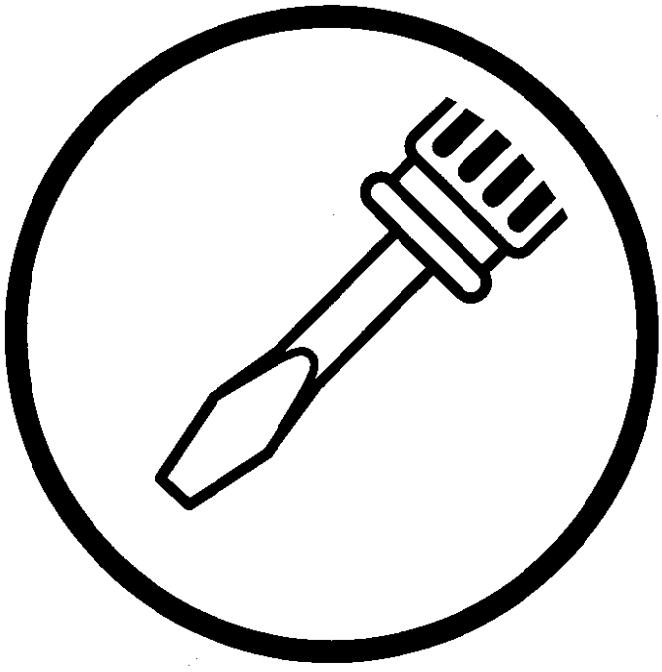
DH4-B980

SERVICE MANUAL

Please read this manual before making any adjustments.

ELECTRONIC EYELET BUTTON HOLER



brother

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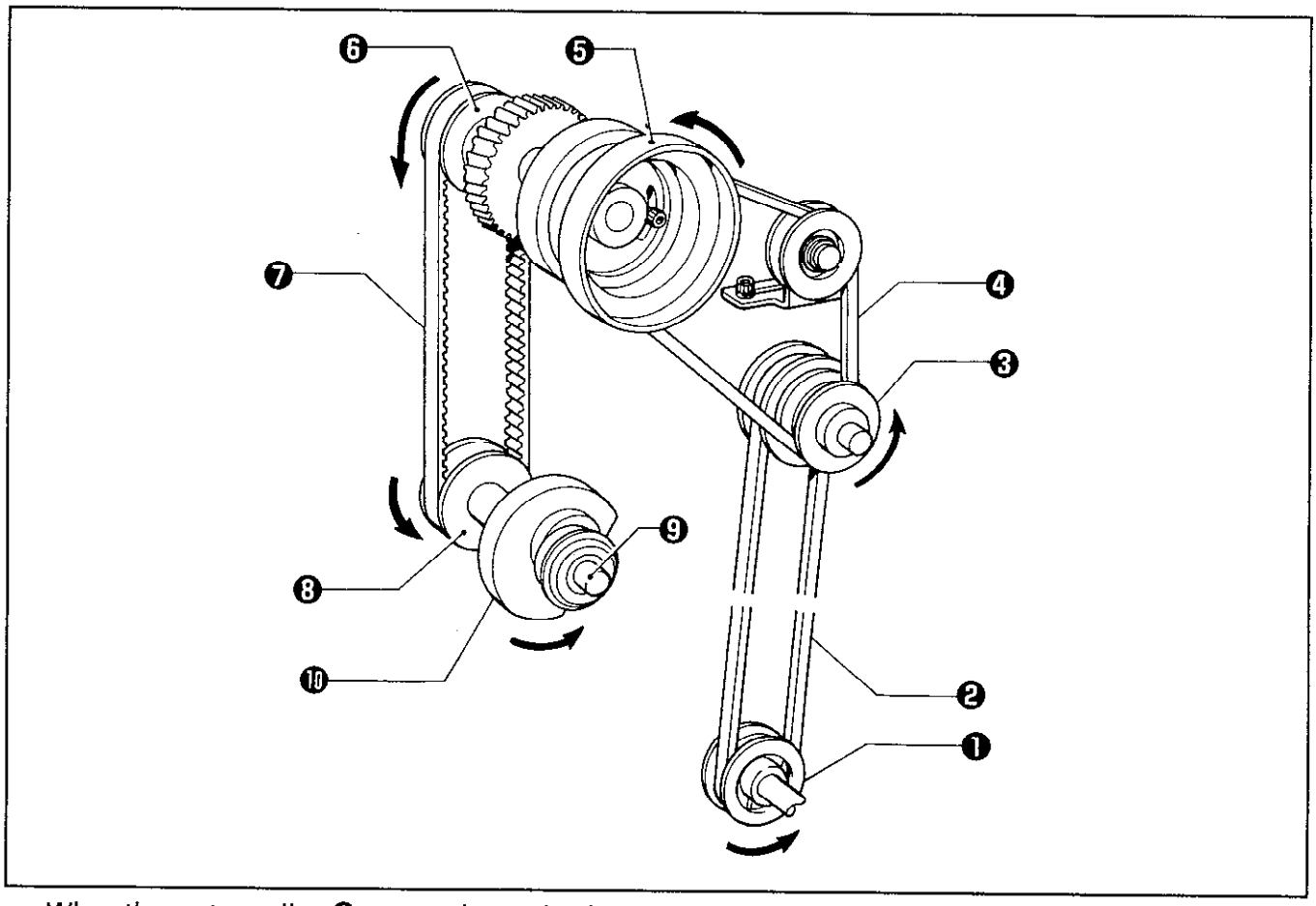
1. MECHANICAL DESCRIPTIONS

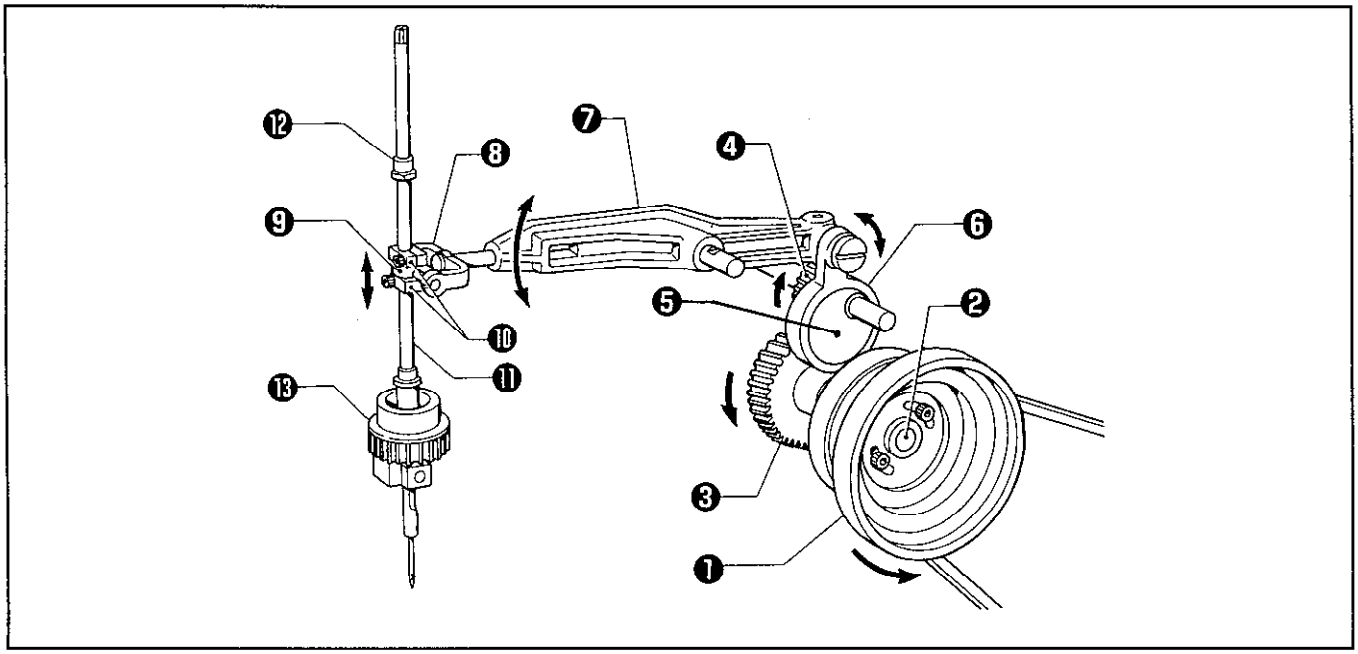
1-1. Upper and lower shaft mechanisms



- When the motor pulley ❶ rotates, its motion is transmitted to the V belt ❷, the idler pulley ❸, and the V belt ❹, and finally to the pulley ❺.
- When the pulley ❺ rotates in the direction of the arrow, its motion is transmitted to the upper shaft timing pulley ❻, the timing belt ❼, and the lower shaft tension pulley ❽, and the lower shaft ❾, causing the lower shaft cam ❿ to turn in the direction of the arrow.

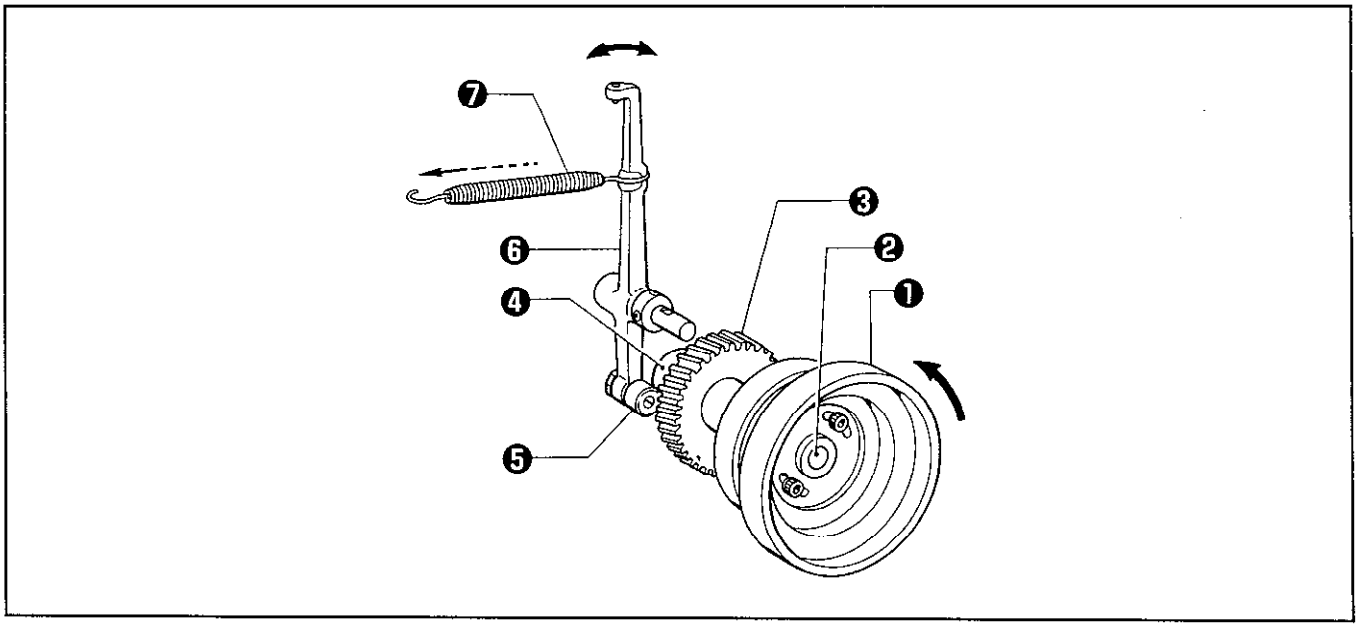
1-2. Needle bar and thread take-up mechanisms

1) Needle bar mechanism



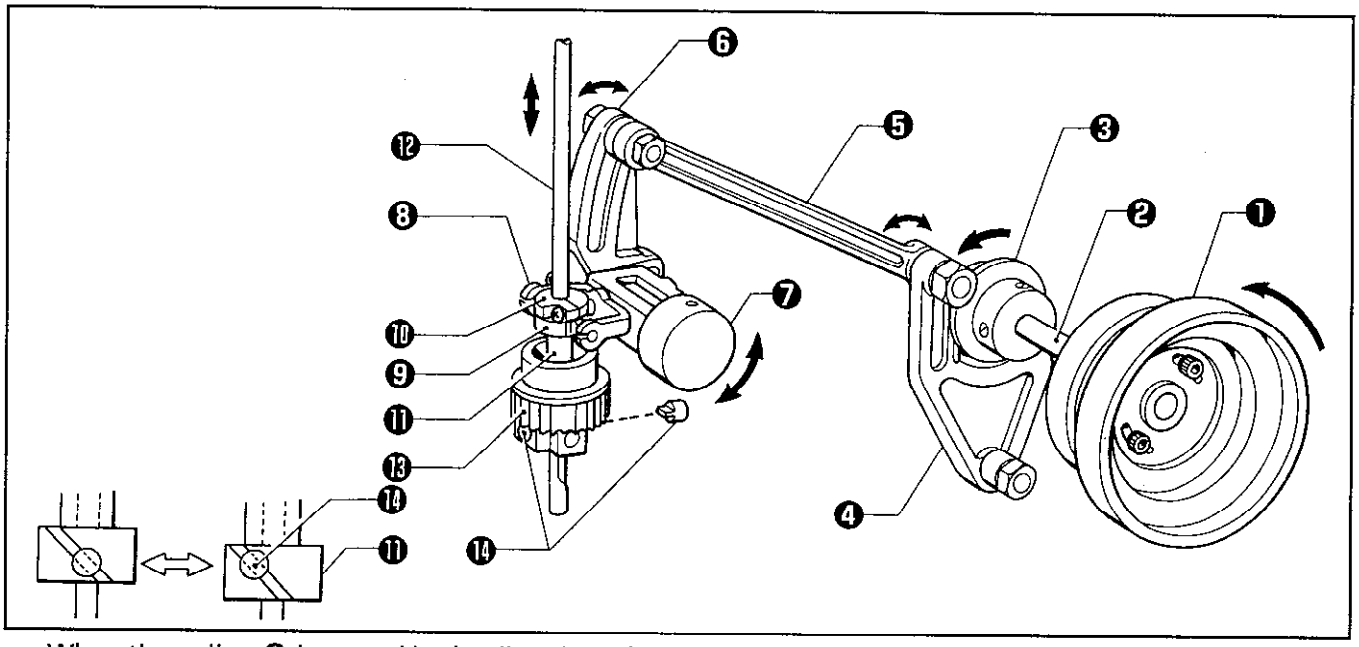
- When the pulley rotates in the direction of the arrow (towards you), its rotation is transmitted to the upper shaft ❷, the needle bar gear ❸, and the driving gear ❹, that makes the eccentric rod ❺ rotate.
- The driving rod ❻, which is engaged with the eccentric rod ❺, rocks the needle bar driving lever ❼.
- The rocking motion of the needle bar driving lever ❼ is transmitted to the needle bar york ❽, the needle bar level feed link ❾, and the needle bar clamp ❿, and then the needle bar ⓫ moves up and down.
- The needle bar ⓫ is guided by needle bar bush (U) ⓬ and the needle bar block ⓭.

2) Thread take-up mechanism



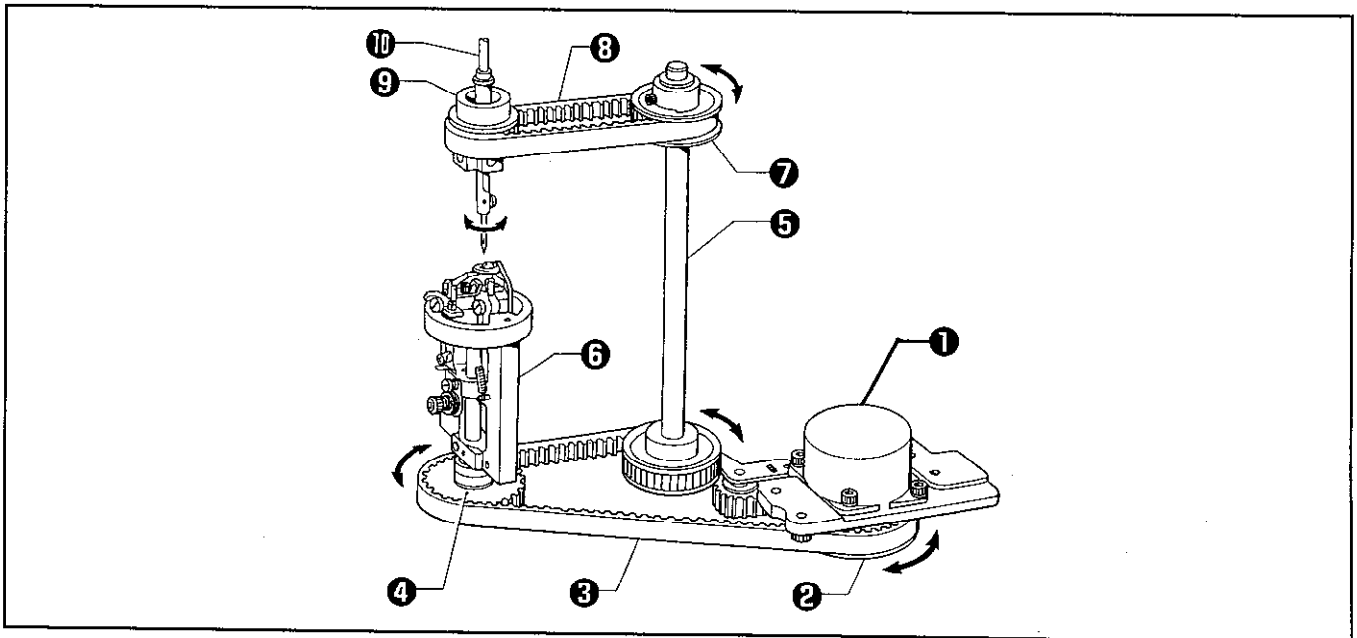
- When the pulley ❶ rotates in the direction of the arrow, the needle bar gear ❸ rotates via the upper shaft ❷.
- The thread take-up cam ❹, which is attached to the needle bar gear ❸, moves the thread take-up ❻ via the thread take-up cam roller ❺.
- The thread take-up cam roller ❺ is always kept in contact with the cam ❹ by the thread take-up spring ❼ attached to the thread take-up ❻.

1-3. Zigzag mechanism



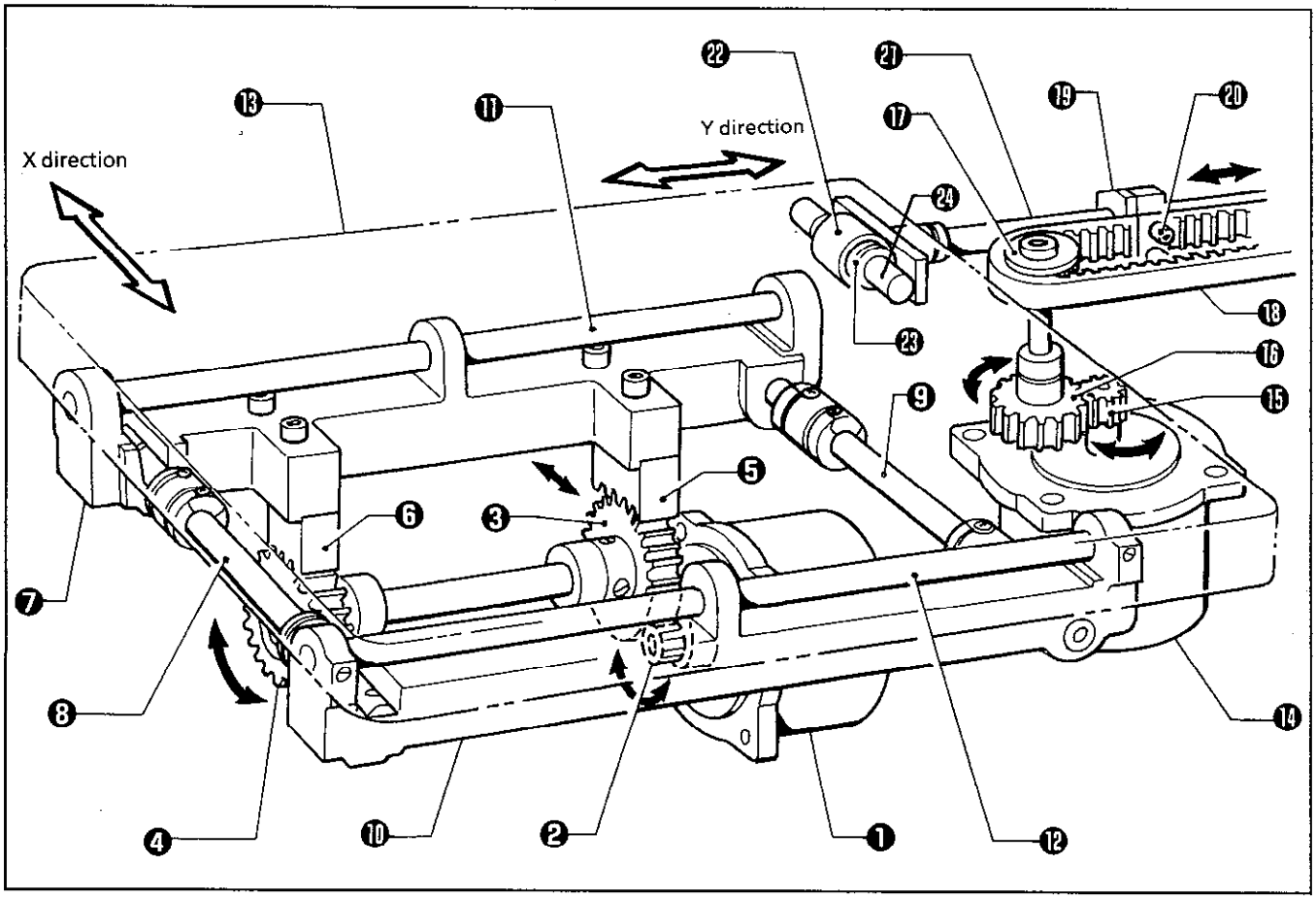
- When the pulley ❶ is turned in the direction of the arrow, its motion is transmitted to the upper shaft ❷ that rotates the zigzag cam ❸, and the zigzag fork ❹ rocks.
- The zigzag rock shaft ❼ is rocked by the zigzag fork ❹, via the zigzag connecting rod ❺, and the zigzag crank ❻.
- The rocking motion of the zigzag rock shaft ❼ is transmitted to the zigzag lever ❽, the needle bar lever feed link ❾, and the needle bar block clamp ❿, those move the needle bar block ⓫ up and down.
- The needle bar ⓬ is fitted on the needle bar block ⓫, and the needle bar guide ⓮ is fitted in the notch of the needle bar block ⓫. When the needle bar block ⓫ moves up and down, the needle bar ⓬ oscillates.

1-4. Needle bar rocking mechanism



- When pulse motor (R) ❶ operates, the motion is transmitted to the driving needle pulley assembly ❷, timing belt (D) ❸, and the looper pulley assembly ❹, which then moves the driving looper shaft assembly ❺.
- The looper base ❻ is rotated by the looper pulley assembly ❹.
- When the vertical shaft (T) pulley (U) assembly ❼, which is attached to the driving looper shaft assembly ❺, rotates, the motion is transmitted to timing belt (U) ❽, and the needle bar block assembly ❾ that rotates the needle bar ❿.

1-5. Feed mechanism



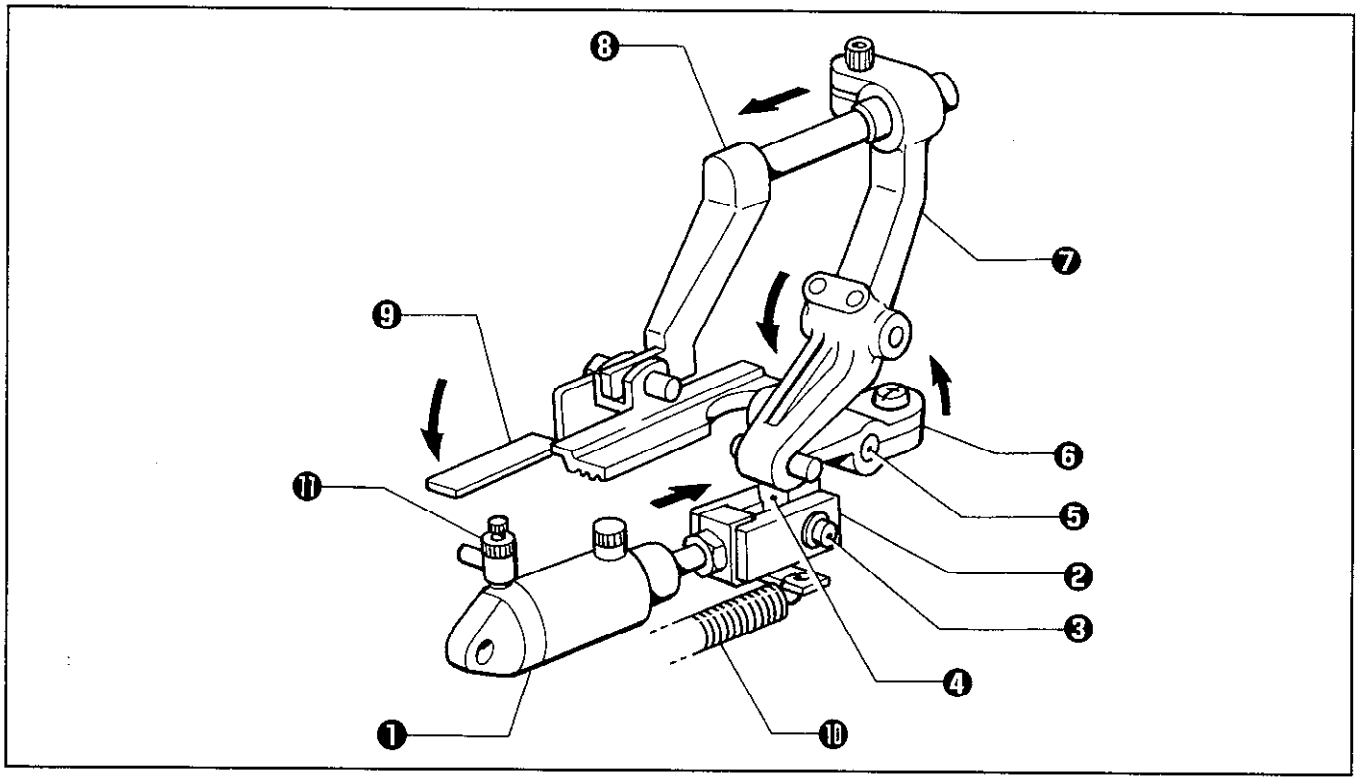
1) X-direction feeding

- When pulse motor (X) ❶ operates, its motion is transmitted to the actuating gear ❷, the idle gears ❸ and ❹, and the X racks ❺ and ❻, that finally moves X-feed shaft holder (L) ❼.
- The X-feed guide shafts (A) ❽ and (B) ❾, which are connected to X-feed shaft holder (L) ❼, move X-feed shaft holder (R) ❿.
- The Y-feed guide shafts ⓫ and ⓬, which are attached to X-feed shaft holders (L) ❼ and (R) ❿, move the feed bar ⓭ in the X direction.

2) Y-direction feeding

- When pulse motor (Y) ⓮ rotates, its motion is transmitted to the actuating gear ⓯, the idle gear ⓰, timing pulley (A) ⓱, that finally moves the Y-timing belt ⓲.
- The Y-timing belt ⓲ is secured by the Y-driving shaft holder ⓳ and the belt holder ⓴, and that moves the Y shaft ㉑.
- The linear bush ㉓, which is fitted in the ball bearing ㉒, is fitted in the Y-guide shaft ㉔ to move the feed bar ⓭ in the Y direction.

1-6. Cloth presser and cloth stretching mechanisms

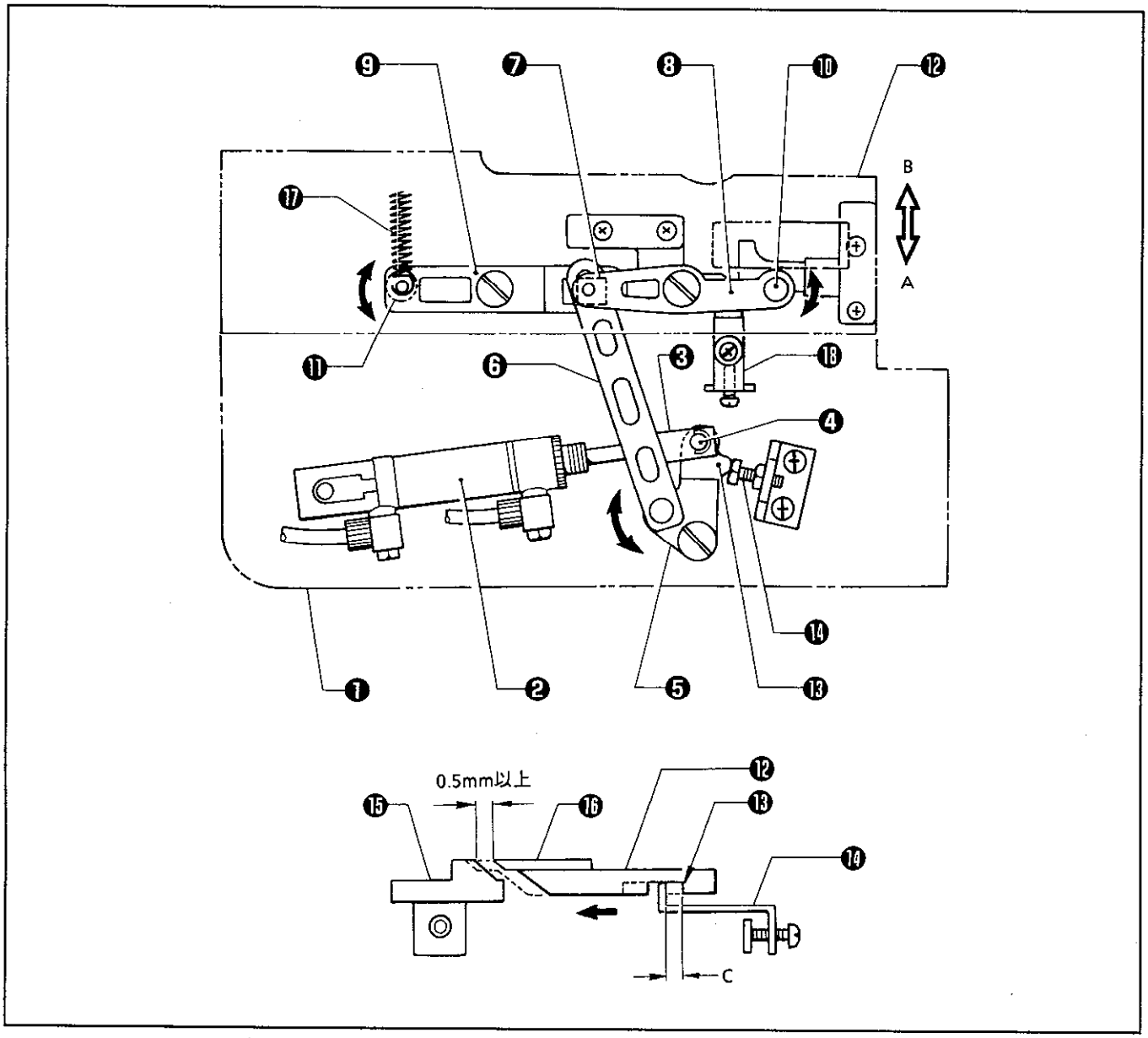


1) Cloth presser mechanism

- Cylinder 16 x 10 ❶ moves clamp lever (B) ❻ in the direction of the arrow according to the cylinder's motion, via the presser cylinder rod ❷, the cylinder rod pin ❸, the presser driving lever ❹, and the clamp lever shaft ❺.
- The end of clamp lever (B) ❻ is fitted on clamp lever (L) ❼, and the cloth presser ❾ attached to clamp arm (L) ❽ lowers.
- When the cylinder ❶ is returned by the presser spring ❿, the cloth presser ❾ rises. The speed controller ⓫ attached to the cylinder ❶ controls the rising speed of the cloth presser ❾.

* The cloth presser mechanism is activated by independently-operated left and right cylinders, that can equalize the pressure of the cloth presser.
The pressure of the cloth presser is always applied to the material equally even when the material thickness changes.

2) Cloth stretching mechanism

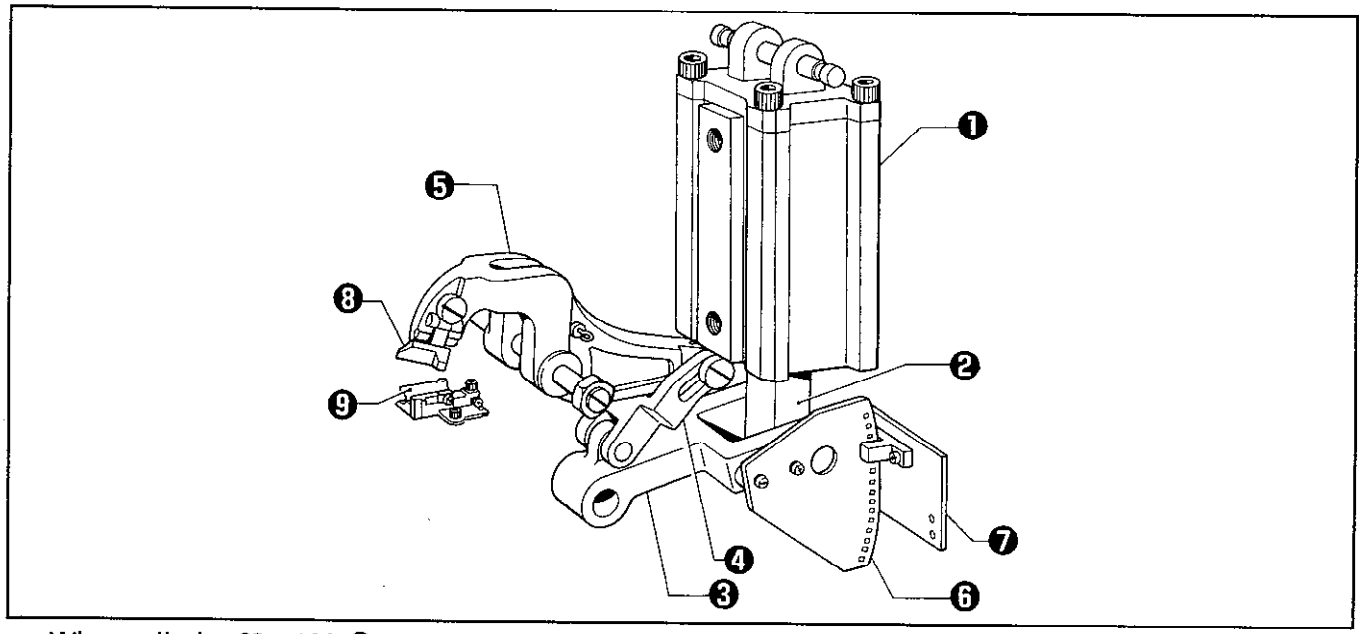


1. • The feed bar ❶ carries the cylinder 16 x 15 assembly ❷, whose end is connected to the opening cylinder rod ❸, cylinder rod pin (B) ❹, and the opening driving lever ❺.
   • The opening connecting rod ❻ attached to the opening driving lever ❺ is connected to the fulcrum lever plate ❽ and the lever ❾ via the slide block ❼.
   • The projection ❿ of the fulcrum lever plate ❽ and the pin ⓫ of the lever ❾ are fitted on the hole of the cloth presser plate ⓬ and the slide block on it.
   • When the cylinder 16 x 15 assembly ❷ operates, and the stopper ⓭ of the opening driving lever ❺ and the bolt ⓮ make contact, the cloth presser plate ⓬ moves in the direction of A, consequently opening a button eyelet on the material.

2. • At this time, there should be at least 0.5 mm clearance between the throat plate ⓯ and the needle plate ⓰. Adjust the clearance using the bolt ⓮.
   • When the cylinder 16 x 15 assembly ❷ is not pressurized, the cloth presser plate ⓬ is moved in the direction of B by the opening spring ⓱. At this time, the stopper ⓭ of the cloth presser plate ⓬ makes contact with the stopper plate ⓲.

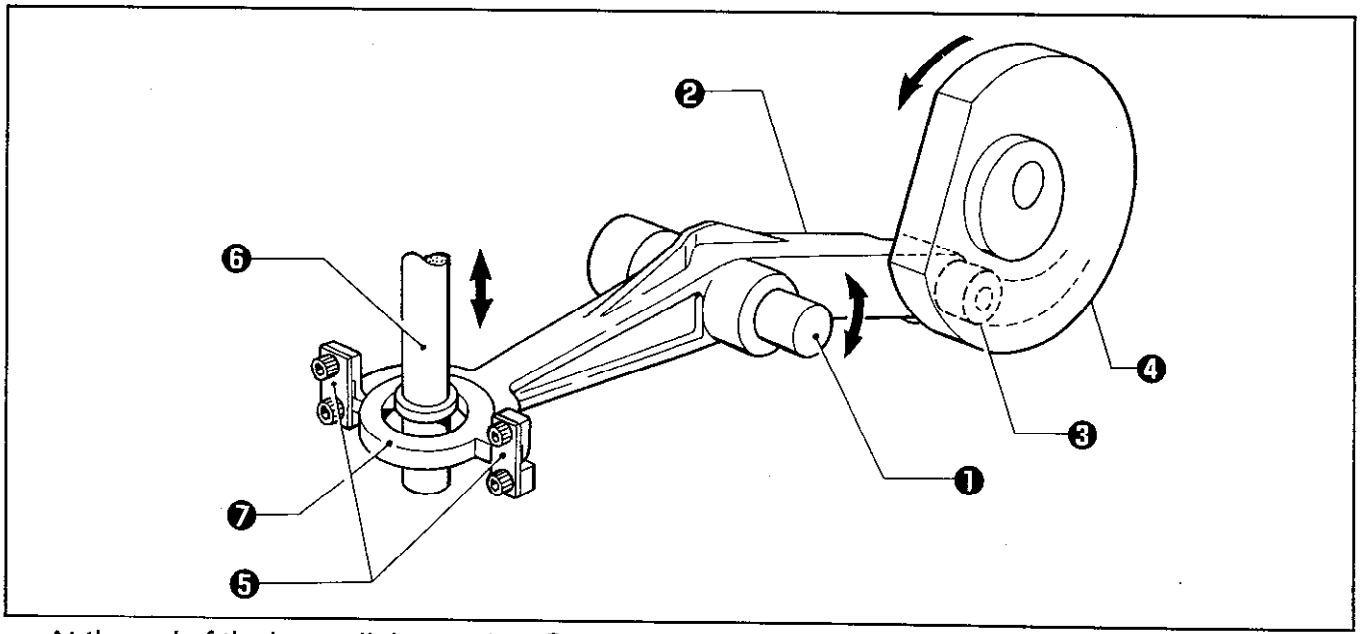
* C indicates the movement of the cloth presser plate ⓬.

1-7. Cutter mechanism



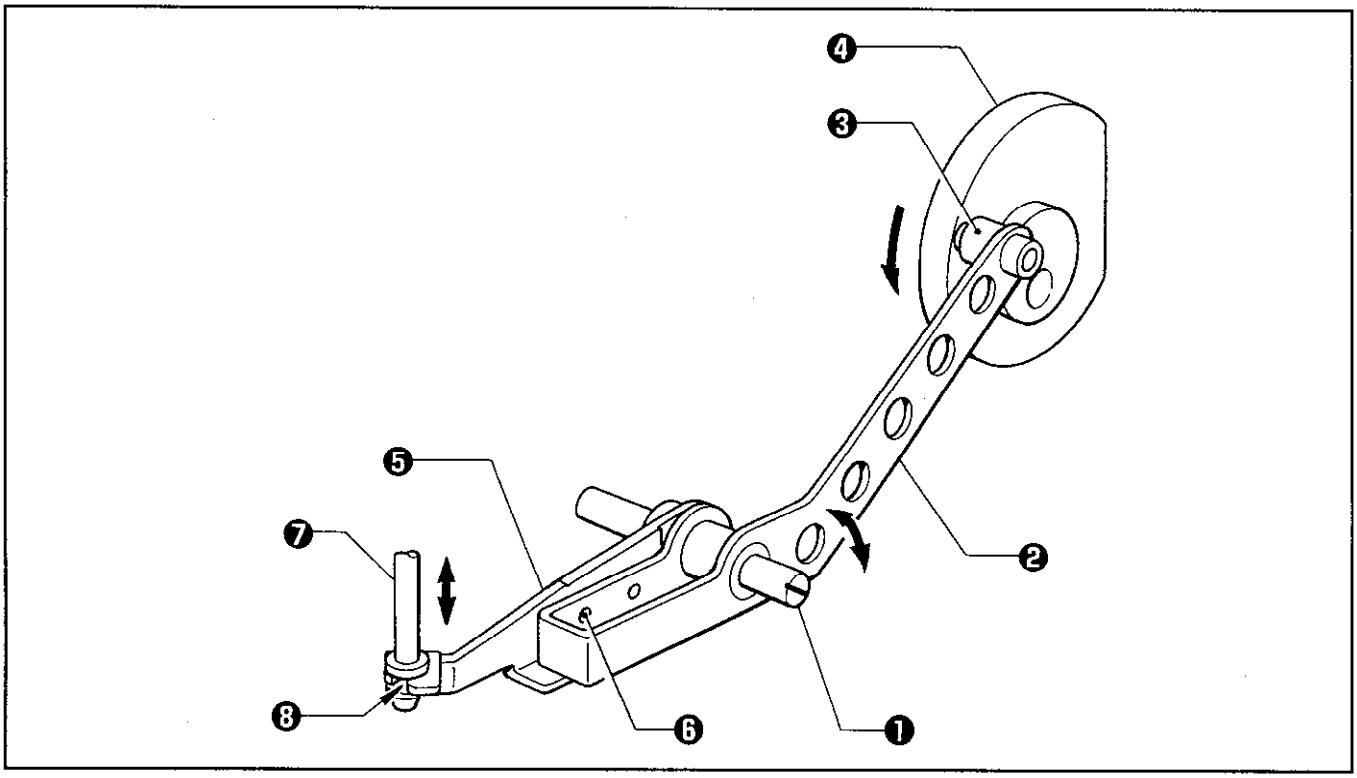
- When cylinder 63 x 100 ❶ operates, the motion is transmitted to the cylinder rod ❷, link (C) ❸, and link (A) ❹, which then activates the cutter lever assembly ❺.
- The cutter sensor partition plate ❻ attached to link (C) ❸, and the cutter sensor assembly ❼ monitor the motion of the cutter sensor assembly ❺.
- Engagement of the hammer ❽ attached to the end of the cutter sensor assembly ❺ and the cutter ❾ attached to the bed, cuts the material requiring button eyelets.

1-8. Looper mechanism



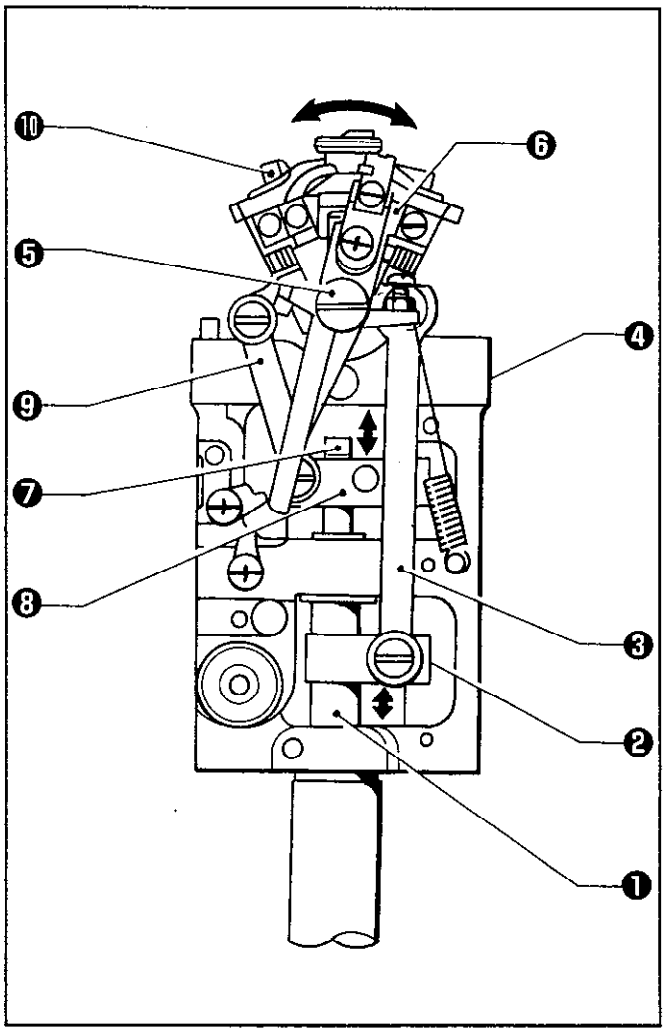
- At the end of the looper link assembly ❷ which has the looper link support shaft ❶ as the pivot of the rocking motion, the looper cam roller ❸ is fitted in the groove in the lower shaft cam ❹. The two looper link springs ❺ are attached to the other end.
- The looper link springs ❺ are secured by the looper driving plate ❼ through which the looper driving shaft ❻ passes.
- When the lower shaft cam ❹ rotates in the direction of the arrow, the looper link assembly ❷ is rocked via the looper cam roller ❸. The looper driving shaft ❻ moves up and down due to the motion of the looper link assembly ❷.

