

CHAPTER 4

SEWING MACHINE REPAIR

The Aircrew Survival Equipmentman (PR) is called upon to perform an enormous amount of repair work on parachutes and survival equipment in all types of maintenance activities. Although lower rated personnel perform much of this work, the task of maintaining the sewing machines in top running condition falls to the senior PRs. Qualified sewing machine operators may assist in this work under supervision; however, determining the causes of malfunctions, making major adjustments, and replacing parts are the responsibilities of the first class and chief petty officer.

This chapter explains the rotory-hook (111 W 155) sewing machine and the oscillating-shuttle (31-15) sewing machine. We gave you an overview of these two types of sewing machines in chapter 3 of the *Aircrew Survival Equipmentman 3 & 2*, volume 1; however, as a senior PR, you need more specific information on the basic structure of these two sewing machines. With the information available, you can repair any of these types of machines the Navy uses. We know it is very difficult to find information on sewing machine repair; therefore, you should use this chapter as a reference when working on the alternating-presser-foot sewing machine and the simple oscillating-shuttle sewing machine.

Your shop may have the Consew Model 225, the Juki LU-562, or the Singer Model 111 W 155 sewing machine. These three sewing machines are essentially identical, and all specifications and instructions are the same for all three sewing machines. For simplicity we will use the Singer 111 W 155 as a model for all three sewing machines.

The oscillating-shuttle, Singer 31-15, sewing machine is representative of the second type of sewing machine used by the Navy. The descriptive term *oscillating shuttle* refers to the action of the sewing hook (the way it makes a stitch in unison with the needle). The 31-15 is used for sewing lightweight fabrics and is ideally suited for use in the maintenance of aviation survival equipment. Although the physical size

of other oscillating-shuttle sewing machines may be quite different from the 31-15, such as the large Class 7 machines, their operation and maintenance are very similar.

111 W 155 SEWING MACHINE

The 111 W 155 sewing machine is a single-needle, compound-feed sewing machine with alternating presser feet. This sewing machine makes the standard US 301 lockstitch and sews medium-heavy fabrics. It is equipped with a vertical-axis rotating hook. This sewing machine is classified as a rotory-type sewing machine and is also equipped with two presser feet; one is a vibrating presser foot, and the other one is a lifting presser foot. The front (vibrating) presser foot, the needle, and the feed dogs move in unison. Together they move the cloth away from the operator with each completed stitch. The rear (lifting) presser foot holds the fabric in place while the vibrating presser foot rises and moves forward to start the feeding action for another stitch. This sewing machine is capable of operating at a speed of 3500 stitches per minute (SPM). The stitch regulator provides a range of 3 1/2 to 32 stitches per inch (SPI).

The 111 W 155 is the same sewing machine in most ways as the 111 W 151, except for its alternating presser feet, which give the 111 W 155 a more positive feeding action. The 111 W 155 also has a longer stitch length (3 1/2 SPI instead of 5 SPI) and a higher maximum presser-foot lift (one-half inch instead of three-eighths inch). The 111 W 155 is an ideal sewing machine to use on medium-heavy fabrics such as vinyl and canvas.

This RTM will also include disassembly and assembly of the 111 W 155 sewing machine. To simplify minor repairs to this sewing machine and the 31-15 sewing machine, we have placed our discussion of disassembly and assembly to the rear of the chapter.

PREVENTIVE MAINTENANCE

If the sewing machine becomes sluggish, an accumulation of dust and lint or a loose power belt may be the cause. To prevent the buildup of dust and lint, you should cover the sewing machine when it is not in use.

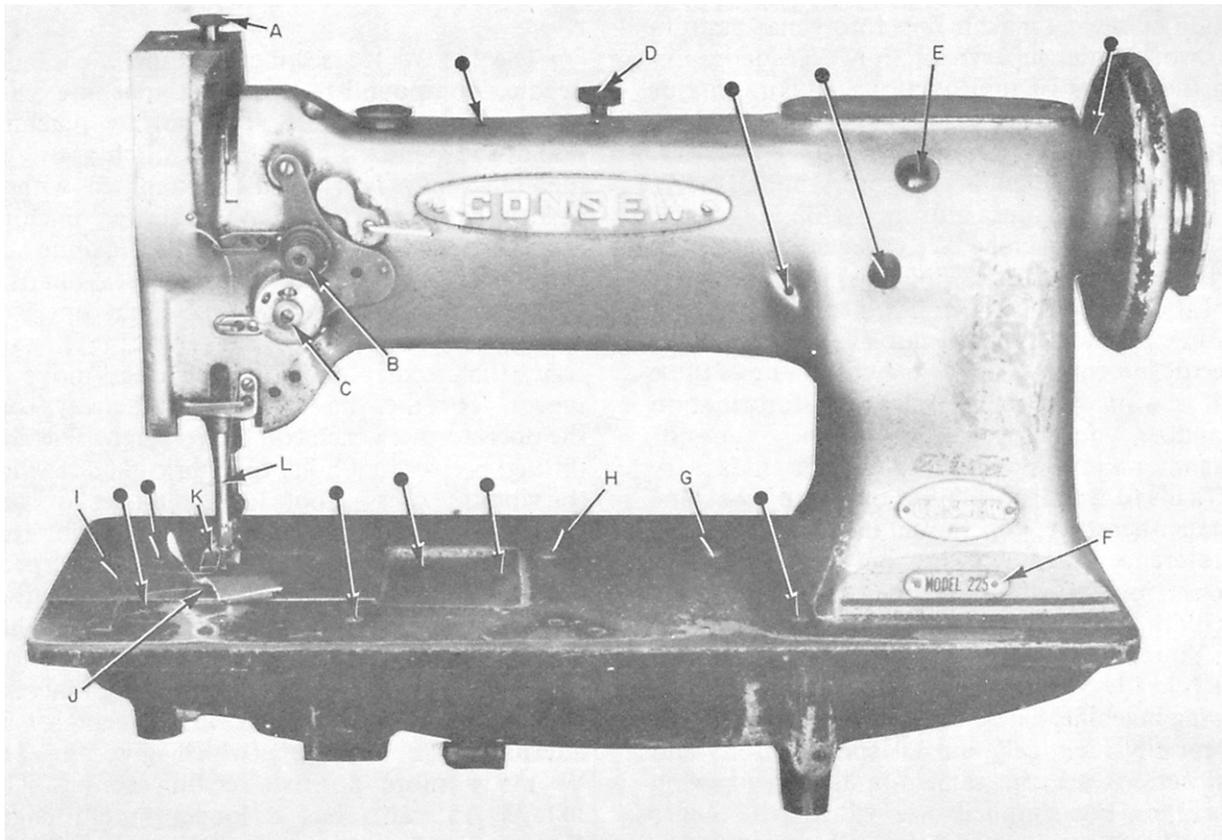
CLEANING AND OILING

Before you attempt to oil or operate a new sewing machine, clean it with diesel fuel. The diesel fuel removes any corrosion-protective lubricants that may have been placed on the sewing machine at the factory. During normal

maintenance, you may use any approved cleaning solvent to clean the sewing machine.

After you use a sewing machine, clean and oil it. A clean and well-oiled sewing machine gives you many hours of trouble-free operation. You may clean hard-to-reach places with a soft-bristle brush or air pressure. Clean the outside of the sewing machine head, the oil pan, the machine stand, and the motor casing with a clean dust cloth or air pressure. Never use air pressure above 25 psi for this purpose.

NOTE: At least once a year, the machine should be thoroughly cleaned and oiled. Figures 4-1 through 4-3 show the oiling points on the 111



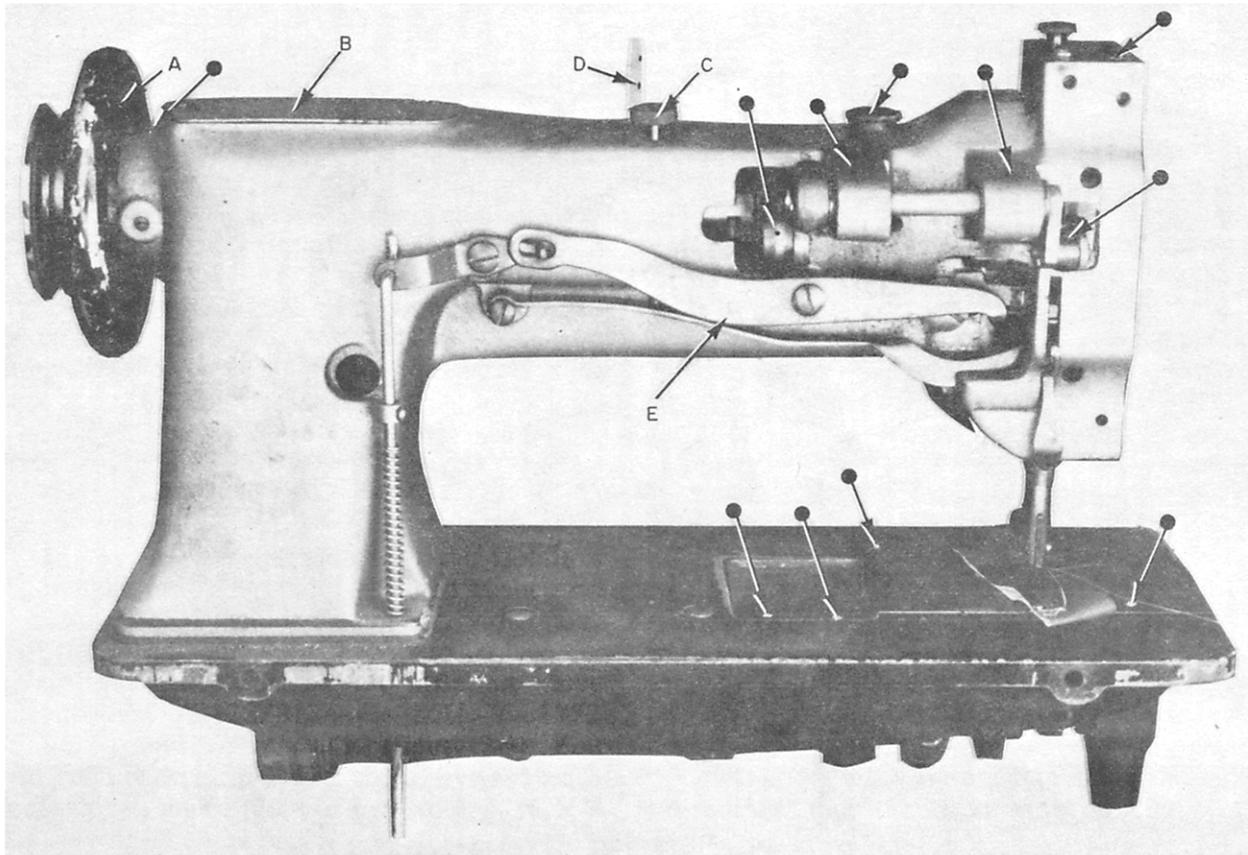
- A. Vibrating presser bar thumbscrew
- B. Tension thumb nut
- C. Thread controller stud thumb nut
- D. Presser bar spring regulating screw
- E. Feed indicator disc
- F. Model number

- G. Hook-driving shaft lock stud
- H. Feed regulating stud (plunger)
- I. Bed slide
- J. Throat plate
- K. Presser foot
- L. Needlebar

● Denotes oiling points

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Figure 4-1.—Front view of Model 225 sewing machine showing oiling points.



A. Balance wheel
B. Arm cap
C. Presser bar spring regulating screw

D. Thread post
E. Knee lift linkage

● Denotes oiling points

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Figure 4-2.—Rear view of Model 225 machine showing oiling points.

W 155 sewing machine. Do not use too much oil; usually 1 drop of oil at each oiling point is sufficient. An excessive amount of oil will soil the project being sewn. We recommend a 10W mineral-base oil. (Use of castor-base oil is no longer required.) If this type of oil is not available through normal supply channels, use the mineral oil or Singer Type B or D.

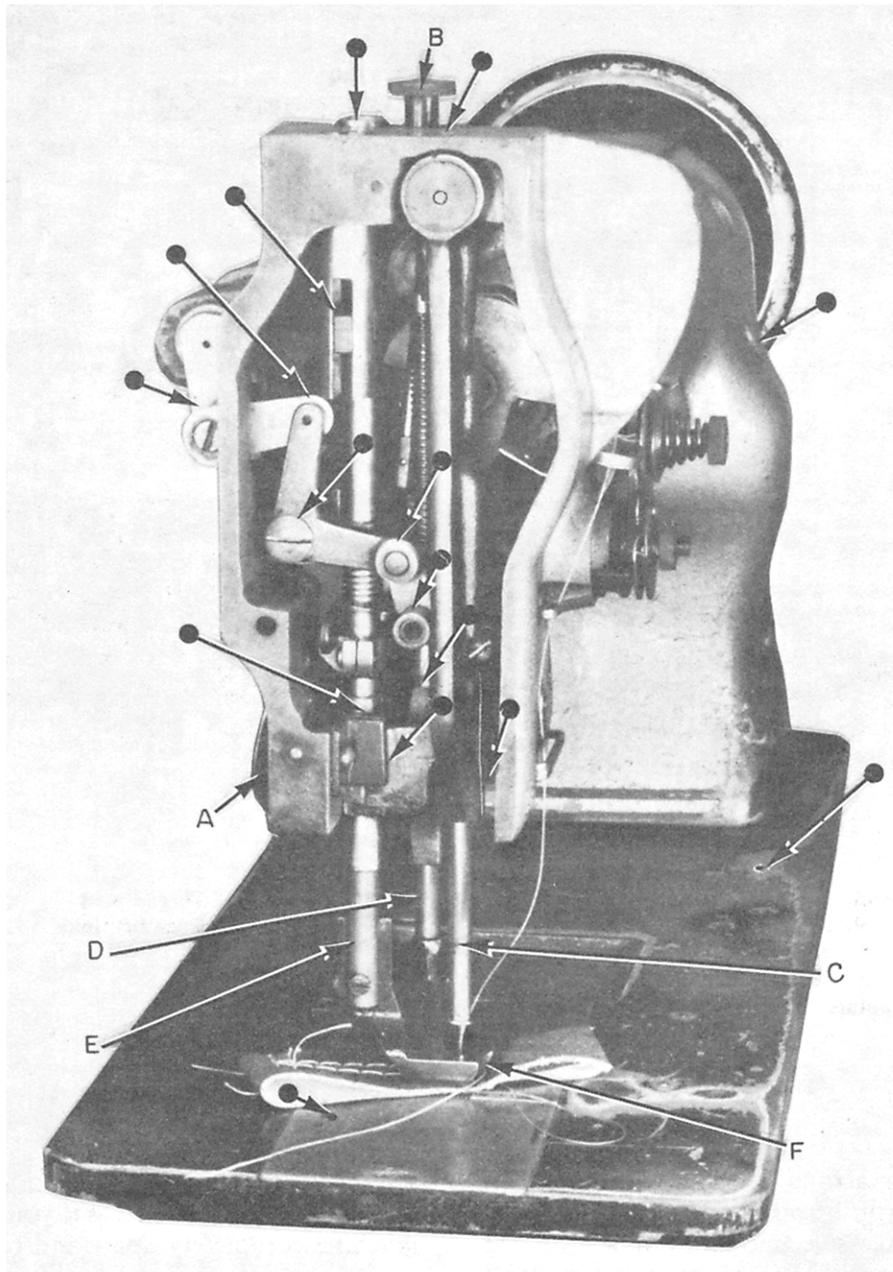
TIMING THE 111 W 155 MACHINE

Timing is the most important step when you are working on any machine. As you read through the following timing and adjustment sequence, you may find that it has changed from steps you are

accustomed to using. This timing and adjustment section is presented as if you are taking your machine completely apart and reassembling it.

1. Timing the arm shaft with the hook drive shaft

To perform this timing step, you must tilt the sewing machine back on its hinges. Turn the balance wheel toward the operator until the thread take-up lever reaches its highest point. You can do this step by placing the fingers of your left hand on top of the thread take-up lever and turning the balance wheel with your right hand. You should be able to feel the high point of



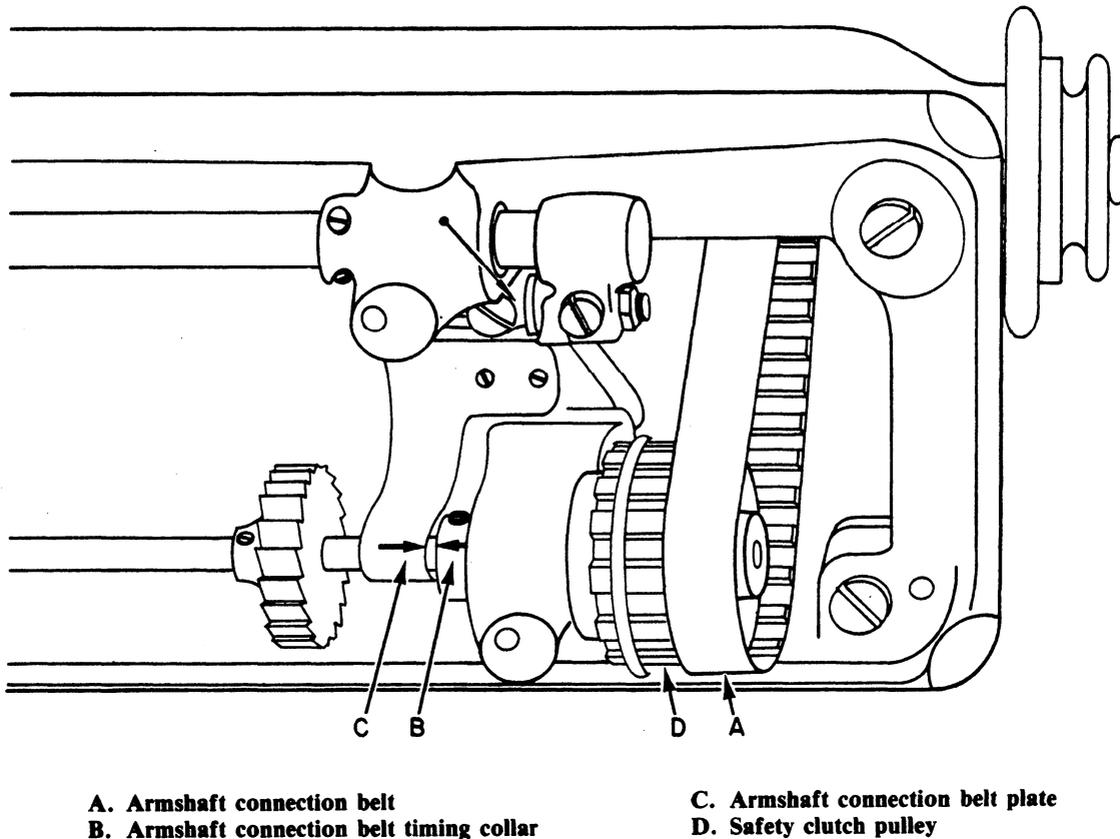
A. Handlift for presser foot
 B. Vibrating presser bar thumbscrew
 C. Needlebar

D. Vibrating presser bar
 E. Presser bar
 F. Presser foot

● Denotes oiling points

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Figure 4-3.—Side view of Model 225 sewing machine showing oiling points.



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Figure 4-4.—Timing arrows.

the thread take-up lever with your fingers. You must check to ensure the arrows on the timing collar and the timing plate are aligned as shown in figure 4-4 (B) and (C). If the arrows don't match, remove the connection belt from the lower pulley (figure 4-4 [A] and [D]). Now turn the lower pulley by hand until the arrow on the timing collar (figure 4-4 [B]) is in direct line with the arrow on the timing plate (figure 4-4 [C]). Replace the connection belt. This completes this timing point.

2. Setting the feed dog height

Proper feed dog height is necessary to obtain proper feeding action. To set the feed dogs, proceed as follows:

a. Turn the balance wheel toward the operator until the feed dog reaches its highest point (figure 4-5), and observe the relationship of the feed dog and the throat plate. If the valley between the teeth is level with the top of the throat

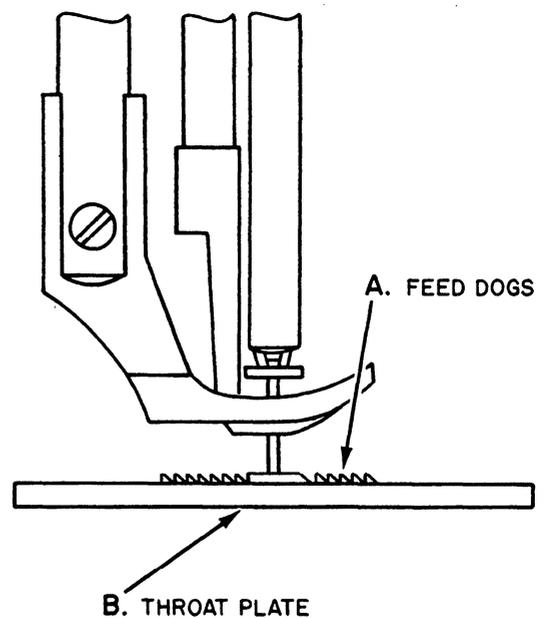


Figure 4-5.—Feed dogs.

plate, the feed dog height is correct; if the valley is not level,

b. Loosen the feed fork screw (figure 4-6 [E], table 4-1, foldout at the end of this chapter), push the feed bar (figure 4-6 [F]) up or down as necessary to obtain the proper feed dog height, and tighten the screw. This completes this timing point.

3. Centering the feeding action

To properly time this class of sewing machine, you must center the feeding action before the hook is timed.

NOTE: Ensure the needlebar rock frame hinge stud and the needlebar rock frame guide bracket are tight to prevent the needle from wandering from side to side or fore and aft.

a. Depress the plunger (figure 4-1 [H]), and turn the balance wheel toward the operator until the plunger drops; keep turning the balance wheel until it stops. This sets the maximum stitch length at 3 1/2 SPI.

b. Turn the balance wheel toward the operator and observe the movement of the feed dogs. If the feed dogs operate properly, consider them properly centered and continue to step 2. If the feed dogs strike the front or the back of the throat plate, proceed as follows:

(1) Loosen the feed-driving crank pinch screw (figure 4-6 [G]), and push the feed dog away from the point where it strikes; then retighten the feed-driving crank pinch screw.

(2) Turn the balance wheel toward the operator until the needle is at its lowest point and observe the relationship of the needle and the hole in the throat plate. If the needle is near the front of the hole but not touching it, proceed to step 4. If the needle needs to be centered, proceed to step 3.

(3) If the needle and throat hole are not properly aligned, loosen the needlebar rock frame rockshaft connection crank pinch screw (figure 4-7 [A], table 4-2, foldout at the end of this chapter) and align the needlebar in the hole of the throat plate; then retighten the screw.

(4) Turn the balance wheel toward the operator and observe the operation of the alternating pressers. If the front foot does not strike the back foot, then the feeding action can be considered to be centered.

4. Timing the hook and the needlebar

In this timing sequence, we will consider that the machine has no timing marks on the needlebar.

a. Remove the throat plate, the feed dog, and the presser feet.

b. Turn the balance wheel toward the operator until the needle is raised three-sixteenths of an inch from its lowest point.

If the point of the hook is in line with the center of the needle, one-sixteenth of an inch above the eye of the needle, and as near to the needle as possible without touching it, then the hook and needlebar can be considered to be in time. If not, proceed to the following steps:

(1) Loosen the pinch screw (figure 4-7 [A]) and move the needlebar (figure 4-7 [B]) to obtain the proper height, as shown in figure 4-7 (C); then retighten the needlebar clamp pinch screw.

(2) Tilt the sewing machine back; loosen the hook saddle pinch screw (figure 4-6 [A]), the hook saddle adjusting screw (figure 4-6 [B]), and the hook drive gear setscrews and spline screws (figure 4-6 [C] and [D]).

(3) Move the hook saddle (figure 4-6 [U]) to the right and the hook drive gear to the left until they are disengaged.

(4) Turn the balance wheel toward the operator until the needle is raised three-sixteenths of an inch from its lowest point.

(5) With the point of the hook in the 7 o'clock position, engage the hook pinion gear and the hook drive gear to align the hook point with the needle. As you engage the hook, it will rotate clockwise, advancing toward the needle until the hook point is centered on the needle. The hook point should be as near as possible to the needle without touching it.

NOTE: The hook guard may be out of adjustment and prevent the hook from being adjusted close enough to the needle; if this is the case, bend the hook guard out of the way enough to allow proper adjustment. See step 8.

(6) Tighten the hook saddle pinch screw and the hook drive gear setscrews and spline screws.

(7) Turn the balance wheel toward the operator to ensure the hook does not strike the needle.

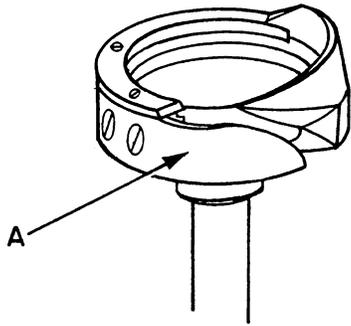


Figure 4-8.—Sewing hook kit.

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(8) The hook guard prevents the sewing hook from striking the needle. Adjust the hook guard (figure 4-8 [A]) by bending it until it is at least as near the needle as the hook point, but does not push the needle.

(9) Install the feed dog, the throat plate, and the presser feet.

NOTE: Ensure the bobbin-case lug (figure 4-9 [A]) is properly engaged in its opening in the bottom of the throat plate (figure 4-9 [B]).

5. Timing the presser-lifting eccentric

The presser-lifting eccentric controls the feeding motion provided by the alternating pressers.

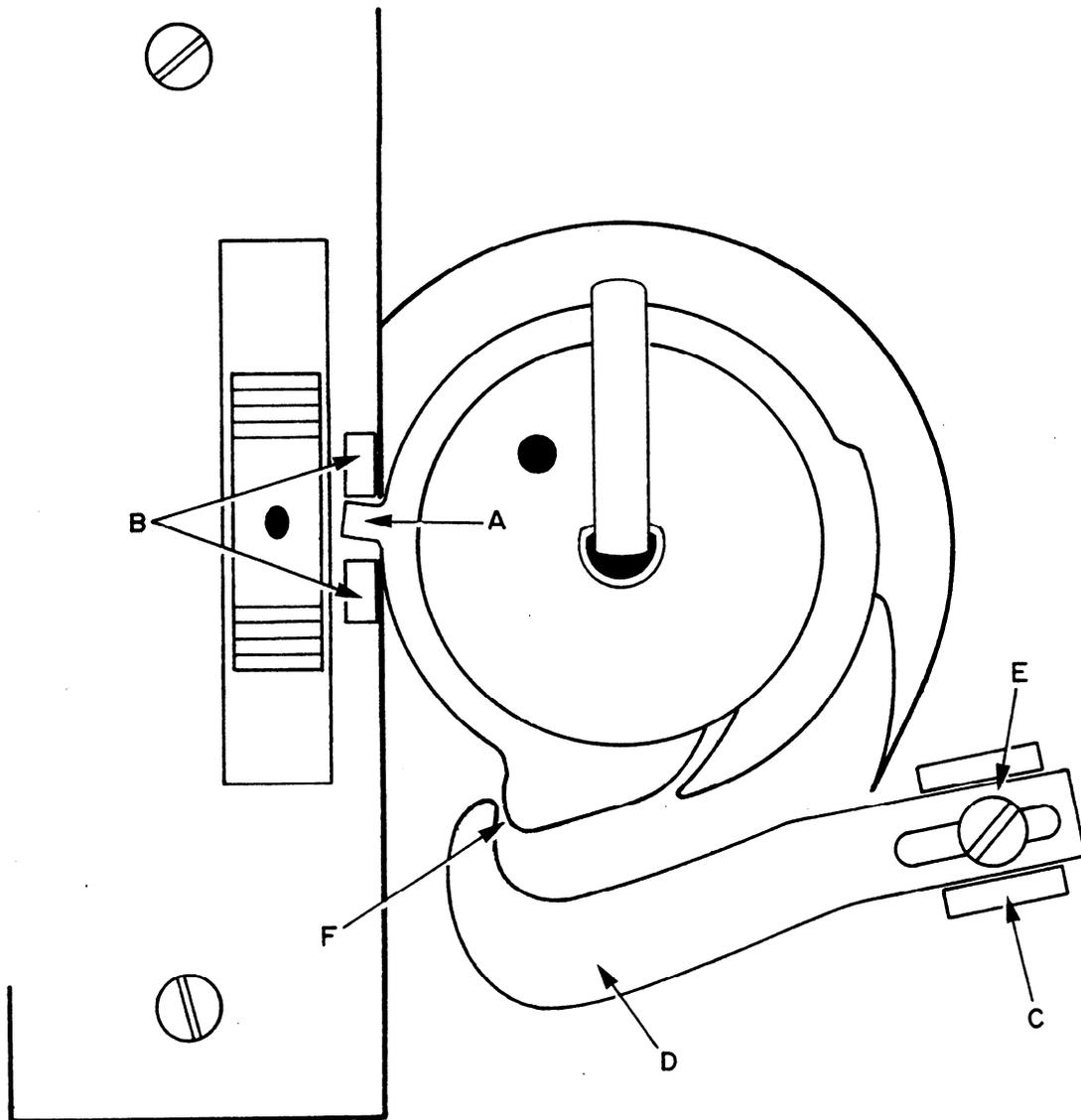


Figure 4-9.—Bobbin case area.

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If the presser-lifting eccentric is not, properly timed, it can cause the machine to feed backward or prevent the machine from making the full stitch length.

The maximum stitch length of 3 1/2 SPI should be set while you are making the following adjustments:

a. Turn the balance wheel toward the operator and observe the action of the feed dogs and the front presser. They should meet at the

throat plate height and travel aft together; if they do not, continue to step b.

b. Turn the balance wheel and loosen the two set screws (figure 4-10B [C] and figure 4-10 [A]) on the presser-lifting eccentric.

c. Hold the eccentric to prevent it from turning; then turn the balance wheel a small amount toward the operator and tighten one of the setscrews.

d. Repeat steps b and c until the front foot meets the feed dog at the throat plate height as the balance wheel is turned toward the operator.

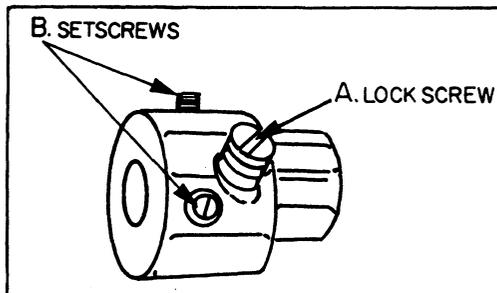
e. Ensure both setscrews are tight.

ADJUSTMENTS

For the sewing machine to operate smoothly and to make a proper locking stitch, you must make some minor adjustments. Even though the machine is in time, a single part that is out of adjustment can cause the sewing machine to skip stitches, break thread, fail to feed the material, or make loose stitches.

1. Adjusting the bobbin-case opener

As the hook rotates clockwise, friction on the bobbin-case opener causes the position lug



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Figure 4-10A.—Presser-lifting eccentric connection link.

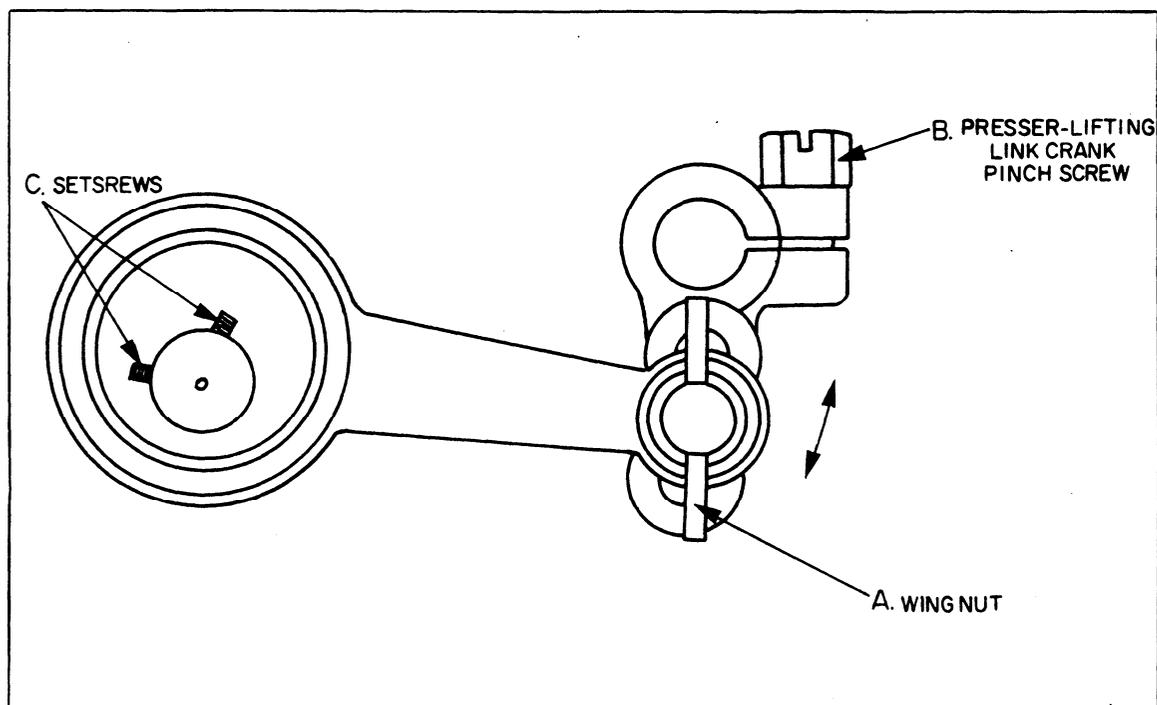


Figure 4-10B.—Presser-lifting eccentric.

