

[54] **BOBBIN THREAD REPLENISHING MECHANISM FOR SEWING MACHINES**

3,490,402 1/1970 Ketterer.....112/186 X

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[57] **ABSTRACT**

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[51] Int. Cl. **D05b 57/14**, D05b 59/00

[58] Field of Search.....112/184, 181, 182, 183, 186, 112/228, 231

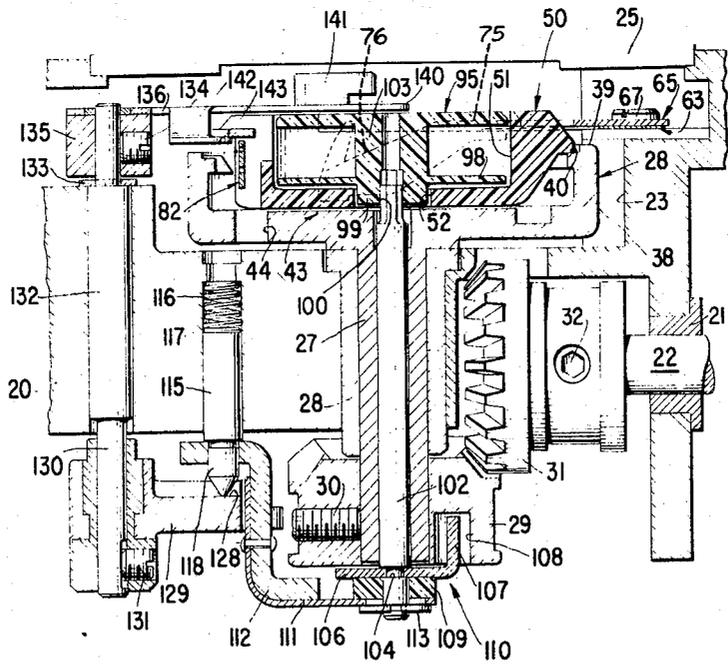
A lockstitch sewing mechanism in which needle thread may be directed to the bobbin for bobbin thread replenishment by a novel route beneath the level of the path of the loop seizing beak of the loop taker together with means for introducing and snubbing the thread on a plain cylindrical bobbin hub of small diameter whereby an appreciable increase in bobbin thread capacity is obtained.

