Nov. 7, 1939. C. F. RUBEL 2,178,544

LOCK STITCH SEWING MACHINE

Filed Jan. 30, 1937 6 Sheets-Sheet 1

FIG. I.

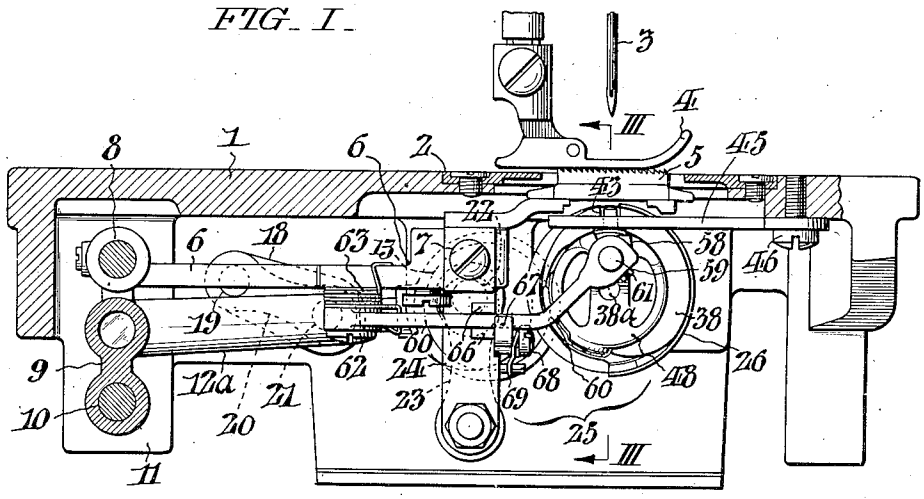
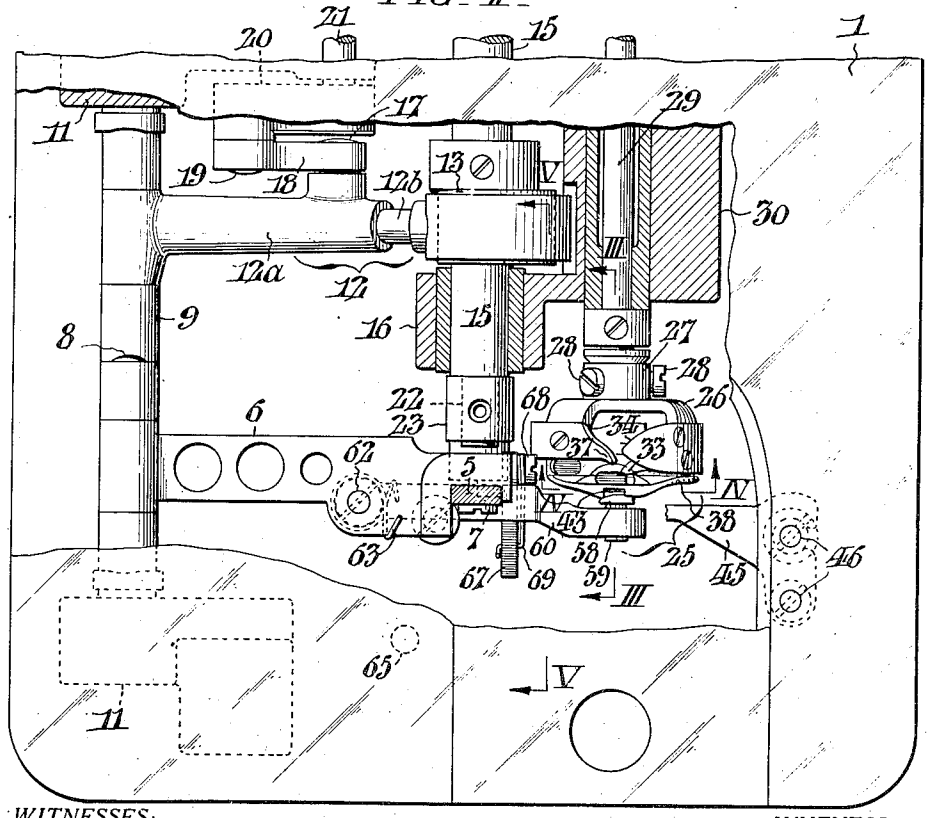



FIG. II.




WITNESSES:
John C. Bergner.
Hubert Fuchs

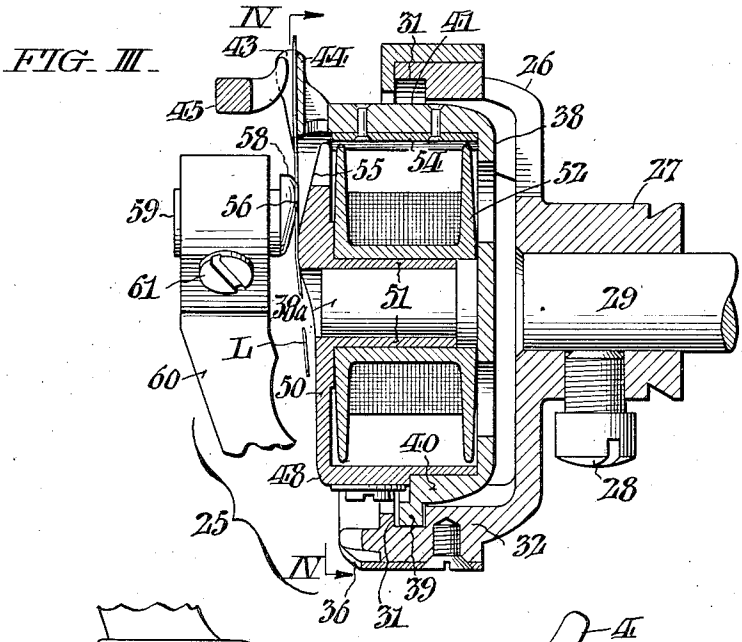
INVENTOR:
Charles F. Rubel,
BY Fraley & Paul
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Nov. 7, 1939. C. F. RUBEL 2,178,544

LOCK STITCH SEWING MACHINE

Filed Jan. 30, 1937 6 Sheets-Sheet 2

FIG. III.