(figure 4-9 [A]) to press against the back of its opening. The bobbin-case opener moves the bobbin case counterclockwise to allow the thread to pass around the bobbin-case-opener lug. If the opener is adjusted too tight, damage to many parts may occur; and if the opener is not set tight enough, extreme upper thread tension may be necessary to lock the stitch properly. Adjusting the bobbin-case opener is accomplished as follows:

- a. Turn the balance wheel toward the operator until the bobbin-case-opener lever (figure 4-9 [C]) moves as far to the right as possible.
- b. If the bobbin-case opener (figure 4-9 [D]) has been removed, reinstall it at this time. Do not tighten the adjusting screw (figure 4-9 [E]) at this time.
- c. Place two thicknesses of paper, as a gauge, between the tip of the bobbin-case opener and its projection on the bobbin case.
- d. Move the bobbin-case opener right or left as necessary to cause the bobbin case to move as far to the right as possible without binding.
- e. Tighten the bobbin-case-opener adjusting screw.
- f. Turn the balance wheel toward the operator and observe the operation of the bobbin case and its opener. Ensure no binds are present and that the bobbin case is pulled counterclockwise as far as possible with each rotation of the hook.

2. Adjusting the total relative lift of the alternating pressers

The total relative lift of the alternating pressers referred to here is that the feet lift one-half inch at total lift. Maximum lift of the alternating pressers is set to sew on heavier goods. There are two types of adjustments, and either type may be found on a given machine. The first type of alternating presser (figure 4-10A) is usually found on earlier sewing machines, while the second type of alternating presser (figure 4-10B) seems to be in current manufacture.

a. Adjusting the first type of alternating presser is accomplished as follows:

- (1) Turn the balance wheel toward the operator until the presser-lifting eccentric lock screw (figure 4-10A [A]) is visible inside the opening at the back of the arm of the machine. (See figure 4-11 [A], table 4-3, foldout at end of this chapter.)

NOTE: Figure 4-10A shows two setscrews (B). They are used to hold the presser-lifting eccentric in place on the feed-driving rockshaft. The adjusting screw is not visible in this figure.

(2) Loosen the lock screw and turn the balance wheel until the adjusting screw is visible in the opening in the back of the arm. (See figure 4-11 [A].)

(3) Turn the adjusting screw counterclockwise to obtain maximum total lift of the pressers.

(4) Turn the balance wheel toward the operator until the lock screw is visible in the opening in the back of the arm and retighten the lock screw.

b. Adjusting the second type of alternating presser is accomplished as follows:

(1) Loosen the presser-lifting eccentric adjusting wing nut (figure 4-10B [A]).

(2) Move the assembly up to decrease the lift or down to increase the total lift of the alternating pressers.

(3) Tighten the wing nut.

3. Adjusting the relative lift of the alternating pressers

The alternating presser feet should each lift to approximately the same height. Do not confuse relative lift with total lift. Here we are adjusting the presser feet to lift to approximately the same height. Adjusting the relative lift of the alternating pressers is accomplished as follows:

a. Turn the balance wheel toward the operator and observe the action of the alternating pressers. If they do not lift equally, proceed to step b.

b. Turn the balance wheel until the foot that lifts too high is just above the throat plate.

c. Loosen the presser-lifting link crank pinch screw (figure 4-11 [B]). The foot should snap down; if it does not, push it down.

d. Tighten the presser-lifting link crank pinch screw.

e. Repeat step a. If necessary repeat steps b through d until the feet lift to the same height.

4. Adjusting the lifting linkage of the alternating pressers

To set the lifting linkage, you must loosen the lifting crank pinch screw (figure 4-11 [B]) and

the presser bar lifting bracket pinch screw (figure 4-11 [C]). Turn the balance wheel toward the operator until the feed dogs rise to meet the forward presser foot at the top of the throat plate. Press the presser bar lifting bracket down to the hand lifting lever (figure 4-11 [D]). Tighten the presser bar lifting bracket pinch screw (figure 4-11 [C]) and the lifting crank pinch screw (figure 4-11 [B]).

5. Adjusting the upper thread-tension-releasing lever

The upper thread-tension release allows the goods to be removed without the needle thread breaking.

a. Lift the presser-lifting lever and observe the thread tension disc. It should separate to release the thread. If not, proceed as follows:

b. Remove the thread controller assembly from the machine as follows:

(1) Remove the thread controller assembly retaining screw (figure 4-6 [I]).

(2) Loosen the thread controller stud setscrew (figure 4-6 [J]).

(3) Pull the thread controller assembly away from the machine.

c. Bend the thread releasing lever (figure 4-12 [B]) away from the thread controller assembly to increase the amount of the release and toward the plate to decrease the tension as needed.

d. Reattach the assembly to the machine and observe the operation. Repeat steps a through d if necessary.

6. Setting the feed indicator disc

Loosen the setscrew in the feed indicator disc (figure 4-1 [E]) so that it spins on the arm shaft. Depress the feed indicator plunger and turn the balance wheel toward you until it drops; keep turning the balance wheel toward you until it stops. The feed-driving eccentric is now set at 3 1/2 SPI.

NOTE: With the plunger engaged, turning the balance wheel toward you decreases the SPI, and turning the balance wheel away from you increases the SPI.

The ideal setting for the indicator disc on the sewing machine is 8 SPI. You accomplish this setting by engaging the plunger and turning the

balance wheel approximately one-fourth of a turn away from you. Release the plunger, make several inches of stitches on a piece of paper, and count the total number of stitches per inch. If you are sewing 8 SPI, depress the plunger and slowly turn the balance wheel toward the operator until the plunger drops.

- Stop.

- Release the plunger and the balance wheel.

- Now turn the feed indicator disc (figure 4-1 [E]) on the arm shaft until 8 shows in the window on the uprise of your machine.

- Tighten the setscrew in the feed indicator disc.

7. Setting the thread controller spring

The thread controller spring prevents the needle from piercing the thread. It takes the slack out of the needle thread until the point of the needle enters the material.

To properly set the tension on the thread controller spring, you must first loosen the thread controller stud setscrew on the tension stud (figure 4-6 [J]). Turn the tension stud counterclockwise for more tension or clockwise for less tension.

A properly adjusted controller spring rests on the thread controller spring stop as the point of the needle enters the material. This action releases all tension on the needle thread.

8. Setting the controller spring stop

You may have to make an adjustment to the controller spring stop to allow the thread controller spring to operate properly. This is a very simple adjustment. By loosening the tension stud screw, shown in figure 4-6 (I), you raise the stop for less action or lower it for more action.

9. Adjusting the thread tension

The thread tension will be the last adjustment required. In most cases, you can make any adjustment required by turning the thumb nut (figure 4-12 [A]) on the needle thread tension disc.

If the stitch is locking on top of the material, turn the nut counterclockwise. This

will loosen the upper thread tension causing the bobbin tension to draw the stitch into the material. A clockwise turn will tighten the upper thread, thus drawing up any stitch that may be locking below the material.

If you cannot correct the tension by adjusting the thread tension disc, adjust the bobbin tension. To do this, tighten or loosen the small screw nearest the center of the spring. This completes all the necessary timing and adjusting on the 111 W 155 sewing machine. If you still have a problem, refer to the troubleshooting portion of this chapter.

TROUBLESHOOTING

While making adjustments or timing the sewing machine, you may overlook a step or a faulty part. The troubleshooting chart (table 4-4) will help you locate and correct most problems.

If the sewing machine is binding (hard to turn), you can locate the problem easily. First, check the feeding action; then set the machine on zero feed and remove the throat plate. Turn the machine by hand. If the bind is still present, remove the arm shaft connection belt. If the bind is located in the hook-driving shaft, the machine will turn freely. Turn the balance wheel by hand. If the bind is located in the arm shaft, the bind will still be present.

SINGER SEWING MACHINES 31-15, 331K1, AND CONSEW C-30

Singer Sewing Machine 31-15, the 331K1, and the Consew C-30 are oscillating-type sewing machines that have a maximum speed of 2,200 stitches per minute. These sewing machines also make the standard lockstitch and are commonly called tailoring machines. As with the 111 W 155

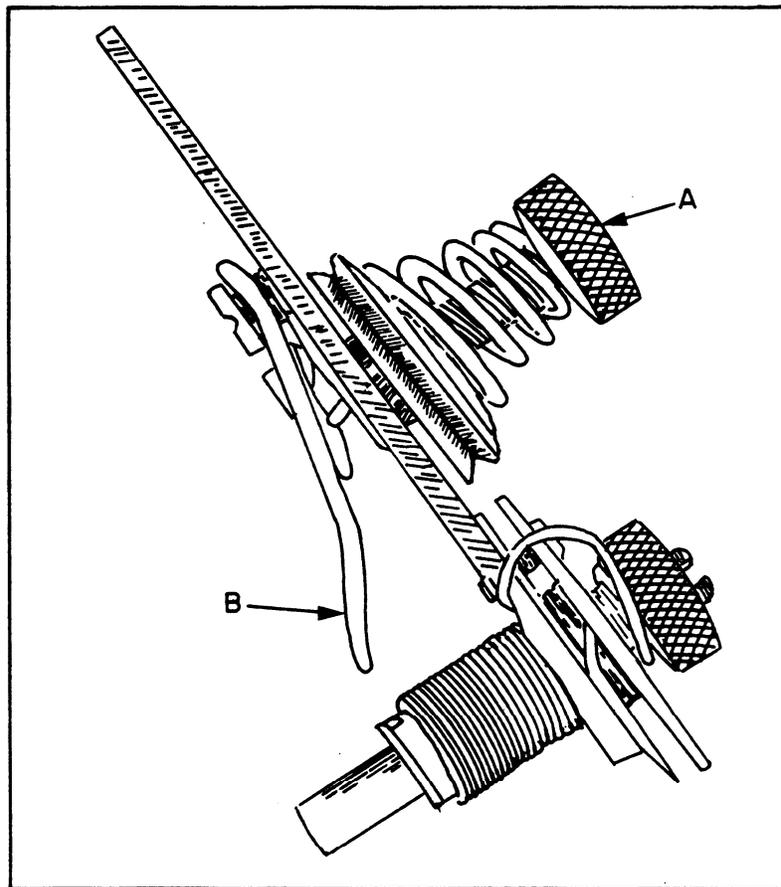


Figure 4-12.—Upper thread unit.

Table 4-4.—Troubleshooting Chart

A. Troubleshooting Chart

Trouble	Probable Cause	Remedy
THREAD BREAKAGE	Thread controller	Adjust spring tension and/or spring stop.
	Right twist thread	Change to left twist (Z).
	Hook point piercing needle thread	Adjust thread controller spring stop.
	Needle eye too small	Select larger size.
	Burr on needle point	Remove burr or replace needle.
	Too much tension	Adjust tension springs.
	Improper threading sequence	Rethread (check first).
	Thread unwinding incorrectly	Adjust stand and/or spool.
	Thread breaks when clearing work	Adjust tension release. Thread take-up lever not at highest point.
SKIPPED STITCHES	Needlebar improperly set	Reset.
	Needle not all the way into bar	Insert correctly.
	Needle incorrectly aligned	Insert correctly.
	Thread too large large for needle eye	Select correct needle.
	Presser bar maladjusted	Adjust presser bar.
THREAD JAMMING UNDER THROAT PLATE	Operating machine without material	Unthread when running without fabric.
	Failure to hold free ends of thread for first stitches	Maintain pressure.
	Needle thread not between tension discs.	Thread disc.
UPPER THREAD LOOPING UNDER MATERIAL	Feed-driving eccentric improperly adjusted	Adjust eccentric.
	No upper thread tension	Adjust or place thread in tension disc.

Table 4-4.—Troubleshooting Chart-Continued

Trouble	Probable Cause	Remedy
FAILURE TO FEED	Feed-driving crank loose	Tighten Pinch Screw.
STITCHES NOT IN LINE	Insufficient presser foot pressure	Add spring pressure.
	Presser bar improperly set	Adjust presser bar.
	Feed dogs too low	Set height to one full tooth.
MATERIAL DAMAGED BY SCUFFING	Presser foot pressure too great	Reduce pressure.
	Feed dogs too high	Set one full tooth or less.
SLUGGISH OPERATION	Improper oil or accumulation of foreign matter	Clean with recommended solvent.
FAILURE TO MAKE A STITCH	Needle in backwards	Install correctly.
	Needle threaded from wrong side	Thread correctly.
	Wrong variety of needle	Change to correct length needle.
	Bent needle	Change.
	Needle not all the way in the needlebar	Insert correctly.
	Needlebar out of adjustment	Adjust needlebar.
	Shuttle driver pin sheared	Replace pin.
	Shuttle too far from needle	Shim shuttle closer to needle.
1. Stitching Problems		
FAILURE TO MAKE A STITCH	Needle in backwards	Remove and reinstall.
	Machine out of time	Inspect and retime.
	Needle threaded from wrong side	Thread correctly.
	Hook too far away from needle	Reset hook saddle.

Table 4-4.—Troubleshooting Chart-Continued

1. Stitching Problems—Continued

Trouble	Probable Cause	Remedy
FAILURE TO MAKE A STITCH	Wrong variety needle	Change to correct length needle.
	Bent needle	Change.
	Needle not all the way in the needlebar	Insert correctly.
	Safety clutch disengaged	Clear jam and reengage clutch.
SKIPPED STITCHES	Hook too far from needle	Move hook saddle.
	Hook out of time	Retime.
	Needlebar improperly set	Reset.
	Needle not all the way into bar	Insert correctly.
	Needle incorrectly aligned	Insert correctly.
	Thread too large for needle eye	Select correct needle.
THREAD BREAKAGE	Thread controller	Adjust spring tension and/or spring stop.
	Right twist thread	Change to left twist (Z).
	Hook point piercing needle thread	Set hook to needle.
	Needle eye too small	Select larger size.
	Burr on needle point	Remove burr or replace needle.
	Hook out of time (retarded)	Retime.
	Too much tension	Adjust tension springs.
	Improper threading sequence	Rethread (check first).
	Thread unwinding incorrectly	Adjust stand and/or spool.
	Thread breaks when clearing work	Adjust tension release. Thread take-up lever not at highest point.

2. Feeding Problems

FEED FAILURE	Arm shaft not in time with sewing hook driving shaft	Retime by take-up lever and timing plate (timing collar spline screw <u>must</u> be in spline).
	Feed lifting cam fork inverted	Install properly.

Table 4-4.—Troubleshooting Chart—Continued

2. Feeding Problems—Continued

Trouble	Probable Cause	Remedy
FEED FAILURE	Feed-driving crank pinch screw loose	Recenter feed and tighten pinch screw.
	Feed-driving eccentric out of spline	Reset.
	Feed dogs set too high	Reset.
	Set at negative feed	Set for stitching.
FEEDING BACKWARDS	Feed lifting cam out of spline	Reset in spline.
	Feed-driving eccentric out of spline	Reset in spline.
	Presser-lifting eccentric out of time	Time eccentric.
	Timing collar out of spline	Reset in spline and retime machine.
STITCHES NOT IN LINE	Insufficient presser foot pressure	Add spring pressure.
	Feed dogs too low	Set height to one full tooth.
MATERIAL DAMAGED BY SCUFFING	Presser foot pressure too great	Reduce pressure.
	Feed dogs too high	Set one full tooth or less.

3. Miscellaneous Problems

THREAD JAMMING	Operating machine without material	Unthread when running without fabric.
	Failure to hold free ends of thread for first stitches.	Maintain pressure.
	Bobbin-case opener incorrectly set	Readjust opener.
	Needle thread not between tension discs	Thread discs.
	Hook too high	Lower hook.
	Turning balance wheel backwards with needle threaded	Remove jam.
	Thread, dirt, lint under bobbin case	Remove case; clean and replace.

Table 4-4.—Troubleshooting Chart-Continued

3. Miscellaneous Problems—Continued

Trouble	Probable Cause	Remedy
NOT STITCHING AS INDICATED	Indicating disc loose	Reset and tighten.
	Indicating disc incorrectly set	Reset and tighten.
	Automatically changing stitches	Adjust feed eccentric gib.
SLUGGISH	Improper oil or accumulation of foreign matter	Clean with recommended solvent and lubricant.
BINDS	Bobbin-case opener set too close	Set to allow thread passage around bobbin-case lug.
	Arm shaft friction washer missing	Install friction washer.
	Balance wheel improperly set for tolerance	Tighten adjusting screw, back off one-quarter turn, tap with mallet.
	Needlebar too high or too low	Reset in frame.
	Feed-driving connection against eccentric body	Set connection flush with cam.
	Hook guard washer rubbing bobbin-case opener lever link	Replace washer. Adjust hook assembly for tolerance.
	Pinion gear against saddle	Relocate on hook shaft.
	Hook driving gear against saddle	Relocate to center on center line of sewing hook shaft.
	Bobbin-case thread jam	Remove case, clear, and reinstall.
	Feed dogs against throat plate	Adjust to proper height. Adjust to center of throat plate.
	Feed bar hinge stud screw	Adjust for proper operating tolerance.
Wrong bed slide over sewing hook	Put recessed slide over sewing hook.	
Alternating pressers out of adjustment	Reset.	

alternating-pressure-foot sewing machine, we will use the 31-15 sewing machine as a model for these three sewing machines. The 31-15 sewing machine is intended for sewing clothing such as flight suits and is excellent for sewing lightweight canvas up to 8 ounces.

The 31-15 sewing machine has a stitch range of 7 to 32 SPI, a clearance of five-sixteenths of an inch under the presser foot, and uses a drop-feeding action. The major components of the Singer Sewing Machine 31-15 are shown in figure 4-13.

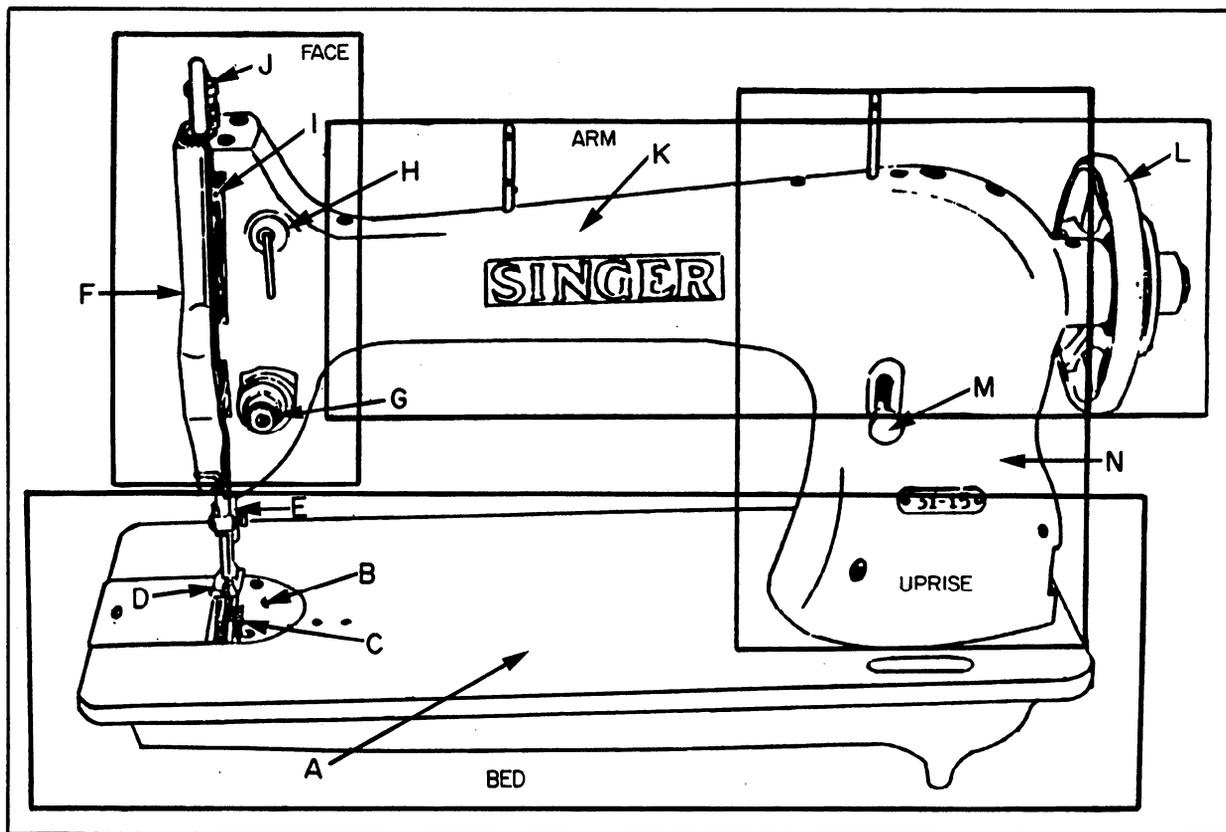
PREVENTIVE MAINTENANCE

Preventive maintenance for the Singer Sewing Machine 31-15 is the same as that for the 111 W 155 sewing machine. Although the preventive

maintenance is the same, the oiling points differ because of the design of the machine. Figures 4-13 through 4-15 show the different oiling points for the 31-15 sewing machine. When you oil this machine, remember 1 drop of a 10W mineral oil at each oiling point is sufficient. Too much oil may soil the project being sewn.

TIMING AND ADJUSTMENTS

The 31-15 sewing machine is the simplest sewing machine in the parachute loft. As with all oscillating-shuttle machines, the main timing point is the needlebar. Once the needlebar is properly set, only minor adjustments are necessary to have a smooth-running sewing machine. Remember you should always refer to the troubleshooting chart before making any adjustment.



- | | |
|--|---|
| A. Bed | H. Thread retainer |
| B. Throat plate | I. Thread take-up lever |
| C. Feed dogs | J. Presser bar presser regulating thumbscrew |
| D. Presser foot | K. Arm |
| E. Needlebar | L. Balance wheel |
| F. Face | M. Feed regulator thumbscrew |
| G. Upper tension regulating thumb nut | N. Uprise |

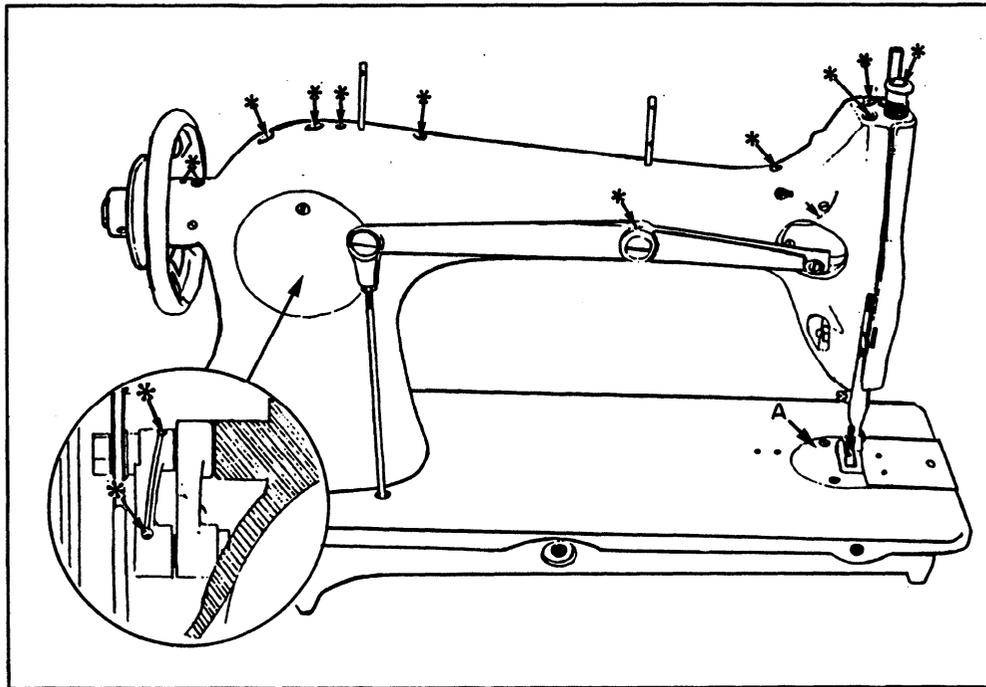
Figure 4-13.—Front view of model 31-15 sewing machine.

Timing the Needle with the Shuttle

When the needle and shuttle are correctly timed, the point of the shuttle on its forward stroke must pass across the center of the diameter of the needle

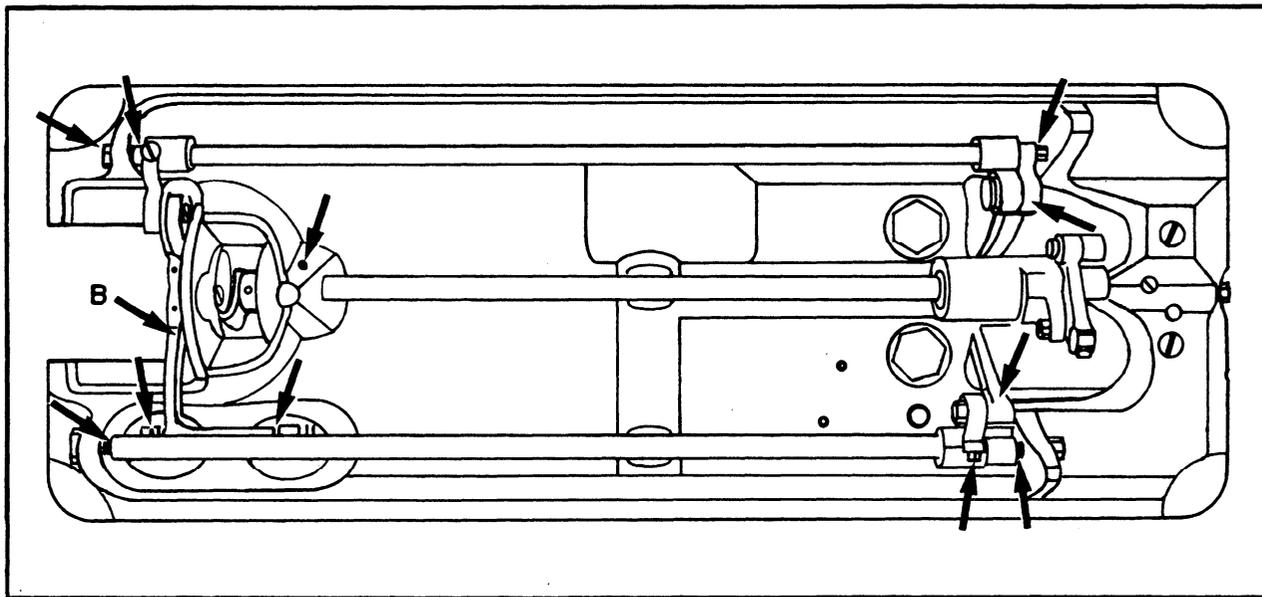
at a point one-sixteenth of an inch above the eye of the needle when the needle is on its upstroke.

To time the machine so the needle and shuttle operate properly, you must proceed as follows: Be sure that the needle is a class 16



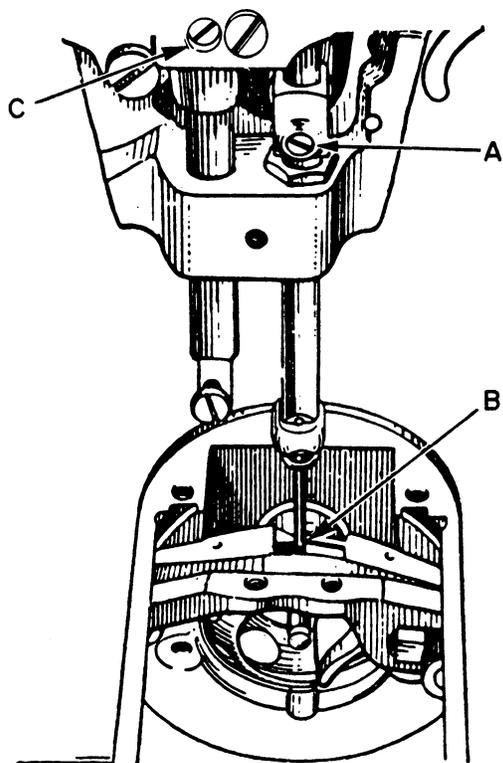
239.263

Figure 4-14.—Rear view of oiling points on model 31-15 sewing machine.



239.264

Figure 4-15.—Bottom view of oiling points on model 31-15 sewing machine.



240.159

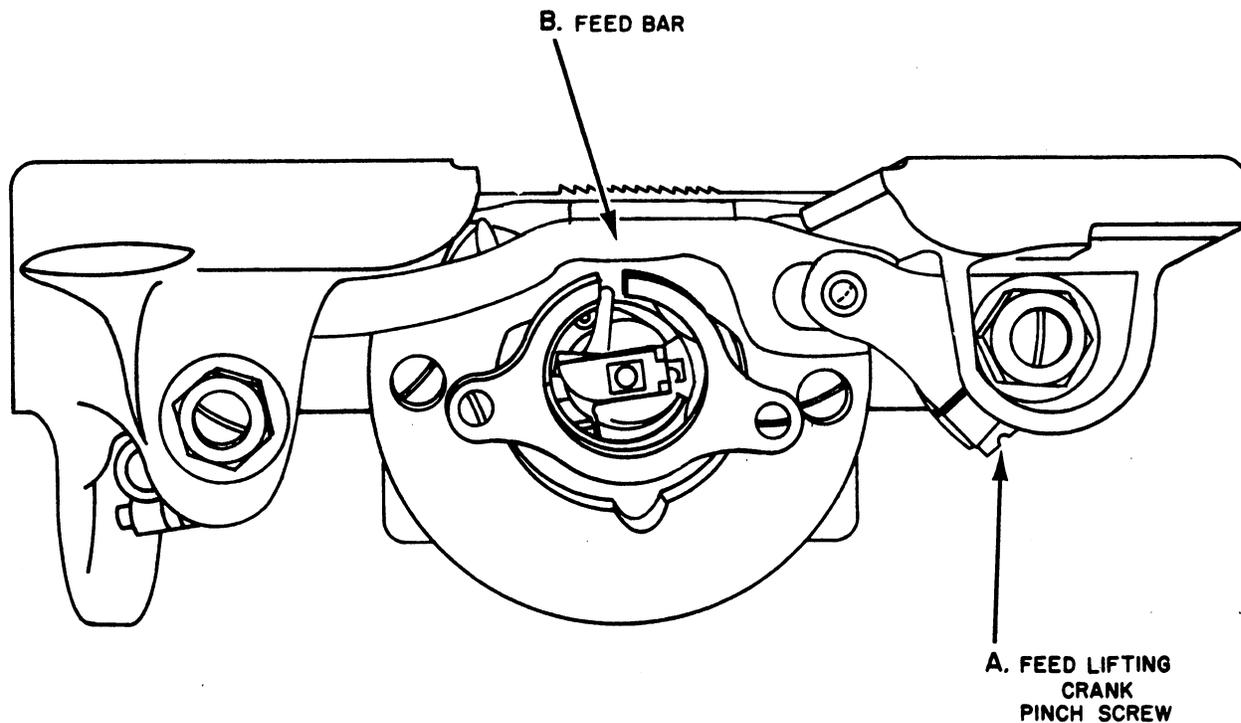
Figure 4-16.—Setting needlebar.

and a variety 87 (16 x 87). Place the needle into the needlebar as far as it will go. Be sure the long thread groove faces the left and the eye of the needle is in line with the shuttle point. Remove the faceplate and loosen the needlebar connecting stud pinch screw (figure 4-16 [A]). Turn the balance wheel toward the operator until the needlebar is on its upstroke and the point of the shuttle is in the center of the eye of the needle. Adjust the needlebar so that the eye of the needle is one-sixteenth of an inch below the shuttle point (figure 4-16 [B]). Now retighten the needlebar connecting stud pinch screw (figure 4-16 [A]).

NOTE: The main timing point for the 31-15 sewing machine is the needlebar.

