THE LOOP-TAKER

Beneath the throat plate on the sewing machine is the loop-taker (the lower thread-carrying mechanism) called the looper, shuttle or hook.

CHAINSTITCH LOOP-TAKERS...

A LOOPER is a blade, usually with an eye near its point designated to carry lower thread through the loop of needle thread formed beneath the fabric. This action of the looper enables needle thread loop to enclose lower thread in the formation of the chainstitch.

An OSCILLATING LOOPER travels toward needle, carrying lower thread through needle thread loop on forward stroke. Lower thread, enclosed by loop, forms a triangle of thread which is held by looper until penetrated by needle on its succeeding downstroke. Looper, then on backward stroke, casts off needle thread loop and stitch is formed and set.

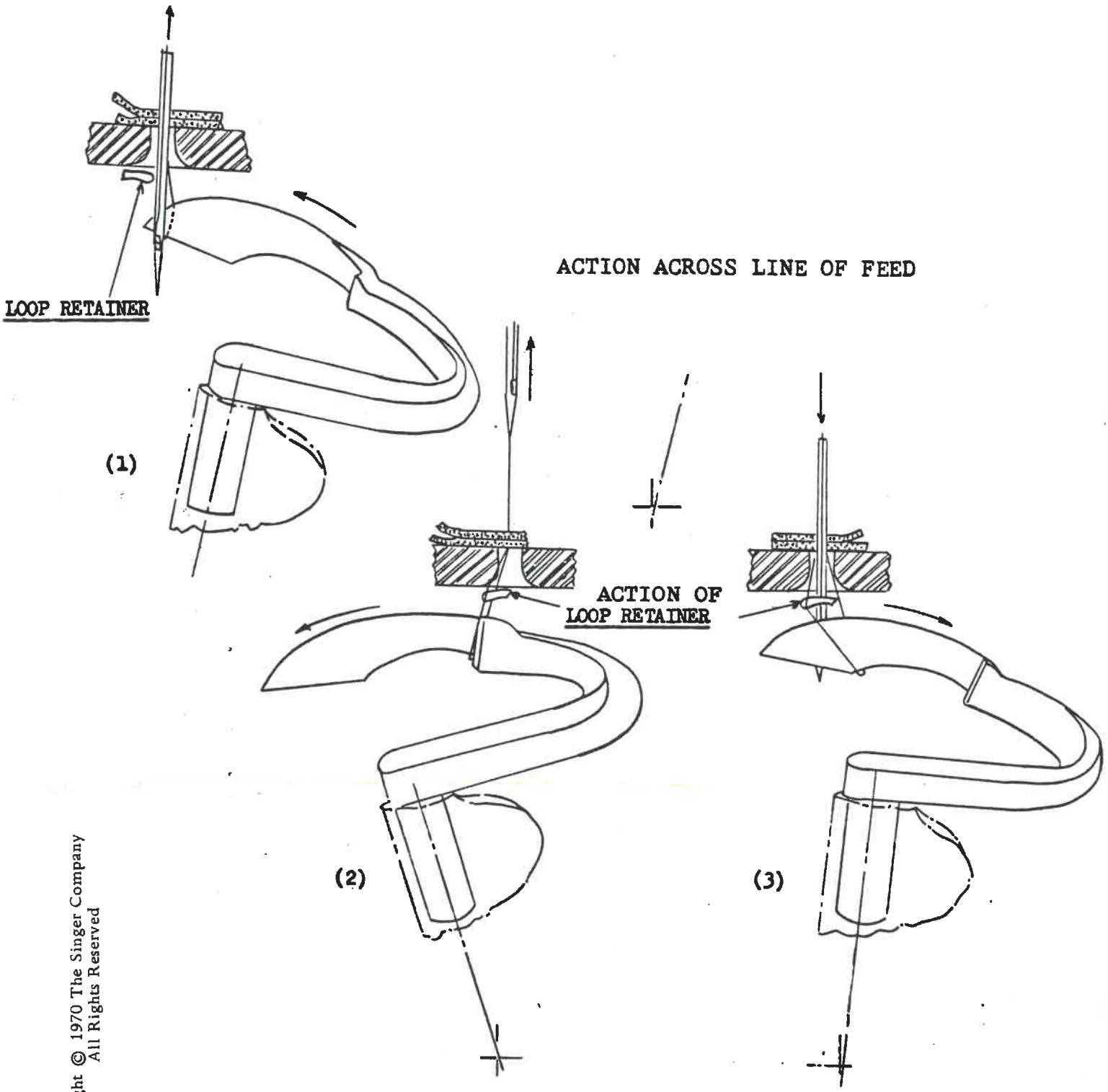
In a sewing machine where the oscillating loopers move along the line of feed, any number of needles can be used in a straight line within the limits of machine design. Since the loop remains on one side of the looper, the triangle of thread must be assisted in its formation by a loop retainer. This retainer moves the looper thread loop away from the looper and into the path of the needle. Spacing of needles depends upon minimum spacing of loopers including required width of looper thread loops in triangle.