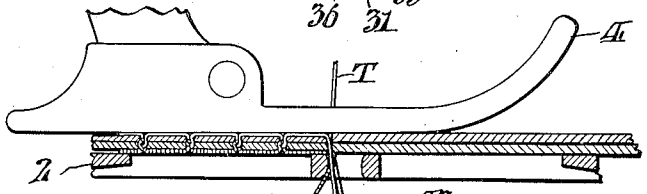
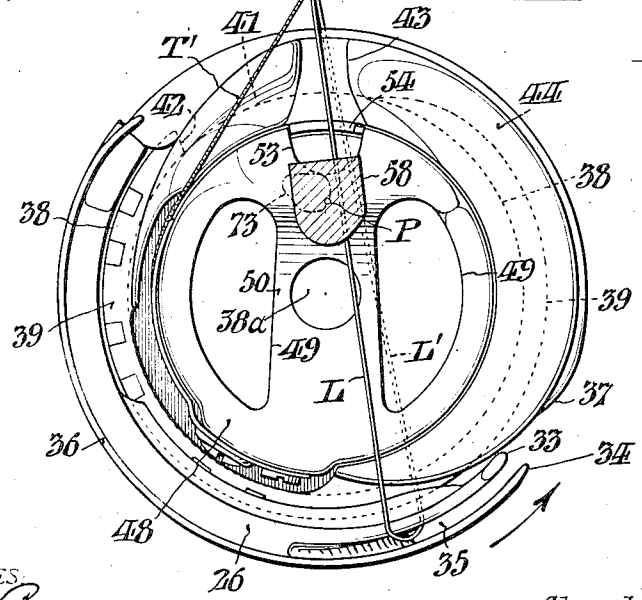




FIG. IV.




WITNESSES
John C. Bergner
Hubert Fischer

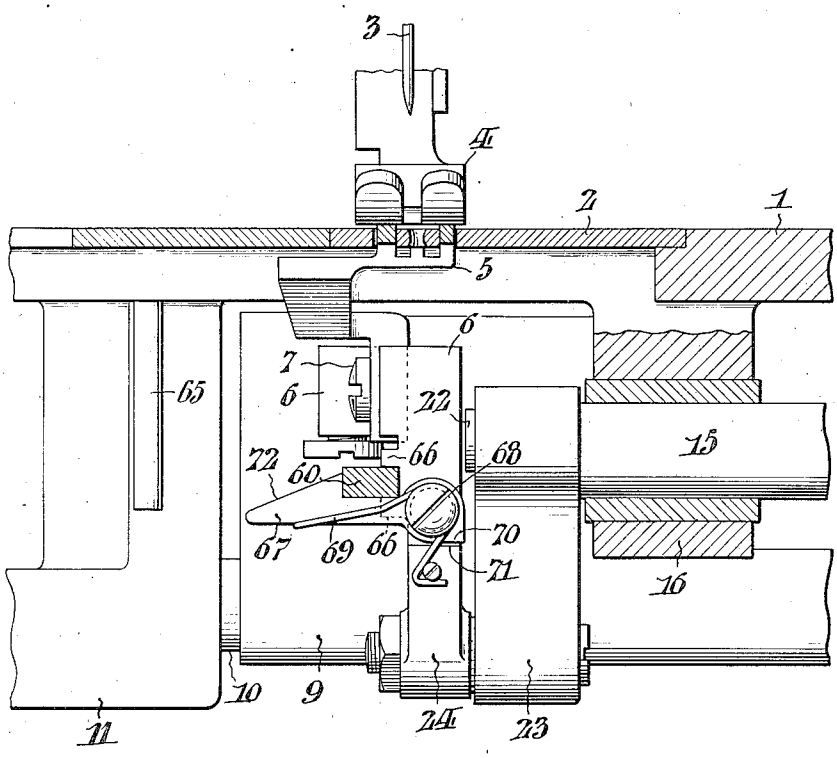
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Nov. 7, 1939. C. F. RUBEL 2,178,544

LOCK STITCH SEWING MACHINE

Filed Jan. 30, 1937 6 Sheets-Sheet 3

FIG. V.




WITNESSES:
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BY

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Nov. 7, 1939. C. F. RUBEL 2,178,544

LOCK STITCH SEWING MACHINE

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FIG. VII

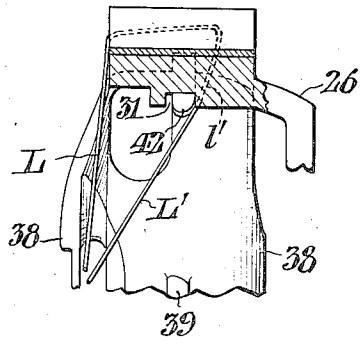
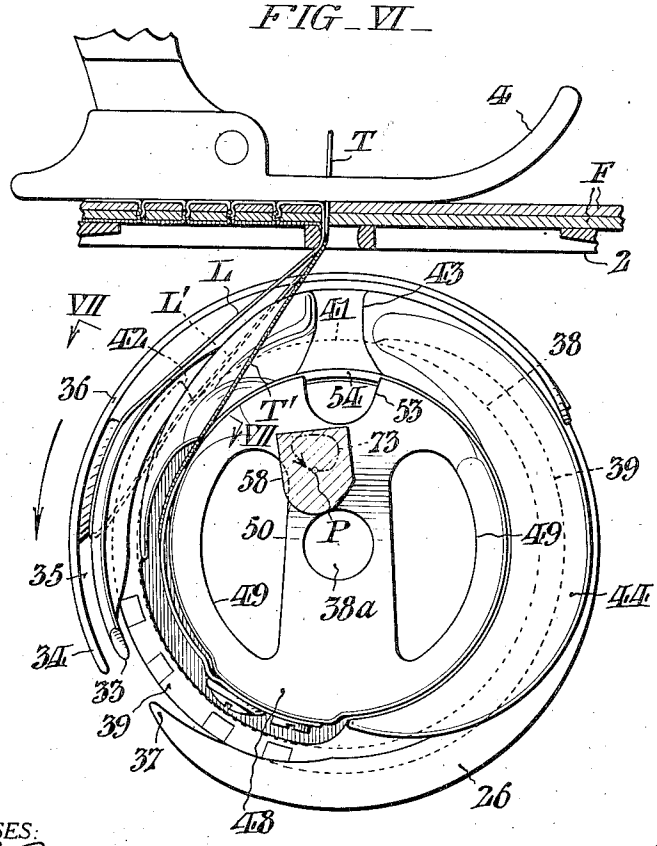



FIG. VI




WITNESSES:
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Nov. 7, 1939. C. F. RUBEL 2,178,544