Adjusting the Feed Dog Height

For average weight material, a full tooth should be visible when the feed dogs are at their highest point. To adjust the feed dog height, you must loosen the feed lifting crank pinch screw (figure 4-17 [A]) in the feed lifting crank and move the feed bar (figure 4-17 [B]) up or down as required. Then you must retighten the feed lifting crank pinch screw.



240.160

Figure 4-17.—Adjusting feed dogs.

Centering the Feeding Action

Set the sewing machine to its maximum stitch length. Loosen the feed-driving rockshaft crank pinch screw (figure 4-18 [A]). Rotate the feed-driving rockshaft (figure 4-18 [D]) so that the feed dog's movement is an equal distance from the front and rear of the throat plate slots. After you do this, retighten the feed-driving rockshaft crank pinch screw.

Setting Side Play of Feed Dogs

Loosen the adjusting screw locknuts (figure 4-18 [B]). Adjust the feed-driving rockshaft (figure 4-18 [D]) to center the side play of the feed dogs by turning the adjusting screws (figure 4-18 [C]) left or right as needed; then retighten the adjusting screw locknuts. Be sure the adjusting screw locknuts hold the feed-driving rockshaft snugly in place without binding.

Timing the Feed-Driving Eccentric

Timing the feed-driving eccentric is accomplished as follows:

1. Set the stitch regulator to its lowest point. This gives the operator the maximum stitch length of 7 SPI.

2. Rotate the balance wheel toward the operator until the feed dogs complete their movement aft and before they begin to drop. At this point the needle must be entering the material being sewn. If this doesn't occur, the following trial-and-error sequence must be made:

Open the cover located on the rear of the uprise. Rotate the balance wheel until the feed-driving eccentric setscrew becomes visible (figure 4-19 [A]). Loosen this screw. Now place your finger or a screwdriver on the feed-driving eccentric to hold the eccentric in place, and rotate the balance wheel a short distance. Retighten the feed-driving eccentric setscrew. Continue this procedure until the sewing machine complies with step 2.

Setting the Presser Bar

Turn the balance wheel until the feed dogs are just below the top of the throat plate. Loosen the presser bar guide lever setscrew (figure 4-16 [C]). Push the presser firmly against the throat plate, aligning the slot between the toes of the presser foot with the hole in the throat plate. Tighten the presser bar guide lever setscrew. This completes

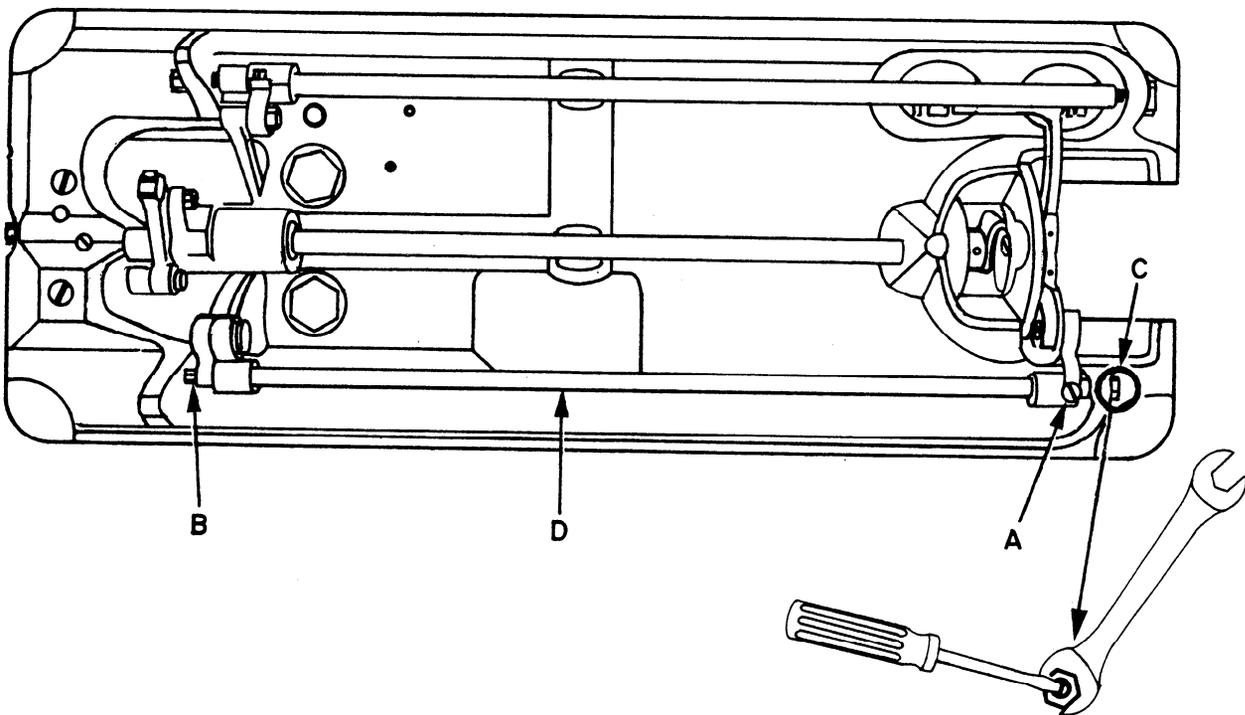


Figure 4-18.—Centering feeding action.

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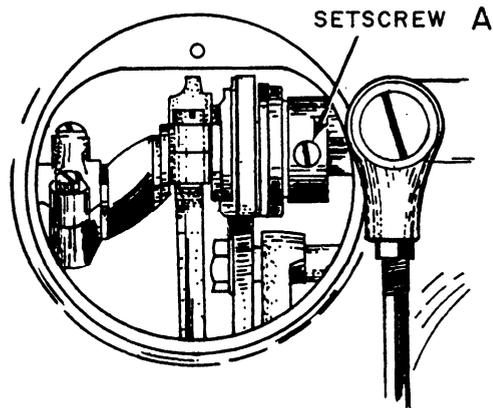


Figure 4-19.—Feed-driving eccentric.

the timing and adjustment procedures for the 31-15 sewing machine.

DISASSEMBLY AND REASSEMBLY OF THE III W 155 SEWING MACHINE

You probably will never need to take the III W 155 class sewing machine completely apart, but you may need to replace some parts. Therefore, you need to know the procedures for disassembling and reassembling the 111 W 155 sewing machine.

The following are some helpful hints that you should remember while working on disassembly and reassembly of any sewing machine:

- All sewing machine screws have a *case-hardened surface, which must be removed by grinding* should it become necessary to use an easyout to remove the screw.

- Using grinding compound is recommended when you are replacing parts that attach to a shaft. Place a small amount of grinding compound on the shaft and rotate the part on the shaft until it moves freely. (Remove all grinding compound before you reassemble the parts.)

- Oiling is a must in the reassembly of parts. A generous amount of 10W mineral oil is justified when you are replacing parts.

- There is one screw (thread take-up lever retaining screw) on the drop-feed type of sewing

machine that has a left-hand thread. It is found in the face of the machine. This screw is removed by turning it clockwise.

DISASSEMBLY

In this section we discuss the purpose of each part of the 111 W 155 sewing machine and the disassembly and reassembly of each part.

Before disassembling any sewing machine, you should select and clean an area that will allow you to work on your project with a minimum of interruptions. Select your tools, cleaning solvents, and a parts breakdown list; then you are ready to begin your project.

Arm Cap

The arm cap (figure 4-2 [B]) permits inspection of the mechanism of the arm. The arm mechanism is exposed when the arm cap is moved to one side or the other. Remove the arm cap by unscrewing the holding screw and spring washer that attach it to the machine arm; then lift the arm cap from the machine.

Faceplate

The faceplate (figure 4-2 [F]) permits inspection and minor adjustment of the parts in the machine face. The mechanism of the machine face is exposed when the faceplate is moved to one side or the other. Remove the faceplate by removing the thumbscrew at the top of the plate; then move the plate slightly to the left to clear the metal projection at the lower left corner and lift the faceplate from the machine.

Knee Lifter Lifting Lever Hinge Screw

The knee lifter lifting lever hinge screw (figure 4-11 [E]) acts as a hinging point for the knee lifter lifting lever. It is removed from the machine by unscrewing it.

Knee Lifter Lifting Lever

The knee lifter lifting lever (figure 4-11 [F]) acts as an extending arm that attaches the presser bar lifting releasing lever bracket to the knee lifter lifting lever. It carries the motion from the knee lifter lifting lever to the presser bar lifting releasing lever bracket. Remove the knee lifter lifting lever by grasping and moving it outward from the machine.

Presser Bar Spring Support Screw

The presser bar spring-support screw (figure 4-11 [G]) acts as a suspension point for the presser bar spring. The screw is loosened approximately one-fourth of an inch to allow for the removal of the presser bar spring. *Do not remove the presser bar spring-support screw from the machine.*

Presser Bar Spring

The presser bar spring (figure 4-11 [H]) applies a constant pressure to the presser bar. To remove the presser bar spring from the machine, lower the presser feet and then grasp the underside of the spring as near the support screw as possible with two fingers of one hand over two fingers of the other hand. Now slide the spring outward to the head of the support screw, rolling the spring up and out of the machine.

Presser Bar Lifting Releasing Lever Bracket Guide Screw

The presser bar lifting releasing lever bracket guide screw, (figure 4-11 [I]) acts as a track and guide for the presser bar lifting releasing lever bracket. Remove the presser bar lifting releasing lever bracket guide screw by unscrewing it from the machine.

Presser Bar Position Guide

The presser bar position guide (figure 4-7 [D]) acts as a track to control the presser bar position guide lever. To remove the presser bar position guide, you should loosen (six turns) the spline screw on the rear side nearest the face of the machine and push the guide through the recess at the top of the machine head.

Presser Bar Position Guide Lever

The presser bar position guide lever is used to align the presser foot, and it operates in the slot of the presser bar guide.

NOTE: The presser bar position guide does not screw out. Loosen the pinch screw on the presser bar position guide lever (figure 4-11 [K]) by inserting the screwdriver into the opening on the rear side of the machine head. This is necessary to allow movement of the presser bar for the removal of attached parts.

Alternating Presser Foot

The alternating presser foot is the rear presser foot and holds the material in place while the needle and front presser foot move forward making another bight. To remove the rear presser foot, you unscrew the presser foot position screw on the left side of the presser bar. Raise the presser bar to its highest position and remove the foot from the rear.

Presser Bar Spring Bracket

The presser bar spring bracket (figure 4-7 [E]) transfers the tension from the presser bar spring to the presser bar. To loosen the presser bar spring bracket from the presser bar, insert the screwdriver through the lower opening provided in the back of the face of the machine. Loosen the presser bar lifting bracket pinch screw (figure 4-11 [C]). Remove the presser bar lifting bell crank retaining screw and lifting bell crank (figure 4-7 [F] and [G]). Now remove the presser bar (figure 4-7 [M]) in a slow upward motion.

Presser-Lifting Bell Crank

The presser-lifting bell crank alternately applies lift to the presser feet. Remove the presser-lifting bell crank retaining screw (figure 4-7 [F]) and then extract the bell crank (figure 4-7 [G]) from the machine.

Presser Bar Lifting Bracket

The presser bar lifting bracket is alternately a hinge point and lifting point for the two presser bars. It is also the controlling part for the presser feet while work is being inserted and removed, and it gives support to the thread tension release slide.

CAUTION

If binding should occur while you are removing the presser bar, insert a screwdriver into the lower slot of the presser bar and rotate it while applying upward motion on the presser bar.

When you remove the presser bar, the following parts will fall off: the presser bar spring bracket (figure 4-7 [E]), the releasing bracket, the releasing bracket spring, the lifting bracket, and the guide lever.

- Now remove the vibrating presser bar connecting link (figure 4-7 [N]) from the face of the machine.

- Loosen the presser-lifting link crank pinch screw (figure 4-11 [B]). Rotate the presser-lifting rockshaft (figure 4-11 [M]) away from the machine about 90 degrees. Remove the presser-lifting bell crank connection from its stud. Now remove the presser-lifting rockshaft; then remove the presser-lifting link crank (figure 4-11 [P]) from its connection link.

Needlebar Rock Frame Position Bracket

The needlebar rock frame position bracket (figure 4-7 [H]) holds the needlebar rock frame in position and prevents any side-to-side play. To remove the needlebar rock frame position bracket, you remove the holding screw and withdraw the bracket from the machine.

Tension Release Rod

The tension release lever rod releases the tension on the thread. This allows the thread to be pulled freely when you remove material from the machine. When the presser bar is lifted, the shoulder on the arm of the presser bar lifting releasing slide bracket presses the tension release rod, thereby releasing the tension on the thread. You remove the tension release rod by tilting the machine backward and allowing the rod to slide from its recess. Unscrew and remove the vibrating presser foot tension spring adjustment thumb-screw (figure 4-11 [Q]). At this point, you can remove the vibrating presser foot (figure 4-11 [R]).

Vibrating Presser Foot

The vibrating presser foot is the foremost foot. It moves fore and aft as well as up and down, and combines its actions with that of the needle and the feed dogs.

Needlebar Rock Frame Hinge Stud

The needlebar rock frame hinge stud (figure 4-7 [I]) acts as a hinging point for the needlebar rock frame. To remove the needlebar rock frame hinge stud, you loosen the setscrew on the top of the machine head; then you press the hinge stud out through the face of the machine.

Needlebar Rock Frame Assembly

The needlebar rock frame assembly (figure 4-7 [O]) consists of seven major parts: the needlebar connecting stud, the needlebar, the needlebar rock frame, the needlebar rock frame slide block, the vibrating presser bar, the vibrating presser bar spring, and the presser bar spring guide rod. To remove the needlebar rock frame assembly, you grasp it and withdraw it from the face of the machine.

Needlebar Connecting Link Oil Guard

The needlebar connecting link oil guard (figure 4-11 [J]) prevents oil from being thrown through the thread take-up lever groove. To remove the needlebar connecting link oil guard, you insert the screwdriver in the opening in the rear of the machine face, remove the holding screw and then remove the oil guard.

Take-up Lever Hinge Stud

The take-up lever hinge stud acts as a hinging point for the thread take-up lever. To remove the take-up lever hinge stud, first you loosen the setscrew located three-fourths of an inch to the right of the thread take-up lever; then you insert the screwdriver in the oil hole and push the take-up lever hinge stud out through the face of the machine.

Thread Take-up Lever

The thread take-up lever pulls the slack out of the needle thread to lock the stitch in the goods being sewn. To remove the thread take-up lever, you turn the balance wheel until the needlebar connecting link is at its lowest position; then withdraw the thread take-up lever through the face of the machine.

Thread Take-up Lever Driving Stud

The thread take-up lever driving stud transfers power and motion from the needlebar connecting link to the thread take-up lever. The thread take-up lever driving stud is attached to the thread take-up lever; they are removed from the machine at the same time.

Needlebar Connecting Link

The needlebar connecting link (figure 4-7 [J]) changes the rotary motion of the needlebar crank

to the vertical motion of the needlebar. Remove the needlebar connecting link by grasping it and then withdrawing it from the face of the machine.

Balance Wheel Adjusting Screw

The balance wheel adjusting screw (figure 4-11 [L]) eliminates end play in the balance wheel and arm shaft. Remove the balance wheel adjustment screw.

Balance Wheel

The balance wheel (figures 4-6 [R] and 4-11 [N]) transfers the motion and power from the one-third-horsepower electric motor to the arm shaft. To remove the balance wheel, you must first loosen the two setscrews attaching it to the arm shaft; then you withdraw it from the machine.

NOTE: The balance wheel is very fragile. Do not hit it with a hammer to remove it.

Arm Shaft Connection Belt

The arm shaft connection belt (figure 4-4 [A]) transfers the power and motion from the arm shaft connection belt pulley to the safety clutch pulley. To remove the arm shaft connection belt, you insert a small screwdriver along the left edge and slide the belt from the safety clutch pulley.

Arm Shaft Connection Belt Pulley Position Screw

The arm shaft connection belt pulley position screw holds the pulley in a fixed position. The arm shaft connection belt pulley position screw is the larger of the two screws on the pulley. The smaller screw is a setscrew. It must be loosened but not removed from the pulley. Remove the arm shaft connection belt pulley position screw by unscrewing it.

NOTE: For machines with ball bearings, the arm shaft arm bushing setscrews are located just to the right of the connection belt pulley. They secure the arm shaft bushing to the arm shaft. These screws are not removed from the bushing; however, they must be loosened for the arm shaft to be removed.

The Presser-Lifting Eccentric

The presser-lifting eccentric supplies the lift for the alternating presser feet. Free the

presser-lifting eccentric by loosening the two presser-lifting eccentric setscrews located through the opening in the rear of the arm (figure 4-11 [A]). You must rotate the balance wheel to loosen the second screw. Be sure the eccentric rotates freely on the shaft.

Feed Indicator Disc

The feed indicator disc shows the operator the number of stitches per inch the machine is sewing. It also allows the operator to set the machine to sew a desired number of stitches per inch. Loosen the feed indicator disc setscrew and ensure the disc will rotate freely on the shaft.

Needlebar Crank

The needlebar crank transfers the motion and power from the arm shaft to the needlebar by the needlebar driving stud. Do not remove the needlebar crank from the arm shaft.

Needlebar Connecting Link Stud

The needlebar connecting link stud transfers the motion and power from the needlebar crank to the needlebar connecting link. Do not remove the needlebar connecting link stud from the arm shaft.

Needlebar Crank Friction Washer

The needlebar crank friction washer acts as a bearing surface between the needlebar crank and the front arm shaft bushing. In some cases the needlebar crank friction washer remains with the machine upon removal of the arm shaft bushing. If this occurs, insert the index finger in the arm shaft recess and remove the washer.

NOTE: The operator must be especially careful when assembling the machine to be certain the needlebar crank friction washer is returned to the arm shaft. Absence of the needlebar crank friction washer will cause the machine to bind.

Arm Shaft

The arm shaft (figure 4-11 [O]) acts as a carrier for, and transfers the power and motion to, the arm shaft connection belt pulley, the feed indicator disc, the needlebar crank friction washer, and the needlebar crank. To remove

the arm shaft, grasp it with the left hand and withdraw it from the face of the machine.

Right- and Left-Hand Bed Slide Plates

The bed slide plates allow for inspection and maintenance of the bobbin assembly. The right-hand bed slide has a cutout on the bottom side. This cutout allows the needle thread to pass over the bobbin case without jamming.

Throat Plate

The throat plate acts as a guide for the feed dog and provides a firm foundation over which the material may flow while the stitch is being made. The throat plate does not need to be removed from the machine.

Needlebar Rock Frame Rockshaft

The needlebar rock frame rockshaft carries the feeding motion and power from the feeding mechanism in the bed of the machine to the needlebar rock frame. To remove the needlebar rock frame rockshaft, you insert the screwdriver in the opening in the rear of the uprise and loosen the needlebar rock frame rockshaft crank pinch screw. Remove the needlebar rock frame rockshaft from the face of the machine.

Needlebar Rock Frame Rockshaft Crank and Connection

The needlebar rock frame rockshaft crank and connection transfers the feeding motion and power from the feed-driving rockshaft crank to the needlebar rock frame rockshaft. To remove the needlebar rock frame rockshaft crank and connection, you loosen the pinch screw at the feed-driving rockshaft crank (figure 4-6 [G]). Then you grasp the feed-driving rockshaft crank (figure 4-6 [H]), slide it to the right to remove it from the feed-driving rockshaft, and withdraw it from the machine. In so doing, the needlebar rock frame rockshaft crank and connection parts are also removed. The parts removed remain as an assembly.

Feed-Driving Rockshaft Crank

The feed-driving rockshaft crank transfers the feeding motion of the feed-driving rockshaft to the needlebar rock frame rockshaft crank and connection. The feed-driving rockshaft crank is

removed simultaneously with the needlebar rock frame rockshaft crank and connection.

Feed-Lifting Cam Fork

The feed-lifting cam fork gives the feed dog its up and down motion during the feeding operation. To remove the feed-lifting cam fork, you unscrew the feed-lifting cam fork screw (figure 4-6 [E]), tilt the fork toward the operator, and withdraw it.

Feed-Driving Rockshaft

The feed-driving rockshaft (figure 4-6 [L]) coordinates the feeding motion of the feed dog and the feeding of the needle. To remove the feed-driving rockshaft, proceed in the following manner (refer to figure 4-6):

- Loosen the hook saddle adjusting screw (figure 4-6 [B]).
- Loosen the hook saddle pinch screw (figure 4-6 [A]).
- Slide the hook saddle to the right as far as possible.
- Loosen the feed-driving rockshaft crank pinch screw (figure 4-6 [G]).
- Loosen the setscrews on each of the feed-driving rockshaft stop collars (figure 4-6 [M]).
- Lift the feed bar toward the operator until it reaches a stop position. Move the bar to the left until it strikes the bed of the machine. Lift the bar upward to clear the bed of the machine and continue moving it to the left until the right end of the shaft reaches the feed-driving crank; this action forces the right feed-driving rockshaft stop collar from the rockshaft. Continue moving the rockshaft to the left until it clears the left stop collar. Withdraw the rockshaft from the machine.

Feed-Driving Rockshaft Stop Collars

The feed-driving rockshaft stop collars and setscrews (figure 4-6 [M]) act as retainers on each end of the feed-driving rockshaft to prevent any side-to-side play. The feed-driving rockshaft stop collars are removed in conjunction with the feed-driving rockshaft.

Feed Bar

The feed bar (figure 4-6 [F]) transfers the power and motion from the feed-driving rockshaft to the feed dog.

Feed Dog

The feed dog aids the needle in feeding the material to the machine. It is attached to the feed bar.

Hook-Driving Shaft and Attached Parts

The removal of the hook-driving shaft (figure 4-6 [N]) begins with the loosening of the attached parts, starting from the right and working to the left.

- Loosen the setscrew and the spline screw in the hook-driving shaft bearing collar. (See figure 4-6 [O].)

- Loosen the two setscrews in the hook-driving shaft lock ratchet. (See figure 4-6 [P].)

NOTE: Machines fitted with cast iron bushings instead of ball bearings will have only one spline screw.

- Loosen the spline screw and the setscrews in the feed-driving eccentric. (See figure 4-6 [Q].)

- Loosen the hook saddle pinch screw (figure 4-6 [A]).

- Loosen the two setscrews in the hook-driving gear.

- Loosen the spline screw in the feed-lifting eccentric (figure 4-6 [T]).

NOTE: After you loosen the spline screw and the setscrews, each part must rotate freely on the shaft.

Safety Clutch Pulley

The purpose of the safety clutch pulley (figure 4-4 [D]) is twofold. First, it is used to transfer the power and motion from the arm shaft connection belt to the hook-driving shaft; second, it protects the hook from being damaged by disengaging when the hook is jammed. To remove the safety

clutch pulley, you loosen the two setscrews (figure 4-6 [S]) that attach the safety clutch pulley to the hook-driving shaft and withdraw the pulley.

Feed-Lifting Eccentric

The feed-lifting eccentric (figure 4-6 [T]) supplies a lifting motion to the feed-lifting eccentric fork. Remove the feed-lifting eccentric by moving the hook-driving shaft to the right until it clears the feed-lifting eccentric, thus allowing the eccentric to drop from the shaft.

Hook-Driving Gear

The hook-driving gear converts the longitudinal motion in the hook-driving shaft to the horizontal motion on the sewing hook. Remove the hook-driving gear by moving the hook-driving shaft to the right until it clears the hook-driving gear, thus allowing the hook-driving gear to drop from the shaft.

Feed-Driving Eccentric

The feed-driving eccentric sets up the motion and controls the feeding mechanism of the sewing machine. Remove the feed-driving eccentric by moving the hook-driving shaft to the right until it clears the feed-driving eccentric, thus allowing it to drop from the shaft.

Feed-Driving Connection

The feed-driving connection carries the feeding motion to the feed-driving crank. Remove the feed-driving connection simultaneously with the feed-driving eccentric. Remove the connection from the eccentric by withdrawing it from the eccentric.

Feed-Driving Crank

The feed-driving crank transfers the feeding motion from the feed-driving connection to the feed-driving rockshaft. The feed-driving crank is attached to the feed-driving connection and is removed from the sewing machine when you remove the feed-driving connection.

Hook-Driving Shaft Lock Ratchet

The hook-driving shaft lock ratchet locks the hook-driving shaft in position while you set the safety clutch. Remove the hook-driving shaft

lock ratchet by moving the hook-driving shaft to the right until it clears the hook-driving shaft lock ratchet, thus allowing it to drop from the shaft.

Arm Shaft Connection Belt Timing Collar and Hook-Driving Shaft Ball-Bearing Collar

The arm shaft connection belt timing collar and the hook-driving shaft ball-bearing collar are the initial timing points on the machine. *Do not remove these parts from the machine.* In machines fitted with cast iron bushings, the timing collar will fall off as the shaft is withdrawn.

Hook-Driving Shaft

The hook-driving shaft (figure 4-6 [N]) transfers power and motion to the units attached to it. To remove the hook-driving shaft, you grasp it and withdraw it to the right.

Bobbin-Case Opener

The bobbin-case opener (figure 4-9 [D]) acts as a lever to pull the bobbin case back from the throat plate. It allows the needle thread to pass between the bobbin case and the throat plate. To remove the bobbin-case opener, you unscrew the adjusting screw (figure 4-9 [E]) and lift it from the hook saddle assembly.

Hook Saddle Screw

The hook saddle screw (figure 4-6 [B]) holds the hook saddle assembly in place. Unscrew the hook saddle screw to remove it.

Hook Saddle Assembly

The hook saddle assembly (figure 4-6 [U]) forms the lower half of the stitch. To remove the hook saddle assembly, unscrew the hook saddle screw and loosen the hook saddle pinch screw (figure 4-6 [A]). Draw the hook saddle assembly slightly toward the operator, slide it to the left until it clears the center hook-driving shaft bushing, and withdraw it from the machine. This completes the disassembly of the sewing machine.

REASSEMBLY

Before reassembling the sewing machine, you will need some grinding compound to smooth parts that may have surface rust or small burrs.

A small amount of grinding compound on the surface is sufficient. Rotate the two parts until they move freely. You will also need some 10W mineral oil to lubricate all moving parts. After you accomplish these tasks, proceed as follows to reassemble the sewing machine.

Hook Saddle Assembly

To replace the hook saddle assembly, hold it in an upright position with the saddle clamp facing the bed of the machine; then place the saddle clamp on the edge of the center hook-driving shaft bushing. Swing the hook saddle assembly toward the bed of the machine and slide it to the right and into place in the opening in the casting.

Hook Saddle Screw

With the hook saddle assembly as far to the right as it will go, replace the hook saddle screw and tighten it.

Bobbin-Case Opener

Lift the machine to the upright position. Replace the bobbin-case opener so that the curved end points toward the bobbin case. Replace the bobbin-case opener adjusting screw and tighten it.

Hook-Driving Shaft

Tilt the machine forward. In replacing the hook-driving shaft, you should note that it has five splined grooves. One of the splined grooves is located at one end of the shaft. Insert the end without a splined groove into the right hook-driving shaft bearing.

Hook-Driving Shaft Lock Ratchet

As the hook-driving shaft is pushed toward the left, or face, of the machine, replace the hook-driving shaft lock ratchet so that the flange with the setscrews faces the left of the machine.

Feed-Driving Connection and Feed-Driving Crank

Hold the feed-driving eccentric with the flange and spring to the right; then place the feed-driving connection, with the feed-driving crank attached, over the cam on the feed-driving eccentric. Be sure the oiling felt faces upward and the crank is toward the operator.

Feed-Driving Eccentric

Holding the feed-driving eccentric in the same manner as stated above, you replace it on the hook-driving shaft.

Hook-Driving Gear

Push the hook-driving shaft through the center hook-driving shaft bushing. Replace the hook-driving gear so that the flange with the setscrews is facing toward the left.

Feed-Lifting Eccentric

Place the feed-lifting eccentric on the hook-driving shaft and slide the hook-driving shaft into the front hook-driving shaft bushing, leaving approximately 2 inches of the hook-driving shaft extended to the right of the rear hook-driving shaft bushing.

Safety Clutch Pulley

Replace the safety clutch pulley so that the safety clutch hook-driving shaft stop collar, with the screws in it, is flush with the right end of the hook-driving shaft. Turn the safety clutch pulley until the spline screw marked with the letter *S* is positioned over the spline in the hook-driving shaft. Tighten the spline screw and the setscrew.

Feed-Driving Rockshaft

The cylinder end of the feed-driving rockshaft is placed from the left into the feed-driving rockshaft bushing. The flat side of the feed-driving rockshaft stop collar is placed flush with the bushing, and the rockshaft is moved forward to enter the stop collar. The feed-driving crank is placed next to the stop collar, and the rockshaft is moved forward to enter the crank. The remaining stop collar is placed on the rockshaft with the flat side to the right. The rockshaft (with the base of the feed bar toward the operator) is moved through and 1 inch past the right bushing. Holding the base of the feed bar toward you, rotate the rockshaft downward toward the bed of the machine and fit the feed dog into the throat plate.

Place the feed-lifting eccentric fork over the feed-lifting eccentric and fit the base of the feed bar into the slot at the top of the feed-lifting eccentric fork. When the feed-lifting eccentric fork is in position, the rounded end of the fork

will be facing you. To secure the feed-lifting eccentric fork to the feed dog, you must place the feed eccentric fork screw into the space provided and tighten it.

The feed-driving rockshaft crank is attached to the needlebar rock frame rockshaft crank and connection. To replace it, insert the needlebar rock frame rockshaft crank and connection with the curved portion upward and the crank hanging down into the arm through the opening in the bed of the machine. Slide the feed-driving rockshaft crank over the feed-driving rockshaft. *Do not tighten the crank.* Ensure all other screws are tight.

This completes the assembly of the parts in the bed of the machine. Now we will assemble the parts located in the arm of the machine.

Needlebar Rock Frame Rockshaft

(At this point, the machine is placed in an upright position.) Place the needlebar rock frame rockshaft in the lower bushing in the face of the machine. Push it through until the end of the shaft is flush with the bushing in the arm of the machine. This may be viewed through the opening in the top of the machine arm. Place the screwdriver through the opening in the right side of the machine arm and engage the needlebar rock frame rockshaft crank. Lift the crank with the screwdriver so that it is on line with the needlebar rock frame rockshaft. With the left hand, push the rockshaft through the crank. *Do not tighten the crank.*

Arm Shaft

In replacing the arm shaft, be certain that the needlebar crank friction washer is on the shaft. Insert the arm shaft in the top bushing in the face of the machine; then push it through until it can be seen through the opening located on the rear of the machine arm.

Presser-Lifting Eccentric Connection Link

Insert the larger end of the presser-lifting eccentric connection link (figure 4-10A) with the oil holes facing up. Slowly push the arm shaft through the arm of the machine until you can see the arm shaft at the opening on the top of the machine nearest the balance wheel.

Presser-Lifting Eccentric

Place the presser-lifting eccentric (figure 4-10B) onto the arm shaft with the small end toward the face of the machine. At this time, slide the presser-lifting eccentric toward the face until it goes inside the connecting link.

Feed Indicator Disc

The feed indicator disc is placed on the arm shaft, through the opening in the top of the machine arm, so that the numbers on the disc may be read right side up. Push the arm shaft through the disc about 1 inch.

Arm Shaft Pulley and Arm Shaft Connection Belt

The arm shaft connection belt acts as a sling for the arm shaft pulley. Use the belt and lower the pulley through the opening in the top of the machine arm. Now turn the belt, while aligning the pulley with the arm shaft, and insert the shaft through the pulley. Be sure you push the shaft through as far as it will go.

Arm Shaft Connection Belt Pulley Position Screw

To replace the arm shaft connection belt pulley position screw, you hold the arm shaft in position with the left hand and move the arm shaft pulley to the left. Turn the arm shaft until the hole is facing up. Now turn the pulley until the hole for the position screw is facing up. Move the pulley to the right, aligning the two holes, and insert the position screw. Tighten the remaining setscrew in the pulley.

Balance Wheel

Before you replace the balance wheel, turn the arm shaft until the groove in the shaft is facing upward. Place the balance wheel on the arm shaft. Now turn the wheel toward the operator until the second screw is directly in line with the groove. Tighten the screw in place. Tighten the remaining setscrew.

Balance Wheel Adjusting Screw

Place the balance wheel adjusting screw in the end of the arm shaft and tighten it. Loosen it one-quarter turn and strike it with a sharp blow

using a rawhide mallet. See that the balance wheel turns freely and that there is no play. If the balance wheel does not turn, or if it turns and there is side-to-side play, repeat the procedure.

CAUTION

This balance wheel is made of cast iron or aluminum and will break if you hit it directly with the mallet.