1-9. Spreader mechanism

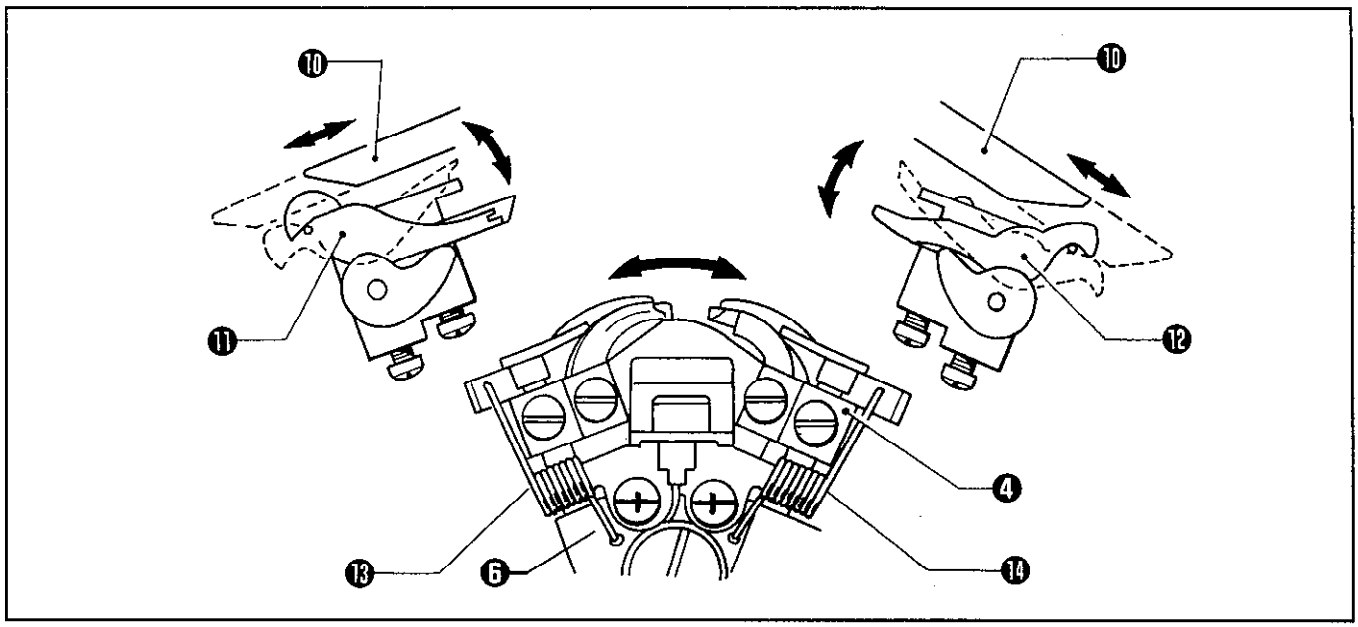


- At the end of the spreader cam lever ❷ which has the looper link support shaft ❶ as the pivot of the rocking motion, the spreader cam roller ❸ makes contact with the circumference of the lower shaft cam ❹, and the spreader driving lever ❺ is attached to the other end using the screw ❻. The forked part of the spreader driving lever ❺ is fitted in the groove ❽ of the spreader link shaft ❼.
- When the lower shaft cam ❹ rotates in the direction of the arrow, the spreader cam lever ❷ is rocked via the spreader cam roller ❸.
  The spreader link shaft ❼ moves up and down due to the motion of the spreader cam lever ❷.

1-10. Double chain stitch looper mechanism



- When the looper driving shaft ❶ moves up and down, the motion is transmitted to the looper link clamp ❷, and the looper link ❸, which rocks LS-holder bracket ❻ with the holder support shaft ❺ secured to the loop base ❹ regarded as the pivot.
- When the spreader link shaft ❼ moves up and down, the motion is transmitted to the spreader link base ❽ and the spreader cam link ❾, which then rocks the spreader differential cam ❿ with the holder support shaft ❺ secured to the loop base ❹ regarded as the pivot.



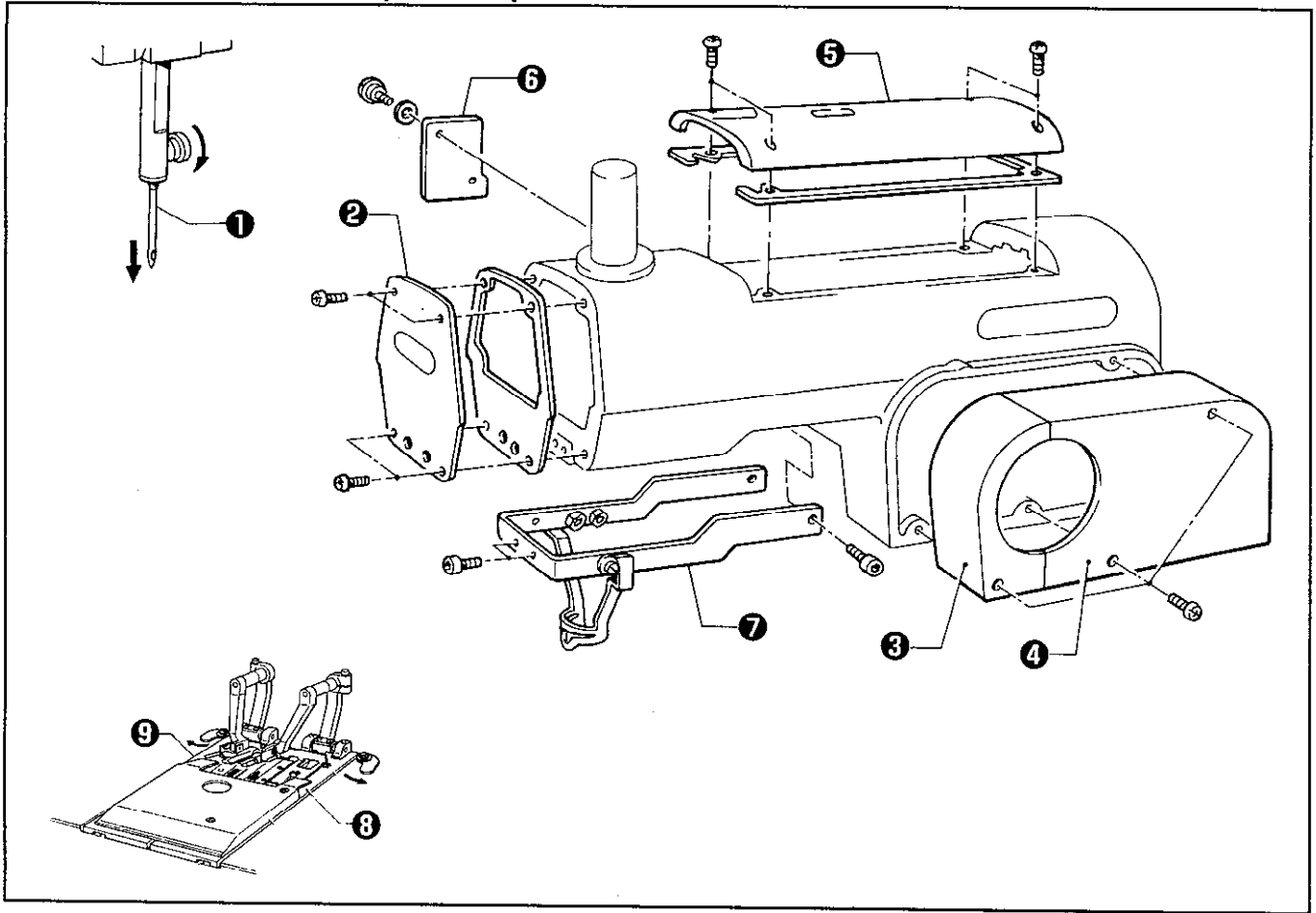
- The rocking motions of the LS-holder bracket ❻ and the spreader differential cam ❿ cause spreader (L) ⓫ to rock.
- In the same way, spreader (R) ⓬ is rocked.

2. DISASSEMBLY

- Turn off the power switch before disassembly, otherwise the machine may operate if the foot switch is depressed by mistake, which could result in injury.
- Disassembly should only be carried out by a qualified technician.
- Be sure to wear protective goggles and gloves when handling the lubricating oil and grease, so that they do not get into your eyes or onto your skin, otherwise inflammation may result. Furthermore, do not drink the oil or eat the grease under any circumstances, as they may cause vomiting and diarrhea.
  Keep the oil out of the reach of children.
- Use only the proper replacement parts as specified by Brother.
- If any safety devices have been removed, be absolutely sure to re-install them to their original positions and check that they operate correctly before using the machine.
- Any problems in machine operation which result from unauthorized modifications to the machine will not be covered by the warranty.
- Disconnect the air hoses from the air supply and wait for the needle on the pressure gauge to drop to "0" before carrying out inspection, adjustment and repair of any parts which use the pneumatic equipment.

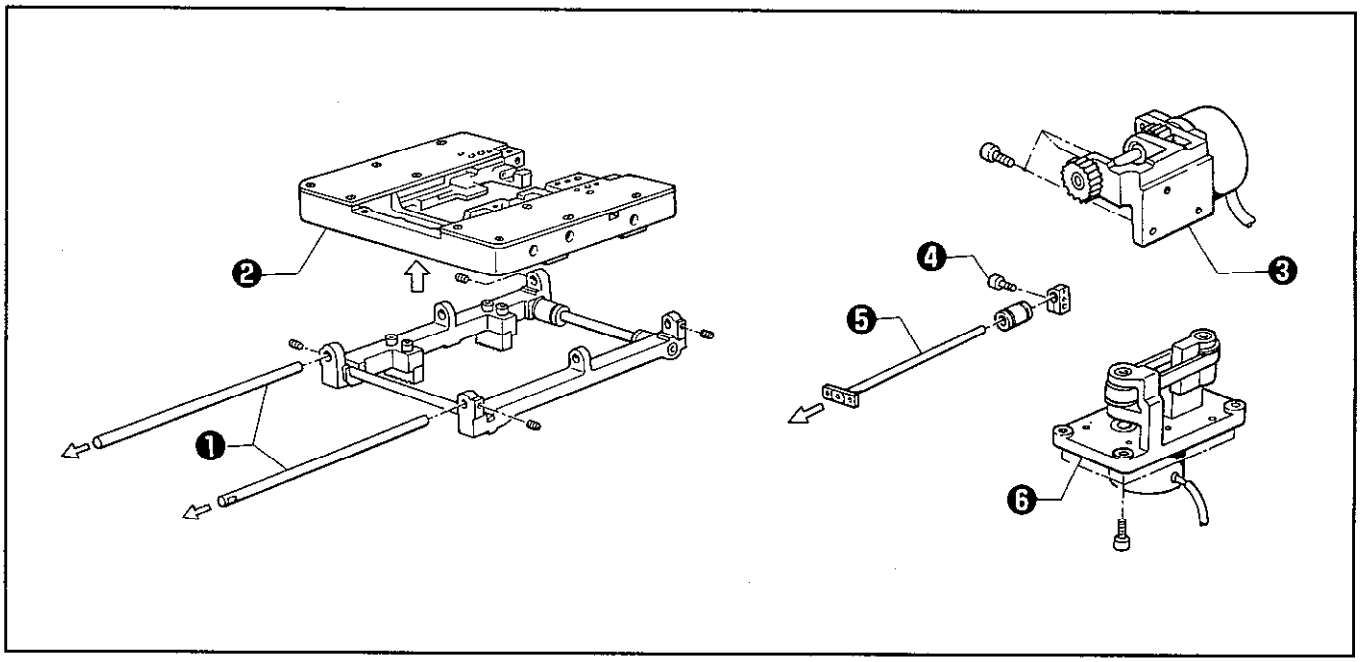
If disassembly is not performed in the correct order, it may be hard to remove parts. Disassemble as follows. The following is the main points of disassembly.

2-1. Covers and cloth presser plates



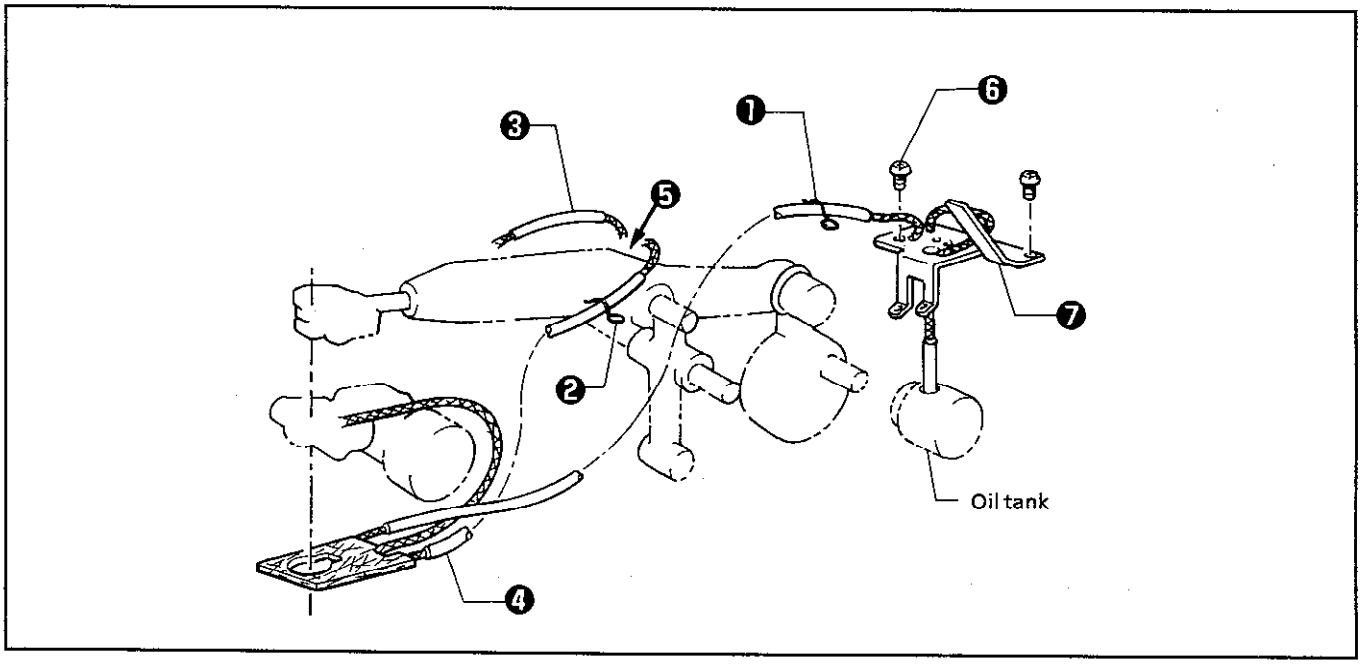
1. Remove the needle ❶.
2. Remove the faceplate ❷, belt covers (F) ❸ and (R) ❹, the top cover ❺, the zigzag window cover ❻, and the driving needle guard cover ❼.
3. Remove cloth presser plates (R) ❽ and (L) ❾.

2-2. Feed mechanism



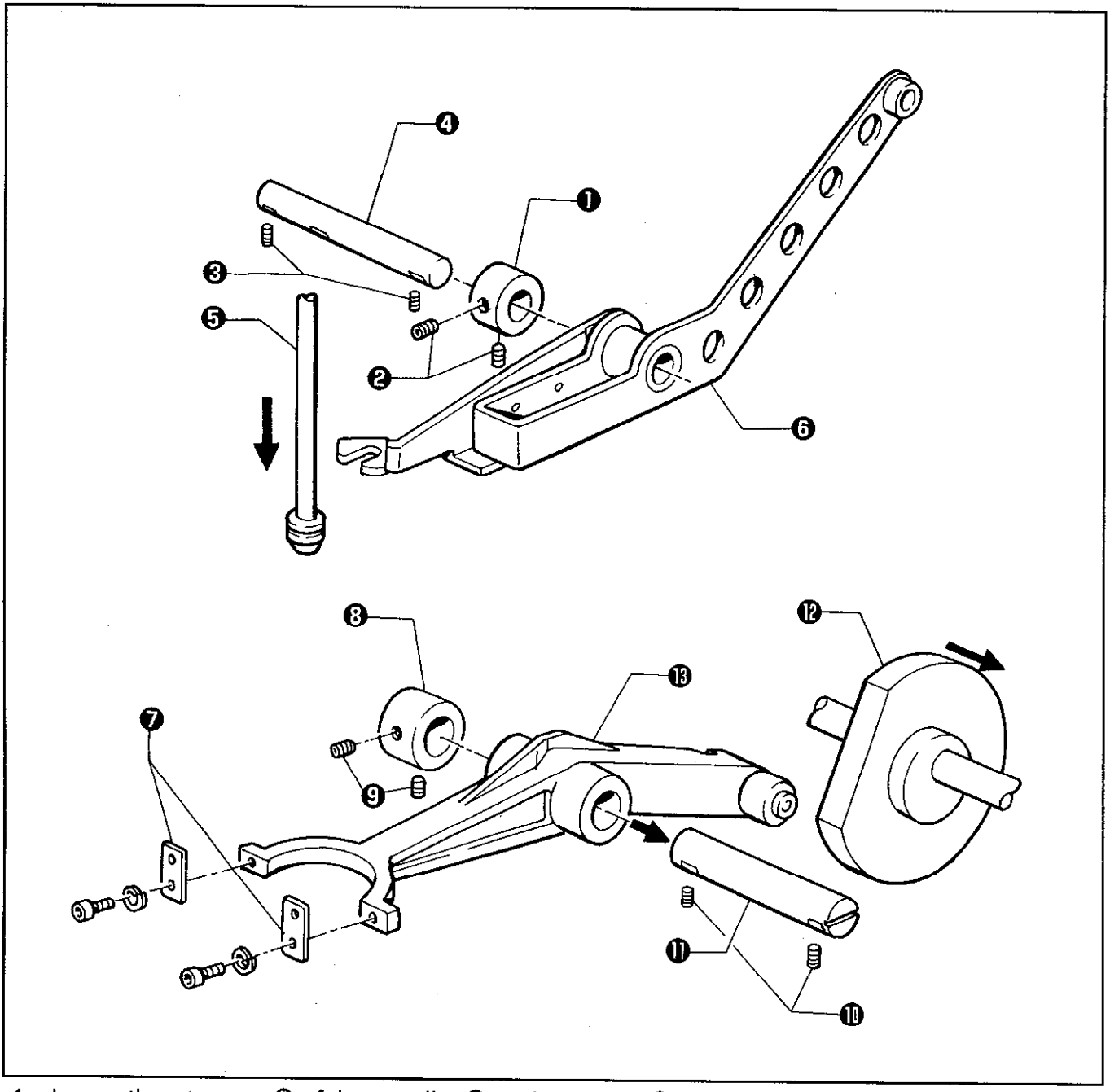
1. Feed bracket ····· Remove the two Y-feed guide shafts ❶ toward you. The feed bracket ❷ unit will come off.
2. X motor unit ····· Remove the motor support ❸, which includes the X motor unit.
3. Y motor unit ····· Loosen the screw ❹ of the Y driving shaft holder, pull out the Y-shaft ❺ toward you, and remove the Y-feed base ❻, including the Y motor unit.

2-3. Lubrication



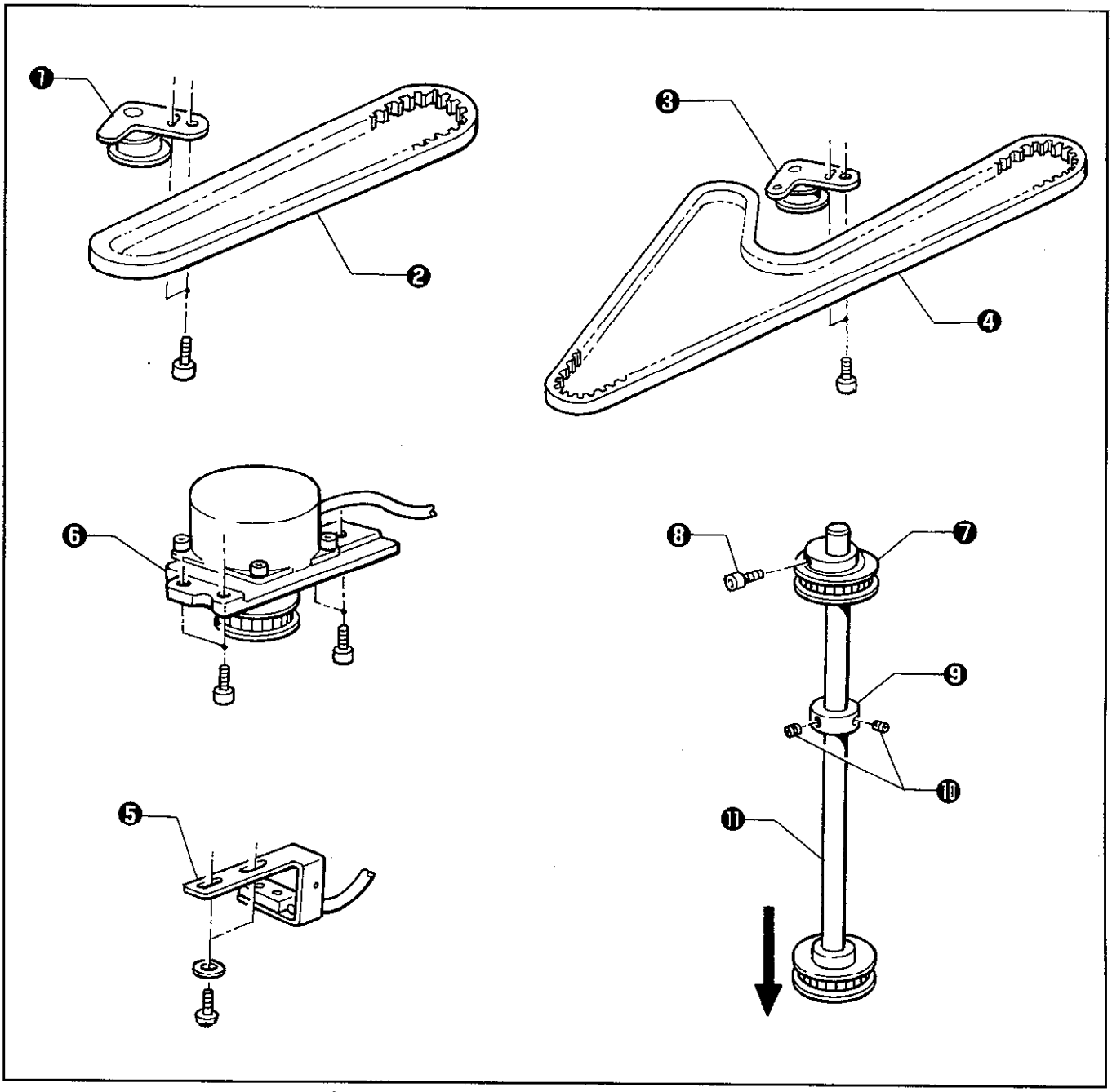
1. Remove the wick supports ❶ and ❷.
2. Remove the wicks ❸ and ❹ from the hole ❺.
3. Remove the two screws ❻ and wick support (L) ❼.

2-4. Looper and spreader



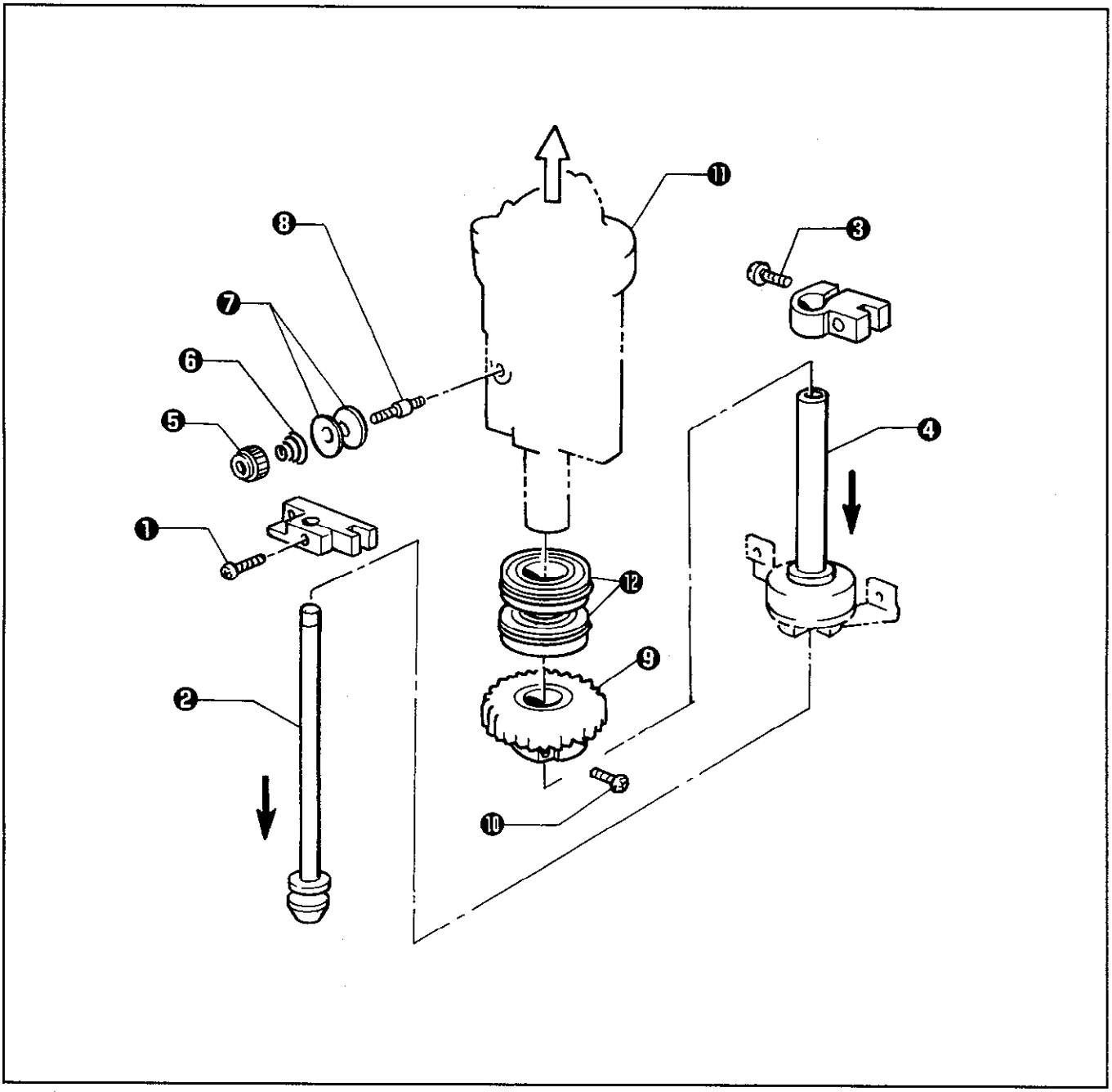
1. Loosen the set screws ❷ of the set collar ❶, and set screws ❸, and remove the looper link support shaft ❹.
2. Position the needle at its lower position. Pull the spreader link shaft ❺ downward, and remove the spreader cam lever ❻.
3. Remove the looper link springs ❼.
4. Loosen the set screws ❾ of the set collar ❽ and the set screws ⓾, and remove the looper link support shaft ⓫.
5. Slide the lower shaft cam ⓬ in the direction of the arrow, and remove the looper link ⓭.

2-5. Needle bar rotating mechanism



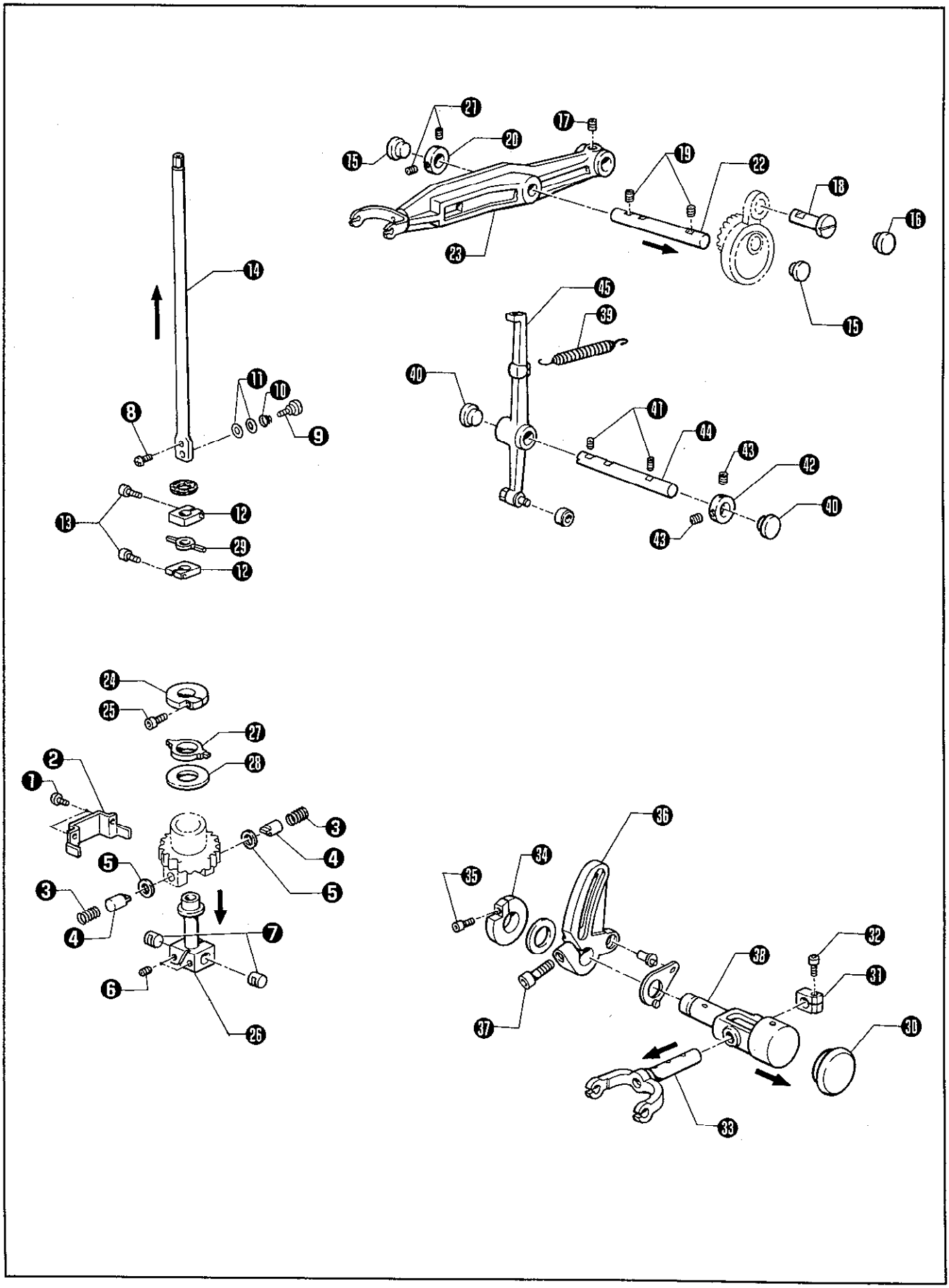
1. Remove the tension pulley ❶ and timing belt (U) ❷.
2. Remove the tension pulley ❸ and timing belt (D) ❹.
3. Remove the R sensor set plate ❺.
4. Remove the motor base ❻.
5. Loosen the bolt ❽ of the vertical shaft (T) pulley ❼ and the set screws ❿ of the set collar ❾.
6. Remove the driving looper shaft ⓫ downward.

2-6. Looper base



1. Loosen the screw ❶, and remove the spreader link shaft ❷ in the direction of the arrow.
2. Loosen the screw ❸, and remove the looper driving shaft ❹ in the direction of the arrow.
3. Remove the tension nut ❺, pre-tension spring (B) ❻, the thread guide discs ❼, and the L-tension stud ❽. Loosen the screw ❿ of the looper pulley assembly ❾, and remove the looper base ⓫ in the direction of the arrow.
   *Be careful not to drop the ball bearings ⓬ when removing the looper pulley assembly ❾.

2-7. Needle bar, thread take-up, and zigzag mechanisms



a. Needle bar mechanism

1. Remove the screw ❶, the needle bar guide support plate ❷, the needle bar guide spring ❸, the needle bar guide ❹, and the washer ❺.
2. Loosen the set screws ❻, and remove the needle bar guide collars ❼.
3. Remove the set screw ❽, the stud screw ❾, the tension spring ❿, and the thread guide discs ⓫. Loosen the bolts ⓭ of the needle bar clamps ⓬, and remove the needle bar ⓮ in the direction of the arrow.
4. Remove the caps ⓯ and ⓰. Loosen the set screw ⓱, and remove the driving rod pin ⓲. Loosen the set screws ⓳ and the set screws ㉑ of the set collar ⓴, pull out the driving lever shaft ㉒ in the direction of the arrow, and remove the needle bar driving lever ㉓.

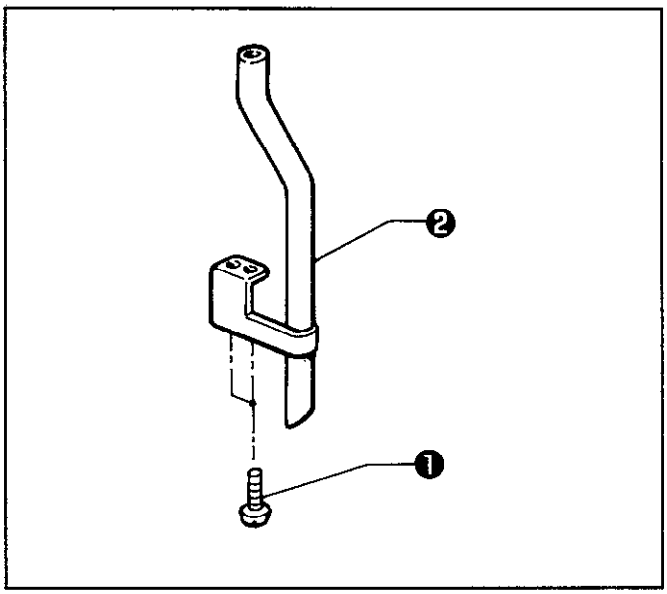
b. Zigzag mechanism

1. Loosen the screw ㉕ of the needle bar block clamp ㉔, and remove the needle bar block ㉖ in the direction of the arrow.
2. Remove the needle bar block clamp ㉔, the needle bar level feed links ㉗ and ㉙, and the needle bar block collar ㉘.
3. Remove the cap ㉚. Loosen the screw ㉜ of the needle bar clamp ㉛, and remove the zigzag lever ㉝ in the direction of the arrow.
4. Loosen the screw ㉟ of the needle bar block clamp ㉞, and the screw ㊲ of the zigzag crank ㊱, and remove the zigzag rock shaft ㊳ in the direction of the arrow.

c. Thread take-up mechanism

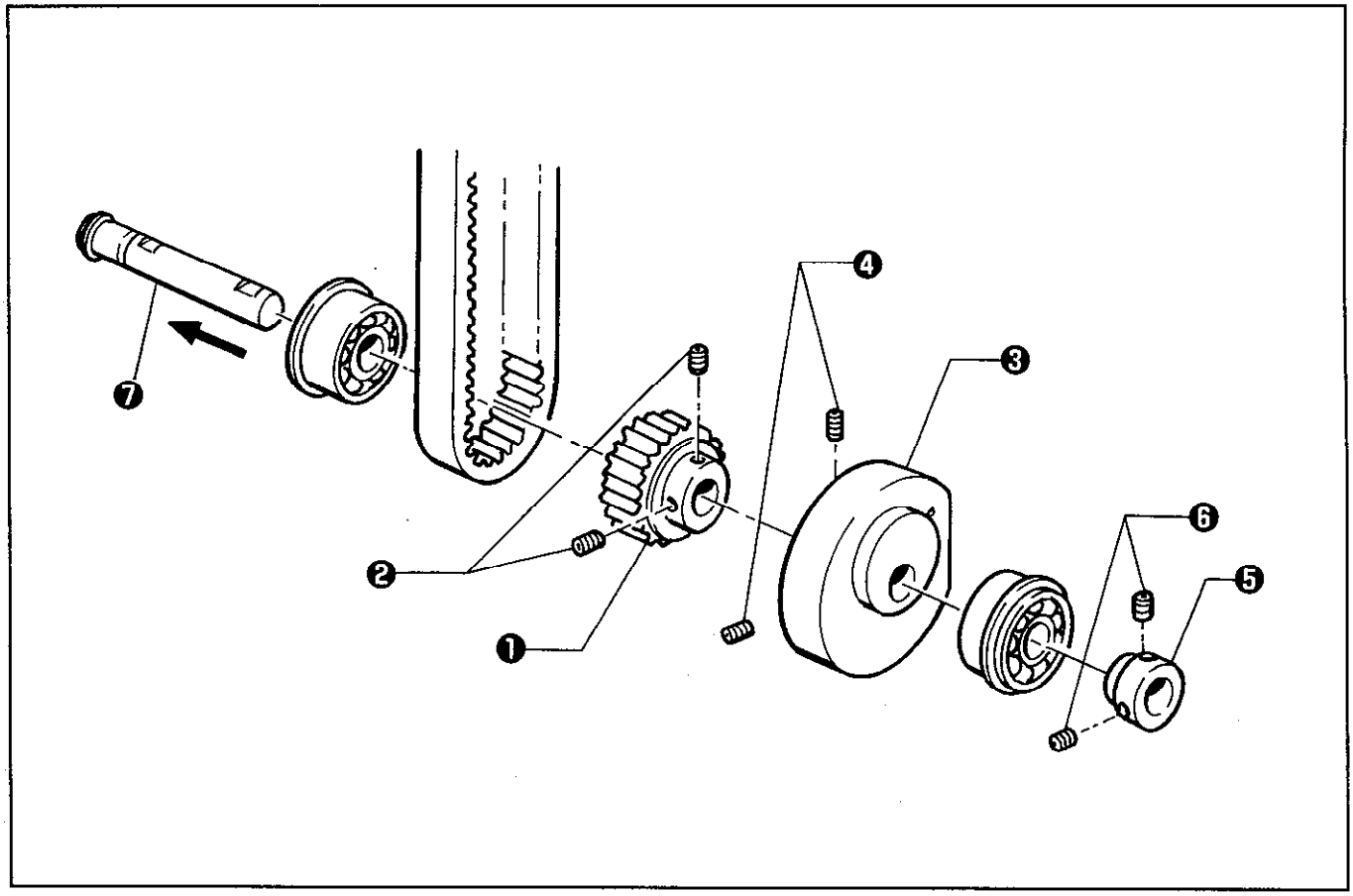
1. Remove the thread take-up spring ㊴ and the cap ㊵.
2. Loosen the set screws ㊶ and the set screws ㊸ of the set collar ㊷, and remove the thread take-up support shaft ㊹ and the thread take-up assembly ㊺.

2-8. Knife pipe assembly



1. Remove the screw ❶.
2. Remove the knife pipe ❷.

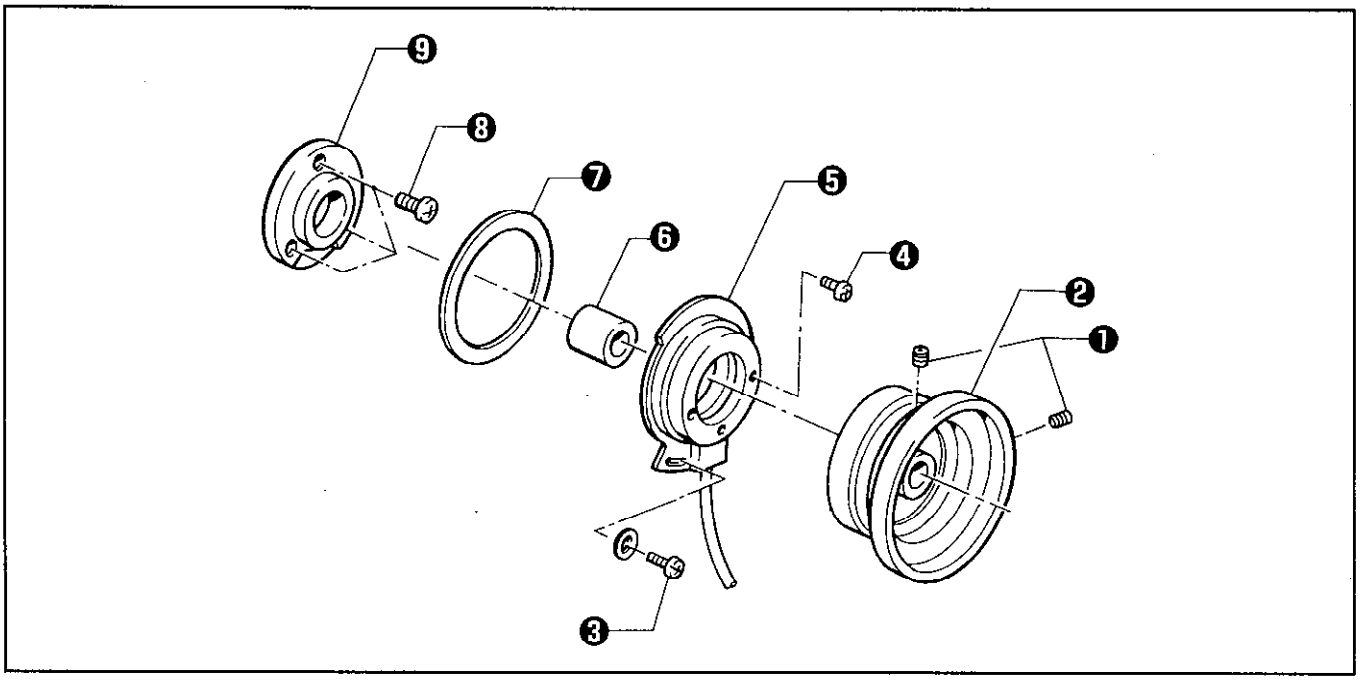
2-9. Lower shaft mechanism



*Before removing the lower shaft, loosen the timing belt, referring to 3-4.

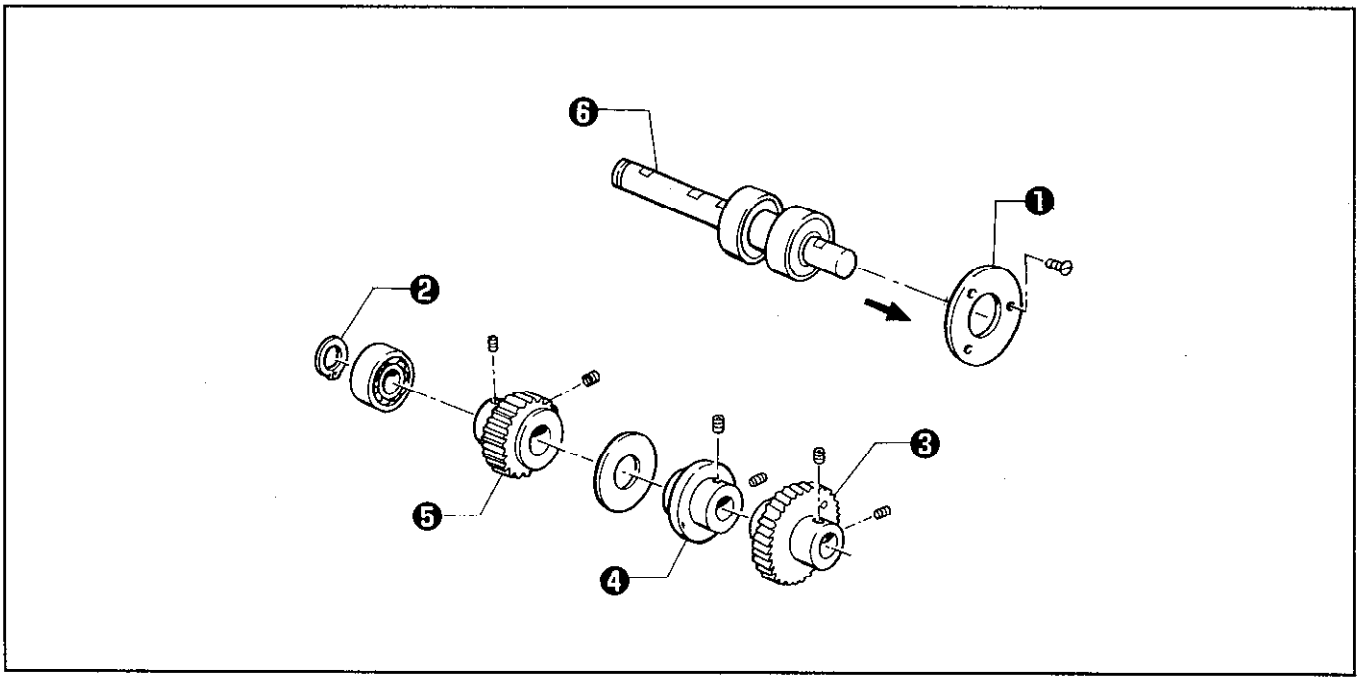
1. Loosen the screws ❷ of the lower shaft tension pulley assembly ❶.
2. Loosen the screws ❹ of the lower shaft cam ❸.
3. Loosen the set screws ❻ of the set collar ❺, and remove the lower shaft ❼ in the direction of the arrow.

