

July 9, 1963

R. E JOHNSON

3,096,736

LOCK STITCH SEWING MACHINE WITH BOBBIN REPLENISHING MEANS

Filed March 17, 1961

6 Sheets-Sheet 1

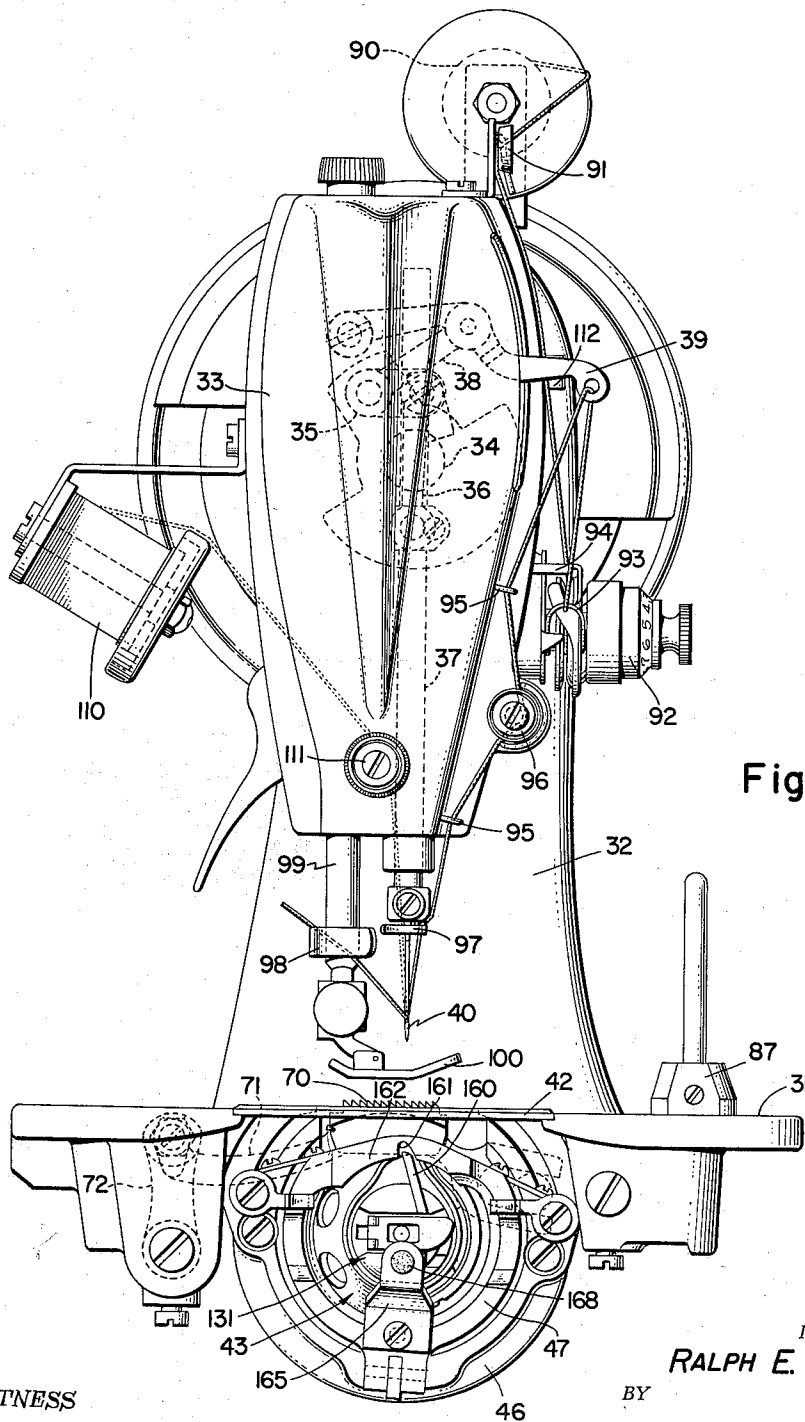


Fig. 1.

WITNESS

Nicholas L. Loefer

BY

Marshall J. Breen
ATTORNEY

INVENTOR
RALPH E. JOHNSON

July 9, 1963

R. E JOHNSON

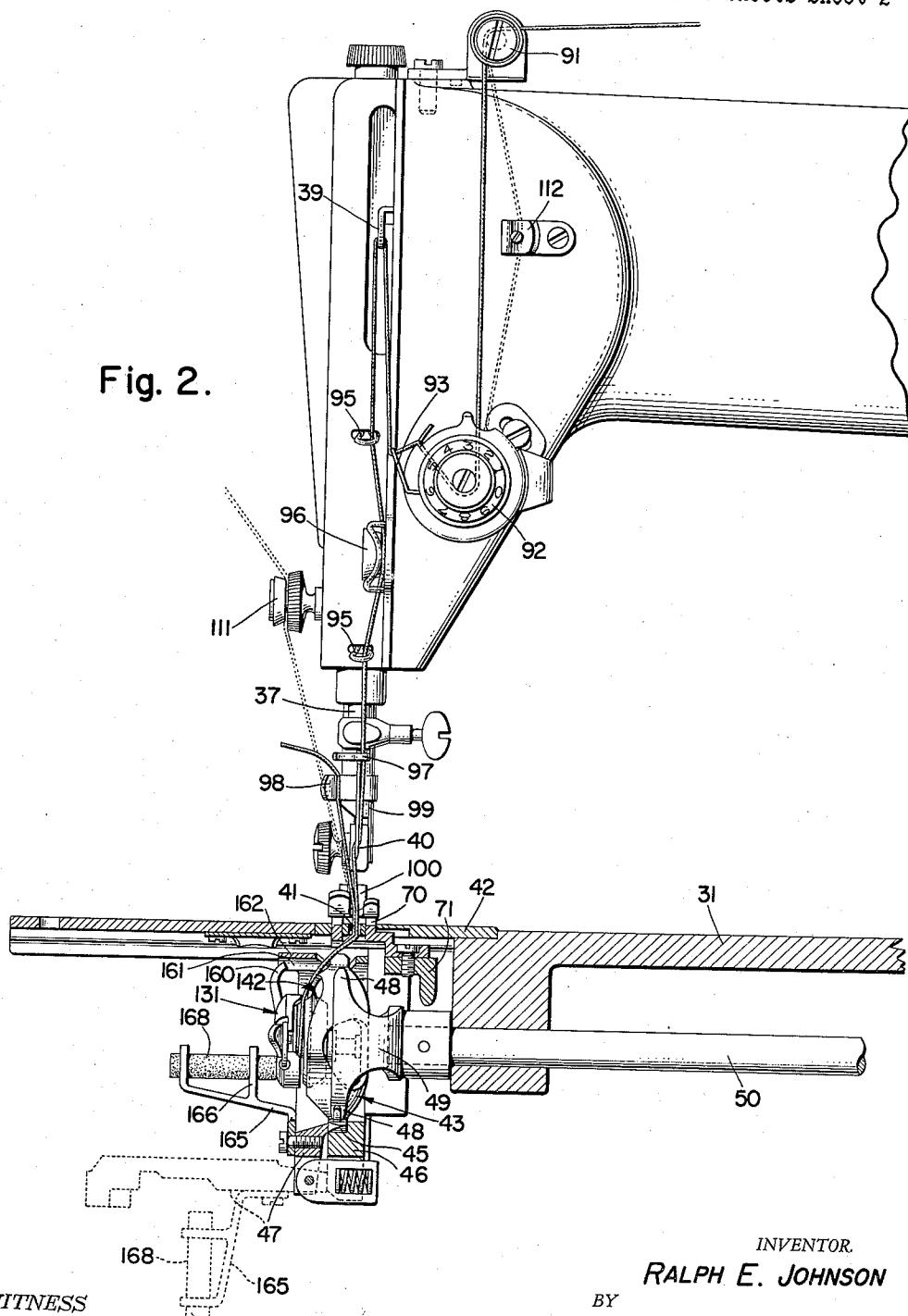
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Fig. 2.



