

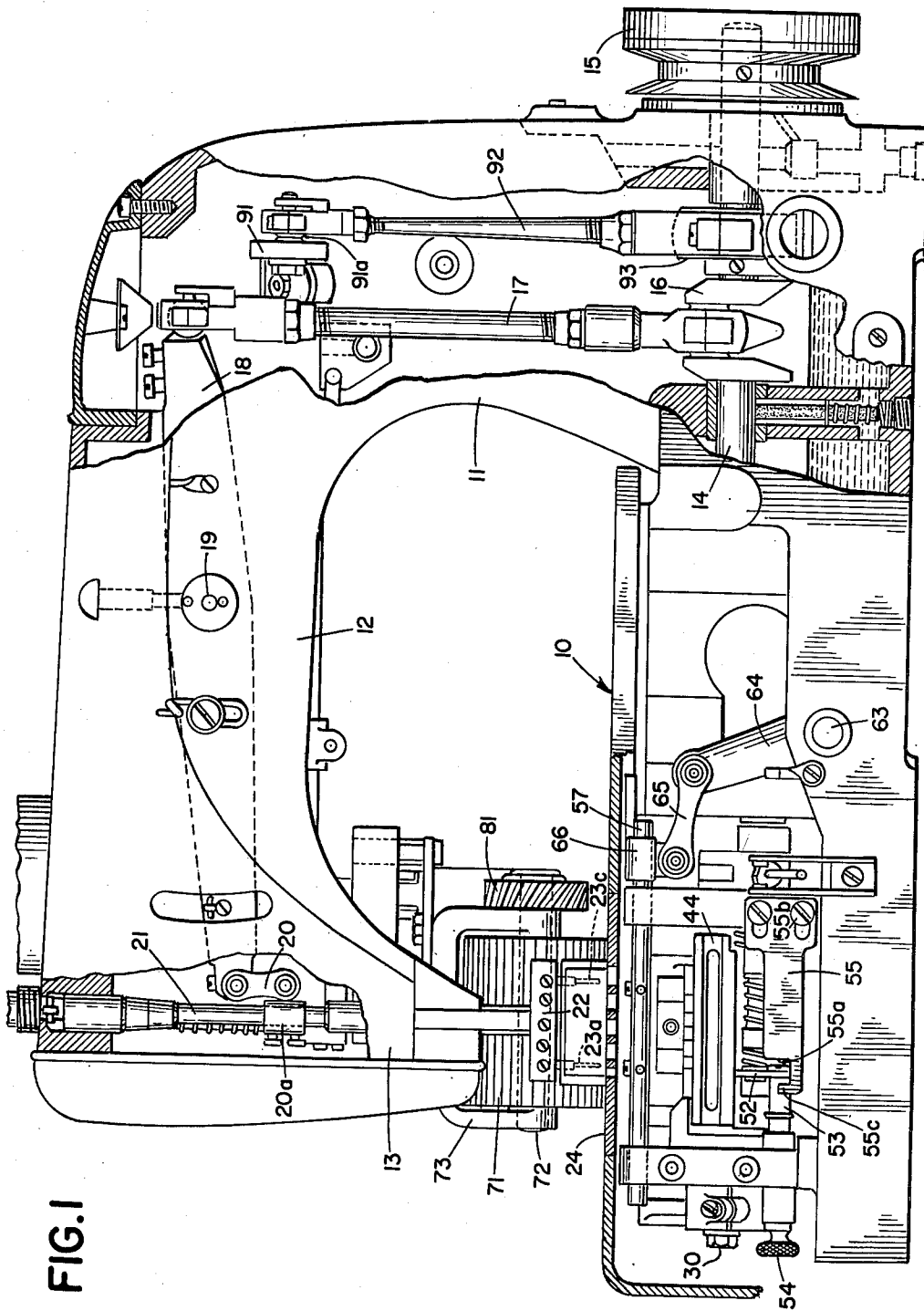
Nov. 27, 1962

G. M. REIMER
SEWING MACHINES

3,065,717

Filed Feb. 7, 1958

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Nov. 27, 1962

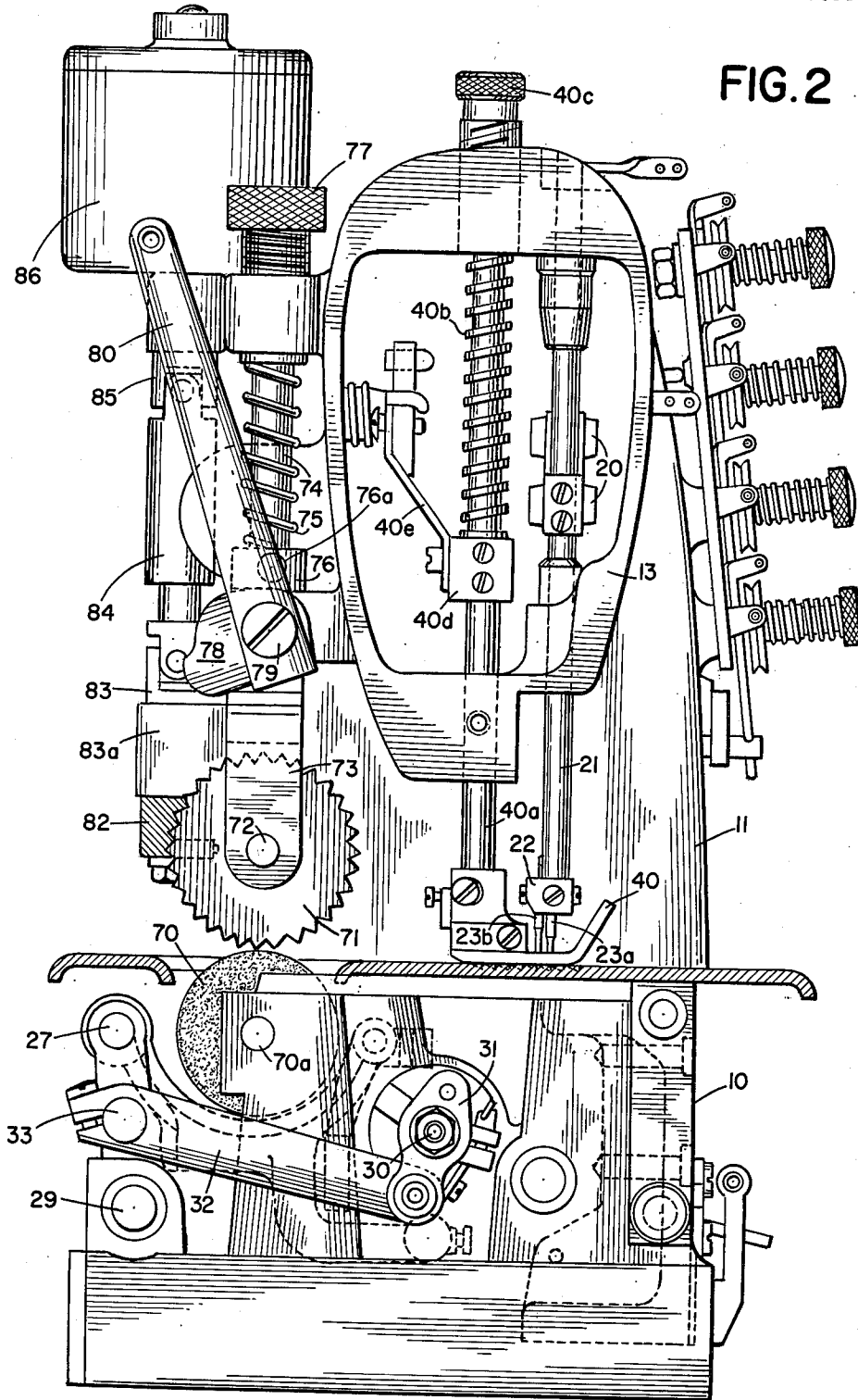
G. M. REIMER
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3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 2

