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LOCK STITCH SEWING MACHINE UNDER BED MECHANISM


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12 Claims. (Cl. 112—263)

The general object of the present invention is to provide improvements in the under-bed mechanism of a lock stitch sewing machine. The invention was primarily devised for use in the construction of a portable sewing machine of relatively small size.

A specific object of the invention is to provide a novel under-bed stitch forming and feed actuating unit which is detachably secured in the hollow base portion of the sewing machine frame, and which includes all of the under-bed sewing machine mechanism except the feed dog, and a portion of its operating mechanism. Another specific object of the invention is to provide a desirable form of feed mechanism in which the feed dog is given its different movements by means of cams or eccentrics carried at the opposite ends of a shaft mounted in the body of the above mentioned unit.

Other specific objects of the invention are to provide improved means for releasably securing the bobbin casing, or holder, in the open ended rotary hook of the sewing machine; and to make the bobbin casing accessible for inspection, the removal of clogging thread accumulations, and bobbin replacement, and to facilitate such replacement; and to adapt the bobbin casing for use with ordinary thread, and also with thread or cord of much larger diameter than the ordinary thread.

The various features of novelty which characterize our invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which we have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is an elevation of a sewing machine with parts broken away and in section;

Fig. 2 is an inverted plan view of the machine shown in Fig. 1;

Fig. 3 is a partial elevation in section on the lines 3—3 of Fig. 1 showing a portion of the feed mechanism;

Fig. 4 is a partial elevation in section on the line 4—4 of Fig. 1;

Fig. 5 is a plan view showing a portion of the apparatus shown in Fig. 9, including the bobbin holder and associated bobbin holder positioning element;

Fig. 6 is a partial elevation in section on the line 6—6 of Fig. 5;

Fig. 7 is a partial elevation in section on the line 1—1 of Fig. 6;

Fig. 8 is a partial elevation in section on the line 8—8 of Fig. 2 showing another portion of the feed mechanism; and

Fig. 9 is a perspective view of a detachable, underbed, stitch forming and feed actuating unit.

In the drawings, we have illustrated an embodiment of the invention comprising a sewing machine frame, which may be an aluminum die casting, comprising a hollow structure including a base A, standard B, arm C and needle bar head D. The base A is of box form open at its lower side, though, if desired, the opening may normally be closed by a detachable bottom wall part. The integral top wall portion a of the base A serves as the cloth plate or work bed of the machine. An electric drive motor F is mounted in the hollow base and rotates a drive pulley F', and through the latter is connected by a belt f to, and rotates a horizontal needle bar shaft G mounted in the arm C. A main underbed shaft H is rotated by the shaft G through a belt φ. The latter is of the sprocket chain type running over notched pulleys or sprocket wheels G' and H' carried by the shafts G and H, respectively, and may well be of the particular form known as a Glimer belt.

The shaft H forms part of an under-bed stitch forming and feed actuating unit shown in perspective in Fig. 9, and comprising a metallic body member I, which may be an aluminum die casting, and is normally in engagement with the work bed a and detachably secured to the latter by three screws l. The shaft H is journaled in front and rear bearing sleeves i and i' anchored in the unit body 1, and carries a gear 2 between said bearings. The gear 2 is in mesh with a gear 3 carried by a short hook shaft h parallel to and alongside the front end portion of the shaft H. As shown, the gears 2 and 3 are helical gears proportioned to drive the hook shaft h with a rotative speed twice that of the main under-bed shaft H. The shaft h is journaled in the member I and carries an open hook J of conventional form at its front end. The member I is formed with a lubricating chamber 5 having an opening at its bottom which is normally closed by a removable cover plate 6. The chamber 5 is normally filled with lubricating oil or grease, and the latter not only lubricates the gears 2 and 3, but also provides lubrication for the adjacent bearings for the shafts H and h.
The unit includes a depending boss 7 at its front end, which, as is shown in Fig. 6, is formed with a passage 17 parallel to the shafts H and h, and receiving an arm or bar 8. The latter has its front end rigidly connected to a block like part 5 which forms an adjustable support for a bobbin casing positioning element K. The latter is connected by a pivot 19 to the support 8, to turn relative thereto about the horizontal axis of said pivot which is below and transverse to the axis of the hook shaft h. As shown, the arm 8 is in the form of a cylinder having its under side flattened for engagement by set screws 11 threaded through the lower portion of the wall of the passage 17. The screws 11 not only maintain the flattened side of the arm 8 horizontal, but also secure the arm in the slightly different longitudinal adjustment positions desirable under different conditions. The positioning element K comprises a plate like part 12 facing the hook J and having its adjacent side formed with a central depression 13. The top portion of the part 12 comprises an uprisng tongue 14 extending upward above shoulder portions 15 of the part 12. Vertical thread channels 16 at opposite sides of the tongue 14 open at their lower ends into the depression 13.

