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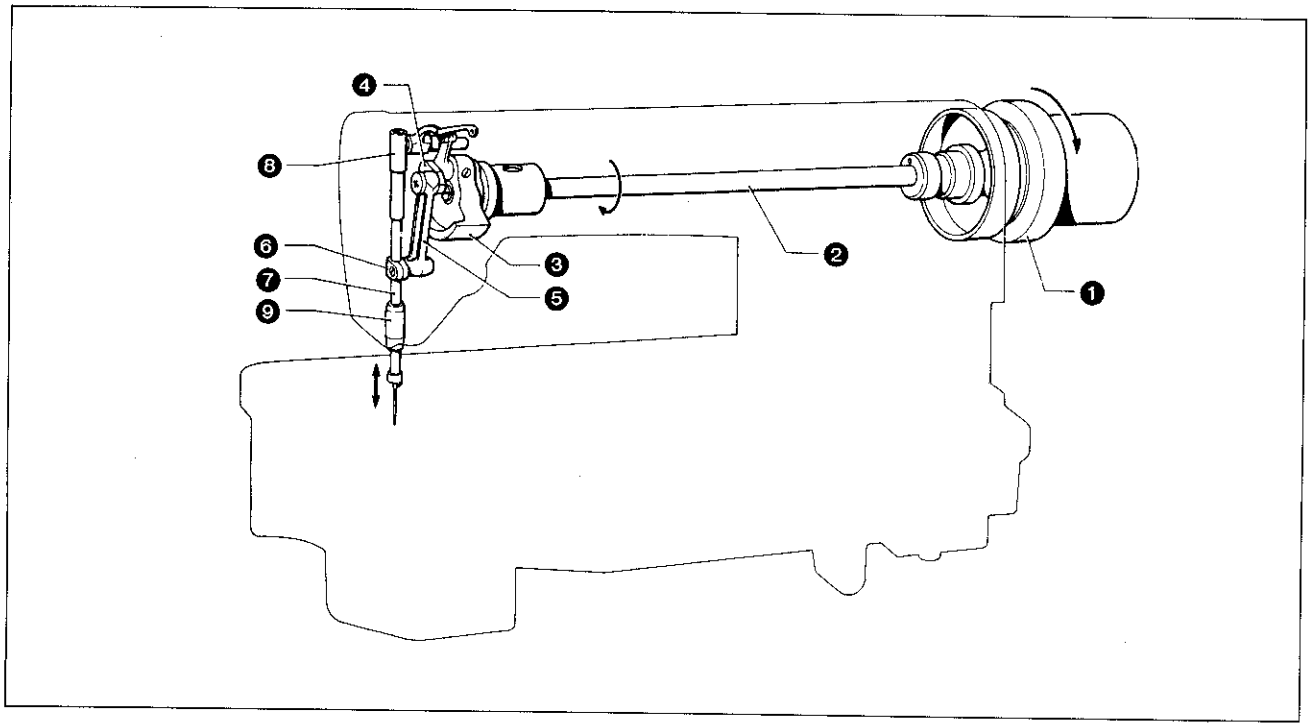
SERVICE MANUAL FOR BAS-350

BROTHER INDUSTRIES, LTD.
NAGOYA, JAPAN

CONTENTS

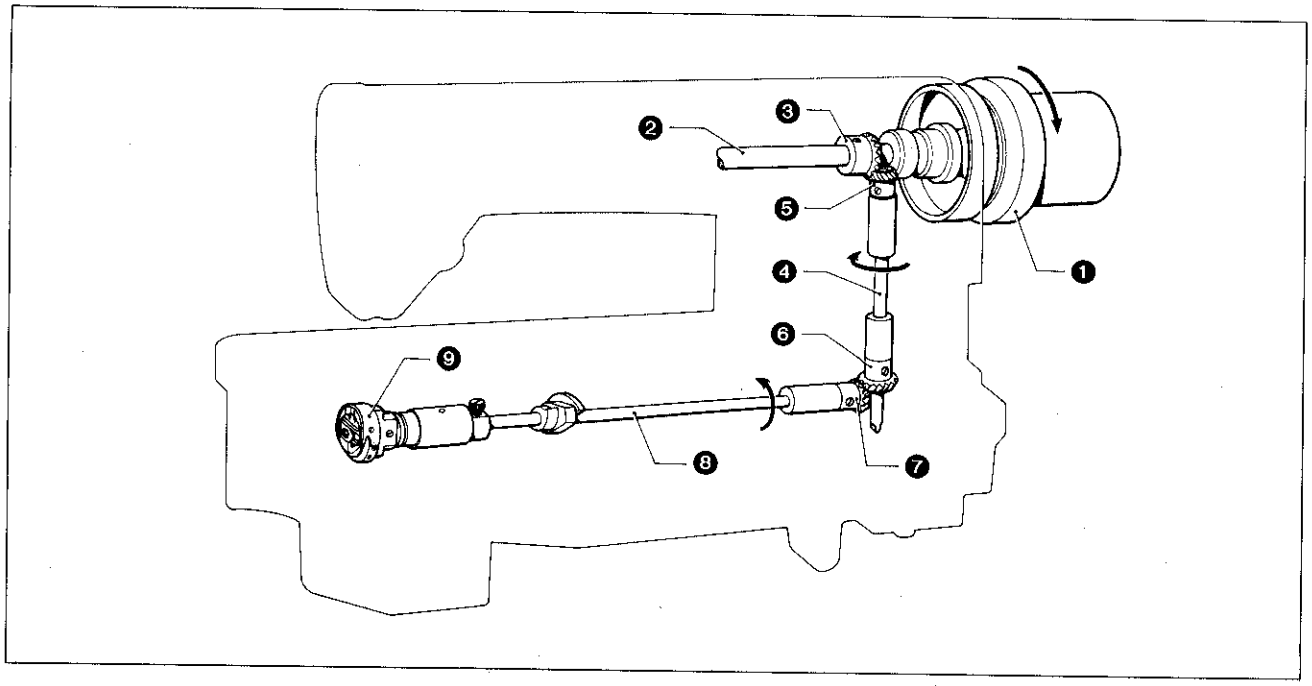
Mechanical Descriptions

1 Arm shaft and needle bar mechanism



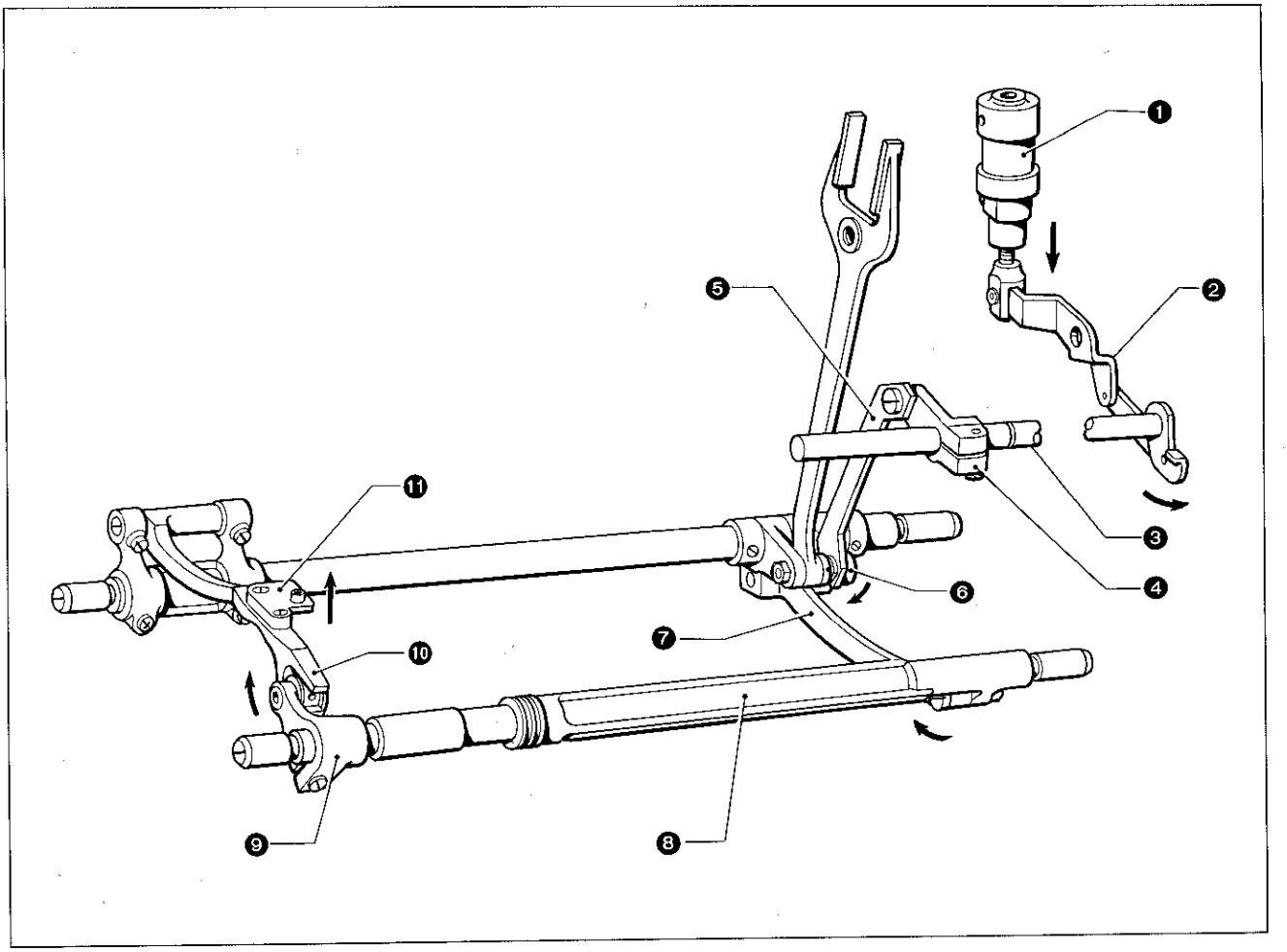
1. Turning the machine pulley ❶ rotates the arm shaft ❷, which in turn causes the thread take-up crank ❸ to rotate.
2. The needle bar connecting link ❺ is driven via the needle bar crank ❹ connected to the thread take-up crank ❸.
3. The needle bar connecting link in turn drives the needle bar ❼ connected to the needle bar clamp ❻.
4. The needle bar is guided by needle bar bushing U ❽ and needle bar bushing D ❾.

2 Rotating hook shaft and rotary hook mechanism



1. Rotation of the machine pulley ❶ is transferred from the arm shaft bevel gear ❸ mounted on the arm shaft ❷ to drive the vertical arm shaft ❹ via vertical arm shaft bevel gear U ❺ mounted on the top of the vertical arm shaft ❹.
2. Motion is relayed from the vertical arm shaft ❹ via the vertical arm shaft bevel gear D ❻ to the rotating hook shaft bevel gear ❼ to drive the rotating hook shaft ❽.
3. The high speed rotating hook ❾ is driven in full revolutions by the rotating hook shaft ❽.

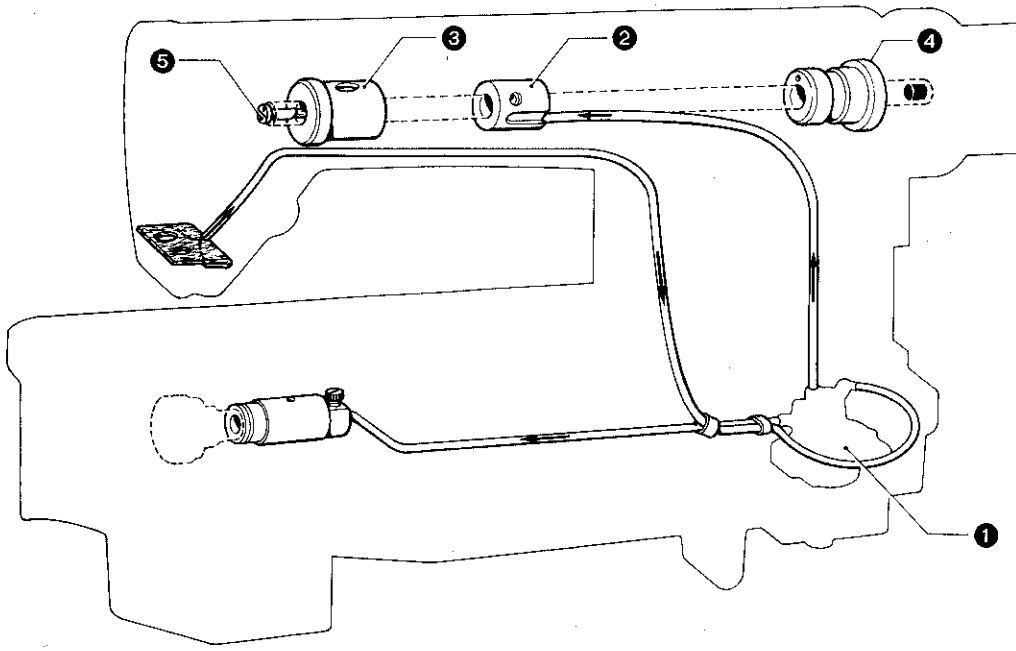
3 Bottom plunger drive mechanism

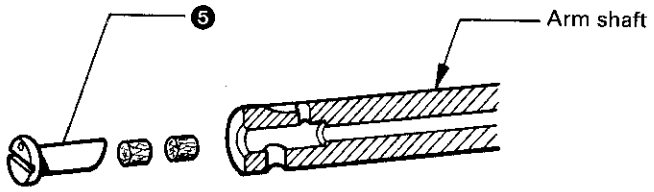


1. When the lever assembly ❷ is driven in the direction of the arrow by the cylinder ❶, the bottom lever ❻ is turned in the direction of the arrow via reverse lever shaft ❸, bottom adjustment lever ❹, and bottom rod S ❺.
2. Feed lifting arm complete ❾ is driven in the direction of the arrow via bottom rod L ❼ and feed lifting shaft ❽.
3. Bottom plunger ⓫ mounted on feed bar ❿ is lifted by feed lifting arm complete ❾.
4. When lever assembly ❷ is driven by cylinder ❶ in the direction opposite the arrow, bottom plunger ⓫ is lowered below the needle plate top.

4 Lubrication system

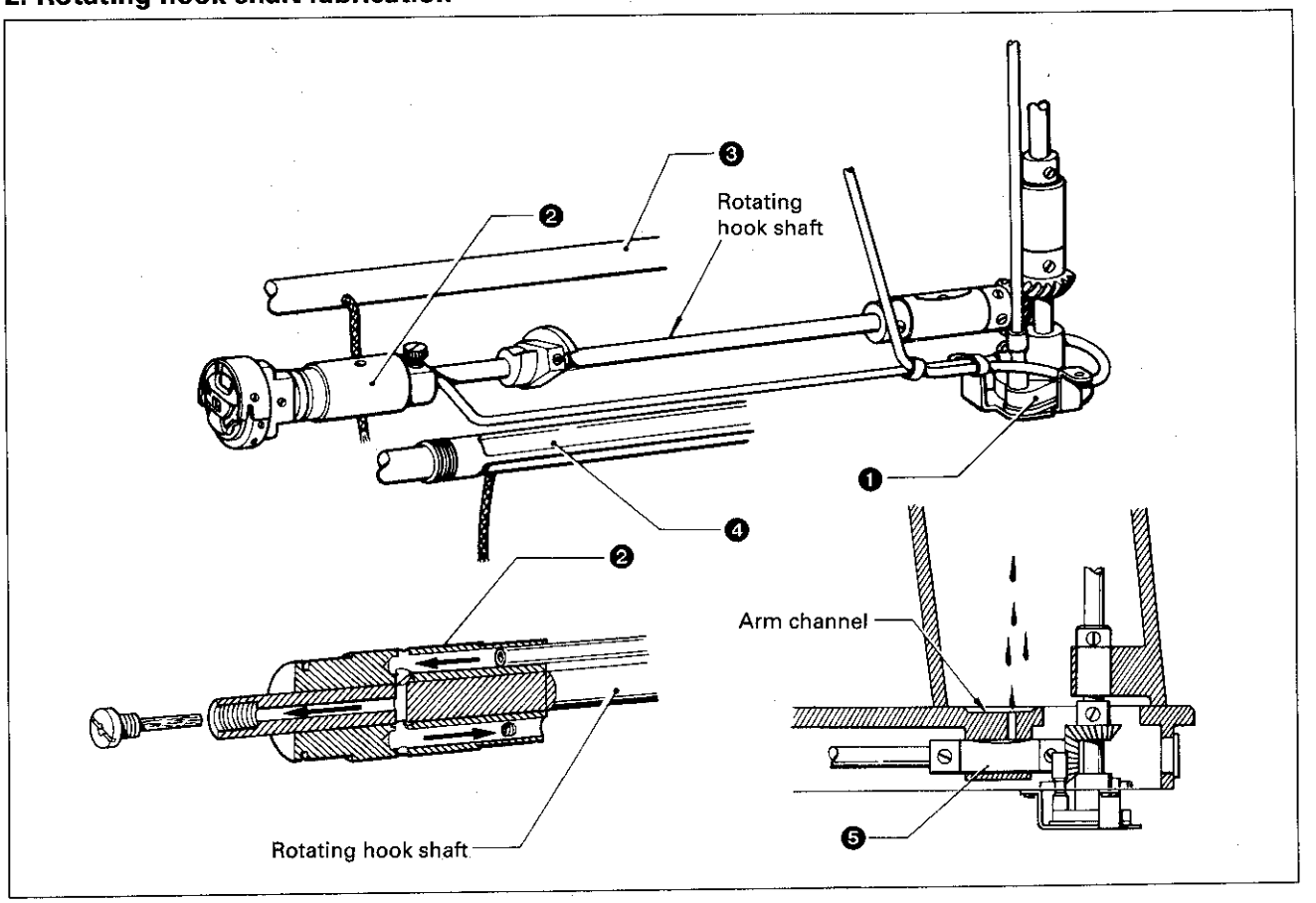
1. Arm shaft lubrication



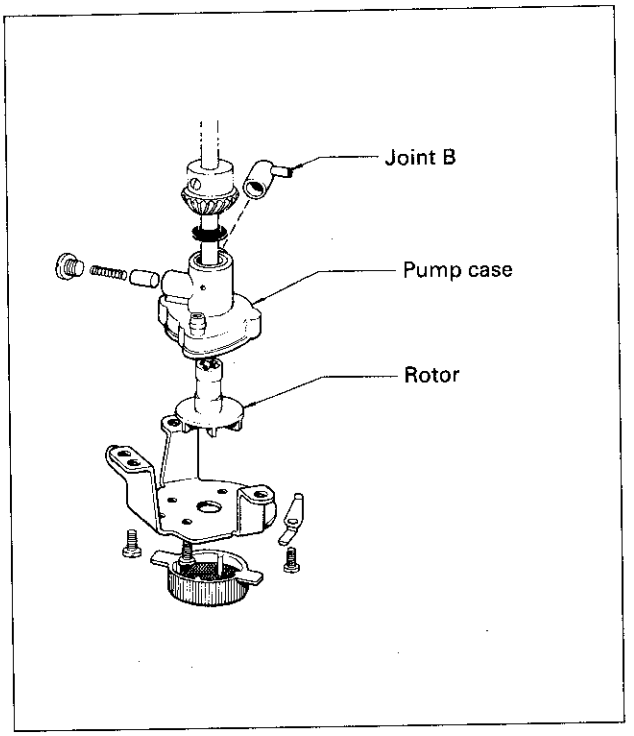


(1) Oil fed by the pump ❶ enters the arm shaft from arm shaft bushing M ❷ to lubricate arm shaft bushing L ❸ and R ❹.
Oil sprayed inside the machine arm lubricates the feed regulator.
(2) An oil fitting ❺ is provided on the left end of the arm shaft for lubrication of the thread take-up and needle bar mechanism via the thread take-up lever and needle bar crank.
(3) A felt pad is attached to the needle bar crank to prevent excessive oil flow and lubrication tube blockage, and to lubricate the needle bar connecting link.
(4) An oil cap ❽ on the right end of the arm shaft prevents oil overflow.
(5) Oil which collects in the needle bar end of the arm is absorbed by the felt pad and sucked back through the tube to the pump ❶.

2. Rotating hook shaft lubrication



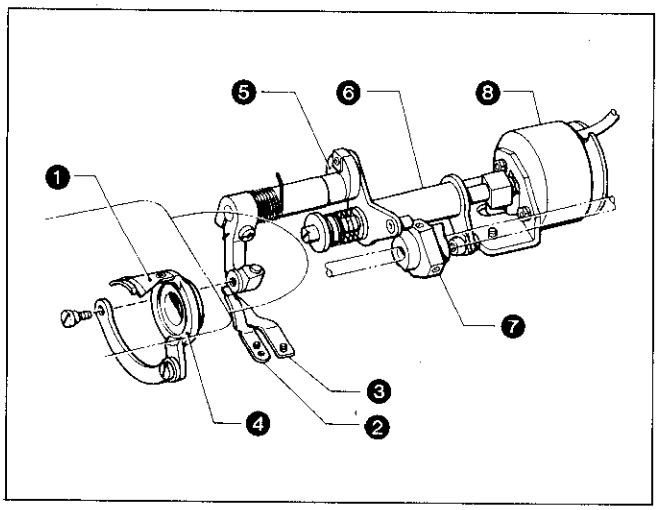
(1) Oil fed by the pump ❶ lubricates the rotating hook shaft and rotating hook shaft bushing L ❷.
(2) Some of the oil at rotating hook shaft bushing L ❷ flows through the rotating hook shaft to lubricate the rotary hook.
(3) Oil is carried from the oil pan by the wick to lubricate the bottom lever shaft ❸ and feed lifting shaft ❹.
(4) Oil sprayed inside the arm lubricates rotating hook shaft bushing R ❺, the bottom lever shaft ❸ and feed lifiting shaft ❹ from the channel in the arm.



3. Pump construction

Centrifugal force generated by the rotation of the rotor connected to the end of the vertical arm shaft raises oil through the hole in the center, and oil is fed to the lubrication tubes through the ports in the oil chamber.

The plunger pump connected to the main pump body suctions oil back from the felt pad in the machine arm.



[5] Thread trimmer

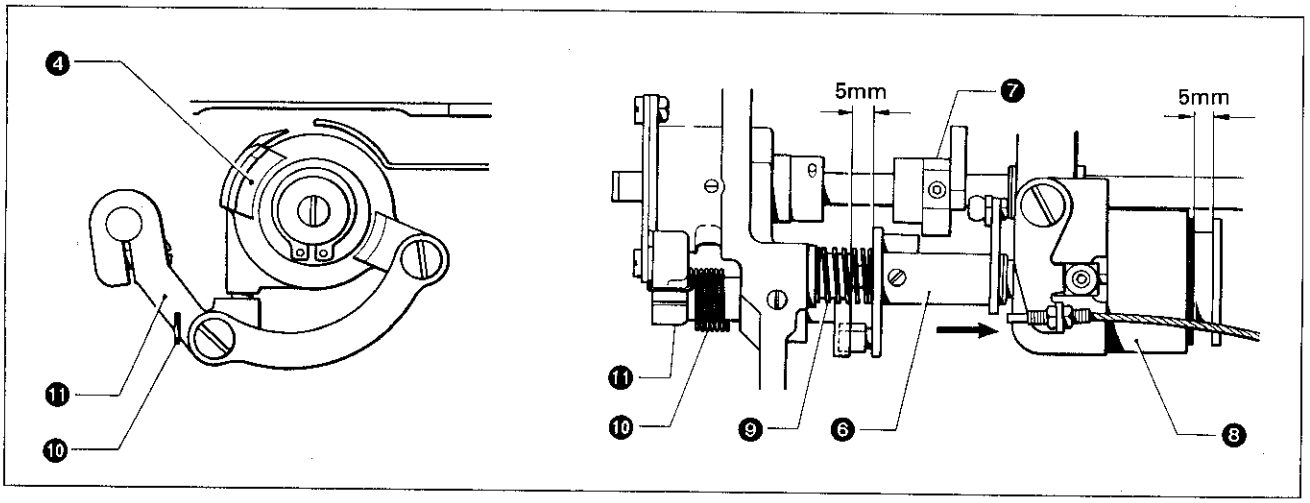
1. Thread trimmer mechanism

The thread trimmer mechanism consists of the movable knife ❶, fixed knife ❷, lower thread finger ❸, movable knife holder ❹, feed fork shaft ❺, lever assembly ❻, thread trimmer clutch ❼ and thread trimming solenoid ❽.

2. Thread trimmer operation

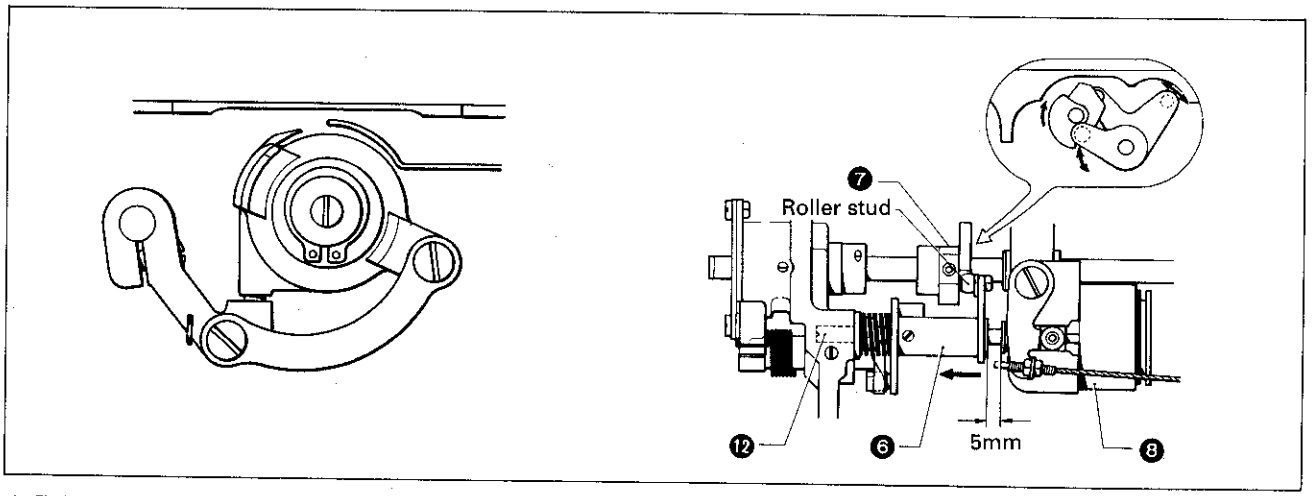
The figure below shows the thread trimmer without the high speed rotary hook.

(1) High speed operation



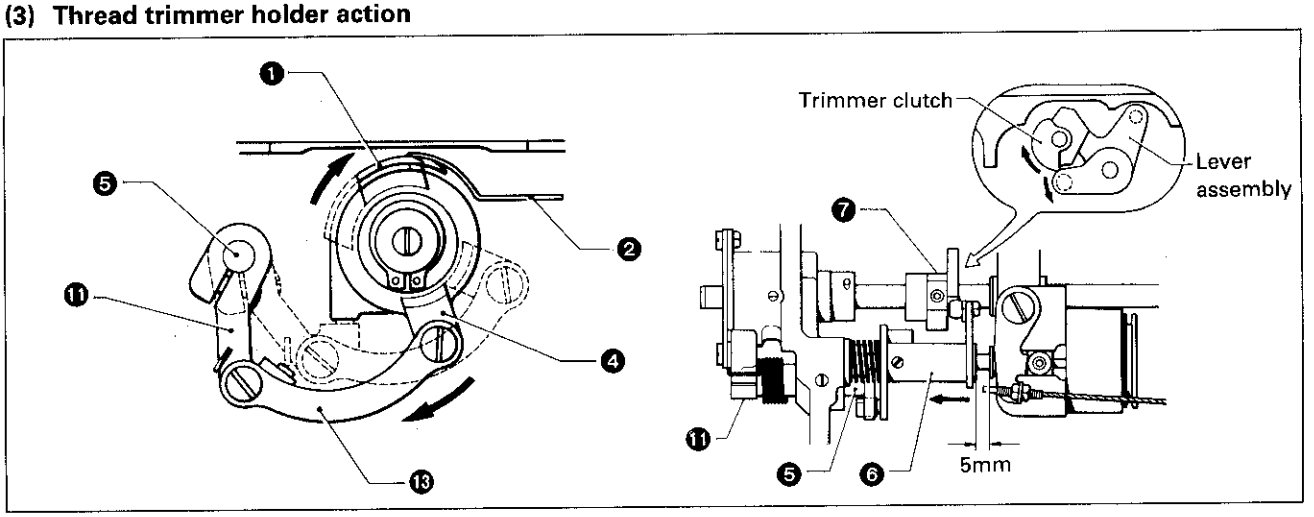
★ Spring ❾ presses the lever assembly ❻ to the thread trimming solenoid ❽, preventing the lever assembly ❻ from engaging the thread trimmer clutch ❼. Accordingly, the thread trimmer holder ❹ does not function. Furthermore, spring ❿ holds thread trimming lever ❶❶ so that thread trimmer holder ❹ does not move.

(2) When the thread trimmer signal is received



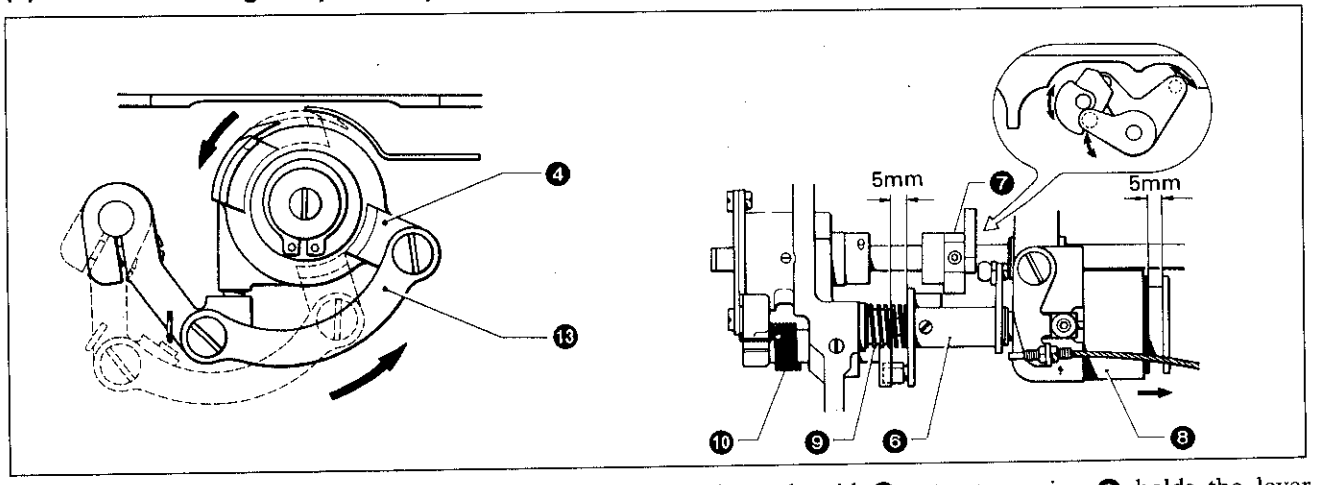
★ When the thread trimmer signal is received, thread trimming solenoid ❽ drives the lever stud ❶❷. The roller stud (right) of the lever assembly ❻ connected to the lever stud ❶❷ moves around the perimeter of the thread trimmer clutch ❼.

(3) Thread trimmer holder action



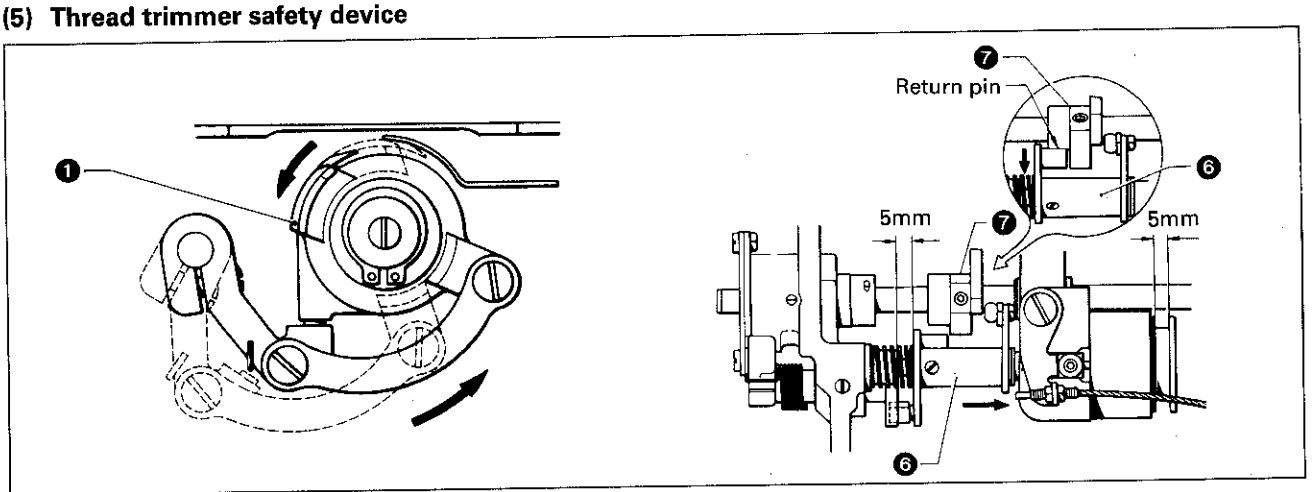
★ As the rotating hook shaft and the thread trimmer clutch ❼ raise the roller stud (right), movement is relayed to the feed fork shaft ❺ via the lever assembly ❻.
★ Movement is then relayed to thread holder ❹ and thread trimming connecting rod ⓭ via thread trimming lever ⓫ connected to the feed fork shaft ❺.
★ The movable knife ❶ connected to thread trimmer holder ❹ moves in the direction of the arrow and overlaps the fixed knife ❷.

(4) Thread trimming complete stop



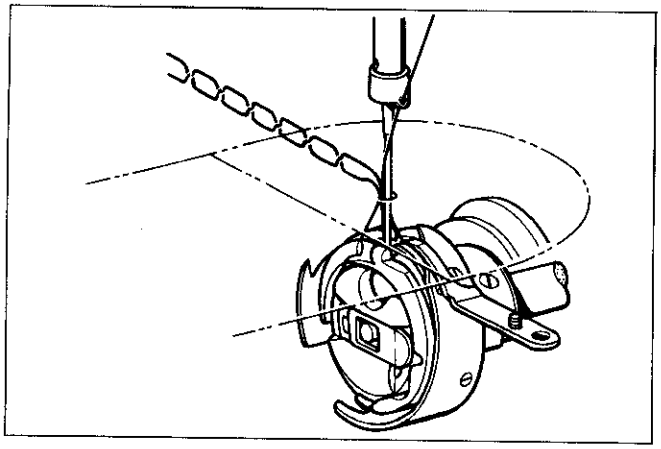
★ When the thread trimmer signal stops, the thread trimming solenoid ❽ retracts, spring ❾ holds the lever assembly ❻, and the roller stud of the lever assembly ❻ moves away from the thread trimmer clutch ❼.
★ The trimming lever spring ❿ returns the thread trimming connecting rod ⓭ and thread trimmer holder ❹ to the initial position (in the direction of the arrow).

(5) Thread trimmer safety device

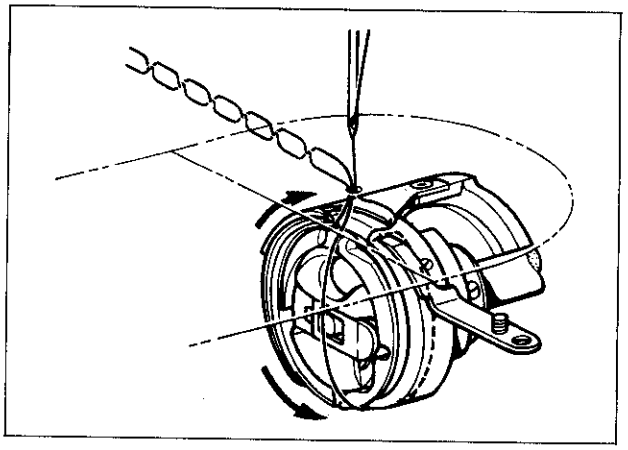


★ If the movable knife ❶ does not completely retract, the return pin (left) of the lever assembly ❻ and the thread trimmer clutch ❼ automatically carry the movable knife ❶ to a position where it will not strike the needle.

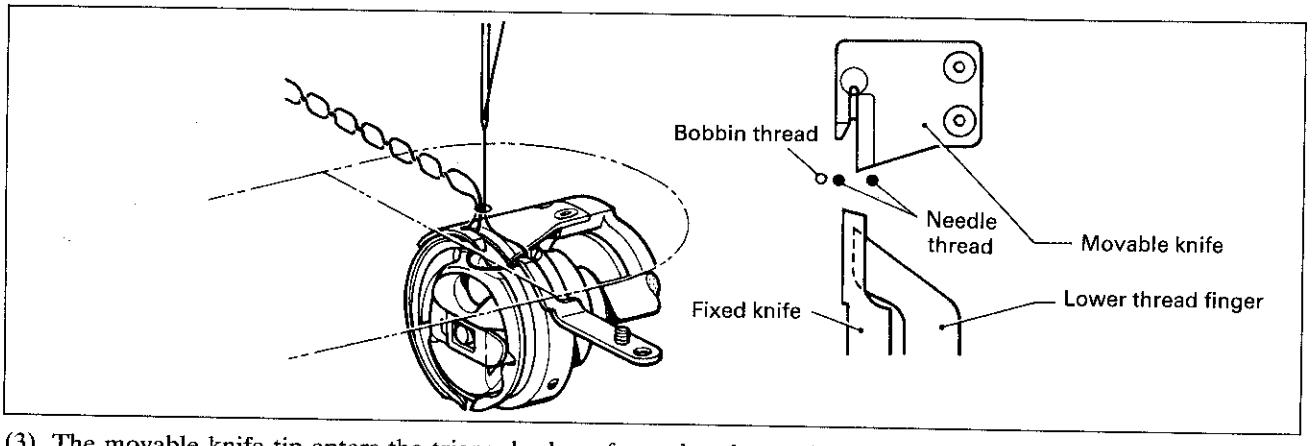
3. Needle and bobbin thread trimming



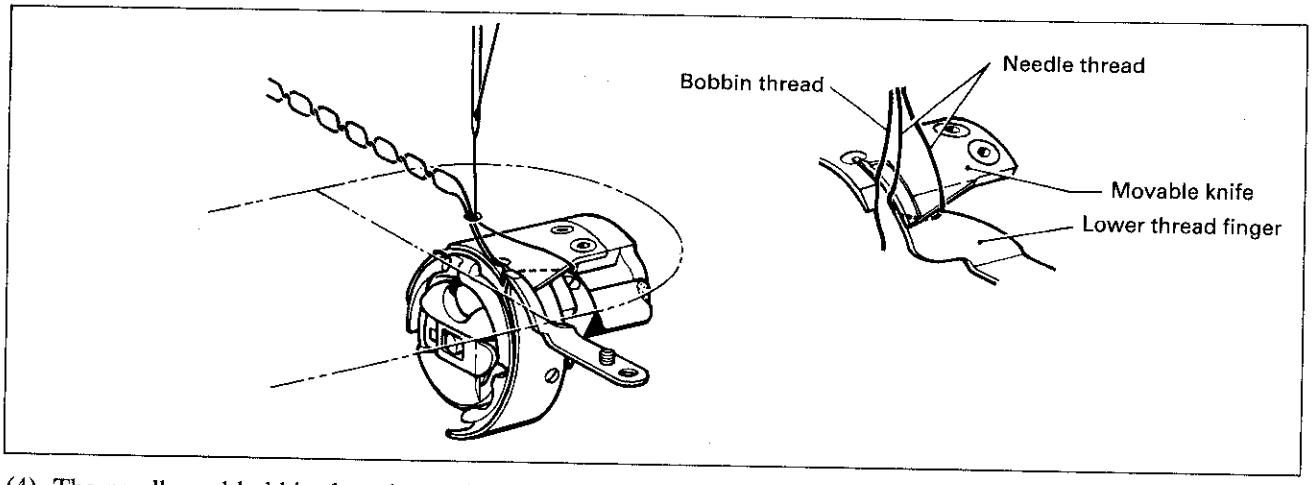
(1) When the needle rises 2.2mm above the down position (stroke-end) the rotary hook point catches the loop formed at the needle.



(2) The thread trimming signal is then relayed, and the thread trimmer clutch drives the movable knife. The needle thread is caught by the rotary hook and fed around the shuttle body.

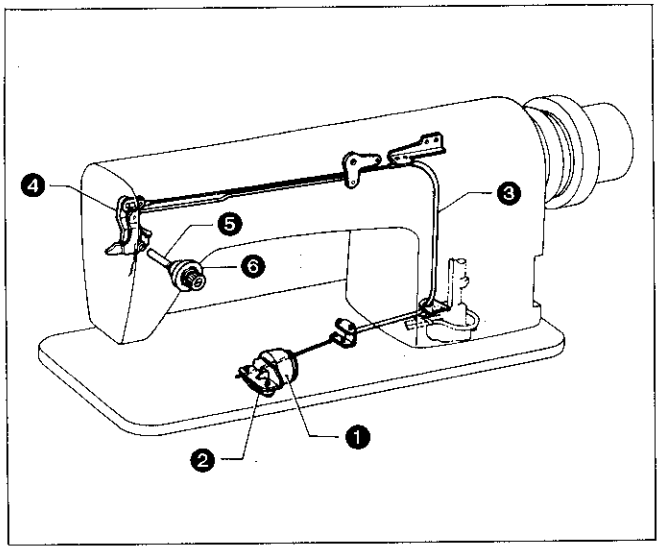


(3) The movable knife tip enters the triangular loop formed underneath the needle plate by the rotary hook point, and needle and bobbin thread loop spreading occurs.
At this point the needle thread take-up is raised slightly above the lowest position (the arm shaft has turned approximately 330°), and the needle thread has been spread by the thread trimmer as shown in the figure above.
If the timing of the above movement is too early, loop spreading will not be performed properly, resulting in thread trimming errors.