FIG. 2



Nov. 27, 1962

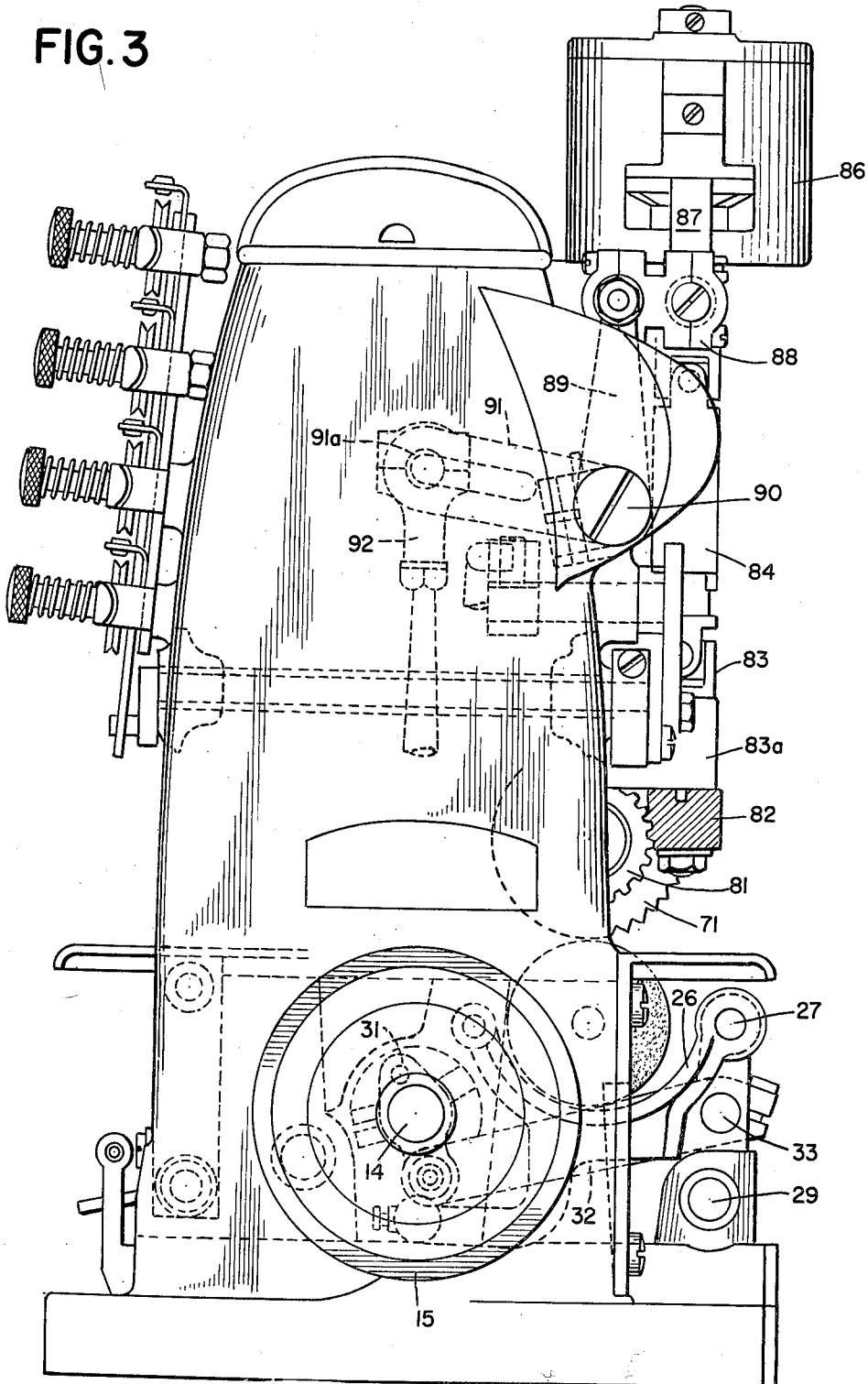
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3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 3

FIG. 3



Nov. 27, 1962

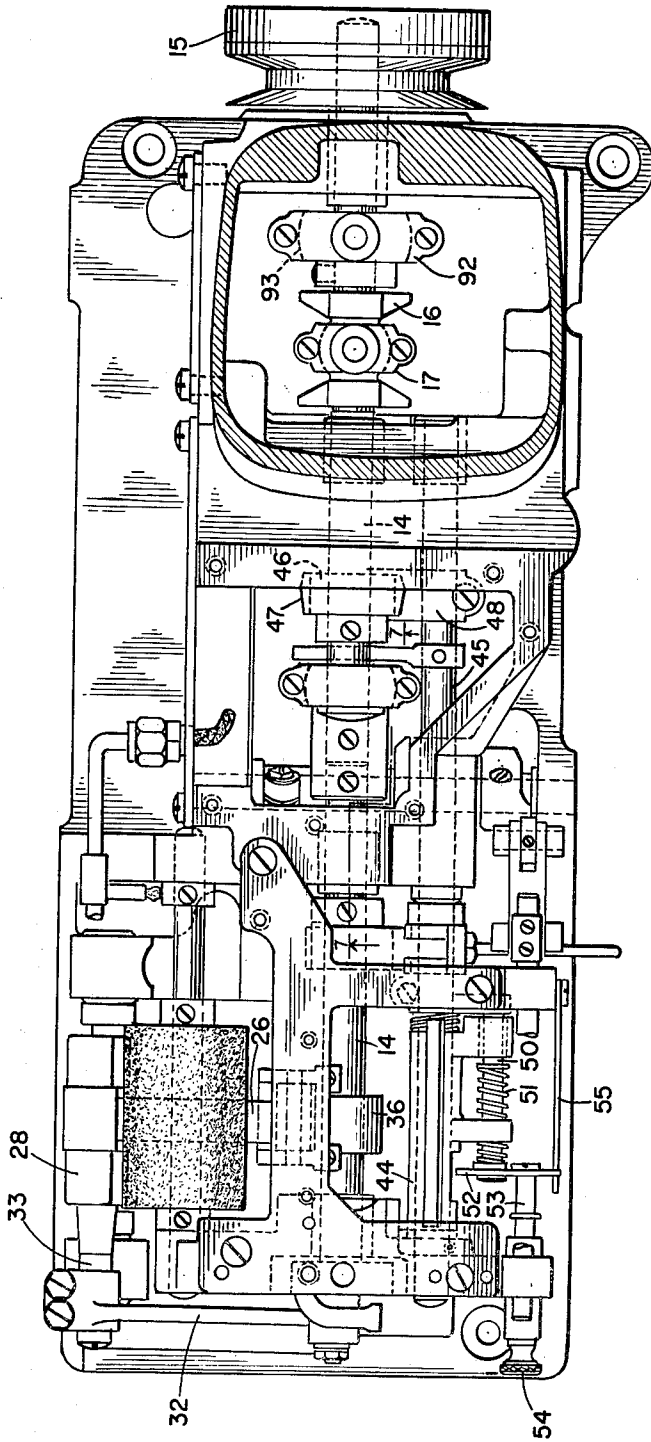
G. M. REIMER
SEWING MACHINES

3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 4

FIG. 4



Nov. 27, 1962

G. M. REIMER
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3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 5

