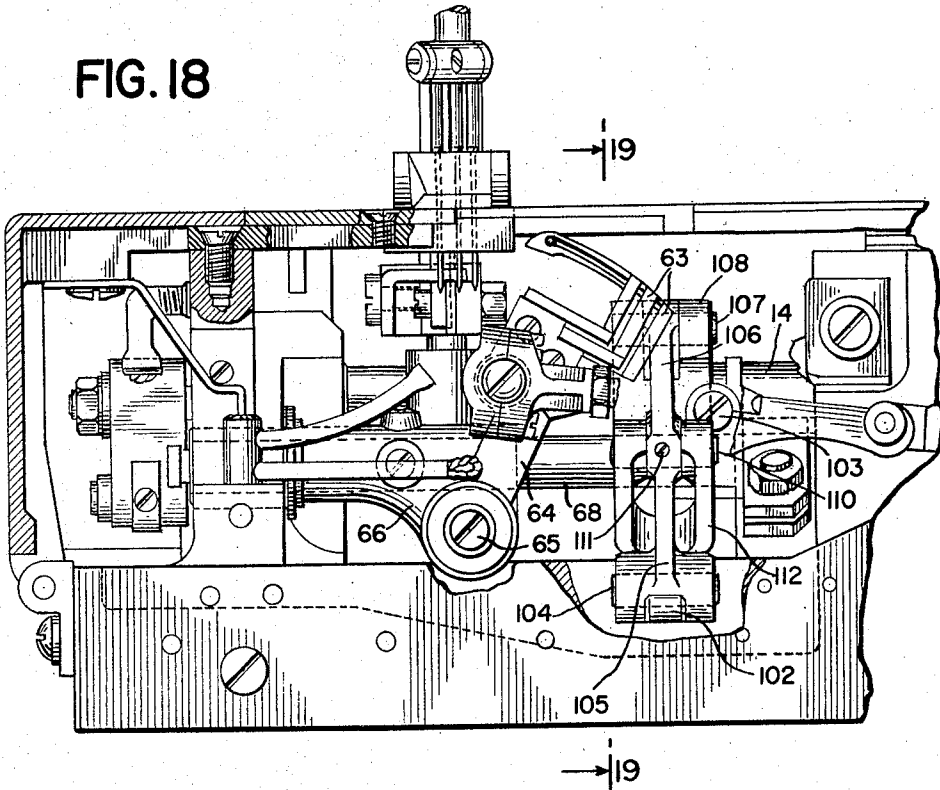
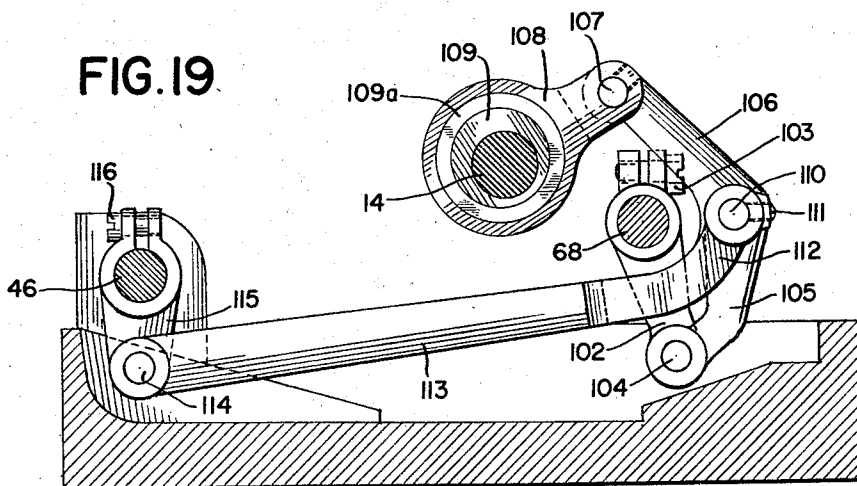


FIG. 19



1

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## FOUR MOTION LOOPER FOR SEWING MACHINES 5

George M. Reimer, Elmwood Park, Ill., assignor to Union Special Machine Company, Chicago, Ill., a corporation of Illinois

Application February 16, 1956, Serial No. 565,818 10

13 Claims. (Cl. 112-166)

This invention relates to sewing machines having a reciprocatory needle bar which is shifted laterally in the direction of feed in the course of stitch formation to provide a needle feed action. It is particularly concerned with machines of this character adapted to form one or more lines of two-threaded chain stitches. In its preferred embodiment it involves a machine having a plurality of needles carried by the needle bar and a plurality of loopers, each cooperating with its respective needle to form a seam of the two-thread chain stitch type, the loopers having their loop seizing and shedding movements transverse to the line of feed and their needle avoid movements in the direction of feed.