[56] **References Cited**

UNITED STATES PATENTS

5 Claims, 12 Drawing Figures

2,862,468 12/1958 Johnson.....112/184 X



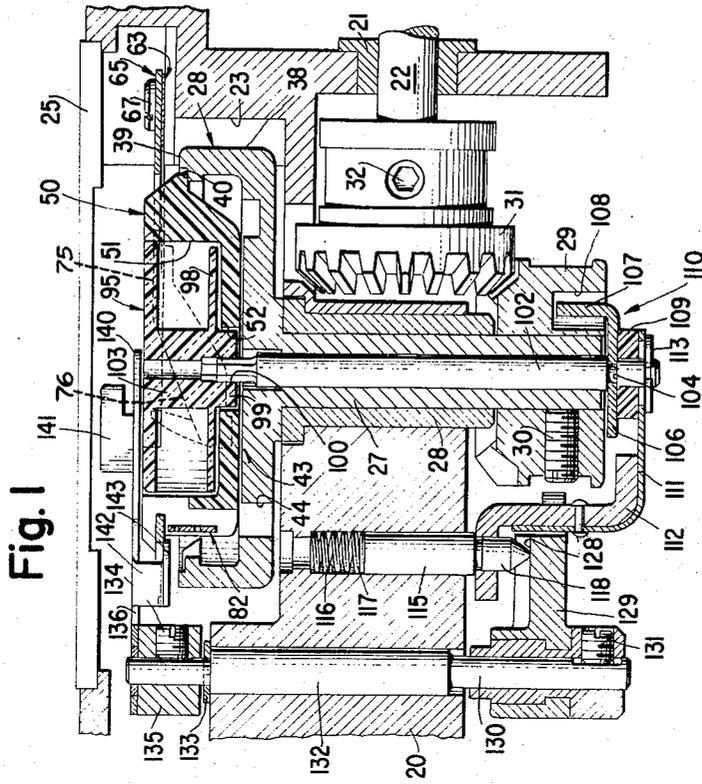


Fig. 1

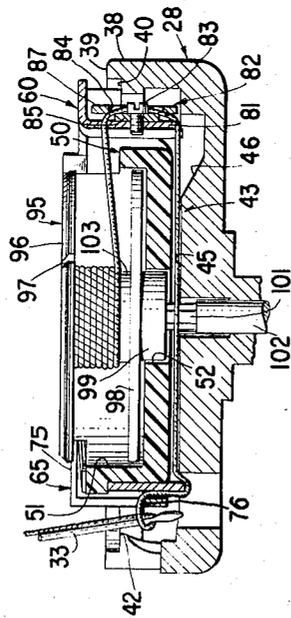


Fig. 3

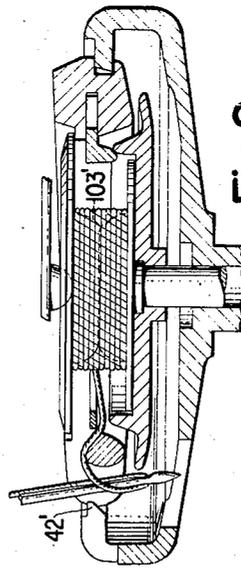


Fig. 2
PRIOR ART

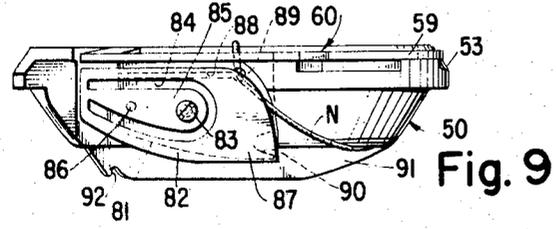
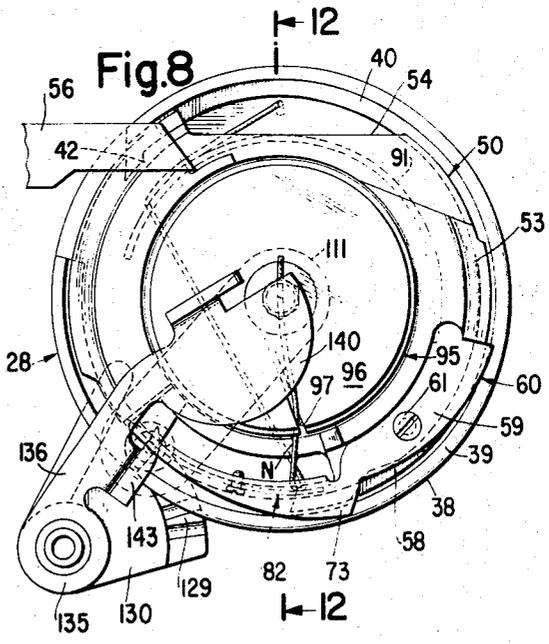
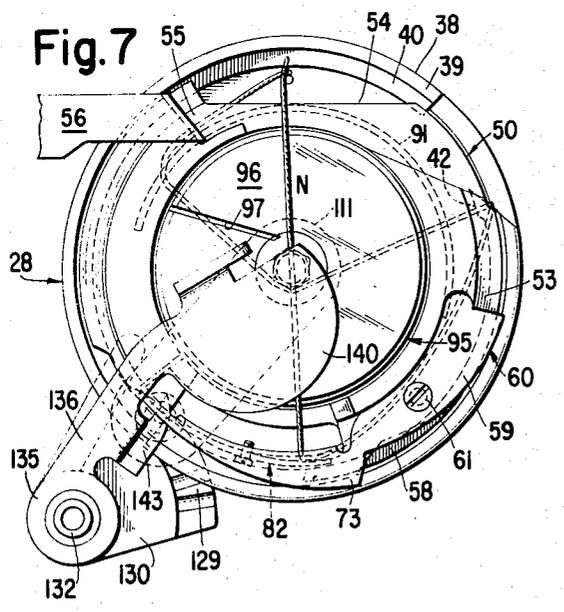
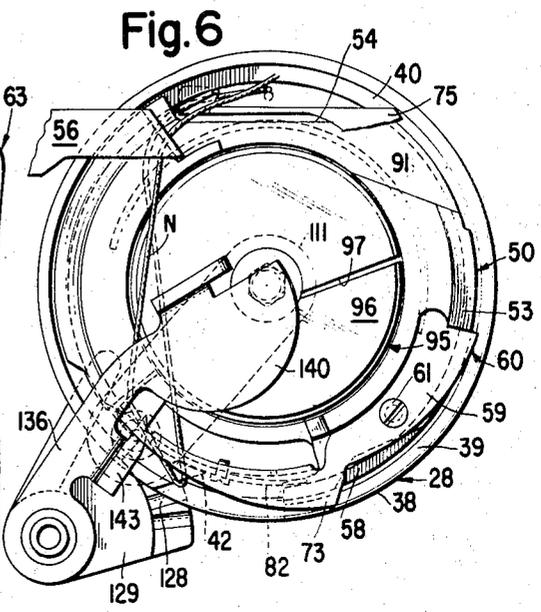
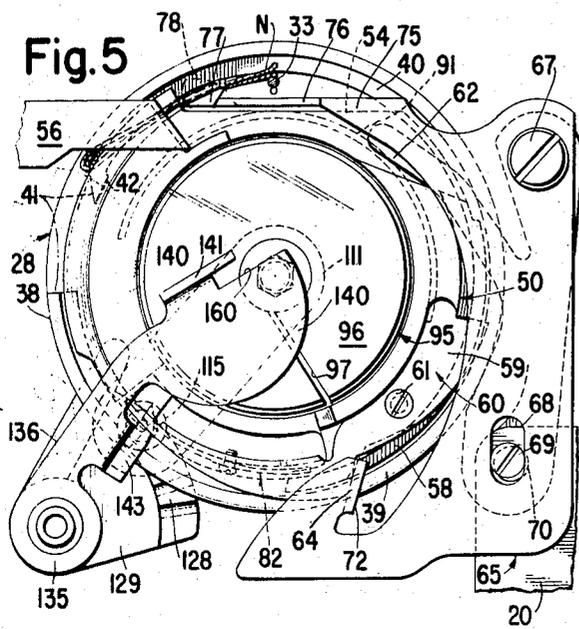
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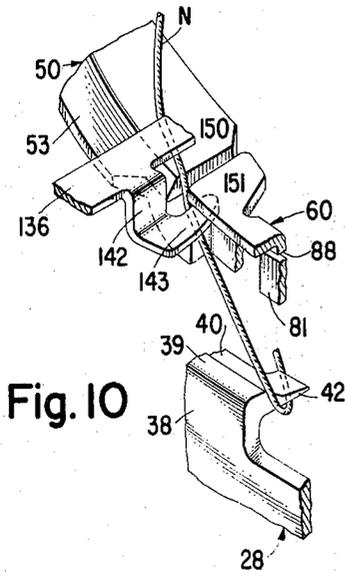