The part 12 is spring biased to turn into its inclined position shown in dotted lines in Fig. 6, but is normally maintained in its vertical position, shown in full lines in Fig. 6, by a notched latch member 17. The spring biasing means for the part 12 may be of any usual form. As indicated in the arrangement shown diagramatically in Fig. 7, the pin 10 is rigidly connected to the element K and is connected to the part 9 by a helical torsion spring 12 which surrounds a right hand end portion of the pin 10 as seen in Fig. 7, and is surrounded by the wall of a cavity 8' coaxial with the pin 10 and extending into the support 9 from the right hand side of the latter as seen in Fig. 7. The inner end 12' of the spring 12 is secured to the pin 10. The outer end 12' of the spring comprises a portion external to the member 9 and loops to form a projection laterally displaced from the adjacent side of the cavity 8' and extending into an opening formed for the purpose in the bed plate a between the pressure foot and the end wall a of the base A, and normally closed by a removable plate 23. The bobbin case may be returned to its position shown in dotted lines in Fig. 6 by equal ease. Thereafter the bobbin case L and its portioning device K may then be returned to their normal positions shown in full lines in Fig. 6 by light finger pressure applied to the upper end of the member K. The latch member 17 is spring biased for counter clockwise rotation about the pivot 10, as seen in Fig. 6, and in consequence the movement of the bobbin case L and support K out of their positions shown in full lines and into their positions shown in dotted lines in Fig. 6 is effected by merely turning the latch 17 clockwise as seen in Fig. 4 to disengage the projection 20. When the bobbin casing and member K are returned to their normal condition, the bobbin casing is automatically latched in the rotary hook J by the spring biased latch member 17. In the preferred form of the invention the plate 23 is in abutting relation with the usual throat plate 39, and extends between the latter and the front end of the top of the sewing machine base A.

An advantageous characteristic of the invention, is the ease and accuracy with which the bobbin casing supporting element 8 may be adjusted toward and away from the member 9 in the original assembly of the apparatus, and in subsequent reassemblies or adjustments which become necessary as a result of the replacement of the hook J, bobbin casing L or member K. To provide the proper clearance or thread space
between the front side of the bobbin case and the adjacent surface of the member K, a clearance of about .012 to .015 of an inch is needed. The precise displacement of the member K from the body I required to provide such displacement may be effected by loosening the screws 11, and then longitudinally adjusting the bar 8 in the boss 7. This adjustment is easily effected when the member K is detached from the sewing machine frame, so that the adjustor is not hampered in effecting the adjustment, and can visually observe the relative positions of the bobbin casing and member K when the latter is latched in place by the member 17, and can readily insert a thin clearance gage between the bobbin casing and the member K.

A special advantage of the bobbin case arrangement is the ease with which the bobbin casing L and its support K can be adjusted from their normal positions shown in full lines, into their positions shown in dotted lines in that figure, and the resultant reduction in the annoyance and trouble caused by the accumulation of thread in and adjacent to the bobbin casing which occurs as a result of thread clogging. Such thread clogging is especially apt to occur, and its results are especially annoying and troublesome, when the housewife or other user of a sewing machine is not mechanically minded or trained and has had little experience in operating sewing machines. With the bobbin case arrangements in most general use, thread clogging is especially troublesome because of its tendency to prevent the removal of the bobbin casing from the rotary hook of the sewing machine.

Ordinarily when clogging occurs and results in thread accumulation in and adjacent to the bobbin casing of the sewing machine disclosed herein, the movement of the latch member 17 out of engagement with the pin 29 will result in the movement of the bobbin casing and member K into their tilted, dotted line positions shown in Fig. 6. Thereafter all that needs to be done to return the mechanism to its normal operating condition, is to lift out the bobbin casing, remove the accumulated thread, make certain that the thread is moving freely from the bobbin to and through the thread passage 28, return the bobbin casing to its position shown in dotted lines in Fig. 6, and tilt the member K and bobbin casing into their normal vertical positions.

