Sept. 24, 1963 J. R. IOANNILLI 3,104,634

LOOPTAKERS AND THREAD CASE CONSTRUCTION

Filed May 3, 1962

3 Sheets-Sheet 1

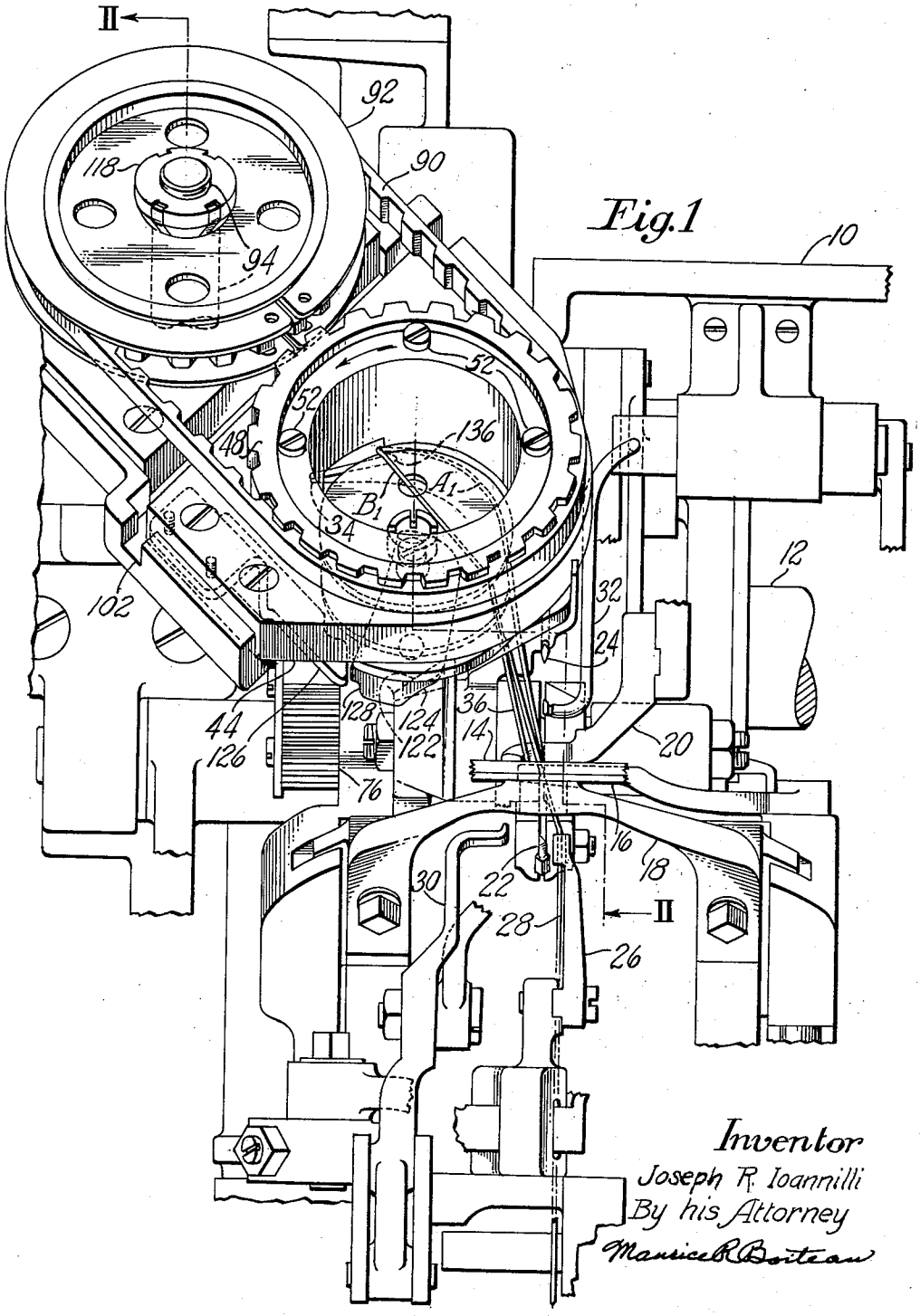