2-10. Synchronizer



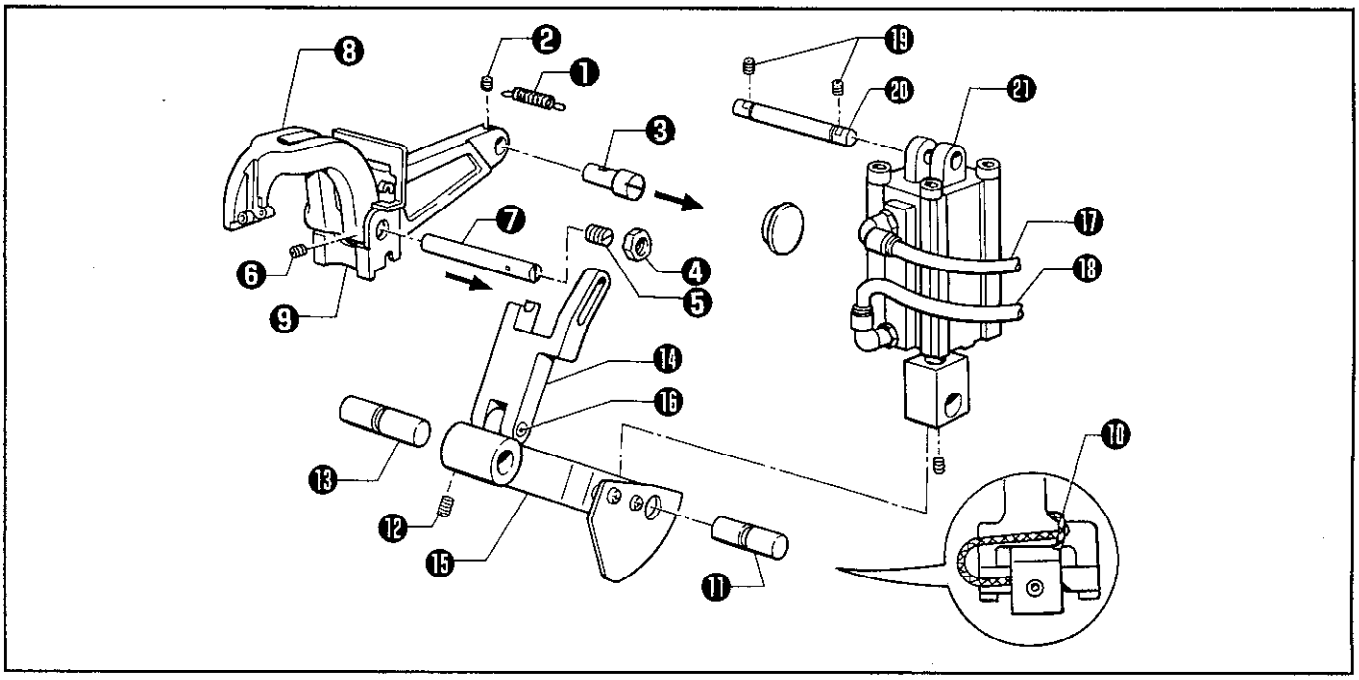
1. Loosen the two set screws ❶, and remove the pulley ❷.
2. Remove the screw ❸ and the two screws ❹, the synchronizer assembly ❺, the upper shaft pulley collar ❻, and the synchronizer packing ❼.
3. Remove the three screws ❽, and the NP support bracket ❾.

2-11. Upper shaft mechanism



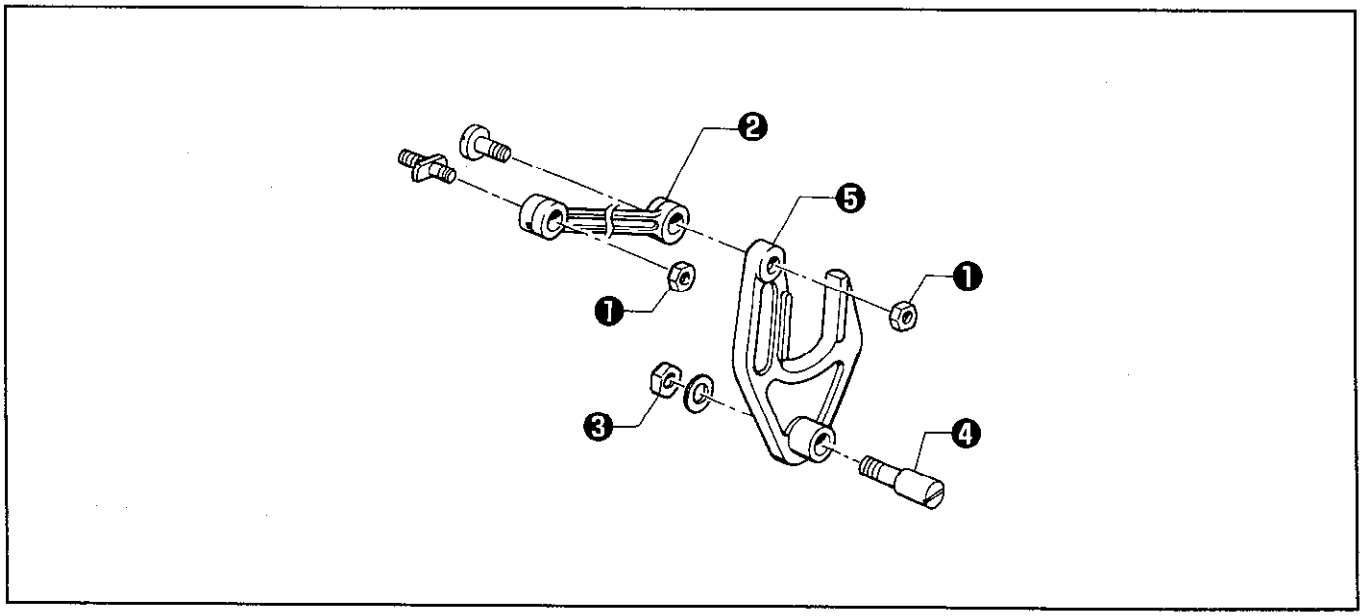
1. Remove ball bearing cap (S) ❶ and the retaining ring ❷.
2. Loosen the set screws of the needle bar gear ❸, the zigzag cam ❹, and the upper shaft tension pulley assembly ❺.
3. Pull the upper shaft ❻ in the direction of the pulley to remove it. The upper shaft unit will come off.

2-12. Cutter mechanism



1. Remove the extension spring ❶, loosen the set screw ❷, and remove link shaft (B) ❸ in the direction of the arrow.
2. Remove the two nuts ❹ and the cutter arm support screw ❺. Loosen the set screw ❻, and remove the cutter lever shaft ❼ in the direction of the arrow, and the cutter lever ❽ along with the cutter lever cover ❾.
3. Remove the wick ❿, and loosen the set screw. Remove the cylinder rod shaft ⓫.
4. Loosen the set screw ⓬, and remove link shaft (A) ⓭, and the combination of link (A) ⓮, link (C) ⓯, and link shaft (C) ⓰.
5. Remove the air tubes ⓱ and ⓲, loosen the two set screws ⓳, and remove the cylinder support shaft ⓴ and the cutter cylinder ㉑.

2-13. Zigzag fork



1. Remove the two nuts ❶, and the zigzag connecting rod assembly ❷.
2. Remove the nut ❸, the zigzag fork support pin ❹, and the zigzag fork ❺.

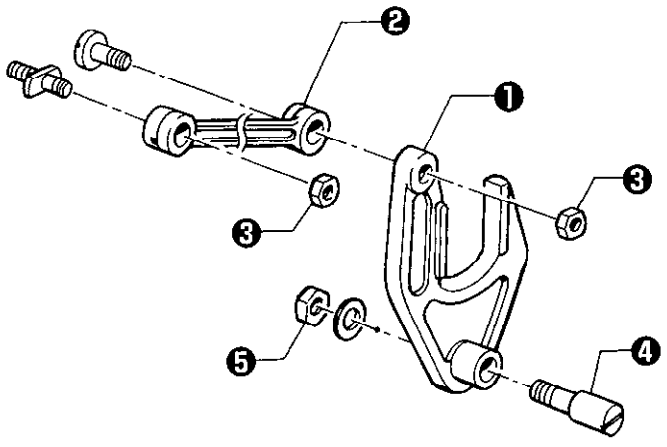
3. ASSEMBLY

⚠ CAUTION

- Maintenance and inspection of the sewing machine should only be carried out by a qualified technician.
- Ask your Brother dealer or a qualified electrician to carry out any maintenance and inspection of the electrical system.
- Turn off the power switch and disconnect the power cord from the wall outlet at the following times, otherwise the machine may operate if the start switch is depressed by mistake, which could result in injury.
  - When carrying out inspection, adjustment and maintenance
  - When replacing consumable parts such as the loopers, spreaders, knife and cutting block
- Disconnect the air hoses from the air supply and wait for the needle on the pressure gauge to drop to "0" before carrying out inspection, adjustment and repair of any parts which use the pneumatic equipment.
- If the power switch and air need to be left on when carrying out some adjustment, be extremely careful to observe all safety precautions.
- Use only the proper replacement parts as specified by Brother.
- If any safety devices have been removed, be absolutely sure to re-install them to their original positions and check that they operate correctly before using the machine.
- Any problems in machine operation which result from unauthorized modifications to the machine will not be covered by the warranty.

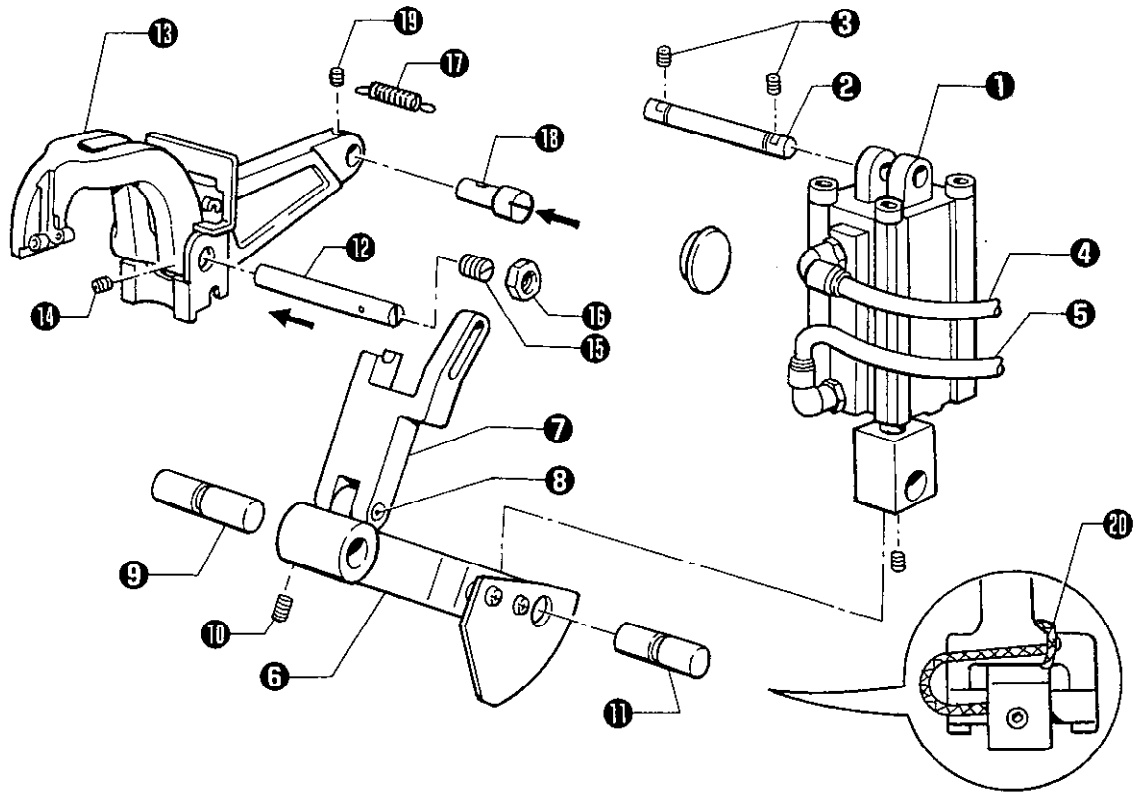
If the assembly is not performed in the correct order, it may be hard to attach parts. Assemble as follows. The following is the main points of assembly.

3-1. Zigzag fork



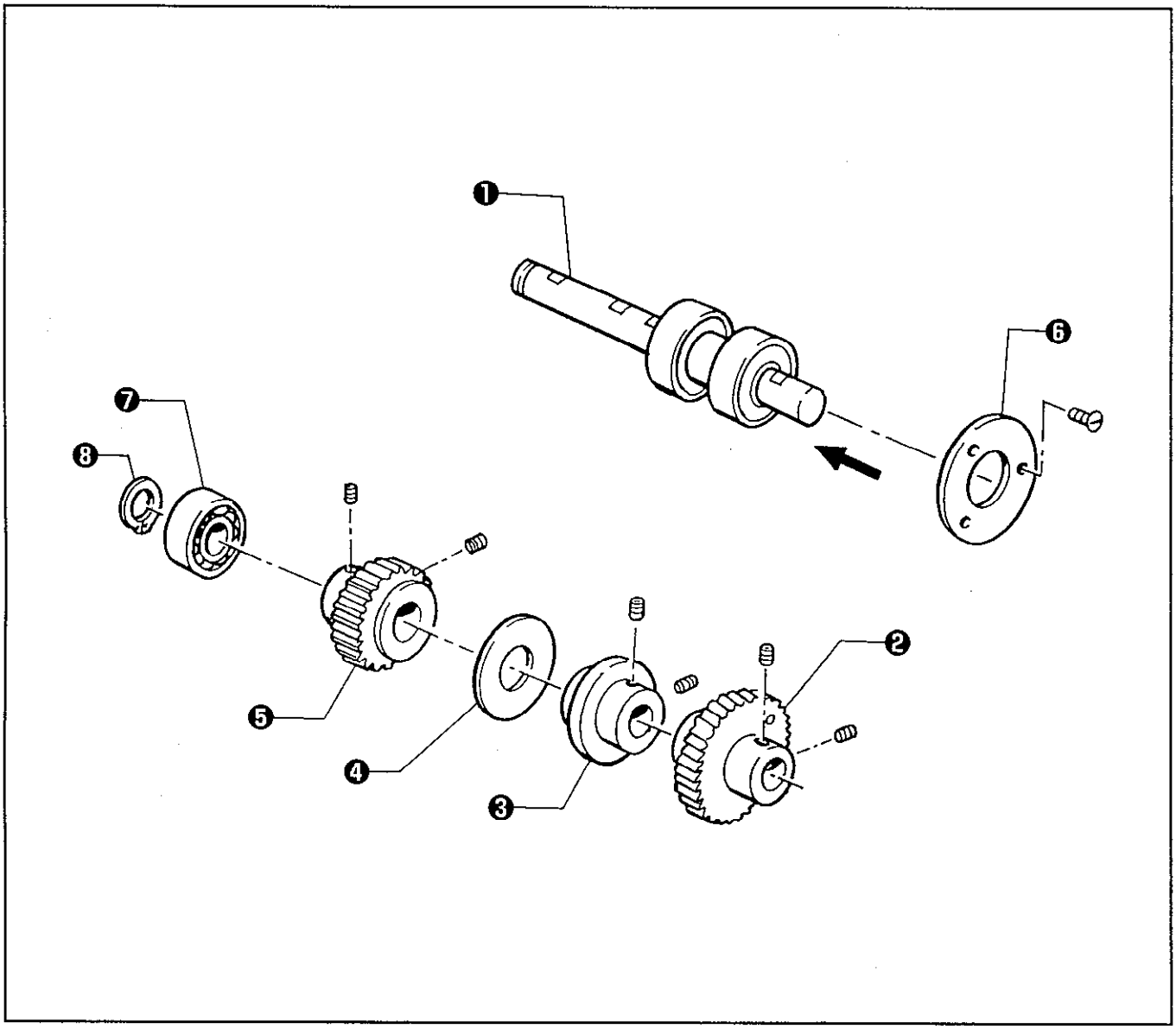
1. Combine the zigzag fork ❶ and the zigzag connecting rod assembly ❷ using the nuts ❸. Insert the zigzag fork support pin ❹ into the hole in the zigzag fork ❶, and put them into the arm from above.
2. Insert the zigzag fork support pin ❹ into the hole in the side of the arm, and secure it using the nut ❺.

3-2. Cutter mechanism



1. Put the air cylinder for cutter ❶ into the arm with the joints facing the front. Insert the cylinder support shaft ❷ into the hole in the air cylinder ❶, and secure it using the set screws ❸.
2. Attach No. 18 air tube ❹ to the upper tube of the cylinder.
   Attach No. 19 air tube ❺ to the lower tube of the cylinder.
3. Combine link (C) ❻, link (A) ❼, and link shaft (C) ❽. Position them in the bed from below, and attach link shaft (A) ❾ to them using the set screw ❿.
4. Attach the cylinder rod shaft ⓫ with the lubrication hole facing the left.
5. Insert the cutter lever shaft ⓬ with its slit facing the right, into the hole in the bed, the cutter lever ⓭, and the hole in the bed, and tighten the screw ⓮ on the screw flat of the cutter lever shaft ⓬.
6. Tighten the cutter arm support screw ⓮ on each end of the cutter lever shaft ⓬, and secure it using the nut ⓰.
7. Hook the extension spring ⓱ over the cutter lever ⓭ and the tab of the bed.
8. Pass link shaft (B) ⓲ with its slit facing the right, through the slot of link (A) ❼, and the hole in the cutter lever ⓭, and tighten the set screw ⓳.
9. Wind the wick ⓴ around the right of link (C) ❻, and insert the end of the wick into the lubrication hole in the cylinder rod shaft ⓫.

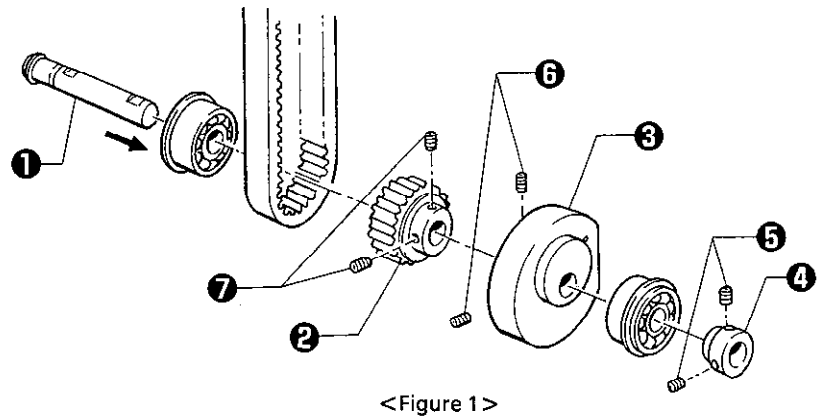
3-3. Upper shaft mechanism



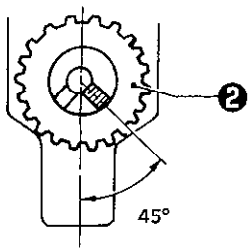
* The emergency stop switch cord should be routed above the upper shaft.

1. Insert the upper shaft unit ❶ into the arm from the right, and place the needle bar gear ❷, the zigzag cam ❸, the thrust washer ❹, the upper shaft tension pulley ❺, and the timing belt on it.
2. Position the zigzag fork so that the zigzag cam ❸ is between the arms.
3. Attach the ball bearing cap ❻ using the set screws.
4. Place the ball bearing ❼ on the upper shaft, and secure it using the retaining ring ❽.
5. Position the needle bar gear ❷ and the zigzag cam ❸ so that they just make contact with the retaining ring closer to the pulley. With the screw flats facing the front, tighten the set screw which comes first when rotated in the rotation direction, against the screw flat. Then tighten the other set screw.
6. Position the zigzag fork between the zigzag cam ❸ and the thrust washer ❹ so that there is no play between them, face the screw flat to the front, and secure the upper shaft tension pulley ❺ by tightening the set screw which comes first when rotated in the rotation direction, against the screw flat. Then tighten the other set screw.
7. Temporarily tighten the pulley with its screw flat facing the front.

3-4. Lower shaft mechanism



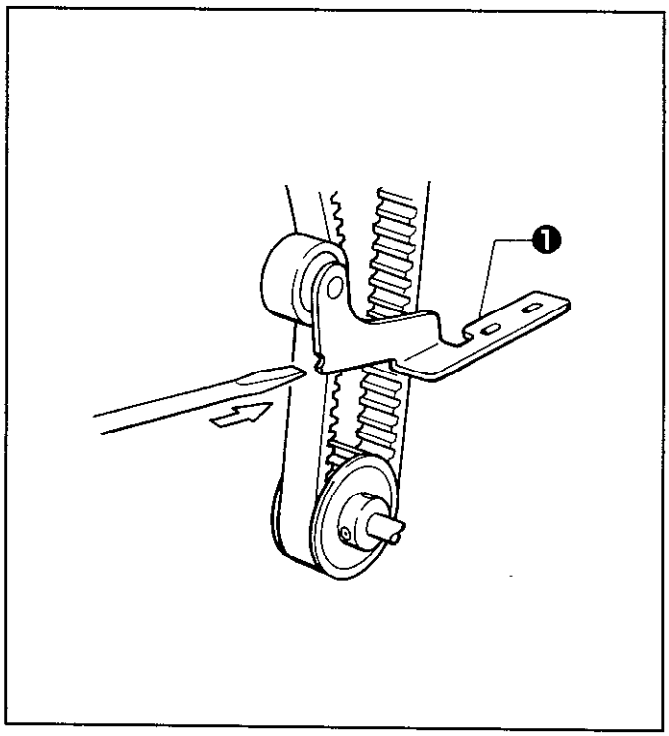
<Figure 1>



<Figure 2>

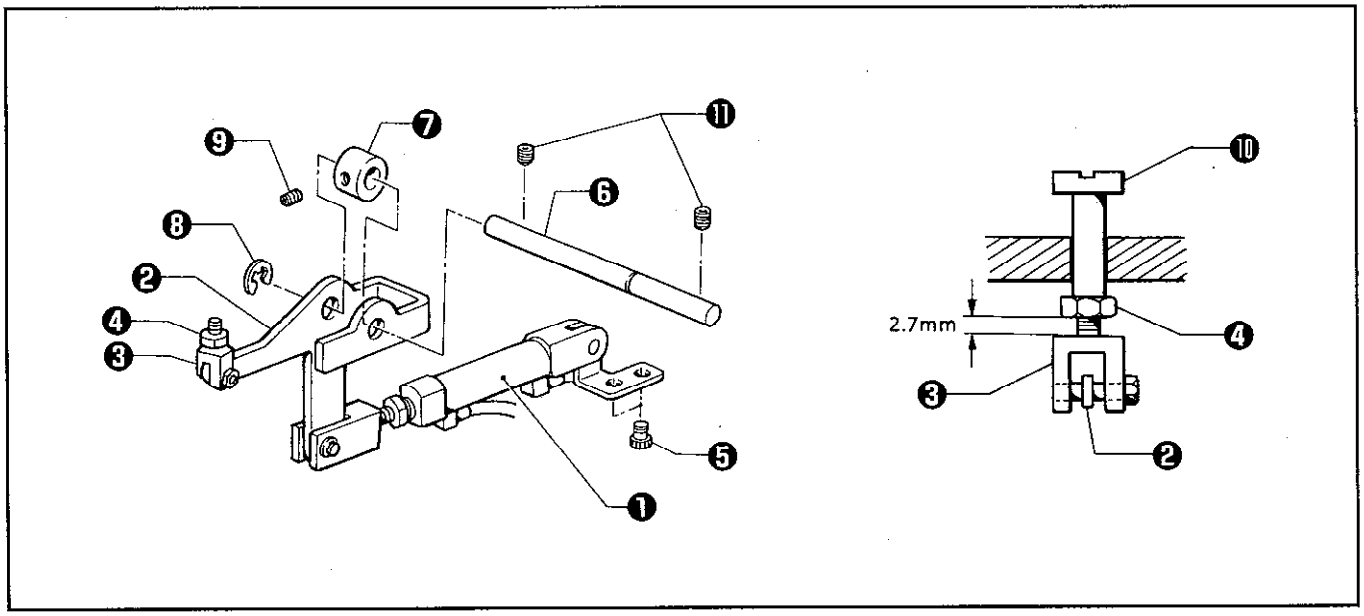
1. Fit the two ball bearings into the holes in the bed, insert the lower shaft ❶ from the left. Put the timing belt, the lower shaft tension pulley assembly ❷, the lower shaft cam ❸, and the set collar ❹, in this order, on the lower shaft ❶, and tighten the set screws ❺ of the set collar ❹ so that there is no play between the parts on the lower shaft ❶.
2. Lightly press the lower shaft tension pulley assembly ❷ and the lower shaft cam ❸ against the left ball bearing, and tighten the set screws ❻ of the lower shaft cam ❸.
   *The screw flat should align with the set screw which comes first when the lower shaft is rotated in the rotation direction.
3. When the screw flat of the upper shaft is at the top, and the set screws ❼ of the lower shaft tension pulley assembly ❷ are as shown in figure 2, loop the timing belt over the lower shaft tension pulley assembly ❷.

Adjusting the timing belt



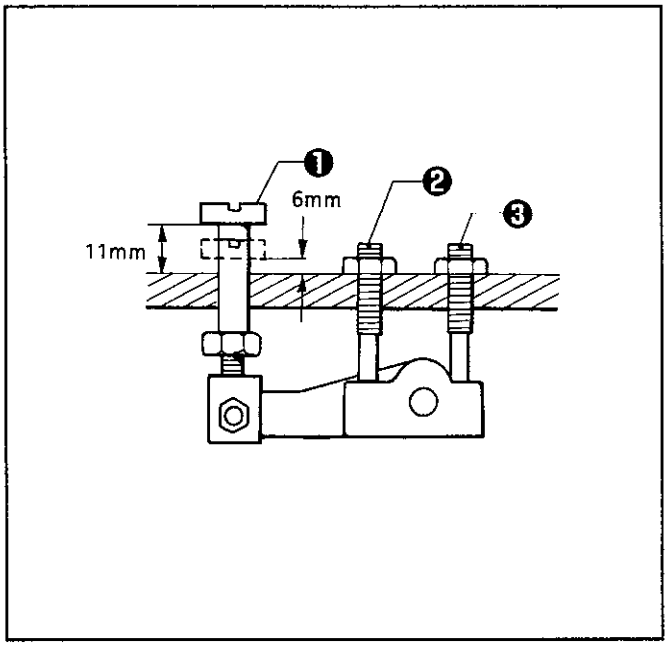
Use a screwdriver or similar tool to press the notch of the tension pulley arm assembly ❶ with a force of 39.2 N (4 kgf), and attach the tension pulley assembly.

3-5. Upper thread trimmer mechanism



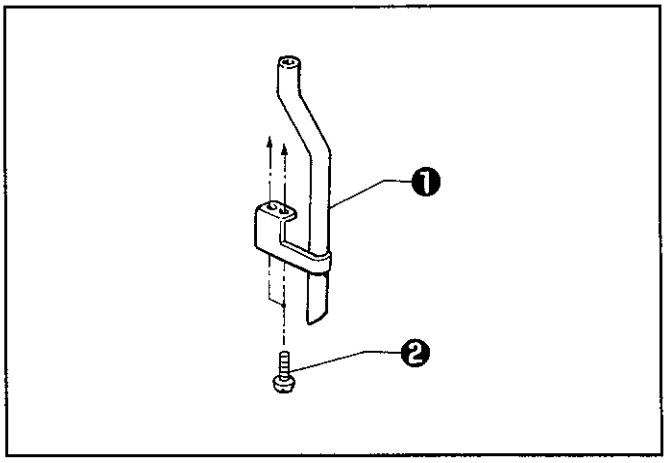
1. Assemble the thread trimmer lever ❷, the thread trimmer adjust screw ❸, and the nut ❹, and attach them to the cylinder 10×15 S assembly ❶. Insert them into the tubular part of the bed, and temporarily tighten the bolts ❺.
2. Insert the thread trimmer lever shaft ❻ into the hole in the bed, and pass it through the thread trimmer lever ❷ and the set collar ❼.
3. Secure the thread trimmer lever ❷ using the retaining ring ❽ and the set collar ❼, and tighten the set screw ❾.
4. Insert the thread trimmer lever hammer ❿ into the hole in the bed, and tighten the thread trimmer adjusting screw ❸ and the nut ❹, until there is 2.7 mm between the nut and the head of the screw ❸.
5. Manually move the thread trimmer lever hammer ❿ up and down, and tighten the set screws ⓫ where the thread trimmer hammer ❿ motion is the smoothest.
6. Tighten the bolts ❺ in the same way.

Adjusting the thread trimming hammer stroke



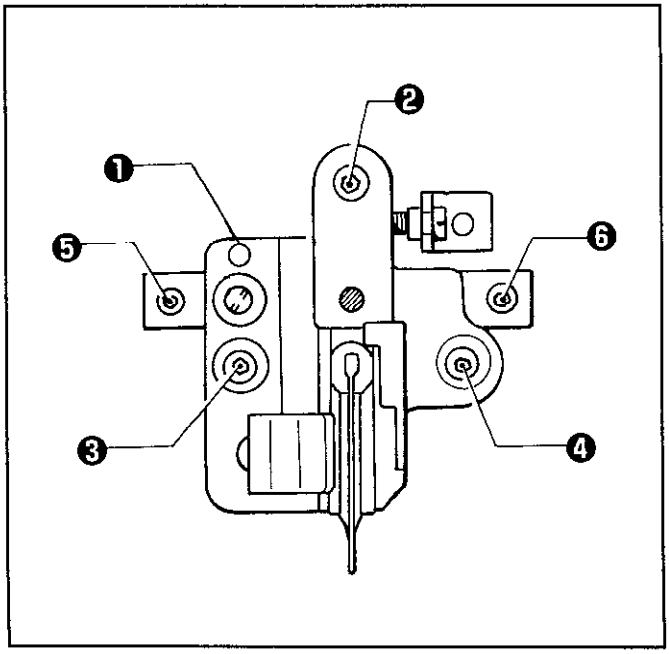
1. Raise the thread trimming hammer ❶, and adjust the screw ❷ so that the clearance with the bed is 11 mm.
2. Lower the thread trimming hammer ❶, and adjust the screw ❸ so that the clearance with the bed is 6 mm.

3-6. Attaching the knife pipe and the knife base



1) Knife pipe

Insert the knife pipe ❶ into the bed from below, and secure it using the screw ❷.

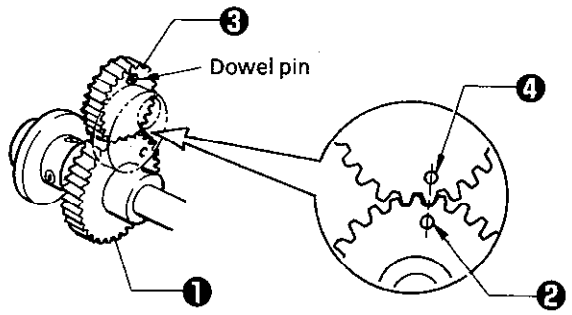


2) Knife base

Insert a bar with a diameter of 4 mm into the hole ❶ in the knife base to fix the knife base position, and tighten the screws ❷ to ❻.

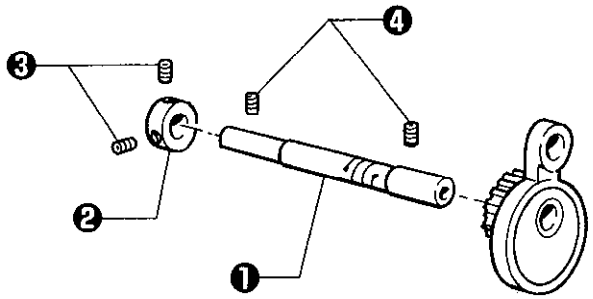
3-7. Driving gear shaft mechanism

1) Assembling the needle bar gear and the needle bar driving gear



Engage the needle bar gear ❶ with the needle bar driving gear ❷ by matching their identification holes ❸ and ❹.
Note: Do not mistake the hole ❹ for the hole in which the dowel pin is inserted.

2) Adjusting the set collar of the needle bar gear



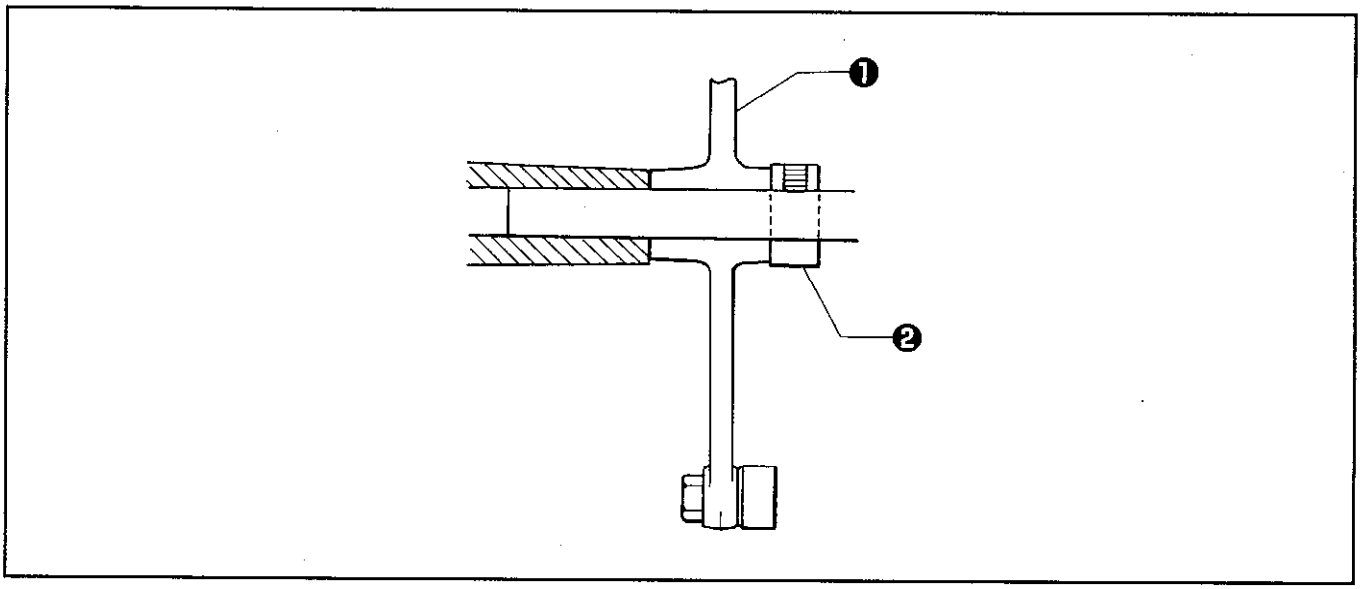
Tighten the set screws ❸ of the set collar ❷ with either set screw at the center of the screw flat on the driving gear shaft ❶.

3) Adjusting the backlash between the needle bar gear and the needle bar driving gear

1. The driving gear shaft ❶ is eccentric. Turn it to adjust the backlash.
   *The driving gear shaft ❶ should be turned in the direction where its lubrication hole is moving upward.
2. While pressing the set collar ❷ toward the pulley so that the driving gear shaft ❶ has no end play, tighten the set screws ❹.

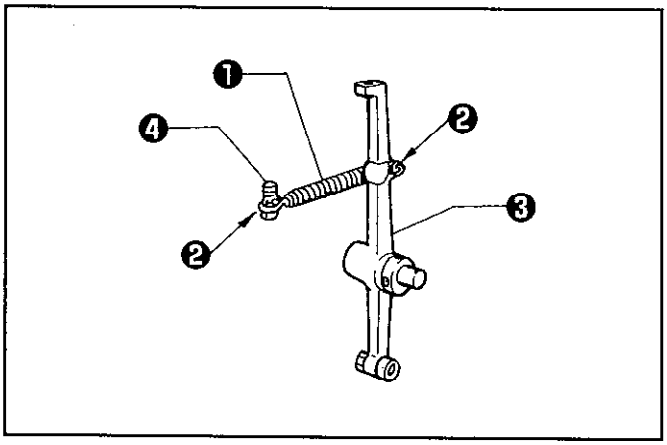
3-8. Needle bar, thread take-up, and zigzag mechanisms

1) Eliminating end play of the thread take-up on the arm



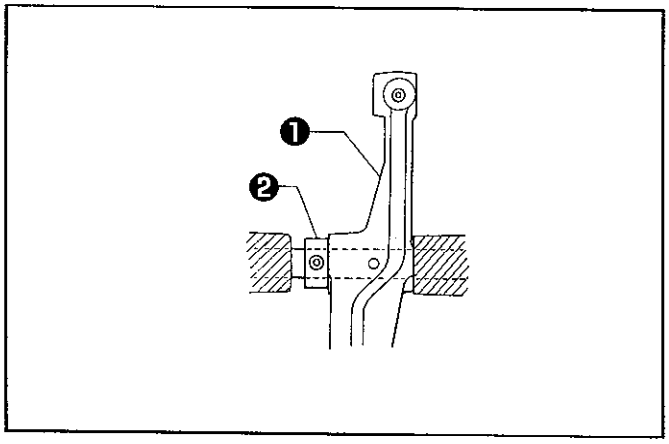
Eliminate end play of the thread take-up ❶ on the arm by placing it between the end of the arm and the set collar ❷.

2) Applying grease to the ends of the thread take-up spring



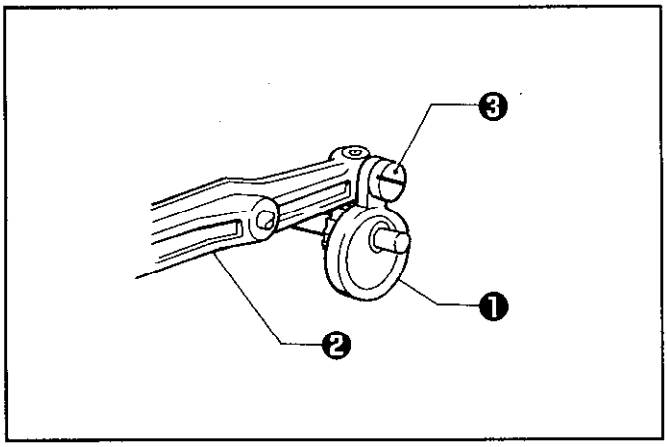
Apply grease to the ends ❷ of the thread take-up spring ❶.
*Apply grease to the ends of the thread take-up ❸ and the spring hook ❹.

3) Eliminating end play of the needle bar driving lever



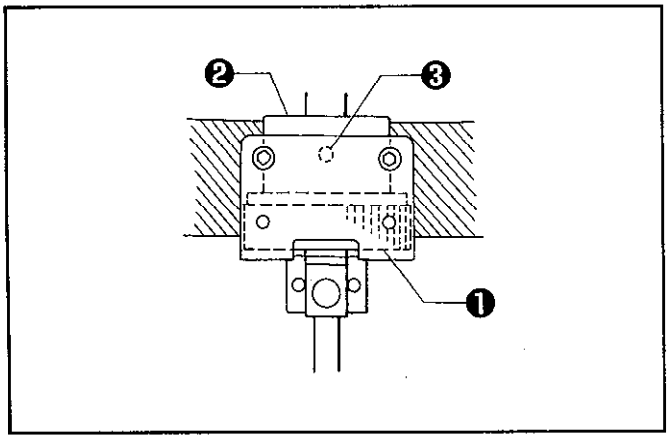
Adjust the position of the set collar ❷ to eliminate end play of the needle bar driving lever ❶.

4) Eliminating end play of the driving rod



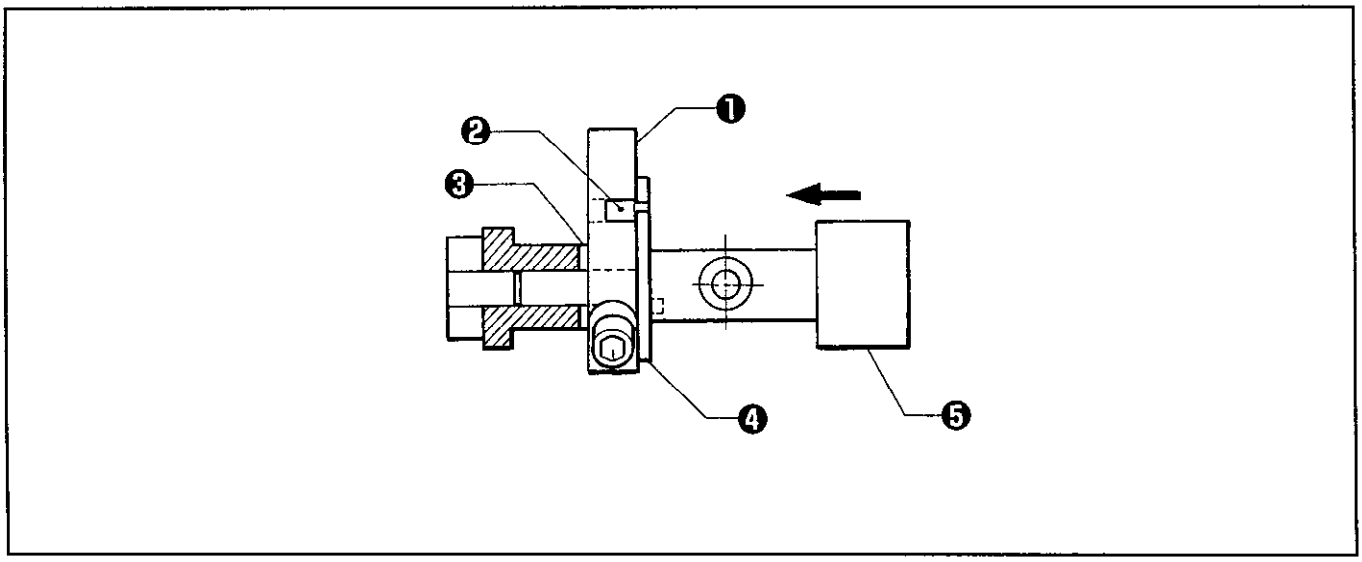
The driving rod ❶ is attached to the needle bar driving lever ❷ and the driving rod pin ❸. The eccentric wheel of the driving rod ❶ is free in the thrust direction.
Place the driving rod ❶ between the edge of the needle bar driving lever ❷ and the head of the rod pin ❸ to eliminate end play of the driving rod ❶.

5) The strength to tighten the set screw of ball bearing 25/20



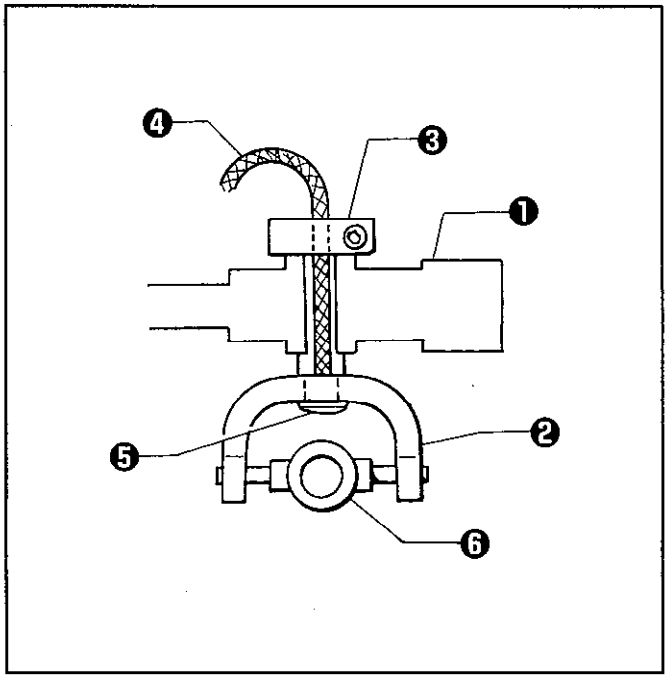
The set screw ❸ of ball bearing 25/20 ❷ for the needle bar gear ❶ should be tightened as little as possible. If it is tightened excessively, unnecessary load may be applied to the needle bar gear ❶, causing pulse motor R to go out of control.
*Be sure to apply the screw lock to the circumference of ball bearing 25/20 ❷ before press fitting it.

6) Eliminating end play of the zigzag rock shaft



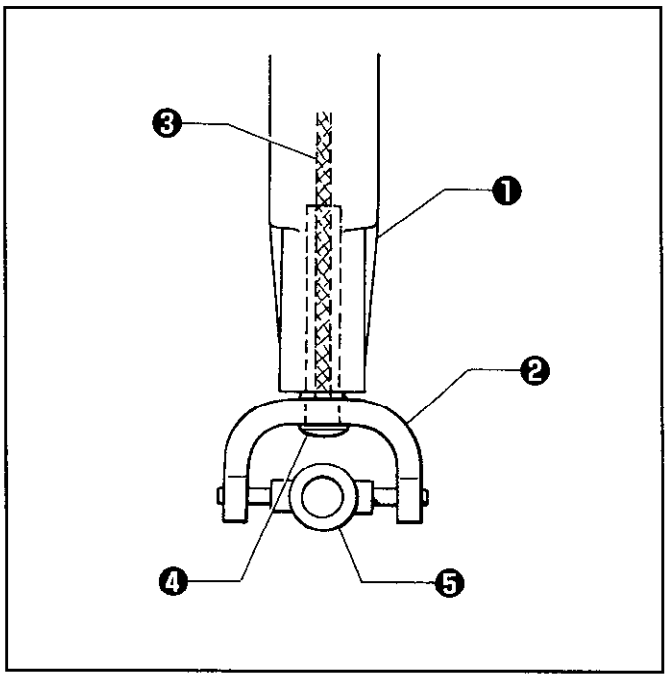
Insert the zigzag eccentric pin ❷ into the zigzag crank ❶, attach the washer ❸ and the needle position control plate ❹ as shown in the above figure, and pass the zigzag rock shaft ❺ through the arm from the right.
At this time, insert a wedge or similar tool into the split of the zigzag crank ❶ for easier adjustment.
Note: Do not fail to attach the washer ❸.

