March 30, 1954

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2,673,541

ROTARY SHUTTLE FOR SEWING MACHINES

Filed June 1, 1951

FIG. 1

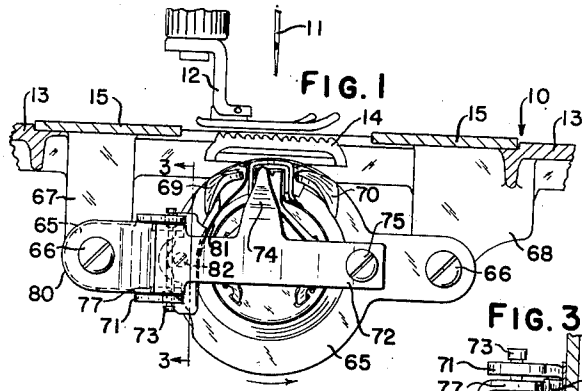


FIG. 2

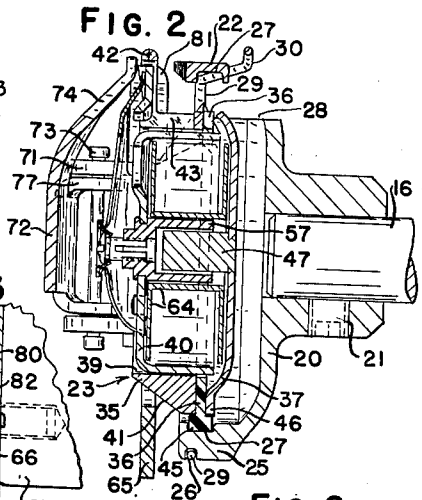


FIG. 3

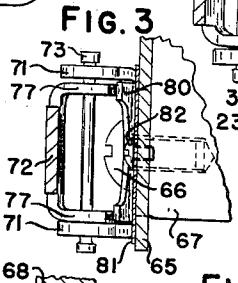


FIG. 4

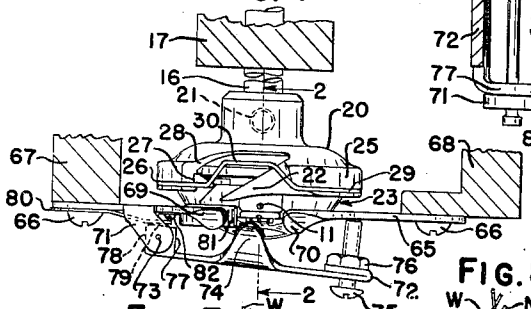


FIG. 5

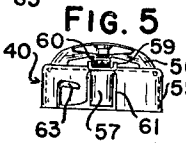


FIG. 6

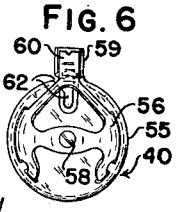


FIG. 7

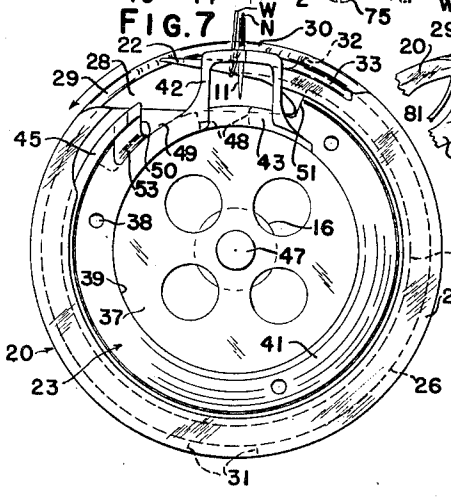


FIG. 8

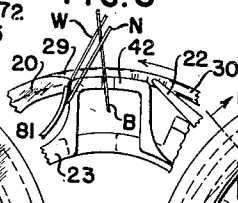


FIG. 9

FIG. 10

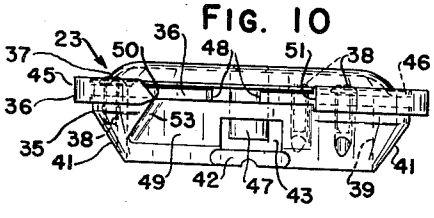
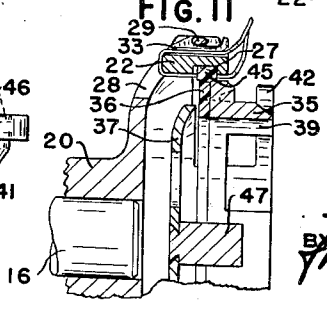


FIG. 11



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ROTARY SHUTTLE FOR SEWING MACHINES

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Application June 1, 1951, Serial No. 229,475

6 Claims. (Cl. 112—181)

1

This invention relates to rotary shuttles for sewing machines and comprises novel means for non-rotatably supporting and retaining the bobbin case base in the rotary hook, for retaining the bobbin case in the base, and for guiding the inner leg of the thread loop to the outside of the hook.