LOCK STITCH SEWING MACHINE

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FIG. IX

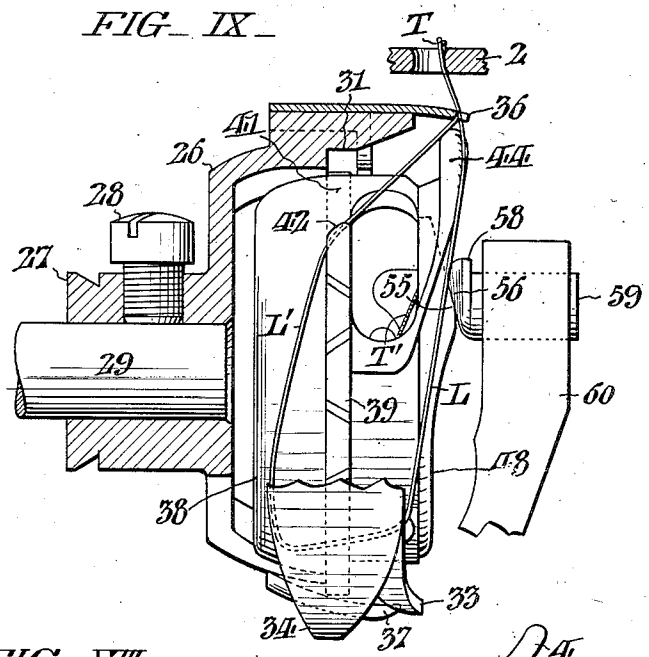
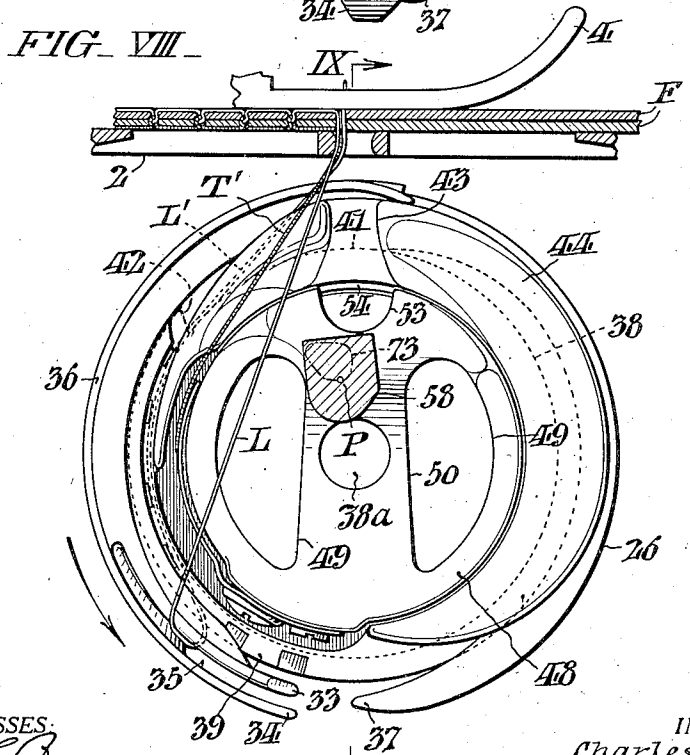



FIG. VIII




WITNESSES:
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BY

INVENTOR:
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Nov. 7, 1939. C. F. RUBEL 2,178,544

LOCK STITCH SEWING MACHINE

Filed Jan. 30, 1937 6 Sheets-Sheet 6

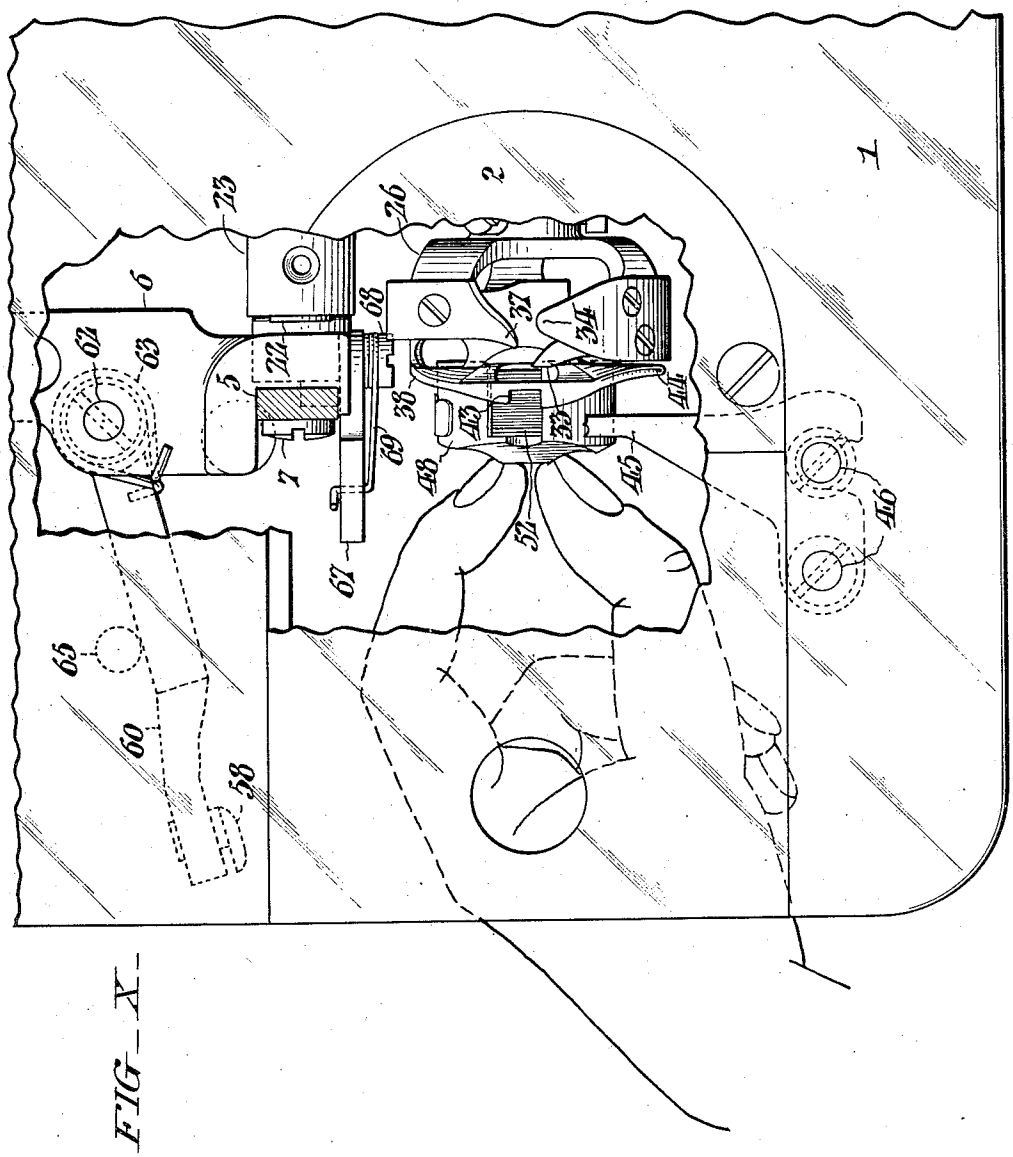



FIG. X.