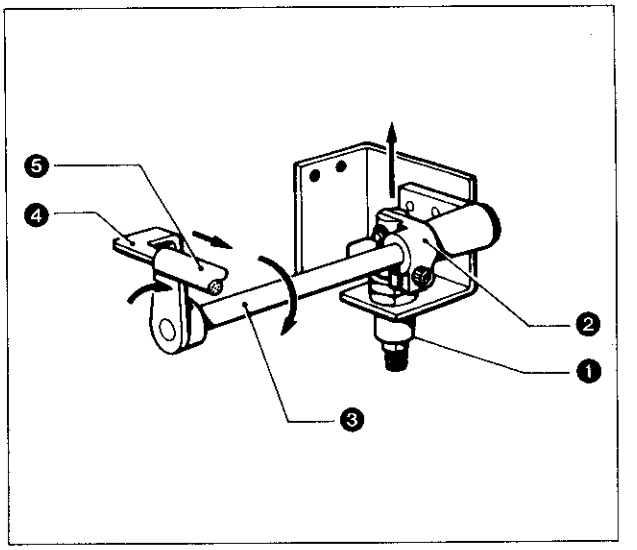
(4) The needle and bobbin threads caught by the movable knife in (3) above are gradually spread by the knife and lower thread finger and cut by the fixed knife tip.
The thread take-up has now approached the top of its stroke.
When the knife is spreading the thread, the tension release mechanism reduces the needle thread tension to prevent excessive tension and to enable the needle thread to be smoothly extended.
The length of thread spread by the movable knife determines the length of thread remaining from the needle tip and bobbin when thread cutting is complete, and effects stitch formation at the beginning of the next sewing procedure.

6 Tension release mechanism



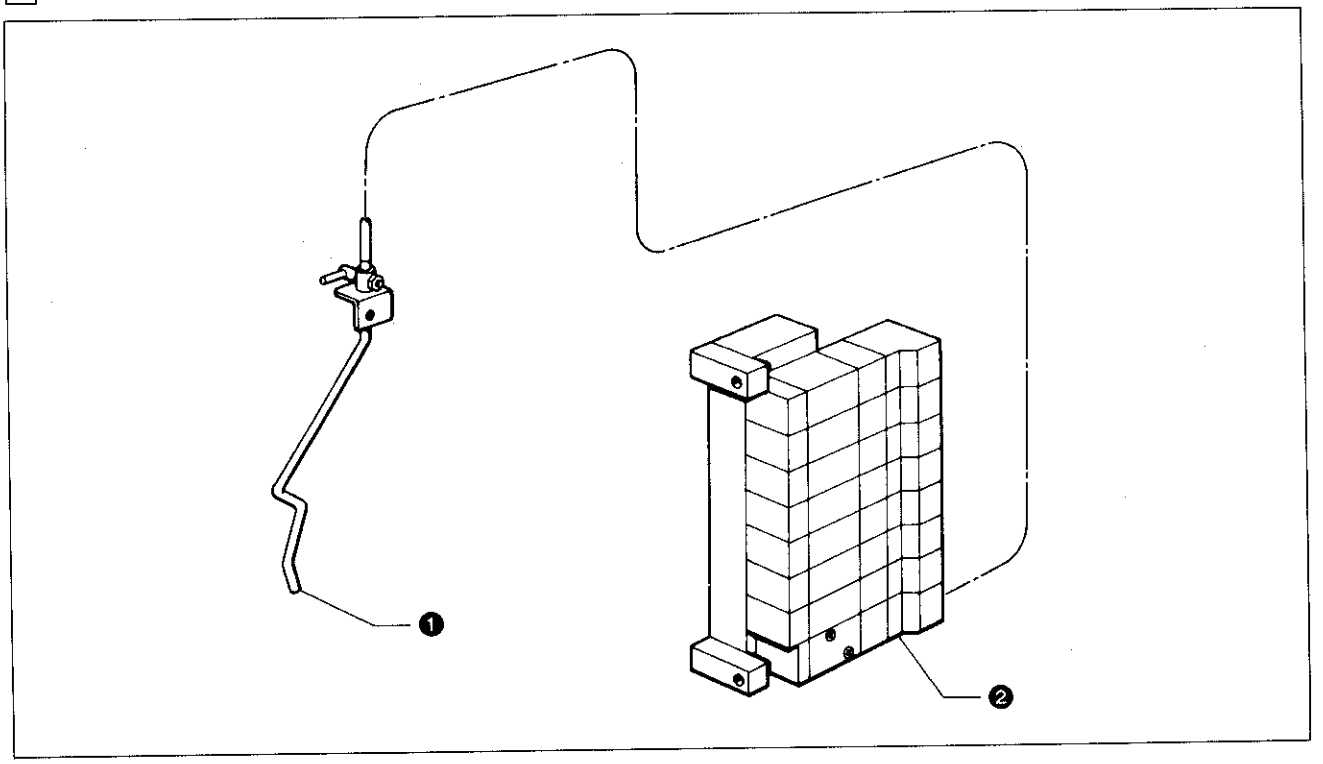
★ When the thread trimming signal is received, the thread trimming solenoid ❶ drives the tension release lever ❷ and tension release wire ❸ so the tension release slide ❹ presses the tension release bar ❺ and opens tension disc ❻.
Power to the thread trimming solenoid is cut when the needle bar is in the needle up stop position and the tension disc closes again.

7 Knife return mechanism



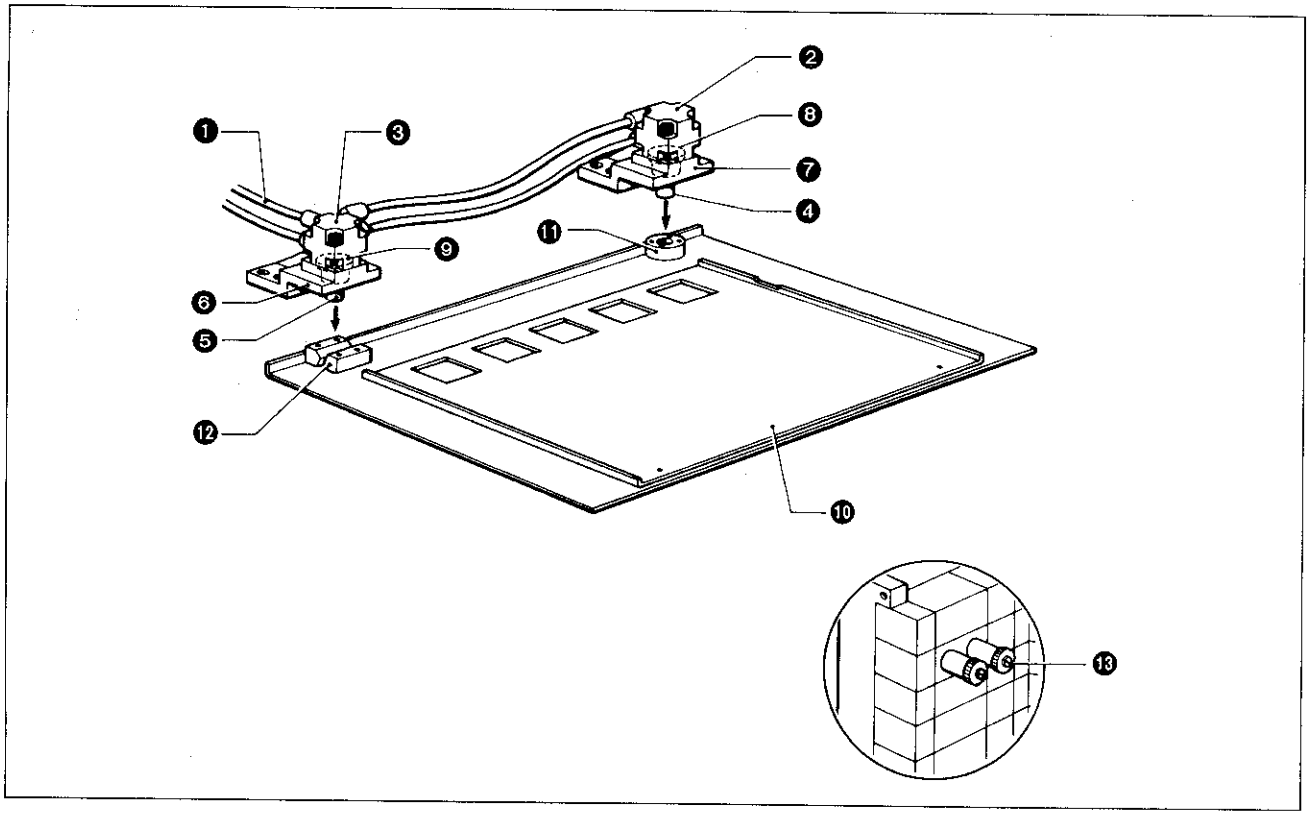
★ After thread trimming is completed, the knife return cylinder ❶ drives the return arm ❹ against the lever stud ❺ via cam return lever ❷ and shaft ❸ to return the movable knife.

8 Needle cooler



★ The needle cooler ❶ solenoid ❷ is synchronized with the sewing machine motor so they turn on and off together. Accordingly, the needle cooler ❶ functions only when sewing.

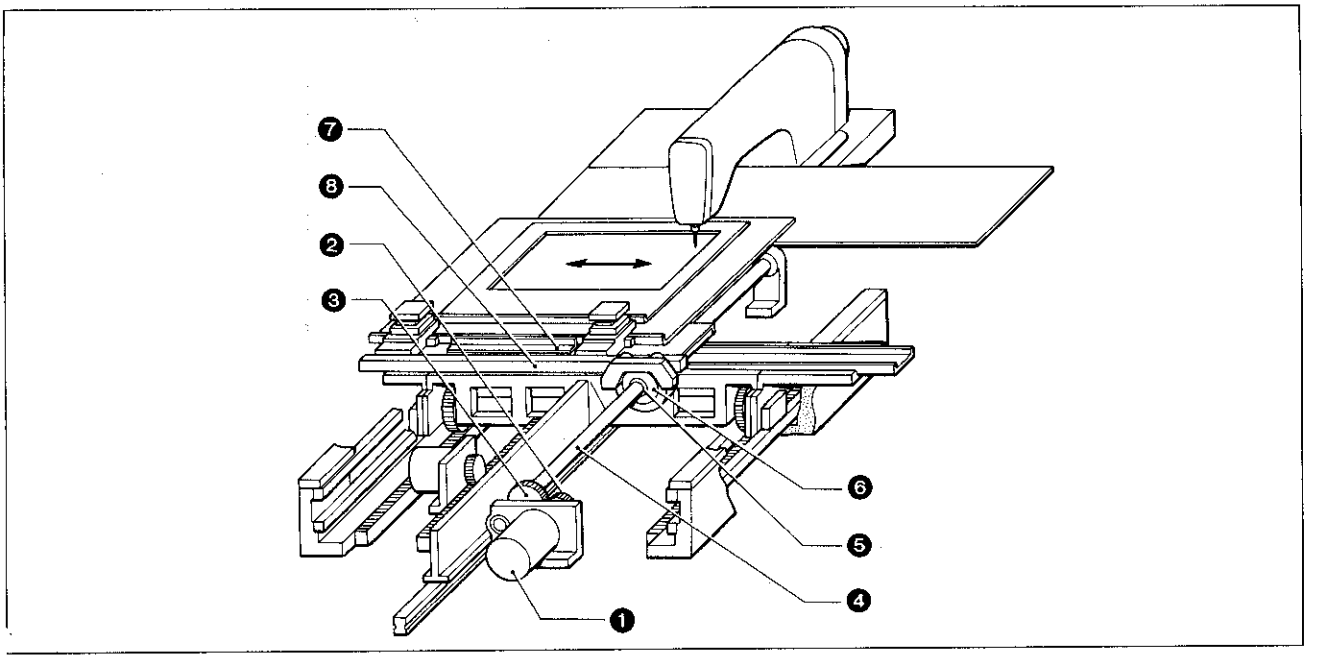
9 Pallet clamp mechanism



1. When pressure is applied to clamp cylinder A ❷ and clamp cylinder B ❸ via air tube ❶, positioning pins ❹ and ❺ mounted on clamp cylinders A and B descend along bushings ❽ and ❾ inserted in cylinder brackets ❻ and ❼.
2. Positioning pin ❹ on cylinder A enters cassette positioner ⓫ on pallet ⓾ first. Positioning pin ❺ on cylinder B then slides into 60° positioning block ⓬ to secure the pallet ⓾ in place.
3. BAS-350 is programmed so that pin B on clamp cylinder B begins to descend 0.4 sec. after pin A on clamp cylinder A. The release valve descent pressure control screw ⓭ on clamp cylinder B ❸ is tightened (screwed in) after cylinder A has fully descended to slow cylinder B ❸ descent so that cylinder A ❷ reaches the bottom before cylinder B ❸.

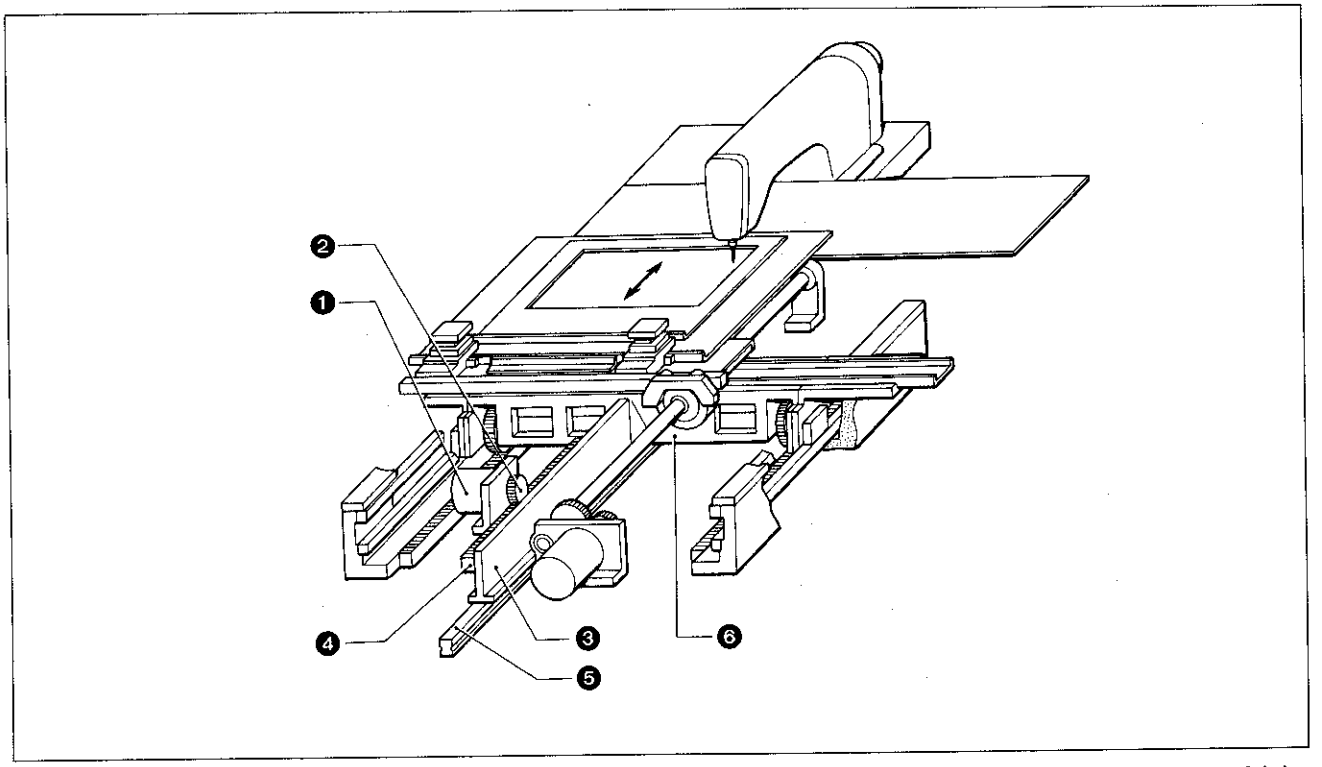
[10] Feed drive mechanism

1. X-feed drive mechanism



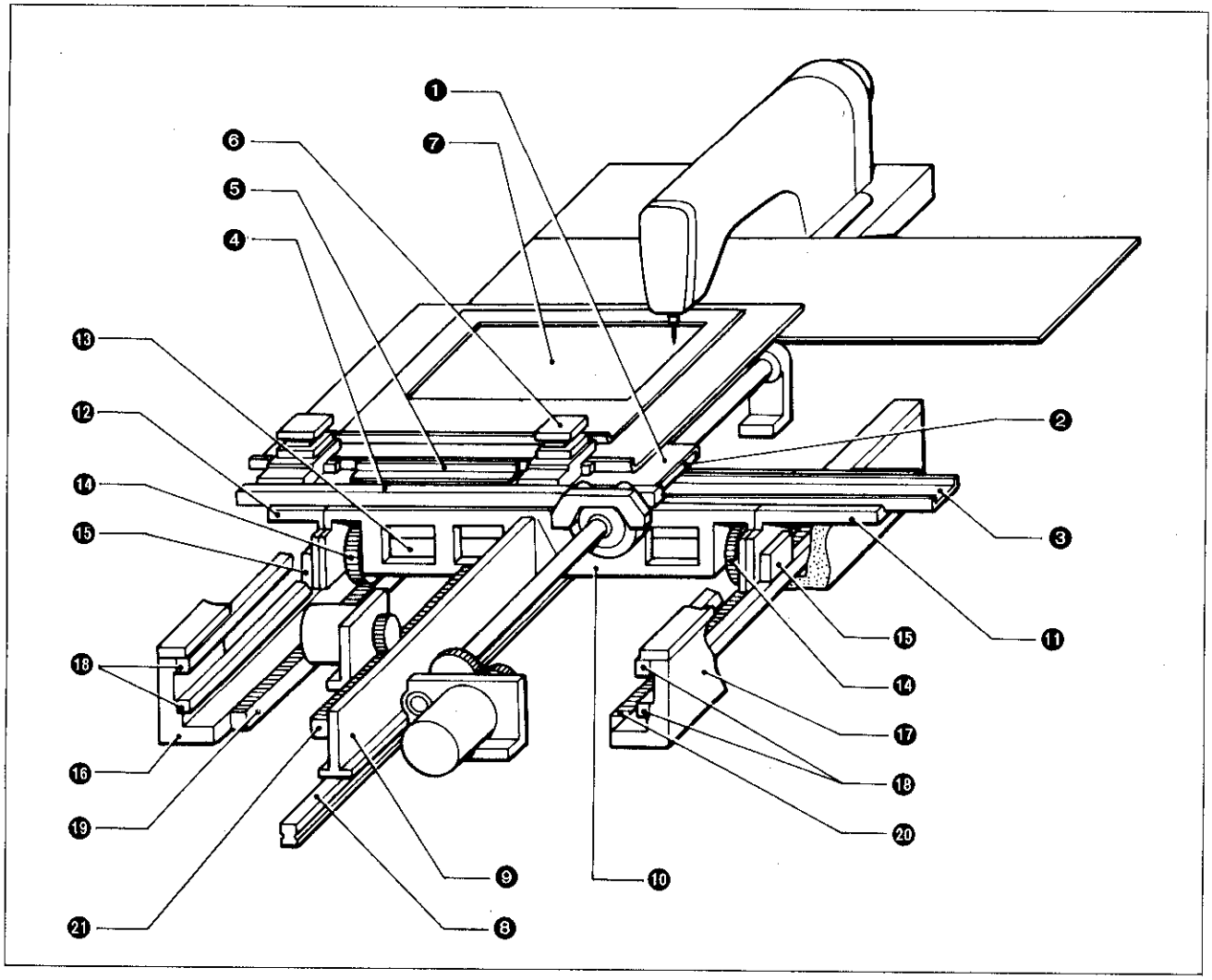
(1) When the pulse motor ❶ turns, ball spline shaft ❹ is turned via X-driving gear ❷ and X-gear assembly ❸.
(2) When ball spline shaft ❹ rotates, X-gear assembly ❻ connected to the spline bearing ❺ turns.
(3) X-gear assembly ❻ meshes with rack ❽ mounted on X-traverse body ❼, thereby transmitting pulse motor ❶ power to the X-feed guide assembly.

2. Y-feed drive mechanism



(1) When the pulse motor ❶ turns, Y-driving rack ❹ mounted on Y-driving rack base ❸ meshes with Y-driving gear ❷, and Y-driving rack base ❸ is driven in a straight line along linear way slim ❺.
(2) Y-driving rack base ❸ is guided by linear way slim ❺, and pulse motor ❶ action is transmitted to the stroke frame ❻ mounted on the Y-driving rack base ❸.

11 Feed guide mechanism



1. X-feed guide mechanism

(1) Slide pack ❷ runs along slide rail ❸ and transmits the motion of the X-rack ❹ to the X-traverse body ❶.
(2) Pallet stop plate ❺ and clamp assembly ❻ are mounted on X-traverse body ❶ and support and drive pallet ❼.

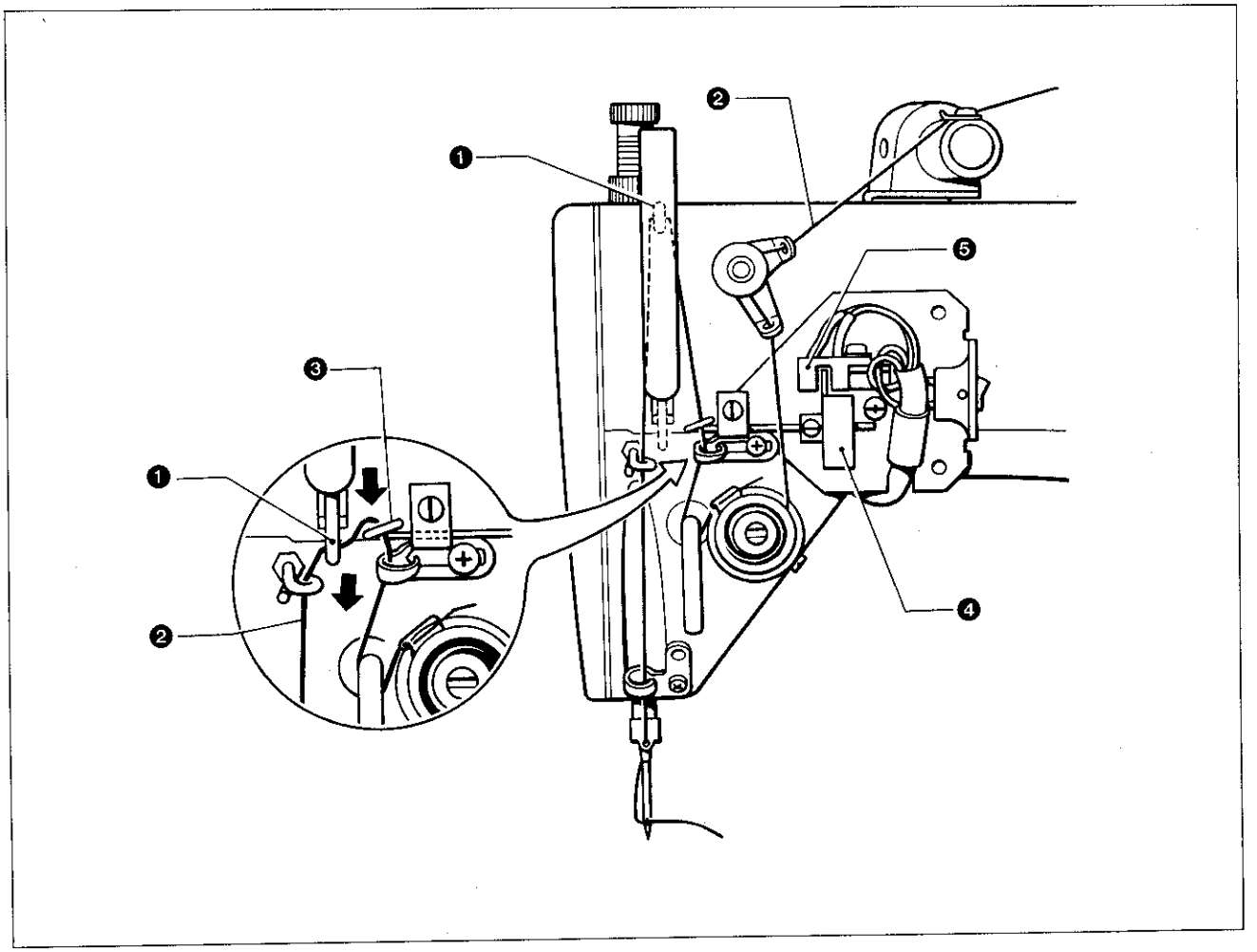
2. Y-feed guide mechanism

(1) Y-driving rack base ❾ guided by linear way slim ❽ transmits the Y-axis motion of Y-driving rack ㉑ mounted on Y-driving rack base ❾ to the stroke frame ❿, also mounted on the Y-driving rack base ❾.
(2) Rail guide L ⓫, R ⓬ and shaft ⓭ are mounted on stroke frame ❿.
The gear assemblies ⓮ are fixed on both ends of shaft ⓭.
(3) A slide pack ⓯ is mounted on both rail guide L ⓫ and rail guide R ⓬. Slide packs ⓯ are guided by the guide rails ⓲ on right and left guide rail bodies ⓰ ⓱, thereby guiding the Y-axis motion of the stroke frame ❿.
(4) The gear assemblies ⓮ on both ends of the shaft ⓭ mounted on the stroke frame ❿ mesh with Y-racks ⓳ and ⓴ mounted on the right and left guide rail bodies ⓰ and ⓱, thereby assisting transmitting Y-axis motion.

[12] Needle thread breakage detector specifications and use

(1) The thread breakage signal is monitored every stitch.
(2) If the thread signal is not received for eight continuous stitches, the needle thread is determined to have broken and the machine is stopped. The emergency stop indicator will light and U-96 will appear in the display. The machine will stop within approximately 10 stitches after a thread breakage occurs, although this will vary slightly with different sewing speeds.
(3) To cancel the emergency stop, turn the emergency stop switch on. The machine will automatically cut the thread, assume the needle up stop position, and await operator input.
(4) The machine can be stepped back after cancelling the emergency stop.
(5) Turn the needle thread breakage detector switch ON for the thread breakage detector to function.
*Turn the needle thread breakage detector switch OFF if the thread breakage detector function is not desired.

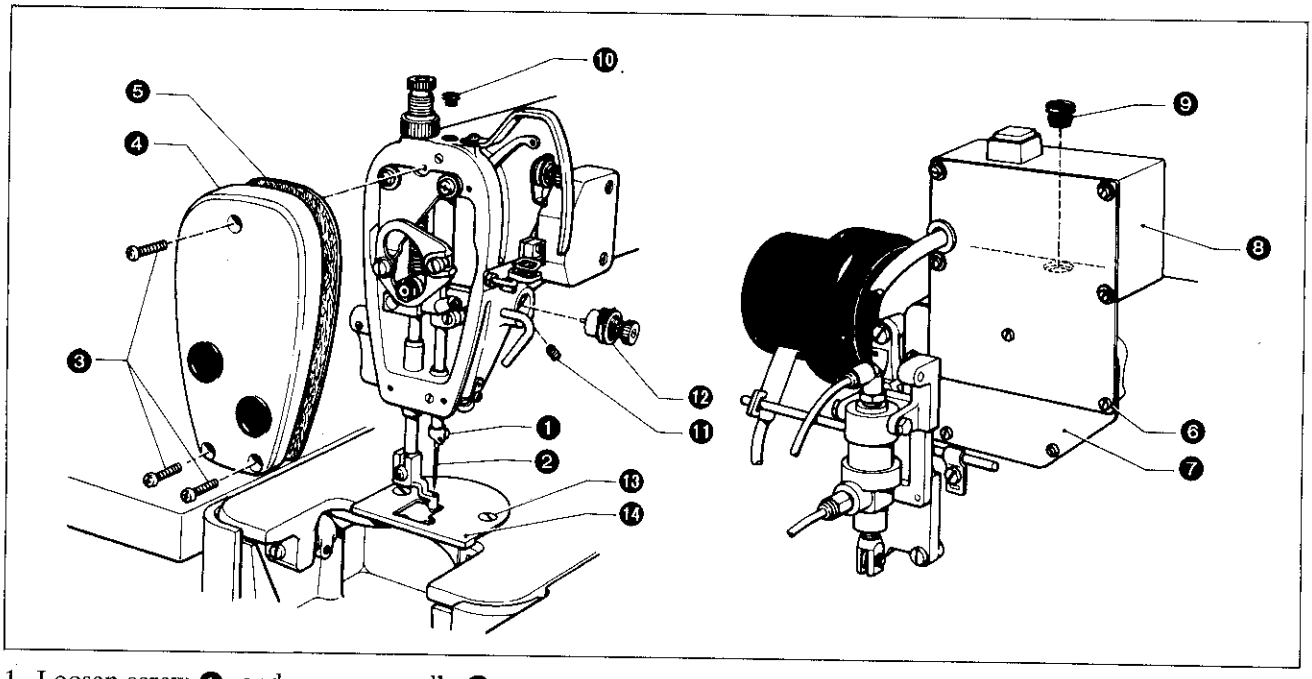
Needle thread breakage detector operation



(1) When the needle thread take-up ❶ reaches the bottom of its stroke, the needle thread ❷ is paid out and tension applied by the tension disc.
(2) When the take-up ❶ goes below stud ❸, the tension on the needle thread ❷ pulls and turns the stud ❸ in the direction of the arrow.
(3) The slit ❹ on stud ❸ moves in the same manner.
(4) A photo-interrupter ❺ picks up the motion of this slit ❹ and sends a signal to the control circuit board.
(5) If the needle thread ❷ breaks, tension cannot be applied to the needle thread and the stud ❸ and slit ❹ will not turn. The photo-interrupter ❺ will no longer detect slit ❹ motion, thereby determining that the needle thread has broken.

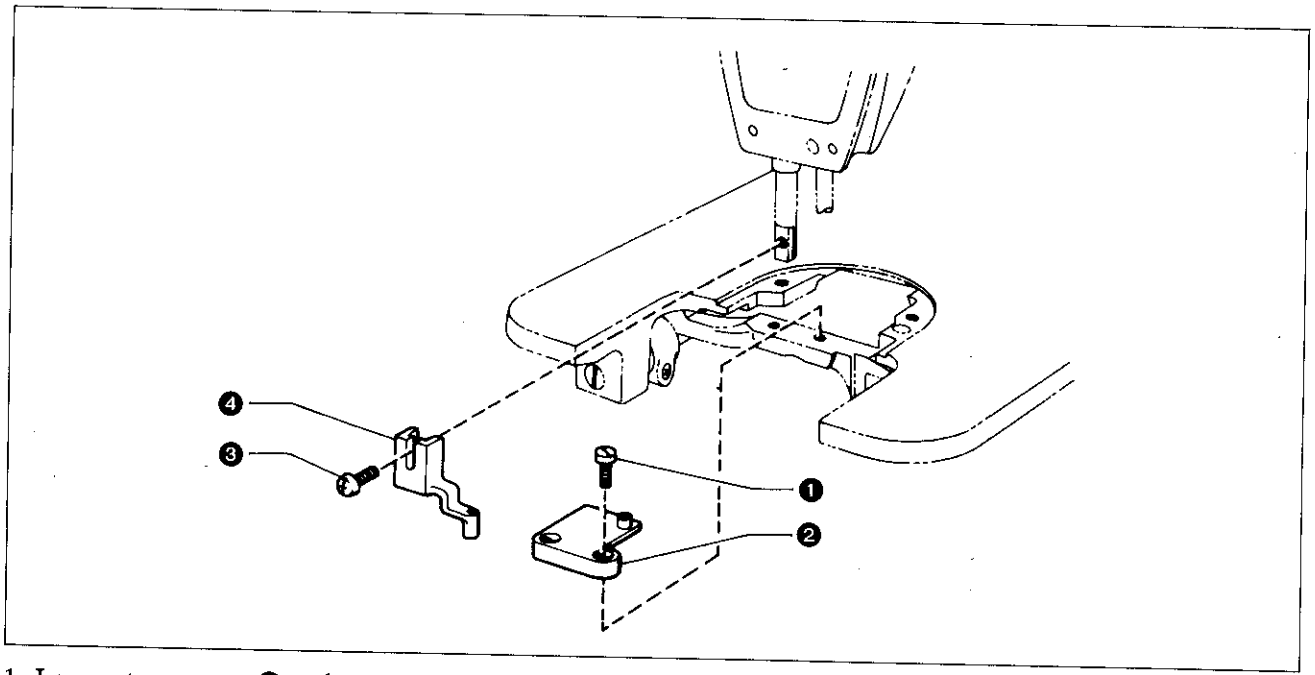
Disassembly

1 Machine cover



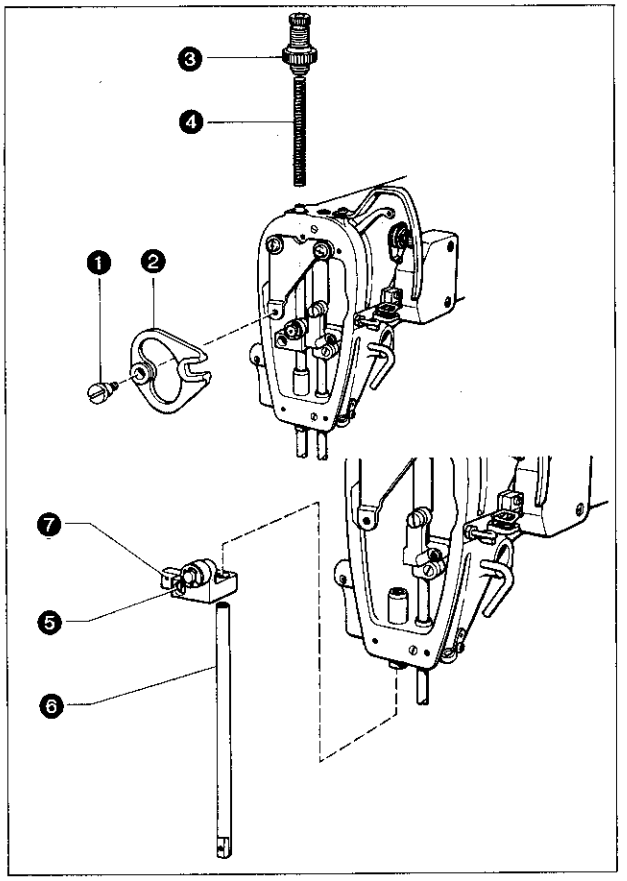
1. Loosen screw ❶, and remove needle ❷.
2. Loosen the three screws ❸, and remove face plate ❹ and gasket ❺.
3. Loosen the seven screws ❻, and remove side plate ❼ and display ❽.
4. Remove arm oil cap ❾, and needle bar oil cap ❿.
5. Remove screw ⓫, and remove needle thread tension regulator bracket ⓬.
6. Remove two screws ⓭, and remove the needle plate ⓮.

2 Presser foot



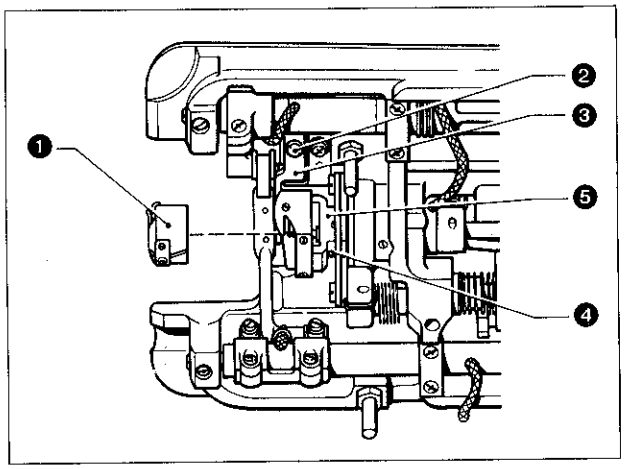
1. Loosen two screws ❶ and remove bottom plunger ❷. (Raise presser foot ❹ with the presser foot lifter lever.)
2. Remove screws ❸ and remove presser foot ❹.

3 Intermittent presser foot assembly



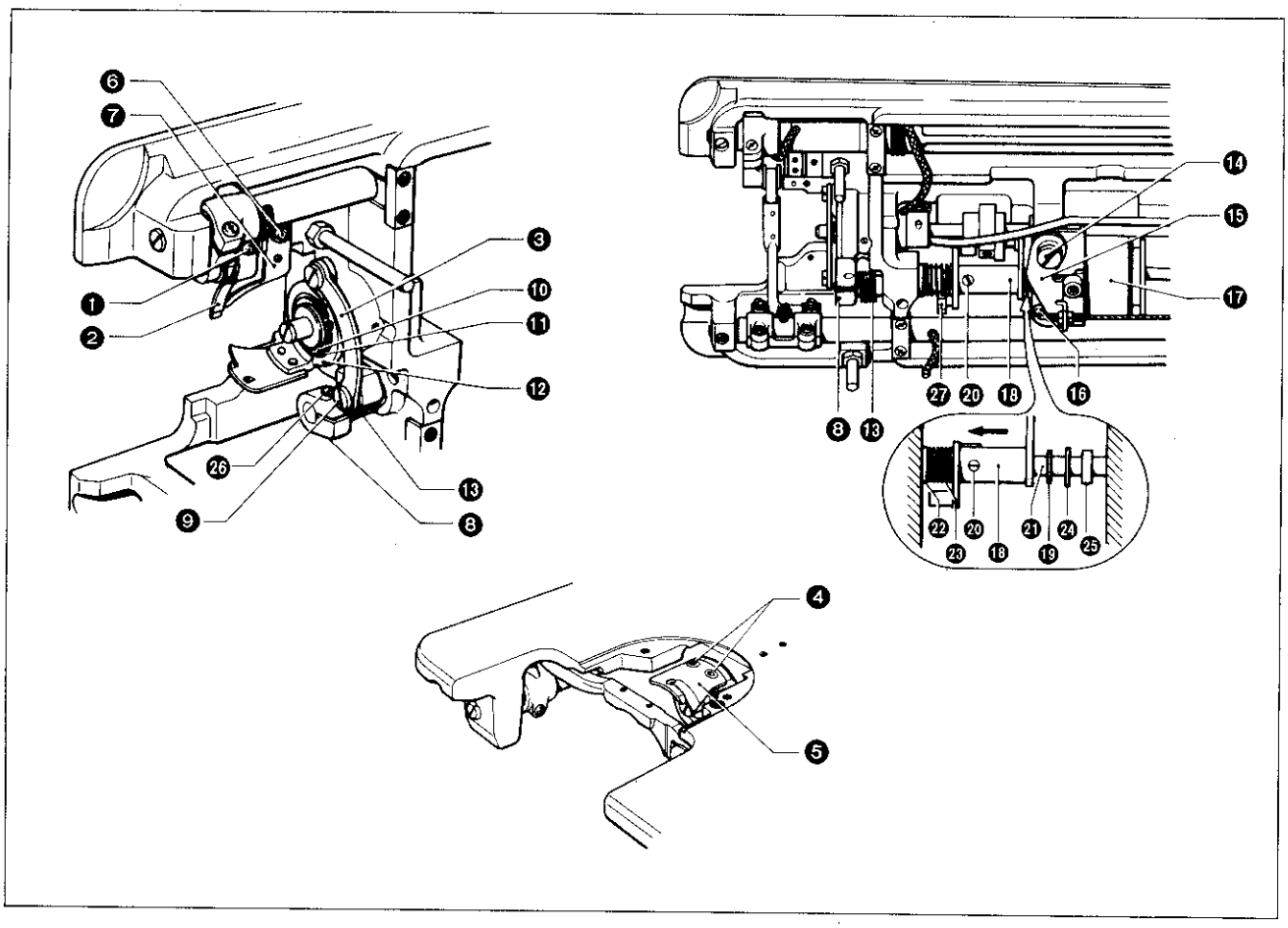
1. Remove screw ❶ and remove the intermittent presser foot cam ❷.
2. Remove screw ❸ and remove spring ❹.
3. Loosen screw ❺, pull the presser bar ❻ out from the top, and remove intermittent presser bar clamp ❼.

4 Rotary hook assembly



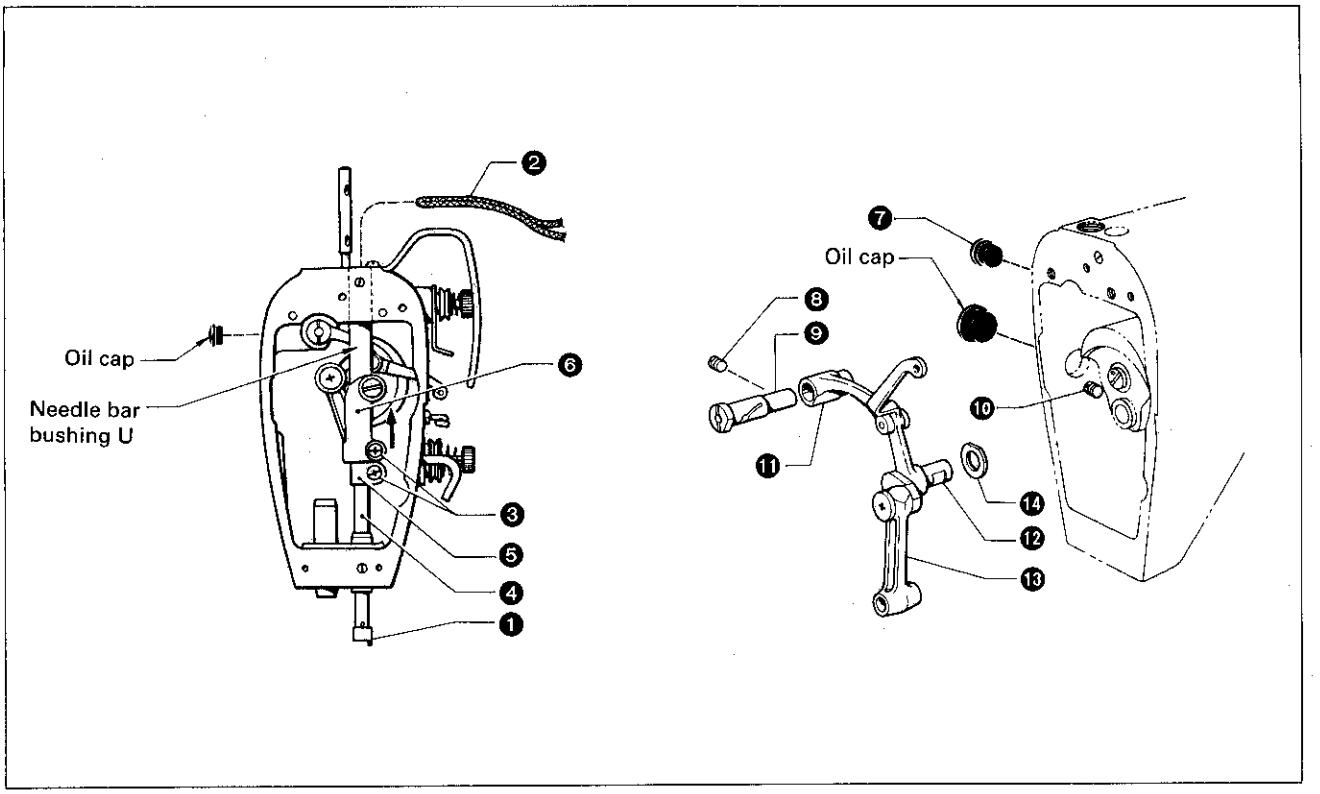
1. Tilt the machine.
2. Remove the bobbin case ❶.
3. Remove screw ❷ and remove bobbin case holder position bracket ❸.
4. Loosen the three set screws ❹ and remove rotary hook ❺.