In the drawing:

Figure 1 is an end view of a portion of a sewing machine showing, in front elevation, a shuttle embodying the features of the present invention;

Figure 2 is an enlarged sectional view on the line 2—2 of Figure 4;

Figure 3 is an enlarged sectional view on the line 3—3 of Figure 1;

Figure 4 is a top plan view of the shuttle of Figure 1, portions of the sewing machine base being shown in section;

Figure 5 is a top plan view of the bobbin case of the shuttle of Figure 1;

Figure 6 is a front elevation of the bobbin case of Figure 5;

Figure 7 is an enlarged front elevation of the rotary hook and bobbin case base of the shuttle of Figure 1, showing the beak of the hook taking a loop of the thread from the needle;

Figure 8 is a fragmentary view of a portion of the parts illustrated in Figure 7, showing the thread loop after it has been carried about the bobbin, bobbin case, and bobbin case base and as it is drawn between the loop guide and the bobbin case base stop;

Figure 9 is a view similar to Figure 7, showing the thread loop being carried by the hook about the bobbin case base;

Figure 10 is a top plan view of the bobbin case base of Figure 7; and

Figure 11 is a fragmentary sectional view on the line 11—11 of Figure 9, the rotary hook being in the position indicated in dot and dash lines in the latter figure.

Referring more particularly to Figures 1 and 4, a sewing machine 10, having a needle 11, presser foot 12, base 13, feed dog 14, shuttle cover plate 15, and shuttle shaft 16, is of the type in which the reciprocating needle 11 is driven synchronously with the shuttle shaft 16, the shaft 16 making two complete revolutions for each down and return stroke of the needle. Shaft 16 is journaled in conventional manner in pendent lugs 17 of the base 13.

It will be understood that the operator faces the machine from the right in Figure 1, this figure being an elevational view of the left end

2

of the machine. For convenience in the present description, direction is described with reference to the shuttle which faces to the operator's left, so that Figure 1 shows the front of the shuttle.

A rotary hook 20 (Figure 4) is secured coaxially to the end of shaft 16 by means of a set screw 21. Hook 20, which is cup-shaped as best seen in Figure 2, has a loop engaging beak 22, and its concave interior, facing the front, contains the bobbin case base 23 as hereinafter described.

As best shown in Figures 2 and 7, hook 20 has a substantial peripheral lip 25 at its forward edge which is grooved about its exterior at 26, and has an internal annular groove 27 aligned with, and extending partially into the inner side of, beak 22. Hook 20 has a portion of its periphery cut away at 28, under and adjacent beak 22 as best shown in Figures 4 and 7.

A spring wire, snap ring, thread guide 29 lies in groove 26 and has a portion 30 offset axially and rearwardly from the plane of groove 26 where the guide 29 bridges the cut away portion 28 of hook 20. The free ends of the snap ring 29 are separated as shown at 31 (Figure 7), permitting the snap ring to be easily assembled to and removed from groove 26 of hook 20. One end of the offset portion 30 rests against a shoulder 32 (Figure 7) on hook 20 at the throat of beak 22. As shown in Figures 7 and 11, a smoothly rounded, thread guiding, groove 33 extends slantwise from the rear of lip 25 at shoulder 32 forward across lip 25, the slanting causing the groove 33 to cut back under guide 29 a short distance.

The bobbin case base 23 comprises three parts, the forward, annular portion 35, the bearing ring 36 and the rear wall portion 37 (Figures 2 and 10). These three parts are joined together by the three, evenly spaced screws 38 threaded into the forward portion 35.

The forward portion 35 defines a central circular space 39 for receiving the bobbin case 40, and has a front wall 41 tapered to the front. At the top, a loop guide 42, substantially rectangular in shape, projects radially from and even with the forward surface. Behind the guide 42, the tapered wall 41 is cut away at 43 (Figure 10) through to the interior space 39 to provide clearance for the needle 11, when the needle is in its lowermost position between guide 42 and the beak 22 as indicated in Figure 7.