To simplify the components of the looper mechanism and to obtain more consistently perfect stitches, across-the-line-of-feed loopers are more frequently used in today's modern chainstitch machines. When this type of looper is used, an avoiding motion is designed into the mechanism to aid the formation of the triangle of thread.

When the oscillating looper starts its forward stroke, needle begins to rise from its lowest position. During forward stroke looper passes behing needle (on the needle-thread-loop-side of needle) just clearing needle and picking up needle thread loop. When needle reaches its highest position, looper completes its forward stroke as needle thread loop encloses looper thread. Looper then moves in front of centerline of needle path, forming a triangle of thread (one side of which is the needle thread and the other side and bottom of which are the looper thread). As needle descends to penetrate this triangle, looper moves backward in front of needle toward its starting position. In its backward movement, looper sheds original needle thread loop which has now enclosed the previous loop of looper thread. Both thread loops are then drawn into a chainstitch as rising needle begins to form its next loop of needle thread.

The obvious disadvantage to across-the-line-of-feed loopers is that in parallel stitching, needles must be staggered to permit spacing for avoiding motion. In most machine designs this would permit no more than three or four needles to be used together.

OSCILLATING LOOPERS



FORMATION OF STITCH TYPE 101 - ACROSS LINE OF FEED

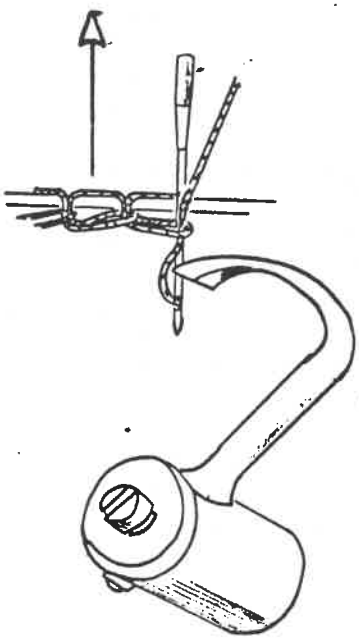


FIGURE 1

Looper entering needle loop - previous stitch being pulled up.

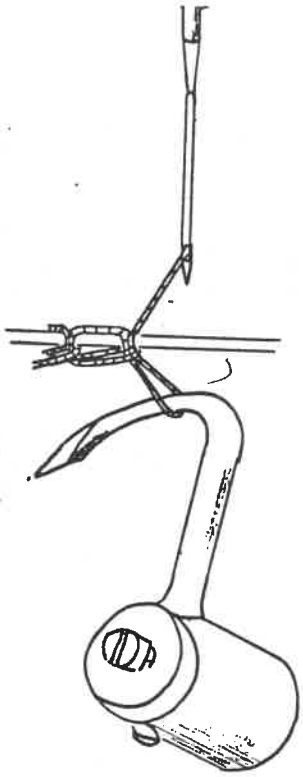


FIGURE 2

Needle at top of stroke.

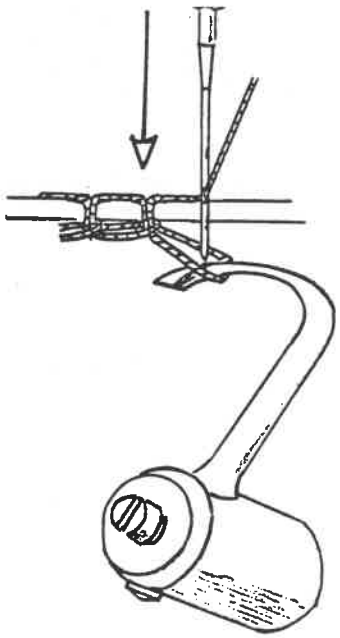


FIGURE 3

Needle entering looper loop.