7) Eliminating end play of the zigzag lever



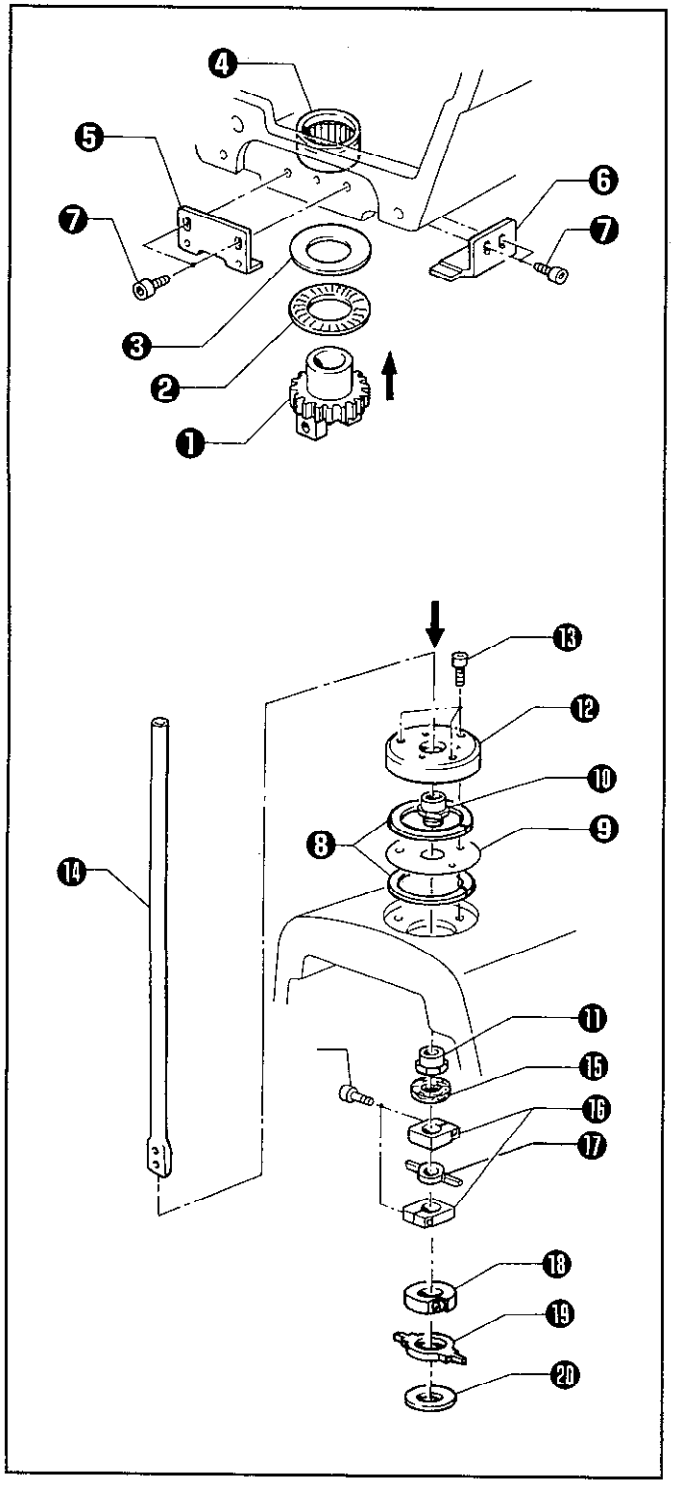
1. Adjust the needle bar clamp (set collar) ❸ so that there is no end play of the zigzag lever ❷ which is connected to the zigzag rock shaft ❶.
   The zigzag lever ❷ should rotate easily in the rotation direction.
2. Pass the wick ❹ through the zigzag lever ❷, and fit the cap ❺.
3. Attach the needle bar level feed link ❻ to the zigzag lever ❷ vertically, and turn it 90°.

8) Attaching the needle bar yoke and the needle bar level feed link



1. Combine the needle bar ❶ and the needle bar yoke ❷, pass the wick ❸ through the needle bar ❶, and fit the cap ❹.
2. Attach the needle bar level feed link ❺ to the needle bar yoke ❷ vertically, and turn it 90°.

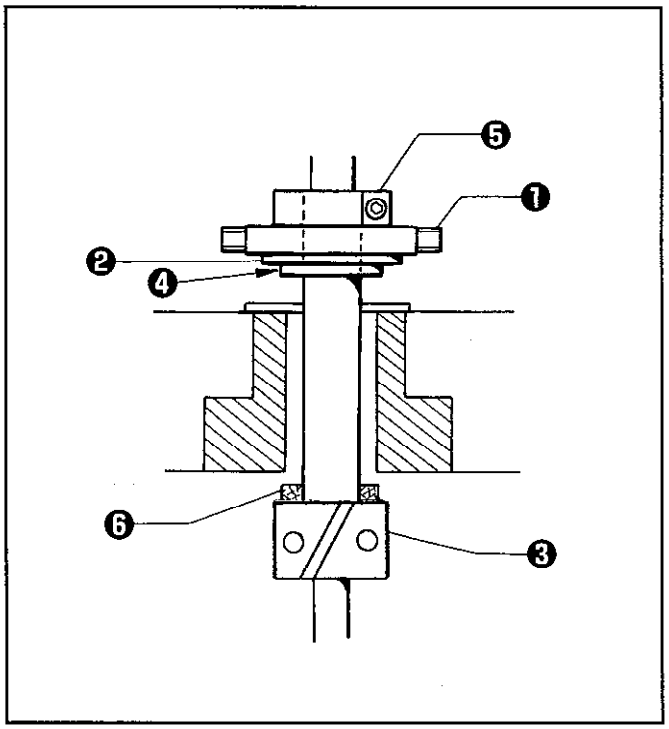
9) Attaching needle bar bush (U) and the needle bar



1. Put the thrust bearing ❷ and the thrust washer ❸ on the needle bar gear ❶. Attach them to bearing 25/20 ❹, and secure them using needle bar gear supports (A) ❺ and (B) ❻ and the screws ❼ so that the needle bar gear ❶ can turn easily but without any end play.
   * Do not forget to attach timing belt (U).

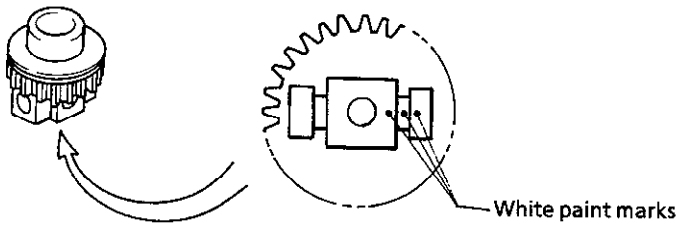
2. Insert the needle bar bush (U) rings ❽ and the needle bar bush (U) spring ❾ into the hole in the arm, and bind them using needle bar bush (U) ❿ and the needle bar bush (U) nut ⓫.
3. Temporarily attach needle bar presser bracket (B) using the bolts ⓭.
4. Pass the needle bar ⓮ through the arm from above, through the needle bar felt ⓯, the needle bar clamp ⓰, the needle bar level feed link ⓱, the needle bar block clamp ⓲, the needle bar level feed link ⓳, and the needle bar block collar ⓴, in this order.

10) Eliminating end play of the needle bar block

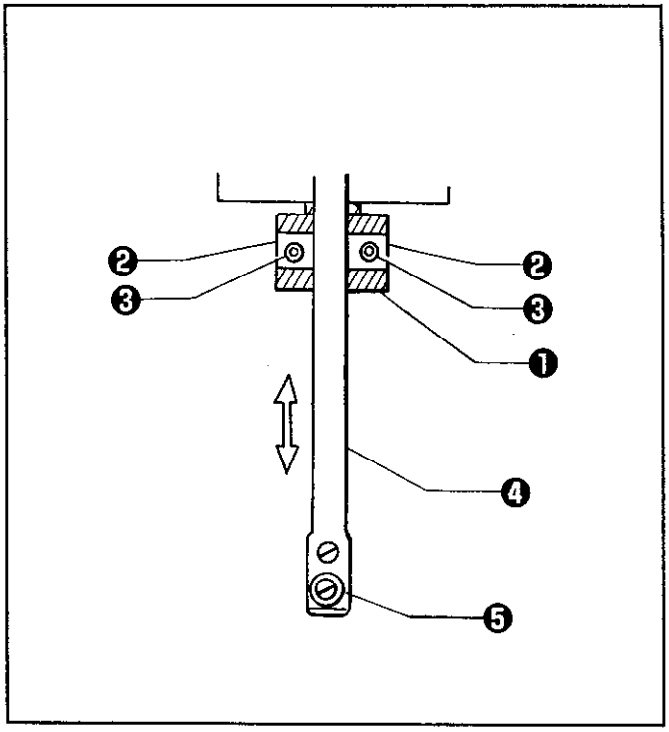


Adjust the positions of the needle bar level feed link ❶ and the needle bar block collar ❷ using the flange ❹ of the needle bar block ❸ and the needle bar block clamp ❺, so that there is no end play.

Notes: Be sure to insert the needle bar block felt ❻.
When assembling the needle bar block and the needle bar gear, align their white paint marks with each other.



11) Adjusting the needle bar in the radial direction

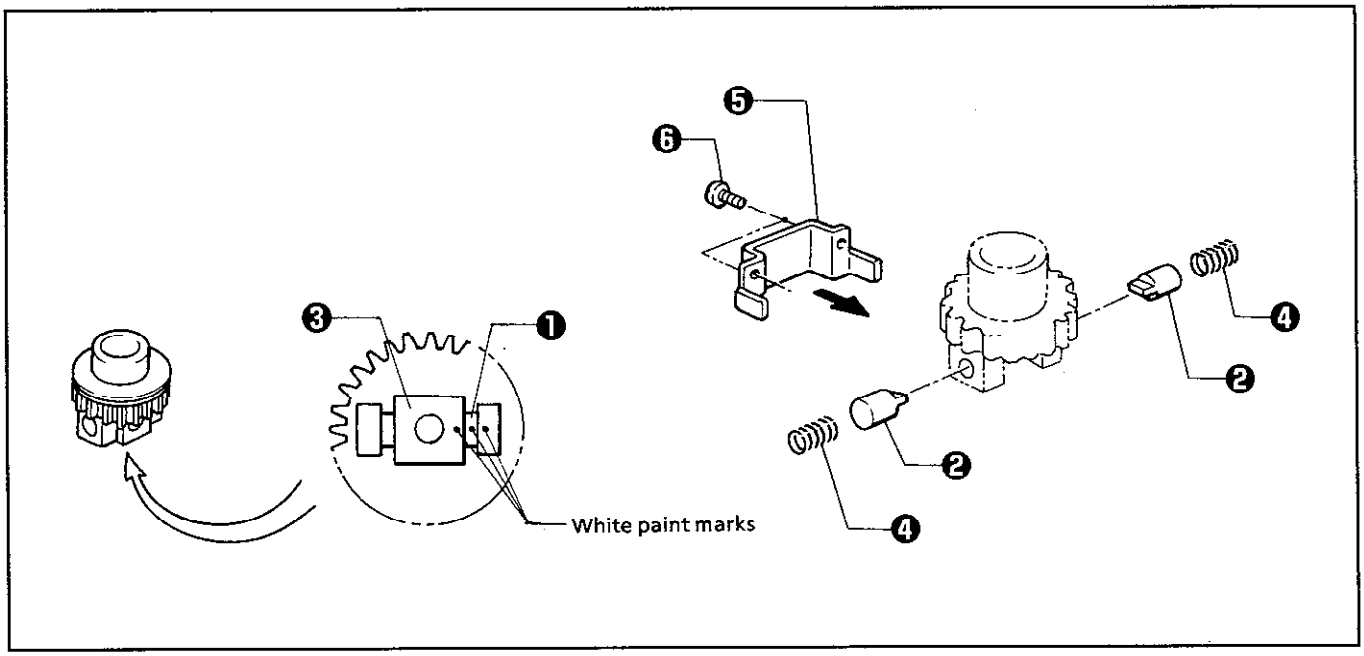


Insert the needle bar guide collars ❷ into the needle bar block ❶, and adjust the position of the needle bar ❹ using the set screws ❸ so that the needle bar can move smoothly.

Note: Position the needle bar ❹ so that the thread guide disc ❺ will face the front when the set screws ❸ are facing the front.

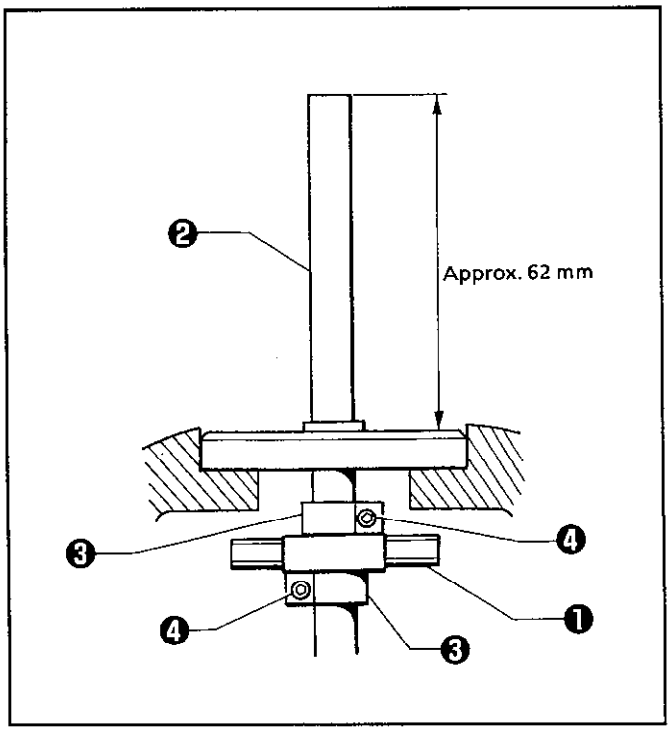
12) Attaching the needle bar block assembly

The needle bar block assembly is a set of the needle bar gear, the needle bar block, and the washers.
When disassembling and then reassembling the needle bar block assembly, align the white marks of the needle bar gear, the needle bar block, and the washers, with each other.



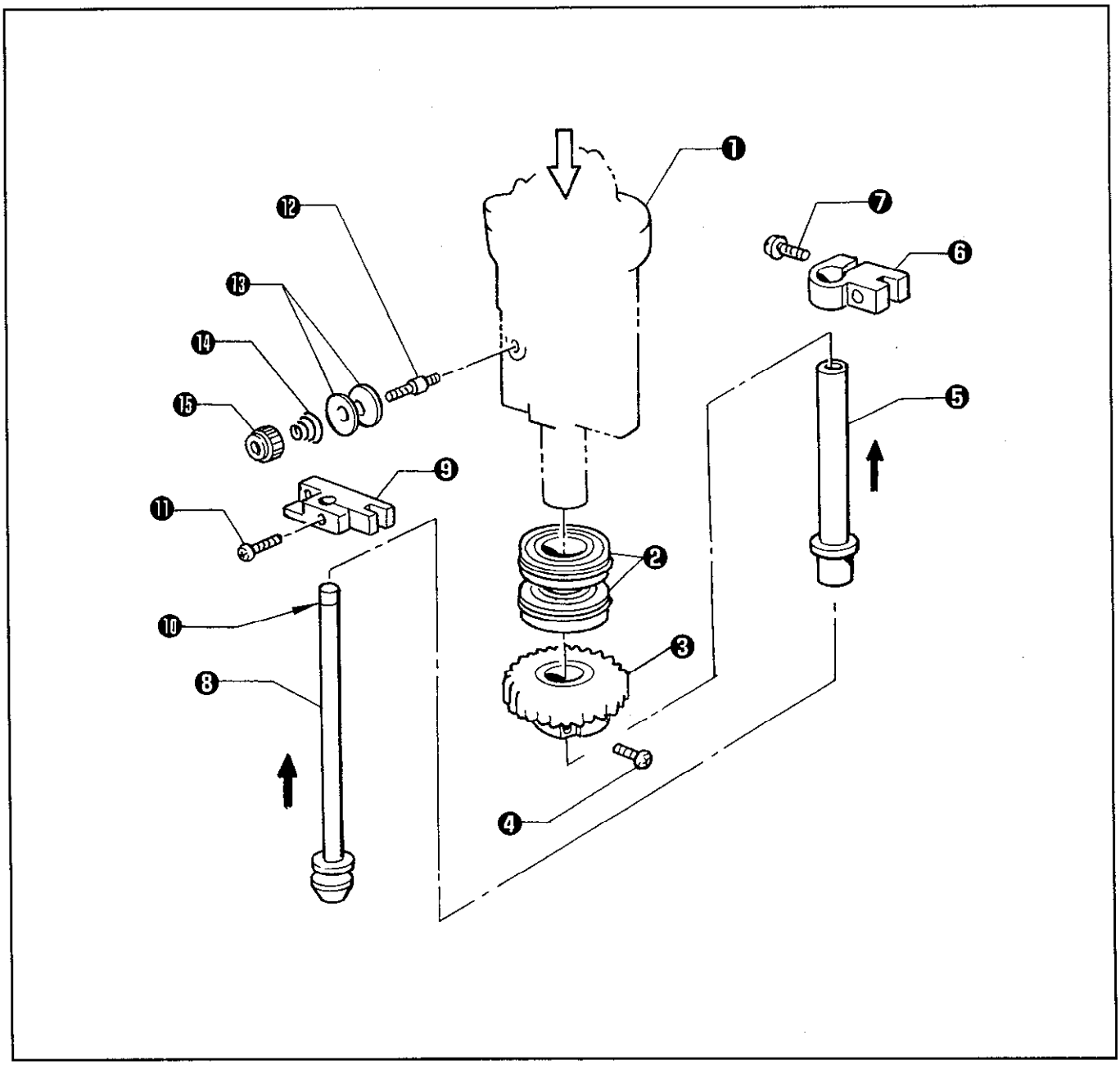
1. Insert the needle bar guides ❷ into the hole in the needle bar block ❸ on each side, taking care of the white paint mark of the washer ❶.
2. Attach the spring ❹ using the needle bar guide support plate ❺, and tighten the screw ❻.

13) Adjusting the height of the needle bar



Turn the pulley to set the needle bar level feed link ❶ at its highest position. Set the height of the needle bar ❷ to approx. 62 mm, eliminate end play between the needle bar clamp ❸ and the needle bar level feed link ❶, and tighten the screws ❹.

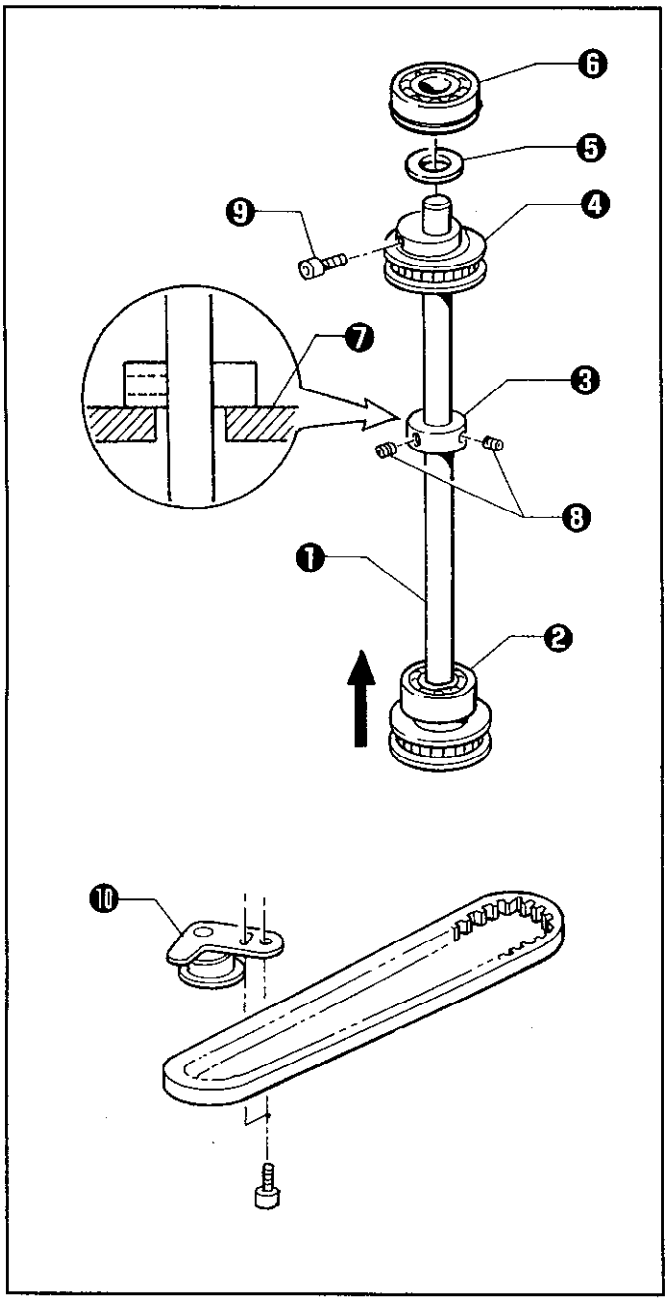
3-9. Looper base



1. Insert the shaft of the looper base ❶ through the hole in the bed, attach the ball bearings ❷ and the looper pulley to the shaft of the looper base ❶ so that there is no end play, and tighten the screw ❹.
2. Insert the looper driving shaft ❺ into the shaft of the looper base ❶, then the looper link clamp ❻ into the looper driving shaft ❺, and tighten the screw ❼.
3. Insert the spreader link shaft ❽ into the hole in the looper driving shaft ❺, then the spreader link base ❾ into the spreader link shaft ❽. Align the reference line ❿ with the top surface of the spreader link shaft ❽, and tighten the screw ⓫.
4. Attach the L-tension stud ⓬, the thread guide discs ⓭, pre-tension spring (B) ⓮, and the tension nut ⓯ to the looper base ❶.

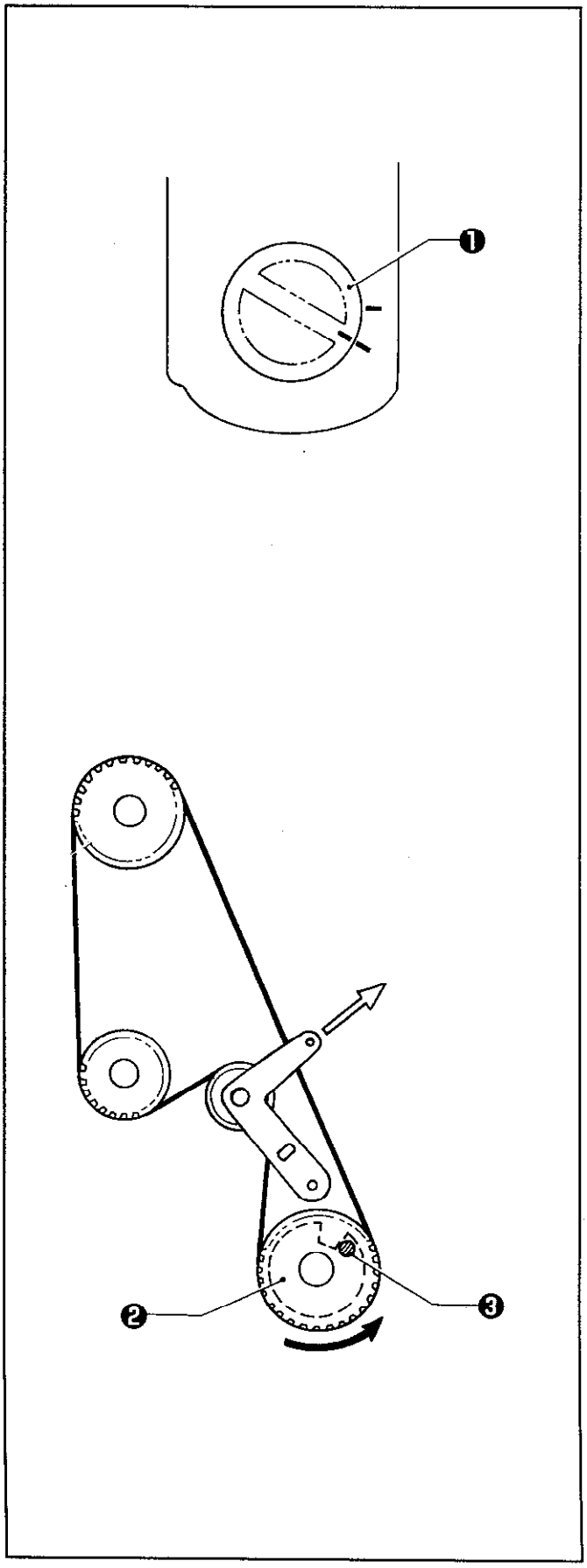
3-10. Needle bar rocking mechanism

1) Driving looper shaft



1. Insert the driving looper shaft ❶ through the hole in the bed from below, place the ball bearing ❷, the set collar ❸, the vertical shaft (T) pulley (U) assembly ❹, the washer ❺, and finally the ball bearing ❻ on the driving looper shaft ❶.
   *Be sure to pass the driving looper shaft ❶ through timing belt (U).
2. Set the clearance between the set collar ❸ and the bed ❼ to 0.02 - 0.03 mm in the thrust direction, and tighten the set screws ❽.
3. Press the vertical shaft (T) pulley (U) assembly ❹ and the washer ❺ against the ball bearing ❻, and tighten the screw ❾.
4. Attach the tension pulley arm (U) assembly ❿ while it is being pulled by a force of 19.6 N (2 kgf).
   <Deflection in the center of span: 3 ± 0.5 mm when 4.9 N (0.5 kgf) is applied>

2) Needle bar rocking mechanism



a. Adjusting the positional relationship between the driving needle pulley assembly and the looper base

1. Align the match mark in the looper base ❶ with that in the bed, as shown in the figure on the left.
2. Turn the driving needle pulley assembly ❷ until the pin ❸ makes contact with the motor base.
3. Attach the timing belt.
4. Make sure that the looper base ❶ can rotate through 360° easily.

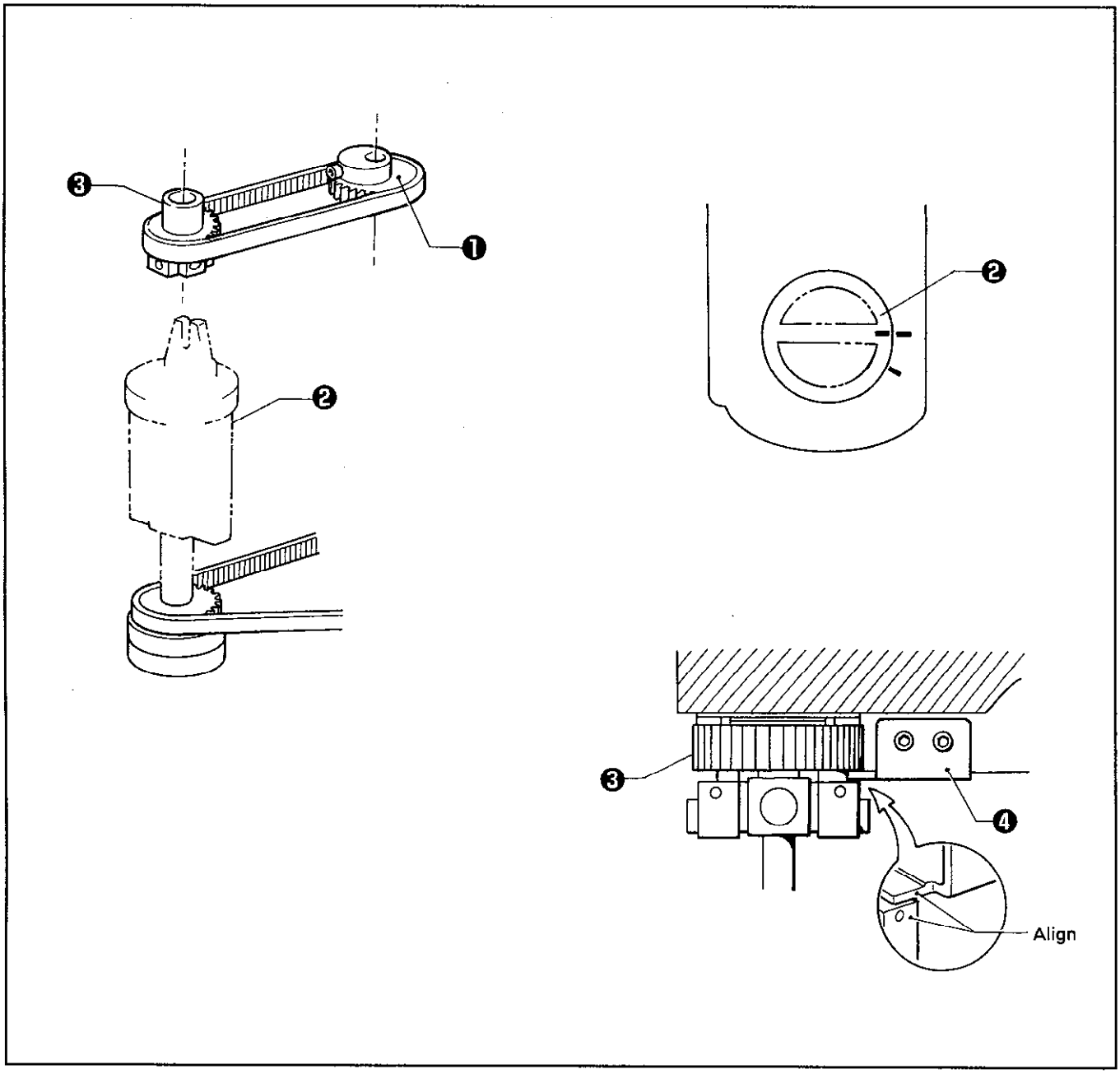
*Tighten the screw of the looper pulley at the front.

b. Adjusting the timing belt tension

Timing belt (D)

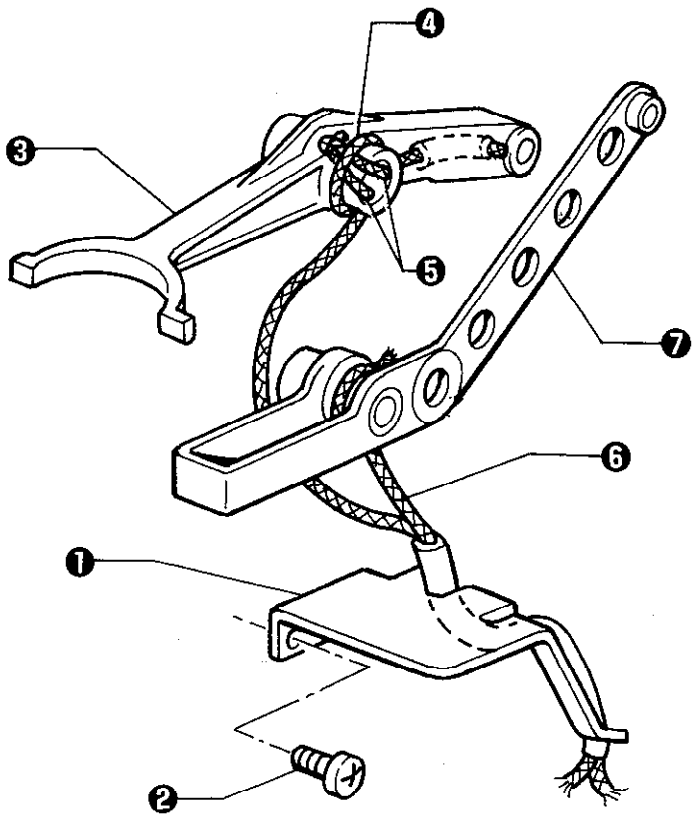
..... Attach the tension pulley arm (U) assembly while it is being pulled by a force of 68.6 N (7 kgf).
<Deflection in the center of span: 6 ± 0.5 mm when 4.9 N (0.5 kgf) is applied>

c. Adjusting the positional relationship between the looper base and the needle bar gear

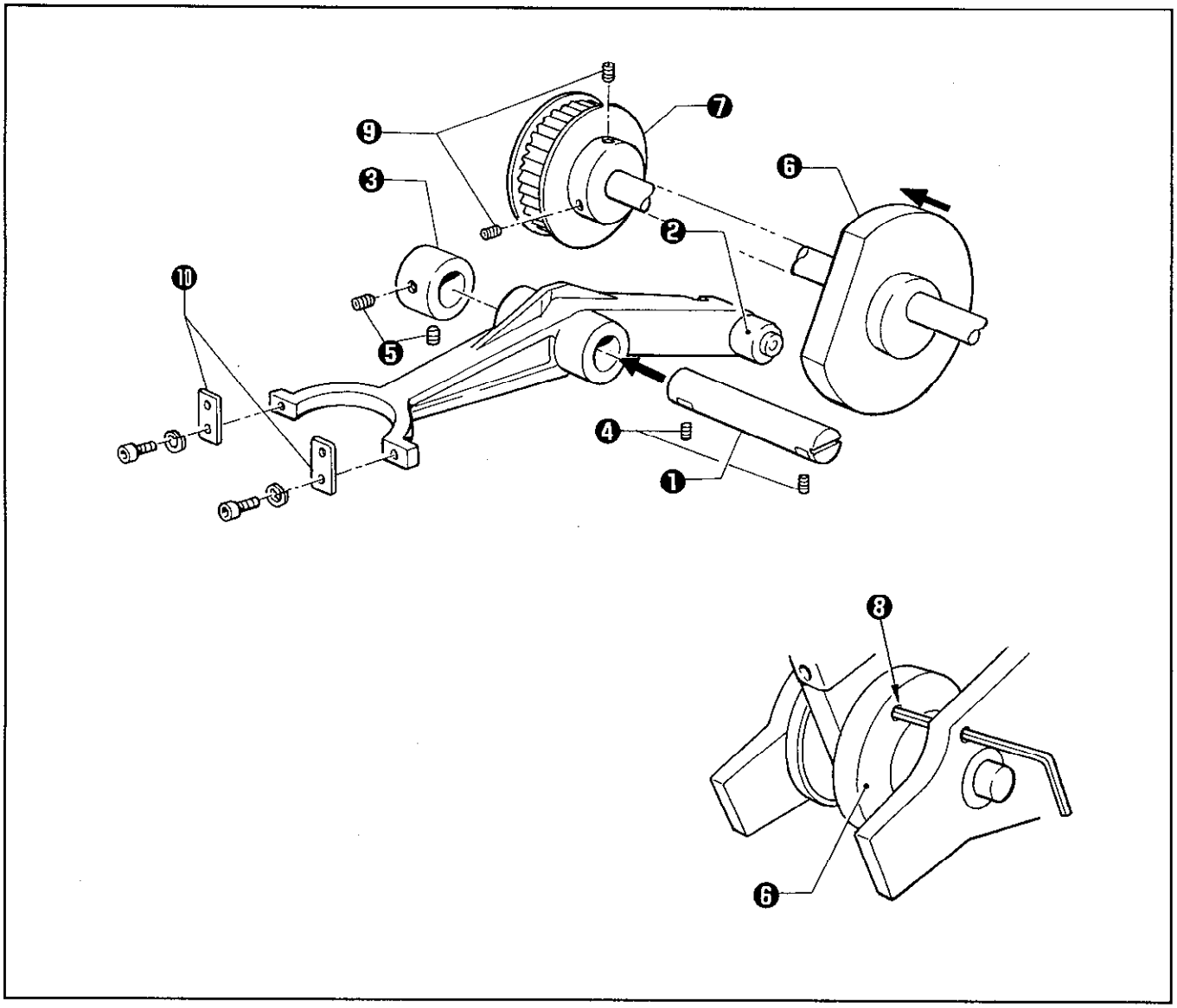


1. Loosen the screw of the vertical shaft (T) pulley (U) assembly ❶.
2. Align the match mark in the looper base ❷ with that in the bed, as shown in the figure.
3. Orient the needle bar gear ❸ in the direction shown in the figure, and align it with needle bar gear support (B) ❹.
4. Tighten the screw of the vertical shaft (T) pulley (U) assembly ❶.

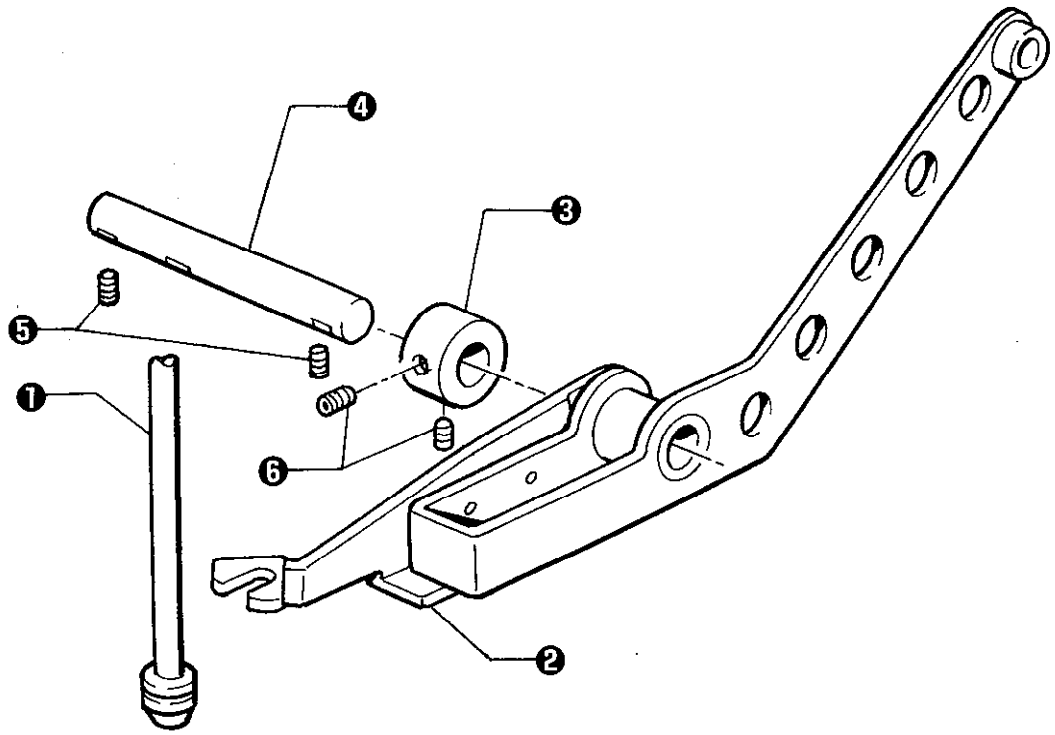
3-11. Looper and spreader



1. Attach the looper link support ❶ using the screw ❷.
2. Wind the wick ❹ around the boss of the looper link ❸.
   Be sure to pass the two wicks ❺ under the wick ❹.
   Wind the wick ❻ around the spreader driving lever ❼, as shown in the figure.



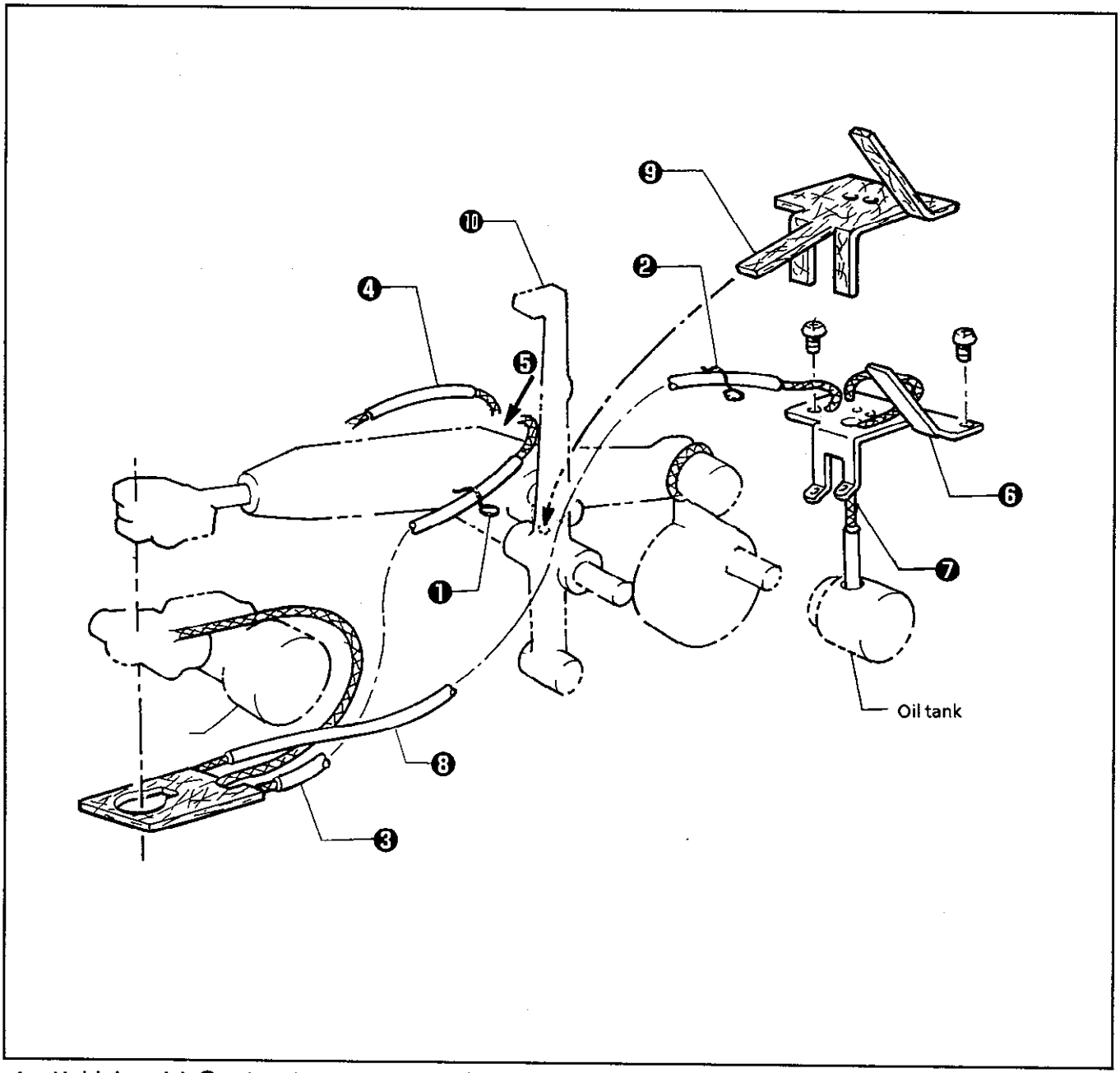
1. Place the looper link ❷ and the set collar ❸ on the looper link shaft ❶, and secure the latter using the set screws ❹.
2. Tighten the set screws ❺ of the set collar ❸ to eliminate end play.
3. Position the lower shaft cam ❻ and the timing pulley ❼ so that they lightly make contact, then tighten the screw on the screw flat at the front and another screw. (The screw flat should face the front and align with the screw which comes first when the lower shaft is rotated in the rotation direction.)
4. Insert an allen wrench (2.5 mm across flats) into the hole in the bed and the hole ❽ in the lower shaft cam ❻. Position the screw flat of the upper shaft at the top (where the needle is at its lowest position), and tighten the set screws ❾ of the timing pulley ❼. (There is no screw flat for these set screws.)
5. Attach the looper link springs ❿ to the looper link ❷ using the four screws.
6. Turn the pulley, adjust so that the looper link clamp will be at the center of the looper driving shaft's stroke, and temporarily tighten the screw.



1. Turn the pulley until it comes to its stop position, and attach the spreader link shaft ❶ to the forked portion of the spreader driving lever ❷ while pulling the former downward.
2. Pass the shaft ❹ through the spreader driving lever ❷ and the set collar ❸, and secure them using the set screws ❺. (The split in the shaft should be facing the right.)
3. Tighten the set screws ❻ of the set collar ❸ to eliminate the end play.

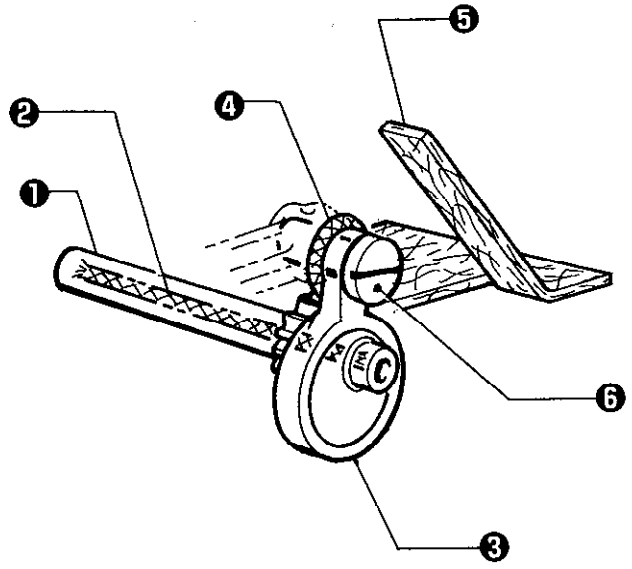
3-12. Lubrication

1) Machine head



1. Hold the wick ❸ using the wick support ❶.
2. Hold the wick ❽ using the wick support ❷.
3. Insert the wicks ❸ and ❹ into the hole ❺.
4. Attach wick support (L) ❻ using the two screws.
   At this time, the emergency stop switch cord should be routed above wick support (L) ❻.
5. Using a pair of tweezers, insert the wick ❼ into the hole in the oil tank.
   At this time, insert the oil tube into the hole, as shown in the figure.
6. Pass the wick ❽ under the wick support (L) felt ❾.
7. Push the wick support (L) felt ❾ into the lubrication hole in the thread take-up ❿.