If the screw can be removed by using your thumb and forefinger, it will be necessary to spread the end of the screw. To do this, remove the screw and spread the end of it with a screwdriver. Replace the screw and run it down until it touches the balance wheel. It should then be tightened snugly when you try to remove it with your fingers.

Alternating Presser Driving Rockshaft

Slide the rockshaft into the rear of the machine through the two bushings. Attach the presser-lifting link crank to the link projecting from the arm. Continue sliding the rockshaft through the crank. Set the machine on its balance wheel end. Install the bell crank link on the rockshaft stud (oil holes up). Install the oil guard into the face at this time.

Needlebar Connecting Link

Turn the balance wheel until the needlebar connecting link stud is at its lowest position. Grasp the needlebar connecting link so that the double cylinders are up. Place the larger of the two cylinders over the needlebar connecting link stud, and ensure that the flush end of the cylinders are facing outward.

Take-up Lever Driving Stud

Place the cylinder of the take-up lever driving stud over the piston of the take-up lever.

Take-up Lever

Grasp the take-up lever with the piston of the take-up lever driving stud and the cylinder of the take-up lever facing the face of the machine. Fit the lever into the slot designed for its operation; at the same time insert the take-up lever driving stud into the remaining cylinder of the needlebar connecting link.

Thread Take-up Lever Hinge Stud

Align the cylinder of the thread take-up lever with the recess for the hinge stud. Before you insert the hinge stud, turn the hinge stud and note the flat machined surface running the length of the stud. Replace the stud with the machined surface up. Install the setscrew.

Needlebar Rock Frame Assembly

Hold the needlebar rock frame in the left hand with the rounded end up and the straight side facing left. Insert the slide block in the space provided with the oil hole facing up.

Before you insert the needlebar rock frame assembly, turn the balance wheel until the needlebar connecting link is at its lowest position. Insert the assembly into the face of the machine so that the connecting stud enters the connecting link and the slide block is placed over the projection on the needlebar rock frame rockshaft. At the same time, the vibrating presser barspring guide rod with the spring attached must be positioned into the hole at the top of the face. Hold the assembly in position.

While you are holding the assembly in position, insert the hinge stud so that the flat surface is up. Install and tighten the setscrew.

Install the needlebar rock frame. Position bracket in position and tighten it in place.

Thread Tension Release Lever Rod

Insert the thread tension release lever rod in the hole in the back of the machine head so that the rounded end is facing toward the operator.

Presser Bar

Insert the presser bar through the upper bushing located in the top of the machine head, about 3 1/2 inches. Place the presser bar position bar guide lever so that the pinch screw is to the rear and the arm is to the left. At this time the lifting-and-releasing unit must be installed. It consists of a lifting bracket, a releasing bracket, and a spring that separates the two parts. While you are holding the unit together, place it into the face so that the two long levers cover the releasing rod. Now twist the presser bar down through the unit. Before you lower the presser bar through the lower bushing, insert the presser bar spring bracket with the slot up. Lower the presser bar through the lower bushing. Turn it so that the

unthreaded end of the hole faces left. Insert the presser foot in the slot. Replace the screw and tighten it.

Presser Bar Position Guide

Place the slotted end of the presser bar position guide through the opening in the top of the machine head so that it fits over the arm of the presser bar position guide lever. When you complete this step, the top of the presser bar position guide will be flush with the top of the machine head. Tighten the spline screw in the rear of the head.

Presser Bar Spring

Tilt the machine down and place the long curved end of the presser bar spring through the opening in the back of the machine head and into the slot in the presser bar spring bracket. Place the small curved end over the presser bar spring-support screw. Push it down and under the presser spring-regulating screw. Tighten the presser bar spring-support screw. Install the large guide screw.

NOTE: Preadjust the spring bracket with the presser foot firmly on the throat plate, and make sure the foot is straight. Raise the presser bar spring bracket about one-eighth inch and tighten the pinch screw.

- At this time, adjust the presser bar guide lever one-quarter inch up from the bottom of the guide as in figure 4-7 (K).

- Tighten the pinch screw (figure 4-11 [B]).

Front Presser Bar Connecting Link

Place the large end of the line on the front presser bar stud.

Bell Crank

The bell crank has three attachment points: (1) the bell crank connection link, (2) the lifting lever bell crank stud, and (3) the front presser bar connecting link stud. All three must be engaged at the same time. Install and tighten the retaining screw.

Front Presser Foot and Presser Pressure-Regulating Thumbscrew

Install the foot on the front presser foot and the regulating screw on the top of the face.

Knee Lifter Lifting Lever

Replace the knee lifter lifting lever so that the slotted end fits over the projection on the knee lifter connection lever. The projection on the curved end of the knee lifter lifting lever fits under the presser bar releasing bracket.

Knee Lifter Lifting Lever Hinge Screw

Align the hole in the knee lifter lifting lever with the corresponding hole in the machine

arm; then insert the hinge screw. Make certain the screw, including the shoulder, is fully inserted.

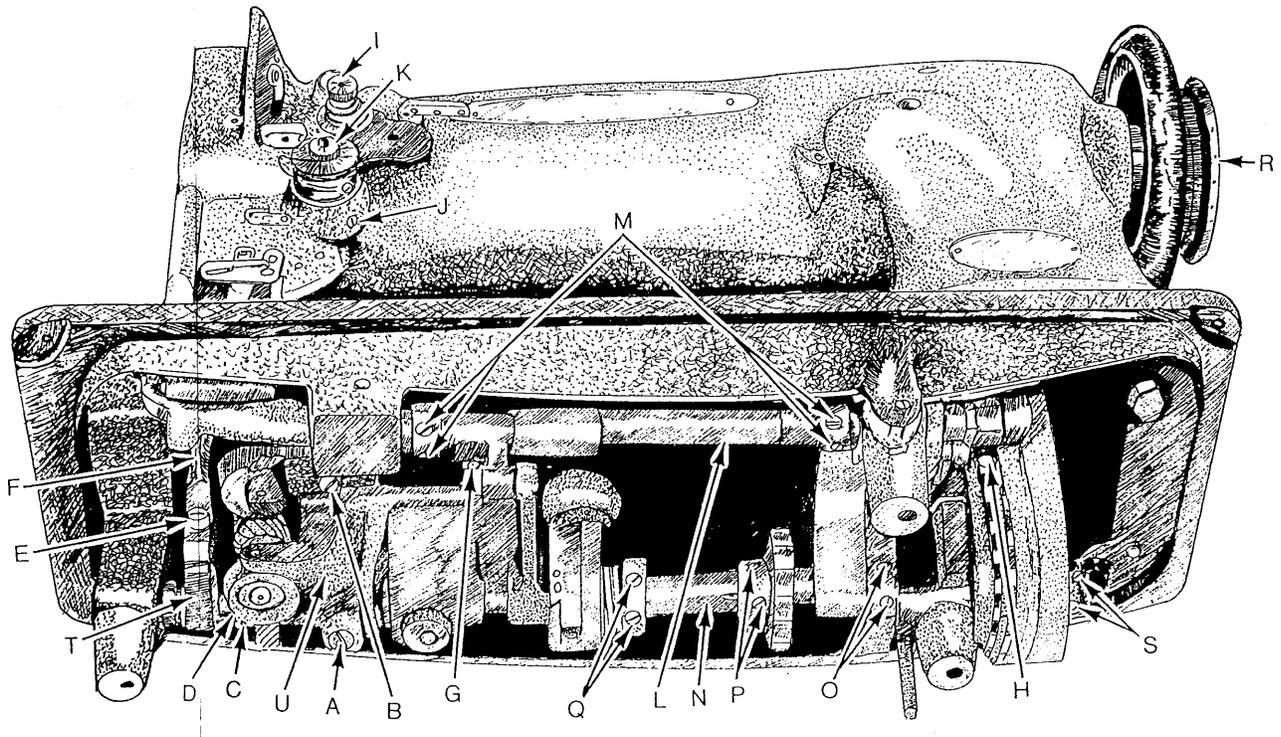
Faceplate

Insert the thumbscrew and secure it.

Arm Cap

Replace the arm cap and the spring washer on the machine arm and screw them in place.

This completes the reassembly of the 111 W 155 sewing machine. It will be necessary to make a few minor adjustments or retune this machine. Timing and adjustment are covered at the beginning of this chapter.



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Table 4-1.—Nomenclature for figure 4-6

A. Hook Saddle Pinch Screw	L. Feed-Driving Rockshaft
B. Hook Saddle Screw	M. Feed-Driving Rockshaft Stop Collars and Setscrews
C. Hook Drive Gear Setscrew	N. Hook-Driving Shaft
D. Hook Drive Spline Screw	O. Hook-Driving Shaft Bearing Collar Setscrews
E. Feed Fork Screw	P. Hook-Driving Shaft Lock Ratchet Setscrews
F. Feed Bar	Q. Feed-Driving Eccentric Setscrews
G. Feed-Driving Rockshaft Crank Pinch Screw	R. Balance Wheel
H. Feed-Driving Rockshaft Crank Pinch Screw	S. Safety Clutch Hook-Driving Shaft Position Collar Setscrew
I. Thread Controller Assembly Retaining Screw	T. Feed-Lifting Eccentric
J. Thread Controller Stud Setscrew	U. Hook Saddle Assembly
K. Thread Controller Thumb Nut	

Figure 4-6.—Bottom view of Model 225.

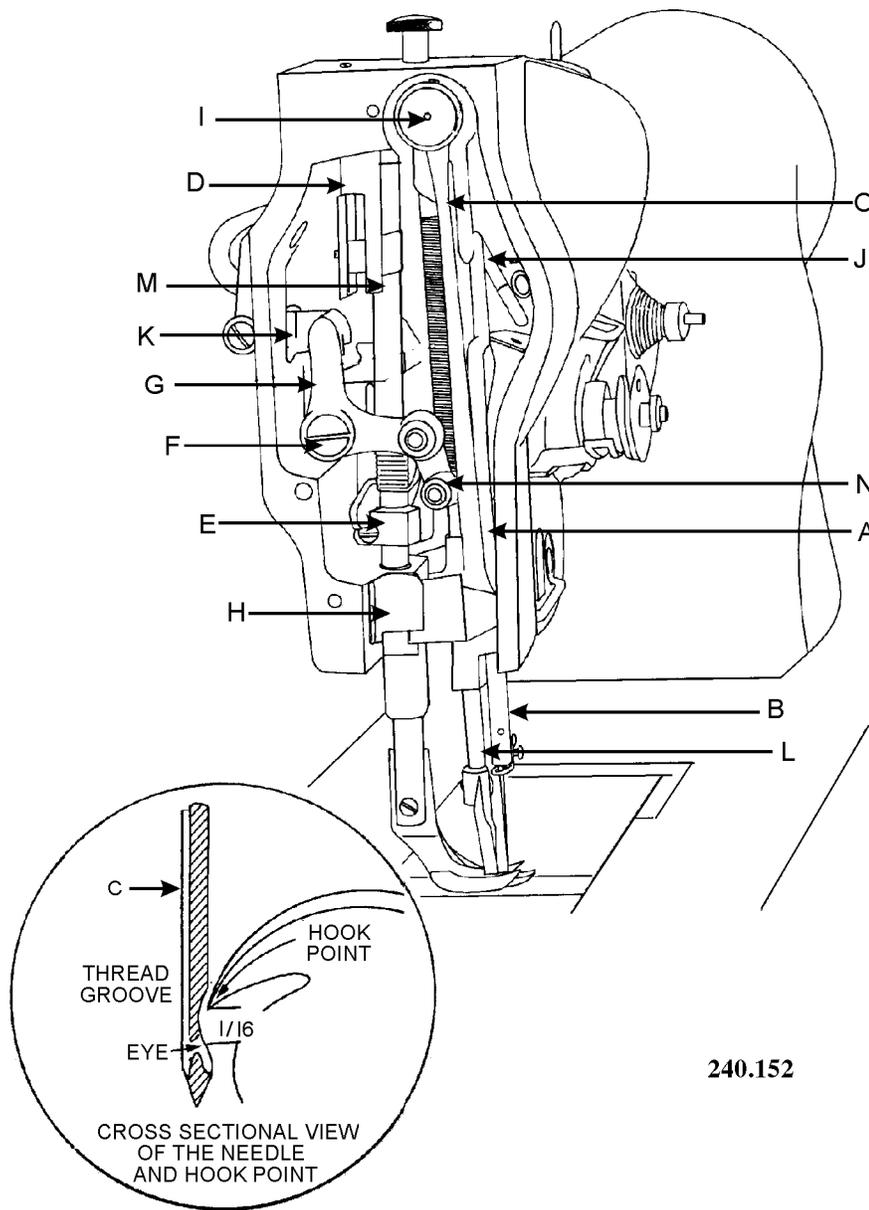
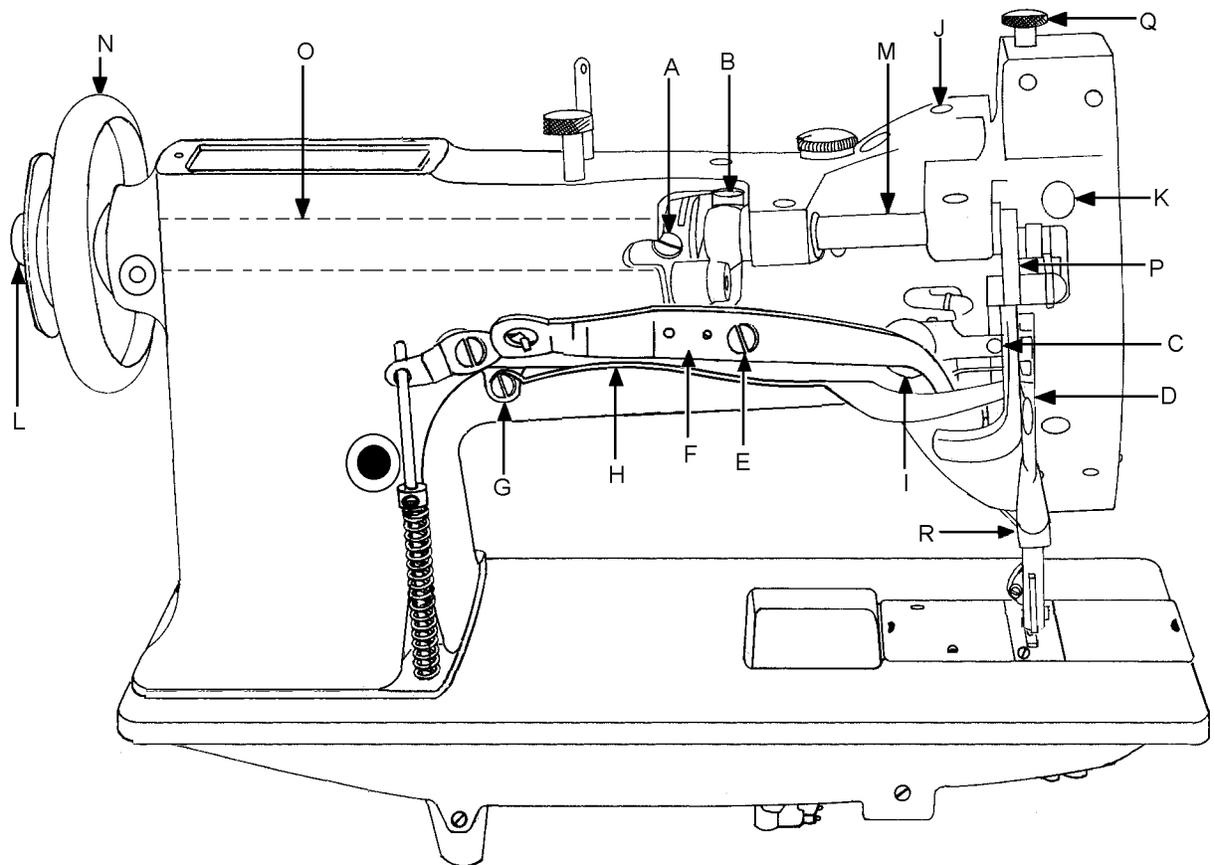


Table 4-2.—Nomenclature for figure 4-7

- A. NEEDLEBAR ROCK FRAME ROCKSHAFT CONNECTION CRANK PINCH SCREW
- B. NEEDLEBAR
- C. NEEDLEBAR POSITION HEIGHT
- D. PRESSER BAR POSITION GUIDE
- E. PRESSER BAR SPRING BRACKET
- F. PRESSER-LIFTING BELL CRANK RETAINING SCREW
- G. PRESSER LIFTING BELL CRANK
- H. NEEDLEBAR ROCK FRAME POSITION BRACKET
- I. NEEDLEBAR ROCK FRAME HINGE STUD
- J. NEEDLEBAR CONNECTING LINK
- K. PRESSER BAR GUIDE LEVER
- L. VIBRATING PRESSER BAR
- M. PRESSER BAR
- N. VIBRATING PRESSER BAR CONNECTING LINK
- O. NEEDLE ROCK FRAME ASSEMBLY

Figure 4-7.—Face view of Model 225



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Table 4-3.—Nomenclature for figure 4-11

A. PRESSER-LIFTING ECCENTRIC SETSCREWS	J. NEEDLEBAR CONNECTING LINK OIL GUARD
B. PRESSER-LIFTING LINK CRANK PINCH SCREW	K. PRESSER BAR GUIDE LEVER PINCH SCREW
C. PRESSER BAR LIFTING BRACKET PINCH SCREW	L. BALANCE WHEEL ADJUSTING SCREW
D. LIFTING SCREW	M. PRESSER-LIFTING ROCKSHAFT
E. KNEE LIFTER LIFTING LEVER HINGE SCREW	N. BALANCE WHEEL
F. KNEE LIFTER LIFTING LEVER	O. ARM SHAFT
G. PRESSER BAR SPRING-SUPPORT SCREW	P. PRESSER-LIFTING LINK CRANK
H. PRESSER BAR SPRING	Q. VIBRATING PRESSER FOOT TENSION SPRING ADJUSTMENT THUMBSCREW
I. PRESSER BAR LIFTING RELEASING LEVER BRACKET GUIDE SCREW	R. VIBRATING PRESSER BAR

Figure 4-11.—Rear view Model 225.

CHAPTER 9

SEWING MACHINES

Learning Objective: Upon completion of this chapter, you will be able to identify and maintain the different types of sewing machines used in the process of repairing or fabricating survival equipment.

Sewing machines are like any other tool you use. If you don't have the correct one, the task is harder or impossible to complete. The same applies to sewing machines. You need the right machine for the job; whether it be lightweight, medium weight, or heavyweight, there is a machine designed to perform each task. You work with various types of sewing machines in the process of repairing or fabricating items in the shop. You need to have all the knowledge and skill YOU can possibly acquire about these machines to fulfill your duty as a PR. If you don't know how to operate and maintain the sewing machines, they will stand idle, not operate properly, or not work at all. When you have a job to do, you need equipment that is operational. Without the proper knowledge of sewing machines, you will not have the confidence to perform necessary sewing machine repairs.

Before you can learn to operate and maintain a sewing machine, you must learn the language of the sewing trade. Through your supervisor and this text, you should become familiar with this language. It is very important that you form a habit of referring to the parts of a sewing machine by their proper names. It would be difficult to communicate with other PRs and impossible to pass a rating exam if you do not know the proper names of the different parts of a sewing machine. Take time to study the illustrations in this chapter that show the important sewing machine parts and their names.

Sewing machines are classified as two types—OSCILLATING and ROTARY. Both types are operated by electric motors and are fitted with rheostats and special clutch arrangements that enable the operator to control the speed.

When it comes to classifying sewing machines into oscillating and rotary, the important part is

the rotary hook and oscillating shuttle. This is the device that is out of sight in the base of the machine, but does the very important job of forming each stitch after the needle has passed thread through the fabric.

Oscillating sewing machines have a sewing hook that rocks back and forth through half of one revolution to complete one stitch.

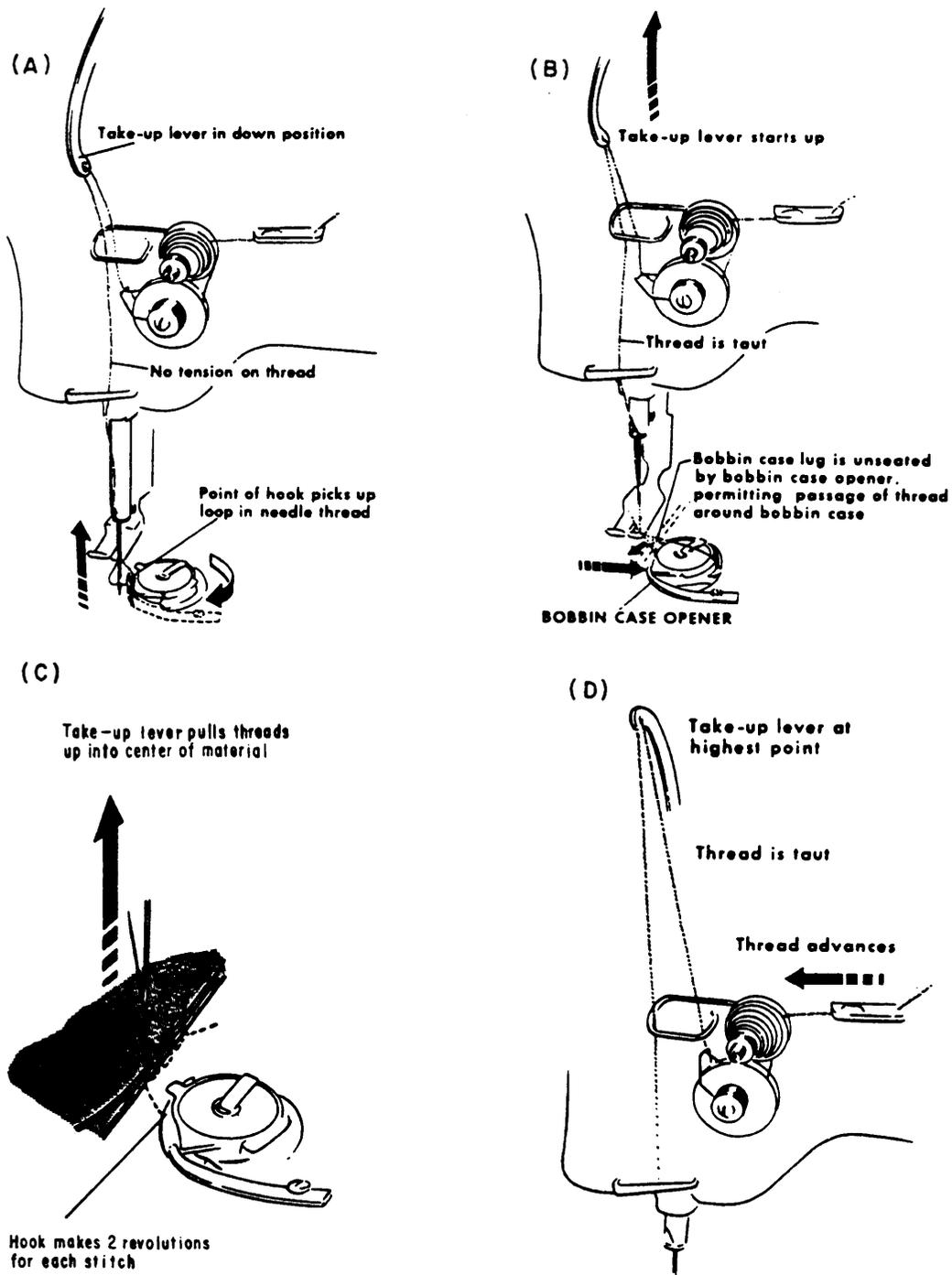
Rotary sewing machines have a hook that makes two complete revolutions to complete one stitch.

The type of stitch commonly used and made by sewing machines in repair work is the lockstitch. The lockstitch makes use of two separate threads. One comes from the spool down through the eye of the needle, the other from the bobbin. In making the lockstitch, these two threads must become interlocked, as shown in figure 9-1.

The thread passing through the eye of the needle is pushed down through the material being sewn. As the needle travels downward to the material, a spring pulls tension on the needle thread to keep it taut to prevent any slack that might tangle the thread around the needle.

After the needle reaches its lowest position and starts its upward movement, the process shown in figure 9-1 begins. A small loop of thread forms alongside the needle beneath the throat plate. The sewing hook catches this loop and carries it around the bobbin, which floats in its track in the bobbin case (view B of figure 9-1). By locking the loop of needle thread around the bobbin thread, the sewing hook forms the stitch.

As the needle completes its upward movement, the thread tension disks hold the needle thread firmly. The thread take-up lever, rising quickly, pulls on the loop that has been formed, and thus tightens the stitch. When the thread take-up lever



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Figure 9-1.—The lockstitch.

reaches its highest position, the stitch is completed. (See views C and D of figure 9-1.)

Now look at figure 9-2. The standard sewing machine has four basic parts: bed, uprise, arm, and face. The BED (1) houses the linkage from the safety clutch pulley to the sewing hook

assembly; the UPRISE (14) houses the arm shaft connection belt; the BALANCE WHEEL (12) is connected to the arm shaft in the ARM (11), which operates the needle bar mechanism in the FACE (6) of the machine.

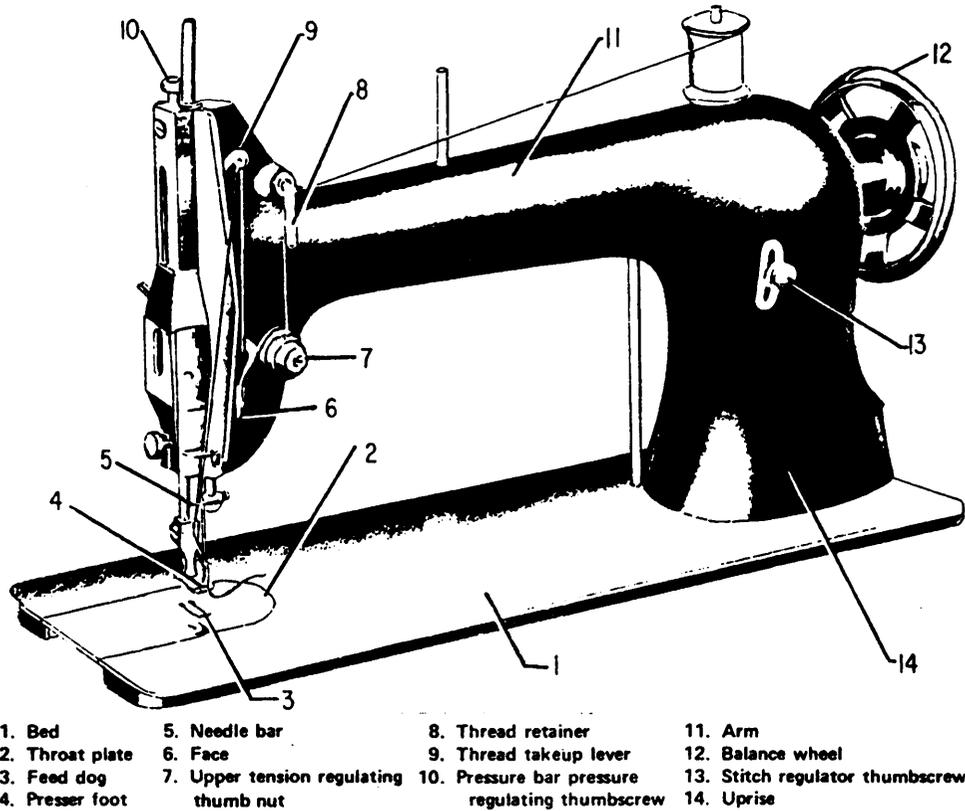


Figure 9-2.—Sewing machine 31-15.

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The machine is powered by an electric motor, which is connected to the motor driving pulley by a clutch. You connect the motor to the clutch by pressing the forward part of the foot treadle. The aft part of the treadle is the brake, which acts upon the clutch.

The material to be sewn is held in position on the feed dog by the presser foot. The pressure of the presser foot upon the material enables the feed dog to push the material forward each time the needle goes up. The pressure of the presser foot on the material is released either by a knee lifter or a hand lifter. The presser foot can be raised by pushing the knee lifter to the right. The hand lifter is located behind the face of the machine. The presser foot may be lifted and locked into position by raising the hand lifter to its highest position.

OSCILLATING TYPE SEWING MACHINES

Two of the most commonly used oscillating sewing machines are the 31-15 and 7-33, both of which are discussed in this chapter.

SINGER SEWING MACHINE 31-15

When starting out as a PR, the 31-15 sewing machine will probably be the one you'll like to use. This machine is smaller and lighter than most of the other machines used in the parachute loft. The manufacturer calls the 31-15 a tailoring machine. It is used to sew and repair clothing, uniforms, shirts, flying clothing, jackets, and lightweight protective covers.

The 31-15 is an oscillating sewing machine that has a recommended speed of 2,200 stitches per minute and makes a lockstitch. It is very good for sewing nylon cloth, and can be used for sewing lightweight canvas up to 8 ounces. The number of stitches can be regulated from 7 to 32 stitches per inch.

When the 31-15 machine is in operation, the balance wheel turns over toward the operator. When hand-turning the balance wheel, always rotate it in this direction. The components of the Singer Sewing Machine 31-15 are shown in figure 9-2.

The following practices and procedures help to ensure safe and smooth operation of the sewing machine:

1. The balance wheel must always turn toward the operator.
2. Do not run the machine with the presser foot resting on the feed dog without material being under the presser foot.
3. Do not run the machine when both bobbin case and needle are threaded unless there is material under the presser foot.
4. Do not try to help the machine by pulling the material. You may bend or break the needle. If properly adjusted, the machine feeds the work without assistance.
5. The slide over the bobbin case should be kept closed when the machine is in operation.
6. Keep your head away from the thread take-up lever and needle bar at the top of the sewing machine face.
7. When running the machine, do not take your eyes away from the needle and presser foot.
8. Keep your fingers from under the needle.
9. When running the machine, keep your fingers away from the belt and pulley areas.

10. Never attempt threading the needle when the machine is turned on.

Lubrication

To ensure easy operation and to prevent unnecessary wear of the moving parts, all sewing machines need oiling. When a machine is in constant use, it should be oiled twice a day. A new machine should be oiled more frequently when in constant use. Use only one drop of oil at each oiling point. A 10W mineral oil is recommended.

Oiling points for the 31-15 machine are shown in figures 9-3, 9-4, and 9-5. Oil should be applied regularly to the shuttle bearing in the shuttle race. Occasionally, remove the faceplate and apply oil to the bearings and points that are uncovered.