The feed mechanism employed to move the work transversely to the path of the sewing machine needle over the cloth plate e, is characterized primarily by the simple means for supporting the feed dog 31 and giving it its feeding movement. In accordance with the present invention, the feed dog 31 is given its up and down movements by a cam or eccentric 32 secured to the front end of the shaft 37 mounted in the body I, and is given its horizontal movements by a cam or eccentric 33 secured to the rear end of the shaft 37. Advantageously and as shown, each of the members 32 and 33 is a ring, i.e., a disc formed with an eccentrically located round hole snugly receiving a corresponding end portion of the shaft 37 and secured to the latter by a set screw. The feed bar 34 to which the feed dog 31 is attached, is mounted on a pivot pin 35 to the upper end of an arm 39. The latter has its lower end rigidly secured to an oscillating shaft 37. As shown, in Figs. 1 and 2, the shaft 37 is horizontal and has its ends pivotally supported by aligned trunnion pivots 37', which are releasably secured in sockets in lug portions 38 of the frame base A, within and adjacent the ends of the latter. The shaft 37 is located at a level but slightly above the bottom of the base A, and is close to the vertical frame wall at the operator's side of the sewing machine. Adjacent its front end, the shaft 37 is provided with spaced apart uprising arms 33 which straddle the adjacent wide end portion of the feed bar 34 remote from the feed dog 31. The feed bar 34 is formed at its underside with a bearing surface 40 adjacent its feed end opposite the spring biased to maintain its bearing surface 40 in contact with the upper side of the eccentric 32, so that the feed dog is moved up once, and down once, during different portions of each revolution of the shaft 37. Normally, the up and down movements of the feed dog alternate with the to an fro horizontal movements of the feed dog.

The horizontal movements of the feed dog are produced by oscillatory movements of the shaft 37 which result from the rotation of the cam 33. The mechanism through which the rotation of the shaft H gives oscillatory movements to the shaft 37, is shown in Fig. 3. That mechanism comprises a lever 41 movably mounted transversely to the shaft 37, and in a general horizontal direction, and is forked at one end having parallel upper and lower fork portions 42 and 43 which straddle the eccentric 33, so that the corresponding end of the lever 41 is moved up and down during each rotation of the shaft 37. The opposite end of the lever 41 is connected by a pivot 44 to an uprising arm 45 secured to the shaft 37 adjacent the rear end of the shaft H. Intermediate its ends, the lever 41 supports a roller element 46 pivoted to turn on its horizontal supporting shaft 47. The latter extends through and is anchored in the lever 41 and is nearer to the bifurcated end of the lever than to the pivot 44. The roller 46 is received in a guide-way 48 formed in two straight parallel walls 49. The guide-way thus formed is a slot open at its ends and open at its side adjacent the lever 41, and is formed in a block like part 49 secured to the end of a shaft 50. The latter is parallel to the shaft H and is journaled in a boss 51 which depends from the under side of the top wall portion of the frame standard B. A collar 52 is secured to the shaft 53 at the opposite side of the boss 51 from the guide-way part 49.

An uprising operating arm 53 has its lower end secured to the collar 52 and extends radially away from the latter upward through an elongated slot 54 in the portion of the top wall of the base A at the right of the standard B as seen in Fig. 1. The arm 53 forms a means for angularly adjusting the shaft 59 and thus varying the inclination to the horizontal of the side walls 48 of the guide-way receiving the roller 46. When those side walls are vertical, the small upper and downward movement given to the forked end of the lever 41 produces no significant angular movement of the shaft 37. Under this condition in which the shaft 37 is not oscillated, the feed dog is given no horizontal to and fro movement, which is desirable under some conditions, as in using the machine to effect darning operations. When the upper end of the lever 53 is pulled toward the user, the upper ends of the walls 48 are shifted to the right of their respective lower ends as seen in Fig. 3 and the shaft 37 is then given oscillatory movements as required to cause the
feed dog to advance the work in the normal direction, i.e. away from the user of the sewing machine. When the user pushes the upper end of the arm 53 to the rear and thus adjusts the guide member 49 in the counter clockwise direction, as seen in Fig. 3, beyond the position in which the guide-way walls 48 are vertical, the normal direction of feed is reversed, and the feed mechanism then moves the work toward the user. Ordinarily when the direction of feed is being reversed, the sewing machine user needs to guide the work with one hand while adjusting the direction of feed with the other hand. The location of the lever 53 at the right hand, or rear end of the machine, and its extension upwards from the base of the machine, facilitates the adjustment of the lever 53 by the user's right hand while the work is being positioned by her left hand.

The feed mechanism disclosed is characterized by its simplicity and effectiveness. In most domestic sewing machines in use, the horizontal feeding movements of the feed dog are effected as a result of oscillatory movements given to the feed shaft similar to or analogous to the shaft 37 shown herein, through a long lever connected at its lower end to said shaft and extending upward through the standard portion B of the sewing machine frame and having its upper end operatively connected to the needle bar actuating shaft G. The use of applicant's short lever 41 has obvious practical advantages, and contributes directly to a reduction in the sewing machine construction and assembly costs. It also permits the length of the stitches formed to be regulated and the direction of the feed to reverse by the angular adjustment of the conveniently located, readily accessible and easily operated handle 53.