FIG. 5

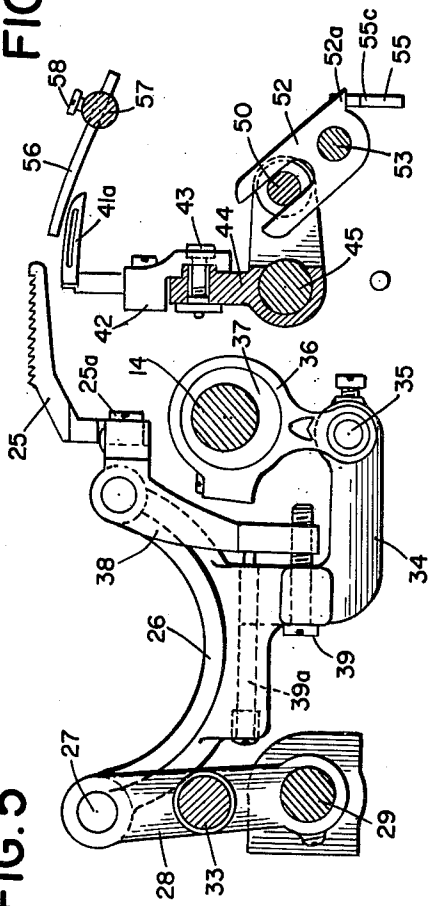


FIG. 7

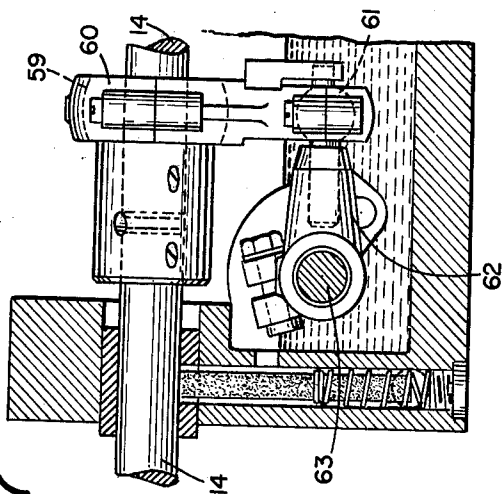


FIG. 8

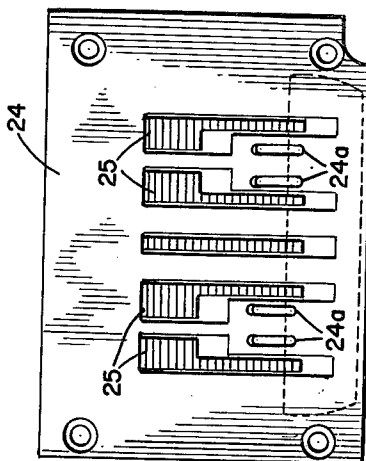
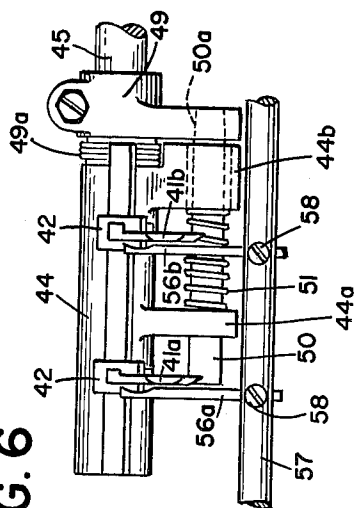


FIG. 6



Nov. 27, 1962

G. M. REIMER
SEWING MACHINES

3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 6

FIG. 11

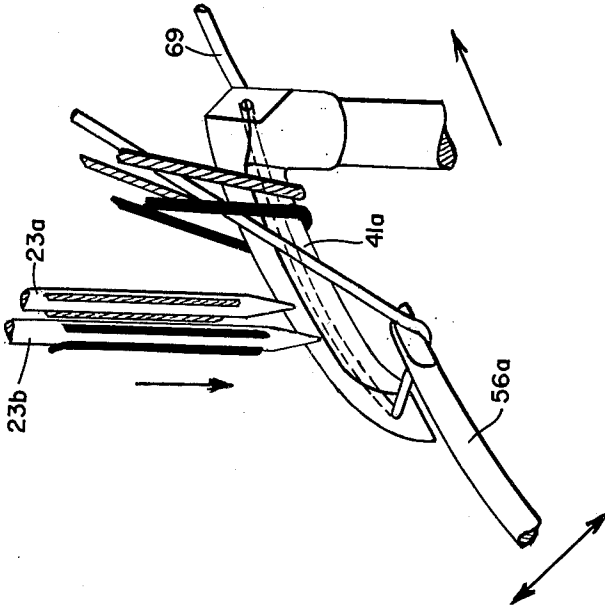


FIG. 10

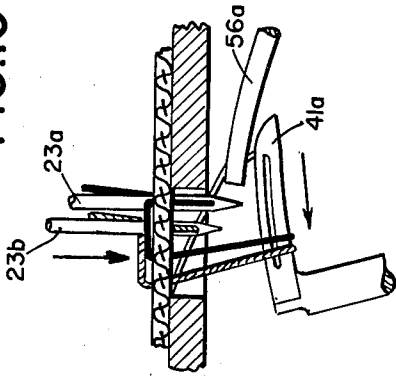


FIG. 9

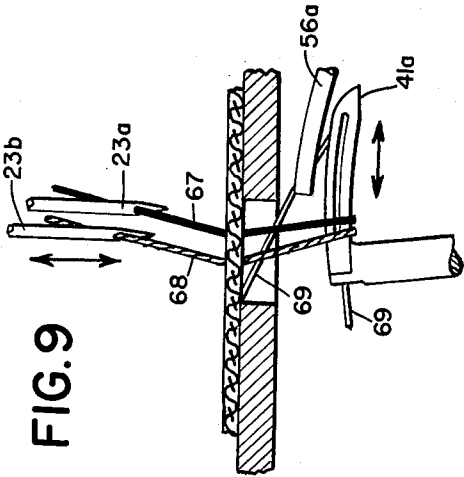


FIG. 12

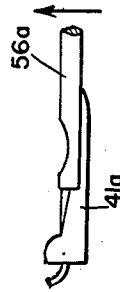
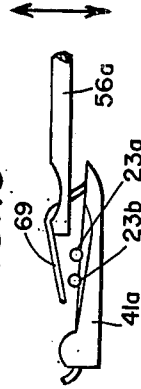


FIG. 13



Nov. 27, 1962

G. M. REIMER
SEWING MACHINES

3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 7

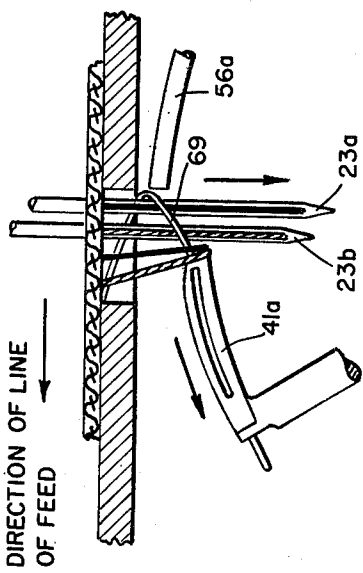


FIG. 14

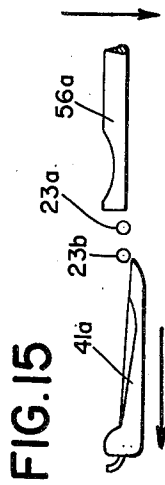


FIG. 15

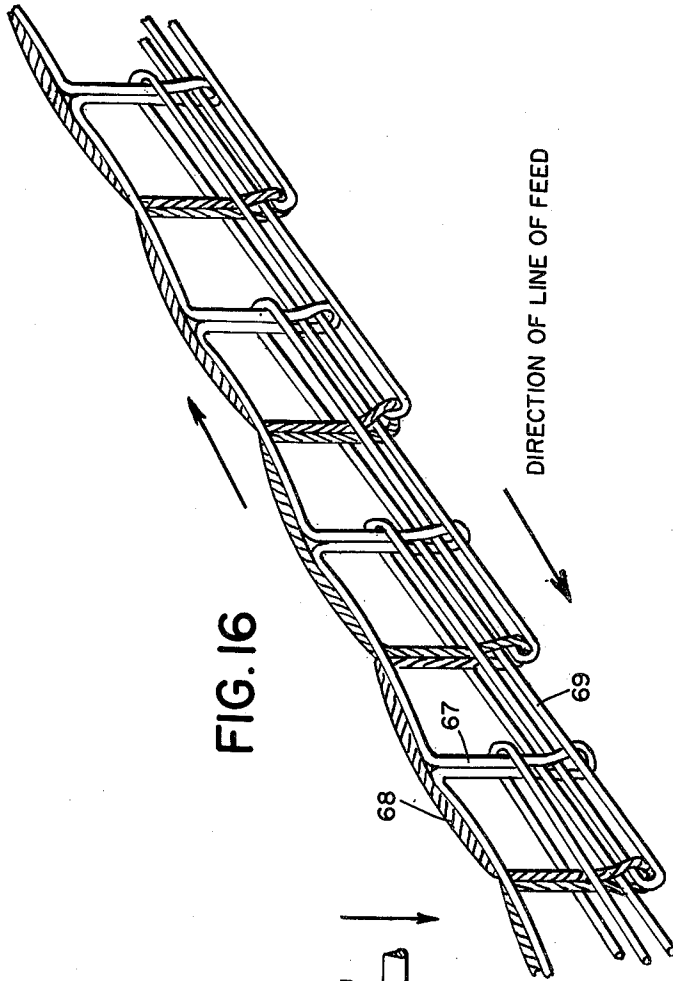


FIG. 16

Nov. 27, 1962

G. M. REIMER
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3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 8