Fig.1

Inventor
Joseph R. Ioannilli
By his Attorney
Maurice R Bouteau

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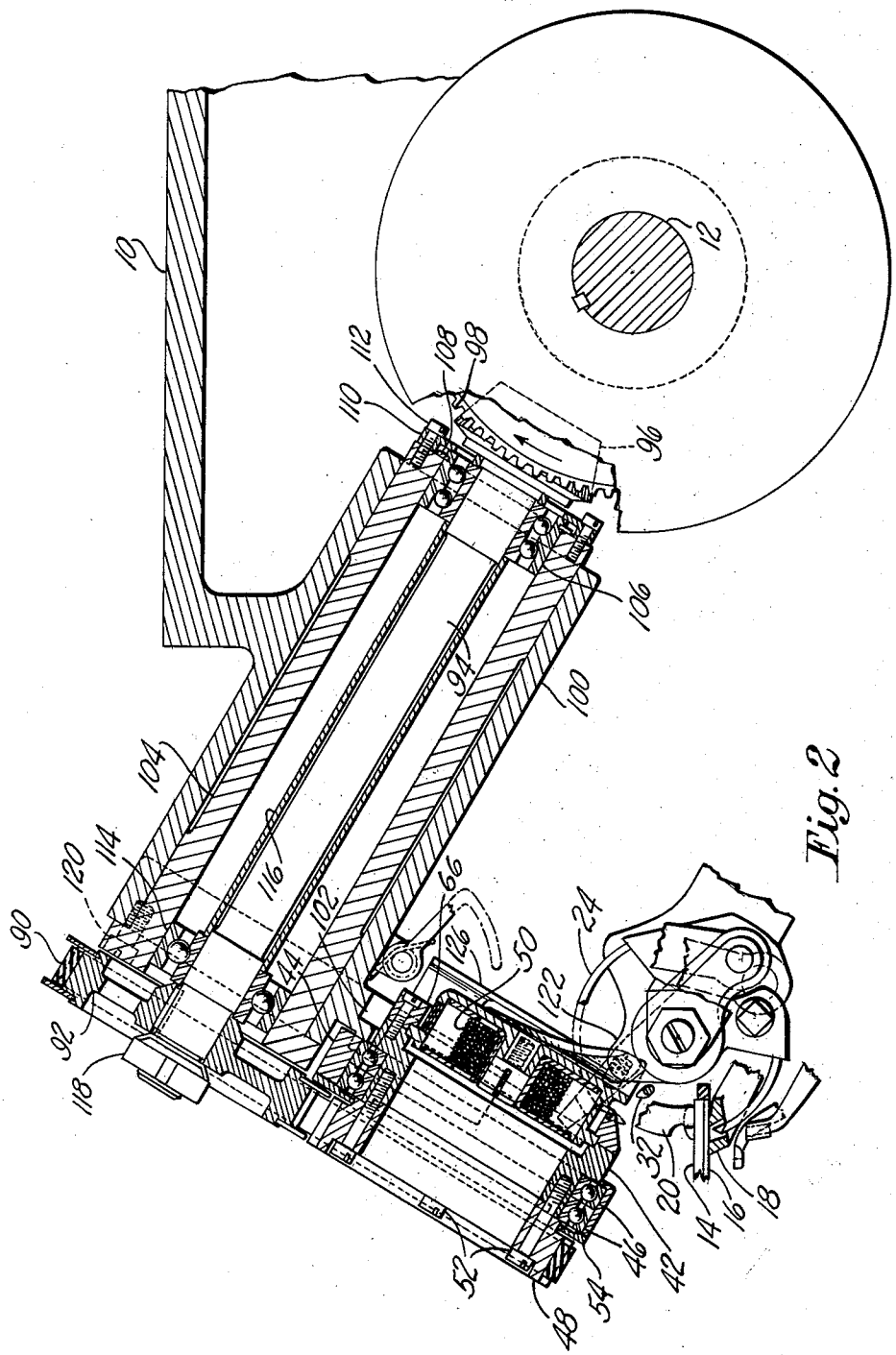