In machines of the character indicated provisions have been made for the movement of the looper in the direction of feed in coordination with the movement of the needle in such direction to enable the looper to cooperate properly with the needle in the course of its needle feed action. The means provided for this purpose, however, have been such that the movement of the looper in the direction of feed has been dependent entirely upon the feed stroke. This has led to difficulties requiring special adjustments of certain parts whenever the feed stroke has been changed. This is because correct stitch formation requires a predetermined relation between the looper and the needle as they cooperate in the formation of stitches. Thus correct stitch formation requires a predetermined spacing, in the direction of stitch formation, between the needle and looper as each of these elements enters the thread loop of the other. At times the loopers must be in front of the needles to a predetermined extent and at times in rear of the needles to a predetermined extent. These relative positions of the loopers and needles are insured by a definite extent of needle avoid movement of the loopers. In a machine having a needle feed action and a feed mechanism adapted to impart a feed movement to the work coordinated with the needle feed action it is difficult to maintain the proper relationship between the needles and loopers when the latter are shifted in the direction of feed to extents which are in direct proportion to the feed stroke. Thus assuming that the feed stroke is reduced to half of its former adjustment, the clearance between the paths of the needles and loopers will be reduced to half their former value. Special means, which are difficult to adjust properly and require separate regulation, are therefore needed to vary the extent of movement of the loopers in the direction of feed in relation to the feed stroke as the latter is varied.

It has been an important object of the present invention to overcome the foregoing difficulties by providing mechanism which will automatically cause the loopers to maintain their proper relationship to the needles, at times in front and at times in rear of the latter, as the feed stroke of the machine is varied. The mechanism is such that the loopers are automatically shifted in the direction of feed to the correct extent to conform with the feed stroke and also maintain the desired needle

2

avoid relationship, regardless of the particular feed stroke for which the machine is adjusted. This is accomplished, in a way to require adjustment only of the feed stroke, by providing two different controls over the movement of the loopers in the direction of feed, one by connections from the work feeding mechanism and varying with the feed stroke for which the machine is adjusted and the other of fixed magnitude to provide a predetermined needle avoid action. The proper needle avoid relationship is thus maintained, without an extra adjustment, whenever the feed stroke is varied.

Various improvements are also incorporated, in accordance with the invention, in the mechanism for imparting the desired reciprocatory and needle feed movements to the needle bar. These include a simple but effective arrangement for preventing undesired wobbling of a link connecting a ball pin at the end of the needle lever with a ball pin carried by the needle bar, the provision of improved means for guiding and preventing turning of the needle bar in the course of its reciprocating and swinging movements, and the provision of improved means for guiding and confining a swinging frame in which the needle bar is reciprocated. These among other advantages insure, and facilitate the maintenance of, the proper coordination of the needles and loopers in the course of their compound movements.

Other objects, features, and advantages of the invention will appear from the detailed description of certain illustrative embodiments thereof which will now be given in conjunction with the accompanying drawings, in which:

Fig. 1 is a view, partly in front elevation, partly in longitudinal section and with parts broken away, of a sewing machine embodying the invention;

Fig. 2 is an end elevational view of the machine, as seen from the left in Fig. 1, with a cover removed from the needle head of the machine;

Fig. 3 is a plan view of the machine with a portion of the overhanging arm broken away, certain cover members removed and certain parts broken away for clarity of illustration;

Fig. 4 is a plan view of the overhanging arm of the machine with parts broken away and shown in section;

Fig. 5 is a transverse vertical sectional view through the base of the machine taken along the line 5-5 of Fig. 3;

Fig. 6 is a side elevational view of a throat plate embodied in the machine;

Fig. 7 is a plan view of the throat plate;

Fig. 8 is a plan view of a feed dog embodied in the machine;

Fig. 9 is a transverse vertical section through the base of the machine, taken along the line 9-9 of Fig. 1;

Fig. 10 is an exploded perspective view of parts embodied in the mechanism for shifting the loopers in the line of feed;

Fig. 11 is an elevational view illustrating the relationship between one of the needles and the cooperating looper as the latter is about to seize the needle thread loop;

Fig. 12 is a plan view of the parts shown in Fig. 11;

Fig. 13 is an elevational view showing the relationship between a needle and its cooperating looper as the needle descends through the loop of the looper thread;

Fig. 14 is a plan view of the parts shown in Fig. 13;

Fig. 15 is a detail view, in elevation, showing the adjustable drive for imparting the needle feed action to the needle bar;

Fig. 16 is a rear elevational view of a portion of the base of the machine showing the feed rocker and its mounting and the looper operating mechanism;

Fig. 17 is an exploded perspective view of a needle bar carrying frame and related parts;

Fig. 18 is a front elevational view of a portion of the base of the machine, with parts broken away for better illustration, and shows a modified mechanism in accordance with the invention for shifting the loopers in the line of feed; and

Fig. 19 is a transverse vertical section through the base of the modified machine, taken along the line 19—19 of Fig. 18.

Referring now to the drawings, the invention has been illustrated in connection with a machine of the general character shown in the Peterson et al. Patent No. 2,577,430, granted December 4, 1951. The illustrative machine is provided with a plurality of needles adapted to be reciprocated from a position above the work support of the frame to a position in which the thread carrying eyes of the needles are below said work support and there cooperate with a plurality of loopers, having loop seizing and shedding movements across the line of feed, for the formation of a plurality of lines of stitches of the two-thread chain stitch type, designated a 401 stitch in accordance with the Federal Specifications. Certain important features of the invention may, however, be used in relation to a single needle machine arranged to cooperate with a single looper having its loop seizing and loop shedding movements in a direction across the line of feed.