WITNESSES:
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INVENTOR:
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BY Fraley & Paul
ATTORNEYS.

Patented Nov. 7, 1939 2,178,544

# UNITED STATES PATENT OFFICE

2,178,544

## LOCK STITCH SEWING MACHINE

Charles F. Rubel, Chicago, Ill., assignor to Union Special Machine Company, Chicago, Ill., a corporation of Illinois

Application January 30, 1937, Serial No. 123,180

43 Claims. (Cl. 112—181)

This invention relates to lock stitch sewing machines, that is to say, to sewing machines of the type wherein a complimental stitch-forming means including a rotary hook cooperates with a needle in producing lock stitch seams.

Ordinarily, in sewing machines of the sort referred to, the rotating component or rotary hook has an internal circumferential raceway or groove which is engaged, with a snug working fit, by a circumferential rib on a non-rotatively held bobbin case holder about which the hook revolves. Due to friction between the extensive bearing areas of the groove and the rib of the relatively rotating components of the complemental stitch-forming means, rapid wear takes place, particularly when the machines are operated at relatively high speeds, with attendant generation of excessive heat and development, after a short time, of a clearance between the sides of the groove and the rib, in which clearance the needle loop thread is pinched and severed as it crosses the groove in passing to the back of the bobbin case holder. When wear has taken place to the extent described, it is necessary to replace either the rotary hook or the bobbin case holder, or both, at very considerable expense.

The chief aim of my invention is to overcome the above contingencies, which objective I attain as hereinafter more fully disclosed, by purposely forming the groove in the hook wider than the rib on the bobbin case holder, so that the latter is permitted limited axial play normally with capacity to "float" freely while sustained solely at the periphery of its circumferential rib; and through provision of a moving steadying or buttressing element whereby said bobbin case holder is pressed inward and its axial play substantially taken up so that its rib is brought into close proximity to the inner wall of the hook groove through only a fraction of one of the two revolutions of the hook during each stitch-forming cycle, at the critical time when the inner limb of the needle loop passes in close proximity along the groove in its movement toward the back of the bobbin case holder. Obviously by relieving the bobbin case holder in this way for the greater part of the excursion of the rotary hook during each stitch-forming cycle, wear due to friction is minimized to such an extent as to not only add very considerably to the life of these parts, but to enable operation of lock stitch sewing machines at much higher speeds than possible heretofore. A further advantage of my improved construction is that it dispenses with the necessity either for means to lubricate the rotary hook, or the use of cooling means, which heretofore, were absolutely essential to the high speed operation of lock stitch sewing machines.

Another object of my invention is to secure the above advantages with a steadying member capable of functioning as a means for retaining the bobbin case within the bobbin case holder and capable moreover, of actuation by a reciprocating part of the machine mechanism.

Another object of my invention is to provide for adjustment of the steadying element to enable compensation for inaccuracies of manufacture as well as for wear when necessary.

Other objects and attendant advantages will appear from the following detailed description of the attached drawings, wherein

Fig. I is a fragmentary view in transverse section, of a lock stitch sewing machine conveniently embodying the present improvements.

Fig. II is a fragmentary view, in plan, of the work support of the machine, with a portion thereof broken out to expose the underlying parts of the machine mechanism.

Fig. III is a fragmentary sectional view on a larger scale, taken as indicated by the arrows III—III in Figs. I and II, axially through the rotary hook and the parts directly associated therewith.

Fig. IV is a fragmentary sectional view taken as indicated by the arrows IV—IV in Figs. II and III.

Fig. V is a fragmentary view in longitudinal section taken as indicated by the arrows V—V in Fig. II.

Fig. VI is a view corresponding to Fig. IV showing the rotary hook in the act of drawing the needle thread loop.

Fig. VII is a fragmentary view looking as indicated by the arrows VII—VII in Fig. VI.

Fig. VIII is a view like Fig. IV showing the rotary hook further advanced in its active rotation, with the needle thread loop fully drawn.

Fig. IX is a fragmentary view partly in elevation, and partly in section taken as indicated by the arrows IX—IX in Fig. VIII; and

Fig. X is a fragmentary view in plan on a larger scale corresponding to Fig. II, and showing the steadying element in retracted position, and the manner in which the bobbin case is removed for the purpose of thread replenishment.

With more detailed reference first more particularly to Figs. I and II of these illustrations, 1 designates the horizontal bed or work support of the sewing machine into which is set a throat plate 2. The needle of the machine is indicated at 3, the presser foot at 4, and feed dog by which

the fabric F (Figs. IV, VI and VIII) is progressed on said work support 1, at 5. By suitable means, not shown, the needle 3 is vertically reciprocated through the throat plate 2 incident to stitch formation in a manner well understood in the art. As shown, the feed dog 5 is secured, with provision for vertical adjustment, to the forward end of a horizontal feed bar 6 beneath the work support 1, by means of a screw 7. At its other end, the feed bar 6 has a pivotal connection at 8 with the top end of a rocker 9 which is secured to a rock shaft 10 supported for oscillation in pendant bracket lugs 11 of the work support. Through a strap link 12, the rocker 9 is actuated from an eccentric 13 on a rotary shaft 15 to impart horizontal to and fro or feed movements to the feed dog 5, said rotary shaft extending longitudinally of the machine beneath the work support and being journaled in suitable fixed bearings whereof one is indicated at 16 in Fig. II. The strap link 12 is of a type comprising telescoping parts 12*a*, 12*b* of which the former has a pivotal connection at 17 with the lower end of a suspension arm or "lazy bar" 18 fulcrumed at 19 to the end of another arm 20 on a regulating shaft 21 which is also suitably journaled beneath the work support 1. By angularly adjusting the shaft 21, the feed stroke of the feed dog can be increased or decreased or the action of said feed dog reversed after the manner set forth in U. S. Patent Number 2,113,572 granted to Norman V. Christensen and the present applicant on April 12, 1938. Up and down or lift movements are imparted to the feed dog 5 by means of a crank 22 at the forward end of the rotary shaft 15, through the medium of a drop link 23 which is pivotally connected at its lower end with a downward projection 24 of the feed bar 6. One of the characteristics of this type of feed mechanism is that adjustment for stitch length or for reversal is not attended by any change in the timing between the movements of the feed bar 6 and the needle 3.