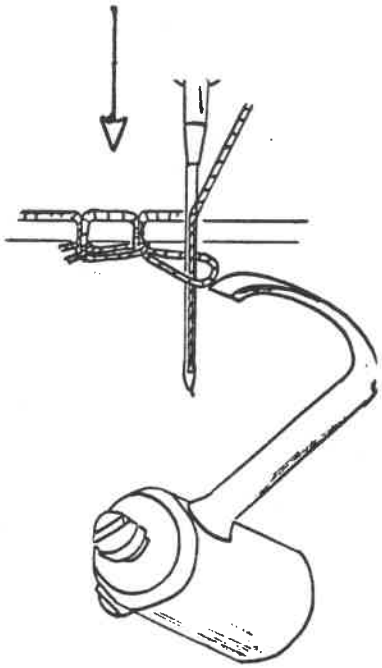


FIGURE 4

Looper sheds loop.

ROTARY LOOPER

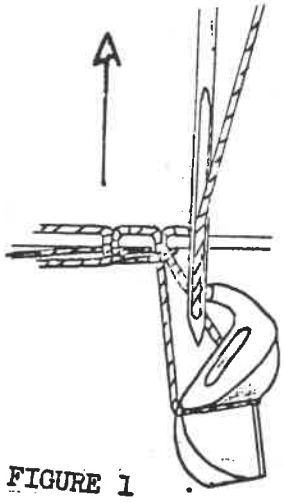


FIGURE 1

Looper entering needle thread loop.

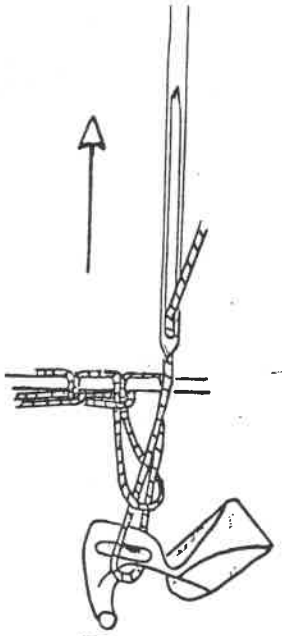


FIGURE 2

Looper carrying new loop into previous loop of needle thread, which has been cast off looper

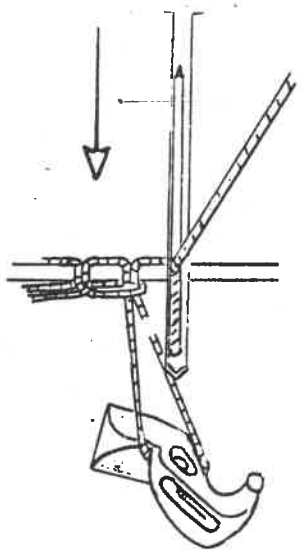


FIGURE 3

Looper carrying enclosed loop of thread around to point of entrance into next loop.

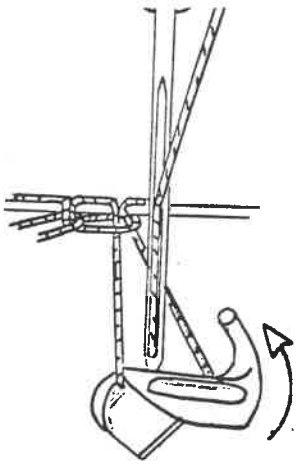


FIGURE 4

Entrance of needle into loop carried by looper. Looper about to enter next loop of thread.

A ROTARY LOOPER (without an eye, when used for single-thread chainstitch) penetrates first loop of needle thread and holds it, while rotating it twists 180° to penetrate next loop of needle thread; passing second loop through first and casting off first loop. First loop is then drawn and tightened into a stitch. Rotary looper, still holding second loop, then continues in its rotation toward next stitch formation.

A Thread positioning instrument known as a SPREADER is used on some machines to expand the needle thread loop sufficiently to permit the entrance of the looper.

LOCKSTITCH LOOP-TAKERS...

In the formation of a lockstitch the lower thread carrier is either a SHUTTLE or a HOOK. These devices contain a BOBBIN. Bobbin holds entire mass of lower thread and passes it en masse through the needle thread loop for each stitch.

In most instances, bobbin is contained in BOBBIN CASE. Case permits bobbin to unwind and includes a tension spring that can exert right amount of tension on bobbin thread of shuttles and hooks, function of bobbin case is designed into them; eliminating need for case or case holder.

BOBBIN CASE HOLDER is that part of shuttle or hook that holds bobbin case in a stationary position, permitting bobbin and shuttle or hook to revolve independently during stitch formation. Bobbin case holder is held within by a spring or gib, but not fastened to shuttle or sewing hook.

The main functional difference between all shuttles and all sewing hooks is the TRAVERSE (or passage) of top thread over lower thread carrier during stitch formation.