5 Thread trimmer assembly



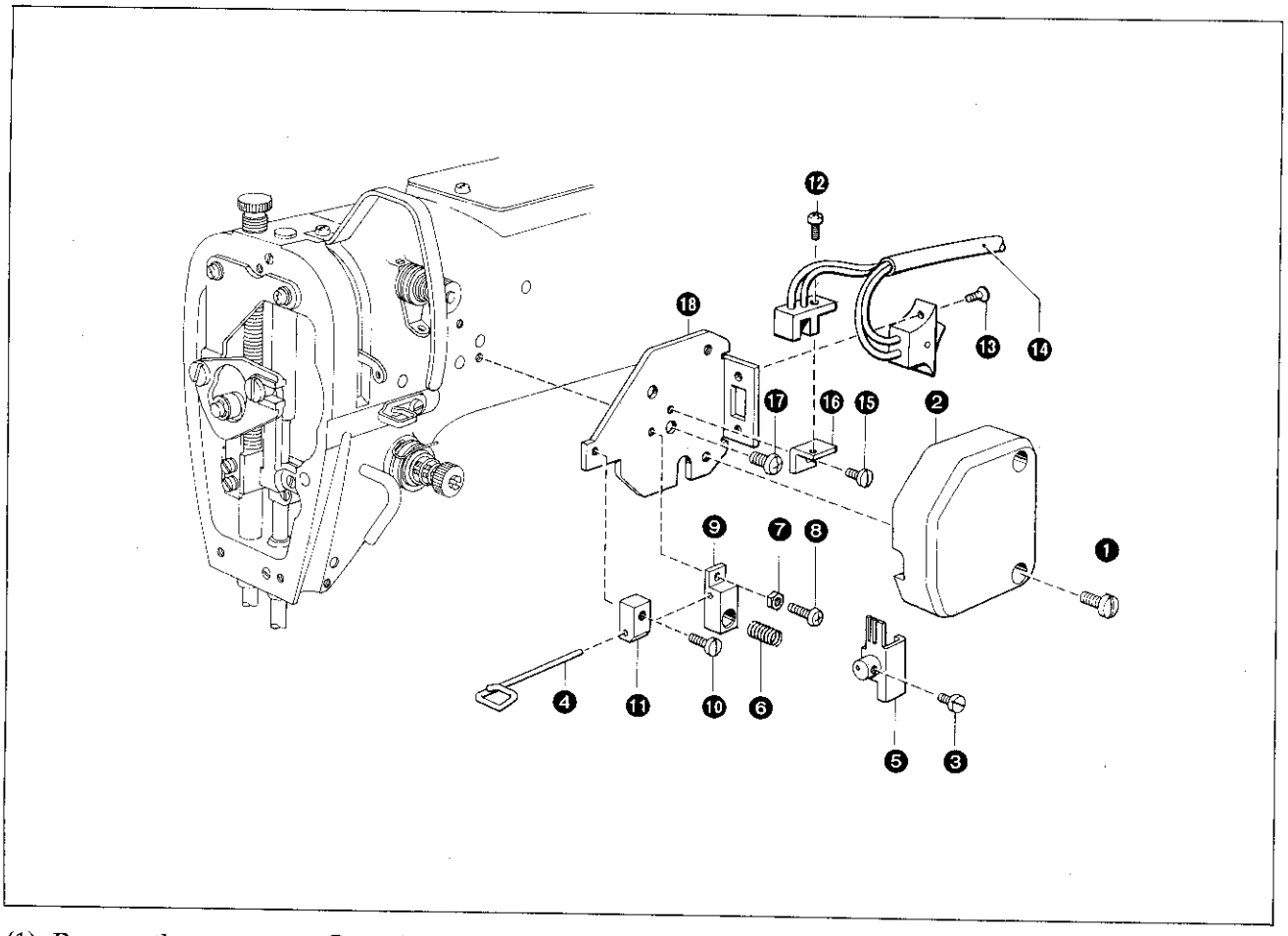
1. Remove screw ❶ and remove fixed knife ❷.
2. Press thread trimming connecting rod ❸ in the direction of the arrow until the two flat screws ❹ are visible.
3. Remove screws ❹, and remove movable knife ❺.
4. Remove screw ❻, and remove lower thread finger ❼.
5. Remove screw ❾ in thread trimming lever ❽.
6. Remove the snap ring ❿, washer ⓫, movable knife holder ⓬, and thread trimming connecting rod ❸.
7. Remove trimming lever spring ⓭.
8. Remove screw ⓮, and remove tension release lever ⓯.
9. Remove screw ⓰, and remove thread trimming solenoid ⓱.
10. Move thread trimmer clutch lever ⓲ in the direction of the arrow, and remove snap ring ⓳.
11. Loosen screw ⓴, and remove lever stud ㉑ to the right (by the thread trimming solenoid).
12. Remove collar ㉒, spring ㉓, lever assembly ⓲, washer ㉔, and cushion ㉕.
13. Remove screw ㉖, and remove thread trimming lever ❽, spring ⓭, and feed fork shaft ㉗.

6 Needle bar assembly



1. Raise the machine.
2. Remove needle bar thread guide ❶.
3. Remove wick ❷ from the top of the needle bar bushing U.
4. Loosen screw ❸, and remove needle bar ❹ and needle bar clamps ❺ and ❻. (Remove the slide block.)
5. Remove oil cap ❼, loosen screw ❽, and remove stud ❾.
6. Remove the oil cap, loosen the two screws ❿, and remove the thread take-up supporter ⓫, needle bar crank ⓬, needle bar connecting rod ⓭, and washer ⓮.

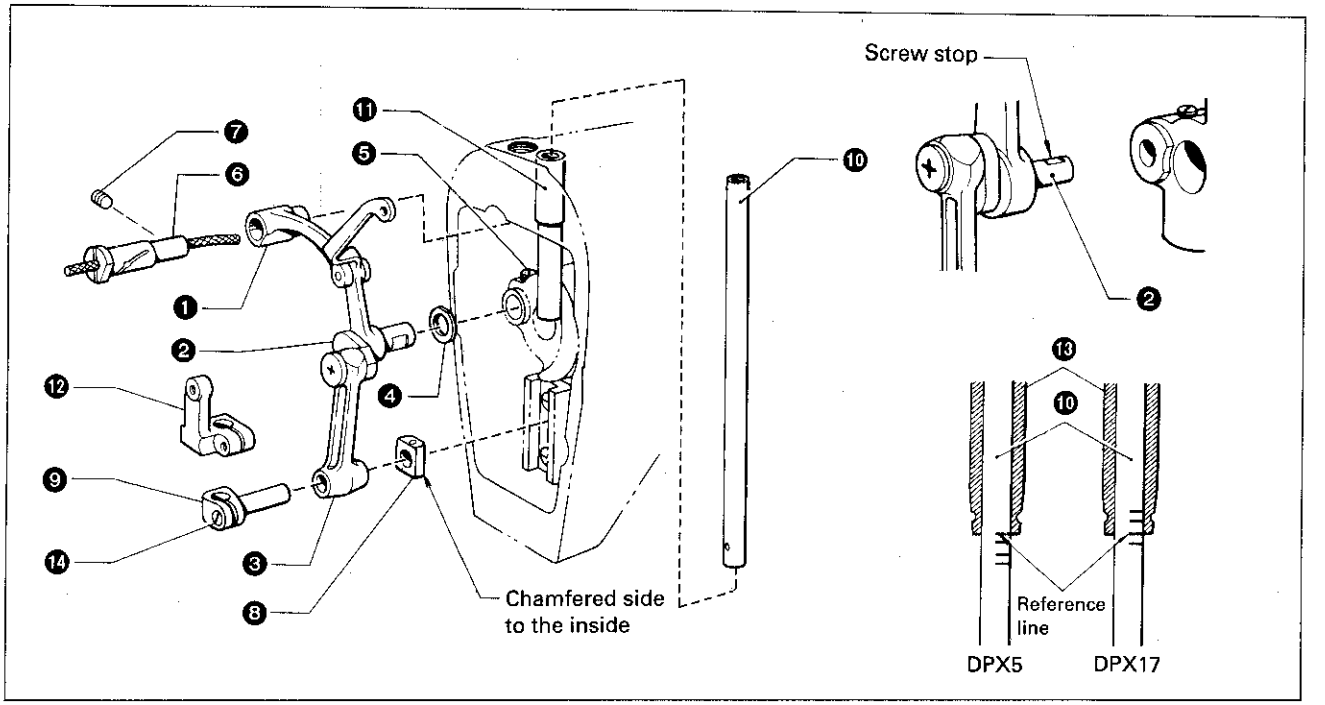
7 Needle thread breakage detector



(1) Remove the two screws ❶, and remove cover ❷.
(2) Loosen screw ❸, and remove shaft ❹, slit ❺, and sensing spring ❻.
(3) Loosen nut ❼, remove screw ❽, and remove shaft support B ❾.
(4) Remove screw ❿, and remove shaft support A ⓫.
(5) Remove screw ⓬ and two screws ⓭, and then remove thread breakage detector complete ⓮.
(6) Remove screw ⓯, and remove setting plate ⓰.
(7) Remove two screws ⓱, and remove thread monitor plate ⓲.

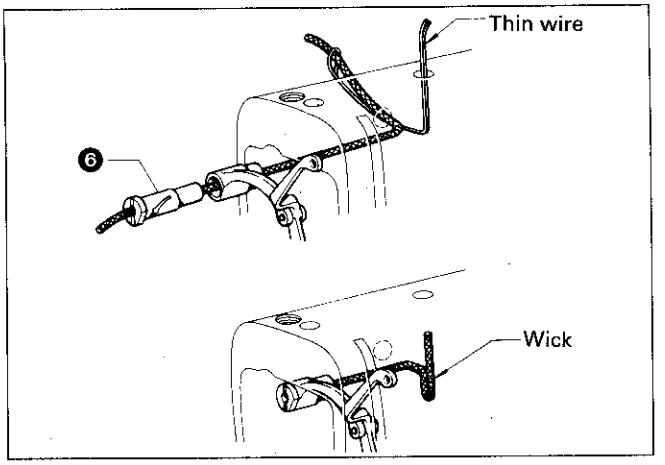
Assembly

1 Needle bar assembly

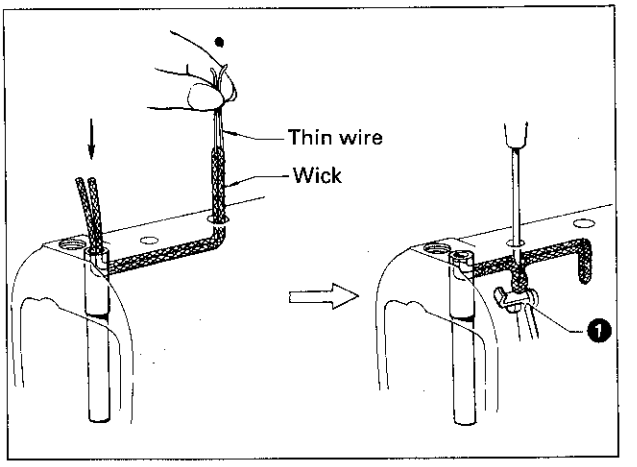


(1) Install the thread take-up lever supporter ❶, needle bar crank ❷, needle bar connecting link ❸, washer ❹, and secure these with set screw ❺.
*See the figure above for the correct position of the needle bar crank screw stop.
(2) Pass the wick through stud ❻.
(3) Slide the stud ❻ into thread take-up lever supporter ❶, fit this in the arm, and then secure with screw ❼.
(4) Slide the slide block ❽ into the channel, and then side the needle bar clamp ❾ into the needle bar connecting link ❸ and slide block ❽.
(Be sure the chamfered side of the slide block is facing the inside.)
(5) Insert the needle bar ❿ from the top of needle bar bushing U ⓫ through needle bar clamps ❾ and ⓬.
(6) Pass the wick through needle bar bushing U ⓫.
(7) Turn the pulley to lower the needle bar to the down stroke end position.
(8) Align the needle bar ❿ reference line with the bottom edge of needle bar bushing D ⓭, and tighten screw ⓮.

■ Wick insertion

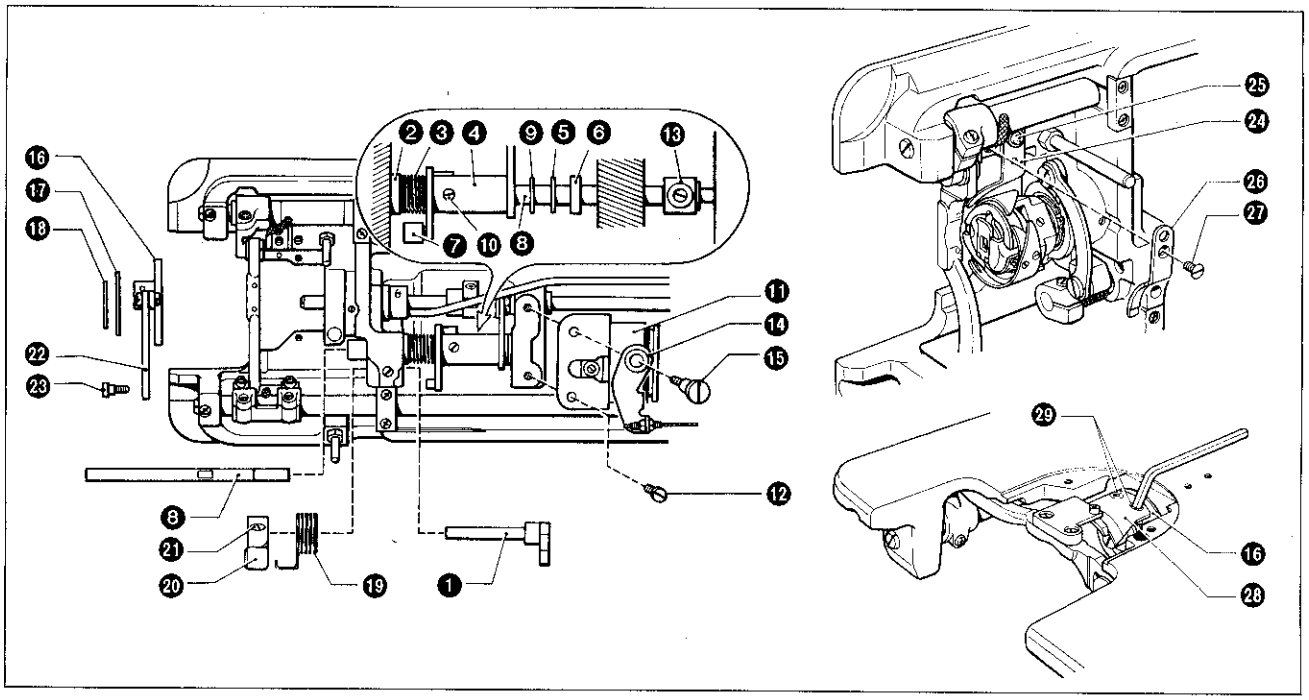


(1) Pass the wick through stud ❻.
(2) Pull the wick through stud ❻ while sliding the stud in place.
(3) Pass a thin wire through the oil hole on the arm top and pull the wick out.
(4) Align one end of the wick with the end of the stud ❻ and the other in the oil hole.



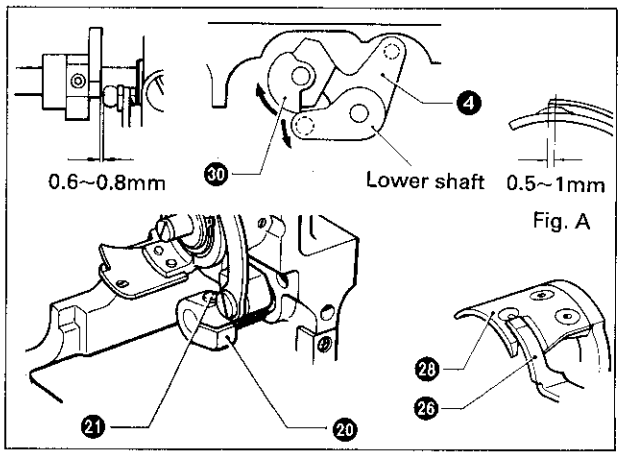
(1) Insert the wick through the top of the needle bar bushing.
(2) Turn the pulley to raise the thread take-up lever to the top of its stroke.
(3) Insert the wick as shown in the top figure until it contacts the top of the thread take-up main ❶.
(4) Stuff both ends of the wick in the holes.

2 Thread trimmer assembly



(1) Set the feed fork shaft ❶ in the arm bed.
(2) Set the collar ❷, spring ❸, lever assembly ❹, washer ❺, and cushion ❻ in the arm bed. (Fit the slide block ❼ of the lever assembly ❹ in the feed fork shaft ❶, and then secure the lever stud ❽.)
(3) Fit the E-ring ❾ on the lever stud ❽.
(4) Secure screw ❿.
(5) Secure thread trimming solenoid ⓫ to the arm bed with screw ⓬.
Be sure the solenoid lever ⓭ on the thread trimming solenoid ⓫ lightly touches lever stud ❽.
(6) Secure tension release lever ⓮ with screw ⓯.
(Refer to page 29 for tension release adjustment.)
(7) Mount the thread trimmer holder ⓰ in the arm bed, and secure with washer ⓱ and snap ring ⓲.
(8) Fit spring ⓳ and thread trimming lever ⓴ in the feed fork shaft ❶, and tighten screw ㉑.
(9) Secure thread trimming connecting rod ㉒ to thread trimming lever ⓴ with screw ㉓.
(10) Secure lower thread finger ㉔ in the arm bed with screw ㉕.
(11) Secure the fixed knife ㉖ to the arm bed with screw ㉗.
(12) Secure movable knife ㉘ to the movable knife holder ⓰ with the two screws ㉙.
(13) Hook spring ⓳ on the thread trimming lever ⓴.
(14) Check the thread trimmer clutch position.

*Set the lower thread finger ㉔ toward the movable knife to assure a sufficient gap to the rotary hook.



■ Thread trimmer timing adjustment

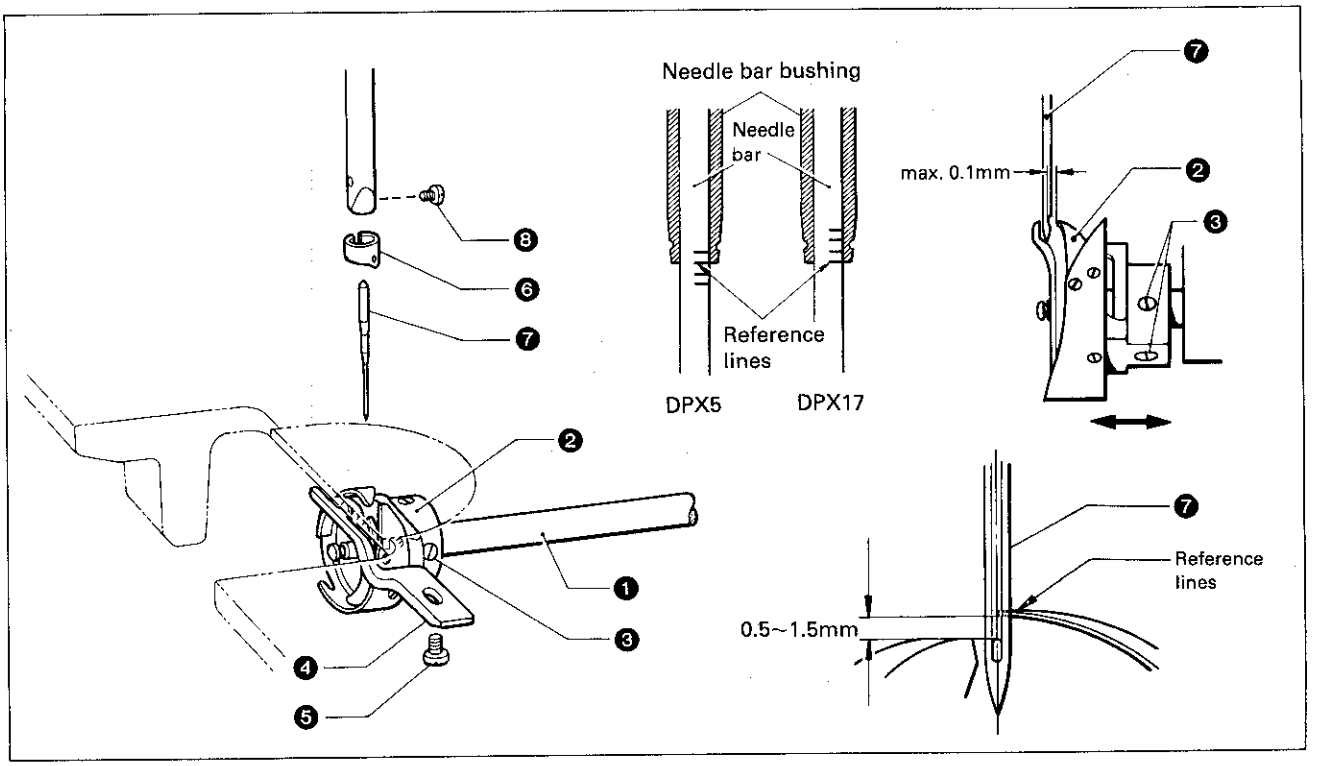
1. Thread trimmer clutch position

★ Turn the pulley to raise the needle bar 7.5mm from the down stroke end position. Press the thread trimming solenoid ⓫ so the indent in the thread trimmer clutch ㉚ contacts the slide, and so that when the lever stud ❹ retracts there is a 0.6 to 0.8mm gap between the clutch side and slide block.

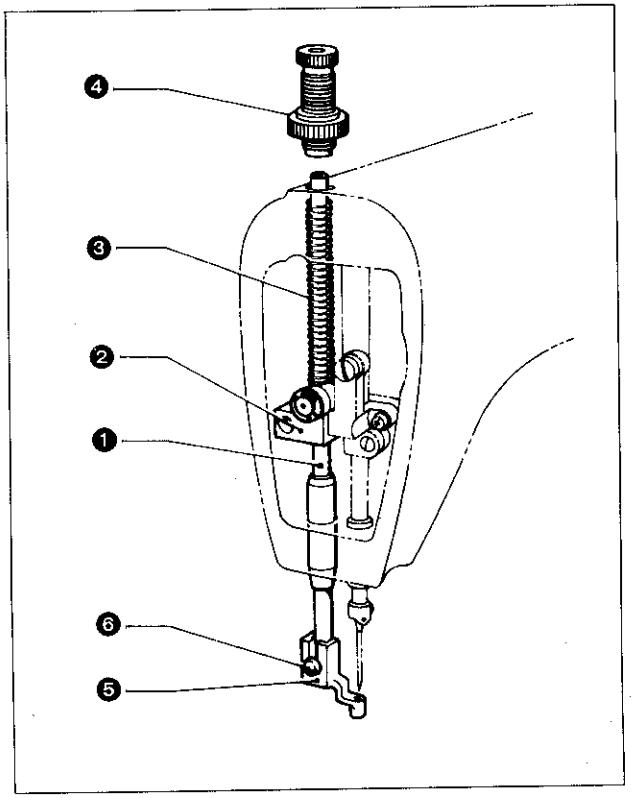
2. Movable knife, fixed knife position

★ The fixed knife ㉖ and movable knife ㉘ must overlap as shown in Fig. A when the slide of lever stud ❹ rides up on the thread trimmer clutch ㉚. To adjust, raise the slide with the thread trimmer clutch ㉚, shift the thread trimming lever ⓴ so the knives overlap, and then tighten screw ㉑.

3 Rotary hook assembly

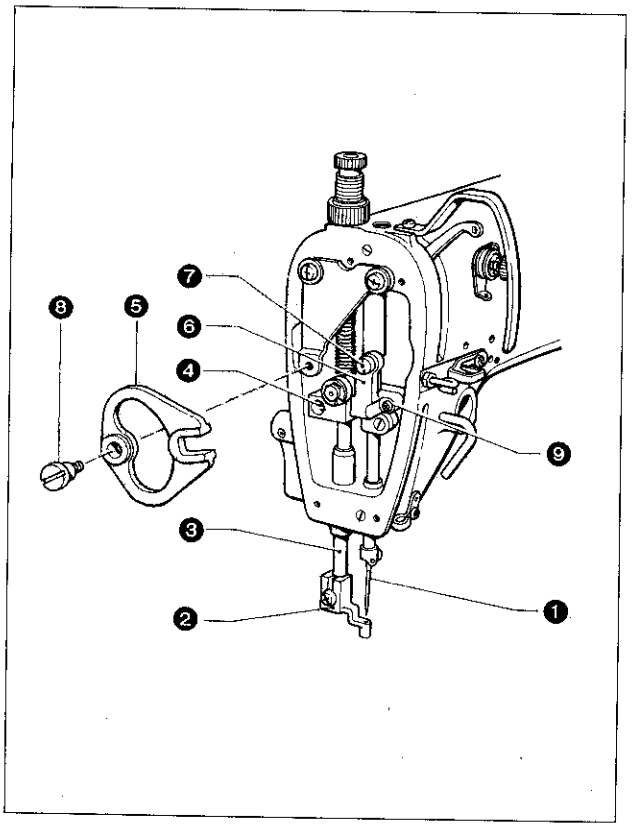


1. Mount the rotary hook ❷ on the lower shaft ❶, and lightly secure it with one of the three screws ❸. Be sure tighten all three screws ❸ after alignment is complefed.
2. Secure bobbin case holder position bracket ❹ with screw ❺.
3. Fit the needle bar thread guide ❻ on the needle bar, and tighten screw ❽ to secure the needle ❼.
4. Turn the pulley to raise the needle bar from the down position until the needle bar reference line is aligned with the bottom of the needle bar bushing.
5. Align the rotary hook point with the needle ❼ center.
   Adjust the rotary hook point to needle hole top gap to 0.5 to 1.5mm, and the needle ❼ to rotary hook point gap to less than 0.1mm.
   *Make sure the bobbin case holder position bracket ❹ to rotary hook ❷ gap is sufficient to allow the thread to pass easily.



4 Presser foot assembly

1. Insert the presser bar ❶ from the top of the arm.
2. Insert the presser bar clamp ❷ in the arm channel, and then pass the presser bar ❶ through the clamp ❷.
3. Mount spring ❸ and tighten the presser adjusting screw ❹.
4. Secure the presser foot ❺ to the presser bar ❶ with screw ❻.



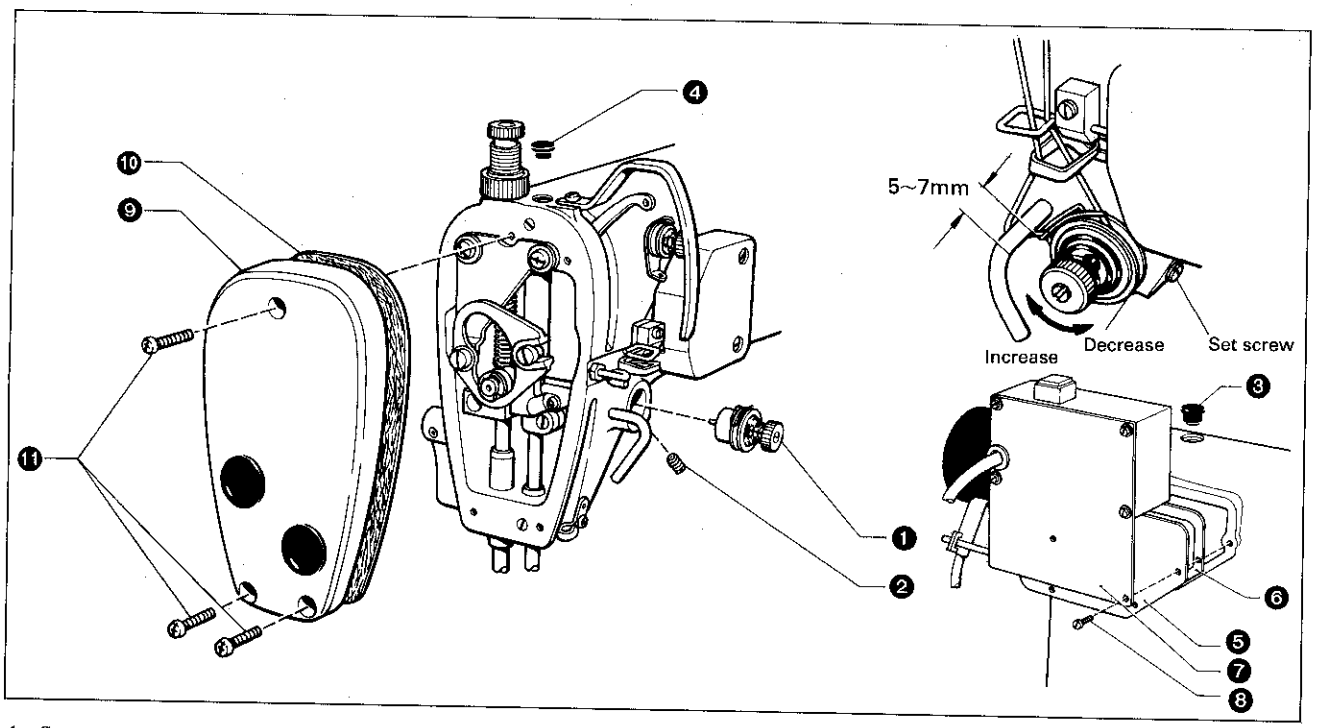
[5] Intermittent presser foot assembly

(1) Turn the pulley to lower the needle bar, position the presser bar ❸ so the needle ❶ enters the center of the hole in the presser foot ❷, and then tighten screw ❹.

(2) Fit the fork in intermittent presser foot cam ❺ onto the stud screw ❼ of needle bar clamp ❻, and then tighten screw ❽.

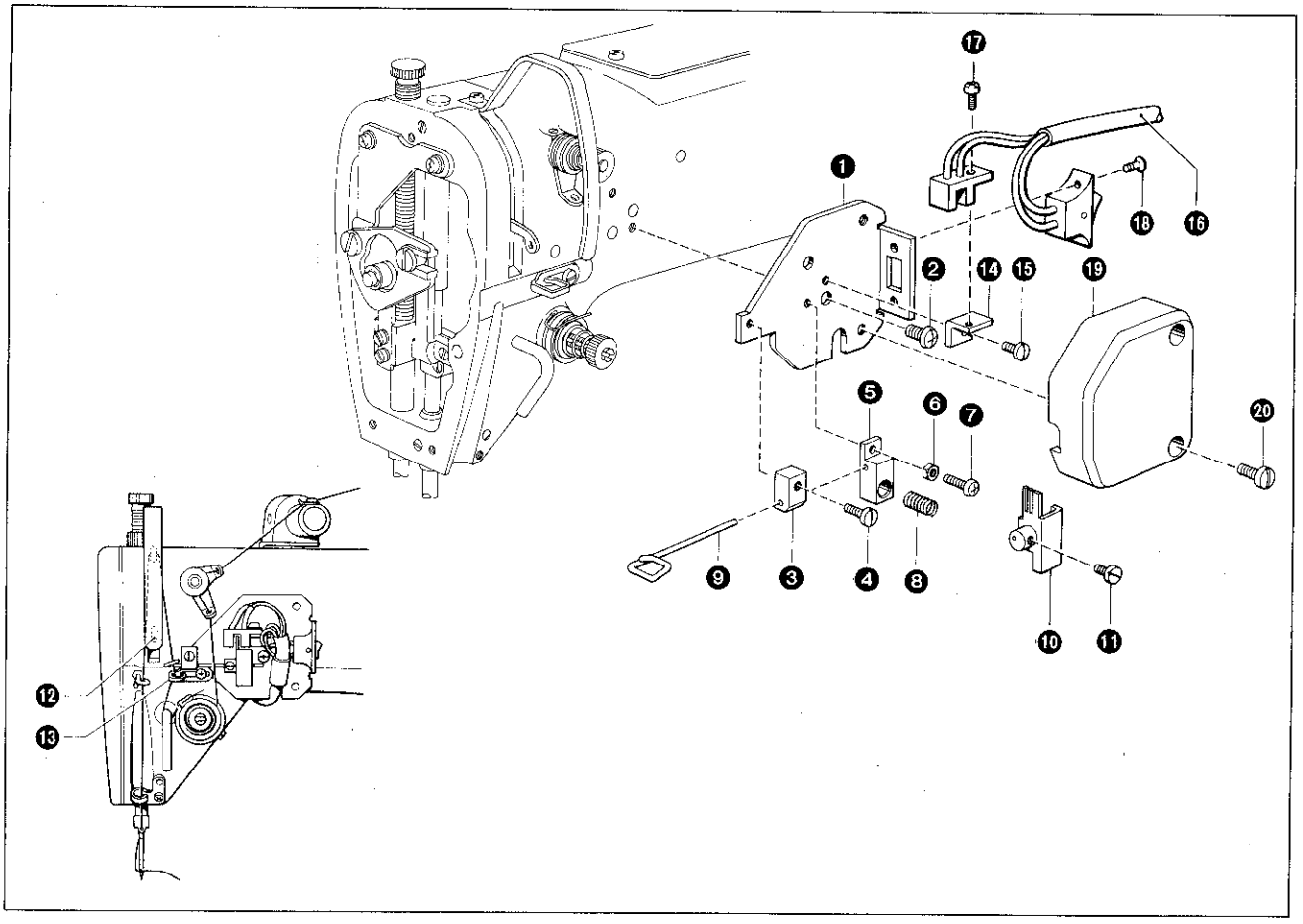
(3) Adjust cam ❺ and needle bar clamp ❻ so the ends are level, and then tighten screw ❾.

[6] Machine cover



1. Secure upper tension regulator bracket ❶ with screw ❷.
   (Thread take-up spring working range is 5 to 7mm; standard tension is approx. 60 to 80g.)
2. Install oil caps ❸ and ❹.
3. Secure rear cover ❺, gasket ❻, and display ❼ with screws ❽.
4. Secure face plate ❾ and gasket ❿ with screws ⓫.

7 Needle thread breakage detector



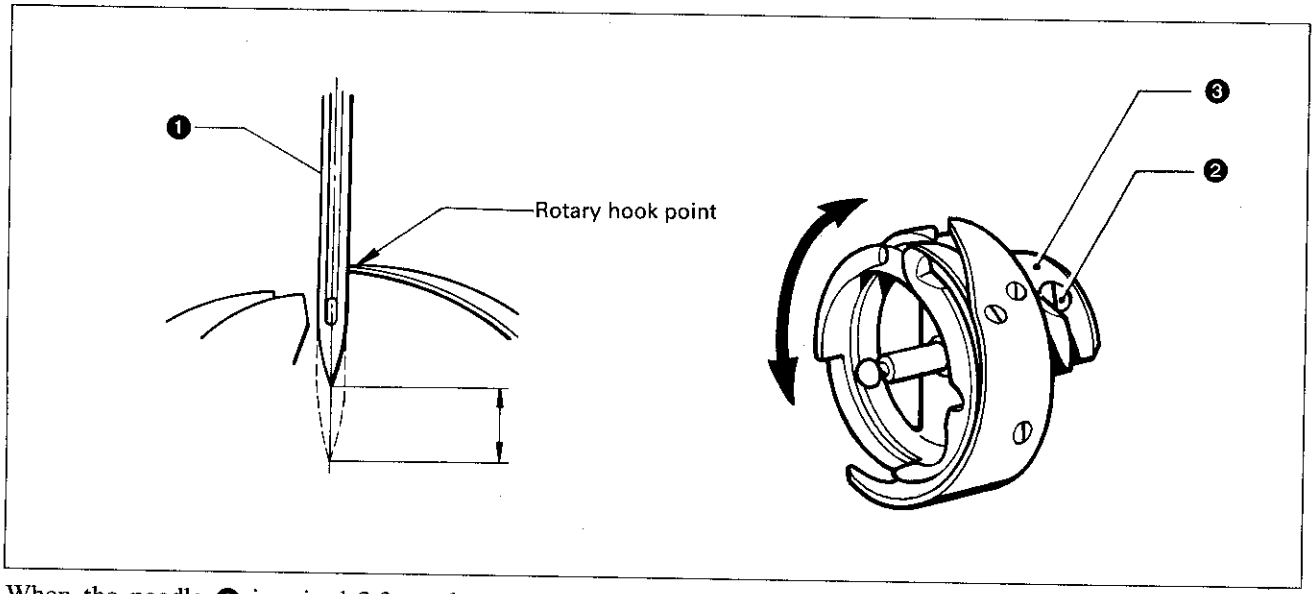
(1) Secure the thread monitor plate ❶ with two screws ❷.
(2) Lightly secure shaft support A ❸ with screw ❹.
(3) Screw nut ❻ onto screw ❼, and then lightly secure shaft support B ❺ with screw ❼ and nut ❻.
(4) Insert sensing spring ❽ into shaft support B ❺, and shaft ❾ into shaft support A ❸, slit ❿, and shaft support B ❺.
(5) Sensing spring ❽ now presses against one end of slit ❿. Adjust the height of screw ❼ so that slit ❿ and shaft support B ❺ are roughly parallel.
(6) Tighten set screw ⓫, adjust the angle of shaft support A ❸ and B ❺ so that shaft ❾ turns smoothly, and then firmly tighten screw ❹ and nut ❻.
(7) Loosen screw ⓫, position the end loop of shaft ❾ approximately in the middle between the thread take-up ⓬ and thread guide ⓭ so that the thread surface is tilted slightly up, and then tighten screw ⓫.
(8) Firmly secure setting plate ⓮ with screw ⓯.
(9) Secure the thread breakage detector ⓰ with screw ⓱ and two screws ⓲. Finally, secure thread monitor cover ⓳ with two screws ⓴ so that the lines of the thread breakage detector ⓰ are inside.

Adjustments

[1] Needle to rotary hook timing

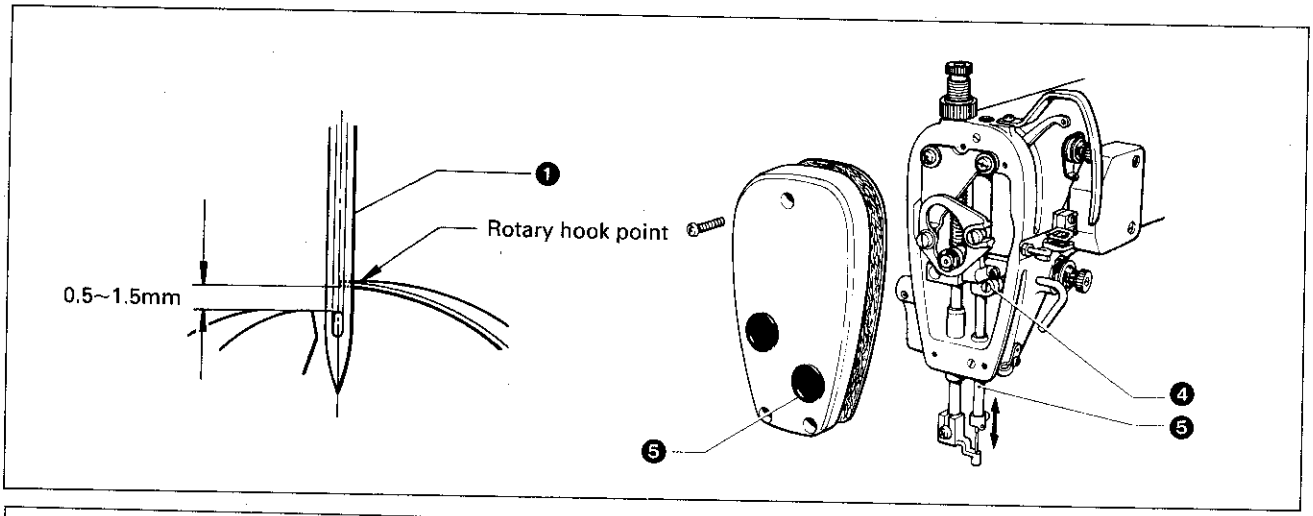
Proper needle to rotary hook timing is required for the needle to rise, forming a loop in the needle thread which is then caught by the rotary hook point.

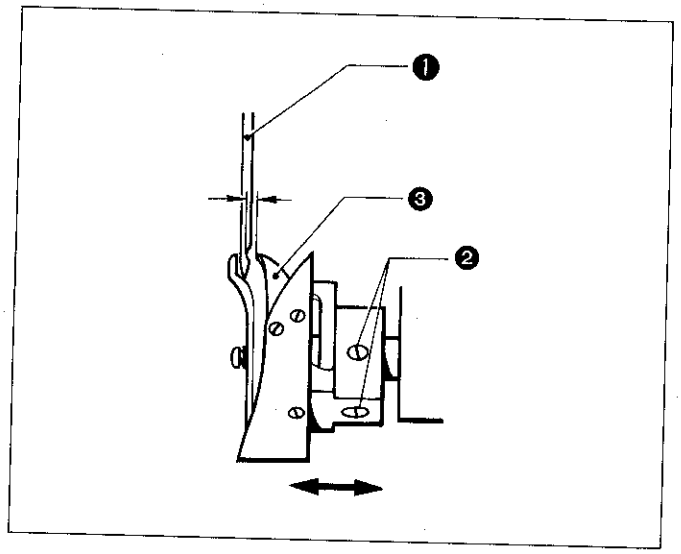
1. Needle bar rise



When the needle ❶ is raised 2.2mm from the down position, the rotary hook point should be aligned with the needle center. Loosen screws ❷ and turn the rotary hook ❸ to adjust.