Fig. 10

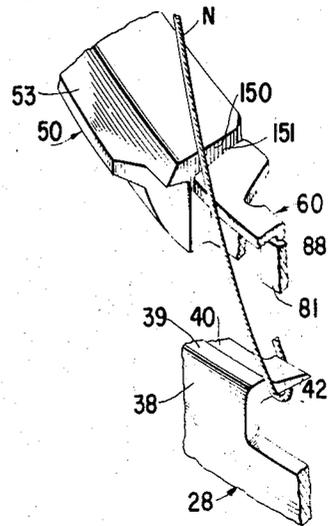


Fig. 11

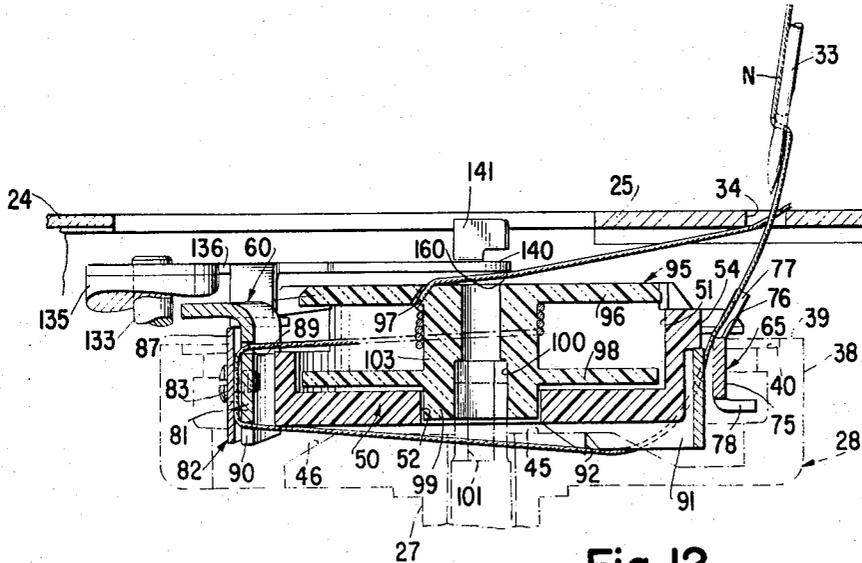


Fig. 12

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BOBBIN THREAD REPLENISHING MECHANISM FOR SEWING MACHINES

BACKGROUND OF THE INVENTION

Mechanisms heretofore known for replenishing thread on a bobbin in place in a loop taker while the stitch forming instrumentalities remain operatively associated as required for sewing have required that the hub of the bobbin be formed with a sufficiently large diameter so that the thread will always be wound at a rate fast enough to prevent slack at loop seizure time. In order to insure against thread breakage which would occur if the needle thread were to be seized a second time by the loop taker during bobbin winding, the bobbin thread capacity of any given size loop taker heretofore had to be sacrificed.