FIG. 18

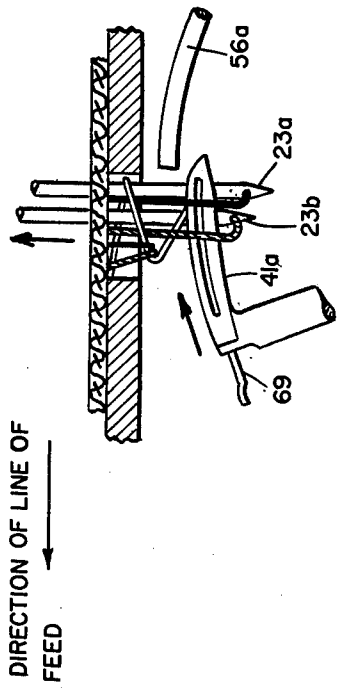


FIG. 17

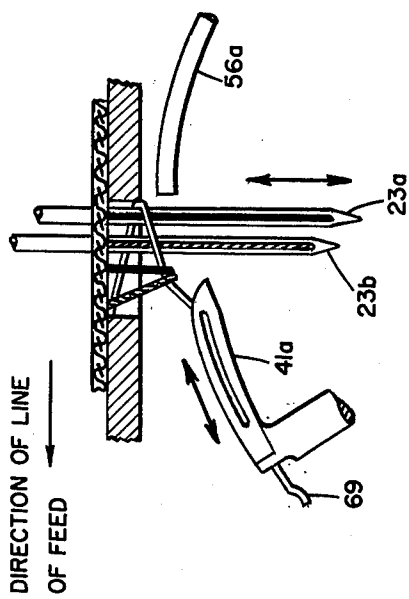


FIG. 20

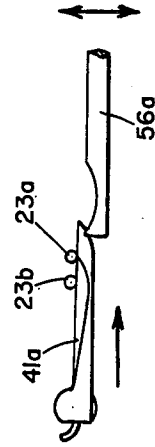
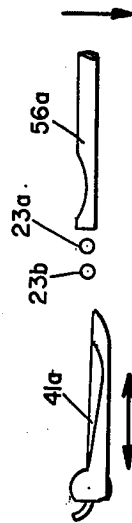