The frame of the machine, as best shown in Fig. 1, is provided with a work supporting base 10, a vertical standard 11, and an overhanging arm 12 terminating in a needle head 13, which carries a needle bar arranged for vertical reciprocation and also swinging movement in the line of feed. A rotary shaft 14, journaled in suitable bearings in the base of the frame, serves to operate all of the operative devices within the machine. For convenience of assembly this shaft is formed in three parts which are connected together by couplings 14a and 14b, Fig. 3. Shaft 14 extends outwardly through the right end wall of the frame and has secured thereto a combined handwheel and pulley 15 adapted for connection by a belt with a suitable power source, such as an electric transmitter, and adapted also for turning by hand. Within the needle head there is disposed, substantially vertically, a needle bar 16 carrying a plurality of needles 17 at its lower end. The needle bar is mounted for reciprocation in a frame designated generally by the reference number 18. It is mounted for swinging movement about a pivot stud 19 retained in appropriate position in an opening in a portion of the top of the frame of the needle head by means of a set screw 19a. The swinging frame 18 is shown in detail in Fig. 17 in relation to various cooperating devices. As shown, it is provided with a pair of spaced bearing blocks 18a and 18b provided with vertically aligned openings in which the needle bar is arranged to reciprocate. A plate-like member 18c, which is suitably secured to the bearing blocks 18a and 18b by welding or the like, is provided with an elongated vertically extending slot 18d through which extends a portion 20b of an arm 20 secured to the needle bar by means of a set screw 20a. Portion 20b of the arm is guided by and arranged for vertical sliding movement in relation to a pair of detachable guide elements 21 secured to the frame 18. These guide elements are fastened to the frame by means of screws 21a. If desired provision may be made for adjustment of the elements 21 toward and away from each other to compensate for wear and the like. For this purpose openings 21b in the elements 21, which cooperate with the screws 21a, may be slightly larger in diameter than the shanks of these screws or they may be elongated slightly in a horizontal direction.

It will be understood that the cooperation of the arm 20 with the guides serves to prevent turning of the needle bar about its axis in the course of its reciprocation. Beneath the guide bars 21 there is secured to the housing of the needle head a bar 22, this being fastened by screws 22a. Bar 22 extends forwardly and has a free portion

thereof overlying the lower end of the frame 18. Screw stud 23 having an enlarged head 23a may be adjustably mounted in the free end of the bar and locked in said position by a lock nut 23b. The inner face of the head 23a cooperates with a surface 18e on the plate 18c of the frame 18 to guide the same and prevent transverse movement of the frame in the course of its swinging movement. Screw stud 23 affords a very simple means for quickly adjusting the position of the guide surface of the head 23a to insure proper cooperation with the surface 18e and to compensate for wear.

Arm 20 secured to the needle bar in the manner explained also carries a ball pin 20c arranged to cooperate with a short link 24. The latter has a spherical seat 24a provided in part by the main body of the link and in part by a detachable cap 24b which is secured to the main body by screws 24c. A spring clip 25 secured to the outer end of the ball pin 20c by means of a screw 25a having screw threaded engagement with an internally threaded opening in the ball is arranged to cooperate with the adjacent face of the link 24 to urge the lower end of the link inwardly, i.e. toward the left (Fig. 1). This serves to take up clearance between the ball pin and the spherical seat and eliminates the tendency of the link to wobble in the course of its movement in operating the needle bar. At its upper end the link 24 is provided with a spherical seat 24d, formed in part by the main body of the link and in part by a cap 24e secured to the main body by screws 24f. The spherical seat 24d cooperates with the ball end 26a of a screw threaded ball pin 26 which projects outwardly from the end of one arm of a needle lever 27 rockably mounted on a pivot 28 extending transversely of the overhanging arm at about its mid point. A set screw 26b serves to lock the ball pin 26 firmly in the end of the needle lever. The opposite arm of the needle lever carries a ball pin 29 (Fig. 1) which receives a spherical strap at the upper end of a pitman 30 which extends downwardly through the vertical standard. At its lower end this pitman cooperates with a crank portion 31 of the shaft 14. Crank 31 may have a spherical crank pin arranged to cooperate with a spherical seat in the strap at the lower end of pitman 30 or this strap and crank pin may be of the construction disclosed in the patent to Attwood, No. 2,729,179, granted January 3, 1956. Through the connections described, the needle lever 27 will be rocked about its pivot 28 and through the link 24 will bring about reciprocation of the needle bar within the frame 18.