2) Driving gear shaft



*Oil is supplied to the gear shaft, the eccentric wheel, and driving rod ❸ through the wick ❷ of the driving gear shaft ❶.

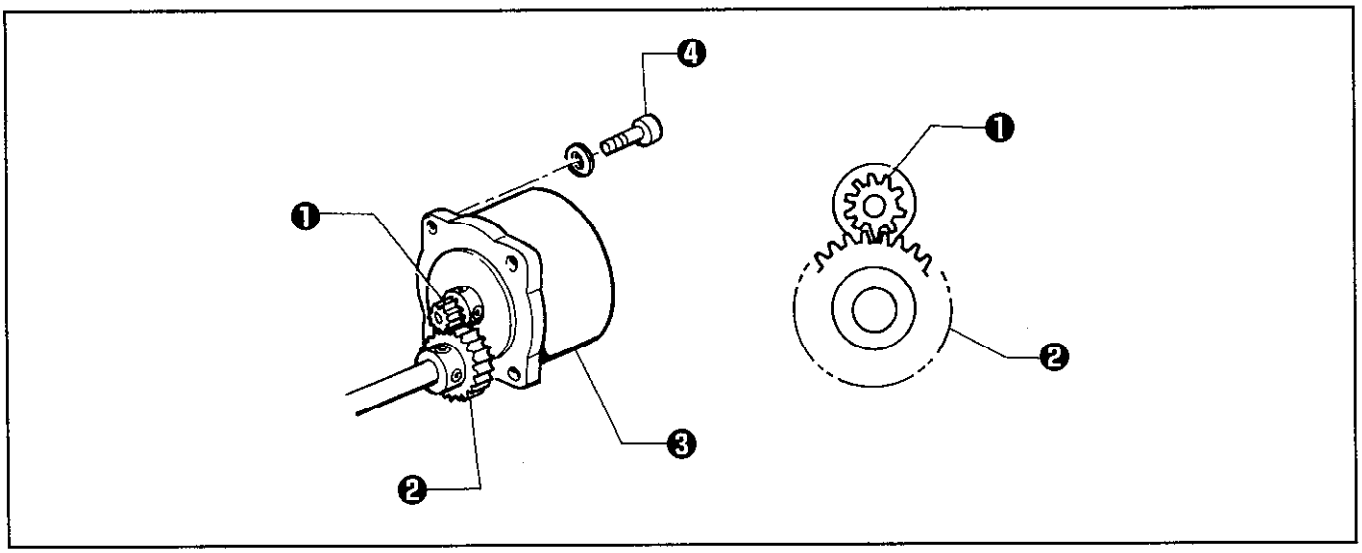
*The wick ❹, which is wound around the boss of the driving rod ❸, makes contact with the felt ❺, and oil is supplied to the driving rod pin ❻.

3-13. Feed mechanism

1) X direction

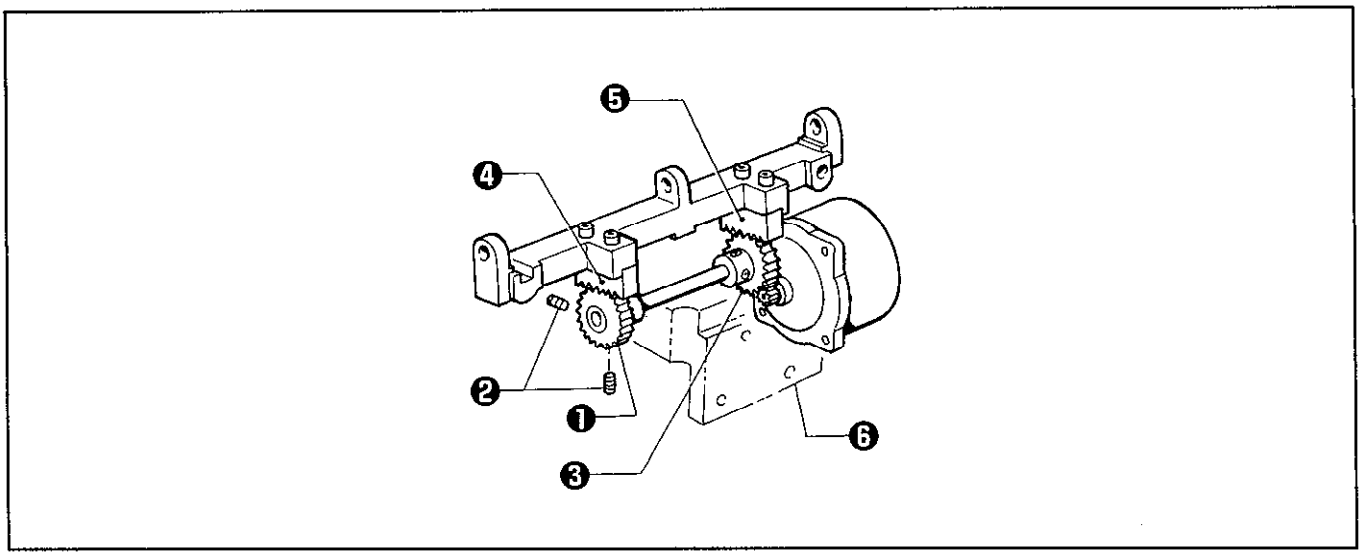
a. Adjusting the backlash between the driving gear and the idle gear

Note: Be sure to remove the motor support. Adjustment should be carried out with the driving gear and the idle gear treated as a unit.



Adjust the backlash between the driving gear and the idle gear when they are engaged, using the weight of pulse motor (X) ❸ (as shown in the figure above).
Tighten the bolt ❹.

b. Adjusting the idle gear

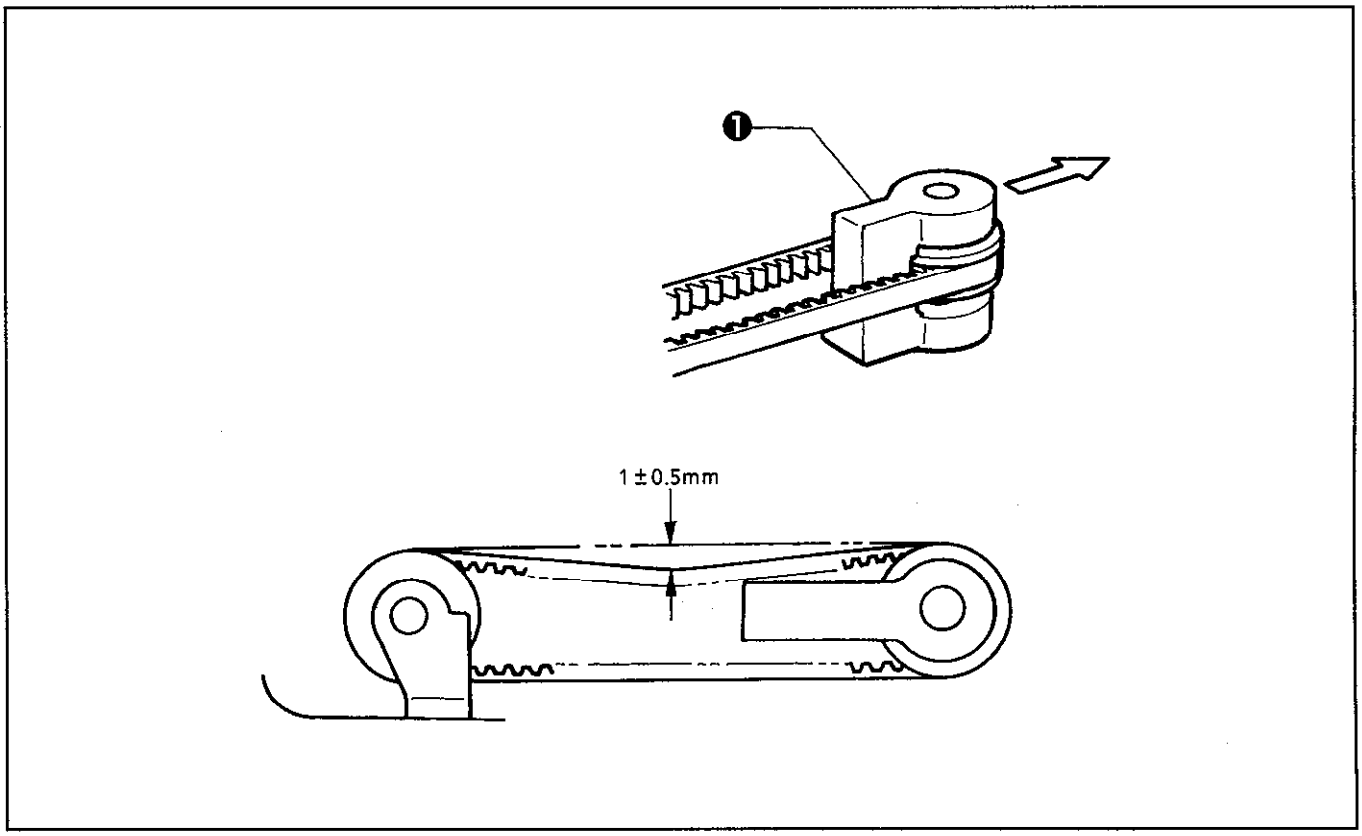


Adjust the positions of the X racks and the idle gear

1. Loosen the set screws ❷ of the idle gear ❶ to adjust the engagement between the X rack ❹ and the idle gear ❶ based on the engagement between the X rack ❺ and the idle gear ❸.
2. Engage the idle gears ❶ and ❸ with the X racks ❹ and ❺, respectively, and attach the motor support ❻ while pressing it.
3. Tighten the set screws ❷ of the idle gear ❶.
   *The idle gear ❶ should have no end play.

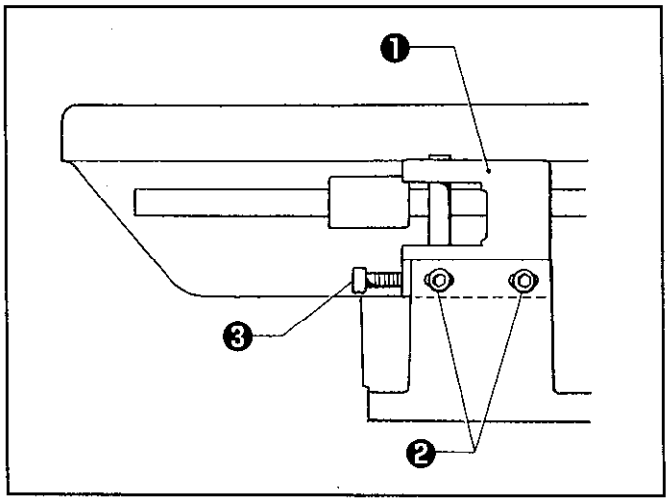
2) Y direction

a. Adjusting the tension of the Y-timing belt



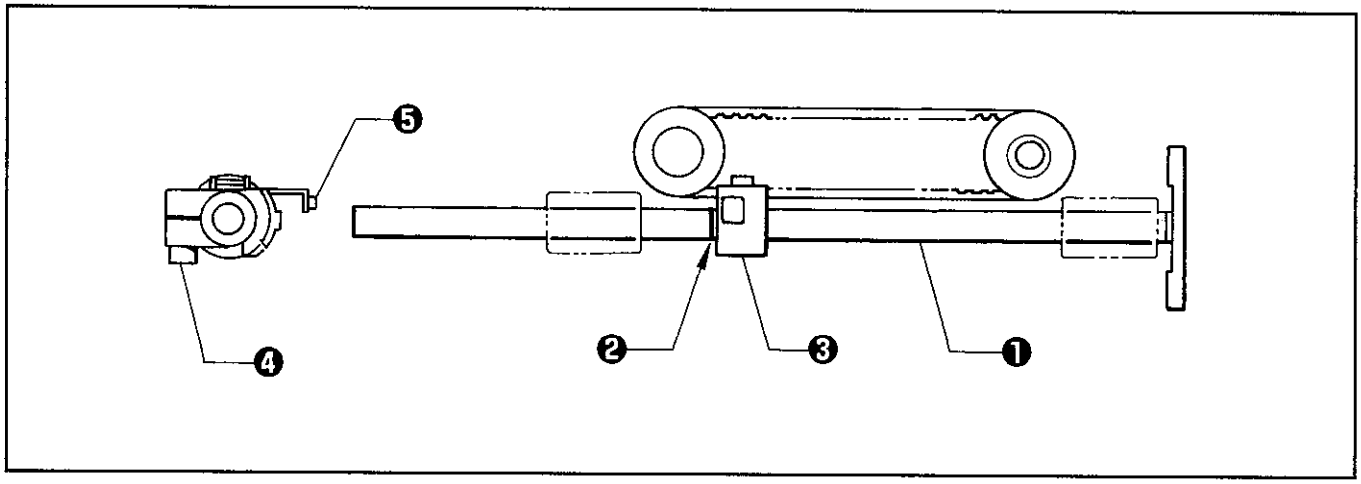
Secure Y-pulley support (L) ❶ while pulling it with a force of 117.6 N (12 kgf).
When the belt deflection is used instead to determine Y-pulley support (L) ❶ position, the deflection will be 1 ± 0.5 mm when the belt is pressed at the center with a force of 4.9 N (0.5 kgf).

The belt tension can be adjusted when the Y-feed base is still attached to the bed.



Loosen the bolts ❷ of Y-support (L) ❶, and use the bolt ❸ to adjust the belt tension.
The tension in this case should be the same value as that above.

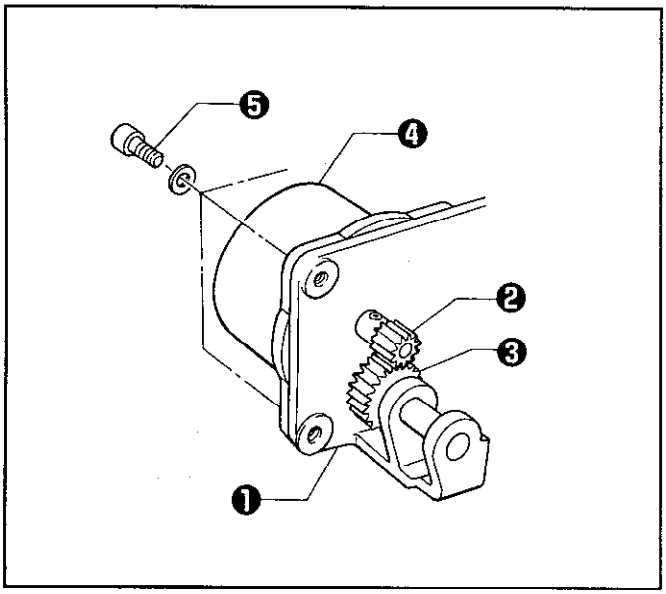
b. Adjusting the position of the Y-driving shaft holder



Align the left end of the Y-driving shaft holder ❸ with the reference line ❷ of the Y shaft ❶.
*When tightening the bolt ❹, the sensor partition plate assembly ❺ should face the top.

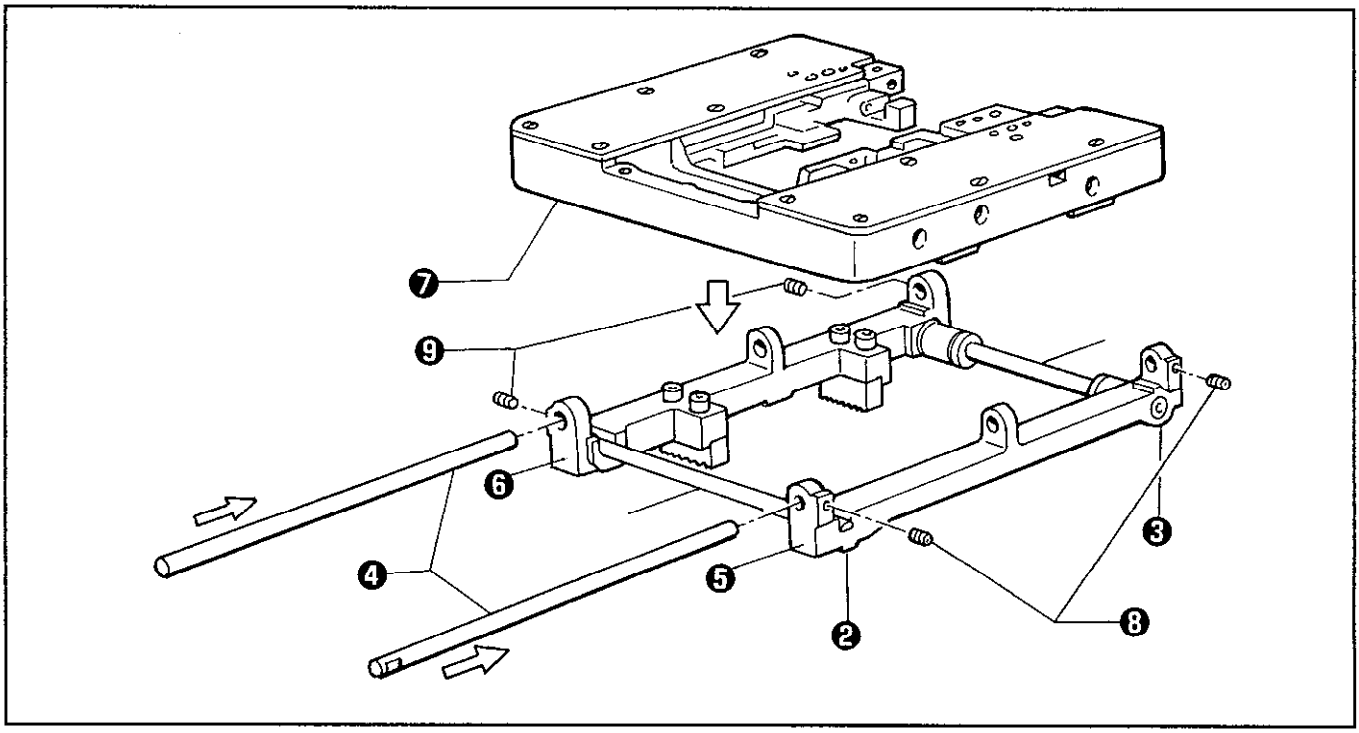
c. Adjusting the backlash between the driving gear and the idle gear

Remove the Y feed base ❶. Adjustment should be carried out with the driving gear and the idle gear treated as a unit.



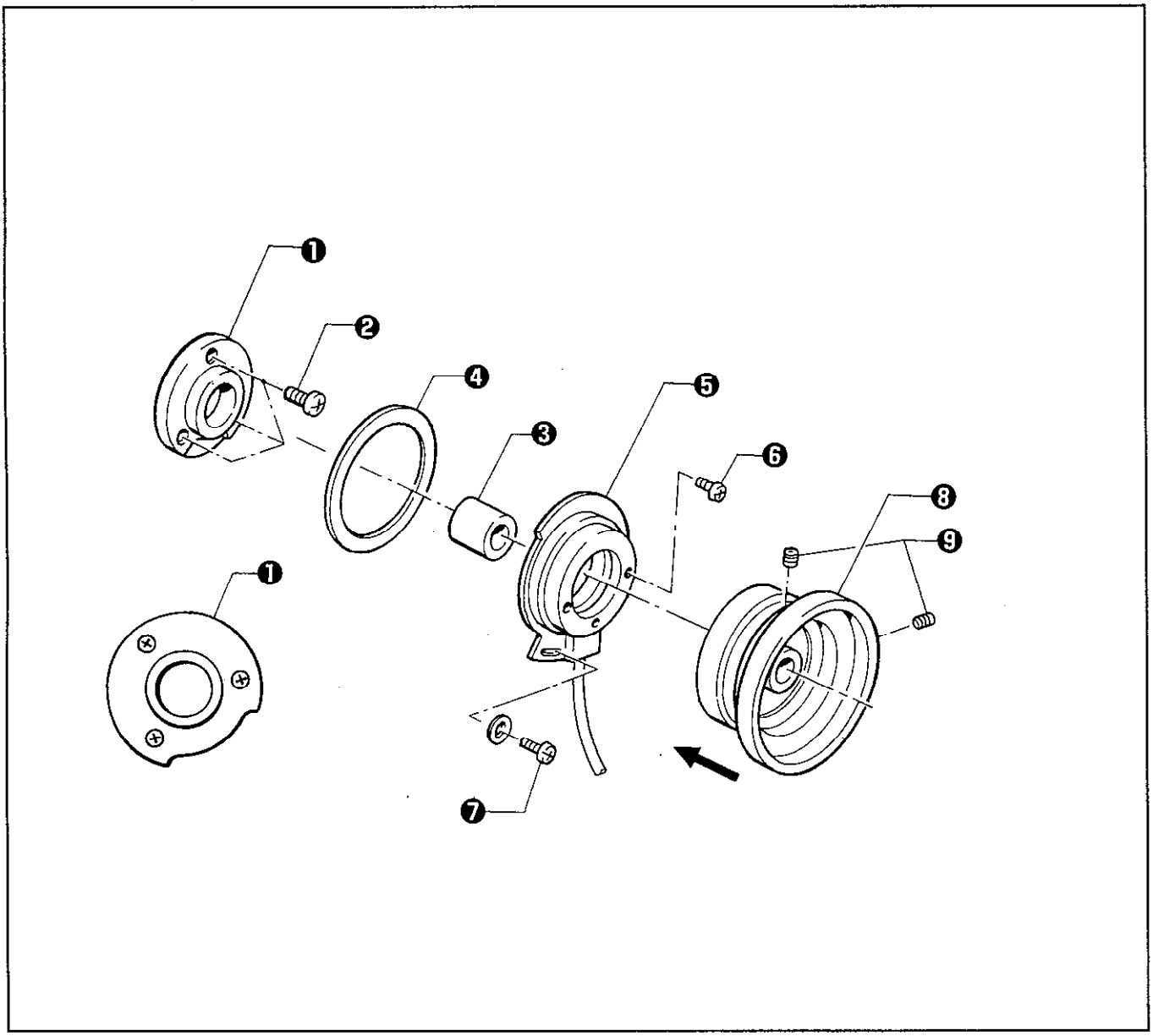
Adjust the backlash between the driving gear ❷ and the idle gear ❸ when they are engaged under the weight of pulse motor (Y) ❹ (as shown in the figure above).
Tighten the bolt ❺.

3) Attaching the X-feed guide shaft



1. Loosen the screw ❷ and the set screw ❸ of the X-feed guide shaft ❶ so that the shaft is still temporarily held in place.
2. Insert the Y-feed guide shafts ❹ into the X-feed shaft holders ❺ and ❻ and the feed bracket ❼, and tighten the set screws ❽ and ❾ (two each).
3. Move the feed bracket ❼ in the X direction a few times.
4. Tighten the screw ❷ and the set screw ❸ of the X-feed guide shaft ❶.

3-14. Synchronizer

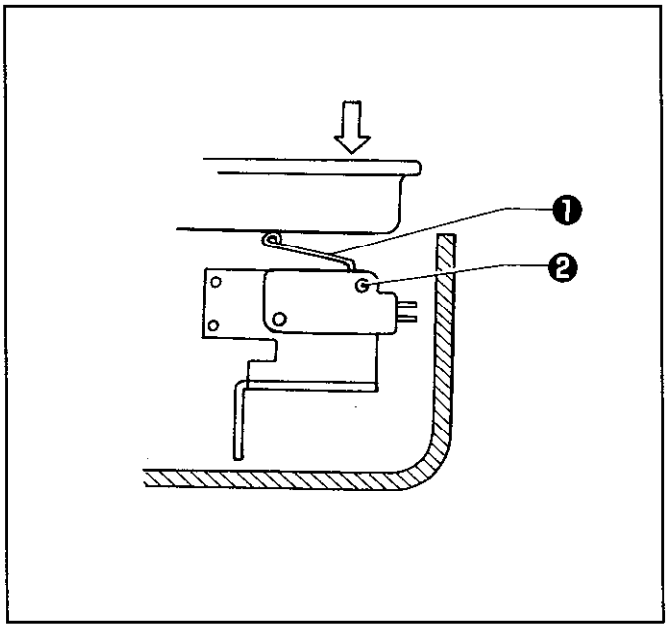


1. Attach the NP support bracket ❶ with its notched portion facing the rear, using the screws ❷.
2. Insert the upper shaft pulley collar (plastic) ❸ into the NP sensor bracket ❶.
3. Secure the synchronizer packing ❹ and the synchronizer assembly ❺ using the two screws ❻ and the screw ❼. Before tightening the screws, turn the synchronizer assembly ❺ fully clockwise.
4. Position the pulley ❽ against the upper shaft pulley collar ❸, and join them using the set screws ❾. The screw flat should face the front and align with the set screw which comes first when the pulley ❽ is rotated in the rotation direction.
5. After attaching the synchronizer, check the machine torque.

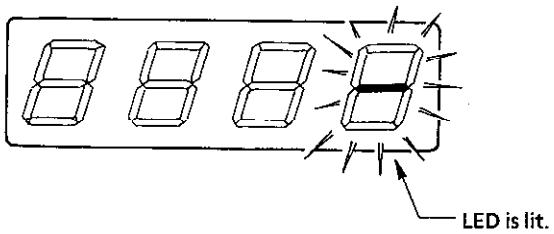
3-15. Covers and presser mechanism

Assembly should be performed in the reverse order of disassembly, referring to 2-1.

3-16. Safety switch assembly



1. Switch to the input check mode.
2. Adjust the height of the safety switch ❶ using the screw ❷ so that that the LED does not go off even if the machine head is lowered and the bed is shaken up and down.



4. ADJUSTMENT

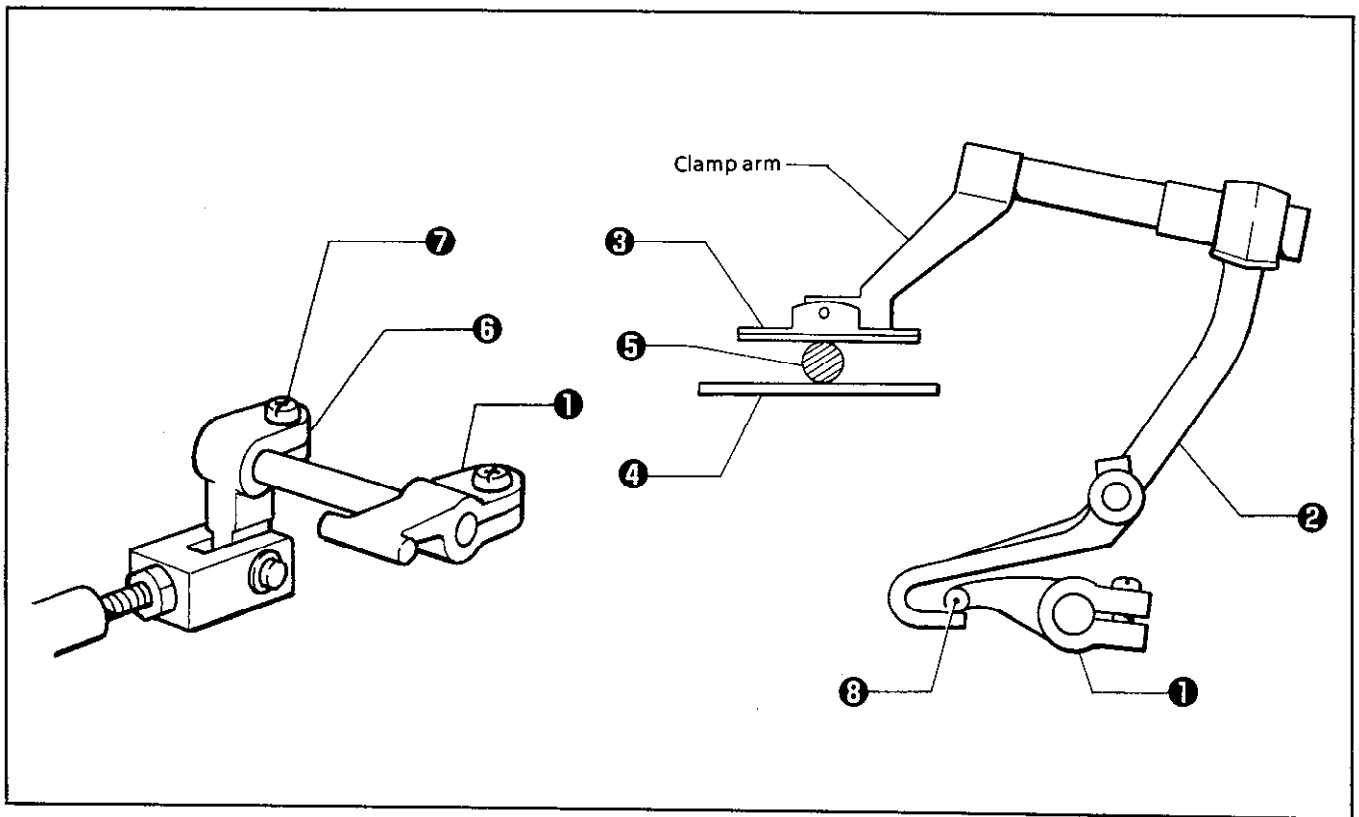
⚠ CAUTION

- Maintenance and inspection of the sewing machine should only be carried out by a qualified technician.
- Ask your Brother dealer or a qualified electrician to carry out any maintenance and inspection of the electrical system.
- Turn off the power switch and disconnect the power cord from the wall outlet at the following times, otherwise the machine may operate if the start switch is depressed by mistake, which could result in injury.
  - When carrying out inspection, adjustment and maintenance
  - When replacing consumable parts such as the loopers, spreaders, knife and cutting block
- Disconnect the air hoses from the air supply and wait for the needle on the pressure gauge to drop to "0" before carrying out inspection, adjustment and repair of any parts which use the pneumatic equipment.
- If the power switch and air need to be left on when carrying out some adjustment, be extremely careful to observe all safety precautions.
- Use only the proper replacement parts as specified by Brother.
- If any safety devices have been removed, be absolutely sure to re-install them to their original positions and check that they operate correctly before using the machine.
- Any problems in machine operation which result from unauthorized modifications to the machine will not be covered by the warranty.

☑ Cloth presser and cloth stretching mechanism

4-1. Adjusting the cloth presser lift height

The cloth presser lift height is adjusted to 12 mm for -00 and -01 specifications, and 16 mm for -02 specification.
(The lift height includes the clearance between clamp lever (B) ❶ and clamp lever L (R) ❷.)



1. Insert the block or the thickness gage ❺ appropriate for specification, between the cloth presser ❸ and the needle plate ❹.

2. Loosen the screw ❼ of the presser driving lever ❺, and put the end ❽ of clamp lever (B) ❶ on the end of clamp lever L (R) ❷.
   Note 1: Make sure that cloth presser L (R) ❸ securely holds the block or the thickness gage ❺.
   Note 2: Make sure that cloth presser cylinder is fully extended.

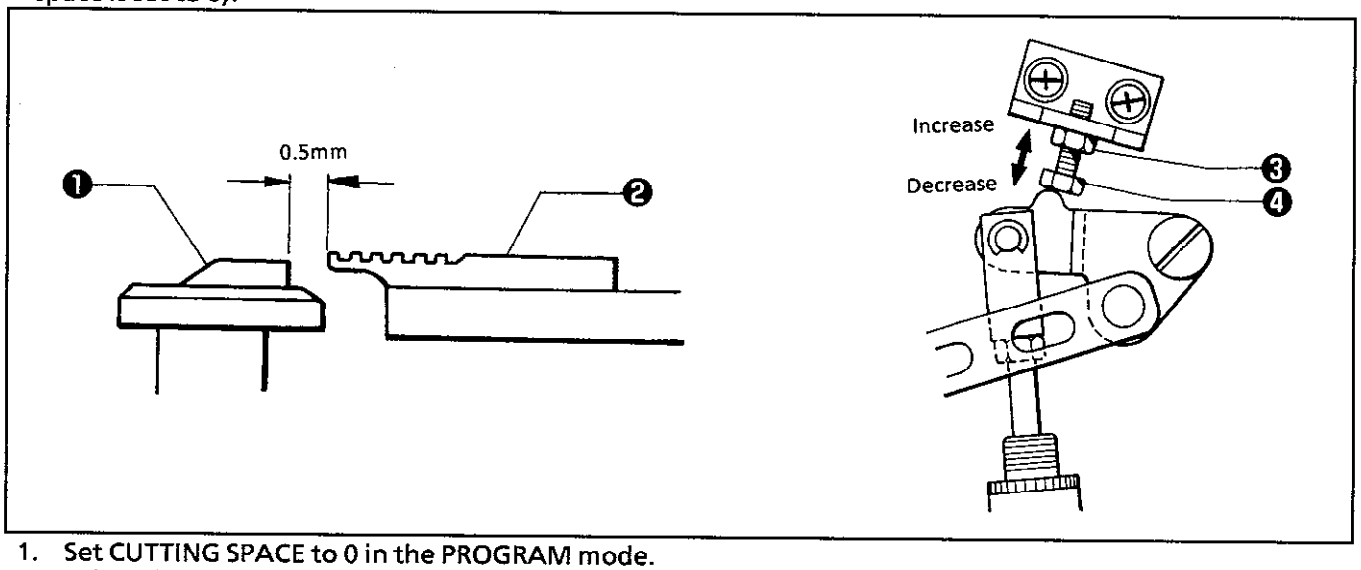
4-2. Adjusting the cloth presser plate

Before this adjustment, make sure that adjustment in 4-5 has been completed.

[Adjusting the position of the cloth presser plate after the cloth is stretched out]

*It is necessary to adjust the throat plate ❶ and needle plate (R) ❷ so that they do not make contact during sewing.

*The standard clearance between the throat plate ❶ and needle plate R ❷ is 0.5 mm (when the cutting space is set to 0).



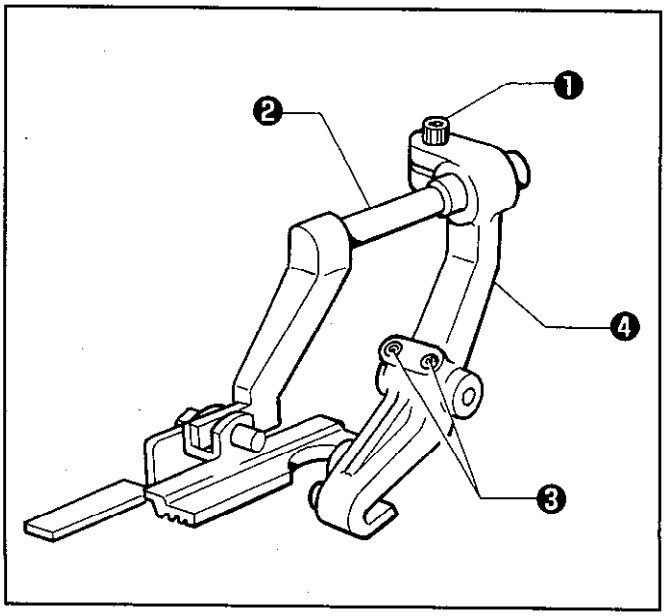
1. Set CUTTING SPACE to 0 in the PROGRAM mode.
2. Select the FEED mode, and press the start switch.
3. Keep pressing the start switch, and make sure that the clearance between the throat plate ❶ and needle plate R ❷ is 0.5 mm.
4. If the clearance is not 0.5 mm, loosen the nut ❸, and turn the bolt ❹ to adjust the clearance.

Note: Adjust the clearance between the throat plate ❶ and needle plate L in the same manner.

4-3. Adjusting the cloth spreading amount

Refer to page 51 of the instruction manual.

4-4. Adjusting the position of the cloth presser



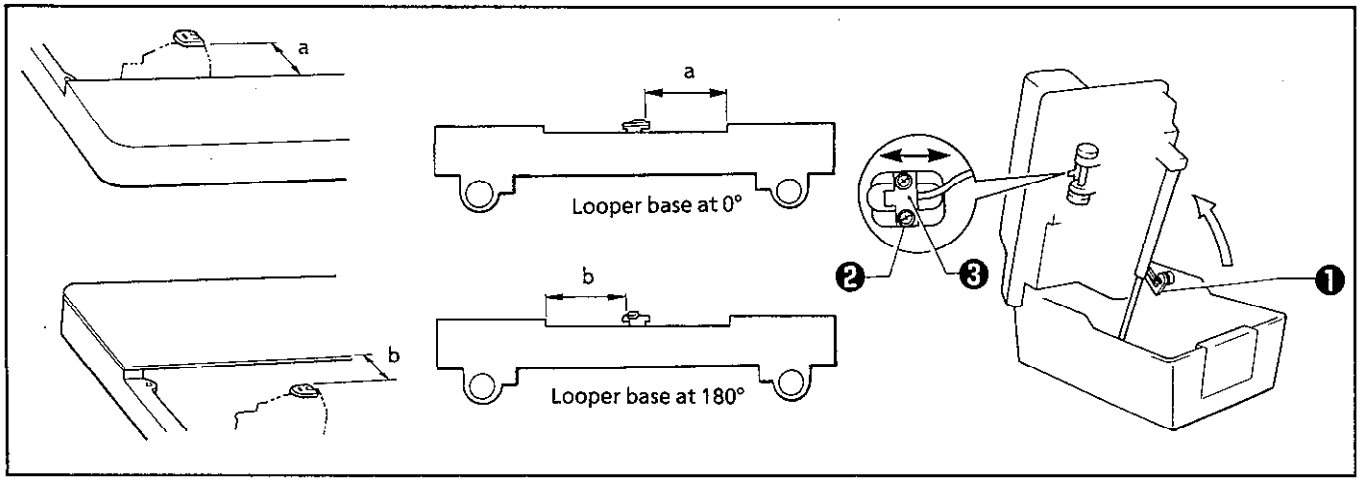
The back and forth and sideways movement of the cloth presser can be respectively adjusted.
The cloth presser should be centrally positioned as to the needle movement.

1. For back and forth movement, loosen the screw ❶, and adjust the position of the clamp arm ❷; for sideways movement, loosen the screws ❸, and adjust the position of the clamp lever ❹.

☑ Home position

4-5. Adjusting the X-home position

Dimension a (when the looper base is at 0°) and dimension b (when the looper base is at 180°) from the stepped portion of the throat plate to both edges of the feed bracket must be equal.

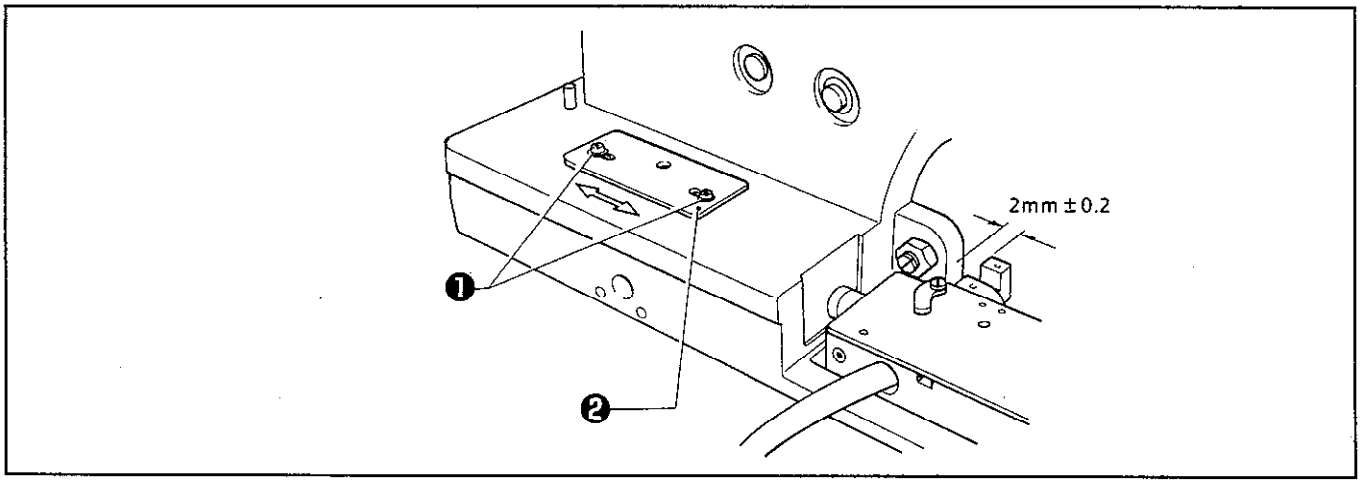


1. In the PROGRAM mode, set TACKING LENGTH D to 0, and switch to the FEED mode.
2. Remove the cloth presser plate, and press the start switch.
3. Move the feed bracket, and measure dimensions a and b.
4. If dimensions a and b are not equal, turn off the power.
5. Raise the machine head, secure it using the head support lever ❶, loosen the screw ❷, and adjust the position of the X-sensor set plate ❸ in the direction of the arrow.
6. Return the machine head to its original position. Repeat the above steps from 1.

Note: The X-home position can be adjusted in increments of 0.2 mm (0.2 pulses).

4-6. Adjusting the Y-home position

The clearance from the rear end surface of the feed bracket to the bed should be 2 mm ± 0.2 mm.



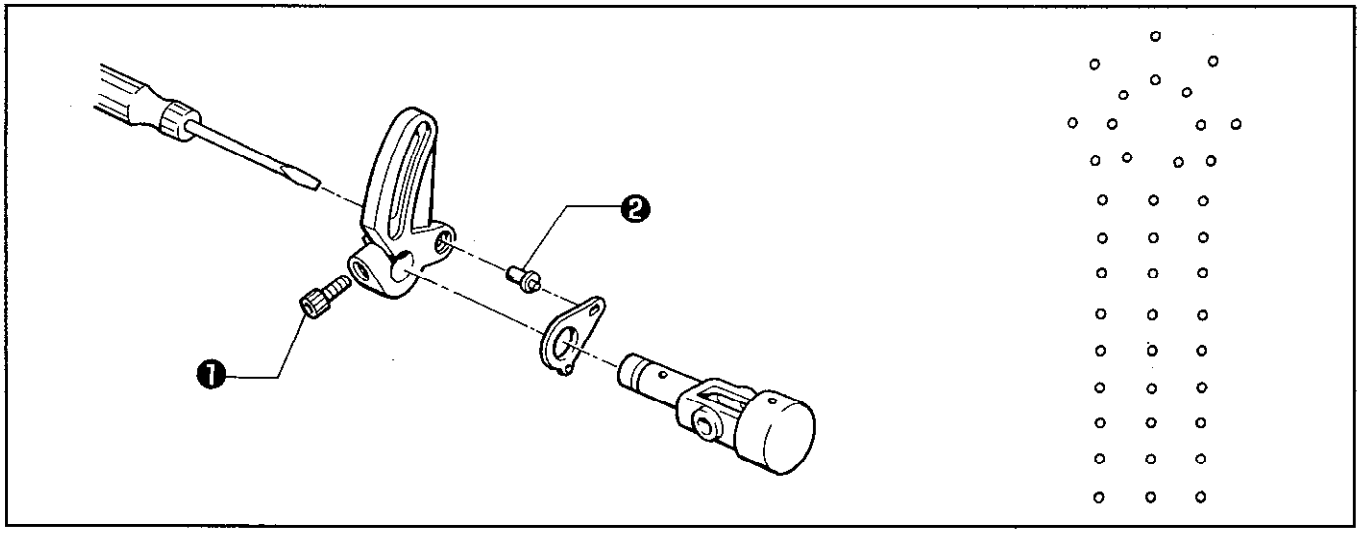
1. After detecting the home position, measure the clearance from the rear end surface of the feed bracket to the bed.
2. If it is not 2 mm ± 0.2 mm, turn off the power.
3. Loosen the screws ❶, and move the Y-sensor set plate ❷ in the direction of the arrow.
4. Repeat the above steps from 1.

Note 1: The Y-home position can be adjusted in increments of 0.2 mm (0.2 pulses).

Note 2: If the clearance is too great, the lower thread may not be held (for -01 specification), and the movable knife and the throat plate may hit each other.