As shown, the sewing machine is provided with a thread spool supporting spindle 55, and take up mechanism 56, a tension device 57, a needle bar 58, and a needle 59 all of which may be conventional in form and arrangement and therefore require no further mention herein. In some cases, the relatively short work bed may be extended, with desirable, by means of an extension plate 59 detachably connected by longitudinally adjustable pivot pins or hinge pinteis 61, to the frame base A at the front end of the latter. As shown in Fig. 1, the extension plate 60 is turned upward into a non-operative position in which its upper end bears against the needle head D. When the part 60 is turned down into its normal horizontal position, a flange portion 62 of the member 60 bears against the front end wall 22 of the frame A.

The major advantages obtainable with the present invention are directly due to, or stem from our novel detachable under-bed, stitch forming and feed actuating unit, comprising the body or frame member I, the main under-bed shaft H, the hook shaft h, and the bobbin casing mechanism supported by the member I. Attention has already been directed to the advantages obtained by the adjustable mountings of the bobbin case adjusting mechanism on the member I, and to some of the advantages of the actuation of the feed dog 31 by the cams or eccentric 32 and 33 mounted on the opposite ends of the shaft H.

In addition to its other advantages, the use of the detachable unit comprising the frame member I contributes directly to a significant reduction in the cost of constructing and assembling the under-bed sewing machine mechanism, by reducing the machining operations on the frame base A and on the parts mounted in the base A and for that reason made less accessible for machining purposes than when mounted in the detachable member I in accordance with the present invention. The use of the novel unit, including the detachable frame member I, not only reduces the sewing machine construction and assembly costs, but it also contributes to the production of a sewing machine of improved construction. Thus, for example, the feed and preferably desirable attachment of the two feed dog actuating cams 32 and 33 to the opposite ends of the same shaft H is made practically feasible by the mounting of the shaft H in the member I. With the shaft H so mounted, simpler actuating connections between the feed shaft 37 and the means for giving the feed dog its movements, and the practical elimination of lost motion in the feed mechanism are made possible.

In consequence of the simple connections and practical elimination of lost motion, no provisions need be made for adjustment of the cams 32 and 33 relative to one another insuring proper relative positions of the cam which will properly time the up and down and to and fro movements of the feed dog. Without arrangement the only timing adjustments which need to be made in assembling the sewing machine, is the tightening up of the set screws which secure the sprocket type pulleys 47 and 48 to their respective shafts G and H, after the back J' of the rotary hook J and the needle bar 59 have been adjusted into their proper relative positions in some convenient state of operation. As will be apparent, general advantages of the detachable unit are obtainable with rotary hooks of other forms than that disclosed herein.

While in accordance with the provisions of the statutes, we have illustrated and described the best form of embodiment of our invention now known to us, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of our invention as set forth in the appended claims and that in some cases certain features of our invention may be used to advantage without a corresponding use of other features.

Having now described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a lock stitch sewing machine, comprising a frame including a work-bed and a needle actuating mechanism above said bed, the improvement comprising an under-bed stitch forming and feed actuating unit for detachable connection to the under side of said work-bed and comprising a body member, a rotary hook and a hook driving shaft journaled in said member, a cam carried by said shaft at one end and operative to give a feed dog horizontal to and fro movements, a second cam carried by said shaft at its other end for giving said feed dog up and down movements, and bobbin case supporting means, mounted on said member and maintaining a bobbin case in operative relation with said rotary hook.

2. A unit as specified in claim 1 in which said hook is carried by a hook shaft which is gear connected to said hook driving shaft.

3. A unit as specified in claim 1 in which said hook driving shaft extends through said body member and has end portions extending away from the respective ends of said body member.
and in which one of said cams is mounted on one of said end portions and the other cam is mounted on the other end of said portions so that each cam is adapted to engage a feed mechanism part in overlapping relation with an end portion of said body member.

4. A unit as specified in claim 1 in which said rotary hook is mounted in said body member to rotate about a horizontal axis and in which said bobbin case supporting means comprises a part detachably connected to said body member and adjustable relative thereto in a direction parallel to said axis.