Simultaneously with the reciprocation of the needle bar it is shifted along the line of feed by the swinging of the frame 18 about the pivot 19. For this purpose there is carried by the shaft 14 an eccentric or crank element arranged to cooperate with a strap 32a at the end of a pitman 32. The strap and the eccentric may have cooperating spherical faces if desired, although they may be of cylindrical form. At its upper end the pitman 32 carries a strap 32b providing a spherical seat cooperating with a ball pin 33 extending laterally from an arm 34 (Figs. 1 and 15) secured to a shaft 35. Arm 34 has an elongated arcuate slot 34a along which the ball pin 33 may be shifted to any desired position and then secured in said position. In this way the extent of angular movement imparted to the shaft 35 may be readily varied. Shaft 35 extends longitudinally of the overhanging arm from a rearwardly extending bulge of the vertical standard to and into a rearwardly extending bulge provided on the housing of the needle head. Within the latter there is clamped upon the shaft an arm 36 which extends downwardly. This arm has an elongated arcuate slot 36a along which may be adjusted screw stud 37 providing a pivot for one end of a link 38. The stud 37 may be adjusted to any desired position along the slot 36a and then set in such position. This provides a further means of adjustment of the swinging movement imparted to the frame 18. The forward end of the link 38 is pivotally

5

connected by a screw stud 39 with the frame 18 at a point adjacent its lower end. Through the connections described, the frame 18 is swung back and forth about the pivot 19 and, as explained, the extent of the swinging movement may be varied by adjusting the position of either or both the ball pin 33 and the screw stud 37 along the slots in their retaining arms. The timing of the reciprocation of the needle bar and its swinging movements is such that the needles will be carried in the direction of feed when the needles are in engagement with the work and they will be returned to their forward position when they are out of engagement with the work.

The mechanism in the base of the machine for advancing the work in the course of stitch formation is shown in Figs. 1, 2, 5, and 16. It comprises a feed dog 40 having a downwardly extending shank with an elongated slot which receives a screw 41 to secure the feed dog to the forward end of a feed bar 42. The elongated slot in the shank of the feed dog enables vertical adjustment of the latter in relation to the feed bar. At its rearward end the feed bar is pivotally connected by means of a hollow shaft 43 with upwardly extending arms of a feed rocker 44. Downwardly extending arms of the latter are secured by screws 45 to a rock shaft 46. At an intermediate point the feed rocker is provided with a laterally extending trunnion or stud 47 to which is secured, by means of screws 48a, a split clamping portion at the rear end of a downwardly and forwardly extending arm 48. At its forward end the latter is pivotally connected by a hollow pin 48b with the lower end of a pitman 49. The upper end of this pitman surrounds and receives motion from a crank pin 50 which is adapted for adjustment along a slot 51a in a disc 51 secured to the end of the drive shaft 14. The construction of this adjustable eccentric or crank is similar to that disclosed in the patent to Wohlpert No. 1,817,727, granted August 4, 1931. By appropriate adjustment of the crank pin 50 the extent of rocking movement imparted to the feed rocker 44 may be varied to impart a desired feed stroke to the feed dog. It will be apparent that through the connections described the feed dog will be given its work advancing and return movements. For imparting lifting and lowering movements to the feed dog, to carry it into and out of engagement with the work, the feed bar 42 is provided with a C-shaped downwardly extending arm 52 pivotally connected by means of a hollow pin 53 with the lower end of a pitman 54. The latter, at its upper end, has a strap portion surrounding an eccentric 55 secured to the shaft 14 in a region directly beneath the feed dog.

Cooperating with the feed dog in advancing the work is a presser foot 56 (Fig. 2) pivotally mounted on a shank element 57 clamped upon the lower end of a presser bar 58 which is vertically slidable in a bearing sleeve 59 carried by the bottom of the needle head housing. A spring 60 urges the presser bar 58 downwardly, this spring having its upper end disposed about a downwardly extending pin 61 carried by a screw-threaded sleeve 62 which, upon appropriate turning in one direction or the other, is lifted or lowered to vary the force of the spring 61.

Cooperating with the needles 17 in the formation of stitches are a plurality of loopers 63 (Fig. 1) mounted on an arm or carrier 64 pivotally mounted, by means of a screw stud 65, upon a downwardly extending portion of a sleeve 66 which is secured by a screw 67 to a rock shaft 68. The latter is suitably journaled in bearings carried by the base of the frame. Loop-seizing and shedding movements are imparted to the loopers 63 by connections from the shaft 14 for rocking the arm 64 about its pivot 65. For this purpose, as best shown in Figs. 1 and 16, the shaft 14 is provided with a spherical crank 69 with which cooperates a strap, having a spherical seat, at the upper end of a pitman 70. At its lower end this pitman has a spherical strap cooperating with a

6

ball pin 71 extending outwardly from an arm 72 of a member clamped upon a rock shaft 73. An arm 74 is secured to the shaft 73 adjacent its forward end and extends upwardly therefrom, this arm being connected by a link 75 with the arm 64. Link 75 has strap portions at its two ends provided with spherical seats cooperating with ball pins carried by the arms 64 and 74. As shown in Fig. 1, the link 75 is of extensible construction so that its effective length may be readily altered to insure proper coaction of the loopers with the needles. Also it is preferably of toggle construction to permit the loopers to be swung toward the right (Fig. 1) for threading purposes and the like.