4-7. Adjusting 0 position (reference line) of the needle

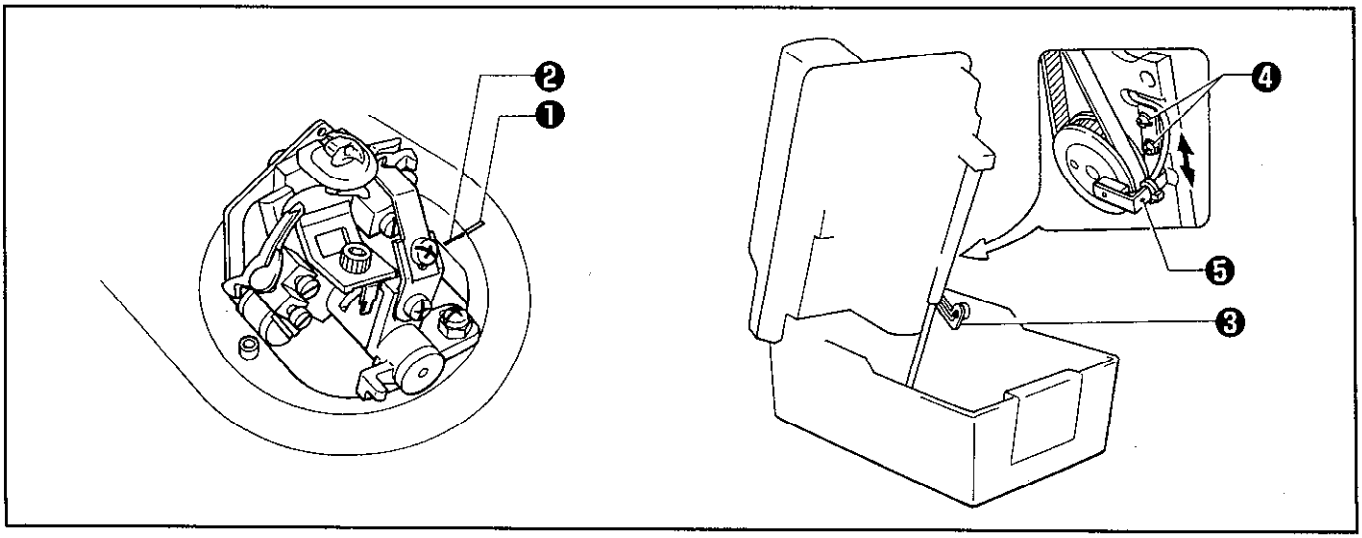
*The 0 position (reference line) of the needle is at the inside needle penetration points.
*If the needle gage is changed, the 0 position (reference line) of the needle is not changed, only the outer needle cloth penetration positions are changed.



1. Insert a short needle (for adjustment).
2. On the operation panel, set KNIFE to OFF position.
3. Place a sheet of paper under the cloth presser, and turn the pulley to trace where the needle will penetrate for an eyelet button hole on the paper.
   At this time, adjust the height of the short needle so that it can penetrate the paper with as small holes as possible.
4. When the inside needle forward cloth penetration points are not identical with that of the returning ones for the straight portion, remove the faceplate, and loosen the bolt ❶.
5. Insert a screwdriver into the arm from the left, and turn the zigzag eccentric pin ❷ to adjust.

4-8. Adjusting the home position of the looper base

The match mark in the looper base must be aligned with that on the bed.



1. After detecting the home position, make sure that the match mark ❶ in the looper base is aligned with the match mark ❷ in the bed.
2. If it is not, turn off the power.
3. Raise the machine head, secure it using the head support lever ❸, loosen the screws ❹, and move the R-sensor set plate ❺ in the direction of the arrow.
4. Return the machine head to its original position. Repeat above steps from 1.

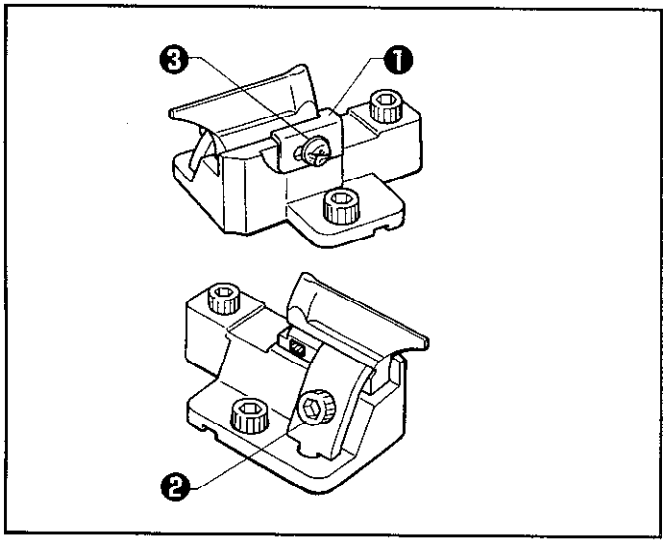
Note: The home position of the looper base can be adjusted in increments of 2.25° (2 pulses).

☑ Cutter

4-9. Fine adjustment of knife position

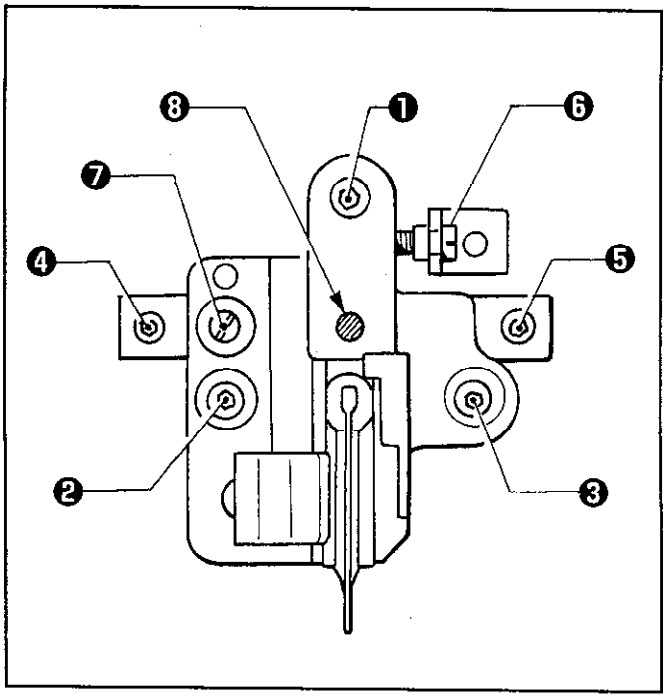
*Before this adjustment, make sure that adjustment in 4-7 has been completed.
*The knife position should be adjusted so that it can correctly cut the eyelet button hole which is formed by the portion where the needle will penetrate at the inside position and round the eyelet.
*The back and forth and sideways movement, and inclination of the knife position can be independently adjusted.

1. Use a short needle (for adjustment).
2. Set the air pressure of the regulator under the table to 0.2 - 0.3 Mps.
   (This is to protect the hammer from being damaged by the knife after the knife position is adjusted.)
3. Select AFTER in the KNIFE area on the operation panel.
4. Place a sheet of paper under the cloth presser, and turn the pulley to trace where the needle will penetrate for an eyelet button hole on the paper.
5. Make sure that the portion where the needle penetrates for the eyelet button hole uniformly overlaps the knife cutting positions.
   (For easier checking, change the value for H CUTTING SPACE in the PROGRAM mode on the operation panel.)
6. If it is not, turn off the power, and adjust the position of the knife.



[Back and forth movement adjustment]

i) Loosen the screw ❷, and adjust the position of the knife.
   After adjustment, loosen the screw ❸, and press the block stopper plate ❶ against the knife.



[Sideways movement adjustment]

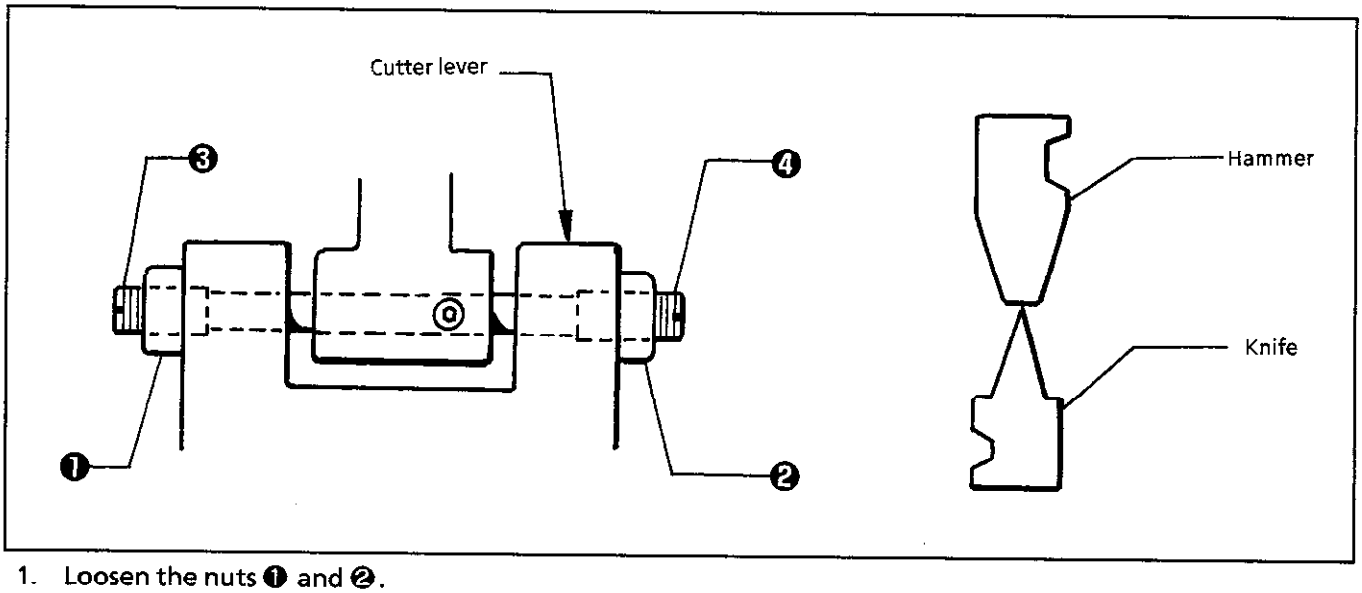
i) Loosen the screws ❶, ❷, and ❸, of the knife bracket.
ii) Loosen the screws ❹ and ❺ of the knife bracket guide.
iii) Turn the knife adjusting screw ❻. Fine adjustment for sideways movement of the knife can be performed without removing the knife bracket and the knife bracket guide.

[Inclination adjustment]

i) Loosen the screws ❶, ❷, and ❸, of the knife bracket.
ii) Loosen the screw ❼, which secures the knife bracket and the knife bracket guide.
iii) Turn the knife adjusting screw ❻. Inclination of the knife can be adjusted by rotating the knife bracket and the knife bracket guide, regarding the pivot ❽ as the center.

4-10. Adjusting the sideways movement of the cutter lever

The cutter lever should be positioned so that the knife can make contact with the center of the hammer.

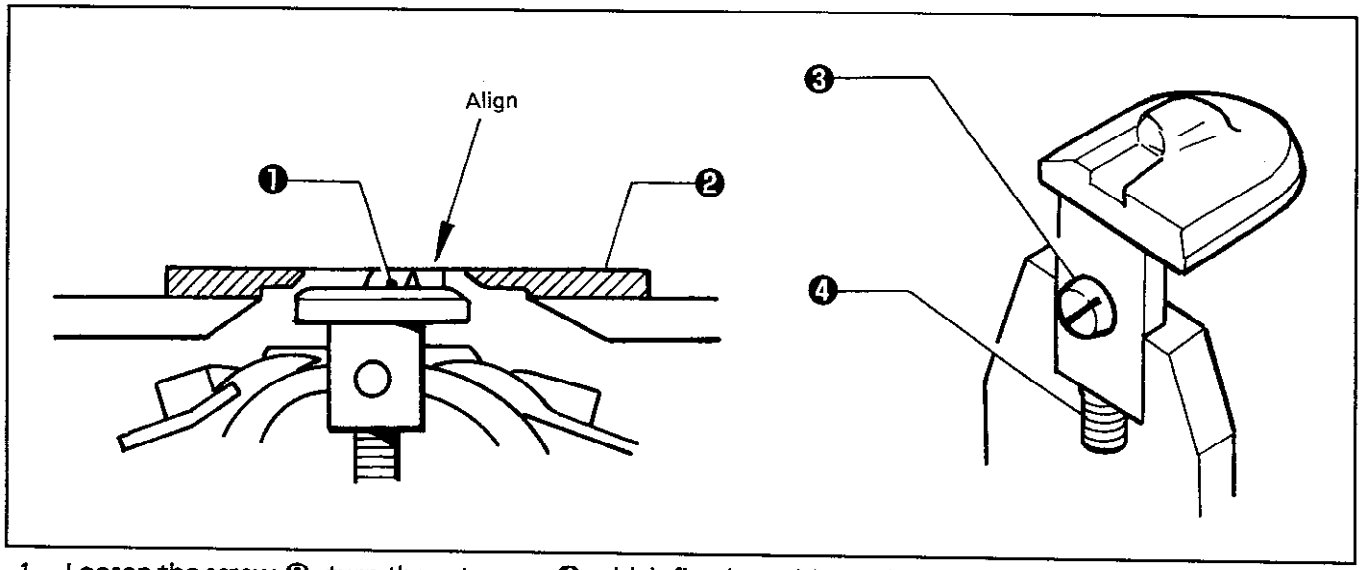


1. Loosen the nuts ❶ and ❷.
2. Turn the cutter arm support screws ❸ and ❹ to adjust the sideways position of the cutter lever.
3. Tighten the nuts ❶ and ❷.

Note: Adjust the cutter arm support screws ❸ and ❹ so that the cutter lever has no end play, and it can operate easily. Too much end play may damage the knife.

4-11. Adjusting the height of the throat plate

To prevent material from being pressed down by the needle which penetrates the material, the top surface of the throat plate ❶ should be flush with the top surface of the needle plate ❷.



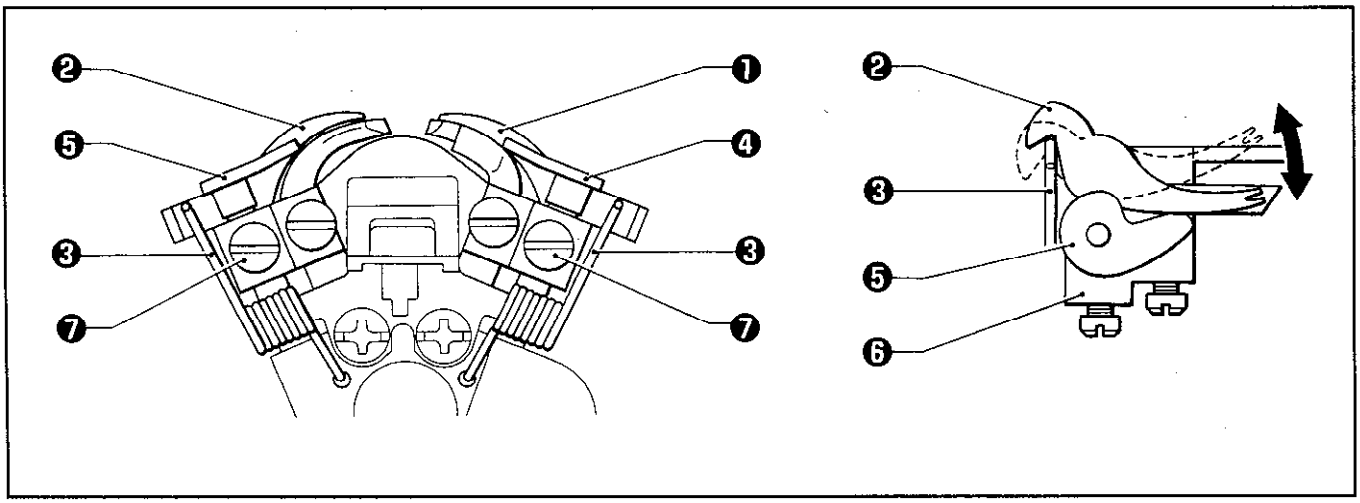
1. Loosen the screw ❸, turn the set screw ❹ which fits the guide, and adjust the height of the throat plate ❶.

Note: The set screw ❹ is adjusted to maintain the height of the throat plate when it is removed and re-installed.

4-12. Adjusting the heights of the spreader and the looper

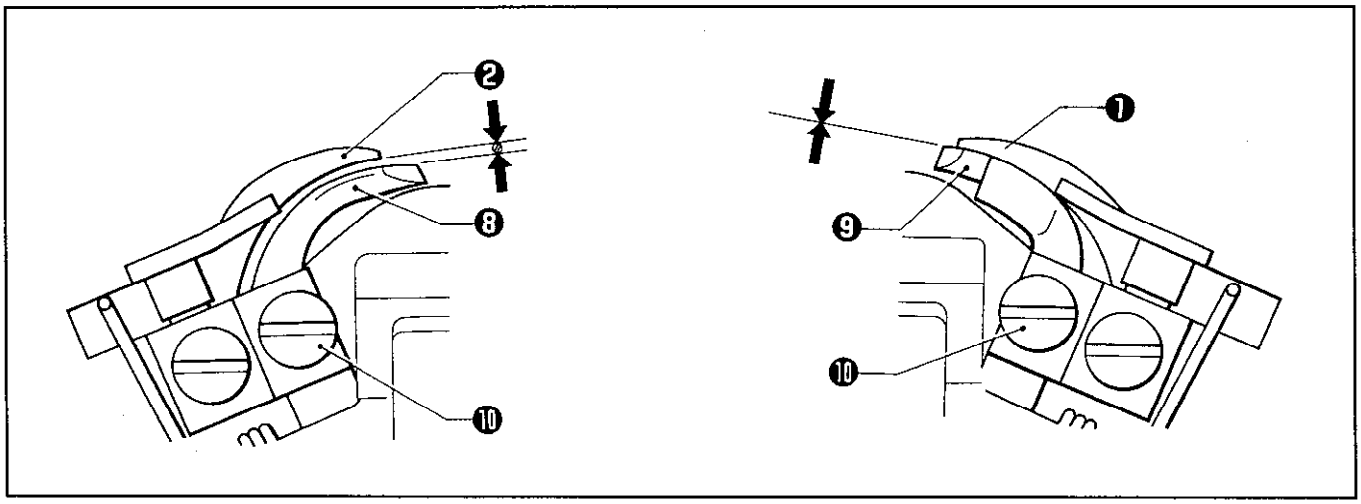
[Spreader height]

*The clearance between spreader (L) and looper (L) must conform to the thickness of the looper thread.
*The clearance between spreader (R) and looper (R) must be just enough that they can move.



1. Spreaders (R) ❶ and (L) ❷ move by means of the springs ❸. Make sure that spreaders (R) ❶ and (L) ❷ move smoothly between the spreader stoppers (R) ❹ and (L) ❺, and the LS-holder bracket ❻, with no looseness.
2. If adjustment is necessary, loosen the screws ❼, and move spreaders (R) ❹ and (L) ❺ up and down.

[Looper height]



1. Set the clearance between looper (L) ❽ and spreader (L) ❷ to the same distance as the thickness of the looper (lower) thread.
2. Set the clearance between looper (R) ❾ and spreader (R) ❶ to as small as possible, but make sure that they do not make contact.
3. If adjustment is necessary, loosen the set screw ❿, and move loopers (L) ❽ and (R) ❾ up and down.

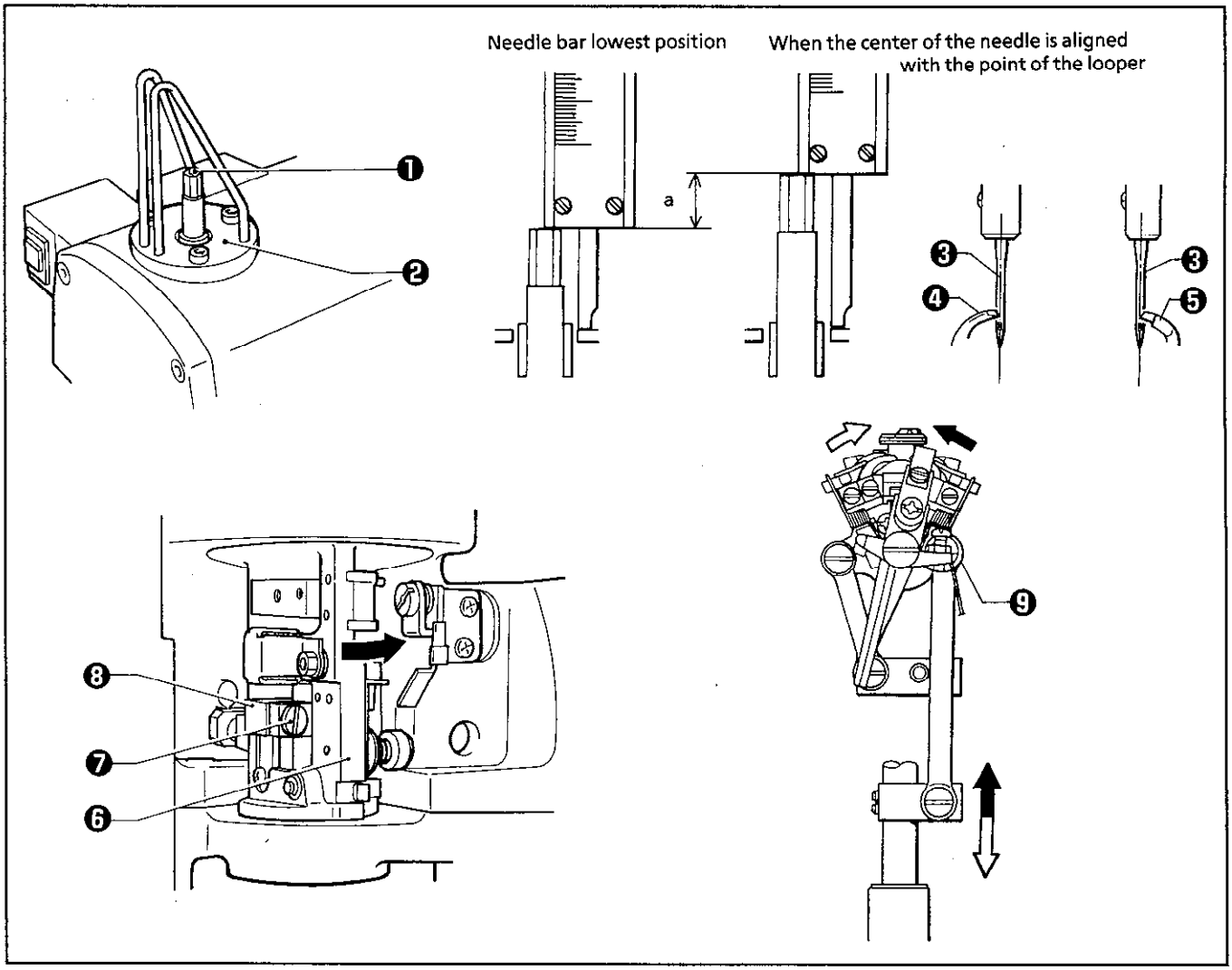
4-13. Adjusting the loop stroke

The loop stroke is the distance the needle bar rises from its lowest position to the position where the tips of loopers (L) and (R) are aligned with the center of the needle. The standard loop stroke is 2.7 mm.

a. Adjusting the timing between the needle and loopers (L) and (R)

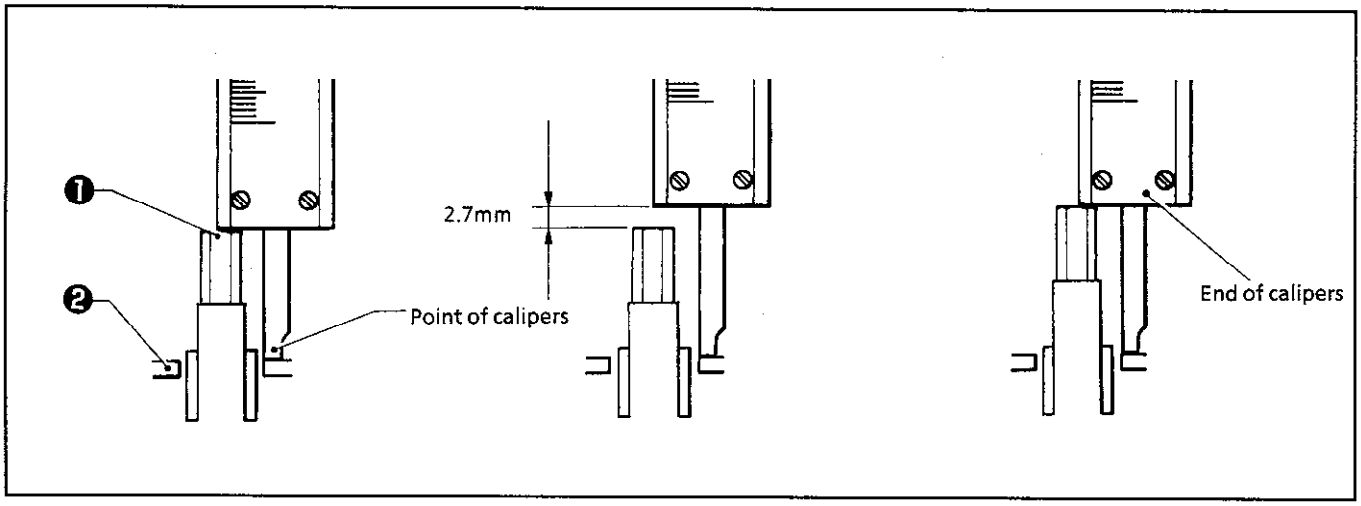
*Before this adjustment, it is necessary to make the amount until the tip of looper (L) is aligned with the center of the needle when the needle rises from its lowest position, and the amount until the tip of looper (R) is aligned with the center of the needle, equal.

*Before this adjustment, set the needle zigzag width to 2.5 mm (standard).

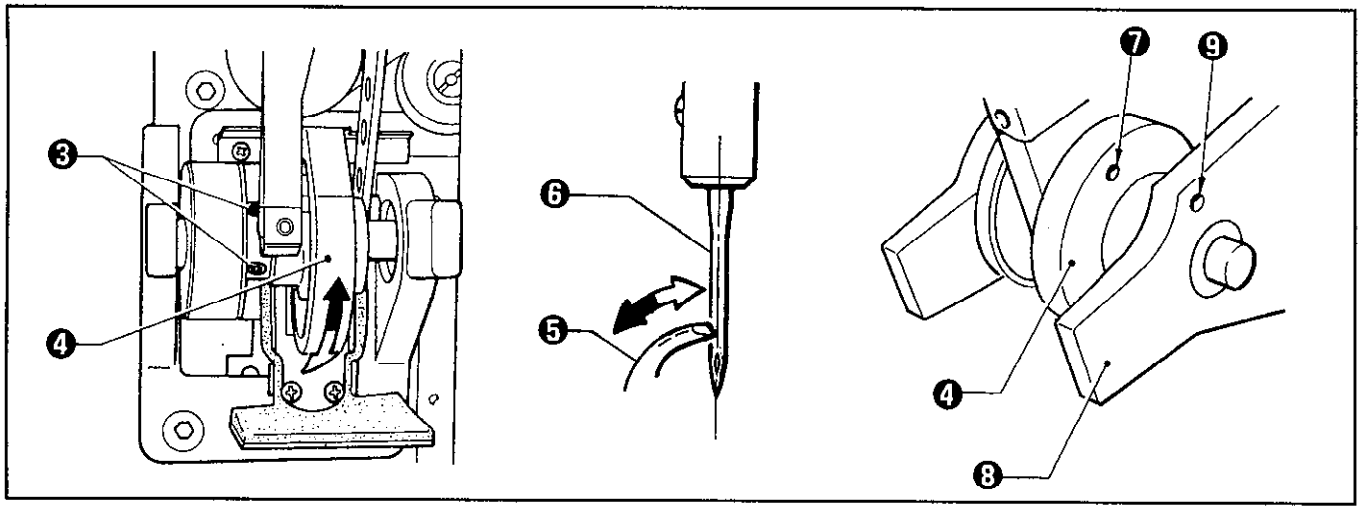


1. Set the needle bar to its lowest position.
2. Use calipers to measure the distance between the end of the needle bar ❶ and the top surface of needle bar presser bracket (B) ❷.
3. When the needle ❸ is at the inside sewing position, turn the pulley until the tip of looper (L) ❹ is aligned with the center of the needle, and measure the distance between the end of the needle bar ❶ and the top surface of needle bar presser bracket (B) ❷. Find distance a which is the difference between this distance and the distance obtained in step 2.
4. When the needle ❸ is at the outside sewing position, find distance a' in the same manner as in the above steps.
   *When the needle ❸ is at the inside sewing position, the center of the needle is aligned with the tip of looper (L) ❹, and at the outside sewing position, it is aligned with the tip of looper (R) ❺.
5. Distance a obtained in step 3 should be equal to distance a' obtained in step 4.
6. Turn the looper base ❻ in the direction of the arrow, loosen the screw ❼, and move the looper link ❽ up and down to adjust the LS-holder bracket ❾ in the direction of the arrow (sideways).

b. Adjusting the loop stroke
Before this adjustment, the timing between the needle and loopers (L) and (R) must be adjusted (as explained in 4-13.a).



1. Set the needle bar to its lowest position with the needle at the inside sewing position, and use calipers to measure the distance from the end of the needle bar ❶ and the top of needle bar presser bracket (B) ❷.
2. Add 2.7 mm to the value obtained in step 1.
3. Touch the end of the calipers against the top of needle bar presser bracket (B) ❷, and then turn the pulley until the end of the needle bar ❶ touches the edge of the calipers. Make sure that the tip of looper (L) is aligned with the center of the needle.
4. In the same way, make sure that the tip of the right looper is aligned with the center of the needle when the needle is at the outside sewing position.

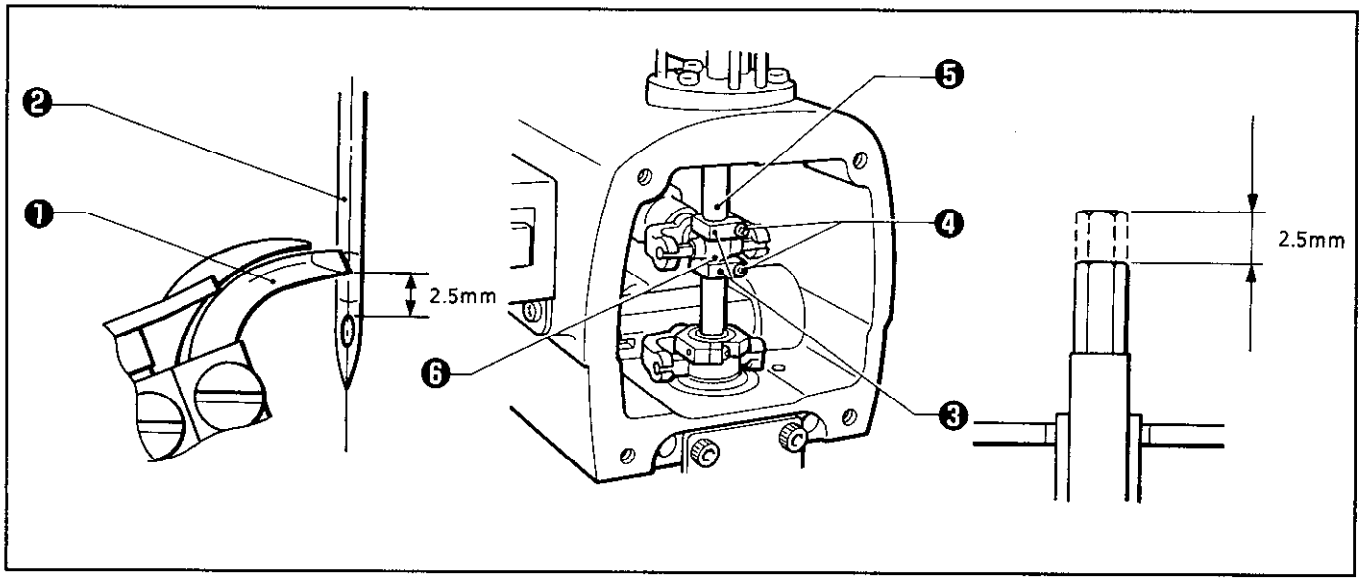


5. If the tips of loopers (L) and (R) are not aligned with the center of the needle, adjust as follows:
   i) Raise the machine head.
   ii) Loosen the two set screws ❸ of the lower shaft tension pulley, hold the pulley so that it does not move, and then turn the lower shaft cam ❹ in the direction of the arrow until the tip of looper (L) ❺ is aligned with the center of the needle ❻. Tighten the screws ❸. After adjustment, make sure that the screws have been adequately tightened.

*Basically, the machine is assembled so that the hole ❼ of the lower shaft cam ❹ is aligned with the hole ❾ of the lower shaft base ❽ when the needle bar is at its lowest position and at the inside sewing position.

4-14. Adjusting the height of the needle bar

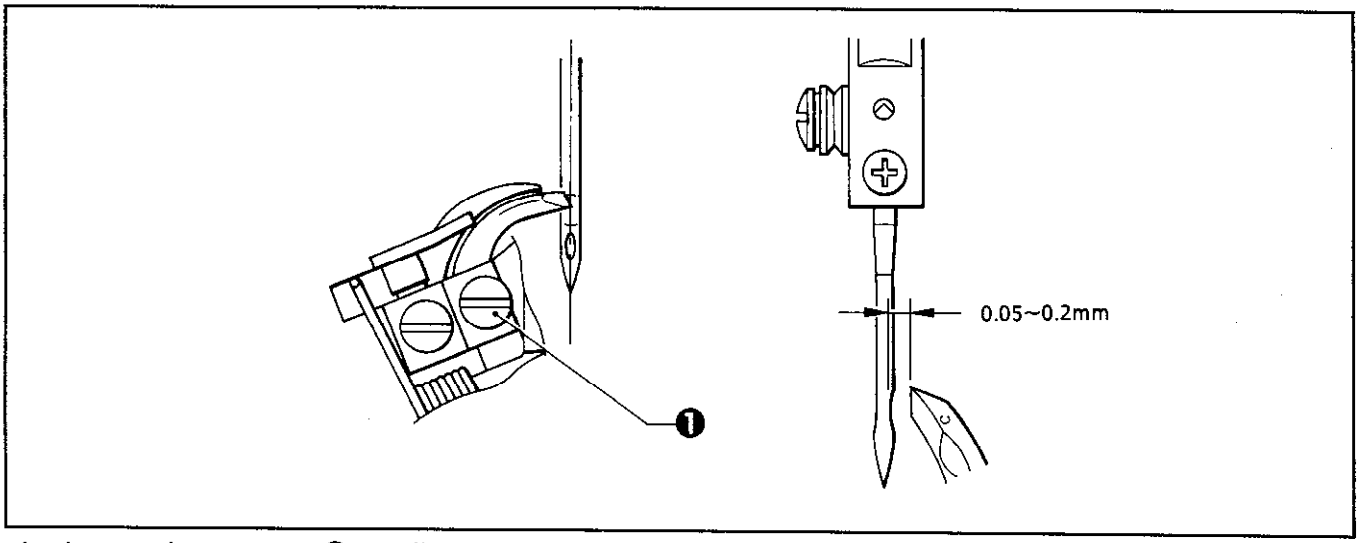
The standard height for the needle bar is 2.5 mm.



1. When the needle is at the inside sewing position, align the tip of looper (L) ❶ with the center of the needle ❷.
2. Remove the faceplate.
3. Loosen the screws ❹ of the needle bar clamps ❸, and adjust the height of the needle bar ❺.
   *First, align the tip of looper (L) ❶ with the top edge of the hole in the needle, and then lower the needle bar 2.5 mm.
4. To rotate the needle bar smoothly, adjust so that there is as little play as possible and only enough to maintain the oil membranes of the needle bar clamps ❸ and the needle bar level feed link ❻.

4-15. Adjusting the clearance between the looper and the needle

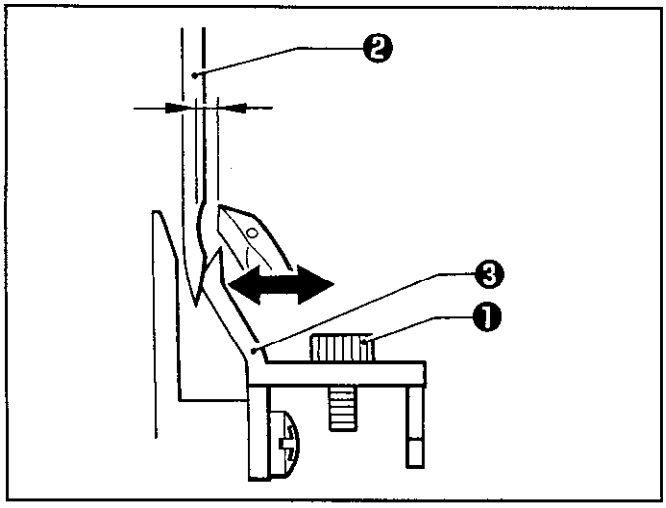
This adjustment is necessary when the needle size is changed.
Set the clearance between the looper and the needle to 0.05 - 0.2 mm.



1. Loosen the set screw ❶ to adjust the clearance.
   *The clearance must be uniform while the looper base is rotating (through 360°). If the clearance is not uniform, adjust the turning center for the needle bar. (This adjustment is performed before shipment from the factory.)

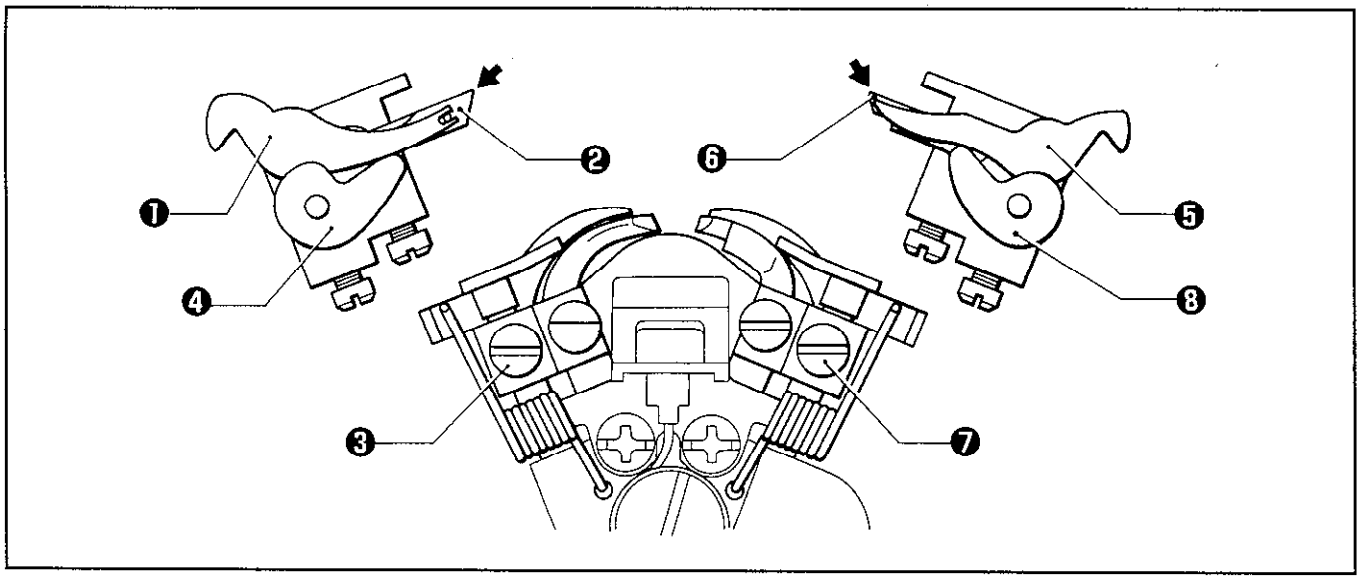
4-16. Adjusting the needle guard

This adjustment is necessary when the needle size is changed.
The needle must remain stationary with respect to the needle guard, until the tip of the looper reaches the needle.



1. Loosen the screw ❶, and move the needle guard ❸ in the direction of the arrows, by an appropriate amount in accordance with the thickness of the needle ❷.
   Note: The looper must securely hook the needle thread.

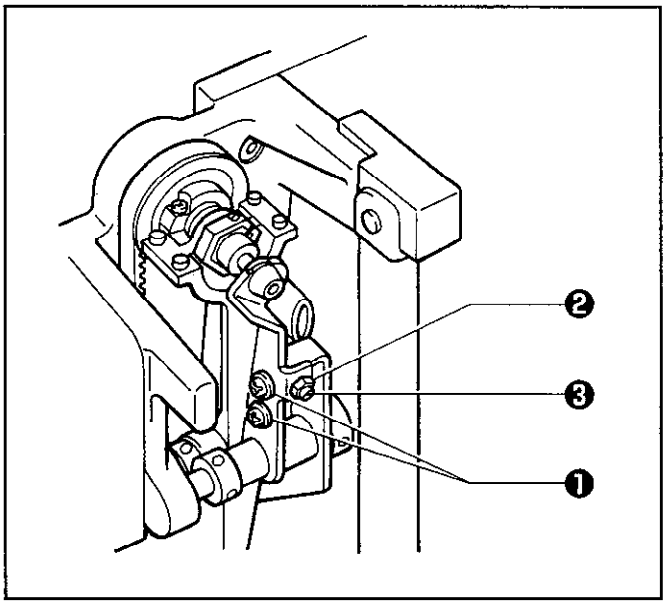
4-17. Adjusting the spreader mounting position



1. Loosen the screw ❸, and adjust the position of spreader stopper (L) ❹ so that the looper thread guide hole in looper (L) ❷ is between the forks of spreader ❶.
2. Loosen the screw ❼, and adjust the position of spreader stopper (R) ❽ so that the tip of spreader (R) ❺ is aligned with the tip of looper (R) ❻.
   Note: Both spreaders (L) ❶ and (R) ❺ should be installed so that they do not project past the tips of loopers (L) ❷ and (R) ❻, respectively.

4-18. Adjusting the spreader timing

When the needle is at the inside sewing position, spreader (L) should touch spreader stopper (L) and stop immediately before the needle bar reaches its lowest position. When the needle is at the outside sewing position, spreader (R) should touch spreader stopper (R) and stop immediately before the needle bar reaches its lowest position.

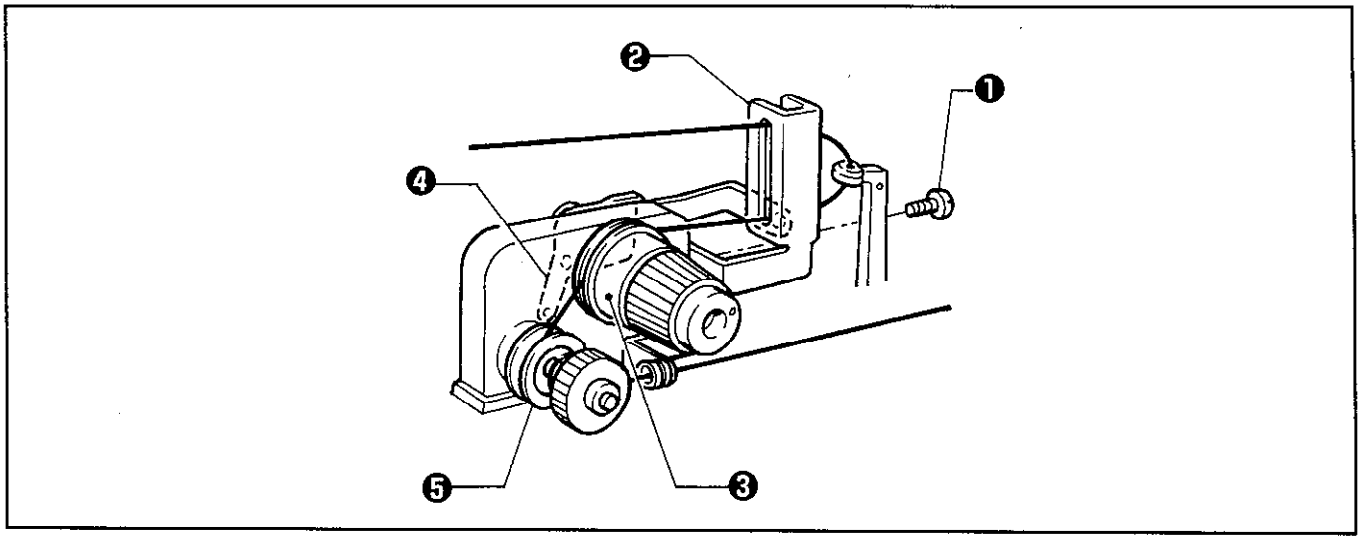


1. Raise the machine head.
2. Loosen the screws ❶ and the nut ❷, then turn the adjust screw ❸ to adjust.
3. After adjustment, tighten the screws ❶ and the nut ❷.

   Note: Make sure that the LS-holder bracket ❹ does not touch the spreader cam link ❺. If it does, return to "4-13. a. Adjusting the timing between the needle and loopers (L) and (R)."

4-19. Adjusting the amount to pull the upper thread and tension release

*The amount to pull the upper thread should be sufficiently maintained to form the correct stitches at the start of sewing.
*The upper thread take-up lever operates as soon as sewing is completed, and is released when the start switch is pressed to move the feed bracket with the needle stopped.