Timing the 31-15

There are two distinct timing operations for the 31-15 machine. One operation times the needle with the shuttle; the other timing operation times the feed dog with the needle. Both the needle with the shuttle and the feed dog with the needle must

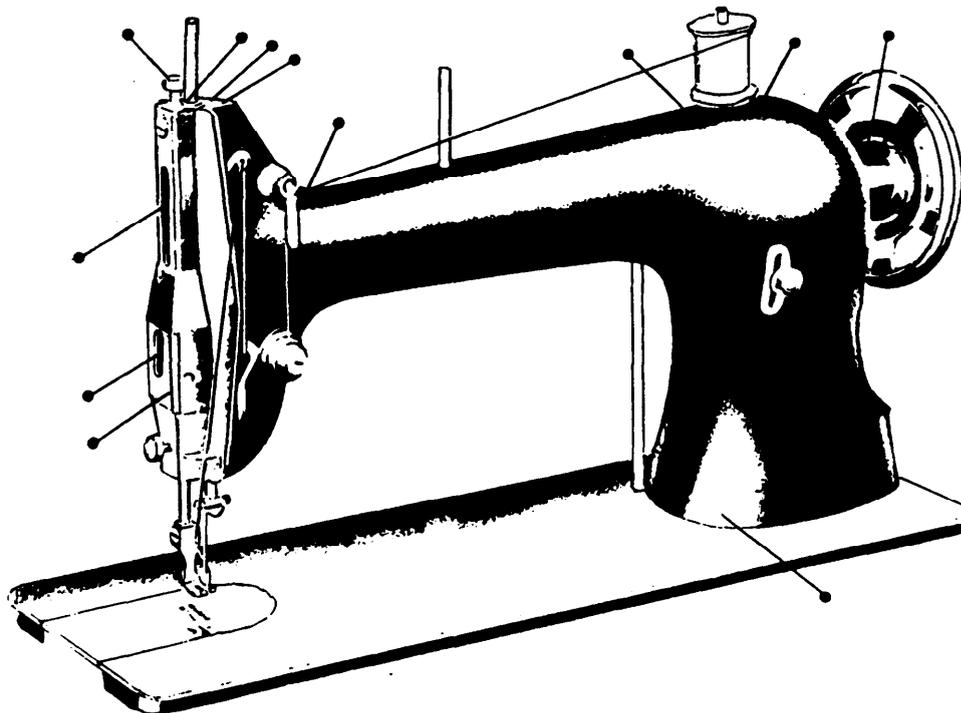
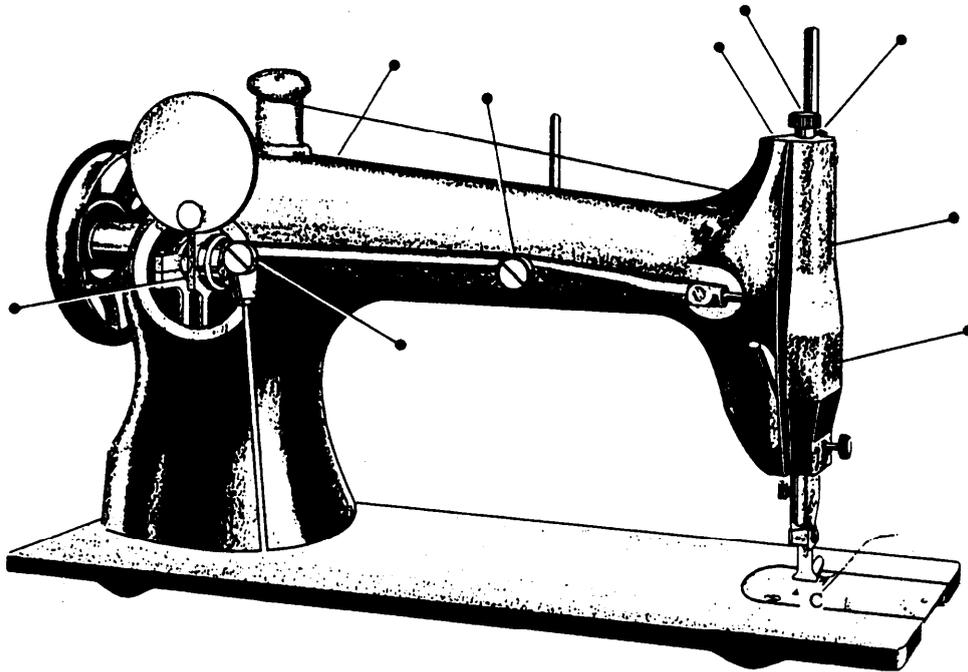


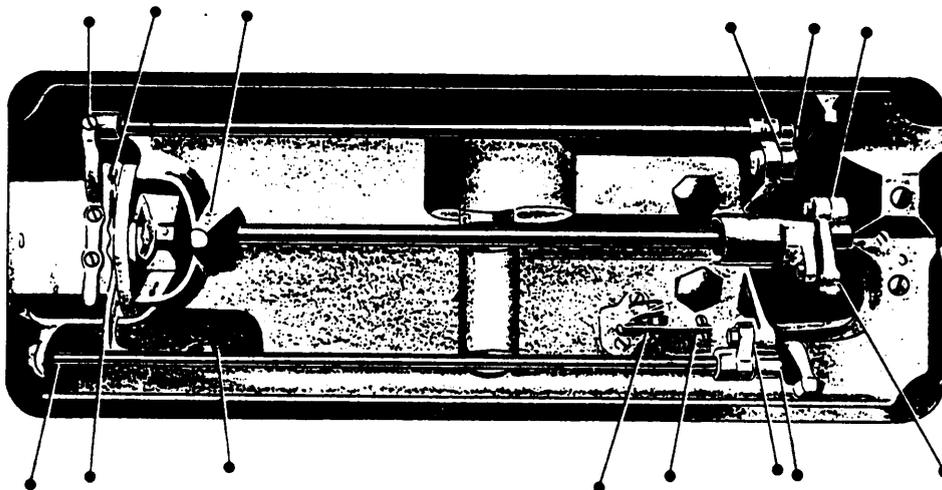
Figure 9-3.—Oiling points at the front of the machine.

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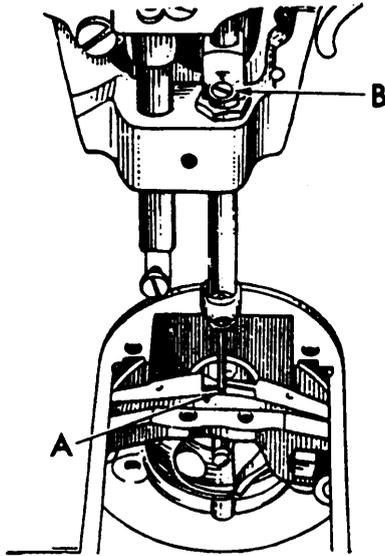
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Figure 9-4.—Oiling points at the back of the machine.



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Figure 9-5.—Oiling points at the base of the machine.



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Figure 9-6.—Timing needle with shuttle.

be in proper time for the machine to function properly. See figure 9-6.

Timing the Needle with the Shuttle

If a class 31 sewing machine does not form the lockstitch, if it skips stitches, or if it frays or breaks thread, the needle is not moving in the proper relationship with the shuttle's motion. First make sure you have the right needle. Check the needle for the correct class, variety 16 x 87, and size. Insert the needle in the needle bar (long groove to the left) as far as it will go (fig. 9-6). Next compare the needle stroke to the shuttle stroke. To do this, remove the throat plate. Turn the balance wheel toward you until the point of the shuttle on its forward stroke reaches the center of the needle while the needle is on the upstroke. At this time, the needle bar should have risen 1/10 inch and the point of the shuttle should be 1/16 inch above the eye of the needle, as shown in A of figure 9-6.

NOTE: Prior to making adjustments to the sewing machine, always follow the troubleshooting chart in Table 9-1.

If the needle eye is not in this position, the following steps should be taken:

1. Loosen the needle bar connecting stud screw, as shown in B of figure 9-6.

2. Move the needle bar up or down as required; and then tighten the screw.

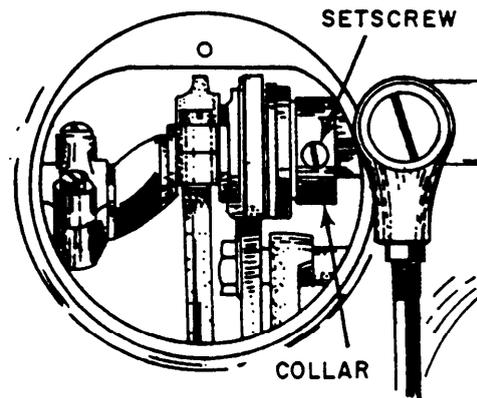
3. Rotate the balance wheel through the full cycle to check the timing.

4. Replace the throat plate.

Timing the Feed Dog with the Needle

The feed driving eccentric is an adjustable connection between the arm shaft (the shaft in the head) and the feed rock shaft (first shaft beneath the bed of the machine). If the feed mechanism is properly timed, the feed dog should be on its downstroke and level with the throat plate when the point of the needle reaches the material. If there is a twisted knot every 1 to 2 inches on the bottom of your material, check the timing of the needle before adjusting the feed mechanism.

To adjust the feed eccentric, first lower the stitch regulator to the lowest position so the machine forms its longest stitch. Turn the balance wheel until the feed dog is on its downstroke and is flush with the throat plate. Move to the rear of the machine and take off the arm side cover. Turn the balance wheel away from you until the feed eccentric collar setscrew is visible (fig. 9-7). Hold the collar with your left thumb. Loosen the screw and rotate the balance wheel away from you until the needle, on its downstroke, reaches the material. Tighten the setscrew. Rotate the balance wheel to check the timing. Recheck the timing of the shuttle point with the needle. When you time the feeding mechanism, you may throw the needle out of time with the shuttle.



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Figure 9-7.—Feed eccentric.

Table 9-1.—Troubleshooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Needle breakage.	<p>Incorrect class and variety needle being used.</p> <p>Needle loose in clamp.</p> <p>Needle too small for fabric.</p> <p>operator pulling on the material.</p>	<p>Use correct class and variety needle.</p> <p>Tighten needle clamp screw.</p> <p>Use larger needle.</p> <p>Allow machine to feed material.</p>
Needle thread breakage.	<p>Thread too heavy for needle.</p> <p>Right twist thread being used.</p> <p>Damp or defective thread being used.</p> <p>Machine incorrectly threaded.</p> <p>Needle incorrectly set.</p> <p>Needle thread tension too tight.</p> <p>Thread take-up spring out of adjustment.</p> <p>Burr on bobbin case, Shuttle point or tension disks.</p> <p>Thread rubbing against presser foot.</p> <p>Needle has burr on eye or point, blunted or bent.</p>	<p>Use larger needle or smaller thread.</p> <p>Use left twist thread.</p> <p>Use only dry smooth thread.</p> <p>Check machine for proper threading.</p> <p>Set needle with long groove to the left.</p> <p>Loosen needle thread tension.</p> <p>Adjust thread take-up spring.</p> <p>Smooth with emery cloth.</p> <p>Adjust presser foot.</p> <p>Replace needle.</p>
Bobbin thread breakage.	<p>Bobbin tension too tight.</p> <p>Bobbin incorrectly threaded.</p> <p>Bobbin wound too full to revolve freely.</p> <p>Rounds of bobbin thread lapped over one another.</p> <p>Bobbin case is dirty.</p>	<p>Adjust bobbin tension.</p> <p>Thread bobbin to revolve clockwise.</p> <p>Remove some of the bobbin thread.</p> <p>Insure bobbin thread is straight when winding bobbin.</p> <p>Clean and lubricate bobbin case.</p>
Skipped stitches.	<p>Machine out of time.</p> <p>Thread controller spring out of adjustment.</p>	<p>Time needle to shuttle.</p> <p>Adjust thread controller spring.</p>
Drawing of seam.	<p>Needle and bobbin tension too tight.</p>	<p>Loosen needle and bobbin tension.</p>
stitches piled up.	<p>Stitch regulator out of adjustment.</p> <p>Pressure on presser foot too tight.</p>	<p>Adjust stitch regulator.</p> <p>Loosen presser foot adjustment screw.</p>
Feed dog striking throat plate.	<p>Feed dog set too high.</p>	<p>Lower feed dog to correct height.</p>

Adjusting the Feed Dog

The height at which the feed dog should be set depends on the weight and number of plies of the material being sewn. If the feed dog is set too low, the material does not feed through the machine; if it is set too high, it may cut or fray the material. The recommended height of the feed dog for sewing lightweight canopy material is slightly less than one tooth above the throat plate. If you are sewing heavier material, raise the feed dog to a height that ensures positive feeding of the material. After you have decided on the correct height for the project you are working on, adjust the feed dog accordingly, by loosening and then tightening the screw, as shown in figure 9-7. You must remember that each time the height of the feed dog is changed, the feeding mechanism may be out of time. For this reason, set the feed dog first, and then make the necessary adjustment on the feeding mechanism. Since most of your canopy repairs involve material of approximately the same weight, one-time adjustment of the feed dog is usually sufficient. Repeated changing of its height is not necessary.

Adjusting the Thread Take-up Spring

To adjust correctly the take-up spring in the tension assembly (fig. 9-8), you should first understand its normal operation. The thread take-up lever pulls the thread take-up spring down about even with the slack thread regulator while the needle is going up. While the take-up lever is coming down with the needle, the thread take-up spring pulls the slack out of the thread and keeps it from getting under the needle. If you do not have this adjusted properly, a loop can form

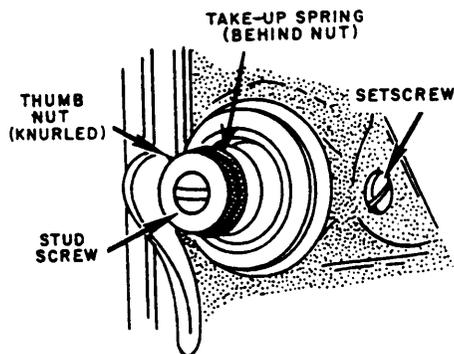


Figure 9-8.—Tension assembly.

over the needle hole in the throat plate, and the needle can split the thread as it enters the needle hole. You should set the spring about 1/4 inch above the slack thread regulator. The thread take-up spring should be set so that the spring will have completed its downward motion and be resting on the stop when the needle, on its downstroke, reaches the fabric.

To adjust the spring, loosen the setscrew, as shown in figure 9-8. To put more tension on the spring, you turn the assembly clockwise; to put less tension on the spring, you turn the assembly counterclockwise.

It may be necessary for you to replace the thread take-up spring because it can bend and become weak. Loosen the setscrew and insert a screwdriver into the slot of the tension screw stud (fig. 9-8). Turn the stud to the left until it is screwed out of the thread take-up spring regulator.

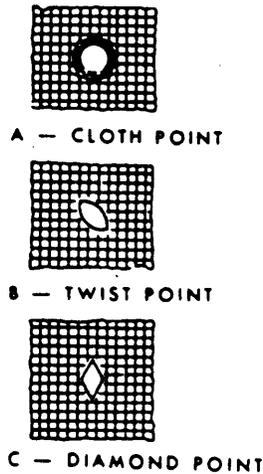
Remove thumb nut (fig. 9-8), the tension spring, and tension discs. The take-up spring is now free for removal. After replacing the old spring with a new one, assemble the parts in reverse procedure.

Replacing the Needle

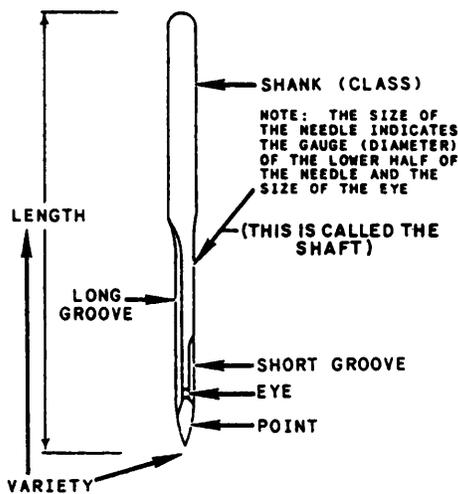
While replacing a needle is a relatively simple job, you must know a few things about needles in order to decide which needle is required when a needle must be replaced. It is very important that the proper needle be used to ensure good machine operation. The selection of needles by class, variety, and size for different machines and materials is necessary to eliminate thread breakage, needle breakage, skipped stitches, and fraying of the thread.

Needles for the various machine classes are selected and ordered by needle number and size. The needle numbers consist of a class number and variety number separated by a "x"; for example, the class and variety needle 16 x 87 is used in the 31-15 sewing machine. Cloth point needles are round, sharp-pointed needles used for sewing cloth, since they do not cut the strands as they are forced between the woven threads of the fabric. Many different varieties of cutting point needles are available, but they are used only for sewing heavy leather. Figure 9-9 shows the shape of the openings made in material by the cloth point (view A), twist point (view B), and the diamond point (view C). Figure 9-9 illustrates why it is important that a round-pointed needle be used in cloth; views B and C show how cutting point needles can cut the warp and filler threads.

239.445



239.446
 Figure 9-9.—Shapes of needle points.



239.447
 Figure 9-10.—Sewing machine needle.

Machine needles have long groove on one side, and either a short groove or a scarf on the opposite side, as shown in figure 9-10. The purpose of the grooves is to allow the thread to fall back into the needle when it enters the material to prevent the thread from breaking or fraying; therefore, it is important that the long groove be placed in the machine properly. On different class machines, the direction varies with the position of the bobbin assemblies. On class 31 machines, the long groove is placed to the left. The scarf is to prevent the oscillating shuttle from striking the needle as it passes close to the needle to pick up the thread loop to form the lockstitch.

Needles are sized by the diameter or gauge of the needle and the needle eye. The selection of the correct size needle is determined by the size and type of thread and material used. The thread must pass freely through the eye of the needle to prevent thread fraying or breaking. The sizes of the class 16 x 87 needles used for most sewing will range from size 18 through size 22. The needle size number increases with the diameter of the needle; therefore size 18 needles are used for lighter weight materials than size 22. Listed below are some of the needle sizes you will be working with and their uses:

1. Size 18. For sewing two to four plies of thin material, such as silk, nylon, or rayon, with size E thread.
2. Size 20. For sewing five or more plies.
3. Size 21. For sewing two to four plies of medium weight materials, such as aircraft cloth, 12-ounce duck, light leather, and artificial leather.
4. Size 22. For sewing two to four plies of medium weight material, such as heavy duck, lightweight and medium weight webbings, and russet leather.
5. Size 24. For sewing elastic or rubberized materials.

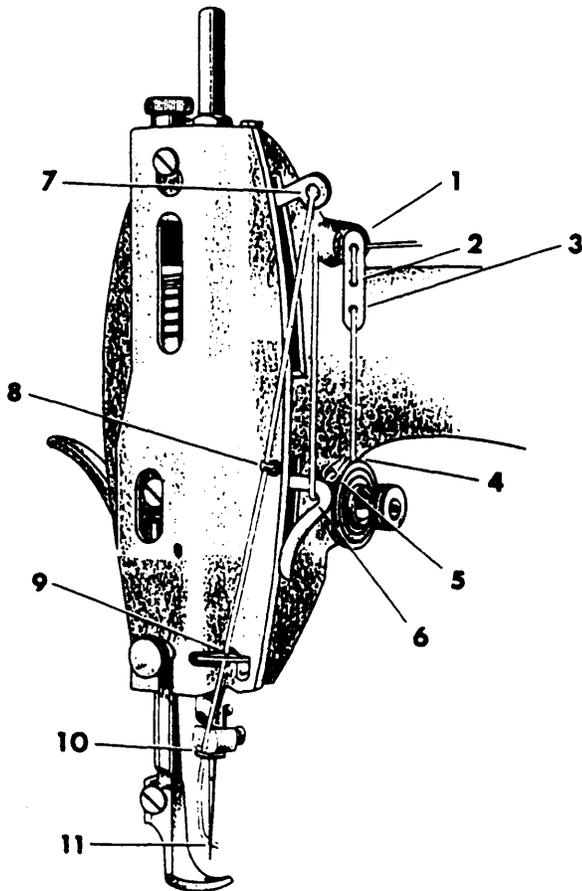
You should check the condition of the needle's point before you start to sew. A dull or rough round needle acts the same as a cutting needle. It cuts or pulls threads and may weaken the seam. The condition of a needle may be checked by sliding the fingernail over the point. If it scratches or catches the nail, the needle should be replaced with a new one. A dull needle may be sharpened by placing it in the chuck of a drill press, and the drill operated at high speed while holding a fine grain sharpening stone lightly against the side of the needle at the proper angle. The point is then polished with a piece of russet leather.

Having selected the proper needle, turn the balance wheel toward you until the needle bar moves to its highest point. Loosen the needle clamp screw and put the shank of the needle up into the groove as far as it will go. Turn the long groove so that it faces to the left and is directly in line with the arm of the machine. Then tighten the clamp screw, and check to see that the needle does not turn or slip. For troubleshooting, refer to table 9-1.

Threading the Machine

Threading a machine is a very simple job. The procedure may vary slightly with different models; but after working with the various machines in the loft, the task becomes automatic.

The component parts used in threading the 31-15 sewing machine are shown in figure 9-11. Use this figure in studying the procedures that follow. Pass the thread from the thread stand to the thread post on top of the machine, right to left through the bottom hole, and then right to left



1. Top hole of thread retainer
2. Middle hole of thread retainer
3. Bottom hole of thread retainer
4. Tension disks
5. Thread takeup spring
6. Tension thread guard
7. Thread takeup lever
8. Thread guide
9. Thread guide
10. Thread guide
11. Needle eye

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Figure 9-11.—Threading the 31-15 sewing machine.

through the top hole. Pass the thread from right to left through the top hole in the thread retainer (1). Pass the thread from left to right through the middle hole in the thread retainer (2). Pass the thread from right to left through the bottom hole in the thread retainer (3). The thread is then passed down and under from right to left between the tension disks (4). Draw the thread up into the thread take-up spring (5), drawing the thread up and beyond the spring end so that it comes out in the center of the spring. The thread is then placed under the tension thread guard (6). Pass the thread up and from right to left through the hole in the thread take-up lever (7). The thread is now drawn down through three thread guides (8), (9), and (10). Pass the thread from left to right through the eye of the needle (11). Draw about 2 inches of thread through the eye of the needle to begin sewing.

Removing the Bobbin Case

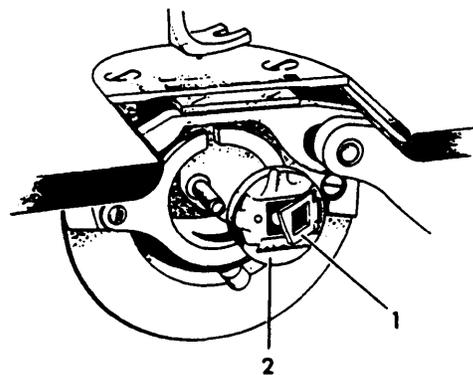
Before attempting to remove the bobbin case, turn the balance wheel toward you until the needle moves upward to its highest position.

Remove the slide in the bed of the machine so you can see what you are doing. Reach under the table with your left hand, and, using your thumb and forefinger, open the bobbin case latch (fig. 9-12) and lift out the bobbin case.

While the latch is held open, the bobbin is retained in the bobbin case. Release the latch, turn the open end of the bobbin case down, and the bobbin will drop out.

Winding the Bobbin

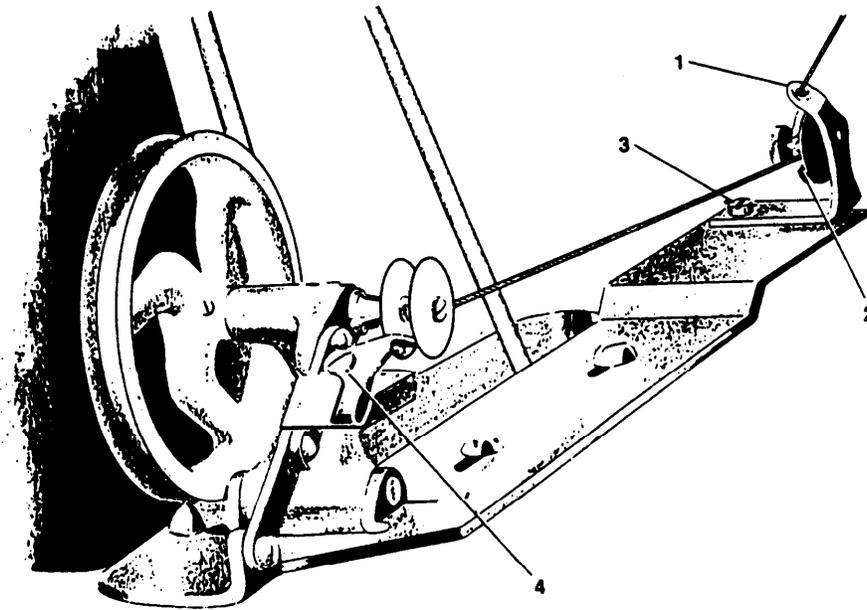
The bobbin winder is fastened to the table with its driving pulley in front of the sewing machine



1. Bobbin case latch
2. Bobbin case

239.269

Figure 9-12.—Removing bobbin case.



- | | |
|-----------------|-----------------------------------|
| 1. Thread guide | 3. Setscrew |
| 2. Tension disk | 4. Bobbin winder stop latch screw |

239.270

Figure 9-13.—Winding the bobbin.

belt. The bobbin winder is so positioned to allow the pulley to drop away from the belt when sufficient thread has been wound on the bobbin.

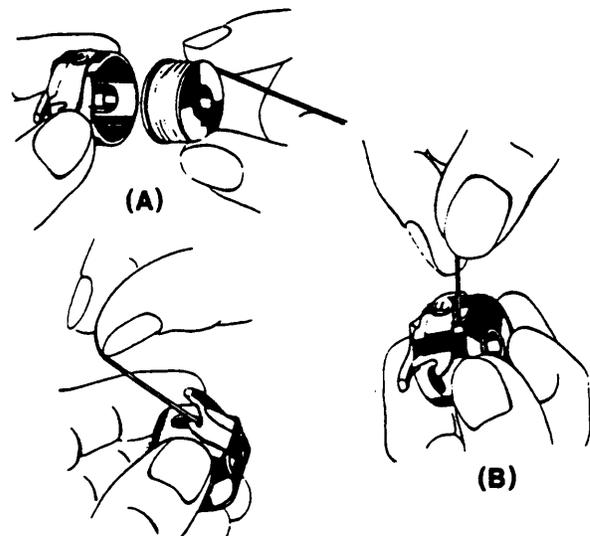
Figure 9-13 illustrates the bobbin-winding operation. The procedure is as follows: Place the bobbin on the bobbin winder and push it on the shaft as far as it will go. Pass the thread from the spool down through the thread guide. Loop the thread around back and through the tension disks.

The thread is then wound around the bobbin a few times and the pulley pushed up against the machine belt. The bobbin can be wound while the machine is being used for sewing. If there is no material under the presser foot, make certain that the presser foot is raised and not riding on the feed dog while winding the bobbin.

When sufficient thread has been wound on the bobbin, the pulley on the bobbin winder drops back from the machine belt automatically. If the thread does not wind evenly on the bobbin, loosen the setscrew in the tension bracket and move the bracket to the right or left as required; then tighten the bobbin winder stop latch screw. The amount of thread wound on the bobbin is regulated by the bobbin winder stop latch. To wind more thread on the bobbin, turn the screw to the right; to wind less thread on the bobbin, turn this screw to the left.

Threading the Bobbin Case

Hold the fully wound bobbin between the thumb and forefinger of the right hand with the thread end running over the top toward the right, as shown in figure 9-14, view A. With the left



239.271

Figure 9-14.—Threading the bobbin case.

hand, hold the bobbin case as shown, with the thread slot near the top.

Place the bobbin into the bobbin case and pull the thread into the slot in the edge of the bobbin case (view B). Draw the thread down under the tension spring and into the delivery eye at the end of the tension spring (view C). When the free end of the thread is pulled, the bobbin will rotate clockwise if the bobbin case has been threaded properly.

Replacing the Bobbin Case

Hold the latch open on the threaded bobbin case with the thumb and forefinger of the left hand, with the latch in a horizontal position. Place the bobbin case on the center stud of the shuttle body. Release the latch and press the bobbin case back until the latch catches the groove near the end of the stud.

Preparing for Sewing

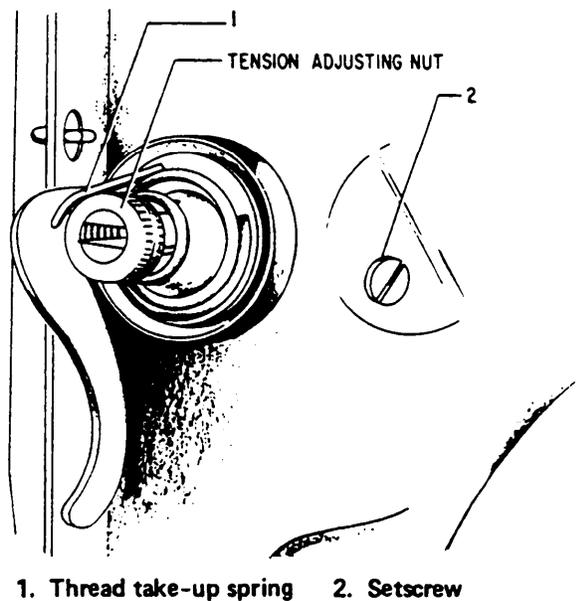
With the left hand, hold the end of the needle thread, leaving it slack from the hand to the needle. Turn the balance wheel toward you until the needle moves down and catches the bobbin thread. Continue to turn the balance wheel forward until the needle comes up and brings the bobbin thread up with the needle thread.

With the thread take-up lever at its highest position, lay both threads back under the presser foot .

Commencing to Sew

Place the edge of the material beneath the presser foot, lower the presser foot, turn the balance wheel by hand until the needle is in the material, and press lightly on the treadle. To prevent fouling the needle thread in the bobbin case, hold the ends of both threads until the first few stitches are made.

While sewing, hold the work flat, but do not pull or push on the material. Let the feed dog carry the work evenly under the presser foot and needle. If the operator pulls on the material, the needle bends, strikes the throat plate, and is either dulled, or more likely, broken. When the needle is about to cross a seam or other unusually thick or uneven place in the work, disengage the clutch, and hand-turn the machine over the rough place; otherwise, the needle may be broken or thrown out of time.



239.272

Figure 9-15.—Adjusting the machine thread tension.

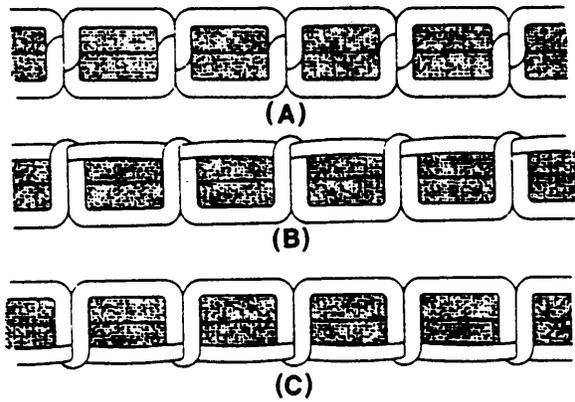
Regulating the Tension

The tension on the needle thread should be regulated only when the presser foot is down. If the tension of the machine thread is not correct, it should be adjusted by turning the tension adjusting nut, as shown in figure 9-15. To INCREASE THE TENSION, turn the nut clockwise; to DECREASE THE TENSION, turn the nut counterclockwise.

The tension on the bobbin thread is regulated by the small screw in the bobbin case tension spring. To increase the tension, turn the screw clockwise; to decrease the tension, turn the screw counterclockwise.

This screw is very small and is easily lost if extreme care is not exercised in backing it out when the tension is decreased. If the screw is tightened excessively or is slightly too long, it will penetrate into the inside of the bobbin case and prevent removal of the bobbin.

When the tension on the bobbin thread has been properly adjusted for a particular size of thread, it is seldom necessary to change it. A correct stitch can usually be obtained by varying the tension on the needle thread, which is an easier adjustment.



239.273

Figure 9-16.—Properly and improperly adjusted tensions.

For ordinary stitching, the needle and bobbin threads should be locked in the center of the thickness of the material, as shown in figure 9-16, view A. When adjusting the tensions, you will not have a cross section of the stitch.

If the tension on the needle thread is too tight, or if the bobbin tension is too loose, the thread will lie straight along the upper surface of the material and appear as small loops, as shown in figure 9-16, view B.

If the tension on the bobbin thread is too tight, or if tension on the needle thread is too loose, the bobbin thread will lie straight along the underside of the material, as shown in figure 9-16, view C.

Regulating the Length of a Stitch

The length of a stitch can be checked at the time the tension of the stitch is checked, as a trial run of stitches is necessary during both procedures.

The length of a stitch is regulated by the thumbscrew in the slot on the front of the uprise of the machine. To LENGTHEN the stitch, loosen the thumbscrew and move the lever DOWN. To SHORTEN the stitch, loosen the thumbscrew and move the lever UP. When the desired length of stitch has been obtained by test running the machine on scrap material, tighten the thumbscrew.

Regulating the Pressure on the Material

Pressure on the material is regulated by the pressure-regulating thumbscrew on top of the

machine face. To increase the pressure, turn the thumbscrew clockwise. The pressure should be just heavy enough to enable the feed dog to move the work along evenly.

Removing Work

Hand-turn the balance wheel toward you until the thread take-up lever is at its highest position. Raise the presser foot, either by the hand lever or by the knee lift, and draw the work and threads straight behind the presser foot. Cut the threads close to the material, leaving free about 2 inches of bobbin and machine thread.

Adjusting the Thread Take-up Spring

The thread take-up spring (fig. 9-15) should be set so that when the eye of the needle reaches the material on the downward stroke of the needle bar, the spring will be through acting on the thread, and will rest against the stop of the thread take-up spring regulator.

If the thread take-up spring is not correctly set, loosen the setscrew (2) in the arm of the machine and turn the tension adjusting stud to the right for more movement of the spring, or to the left for less movement. When the spring is correctly set, retighten the setscrew.

The tension on the thread take-up spring should be just sufficient to take up the slack of the needle thread until the eye of the needle reaches the material on its descent. To increase the tension on the thread take-up spring, loosen the tension adjusting stud and move the take-up spring from the recess in the regulator to the right between the regulator and the tension disks. When the required tension is obtained, securely tighten the tension adjusting stud and move the spring back into its position in the regulator recess. To decrease the tension, move the spring to the left between the regulator and the tension disks.

SINGER SEWING MACHINE 7-33

The class 7-33 sewing machine is a lockstitch heavy duty machine, and is intended for use in sewing heavy canvas, webbings, and other material not adaptable to the lighter duty sewing machines. The only difference between the 7-31 and the 7-33 is that the 7-33 has the clutch on the motor, while the 7-31 has the clutch on the balance wheel. The operation and maintenance techniques are identical. The procedure for operating the 7-33 sewing machine is the same as for the 31-15 sewing machine.