1. Every shuttle passes itself and entire mass of lower thread through needle thread loop. Loop slips between shuttle and shuttle holder, enclosing lower thread.

2. On every sewing hook, the hook point passes the needle thread loop, not around itself, but around the stationary bobbin case containing entire mass of lower thread. Loop is case off, after it has enclosed lower thread.

There are three types of shuttles - - -

The VIBRATING (or RECIPROCATING) SHUTTLE produced the lockstitch on the earliest machines made by Hunt, Howe and Singer.

Traveling to and fro in a short horizontal raceway, the vibrating shuttle forms the entire lockstitch during just its forward motion. Mechanical fingers, located at each end of the shuttle, drive the shuttle back and forth. During its forward movement, the shuttle is pushed by the driving finger at its rear (or heel of shuttle). As distance between the two driving fingers

is always greater than the length of the shuttle, there is now a gap in front of the shuttle point. This permits needle thread loop to form in front of shuttle point, between shuttle point and its driving finger. Shuttle, carrying the entire mass of lower thread, passes through needle thread loop. When loop approaches heel of shuttle, shuttle reaches end of its forward stroke and front-driving-finger contacts shuttle to reverse its movement. This creates a gap at heel of shuttle, allowing needle thread loop which has now enclosed the lower thread to escape from shuttle and to be drawn up into stitch while shuttle, free of loop, returns to beginning of its next forward stroke.

These shuttles are slow, noisy and not always reliable for uniform stitching. To overcome these difficulties, the following loop-takers were developed.

OSCILLATING SHUTTLE - travels to and fro in a vertical semi-circular arc, forming the lockstitch in the following manner:

After the needle has penetrated the material and as the needle starts to rise from lowest point of its stroke, needle thread being flexible, bulges away from needle to form a loop which is entered by the point of the shuttle. As the needle continues its rise, and the shuttle progresses in its forward motion, take-up lever is lowered to provide sufficient needle thread to be drawn down through material to form a loop large enough to enclose the shuttle.

The shuttle, carrying the entire mass of lower thread within itself, passes itself completely through this loop of needle thread. As loop approaches heel of shuttle take-up lever starts its upward stroke to remove the slack thread, and shuttle stops its forward motion, to commence its return movement. This reversal opens a clearance gap between heel of shuttle and leg of shuttle driver. Take-up draws needle thread loop through this clearance gap, carrying with it the bobbin thread which has been enclosed by needle thread loop as it passed over bobbin case. Feed dog moves forward, pulling material, and bobbin thread becomes taut as take-up draws remaining slack of needle thread up through material, setting the stitch with lock of needle and bobbin threads that are drawn snugly between the plies of the material being sewn.

ROTARY SHUTTLE - revolves continuously in one direction, making two revolutions for each stitch. During first revolution, rotary shuttle passes itself and entire mass of lower thread through needle thread loop. At end of first revolution, shuttle casts off loop and continues on second revolution free of needle thread. While upper and lower threads are being drawn, tightened and set into a stitch and needle is descending and rising to form next thread loop, rotary shuttle is rotating to enter new loop to begin next stitch formation.

Shuttles are also classified according to their construction of appearance, as follows - - -

Central Bobbin Shuttle - carries a round bobbin over a post in its center, bobbin being enclosed in bobbin case with latch for holding it in place on shuttle post. Bobbin case is fitted with a position finger which engages in a slot to hold the bobbin case stationary, as shuttle oscillates.

Long Beak Shuttle - carries a round bobbin in a circular opening in the frame of the shuttle itself. Bobbin is held in place by spring cover. Point of the shuttle is long and curving, giving the shuttle its name. Unwinding bobbin as the shuttle oscillates, is controlled by a pressure spring against which bobbin is held by spring cover. The long point on this shuttle holds the needle thread loop until the needle has risen to the top surface of the material being stitched, before pulling the loop down to pass around the bobbin. In work on leather or similar close-grained materials, this relieves the thread of considerable strain, and avoids making a larger needle hole in the material than the thread will fill.