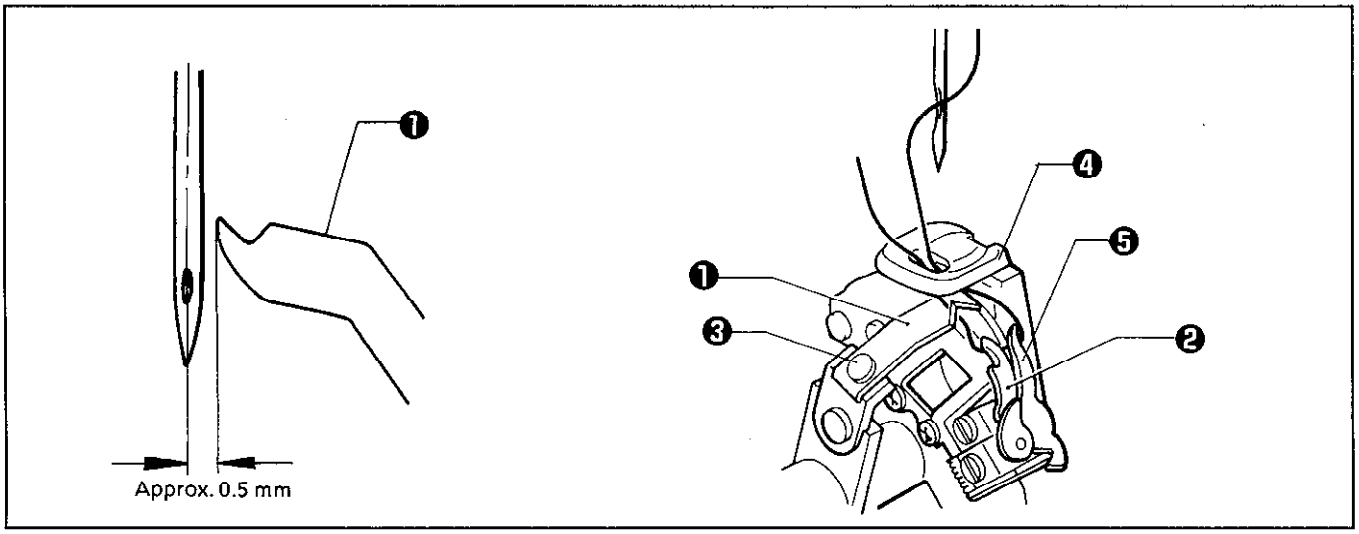


1. Loosen the screw ❶, and move the upper thread take-up lever guide ❷ up and down to adjust the amount to pull the upper thread.
   - The upper thread tension mechanism has double tension mechanisms. The main tension disc ❸ is open after sewing is completed, and closed when the start switch is pressed to move the feed bracket with the needle stopped.
   - The upper thread tension plate ❹ and the upper thread take-up lever are interlocked.
   - The sub tension disc ❺ is always kept closed to give the upper thread tension. The tension will change the thread end length at the start of sewing.

4-20. Adjusting upper thread trimming

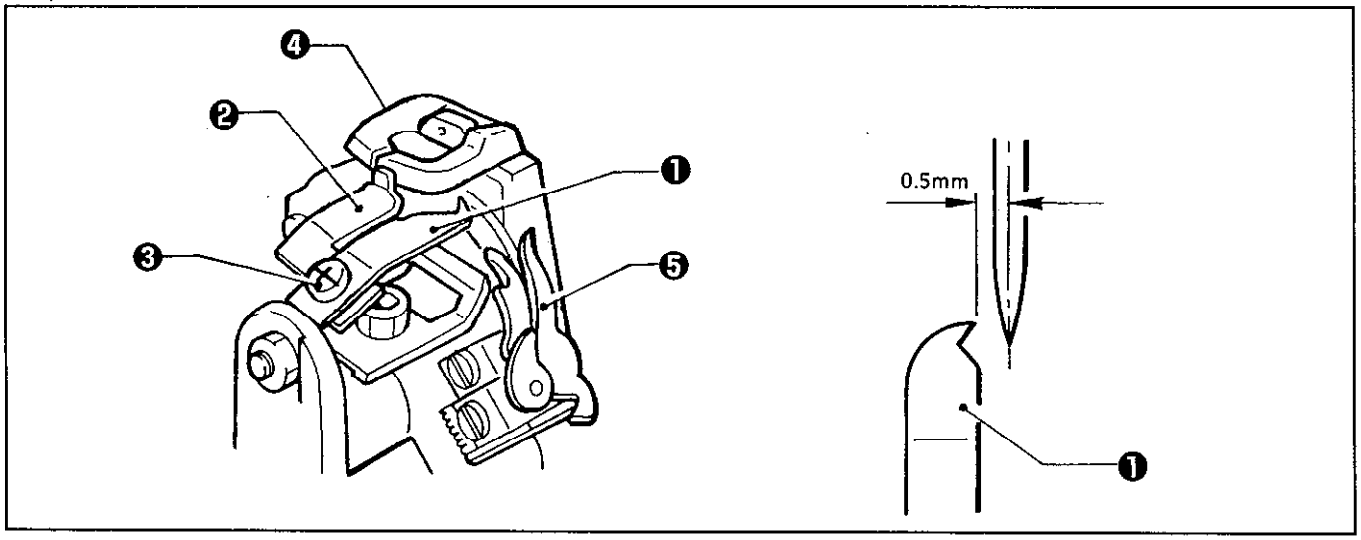
Upper thread trimming will be performed on the correct time after sewing is completed.

a. Adjusting the upper movable knife mounting position (for specifications-00 and -01)
The upper movable knife ❶ must cut the upper loop which is caught by looper (R) ❷, in one place (front). If the upper loop is cut at 2 places (front and rear), the thread end length from the needle will be shorter, causing skipped stitches at the start of sewing.



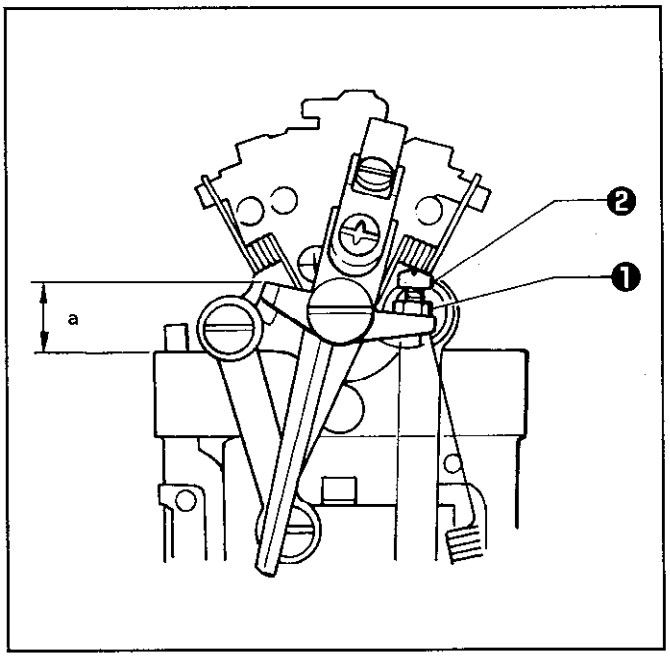
1. Loosen the screw ❸, and adjust the clearance between the needle and the point of the upper movable knife ❶, to approx. 0.5 mm.
2. The height of the upper movable knife ❶ should be between the bottom of the throat plate ❹ and spreader R ❺.

b. Adjusting the upper movable knife mounting position (for specification -02)
The mounting position of upper movable knife B ❶ is determined by the position of the lower thread presser ❷.



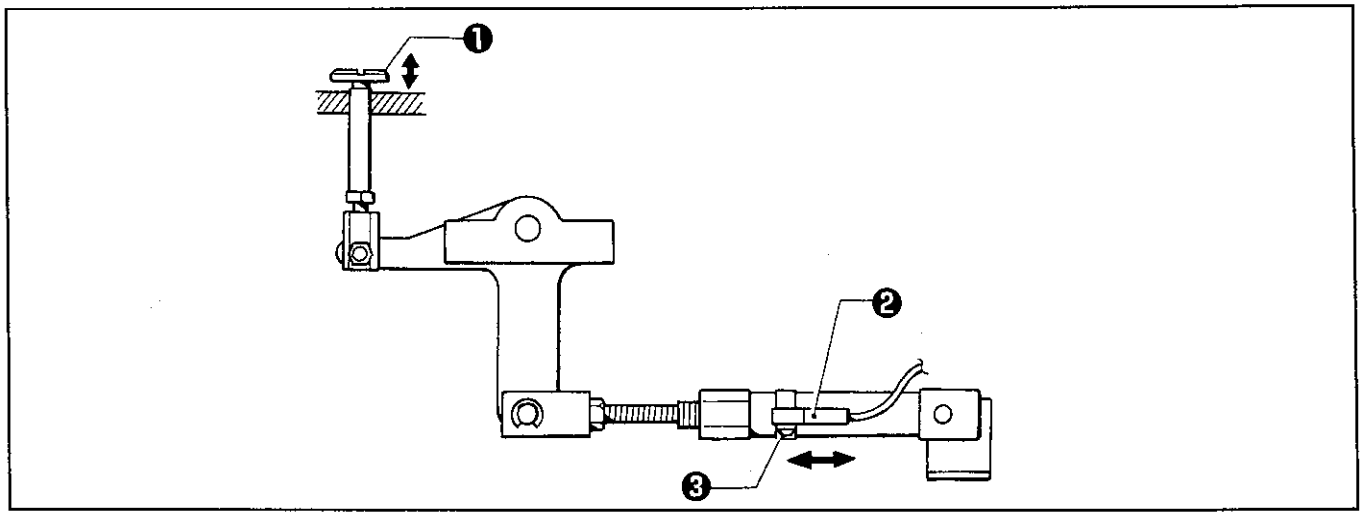
1. Loosen the screw ❸, and position upper movable knife B ❶ between the projection of the throat plate ❹ and spreader (R) ❺.
2. Adjust the clearance between the needle and the point of upper movable knife (B) ❶ to 0.5 - 1.0 mm.
If adjustment can not be performed, reconfirm 4-11 and 4-22.

c. Adjusting the position of the thread trimmer lever bracket
When the needle is swinging to the right with the maximum stitch width, the needle should be able to pass the upper movable knife sufficiently.



1. Loosen the nut ❶, and turn the screw ❷ to adjust the position of the thread trimmer lever bracket.
At this time, dimension a to the shoulder of the thread trimmer lever bracket should be 10 mm.
Note: Turn the looper base, and make sure that the thread trimmer lever bracket can smoothly go in under the thread trimmer lever hammer. The height of the thread trimmer lever hammer is adjusted to 11 mm.

d. Adjusting the upper thread trimmer sensor
If this adjustment has not been made correctly, error E-16, E-46, or E-76 may occur.



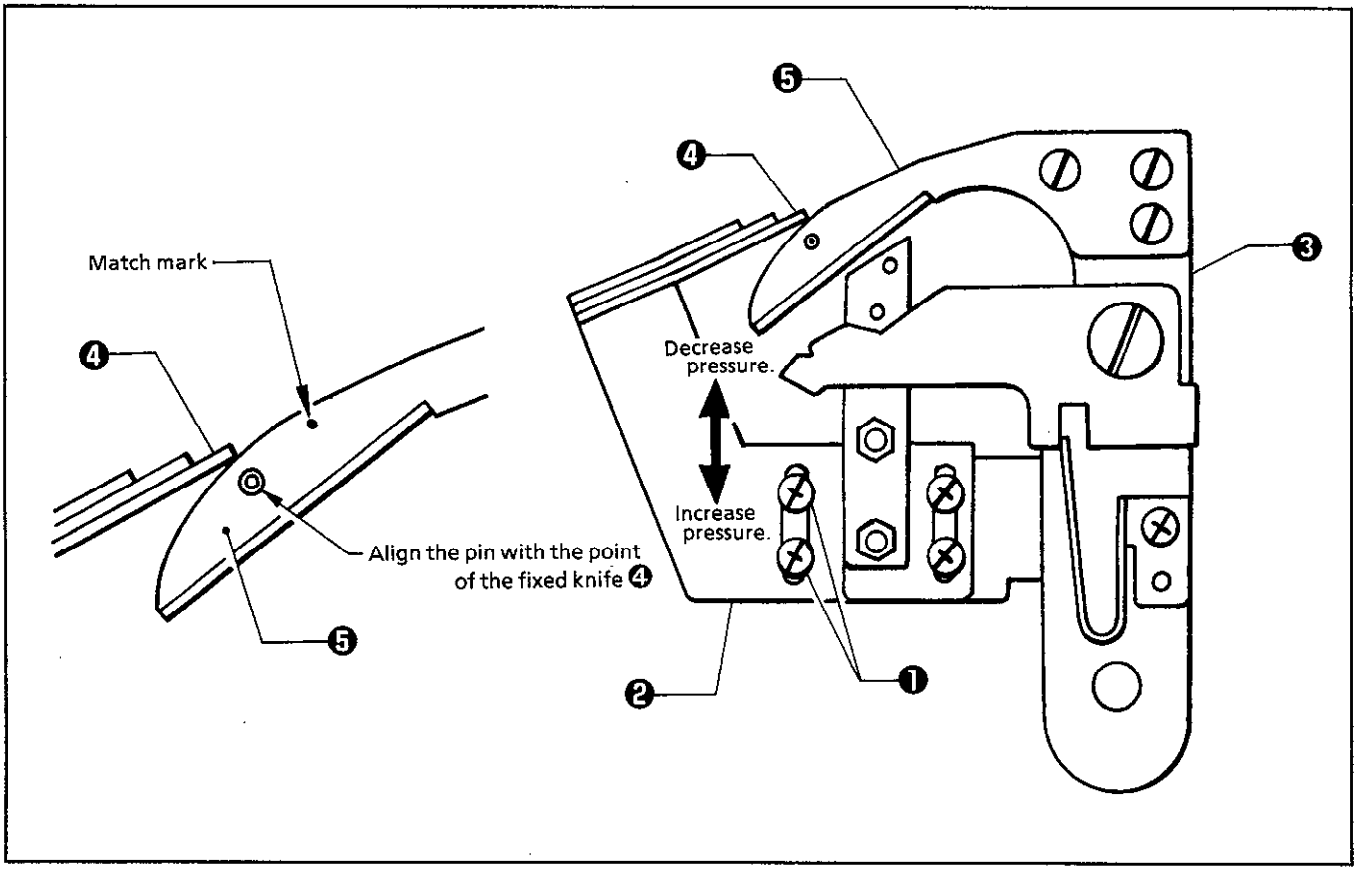
1. Switch to the input check mode.
2. Check the LED. When the thread trimmer lever hammer ❶ is pressed, the LED should go out. When the thread trimmer lever hammer ❶ is pulled, the LED should be lit.
   - If the LED remains lit or never comes on, adjust the position of the upper thread trimming sensor ❷.

4-21. Adjusting the lower thread trimmer

[Adjusting the thread trimmer which can cut the lower thread and gimp, leaving them longer (for specification -01)]

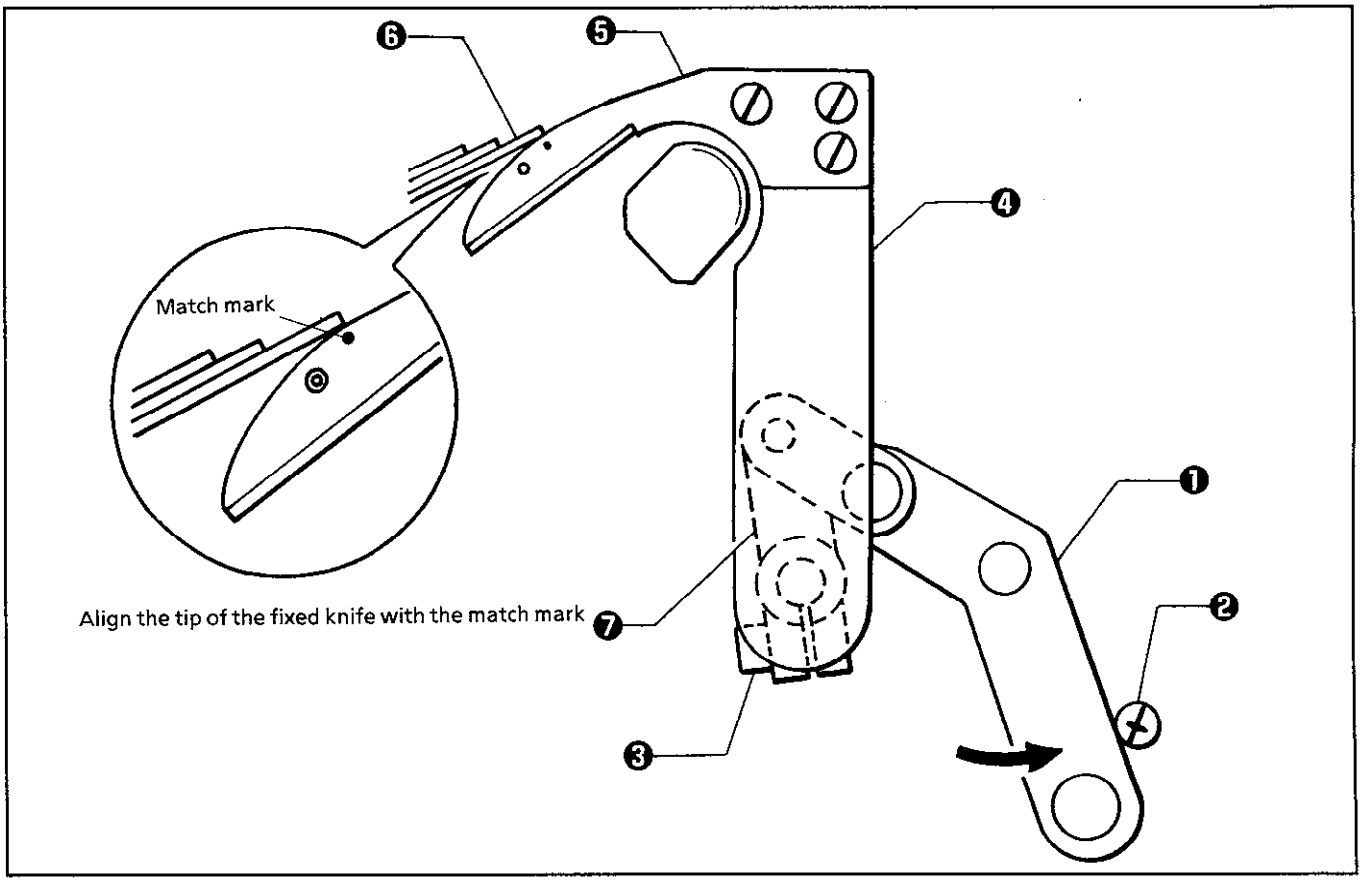
The thread trimmer is operated by means of an air cylinder when the feed bracket is returned to the home position.

a. Adjusting the knife pressure
Adjust the knife pressure so that the thread can be cut neatly.
Note: Do not subject the knife to excessive pressure. It may cause the knife to wear quickly or damage it.



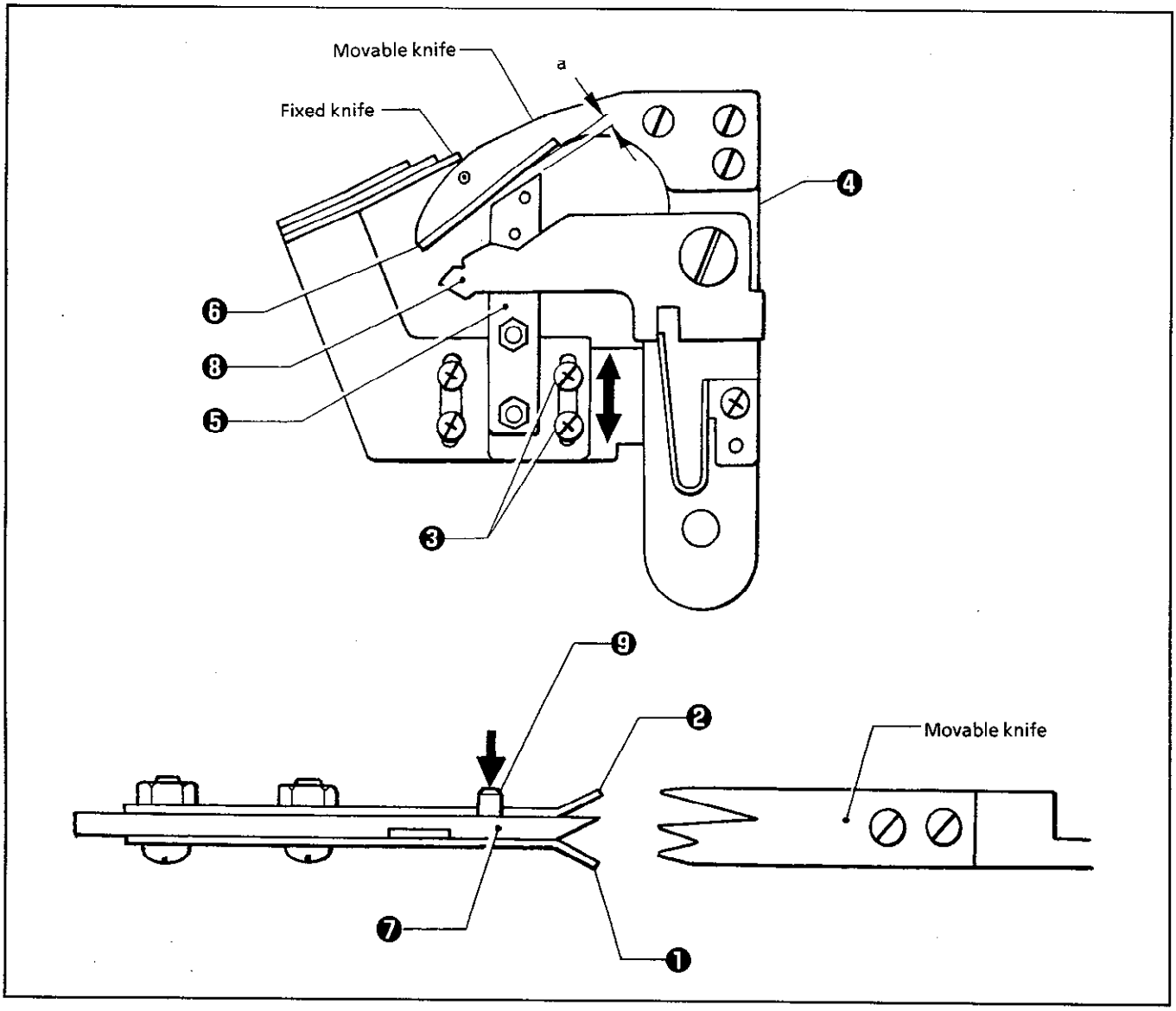
1. Loosen the screws ❶, and move the fixed knife set plate ❷ along the slot which the screws ❶ are in, in the direction of the arrow.
*The standard adjustment is done as shown in the above enlarged view, which indicates the first point to make contact with the point of the fixed knife ❹ and the pin of the movable knife ❺ when the thread trimmer arm ❸ operates.

b. Adjusting the position of the thread trimmer arm
The rocking stroke of the thread trimmer arm is fixed to the drive cylinders.



1. Turn the thread trimmer link lever ❶ in the direction of the arrow until it touches the stopper screw ❷.
2. Loosen the screw ❸, adjust the position of the thread trimmer arm ❹, and determine the engagement between the movable knife ❺ and the fixed knife ❻. The above figure shows standard adjustment.
   Note: When tightening the screw ❸, make sure that the thread trimmer lever arm ❼ and the thread trimmer arm ❹ can move smoothly without any end play.
   Note: Too little engagement may cause the lower thread not to be hooked, leading to thread cast-off at the start of sewing.

c. Adjusting the thread clamp assembly and thread clamp opener
The lower thread should go under thread clamp (D) ❶; the gimp should go under thread clamp (U) ❷. Install the thread clamp assembly correctly, and make sure that the thread clamp opener operates correctly.



1. Loosen the screws ❸, and move the thread clamp assembly along the fixed knife set bracket in the direction of the arrow. Decrease clearance a to as narrow as possible so that the thread clamp assembly ❺ and the thread handler ❻ do not make contact with each other when the thread trimmer arm ❹ rotates.
   Note 1: If clearance a is too great, the lower thread may not be hooked correctly, leading to thread cast-off at the start of sewing.
   Note 2: If the thread clamp assembly ❺ is installed on an angle, thread clamp (D) ❶ may not open because it makes contact with the throat plate, and fail to hook the lower thread, leading to thread cast-off at the start of sewing.

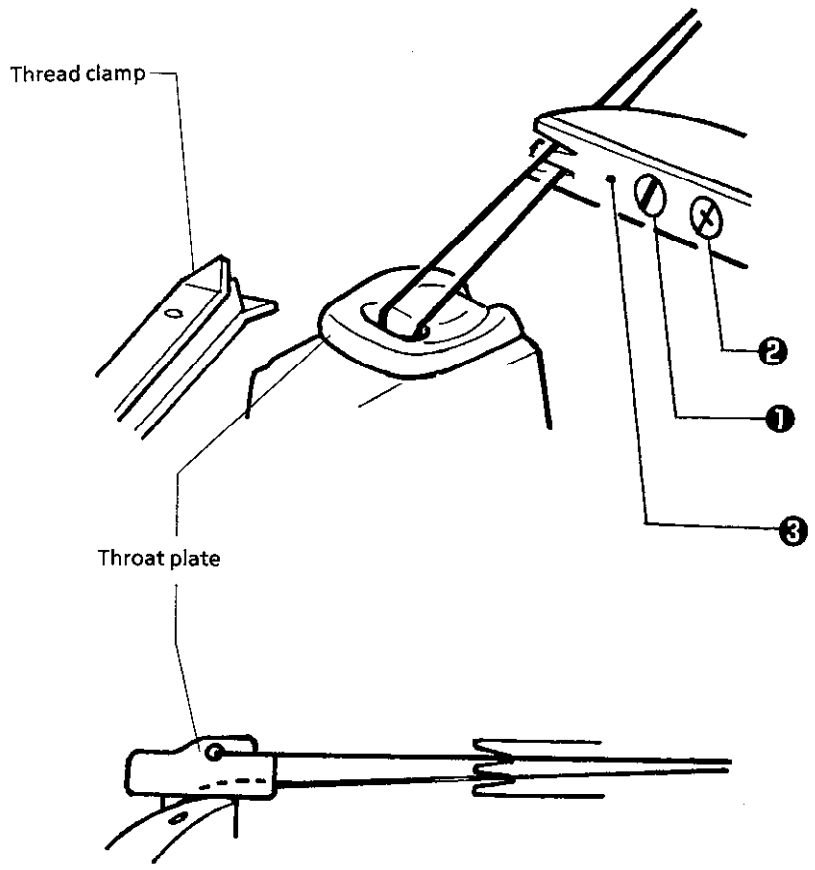
The lower thread must pass over the projection of thread clamp (M) ❼, and be securely held by thread clamp (D) ❶.

1. Make sure that thread clamp (D) ❶ is opened at least 0.3 mm when the thread clamp opener ❽ presses the thread clamp opener pin ❾ down.
2. Make sure that thread clamp (D) ❶ is closed just before the thread is trimmed.
3. When the thread trimmer arm ❹ returns to its original position after thread trimming, the thread clamp opener ❽ should travel around the thread clamp opener pin ❾. Make sure that thread clamp(D) ❶ should not be open.
   Note: When the start switch is pressed and the feed bracket moves to the sewing start point, the lower thread should be securely hooked by thread clamp (D) ❶.
   On the contrary, the gimp should be just released from thread clamp (U) ❷ to prevent double-cutting it.

d. Adjusting the thread handler

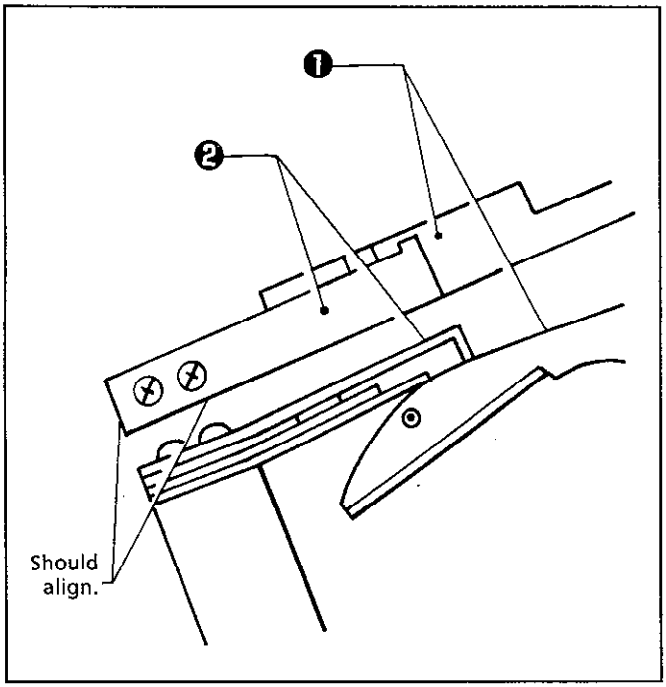
*The thread handler separates the lower thread and the gimp, and guides them to their respective threading routes. The lower thread is guided into thread handler (D); the gimp is guided into thread handler (U).

*When the thread trimmer arm operates, the throat plate turns 45°.
Then, the gimp moves onto the projection on the thread plate, and this creates the height difference between the lower thread and the gimp. A triangle is formed by the lower thread and the gimp at the last stitch, into which the thread handler moves to separate the lower thread and the gimp.



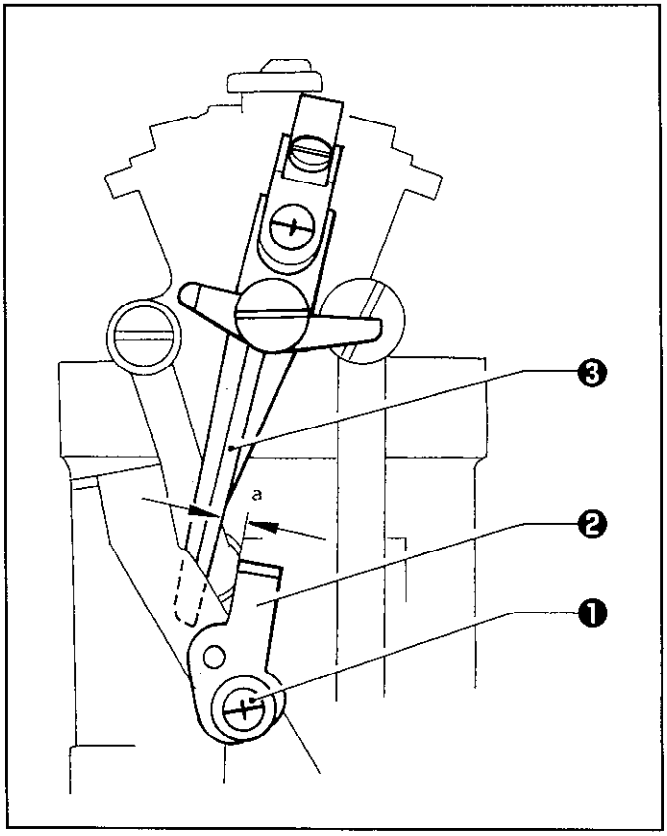
1. In the PROGRAM mode, set the stitch pitch to 2 mm to decrease the total number of stitches.
2. Press the start switch in the MANUAL mode, and turn the pulley manually until the last stitch.
3. When the pulley is stopped with its match mark aligned with that in the arm after a series of operations is completed, press the start switch again and again to check each thread trimming operation.
4. Loosen the screws ❶ and ❷. Adjust the thread handler ❸ by turning it while pivoting on the screw ❶.
   Note: When changing the height of the throat plate, be sure to adjust the thread handler because the triangle formed by the lower thread and the gimp will change.

e. Adjusting the thread guide plate



When the movable knife ❶ moves, the lower thread and the gimp should be guided to the notches in the movable knife ❶. Adjust the position of the thread guide plate ❷ so that the end of the movable knife ❶ aligns with the end of the thread guide plate ❷.

f. Adjusting the amount to pull the lower thread required for thread trimming



*When the thread handler catches the lower thread to guide it to the fixed knife, the lower thread should be pulled sufficiently to prevent the thread snapping and deviation from stitching path.

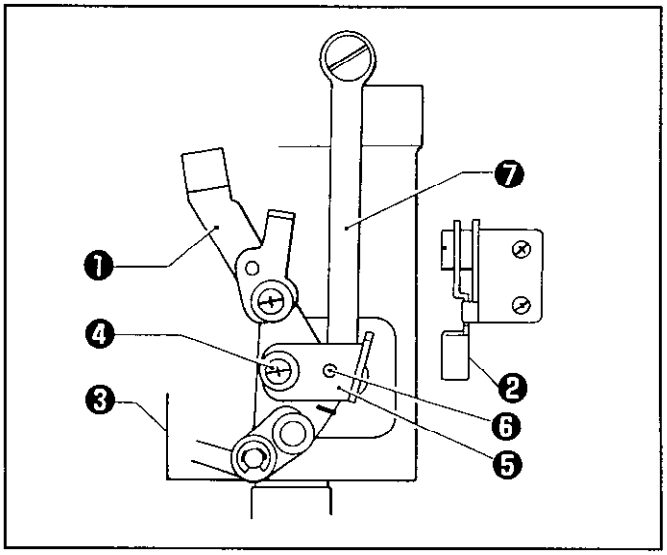
*To cut the lower thread when the feed bracket is at the home position, the thread trimmer lever bracket will continue to operate just before the looper turns 45°, and the lower thread will be pulled.

1. Loosen the screw ❶, turn the tension release plate ❷ to adjust clearance a between the tension release plate ❷ and thread trimmer lever bracket B ❸.
   Note: If the lower thread has snapped, reconfirm 5-1.

g. Adjusting the amount to pull the lower thread for safety stitching
To secure the first stitch, while looper L is catching the first upper loop, the lower thread should be taut between looper L and the throat plate, and not be pulled off thread clamp (D).

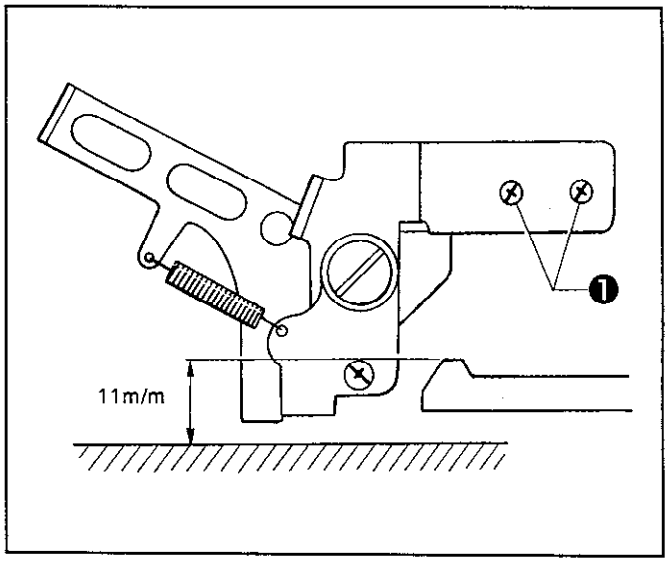
1. After automatic sewing is completed, switch to the MANUAL mode, and press the start switch.
2. Turn the pulley manually to check the condition of the lower thread.

To prevent the lower thread from being pulled off thread clamp (D) while the feed bracket is moving to the sewing start position, the pressure of thread clamp (D) should be sufficiently strong enough, and the tension release lever ❶ should be oscillated by the tension release claw ❷ to pull the lower thread appropriately while the looper base returns to the home position after thread trimming is completed.
When the stitch length is greatly changed, it is necessary to adjust the amount of lower thread to be pulled.



1. Turn off the power.
2. Turn the looper base ❸ manually to check the angle of the tension release lever ❶.
3. Loosen the screw ❹, turn the tension release claw ❺ regarding the pivot ❻ as the center to adjust the angle of the tension release lever ❶.
   Note: When the tension release lever ❶ oscillates with its maximum stroke, make sure that it does not make contact with the looper link ❼.

h. Adjusting the amount to pull the gimp (for specification -01)



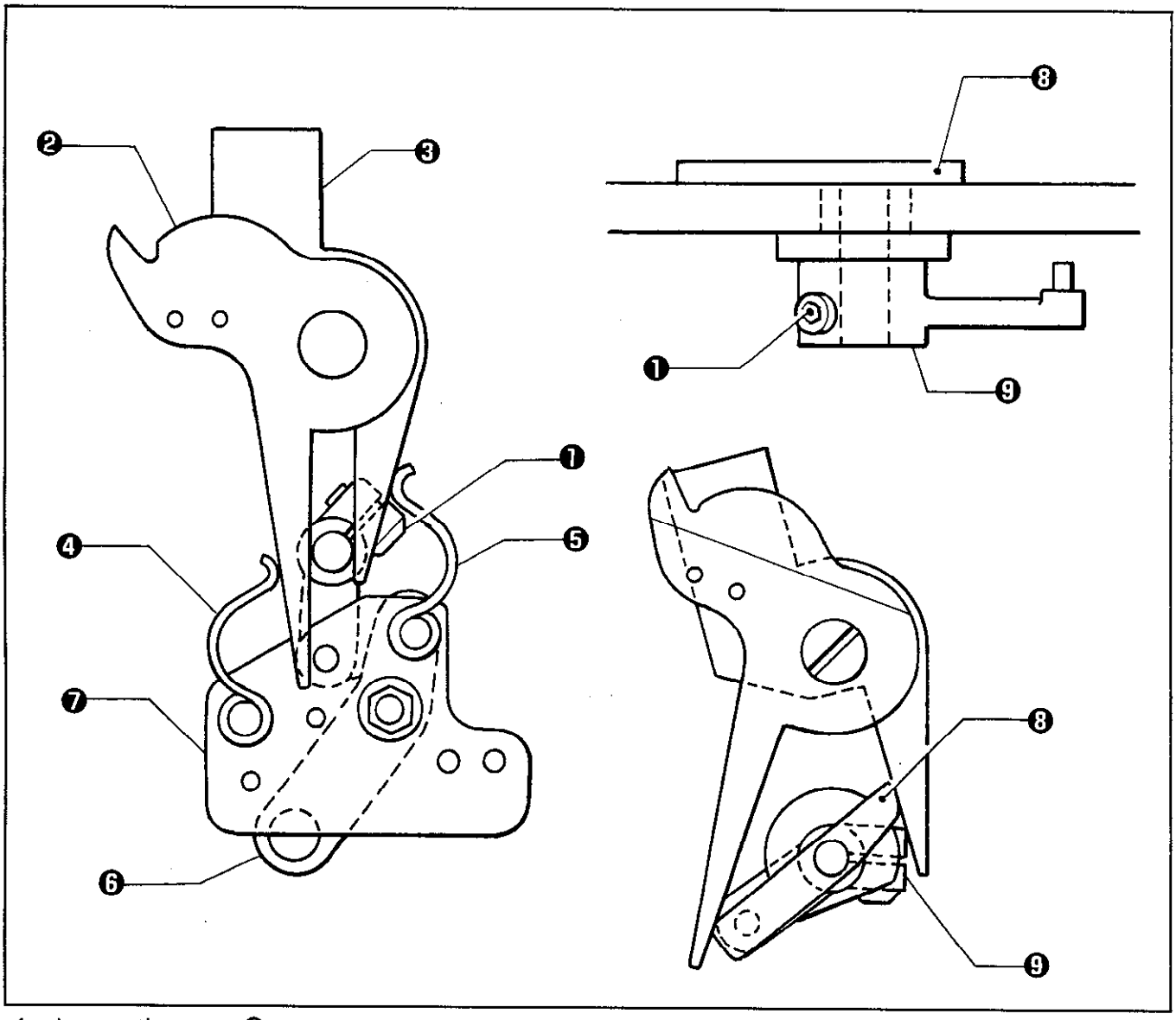
The amount of the gimp required for thread trimming is pulled by the thread trimmer that cuts the lower thread and the gimp, leaving them longer.
If adjustment is not correct, the gimp sewn in stitches may be pulled, and stitch formation around the button eyelet may be distorted.

1. Loosen the screws ❶, and set the distance from the bed to the upper end of the roller to 11 mm.

[Adjusting the thread trimmer which can cut the lower thread and gimp, leaving them shorter (for specification -02)]

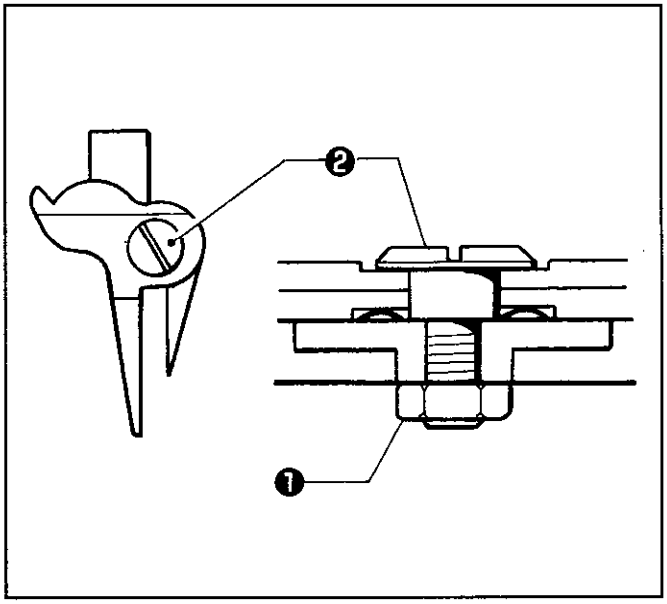
The thread trimmer operates by means of an air cylinder when the feed bracket is at the home position.

a. Adjusting the knife engagement
Movable knives (L) and (R) should overlap each other by approx. 1 mm.



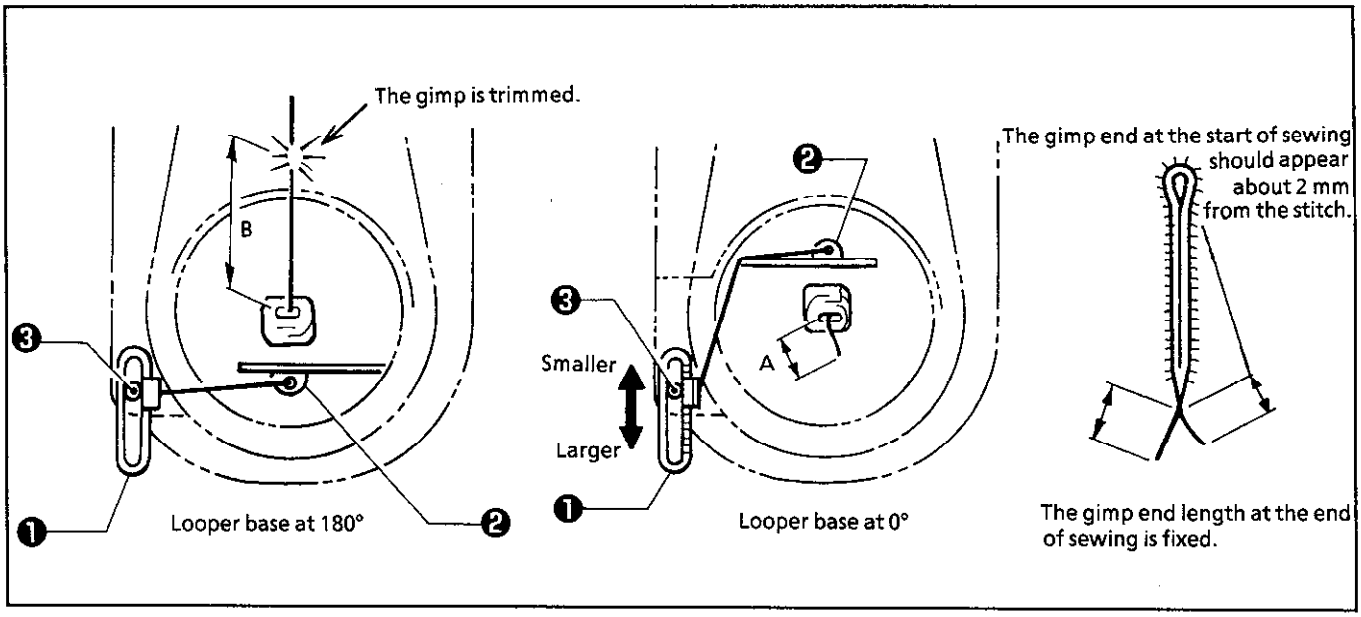
1. Loosen the screw ❶.
2. With springs (L) ❹ and (R) ❺ attached to movable knives (L) ❷ and (R) ❸, align the end of thread trimmer link lever (J) ❻ with the match mark on the rear of the link fulcrum plate ❼, and tighten the screw ❶.
   Note: Make sure that the movable knife driving cam ❽ and thread trimmer lever arm B ❾ rotate smoothly without any gap.
3. Move thread trimmer link lever (J) ❻ to check engagement between movable knives (L) ❷ and (R) ❸.
   If the engagement is insufficient, return to step 2 to perform fine adjustment so that the end of thread trimmer link lever (J) ❻ overlaps with the match mark on the rear of the link fulcrum plate ❼.

b. Adjusting the knife pressure
Adjust the knife pressure to the lowest where the knife can still cut the material.