The bearing ring 36 is annular but split with its ends separated slightly as shown at 48, Fig-

ure 7. It should be made of resilient material having good bearing properties, for example, nylon, and is T-shaped in cross-section. The ring 36 has a broader rim portion 45 which in operation is closely guided in groove 27 of the hook 20, the radial and side clearances being of the order of three thousandths of an inch.

The rear wall portion 37 is dished rearwardly to provide maximum space for the bobbin case 40, and is provided with a radially extending lip 46 in which the heads of screws 38 are seated. An axially extending stud 47 is joined to the center of the rear wall 37 in conventional manner.

The three parts of the bobbin case base are assembled within the hook. The rear wall portion 37 is inserted first. Then the bearing ring 36, being split and of resilient material, is sprung sufficiently to introduce the rim 45 into the groove 27 of the hook. The forward portion 35 is then placed in position against the ring 36 and the three parts are joined together by the screws 38, all three parts being suitably drilled therefor. The forward and rear portions 35 and 37 have an outside diameter on the face contacting the bearing ring 36 such as to just fit within the rim portion 45 and to face against the narrow portion of ring 36. The ring is thus aligned with the front and rear portions and screws 38 are inserted aligning the three parts with exactness.

Access to the rear of the bobbin case base 23 for inserting and tightening the screws 38 is provided by the cut away portion 28 of the hook 20, it being necessary, of course, to turn the bobbin case base 23 within hook 25 to expose each screw. The three screws 38, being threaded into the forward portion 35, clamp the narrow portion of the bearing ring 36 between the flat rear face of the forward portion 35 and the forward flat face of rim 45 of the rear portion 37. The bearing ring 36 is thus effectively and rigidly locked to the forward and rear portions 35 and 37 to form a unitary bobbin case base 23 supported in groove 27 of the hook by the bearing rim 45. Further rigidity and precision in alignment of the ring 36 may be obtained by having the outside diameter of either or both of the forward and rear portions 35 and 37 precisely fit the desired inside diameter of the rim 45 of ring 36.

Portions along the top of parts 35, 36 and 37 of the bobbin case base 23 are all cut away peripherally at 49 (Figure 7) to the same radial depth, leaving a loop-detaining horn or shoulder at 50 and another shoulder 51 at opposite sides of the loop guide 42. The loop-detaining shoulder 50 is preferably tapered back on either side from a vertical straight edge, as best seen in Figure 10, and faces in the direction opposed to the rotation of hook 20. The tapered forward wall 41 of the bobbin case base 23 is cut back at an angle, as best seen in Figure 10, slightly beyond shoulder 50, the cut away portion ending in a thread guiding, smoothly rounded, groove 53, which extends from shoulder 50 tangentially and forward with respect to the front of the bobbin case base 23.

The bobbin case 40 (Figures 5 and 6) is entirely conventional. It comprises a cup-shaped bobbin-containing body portion 55 and a dished spring portion 56. A hollow, cylindrical stud 57 is joined centrally to the body portion 55 by swaging, as shown in Figure 2. A thread tension adjusting screw 58 is threaded into the stud 57 and secures the spring 56 to the body portion 55. The spring 56 is provided with peripheral lugs that fit into slots in the body 55, and is spherically rounded or dished, as best seen in Figure 5. Screw 58 is countersunk in spring 56 so that the thread loop may easily pass over the front face of the bobbin case 40. The body 55 is provided with a radially extending tongue 59 that fits within loop 42 of the bobbin case base, and spring 56 has a similar tongue 60 to supply tension to the bobbin thread. Body portion 55 is slotted at 61 (Figure 5) to provide clearance for the needle 11 and at 62 (Figure 6) for easy threading. An L-shaped slot 63 (Figure 5) is cut in the rim of body 55 to assist in threading the bobbin case. The bobbin thread (not shown) is led from the bobbin through slot 63 and through the slot 62 between the tongues 59 and 60 up toward the work.

A conventional spool type bobbin 64 is shown in Figure 2 mounted on the stud 57, bobbin case 40 being mounted in the central space 39 of bobbin case base 23, with the cylindrical stud 57 placed over stud 47 of the bobbin case base.