WITNESS

Nicholas Leszczak

INVENTOR.

RALPH E. JOHNSON

BY

Marshall J. Breen
ATTORNEY

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R. E JOHNSON

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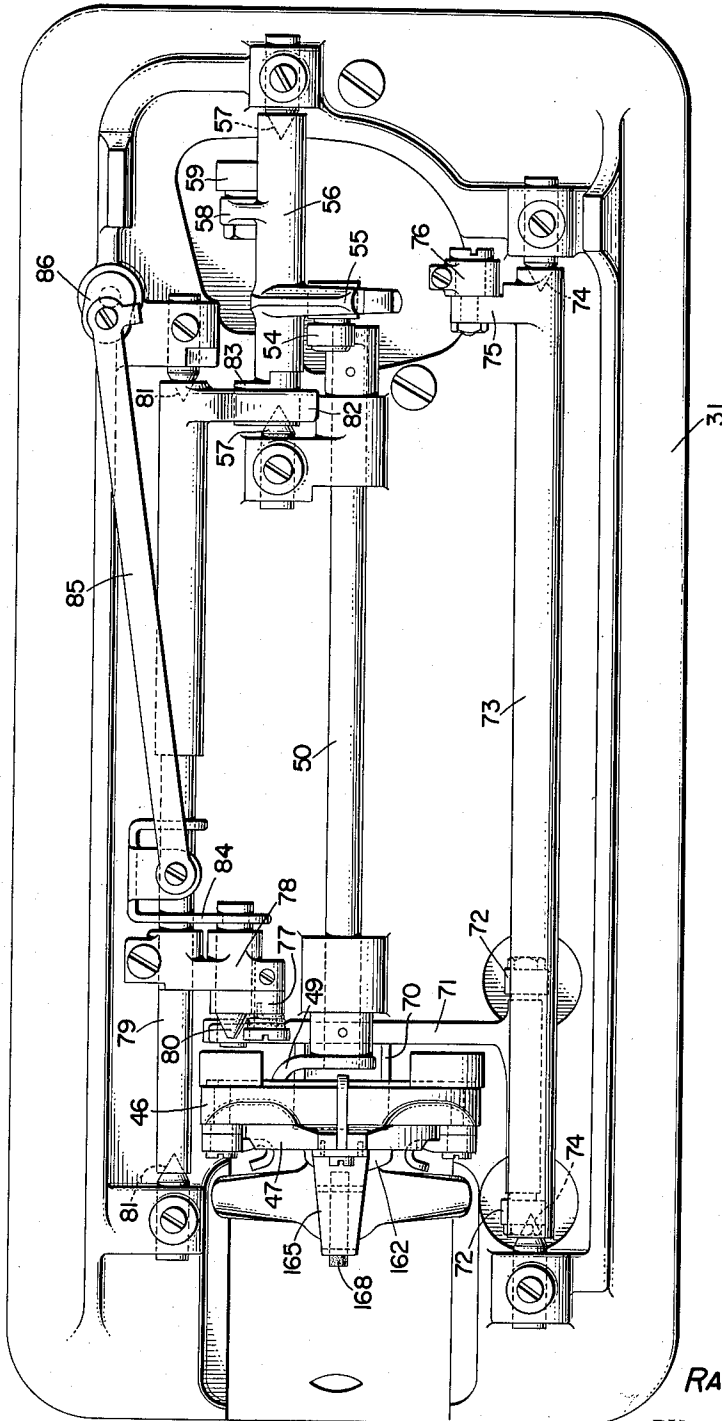


Fig. 3.

INVENTOR.

RALPH E. JOHNSON

BY

Marshall J. Breen
ATTORNEY

WITNESS

Nicholas L. Luszczak

July 9, 1963

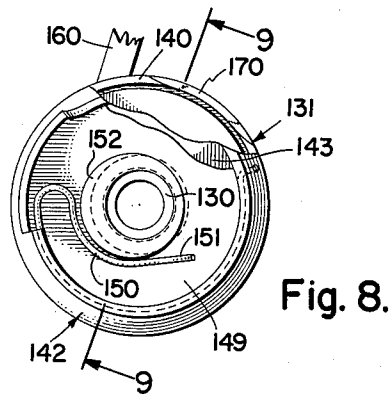
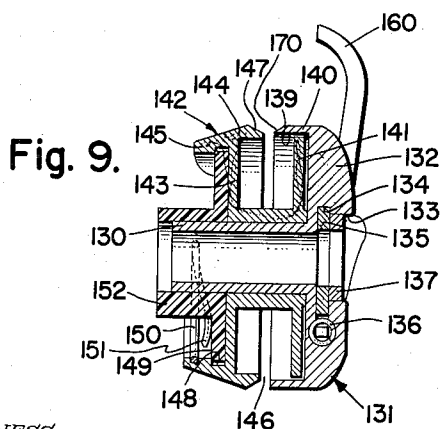
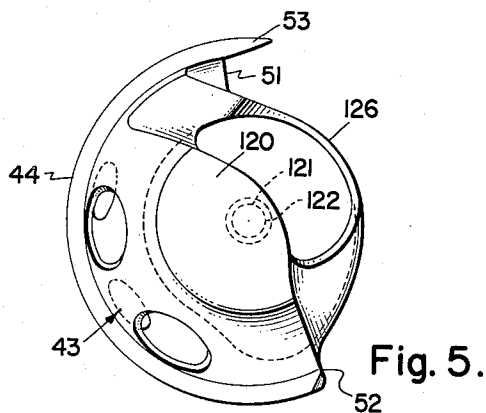
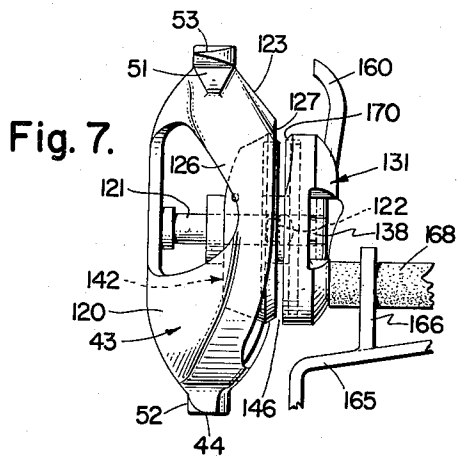
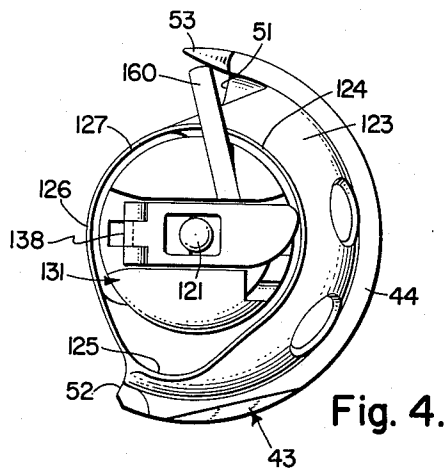
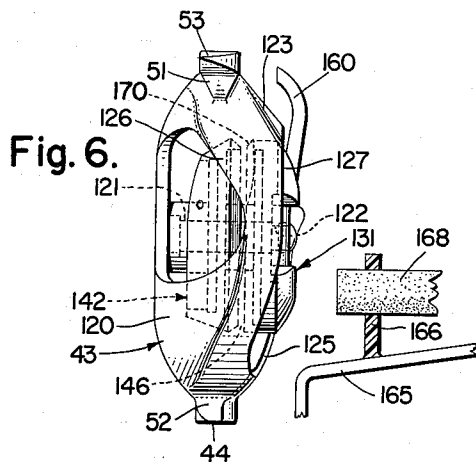
R. E. JOHNSON

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WITNESS

Nicholas Leszczak

INVENTOR.