FIG. 19



Nov. 27, 1962

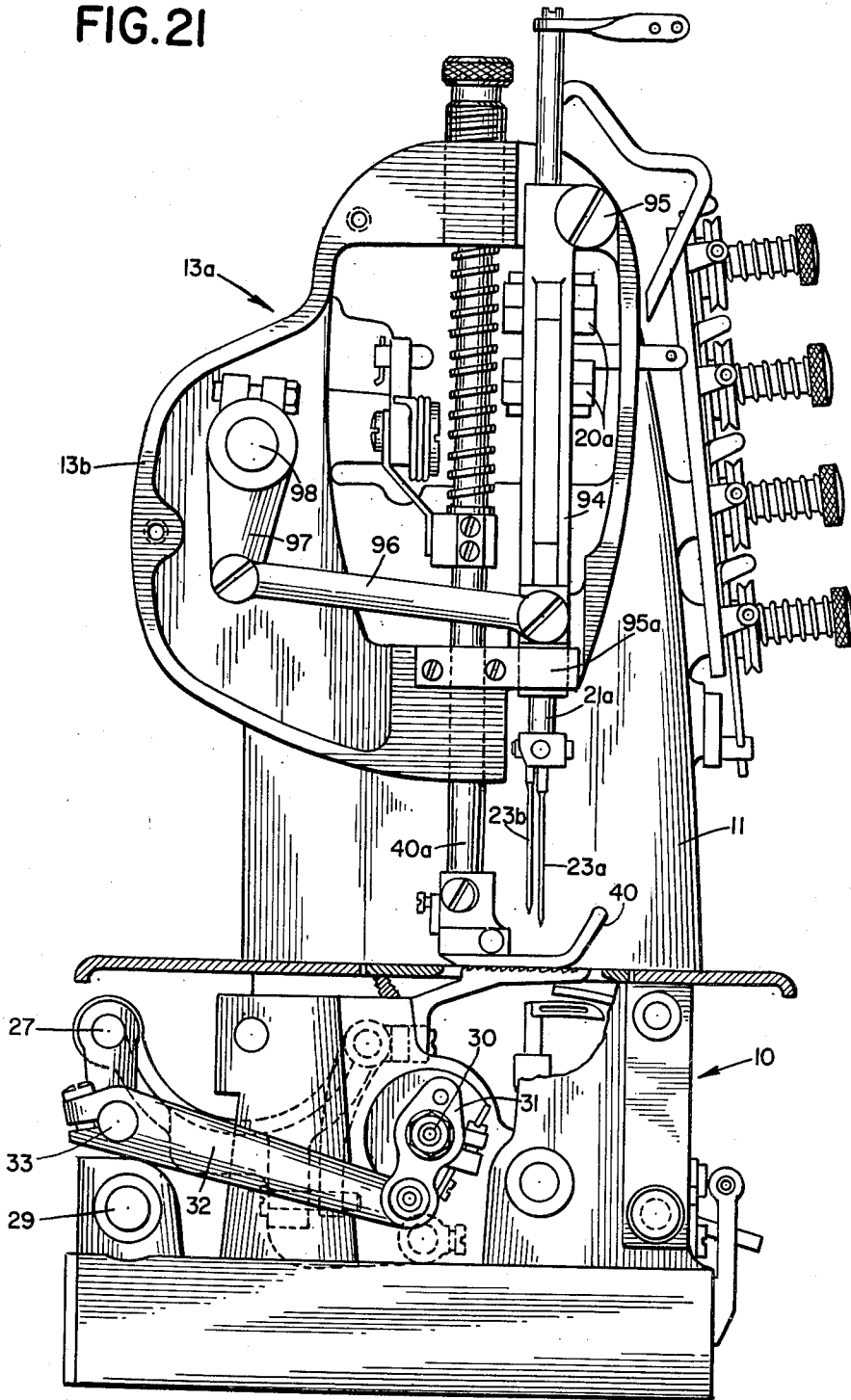
G. M. REIMER
SEWING MACHINES

3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 9

FIG. 21



Nov. 27, 1962

G. M. REIMER
SEWING MACHINES

3,065,717

Filed Feb. 7, 1958

10 Sheets-Sheet 10

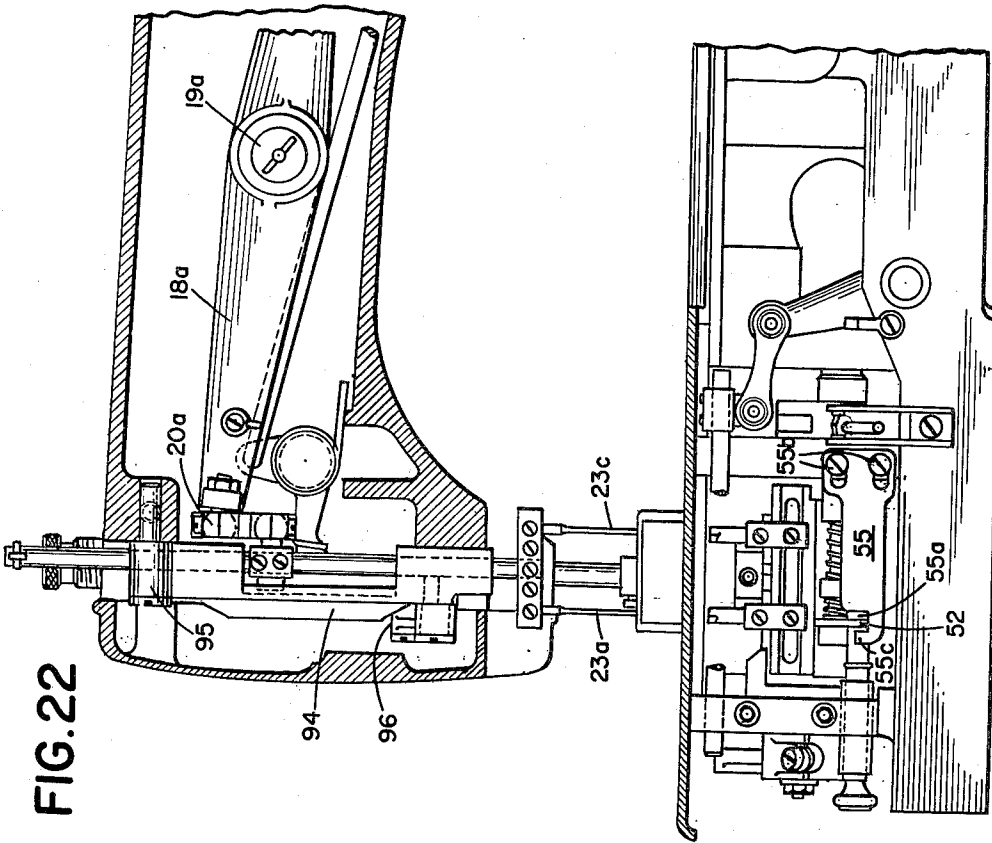


FIG. 22

FIG. 23

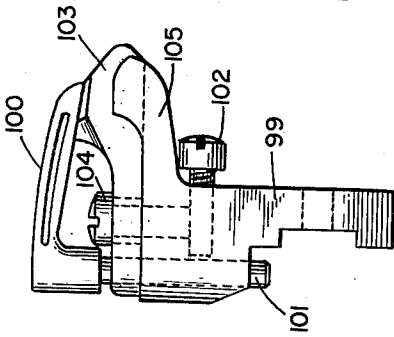


FIG. 24

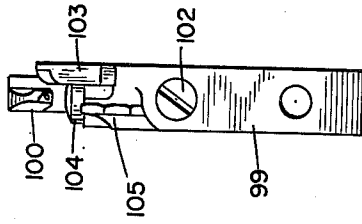
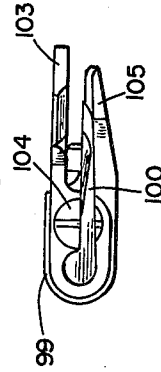


FIG. 25



1

3,065,717

SEWING MACHINES

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

Filed Feb. 7, 1958, Ser. No. 713,896
8 Claims. (Cl. 112-165)

This invention relates to a sewing machine adapted for the high speed formation of a strong seam in garments and the like subject to hard usage. It is particularly useful in the seaming of work in which relatively heavy or stiff materials are to be united with a strong, closely stitched seam. Typical uses of the machine are in the sewing of bags, in-seaming and out-seaming on trousers, overalls, uniforms, dresses and the like and in waistband operations and other operations requiring multiple lines of stitching.

Machines of the foregoing type adapted to produce a strong seam of the 401 type of the Federal Specifications, or one of equal strength, are capable of operation only at speeds of between 4000 and 45000 r.p.m. This is particularly true in connection with machines equipped with intermittently driven puller rollers as required for the proper feeding of certain types of work. The one-way clutch mechanisms employed in such machines have a maximum speed limitation of the character mentioned. Therefore, in the use of machines of the type indicated, as heretofore constructed, a definite limitation is imposed upon their output in the production of the normally required, relatively short stitch length.

It has been a primary purpose of the present invention to provide a machine of the general character indicated which is capable of producing a seam having a strength and resistance to gapping equal to that provided by a series of 401 type stitches, having substantially the same appearance and same resistance to opening or gapping, and having equivalent stitch length, at double the speed attainable with machines as heretofore constructed.

In achieving the foregoing end a number of important features have been combined in the new machine. For the formation of a single seam two needles arranged for reciprocation by a needle bar are disposed one directly behind the other in the direction of seam formation, the needles having their points or their axes spaced apart a distance equal to one-half the extent of feed of the work upon each cycle of operation of the machine. Cooperating with both needles is a single, two-motion looper arranged for swinging movement in the direction of feed and adapted to seize the loops of needle thread from both needles as the looper swings forwardly, in the direction opposite to that in which the work is fed. A spreader having a two-motion movement across the line of feed is arranged to engage the loop of thread carried by the looper and carry this laterally a suitable distance to form a triangle between this leg of the looper thread loop, the adjacent face of the looper blade, and preceding loops of needle thread which are in the course of being pulled up to the work. The triangle so formed is of adequate size to enable the downward passage of both needles there-through. As a result of this coaction of the needles, looper and spreader there is produced a modified form of 402 type stitch. It will have substantially the same appearance as a regular two-thread chain stitch produced with a stitch length only half that of the actual feed stroke of the machine constructed and operated in accordance with the present invention. Thus a machine operating at 4000 r.p.m. with a feed stroke of .200" will produce what appears to be a single seam equivalent to that provided by a machine having a single needle and a single looper operating at 8000 r.p.m. with a feed stroke of .100".

2

The invention also contemplates the simultaneous production of a plurality of laterally spaced lines of stitching of the character discussed above. Thus, two or more such lines of stitching may be formed simultaneously at a rapid rate for various purposes as in the attachment of waistbands to garments. Moreover, one or more of the laterally spaced lines of stitching may be produced with only one needle so that such line or lines of stitching will be of the 401 type with a stitch length equal to the feed stroke. Thus lines of 401 stitches may be produced simultaneously in any combination with the modified 402 lines of stitches.

Machines constructed in accordance with the invention may also be provided with auxiliary work feeding means, such as a puller roller, to insure the proper advance of multiple layers of work to be stitched together. It has been found, moreover, that the multiple needles, arranged in the manner indicated, may advantageously be advanced in the direction of feed while engaged with the work to impart a needle feed action thereto. This insures proper advance of the work at the rapid rate contemplated and does not interfere with the proper cooperation of the needles with the looper in the formation of the desired stitches. Such needle feed action may be provided in machines adapted to produce a plurality of lines of stitching of the character indicated in spaced, parallel relation. It will be understood that the needle bar in such cases will be provided with a needle clamp adapted to retain a pair of needles in the proper relation for each line of stitching to be formed, and a looper will be provided for cooperation with each of such pairs of needles.

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

FIG. 1 is a view largely in front elevation but partly in vertical section of a machine embodying the invention;

FIG. 2 is a view largely in end elevation, as seen from the left in FIG. 1, with a cover plate removed and a portion of the base shown in section;

FIG. 3 is an end elevational view of the machine as seen from the right in FIG. 1;

FIG. 4 is a plan view of the work supporting base of the machine, with the cloth plate removed, and includes a horizontal section through the vertical standard of the frame;

FIG. 5 is a transverse vertical section through the work supporting base of the machine showing the work feeding and looper mechanisms and certain related parts;

FIG. 6 is a plan view of the looper and spreader mechanism of the machine;

FIG. 7 is a detail view in vertical section taken along the line 7-7 of FIG. 4;

FIG. 8 is a plan view of throat plate, showing the feed dog cooperating therewith, for use in a machine adapted to have four pairs of needles;

FIG. 9 is a vertical sectional view illustrating the relation between the needles, looper and spreader at a point in the cycle of the machine;

FIG. 10 is a similar view at a later point in the cycle of the machine;

FIG. 11 is a perspective view of the parts at substantially the point in their cycle illustrated in FIG. 10;

FIGS. 12 and 13 are plan views of the looper and spreader at the points in a cycle illustrated in FIGS. 9 and 10, respectively;

FIG. 14 is a view similar to FIGS. 9 and 10 but at a later point in the cycle of operation of the machine;

FIG. 15 is a plan view of the looper and spreader at the same point in the cycle as in FIG. 14;

FIG. 16 is a schematic view of the form of a line of stitching produced in accordance with the invention;

FIGS. 17 and 18 are views similar to FIG. 9 but at later stages in a cycle of operation;

FIGS. 19 and 20 are plan views of the looper and spreader corresponding, respectively, with the positions assumed in FIGS. 17 and 18;

FIG. 21 is a view similar to FIG. 2 showing a modified construction in which a needle feed action is embodied in the machine;

FIG. 22 is a longitudinal vertical section through the left hand portion of the work supporting base and a corresponding portion of the overhanging arm and needle head of the modified machine;

FIG. 23 is a side elevational view of a looper with a needle guard and a needle deflector assembled therewith;

FIG. 24 is a front elevational view of the parts shown in FIG. 23; and

FIG. 25 is a plan view of the parts shown in FIG. 23.