As on any Singer sewing machine, the balance wheel of the 7-33 should always turn toward the operator.

Lubrication

The 7-33 machine is oiled at all the oiling points shown in figures 9-17 and 9-18. The machine should be oiled twice daily when it is in

constant use. Use a castor base oil as recommended by the manufacturer.

Needles and Thread

The procedure for ordering needles is the same for the 7-33 machine as for the 31-15 sewing machine. Refer to table 9-2 for the relative sizes of needles and thread.

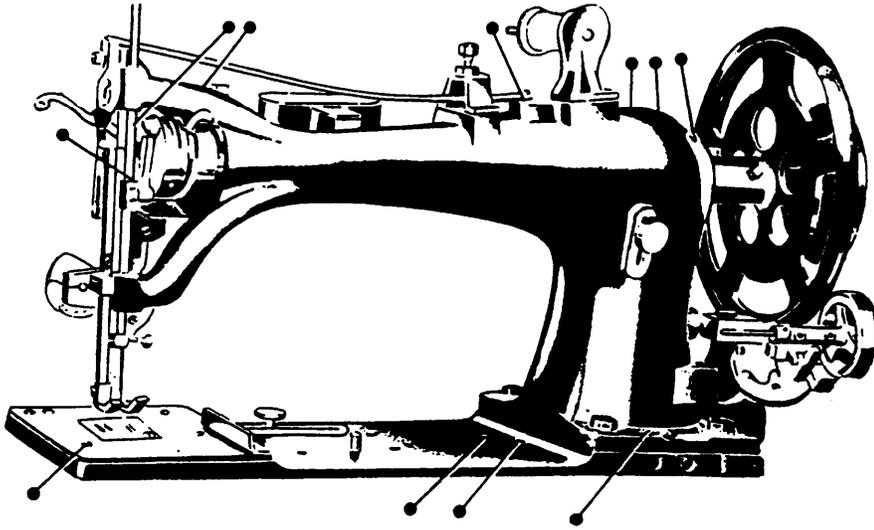


Figure 9-17.—Oiling points at the front of the 7-33 sewing machine.

239.274

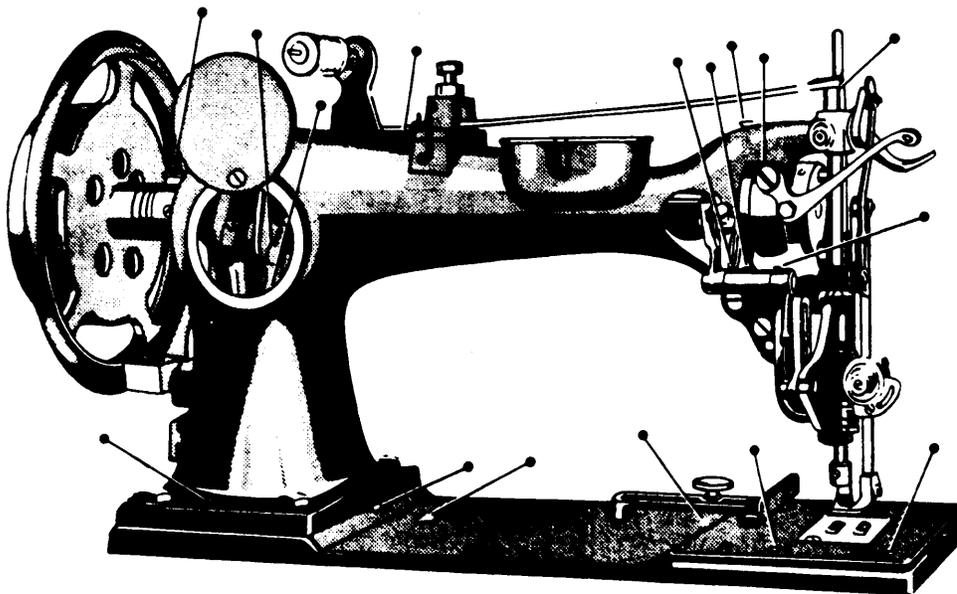


Figure 9-18.—Oiling points at the back of the 7-33 sewing machine.

239.275

Table 9-2.—Relative sizes of needles and thread

Machine	Needle class and variety	Needle sizes	Classes of work	Needle size	Cord size
7-31 or 7-33	7 x 1	19, 21, 22, 23, 24 25, 26, and 27.	Medium to heavy canvas.	24	3-cord
7-31 or 7-33	7 x 5	28, 29, 30, and 31.	Heavy canvas and webbing.	28	6-cord

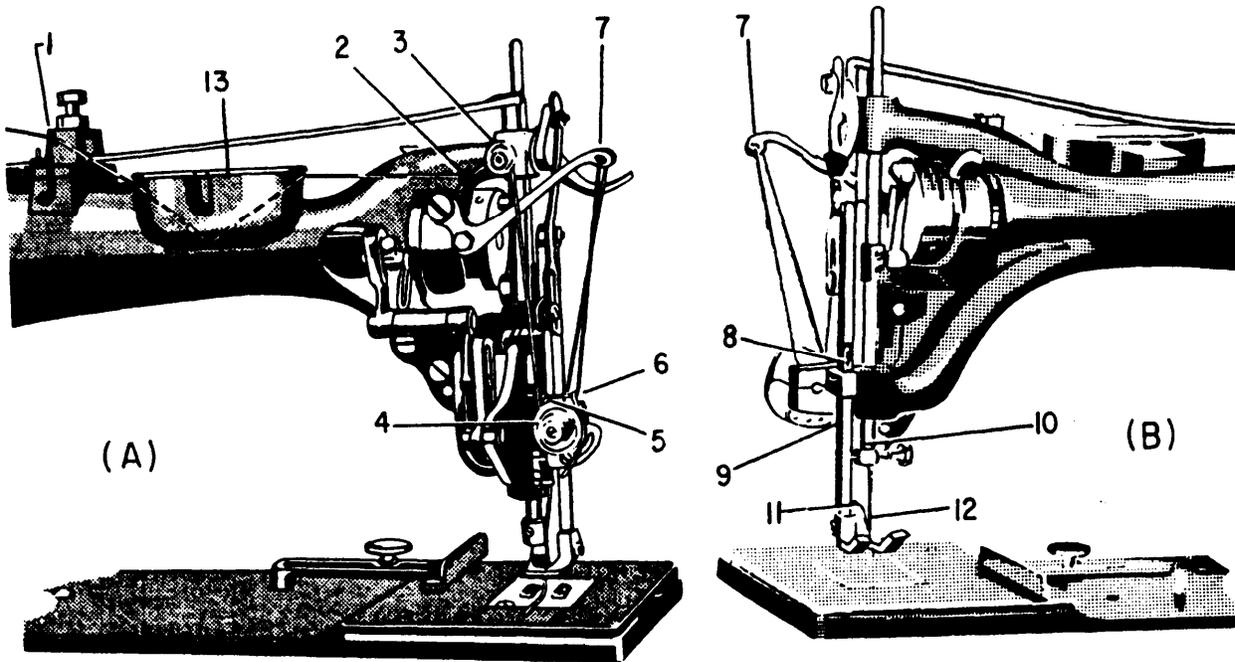
Setting the Needle

The same procedure may be followed with this machine as for the 31-15 sewing machines.

Threading the Machine

Turn the balance wheel toward you until the thread take-up lever (7) moves up to its highest position (fig. 9-19). Pass the thread from the thread stand to the thread post, right to left

through the bottom hole, then right to left through the top hole. Pass the thread through the two thread guides (1) and (2). Continue the passage of thread between the retainer disks (3), down and under the tension disks (4). Pass the thread into the loop of the thread take-up spring (5), under the wire loop (6), up, and from back to front through the hole in the thread take-up lever (7). Now pass the thread down through the thread guide (8), into the slot in the vibrating presser bar (9), and on down through the thread



- 1. Thread guide
- 2. Thread guide
- 3. Retainer disks
- 4. Tension disks
- 5. Thread takeup spring

- 6. Wire loop.
- 7. Thread takeup lever
- 8. Thread guide
- 9. Slot in the vibrating presser bar
- 10. Thread guide on the needle clamp

- 11. Eye of the needle
- 12. Hole in the lifting presser foot
- 13. Lubricating cup

Figure 9-19.—Threading the 7-33 sewing machine.

239.276

guide (10), which is located on the needle clamp. The needle is now threaded from left to right through the eye of the needle (11). After the needle is threaded as shown in figure 9-19, pass the thread down through the hole in the lifting presser foot (12). Draw about 4 inches of thread through the hole in the lifting presser foot with which to begin sewing.

Notice that the lubricating cup has been bypassed. No lubricant is used on the threads and cords used in the manufacture or repair of parachutes.

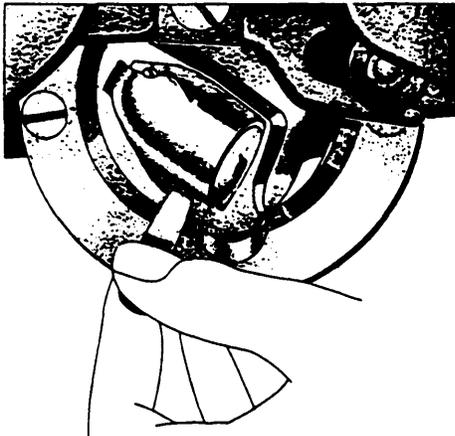
Removing the Bobbin

Turn the balance wheel forward to bring the needle bar and thread take-up lever to its lowest position. With the aid of the shuttle opening tool or a small screwdriver, insert the blade end in the slot in the spring latch beneath the shuttle cylinder (fig. 9-20). Press the latch away from the cylinder and it will swing out. The bobbin will then slide out of the shuttle cylinder.

Winding the Bobbin

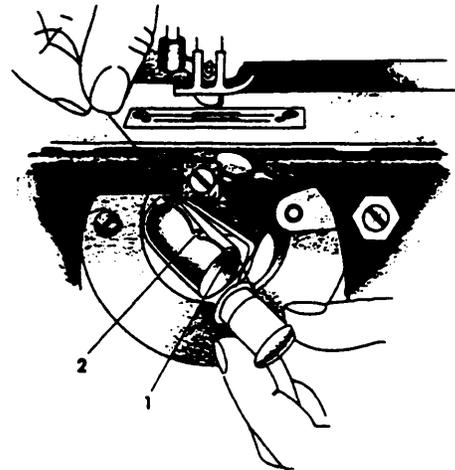
Place the bobbin on the bobbin winder spindle and push it up closely against the shoulder. The small pin in the shoulder must enter the slot in the bobbin.

Pass the thread from the thread stand through the hole in the left side of the bobbin from the inside. Push the bobbin winder pulley up against the balance wheel, and place the bobbin winder



239.277

Figure 9-20.—Removing the bobbin from the shuttle cylinder.



1. Thread slot in the cylinder
2. Delivery eye and tension spring

239.278

Figure 9-21.—Replacing the bobbin.

latch in position. Raise the presser foot and start the machine. The end of the thread should be held until a few turns are wound on the bobbin to prevent slipping. When sufficient thread has been wound on the bobbin, the bobbin winder will stop automatically.

Replacing the Bobbin and Threading the Shuttle

Take the bobbin between the thumb and forefinger of the left hand, as shown in figure 9-21. The free end of the thread should be drawn off from the underside toward the right. Place the bobbin in the shuttle cylinder as far as it will go. Draw the thread into the slot in the cylinder and under the tension spring into the delivery eye. Push the shuttle cylinder in until it is locked by the spring latch. There should be about 3 inches of thread hanging free from the shuttle with which to begin sewing.

Regulating the Tension

The tension on the needle thread is regulated by the thumb nut at the front of the thread retainer disks. The tension on the thread retainer disks should be just enough to cause the tension wheel to turn when the thread is taken from the spool.

The tension on the bobbin thread is regulated by the small screw that holds the tension spring to the shuttle cylinder. To increase the tension,

turn the screw clockwise. To decrease the tension, turn the screw counterclockwise.

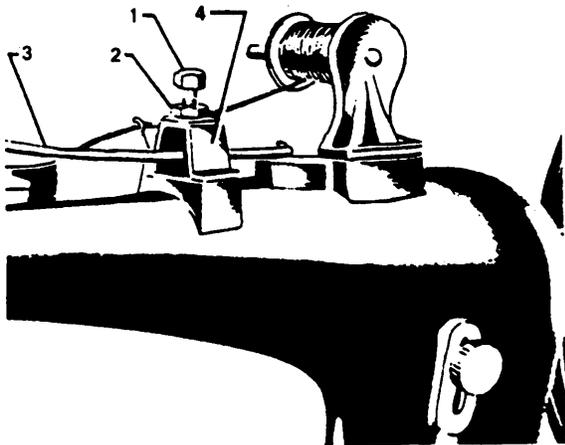
The tension on the machine and bobbin threads should be checked by test-running a row of stitches on scrap material. The lockstitch should lock in the center of the material, as described for the 31-15. When sewing webbings with the 7-33 sewing machine, the specifications for webbing sewing should be checked to determine at what ply of the webbing the stitch should lock.

Regulating the Length of Stitch

The procedure for regulating the stitch on the 7-33 sewing machine is the same as for the 31-15.

Regulating the Pressure on the Material

The pressure on the material is regulated by means of the hexagon head screw (1). (See figure 9-22.) Loosen the hexagon head locknut (2) and turn the adjusting screw clockwise to increase the pressure, or counterclockwise to decrease the pressure on the spring (3). When the desired pressure has been obtained, hold the adjusting screw with a wrench to keep it from turning while



- | | |
|---------------------------------|------------|
| 1. Hexagon head adjusting screw | 3. Spring |
| 2. Hexagon head locknut | 4. Bracket |

239.279

Figure 9-22.—Regulating the pressure on the material.

the locknut is being tightened against the bracket (4).

The pressure should be just heavy enough to enable the feed dog to move the work along evenly, and to prevent the work from rising with the needle.

Preparing the Sewing

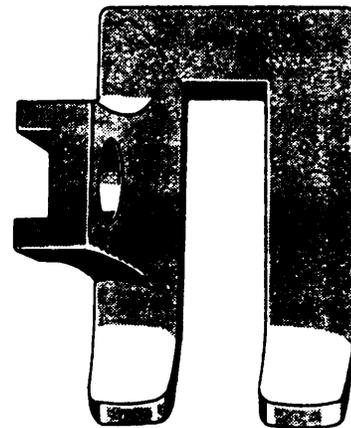
The same sewing preparatory procedures are used for the 7-33 as for the 31-15 sewing machine, except there is no knee lifting device. The hand presser bar lifter is the only device provided for lifting the presser foot on the class 7-33 sewing machine.

Removing the Work

Stop the machine and raise the thread take-up lever to its highest position. Draw about 3 inches of thread through the thread retaining disks. Raise the presser foot and draw the work back, cutting the threads close to the material. Leave the ends of the threads under the presser foot .

Modification of Presser Foot for Webbing Sewing

The modification of a presser foot is illustrated in figure 9-23. The presser foot should be cut



239.280

Figure 9-23.—Modification of presser foot for webbing sewing.

along the dotted line, removing the right portion of the foot. After cutting, the edges should be filed down to a smooth round finish.

Parachute harness and webbing sewing is classified as a major repair. However, there are various other sewing projects requiring webbing sewing.

medium weight and heavyweight material. They are capable of sewing at a speed of approximately 3,000 stitches per minute (spin). The lockstitch is formed in the bobbin assembly by the rotary hook on the 111 machines. The class 111 machine is commonly used for sewing aircraft protective covers, upholstery, and soundproofing.

ROTARY SEWING MACHINES

Some of the most commonly used rotary sewing machines are the class 111 W series. They are the type used to teach basic sewing in PR "A" school, and can be found in almost any PR shop.

DIFFERENT MODELS OF THE 111 W SEWING MACHINE

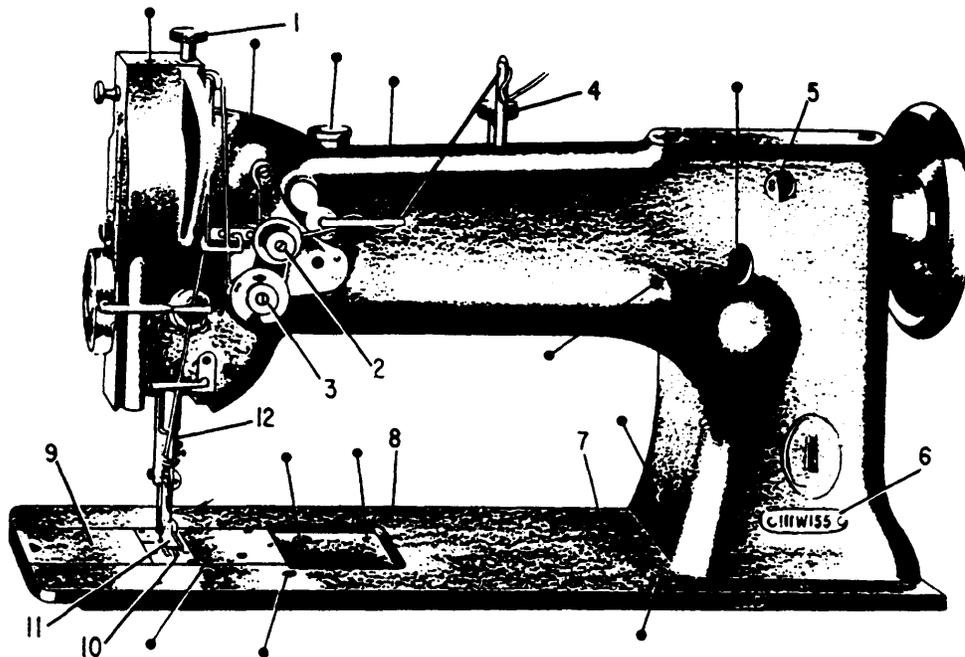
The following text discusses the various models of the 111 W sewing machine.

CLASS 111 SEWING MACHINES

The class 111 sewing machines are one line (single needle) lockstitch machines designed to sew

111 W 150 Sewing Machine

The 111 W 150 sewing machine is a high-speed, single-needle, lockstitch, compound feed machine employing a gear-driven rotary hook with a vertical axis. It is designed for sewing medium weight fabrics such as



- | | |
|--|-----------------------------------|
| 1. Vibrating presser bar thumbscrew | 7. Hook driving shaft lock stud |
| 2. Tension thumb nut | 8. Feed regulating stud (plunger) |
| 3. Thread controller stud thumb nut | 9. Bed slide |
| 4. Presser bar spring regulating screw | 10. Throat plate |
| 5. Stitch indicator disk view hole | 11. Presser foot |
| 6. Model number | 12. Needle bar |

Figure 9-24A.—Class 111 sewing machine, front view showing oiling points.

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flight clothing, nylon, twills, and lightweight canvas.

111 W 151 Sewing Machine

The 111 W 151 sewing machine is also a single-needle, lockstitch, rotary hook machine, intended for high-speed straight stitching of medium heavy materials.

The 111 W 151 sewing machine differs from other models of the class 111 machines in that it has a single presser foot instead of the alternating presser foot.

111 W 152 Sewing Machine

The 111 W 152 sewing machine is a single-needle, lockstitch, compound feed machine with a vertical axis sewing hook. This machine has alternating pressers with a 3/8-inch lift. It has a safety clutch that prevents the hook from being damaged or getting out of time due to accidental strain.

111 W 153 Sewing Machine

The 111 W 153 sewing machine is similar to the 111 W 152, but it is used for sewing heavy work such as automobile and truck upholstery, tents, awnings, and leather flight jackets.

111 W 154 Sewing Machine

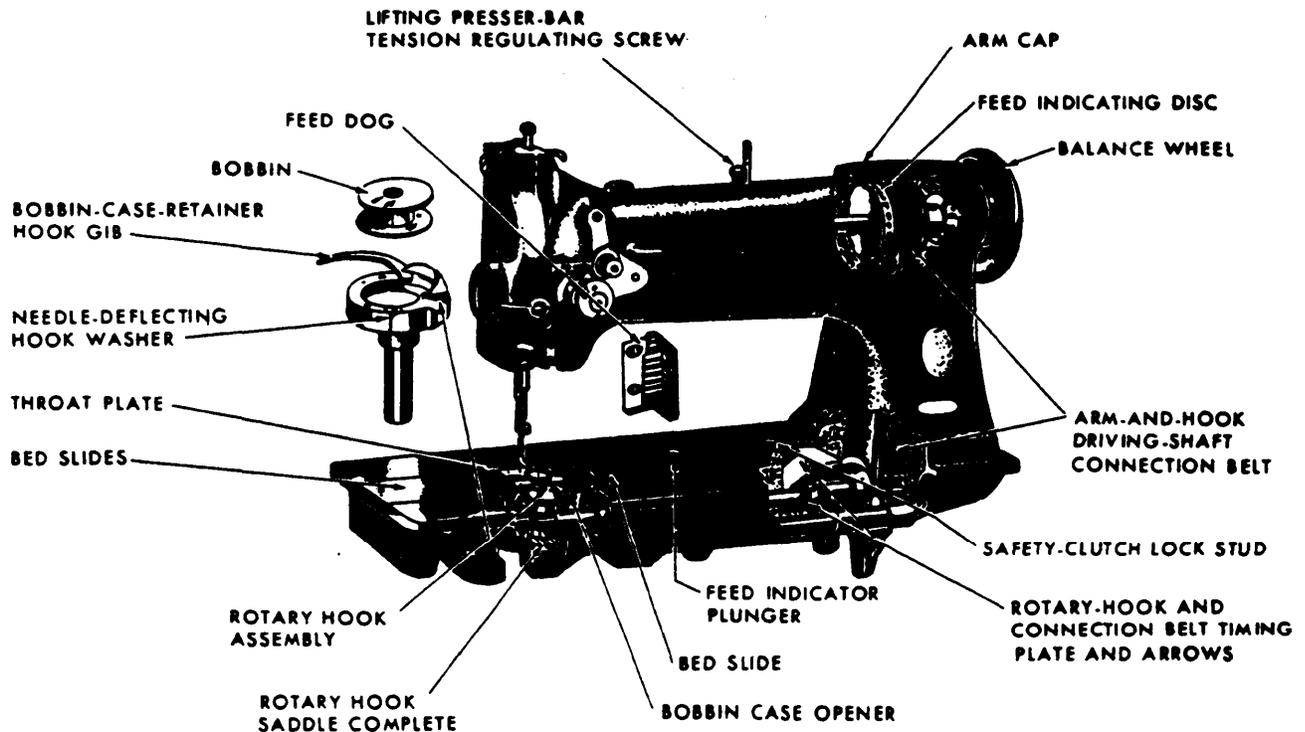
The 111 W 154 sewing machine is also similar to the 111 W 152, but its alternating pressers have a lift of 1/2 inch, and the machine is designed for stitching upholstery work, leather coats, and binding heavy materials such as felt padding.

111 W 155 Sewing Machine

The 111 W 155 sewing machine is similar to the 111 W 154 except that its minimum stitches per inch is 3 1/2, and it has an adjustable lifting eccentric for instantly setting the alternating pressers to the minimum amount of lift required for the work to be sewn.

FUNCTIONAL FEATURES

The oiling parts for class 111 sewing machine are shown in figure 9-24A. Figure 9-24B identifies



239.448

Figure 9-24B.—Class 111 sewing machine, front view showing components and parts.

the component parts. The primary feature of each component is explained in the following text:

- **Lifting Presser Bar Tension Regulating Screw.** Regulates the pressure on the alternating presser foot.

- **Feed Indicating Disc.** Indicates the number of stitches per inch which are being made by the machine.

- **Balance Wheel.** Provides a connection between the driving unit and the sewing machine head.

- **Arm-and-Hook Driving Shaft Connection Belt.** Connects the upper arm shaft with the hook driving shaft.

- **Feed Dog.** Feeds the material from the under side.

- **Rotary Hook Assembly.** Contains the mechanism that forms the lockstitch by using the needle and bobbin threads.

- **Bobbin.** Contains the lower thread used in forming the lockstitch.

- **Bobbin Case Retainer Hook Gib.** Holds the bobbin case in the bobbin race.

- **Needle-deflecting Hook Washer.** Deflects the needle so the rotary hook will not strike the needle.

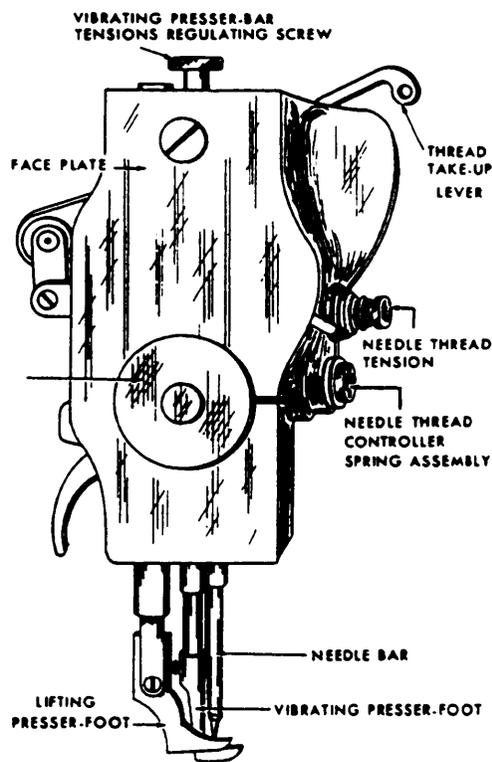
- **Throat Plate.** Surrounds the feed dog and keeps the material from slipping after the feed dog has been adjusted to the proper height.

- **Bed Slides.** Covers the feed eccentric and rotary hook assembly on each side of the throat plate.

- **Feed Indicator Plunger.** Used in connection with the feed indicator to regulate the number of stitches per inch desired.

- **Safety-clutch Lock Stud.** Re-engages the needle with the hook driving assembly after clearing a thread jam.

- **Bobbin Case Opener.** Prevents thread from jamming underneath the throat plate on the bobbin case base.



239.449

Figure 9-25A.—Class 111 sewing machine, side view.

- **Rotary Hook Saddle Complete.** The rotary hook is operated by the spiral driving pinion gear, which, in turn, is operated by the hook driving gear located on the hook driving shaft.

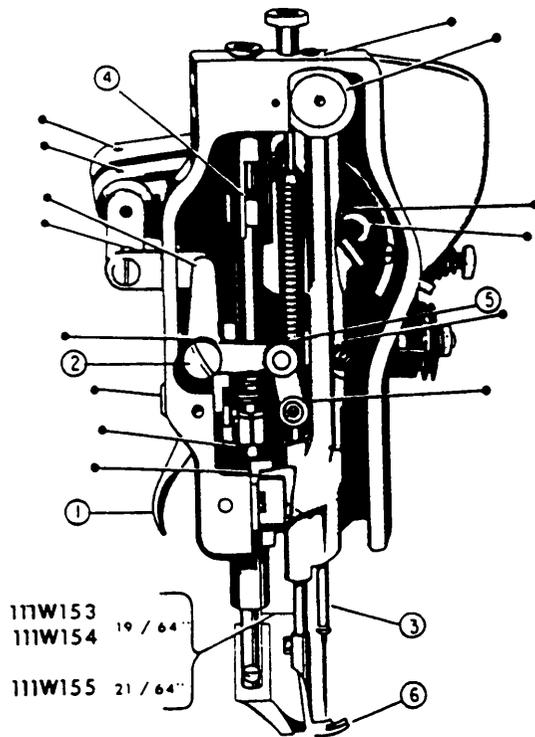
- **Rotary Hook and Connection Belt Timing Plate and Arrows.** Used to time the arm shaft with the hook driving shaft.

The following parts are shown in the side view of the Class 111 sewing machine (figures 9-25A and 9-25 B).

- **Thread Take-up Lever.** Pulls the needle thread against the tension disc after the lockstitch is formed at the rotary hook and pulls sufficient thread from the spool to make the next stitch.

- **Vibrating Presser Bar Tension Regulating Screw.** Regulates the pressure on the presser foot. Only sufficient pressure to hold the material securely is needed.

- **Face Plate.** Covers and protects the mechanism of the two presser feet and needle bar.



1. Hand lift for presser foot
2. Vibrating presser bar thumbscrew
3. Needle bar
4. Vibrating presser bar
5. Presser bar
6. Presser foot

239.282

Figure 9-25B.—Class 111 sewing machine, side view showing oiling points.

● **Needle Thread Lubricator.** Lubrication of the thread when sewing leather. Lubrication of the thread prevents it from fraying, and prevents the needle from becoming hot when sewing at high speed.

● **Needle Thread Tension.** Regulates the tension on the needle thread so that the lockstitch may be adjusted properly.

● **Needle Thread Controller Spring Assembly.** Removes sufficient slack from the needle thread when the needle is descending to prevent the needle from splitting the thread.

● **Needle Bar.** Holds the needle and carries the thread to the rotary hook where the lockstitch is formed.

● **Vibrating Presser Foot.** Holds the material in place while the alternating presser foot rises to make another stitch.

● **Lifting Presser Foot.** Holds the material in place while the vibrating presser foot and feed dog go forward to get material for the next stitch.

The class 111 machine is a compound feed machine. This means that the feed dog, vibrating presser foot, and needle move together to feed the material. Some class 111 machines are equipped with a compound feed only, such as the 111 W 151; and others are equipped with a combination of the compound feed and alternating presser foot that holds the material while the needle and vibrating presser foot are moving into position for the next stitch, such as the 111 W 155.

Perhaps the description of the feed mechanism gave you a hint that the class 111 sewing machine is a more complicated machine than the class 31. It is indeed.

Timing the 111 W Class Sewing Machines

The first step in timing the 111 W machine is to set the feed driving eccentric on zero stitches per inch (0 spi). Set the needle bar. With the needle bar in its lowest position (needle bar crank in the horizontal position, the rounded portion on the top and driving stud at the bottom), the connecting link will be vertical. Set the needle bar with the upper timing mark just visible at the base of the needle bar rock frame, and tighten the needle bar pinch screw. The needle bar is then properly set.

To set a needle bar that has no mark, set the feed eccentric for eight stitches to the inch. Then set the needle bar so that when it rises $\frac{3}{32}$ inch from its lowest position and the point of the sewing hook is at the center of the needle, the needle eye will be about $\frac{1}{16}$ inch below the hook point.

The next step is to time the arm shaft with the hook drive shaft. With the connection belt removed, rotate the balance wheel toward the operator until the thread take-up lever is at its highest point, then align the arrow on the hook drive shaft collar with the timing plate arrow, and replace the connection belt. Rotate the balance wheel and check. The next step is to center the feeding action. For this step the feed driving eccentric must be set on zero spi. With the needle entering the feed dog, center the needle in the hole

in the feed dog with a distance of $17/32$ inch between the needle bar and the presser bar.

In centering the feeding action, the following sequence should be followed: Hold the needle centered in the feed dog with a $17/32$ -inch space between the needle bar and presser bar. Tighten the feed driving crank and feed driving rockshaft crank pinch screws, making sure that the crank is flush with the end of the feed driving rockshaft and parallel with the bed. Next, tighten the needle bar rock frame rockshaft crank pinch screw in the back of the uprise. **The shank of the presser foot is $17/32$ inch wide and may be used for measuring the space.**

The next step is to set the sewing hook to or from the needle. This is done by moving the hook saddle left or right as necessary; the hook should pass the needle as closely as possible without touching. When this is done, retighten the hook saddle screws. Next, set the sewing hook with the needle. With the needle bar on the upstroke, the lower timing mark on the needle bar should be just visible at the base of the needle bar rock frame. Set the point of the sewing hook in the center of the needle $1/16$ inch above the eye. To advance the sewing hook, move the hook drive gear to the right; and to retard, move the hook drive gear to the left.

NOTE: The first screw in the hook pinion gear and the second screw in the hook drive gear are splined screws. The hook drive gear must be centered in relation to the sewing hook shaft at the bottom of the hook saddle. "

Lubrication of The Class 111 Sewing Machines

Figures 9-24A, 9-25B, and 9-26 show the various lubrication points on class 111 sewing machines. Oiling points are indicated by the unnumbered arrows. Familiarization with the nomenclature of the machines may also be accomplished by studying these illustrations.

To lubricate the class 111 machine, swing back the top cover and oil the bearings, then replace the cover.

Loosen the thumbscrew in the upper end of the faceplate, turn the faceplate upward, and oil the wick and bearings, as shown in figure 9-25B. After oiling, turn down the faceplate and tighten the thumbscrew.

Turn the machine back on its hinges and apply oil at the places designated by the arrows in figure 9-27. All contacting parts on the bottomside of the machine should also be oiled.