SUMMARY OF THE INVENTION

In the present invention, thread from a sewing machine needle after the first seizure by the loop taker is introduced into the bobbin by a novel route to initiate replenishment of the bobbin thread. By directing the replenishment thread from the needle to the bobbin so as to extend on the opposite side of the plane containing the path of the loop seizing beak from the needle thread supply, a loop of needle thread will not be formed in the path of the loop taker beak after the initial needle thread loop has been seized. Regardless of the slack in the thread, the needle thread will not be presented in a loop into the path of the loop taker beak during the remainder of the winding operation. It becomes possible, by virtue of this arrangement, to design the bobbin shape without concern for minimum hub diameter and an appreciable increase in bobbin thread capacity may be realized without any increase in loop taker size and without the need to increase the thread manipulating capacity of the sewing instrumentalities.

This invention also provides a bobbin thread replenishing mechanism for lockstitch sewing machines in which the bobbin thread is subjected to the action of a spring tensioning device so that during sewing, uniform bobbin thread tension will be imposed irrespective of the quantity of thread wound on the bobbin. This invention, moreover, provides for a novel and effective mechanism for selectively rendering a sewing machine loop taker effective either to wind replenishment thread on the bobbin therein or to form lockstitches.

With the above and additional objects and advantages in view, as will hereinafter appear, this invention will now be described in detail with reference to the accompanying drawings of a preferred embodiment in which:

FIG. 1 represents a vertical cross-sectional view taken lengthwise along a sewing machine bed and through the axis of rotation of a rotary hook constructed in accordance with this invention,

FIG. 2 represents a vertical cross sectional view of a prior art rotary hook shown as the loop taker moves past the needle while thread from the sewing machine needle is being replenished on a bobbin in the hook,

FIG. 3 represents a vertical cross-sectional view of the rotary hook of this invention shown as the loop taker moves past the needle while thread from the sewing machine needle is being replenished on a bobbin in the hook,

FIG. 4 is a disassembled perspective view of the rotary hook of this invention including the mechanism for constraining the bobbin case in place on the hook and the mechanism for replenishing bobbin thread,

FIG. 5 is a top plan view of the rotary hook of FIGS. 1 and 4 with the mechanism for replenishing bobbin thread shown in solid lines in operative condition for bobbin winding and with the hook shown in a position immediately after seizure of a thread loop from the needle,

FIG. 6 is a top plan view similar to FIG. 5 but showing the hook in a position in which the thread loop seized thereby is being deflected to the action of the bobbin thread tensioning spring,

FIG. 7 is a top plan view similar to FIG. 5 but showing a position of parts in which the thread loop is about to be shed from the hook beak,

FIG. 8 is a top plan view similar to FIG. 5 but showing a position in which the thread loop is entering the bobbin flange slot,

FIG. 9 is an elevational view of the bobbin case illustrating the bobbin thread tensioning spring means and showing the thread as it is located with respect to the spring means in the position of parts as shown in FIG. 8,

FIG. 10 is a perspective view of a fragment of the bobbin case, bobbin thread tensioning spring means, thread replenishing control lever, and hook beak and including a representation of the thread being directed to the bobbin thread tensioning spring during bobbin replenishment,

FIG. 11 is a perspective view similar to FIG. 10 but showing a needle thread loop by-passing the bobbin thread tensioning spring during sewing, and

FIG. 12 is a cross-sectional view through the rotary hook taken substantially along line 12-12 of FIG. 8 but showing the position of the thread after several rotations of the bobbin at the start of thread replenishment and indicating the manner in which the beginning end of thread is severed.

The loop taker illustrated in the drawings is adapted for use with a sewing machine such as is disclosed in the U.S. Pat. No. 2,862,468, Dec. 2, 1958, of R. E. Johnson which is incorporated herein by reference. The above-cited patent may be referred to for disclosure of all of the sewing machine mechanism save for the loop taker and mechanism directly related with the loop taker such as the bobbin thread replenishing mechanism.

In the drawings, 20 denotes the bed of a sewing machine frame carrying a bushing 21 in which a bed shaft 22 is journaled. The bed 20 is formed with an upwardly open loop taker accommodating cavity 23 closed by a slide cover plate 24 and by a throat plate 25. Rotatable in a bushing 26 carried in the bed is a hollow loop taker shaft 27 which is attached as by welding or the like to the underside of a loop taker indicated generally at 28 which is disposed in the cavity 23.