2. Needle bar height

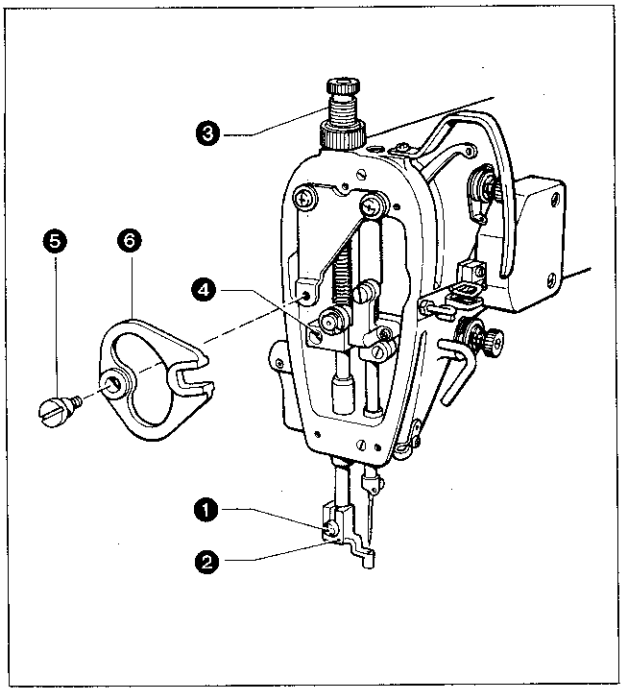




When the rotary hook point is aligned with the needle ❶ center, the rotary hook point to needle hole top gap should be 0.5 to 1.5mm. Remove the oil cap, loosen screw ❹, and vertically adjust the needle bar ❺ height to adjust the gap.

3. Needle to rotary hook point gap

The needle ❶ to rotary hook point gap should be less than 0.1mm. Loosen set screws ❷ and move the rotary hook ❸ front or back to adjust.



[2] Presser foot

★ Adjust the presser foot as described below after positioning the presser foot in the lowest position by turning the pulley.

(1) Loosen set screw ❶, set the bottom of the presser foot ❷ lightly against the material, and then retighten screw ❶.
*Adjusting the presser foot too low will cause the material to pucker when sewing. Setting the presser foot too high may result in skipped stitches.

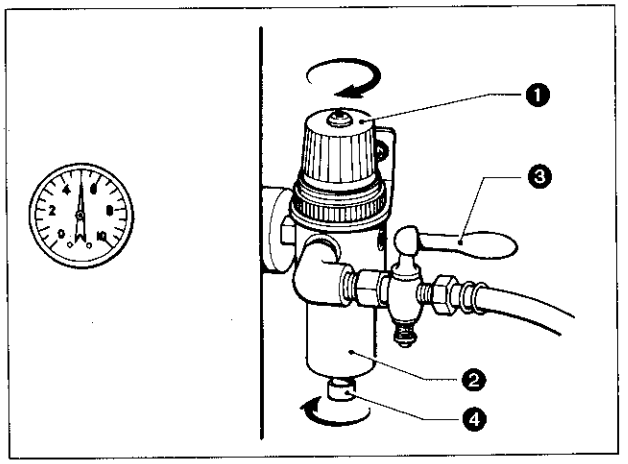
(2) Turn the pulley again and make sure the needle passes through the center of the needle hole in the presser foot ❷. If the needle does not pass the center of the needle hole, loosen presser adjusting screw ❸, loosen screw ❹, and then readjust the presser foot position. Firmly retighten screw ❹ and presser adjusting screw ❸ when the adjustment is completed.
*The presser foot stroke can be set to either 4mm or 7mm depending on the position in which the presser cam is installed.

◆When the intermittent presser foot is not used

Remove the presser cam as described below if the intermittent presser foot is not required.

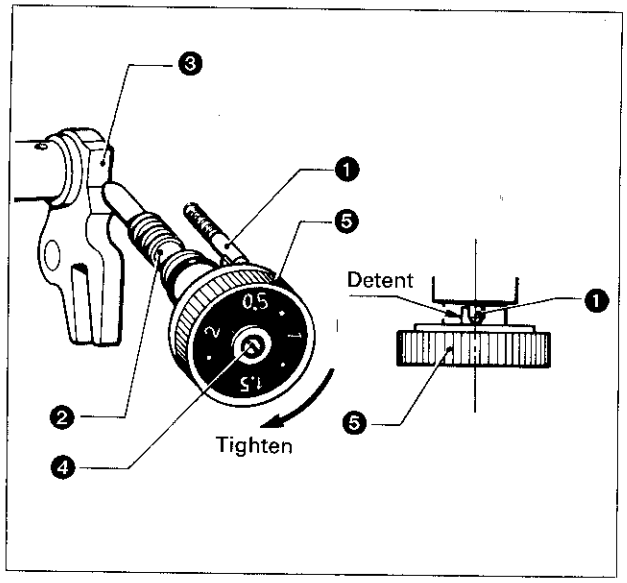
(1) Remove the face plate.
(2) Turn the pulley to fully raise the presser bar.
(3) Remove stud screw ❺ and remove the presser cam ❻.

[3] Air pressure



(1) The air pressure should be set at 5kg/cm^2. To adjust, turn the control knob ❶.
(2) When water collects in the bottle ❷, close cock ❸ and then open drain cock ❹.

4 Bottom plunger

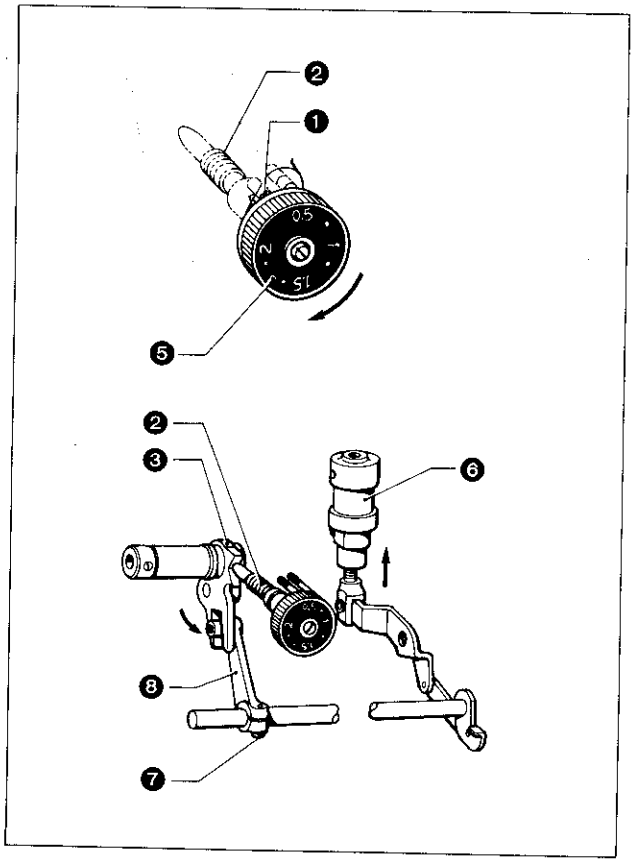


★ Loosen the set screws for the feed regulator lever and bottom adjusting lever before adjusting the bottom plunger.

1. Adjuster screw adjustment

(1) Turn length control screw ❷ all the way in so that the feed regulator ❸ does not move when there is only the center pin ❶.
(2) Loosen set screw ❹, adjust pin ❶ so the detent on length control plate ❺ contacts the left side of pin ❶, and then tighten screw ❹.
(3) Loosen adjustment screw ❷, and add the second pin ❶.

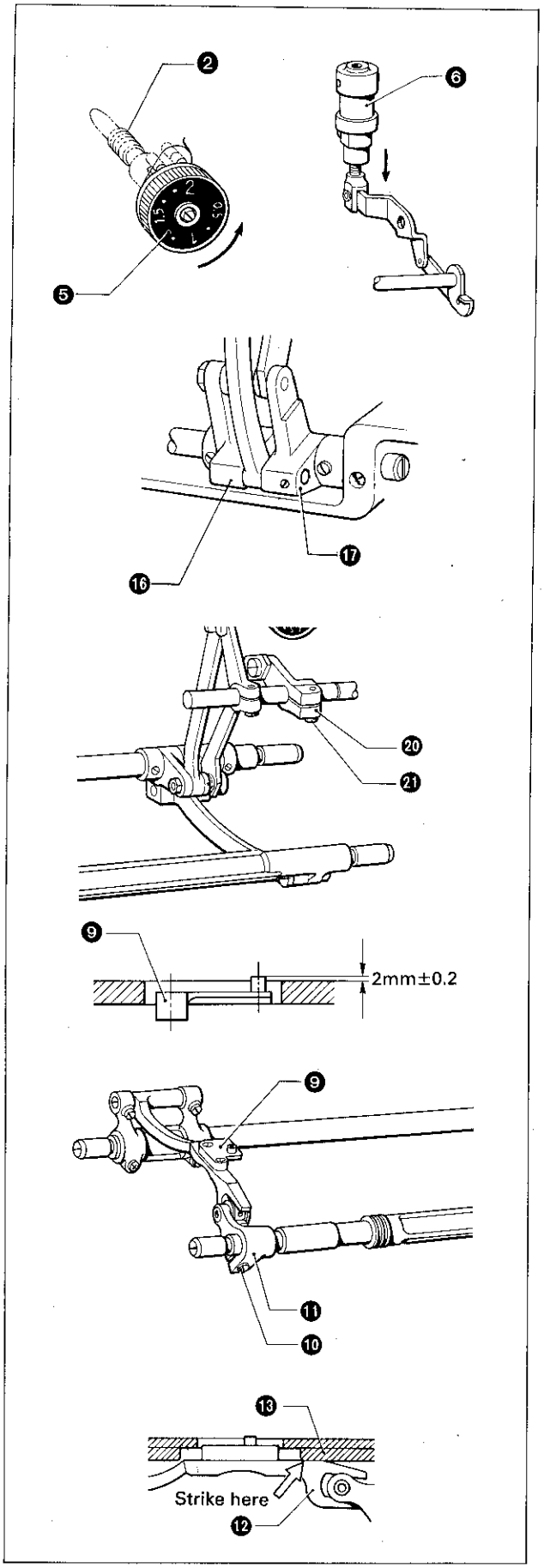
2. Bottom cylinder adjustment



(1) Tighten length control screw ❷ until the left pin ❶ and length control plates ❺ touch.
(2) Adjust length control screw ❷ so the end of the screw contacts the reverse feed side of the feed regulator ❸ when the bottom cylinder ❻ is fully retracted (in the direction of the arrow), and then tighten feed regulator lever ❽ with screw ❼.

3. Bottom plunger adjustment

★ Drain all air from the air lines before adjusting the bottom plunger.

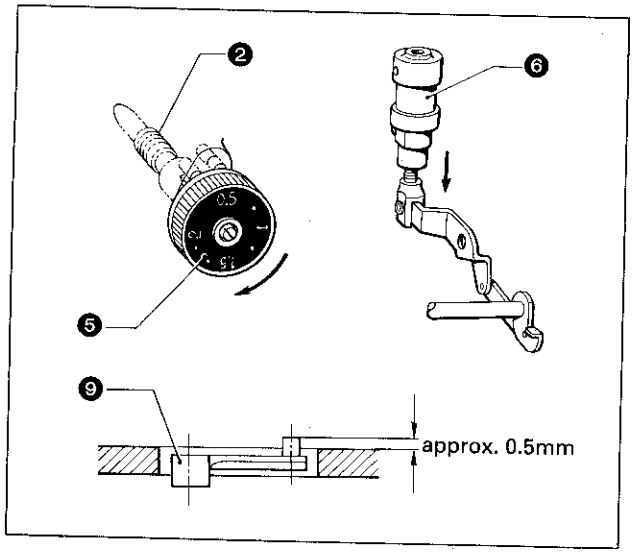


- **Bottom plunger height adjustment**

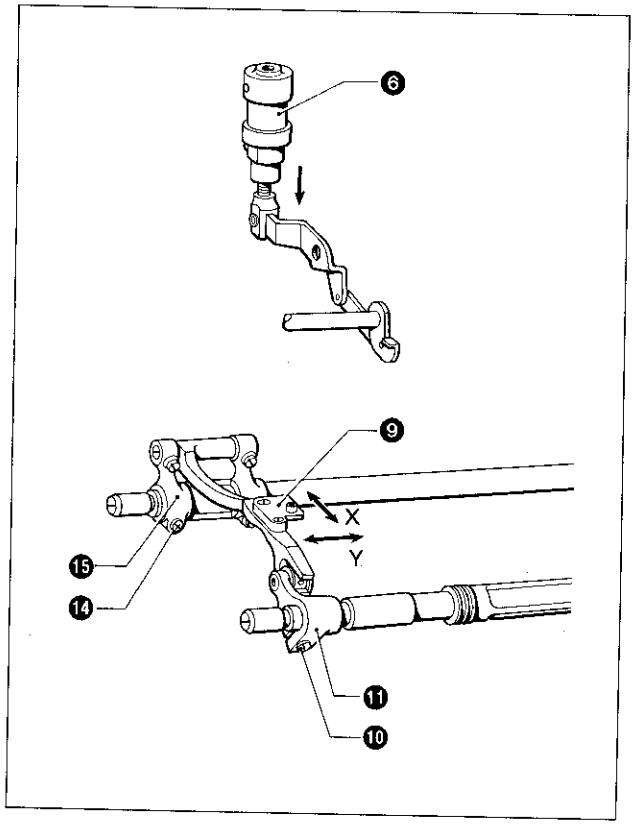
(1) Loosen length control screw ❷, set the length control plate ❺ to the maximum setting, and extend the bottom cylinder ❻ in the direction of the arrow. Now turn the pulley and lower the needle.

(2) Adjust bottom lever ⓰ and ⓱ to the same phase, and tighten bottom adjustment lever ㉑ with screw ⓴.

(3) Loosen screw ⓾ and adjust feed lifting arm ⓫ so the bottom plunger height is 2mm ± 0.2mm.
If the bottom plunger ❾ is too high, the feed bar ⓬ may strike the bed ⓭.



(4) Screw in length control screw ❷, set the length control plate ❺ to the minimum setting, extend bottom cylinder ❻ in the direction of the arrow, and make sure the bottom plunger ❾ height is approximately 0.5mm.



- **Bottom plunger and needle position adjustment**

(1) Turn the pulley to lower the needle.

(2) Extend bottom cylinder ❻ in the direction of the arrow to raise the bottom plunger ❾. Adjust so that the needle enters the center of the needle hole in the bottom plunger ❾.

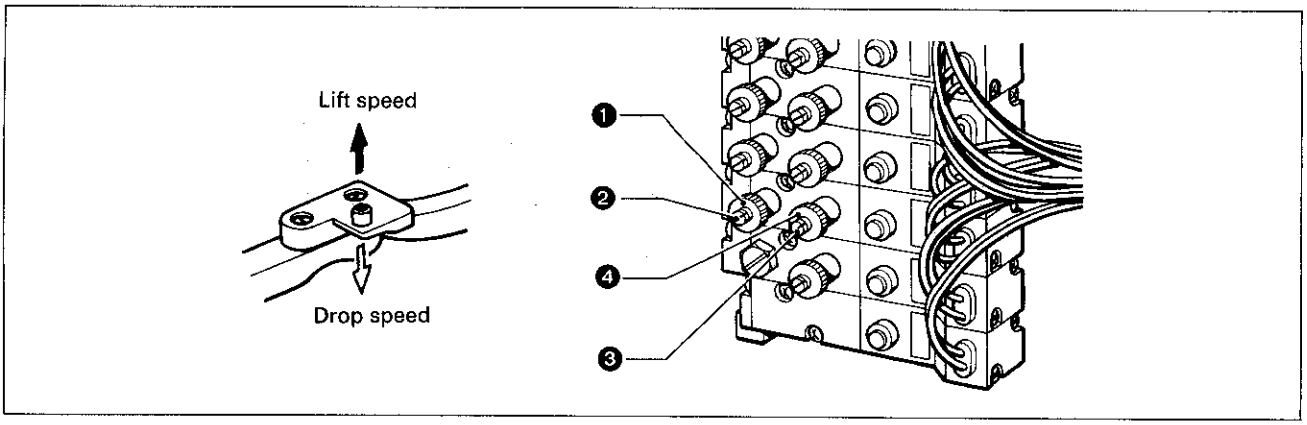
[Direction X]

Loosen screw ⓮ and adjust the feed bar arm ⓯.

[Direction Y]

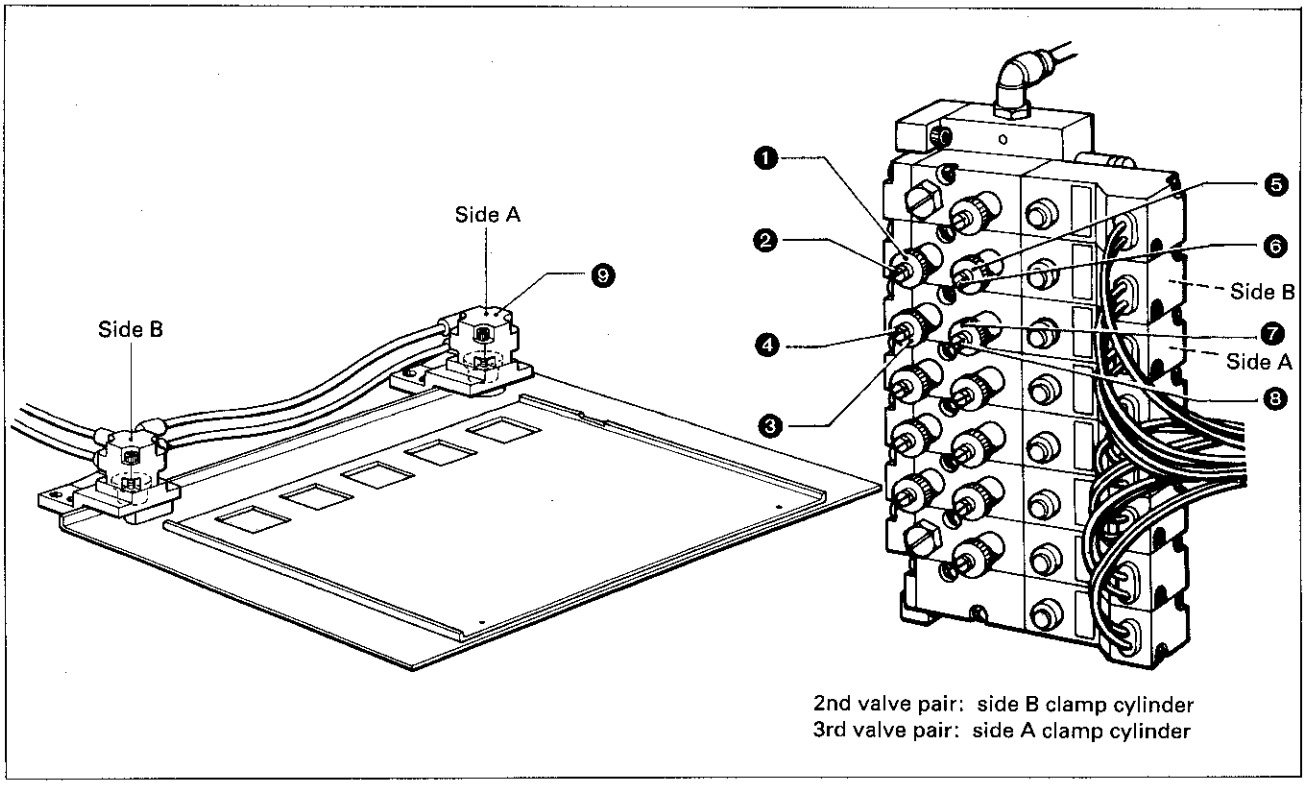
Loosen screw ⓾ to adjust the feed lifting arm ⓫, and loosen screw ⓮ to adjust the feed bar arm ⓯.

5 Bottom cylinder speed (3rd valve pair from bottom)



- **Bottom plunger lift speed**
  If the bottom plunger rises too slowly, several stitches will be sewn while the bottom plunger is down, eliminating the purpose of the bottom plunger. The bottom plunger should be adjusted to move as quickly as possible by loosening nut ❶ and adjusting speed control ❷.
- **Bottom plunger drop speed**
  If the bottom plunger drops too slowly, the bottom plunger may strike the pallet feed plate when the material is fed but the bottom itself does not move. Loosen nut ❸ and adjust speed control ❹ so that the bottom plunger moves quickly before the feed mechanism begins to move to the next sewing position.

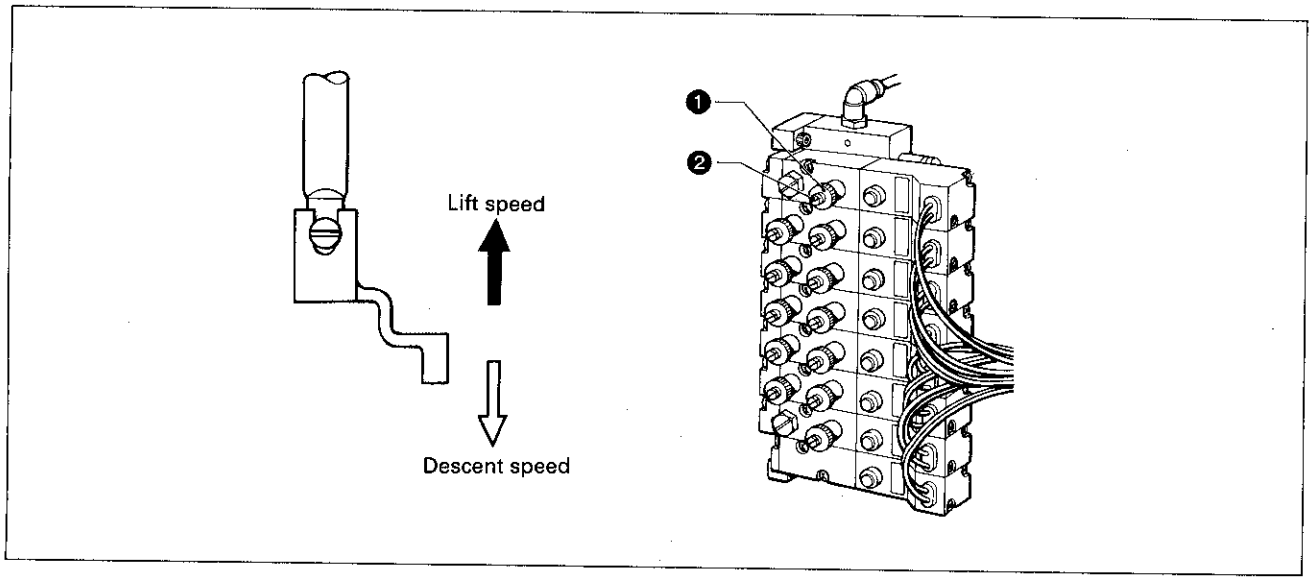
6 Pallet clamp cylinder speed (2nd and 3rd valve pairs)



- **Presser clamp lift speed**
  Loosen nuts ❶ and ❸ and turn speed controls ❷ and ❹ to adjust the pallet clamp lift speed.
- **Presser clamp drop speed**
  Loosen nuts ❺ and ❼ and turn speed controls ❻ and ❽ to adjust the pallet clamp drop speed.

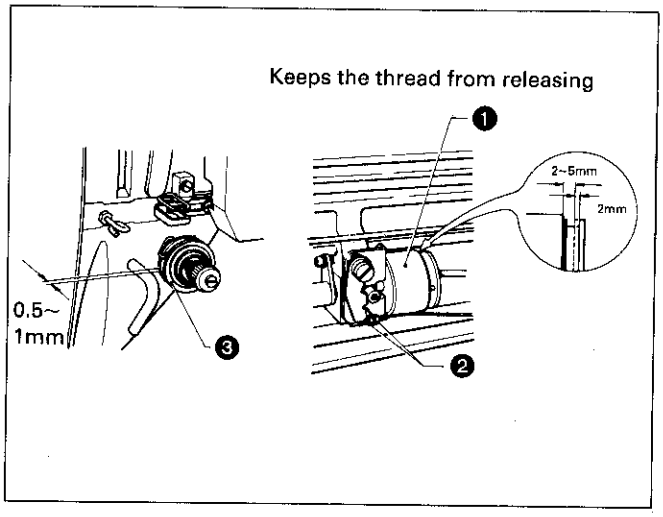
Note: Adjust cylinder A ❾ so that it drops faster than B. Both right and left pallet clamp cylinders should rise at the same speed.

7 Presser foot lifter cylinder speed (Top valve)



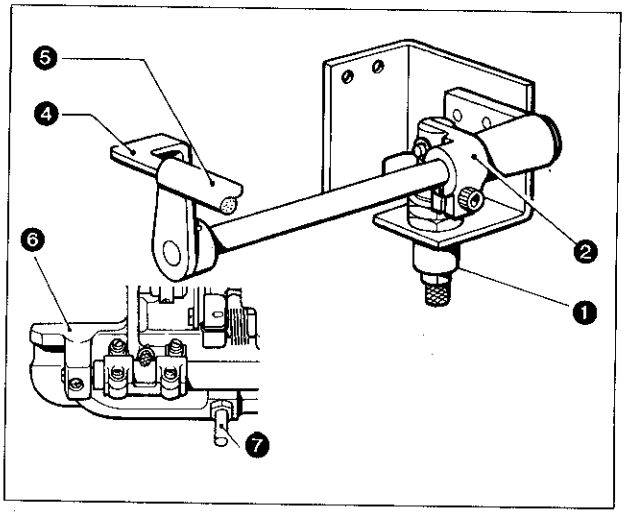
- **Presser foot lifter speed**
  If the presser foot lifter rises slower than necessary, the presser foot and pallet may strike and be damaged. Loosen nut ❶ and turn speed control ❷ so that the presser foot rises as quickly as possible.

8 Tension release



★ The thread trimming solenoid will feel light during the first 0 to 2mm of its stroke (tension release mechanism is not working), but will stiffen from 2 to 5mm. Turn nut ❷ to adjust.
Make sure the tension disc ❸ opens 0.5 to 1mm at this time. Also make sure the tension disc is closed when the thread trimming solenoid is not operating.

9 Knife return assembly

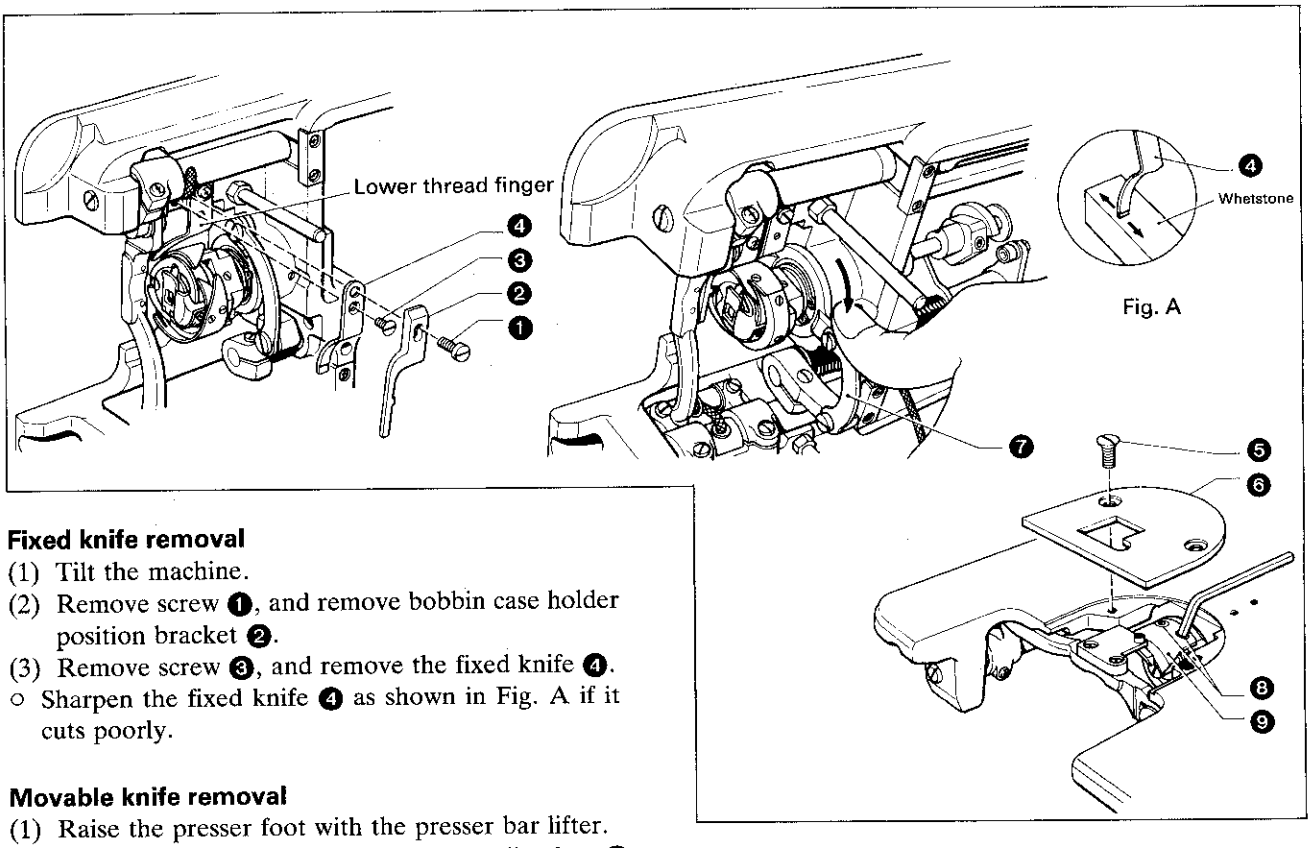


★ Adjust lever ❷ when the knife return cylinder ❶ is retracted so that the machine bed ❻ and claw ❹ do not touch, and so that stud S ❼ and claw ❹ do not strike when the machine bed ❻ is tilted.
Adjust the knife return cylinder ❶ so that claw ❹ pushes thread trimmer lever stud ❺ back if it does not return.

10 Thread trimmer assembly

1. Fixed knife and movable knife replacement

*Turn the power off.



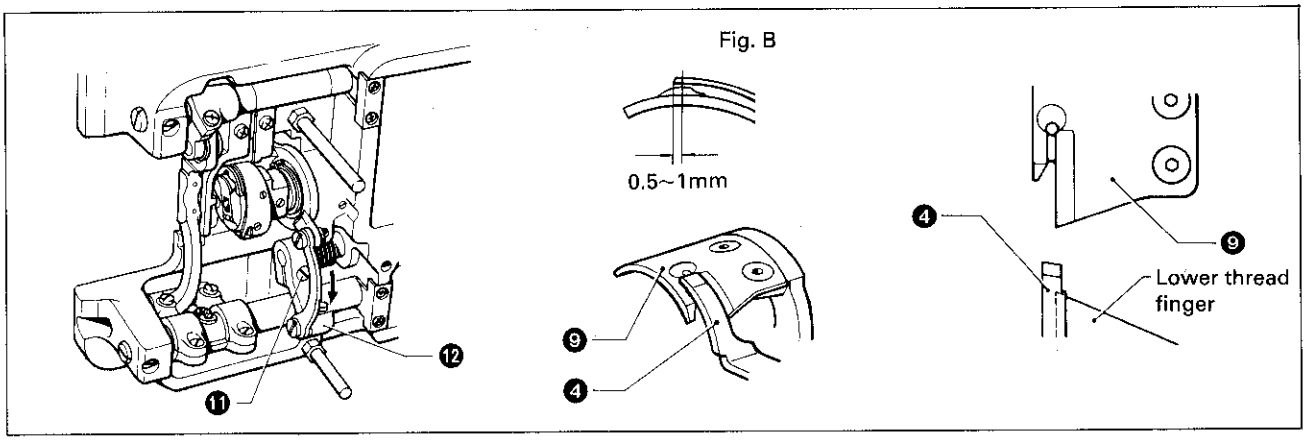
Fixed knife removal

(1) Tilt the machine.
(2) Remove screw ❶, and remove bobbin case holder position bracket ❷.
(3) Remove screw ❸, and remove the fixed knife ❹.
○ Sharpen the fixed knife ❹ as shown in Fig. A if it cuts poorly.

Movable knife removal

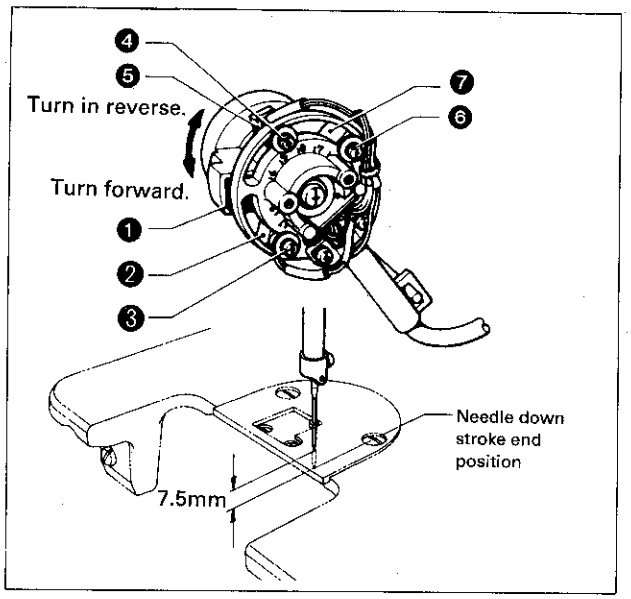
(1) Raise the presser foot with the presser bar lifter.
(2) Remove screw ❺, and remove the needle plate ❻.
(3) Turn the main pulley, and stop the needle bar at the top of its stroke.
(4) Move the thread trimming connecting rod ❼ by hand in the direction of the arrow until screws ❽ is visible.
(5) Remove the two screws ❽, and remove the movable knife ❾.
*Remove the needle before attempting removal of the needle plate ❻ and movable knife ❾.
*Installation is the reverse of removal.

2. Fixed knife, movable knife, and lower thread finger adjustment



(1) Install the fixed and movable knives. The movable knife ❾ should overlap the fixed knife ❹ tip as shown in Fig. B when the movable knife is driven to the end of its stroke with the thread trimmer clutch. To adjust, loosen screw ⓫ and adjust the thread trimming lever ⓬.
*Set the lower thread finger toward the movable knife ❾ to assure a sufficient gap between the lower thread finger and rotary hook.

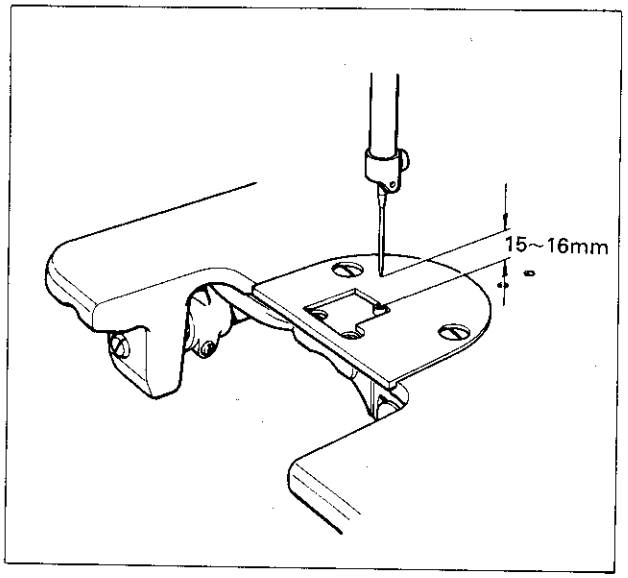
11 Position detector



1. Thread trimmer signal position adjustment (sync-2 signal adjustment)

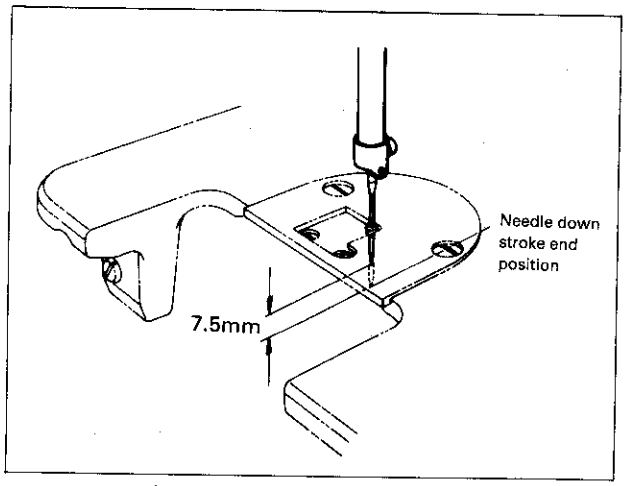
(1) Remove the synchronizer cover.
(2) Turn the machine pulley in reverse to raise the needle 7.5mm from the down stroke end position. The bottom of magnet ❶ and top of thread trimmer element ❷ should be aligned at this time.
(3) If the bottom of magnet ❶ and top of thread trimmer element ❷ are not aligned at this time, loosen screw ❸, and adjust the position of thread trimmer element ❷.
*Turn the power off before adjusting the thread trimmer element.
*Screw ❸ should be tightened to about 6 to 10kg-cm.
*The thread trimmer solenoid operates on the eighth encoder signal pulse after the thread trimmer signal is detected, passes the magnet and is cancelled.

2. Needle up position adjustment



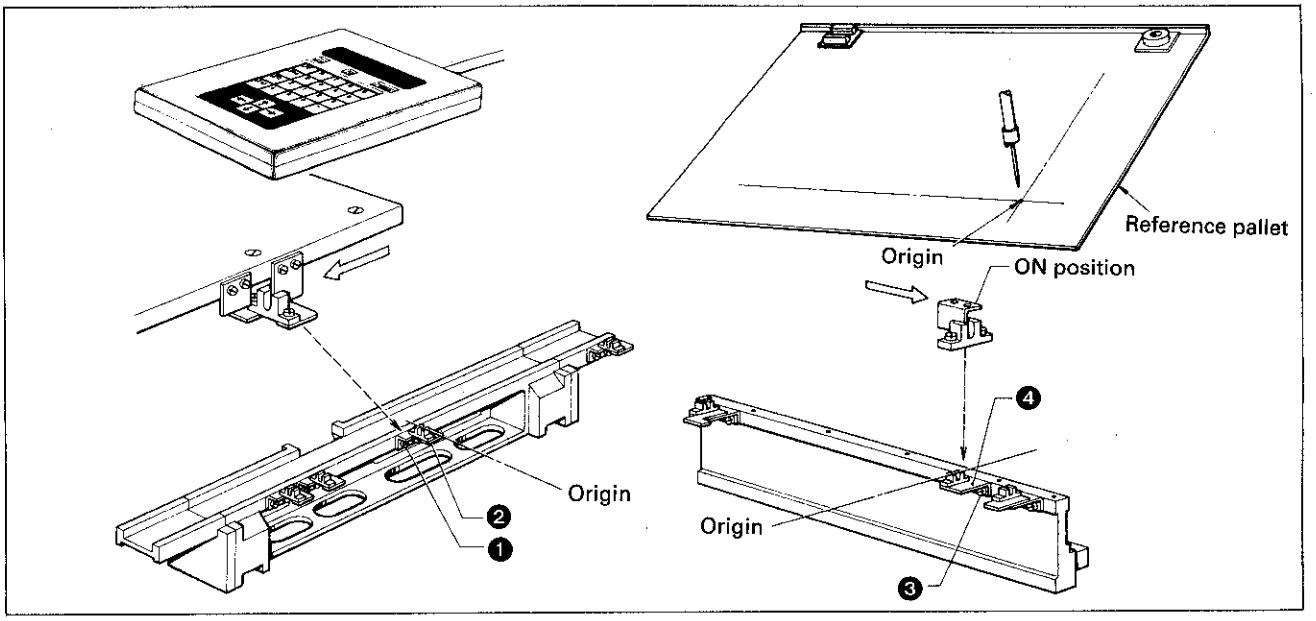
1. The distance from the needle plate to the needle tip should be 15 to 16mm when the needle is in the up position (machine stop position after thread trimming).
2. To adjust the needle up position, loosen screw ❹ and move the needle up position element ❺ (red, yellow, black leads).
3. Turn the machine pulley forward to lower the needle, and turn the start switch on. Loosen screw ❹ and move the needle up position element ❺ to adjust the distance from the needle plate to needle tip to 13mm when U-11 appears in the display.
*Turn the power off when adjusting the needle up position element position.
*Turn the element clockwise to raise the needle and counterclockwise to lower the needle.
*Screw ❹ should be tightened to about 6 to 10kg-cm.

3. Synchronizer signal position adjustment (sync-1 signal adjustment)



(1) Turn the machine pulley forward to raise the needle 7.5mm from the down stroke end position. The top of magnet ❶ and bottom of synchronizer element ❼ should be aligned at this time.
(2) If the top of magnet ❶ and bottom of synchronizer element ❼ are not aligned at this time, loosen screw ❻, and adjust the position of element ❼.
*Turn the power off before adjusting the element.
*Screw ❻ should be tightened to about 6 to 10kg-cm.

12 Origin position



★ Use the programmer and reference pallet to check the origin position.

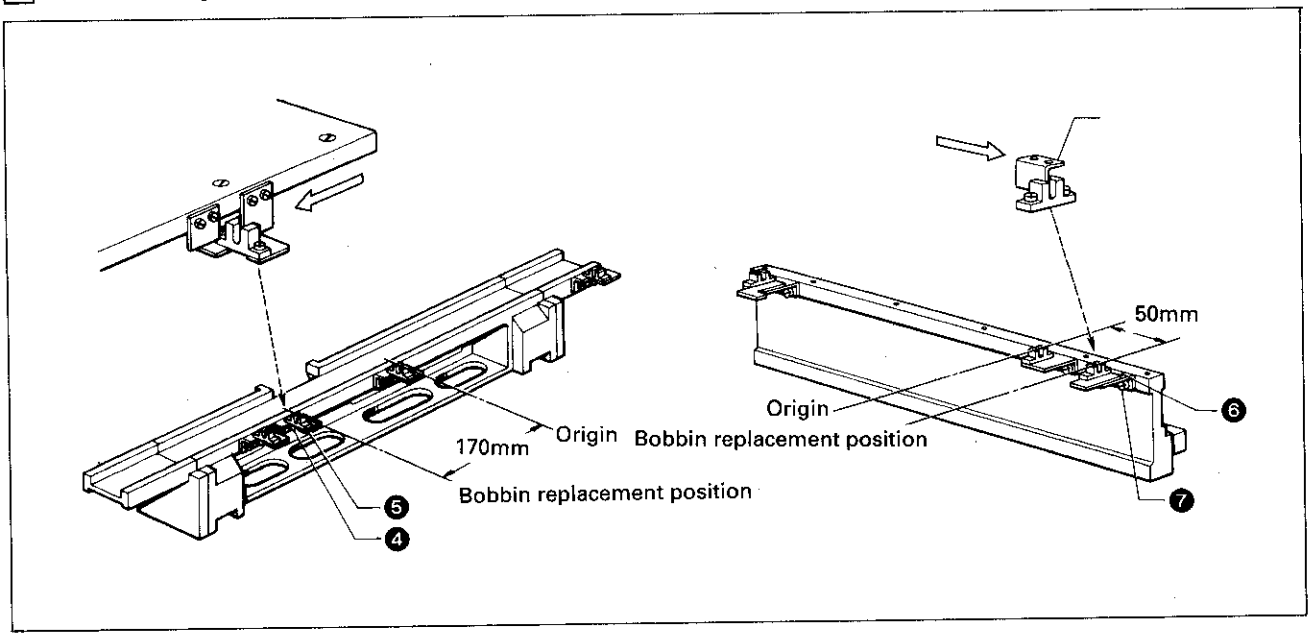
1. X-origin position adjustment

(1) Loosen the two screws ❶, and adjust bracket ❷.
(2) Check the origin position after adjusting the bracket.