In front of the rotary hook 20 is a thread guard 65 (Figures 1 and 4) which is secured by means of screws 66 to two lugs 67 and 68 pendant from base 13. The central portion of the thread guard 65 is generally circular about the forward portion of the bobbin case base 23, the upper part of this circular portion being split at the top into two arms 69 and 70. These arms are twisted, as shown in Figures 1 and 4, to form broader protective portions adjacent the top of the rotary hook 20 and bobbin case base 23. Arm 69 is shorter than arm 70 for reasons that will hereinafter become apparent.

To the left of the bobbin case base 23, away from the operator, the thread guard 65 has two forwardly projecting ears 71, as best seen in Figures 1 and 4, which support a bobbin case door or gate 72 hinged thereto by means of pin 73. Gate 72 has an upwardly projecting, rearwardly offset arm 74, tapered to a narrow portion toward the top. The arm 74 is adapted to lie in front of and close to the loop guide 42 at the top of the bobbin case base 23 when gate 72 is closed. The tongue 59 of the bobbin case 40, in operation, lies within the loop guide 42, so that the end of the arm 74 also lies in front of tongue 59 and serves as a retaining means for securing the bobbin case within the bobbin case base 23, preventing the case from moving axially forward more than a small distance which is provided for end play and clearance. The right end of gate 72 bears a screw 75 and lock nut 76 so as to provide an adjustable stop contacting the thread guard 65 to limit the closing of gate 72 as it is swung about the hinge pin 73.

The left end of gate 72 has two rearwardly projecting ears 77 pierced by pin 73 as part of the hinged joint. Ears 77 are substantially square in outline with flat sides 78 and 79 at approximately right angles to one another. A leaf spring 80 having one end held by the screw 66 against thread guard 65 has its other end offset forwardly and engaging the rear of ears 77. As best shown in Figures 3 and 4, when gate 72 is closed, spring 80 engages the sides 79 of ears 77 at a slight bias so as to urge gate 72 closed. When gate 72 is swung open, it will be apparent that the sides 78 of the ears 77 are engaged by spring 80 to maintain the gate in its open position.

Adjacent the bobbin case base 23, another leaf

spring, the bobbin case base stop 81, is secured to the thread guard 65 by the screw 82, as best seen in Figures 1, 3 and 4. Stop 81 is angled and curved up around the forward portion of the bobbin case base 23 between arm 69 of the thread guard and the thread loop guide 42 of base 23 so as to present a flat, resiliently supported surface toward the loop guide 42 facing the direction in which the hook 20 rotates as indicated by the arrows in the drawing.

In Figures 7, 8, 9 and 11, portions of the thread loop are shown during various stages in the operation of the machine. The leg of the loop leading to the needle 11 is denoted by the character "N" and the leg leading to the work, by the character "W."

The operation of the hereindescribed shuttle mechanism will be apparent from the foregoing. The bobbin case base 23, carrying therein the bobbin case 40 and bobbin 64, is supported in the rotary hook 20 by the rim 45 of the base 23 riding in groove 27. Rotation of the base 23 with hook 20 is prevented by the stop 81. The arm 70 of the thread guard 65 prevents rotation of the bobbin case base 23 in the other direction in a similar manner.

The bobbin case 40 is prevented from rotating in the base 23 by reason of its tongue 59 being contained in the loop guide 42. Arm 74 of the gate 72 is directly in front of the tongue 59, thereby preventing the bobbin case 40 being substantially displaced axially forward, a slight axial movement being permitted for clearance between the parts.

The bobbin 64, freely rotatable on stud 57, is carried within bobbin case 40. The bobbin case 40 and base 23, one within the other, are mounted within the hook 20, but are restrained from rotating with the hook as above described, the hook being rotatable therearound.

As the needle 11 is lowered from the position indicated in Figure 1, it carries with it the thread, with which it is threaded in the usual manner, through the cut away portions 43 of the bobbin case base and 61 of the bobbin case as best seen in Figure 4. The rotary hook 20 is simultaneously rotated in the direction indicated by the arrows in the figures of the drawing. After the needle 11 has reached its lowermost position and has begun to return to its raised position, having reached the position indicated in Figure 7, the thread W, extending from the work (not shown) to the needle 11, is slackened and the loop thus formed is engaged by the beak 22 of the hook 20.

As the needle continues to rise, the beak 22 carries the thread loop toward the shoulder 50. When the beak has reached the position indicated in broken lines at 22*a* in Figure 9, the loop is engaged by the detaining shoulder 50 in the manner indicated in Figure 11.

As the thread loop is carried toward shoulder 50, beak 22 enters farther into the loop, which is forced down toward the throat of the beak. As the leg W of the loop is carried toward shoulder 32 of the hook, the offset portion 30 of the thread guide 29 forces the leg W toward the front of the hook 20.