Cooperating with the needle 3 below the work support 1 is the complemental stitch-forming mechanism with the construction and operation of which the present invention is more especially concerned, said mechanism being generally designated by the numeral 25. As shown, this complemental stitch-forming mechanism includes a rotating component or rotary hook 26 whereof the hub 27 is secured by means of set screws 28, to another longitudinal shaft 29, which, adjacent its forward end, is journaled in a bearing 30 beneath the work support 1. By suitable transmission means which may be of the form exemplified in the copending patent application supra, the shaft 29 is driven from the shaft 15 at multiplied speed so that said rotary hook 26 makes several revolutions (in this instance, two) for each reciprocation of the needle 3 during each stitch-forming cycle. The rotary hook 26 is generally of standard design, with a circumferential raceway or groove 31 internally of its cylindric body 32, a needle thread-seizing beak 33, a guard spur 34 overlying a receiving throat 35 for said loop, a thread-deflecting flange 36, and a loop-releasing tail 37. The non-rotating component of the complemental stitch-forming mechanism is in the illustrated instance a bobbin case holder designated 38 which is accommodated within the hollow of the rotary hook 26, and which like the latter, is generally of standard design, in that it is formed with a circumferential rib 39 externally of its cylindric body 40 for engaging the internal groove or raceway 31 of said hook. In accordance with my invention, however, the rib 39 is made substantially narrower in width than the groove 31 as a result of which the non-rotating component or bobbin case holder 38 is permitted to "float" normally, i. e., to freely shift axially within the limits of said groove while sustained solely at the periphery of its rib as shown in Fig. III. As ordinarily, the rib 39 of the bobbin case holder 38 is interrupted for a short distance as at 41 with consequent provision of a loop-clearing interval and a loop-arresting shoulder 42. The bobbin case holder 38 is prevented from rotating with the hook 26 due to engagement of a frontal vertical notch 43 at the top of its face flange 44 by the lateral projection of a detaining finger 45 secured to the underside of the work support 1 by screws 46, see Figs. I–III. Housed within the hollow of the holder 38 is a removable bobbin case 48 which is closed at the front except for a pair of vertical openings 49 at opposite sides of a central vertical bar 50. Extending inwardly from the bar 50 axially of the bobbin case 48 is a tubular boss 51 which freely engages a central stud 38*a* in the bobbin case holder 38, and which in turn constitutes a rotative bearing for the spool or bobbin 52. The bobbin case 48 is notched at the top as at 53 to engage a stop lug projection 54 internally of the holder 38, whereby it is restrained against rotation with the rotary component or hook 26. Near the top and at the front, the bobbin case 48 is formed, in accordance with my invention, with a beveled surface 55 for camming action with a correspondingly beveled surface 56 of a buttressing or steadying element 58 whereof the shank 59 is adjustable both longitudinally and rotatively in the upwardly inclined free end of a supporting arm 60, and securable in adjustable positions by a set screw 61. From Figs. I and II, it will be observed that the arm 60 underreaches the feed bar 6, and is fulcrumed on a screw stud 62 engaging upwardly into said bar. A torsion spring 63 with its coil surrounding the fulcrum hub of the arm 60, tends to swing said arm horizontally outward away from the bobbin case 48 to the retracted position shown in Fig. X against a stop 65 fixed in the work support 1. When the arm 60 is retracted as just described, it will be seen that the rotary hook is readily accessible for convenience in removing the bobbin case 48 when thread replenishment is necessary. Normally, however, the arm 60 is held in its operative position between vertically-spaced bracing lugs 66 on the downward projection 24 of the feed bar 6 in opposition to the influence of the spring 63, see Figs. I, II and V, by a hook detent or latch 67 which latter is pivoted at 68 to the front end of said projection. As shown in Fig. V, the hook detent 67 is yieldingly urged upwardly by a torsion spring 69 and limited in its upward movement through coaction of a flat 70 thereon with a shoulder 71 on the projection 24 of the feed bar 6. When, after thread replenishment, the arm 60 is swung inward from the retracted position shown in Fig. X, the latch 67 is automatically depressed through coaction of the bevel edge 72 at its free end with the bottom edge of said arm. Finally when the arm 60 is again lodged between the lugs 66 in the pendant projection 24 of the feed bar 6, the latch 67 is lifted by its spring 69 to the locking position shown in Fig. V. Release of the arm 60 is effected simply by pressing down the free end of

the latch 67 in a manner which will be obvious from Fig. V.

The stitch-forming cycle of the machine is as follows: By virtue of the connection of the steadying element 58 to the feed bar 6, the center P of its bearing surface 56 is moved in an irregular elliptic orbit as shown in dot and dash lines at 73 in Figs. IV, VI and VIII. At the beginning of the first revolution of the rotary hook 26 during each stitch-forming cycle immediately after the needle 3 has penetrated the fabric F, the needle thread T is engaged by the hook beak 33 and directed into the throat 35 by coaction of the guard spur 34 as shown in Fig. VI, with the rearwardly-deflected inner limb L' of the loop intercepted by the arresting shoulder of the rib 39 and resting on the surface of the holder body 40 crosswise of the groove 31 and with a portion *l'* thereof lying, as shown in Fig. VII, substantially parallel to the inner shoulder of said rib and the corresponding inner shoulder of said groove. If, in a rotary hook of ordinary construction a clearance substantially equal to the thickness of the needle thread exists at the region of the shoulder 42, the needle thread is pinched between the rib and the side of the groove and severed as the hook advances in its rotation. In the complemental stitch-forming means of my invention such contingency is precluded by positive maintenance of the rib 39 in close proximity or light bearing contact with the rear shoulder of the groove 31 at this critical period in the manner about to be explained. By light contact, I mean that the rear side face of the rib 39 is brought sufficiently close to the contiguous rear shoulder of the groove 31 to preclude entry and pinching of the loop thread between them. Contemporaneous with the events just described, the feed dog 5 is in its lowermost position and moving through its idle stroke as indicated by the arrow on the orbit ellipse 73 in Fig. VI, with the steadying element 58 bearing full upon the inclined surface 55 of the bobbin case 48, and hence with the inner shoulder of the rib 39 of the holder substantially in engagement with the inner shoulder of the hook groove 31 so that pinching of the needle thread T cannot possibly occur as heretofore. This condition obtains while the point P moves rightward along the short lower flat stretch of the orbit ellipse 73 (corresponding to substantially a quarter rotation of the shaft 15) and while the hook 26 makes substantially a half rotation from the moment of first engaging the needle thread T, through the position of Fig. VI, to the position of Fig. VIII when the needle thread loop is substantially full drawn. During this interval, the front limb L of the loop is drawn down over the front faces of the bobbin case holder flange 44 and the bobbin case 48, and the inner limb L' wrapped further about the cylindric body 40 of the bobbin case holder 38 as shown. As the hook 26 continues in its rotation from the position of Fig. VIII, the center P moves upward of the right hand end of the orbit ellipse 73, with attendant separation of the steadying element 58 from the beveled surface 55 of the bobbin case so that the front limb L of the needle thread T can pass between them as shown in Fig. IV as the loop is fully drawn. From then on, the steadying element 58 remains clear of the bobbin case 48 during the remainder of the active loop drawing rotation of the rotary hook as well as during the whole of the succeeding or idle rotation of the hook as the point P moves along the upper portion of its elliptic orbit, while the feed dog 5 performs its active stroke in progressing the fabric F on the work support 1 of the machine and incidentally determines the stitch length. In moving around the bobbin case holder 38, the needle thread loop is, of course, interengaged in the usual way with the bobbin thread which is indicated at T' in Figs. IV, VI and VIII. Thus, in accordance with my invention, the bobbin case holder 38 is restrained against axial movement only for a short period during the initial part of each stitch-forming cycle—to be exact, during less than a half revolution of the first rotation of the rotary hook in such cycle—so that said holder is normally free to float sustained solely on the periphery of its circumferential rib 39. This is obviously advantageous since it not only eases passage of the needle thread about the bobbin holder, but precludes overheating and rapid wear of the relatively rotating components of the cooperative stitch-forming means. As a consequence, the sewing machine can be safely operated at high speeds which were heretofore regarded as excessive. In this connection it is to be noted that the effective motion of the steadying element 58 results from the up and down component rather than from the horizontal component of movement of the feed bar. Accordingly the action of the element 58 will be the same during reversal of the feeding mechanism as in the normal operation of the latter. In other words, since the timing between the needle 3 and the feed bar 6 remains unchanged by adjustments of the feed mechanism for stitch length or for reversal as already pointed out hereinbefore, it also follows that the instant of taking up the axial play between the bobbin case holder and the rotary hook will always occur at the same time during each stitch forming cycle.