To lubricate the hook, remove the bed slide and place oil in the oil well (fig. 9-26). This

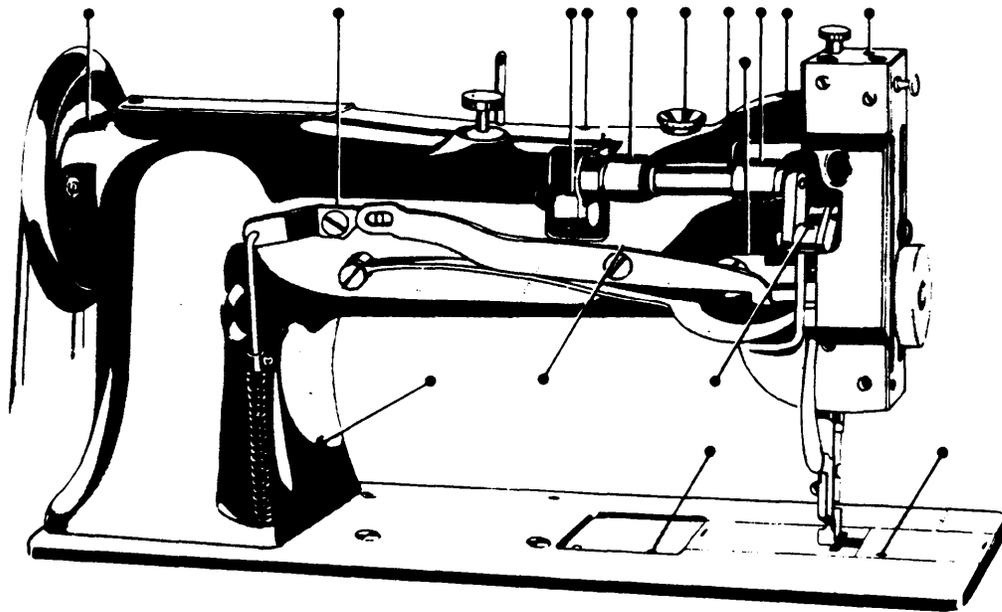
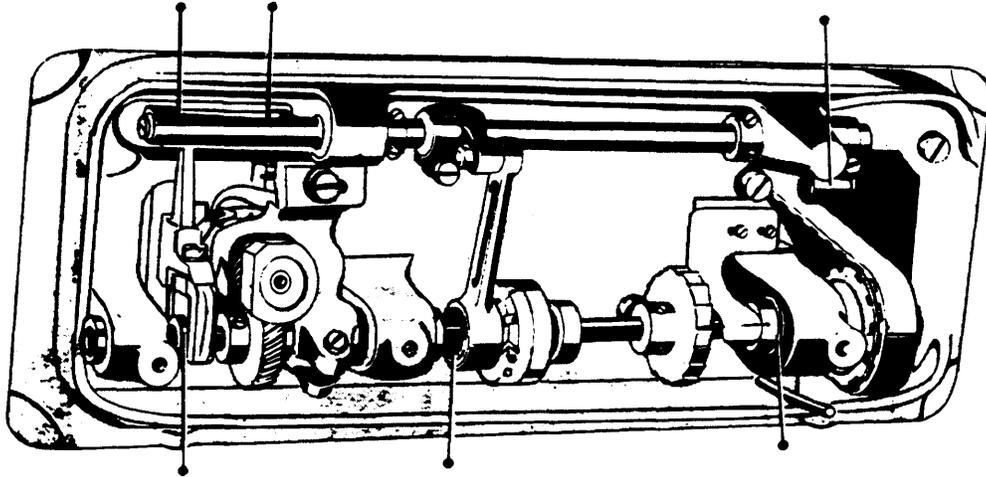


Figure 9-26.—Rear of machine, showing oiling points.

239.283

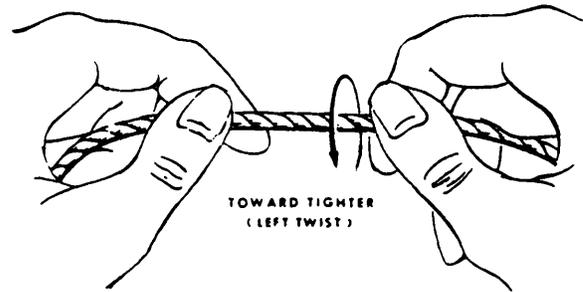


239.284

Figure 9-27.—Base of machine, showing oiling points.

lubricates the upper hook bearing and the mechanical opener mechanism.

The small, green felt pad on the side of the bobbin case should be kept wet with oil to lubricate the hook race. When this pad is wet, it appears nearly black; when it appears light green, it indicates that it is dry. When a machine is new, oil should be applied to this felt pad EACH TIME A BOBBIN IS REPLACED.



239.267

Figure 9-28.—How to determine the twist of thread.

Needles and Thread

The thread used on rotary sewing machines is left twist. To determine the twist of thread, refer to figure 9-28.

Table 9-3 lists the class and variety of needles and the needle size range for each of the class 111 machines.

The size of needle to be used is determined by the size of the thread and material used. The thread must pass freely through the eye of the needle. If rough or uneven thread is used, or if it passes with difficulty through the eye of the

Table 9-3.—Data for Class 111 Sewing Machine

Sewing Machine	Stitches per minute	Stitches per inch	Needle class and variety	Needle size range
111 W 150	3,500	5 to 32	135 x 7	7 to 24
111 W 151	3,500	5 to 32	135 x 17	14 to 26
111 W 152	2,900	5 to 32	135 x 17	12 to 24
111 W 153	2,900	5 to 32	135 x 17	12 to 24
111 W 154	2,900	5 to 32	126 x 11	22 to 27
111 W 155	3,500	3 1/2 to 32	135 x 17	12 to 24

needle, the machine will not function properly.

Needles used on rotary sewing machines are ordered the same way as those for oscillating sewing machines.

The needles for rotary sewing machines have seven parts. This is one more part other than the needles for the oscillating machines. The additional part is the SCARF, which is a small indentation just above the short thread groove. The purpose of the scarf is to permit the point of the sewing hook to come close enough to pick up the needle thread without striking the needle.

Operation

Operation of rotary sewing machines is the same as for the oscillating sewing machines.

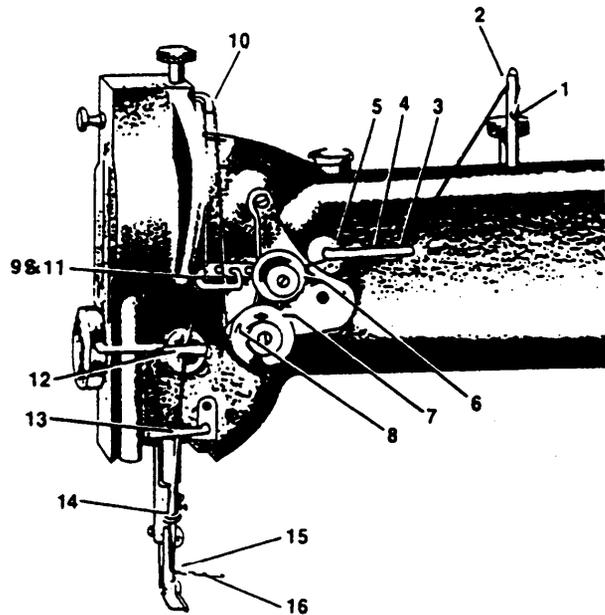
Setting the Needle

Turn the balance wheel toward you until the needle bar moves up to its highest position. Loosen the setscrew in the needle bar and slip the needle up into the bar as far as it will go. The needle must be inserted with its long thread groove toward the left, the eye of the needle being directly in line with the machine bed. Retighten the setscrew.

Threading the Machine

Pass the thread from the thread stand from back to front (fig. 9-29) through the lower hole (1) in the thread post on top of the machine, then from right to left through the upper hole (2) in the post. Pass the thread down through hole (3), up through hole (4), and down through the hole (5) in the thread guide on the front of the machine. Continue the thread over from right to left between the tension disks (6), and down, from right to left, around the thread controller (7). Then the thread should go up into the fork (8) in the thread controller disk against the pressure of the wire controller. The thread is then passed up through the thread guide (9), and from right to left through the hole in the thread take-up lever (10).

Pass the thread down through the thread guide (11), and between the felt pad and the felt pad retainer finger (12). (If the machine you are threading does not have the felt pad and retainer



1. Lower hole in thread post
2. Upper hole in thread post
3. Hole in thread guide
4. Hole in thread guide
5. Hole in thread guide
6. Tension disks
7. Thread controller
8. Fork in the thread controller
9. Thread guide
10. Thread takeup lever
11. Thread guide
12. Felt pad and retainer finger
13. Thread guide
14. Thread guide
15. Eye of needle
16. Free end of thread

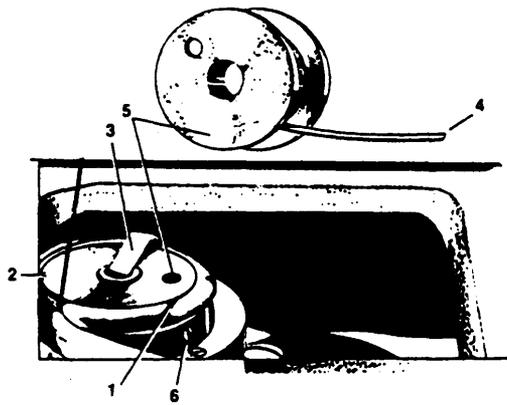
239.285

Figure 9-29.—Threading the class 111 sewing machine.

finger installed, bypass this component.) Finish the threading by passing the thread down through the thread guide (13), through the thread guide (14) at the bottom of the needle bar, and from left to right through the eye of the needle (15). Always thread a needle toward the bobbin.

Removing the Bobbin

To remove the bobbin, draw out the right-hand slide plate in the bed of the machine. Insert the fingernail of the forefinger under the latch; raise the latch and lift the bobbin out. (See figure 9-30).



1. Slot in the bobbin case
2. Projection on the bobbin case
3. Bobbin case latch
4. End of bobbin thread
5. Bobbin
6. Tension adjusting setscrew

239.236

Figure 9-30.-Bobbin case threaded.

Winding the Bobbin

To wind the bobbin and adjust the bobbin winder, follow the procedure given for the 31-15 sewing machine.

Replacing the Bobbin and Threading the Bobbin Case

Hold the bobbin between the thumb and forefinger of your right hand with the thread drawn out on the bottom from left to right. Place the bobbin on the center stud of the bobbin case; then push down the latch.

Draw the thread into the slot (1), and under the back of the projection (2). Leave a loose end of thread about 2 inches long above the slide. When closing the slide plate, leave just enough space for the thread to pass through when it is first picked up by the needle.

Regulating the Tension

The tension on the needle thread is regulated by the tension thumb nut located at the front of the tension disks on the front of the machine. To increase the tension, turn this thumb nut clockwise. To decrease the tension, turn the thumb nut counterclockwise.

The tension on the bottom (bobbin) thread is regulated by means of the small screw nearest the

center of the tension spring in the outside of the bobbin case (1), as shown in figure 9-30. To increase the tension, turn this screw clockwise. To decrease the tension, turn the screw counterclockwise.

Regulating the Length of Stitch

The number of stitches per inch is stamped on the stitch indicating disk, which can be seen through the hole on the uprise.

To change the length of stitch, press down the feed regulating stud (plunger), located in the bed of the machine. At the same time, turn the balance wheel slowly until the plunger enters a notch in the adjustable feed eccentric disk. Continue to hold the plunger and turn the balance wheel forward or backward until the number of stitches per inch desired can be seen through the hole in the front of the uprise. Disengage the plunger by releasing it.

Regulating the Pressure on the Material

The pressure on the material is regulated by the presser bar regulating screw at the back of the sewing machine. The screw acts on a flat spring. To increase the pressure, turn this screw downward. To decrease the pressure, turn this screw upward. The pressure should be only heavy enough to enable the feed to move evenly along whatever thickness of material you are using.

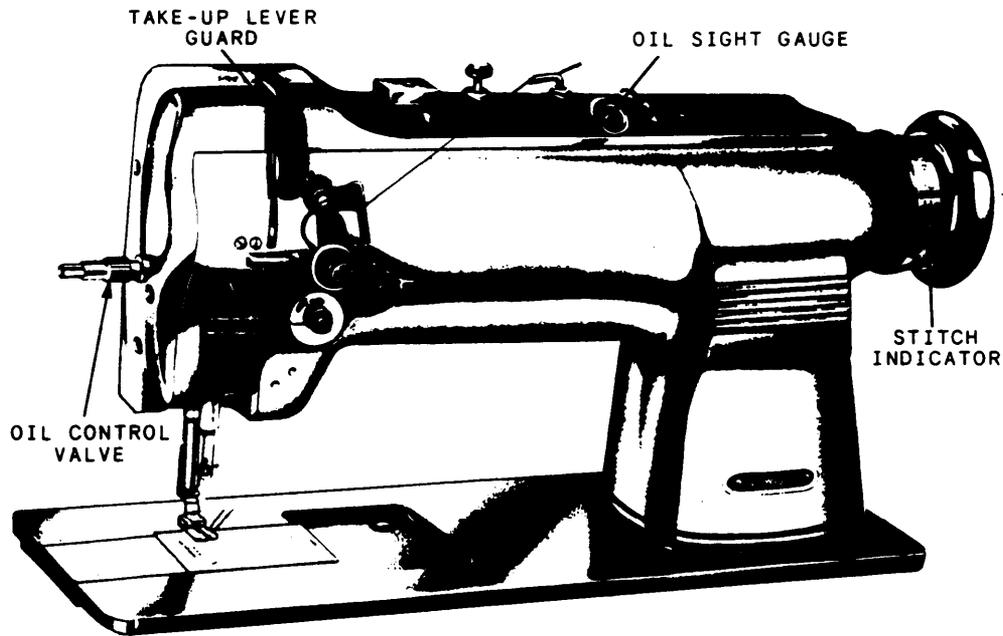
Preparing for Sewing

With the left hand, hold the end of the needle (machine) thread, leaving it slack from the hand to the needle. Turn the balance wheel over toward you until the needle moves down and up again to its highest position. If the sewing machine is properly timed, this will bring the bobbin thread up with the machine thread through the hole in the feed dog. Lay the threads back under the presser foot and close the slide.

Place the material under the presser foot. Lower the presser foot either by hand or by the knee lift, and begin to sew. Start the sewing by turning the balance wheel over toward you as you depress the treadle.

Removing the Work

After the machine has stopped, move the thread take-up lever to its highest position. Raise



240.80

Figure 9-31.—The 211 W 151 sewing machine.

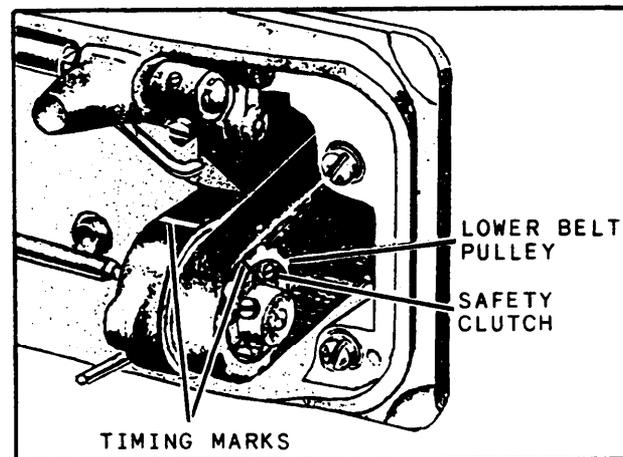
the presser foot, draw the work back, and cut the threads close to the material. Lay the ends of the threads back under the presser foot.

SINGER SEWING MACHINE 211 W 151

This machine performs the same functions as the 111 W 151. It is a newer model, more streamlined and modern in appearance, and has some design features not found in the 111 W 151 machine. (See figure 9-3 1.) These features include a new lubrication system, a thread take-up lever guard, a thread lubricator, and a new stitch indicator.

The 211 W 151 sewing machine is a high-speed (4,000 rpm maximum), single-needle, lockstitch-type machine, designated for sewing medium to heavyweight fabrics. It is belt-driven and has a rotary hook on a vertical axis, which makes two revolutions for each stitch.

It has a safety clutch (fig. 9-32) that is adjustable to suit the sewing conditions; this protects the sewing hook from damage. If the hook is obstructed by foreign matter, the clutch will disengage and re-engage only after the area has been cleared. The feeding mechanism is a compound drop and needle feed with the longest stitch at five stitches per inch.



240.81

Figure 9-32.—Safety clutch and lower belt pulley.

Other features of the machine include a hinged presser foot, a presser bar lift of 1/4 inch, a needle bar stroke of 1 5/16 inches, a bed that is 20 3/8 inches long by 7 inches wide, and a space of 10 1/2 inches to the right of the needle.

Needles

The needles used in this machine vary according to the clearance under the presser foot.

Use 135 x 7 needles with machines set with 1/4-inch clearance under the presser foot, and 135 x 17 needles with those set with 3/8-inch clearance (lift).

Adjustments

Adjustments to the 211 W 151 are basically the same as for 111 W 151. These adjustments are discussed in the following text.

SETTING THE NEEDLE BAR.— Place the needle bar up into the needle bar holder as far as possible. Hold in this position and turn the balance wheel toward the operator until the needle bar is at its lowest position. When in this position, set the bar so the upper timing mark is just visible below the needle bar frame, and tighten the needle bar connecting stud pinch screw.

In case the needle bar does not have timing marks, set the machine to zero stitches per inch and place the needle bar up in the holder as far as possible. Turn the balance wheel by hand until the bar is at its lowest position. After reaching the lowest position of the needle bar, continue turning the balance wheel toward the operator until it reaches 3/32 inch above its lowest point, then set the eye of the needle 1/16 inch below the point of the sewing hook.

SETTING THE NEEDLE.— To set the needle, insert the needle shank as far as possible into the needle bar with the long groove of the needle to the left and tighten the screw. (See figure 9-33.)

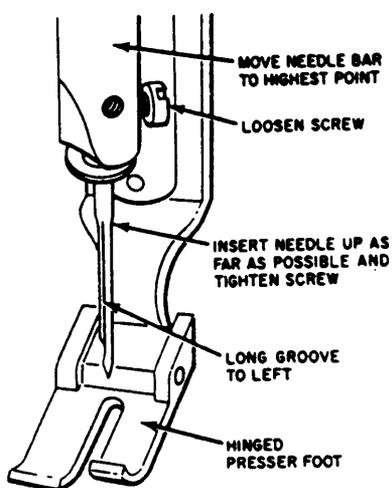
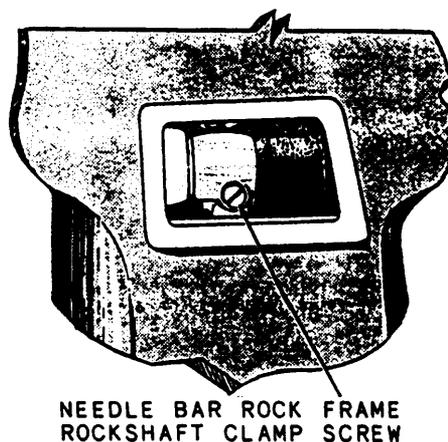


Figure 9-33.—Setting the needle.

240.82



240.83

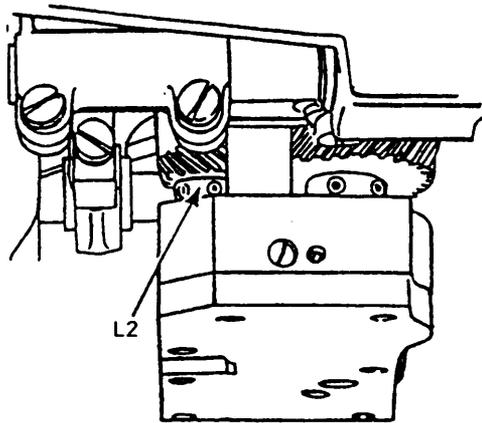
Figure 9-34.—Needle bar rock frame rockshaft damp screw.

RELATIVE POSITION OF NEEDLE BAR AND PRESSER BAR.— To set the relative position of the needle bar to the presser bar, loosen the needle bar rock frame rockshaft clamp screw, which is located behind the cover plate on the front upright position of the arm (fig. 9-34). Set the needle bar so the distance between the needle bar and presser bar is 17/32 inch. Retighten the clamp screw.

NOTE: A handy tool for this adjustment can be manufactured locally from a thin piece of metal stock filed to exactly 17/32-inch width. This gauge should be placed between the two bars while the clamp screw is being tightened. This enables the operator to keep pressure on the loose needle bar.

ADJUSTMENT HEIGHT OF SEWING HOOK.— Before attempting to adjust the height of the sewing hook, it is necessary to make a feeler gauge for testing the height. This gauge can be made of 0.032-inch shim stock, or a regular feeler gauge can be cut or trimmed down so it will fit in the small groove in the throat plate, which retains the bobbin case stop finger.

If, after testing, the hook height is unsatisfactory, turn the balance wheel so the two setscrews in the bottom of the hook are accessible; loosen them with an Allen wrench. Remove the cloth washer from the bobbin case and turn the hook until the height adjusting screw is directly



239.450

Figure 9-35.—Timing the sewing hook.

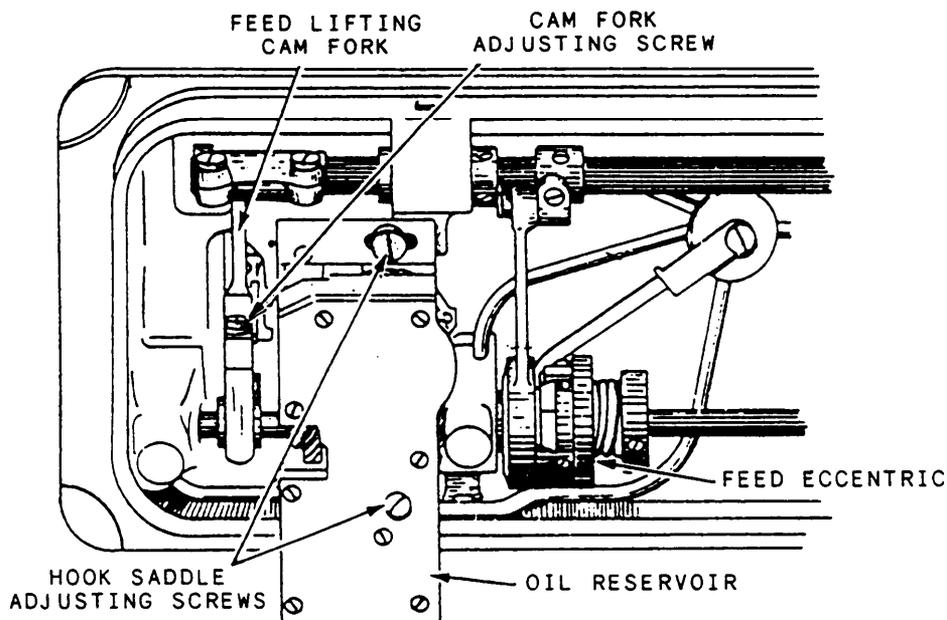
under the hole in the bobbin case. (See figure 9-35.) Turn the screw into raise the hook, and out (while pressing down on the hook) to lower it. The gauge should barely pass between the throat plate and bobbin case stop finger. Retighten the Allen setscrews and turn the adjusting screw in so that a slight tension is left on the screw.

SETTING SEWING HOOK TO OR FROM NEEDLE.— To set the relative position of the

hook saddle to the needle, loosen the hook saddle adjusting screws (fig. 9-36) and slide the hook saddle to the right or left, as necessary, to set the point of the hook as close to the needle as possible (without actually touching). After setting the hook saddle, check the clearance between the hook drive gear and the face of the hook saddle. This clearance should be 0.008 inch; if it is not, reset it by loosening the screw and setscrew in the hook drive gear, and move the gear to the right or left to get the proper clearance.

TIMING BOBBIN CASE OPENER.— To set the bobbin case opener, turn the balance wheel toward the operator until the lower timing mark on the needle bar is barely visible below the needle bar frame on its upward stroke. Tip the machine back and loosen the two Allen screws in the bobbin case opener drive gear; then line up the timing marks by turning the opener shaft with a screwdriver. The timing marks are located as follows: one on the flange of the opener, and the other on the hook saddle (fig. 9-35). Adjust the opener so it lightly touches the bobbin case and turns it enough to make a sufficient opening for a free passage of thread between the bobbin case stop finger and the throat plate. Tighten the screws in the bobbin case opener drive gear.

RAISING OR LOWERING THE FEED DOG.— To raise or lower the feed dog, remove



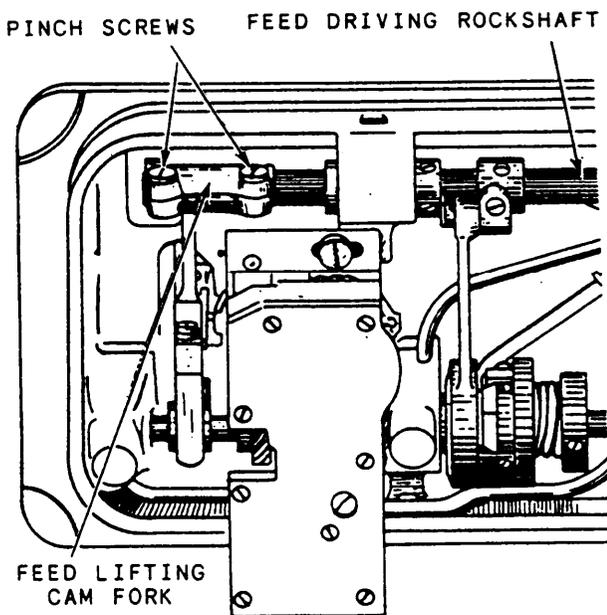
240.85

Figure 9-36.—Hook saddle assembly showing bobbin case raceway oil reservoir.

the throat plate and clean all lint and dirt from between the grooves and teeth of the feed dog. Tip the machine back and turn the balance wheel toward the operator until the feed dog is in its highest position. Loosen the screw in the feed lifting cam fork and raise or lower the dog as desired; then retighten the screw. A properly set feed dog will show a full tooth above the throat plate when at its highest position.

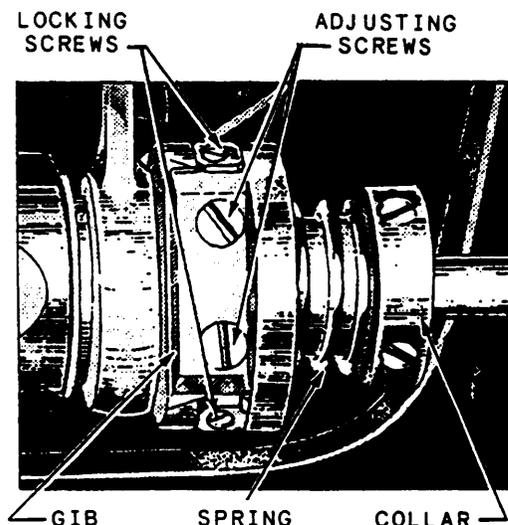
After adjusting the feed dog, check to see that the needle is properly set in the hole in the feed dog. If adjustment is needed, loosen the pinch screws in the feed driving rock frame, and set the needle so that when it is all the way down, it will be slightly forward of center in the hole. Retighten the pinch screws. The feed adjustment points are illustrated in figure 9-37.

ADJUSTING FEED ECCENTRIC.— The feed eccentric (fig. 9-38) may occasionally need adjustment to remove play caused by wear of the gib, or by looseness between the feed eccentric and the eccentric body. To adjust the gib, loosen the two locking screws, then turn inward on the adjusting screws until all play is eliminated and the eccentric fits in the slot properly.



240.86

Figure 9-37.—Feed adjustment for the 211 W 151 sewing machine.



240.87

Figure 9-38.—The feed eccentric.

CAUTION

LOCKING SCREWS MUST BE LOOSENED BEFORE ATTEMPTING TO LOOSEN ADJUSTING SCREWS. RETIGHTEN THE LOCKING SCREWS AFTER ADJUSTMENT IS MADE.

The feed eccentric collar may be moved to the right or left to change spring tension, but it is ordinarily set flush with the hub of the eccentric body.

CHANGING THE LENGTH OF THE STITCH.— TO change the length of stitch, stop the machine. Turn the balance wheel, by hand, toward the operator until the button drops (clicks), then turn the machine pulley until the number representing the desired stitches per inch is lined up properly and then release the button.

CAUTION

DISENGAGE THE BUTTON BEFORE ATTEMPTING TO SEW. DO NOT ENGAGE THE BUTTON WHILE THE MACHINE IS IN OPERATION.

Removing Components

To remove the hook, takeoff the presser foot, throat plate, and feed dog; then loosen the two

Allen screws in the hub of the hook and lift the hook off the hook shaft. To remove the bobbin case from the hook assembly, loosen the hook gib screws, lift off the gib, and then lift out the bobbin case.

Removing the Arm Shaft Connection Belt

When the arm shaft connection belt is disconnected for any reason, the machine will be completely out of time. Therefore, the needle should be removed before removing the belt to prevent damage. To remove the belt, slide it off the lower belt pulley, loosen the screws in the machine pulley, and remove the pulley and ball bearing, which come out through the end of the arm.

Replace the belt by reversing this procedure. Remove the end play from the shaft by lightly setting the setscrews and tapping the balance wheel into position with the palm of the hand and then securely setting the setscrews. Place the belt over the upper belt pulley and line up the timing marks on the lower belt pulley and on the bed of the machine. While holding the lower belt pulley in position, turn the balance wheel toward the operator's position until the thread take-up lever is at its highest position, then slide the belt onto the lower belt pulley. The arm shaft connection belt and the lower belt pulley are illustrated with the safety clutch in figure 9-32.

CAUTION

DO NOT TAMPER WITH THE SAFETY CLUTCH. ITS TORQUE IS PRESET AT THE FACTORY.

Lubrication

The hook saddle is equipped with an oil reservoir (fig. 9-36), which contains oil to be pumped to the bobbin case raceway. The flow of this oil is controlled by a control valve screw located just aft of the bobbin case opener in the hook saddle. For more oil, turn the valve screw clockwise; counterclockwise for less oil.

CAUTION

DO NOT ADJUST FLOW OF OIL WITHOUT FIRST LOOSENING THE

LOCKING SCREW LOCATED ON THE SIDE OF THE HOOK SADDLE JUST ABOVE THE CAM SHAFT GEAR. AFTER ADJUSTING THE CONTROL VALVE SCREW FOR PROPER FLOW, RETIGHTEN THE LOCKING SCREW.

SINGER SEWING MACHINE 143 W 2 AND 3

This type of machine is not as common as those previously described, but it has unlimited uses in the repair and maintenance of parachutes and survival equipment.

The 143 W 2 is a high-speed sewing machine that has an aluminum alloy vibrating needle bar frame and a rotary hook. It is intended for overseaming and zigzag stitching on fine and general fabrics and lightweight leather. It has ball bearings on the rear end of the arm shaft and hook driving shaft. The needle bar has a maximum throw of 3/16 inch, vibrating both sides of a centerline.

The 143 W 3 sewing machine is similar to the 143 W 2 except that the needle has a maximum throw of 5/16 inch.

The maximum speed recommended for machine 143 W 2 is 3,500 stitches per minute, and for machine 143 W 3, 3,000 stitches per minute, the speeds depending on the material being sewn.

Needle and Thread

The needles for the 143 W 2 and 143 W 3 sewing machines are of class and variety 135 x 7; the sizes from 7 to 24.

Left twist thread should be used on these machines. To make a smooth even stitch with the sewing machine, use good, firmly twisted and smoothly finished thread. The thread should pass freely through the eye of the needle.

Setting the Needle

Push the needle up in the needle bar as far as it will go, with the LONG THREAD GROOVE TO THE FRONT, and secure it firmly with the setscrew. It may be necessary to turn the needle slightly to the right or left for some threads if stitches are missed.

Bobbin and Bobbin Case

The procedure for removing the bobbin case, winding the bobbin, threading the bobbin case, and replacing the bobbin case is the same as for the 31-15 sewing machine. The only exception to this is that when the bobbin case is threaded, the thread should be drawn from the **BOTTOM** from left to right, instead of from the top as given for the 31-15.

Threading the Needle

These machines are threaded in the same way as the 111 series machines, described earlier in the chapter. When threaded up to the needle, thread the needle from the front through the eye to the back. The long thread groove should be in front when the needle is properly set in the needle bar.

Regulating the Length of Stitch

To adjust the length of stitch, depress the stitch regulator lever (fig. 9-39) on the uprise and, at the same time, turn the balance wheel forward until the lever engages in the notch in the stitch

regulator flange. Hold the lever in the notch and turn the balance wheel backward or forward (as necessary) until the desired number of stitches per inch is shown opposite the arrow on the stitch regulator.