2. Y-origin position adjustment

(1) Loosen the two screws ❸, and adjust bracket ❹.
(2) Check the origin position after adjusting the bracket.

13 Bobbin replacement position



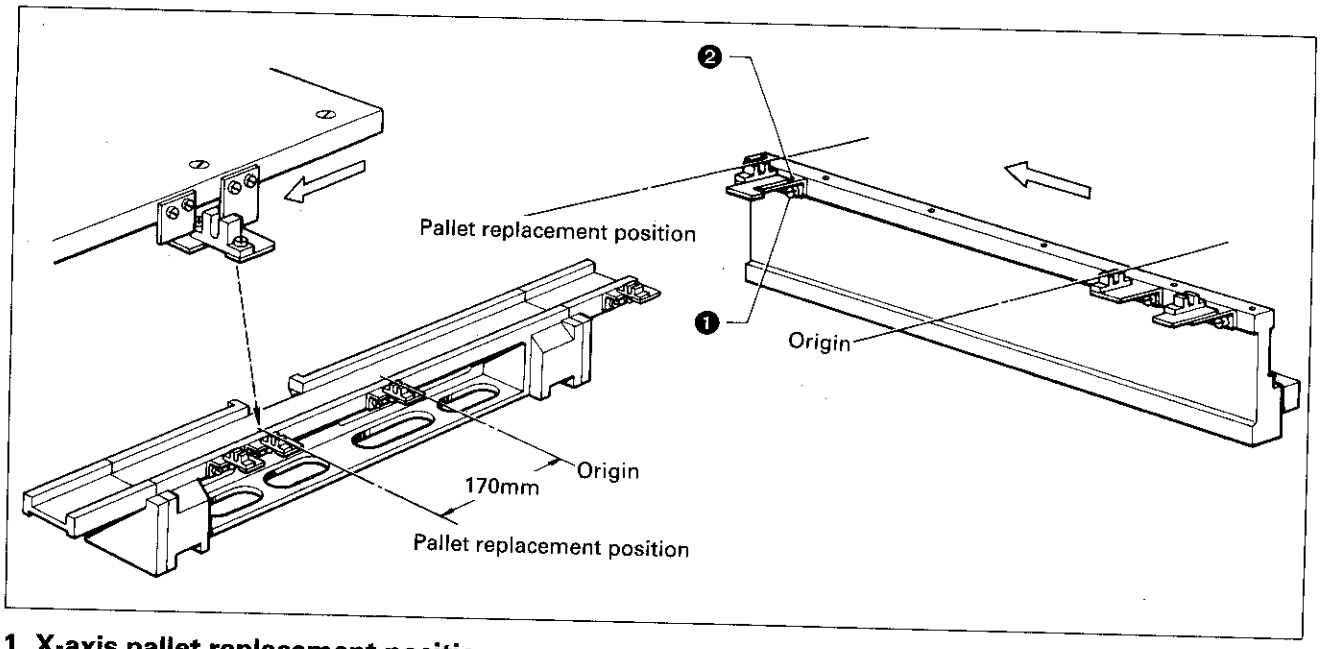
1. X-axis bobbin replacement position

(1) Loosen the two screws ❹ and adjust bobbin replacement position LS bracket ❺ with the pallet 170mm (1700 pls) from the origin.
(2) Check the bobbin replacement position after adjustment.

2. Y-axis bobbin replacement position

(1) Loosen the two screws ❻ and adjust bobbin replacement position LS bracket ❼ with the pallet 50mm (500 pls) from the origin.
(2) Check the bobbin replacement position after adjustment.

14 Pallet replacement position



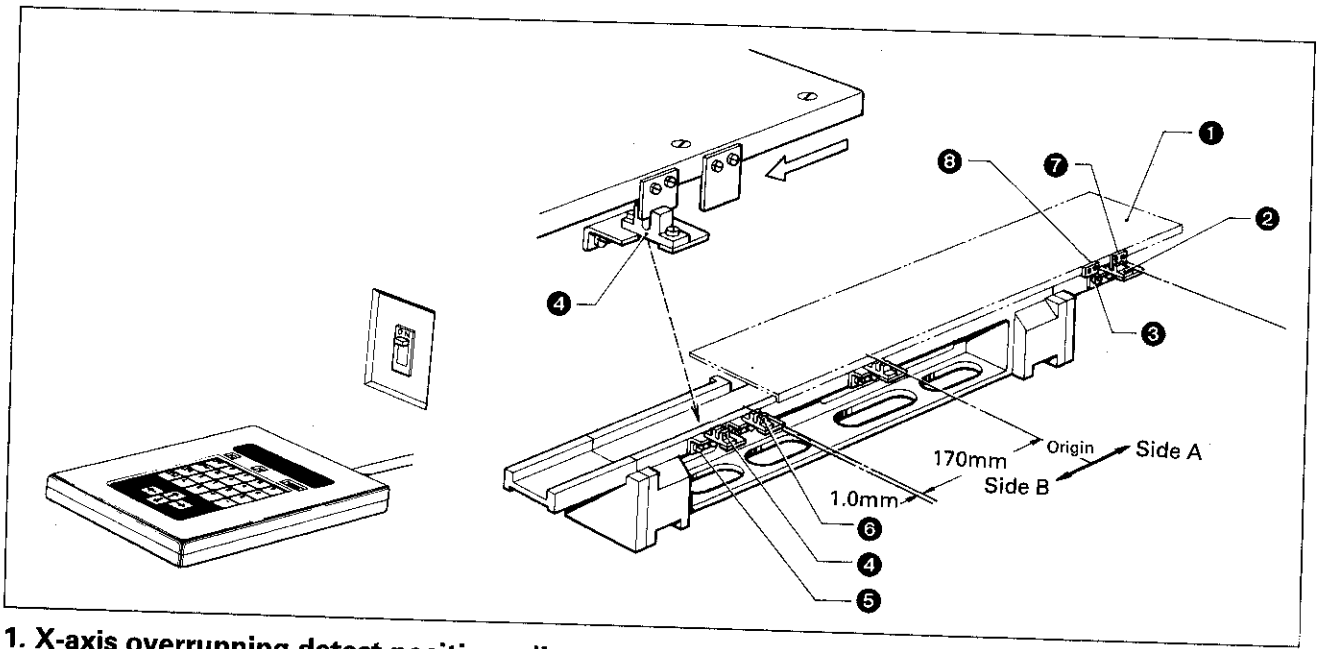
1. X-axis pallet replacement position

The X-axis pallet replacement position is the same as the X-axis bobbin replacement position. Refer to p. 32, X-axis bobbin replacement position.

2. Y-axis pallet replacement position

(1) Loosen the two screws ❶ and adjust pallet replacement position LS bracket ❷ with the pallet 250mm (2500 pls) from the origin.
(2) Check the pallet replacement position after adjustment.

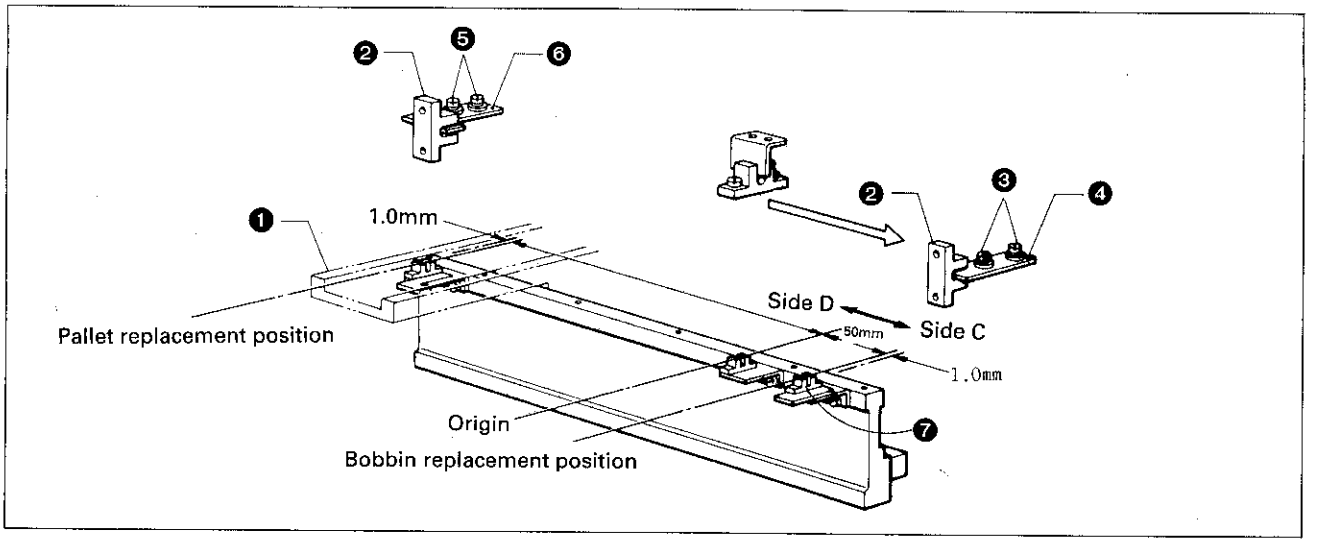
15 Overlimit switch



1. X-axis overrunning detect position adjustment

(1) Turn the power on.
(2) Use the programmer to move the X-traverse body ❶ on side B to the origin position. Dog ❼ should trip overlimit switch ❻ on when X-traverse body ❶ is moved another 351mm (3510 pls) beyond the origin position on side A. Loosen the two screws ❸ and adjust the overlimit switch ❷ so that the switch comes on at this position.
(3) Again use the programmer to move the X-traverse body ❶ from the origin position 171mm (1710 pls) across side B, at which point dog ❽ should trip overlimit switch ❹ on. Loosen the two screws ❺ and move the overlimit switch ❹ to adjust.
*Make sure that bobbin replacement position limit switch ❻ comes on before the pallet replacement position overlimit switch ❹.

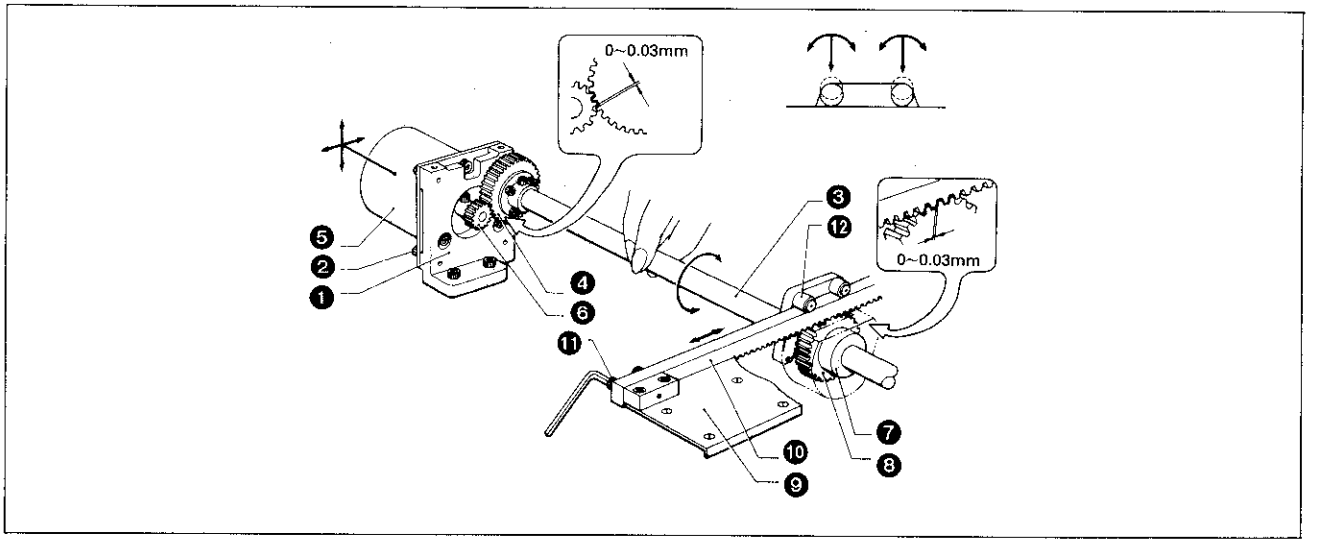
2. Y-axis overrunning detect position adjustment



(1) Turn the power on.
(2) Use the programmer to move the stroke frame ❶ to the origin position. Overlimit switch ❷ should come on when the stroke frame ❶ is moved another 51mm (510 pls) beyond the origin position on side C. Loosen the two screws ❸ and adjust the overlimit switch dog ❹ so that the switch comes on at this position.
(3) Again use the programmer to move the stroke frame ❶ from the origin position 251mm (2510 pls) across side D, at which point dog ❻ should trip overlimit switch ❷ on. Loosen the two screws ❺ and move the overlimit switch dog ❻ to adjust.
*Make sure that bobbin replacement position limit switch ❼ comes on before overlimit switch ❷.

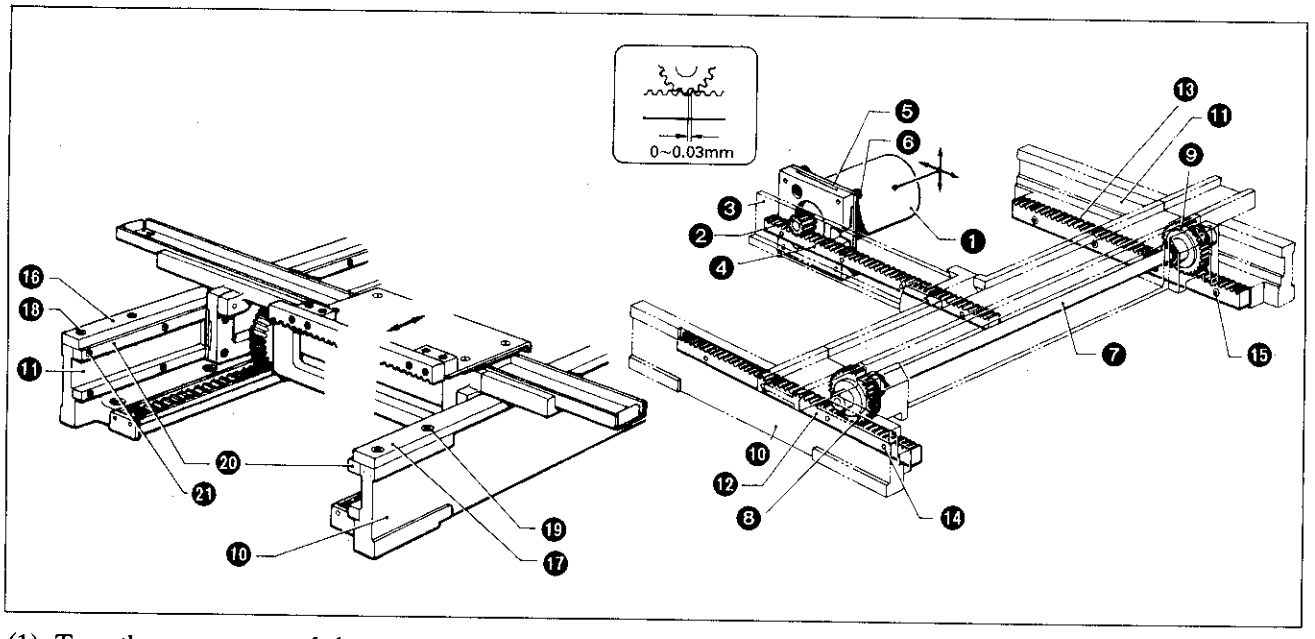
16 Drive mechanism backlash adjustment

1. X-axis pulse motor adjustment



(1) Turn the power on and the emergency stop switch on.
Loosen the four screws ❷ holding the pulse motor bracket ❶, and adjust the backlash at gear assembly ❹ on shaft ❸ and gear assembly ❻ on pulse motor ❺ to 0~0.03mm.
(2) Next adjust the backlash between X-rack ❿ on X-traverse body ❾ and gear assembly ❽ on bearing ❼. To adjust, loosen the eight screws ⓫ in X-rack ❿, and slide the rack against gear assembly ❽ so the backlash is 0 to 0.03mm.
(3) Turn the emergency stop switch and the power switch off, turn the eccentric shaft of each cam follower ⓬ so that each cam follower ⓬ lightly contacts X rack ❿, and then tighten the nuts. Make sure the X-axis feed guide moves smoothly when the feed guide moves in the X-axis.
*Adjust the X-axis feed guide operating force to 6 to 13kgf.

2. Y-axis pulse motor adjustment



(1) Turn the power on and the emergency stop switch on.
Loosen the four screws ❻ holding the pulse motor bracket ❺, and adjust the backlash at Y-driving rack ❹ on Y-driving rack base ❸ and Y-gear ❷ on pulse motor ❶ to 0~0.03mm when the Y-axis feed guide is moved forward and back.

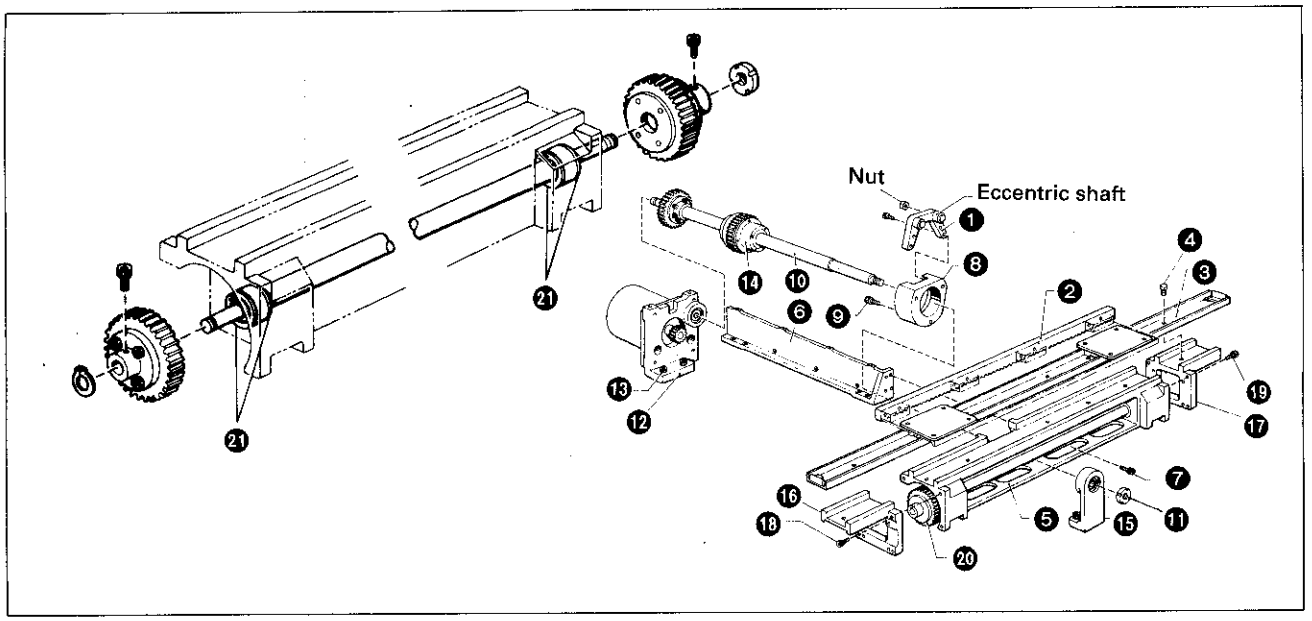
(2) Next adjust the backlash between Y-racks ⓬ and ⓭ on Y-guide L ⓾ and Y-guide R ⓫ and gear assemblies ❽ and ❾ on the ends of stroke frame ❼. To adjust, loosen screws ⓮ and ⓯ in Y racks ⓬ and ⓭, and slide the rack against gear assemblies ❽ and ❾ so the backlash is 0 to 0.03mm.

(3) Turn the power switch off, and loosen the five screws ㉑ in each top guide rail ⓴. Apply pressure to each top guide rail ⓴ while evenly tightening the six screws ⓲ and ⓳ in presser plates ⓰ and ⓱ on Y-guide L ⓾ and R ⓫. When the operating force of the Y-axis feed guide is 6 to 13kgf, firmly tighten the five screws ㉑ in each top guide rail ⓴.

(4) If the Y-axis feed guide does not move smoothly, readjust screws ⓲ and ⓳ in presser plates ⓰ and ⓱.

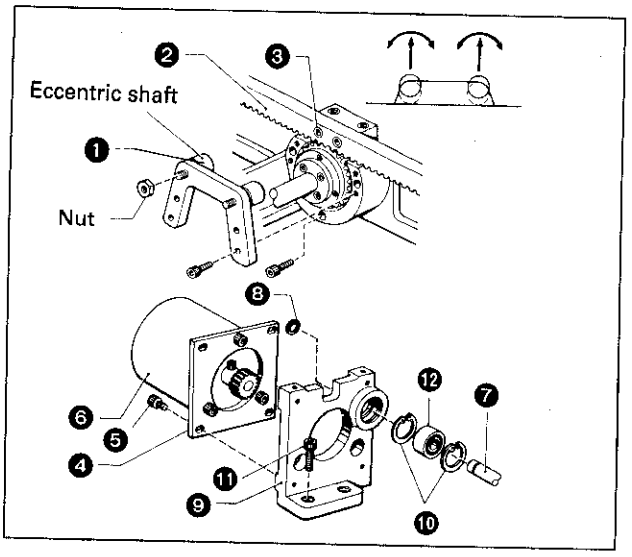
17 Bearing replacement and adjustment

1. Stroke frame bearing replacement and adjustment



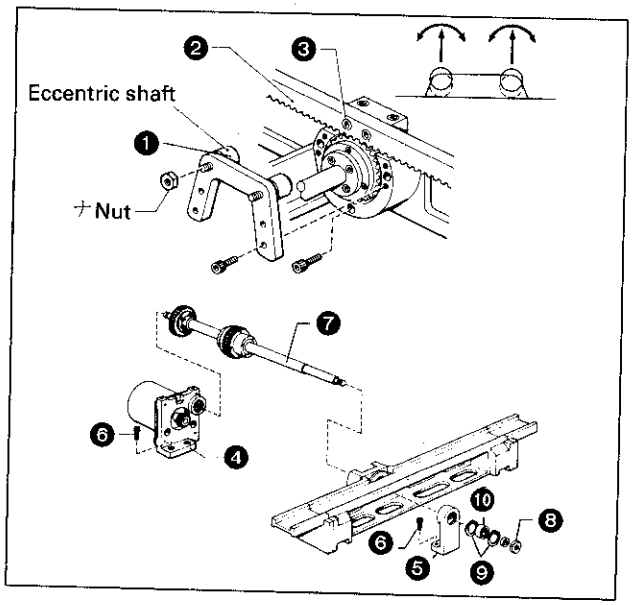
(1) Remove the nuts holding the X-rack back-up cam followers ❶.
(2) Turn the eccentric shaft of each cam follower to separate the X-rack ❷ and cam follower ❶, and then remove the cam follower ❶.
(3) Loosen the seven screws ❹ holding the X-slide rail ❸, and remove the slide rail ❸ from the stroke frame ❺.
(4) Remove the fours screws ❼ connecting stroke frame ❺ with Y-driving rack base ❻, and then remove Y-driving rack base ❻ from the stroke frame ❺.
(5) Remove the three screws ❾ connecting stroke frame ❺ and X-drive housing ❽, and then remove X-drive housing ❽ from stroke frame ❺.
(6) Remove nut ⓫ on shaft ⓾. Loosen the two screws ⓭ in X-motor bracket ⓬, and then remove shaft ⓾ from housing ⓯, taking care that bearing and gear assembly ⓮ does not come off shaft ⓾.
(7) Loosen the three screws ⓲ and ⓳ in rail guide L ⓰ and R ⓱ on respective ends of stroke frame ❺, and then remove rail guides ⓰ and ⓱ from the stroke frame ❺.
(8) Once all parts have been removed from stroke frame ❺, remove the right and left gear assemblies ⓴. (Refer to page 43, gear replacement.)
(9) Remove the two right and left snap rings ㉑, remove the bearings, and then install the new bearings.
(10) To reassemble reverse the above procedure.
*Take sufficient care and refer to the appropriate cautions during reassembly.
(11) Make sure both X and Y feed guide mechanisms work smoothly when the unit is fully reassembled.

2. Ball spline shaft bearing replacement and adjustment



A. Pulse motor side

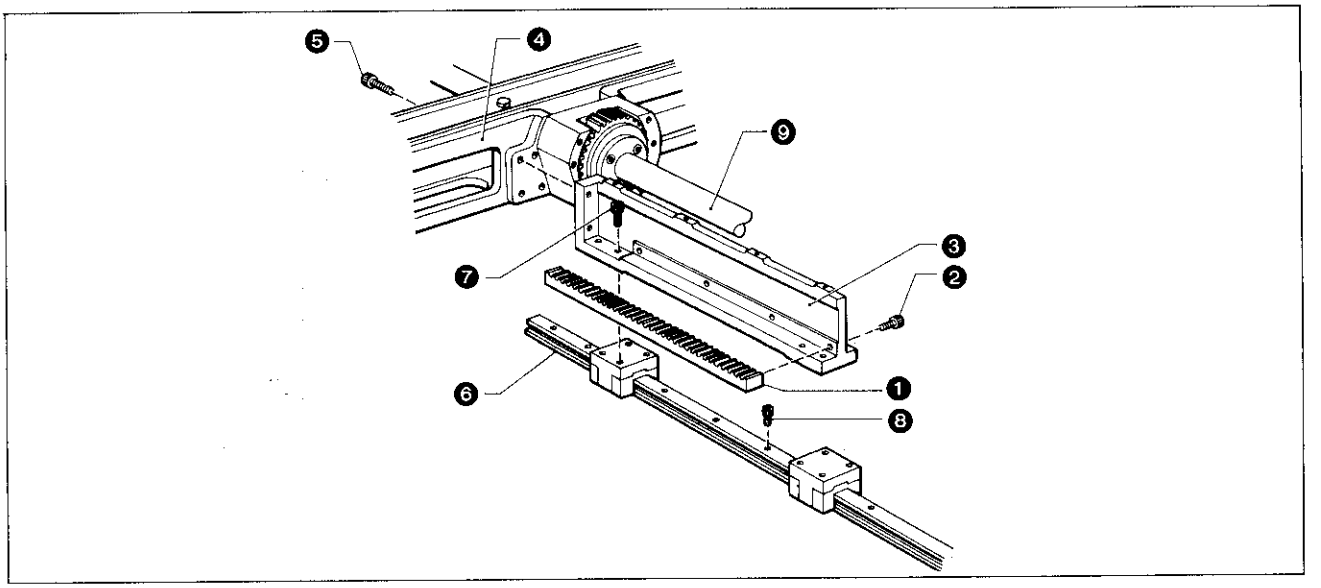
(1) Remove the nuts for cam followers ❶.
(2) Turn each cam follower eccentric shaft to separate the X-rack ❷ and cam followers ❶ and then remove the two cam followers ❶.
(3) Loosen the eight screws ❸ holding the X-rack ❷, and remove the X-rack ❷.
(4) Remove the four screws ❺ holding the motor bracket ❹, and remove the motor ❻.
(5) Remove snap ring ❽ in ball spline shaft ❼ and snap ring ❿ in motor bracket ❾.
(6) Loosen the two screws ⓫ in X-motor bracket ❾, and then remove bracket ❾.
(7) Install the new bearings ⓬.
(8) To reassemble reverse the above procedure.
*Adjust the parallelism of shaft ❼ and linear way slim to within 0.03mm/300mm, and then tighten screws ⓫ in bracket ❾.



B. Machine side

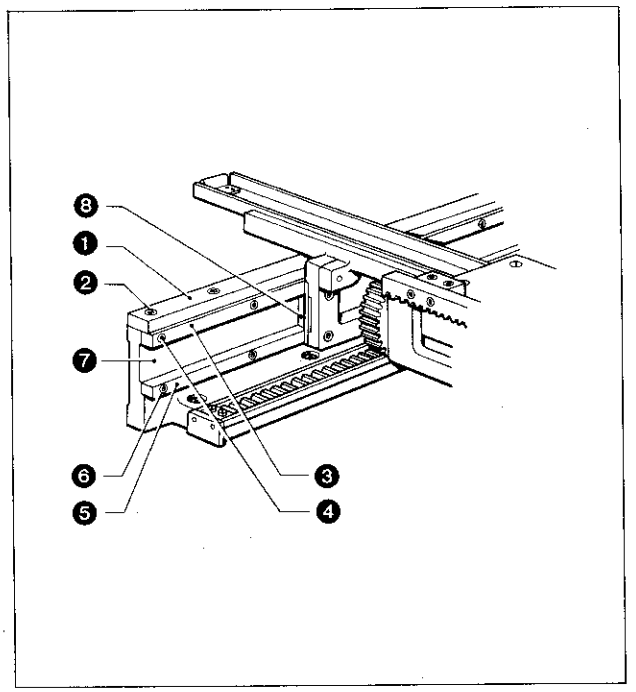
(1) Remove the nuts for cam follower ❶.
(2) Turn each cam follower eccentric shaft to separate the X-rack ❷ and cam followers ❶, and then remove the two cam followers ❶.
(3) Loosen the eight screws ❸ holding the X-rack ❷, and remove the X-rack ❷.
(4) Loosen the two screws ❻ holding the motor bracket ❹ and housing ❺, and then remove the motor bracket ❹ and housing ❺.
(5) Remove nut ❽ on ball spline shaft ❼, and remove snap ring ❾ for housing ❺.
(6) Disconnect ball spline shaft ❼ and housing ❺, and replace bearing ❿.
(7) To reassemble reverse the above procedure.
*Adjust the parallelism of shaft ❼ and linear way slim to within 0.03mm/300mm, and then tighten the screws for housing ❺ and motor bracket ❹.

3. Linear way slim replacement and adjustment



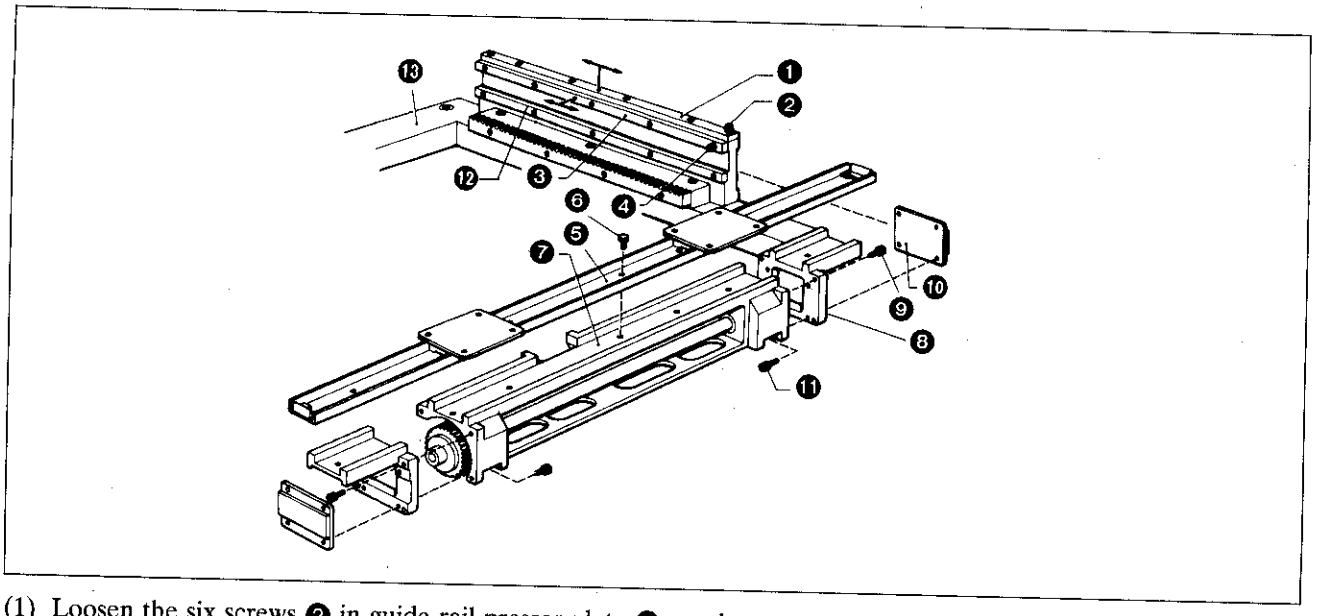
(1) Loosen the four screws ❷ in Y-driving rack ❶, and remove Y-driving rack ❶ from Y-driving rack base ❸.
(2) Loosen the four screws ❺ connecting Y-driving rack base ❸ and stroke frame ❹, and then remove Y-driving rack base ❸ from stroke frame ❹.
(3) Loosen the two sets of four screws ❼ connecting Y-driving rack base ❸ and linear way slim ❻, and remove Y-driving rack base ❸ from linear way slim ❻.
(4) Loosen the screws ❽ in the linear way slim ❻ rail, and replace the linear way slim ❻.
(5) Temporarily tighten the linear way slim ❻ rail in place.
(6) Set Y-driving rack base ❸ against the index on the linear way slim ❻ slide block, and tighten screws ❼.
(7) Adjust the parallelism of Y-driving rack base ❸ and shaft ❾ to within 0.03mm/300mm, and then firmly secure the rails of linear way slim ❻ with screws ❽.
*Parallelism is adjusted with the linear way slim ❻ rail.
(8) Reverse the above procedure to reassemble.
*Take sufficient care and refer to the appropriate cautions during reassembly.
(9) Make sure both X and Y feed guide mechanisms work smoothly when the unit is fully reassembled.

4. Y guide rail replacement and adjustment (guide rails L, R)



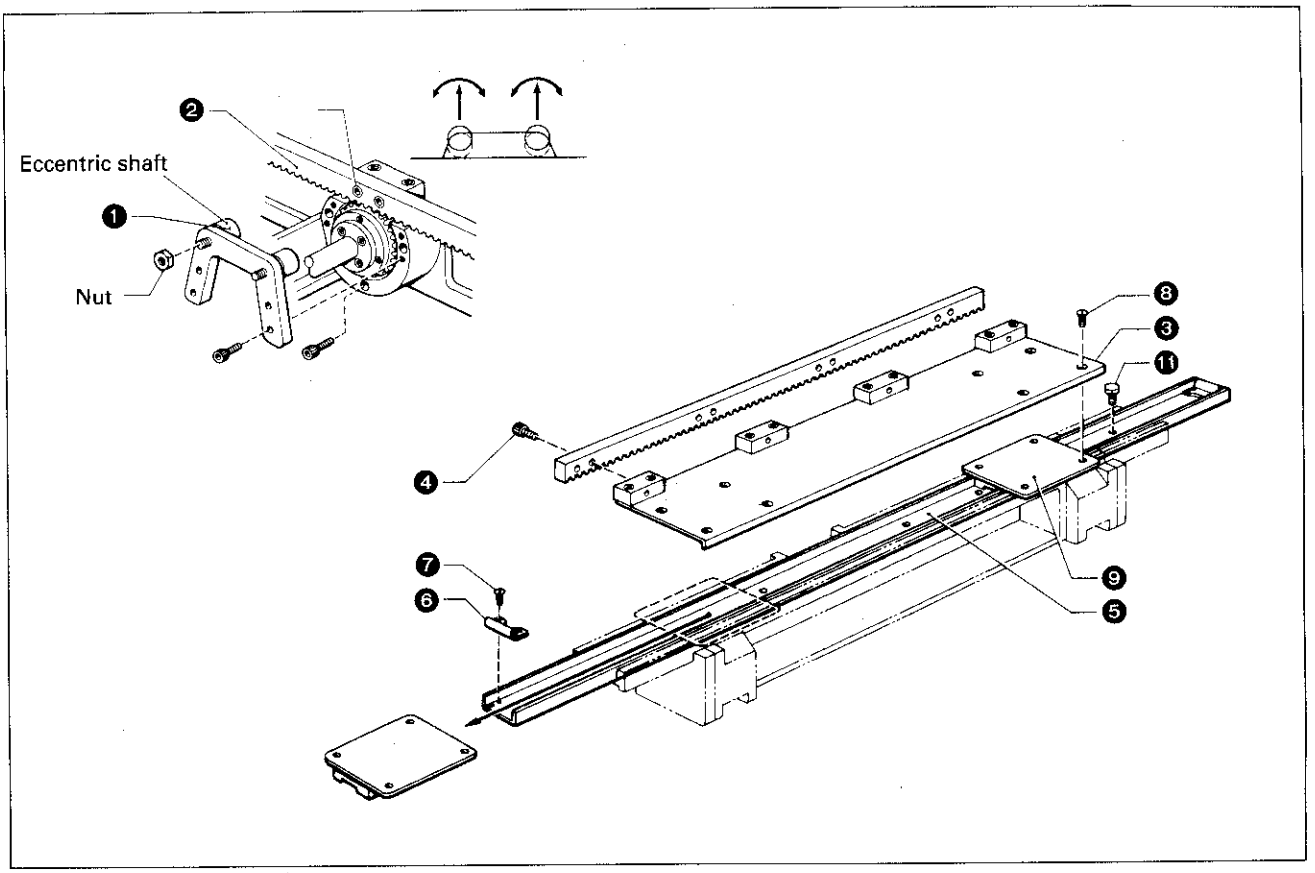
(1) Loosen the six screws ❷ in guide rail presser plate ❶, so that presser plate ❶ moves easily.
(2) Loosen the five screws ❹ in the top guide rail ❸, and then remove guide rail ❸.
(3) Loosen the five screws ❻ in the bottom guide rail ❺, remove guide rail ❺, and install the new guide rail.
*To install the new bottom guide rail ❺, press it firmly against Y-guide ❼ and tighten the five screws ❻.
(4) Set the slide pack ❽ in place, and lightly tighten the five screws ❹ in the top guide rail ❸.
(5) Screw the six screws ❷ for presser plate ❶ in equal amounts and apply pressure to the top guide rail ❸. When the Y-feed guide assembly operating strength is 6 to 13kgf, firmly tighten the five screws ❹ in the top guide rail ❸.
(6) If the Y-feed guide assembly does not move smoothly, readjust the six screws ❷ in presser plate ❶.
*Both right and left guide rails are replaced at the same time as described above.

5. Y-slide pack replacement and adjustment (slide packs L, R)



(1) Loosen the six screws ❷ in guide rail presser plate ❶, so that presser plate ❶ moves easily.
(2) Loosen the five screws ❹ in the top guide rail ❸ so that guide rail ❸ moves easily.
(3) Loosen the seven screws ❻ in X-slide pack rail ❺, and remove slide pack rail ❺ from stroke frame ❼.
(4) Loosen the three screws ❾ connecting rail guide ❽ and stroke frame ❼, and remove rail guide ❽ from stroke frame ❼.
(5) Loosen the four screws ⓫ in slide pack ⓾ connected to rail guide ❽, and install the new slide pack.
(6) Lightly tighten the five screws ❹ in top guide rail ❸.
(7) Lightly tighten the new slide pack to rail guide ❽ with four screws ⓫. When slide pack ⓾ is supported by guide rails ❸ and ⓬, the distance between the mounting surface of X-slide pack rail ❺ on rail guide ❽ and the mounting surface of table hodling base A ⓭ should be 117.3 to 117.4mm. Adjust the slide pack and rail guide ❽ to this setting and then firmly tighten the four screws ⓫.
(8) Secure the rail guide ❽ and stroke frame ❼ with three screws ❾.
*Make sure the surface of rail guide ❽ is flush with the mounting surface of X-slide pack rail ❺ on stroke frame ❼.
(9) Secure the X-slide pack rail ❺ to the stroke frame ❼ with the seven screws ❻.
(10) Screw the six screws ❷ for presser plate ❶ in equal amounts and apply pressure to the top guide rail ❸. When the Y-feed guide assembly operating strength is 6 to 13kgf, firmly tighten the five screws ❹ in the top guide rail ❸.
(11) If the Y-feed guide assembly does not move smoothly, readjust the six screws ❷ in presser plate ❶.
*Both right and left slide packs are replaced at the same time as described above.