Fig. 2

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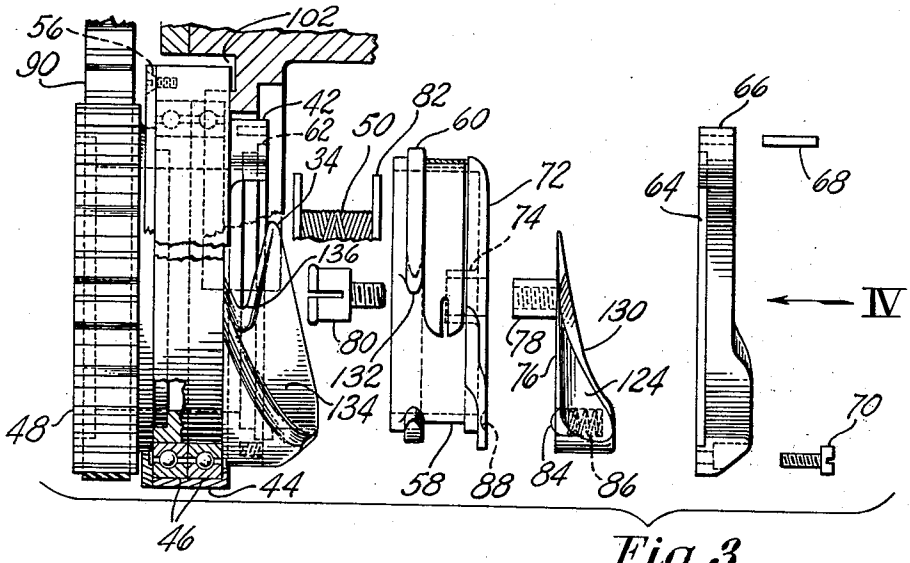

Fig. 3

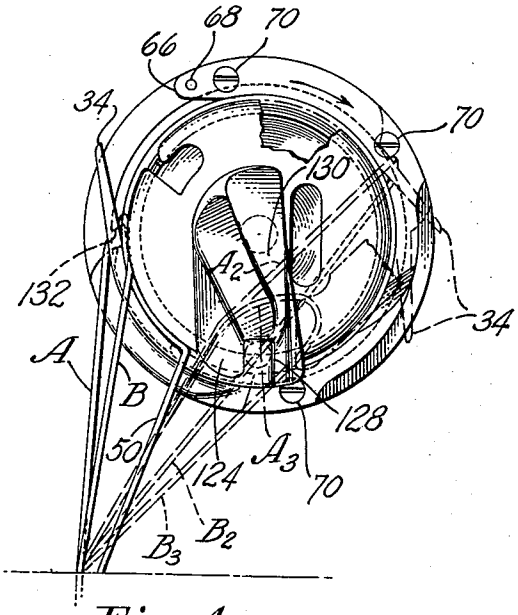

Fig. 4

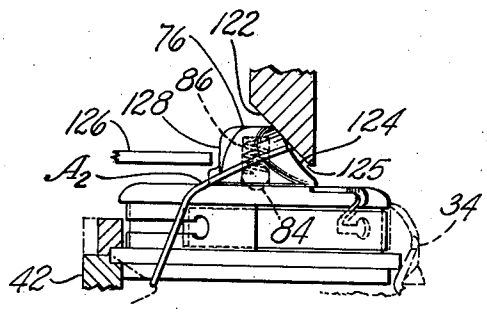

Fig. 5

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3,104,634 LOOPTAKERS AND THREAD CASE CONSTRUCTION

Joseph R. Ioannilli, Beverly, Mass., assignor to United Shoe Machinery Corporation, Boston, Mass., a corporation of New Jersey

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8 Claims. (Cl. 112—38)

This invention relates generally to improvements in lock stitch shoe outsole sewing machines or stitchers and more particularly to an improved looptaker and locking thread case construction for such machines.

A well known form of outsole stitcher comprises a curved hook needle and a looptaker in the form of a rotary hook for casting loops of thread withdrawn from the work by the needle about a stationary locking thread case inside the rotary hook to form stitches. In the conventional form of stitcher the rotary hook is journaled in a split raceway and driven by gears two or three revolutions during each sewing cycle. The thread case is retained against rotation by a pair of alternately engaging reciprocating pins slidable in a stationary casing. The pins enter notches in the thread case and are alternately withdrawn to permit passage of the needle loop. The rotary hook and thread case construction included in such conventional stitchers suffers from inadequate lubrication, an excessive rate of wear, noisy operataion and most importantly, a limitation on sewing speeds.