In order to facilitate spreading and casting of the needle thread loop toward the back of the bobbin case holder 38, the thread-arresting shoulder 42 of the rib 39 is cut back somewhat more than usual. Accordingly the loop-seizing beak 33 must travel somewhat further than ordinarily before the thread T is engaged by the shoulder 42, thereby allowing a little more time than ordinarily for the inner limb L' of the loop to be carried rearwardly and outwardly along the angularly receding inner edge of said beak, the loop being therefore spread wider and therefore more easily cast off.

When required to compensate for wear of the parts after long periods of service or to adapt the sewing machine for use of threads of different gauges, the steadying element 58 may be adjusted in the arm 60 upon loosening the set screw 61.

My invention is not necessarily restricted to the use of the feed mechanism of the sewing machine as a means for actuating the steadying element 58 to periodically restrain the bobbin case holder of the complemental stitch-forming means, since, if desired or found more convenient in practice, it may be coordinated with any other moving part of the machine mechanism and its cam face variantly shaped in order that it may function in the way herein set forth.

Having thus described my invention, I claim:

1. In a lock stitch sewing machine, stitch-forming mechanism including two relatively rotating components, said components being operatively interconnected with provision for limited endwise play; and moving means operative to

take up the end play between said components during a portion of each stitch-forming cycle.

2. In a lock stitch sewing machine, stitch-forming mechanism including two relatively rotating components, said components being operatively interconnected with provision for limited endwise play; and means operative to periodically engage one of said components for taking up the end play between it and the other component during a portion of each stitch-forming cycle.

3. In a lock stitch sewing machine, stitch-forming mechanism including a rotatable component and a non-rotatable component, said components being operatively interconnected with provision for limited endwise play; and means operative to periodically engage one of said components for taking up the end play between it and the other component during a portion of each stitch-forming cycle.

4. In a lock stitch sewing machine, stitch-forming mechanism including a rotatable component and a non-rotatable component, said components being operatively interconnected with provision for limited endwise play; and means operative to periodically engage the non-rotatable component for taking up the end play between it and the rotatable component during a portion of each stitch-forming cycle.

5. In a lock stitch sewing machine, stitch-forming mechanism including two relatively rotating components, one axially within the other, said components being operatively interconnected with provision for limited endwise play; and moving means operative to take up the end play between said components during a portion of each stitch-forming cycle.

6. In a lock stitch sewing machine, stitch-forming mechanism including two relatively rotating components, one axially within the other; and having a circumferential rib and groove interengagement with provision normally of limited endwise play; and means operative to periodically engage one of said components to maintain one side of the rib in bearing contact with the corresponding side of the groove during a portion of each loop-forming cycle.

7. In a lock stitch sewing machine, stitch-forming mechanism including two relatively rotating components, said components being operatively interconnected with provision for limited endwise play; and means operative to take up the end play between said components during the initial portion of each stitch-forming cycle.

8. In a lock stitch sewing machine, stitch-forming mechanism including two relatively rotating components, said components being operatively interconnected with provision for limited endwise play; a steadying element operative by camming action with one of said components to take up the end play existing between the latter and the other component during a portion of each stitch-forming cycle.

9. In a lock stitch sewing machine a needle; cooperative stitch-forming mechanism including a rotary hook and a non-rotatable bobbin case holder whereof one has a circumferential groove and the other a corresponding but narrower cooperating rib, whereby the two are held assembled with capacity for limited relative axial play normally; and means operative to positively maintain said elements against relative axial play, with a side of the rib on the one in engagement with the contiguous side wall of the groove in the other, during the interval in each stitch-forming cycle when the inner leg of the needle thread loop passes across said groove toward the back of the bobbin case holder.

10. In a lock stitch sewing machine, a needle; cooperative stitch-forming means including a rotary hook making several revolutions during each stitch-forming cycle, said hook having an internal circumferential groove, a non-rotative bobbin case holder with an external circumferential rib corresponding in diameter to that of the groove of the rotary hook but of a lesser width, whereby said holder normally has limited axial play, and a bobbin case within the holder; and a steadying element operative to press upon the bobbin case so that the back wall of the circumferential rib of the bobbin case holder bears upon the contiguous wall of the hook groove during a portion of one of the several revolutions of said hook at the time when the inner limb of the needle loop passes across said groove toward the back of the bobbin case holder.

11. In a lock stitch sewing machine, a reciprocating needle; cooperative stitch-forming mechanism including a non-rotatable component and a rotatable component making several rotations for each reciprocation of the needle during each stitch-forming cycle, said components being operatively interconnected with provision for limited endwise play; and means operative to take up the end play between said components during a portion of one revolution of the rotatable component.

12. In a lock stitch sewing machine, a reciprocating needle; cooperative stitch-forming mechanism including a non-rotatable component, and a rotatable component making several rotations for each reciprocation of the needle during each stitch-forming cycle, said components being operatively interconnected with provision for limited endwise play; and means operative to take up the end play between said components during a portion of the first revolution of the rotatable component during each stitch-forming cycle.