The loop taker disclosed in the drawings is a rotary hook which is imparted turning movement in one direction during operation of the sewing machine by a bevel gear 29 made fast on the loop taker shaft by a set screw 30 and in mesh with a bevel gear 31 secured by a set screw 32 to the bed shaft. Preferably, the rotary hook partakes of two revolutions during each cycle of endwise reciprocation of a needle 33 which cooperates therewith in the formation of stitches passing through a needle hole 34 in the throat plate.

The rotary hook of this invention has an upwardly open cup-shaped form including a rim 38 having an upwardly extending bearing shoulder 39. The rim is also formed with an annular inwardly extending bearing rib 40 having a lateral opening 41 formed at one side with a needle thread loop seizing beak 42. The needle 33 reciprocates in a path which traverses the plane containing the path of circular movement of the loop seizing beak 42.

The cup-shaped rotary hook 28 includes a base 43 formed internally with an annular recess 44, a portion of which may extend completely through the hook base to provide clearance for the dip of the needle. The recess 44 has another function, i.e., to isolate a raised annular boss 45 at the center of the base. Segments of the edge of the boss 45 are chamfered as at 46 while intervening portions 48 of the peripheral edge are formed substantially square. This raised boss 45 serves a function in pulling off and positioning a bobbin thread during sewing as described in greater detail in my copending U.S. Pat. application Ser. No. 135,671 filed Apr. 20, 1971 to which reference may be had.

Constrained within the cup-shaped rotary hook is a bobbin case indicated generally at 50. The bobbin case is formed with an upwardly open bobbin accommodating cavity 51 through the bottom of which a large control aperture 52 extends. Externally, the bobbin case is formed with a bearing flange 53 which rests upon the bearing rib 40 of the rotary hook and is constrained radially against the bearing shoulder 39. The bobbin case flange at one side is slabbed, as at 54, substantially along a chord to provide clearance for the path of needle reciprocation between the bobbin case and the rotary hook. Adjacent to the slabbed portion 54 the bobbin case flange 53 is also formed with a shallow recess 55 into which fits a rotation restraining element 56 secured by a screw 57 to the machine bed 20. The bobbin case flange 53 substantially diametrically opposite the slabbed portion 54 is formed with a recess 58 on which a support arm 59 of a thread tensioning spring bracket 60 is secured by a fastening screw 61.

The bobbin case 50 adjacent to the recess 58 in the flange 53 is formed with a radial opening 80 across which opening the thread tensioning spring bracket 60 spans. A downturned arm 81 on the bracket 60 is also disposed in the bobbin case radial opening 80 and provides a mounting surface against which a bobbin thread tensioning spring 82 is secured by a screw 83. Preferably, the spring 82 is formed with slot 84 in the form of a U-shaped loop separating a tongue 85 through which the securing screw 83 and a locating pin 86 on the bracket 81 pass. Surrounding the tongue 85 is an outer spring blade portion 87 which frictionally engages the bobbin thread against the downturned bracket arm 81 to provide the bobbin thread tension. The downturned arm 81 is formed with a thread entry slot 88 which, as shown in FIGS. 4 and 9 terminates in an eyelet 89 for directing the thread to the spring blade portion 87 of the spring. Below the spring 82, the downturned arm 81 is formed with a thread guiding groove 90 from which the bobbin thread leaves the spring and proceeds to the stitching point. The tension exerted on the thread by the spring blade portion 87 may be adjusted by regulating the fastening screw 83.

For additional restraint of the bobbin case within the rotary hook, a holddown spring arm 62 which extends from a base plate 63 and a rotation restraining arm 64 extending from a base plate 65 are provided. Each of the base plates 63 and 65 is formed with an aperture 66 for a shouldered screw 67 threaded into the machine bed; and each of the base plates is formed with an elongated slot 68 to accommodate the eccentric head 69 of a locating pin 70 secured by a set screw 71 in the machine bed. The rotation restraining arm 64 is formed with a downturned lip 72 which abuts a shouldered portion 73 on the support arm 59 of the thread tensioning spring bracket 60.

The base plate 65 is formed with another arm 75 which, as shown in FIGS. 5 and 6 extends alongside the slabbed portion 54 of the bobbin case between the path of needle reciprocation and the bobbin case. This arm 75, acts as a support for the bobbin thread during sewing to hold the bobbin thread away from the path of the loop taker beak 42. The arm 75 is formed with a downwardly tapering upper edge 76 which as shown in FIG. 1 extends beneath the level of the path of the hook beak and is joined at the free extremity by an upwardly projecting tang 77. The purpose of the thread tang 77, is to prevent a bobbin thread from being carried off the free end of the arm 75. Also formed at the free extremity of the arm 75 is an outwardly extending thread guard finger 78 adapted to project beneath the inwardly extending bearing rib 40 on the rotary hook when the base plate 65 is secured in place. The thread guard finger 78 serves to direct each needle thread loop manipulated by the rotary hook beak completely over the arm 75 and thus prevents the needle thread loops from lassoing the arm 75. It is also the purpose of the outwardly extending finger 78 to prevent the beginning end of a bobbin thread from accidentally being directed twice to the bobbin thread tensioning spring when a prewound bobbin is inserted into the machine.