The basic machine to which the present invention has been applied is of the character disclosed in the Hayes et al. Patent No. 2,688,293, granted September 7, 1954. Reference may be had to said patent for certain details of the construction which may not be fully illustrated and described herein.

Referring now to the drawings, the machine has a frame comprising a work supporting base 10, a vertical standard 11 and an overhanging arm 12 terminating in a needle head 13. Extending longitudinally of the work supporting base is a main rotary drive shaft 14 which projects outwardly at the right end of the base (FIG. 1) and has secured thereto a combined hand-wheel and pulley 15 through which power may be supplied to the machine from an electric transmitter or the like. Within the portion of the base beneath the vertical standard the shaft 14 has a crank 16 provided with an eccentrically located spherical formation cooperating with a strap at the lower end of a pitman 17. At its upper end this pitman carries a strap cooperating with a ball pin projecting outwardly from a needle lever 18. The latter is mounted for rocking movement about a pivot 19 extending transversely of the overhanging arm. At its opposite end the lever 18 is connected by a link 20 with a clamp 20a secured to a needle bar 21 mounted for vertical reciprocation in suitable bearing sleeves carried by the needle head. To the lower end of the needle bar there is secured a clamp 22 adapted to carry a plurality of thread carrying needles. In FIGS. 1 and 2, and related views, the illustrative machine is provided with four such needles two of which are indicated at 23a and 23c in FIG. 1. Another needle 23b is shown in FIG. 2 this being directly in rear of needle 23a along the line of feed. A similar needle is provided directly in rear of needle 23c in the direction of feed. Upon each revolution of the drive shaft 14 the needle bar will be reciprocated to carry the thread carrying pointed ends of the needles from a position above the work support to a position beneath the latter. They are passed through suitable openings 24a in a throat plate 24, which may be of the character shown in FIG. 8, into cooperation with loopers to be described. The elongated openings 24a are each adapted to receive a pair of needles one behind the other in the direction of feed. In the embodiment of the invention under discussion only two of these openings are being utilized. As shown in the drawings, the forward needles 23a and 23c have their pointed ends at a somewhat lower elevation than those of the needles behind them so that they approach the loopers slightly earlier than the rearward needles.

The spacing of the needles of each pair, such as 23a and 23b, is one-half of the distance through which the work is advanced upon each revolution of the drive

shaft 14, by the means to be described. Thus in a machine having a feed stroke of .20 inch the needles will have their axes spaced apart .10 inch. Therefore, the pair of aligned needles will pass needle threads through the work at points directly aligned in the direction of feed at intervals of .10 inch throughout the length of a seam. The feed travel may be varied to suit the requirements of the work to be performed and the spacing of each pair of needles will be varied accordingly to equal one-half the feed travel. Different clamps 22 may be provided for attachment to the needle bar in order to obtain the desired needle spacing. In the example given, the machine will provide a seam which is comparable to a 401 line of stitching having ten stitches to the inch with a feed stroke of $\frac{1}{2}$ of an inch. If the feed stroke is changed to $\frac{1}{4}$ of an inch the needle spacing will be $\frac{1}{4}$ of an inch and the seam produced will be comparable to a 401 line of stitching having 14 stitches per inch.

For advancing the work in relation to the stitch forming devices and in the region thereof, there is provided a four-motion feed mechanism best shown in FIGS. 2, 3 and 5. It comprises a feed dog 25, preferably having a plurality of segments as shown in FIG. 8, and having a shank mounted on an arcuately formed feed bar 26. At its rearward end the feed bar is pivotally mounted by means of a shaft 27 on the upper end of a feed rocker 28 secured at its lower end to a shaft 29 suitably journaled in bearings carried by the work supporting base of the frame. Rocking movements are imparted to the feed rocker 28 by means of an adjustable eccentric or crank element 30 provided adjacent the left end (FIG. 1) of the shaft 14. Adjustment of the eccentricity of the crank element 30 serves to vary the feed stroke. A pitman 31 cooperating with the crank element has its lower end pivotally connected with an arm 32 the opposite end of which is clamped upon a trunnion 33 extending laterally from the feed rocker 28. It will be apparent that as a result of this connection the feed rocker will be swung back and forth about the axis of the shaft 29 to an extent dependent upon the adjustment of eccentricity of the crank element 30. In the illustrative example given above the effective feed stroke imparted to the feed dog would be $\frac{1}{2}$ of an inch.

Lifting and lowering movements are imparted to the feed dog through a downwardly and forwardly extending arm 34 of the feed bar 26. A pin 35 fixedly mounted in the forward end of the arm 34 is pivotally connected with a pitman 36 having a strap surrounding an eccentric 37 secured to the drive shaft 14. Provision is also made for varying the height of the feed dog 25 and its angular relation to the throat plate through which it passes. For this purpose the feed dog is mounted for slight vertical adjustment on the outer end of a horizontally extending arm of a bell crank 38 pivotally connected with the forward end of the feed bar 26. A screw 25a serves to retain the feed dog at the desired elevation within the forward end of the arm indicated. A downwardly extending arm of the bell crank 38 cooperates with a screw 39 the head of which limits the extent of counterclockwise movement of the bell crank (FIG. 5). Clockwise movement of the bell crank is limited by a screw 39a. Thus, by proper adjustment of the two screws 39 and 39a, the angular position of the bell crank 38 may be varied as desired. This enables the most effective cooperation of the feed dog with the work to advance the same properly and the elevation of the feed dog in the bell crank 38 and the eccentricity of the crank element 30 serve to determine the effective feed stroke of the feed dog.

Cooperating with the feed dog in advancing the work is a presser foot 40 (FIG. 2) which serves to hold the work against the throat plate when the feed dog is lowered or retracted and against the feed dog when the lat-

ter is elevated. This presser foot may be of conventional construction and is preferably pivotally mounted upon a shank element secured to a presser bar 40a which is urged downwardly by a spring 40b. Said spring reacts at its upper end against the bottom of an adjustable sleeve which may be turned by knurled head 40c to vary the force of the spring. At its lower end the spring acts against a block 40d secured to the presser bar. Provisions of the usual type, including a lever 40e, are made for lifting the presser bar to carry the presser foot away from the throat plate, under control of a treadle or knee press, to facilitate introduction and removal of work.