6. X-slide pack replacement and adjustment

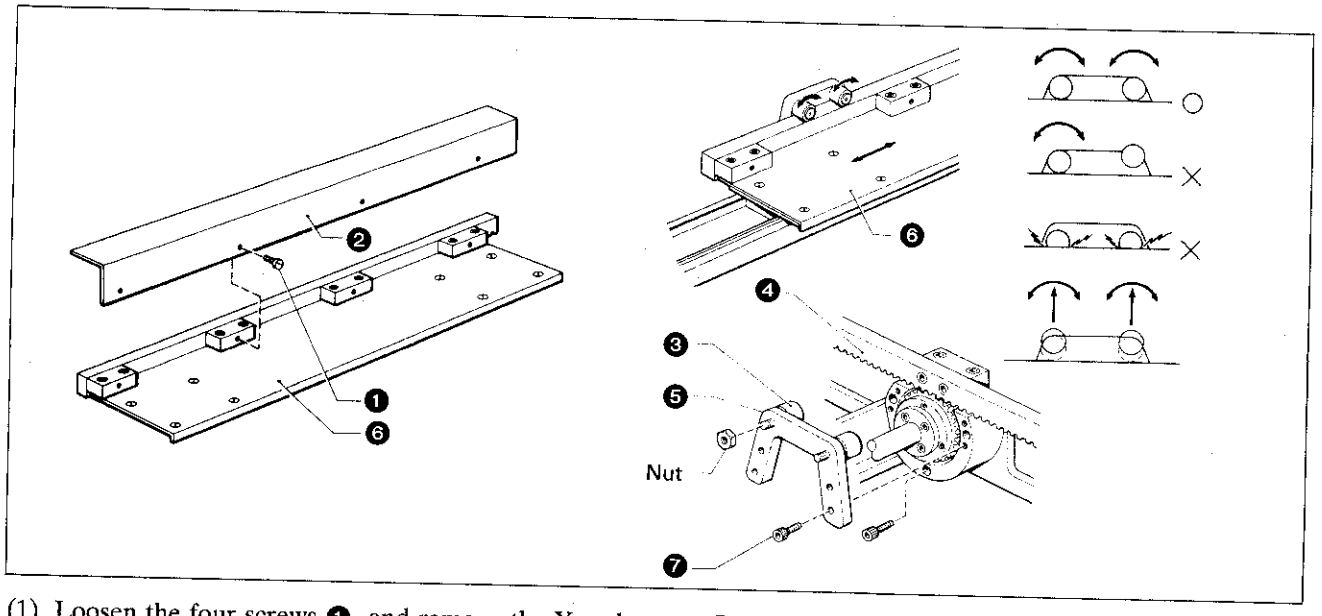


(1) Remove the nuts in X-rack back-up cam followers ❶.
(2) Turn the eccentric shaft of each cam follower ❶, and then remove the cam followers ❶.
(3) Loosen the eight screws ❹ holding the X-rack ❷ on the X-traverse body ❸, and remove the X-rack ❷.
(4) Loosen the screw ❼ in one of the stoppers ❻ on the ends of the X-slide pack rail ❺, and remove the stopper ❻.
(5) Remove the two sets of four screws ❽ holding the slide packs ❾, and remove the slide packs ❾ from the X-traverse body ❸.
(6) Remove the slide packs ❾ from the slide pack rail ❺, and install the new slide packs.
(7) To reassemble reverse the above procedure.
*Take sufficient care and refer to the appropriate cautions during reassembly.
*Refer to X-rack back-up cam follower replacement and adjustment (p. 41) for cam follower ❶ adjustment.
(8) Check the pallet origin position when the unit is fully reassembled.
*Replacing the X-slide pack may change the Y-axis origin position and X pallet parallelism.

7. X-slide pack rail replacement and adjustment (Refer to the above figure.)

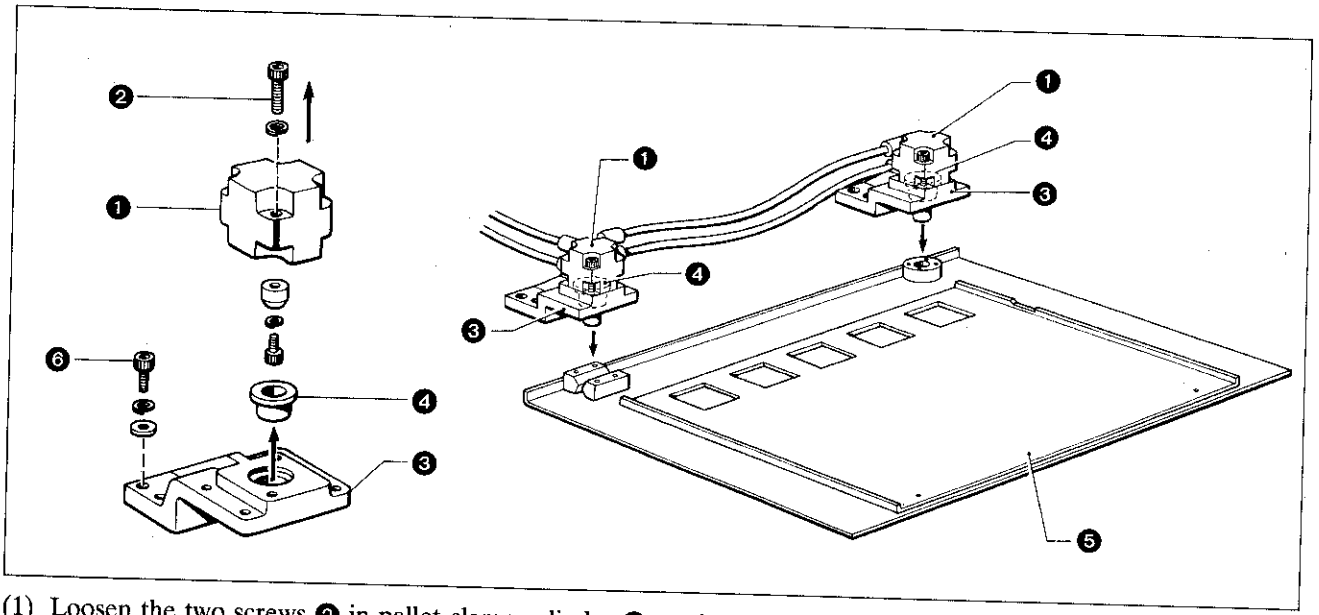
(1) Remove the two X-rack back-up cam followers ❶.
(2) Turn the eccentric shaft of each cam follower to separate the X-rack ❷ and cam follower ❶, and then remove the cam followers ❶.
(3) Loosen the eight screws ❹ holding the X-rack ❷ on the X-traverse body ❸, and remove the X-rack ❷.
(4) Loosen the screw ❼ in one of the stoppers ❻ on the ends of the X-slide pack rail ❺, and remove the stopper ❻.
(5) Loosen the seven screws ⓫ holding the slide pack rail ❺, and remove the slide pack rail ❺ from the X-traverse body ❸ and stroke frame ❾. Install the new slide pack rail.
(6) To reassemble reverse the above procedure.
*Take sufficient care and refer to the appropriate cautions during reassembly.
*Refer to X-rack back-up cam follower replacement and adjustment (p. 41) for cam follower ❶ adjustment.
(7) Make sure the X-feed guide assembly moves smoothly when the unit is fully reassembled.

8. X-rack back-up cam follower replacement and adjustment



(1) Loosen the four screws ❶, and remove the X-rack cover ❷.
(2) Remove the nut from the cam follower ❸ to be replaced.
(3) Turn the eccentric shaft of the cam follower to separate the X-rack ❹ and cam follower ❸, and then remove the cam follower ❸.
(4) Replace the cam follower ❸ with the new cam follower. Turn the eccentric shaft and adjust the cam follower so that it backs X-rack ❹ and allows X-traverse body ❻ to move easily.
(5) Tighten the nut to secure cam follower ❸ after the adjustment is completed.
(6) Move the X-feed guide assembly and make sure each of the cam followers ❸ rotates properly. If the cam followers ❸ do not turn, readjust the eccentric shaft. The X-feed guide assembly operating force should be 6 to 13kgf.
*If the cam follower ❸ still will turn after readjustment, loosen the four screws ❼ in cam follower bracket ❺, bring the cam follower in contact with X-rack ❹, and then tighten screws ❼.

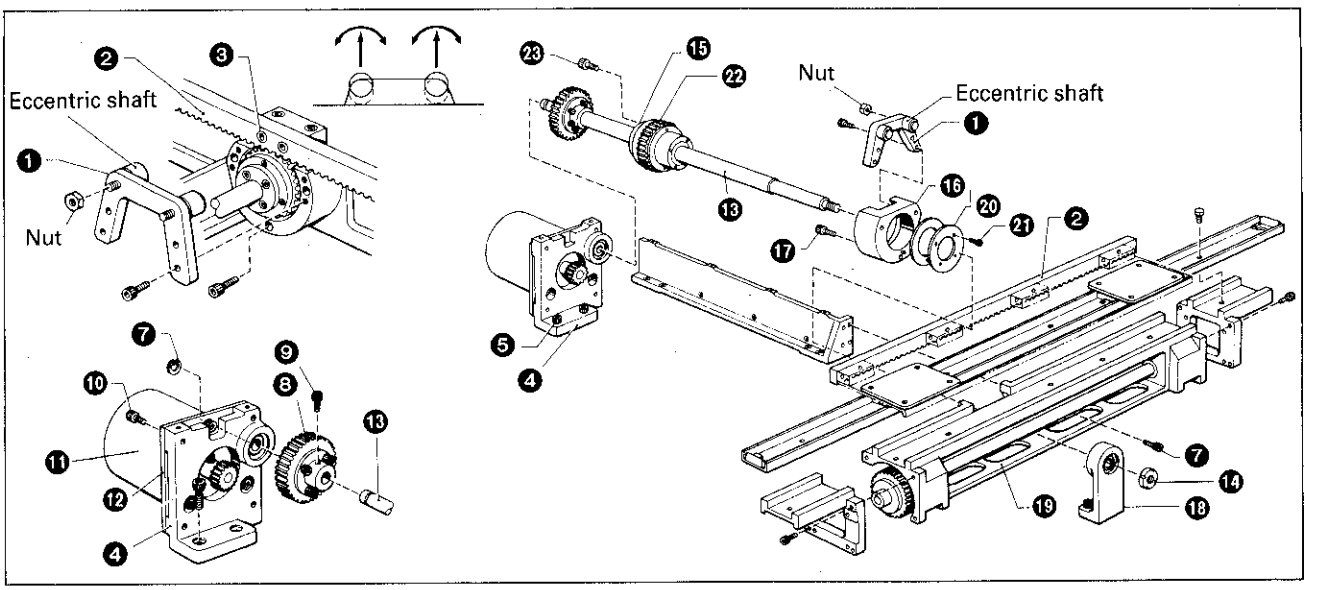
9. Pallet clamp cylinder guide bushing replacement



(1) Loosen the two screws ❷ in pallet clamp cylinder ❶, and pull cylinder ❶ out from the top.
(2) Pull guide bushing ❹ in pallet clamp cylinder mounting bracket ❸ out from the top, and insert the new bushing.
(3) Reverse the procedure to reassemble.
*Changing the position of mounting bracket ❸ will cause the pallet ❺ origin position to change. Do not loosen the four screws ❻ in mounting bracket ❸ as the position of cylinder ❶ and pallet origin will change.
(4) Check the pallet ❺ origin after reassembly.

10. Gear assembly replacement and adjustment

(1) X drive gears replacement and adjustment



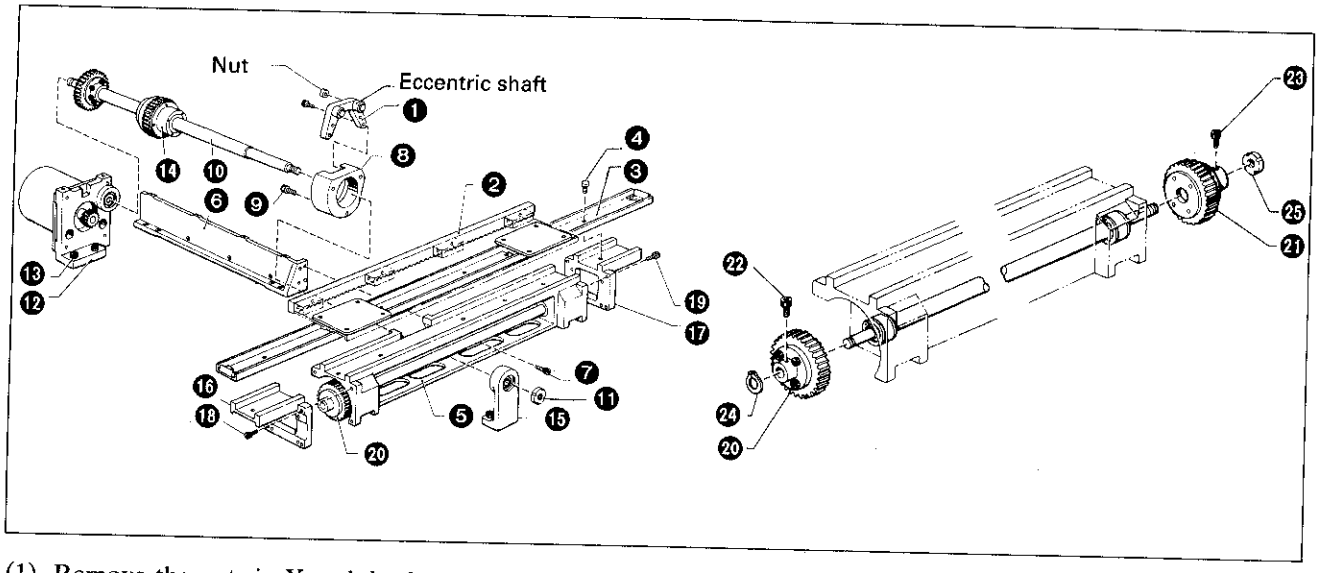
A. X follower gear

(1) Remove the each nut in X-rack back-up cam followers ❶.
(2) Turn the eccentric shaft of each cam follower to separate the X-rack ❷ and cam followers ❶, and then remove the cam followers ❶.
(3) Loosen the eight screws ❸ holding the X-rack ❷ and remove the X-rack ❷.
(4) Loosen the four screws ⑩ holding X-motor bracket ⑫, and remove X-motor ⑪.
(5) Remove the snap ring ❼ holding ball spline shaft ⑬.
(6) Loosen the two set screws ❾ in gear assembly ❽.
(7) Loosen the two screws ❺ in X-motor bracket ❹, and remove bracket ❹.
(8) Replace gear assembly ❽.
(9) Reverse the above procedure to reassemble.
*Take sufficient care and refer to the appropriate cautions during reassembly. Particular care is required to make sure the ball spline shaft and linear way slim are parallel.
(10) Make sure the X-feed guide assembly moves easily after reassembly.

B. Spline bearing gear

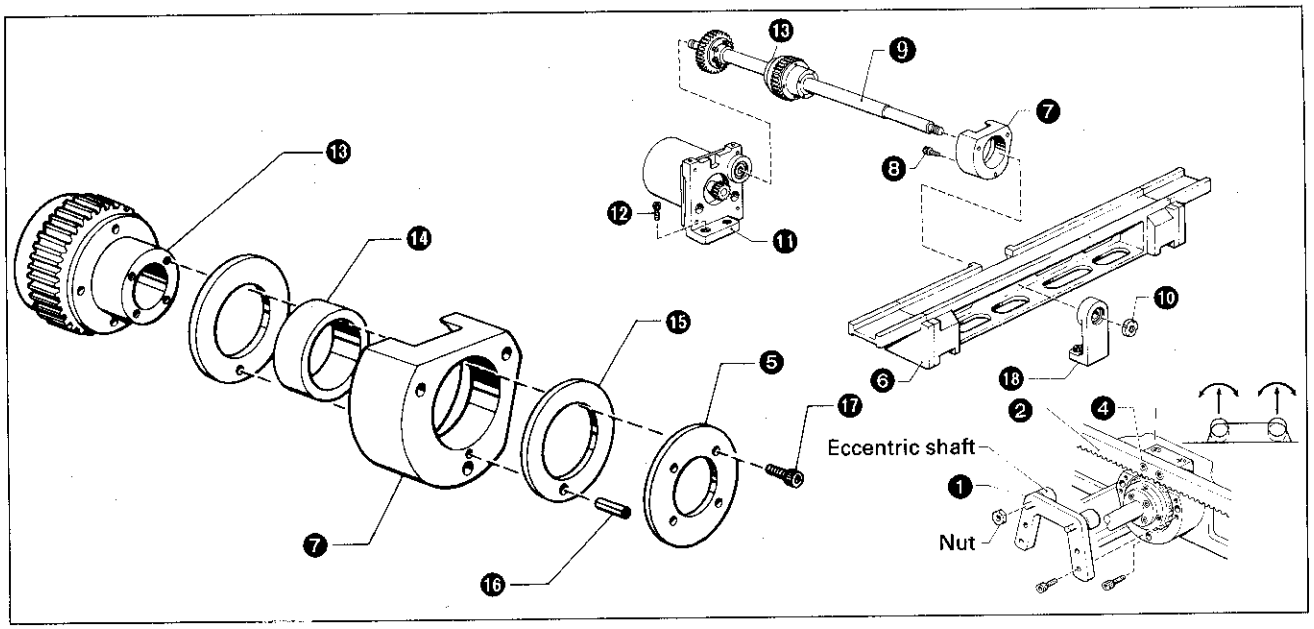
(1) Remove the nuts in X-rack back-up cam followers ❶.
(2) Turn the eccentric shaft of each cam follower to separate the X-rack ❷ and cam followers ❶, and then remove the cam followers ❶.
(3) Loosen the eight screws ㉔ holding X-rack ❷ on the X-traverse body ㉔, and remove the X-rack ❷.
(4) Loosen the three screws ⑰ holding X-drive housing ⑯.
(5) Remove the nut ⑭ on ball spline ⑬. Loosen the two screws ❺ in X-motor bracket ❹, and remove the ball spline ⑬ from the housing ⑱ and stroke frame ⑲, taking care that the spline bearing ⑮ does not come off ball spline ⑬.
(6) Loosen the four screws ㉑ in thrust sustainer ⑳, and remove thrust sustainer ⑳.
(7) Loosen the four screws ㉓ in gear assembly ㉒ on bearing ⑮.
(8) Pull the gear assembly ㉒ and bearing ⑮ apart, and install a new gear assembly.
*DO NOT take the ball spline ⑬ and bearing ⑮ apart.
(9) Reverse the above procedure to reassemble.
*Take sufficient care and refer to the appropriate cautions during reassembly. Particular care is required to make sure the ball spline shaft and linear way slim are parallel, and in adjusting the X-rotation bushing gap (p. 44) in the thrust direction.
(10) Make sure the X-feed guide assembly moves easily after reassembly.

(2) Y-gear replacement and adjustment



(1) Remove the nuts in X-rack back-up cam followers ❶.
(2) Turn the eccentric shaft of each cam follower to separate the X-rack ❷ and cam followers ❶, and then remove the cam followers ❶.
(3) Loosen the seven screws ❹ holding the X-slide pack rail ❸ and remove the X-slide pack rail ❸ from the stroke frame ❺.
(4) Remove the four screws ❼ connecting stroke frame ❺ and Y-driving rack base ❻, and disconnect the Y-driving rack base ❻ and stroke frame ❺.
(5) Remove the three screws ❾ connecting stroke frame ❺ and X-drive housing ❽, and disconnect the X-drive housing ❽ and stroke frame ❺.
(6) Remove the nut ⓫ in ball spline ⓾. Loosen the two screws ⓭ in X-motor bracket ⓬, and remove ball spline ⓾ from the stroke frame ❺ and housing ⓯, being careful that the bearing ⓮ does not come off ball spline ⓾.
(7) Loosen the three screws ⓲ ⓳ each in rail guide L ⓰ and R ⓱ on both ends of the stroke frame ❺, and then disconnect the stroke frame ❺ and rail guides L ⓰ and R ⓱.
(8) Loosen the two set screws ㉒ ~ ㉓ in both gear assemblies ⓴ ~ ㉑.
(9) Once all parts are removed from the stroke frame ❺, loosen nut ㉕ on one end and replace the gear assembly.
(10) Remove the snap ring ㉔ on the other end and replace that gear assembly.
(11) Reverse the above procedure to reassemble.
*Take sufficient care and refer to the appropriate cautions during reassembly.
(12) Make sure the X- and Y-feed guide assemblies move easily after reassembly.

11. X-rotation bushing and thrust bushing replacement and adjustment



(1) Remove the nuts in X-rack back-up cam followers ❶.
(2) Turn the eccentric shaft of each cam follower to separate the X-rack ❷ and cam followers ❶, and then remove the cam followers ❶.
(3) Loosen the eight screws ❹ holding the X-rack ❷ to the X-traverse body ❸, and remove the X-rack ❷.
(4) Remove the three screws ❽ connecting stroke frame ❻ and X-driving housing ❼, and disconnect the X-driving housing ❼ and stroke frame ❻.
(5) Remove the nut ❿ in ball spline ❾. Loosen the two screws ⓬ in X-motor bracket ⓫, and remove ball spline ❾ from the stroke frame ❻ and housing ❼, being careful that the bearing ⓭ does not come off ball spline ❾.
(6) Loosen the four screws ⓱ in thrust sustainer ❺ to free the thrust sustainer ❺.
(7) Disconnect the ball spline ⓭ and X-driving housing ❼. Do not disconnect the ball spline and bearing.
(8) Remove bushing ⓮ from housing ❼, and replace with a new bushing.
*Make sure there is a 0.05 to 0.08mm gap between bearing ⓭ and bushing ⓮.
(9) Position spacer ⓯ with the positioning pin ⓰.
*There should be less than 0.03mm of play in the direction of thrust when the unit is reassembled.
(10) Reverse the above procedure to reassemble.
*Take sufficient care and refer to the appropriate cautions during reassembly.
(11) Make sure the X- and Y-feed guide assemblies move easily after reassembly.

Adjustment Guide (Reference)

1. Make sure all parts move smoothly when the machine is fully assembled. Tolerances are as noted below.

X-gear bushing

Play in radial direction	0.05~0.07mm
Play in thrust direction	Less than 0.03mm

Ball spline and linear way slim parallelism	Less than 0.03mm/300mm
Ball spline and Y-guide parallelism, both ends	Less than 0.03mm/300mm
X-gear and X-rack backlash	Less than 0.02mm
X-follower gear and driving gear backlash	Less than 0.02mm
Y-driving gear and Y-driving rack backlash	Less than 0.02mm
Y-gear and Y-rack backlash (both sides)	Less than 0.02mm
Pallet mounting surface: needle plate surface	0.2 to 0.5mm higher
Stroke frame: support A mounting surface	Less than 0.05mm/500mm
Pallet X-axis: feed assembly X-axis parallelism	Less than 0.01mm/350mm
Pulse motor: Y-driving rack perpendicularity	Less than 0.01mm/100mm
X-rack: X-rail guide parallelism	Less than 0.01mm/560mm

Grease and screw lock should be applied to the following places.

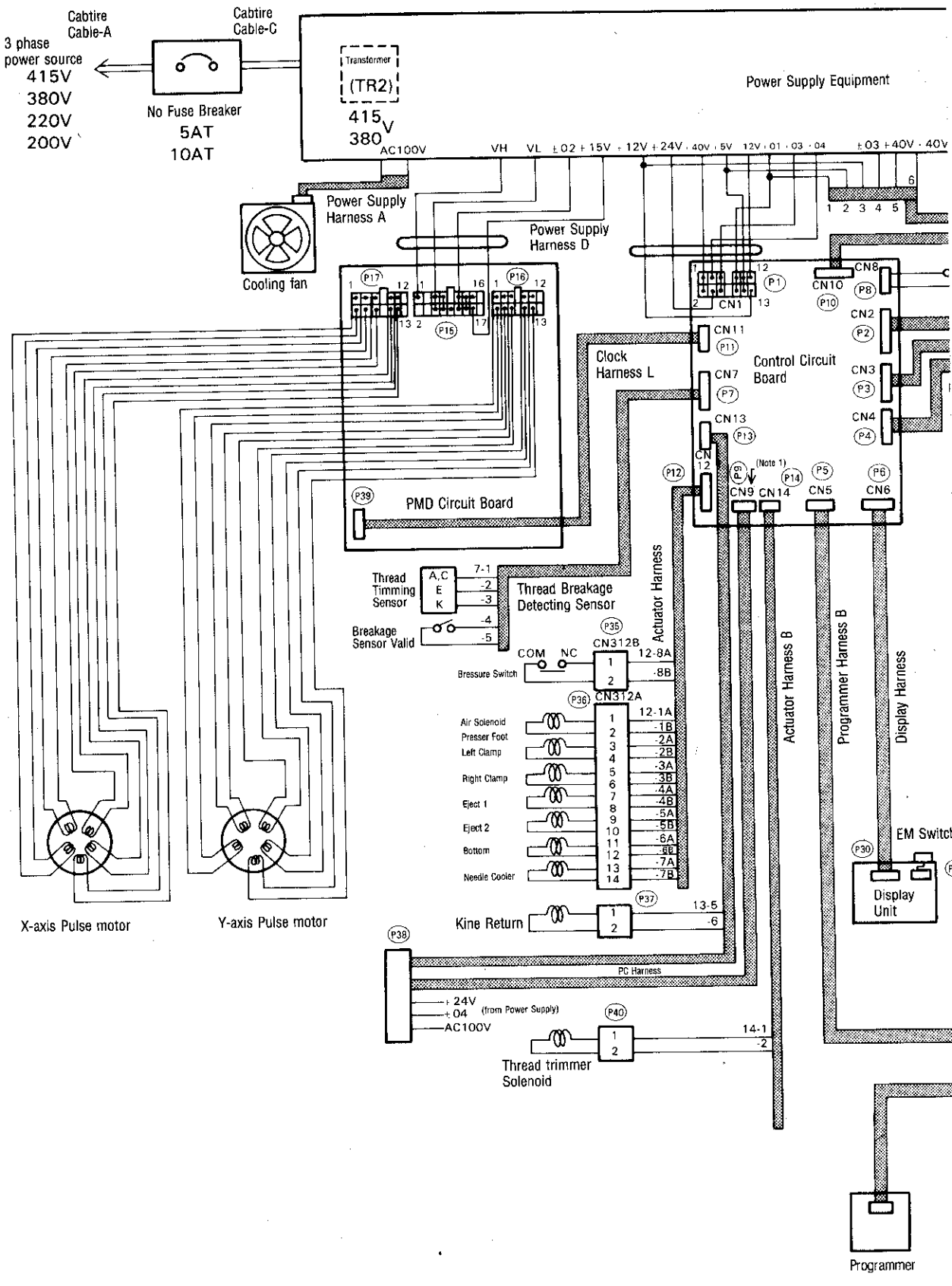
Grease:

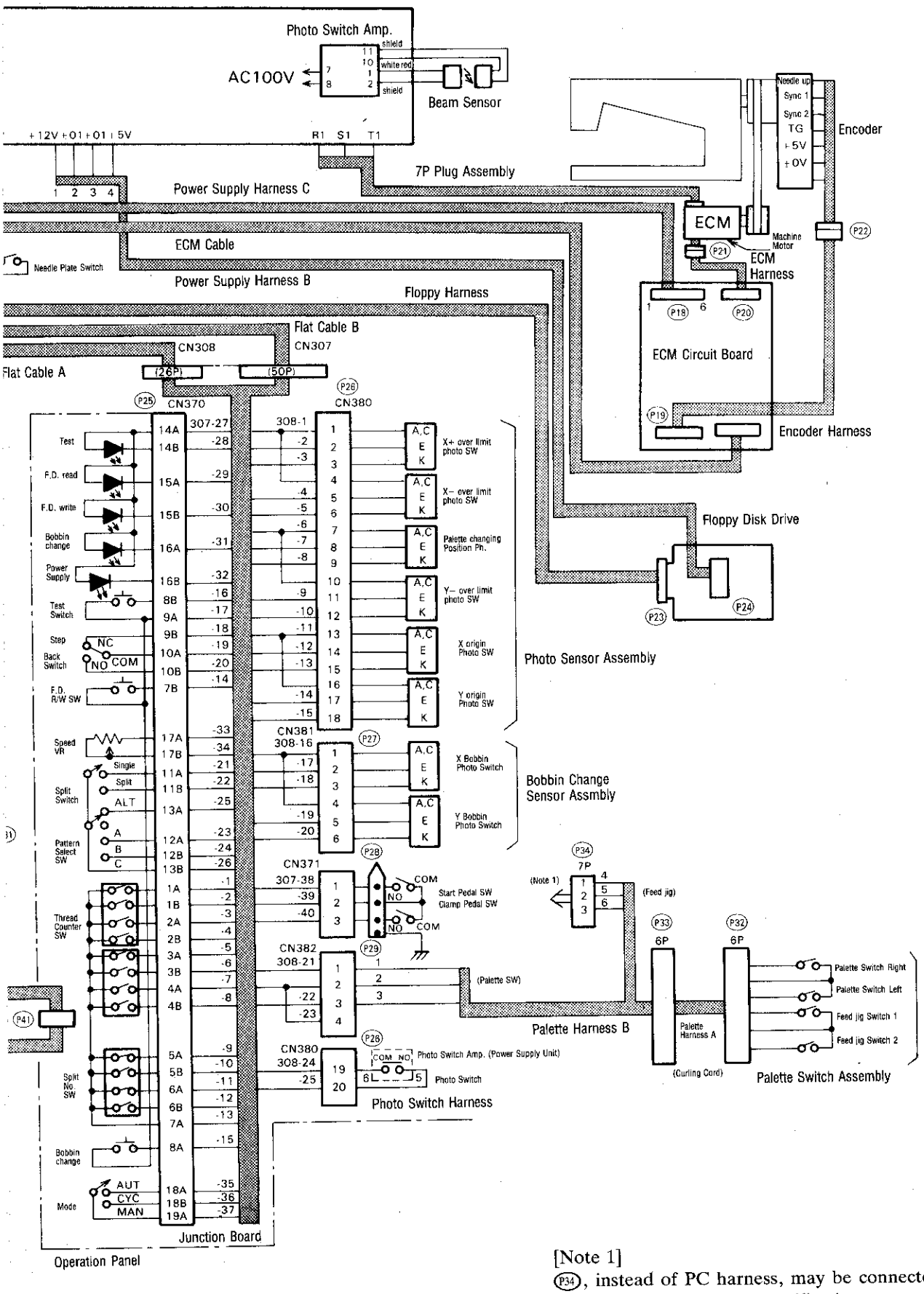
(1) X, Y-feed guide rails
(2) X-feed gear
(3) X-feed rack
(4) Y-feed gear
(5) Y-feed rack
(6) Guide gears on both ends of the Y-feed assembly
(7) Guide racks on both ends of the Y-feed assembly
(8) Linear way slim
(9) Eccentric cam follower
(10) Thrust washer and radial bushing on X-feed gear assembly

Apply screw lock to:

Use "Three Bond 1787" for wood screws to hold the nuts on the work table.

Control circuit block diagram





[Note 1]
(P34), instead of PC harness, may be connected to (P9) (or CN9) according to a specification.

1 Connector descriptions

Connector No.	Location	Main signals	Result of improper connection
P1	Power source–control circuit board	+5 V (control circuit board, FDD) +12V (RS-232C, FDD motor) −12V (RS-232C) +24V (solenoid valve) +40V (thread trimmer solenoid)	Control function errors; machine will not operate. Programmer will not operate properly. Thread trimming does not occur. Sewing speed cannot be controlled.
P2 P23	Control circuit board–FDD	FDD control signal Data R/W signal	Disk read/write errors
P3 P25 P28	Control circuit board–junction board Junction board–operation panel Junction board–treadles	Operation panel switch input signal Display output signal Speed adjustment input signal	Operation panel switches will not operate properly. Operation panel LEDs do not light. Start, clamp switches do not work.
P4 P26 P27 P29 P32 P33	Control circuit board–junction board Junction board–photo sensor assembly Junction board–bobbin change sensor Junction board–pallet harness B Pallet harness A–pallet switch assembly Pallet harness B–pallet harness A	Photo sensor input signal Bobbin change sensor input signal Pallet switch input signal Photo switch input signal	Origin cannot be located; emergency stop activated. Photo switch becomes ON, cannot be cancelled. Pallet number cannot be read. Bobbin change position cannot be located; emergency stop activated.
P5 P41	Control circuit board–operation panel Operation panel–programmer	Programmer power Programmer I/O signal (RS-232C)	Programmer switch does not work. Programmer display errors Programmer does not work.
P6 P30 P31	Control circuit board–display unit Display unit–EM switch assembly	Display power Display output signal Emergency stop switch signal	Display does not work. Emergency stop switch is activated, cannot be cancelled.
P7	Control circuit board–thread trimmer sensor assembly	Thread breakage sensor input signal Thread breakage selector signal	Machine stops due to needle thread breakage but needle thread is not broken. Machine does not stop even though needle thread broke.
P8	Control circuit board–needle plate switch assembly	Needle plate switch input signal	Error U95 is indicated, cannot be cancelled.
P9 P34 (Note 1)	(Note 1) Control circuit board–pallet switch assembly	Jig number switch signal	AUT CYC operation not possible as jig number cannot be read. Error U17 displayed.

Note 1 P9 may be connected to P38 depending on model specifications.

(P10)	Control circuit board–ECM circuit board	Motor brake, clutch control signal Needle up, synchronization signal Speed signal	Machine speed cannot be controlled. Machine does not work. Feed assembly will not operate properly. Thread trimmer will not operate properly. Machine does not stop in needle up position.
(P11) (P39)	Control circuit board–PMD circuit board	Pulse motor operation command	Pulse motor will not operate properly.
(P12) (P36) (P35)	Control circuit board–solenoid valve Solenoid valve Pressure switch	Solenoid drive signal Pressure switch input signal	Presser foot, clamp, bottom, and needle cooler will not operate properly. Error [U85] displayed, cannot be cancelled.
(P13) (P37)	Control circuit board–knife return solenoid	Solenoid drive signal	Solenoid does not work.
(P14) (P40)	Control circuit board–thread trimmer solenoid	Thread trimmer signal	Thread trimmer does not work.
(P15) (P16) (P17)	Power–PMD circuit board PMD circuit board–pulse motor	+140V, +5V, +15V Motor drive current	Pulse motor operation will be out of synchronization. Pulse motor will not operate properly.
(P18)	Power–ECM circuit board	+5V, +12V	Machine does not work. Machine does not work at proper speed. Machine runs at abnormally high speed, fuse F4 blows.
(P19)	ECM circuit board–synchronizer assembly (P22)	Needle up signal Sync signal 1 Sync signal 2 Speed signal +5V	Machine does not work. Error [U90] displayed. Thread trimmer will not operate properly.
(P22)	ECM circuit board–synchronizer assembly (P19)	Needle up signal Sync signal 1 Sync signal 2 Speed signal +5V	Machine runs at abnormally high speed, fuse F4 blows. Thread trimmer will not operate properly.
(P24)	Power–FDD	+5V, +12V	FDD does not work.
(P31)	EM switch assembly–display unit	EM switch signal	Error [U80] displayed, machine does not work.
(P20) (P21)	ECM circuit board–machine motor	Brake, clutch signals	Error [U90] displayed, machine does not work. Machine runs at abnormally high speed, fuse F4 blows.

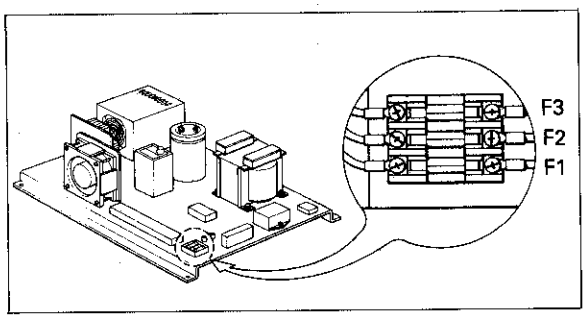
Electrical adjustments

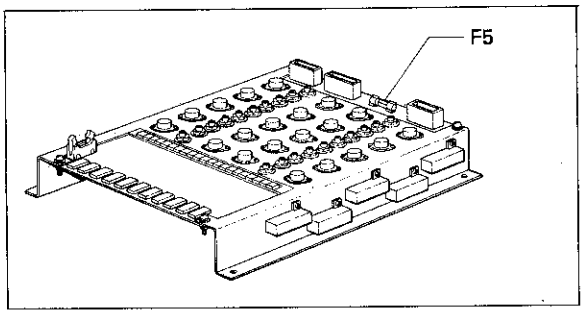
Be sure to turn the power off before beginning any adjustments or replacements.

1 Fuse descriptions

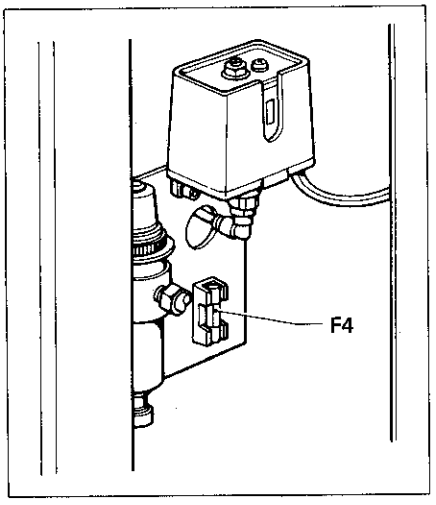
1. Fuse locations

a. Fuses F1~F3 are in the fuse holder of the power supply unit, and fuse F5 is on the pulse motor circuit board inside the left front cover.





b. Fuse F4 is below the pressure switch inside the air cock cover on the front right side.



2. Fuse capacities

No.	Type and capacity	Application
1	Standard 5A-125V	Pulse motor (V_H)
2	Standard 3A-125V	Solenoid (+24 V)
3	Standard 3A-125V	AVR, fan (100 VAC)
4	Standard 5A-125V	Brake, clutch (+40 V)
5	Slow blow fuse, 1A-250V	Pulse motor circuit board logic

3. Fuse replacement

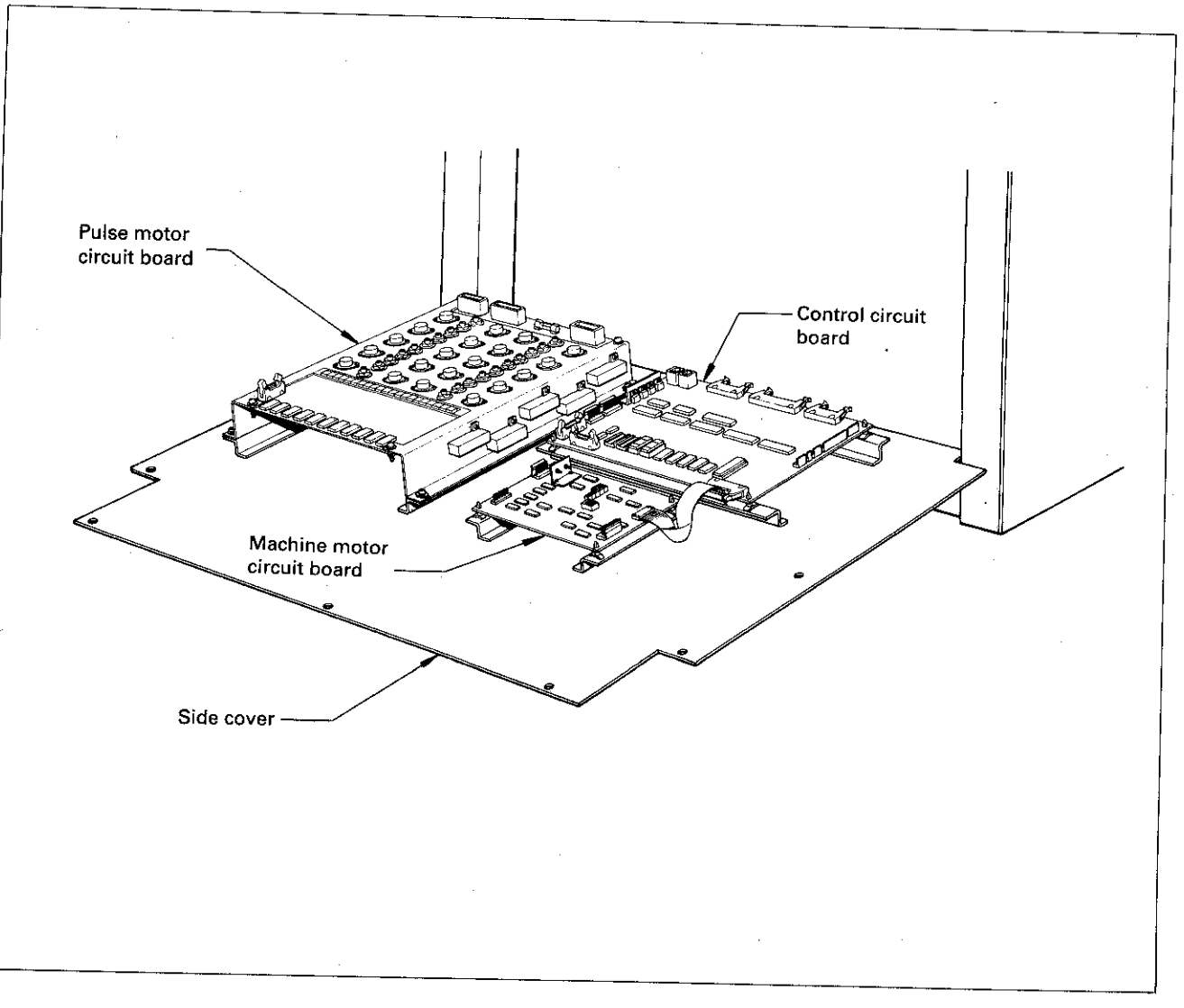
Refer to the table below for indications of a blown fuse. Be sure to replace each fuse with one of equivalent capacity and type.

Fuse No.	Problem if fuse blows	Reference page
1	• Pulse motor torque will drop, strange sound will appear, and feed mechanism will not work. • A strange sound will appear and the machine will not sew according to the program.	73, #15, 3, 4
2	• The air solenoids will no longer work, causing the presser foot, clamp, needle cooler, and other mechanisms to stop.	71~72, #9
3	• Fan will not work. • Machine will not operate.	69, #1
4	• Machine motor will not work; error U90 will appear.	67, #27
5	• Feed mechanism will not work; pulse motor LED will not light.	73~75, #15

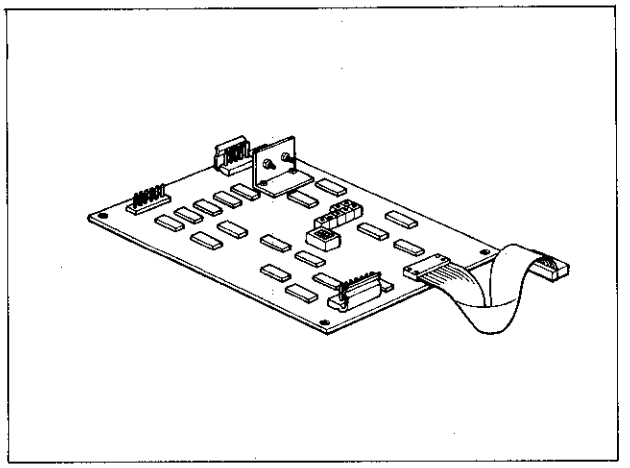
2 Circuit board and DIP switch descriptions

1. Circuit board locations

The machine motor circuit board, control circuit board, and pulse motor circuit board are inside the side cover and positioned as shown below.