Secured in a reception seat formed beneath the bobbin case at the side opposite the thread tensioning spring 82 is an arcuate thread camming blade 91 preferably having a curvature coinciding closely with that of the boss 45 which projects upwardly within the cup-shaped rotary hook. As shown in FIG. 12 the blade 91 depends below the level of the boss 45 and is spaced outwardly thereof to provide thread clearance. A notch 92 is formed near one extremity of the blade 91 to limit the influence which the blade can exert on the bobbin thread.

Freely rotatable in the bobbin accommodating cavity 51 of the bobbin case is a bobbin indicated generally at 95. The bobbin includes a top flange 96 formed with an outwardly extending slot 97 skewed slightly from a true radial position on the top flange. The bobbin is formed with a bottom flange 98 having a depending boss 99 which fits into the central aperture 52 of the bobbin case. The boss 99 is formed with a noncircular central aperture 100. As shown in the drawings, the aperture 100 may be hexagonal to match the hexagonal extremity 101 of a driving spindle 102 which is arranged in the hollow loop taker shaft for driving the bobbin when it is desired to replenish thread thereon. Between the flanges 96 and 98 of the bobbin a plain cylindrical hub 103 is provided.

The spindle 102 forms a part of the bobbin thread replenishing mechanism of this invention and, more particularly, is included in the device indicated generally at 110 in the drawings for selectively rotating the bobbin 95 to wind replenishment thread thereon. As shown in FIGS. 1 and 4, the spindle 102 near its lower extremity is formed with an annular groove 104 in which the opposed spring arm 105 of a friction washer 106 are snapped. The friction washer includes an upturned finger 107 which is accommodated in a notch 108 formed on the underside of the bevel gear 29 on the loop taker shaft. By this arrangement the spindle 102 will be driven with the loop taker by way of the friction coupling between the friction washer 106 of the spindle 102. Should sufficient resistance to the turning of the spindle 102 arise, the spindle, may turn freely relatively to the washer 106 and a driving relationship will be reinstated only when the resistance to turning drops below the torque necessary to cause the friction washer to slip on the spindle 102.

Beneath the friction washer 106 on the spindle 102 is positioned a plain washer 109 and the lateral arm 111 of an angle bracket 112. A spring clip 113 seated in an annular notch 114 in the spindle 102 maintains the parts on the spindle. The angle bracket 112 has fastened thereto an upstanding cylindrical guide stud 115 which slides in a guide bore 116 formed in the bed 20. A coil spring 117 which is confined in the guide bore 116 bears against the guide stud 115 and biases the bracket 112 and the spindle 102 downwardly.

The guide stud 115 extends through the angle bracket 112 and is formed beneath the angle bracket with a tapered cam follower head 118. The cam follower head 118 tracks a cam surface 128 formed on a radial arm 129 which projects from a hub 130 secured as by a set screw 131 on the lower extremity of a fulcrum stud 132 journalled in the machine bed 20. The radial arm 129 may preferably be formed of a synthetic plastic material for quiet cooperation with the cam follower head, in which case the hub 130 may be formed as a metallic insert. The fulcrum stud 132 is retained in the machine bed 20 by a spring clip 133 and above the machine bed has fastened thereon by a set screw 134 the hub portion 135 of a control arm 136. The control arm 136 is formed with a blade 140 which, as shown in FIGS. 1 and 5 through 8, extends over the loop taker 28. A finger grip tab 141 is formed to extend upwardly from the blade 140 and serves, as will be explained in greater detail below, for manual positioning of the control arm 136. A downturned finger 142 is formed on the control arm 136 closely adjacent to the hub 135. A projection 143 which extends radially outward along the arm 136 from the downturned finger 142 serves as a thread camming instrumentality when the control arm 136 is turned in a clockwise direction into the position shown in FIGS. 5 through 8 and forces any thread which is being carried by the loop seizing beak 42 of the loop taker 28 to be introduced to the bobbin thread tensioning spring 87 and to be directed into the bobbin for replenishment of the bobbin thread supply.