Regulating the Width of the Zigzag

The extreme width of the zigzag (needle throw) on the 143 W 2 is $\frac{3}{16}$ inch; it is $\frac{5}{16}$ inch on the 143 W 3. The width of bight is regulated by turning the knurled knob on the needle vibrator regulating spindle head (fig. 9-39) at the front of the machine. To increase the width of the stitch, turn the regulating spindle head to the left, and to the right to decrease.

Setting the Needle Bar

The two adjustment marks on the needle bar are $\frac{3}{32}$ inch apart. To set, insert the needle bar up into the needle bar frame so the upper mark is just visible at the lower end of the needle bar frame with the bar at its lowest position. The eye of the needle should be $\frac{1}{16}$ inch below the point

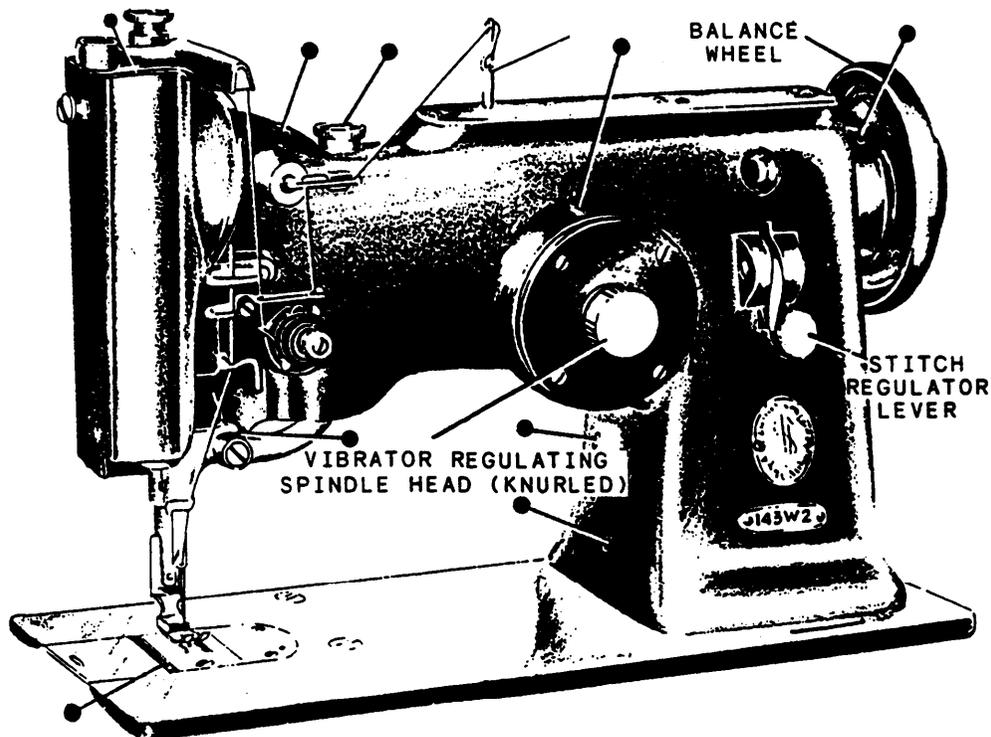


Figure 9-39.—Oiling points at the front of the 143 W 2.

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of the hook, and the long thread groove toward the operator.

Setting and Timing the Needle Bar Frame

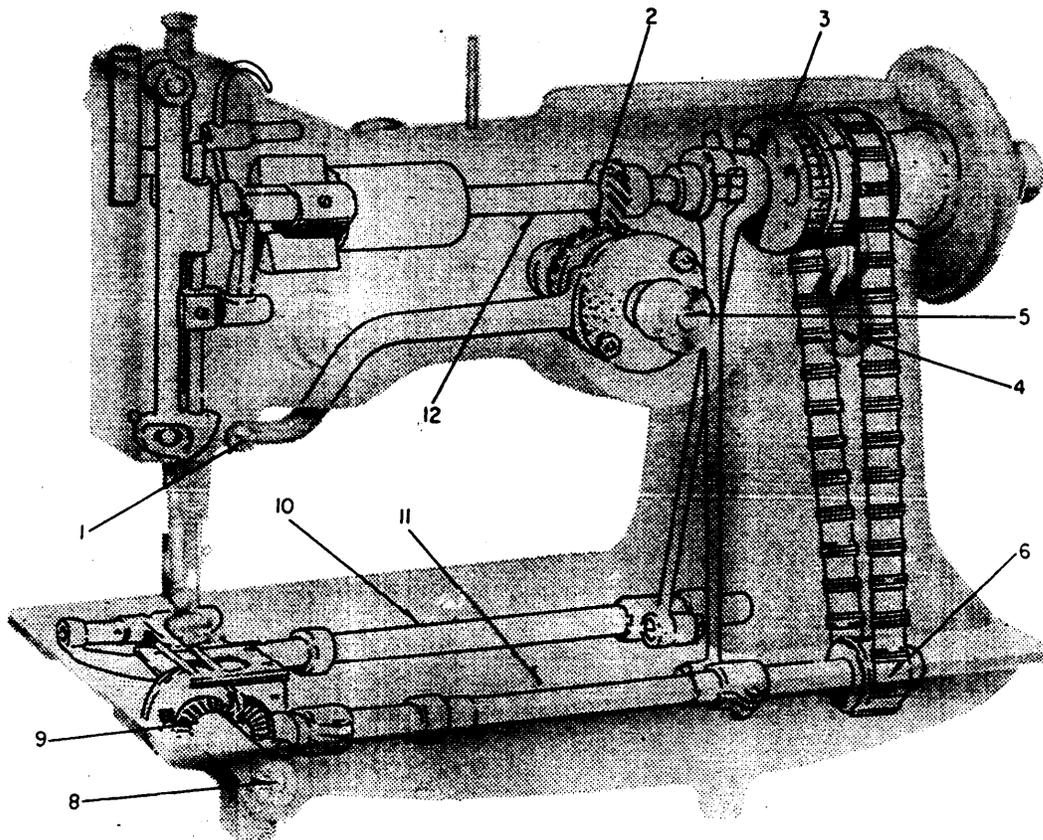
Turn the regulating spindle head all the way to the right. This will cause the machine to sew a straight stitch. The needle should be centered in the hole in the throat plate. If not, loosen the setscrew that holds the eccentric stud (1) and turn the stud until it is centered (fig. 9-40.) Turn the needle regulating spindle head (5) to the extreme left for the widest throw. Turn the balance wheel forward until the needle is at its lowest position. The needle bar should start to move in a sideward movement as the needle starts to rise. If it does not, you must advance or retard the vibrator pinion gear (2), shown in figure 9-40.

Timing Sewing Hook

Turn the balance wheel toward the operator's side until the needle bar is all the way down and has risen until the lower timing mark is just visible below the needle bar frame. Loosen the setscrews (10) in the lower belt pulley (fig. 9-41) and set the hook point to the center of the needle eye. Retighten the setscrews.

Setting the Hook Distance To or From Needle

Loosen the two hook shaft retaining screws (8) (fig. 9-41) and the two screws in the hook pinion gear (7), and slide the hook to the correct position. Retighten the hook shaft retaining screws. Set the gear in the proper place on the shaft—gear aligned with hook drive gear—and



- 1. Eccentric stud
- 2. Vibrator pinion gear
- 3. Stitch regulator
- 4. Stitch regulator lever

- 5. Regulating spindle head
- 6. Lower belt pulley
- 7. Hook drive gear
- 8. Hook spindle screw

- 9. Hook pinion gear
- 10. Feed driving rockshaft
- 11. Hook drive shaft
- 12. Arm shaft

Figure 9-40.-X-ray view of zigzag sewing machine.

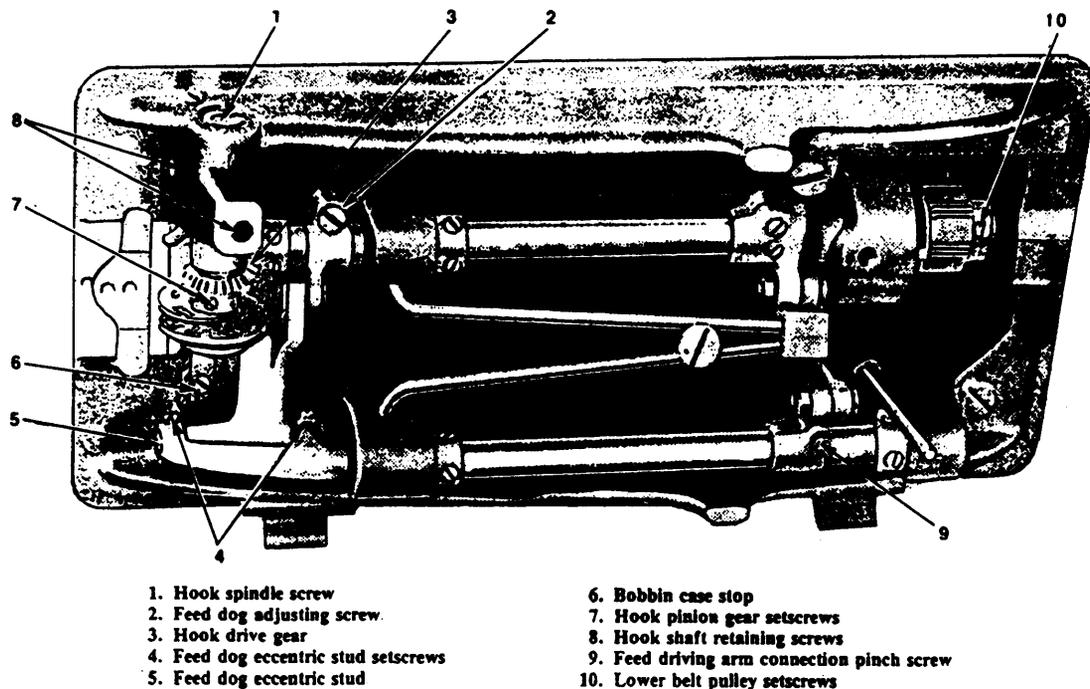


Figure 9-41.—Adjustments in the bed of the machine.

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retighten the two setscrews to hold the hook in position.

Raising or Lowering the Feed Dog

The feed dog should show a full tooth above the throat plate when at its highest position. To adjust the dog, remove the throat plate and make sure all lint, dirt, or other obstruction is removed, then replace the throat plate. Turn the balance wheel forward until the feed dog is at its highest position; then loosen the feed dog adjusting screw (2) (fig. 9-41), and raise or lower the feed dog as required. Retighten the adjusting screw to hold the feed dog in position.

To prevent the feed dog from striking either end of the slots in the throat plate, loosen the pinch screw (9) (fig. 9-41) and move the feed dogs forward or backward (as necessary) until the longest stitch can be taken without striking the throat plate.

Sewing Techniques

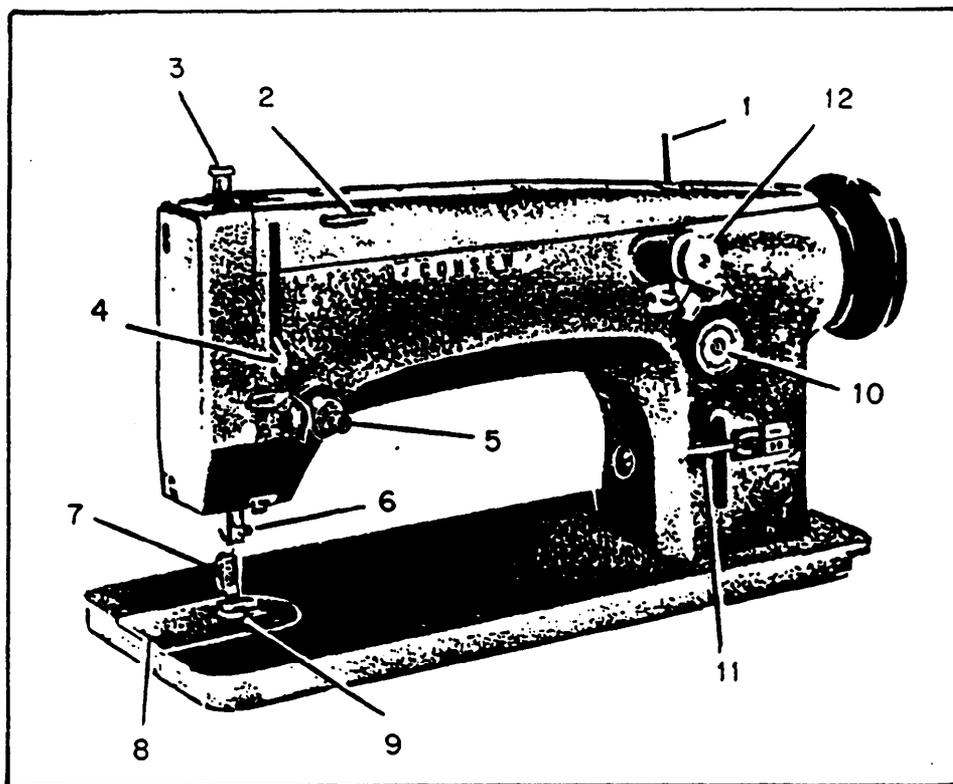
In this chapter we pointed out the need to let the machine feed the material being sewn, and

other techniques to obtain a good seam. At first you will find it very difficult to turn corners when using a sewing machine. If you will follow these instructions you will find it very easy to make a turn and not lose your stitch.

Stop the machine while the needle is rising, but before it is out of the material, raise the presser foot and turn the work. This method uses the needle as a pivot. When the material lies in the new position, lower the foot and continue sewing.

Removing the Work

Raise the presser lifter and turn the machine by the balance wheel until the take-up lever is at its highest position. Draw the work out away from you. If the threads do not draw out easily, the take-up lever is not in the right position. If the machine is stopped as directed, the needle will not be unthreaded when you start to sew, even if only a short end is left through the eye of the needle.



- | | |
|-----------------------|--|
| 1. Spool pin | 7. Presser foot |
| 2. Thread guide | 8. Slide plate |
| 3. Pressure regulator | 9. Needle Plate |
| 4. Take-up lever | 10. Stitch length regulator |
| 5. Tension regulator | 11. Feed direction lever (for tacking) |
| 6. Needle bar | 12. Zigzag width regulator |

Figure 9-42.-Consew 99R.

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CONSEW 99R and 99R-3 SEWING MACHINE

The Navy has recently acquired new model zigzag sewing machines (fig. 9-42), model 99R-3 is not shown, capable of the rope sewing needed to install the four-line release system. Two models are available-the 99R and the 99R-3. Both models are rotary hook-type machines. They are fairly conventional machines, and the operation of both is very similar to that of the machines we have already discussed.

Models 99R and 99R-3 machines are identical in outward appearance; the difference is in the type of stitch they make. In model 99R, every successive stitch forms a symmetrical zigzag pattern stitch, type 304. In

model 99R-3, a zigzag pattern is formed by successive pairs of stitches, type 308.

Threading the 99R and 99R-3 Machines

Follow the instructions below when threading the needle and bobbin on the 99R and 99R-3 sewing machines:

1. Turn the balance wheel toward you until you are able to position the needle so you can place the thread through its eye. Remember, always thread the needle toward the bobbin. In this case, you run the thread from front to back.

2. Hold the loose end of the needle thread in your left hand, turn the hand wheel toward

you with your right hand until the needle moves down and up again to its highest position.

3. Pull the needle thread gently and the bobbin thread will come up with it through the hole in the needle plate.

4. Place both ends of the thread beneath and in back of the presser foot.

5. With the needle at its highest point, place the material to be sewn beneath the presser foot and fully lower the presser foot lifter lever.

6. Start sewing.

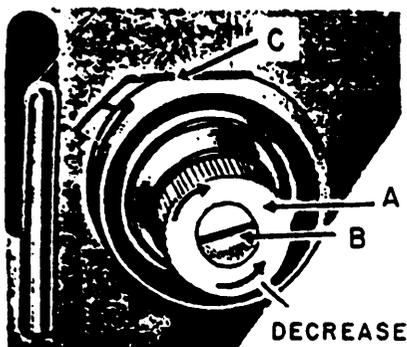
Regulating the Tension

Tension is the key word to good sewing. For perfect stitching, the tension of the upper and lower threads should be balanced and just sufficiently tight to lock both threads in the center of the material (look again at figure 9-16).

The machine is correctly adjusted to make a perfect stitch before leaving the factory. When adjustments do become necessary, the problem is more likely to be caused by the upper thread tension, so always begin there. To adjust the upper thread tension, proceed as follows:

1. Lower the presser foot. Remember upper thread tension adjustments must be made with the presser foot down.

2. Check the upper thread tension. If it is loose, turn the tension nut (A in fig. 9-43)



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Figure 9-43.—Upper thread tension.

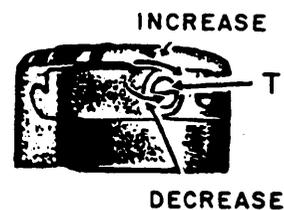
clockwise to increase the tension; if the upper thread tension is tight, turn the tension nut counterclockwise to loosen it.

Adjusting the Bobbin Thread Tension

When you find it necessary to adjust the bobbin thread tension, turn the tension screw (T of fig. 9-44) on the bobbin case clockwise to increase the tension, and turn the screw counterclockwise to decrease the tension.

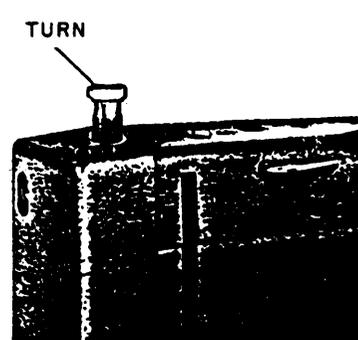
Regulating the Pressure of the Presser Foot

The pressure of the presser foot should be adjusted according to the type of material being sewn. The heavier the material, the heavier the pressure. The lighter the material, the lighter the pressure. The pressure should be only heavy enough to prevent the material from rising with the needle and to enable the feeder mechanism to move the work along evenly. The pressure becomes tighter as the regulating thumbscrew is turned clockwise, and looser as the thumbscrew is turned counterclockwise (fig. 9-45).



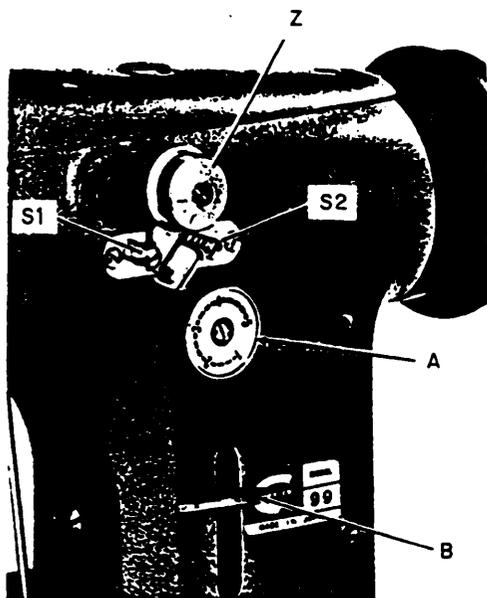
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Figure 9-44.—Bobbin thread tension.



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Figure 9-45.—Adjusting the presser foot pressure.



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Figure 9-46.—Stitch regulator.

Stitch Regulator and Reverse Sewing and Tacking

For reverse sewing and tacking, proceed as follows:

1. When the number 1 on dial A of figure 9-46 is set uppermost on a vertical line, the feeder does not move the material.
2. When the dial (A) is turned counterclockwise and lever (B) is raised as far as it will go, the machine makes forward stitches, increasing in size as the dial knob is turned toward the larger numbers.
3. For reverse sewing, lower the lever (B) as far as it will go.
4. By moving the lever up and down during sewing, you can easily make forward or reverse stitches continuously and at will. You can make use of this feature for locking the thread at the start or end of seams.

Straight and Zigzag Sewing

Be sure that stops S1 and S2 are set at the extreme ends of their slot. If not, use a screwdriver to loosen them about one turn, and then tighten them in their extreme positions. Turning the zigzag regulating knob Z clockwise as far as it will go causes the machine to sew with a straight stitch. Turning this knob counterclockwise produces a

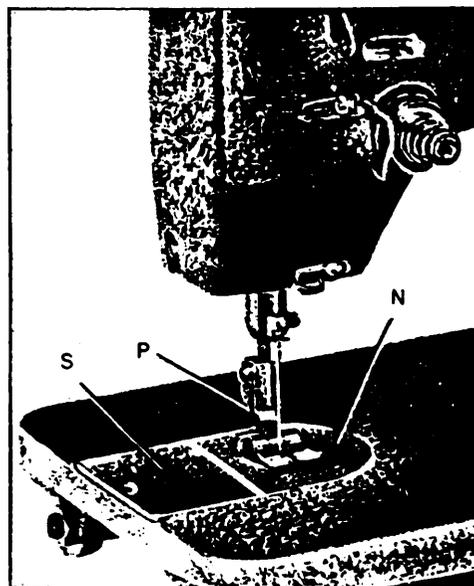
zigzag stitch. The zigzag becomes wider the more this knob is turned in a counterclockwise direction. The widest zigzag stitch is sewn when knob Z cannot be turned any further. This occurs when the pointer at the underside of knob Z points at the largest number on the dial and is stopped by stop S2.

When you want to control the width of the zigzag between certain minimum and maximum limits between the numbers on the dial, use a screwdriver to set stops S1 and S2 to the selected widths. Be sure to set stop S1 as far to the left as possible when a straight stitch is desired.

NOTE: The zigzag regulating knob can be moved into any desired position while the machine is operating. Do not turn the zigzag regulating knob when the machine is at rest and the needle is in the material. If you do you may bend or break the needle. Turn the handwheel toward you to raise the needle out of the material before operating the regulating knob.

Preparing the Machine for Rope Stitching (Model 99R-3 only)

For rope stitching, the standard combination of presser foot, feed dog, and (throat) needle plate is replaced with a special set of components designed specifically for this purpose. To do this, move slide plate (S of fig. 9-47) as far to the left



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Figure 9-47.—Rope stitching.

as it will go. Using a screwdriver, remove the two screws holding the needle plate (N) to the bed of the machine. Remove presser foot (P) from the presser bar and lift the needle plate off the bed. Now the feed dog becomes exposed. Loosen the two screws that attach the feed dog to its carrier, and remove the feed dog.

Proceeding in reverse order, first install the special rope-sewing feed dog on the feed dog carrier, making certain that the two screws are tightened well. Next, put in place the special (throat) needle plate, and then the special presser foot, tightening all their screws securely, and close the slide plate.

Adjust the stitch length and the width of zigzag to suit the rope to be sewn.

Setting the Needle Bar at the Correct Height

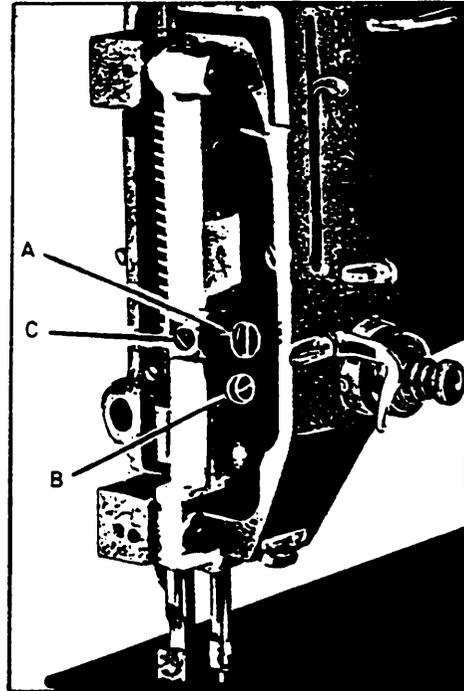
Before adjusting the height of the needle bar, make sure that the needle is pushed up into the needle bar as far as it will go. Now, remove the faceplate from the machine. Set the zigzag control knob for straight sewing and turn the handwheel toward you until the needle reaches the lowest point of its downward stroke. See that the needle enters the needle slot in the throat (needle) plate at the very center. When the needle is centered, proceed in the following manner:

Remove the slide plate, needle (throat) plate and feed dog. Continue turning the handwheel toward you until the needle bar has risen approximately $\frac{3}{32}$ inch above its lowest position. The point of the sewing hook should now be at the center of the needle at a distance approximately $\frac{3}{32}$ inch above the eye.

If adjustment should be required, loosen the setscrew (B of fig. 9-48) in the needle bar connecting stud to raise or lower the needle bar as may be necessary. Be sure to tighten the setscrew after making this adjustment.

Centering the Needle in the Throat (Needle) Plate

If the needle needs centering within the needle slot in the needle (throat) plate, set



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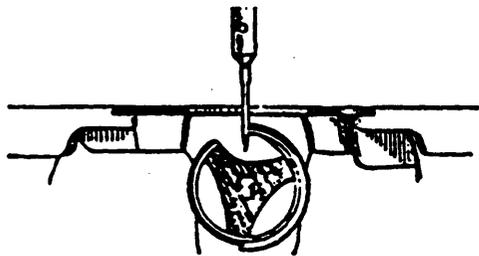
Figure 9-48.-Setting needle bar.

the machine for straight sewing and turn the handwheel toward you until the needle bar reaches the lowest point of its downward stroke. Loosen setscrew (C of fig. 9-48) and turn eccentric stud (A of fig. 9-48) until the needle is centered correctly. Retighten setscrew (C).

Set the zigzag knob to the widest stitch position and turn the handwheel toward you. Observe the passage of the needle through the needle (throat) plate. It should pass at about an equal distance from either end of the needle slot when making the left and right zigzag stitch. If necessary, readjust the eccentric stud (A of fig. 9-48) as described before.

Timing the Sewing Hook

Remove the presser foot, slide plate, throat (needle) plate and bobbin case. Also remove the feed dog. With a new needle in the machine, turn the handwheel toward you until the needle bar reaches its lowest point. Continue turning and allow the needle bar to rise about $\frac{3}{32}$ inch while on its upward stroke. With needle bar in this



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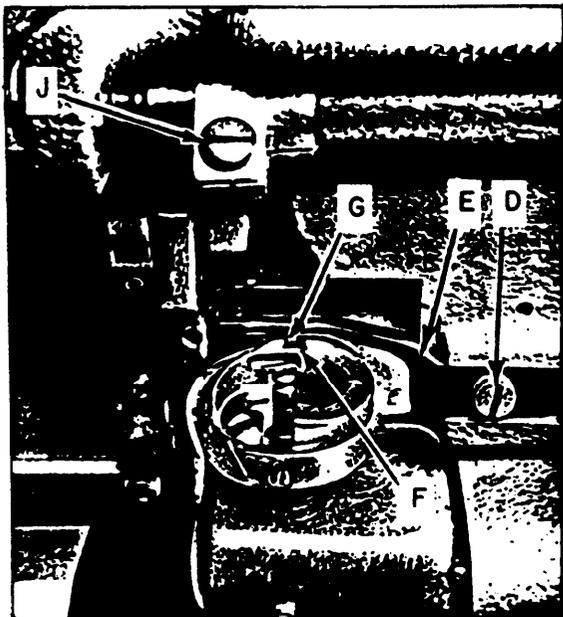
Figure 9-49.—Timing sewing hook.

position, the point of the sewing hook should be at the center of the needle (fig. 9-49).

If the sewing hook is not timed correctly, loosen the three setscrews in its hub. Turn the hook on its shaft to align the point with the center of the needle, as shown in figure 9-50. Tighten the three setscrews.

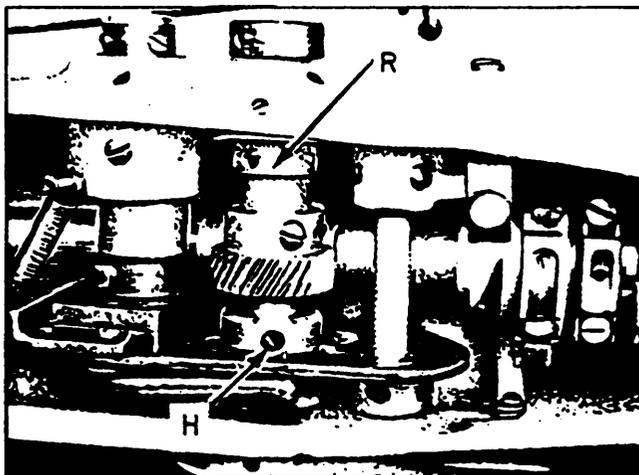
To Remove and Replace the Sewing Hook

Remove the needle, slide plate, and bobbin case. Take out screw (D of fig. 9-50) and remove hook retainer (E of fig. 9-50). Loosen the three setscrews in the hub. Turn the handwheel until the thread guard (widest part) of the hook is at



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Figure 9-50.—Sewing hook.



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Figure 9-51.—Removing sewing hook.

the bottom, then remove the sewing hook from its shaft (fig. 9-5 1).

When installing a new sewing hook, have the thread guard at the bottom. Now turn the bobbin case holder until the notch (F) is at the top. Replace the hook retainer (E) watching that the projection (G) near its end (fig. 9-50) enters notch (F) in the bobbin case holder. Fasten the hook retainer to the underside of the bed by means of its screw. Replace the needle and time the sewing hook as described in the preceding paragraph. Reinstall the bobbin case, throat plate, and slide plate.

Timing the Feeding Mechanism

The feeding mechanism is timed at the factory for average stitching performance. Normal timing is such that the feed dog teeth, rising from their lowest position, should be just flush with the surface of the throat (needle) plate after the needle point has traveled about 5/16 inch above the plate while on its upstroke.

To adjust the feeding mechanism, remove the top cover from the machine. Turn the handwheel toward you until the two setscrews, which lock the feed eccentric into the main shaft, come into view (fig. 9-5 1). Loosen both setscrews; lightly tap the feed eccentric toward you to advance the feed timing. To retard the feed timing, tap the eccentric to rotate it toward the rear of the machine.

NOTE: Rotate the eccentric no more than about 1/16 inch, then tighten its setscrews and check for results.

Timing the Movement of the Needle Bar Frame

Set the zigzag knob for straight stitch. Turn the handwheel and observe the travel of the needle into and out of the needle slot in the throat (needle) plate. If the needle is not centered in the slot, make the adjustments that have been described.

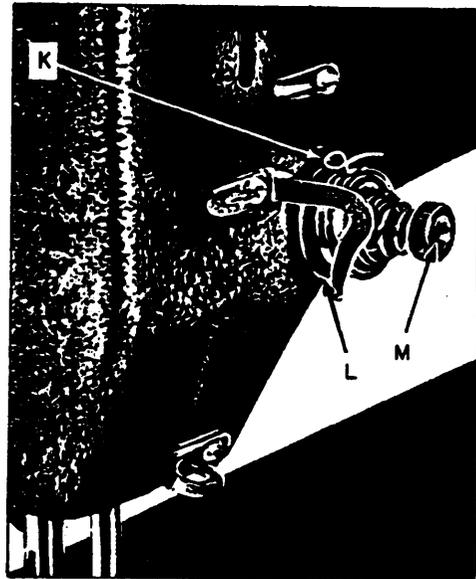
Now adjust the needle to produce the widest zigzag stitch. Turn the handwheel toward you and observe vibration (sidewise movement) of the needle bar. The needle bar, on its upward movement, should begin to vibrate when the point of the needle is no less than about 3/32 inch above the throat plate, and should stop vibrating when the needle has reached approximately the same position on its downward movement. To adjust the vibration of the needle bar on model 99R, loosen the setscrews (H of figure 9-51) in the vibrator cam and slightly turn this cam on its shaft. Tighten the setscrews and check for results.

On model 99R-3, the vibration of the needle bar is produced by a plate cam located at R on figure 9-51. Loosen its setscrews and slightly turn the cam on its shaft, following the same procedure as outlined in the preceding paragraph. Be sure to retighten the setscrews.

To Raise or Lower the Feed Dog

When at its highest position, the feed dog should usually rise above the throat (needle) plate the full depth of the teeth.

To adjust the position of the feed dog, loosen screw (J of fig. 9-50) and raise or lower the feed dog; then tighten the screw. When raising or lowering the feed dog, be careful that its underside does not drop so low that it strikes the hook.



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Figure 9-52.—Adjusting thread take-up spring.

Adjustment of the Thread Take-up Spring

The thread take-up spring (K of fig. 9-52) should be set so that when the eye of the needle reaches the material on the downward stroke, the spring has completed its action and rests against the top of the thread take-up spring regulator.

If the thread take-up spring is not correct, loosen setscrew (L of fig. 9-52) and turn the tension stud (M) to the left for reduced movement of the spring, or to the right for more movement. After the take-up spring is set correctly, tighten setscrew (L).

Regulation of the tension of the thread take-up spring (K) is done by turning the tension stud (M) to the right to increase tension or to the left to decrease it. Tension of the spring should just be enough to take up the slack of the needle thread until the eye of the needle reaches the material on its downward movement.