The mechanism for shifting the loopers along the line of feed, both to follow the swinging movement of the needles and to provide a needle avoid action, is best disclosed in Figs. 9 and 10. It comprises an arm 76 having a split hub clamped by a screw 77 upon the shaft 68 to which is secured the sleeve 66 (Fig. 1) as previously described. Arm 76 has rearwardly extending forks formed by spaced lower prongs 78 and spaced upper prongs 79 which form guideways for the sliding movement of blocks 80. The latter are rockably mounted on an arm of a lever 81 by means of a hollow pin 82. Spring clips 83, cooperating with grooves extending around the pin 82 adjacent its outer ends, serve to hold the blocks in assembled relation on the pin. The pin is, in turn, fixedly mounted on the arm 81 and held against movement with respect thereto by means of a set screw 82a. Lever 81 is rockably mounted at the lower end of a pitman 84. The latter is forked to provide spaced downwardly extending portions which straddle the lever and are pivotally connected therewith by means of a pin 85 which is secured within a central opening in the lever by means of a set screw 86. Pitman 84 has a strap portion 84a surrounding an eccentric 84b secured to the shaft 14. The opposite arm of lever 81 is pivotally connected, by means of a pin 87, with an arm 88 which has a forked end arranged to straddle the end of the lever 81, the spaced portions of the forked end of arm 88 being provided with openings aligned with an opening 81a through the lever in which the pin 87 is received. The pin is held in fixed relation to the lever by means of a set screw 89. Arm 88 has a split hub portion surrounding the shaft 46 to which the feed rocker is secured, this hub being firmly clamped upon the shaft 46 by means of a screw 90.

The operation of the foregoing mechanism may be explained as follows. Let us assume firstly that the arm 88 is held fixed so that a fixed pivot is provided by the pin 87. The eccentric 84b will then shift the pitman 84 back and forth in a longitudinal direction and will cause the lever 81 to rock about the pin 87. In doing this the arm 76 will be rocked and in turn will rock the shaft 68 to impart the desired needle avoid movements to the loopers. Now let us assume that the pitman 84 is held stationary so that pin 85 forms a fixed pivot for the lever 81, it will be seen that the rocking movements of the feed rocker and its shaft 46 will then, through the arm 88, cause rocking of the lever 81 about pin 85 and cause corresponding rocking movements to be imparted to the arm 76 and shaft 68 to shift the loopers along the line of feed. It should be noted in this connection that feeding movements of the feed dog are imparted by counterclockwise rocking of the feed rocker and its shaft 46. This will cause lifting of the left arm of lever 81 and lowering of the right arm to impart a counterclockwise movement to the rock shaft 68, thus bringing about movement of the loopers in the direction of feed. It will be understood that at the same time the needles will be shifted in the direction of feed to the same extent by the needle feed mechanism described. On the return movement of the feed dog and the needles the loopers will be shifted in the opposite direction to follow the movement of the needles. The extent of movement of

the loopers by the connections from the feed rocker is substantially equal to the feed stroke, for all adjustments of the latter.

Actually, of course, the two movements described above take place simultaneously, i.e., the movement of the loopers in synchronism with the movement of the feed dog and the swinging movement of the needles will have imposed upon it the needle avoid effect imparted by the eccentric 84b. The net result is indicated schematically in Figs. 11 to 14 inclusive. Thus as shown in Figs. 11 and 12 the looper 63 in moving toward the left to seize the needle thread loop will pass in rear of the needle, by virtue of the action of the needle avoid eccentric 84b at this time. At a different point in the cycle, when the needle 17 is descending to pass through the loop of looper thread, the needle avoid eccentric 84b will insure the positioning of the looper in front of the downward path of the needle as shown in Figs. 13 and 14. Throughout the movement of the needle and looper at these two different points in the cycle, the two will be shifted together in the direction of feed to maintain the same relationship by virtue of the connection from the feed rocker to the looper supporting rock shaft 68. This will be the case regardless of the feed stroke for which the machine is set, assuming, of course, that the needle feed action is set to correspond with the feed stroke of the feed dog. Also it will be understood that the relationship depicted in Figs. 11 to 14 between one needle and one looper will be similarly maintained between the other needles and other loopers in a multiple needle and multiple looper machine.

In Figs. 6 and 7 there is illustrated a suitable form of throat plate 91 which may be provided in the cloth plate of the work supporting base in the region of stitch formation. This plate has openings 92, 93, 94 and 95 therethrough to accommodate the portions 40a, 40b, 40c and 40d of the feed dog 40 shown in Fig. 8. These portions of the feed dog will pass upwardly and downwardly through the openings in the throat plate as the lifting and lowering movements are imparted to the feed bar and they will move longitudinally of the openings in response to the feed and return movements of the feed bar. The feed dog as shown is provided with openings 40e for the passage of the needles therethrough.

A needle guard is preferably mounted on the feed bar to cooperate with the needles and insure their proper positioning in relation to the path of the loopers. A suitable form of such guard is shown in Fig. 5 and partially in Figs. 1 and 3. It comprises a member 96 having a pin 97 slidable, for purposes of adjustment, in a guide groove 98 in the face of the feed bar. It is secured to the feed bar by means of a screw 99 passing through an elongated slot 100 in the member 96. Groove 98 and slot 100 allow for slight adjustment of the member 96 from front to rear of the feed bar. At its forward end the member 96 has a laterally extending portion which is slotted to provide a plurality of horizontally extending fingers 101 which project transversely of the line of feed. These fingers, as best shown in Fig. 3, extend in rear of the needles 17, one finger being in rear of and closely adjacent the path of reciprocation of a related needle. They are disposed below the loop-seizing and shedding portions of the loopers 63. It will be apparent that the fingers 101 shift in the direction of feed along with the feed dog and the needles in the course of their feed and return movements.