As best illustrated in FIGS. 10 and 11, a thread accommodating passageway is provided between one edge 150 of the bobbin case opening 80 and one extremity 151 of the bracket 60 which supports the bobbin thread tensioning spring 82. When the control arm

136 is swung counterclockwise into position illustrated in dotted lines in FIG. 5 the projection 143 will be remote from the thread accommodating passageway between surfaces 150, 151, and as shown in FIG. 11, a needle thread N being manipulated by the loop taker beak 42 will pass transversely of the thread accommodating passageway and cannot enter the passageway. When the control arm 136 is shifted in a clockwise direction into the solid line position as shown in FIG. 5, the projection 143 will be disposed adjacent the passageway between the surfaces 150, 151 as shown in FIG. 10, and needle thread N being manipulated by the loop seizing beak 42 will be urged and deflected into the thread accommodating passageway.

When it is desired to replenish thread on the bobbin, it is necessary for the operator of the sewing machine to detain the free end of thread extending from the eye of the needle 33 above the throat plate 25, and to shift the control arm 136 in a clockwise direction as shown in FIGS. 5 through 8 into a position extending over the bobbin 95. When the control arm is shifted in a clockwise direction the cam surface 128, acting upon the cam follower head 118 will elevate the spindle 102 causing the hexagonal end 101 of the spindle to enter in driving relationship with the noncircular aperture 100 in the bobbin. It is only necessary thereafter, for the operator of the machine to initiate the sewing machine drive to cause reciprocation of the needle 33 and rotation of the loop taker 28 as if these parts were to be actuated in the formation of stitches.

On the first dip of the needle both limbs of the needle thread through the eye of the needle will depend downwardly through the needle aperture 34 in the throat plate, and the loop taker beak 42 will seize this needle thread loop as illustrated in FIG. 5. As rotation of the loop taker continues, the seized loop of needle thread will continue to be drawn out as illustrated in FIG. 6 with both limbs of the seized needle thread loop passing over the downwardly extending finger 78 of the arm 75 as clearly shown in FIG. 6. That limb of the seized needle thread loop which extends over the bobbin 95, which is the free end of the needle thread loop from the needle eye detained above the throat plate 25, will encounter the projection 143 of the control arm 136 as is best shown in FIG. 10. The thread limb will be influenced by the projection 143 so as to enter between the surfaces 150, 151, thence into the thread entry slot 88 and finally upon continued rotation of the loop seizing beak into the position shown in FIG. 7 into the thread eyelet 89. The needle thread at this stage will have, therefore, been introduced between the downturned arm 81 of the bracket 60 and the blade 87 of the bobbin thread tensioning spring 82 but the thread will not as yet have been introduced into the bobbin nor will the thread have been cast loose from the loop taker beak and drawn into the thread guiding groove 90.

As rotation of the loop taker beak continues beyond the position shown in FIG. 7 the loop of needle thread will be drawn off the loop taker beak 42 and depending upon the position in which the bobbin happened to be when the spindle 102 was elevated, the radial slot 97 in the top flange of the bobbin will be moved past the free end of the needle thread loop which extends from the eyelet 89 over the bobbin 95 and to the needle aperture

34 in the throat plate. As the bobbin continues to turn with the loop taker, the limb of needle thread which enters the bobbin through the slot 97 will be wrapped about the hub 103 of the bobbin. As wrapping of the thread begins the slack will be dissipated in the thread and it will be drawn into the groove 90.

The slot 97 is preferably skewed with respect to a radius of the bobbin so that the limb of needle thread extending to the throat plate will be moved back and forth across an edge 160 formed on the blade 140 of the control arm 136. An abraiding action of the thread back and forth across the edge 160 will sever the thread limb after just a few rotations of the bobbin after which the retained free end of the needle thread may be withdrawn and discarded. Thereafter, continued rotation of the bobbin will serve to wind thereon replenishment thread for later use as bobbin thread in the formation of lockstitches. The replenishment thread is drawn into the bobbin in a path as illustrated in FIG. 12, that proceeds from the path of reciprocation of the needle downwardly between the bobbin case 50 and the loop taker base 43, between the bobbin thread tensioning spring blade 87 and the downturned arm 81 of the bracket 60 and then into the bobbin.