RALPH E. JOHNSON

BY

Marshall J. Breen
ATTORNEY

July 9, 1963

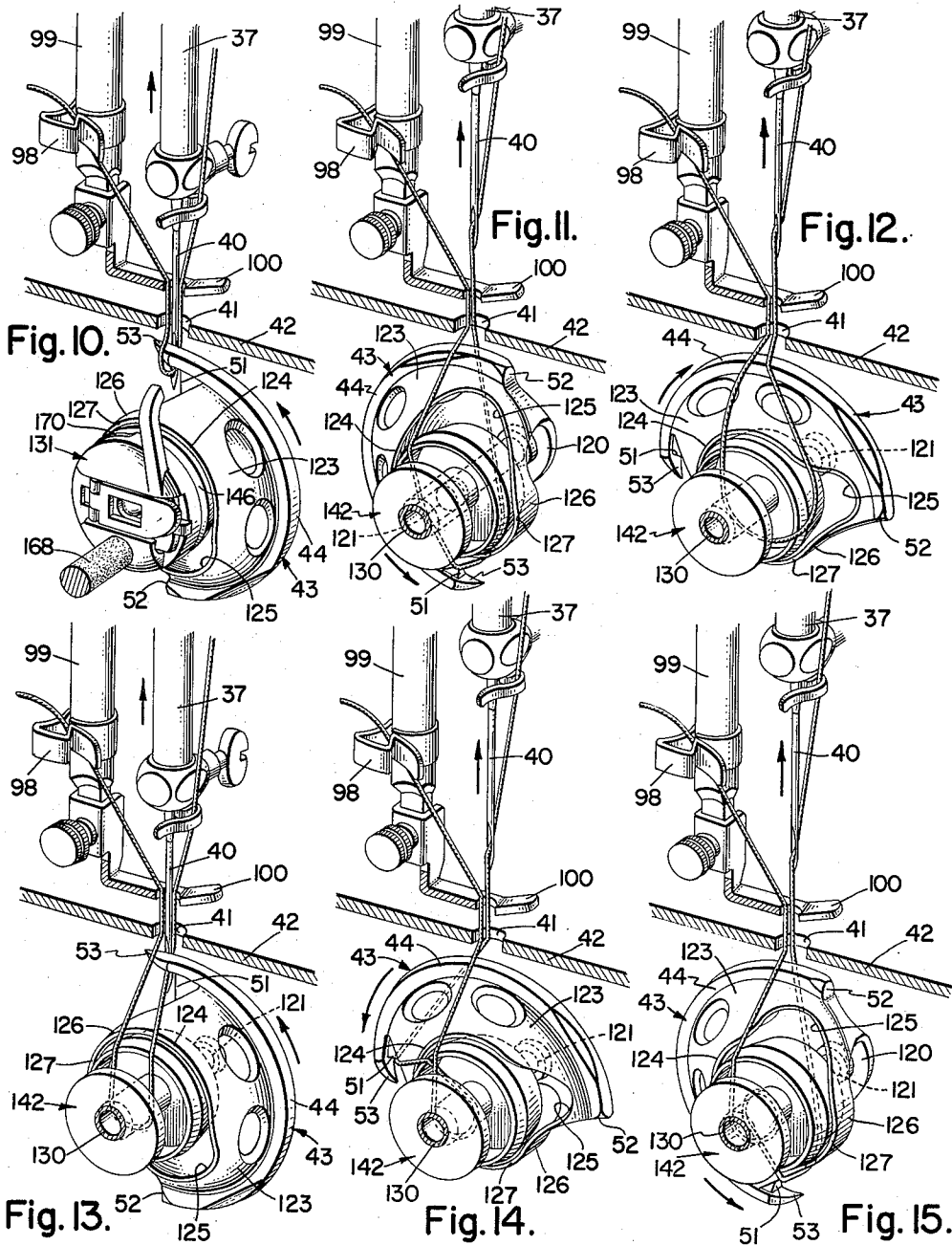
R. E JOHNSON

3,096,736

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WITNESS

Nicholas Leszczak

INVENTOR.

RALPH E. JOHNSON

BY

Marshall J. Brown
ATTORNEY

July 9, 1963

R. E. JOHNSON

3,096,736

LOCK STITCH SEWING MACHINE WITH BOBBIN REPLENISHING MEANS

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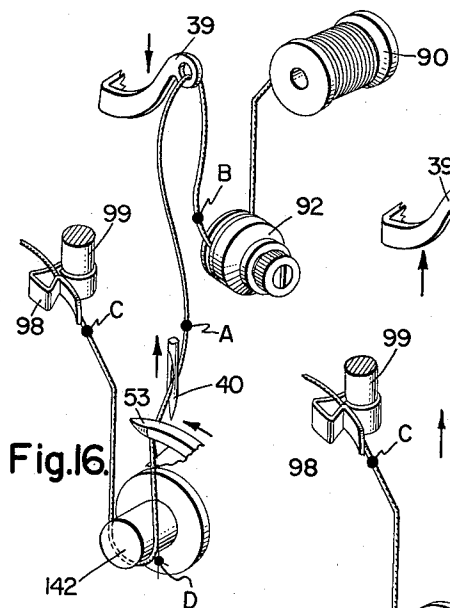


Fig. 16.

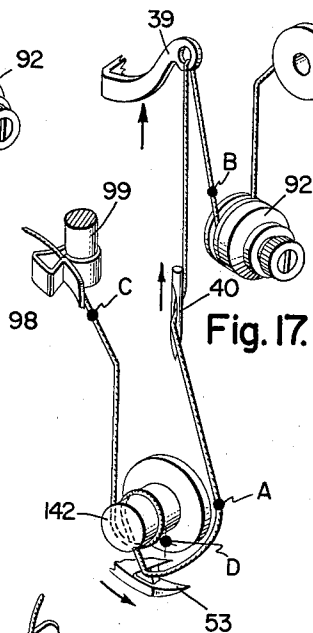


Fig. 17.

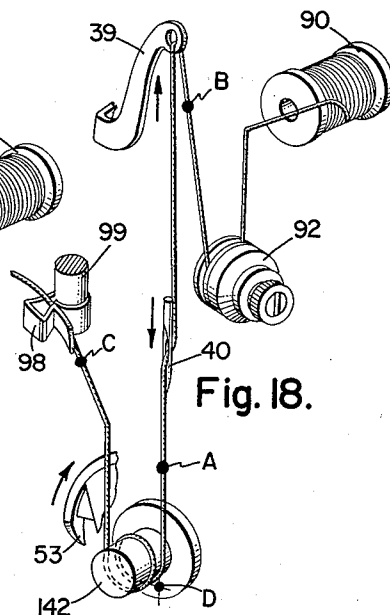


Fig. 18.

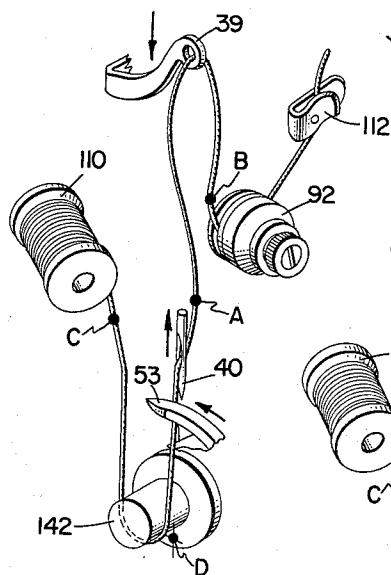


Fig. 19.

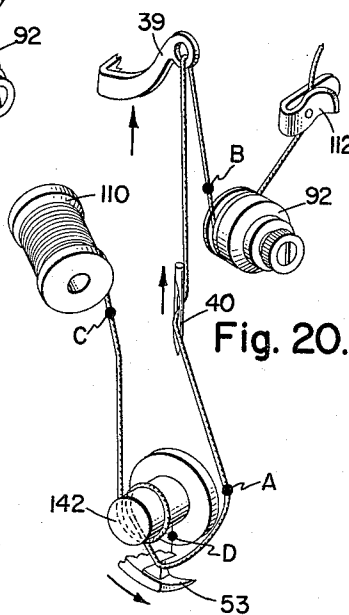


Fig. 20.