The stitch forming devices include a looper 41a (FIG. 5) cooperating with the needles 23a and 23b. If two lines of stitching are to be formed, another looper 41b (FIG. 6) cooperates with the needle 23c and another needle directly in rear of the latter at half the feed stroke distance. Each of the loopers is carried by a clamping member 42 which is adjustably secured by a bolt 43 in the desired location along an elongated opening or slot through a looper carrier 44 for cooperation with its pair of needles. Bolt 43 cooperates with the elongated slot or opening through the looper carrier 44 mounted on a shaft 45 parallel with the main drive shaft 14. It will be understood that as many loopers are provided as pairs of needles arranged to form separate lines of stitching. Shaft 45 is arranged to be rocked by an eccentric 46 on the shaft 14 (FIG. 4) cooperating with a strap 47 at the upper end of a pitman. The lower end of this pitman is pivotally connected with an arm 48 secured to the shaft 45. Adjacent the looper carrier 44 there is secured to the shaft 45 an arm 49 (FIG. 6). Looper carrier 44 is capable of swinging about the shaft 45 but when the machine is in its operative condition the looper carrier is constrained to rock with the shaft 45 through the arm 49. For this purpose a pin 50 is slidably mounted in forwardly extending arms 44a and 44b of the carrier 44 and is urged by a spring 51 toward the right (FIG. 6) to engage the tapered end 50a of the pin with an aligned, tapered opening in the arm 49. Provision is made for disengaging the pin 50 from the arm 49 and thus permit the carrier 44 to be rocked forwardly to carry the loopers into an accessible position for threading and the like. Such forward swinging of the carrier may be effected by a spring 49a whenever the pin 50 is withdrawn from the opening in the arm 49. Such withdrawal of the pin is effected by a forked arm 52 secured to a shaft 53 (FIGS. 4 and 5) having a knurled head 54 by which the shaft 53 may be drawn manually toward the left (FIG. 4). At this time the forked end of arm 52 cooperating with an annular groove in the head of pin 50 serves to draw the latter toward the left to disengage the end 50a of pin 50 from the opening in arm 49. Such movement of the pin 50 and shaft 53 is prevented, however, during the portion of each cycle of operation of the machine in which the needles are cooperating with the loopers. For this purpose the arm 52 has a projection 52a cooperating with a notch 55a in a plate 55 adjustably secured to the front face of the base of the machine by screws 55b (FIG. 1). It is only when the loopers 41a, etc. are rocked forwardly into their extreme loop-seizing position, as shown in FIG. 5, that the projection 52a is lifted above the hook 55c at the left end of plate 55 which would normally prevent the shifting of the shaft 53 any substantial distance toward the left. This occurs only when the needles are retracted to a position above the work.

Cooperating with the loopers and needles in the formation of the desired stitches are a plurality of spreader elements 56, one for each looper and a pair of cooperating needles. These spreader elements are secured in appropriate positions along a slide rod 57 by means of set screws 58 and project laterally from said rod. At an appropriate time in the cycle of operation of the machine the rod 57 is shifted toward the right (FIG.

6) to enable the elements 56 to pick up the loops of looper thread carried by their respective loopers and open these out to permit the related pairs of needles to enter the loops on the next descent of the needle bar. Such movement of the rod 57 is produced by a spherical eccentric 59 (FIG. 7), secured to the shaft 14, cooperating with a spherical seat at the upper end of a pitman 60. The lower end of this pitman cooperates with a ball pin 61 extending outwardly from the outer end of an arm 62 secured to a rock shaft 63. Adjacent the forward end of the rock shaft 63 there is secured thereto an arm 64 (FIG. 1) which is connected by a link 65 with a clamp 66 secured to the rod 57. It will be apparent that upon each revolution of the drive shaft 14 the rod 57 will thus be shifted toward the right to perform the loop opening action mentioned, and it will later in the cycle be restored to its inactive position in preparation for the next loop opening action.

In FIGS. 9-20 inclusive, there is illustrated the mode of cooperation of the needles, looper and spreader in the formation of the desired line of stitching of the character shown in FIG. 16. Referring to FIG. 9, the looper 41a is shown in its extreme right-hand position, actually toward the front of the machine, which it assumes after having seized the loops of needle thread 67 and 68 from their respective needles 23a and 23b. The latter, subsequent to the seizure of their thread loops, have been elevated to a position above the work support and are ready to descend. Before or as they move downwardly the spreader 56a is shifted in the manner explained to engage the loop of looper thread 69 and carry this slightly away from the blade of the looper, thus opening up a triangle or the like for the entry of the needles 23a and 23b with their threads. The triangle thus opened up is formed between the previous needle thread loops still held by the looper, the branch of the looper thread and the face of the looper blade 41a. In FIG. 11 the parts are shown in perspective at substantially the same point in a cycle as is illustrated in FIG. 10. As the needles continue their downward movement the looper 41a is retracted to shed the previous loops of needle thread, as shown in FIG. 14, so that these loops may be drawn up to the underside of the work along with the looper thread loop. Now as the needles have reached their lowermost position, as shown in FIG. 17, the needles are raised again to open up new loops of needle thread and the looper 41a is shifted toward the right to seize these new loops. The relationship of the various elements at the time the new loops are first seized is shown in FIG. 18. As the cycle of operation continues, the needles, looper and spreader will assume the various relationships described above with respect to FIGURES 9 to 15 and the first set of needle thread loops, together with the first looper thread loop, will be drawn up against the underside of the work while the new set of needle thread loops will be temporarily held by the looper and the thread of the latter will again be opened out in the manner shown in FIG. 10 for re-entry by the needles.

To assist in advancing the work through the stitch forming zone and to insure maintenance of the several layers of work in their proper relation at the relatively high speed of advance of the work, auxiliary work feeding means is preferably employed. This may be in the nature of a puller mechanism or it may be in the form of a needle feed action imparted to the needles. When a puller mechanism is provided, this may comprise an idler roller 70 suitably mounted in the work supporting base of the frame and arranged to revolve with or about a shaft 70a (FIG. 2). As shown, the idler roller fits into the concavity of the feed bar 26. Cooperating with the roller 70 is a toothed or serrated feed roller 71 carried by a shaft 72 journaled in forked downward extensions 73 (FIGS. 1 and 2) of a bar 74 (FIG. 2) arranged for up and down movement in suitable bearing sleeves carried by rearwardly extending lugs on the needle head 13.

A spring 75, coacting at its lower end with a collar 76 secured to the rod 74 and at its upper end with the bottom of an adjustable sleeve having a knurled head 77, serves to urge the feed roller 71 downwardly against the work to grip the latter in cooperation with the roller 70. The force with which the spring 75 urges roller 71 downwardly may be varied by turning the knurled head 77 and thus varying the elevation of the lower end of its connected sleeve. Roller 71 may be lifted under manual control to facilitate the introduction and removal of work. For this purpose a cam 78 rockably mounted on a lug extending rearwardly from the needle head 13, by means of a pivot screw or stud 79, is arranged to be turned through a suitable angle by a lever arm 80. This may be grasped directly by the operator to cause the periphery of the cam 78 to engage a pin 76a projecting from the collar 76 and thus lift the rod 74. A slight dwell in the cam 78 serves to retain the parts in such elevated position until the lever arm 80 is restored to the position shown in FIG. 2.

Feed movements are imparted to the roller 71 by means best shown in FIGS. 1 and 2. Such means comprise a spiral gear 81 secured to the shaft 72 which carries the roller 71. Meshing with the spiral gear 81 is a spiral pinion 82 secured to the lower end of a shaft 83 carried by a member 83a which partakes of the up and down movements of the roller 71. Shaft 83 is connected by an extensible coupling 84 with a shaft 85 extending downwardly from a one-way clutch unit 86. This may be of any well known construction and may have an arm 87 (FIG. 3) arranged to be oscillated back and forth about the axis of unit 86 and to impart turning movements to a driven element of the clutch which is secured to the shaft 85. Arm 87 has a ball pin which is received within a spherical strap of a short link 88 the opposite end of which has a spherical strap cooperating with a ball pin projecting laterally from an arm 89 (FIG. 3). The latter is secured to a rock shaft 90 which, adjacent its opposite end, near the top of the vertical standard, carries an arm 91 having an elongated slot or opening therein. Within this slot is adjustably secured a bolt 91a carrying a ball pin cooperating with a strap at the upper end of a pitman 92, the lower end of which has a strap cooperating with a spherical eccentric 93 carried by the main drive shaft 14. The arrangement is such that upon each revolution of the shaft 14 the arm 87 will be shifted back and forth to an extent determined by the location of the bolt 91a along the slot or opening in the arm 91. Corresponding movements will be imparted to the feed roller 71 in one direction, i.e., clockwise in FIG. 2.