An important object of the present invention is accordingly to increase attainable sewing speeds of outsole stitchers.

A related object is to extend substantially the useful life of outsole stitchers operated at higher speeds than have heretofore been attained.

Another object is to achieve economy in the manufacture of outsole stitchers by reducing the number and complexity of especially produced component parts.

Still another object is the reduction of noise and vibration attending the high speed operation of outsole stitchers.

An important object is to improve the manner in which the needle thread is handled by the thread manipulating instrumentalities of stitchers so that the thread is not unduly weakened during stitch formation.

According to a feature of the present invention the locking thread case is retained against rotation by a nose connected to the case by a releasable detent. The nose is engaged by a fixed abutment member and as a result moving retainers such as the reciprocating pins described in connection with conventional machines are thus entirely eliminated. The nose is formed with a surface over which the thread passes as the needle loop is being expanded by the rotary hook. The contour of the nose is also such that it defines with the abutment member a tapered passage into which one leg of the needle loop is guided during expansion of the needle loop with minimum abrasion and stress being applied to the thread. The detent connecting the nose to the thread case is releasable to permit the thread case to revolve with the rotary hook without damage in the event that lint and thread fiber accumulations or other obstructions cause binding together of the hook and case.

Cooperating with the featured retainer arrangement is an improved mounting and drive for the rotary hook according to another feature of the invention. In the present machine the rotary hook is mounted on ball bearings and driven with little noise or vibration in timed relation with other instrumentalities of the machine by a flexible cogged belt. The combination of the improved mounting and drive for the rotary hook greatly enhances the performance of the thread case retainer construction by reducing eccentricity in rotary hook motion. Such eccentricity would be particularly objectionable because of the tendency to abrade the needle thread repeatedly as it passes between the nose and abutment because at this point the eccentricity is translated into a reciprocating rubbing motion.

The objects and features as well as numerous advantages of the present invention will be realized from a detailed description of an illustrative embodiment taken in connection with the accompanying drawings in which,

FIG. 1 is a fragmentary view in front elevation of an outsole stitcher including a thread case and rotary hook mounted and driven according to the present invention;

FIG. 2 is a view in cross section taken along the line II—II of FIG. 1 and particularly depicting details of the rotary hook drive;

FIG. 3 is a view of parts of the rotary hook and locking thread case shown in FIGS. 1 and 2, here depicted in exploded relationship;

FIG. 4 is a view of the rear of the rotary hook and thread case assembly of FIG. 3, as viewed from the direction of the arrow IV of FIG. 3; and

FIG. 5 is a view of the side of the thread case in which the rotary hook and thread case retainer abutment are fragmentarily illustrated in cross section.

The present invention is embodied in a machine comprising a frame **10** shown fragmentarily in FIGS. 1 and 2 in which is journaled a sewing shaft **12** for operating work feeding and stitch forming instrumentalities of the machine. A work piece illustrated in FIG. 1 as consisting of an outsole **14** and a welt **16** rests on a work support **18** and is clamped by a presser foot **20**, the work support and presser foot comprising a work clamp while being pierced by an awl **22** to form an opening for a curved hook needle **24**. To form stitches the needle **24** penetrates through the work piece **14**, **16** passing through an opening previously formed by the awl **22** and is threaded by a looper **26** which has previously laid the needle thread indicated at **28** behind a thread finger **30** for thread storage to be released later in the sewing cycle as the needle is withdrawn from the work. As the needle is being withdrawn the loop of thread which it carries is opened by a loop spreader **32** for entry of a looptaker or rotary hook beak **34**. The thread handling, work piercing and work feeding devices described thus far are constructed and arranged in a conventional manner and form no part of the present invention which is directed more particularly to the means for interlocking the needle thread **28** with a locking thread **36** as will now be described. It will also be appreciated that for purposes of the present invention work feed may be accomplished either continuously or intermittently by the work clamp, the awl, the needle or a combination of these.