5. A lock stitch sewing machine comprising a frame including hollow base, standard and arm, and a needle bar shaft journaled in said arm and carrying a pulley directly above said standard, an under-bed, stitch forming and feed actuating unit comprising a body member detachably secured to said frame base, a hook rotating shaft journaled in said body member with one end portion extending therefrom into the space directly beneath said standard, a pulley secured to said end portion adjacent said body member, a cam secured to said end portion at a greater distance from said body member, a timing belt connecting said pulleys, a feed bar oscillating shaft journaled in said base and parallel to said hook actuating shaft and having a transverse arm, a lever having one end connected to said arm to turn about an axis parallel to said shaft and having fork portions at its opposite end which straddle said cam, and having a lateral projection adjacent its forked end and a guide member mounted in said shaft and formed with a guide way open at one side and extending transversely to said axis and receiving said lateral projection whereby the rotation of said cam through a particular portion of each revolution oscillates said feed shaft in one direction or in the opposite direction, depending on the angular adjustment of said guide member.

6. A lock stitch sewing machine as specified in claim 5, in which said needle bar shaft carries a second pulley, and comprising a motor mounted in said base and having said pulley, and a driving belt running over the two last mentioned pulleys.

7. A lock stitch sewing machine as specified in claim 5 in which said hook actuating shaft supports a second cam at its end remote from the first mentioned cam, and in which said oscillating shaft has a second upspringing arm, and comprising a feed bar pivoted at one end to said upspringing arm to turn about an axis parallel to said oscillating shaft and having a bearing surface at its under side resting on said second cam.

8. A sewing machine comprising a frame having a hollow base portion and an upspringing standard with depending side and end walls, a hook actuating shaft journaled in said base portion to turn about an axis intersecting said end walls and intermediate said side walls, a separate cam carried by said shaft adjacent each end, an oscillating feed shaft journaled in said hollow base to turn about an axis parallel to the first shaft and adjacent the lower edge of one of said side walls and having an upspringing arm at each end, a feed bar pivotally connected to the upspringing arm remote from said standard to turn about an axis parallel to said oscillating shaft and having a bearing surface intermediate its ends resting on the cam carried by the adjacent end of said hook actuating shaft, a lever pivotally connected to the upper end of the arm adjacent said standard to turn about an axis parallel to said oscillating shaft, the opposite end of the lever having spaced apart fork portions straddling the second cam carried by the actuating shaft, said lever having a lateral projection at one side adjacent its opposite end, a guide member mounted to turn about an axis parallel to said oscillating shaft and formed with a guideway open at one side to receive said projection, and having parallel guide walls at opposite sides of said projection adapted to be turned by the rotation of said member from a position in which said guide walls are inclined away from the vertical in one direction into a position in which they are inclined away from the vertical in the opposite direction, whereby the feed mechanism is adjusted to feed work in one direction or in the opposite direction, said base portion being formed with a slot in its top wall adjacent said standard, and an arm extending through said slot and having its lower end attached to said guide member and operative to oscillate said member about its axis.

9. Bobbin case supporting means operative to normally maintain a bobbin case in an open ended rotary sewing machine hook turning about a horizontal axis and adjustable to effect the removal and replacement of the bobbin case and comprising a bobbin case supporting member mounted to turn about a horizontal pivot below and transverse to the axis of said hook and biased to turn from a normal upright position in which it is adapted to hold a bobbin case in said hook, into an inclined position in which the bobbin case is withdrawn from the hook and is accessible for removal and replacement, supporting means including a shaft parallel to and substantially below said hook axis, an uprising latch member pivoted on said shaft and biased for movement about the latter into a position in which it engages a portion of said supporting member at a level adjacent that of said hook axis and latches said supporting member in its upright position.

10. A sewing machine bobbin case adapted for use in sewing either with a first thread of one diameter or with a second thread of greater diameter and stiffer than said first thread, and comprising a cup shaped casing having a base member and cylindrical wall extending therefrom and forming a bobbin chamber, and a circumferential rim extending away from said wall, said wall being formed with a first thread outlet and with a second thread outlet for the passage of thread received from said second thread outlet, and a spring attached to said bobbin casing and operative to tension the thread passing through said first thread outlet.

11. A bobbin case as specified in claim 10, in which said rim opening is adapted to receive thread from each of said thread outlets.

12. An under-bed stitch forming and feed actuating unit for lock stitch sewing machines having a frame and including a work-bed and a needle actuating mechanism mounted in said frame above said work-bed, said unit comprising a body member for detachable connection to the underside of said work-bed, a rotary hook and a hook driving shaft journaled in said member, a
cam carried by said shaft at one end and operated to give a feed dog horizontal to and fro movements, and a second cam carried by said shaft at its other end for giving said feed dog up and down movements.

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