13. In a lock stitch sewing machine, feed mechanism; stitch-forming mechanism including two relatively rotating components, said components being operatively interconnected with provision for limited endwise play; and means deriving motion from the feed mechanism operative to take up the end play between said components during a portion of each stitch-forming cycle.

14. In a lock stitch sewing machine, feed mechanism; stitch-forming mechanism including two relatively rotating components, said components being operatively interconnected with provision for limited endwise play; and means deriving motion from the feed mechanism operative to take up the end play between said components during the initial portion of each stitch-forming cycle.

15. In a lock stitch sewing machine, a feed dog and means for reciprocating it once for each stitch-forming cycle; stitch-forming mechanism including a non-rotatable component, and a rotatable component making several rotations during each stitch-forming cycle, said components being operatively interconnected with provision for limited endwise play; and means connected to the feed mechanism and operative to take up the end play between said components during a portion of one of the revolutions of said rotatable component during each stitch-forming cycle.

16. In a lock stitch sewing machine, a feed dog and means for reciprocating it once for each stitch-forming cycle; stitch-forming mechanism

including a non-rotatable component and a rotatable component making several rotations during each stitch-forming cycle, said components being operatively interconnected with provision for limited endwise play; and means connected to the feed mechanism and operative to take up the end play between said components during a portion of the first revolution of said rotatable component during each stitch-forming cycle.

17. In a lock stitch sewing machine, a needle; cooperating stitch-forming means including a rotary hook with an internal circumferential groove, a non-rotatable bobbin case holder within the rotary hook having an external circumferential rib corresponding in diameter to the groove of said hook but of a lesser width, whereby the bobbin case holder normally has limited axial play, and a bobbin case within the holder; a retractable element for maintaining the bobbin case in place within the holder; and means for periodically actuating said element to press against the bobbin case so that the back wall of the circumferential rib of the bobbin case holder bears upon the contiguous wall of the hook groove during a portion of each stitch-forming cycle.

18. In a lock stitch sewing machine, stitch loop forming mechanism including two relatively rotating coaxial components normally out of endwise bearing contact; and means for bringing said components into endwise bearing contact during a portion of each stitch loop forming cycle to insure against entry and pinching of the loop thread between them.

19. In a lock stitch sewing machine, stitch loop forming mechanism including two relatively rotating coaxial components, one having a circumferential rib and the other a circumferential rib receiving groove which is somewhat wider than the rib for allowance of a limited amount of endwise play between said components normally; and means for bringing said components into endwise bearing contact during a portion of each stitch loop forming cycle to insure against entry of the loop thread and pinching thereof between contiguous side faces of the rib and the groove.

20. In a lock stitch sewing machine, stitch-forming mechanism including a rotary hook, a non-rotating bobbin case holder within the rotary hook, and a bobbin case within said holder, said hook and bobbin case holder being interconnected with provision for limited endwise play; a steadying element adapted to coact with the front face of the bobbin case in taking up the end play between the bobbin case holder and the rotary hook during a portion of each stitch-forming cycle; and actuating means supporting said steadying element with capacity to be retracted out of the way for freedom of access to the bobbin case for the purpose of thread replenishing.

21. In a lock stitch sewing machine, stitch-forming mechanism including a rotary hook, a non-rotating bobbin case holder within the rotary hook, and a bobbin case within said holder, said hook and bobbin case holder being interconnected with provision for limited endwise play; a steadying element adapted to coact with the front face of the bobbin case in taking up end play between the bobbin case holder and the rotary hook during a portion of each stitch-forming ing cycle; and actuating means pivotally supporting said steadying element with capacity to be swung to a retracted position for freedom of access to the bobbin case for the purpose of thread replenishing.

22. In a lock stitch sewing machine, stitch-forming mechanism including a rotary hook, a non-rotating bobbin case holder within the rotary hook, and a bobbin case within said holder, said hook and bobbin case holder being interconnected with provision for limited endwise play; a steadying element adapted to coact with the front face of the bobbin case in taking up the end play between the bobbin case holder and the rotary hook during a portion of each stitch-forming cycle; actuating means supporting said steadying element with capacity to be retracted out of the way for freedom of access to the bobbin case for the purpose of thread replenishing; spring means tending to move the steadying element to its retracted position; and latch means to normally maintain said element in its operative position.

23. Lock stitch mechanism for a sewing machine comprising a pair of relatively rotating components normally out of endwise contact; a bobbin case within one of said components; and means for retaining the bobbin case in the last mentioned of said components and operative to intermittently bring the two components into endwise bearing contact so as to prevent entry of thread between their contiguous side faces.

24. Lock stitch mechanism for sewing machines comprising a rotating component and a non-rotating component normally out of endwise bearing contact; a bobbin case within the non-rotating component; and means for retaining the bobbin case within the non-rotating component and operative to intermittently bring the two components into endwise bearing contact so as to prevent entry of thread between their contiguous side faces.

25. In a lock stitch sewing machine, stitch loop forming mechanism including two coaxial components, one of which rotates in relation to the other without constant endwise bearing contact and means for establishing such an endwise bearing contact between the relatively rotating elements once during each cycle of stitch formation.

26. In a lock stitch sewing machine, stitch-forming mechanism including a rotating component with a circumferential shoulder; a non-rotating component with a circumferential rib which is interrupted to provide a needle loop detaining horn; and a member for limiting outward axial play of the non-rotating component so that its rib is normally out of contact with the circumferential shoulder of the rotating component; said member having a single spot projection between which and the non-rotating component, one limb of the needle loop is adapted to pass.

27. In a lock stitch sewing machine, stitch-forming mechanism including a rotating component with a circumferential shoulder; a non-rotating component with a circumferential rib which is interrupted to provide a needle loop detaining horn; and a member for limiting outward axial play of the non-rotating component so that its rib is normally out of contact with the circumferential shoulder of the rotating component, said member having a single spot projection lying substantially in the vertical plane of the axis of the rotating component, between which projection and the non-rotating component, one limb of the needle loop is adapted to pass.

28. In a lock stitch sewing machine, stitch-forming mechanism including a rotating component with a circumferential shoulder; a non-

rotating component with a circumferential rib which is interrupted to provide a needle loop detaining horn; a member for limiting outward axial play of the non-rotating component so that its rib is normally out of contact with the circumferential shoulder of the rotating component, said member having a single spot projection between which and the non-rotating component, one limb of the needle loop is adapted to pass; and means for imparting orbital movement to said projection in a plane parallel to that of the non-rotating component.