Referring to FIGS. 2 and 3, the difference between the manner in which the thread is directed to the bobbin during bobbin thread replenishment with the present invention as compared with that of prior known devices is illustrated. In the prior art devices as shown in FIG. 2, wherein the needle thread is directed immediately from the path of needle reciprocation into the space between the bobbin flanges, both limbs of thread extending from the eye of the needle are held on a level at or above the level of the loop taker beak which is indicated at 42' in FIG. 2. As a result, even a small degree of slack in the thread being delivered to the bobbin will cause formation of a loop of the thread located directly in the path of the loop seizing beak 42'. Since seizure of a needle thread loop after bobbin thread replenishment has begun would cause thread breakage and disruption of the replenishment operation, care had to be taken with the prior art construction that bobbin thread would always be wound faster than that minimum rate which would permit the formation of a needle thread loop in the path of the loop seizing beak. As a result, an extremely large diameter hub 103' was required in such prior art bobbins and accordingly, the capacity of these bobbins commensurate with any given sized loop taker was limited. Referring to FIG. 3 which shows the condition obtained with the present invention, the needle thread which is directed to the bobbin during bobbin thread replenishment extends from the needle eye downwardly well beneath the level of the path of the loop seizing beak 42. In the event that slack should develop in this needle thread during bobbin thread replenishment, any loop which might form adjacent to the needle path would occur well below the level of the loop seizing beak and no thread loop would be presented for the beak to seize. Consequently, a small diameter hub 103 may be provided on the bobbin and slack thread may be tolerated during the initial stages of the winding operation without objectionable loop seizure and thread breakage.

When sufficient thread has been wound on the bobbin, the bobbin thread replenishing operation may be terminated by shifting the control arm 136 counterclockwise as viewed in FIG. 5 to the dotted line position shown in this view. The cam surface 128 will shift relatively to the cam follower head 118 allowing the spring 117 to lower the spindle 102 out of driving engagement with the bobbin. If work is inserted on the throat plate 25 beneath the path of needle reciprocation, subsequent operation of the needle and loop taker will result in the formation of lockstitches in a manner which is well known in the prior art.

Having set forth the nature of this invention, what is claimed herein is:

1. In a lockstitch sewing machine having a cup-shaped circularly moving loop taker including a peripheral rim formed with a thread seizing beak, a thread carrying bobbin journaled in said loop taker, and a thread carrying needle supported for endwise reciprocating movement in a path which traverses the plane in which the thread seizing beak moves and extends between the loop taker rim and the bobbin, means for replenishing thread on said bobbin while in said loop taker from thread carried by said needle including means for directing thread from said needle onto said bobbin, bobbin rotating mechanism for winding thread from the needle onto the bobbin during circular movement of said loop taker and reciprocatory movement of said needle, and thread guiding means effective to constrain the thread leading to the bobbin during bobbin thread replenishment in a path which extends inside the cup-shaped loop taker and within the plane in which the thread seizing beak moves so as to prevent the formation of needle thread loops in the path of the loop taker thread seizing beak while the bobbin thread is being replenished.

2. A circularly moving sewing machine loop taker having a cup-shaped body formed at the rim with an inwardly extending loop seizing beak adapted to cooperate in the formation of lockstitches with a thread carrying needle which is endwise reciprocatory in a path substantially parallel to the axis of movement of said loop taker, a stationary bobbin case journaled in said loop taker and accommodating a thread carrying bobbin therein, means for replenishing thread on said bobbin while in place in said loop taker from thread carried by said needle comprising a spring element on said bobbin case for applying tension to a thread leading to said bobbin, means on said bobbin case formed with a thread guiding slot for directing a loop of needle thread seized by said loop taker beak to the influence of said spring element, said thread guiding slot being open at one extremity toward which said loop taker beak moves carrying a seized needle thread loop, and being closed at the opposite extremity, said closed thread guiding slot extremity being positioned so that the shortest path for that limb of the needle thread loop extending therefrom to the path of needle reciprocation occurs within said cup-shaped loop taker body between the bobbin case and the loop taker, means for directing into the bobbin the other limb of a needle thread loop introduced into said thread guiding slot and a device for rotating said bobbin to wind thread thereon.

3. A circularly moving sewing machine loop taker as set forth in claim 2 in which said means for directing said limb of needle thread loop to the bobbin comprises means supporting one flange of said bobbin exteriorly of said bobbin case, and said exteriorly supported bobbin flange being formed with a radial slot for accommodating passage into the bobbin of said other limb of needle thread loop.

4. A circularly moving sewing machine loop taker as set forth in claim 3 in which said means on said bobbin case formed with a thread guiding slot extends adjacent to a protective shoulder formed on said bobbin case for preventing needle thread loops being manipulated by said loop seizing beak from entering said thread guiding slot, and a thread camming finger shiftably supported

on said sewing machine adjacent to said loop taker and having an effective position contiguous to said protective shoulder for urging a needle thread loop being manipulated by said loop taker beak into said thread guiding slot.

5. A circularly moving sewing machine loop taker as set forth in claim 4 in which said thread camming finger is carried by an operator influenced element shiftably supported adjacent to the loop taker, and in which a thread cutting blade is carried by said operator influenced element for movement into a position overlying the radial slot in said bobbin flange when said thread camming finger occupies an effective position.

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