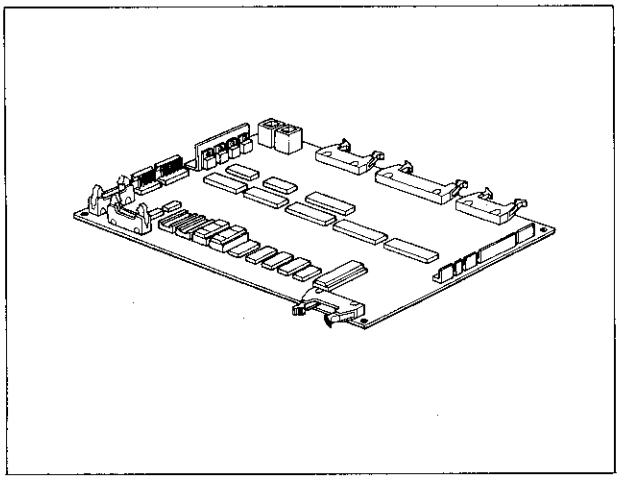


2. Circuit board functions

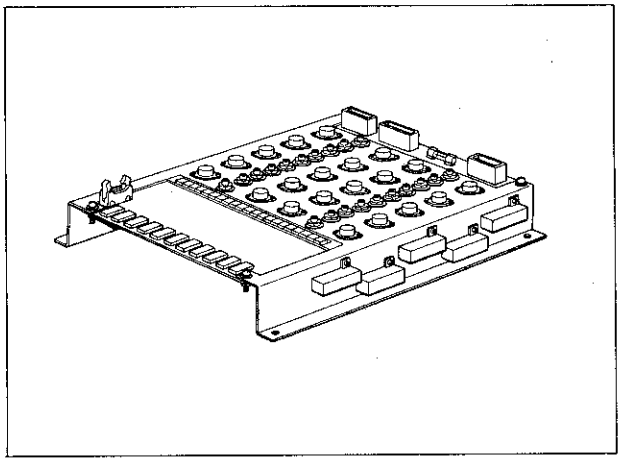


Circuit board functions are described below. Refer to these functions as necessary prior to circuit board replacement.

(1) Machine motor circuit board
- Machine motor speed control
- Outputs synchronization signal, needle up signal, and speed signal to control circuit board.

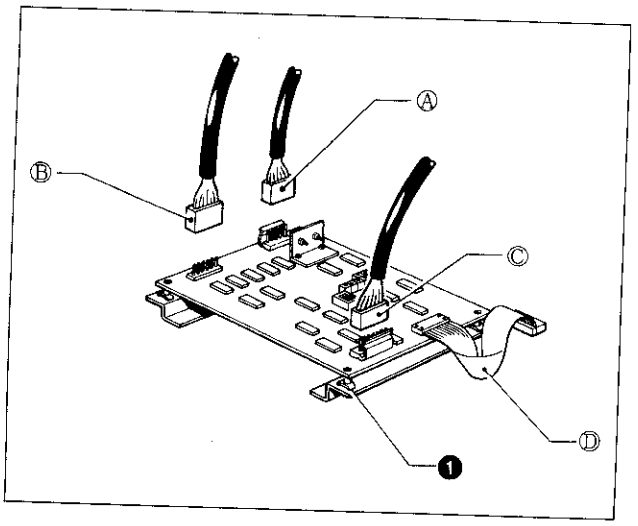


(2) Control circuit board functions
- Outputs command signal to machine motor circuit board
- Outputs command signal to pulse motor circuit board
- Floppy disk control
- Air solenoid control (clamp, thread trimmer, bottom plunger)
- Switch input determination
- Programming control



(3) Pulse motor circuit board functions
- Pulse motor drive

3. Circuit board replacement

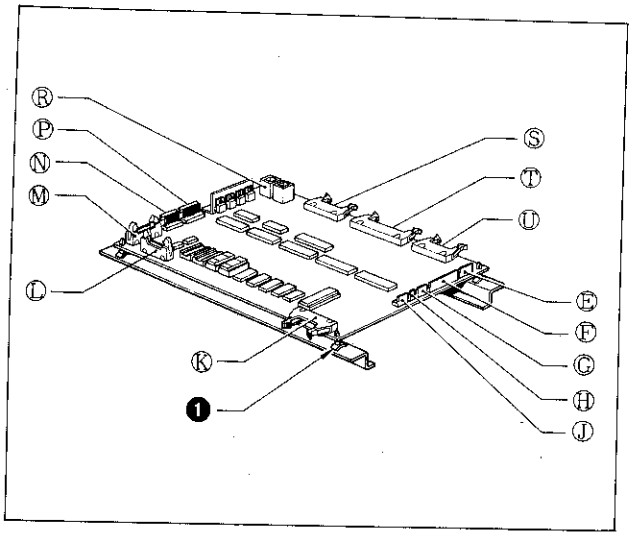


★ Always turn the power switch OFF before opening the side cover and replacing any circuit board.

[1] Machine motor circuit board replacement

(1) Disconnect connectors Ⓐ, Ⓑ, and Ⓒ, and flat cable Ⓓ.

(2) Squeeze the four spacers ❶ to the inside and remove the circuit board. To mount the new circuit board, align each corner with the respective spacer and squeeze one corner on at a time.

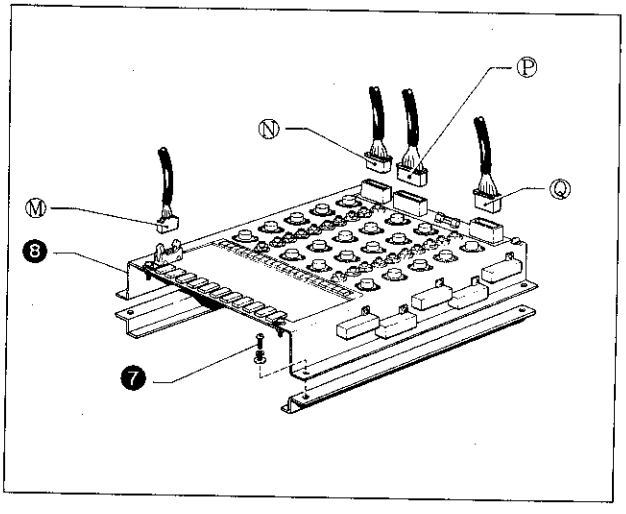


[2] Control circuit board replacement

(1) Disconnect connectors Ⓔ to Ⓤ (total 14).

(2) Squeeze the six spacers ❶ to the inside and remove the circuit board.
To mount the new circuit board, align each mounting hole with the respective spacer and squeeze each one, one at a time.

(3) When reconnecting the connectors, press on the back of the connector. Each will fit tightly, but do not apply excessive force.
*Similar caution is required when replacing the PROM.



[3] Pulse motor circuit board replacement

(1) Disconnect connectors Ⓜ, Ⓝ, Ⓟ, and Ⓠ.

(2) Remove the four screws ❼ and replace the pulse motor circuit board. ❽

[3] DIP switch and speed control adjustment

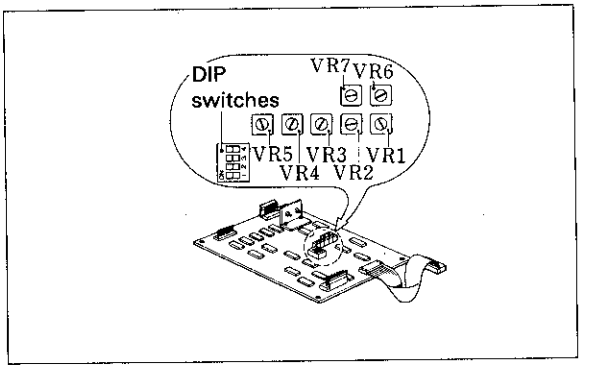
1-1 Machine motor circuit board DIP switches (for machine speed inspection)

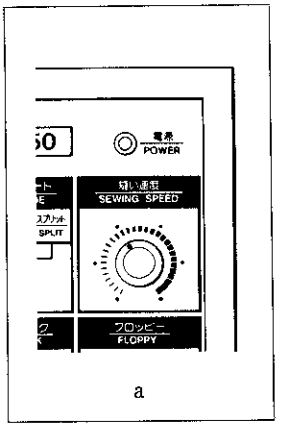
Dip1	Dip2	Dip3	Dip4	Motor speed (rpm)	
ON	OFF	OFF	OFF	Thread trimming speed	(230rpm)
ON	ON	OFF	OFF	Low	(800rpm max.)
ON	ON	ON	OFF	Medium	(1.400rpm max.)
ON	ON	ON	ON	High	(2.000rpm max.)
ON	ON	OFF	ON	High (option)	(2.000rpm max.)

Note 1 The speed control on the operation panel is used to regulate all speeds other than thread trimming speeds.

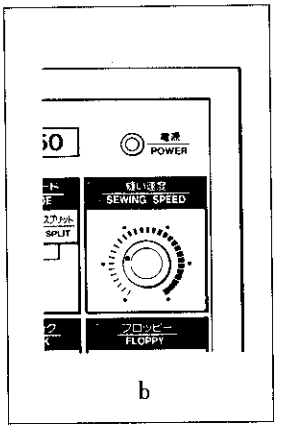
Note 2 DIP 1 should always be ON during inspection; DIP 2 should be on at all other times except during thread trimming speed adjustment.

Note 3 Turn all DIP switches OFF after inspection and adjustment is completed.





a



b

1-2 Speed controls

VR1 to VR5 can be used to adjust the machine speed according to the DIP switch settings in 1-1 above.

a. Thread trimming speed ..... VR5 (230 rpm)
b. Low ..... VR4 (800 rpm)
c. Medium ..... VR3 (1400 rpm)
d. High ..... VR1 (2000 rpm)
e. With options ..... VR2 (2000 rpm)

1-3 Brake timing adjustment

a VR6...Used to adjust the machine motor brake timing in the normal sewing mode.

(1) Adjust the speed control on the operation panel as shown in Fig. a. (Pointing at about 11:00)
(2) Turn VR6 to the left so that the brake comes on (a click will be heard) when the machine speed is dropped from high to thread trimming speed with the DIP switches.
(3) Adjust the speed control on the operation panel as shown in Fig. b. (pointing at about 10:00)
(4) Turn VR6 right so that the brake does not come on.
(5) Repeat from step ❶ until the brake comes on regularly as described in steps ❷ and ❹.

b. VR7...(use with options) Adjust to the same setting as VR6.

2. Control circuit board DIP switches (used to adjust for optional accessories)

★ There are two series of control circuit board DIP switches for use with different machine specifications. DIP switch series 1 uses switches 1~8; series 2 uses 5~8 with others provided for use with future options. (All switches in 2 should be ON.)
Future improvements and modifications of specifications may cause these switches to be reassigned.

2-1 DIP switch 1

No.	Function when ON	Function when OFF	Notes
1	Clamp remains in current position when sewing is completed.	Clamp automatically releases jig when sewing is completed.	Clamp automatically releases jig when sewing is completed in AUT and CYC regardless of switch position.
2	Note 1	Note 1	2 and 3 are both normally ON
3	Note 1	Note 1	
4	—	—	Unassigned; should be OFF.
5	—	—	Unassigned; should be OFF.
6	Automatic clamping	Automatic clamping does not occur.	Clamps automatically in AUT and CYC regardless of switch position.
7	800spm regardless of stitch length	Sewing speed adjusted according to stitch length	
8	—	—	Unassigned; should be OFF.

Note 1 Switches 1-2 and 1-3 are used to adjust the clamp mode; both should normally be ON.

DIP switch 1-2	DIP switch 1-3	Clamp operation
ON	ON	(a) When clamp is up, right clamp descends; 0.4sec. later left clamp descends; 0.4sec. later presser foot descends. (b) When clamp is down, right and left clamp rise together; 0.4sec. later presser foot rises. (Next operation does not begin until pallet switch is OFF.)
ON	OFF	(a) When right/left clamp are both down, presser foot rises and 0.4sec. later right/left clamps rise. (b) When left clamp is up, left clamp descends. (c) When right clamp is up and left clamp is down, right clamp descends and 0.4sec later presser foot descends.
OFF	ON	(a) When right/left clamps are both down, left clamp rises and 0.4sec. later presser foot rises. (b) When left clamp is up, right clamp rises. (c) When right clamp is up, left/right clamps descend and 0.4sec. later presser foot descends.
OFF	OFF	(a) When both clamps are down, presser foot rises, and 0.4sec. later left/right clamps rise. (b) When both clamps are up, left/right clamps rise, and 0.4sec. later presser foot rises.

2-2 DIP switch series 2

No.	Function when ON	Function when OFF	Notes
5	—	—	Unassigned
6	Note 2	—	Unassigned
7	—	—	Unassigned
8	—	—	Unassigned

Note 2 DIP switch 2-6 should always be ON.

The DIP switches are factory set as follows.

① Machine motor circuit board (ECM circuit board)

Dip1	OFF
2	OFF
3	OFF
4	OFF

② Control circuit board

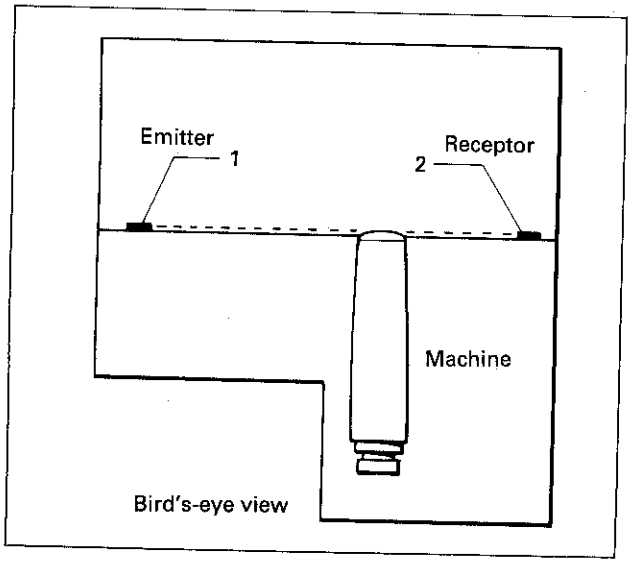
Dip1−1	ON
1−2	ON
1−3	ON
1−4	OFF
1−5	OFF
1−6	OFF
1−7	OFF
1−8	OFF

Dip2−1	ON
2−2	ON
2−3	ON
2−4	ON
2−5	ON
2−6	ON
2−7	ON
2−8	ON

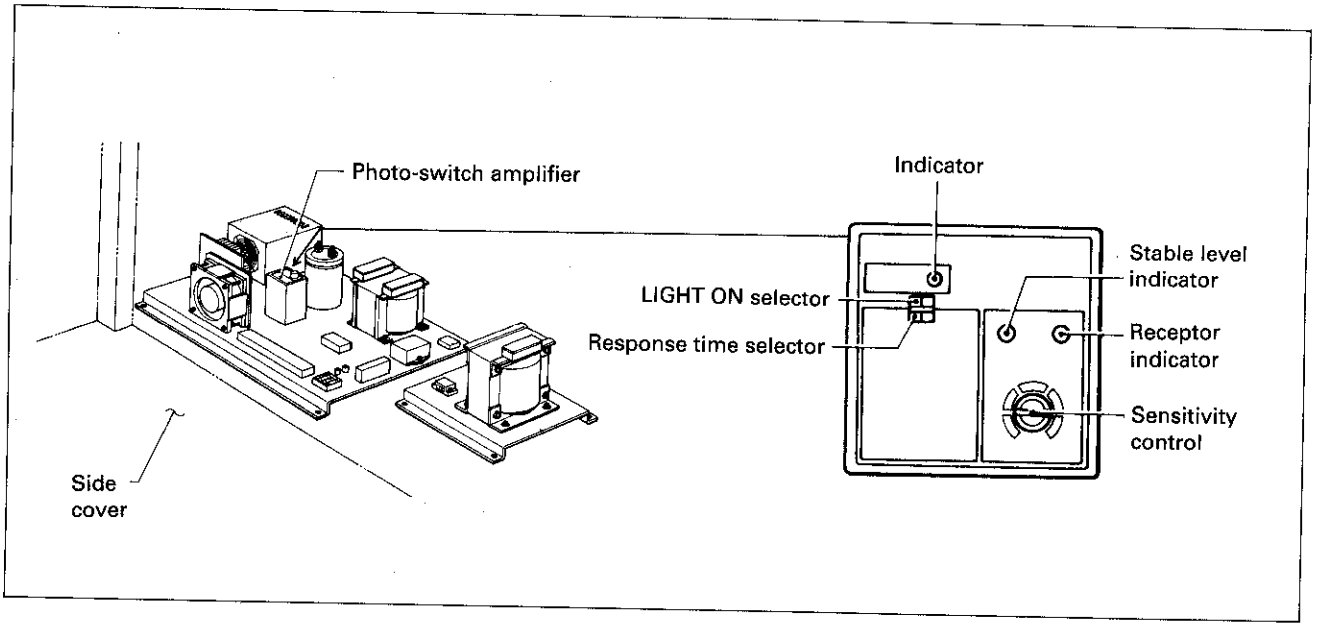
[4] Safety mechanism

1. A photo-beam switch and needle plate switch are provided on this machine to increase operator safety during sewing machine operation. These switches will stop or prevent sewing machine operation if the operator's hand or other articles enter the sewing machine work area during machine operation (photo-beam switch), or the machine is started with the needle plate open after bobbin replacement (needle plate switch).
2. The photo-beam switch consists of a light emitting diode and a receptor for continuous monitoring of light beam reception.
   The photo-beam is invisible. Should the beam be broken by the operator's hand or some other article, a signal will be sent to the control circuit board, an error will be indicated on the display, and the machine will stop.

3. Photo-beam switch adjustment

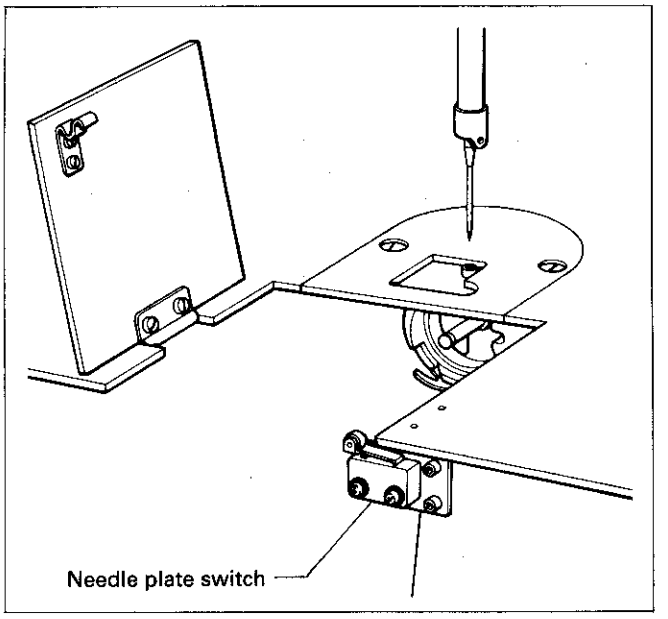


(1) Align the optical axis of the photo-beam sensor. Error [U95] will appear when the optical axis is out of alignment right or left.
(2) Open the side cover of the machine, and adjust the photo-beam switch amplifier as described below.
   a. Set the LIGHT ON/DARK ON selector to LIGHT ON.
   b. Adjust the response time to 1ms.
   c. Set the sensitivity control to one stop above minimum.



(3) Set the sensitivity indicator to the best position for the application. The above is simply a guide. Check switch operation after adjustment.

4. Needle plate switch

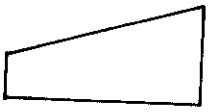


Adjust the needle plate switch so that the sewing machine will only operate when the needle plate is fully closed. The cassette, needle plate, and other parts may be damaged if the sewing machine can operate while the needle plate is partially open.

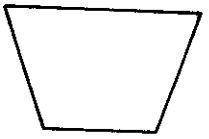
Trouble shooting Guide

1 Flowchart description

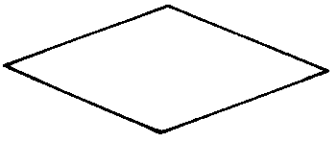
1. Manual procedure



2. Manual switch operation



3. Determine



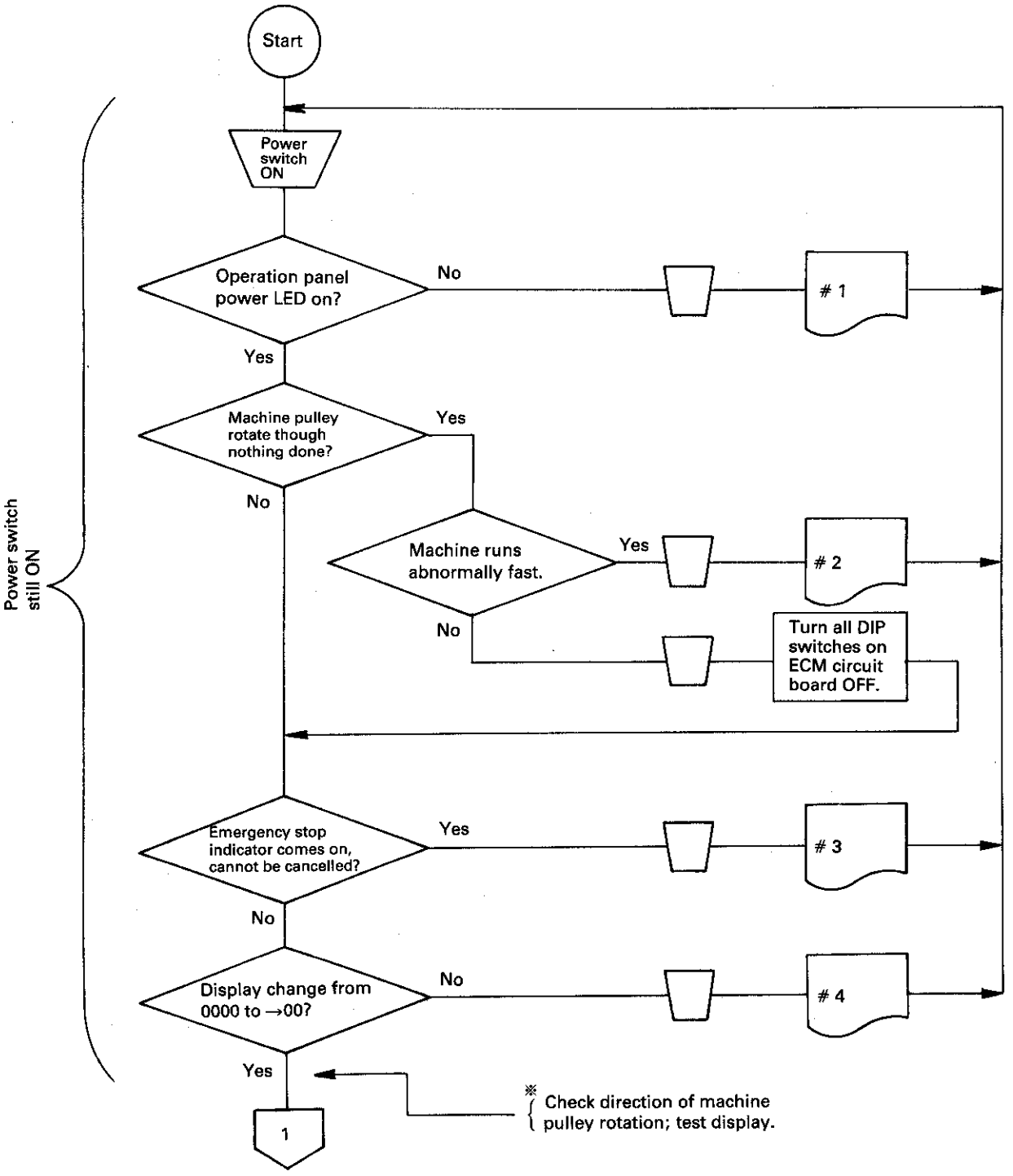
4. Reference item or page

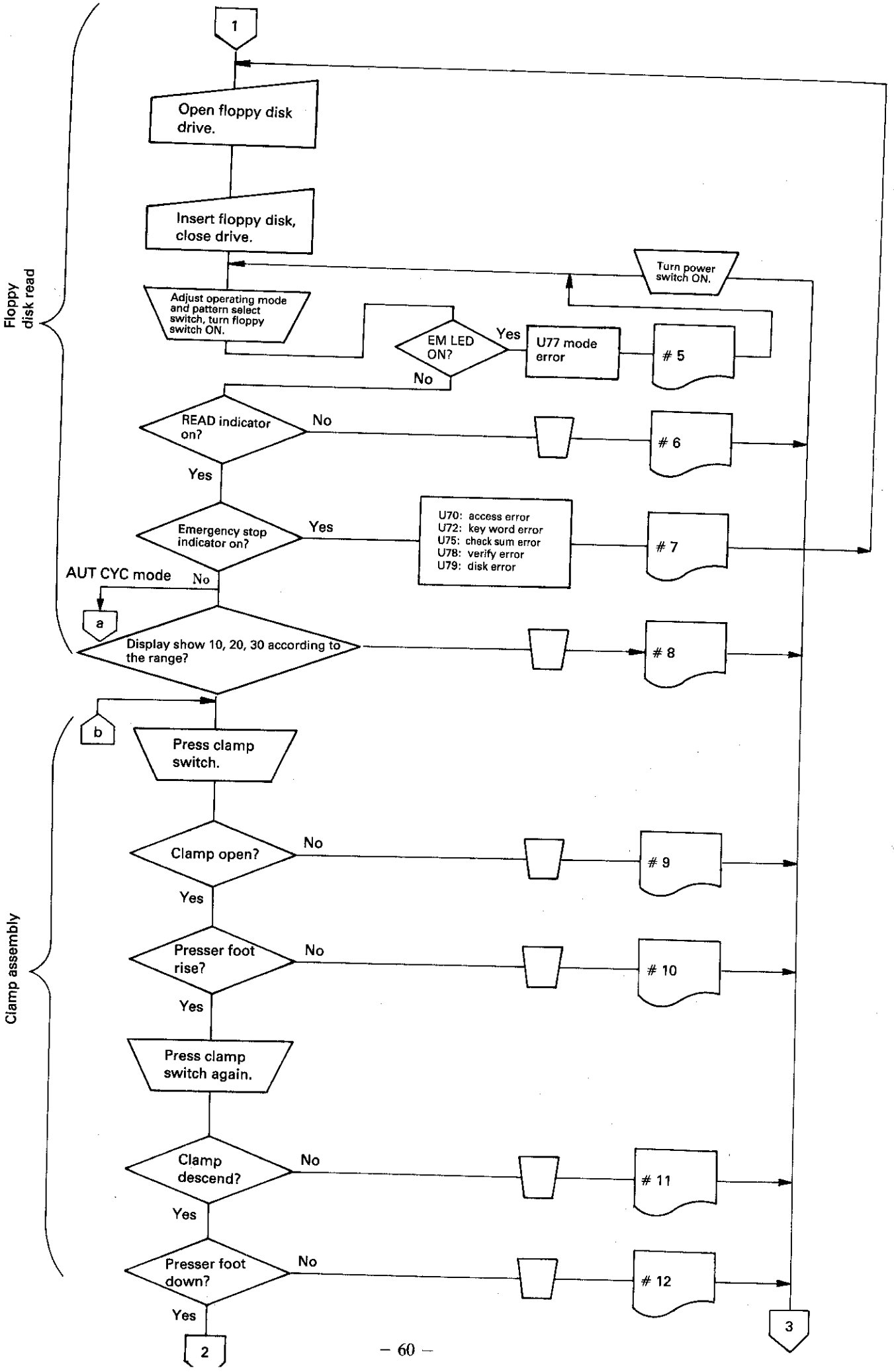
5. Settings or conditions

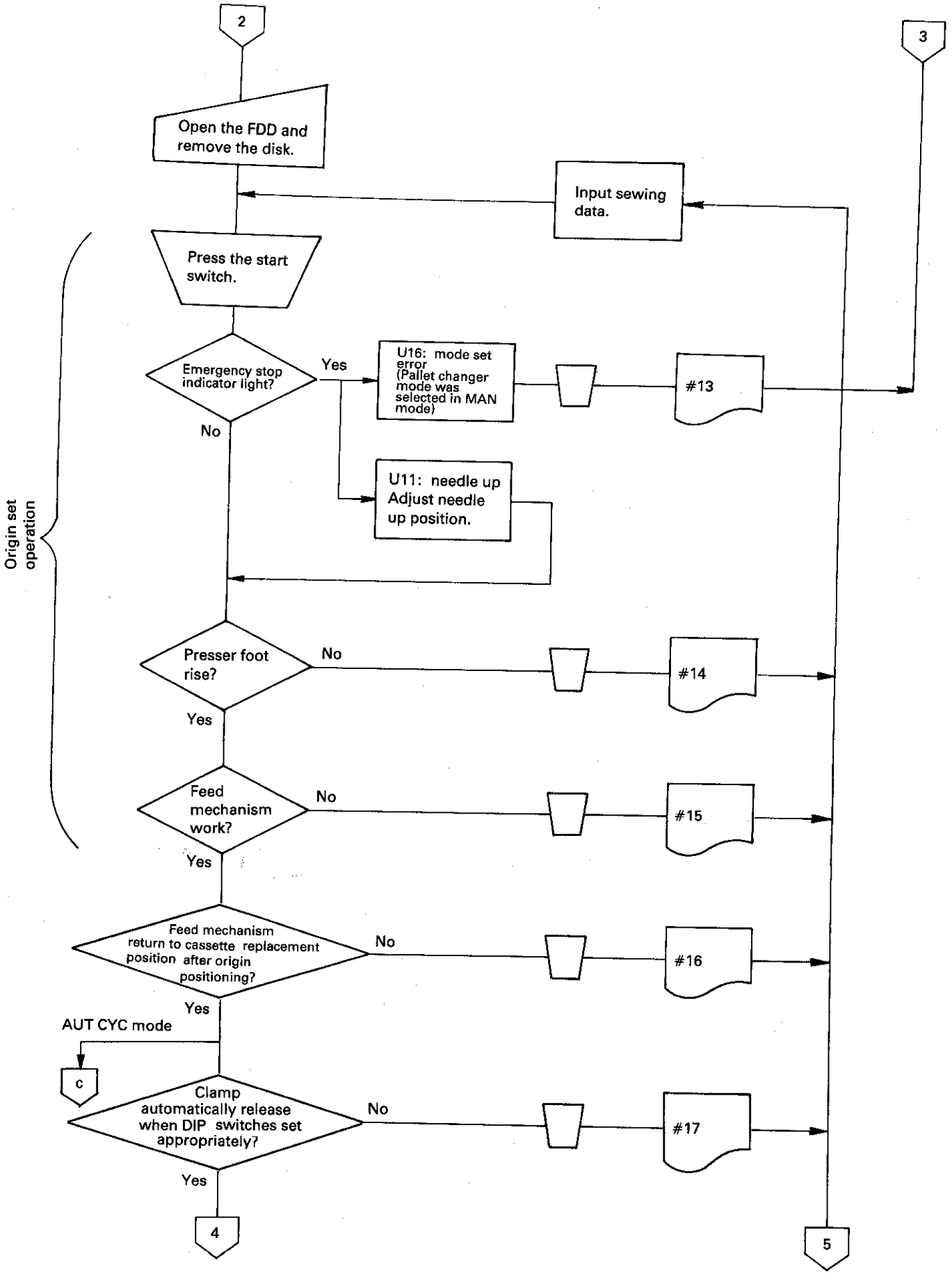
6. Continuation of flowchart

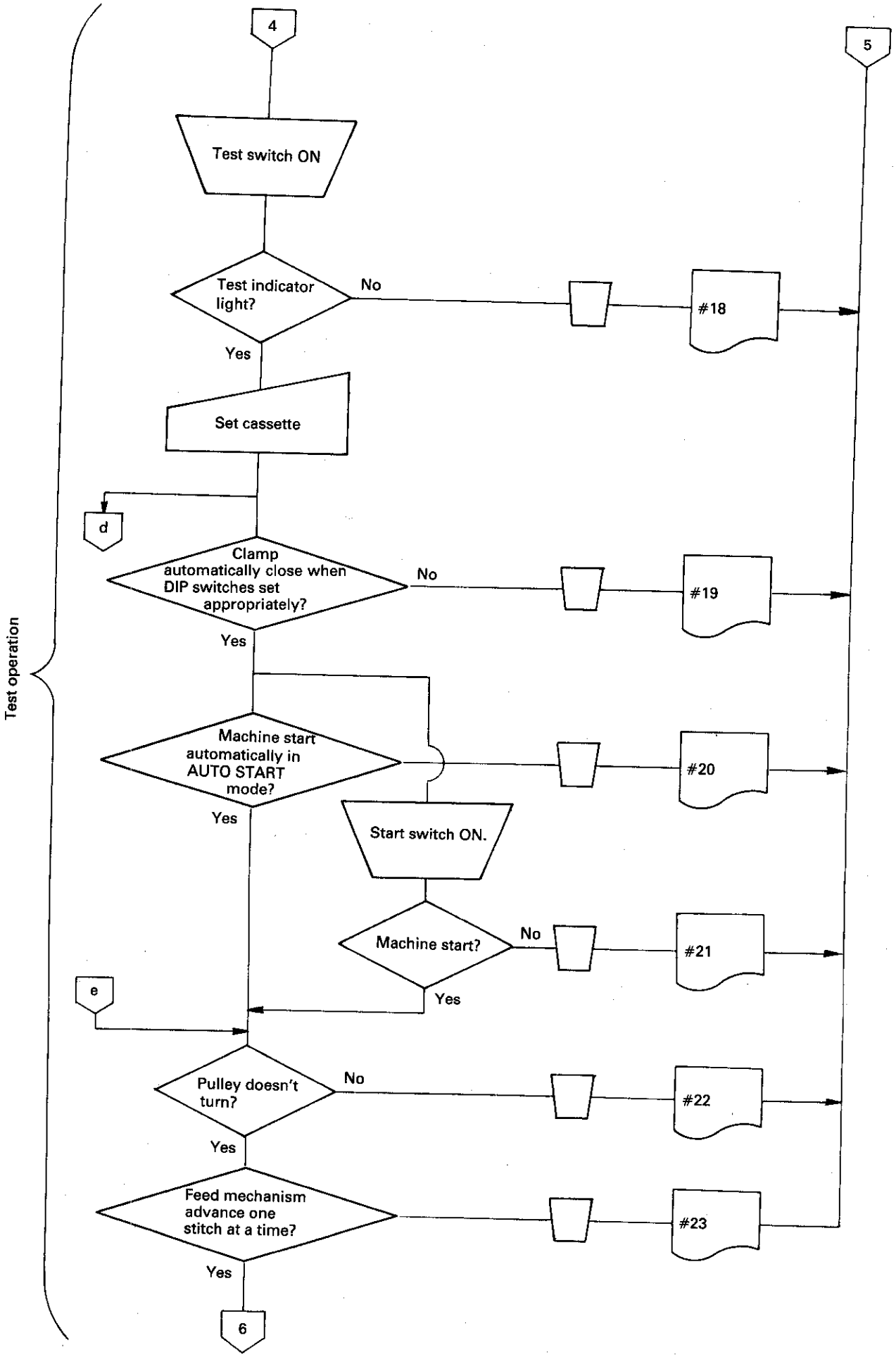
7. Power switch OFF

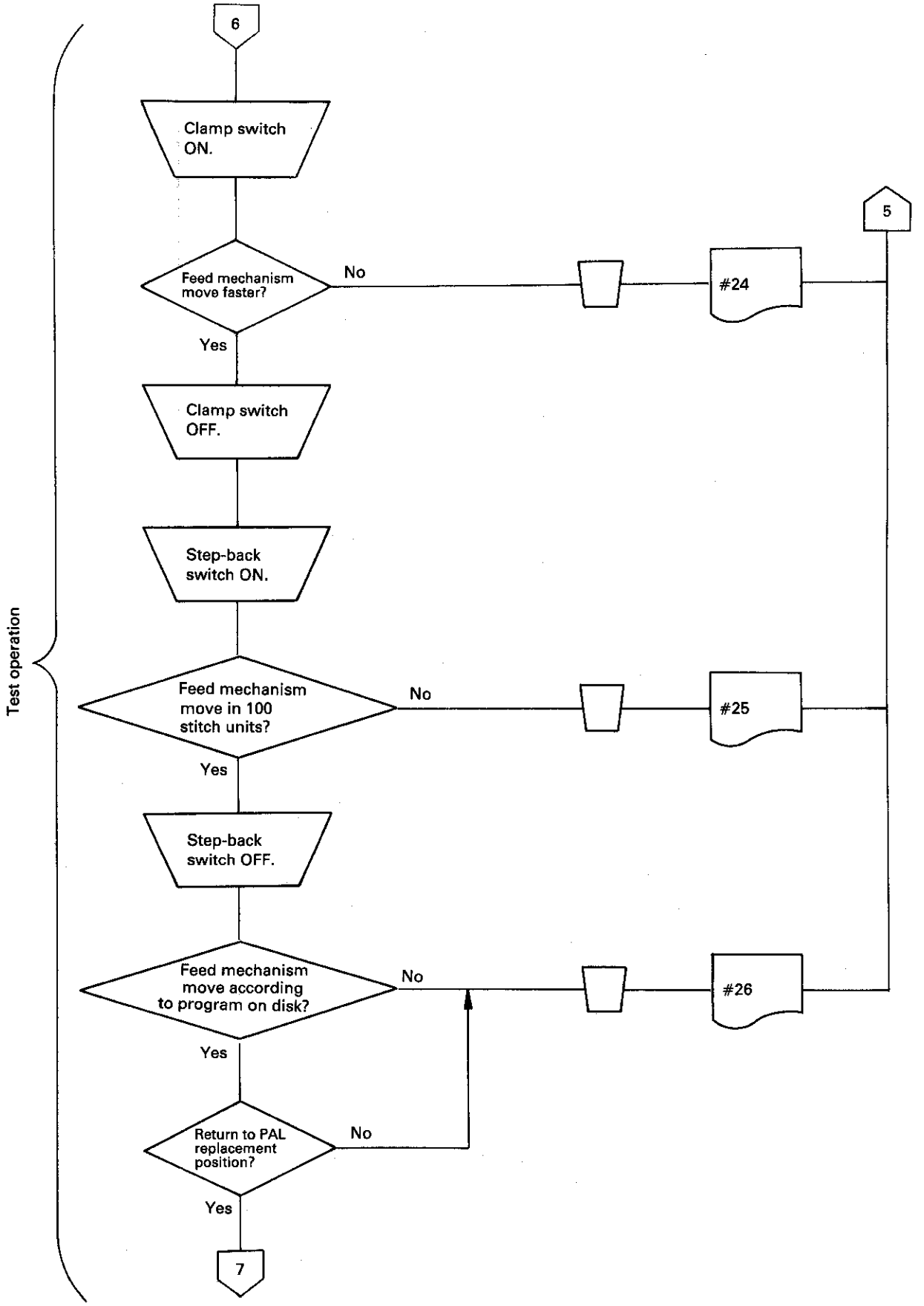
[▽ Turn the power switch OFF.]