In Figs. 18 and 19 there is illustrated a modified arrangement for rocking the looper carrying shaft 68, both in accordance with the movement of the feed dog and to provide a needle avoid action. The mounting of the loopers and the connections for imparting loop seizing and shedding movements to the latter and also for operating the feed bar and feed dog and other parts of the machine are the same as in relation to the embodiment

first described, and the various parts shown are correspondingly numbered in Figs. 18 and 19.

The mechanism for rocking the looper carrying shaft 68, to cause the loopers to follow the needles in their needle feed action and also to impart a needle avoid movement to the loopers, comprises a downwardly extending arm 102 secured to the shaft 68 by means of a clamping screw 103. The upper end of arm 102 is provided with a split sleeve for this purpose. At its lower end the arm 102 is pivotally connected by means of a pin 104 with a lower arm 105 of a C-shaped lever having an upper arm 106. The latter is pivotally connected by means of a pin 107 with a pitman 108 having a strap portion surrounding an eccentric 109 secured to the main shaft 14. A needle bearing unit 109a is preferably provided between the eccentric and the strap. The lever 105, 106 carries a pivot pin 110 adjacent its mid point, this pin being retained on the lever by a set screw 111. Branched extensions 112 of a link 113 are pivotally connected with the lever 105, 106 by means of the pin 110. At its rear end the link 113 is pivotally connected by means of a pin 114 to the lower end of an arm 115 having a split sleeve at its upper end clamped by means of a screw 116 upon the feed rocker carrying shaft 46.

Ignoring the action of the eccentric 109 through the pitman 108, and assuming that the pin 107 is held fixed, it will be seen that the rocking of the feed rocker shaft 46 will cause the lever 105, 106 to rock about the pin 107 and thereby swing the arm 102 to rock the shaft 68. The relationship of the parts is such that the loopers 63 will thereby be shifted back and forth along the line of feed in unison with and to the same extent as the feed dog. Now ignoring the action of the connections from the feed rocker shaft 46, and assuming that the pin 110 is held in fixed position, the eccentric 109 will rock the lever 105, 106 about the pin 110 and thereby swing the arm 102 to rock the shaft 68 to impart the desired needle avoid movements to the loopers. Actually, it will be understood, the two motions are applied to the looper rock shaft 68 so that neither of the pins 107 and 110 remains in a fixed position but the movements of the feed rocker shaft 46 and pitman 108 impart their combined effect to the arm 102 to provide the desired relationship between the loopers and the needles at all times. It will be appreciated that both of the pins 107 and 110 provide floating pivots and their movements are constrained to a particular path by the nature of the linkage. While a preferred embodiment of the invention and a possible modification of a portion of the mechanism therein have been described in considerable detail, it will be understood that various changes may be made in the construction and arrangement of the several parts without departing from the general principles and scope of the invention as defined by the appended claims.

What is claimed is:

1. In a sewing machine having a rotary drive shaft, work feeding mechanism comprising a feed dog arranged to feed the work step-by-step in a predetermined direction, a needle arranged for reciprocation through the work and for movement in the direction of feed while engaged with the work to assist the feeding action of the feed dog, and a looper mounted for loop seizing and shedding movements in a direction transverse to the direction of feed and movements parallel with the direction of feed, the combination of connections from said shaft for operating said feed dog and said needle and for imparting loop seizing and shedding movements to said looper, eccentric means carried by said shaft separate from the connections from said shaft for operating the feed dog, and means for shifting said looper in a direction parallel with the direction of feed controlled in part by said connections for operating the feed dog and in part by connections from said eccentric means.
2. In a sewing machine having a rotary drive shaft,

work feeding mechanism comprising a feed dog arranged to feed the work step-by-step in a predetermined direction, a needle arranged for reciprocation through the work and for movement in the direction of feed while engaged with the work to assist the feeding action of the feed dog, and a looper mounted for loop seizing and shedding movements in a direction transverse to the direction of feed and movements parallel with the direction of feed, the combination of connections from said shaft for operating said feed dog and said needle and for imparting loop seizing and shedding movements to said looper, eccentric means carried by said shaft separate from the connections from said shaft for operating the feed dog, and means for shifting said looper in a direction parallel with the direction of feed controlled in part by said connections for operating the feed dog and in part by connections from said eccentric means, the arrangement being such that said looper is shifted by said looper shifting means at times in the same direction and at a times in opposite directions under the separate controls from said feed dog operating connections and from said eccentric means.