For interlocking the threads **28**, **36** there is provided a looptaker body **42** rotatably mounted on a supporting plate **44** by means of thin-race ball bearings **46**. The beak **34** is integral with the body **42** which at its outer end is connected to an annular pulley **48** providing a central passage for replenishment of a locking thread supply **50** as will be explained. The central opening of the pulley **48** is counterbored at its outer end and the inner end of the pulley is of reduced diameter to clamp the inner races of the bearings **46** against a shoulder on the body **42**, clamping pressure being applied by screws **52** passing loosely through the pulley and engaging the threads of tapped holes in the looptaker body. The outer races of the bearings **46** are seated in a counterbored opening in the plate **44** and are clamped therein by a thin retainer **54** which coincides in shape with the plate **44** and is secured to the plate by means of screws one of which is shown at **56** in FIG. 3.

Fitted inside the looptaker body **42**, as best shown in

FIGS. 3 to 5 inclusive, is a cup shaped thread case 58 formed with an interrupted flange 60 which engages a guideway 62 machined partly in the looptaker body and complemented by a portion 64 formed in an arcuate keeper 66. The thread case in the looptaker assembly is free to remain stationary as the looptaker is rotated about it. The keeper 66 is pinned to the body 42 by a dowel 68 and retained in position by three screws 70.

The thread case 58 includes an end wall surface 72 and an integral perforated stud 74. A retainer nose 76 formed with a cylindrical shank 78 is received loosely within the stud 74 and is held in place by a screw 80 having an enlarged slotted head which, with the outside of the stud 74, serves as a guide and retainer for a locking thread spool 82. The nose 76 is tapered from a thin section coinciding with the central portion of the thread case to a section of maximum thickness at the periphery of the thread case. In the thickest portion there is formed an opening in which is received a ball 84 backed by a compression spring 86. The ball 84 enters a spherical depression or socket 88 in the surface 72, the ball and socket comprising a detent arrangement which cooperates with means to be described to hold the thread case against rotation with the looptaker under normal operating conditions but releases the thread case to revolve with the looptaker in the event that an obstruction causes binding of the thread case to the looptaker.

Passing over the pulley 48 is a flexible cogged belt 90 driven by a flanged pulley 92 mounted on an inclined intermediate shaft 94. The cogs on the belt 90 enter grooves in the pulley 48 and 92 to maintain the proper time relationship between the looptaker and the other instrumentalities of the machine. At its inner end the shaft 94 carries a bevel gear pinion 96 meshing with a gear 98 keyed to the sewing shaft 12. The tooth ratio of the pinion 96 and the gear 98 is 1 to 3 so that the beak 34 of the looptaker is driven through three complete revolutions for each revolution of the sewing shaft 12.

The support for the shaft 94 is designed both for ease and economy of manufacture and for convenience and accessibility for maintenance. To this end the frame 10 is formed with an integral hollow extension 100 terminating at its outer end in a shelf 102, to which the plate 44 is fixedly secured. Received within the extension 100 is a headed sleeve 104 in which the shaft is journaled and which may be readily removed from the machine for replacement of component parts and for adjustment. The shaft 94 is rotatable at its inner end in a double row thrust ball bearing 106, having a snap ring 108 entering a groove in its outer race to act as a shoulder. The outer race is fixedly secured in the sleeve 104 by a clamp ring 110 through which loosely pass screws 112 engaging the threads of tapped holes in the sleeve. At its outer end the shaft 94 rotates in a ball bearing 114, the outer race of which is pressed into the bore of the sleeve 104. The inner races of the bearings 106, 114 are clamped in position on the shaft 94 by a tubular spacer 116 and a nut 118 threaded on the outer end of the shaft. Screws 120 clamp the sleeve 104 to the frame extension 100 and are quickly removed for withdrawal of the sleeve in order to replace or adjust the pinion 96, or the bearings 106 and 114.

The thread case is retained against rotation with the looptaker by an upward projection 122, seen in FIGS. 1 and 2, which engages a sloping lead surface 124 of the nose 76, best seen in FIGS. 1 and 5. Defined between the nose and the projection 122 is a tapered passage 125 (FIG. 5), into which the needle loop enters after having been passed about the thread case in order to be released from the case as the needle loop is being contracted by conventional takeup action. In order to retain the thread case against rotation in the reverse or clockwise direction, as seen in FIG. 1, in the event that the operator should turn the shaft 12 manually in the reverse direction, a retainer finger 126 is fixedly secured to the underside of the shelf 102, and engages a generally vertical surface 128 opposite the surface 124 on the retainer nose. The normal spacing between the finger 126 and the surface 128 is sufficient to permit a slight oscillatory motion of the thread case as the needle loop is drawn between the surfaces 122 and 124.