As the hook 20 is rotated still farther to the position indicated in full lines in Figure 9, the leg W is guided into the thread guide groove 33 in the hook. The leg N of the loop leading to the needle is detained by the shoulder 50, and the loop is carried down around both sides of the bobbin case 40 and base 23. It will be understood that the increased length of thread for the loop is pulled down through the needle and is supplied by the falling of the conventional take-up lever (not shown).

As hook 20 is turned still farther in the direction indicated by the arrows, the shoulder 32 of the hook is carried past its lowermost position and the take-up lever begins to rise, shortening the thread loop. The leg N of the loop from the shoulder 32 to the forward edge of the rim 25 of the hook is carried over the rounded rear wall 37 of the bobbin case base between the base and hook 20, and the leg W of the loop from groove 33 to the work is carried over the tapered front wall 41 of the bobbin case base and the dished spring 56 of bobbin case, thereby including the thread B from the bobbin within the loop.

As the take-up lever shortens the loop, it is drawn up between the stop 81 and the loop guide 42 as shown in Figure 8. It will be apparent that the leg W is also drawn up between tongue 59 of the bobbin case and the arm 74 of the bobbin case gate 72, the gate being adjusted to allow a slight axial displacement of the case within base 23. Further lifting of the take-up lever sets the loop in the work in the usual manner.

It will now be apparent that there is provided a cheaply manufactured and efficiently operating shuttle for sewing machines, particularly adapted for use in machines for domestic use, where manufacturing costs must be kept to a minimum. The snap ring thread guide is a cheaply-made and easily-installed means for moving the leg W of the thread loop forward to the forward edge of rim 25 on hook 20. In combination with shoulder 32 and groove 33, a path for the thread, as the thread loop is lengthened and shortened, is so formed that there are no rough surfaces or sharp edges to catch the thread as it is drawn therethrough. The thread guide 29 being a part separate from the hook 20, the hook is simplified and becomes a member which is more easily cast and machined, resulting in lower production cost.

Gate 72 is easily opened by the operator for removal or insertion of the bobbin 64 and bobbin case 40. In its open position, it is held open by the action of spring 80 cooperating with the flat sides 78 of the ears 77. It is easily closed and the spring 80, cooperating with the flat sides 79 of ears 77, holds it firmly closed. The regulating screw 75 enables the gate to be easily adjusted so that the arm 74 will prevent the bobbin case from moving forward out of the space 39 in the base 23, but so that the thread loop may be easily drawn up between tongue 59 and arm 74. The parts forming the gate 72 are simple in form and may be cheaply manufactured.

The spring stop 81 resiliently holds the bobbin case base 23 from rotating with hook 20 by its contact with the loop guide 42. The stop 81 also provides spring means for contacting the loop guide 42 so that the thread loop may be easily drawn up between guide 42 and the spring 81 without requiring that the bobbin case base be rotated in a direction opposed to the direction of rotation of the hook 20.

The particular construction of the bobbin case base 23 herein disclosed presents advantages which will be obvious to those familiar with the art. The resilient bearing ring 36 serves both as a bearing member between the base 23 and the hook 20 and as a retaining means for holding the base within the hook. This eliminates the necessity for a gib ring or other retaining means, and allows the groove 27 to be machined out of

one member, the hook 20, with great accuracy and without edges and cracks in which lint and dust may catch.

The use of nylon for the bearing ring 36 also presents obvious advantages. It is self-lubricating, eliminating the use of oil which is a dirt and lint catcher. It also has a low coefficient of friction, and thus generates little or no heat with its consequent distortion and wear of parts.

While there is herein described, and in the drawings shown, illustrative embodiments of the invention, it is to be understood that the invention is not limited thereto, but may comprehend other constructions, arrangement of parts, details and features without departing from the spirit of the invention. I desire to be limited, therefore, only by the scope of the appended claims.

I claim:

1. A rotary shuttle for a sewing machine comprising a cup-shaped rotary hook having an internal annular groove, a bobbin case base adapted to be assembled within said hook and having a separate, resilient, split-ring, rim member of bearing material adapted to rotatably engage said groove, and means for rigidly securing said rim member to said base while said rim member and said base are within said hook, whereby said rim member may be introduced into said groove and secured to said base to operably act as retaining means and bearing member of said shuttle.