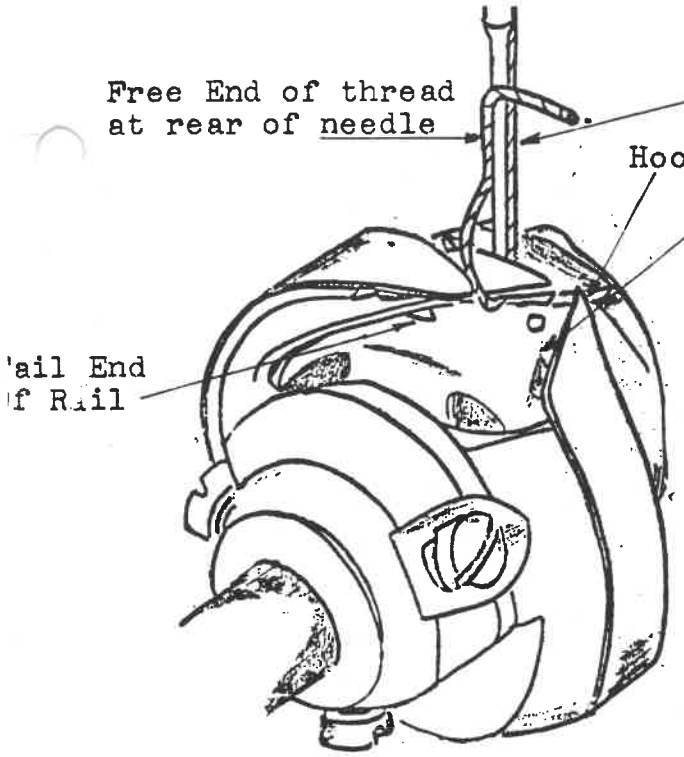
Cylinder Shuttle - carries a long, spool-shaped bobbin in a cylindrical container hinged to the shuttle frame at one end. Container is held in closed position by a spring latch. The chief advantage of the cylinder shuttle is its large thread capacity; an important feature, when heavy threads are required.

OSCILLATING HOOK - travels to and fro in a horizontal, semi-circular arc. During its forward rotation, point of hook passed needle thread loop around bobbin case within hook body. On its backward rotation, hook casts off loop and returns to begin next stitch cycle.

ROTARY HOOK - forms the lockstitch by carrying the needle thread loop around the bobbin, containing entire under-thread supply, in the following manner:

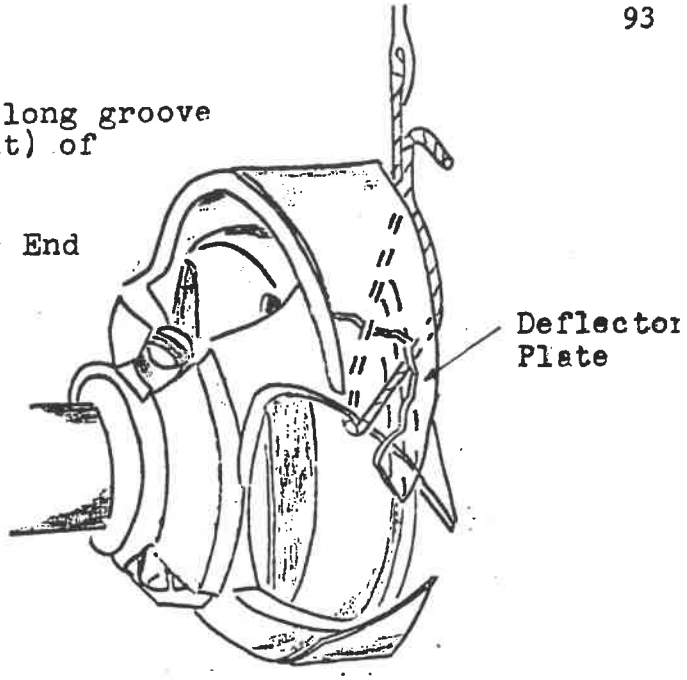
Rotary hook revolves continuously in one direction, making two revolutions for each stitch. As needle starts to rise from lowest point of its stroke, needle thread forms a loop which is entered by point of sewing hook. As needle continues its rise and hook progresses in its rotation, take-up provides sufficient slack needle thread to be drawn through the material to form a loop large enough to enclose entire bobbin case. On its first revolution the hook point carries the loop around the bobbin case. Thread loop is reversed by the thread guard (twisted 180°), insice of loop sliding over top of bobbin case, while outside of loop (free end of thread, or thread coming from previous stitch) passes around back of bobbin case holder. As take-up starts to rise, loop is drawn up through the cast-off opening of hook before the revolution is completed. During second revolution of hook, take-up completes its upward stroke, drawing the slack thread through the material and setting the stitch. Meanwhile, the feed dog has moved forward, carrying the material ahead and drawing the required amount of under thread from the bobbin for the next stitch.