The nose 76 as seen in FIGS. 2 and 3, is formed with a concave differentially tapered back surface 130. Such a configuration is advantageous in affording a high degree of control over the flow of the needle loop as will be appreciated from the showing of FIGS. 1 and 4 in which the forward leg of the needle loop at the time of entry of the beak 34 into the loop is identified by the reference character A and the rearward leg at the same time is identified by the reference character B. In conventional manner the flange 60 of the present thread case is undercut to form a hook 132 in the path of the needle loop, and the beak 34 is formed with a tapered ledge 134 extending from a throat 136 to the inner end of the looptaker for controlling the expansion of the needle loop. The hook 132 causes the leg A to flow over the closed back surface 72 of the thread case while the leg B flows over the open front of the case so that the loop is given a half twist in the process of passing over the thread case. As will be seen in FIG. 1 which represents maximum expansion of the needle loop the leg B here denoted as B_1 has assumed a chordal position across the open end of the thread case and the leg A here denoted as A_1 extends from the looptaker throat 136 over the ledge 134. As the beak 34 continues to rotate, the leg A_1 drops off the ledge 134 and because of the shape of the back surface 130 of the nose continues to lag behind the leg B. The relative positions of the legs after the leg A, has dropped off the ledge 134, are illustrated in FIG. 4 in which symbols B_2 and A_2 are applied to the legs extending over the open and closed ends of the thread case respectively at a time when the needle loop is starting to be contracted by takeup action. Shown as A_3 and B_3 in FIG. 4 are the legs A_2 and B_2 after the loop has been further contracted by the takeup and as the needle thread has advanced into the passage between the surfaces 122 and 124. Because there remains a degree of friction in the mounting of the flange 60 within the guideway 62, 64 the thread case tends to rotate with the looptaker and this tendency normally maintains the nose 76 in abutment with the projection 122. With continued takeup action after the needle loop has passed the position A_3, B_3, the thread passes between the finger 126 and the surface 128 and wedges the sloping lead surface 124 away from the projection 122 to escape. At this point the needle loop surrounds the locking thread 50 and the loop continues to contract for setting the thus-formed thread lock within the outsole 14.

The surface 130 affords a higher degree of uniformity in the timing of the needle loop release from the beak 34 than has heretofore been possible. This improvement in loop release timing enhances the accuracy of thread measurement in the present machine and results in more uniform placement of thread locks in the work piece. It will be appreciated from comparing the position of the leg A_2 in FIG. 4 with the profile of the nose 76 as seen in FIG. 3 that at this time the leg A_2 has progressed along a very gradual taper of the surface 130 and is retarded so that it lags the leg B_2 by the much steeper taper toward which it is flowing. This lag of the leg A_2 provides a slight excess of thread to assure uniformity of release of the needle loop after the beak 34 has moved past the position of maximum loop extension and the leg A has fallen off the ledge 134. Another advantage inherent in the contour of the surface 130 is the fact that the leg A_2 lies over a minimum thickness of the nose 76 so that in effect the presence of the nose does not add appreciably to the thread requirement of the loop and consequently has an insignificant effect on thread wear attributable to

repeated passage of successive thread portions through the work piece.

Although the present thread case retaining arrangement will function satisfactorily with a split raceway mounted, gear-driven looptaker when the machine is new and there is little eccentricity or looseness in the looptaker motion or in the support of the thread case within the looptaker, special care is necessary to minimize thread abrasion and wear as the needle loop passes between the surface **122** and the projection **124**. As has already been generally indicated, any eccentricity in the rotation of the looptaker is translated into a reciprocating, sawing motion of the nose **76** against the projection **124**. Accordingly, the bearings **46** upon which the looptaker is rotatably supported and the flexible shock absorbing upwardly biasing character of the drive provided by the belt **90** by assuring continued concentricity of looptaker rotation over an extended useful life contribute materially to the success of the present thread case retainer arrangement over an extended period of machine utilization. In addition, because the bearings **46** may include a quantity of sealed-in lubricant, wear is minimized without the risk of soiling the work piece.