29. In a lock stitch sewing machine, stitch-forming mechanism including a rotating component with an internal circumferential groove; a non-rotating component with a circumferential rib engaging the groove of the rotating component, said rib being interrupted to provide a needle loop detaining horn and being narrower than the groove so that it is normally out of contact with both sides of said groove; and a member for limiting outward axial play of the non-rotating component, said member having a single spot projection between which and the non-rotating component, one limb of the needle loop is adapted to pass.

30. In a lock stitch sewing machine, stitch-forming mechanism including a rotary hook with an internal circumferential groove; a non-rotating bobbin case holder with a circumferential rib which is interrupted to provide a needle loop detaining horn and which is narrower than the groove; a bobbin case within the bobbin case holder; and a member for limiting outward axial play of the bobbin case holder so that the rib of the latter is normally out of contact with both sides of the groove in the rotary hook, said member having a single spot projection between which and the front face of the bobbin case, one limb of the needle loop is adapted to pass.

31. In a lock stitch sewing machine, stitch-forming mechanism including a rotating component with an internal circumferential groove; a non-rotating component with a circumferential rib which is interrupted to provide a needle loop detaining horn and which is narrower than the groove; a member for limiting outward axial play of the non-rotating component so that its rib is normally out of contact with both sides of the groove in the rotating component, said member having a single spot projection between which and the non-rotating component one limb of the needle loop is adapted to pass; and means for imparting orbital movement to said member in a plane parallel to that of the bobbin case holder.

32. In a lock stitch sewing machine, stitch-forming mechanism including a rotary hook with an internal circumferential groove; a rotating bobbin case holder with a circumferential rib which is interrupted to provide a needle loop detaining horn and which is narrower than the groove a bobbin case within the bobbin case holder having a cam surface on its front face; and a member for limiting outward axial play of the bobbin case holder so that the rib of the latter is normally out of contact with both sides of the groove in the rotary hook, said member having a single spot projection between which and the cam surface on the bobbin case, one limb of the needle loop is adapted to pass.

33. In a lock stitch sewing machine, stitch-forming mechanism including a rotary hook with an internal circumferential groove; a non-rotating bobbin case holder with a circumferential rib which is interrupted to provide a needle loop detaining horn and which is narrower than the groove; a bobbin case within the bobbin case holder having a cam surface on its front face; a member for limiting outward axial play of the bobbin case holder so that the rib of the latter is normally out of contact with both sides of the groove in the rotary hook, said member having a single spot projection between which and the cam surface on the bobbin case, one limb of the needle loop is adapted to pass; and means for imparting orbital movement to said member in a plane parallel to that of the bobbin case holder.

34. In a lock stitch sewing machine, a reciprocating needle; complemental stitch-forming means including a rotating component adapted to revolve twice for each reciprocation of the needle and having a circumferential shoulder, and a non-rotating component with a circumferential rib which is interrupted to provide a needle loop detaining horn; and a member for limiting outward axial play of the non-rotating component, said member having a single spot projection between which and the non-rotating component, one limb of the needle loop is adapted to pass, said spot projection lying in a vertical plane through the axis of the rotating component at a level above the latter.

35. In a lock stitch sewing machine, a reciprocating needle; complemental stitch-forming means including a rotating component adapted to revolve twice for each reciprocation of the needle and having a circumferential shoulder, and a non-rotating component with a circumferential rib which is interrupted to provide a needle loop detaining horn; a member for limiting outward axial play of the non-rotating component, said member having a single spot projection lying in a vertical plane through the axis of the rotating component at a level above the latter between which spot projection and the non-rotating component, one limb of the needle loop is adapted to pass; and means for imparting orbital movement to said member in a plane parallel to that of the non-rotating component.

36. In a lock stitch sewing machine, a reciprocating needle; complemental stitch-forming means including a rotary hook adapted to revolve twice for each reciprocation of the needle and having a circumferential groove, a non-rotating bobbin case holder with a circumferential rib which is interrupted to provide a needle loop detaining horn and which is narrower than the groove, and a bobbin case within the bobbin case holder having a cam surface on its front face; a member for limiting outward axial play of the bobbin case holder so that the rib of the latter is normally out of contact with both sides of the groove in the rotary hook, said member having a single spot projection between which and the cam surface on the bobbin case, one limb of the needle loop is adapted to pass; and means for imparting orbital movement to said member in a plane parallel to that of the bobbin case holder.

37. A lock stitch sewing machine with stitch-forming mechanism including a hollow rotary hook component and a non-rotating bobbin holder component within the hook component, said components having opposing circumferential shoulders normally out of contact; and periodically actuated abutment means operative upon one of said components to cause rapidly recurring light momentary contacts between the shoulders.

38. A lock stitch sewing machine with stitch-

forming mechanism including a hollow rotary hook component and a non-rotating bobbin holder component within the hook component, said components having opposing circumferential shoulders normally out of contact; and periodically actuated abutment means operative upon one of said components to cause light momentary contact between the shoulders at a time in each stitch-forming cycle when the tendency of the needle thread to enter between said shoulders is greatest.

39. A lock stitch sewing machine with stitch-forming mechanism including a hollow rotary hook component and a non-rotating bobbin holder component within the hook component, said components having opposing circumferential shoulders normally out of contact; and intermittently actuated abutment means operative upon one of said components to cause rapidly recurring light momentary contacts between the shoulders, said abutment means occupying a retracted position relative to said one component at the time when the needle thread passes between the contact surfaces of said abutment means and said one component.

40. A lock stitch sewing machine with stitch-forming mechanism including a rotary component and a non-rotating component having capacity for relative axial play; and moving means for periodically reducing the axial play between said components.

41. A lock stitch sewing machine including a reversible feeding mechanism; stitch-forming mechanism comprising a rotary component and a non-rotating component having capacity for relative axial play; and means deriving motion from the reversible feeding mechanism for periodically reducing and substantially taking up the axial play between said components.

42. A lock stitch sewing machine comprising a needle; feeding mechanism including a moving member, means for actuating the moving member, and means whereby the movements of the member may be adjusted for variation of stitch length without change in the timing thereof in respect to the movements of the needle; complemental stitch forming mechanism including two relatively rotatable components which have capacity for limited axial play; and means connected to the moving member of the feeding mechanism for taking up the axial play between the aforesaid components during a portion of each stitch forming cycle.

43. A lock stitch sewing machine comprising a needle; feeding mechanism including a moving member, means for actuating the moving member, and means whereby the movements of the member may be reversed without change in the timing of said member in respect to the movements of the needle; complemental stitch forming mechanism including two relatively rotatable components which have capacity for limited axial play; and means connected to the moving member of the feeding mechanism for taking up the axial play between the aforesaid components during a portion of each stitch forming cycle.

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