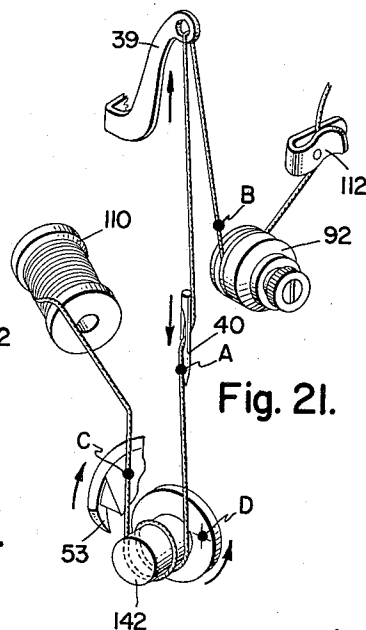


Fig. 21.

WITNESS

Nicholas Leszcyak

INVENTOR.
RALPH E. JOHNSON
BY

Markell J. Breen
ATTORNEY

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3,096,736

LOCK STITCH SEWING MACHINE WITH BOBBIN REPLENISHING MEANS

Ralph E. Johnson, Boonton, N.J., assignor to The Singer Manufacturing Company, Elizabeth, N.J., a corporation of New Jersey

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12 Claims. (Cl. 112—181)

This invention relates to lock stitch sewing machines, and more particularly, to a novel and improved mechanism in a lock stitch sewing machine for replenishing the supply of under or locking thread in the loop taker with thread carried by the needle during conventional inter-related motions of the stitch forming instrumentalities.

Heretofore, known sewing machines capable of accomplishing winding of the bobbin in the loop taker during continued operation of the stitch forming instrumentalities have provided means for anchoring a thread seized from the needle to a rotatable bobbin or to a member such as the loop taker rotatable relatively to or with the bobbin. In these known machines it has been essential during the winding process and with exception of the initial needle loop seizure, that the thread from the needle to the bobbin being wound be constrained out of the path of the loop seizing beak of the loop taker. Although the ability of these known machines to replenish bobbin thread during continued operation of the stitch forming instrumentalities is highly advantageous in the provision of completely automatic sequences of bobbin winding and sewing, the continued operation of the needle, loop taker and take-up mechanisms during winding presents certain problems of needle thread control during the winding process. Since the loop taker does not seize other than the initial needle thread loop during the winding process of these known machines, the needle thread slackened by the take-up on each subsequent needle penetration during winding is not drawn out and controlled by the loop taker as it is during sewing.

It is an object of this invention to provide a novel and improved means for replenishing the under or bobbin thread in a lock stitch sewing machine during continued operation of the stitch forming instrumentalities in which the loop taker seizes and manipulates a loop of thread carried by the needle during each needle penetration, shedding the seized loops onto the bobbin during bobbin replenishment and completely about the bobbin during sewing, whereby substantially the same degree of control of slackness in the needle thread is maintained during bobbin winding as during sewing.

It is an object of this invention to provide a construction of loop taker and bobbin for a lock stitch sewing machine which may be arranged at will for deposit of successive thread loops seized and manipulated by the loop taker onto the bobbin, or for the passage of successive thread loops seized and manipulated by the loop taker completely about the bobbin in conventional lock stitch formation.

A further object of this invention is to provide in a lock stitch sewing machine a means effective during operation of the stitch forming instrumentalities for winding on a bobbin in place in the loop taker selectively either limb of a thread passed through the eye of the sewing machine needle.

A still further object of this invention is to provide in a lock stitch sewing machine a novel and improved means effective during operation of the stitch forming instrumentalities for replenishing thread on the bobbin in place in an oscillating shuttle.

With the above and additional objects and advantages in view as will hereinafter appear this invention com-

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prises the devices, combinations, and arrangements of parts hereinafter described and illustrated in the accompanying drawings of a preferred embodiment in which:

FIG. 1 represents a head end elevational view of a sewing machine having this invention applied thereto,

FIG. 2 represents a front elevational view of a portion of the sewing machine of FIG. 1 with the work supporting bed and portions of the mechanism carried therebeneath illustrated in vertical cross section taken substantially along the axis of the looper drive shaft,

FIG. 3 represents a bottom plan view of the sewing machine of FIGS. 1 and 2,

FIG. 4 represents an enlarged elevational view of the face of the loop taker for the sewing machine of FIGS. 1, 2 and 3 including the bobbin thread case therein,

FIG. 5 represents a rear elevational view of the loop taker of FIG. 4,

FIG. 6 represents a left side elevational view of the loop taker of FIG. 4 with the bobbin thread case illustrated in sewing position and including a fragment of a permanent magnet means for constraining the bobbin thread case in winding position,

FIG. 7 represents a left side elevational view of the loop taker of FIG. 4 similar to that of FIG. 6 but showing the bobbin thread case disposed in the winding position,

FIG. 8 represents an enlarged rear elevational view of the bobbin thread case with a portion of the peripheral flange of the bobbin broken away to illustrate the sharpened thread cutting edge formed on the bobbin thread case,

FIG. 9 is a cross sectional view of the bobbin and bobbin thread case taken substantially along line 9—9 of FIG. 8,

FIGS. 10 through 15 represent perspective views of the sewing machine stitch forming instrumentalities illustrating various critical relative positions of the parts during the winding on a bobbin of the initial and the next succeeding loop of thread carried by the needle,

FIGS. 16, 17 and 18 represent diagrammatic perspective views of the stitch forming instrumentalities including the needle thread in various critical relative positions of the parts during the winding of one loop of thread on the bobbin showing the manner in which thread from the conventional needle thread supply is wound on the bobbin when the free end of thread carried by the needle is clamped relatively to the sewing machine frame, and

FIGS. 19, 20 and 21 represent diagrammatic perspective views similar to FIGS. 16, 17 and 18 but showing the manner in which the free end of thread carried by the needle is wound on the bobbin when the thread from the conventional needle thread supply is clamped relatively to the sewing machine frame.

Referring particularly to FIGS. 1, 2 and 3, the sewing machine to which this invention is applied comprises a casing including a work supporting bed 31, a standard 32 rising from the bed, and a bracket arm 33 carried by the standard and overhanging the bed. Journaled in the bracket arm is a main shaft 34 having a balance wheel driving pulley fast thereon. The main shaft carries a compound crank 35 operatively connected to a drive link 36 for a needle bar 37 carried for endwise reciprocation in the bracket arm, and a drive link 38 for oscillating a needle thread take-up lever 39 fulcrumed in the bracket arm.

A thread carrying eye-pointed needle 40 carried by the needle bar partakes of work penetrating motion through a needle aperture 41 formed in a throat plate 42 carried on the bed 31 and cooperates in the formation of lock stitches with a loop taker 43 carried beneath the bed. In the preferred embodiment of this invention the loop taker

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comprises an oscillating shuttle best illustrated in FIGS. 4, 5 and 6. The shuttle, which will be described in greater detail hereinbelow, is formed with an arcuate bearing rib 44 extending about slightly more than half the periphery of the shuttle. The shuttle bearing rib is journaled in an open raceway 45 formed in a shuttle supporting member 46 secured to the base and is constrained within the raceway by a retainer member 47 hinged to the shuttle supporting member 46 as illustrated in FIG. 2. The spaced fingers 48, 48 of a shuttle driving member 49 fast on an oscillating shuttle driving shaft 50 journaled beneath the bed operate against substantially radial abutments 51, 52 formed at opposite extremities of the shuttle bearing rib 44 to impart oscillatory motion to the shuttle. A loop seizing beak 53 formed at one extremity of the shuttle bearing rib 44 outwardly of the radial abutment 51 serves to engage and draw out loops of thread carried by the needle as is conventional in lock stitch sewing machines.

Referring to FIG. 3, the shuttle driving shaft 50 is formed beneath the casing standard with a crank 54 embraced between the bifurcated arms 55 of rocker 56 pivoted between pintles 57—57 set into the bed. An arm 58 on the rocker is pivotally connected to a pitman 59 operatively connected to a driving element such as a crank (not shown) on the main shaft 34. Motion is thus imparted by the main shaft 34 to the needle, take-up, and shuttle in timed relation in the formation of stitches.