Other advantages of the present construction may be seen from FIG. 1 in which it will be observed that the axis of rotation of the looptaker is displaced laterally from the plane of the needle and the lower corner of the plate **44** has been cut away to provide an unobstructed view of the sewing point to the operator without increasing the thread requirement of the needle loop. Another advantage lies in the fact that the line of centers of the pulleys **48** and **92** is inclined approximately 45° from the vertical, thereby removing the shaft **94** and the gearing **96**, **98** from the most congested area directly behind the sewing point, an important factor in simplifying actuating connections for the needle, the awl and the work clamping instrumentalities, particularly in a single shaft machine in which the present invention is embodied.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a lock stitch shoe outsole sewing machine having a work support, stitch forming and thread manipulating instrumentalities including a hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an inner end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose on the outside of the end wall of the thread case, fixed abutment means engaging the nose to retain the thread case against rotation, and driving means including a cogged belt for continuously rotating the looptaker in timed relation with the needle and other stitch forming and thread manipulating instrumentalities.

2. In a lock stitch shoe outsole sewing machine having a sewing shaft, a work support, stitch forming and thread manipulating instrumentalities including a curved hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an inner end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose on the outside of the end wall of the thread case, fixed abutment means engaging the nose to retain the thread case against rotation in either direction, an inclined shaft driven by the sewing shaft and a cogged belt for continuously rotating the looptaker in timed relation to the sewing shaft.

3. In a lock stitch shoe outsole sewing machine having a sewing shaft, a work support, stitch forming and thread manipulating instrumentalities including a curved hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an inner end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose on the outside of the end wall of the thread case, abutment means engaging the nose to retain the thread case against rotation and defining with the nose a tapered passage for the loops, an inclined shaft driven by the sewing shaft and a cogged belt connecting the inclined shaft and the looptaker for continuously rotating the looptaker in timed relation to the sewing shaft.

4. In a lock stitch shoe outsole sewing machine having a horizontal work support, stitch forming and thread manipulating instrumentalities including a hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose on the outside of the end wall of the thread case, detent means releasably coupling the nose to the thread case under conditions of normal torque and abutment means engaging the nose to retain the thread case against rotation.

5. In a lock stitch shoe outsole sewing machine having a horizontal work support, stitch forming and thread manipulating instrumentalities including a hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose pivotally mounted concentrically with the looptaker on the outside of the end wall of the thread case, detent means releasably coupling the nose member to the thread case under conditions of normal torque and abutment means engaging the nose to retain the thread case against rotation.

6. In a lock stitch shoe outsole sewing machine having a horizontal work support, stitch forming and thread manipulating instrumentalities including a hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose pivoted on the outside of the end wall of the thread case, detent means including a socket formed in the end wall and a spring pressed ball in the nose engaging the socket for releasably coupling the nose to the thread case under conditions of normal torque and abutment means engaging the nose to retain the thread case against rotation.

7. In a lock stitch shoe outsole sewing machine having a horizontal work support, stitch forming and thread manipulating instrumentalities including a hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose releasably coupled to the outside end wall of the thread case, the nose being formed with a concave surface over which the needle loop flows in being passed about the thread case, and an abutment means engaging the nose to retain the thread case against rotation.

8. In a lock stitch shoe outsole sewing machine having a horizontal work support, stitch forming and thread manipulating instrumentalities including a hook needle for withdrawing from the work, carrying loops of needle thread, a cup shaped thread case having an end wall and enclosing a supply of locking thread, and a rotary looptaker formed with a beak for entering and passing the needle thread loops about the thread case, the combination of a nose releasably coupled to the outside end wall of the thread case, the nose being formed with a concave surface over which the needle loop flows in being passed

about the thread case and a sloping lead surface and a projection engaging the nose to retain the thread case against rotation and defining with the sloping lead surface a tapered passage entered by the needle loop to wedge the nose away from the projection to permit the loop to escape from the thread case.

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