3. In a sewing machine having a rotary drive shaft, work feeding mechanism comprising a feed dog arranged to feed the work step-by-step in a predetermined direction, a needle arranged for reciprocation through the work and for movement in the direction of feed while engaged with the work to assist the feeding action of the feed dog, and a looper mounted for loop seizing and shedding movements in a direction transverse to the direction of feed and movements parallel with the direction of feed, the combination of connections from said shaft for operating said feed dog and said needle and for imparting loop seizing and shedding movements to said looper, said connections for operating said feed dog being adjustable to vary the extent of movement of the feed dog, eccentric means carried by said shaft separate from the connections from said shaft for operating the feed dog, and means for shifting said looper in a direction parallel with the direction of feed controlled in part by said connections for operating the feed dog and in part by connections from said eccentric means.

4. In a sewing machine having a rotary drive shaft, work feeding mechanism comprising a feed dog arranged to feed the work step-by-step in a predetermined direction, a needle arranged for reciprocation through the work and for movement in the direction of feed while engaged with the work to assist the feeding action of the feed dog, and a looper mounted for loop seizing and shedding movements in a direction transverse to the direction of feed and movements parallel with the direction of feed, the combination of connections from said shaft for operating said feed dog and said needle and for imparting loop seizing and shedding movements to said looper, eccentric means carried by said shaft separate from the connections from said shaft for operating the feed dog, and means for shifting said looper in a direction parallel with the direction of feed controlled in part by said connections for operating the feed dog and in part by connections from said eccentric means, said looper shifting means comprising a lever having floating pivots at each end thereof and at a point intermediate its ends, one of said pivots being connected with said connections for operating the feed dog, another being connected with said connections from said eccentric, and the third being connected with said looper shifting means.

5. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a feed dog in said base, connections from said shaft for operating said feed dog to feed work supported by said base, a needle bar mounted for reciprocation and for lateral movements in said

head, said bar carrying a needle at its lower end for movement through the work upon reciprocation of said bar and for movement with the work in the direction of feed upon said lateral movements of said bar, a looper mounted for loop seizing and shedding movements transverse to the line of feed and for rocking movements in the direction of feed, eccentric means on said shaft for imparting loop seizing and shedding movements to said looper, eccentric means on said shaft separate from the connections from said shaft for operating the feed dog for imparting rocking movements to said looper, and means controlled by said connections for operating said feed dog for modifying the rocking movements imparted to said looper by said last mentioned eccentric means, said means controlled by said connections for operating said feed dog serving to rock said looper to an extent equal to the feed movement of said feed dog.

6. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a feed dog in said base, connections from said shaft for operating said feed dog to feed work supported by said base, a needle bar mounted for reciprocation and for lateral movements in said head, said bar carrying a needle at its lower end for movement through the work upon reciprocation of said bar and for movement with the work in the direction of feed upon said lateral movements of said bar, a looper mounted for loop seizing and shedding movements transverse to the line of feed and for rocking movements in the direction of feed, eccentric means on said shaft for imparting loop seizing and shedding movements to said looper, eccentric means on said shaft separate from the connections from said shaft for operating the feed dog for imparting rocking movements to said looper, and means controlled by said connections for operating said feed dog for modifying the rocking movements imparted to said looper by said last mentioned eccentric means, said means controlled by said connections for operating said feed dog serving to rock said looper to an extent equal to the feed movement of said feed dog, and said eccentric means for imparting rocking movements to said looper serving to provide needle avoid movements of said looper.

7. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a feed dog in said base, connections from said shaft for operating said feed dog to feed work supported by said base, a needle bar mounted for reciprocation and for lateral movements in said head, said bar carrying a plurality of needles at its lower end for movement through the work upon reciprocation of said bar and for movement with the work in the direction of feed upon said lateral movements of said bar, a plurality of loopers mounted for loop seizing and shedding movements transverse to the line of feed and for rocking movements in the direction of feed, eccentric means on said shaft for imparting loop seizing and shedding movements to said loopers, eccentric means on said shaft separate from the connections from said shaft for operating the feed dog for imparting rocking movements to said loopers, and means controlled by said connections for operating said feed dog for modifying the rocking movements imparted to said loopers by said last mentioned eccentric means.

8. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a feed dog in said base, connections from said shaft for operating said feed dog to feed work supported by said base, a needle bar mounted for reciprocation and for lateral movements in said head, said bar carrying a needle at its lower end for movement through the work



upon reciprocation of said bar and for movement with the work in the direction of feed upon said lateral movements of said bar, a looper mounted for loop seizing and shedding movements transverse to the line of feed and for rocking movements in the direction of feed, eccentric means on said shaft for imparting loop seizing and shedding movements to said looper, eccentric means on said shaft separate from the connections from said shaft for operating the feed dog for imparting rocking movements to said looper, a pitman having a strap cooperating with said last mentioned eccentric means, a lever pivotally connected with said pitman, connections from said lever to said looper for rocking said looper to impart needle avoid movements thereto, and connections to said lever from said connections for operating said feed dog for rocking said looper in coordination with the movements of said feed dog in the direction of feed.

9. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a feed dog in said base, connections from said shaft for operating said feed dog to feed work supported by said base, a needle bar mounted for reciprocation and for lateral movements in said head, said bar carrying a needle at its lower end for movement through the work upon reciprocation of said bar and for movement with the work in the direction of feed upon said lateral movements of said bar, a looper mounted for loop seizing and shedding movements transverse to the line of feed and for rocking movements in the direction of feed, eccentric means on said shaft for imparting loop seizing and shedding movements to said looper, eccentric means on said shaft separate from the connections from said shaft for operating the feed dog for imparting rocking movements to said looper, a pitman having a strap cooperating with said last mentioned eccentric means, a lever having substantially its mid-point pivotally connected with said pitman, connections from one end of said lever to said looper for rocking said looper, and connections from the other end of said lever to said connections for operating said feed dog arranged to rock said lever in coordination with the movements of said feed dog in the direction of feed.

10. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a four motion feed dog in said base, connections from said shaft for operating said feed dog to advance work supported by said base along a predetermined line of feed, said connections including a feed rocker pivotally mounted in said base, a needle bar mounted for reciprocation and for lateral movements in said head, a needle carried by said needle bar for movement through the work upon reciprocation of said bar and for movement with the work along the line of feed upon said lateral movements of the bar, a looper rock shaft in said base extending transversely of the line of feed, a looper carrier mounted on said rock shaft for pivotal movements in a direction parallel therewith and for swinging movements in the direction of feed upon rocking of said shaft, a looper carried by said looper carrier arranged to cooperate with said needles in stitch formation, connections from said rotary drive shaft for imparting pivotal movements to said carrier to seize and shed needle thread loops, eccentric means on said drive shaft separate from the connections from said shaft for operating the feed dog, a member connected with said rock shaft for rocking the same, and connections from said feed rocker and from said eccentric means for imparting compound movements to said member.

11. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a four motion feed dog in said base, connections from said shaft for operating said feed dog to ad-

vance work supported by said base along a predetermined line of feed, said connections including a feed rocker pivotally mounted in said base, a needle bar mounted for reciprocation and for lateral movements in said head, a needle carried by said needle bar for movement through the work upon reciprocation of said bar and for movement with the work along the line of feed upon said lateral movements of the bar, a looper rock shaft in said base extending transversely of the line of feed, a looper carrier mounted on said rock shaft for pivotal movements in a direction parallel therewith and for swinging movements in the direction of feed upon rocking of said shaft, a looper carried by said looper carrier arranged to cooperate with said needles in stitch formation, connections from said rotary drive shaft for imparting pivotal movements to said carrier to seize and shed needle thread loops, eccentric means on said drive shaft separate from the connections from said shaft for operating the feed dog, a lever having three floating pivots, one adjacent each end and the third intermediate the ends of said lever, a pitman cooperating with said eccentric means and connected with one of said pivots for shifting the latter, connections from said feed rocker for shifting another of said pivots, and connections from still another of said pivots to said rock shaft for rocking the latter.

12. In a sewing machine having a frame with a work supporting base, a vertical standard and an overhanging arm terminating in a needle head, a rotary drive shaft in said frame, a four motion feed dog in said base, connections from said shaft for operating said feed dog to advance work supported by said base along a predetermined line of feed, said connections including a feed rocker pivotally mounted in said base, a needle bar mounted for reciprocation and for lateral movements in said head, a needle carried by said needle bar for movement through the work upon reciprocation of said bar and for movement with the work along the line of feed upon said lateral movements of the bar, a looper rock shaft in said base extending transversely of the line of feed, a looper carrier mounted on said rock shaft for pivotal movements in a direction parallel therewith and for swinging movements in the direction of feed upon rocking of said shaft, a looper carried by said looper carrier arranged to cooperate with said needle in stitch formation, connections from said rotary drive shaft for imparting pivotal movements to said carrier to seize and shed needle thread loops, eccentric means on said drive shaft separate from the connections from said shaft for operating the feed dog, a lever having three floating pivots, one adjacent each end and the third intermediate the ends of said lever, a pitman cooperating with said eccentric means and connected with said intermediate pivot for shifting the latter, connections from said feed rocker to one of the pivots adjacent the end of said lever for shifting said pivot, and connections from the pivot adjacent the other end of the lever to said rock shaft for rocking the latter.

13. In a sewing machine having a rotary drive shaft, a feed dog for advancing work in a predetermined direction, a needle bar carrying a needle arranged for reciprocation through the work and for lateral movement in the direction of feed while engaged with the work, and connections from said shaft for operating said feed dog and reciprocating and imparting said lateral movements to said needle bar, the combination of a rock shaft in said base extending in a direction transverse to the direction of feed, a member secured to said shaft and arranged to rock therewith, a looper carrier mounted on said member for pivotal movement about an axis parallel with the direction of feed, a looper mounted on said carrier for cooperation with said needle, connections from said drive shaft for swinging said carrier about its pivot to impart loop seizing and shedding movements to said looper, an operating member connected with said rock shaft for rocking the same, means operated by said connections for



operating said feed dog for shifting said operating member and thereby rocking said rock shaft in accordance with the movement of said feed dog in the direction of feed, and connections from said drive shaft to said operating member for modifying the rocking movement imparted thereby to said rock shaft to impart a needle avoid movement to the looper.

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