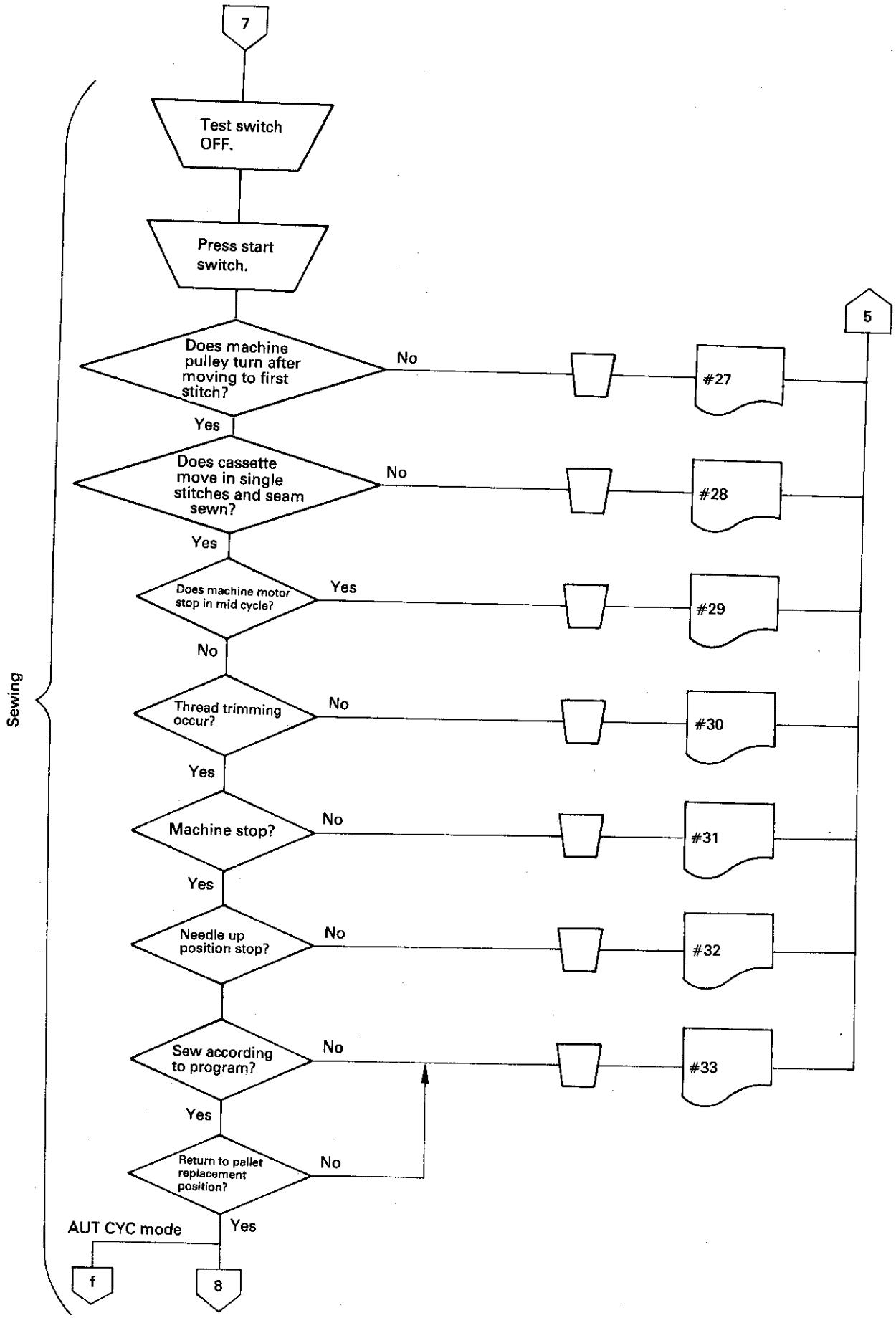


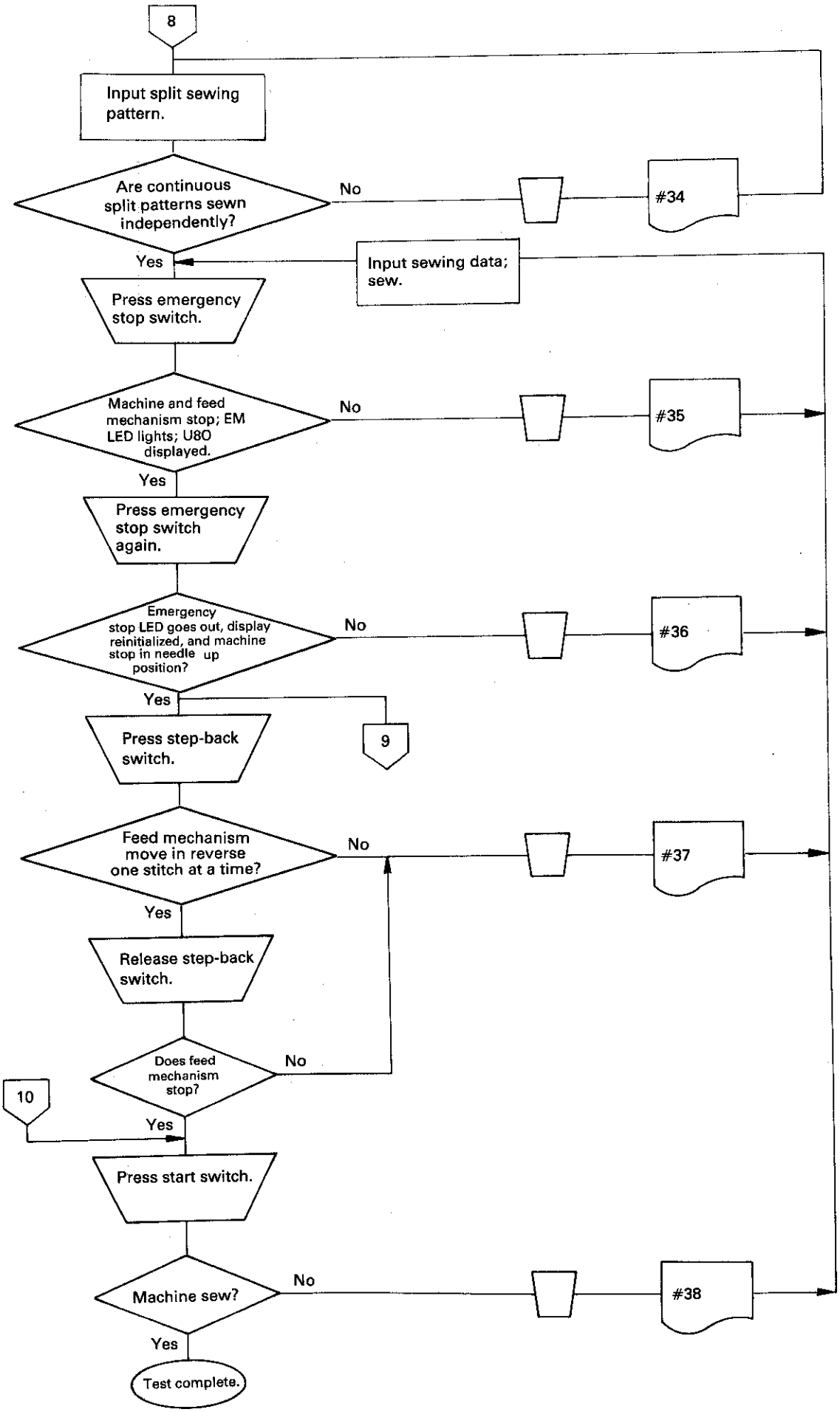

Floppy disk read
1
Open floppy disk drive.
Insert floppy disk, close drive.
Turn power switch ON.
Adjust operating mode and pattern select switch, turn floppy switch ON.
EM LED ON?
Yes
U77 mode error
5
No
READ indicator on?
No
6
Yes
Emergency stop indicator on?
Yes
U70: access error
U72: key word error
U75: check sum error
U78: verify error
U79: disk error
7
AUT CYC mode
No
a
Display show 10, 20, 30 according to the range?
8
b
Clamp assembly
Press clamp switch.
Clamp open?
No
9
Yes
Presser foot rise?
No
10
Yes
Press clamp switch again.
Clamp descend?
No
11
Yes
Presser foot down?
No
12
Yes
2
3

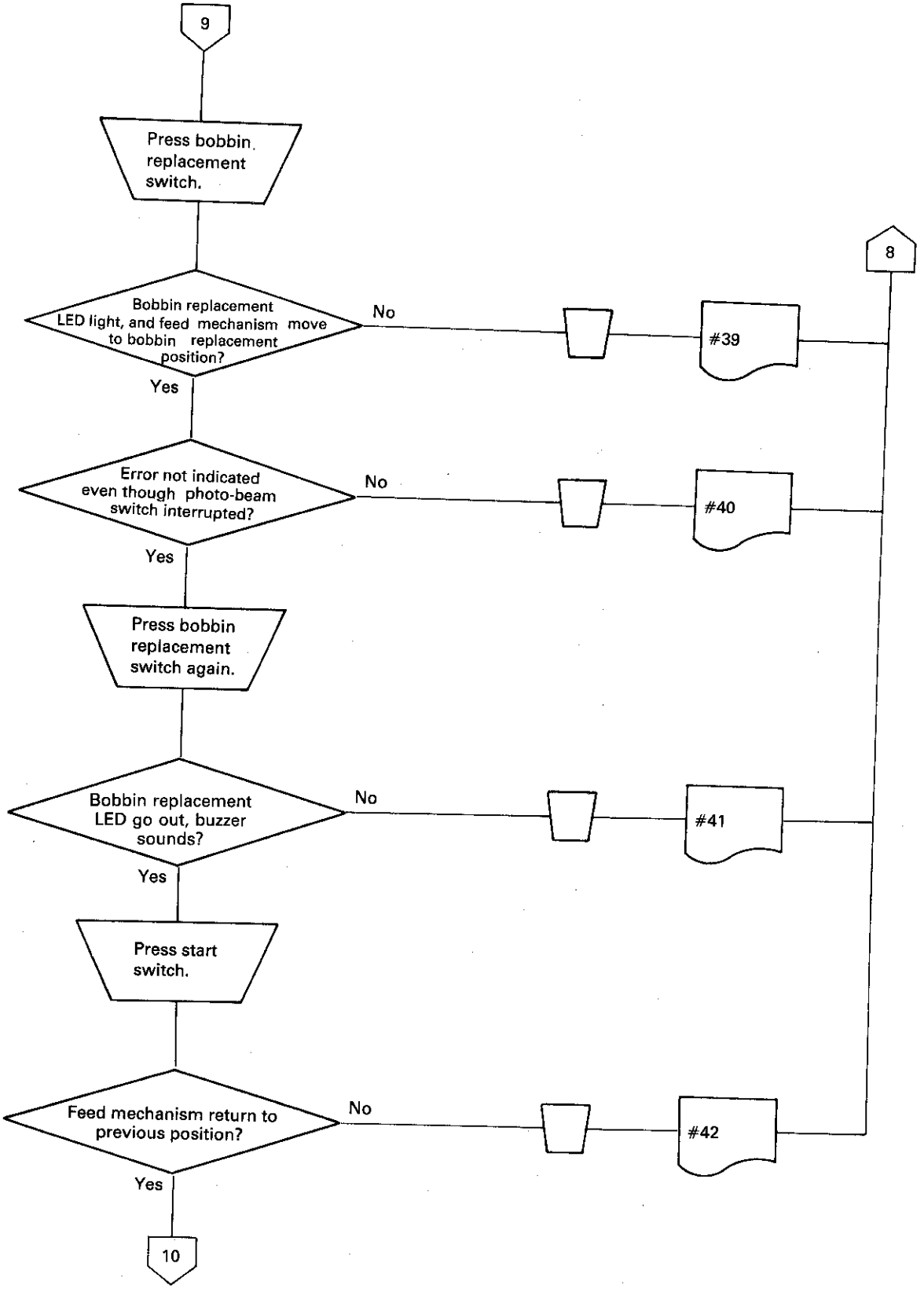

2
3
Open the FDD and remove the disk.
Input sewing data.
Press the start switch.
Origin set operation
Emergency stop indicator light?
Yes
No
U16: mode set error (Pallet changer mode was selected in MAN mode)
#13
U11: needle up Adjust needle up position.
Presser foot rise?
No
Yes
#14
Feed mechanism work?
No
Yes
#15
Feed mechanism return to cassette replacement position after origin positioning?
No
Yes
#16
AUT CYC mode
C
Clamp automatically release when DIP switches set appropriately?
No
Yes
#17
4
5


Test operation
4
Test switch ON
Test indicator light?
No
#18
Yes
Set cassette
d
Clamp automatically close when DIP switches set appropriately?
No
#19
Yes
Machine start automatically in AUTO START mode?
#20
Yes
Start switch ON.
Machine start?
No
#21
Yes
e
Pulley doesn't turn?
No
#22
Yes
Feed mechanism advance one stitch at a time?
#23
Yes
6
5

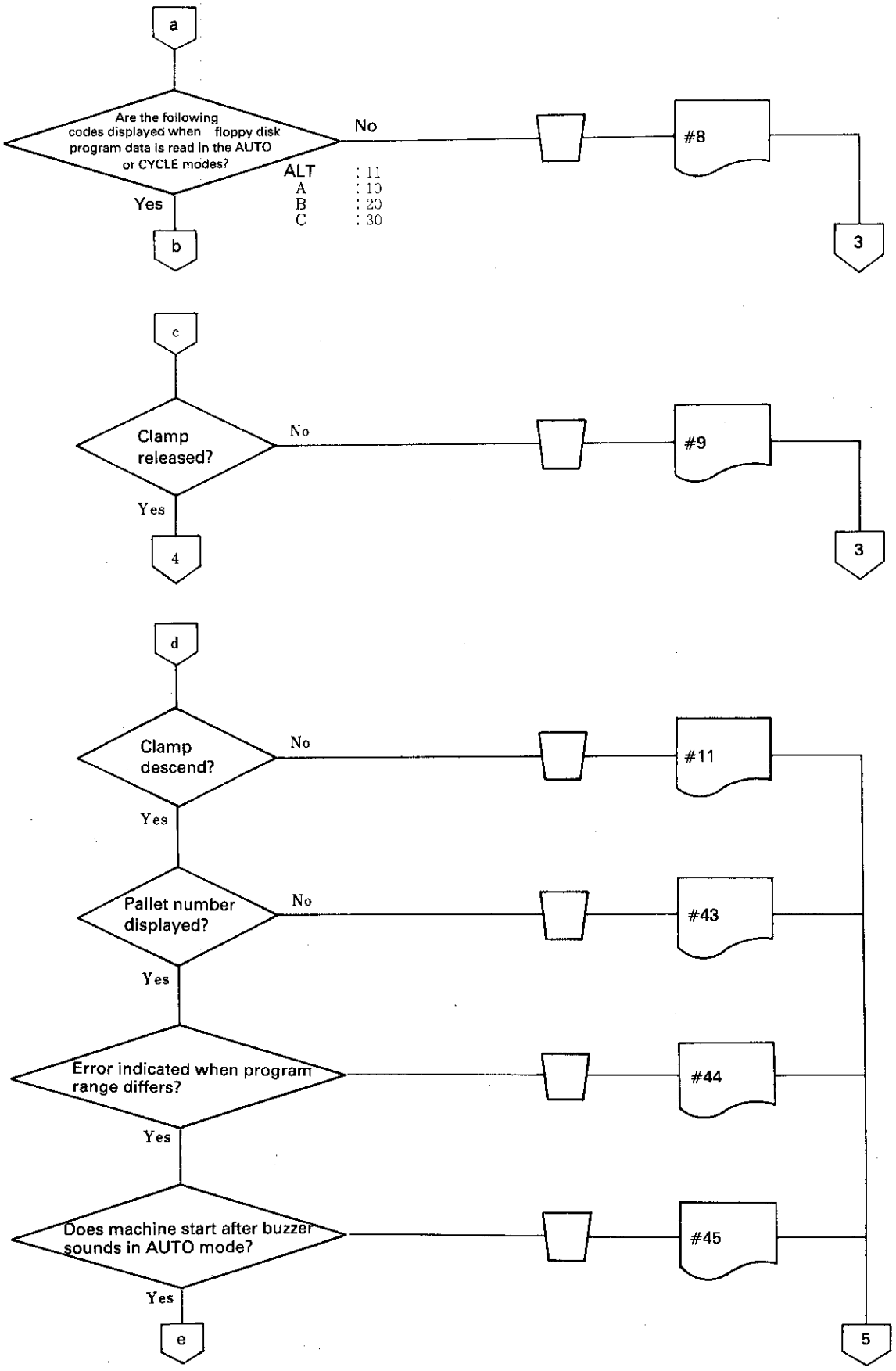

Test operation
6
Clamp switch ON.
Feed mechanism move faster?
No
#24
5
Yes
Clamp switch OFF.
Step-back switch ON.
Feed mechanism move in 100 stitch units?
No
#25
Yes
Step-back switch OFF.
Feed mechanism move according to program on disk?
No
#26
Yes
Return to PAL replacement position?
No
Yes
7

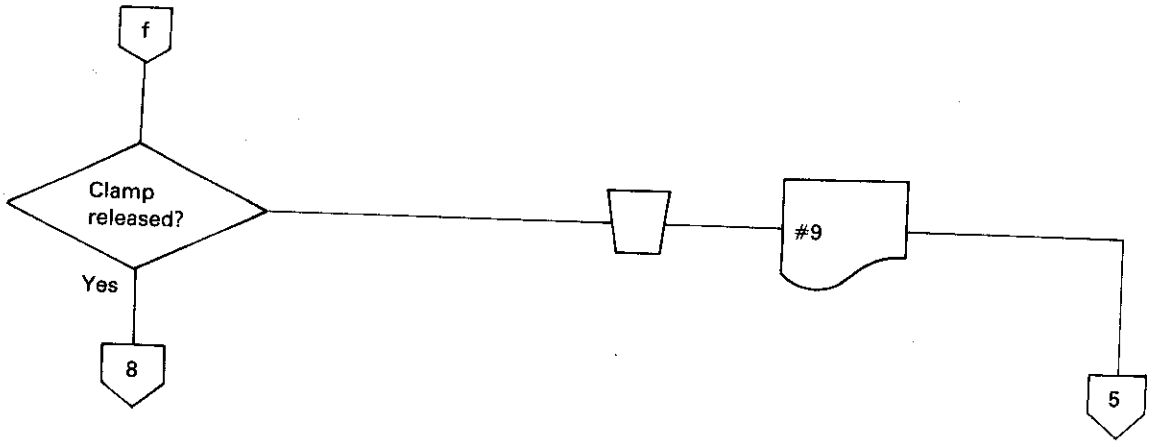

7
Test switch OFF.
Press start switch.
Does machine pulley turn after moving to first stitch?
No
#27
Yes
Does cassette move in single stitches and seam sewn?
No
#28
Yes
Does machine motor stop in mid cycle?
Yes
#29
No
Thread trimming occur?
No
#30
Yes
Machine stop?
No
#31
Yes
Needle up position stop?
No
#32
Sew according to program?
No
#33
Yes
Return to pallet replacement position?
No
AUT CYC mode
Yes
f
8
5
Sewing


8
Input split sewing pattern.
Are continuous split patterns sewn independently?
No
#34
Yes
Input sewing data; sew.
Press emergency stop switch.
Machine and feed mechanism stop; EM LED lights; U80 displayed.
No
#35
Yes
Press emergency stop switch again.
Emergency stop LED goes out, display reinitialized, and machine stop in needle up position?
No
#36
Yes
9
Press step-back switch.
Feed mechanism move in reverse one stitch at a time?
No
#37
Yes
Release step-back switch.
Does feed mechanism stop?
No
10
Yes
Press start switch.
Machine sew?
No
#38
Yes
Test complete.


9
Press bobbin replacement switch.
Bobbin replacement LED light, and feed mechanism move to bobbin replacement position?
No
#39
8
Yes
Error not indicated even though photo-beam switch interrupted?
No
#40
Yes
Press bobbin replacement switch again.
Bobbin replacement LED go out, buzzer sounds?
No
#41
Yes
Press start switch.
Feed mechanism return to previous position?
No
#42
Yes
10

The previous flowchart applies to manual operation. The following flowchart applies to the AUTO and CYCLE modes.




f
Clamp released?
Yes
8
#9
5

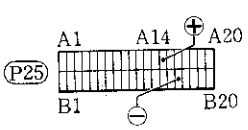
[2] Troubleshooting guide

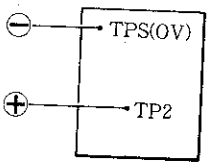
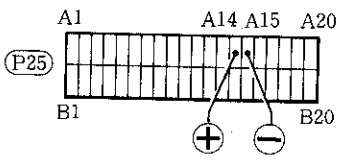
Notes

1. Turn the power switch off before pulling the plug from the receptacle.
2. Turn the power switch off before opening any of the doors or disconnecting the cables.
3. Circled items: Turn the power switch off before measuring the resistance
   Boxed items: Measure the voltage with the power switch on.
4. Be sure replacement fuses are the same capacity and type as the original fuse.
5. Be sure to correct the cause of any error code before proceeding with other adjustments or repairs.

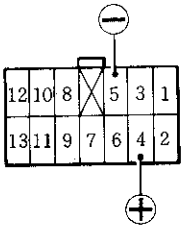
≪Before adjustment≫

1. Make sure there are no blown fuses.
2. Make sure all plugs and connectors are properly connected.
3. Confirm the cause of items marked with with the flowcharts on the preceding pages.

Inspection item	Cause	Check	Replacement part(s)	Reference page
#1 Power LED does not light when power switch is ON.	1. No power supply	(a) Measure the 3-phase power supply voltage with a tester. OK if AC 200V (or 415, 380V) per phase		
	2. Defective power switch, cord	(a) Remove the side cover and operation panel cover, turn the power switch ON with the power cord disconnected, and check the continuity of the power plug and power supply unit terminals. OK if continuity exists.	No fuse breaker, cord	
	3. Regulator defective Power harness D defective Power harness B defective Power harness C defective Display circuit board defective Display harness defective	(a) Check the regulator's +5V output terminal with connectors (P1), (P18), (P24), disconnected; OK if +5V exists. (b) Check with (P1), (P18), (P24), connected. (c) Disconnect connector (P6); check for short between pins 1 and 2.	Regulator 2 Power harness B Power harness C Power harness D Control circuit board ECM circuit board FDD Display circuit board Display harness	46
	4. LED or power cord defective 	(a) Disconnect connector (P25 or CN370) of junction board and measure resistance OK if needle moves in maximum range.	Operation panel assembly	46

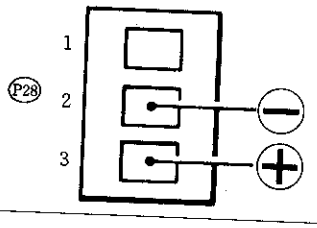
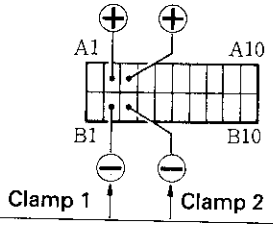
Inspection item	Cause	Check	Replacement part(s)	Reference page
#2 Machine begins to run at high speed when power switch is turned ON.	1. Encoder harness defective	a. Make sure connector (P22) is firmly connected. b. Make sure connector (P19) is firmly connected.	Encoder harness	46 48
	2. Encoder signal is not output. ECM circuit board  	(c) Turn power off, disconnect connector (P21), turn power on and apply tester; OK if tester reads 0V→5V→0V when machine pulley is turned.	Encoder assembly	46
#3 Emergency stop LED lights when power switch is turned ON.	1. Carriage overtravel if error U81, U82, U83, or U84 appears.	a. Turn power switch OFF, and manually set the carriage so it is in the overtravel position.		46
	2. Air pressure switch is not ON; U85 displayed.	b. Measure pressure in air lines; OK if 5 kg/cm^2.		24
#4 Display does not change from 0000 to 00 when power is turned on.	1. Display harness defective	(a) Disconnect connectors (P6) and (P30) on display harness; measure continuity of connectors. OK if continuity exists to corresponding terminals.	Display harness	46
	2. Display circuit board defective	a. Replace display circuit board.	Display circuit board	46
	3. Control circuit board defective	a. Replace control circuit board.	Control circuit board	52
#5 Emergency stop occurs when disk inserted in FDD and FLOPPY switch is turned ON.	1. Error U77 displayed.	a. Check if switch not set to ALT in MAN mode.		
#6 FLOPPY switch ON but READ LED not on.	1. READ LED defective Power cord defective  	(a) Disconnect junction board connector (P25 or CN370), measure resistance OK if needle moves in maximum range.	Operation panel assembly	46
	2. Control circuit board defective	Replace control circuit board.	Control circuit board	52

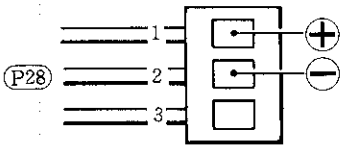
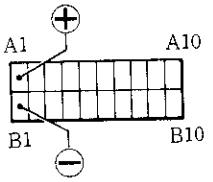
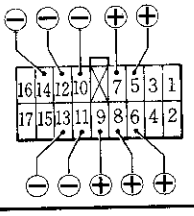
<table>
<tr><th>Inspection item</th><th>Cause</th><th>Check</th><th>Replacement part(s)</th><th>Reference page</th></tr>
<tr><td rowspan="5">#7
Emergency stop occurs during floppy disk reading.</td><td>1. When U70 displayed
1-1 FDD defective
1-2 FDD harness defective
1-3 Control circuit board defective</td><td>a. Replace FDD.
(a) Disconnect connector (P2) and (P23), measure continuity of FDD harness terminals; OK if continuity exists.
Replace control circuit board.</td><td>FDD
FDD harness
Control circuit board</td><td>46
46

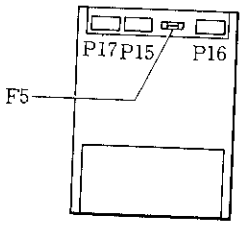
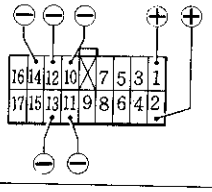
52</td></tr>
<tr><td>2. When U72 displayed (key word error)
Floppy write error</td><td>Set to the program mode to read the pattern data, press 111E, and turn the FLOPPY switch on to write data.</td><td></td><td></td></tr>
<tr><td>3. U75 displayed (check sum error)
3-1 Disk defective
3-2 Control circuit board defective</td><td>a. Reinsert disk into FDD.
a. Replace control circuit board.</td><td>Control circuit board</td><td>52</td></tr>
<tr><td>4. U78 displayed (verify error)
4-1 FDD defective
4-2 Control circuit board defective</td><td>a. Replace FDD.
a. Replace control circuit board.</td><td>FDD
Control circuit board</td><td>52</td></tr>
<tr><td>5. U79 displayed (access error)</td><td>a. Check if disk in drive.
b. Check if disk properly inserted.
c. Insert the disk with correct program data.</td><td></td><td></td></tr>
<tr><td>#8
Display not correct after data read operation.</td><td>1. Control circuit board defective</td><td>a. Control circuit board defective</td><td>Control circuit board</td><td>52</td></tr>
<tr><td rowspan="2">#9
Clamp is not released even though clamp switch is pressed.</td><td>1. Power supply unit defective
 
</td><td>(a) Disconnect (P1) on control circuit board, measure voltage; OK if +24V.
b. Check for improper connection in connector pins and cord.</td><td>Power supply unit

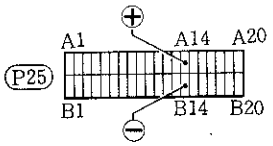
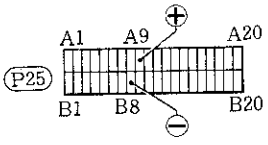
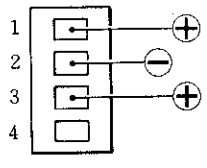
Power harness D</td><td>46

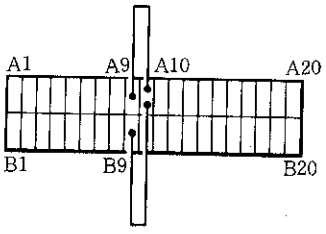
47</td></tr>
<tr><td>2. Power harness D defective
<table><tr><th>Pin No.</th><th>Terminal mark</th></tr><tr><td>1, 2</td><td>+40V</td></tr><tr><td>3</td><td>04</td></tr><tr><td>4</td><td>+24V</td></tr><tr><td>5, 6</td><td>03</td></tr><tr><td>8, 9</td><td>01</td></tr><tr><td>10, 11</td><td>+5V</td></tr><tr><td>12</td><td>−12V</td></tr><tr><td>13</td><td>+12V</td></tr></table></td><td>(a) Disconnect power harness D, check for continuity.</td><td>Power harness D</td><td>46</td></tr>
</table>

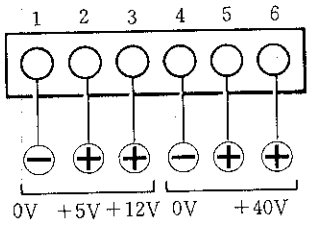
Inspection item	Cause	Check	Replacement part(s)	Reference page
#9 Clamp is not released even though clamp switch is pressed.	3. Clamp switch or cord defective  	(a) Disconnect junction board (P28) (CN371), measure resistance; OK if continuity exists when clamp switch is ON. b. Reconnect (P3) connecting junction board and control circuit board.	Foot switch assembly	46 47
	4. Foot switch harness defective	(a) Disconnect foot switch and junction board (P3), and foot switch connector; check for continuity. b. Reconnect (P3), foot switch.	Foot switch harness	46 47
	5. Actuator harness A defective	(a) Disconnect control circuit board (P12), disconnect (P36) at air solenoid assembly, and check for continuity between corresponding pins.	Actuator harness A	46
	6. Air cylinder operation defective	Adjust so cylinder shaft moves easily.		28
	7. Solenoid valve and cord defective  	(a) Disconnect control circuit board connector (P12), measure continuity to valve and cord; OK if needle moves. b. Reconnect connectors.	Solenoid valve Air system	28
	8. Control circuit board defective	If 1~6 above are not applicable, replace control circuit board.	Control circuit board	52
#10 Presser foot does not rise though clamp switch pressed.	See #9.	See #9.	See #9.	
#11 Clamp does not work though clamp switch pressed.	See #9.	See #9.	See #9.	
#12 Presser foot does not descend though clamp switch pressed.	See #9.	See #9.	See #9.	

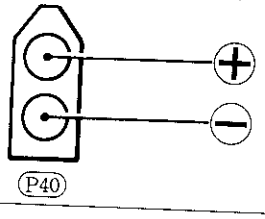
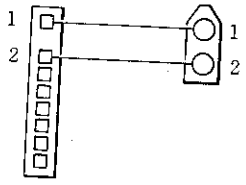
Inspection item	Cause	Check	Replacement part(s)	Reference page
#13 Emergency stop occurs when start switch is ON.	1. U16 error	Set DIP switch 2–6 ON.		53
#14 Presser foot does not rise at start.	1. Start switch or cord defective  	(a) Disconnect junction board connector (P28) (CN371), measure resistance; OK if continuity exists when start switch is ON.	Foot switch assembly	46
	2. Foot switch harness defective	(a) Disconnect foot switch harness, check continuity at both ends.	Foot switch harness assembly Foot switch connector	46
#14		b. Reconnect (P4) connecting junction board and control circuit board.		47
	3. Actuator harness A defective	(a) Disconnect (P12) on control circuit board, disconnect air solenoid assembly connector (P36), and check for continuity between corresponding pins.	Actuator harness A	46
	4. Air cylinder operation defective	Adjust so cylinder shaft moves easily.		29
	5. Solenoid valve and cord defective  	(a) Disconnect connector (P12) on control circuit board, measure for continuity; OK if needle moves.	Solenoid valve Air system	29
	6. Control circuit board defective	Replace control circuit board	Control circuit board	52
#15 Feed mechanism does not move though start switch is pressed.	1. Pulse motor regulator defective  	(a) Remove the side covers, disconnect PMD circuit board connector (P15), and measure voltage at terminal (P15); OK if +5.5V.	Regulator 2	46

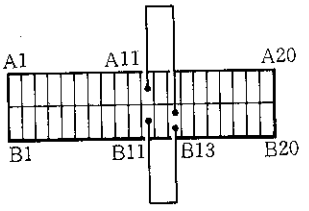
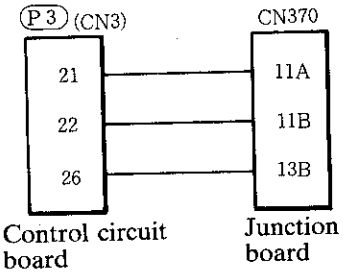
Inspection item	Cause	Check	Replacement part(s)	Reference page
#15 Feed mechanism does not move though start switch is pressed.	2. Blown fuse  	(a) Check continuity at F5 on pulse motor (PMD) circuit board; OK if approximately 0Ω.	Fuse F5 (1A, slow blow)	49
	3. Power harness A defective Pin No. / Terminal mark: 1 VH, 2 VH (Check one.); 5 VL, 6 VL, 7 VL, 8 VL, 9 VL (Check one.); 10 02, 11 02, 12 02, 13 02, 14 02 (Check one.); 15 V	(a) Check continuity of harness connector (P15) and corresponding press-fit terminal.	Power harness A	46
	4. Power supply defective (high voltage)  	(a) Disconnect (P15) on PMD circuit board, measure voltage; OK if approx. +150V.	Power supply unit	46
	5. Power supply defective (for PMD logic)	(a) Disconnect (P15) on PMD circuit board, measure voltage; OK if approx. +17V.	Power supply unit	46
	6. Clock harness defective	(a) Disconnect clock harness connecting PMD circuit board and control circuit board at (P11) and (P39), and check for continuity at each terminal.	Clock harness	46
	7. PMD circuit board defective	Replace PMD circuit board.	PMD circuit board	
	8. Control circuit board defective	Replace control circuit board.	Control circuit board	52

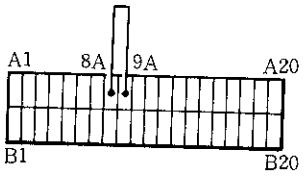
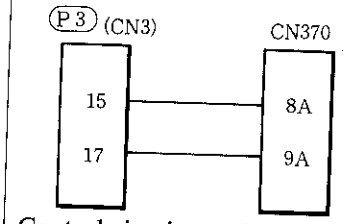
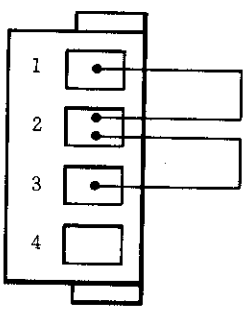
Inspection item	Cause	Check	Replacement part(s)	Reference page
#16 Pallet does not return to replacement position after origin location.	1. Pulse motor out of phase, so pallet position photo switch did not function.	a. Adjust X and Y axis torque. (refer to pages 42, 43.)		34, 35 42, 43
	2. Bobbin replacement position photo switch did not function for same reason.			32
	3. Overtravel photo switch activated for same reason.			33, 34
	* Error code displayed due to photo switch short, cord defect monitoring; check the corresponding switch or cord.			
	4. Control circuit board defective	Replace control circuit board.	Control circuit board	52
#17 Auto clamp does not function due to DIP switch setting.	See #9.	See #9.	See #9.	
#18 Test LED doesn't light but test switch is ON.	1. LED or cord defective 	(a) Disconnect (P25 or CN370) or junction board, measure resistance OK if needle moves in maximum range.	Operation panel assembly	46
	2. Switch or cord defective 	(a) Disconnect (P25) of junction board, measure resistance; OK if continuity exists.	Operation panel assembly	46
	3. Control circuit board defective	Replace control circuit board.	Control circuit board	52
#19 Auto clamp does not work due to DIP switch settings.	1. Pallet switch or cord defective	(a) Disconnect (P29 or CN382) of junction board, measure resistance.	Pallet harness B Pallet harness A Pallet switch assembly	46
	2. Pallet harness defective 	OK if continuity exists when pallet switches right/left are ON.		46
	3. See #9.	See #9	See #9	

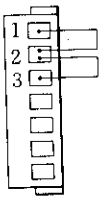
Inspection item	Cause	Check	Replacement part(s)	Reference page
#20 Does not start automatically in Auto start mode.	1. Control circuit board defective	Replace control circuit board.	Control circuit board	52
#21 Does not start but start switch is pressed.	See #15.	See #15.	See #15.	
#22 Machine pulley turns when started in test mode.	1. Control circuit board defective	Replace control circuit board	Control circuit board	52
#23 Feed mechanism does not move in test mode.	See #15.	See #15.	See #15.	
#24 Feed mechanism does not move faster when clamp switch is pressed in test mode.	1. See #9, #3, #4.	See #9, #3, #4.	See #9, #3, #4.	
	2. Control circuit board defective	Replace control circuit board	Control circuit board	52
#25 100 stitch feed is not possible in test mode.	1. Step-back switch or cord defective 	(a) Disconnect (P25) of junction board, measure continuity; OK if ... when ON A10–B10 0Ω A10–B9 ∞Ω if ... when OFF. A10–B10 ∞Ω A10–B9 0Ω	Operation panel assembly	46
	2. Control circuit board defective	Replace control circuit board.	Control circuit board	52
#26 Does not move according to the program during the test mode.	1. Improperly adjusted feed mechanism.			
	2. See #15.	See #15.	See #15.	
#27 Machine does not operate when sewing begins.	1. Blown fuse	(a) Remove fuse No. 4 (open the air cock door), check the continuity; OK if continuity exists.	Fuse B (5A)	49

Inspection item	Cause	Check	Replacement part(s)	Reference page
#27 Machine does not operate when sewing begins.	2. Power supply unit defective  	(a) Disconnect (P18) (P4 on machine circuit board) from ECM circuit board (machine circuit board), measure the voltage. 1~3 and 4~6 are on different circuits; 1 and 4 should be measured separately with the ⊖ terminal of the tester.	Power supply unit	46
	3. Power harness C defective	(a) Disconnect (P18) from ECM circuit board, check the continuity of the cords to the terminal block on the power supply unit.	Power harness C	46
	4. ECM cable defective	(a) Check the continuity between the sockets corresponding to (P10) of the control circuit board, and ECM circuit board.	ECM circuit board	46
	5. ECM harness defective	(a) Disconnect (P20) (P3 on ECM circuit board) and (P21), and check the continuity.	ECM harness	46
	6. Encoder harness defective	(a) Disconnect (P19) (P2 on ECM circuit board) and (P22), and check the continuity.	Encoder harness	46
	7. ECM circuit board defective	Replace ECM circuit board.	ECM circuit board	52
	8. Control circuit board defective	Replace control circuit board.	Control circuit board	52
	9. Synchronizer defective	Replace synchronizer assembly.	Synchronizer assembly #8	32
	10. Motor defective	Replace sewing machine motor.	MD972 motor assembly	
#28 Seams are not formed properly. (Motor pulley turns but pallet does not move.)	1. Synchronizer defective	(a) OK if sync signal output is greater than 4.5V.	Synchronizer assembly #8	32
	2. Control circuit board defective	Replace control circuit board.	Control circuit board	52

Inspection item	Cause	Check	Replacement part(s)	Reference page
#29 Sewing machine suddenly stops while sewing.	1. Excessive load	Adjust sewing machine head.		
	2. ECM circuit board defective	Replace ECM circuit board.	ECM circuit board	52
	3. Poor contact in power supply, ECM cable, ECM harness, encoder harness	Reconnect plugs and connectors.		47
#30 Thread trimming does not occur.	1. Synchronizer defective	(a) OK if sync signal, needle up signal are greater than 4.5V.	Synchronizer assembly #8	46
	2. Thread trimming solenoid defective (open circuit)  	(a) Disconnect connector (P40), check with tester; OK if needle moves.	Thread trimming solenoid	
	3. Actuator harness B defective  	(a) Disconnect connectors and (P14) (P40), check for continuity.	Actuator harness B	46
	4. Improper thread trimming timing	Adjust position of magnet for sync signal 2.		31
	5. ECM circuit board defective	Replace ECM circuit board.	ECM circuit board	52
	6. Control circuit board defective	Replace control circuit board.	Control circuit board	52
#31 Machine does not stop after thread trimming.	1. ECM circuit board defective	Replace ECM circuit board.	ECM circuit board	52
	2. Control circuit board defective	Replace control circuit board.	Control circuit board	52
#32 Machine does not stop in needle up position.	1. Poor encoder adjustment	Adjust needle up signal position.		31
	2. ECM circuit board defective	Replace ECM circuit board.	ECM circuit board	
	3. Control circuit board defective	Replace control circuit board.	Control circuit board	52

<table>
<tr><th>Inspection item</th><th>Cause</th><th>Check</th><th>Replacement part(s)</th><th>Reference page</th></tr>
<tr><td>#33
Does not sew according to program.</td><td></td><td>See #27.</td><td></td><td></td></tr>
<tr><td rowspan="3">#34
Continuous, independent, split program sewing is not possible.</td><td>1. Selector switch and cord defective
 
</td><td>(a) Disconnect (P25) on junction board, check for continuity; OK if as in table below.
<table><tr><th></th><th>13B−11A</th><th>13B−11B</th></tr><tr><td>Continuous</td><td>∞</td><td>∞</td></tr><tr><td>Independent</td><td>0Ω</td><td>∞</td></tr><tr><td>Split</td><td>∞</td><td>0Ω</td></tr></table></td><td>Operation panel assembly</td><td>46</td></tr>
<tr><td>2. Flat cable B defective
 
</td><td>(a) Disconnect control circuit board connector (P3) and junction board connector (P25), check for continuity.</td><td>Junction board M2 assembly</td><td>46</td></tr>
<tr><td>3. Control circuit board defective</td><td>Control circuit board defective</td><td>Control circuit board</td><td>52</td></tr>
<tr><td>#35
Machine does not stop during sewing even though emergency stop switch is pressed.</td><td>1. Control circuit board defective</td><td>Control circuit board defective</td><td>Control circuit board</td><td>52</td></tr>
<tr><td>#36
Thread trimming does not occur even though emergency stop is cancelled during sewing procedure.</td><td></td><td>See #30, #31, #32.</td><td></td><td></td></tr>
<tr><td>#37
Step-back switch does not work.</td><td></td><td>See #25.</td><td></td><td></td></tr>
<tr><td>#38
Sewing cannot be started from the middle of pattern.</td><td></td><td>See #27, #28, #29, #30.</td><td></td><td></td></tr>
</table>

<table>
<tr><th>Inspection item</th><th>Cause</th><th>Check</th><th>Replacement part(s)</th><th>Reference page</th></tr>
<tr><td rowspan="4">#39
Bobbin replacement switch pressed but feed mechanism does not move to bobbin replacement position.</td><td>1. Bobbin replacement switch defective
  </td><td>(a) Disconnect junction board connector (P25) (CN370), check for continuity; OK if continuity exists when switch is pressed.</td><td>Operation panel assembly</td><td>46</td></tr>
<tr><td>2. Flat cable B defective
  </td><td>(a) Disconnect control circuit board connector (P3) and junction board connector (P25), check for continuity.</td><td>Junction board M2 assembly</td><td>46</td></tr>
<tr><td>3. Poor bobbin photo switch position</td><td>(a) Adjust switch position</td><td></td><td>32</td></tr>
<tr><td>4. Control circuit board defective</td><td>Control circuit board defective</td><td>Control circuit board</td><td>52</td></tr>
<tr><td>#40
Bobbin photo switch is activated while changing bobbin, and error is indicated.</td><td>1. Control circuit board defective</td><td>Control circuit board defective</td><td>Control circuit board</td><td>52</td></tr>
<tr><td>#41
Buzzer does not sound when bobbin replacement switch is pressed after bobbin replacement.</td><td></td><td>See #39.</td><td></td><td></td></tr>
<tr><td>#42
Feed assembly does not return to previous position following bobbin replacement.</td><td></td><td>See #15.</td><td></td><td></td></tr>
<tr><td>#43
Pallet number not displayed when cassette is loaded in AUTO, CYC mode.</td><td>1. Pallet detector limit switch and cord defective
  </td><td>(a) Disconnect junction board connector (P29) (CN382), check for continuity; OK if results as shown in table below.
<table><tr><th></th><th>1–2</th><th>2–3</th></tr><tr><td>PAL-R ON</td><td>0Ω</td><td>∞</td></tr><tr><td>PAL-R OFF</td><td>∞</td><td>∞</td></tr><tr><td>PAL-L ON</td><td>∞</td><td>0Ω</td></tr><tr><td>PAL-L OFF</td><td>∞</td><td>∞</td></tr></table></td><td>Pallet switch assembly
Pallet harness A
Pallet harness B</td><td>46</td></tr>
</table>

<table>
<tr><th>Inspection item</th><th>Cause</th><th>Check</th><th>Replacement part(s)</th><th>Reference page</th></tr>
<tr><td rowspan="3">#43
Pallet number not displayed when cassette is loaded in AUTO mode.</td><td>2. Cassette detector limit switch and cord defective
 
</td><td>(a) Disconnect control circuit board connector (P9) (CN9), check for continuity; OK if results as shown in table below.
<table><tr><th></th><th>1–2</th><th>2–3</th></tr><tr><td>JIG-1 ON</td><td>0Ω</td><td>∞</td></tr><tr><td>JIG-1 OFF</td><td>∞</td><td>∞</td></tr><tr><td>JIG-2 ON</td><td>∞</td><td>0Ω</td></tr><tr><td>JIG-2 OFF</td><td>∞</td><td>∞</td></tr></table></td><td>Limit switch</td><td>46</td></tr>
<tr><td>3. Pallet harness A defective</td><td>(a) Disconnect pallet harness A (curl cord), and check continuity of terminals.</td><td>Pallet harness A</td><td>46</td></tr>
<tr><td>4. Control circuit board defective</td><td>Replace control circuit board.</td><td>Control circuit board</td><td>52</td></tr>
<tr><td>#44
Jig recognition function does not work.</td><td>Control circuit board defective</td><td>Replace control circuit board.</td><td>Control circuit board</td><td>52</td></tr>
<tr><td>#45
Machine does not start in AUTO mode after cassette number reading.</td><td>Control circuit board defective</td><td>Replace control circuit board.</td><td>Control circuit board</td><td>52</td></tr>
</table>

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