The exact instant at which needle thread loop is reversed or twisted 180° during the stitch formation may vary in different machines. It can be observed however by slowly turning mechanism in correct rotation while watching passage of thread around bobbin case. This reversal of the loop is necessary to obtain correct interlock in stitch formation with a continuously rotating hook.



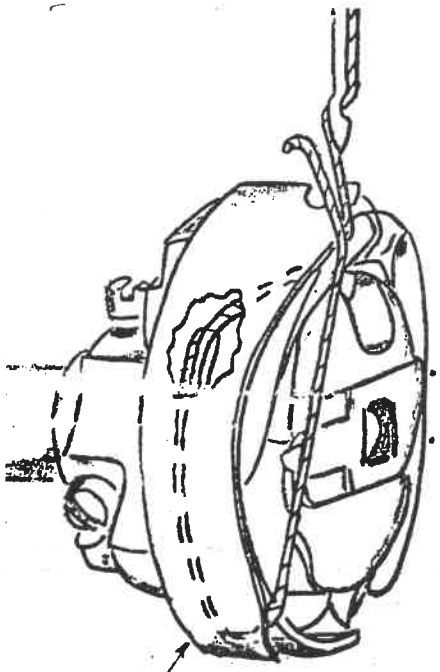
PICKING UP THE LOOP.

(1)



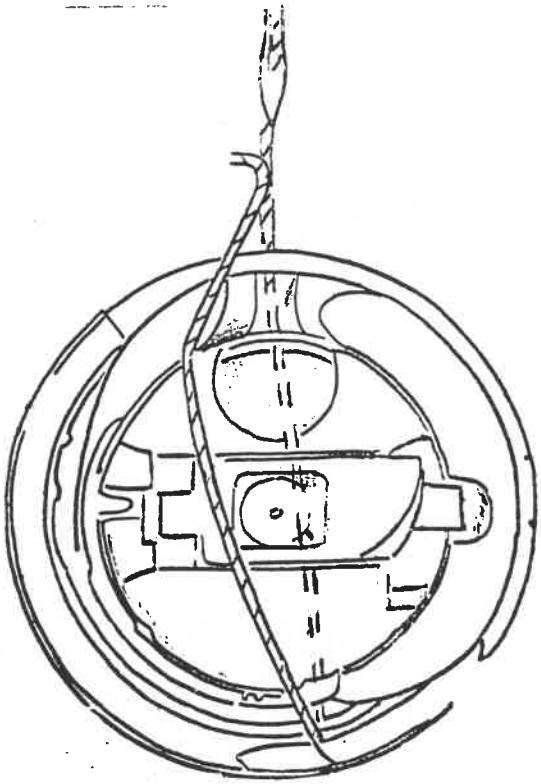
180° Twist Of Loop

(2)



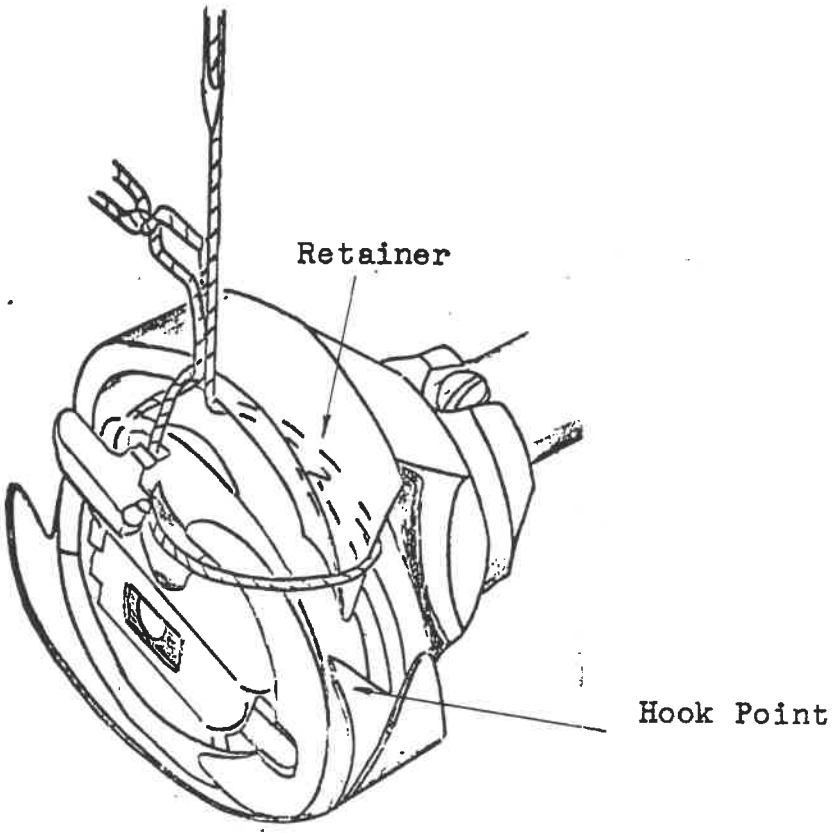
DEFLECTOR PLATE ACTING.