For feeding work fabrics across the throat plate, a conventional four motion drop feed mechanism is illustrated in the drawings. A feed dog 70 operating upwardly through slots in the throat plate 42 is carried by a feed bar 71 pivoted at one extremity between upright rock arms 72 formed on a feed advance rock shaft 73. The feed advance rock shaft is pivoted between pintles 74 set into the bed and formed beneath the casing standard with a rock arm 75 pivotally connected to a feed advance pitman 76 operatively connected to a driving element such as an eccentric (not shown) on the main shaft. A link 77 which is pivotally connected to the opposite extremity of the feed bar is adapted to be pivotally connected to a rock arm 78 secured to a feed lift rock shaft 79 by means of a retractible pivot pin 80. The feed lift rock shaft 79 is pivoted between pintles 81 set into the bed and is formed with a rock arm 82 beneath the casing standard which underlies a feed lift cam 83 formed on the rocker 56. The retractible pivot pin 80 is carried by a bracket 84 slidable on the feed lift rock shaft 79 and connected by means of a pivoted link 85 to a crank 86 set into the bed which crank may be turned by means of an operator-influenced handle 87 disposed above the bed as illustrated in FIG. 1 to at will retract the pivot pin 80 from the link 77 throwing the feed dog out of operation or to reintroduce the pivot pin into the link 77 throwing the feed dog into operation.

FIGS. 1 and 2 of the drawings include the needle thread, i.e., the thread which is passed through the eye of the needle. FIG. 1 illustrates the position of sewing machine parts in readiness to begin the bobbin winding operation, and FIG. 2 illustrates the position of sewing machine parts during the bobbin winding operation. The thread illustrated in solid lines in FIGS. 1 and 2 represents the preferred threading when thread from a supply spool 90 carried atop the sewing machine bracket arm is to be used both for the supply of thread to be wound on the bobbin and also for the supply of needle thread to be used in subsequent stitch formation. From the supply spool 90 the thread is directed to a thread guide 91 on the bracket arm thence to a conventional thread tensioning device, a stationary thread guide 94 on the bracket arm, the take-up lever 39, a pair of thread guides 95—95 on the bracket arm leading toward the needle between which thread guides may be arranged a light auxiliary tensioning device 96, through a thread guide 97 on the needle bar and thence through the eye of the needle. When in readiness to begin winding of thread on the bobbin, as illus-

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trated in FIG. 1, the tag end of thread extending from the eye of the needle is secured in a thread clamp 98 secured in the presser bar 99 carrying the conventional presser foot 100 which opposes the feed dog 70. As illustrated in FIG. 2, the tag end of thread remains clamped in the thread clamp 98 during bobbin winding and the thread which is wound on the bobbin is obtained from the supply spool 90.

Illustrated in dashed lines in FIGS. 1 and 2 is an alternative threading arrangement which may utilize an auxiliary supply spool 110 from which thread will be wound on the bobbin or which may operate to wind on the bobbin the tag end of a thread extending from the needle eye but drawn from the supply spool 90. In the alternative threading arrangement, the tag end of thread from the eye of the needle or the thread from the auxiliary supply spool 110 whichever the case may be, is directed through a thread guide 111 on the sewing machine bracket arm to the eye of the needle and thence in a path through the thread guides, take-up, check spring and tensioning device identical with the preferred threading described above. Between the tensioning device 96 and the supply spool 90, however, a thread clamping member 112 is provided into which the thread is secured when the alternate threading arrangement is to be utilized. When thread from an auxiliary supply spool 110 is to be wound on the bobbin the tag end of such thread is secured in the thread clamping member 112, however, the thread clamping member 112 is preferably located slightly to one side of the conventional path of the thread between the thread guide 91 and the tensioning device 92 such that when the tag end of a thread from the eye of the needle but drawn from the supply spool 90 is to be wound on the bobbin, the thread limb between the guide 91 and the tension device 92 may be introduced conveniently into the thread clamping member 112.

It is pointed out that in either alternative threading arrangement, it is necessary to detain both limbs of the thread which passes through the eye of the needle on that side of the loop taker on which the needle aperture 41 is situated during the winding of thread on the bobbin, so that a loop of thread is presented to the loop taker rather than merely a single limb of the thread. The spool 90 and the thread clamping member 98 when used with thread from the spool 90, and the spool 110 and the thread clamping member 112 when used with thread from the spool 110 serve this purpose of detaining both extremities of a continuous length of thread passed through the eye of the needle at the opposite side of the work support from the loop taker thus insuring a loop of thread for manipulation by the loop taker.

The thread clamping members 98 and 112 serve the additional purpose, as will be described in detail hereinbelow, of controlling positively that selected extremity of the thread passing through the eye of the needle which shall be wound on the bobbin.

Referring to FIGS. 4 to 9, the construction of the loop taker 43 and the parts associated therewith will now be described. Extending diametrically across and offset rearwardly from the arcuate semi-circular bearing rib 44 is a rear wall 120 of the shuttle from which at substantially the center of curvature of the bearing rib 44 extends a cylindrical post 121 formed near the free extremity with an annular groove 122. Extending forwardly and inwardly from the arcuate bearing rib 44 is a front skirt 123 terminating in arcuate substantially planar free edge 124 equidistant from the post 121 except near that extremity of the bearing rib 44 opposite the loop seizing beak 53 at which the front skirt 123 is cut away as at 125. Extending between the extremities 51 and 52 of the bearing rib and joining with both the rear wall 120 and the front skirt 123 is a bridge piece 126 completing an annular casing about the post 121. As illustrated in FIGS. 6 and 7, the bridge piece 126 extends forwardly and inwardly from the cut away portion 125 of the front skirt, and with

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exception of the juncture with the cut away portion 125, provides a free edge 127 substantially co-planar with the free edge 124 of the front skirt 123.

Journalled on the post 121 is a cylindrical sleeve 130 formed as a part of a bobbin thread case indicated generally as 131. The sleeve 130 extends from a circular head portion 132 which is formed with a transverse slot 133 undercut as at 134 slidably to accommodate a latch block 135. The latch block is formed to embrace the annular groove 122 in the post and is biased by the spring 136 into latched relation with the annular groove in the post to secure the bobbin thread case in a sewing position in the shuttle as illustrated in FIG. 6. As is conventional in bobbin thread cases, an operator influenced latch release lever 137 is hinged to the latch block 135 and formed with an inturned lever arm 138 abutting the bobbin thread case for releasing the latch block from the post 121.

The circular head portion 132 of the bobbin thread case is undercut as at 139 to provide a peripheral lip 140 arranged to overlies one flange 141 of a bobbin 142 freely journaled on the cylindrical sleeve 130. The bobbin is provided with a second flange 143 formed at the periphery with a lip 144 extending toward the flange 140 and with a lip 145 extending away from the flange 140. The lip 144 is spaced from the peripheral lip 140 of the bobbin thread case when the bobbin is in place on the sleeve 130 as illustrated in FIG. 9 so as to define between said lips a slot 146 for introduction of thread to the bobbin. To facilitate such introduction of thread the outer surface of the lip 144 is beveled inwardly as at 147.

The lip 145 is formed adjacent the flange 143 with an internal undercut 148 into which is snapped a frictioning washer 149 of flexible resilient material such as nylon, hard rubber or the like. Both the undercut 148 and a leaf spring 150 anchored in the lip 145 of the bobbin and having an inturned free extremity 151 bearing against the washer 149 serve to urge the washer against the flange 143 of the bobbin into frictional engagement therewith. The washer 149 is formed with an eccentric hub 152 journaled on the cylindrical sleeve 130 of the bobbin thread case. The leaf spring 150 bearing against the eccentric hub 152 biases the hub against the cylindrical sleeve 130 to provide a frictional resistance to turning of the bobbin 142. The frictional resistance to turning of the bobbin, which gives rise to the bobbin thread tension during sewing, may be selectively adjusted by turning the washer 149 to shift the angular position of the eccentric hub 152 relatively to the leaf spring 150. Since the frictional resistance of the washer 147 against the bobbin flange 142 is always considerably higher than that between the washer hub 152 and the sleeve 130, the washer, bobbin, and leaf spring will be interlocked frictionally for rotation as a unit in any selected relative angular position of the eccentric hub 152.