In FIGS. 21 and 22 there is shown a modified construction in which the desired rapid and proper advance of the work in relation to the stitch forming devices is insured by a needle feed action provided in substantially the same manner as disclosed in the patent to Peterson et al. No. 2,577,430, granted December 4, 1951. For this purpose the needle bar designated 21a in lieu of being supported for reciprocation in fixed bearing sleeves carried by the needle head, is mounted for reciprocation in a rock frame 94 pivotally mounted on the needle head by means of a screw stud 95. Adjacent its lower end the frame 94 has pivotally connected therewith a link 96 the opposite end of which is pivotally connected with an arm 97 secured to a rock shaft 98. The latter corresponds with the shaft 90 of the first embodiment and is rocked by similar connections from the main drive shaft 14. It is somewhat longer than the shaft 90, however, and extends into a rearwardly projecting portion 13b of the needle head 13a. By appropriate adjustment of the bolt or ball pin 91a (FIG. 3) along the slot or opening in the arm 91, the movement imparted to the rock frame 94 in the direction of feed of the work may be so regulated that the needles when engaged with the work will move in the feed direction at the same rate as the feed dog, thus imparting a needle feed action at the appropriate

rate. It will be understood that the needle bar 21a is reciprocated in the frame 94 by connections similar to those employed in the first embodiment. It includes a needle lever 18a pivotally mounted on a transverse shaft 19a in the overhanging arm and arranged to be rocked by connections of the type shown in FIG. 1 from the main shaft 14. Within the needle head the end of the lever 18a carries a ball pin cooperating with a spherical strap in a link 20a the lower end of which cooperates with a ball pin carried by a block secured to the needle bar 21a. A plate 95a (FIG. 21) secured to the needle head cooperates with the lower end of the frame 94 to guide it in its swinging movements. It will be understood that except for the differences described above the machine illustrated in FIGS. 21 and 22 may be of the same construction as the embodiment first described.

In FIGS. 23, 24 and 25 there is shown a looper assembly which may advantageously be employed in connection with either of the above-described embodiments of the invention. This comprises a looper holder 99 arranged to be secured in the manner described to the rock frame 44 in properly adjusted position. A looper 100 having a stem or shank 101 fitting into a vertical opening through a portion of the holder 99 is retained in desired position with the looper blade extending in the direction of feed by means of a set screw 102. A needle guard 103 is mounted on the top of the holder 99. It has an opening arranged to receive the stem 101 of the looper about which the needle guard may be angularly adjusted to a slight extent. It is locked in set position by means of a screw 104 passing through a slightly enlarged opening in the needle guard. Preferably formed integrally with the holder 99 is a needle deflector 105. The relationship between the looper 100, needle guard 103 and needle deflector 105 is shown in the three views mentioned. It is such as to insure maintenance of the proper relationship between the needles and the looper in the course of stitch formation.

While the invention has been described in considerable detail in relation to several embodiments thereof, it will be understood that various changes may be made in the construction of the machine without departing from the general principles and scope of the invention. As has been indicated, a machine constructed in accordance with the invention may be adapted to form either a single line of stitching of the character shown in FIG. 16, or 2, 3, 4 or more such lines of stitching. For each line of stitching to be formed there will be provided a pair of needles, one directly behind the other, in the line of feed with a spacing between the needles of one-half of the extent of feed imparted to the work during each cycle of the machine.

What is claimed is:

1. In a sewing machine having a frame comprising a work supporting base and an overhanging arm terminating in a needle head, a power receiving rotary drive shaft, work feeding means in said base arranged to advance work to be stitched a predetermined feed distance upon each revolution of said shaft, and a needle bar mounted for reciprocatory movement in said needle head, the combination of means for producing a two-needle-thread chainstitch which comprises a pair of thread-carrying needles carried by said needle bar for reciprocation therewith, one needle being disposed directly behind the other in the direction of feed, said needles having their longitudinal axes spaced apart to the extent of one-half said feed distance, a thread-carrying looper mounted for only a two-motion swinging movement in a vertical plane parallel with the direction of feed and arranged to seize loops of thread from both of said needles on the same side thereof, a spreader mounted for movement in a direction perpendicular to said plane and arranged to engage and open out a loop of thread carried by said looper for passage therethrough of both of said needles, and driving connections from said shaft to said needle

bar, looper and spreader for imparting said respective movements thereto in coordinated relation.

2. In a sewing machine of the character set forth in claim 1, said needle bar being mounted in a frame carried by said needle head and arranged to swing in the direction of advance of the work, and connections from said shaft for swinging said frame in the direction of feed while said needles are engaged with the work to impart a feeding movement to the work substantially the same as that imparted by said work feeding means.

3. In a sewing machine of the character set forth in claim 2, said looper having a forwardly extending blade which seizes the loops of needle thread as the looper is swung in a direction opposite to the direction of advance of the work.

4. In a sewing machine having a frame comprising a work supporting base and an overhanging arm terminating in a needle head, a power receiving rotary drive shaft, work feeding means in said base arranged to advance work to be stitched a predetermined feed distance upon each revolution of said shaft, and a needle bar mounted for reciprocatory movement in said needle head, the combination of means for producing a plurality of lines of two-needle-thread chainstitches which comprises a plurality of laterally spaced pairs of thread-carrying needles carried by said needle bar for reciprocation therewith, one needle of each pair being disposed directly behind the other needle of the pair in the direction of feed, said needles of each pair having their longitudinal axes spaced apart to the extent of one-half of said feed distance, a plurality of thread-carrying loopers mounted for only a two-motion swinging movement in vertical planes parallel with the direction of feed, each of said loopers being arranged to seize loops of thread from the same side of both needles of a related one of said pairs of needles, a plurality of spreader elements mounted for movement in a direction perpendicular to said planes, each of said spreader elements being arranged to engage and open out a loop of thread carried by a related one of said loopers for passage therethrough of the related pair of needles, and driving connections from said shaft to said needle bar, loopers and spreader elements for imparting said respective movements thereto in coordinated relation.

5. In a sewing machine of the character set forth in claim 4, said needle bar being mounted in a frame carried by said needle head, means in said head for retaining said frame for swinging movement in the direction of advance of the work, and connections from said shaft for swinging said frame in the direction of feed while said needles are engaged with the work to impart a feeding movement to the work substantially the same as that imparted by said work feeding means.

6. In a sewing machine of the character set forth in claim 5, said loopers having forwardly extending blades each of which seizes the loops of needle thread from its related needles as the looper is swung in a direction opposite to the direction of advance of the work.

7. In a sewing machine having a frame comprising a work supporting base and an overhanging arm terminating in a needle head, a power receiving rotary drive shaft, work feeding means in said base arranged to advance work to be stitched a predetermined feed distance upon each revolution of said shaft, and a needle bar mounted for reciprocatory movement in said needle head, the combination of means for producing a two-needle-

thread chainstitch which comprises a pair of thread-carrying needles carried by said needle bar for reciprocation therewith, one needle being disposed directly behind the other in the direction of feed, said needles having their longitudinal axes spaced apart to the extent of one-half said feed distance, a thread-carrying looper mounted for only a two-motion swinging movement in a vertical plane parallel with the direction of feed and arranged to seize loops of thread from both of said needles on the same side thereof, a spreader mounted for movement in a direction perpendicular to said plane and arranged to engage and open out a loop of thread carried by said looper, and driving connections from said shaft to said needle bar, looper and spreader for imparting said respective movements thereto in coordinated relation, said looper being arranged to seize both needle thread loops as the needles begin their upward movement and hold said loops while said needles are retracted from the work, said spreader then serving to open the loop of looper thread, and said needles being carried downwardly through said loop of looper thread while it is thus opened.

8. In a sewing machine having a frame comprising a work supporting base and an overhanging arm terminating in a needle head, a power receiving rotary drive shaft, work feeding means in said base arranged to advance work to be stitched a predetermined feed distance upon each revolution of said shaft, and a needle bar mounted for reciprocatory movement in said needle head, the combination of means for producing a two-needle-thread chainstitch which comprises a pair of thread-carrying needles carried by said needle bar for reciprocation therewith, one needle being disposed directly behind the other in the direction of feed, said needles having their longitudinal axes spaced apart to the extent of one-half said feed distance, a thread-carrying looper mounted for only a two-motion swinging movement in a vertical plane in the direction of feed and arranged to seize loops of thread from both of said needles on the same side thereof, said needles being then carried to a position above the work, means for then opening out a loop of the thread carried by said looper to form a triangle defined by a branch of said looper thread loop, the looper and loops of needle thread previously seized by the looper, said needles being then passed through said triangle upon the downward movement of the needle bar, and driving connections from said shaft for imparting reciprocatory movements to said needle bar, for swinging said looper and for operating said means for opening out a loop of said looper thread in coordinated relation.

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