(3)



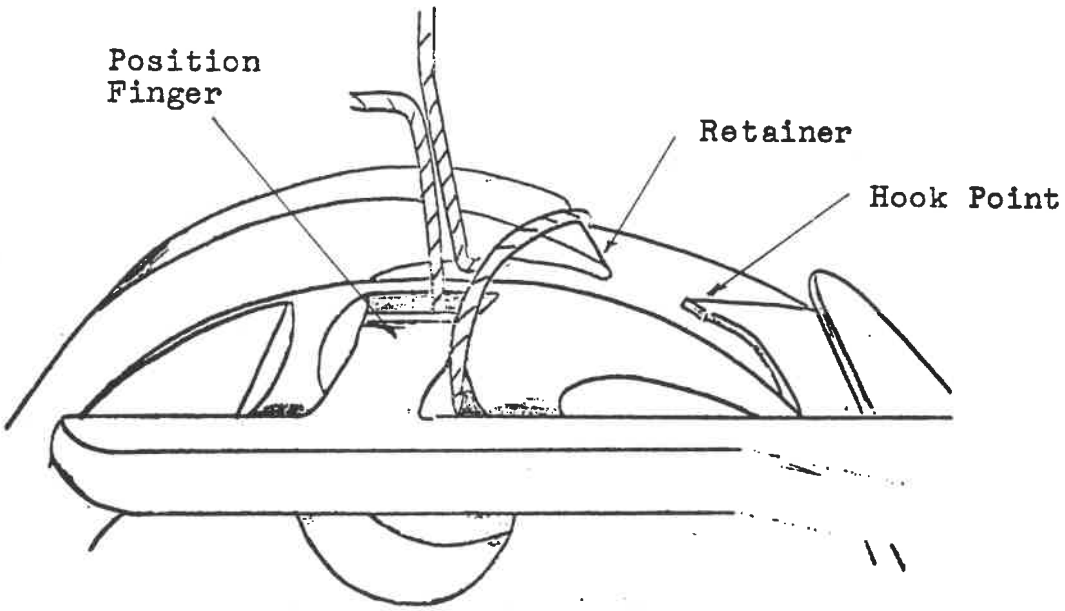
SIX O'CLOCK POSTION.

(4)



LOOP ON RETAINER.

(5)



LOOP AT FINGER.

(6)

Without this twist, thread loops would merely pile up and jam the sewing mechanism.

It should be noted that in the movement of each lower thread carrier, some time must be allowed for stitch to be drawn, tightened and set. In reciprocating devices this function is performed during the backward (or return) stroke. In rotating devices it is usually accomplished during the second revolution. The exception is - - -

VARIABLE-MOTION HOOK - makes but <u>one</u> revolution for each stitch; traveling <u>slowly</u>, while needle thread loop is entered by hook point; <u>rapidly</u>, while loop is passed around bobbin case and is cast off to enclose lower thread; then <u>slowly</u> again while stitch is being set and hook point enters next loop of needle thread.

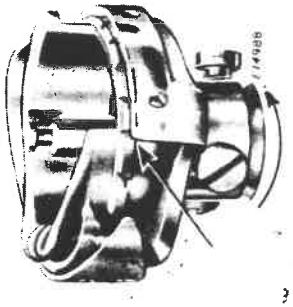
Sewing hooks and shuttles are also classified according to their <u>mounted</u> positions, as follows - - -

<u>Vertical-Axis Hook (or Shuttle)</u> - rotates (or oscillates) in a horizontal plane parallel with bed of machine and is mounted on a vertical shaft.

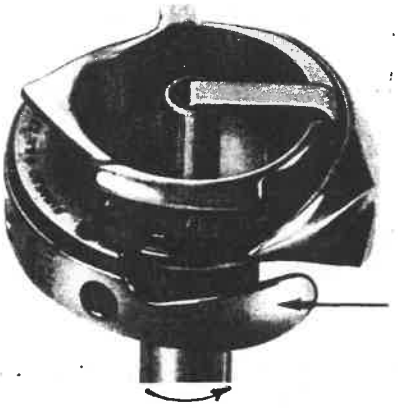
<u>Horizontal-Axis Hook (or Shuttle)</u> - rotates (or oscillates) in a vertical plane along line of feed and is mounted on a horizontal shaft.