Extending radially from the circular head 132 of the bobbin thread case 131 is a rotation restraining finger 160, which as illustrated in FIGS. 1 and 2 is constrained in a rotation restraining notch 161 formed in a plate 162 spanning the hinged shuttle retainer 47. As illustrated in FIG. 2, the plate 162 and the notch 161 therein are of considerable width so as to constrain the rotation restraining finger 160 not only when the bobbin thread case is held on the post 121 of the shuttle by means of the latch block 135 but also when the latch block 135 is released and the bobbin thread case is shifted outwardly along the post 121 to the position illustrated in FIG. 2. A bracket 165 carried on the hinged shuttle retainer 47 is provided with non-ferrous lugs 166 and 167 in which is secured a permanent magnet 168. As illustrated in FIG. 2, the magnet 168 serves to hold the bobbin thread case 131, which is preferably formed of steel, in the unlatched and extended position relatively to the shuttle post.

Referring to FIG. 8, a portion of the bobbin flange 143 is broken away clearly to illustrate a portion of the

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peripheral lip 140 of the head portion of the bobbin thread case. At one side of the rotation restraining finger 160 the peripheral lip is beveled to a sharp cutting edge 170. This cutting edge 170 serves during the transition from bobbin winding to sewing to sever one of the limbs of thread wrapped on the bobbin leaving a single bobbin thread for sewing. The location of the cutting edge as illustrated in FIGS. 7 and 8 is suitable for use when the sewing machine is initially threaded as illustrated in solid lines in FIGS. 1 and 2 as illustrated in FIGS. 10 through 18. Should it be desired to thread the machine as illustrated in dotted lines in FIGS. 1 and 2 and provide for the thread manipulation as illustrated in FIGS. 19, 20 and 21, a bobbin thread case is required in which the sharpened cutting edge 170 is disposed at the opposite side of the rotation restraining finger from that illustrated in FIGS. 7 and 8.

Operation

With the needle threaded as illustrated in solid lines in FIGS. 1 and 2, the operator may replenish a supply of thread on the bobbin by manually releasing the latch block 135 on the bobbin thread case, manually shifting the bobbin thread case outwardly against the magnet 168, and operating the sewing machine as if to sew conventional lock stitches. The winding process may continue for as many needle penetrations as is necessary to supply the desired bobbin thread, following which conventional lock stitch sewing may be commenced simply by shifting the bobbin thread case into the shuttle. The latch block 135 will be urged into latching relation by the spring 136 and the sharpened cutting edge 170 will sever the anchored limb of thread from the bobbin to the thread clamp 98 leaving a continuous thread from the bobbin to the needle and thence to the supply spool 90.

Replenishment of bobbin thread may be effected with or without work fabrics in place beneath the presser foot. Without work fabrics it is preferable that the presser foot be raised particularly if a known release mechanism for the tension device 92 operated by raising the presser foot is used. Without work beneath the presser foot, however, the replenishing operation will function with the presser foot down, the feed dog operative and the needle thread tension device 92 effective. With work fabrics beneath the presser foot it is necessary that the presser foot remain down during bobbin replenishment and that the feed dog be thrown out of operation by the operator influenced handle 87.

The process by which thread carried by the needle is wound on the bobbin will now be described with particular reference to FIGS. 10 through 15.

FIG. 10 illustrates the position of the parts during initial loop seizure by the shuttle beak 53 with the bobbin thread case 131 unlatched from the shuttle post and shifted outwardly against the magnet 168. The arrows adjacent the shuttle and needle in FIGS. 10 through 15 indicate the direction of motion of these parts respectively. It will be noted in FIG. 10 as well as in FIG. 2 that when the bobbin thread case is held by the magnet 168, the thread accommodating slot 146 leading into the bobbin is exposed outwardly beyond the co-planar free edges 124 and 127 of the front skirt and bridge piece respectively of the shuttle.

FIG. 11 represents the position of the parts as the shuttle nears completion of its loop seizing motion. The co-planar free edges 124 and 127 on the shuttle have guided the anchored limb, i.e., that limb of the seized loop which extends to the thread clamp 98, into the bobbin through the thread accommodating slot 146 while the supply limb, i.e., that limb of the seized loop which extends to the needle eye and the supply spool 90, about the rear of the shuttle.

During the shuttle motion from the position illustrated in FIG. 10 to that illustrated in FIG. 11, the shuttle driver 49 will have been in driving engagement with the abutment 52 at the heel of the shuttle bearing rib providing a gap between the shuttle driver and the abutment 51 near the beak 53 for passage therebetween of the thread

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loop. In the position of parts illustrated in FIG. 12, the take-up lever 39 will begin to draw up the loop expanded by the shuttle and in so doing will draw the supply limb over the rear wall 120 of the shuttle and angularly across the abutment 52 at the heel of the shuttle bearing rib. The bridge piece 126 of the shuttle plays an important role in controlling the thread loop deposited on the bobbin at this point in the progress of the thread loop about the shuttle. When sewing with the shuttle of this invention and in conventional shuttle construction, the needle thread loop is carried completely about the bobbin thread case so that when the position of parts as illustrated in FIG. 12 is reached, both limbs of the thread loop will be drawn across the bobbin, one limb across the exposed face of the thread case and the other limb to the rear of the shuttle. The entire thread loop will thus be disposed near the periphery of the shuttle and will be drawn up by the take-up along the shuttle raceway without danger of the loop being entered by the heel of the shuttle bearing rib. When winding thread on the bobbin with the present invention, however, the anchor limb of the thread loop is wrapped about the bobbin as illustrated in FIG. 12 and the bridge piece 126 serves to guide that wrapped limb of the thread loop outwardly to the shuttle bearing rib and prevents the shuttle from backing out of the loop as the shuttle reverses direction.

When the shuttle reverses direction, as illustrated in FIG. 13, the shuttle driver will contact the abutment 51 near the beak 53 and open a gap at the abutment 52 so that the supply limb of the thread loop may pass therebetween in response to the take-up action into the cut-away portion 125, and ride gradually up the inclined edge to the free edge 124 of the front skirt 123 of the shuttle.

FIGS. 10, 11 and 12 thus illustrate the manner in which the shuttle during the first oscillation in the winding process, places a loop of thread on the bobbin and guides both limbs of the wrapped loop over the free edge 124 of the front skirt of the shuttle so that both limbs extend over the shuttle bearing rib to the needle aperture 41.

FIGS. 13, 14 and 15 illustrate the position of parts during subsequent oscillation of the shuttle during the winding process. FIG. 13 illustrates the same position of shuttle and needle as in FIG. 10, however, with a previous loop of thread wrapped on the bobbin. As illustrated in FIG. 13 the supply limb of thread to the needle eye will be carried by the descent of the needle into the path of the loop seizing beak of the shuttle while the anchor limb of the thread will remain guided between the edge 127 of the bridge piece 126 and the needle aperture outside the path of the loop seizing beak.

FIGS. 14 and 15 illustrate the manner in which the seized supply limb of thread is carried by the shuttle and the resulting loop deposited in the bobbin. FIG. 15 illustrates the same position of the shuttle and needle as in FIG. 11 and on continued motion of the parts during reverse motion of the shuttle, the supply limb will be manipulated precisely as illustrated in FIG. 12.