2. A rotary shuttle for a sewing machine comprising a cup-shaped rotary hook having an internal annular groove; a three-part bobbin case base consisting of an annular, bobbin case receiving, forward portion; a resilient, split-ring, rim member of bearing material adapted to rotatably engage said groove; and a rear wall portion; and securing means for securing said forward and rear portions together with said rim member clamped therebetween, whereby said rear portion, said rim member and said forward portion may be successively introduced within said hook, said rim member being sprung and then expanded into said groove and then rigidly clamped and secured between said forward and rear portions by said securing means while within said hook.

3. A rotary shuttle for a sewing machine comprising a cup-shaped rotary hook having an internal annular groove; a bobbin case base consisting of an annular, bobbin case receiving, metallic forward portion; a metallic rear wall portion; a resilient, split-ring, rim member of bearing material, T-shaped in cross-section, and having its broader peripheral rim adapted to be closely received in said groove; said metallic portions having flat surfaces adapted to abut, respectively, either side of the narrower internal portion of said rim member, one of said metallic portions having an outside diameter adapted to closely underlie the peripheral rim of said rim member when said member is closely received in said groove; and screw members adapted to secure said metallic portions together with said rim member rigidly clamped therebetween; said metallic portions and said rim member being precisely preformed for assembly by said screw members while within said hook, whereby the unassembled parts of said base may be introduced into said hook, the rim member being compressed and then expanded in said groove, and the parts then assembled in operating relation, the rim member operably serving as bearing member and retaining means.

4. A rotary shuttle for sewing machines comprising, in combination, a rotary hook having an internal annular groove and an external annular groove, a bobbin case base adapted to be assembled within said hook and having a separate, resilient rim member of bearing material adapted to rotatably engage said internal groove, means for securing said rim member rigidly to said base while said rim member and said base are within said hook, a spring wire, thread guide adapted to be resiliently secured in said external annular groove, a thread guard secured to the frame of the sewing machine adjacent the front of said hook, resilient means mounted on said thread guard for preventing the rotation of said base with said hook, a hinged gate secured to the frame of the sewing machine adjacent said base for retaining a bobbin case within said base, and means for holding said gate in closed position.

5. A rotary shuttle for sewing machines comprising, in combination, a shuttle shaft for rotating the shuttle; a cup-shaped rotary hook co-axially mounted on one end of said shaft with its open end facing away from said shaft and having a portion of its peripheral lip cut away to form a beak for engaging the thread loop, said hook having an external snap ring-receiving peripheral groove and an internal annular bobbin case base bearing groove, said internal groove being aligned with said beak; a snap ring thread guide adapted to snap into non-rotatable engagement with the external groove of said hook and having a portion adjacent said beak offset axially with respect to said hook for guiding one leg of the thread loop to the open end of said hook; a bobbin case base having an annular split-ring, resilient rim member adapted for rotary engagement in the internal groove of said hook and adapted to be secured to said base while engaged in said groove, said rim member being interrupted along a portion of its periphery to provide an abrupt, radially disposed shoulder for detaining one leg of the thread loop, and said base having a central, bobbin case-receiving, circular recess, open at one axial end, and a radial, loop-guiding projection adjacent said cut-away portion of the rim member; a bobbin case adapted to be non-rotatably contained in said recess; a bobbin rotatably retained in said case; a spring-held gate hingedly supported adjacent the open end of said hook and having a portion thereof adapted to remain adjacent a portion of said bobbin case when the gate is in closed position for retaining said case in the recess; and a leaf spring resiliently fixed adjacent the loop-guiding projection of said base for preventing the rotation thereof.

6. In a rotary shuttle for a sewing machine, the combination comprising a rotary hook, a cup-shaped bobbin case base non-rotatably supported within said hook, a bobbin case non-rotatably supported with said base, and means for retaining said case in said base including a gate hingedly supported on said machine adjacent said shuttle, said gate having flat portions at substantially right angles one to the other and substantially equi-distant from the axis of the gate hinge, a leaf spring secured to said machine and adapted to contact said flat portions to resiliently hold said gate in an open position and alternatively hold said gate biased

toward a closed position, adjustable stop means for limiting the swinging of said gate toward its closed position, and an offset arm on said gate adapted to lie closely adjacent and normally spaced from a portion of said bobbin case when said gate is closed to prevent the axial exit of said bobbin case from the open end of said base, whereby said gate may be opened to insert said bobbin case and may be closed to retain the case in said base and the thread loop may be easily drawn up through and between said offset arm and said case.

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