<u>Transverse, Horizontal-Axis Hook (or Shuttle)</u> - rotates (or oscillates) in a vertical plane across the line of feed. (Used in some zig zag stitching machines and in other vibrating needle bar machines.)

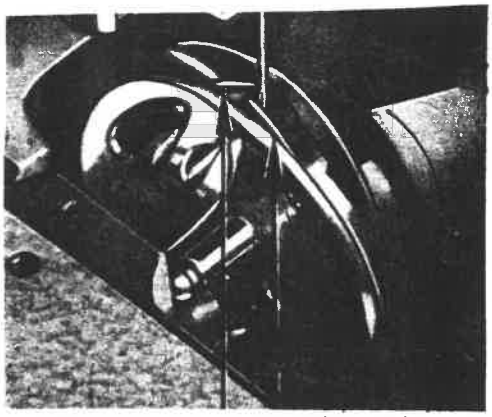
<u>Vibrating, Horizontal-Axis Hook (or Shuttle)</u> - a comparatively rare type, rotating (or oscillating) vertically along line of feed, to form the stitch, and moving en masse back and forth across line of feed in time with movement of a vibrating needle bar, to ensure entrance of loop taking point in needle thread loop (for zig zag and other stitching).



HORIZONTAL-AXIS HOOK



VERTICAL-AXIS HOOK



Needle Swing For ZIG ZAG

TRANSVERSE HOOK

The stitch is formed by all types of <u>HOOKS</u>, in a similar manner. Although they may not look alike, each hook has the same basic parts and functions. Each has a hook body with an internal raceway and a gap to form a raceway entrance and a raceway exit for the needle thread loop. Each has a bobbin. On the outside of each bobbin case or holder there is a rail which contains another gap. Front end of this rail is called the detainer.

All the hooks begin by picking up the needle loop. During loop pick up and for a short time thereafter, gap in raceway and gap in rail are in same position (open). As hook continues to rotate and expand, thread loop slips down hook point and passes entrance to raceway. At this moment the two gaps which were previously matched have begun to close until detainer on bobbin case enters raceway of hook. When gaps are unmatched, thread is locked in hook until hook revolves to position where gaps will start to match again. At this moment hook is nearly at end of first rotation and thread loop leaves the hook. The needle thread loop has passed completely around the bobbin case and bobbin case holder, enclosing the bobbin thread.

All three basic hooks revolve at a speed twice that of arm shaft on sewing machine. As needle starts its up-stroke, presenting needle thread loop to hook point, thread loop will have to enclose bobbin case and then cast-off before needle reaches top of its stroke. These actions are completed before end of first rotation of hook. Drawing up of threads and stitch setting is accomplished during second rotation of hook. There is an important reason for this design. If hook rotates at same speed as arm shaft, all of these actions must be completed during one rotation of hook. This is quite difficult, as hook point and needle might catch thread-loop after cast-off unless thread loop is drawn very quickly into fabric as needle descends.

There is one other type of hook still in use, called a 3 to 1 hook. It revolves three times as fast as arm shaft. In a standard 2 to 1 hook, thread loop is cast from hook just before end of the first revolution. The 3 to 1 hook casts the loop some time during the second revolution. Hook point is prevented from catching needle loop on second revolution by a brush that holds loop away from point. On today's high speed machines such a hook would travel at speeds of 15,000 R.P.M. and higher.

A MECHANICAL OPENER - is used on machines having vertical-axis sewing hooks to insure the correct passage of thread around lower thread carrier. This device consists of a finger actuated by an eccentric on the vertical hook shaft or on a hook washer. Eccentric is so located that as hook revolves finger pushes against bobbin case, rotating it slightly in opposite direction from hook rotation. This action opens a clearance gap at just the right moment between position finger on bobbin case (or holder) and position slot on underside of throat plate, permitting needle thread loop to be drawn through gap.

This device can be used to solve similar problems on horizontal-axis hooks in high speed machines.

Many other hook and shuttle designs, such as the hook saddle, were developed to overcome problems of thread handling which are now better accomplished by means of take-ups and other thread controllers.

Some of the older features in loop-takers are slowly becoming obsolete or of less importance as the advantages and possibilities of auxiliary thread controls become more evident. Take-ups, tension devices and other thread controllers are therefore the subject of our next discussion.