FIGS. 16, 17 and 18 illustrate the manner in which thread is drawn from the supply spool 90 during winding initiated with the thread arranged as shown in solid lines in FIGS. 1 and 2. In FIGS. 16, 17 and 18, which illustrate the deposit on the bobbin of a loop of thread other than the initial loop, B indicates a point on the thread emerging from the tension device 92 at loop seizure in FIG. 16, A indicates a point on the thread substantially at the needle eye at loop seizure in FIG. 16 and C indicates a point on the thread immediately adjacent the thread clamp 98 at loop seizure in FIG. 16. D indicates a point on the bobbin 142 vertically beneath the axis of turning movement of the bobbin relatively to the bobbin thread case.

It will be noted in FIG. 17 that the thread necessary to provide the loop made by the shuttle is given up by the take-up 39 since the thread at points B and C have not

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moved whereas the thread at point A has been reeved through the eye of the needle.

FIG. 18 which illustrates the position of parts after a loop of thread has been deposited on the bobbin, illustrates that a supply of thread equal to that wound on the bobbin will be drawn from the supply spool 90 by the take-up as indicated by the changed position of the points A and B on the thread. The point C on the thread will not have moved. FIG. 18 illustrates, moreover, that the bobbin does not rotate but that the formed thread loops are deposited on the bobbin each successive loop on top of the last. With the arrangement illustrated in FIGS. 16, 17 and 18, it is the anchored limb of the thread extending to the thread clamp 98 which is severed by the cutting edge 170 when sewing is to be commenced such that the thread limb extending from the outside of the coil placed on the bobbin becomes the bobbin thread to be used in sewing.

FIGS. 19, 20 and 21 illustrate the manner in which the thread will be replenished on the bobbin when winding is initiated with the thread arranged as shown in dotted lines in FIGS. 1 and 2. In FIGS. 19, 20 and 21, B indicates a point on the thread just emerging from the tension device 92 at loop seizure, A indicates a point on the thread substantially at the needle eye at loop seizure, and C indicates a point on the thread just emerging from the auxiliary supply spool 110 at loop seizure. D indicates a point on the bobbin 142 vertically beneath the axis of turning movement of the bobbin at loop seizure.

As illustrated in FIGS. 19 and 20, the thread loop is formed and deposited on the bobbin in precisely the same fashion as illustrated in FIGS. 16 and 17 during formation and deposit of the thread loop the bobbin does not turn since during that period only thread given up by the take-up is involved. FIG. 21, however, may be compared with FIG. 18 to indicate the difference resulting from the two alternative threading arrangements. In FIG. 20, the take-up in order to regain that amount of thread which has been detained on the bobbin cannot draw thread through the tension device 92 because the thread is secured on the thread clamp 112. Point B on the thread will not move. The required thread will instead be drawn from the auxiliary thread spool 110 as indicated by the changed position of point C on the thread. The bobbin 142 will be rotated by the action of the take-up as indicated by the changed position of the point D thereon. In the operation as illustrated in FIGS. 19, 20 and 21, the supply limb of the thread is looped on top of the coil of thread on the bobbin during each oscillation of the shuttle and then drawn off to wind on an equal amount of thread from the auxiliary supply spool. With the arrangement illustrated in FIGS. 19, 20 and 21, it is the supply limb of thread leading to the eye of the needle which is severed by a cutting edge similar to that illustrated at 170 in the drawings but located at the opposite side of the rotation restraining finger 160 when sewing is to be commenced. In this way the thread limb extending from the outside of coil placed on the bobbin will become the bobbin thread used in sewing.

While the preferred embodiment of this invention is illustrated and described hereinabove with reference to an oscillating shuttle and whereas this is the first sewing mechanism of which I am aware in which during continued operation of the needle and loop taker, successive coils of thread may be replenished on a bobbin in place in the loop taker of a sewing machine employing an oscillatory shuttle, it is pointed out that this invention is not limited to use with an oscillatory shuttle.

This invention may be applied to a sewing machine having a loop taker rotatable in one direction as for instance the type referred to in the art as "rotary hook." In applying this invention to a rotary hook sewing machine similar considerations and advantages will obtain as when applied to an oscillating shuttle. An advantage is that only a minimum of structural change is neces-

sary to the rotary hook per se, that is, thread guiding surfaces are required which will ensure that both limbs of the loop of thread detained on the bobbin during winding be guided clear of the loop seizing beak as the thread loop is deposited on the bobbin, and a thread guiding arrangement is required whereby the supply limb of the thread loop being wound on the bobbin is unerringly seized by the hook beak during each loop seizing motion of the rotary hook.

Whether applied to a rotary hook or a shuttle, an advantage of this invention is that a thread loop is seized and manipulated following each work penetration of the needle whether during winding of the bobbin or during the subsequent sewing so that the thread slackened by the take-up during work penetration remains fully controlled by the loop taker.

Having set forth the nature of this invention what I claim herein is:

1. In a lock stitch sewing machine, a work penetrating thread carrying needle, a loop taker cooperating with said needle, a loop seizing beak of said loop taker, means for driving said needle and loop taker in timed relation as is required for the formation of lock stitches, thread loop manipulating means including a body portion on said loop taker formed to expand and control loops of thread seized by said loop seizing beak, a thread accommodating bobbin, means for journaling said bobbin in said loop taker with capacity for relative axial movement of said bobbin and said loop taker body portion, bobbin constraining means for positioning said bobbin relatively to said loop taker body portion in a lock stitch forming position relatively to said thread manipulating means locating said bobbin completely within the path of said loops being expanded and controlled by said thread manipulation means, means for positioning said bobbin axially relatively to said loop taker body portion in a bobbin winding position locating said bobbin spanning the path of said loops being expanded and controlled by said thread manipulating means, means for maintaining said last mentioned means effective for deposit of needle thread on said bobbin during motion of said needle and loop taker in timed relation as is required for the formation of lock stitches

2. In a lock stitch sewing machine having a work support formed with a needle aperture, a work penetrating eye pointed needle adapted to carry a continuous length of thread passed through the eye of said needle, means for supporting said needle on said sewing machine at one side of said work support for endwise movement of said needle eye through said needle aperture, a loop taker supported on said sewing machine at the opposite side of said work support for cooperation with said needle, a loop seizing beak on said loop taker, means for driving said needle and said loop taker in timed relation for seizure by said loop seizing beak of one limb of a continuous length of thread passed through the eye of said needle during each work penetration of said needle, thread loop manipulating means associated with said loop taker for forming, expanding and controlling a loop in said thread limb upon each seizure thereof by said loop seizing beak, a thread accommodating bobbin, means for positioning said bobbin relatively to said loop taker completely within the path of a thread loop controlled by said thread loop manipulating means, bobbin replenishing means for positioning said bobbin and said thread manipulating means relatively to each other with said bobbin in a position spanning the path of said thread loops controlled by said thread manipulating means, means for maintaining said bobbin replenishing means effective during a plurality of successive work penetrations of said needle, and means effective during operation of said bobbin replenishing means for detaining on that side of said work support opposite that occupied by said loop taker a portion of both limbs of said continuous thread passed through the eye of said needle.

3. In a lock stitch sewing machine having a work penetrating thread carrying needle, a loop taker, a loop seizing beak on said loop taker, means for driving said needle and said loop taker in timed relation for seizure by said loop seizing beak of a loop of thread from said needle during each work penetration of said needle, thread loop manipulating means including a body portion of said loop taker formed to expand and control the path of loops of thread seized by said loop seizing beak, a thread accommodating bobbin, means for constraining said bobbin relatively to said thread loop manipulating means to locate said bobbin completely within the path of said loops controlled by said thread loop manipulating means, and a take-up mechanism operated in timed relation with said needle and loop taker for drawing said expanded thread loops from said loop taker between successive work penetrations of said needle, means for winding thread carried by said needle on said bobbin comprising bobbin constraining means effective to position said bobbin and said thread manipulating means relatively to each other with said bobbin in a position spanning the path of said thread loops being controlled by said thread manipulating means, and means for maintaining said last mentioned means effective during a plurality of successive work penetrations of said needle to deposit on said bobbin a plurality of successive thread loops each seized by said loop seizing beak, controlled by said thread manipulating means, and drawn from said loop taker onto said bobbin by said take-up.

4. In a lock stitch sewing machine having a work supporting frame formed with a needle aperture, a work penetrating eye pointed needle adapted to carry a continuous length of thread passed through the eye of said needle, means for supporting said needle on said sewing machine at one side of said work support for endwise movement of said needle eye through said needle aperture, a loop taker supported in said sewing machine at the opposite side of said work support for cooperation with said needle, a loop seizing beak on said loop taker, means for driving said needle and loop taker in timed relation for seizure by said loop seizing beak of one limb of a continuous length of thread passed through the eye of the needle during each work penetration of said needle, thread loop manipulating means including a body portion of said loop taker for forming, expanding and controlling a loop in said thread limb upon each seizure thereof by said loop seizing beak, a thread accommodating bobbin, means for constraining said bobbin relatively to said thread manipulating means to locate said bobbin completely within the path of said loops controlled by said thread loop manipulating means, and a take-up mechanism operated in timed relation with said needle and loop taker and operative on said seized limb of a thread passed through the eye of the needle for drawing said expanded thread loops from said loop taker between successive work penetrations of said needle, means for winding a continuous thread passing through the eye of said needle on said bobbin comprising, means for detaining on that side of the work support opposite that occupied by said loop taker a portion of both limbs of said continuous thread passed through the eye of said needle, means for constraining said bobbin and said thread manipulating means relatively to each other with said bobbin in a position spanning the path of said thread loops being controlled by said thread manipulating means for deposit on said bobbin of the thread loops drawn from said loop taker by said take-up, means for maintaining said last mentioned means effective during a plurality of successive work penetrations of said needle, and thread guiding means for directing one limb of said thread loop deposited on said bobbin in the path of said loop seizing beak during each of said plurality of successive work penetrations of said needle.

5. In a sewing machine having a work penetrating thread carrying needle, a loop taker, a thread accom-

modating bobbin associated with said loop taker, a needle thread take-up mechanism, and actuating means for operating said needle, loop taker and take-up mechanism for seizure and formation by said loop taker of a loop in a thread carried by said needle during each work penetration of said needle and for shedding of said thread loop from said loop taker between each successive work penetration of said needle, means for winding thread carried by said needle onto said bobbin comprising, means for directing onto said bobbin a thread loop shed from said loop taker, and means effective during a plurality of successive work penetrations of said needle for maintaining said thread loop directing means effective to cast onto said bobbin the successive thread loops shed by said loop taker.

6. In a lock stitch sewing machine having a reciprocatory thread carrying needle, an oscillating shuttle, a thread accommodating bobbin carried in said shuttle, and actuating mechanism operatively connecting said needle for reciprocation and said shuttle for oscillation in timed relation for the formation of lock stitches, means for winding on said bobbin in said shuttle successive loops of thread carried by said needle during successive reciprocations of said needle and oscillations of said shuttle in timed relation by said actuating means, and means effective during subsequent operation of said needle and said shuttle by said actuating mechanism for sewing lock stitches using thread wound on said bobbin by said last mentioned means.

7. In a lock stitch sewing machine having a work support formed with a needle aperture, a work penetrating eye pointed needle adapted to carry a continuous length of thread passed through the eye of said needle, means for supporting said needle on said sewing machine at one side of said work support for endwise movement of said needle eye through said needle aperture, a loop taker supported on said sewing machine at the opposite side of said work support for cooperation with said needle, a loop seizing beak on said loop taker, means for driving said needle and said loop taker in timed relation for seizure during each work penetration of said needle by said loop seizing beak of one limb of a continuous length of thread passed through the eye of said needle, thread loop manipulating means associated with said loop taker for forming, expanding and controlling a loop in said thread limb upon each seizure thereof by said loop seizing beak, a thread accommodating bobbin, bobbin constraining means for positioning said bobbin relatively to said loop taker completely within the path of a thread loop controlled by said thread loop manipulating means, means for winding a thread on said bobbin comprising, means for releasing said bobbin constraining means, means for maintaining said bobbin in a winding position spanning the path of said thread loops controlled by said thread manipulating means during a plurality of successive work penetrations of said needle, and means effective during operation of said means for winding said bobbin for detaining on that side of said work support opposite that occupied by said loop taker a portion of both limbs of said continuous thread passed through the eye of said needle, means for sewing lock stitches using thread wound by said means for winding a thread on said bobbin comprising means for re-establishing said bobbin constraining means, and thread cutting means associated with said bobbin and effective when said bobbin constraining means is re-established to sever a selected one of said limbs of thread wound on said bobbin.

8. In a lock stitch sewing machine having a work support formed with a needle aperture, a work penetrating eye pointed needle adapted to carry a continuous length of thread passed through the eye of said needle, means for supporting said needle on said sewing machine at one side of said work support for endwise movement of said needle eye through said needle aperture, a loop taker supported on said sewing machine at the opposite side

of said work support for cooperation with said needle, a loop seizing beak on said loop taker, means for driving said needle and said loop taker in timed relation for seizure during each work penetration of said needle by said loop seizing beak of one limb of a continuous length of thread passed through the eye of said needle, thread loop manipulating means associated with said loop taker for forming, expanding and controlling a loop in said thread limb upon each seizure thereof by said loop seizing beak, a bobbin case journaled in said loop taker, means for restraining said bobbin case from rotation relatively to said sewing machine work support, a thread accommodating bobbin journaled in said bobbin case, latch means on said bobbin case and on said loop taker for constraining said bobbin relatively to said loop taker completely within the path of a thread loop controlled by said thread loop manipulating means, means for winding a thread on said bobbin comprising, means for releasing said latch means, means for maintaining said bobbin case and said bobbin in a winding position spanning the path of said thread loops controlled by said thread manipulating means during a plurality of successive work penetrations of said needle, and means effective during operation of said means for winding said bobbin for detaining on that side of said work support opposite that occupied by said loop taker a portion of both limbs of said continuous thread passed through the eye of said needle, and means for sewing lock stitches using thread wound on said bobbin by said means for winding a thread on said bobbin comprising, means for re-establishing said latch means, and a sharpened thread cutting edge formed on said bobbin case to sever a selected one of said limbs of thread wound on said bobbin when said latch means is re-engaged.

9. A lock stitch sewing machine as set forth in claim 7 in which said means for maintaining said bobbin in said winding position during a plurality of successive work penetrations of said needle comprises ferrous metal associated with said bobbin and a magnet carried by said sewing machine work support.

10. In a lock stitch sewing machine having a frame including a work support formed with a needle aperture, a thread carrying eye pointed needle shiftably supported on said frame at one side of said work support for work penetrating motion through said needle aperture, a needle thread take-up and a needle thread tensioning device carried by said frame on that side of the work support on which said needle is supported, means for directing a continuous thread from a first extremity successively to said tensioning device, take-up, and needle eye to a second extremity, a loop taker carried in said frame at the opposite side of said work support from that on which said needle is supported, actuating means carried by said frame and operatively connecting said needle take-up and loop taker for lock stitch forming motions in timed relation, a thread accommodating bobbin, means for constraining said bobbin relatively to said loop taker within the path of thread loops manipulated by said loop taker for conventional lock stitch formation, means for depositing on said bobbin in place in said loop taker successive needle thread loops engaged and manipulated by said loop taker, thread clamping means effective during operation of said thread depositing means for securing relatively to said sewing machine frame a selected one of said continuous thread extremities passing through the eye of the needle, and a thread cutting device effective to sever that limb of thread wound on said bobbin by said thread depositing means which extends to said thread clamping means so that lock stitches may be formed by said sewing machine using thread wound on said bobbin by said thread depositing means.

11. A lock stitch sewing machine as set forth in claim 10 in which said thread clamping means is carried on said sewing machine frame in a position for engagement with

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said second extremity of continuous thread passing through said needle eye.

12. A lock stitch sewing machine as set forth in claim 10 in which said thread clamping means is carried on said sewing machine frame adjacent to said thread tensioning device in a position for engagement with said first extremity of continuous thread passing through said needle eye. 5

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