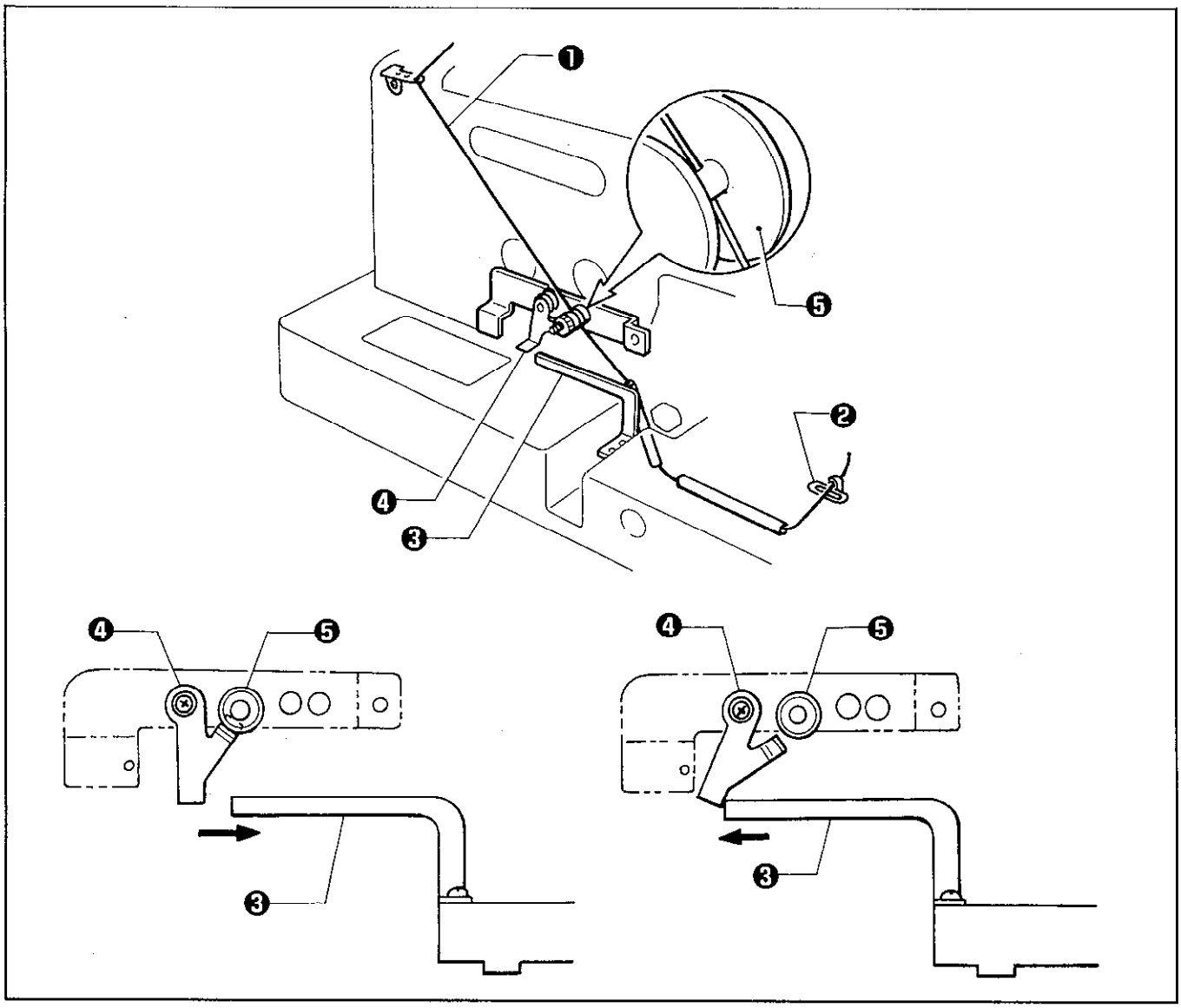
1. Loosen the nut ❶.
2. Turn the stud screw ❷ to adjust the knife pressure.
   Note: When the stud screw ❷ is fully tightened, the movable knife will not operate. Tighten the stud screw ❷ slowly while checking that the movable knife can operate smoothly.

c. Adjusting the gimp pull force and tension
*The gimp should be completely sewn in a few stitches at the start of sewing, and the gimp end length from the stitches should be as small as possible.
*The gimp is pulled by utilizing the difference in distance between gimp thread guide (J) ❶ and gimp thread guide (C-J) ❷ when the looper base returns to 0° from 180° after the gimp is trimmed.
*The gimp is trimmed when the feed bracket is at the home position. When the stitch length is changed, dimensions B and A will change. It is necessary to adjust the force to pull the gimp.
Also, dimension A differs according to the gimp type and the gimp tension, so it is necessary to adjust the force to pull the gimp.



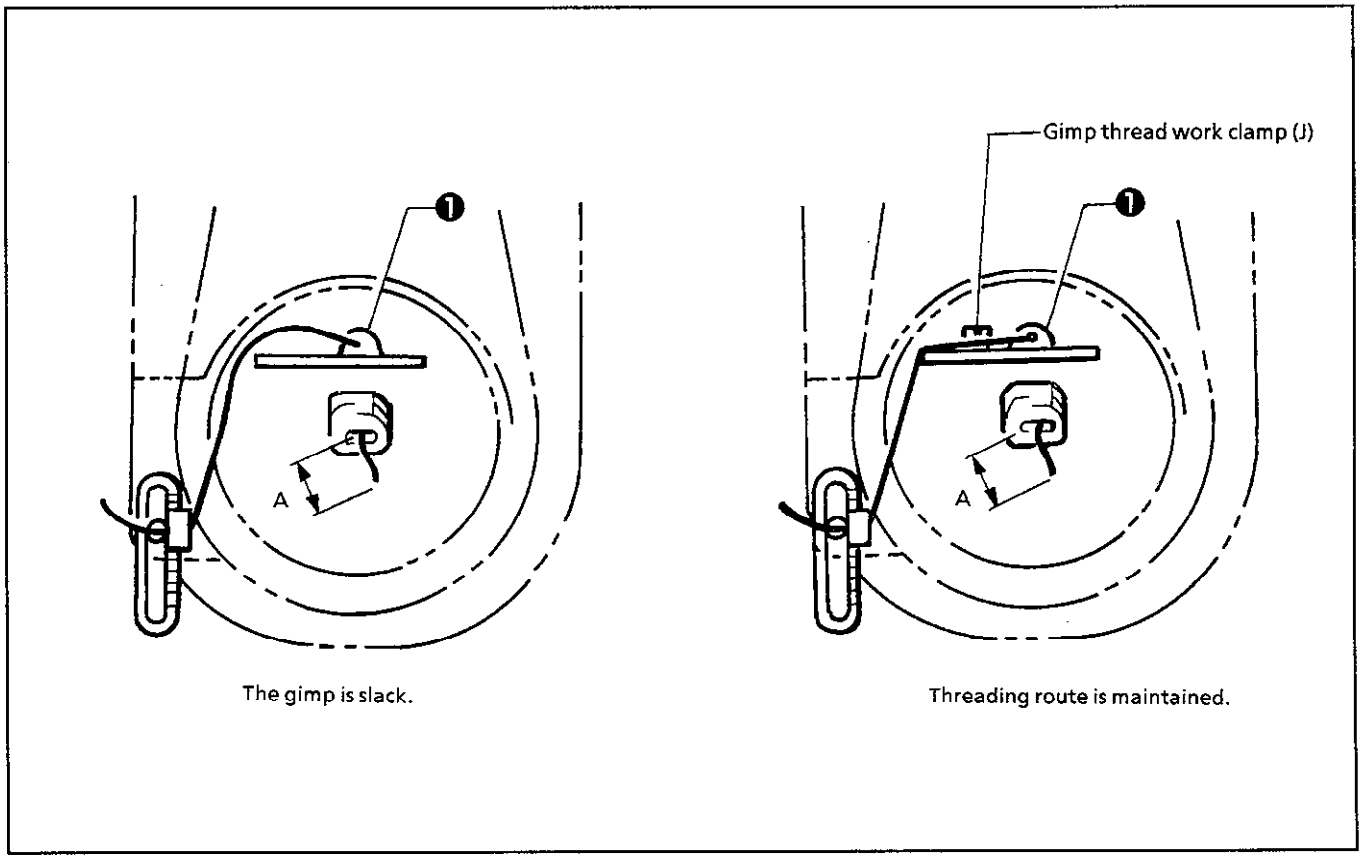
1. Loosen the screw ❸, and adjust so that the gimp appears about 2 mm from the first covering stitch at the start of sewing.
   Note: The tip of the gimp is pressed down on the material by a few stitches at the start of sewing, and pulled by the movement of the feed bracket. If the gimp is excessively taut when the feed bracket is at the sewing start position, or dimension A is too small, the gimp may come out from under the stitches.

When the looper base rotates and the gimp ❶ is pulled, the gimp tension at the side of the spool stand should be stronger than that close to throat plate, regarding gimp thread guide (J) ❷ as the center.
During sewing, on the contrary, the tension should be weak so that the gimp can be sewn under the stitches.



1. During sewing, gimp thread take-up guide (J) ❸ moves toward the front in accordance with the movement of the feed bracket, and the gimp thread release plate ❹ releases the thread tension disc ❺.
2. After sewing is completed, the feed bracket moves to the home position to trim the gimp ❶, gimp thread take-up guide (J) ❸ pushes the gimp thread release plate ❹, and the thread tension disc ❺ is closed.

d. Using gimp thread work clamp (J)

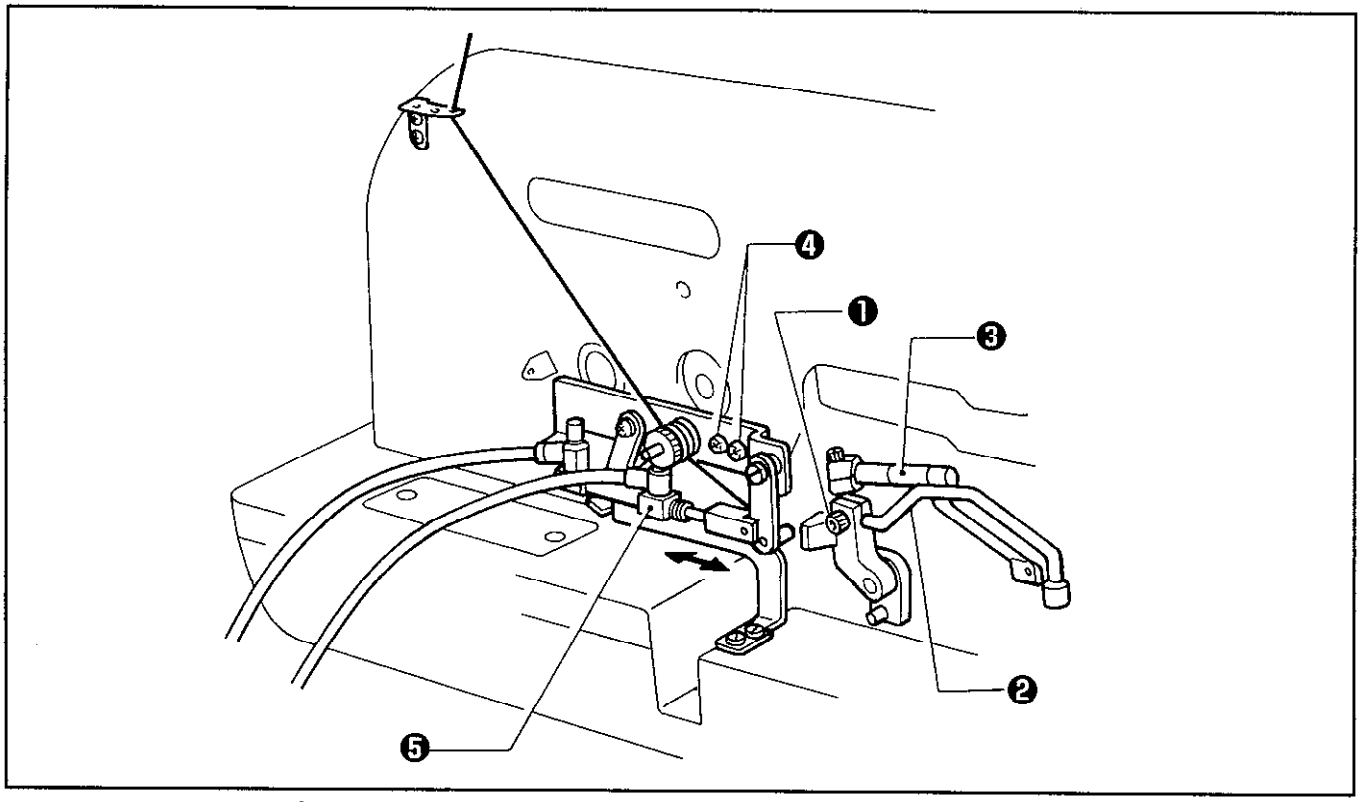


When the gimp is stiff, dimension A (gimp length from the throat plate) may vary.
In this case, pass the gimp through gimp thread work clamp (J) attached to gimp guide (C-J) ❶.
Note: When thick and soft gimp is passed through gimp thread work clamp (J), the gimp tension may be too great during sewing.

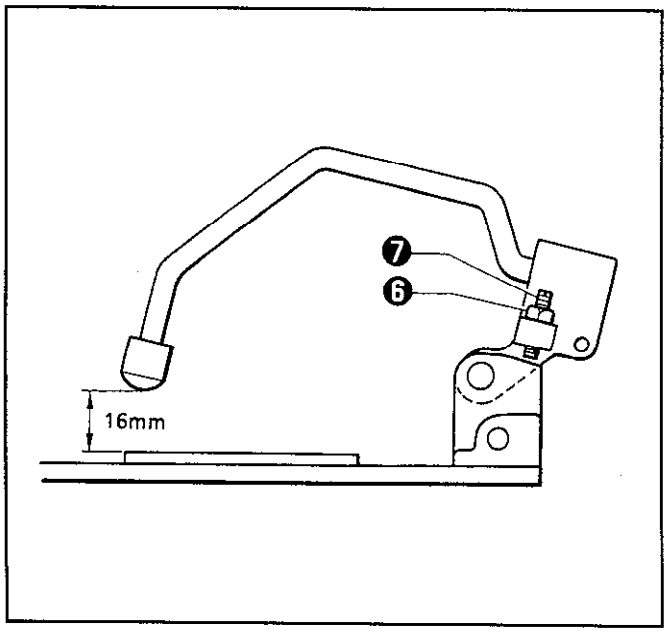
e. Adjusting the sub presser

*The sub presser holds the material until the lower thread and the gimp are trimmed after the cloth presser rises.

*The sub presser should be adjusted so that it can operate when the feed bracket is at the home position, and will be stationary on the needle plate without subjecting it to any pressure.



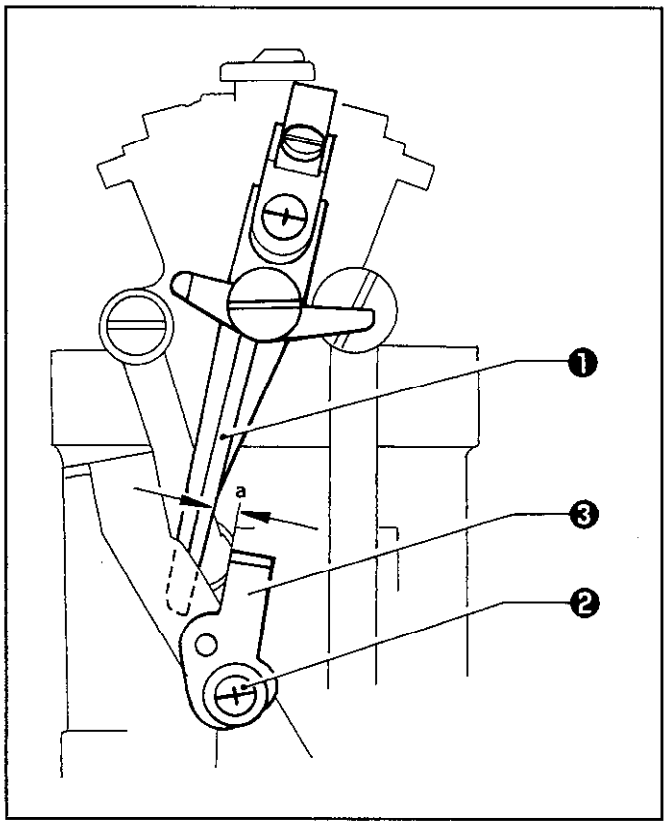
1. Loosen the screw ❶, and position the sub presser arm ❷ on the needle plate so that the sub presser ❷ can hold the material next to clamp arm (L-J) ❸.
   Note: Be sure that the sub presser ❷ does not make contact with clamp arm (L-J) ❸.
2. Turn on the power to set the home position.
3. Turn off the air, and loosen the screws ❹.
4. With the rod of the sub presser cylinder ❺ fully extended, adjust so that the sub presser ❷ can be stationary to the needle plate without subjecting it to any pressure.
   Note: If excessive pressure is applied to the sub presser when the feed bracket is at the home position, the feed bracket may be in an inappropriate position in the Y direction.



The lift height of the sub presser is set to 16 mm.

1. Loosen the nut ❻, and turn the screw ❼ to adjust the height.

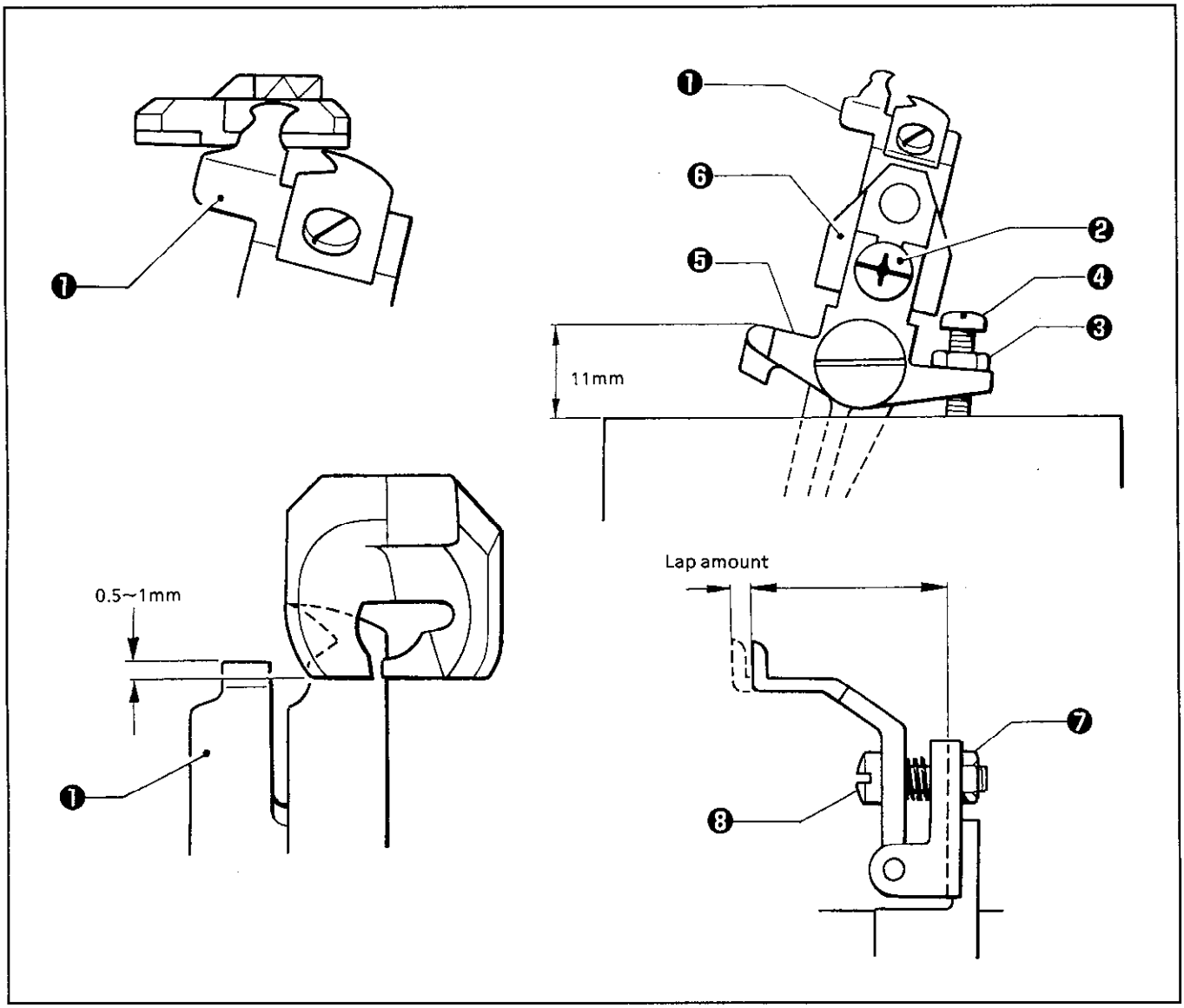
f. Adjusting the length of the lower thread to be pulled for a safe sewing start
*To secure the first stitch, while looper L is holding the first upper loop, the lower thread should be taut between looper L and the throat plate, and not be pulled off the lower thread presser.
*Thread trimmer lever bracket (B) ❶ is operating just before the lower thread is trimmed when the feed bracket is at the home position, and that causes the lower thread to be pulled.



1. After automatic sewing is completed, switch to the MANUAL mode, and press the start switch.
2. Turn the pulley manually to check the condition of the lower thread.
3. If adjustment is necessary, loosen the screw ❷, and turn the tension release plate ❸ to adjust distance a between the tension release plate ❸ and thread trimmer lever bracket (B) ❶.

4-22. Adjusting the position of the lower thread presser (for specification -02)

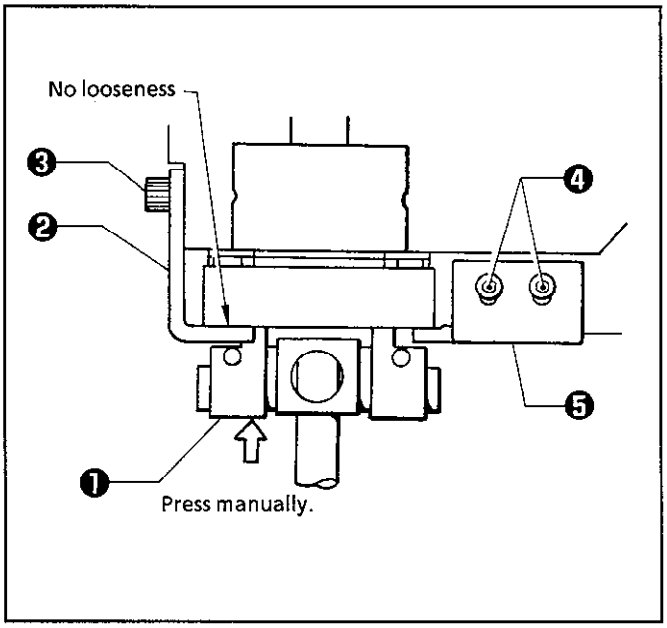
The lower thread presser ❶ should be adjusted to that it can securely clamp the lower thread.



1. Loosen the screw ❷, and move the lower thread presser ❶ up and down so that its top surface is flush with the groove in the throat plate.
2. Make sure that the lower thread presser ❶ does not fill the front groove of the throat plate.
   If it does, loosen the nut ❸, and adjust the screw ❹.
   Note: Set the height from the stopper portion of thread trimmer lever bracket (B) ❺ to the top of the looper base, to 11 mm at maximum.
3. Make sure that the front of the throat plate overlaps with the lower thread presser ❶ by 0.5 - 1 mm when thread trimmer lever bracket (B) ❺ operates.
   If adjustment is necessary, remove the lower thread presser base ❻, loosen the nut ❼, and adjust the screw ❽.

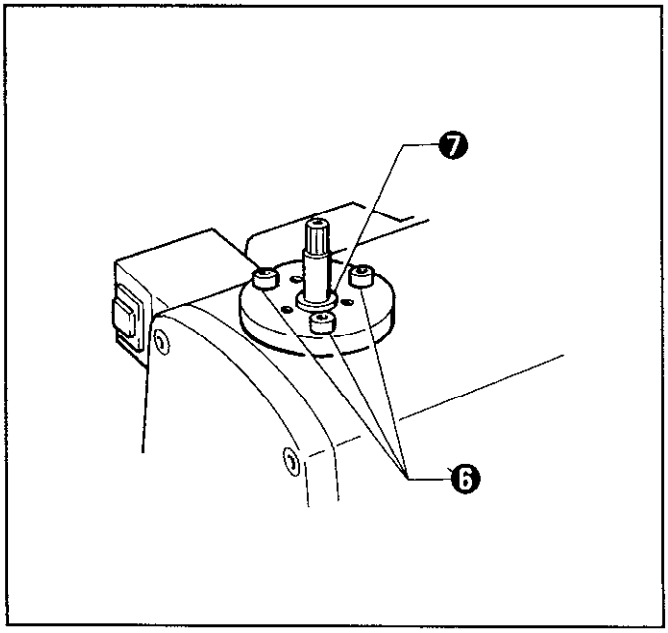
4-23. Adjusting the rotating centers of the needle bar and the looper base

*The rotating centers of the needle bar and the looper base are adjusted before shipment from the factory.
*When disassembling the machine or exchanging parts such as the needle bar gear assembly, the needle bar, and looper base, adjust the clearance between the needle and the point of the looper so that it does not change through 360°.
*Before adjusting the position of needle bar bush (U), be sure to check there is no gap between the needle bar gear ❶ and needle bar gear support (A) ❷.



1. Raise the needle bar gear ❶ using your fingers to check the looseness.
   Note: If the looseness is great, the center of rotation can not be adjusted.
2. Loosen the screw ❸, and adjust needle bar gear support (A) ❷ so that the needle bar gear assembly can rotate smoothly without gap.
3. Loosen the screws ❹, and adjust needle bar gear support (B) ❺ in the same manner as above.
   Note: When needle bar gear support (A) ❷ or (B) ❺ is raised excessively, the looper base may be in an inappropriate position.

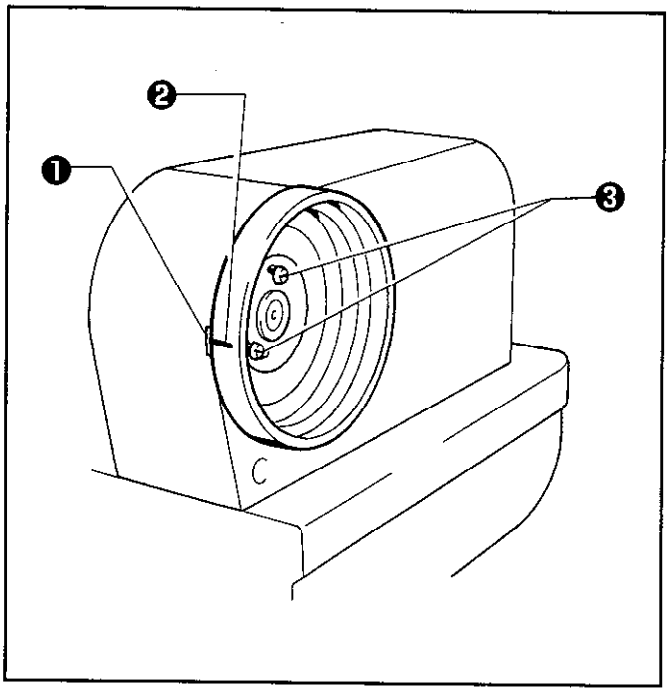
When the looper base is at 360° where the needle bar can move lightly up and down, adjust the position of needle bar bush (U) ❼.



1. Loosen the screw ❻ a little, and tap on the needle bar to adjust the position of needle bar bush (U) ❼.
   Adjust the back and forth movement of needle bar bush (U) ❼ so that the clearance between the needle and the point of the looper is not changed when the looper base is at 0° and 180°.
   Adjust the sideways movement of needle bar bush (U) ❼ so that the clearance between the needle and the point of the looper is not changed when the looper base is at 90° and 270°.
   Note: If the needle penetration movement is adjusted to one point, the clearance between the needle and the point of the looper will not be fixed.

4-24. Adjusting the needle bar stop position

The needle bar should stop when it rises from the lowest point at the outside sewing position.



1. Loosen the screws ❸, and align the notch ❶ of belt cover (F) with the timing mark ❷ on the pulley.
   Note: When the stop position is changed, the operation range of spreader (R) will change. Reconfirm the mounting position of the upper movable knife.

5. POWER SUPPLY EQUIPMENT

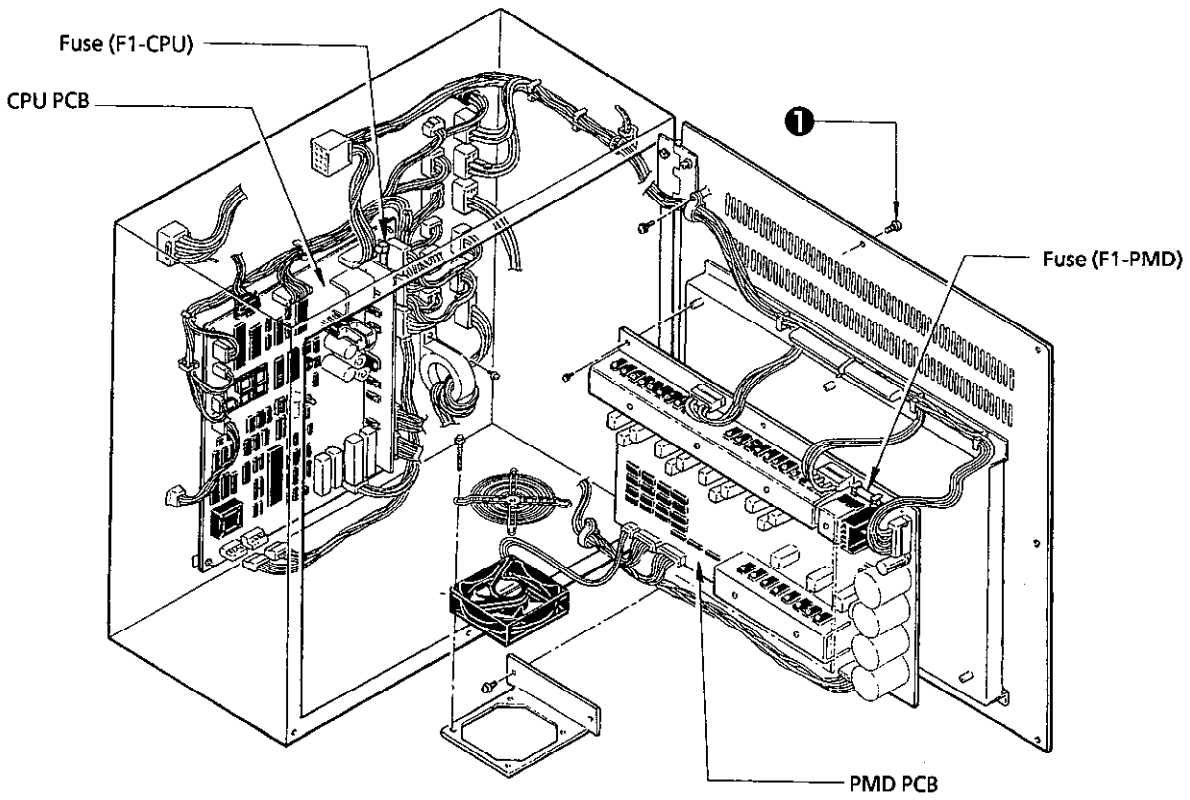
⚠ CAUTION

- Be sure to turn off the power, disconnect the plug, and wait at least 5 minutes before opening the cover of the control box.
  Take care not to touch high voltage area, as injuries could result.

Be sure to turn off the power and disconnect the plug before replacing and adjusting the parts associated with the power supply equipment.

5-1. Fuses

1) Fuse positions



Here the PDH-A1-CPU PCB is abbreviated to CPU PCB, and the PDH-A2-PMD PCB, to PMD PCB.

1. Remove the 5 screws ❶ and open the side plate of the control box.
2. The F1-CPU fuse is vertically attached to the upper right of the CPU PCB, which is seen at the front. The F1-PMD fuse is horizontally attached to the upper right of the PMD PCB, which is located on the inside of the cover.

2) Fuse capacity

(1) Fuse F1-CPU on the CPU PCB

Fuse no.	Type and capacity	Use
F1	Cartridge fuse 8A-AC250V General melting type BØ6.4 x 30 mm	For solenoid valve (+ 30V)

(2) Fuse F1-PMD on the PMD PCB

Fuse no.	Type and capacity	Use
F1	Cartridge fuse 20A-AC250V General melting type BØ6.4 x 30 mm	For X-, Y-, and θ-axis motors

3) Replacing the fuses

The following tables are statuses when fuses have blown.
When replacing the fuses, be sure to use identical ones with the same capacity and same type.

(1) Fuse F1-CPU on the CPU PCB

Fuse no.	Faulty status
F1	Cloth presser, knife, upper and lower thread trimmers, cloth stretching mechanism, upper thread tightening will not operate.

(2) Fuse F1-PMD on the PMD PCB

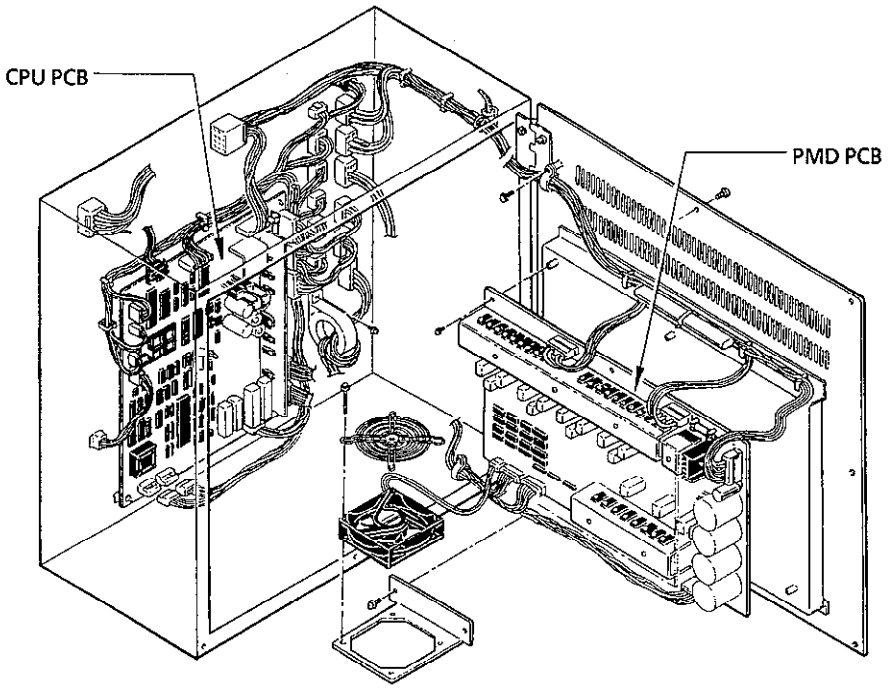
Fuse no.	Faulty status
F1	X-, Y-, and θ-axis motors will not operate.

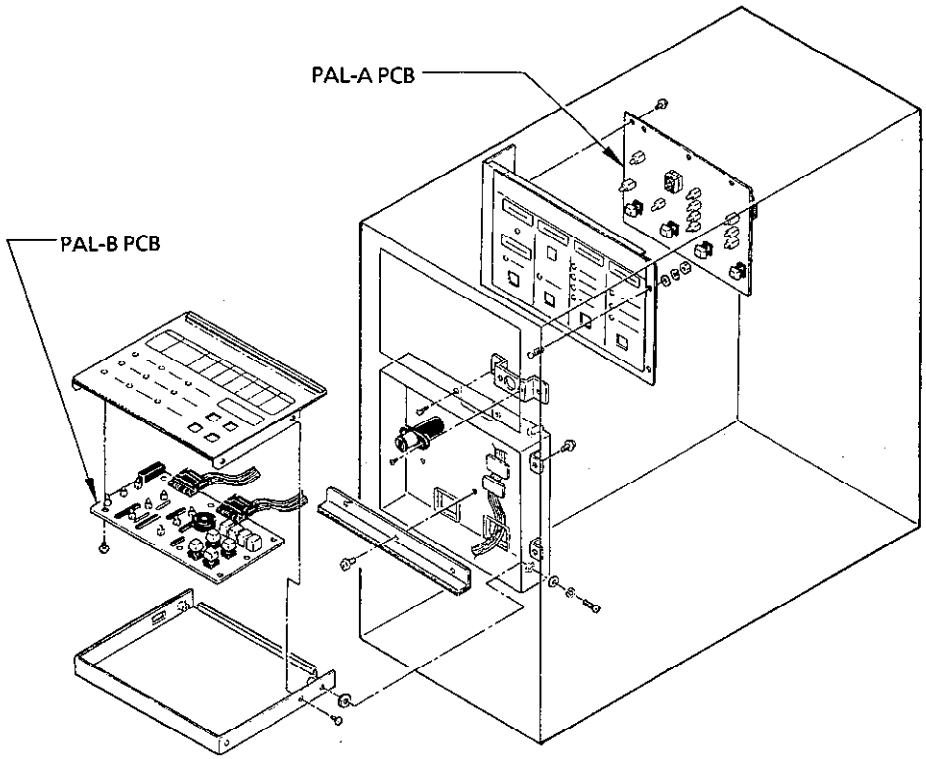
5-2. PCBs

1) PCB positions

Note: Here the PDH-A1-CPU PCB is abbreviated to CPU PCB, the PDH-A2-PMD PCB to PMD PCB, the PDH-A1A-PAL PCB to PAL-A PCB, and the PDH-A1B-PAL PCB to PAL-B PCB.

There are 4 PCBs inside the control box as follows: the CPU PCB, the PMD PCB, the PAL-A PCB, and the PAL-B PCB.





2) PCB functions

(1) CPU PCB

- Outputs command signals of the X-, Y-, and θ -axis motors to the PMD PCB.
- Drives air cylinders (for cloth presser, knife, upper and lower thread trimming, cloth stretching, and upper thread tightening).
- Controls input and output of the PAL-A PCB and the PAL-B PCB.
- Controls the main shaft motor.
- Controls eyelet buttonhole data.

(2) PMD PCB

- Controls X-, Y-, and θ-axis motors.

(3) PAL-A PCB

- Inputs each setting.
- Displays outputs (on the LED).

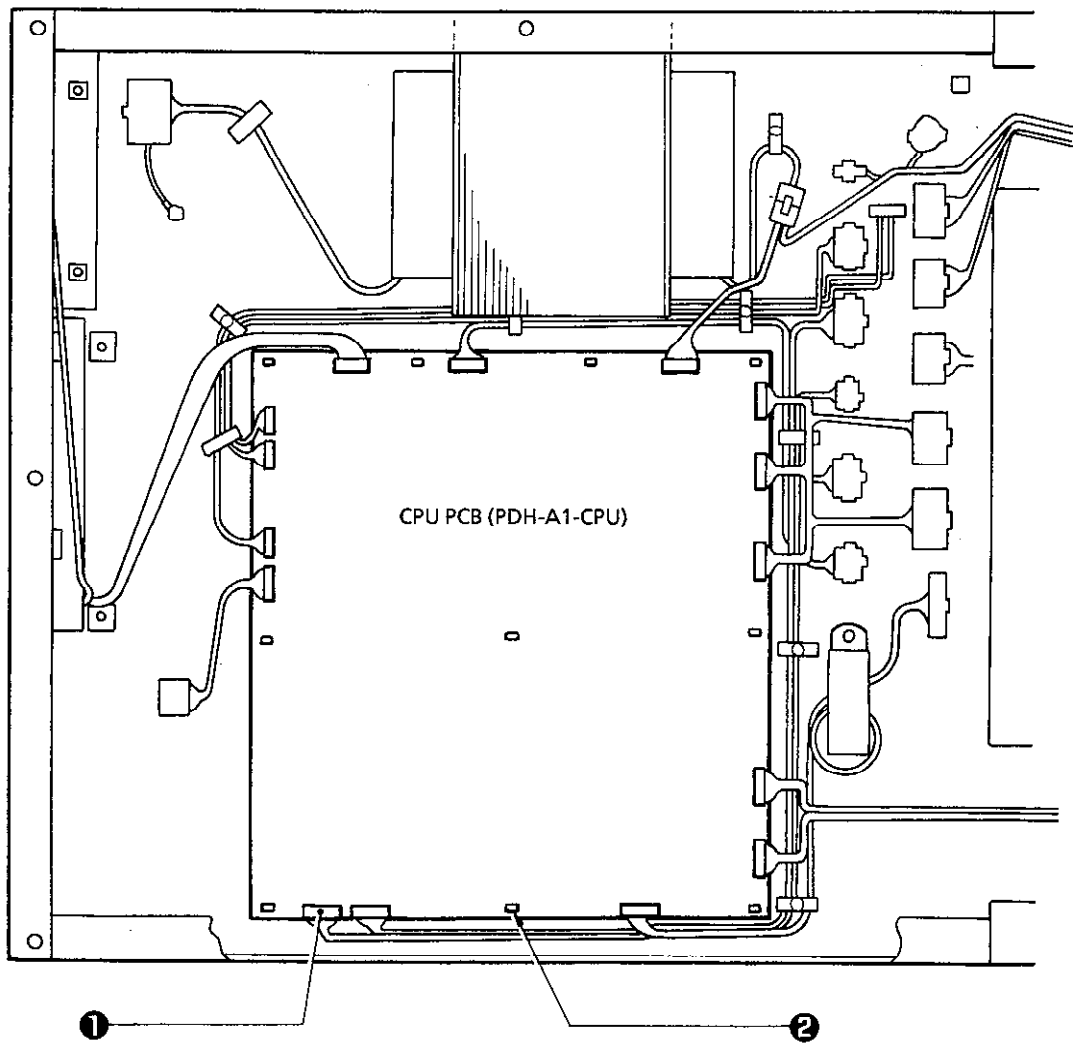
(4) PAL-B PCB

- Inputs eyelet shape data.
- Displays each piece of data (including counter number and error code).
- Controls input and output of the PAL-A PCB

5-3. Replacing the PCBs

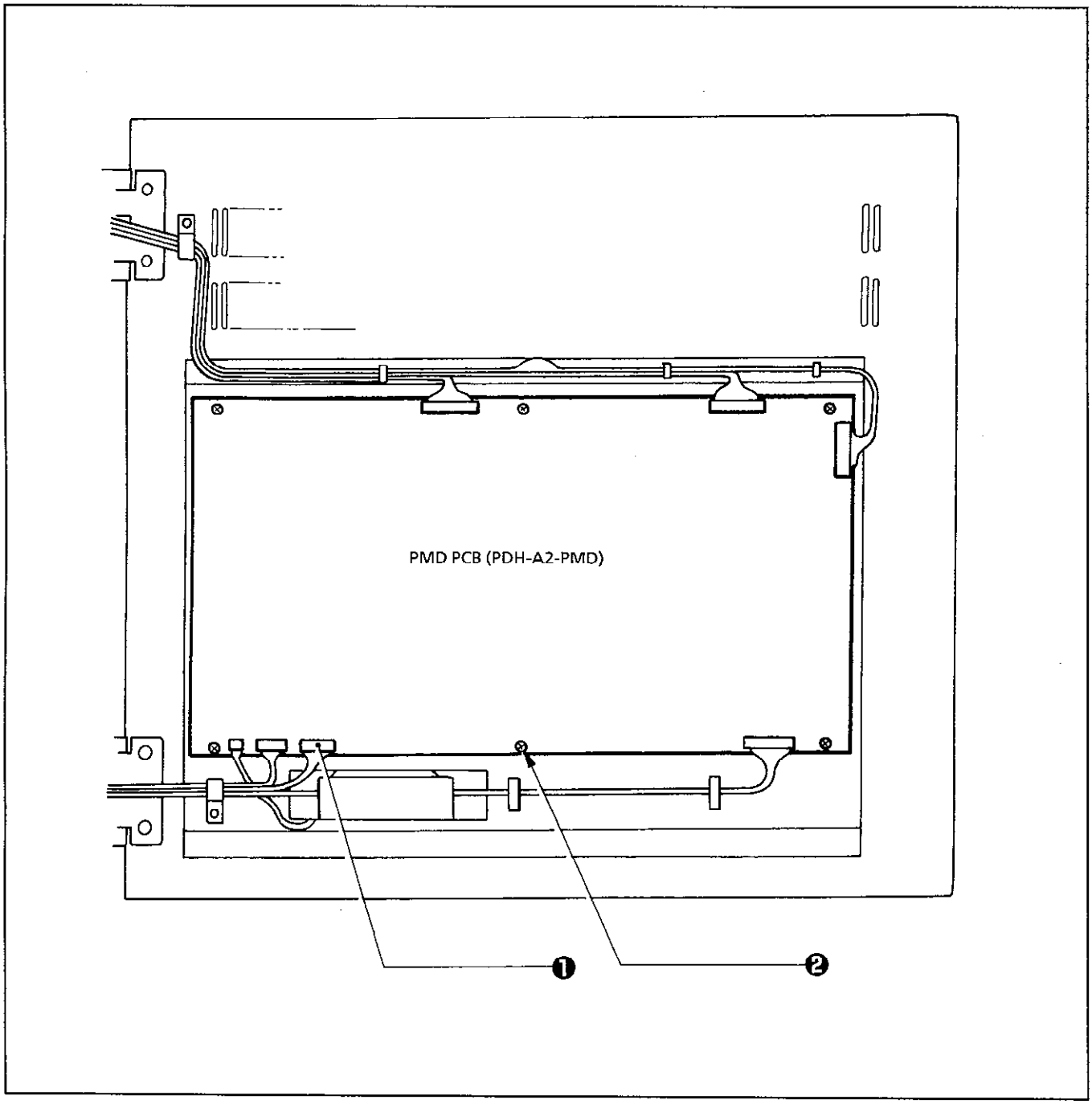
Be sure to turn off the power and disconnect the plug.
PCBs are easily damaged by static electricity. Take care not to charge with electricity.

1) Replacing the CPU PCB (PDH-A1-CPU)



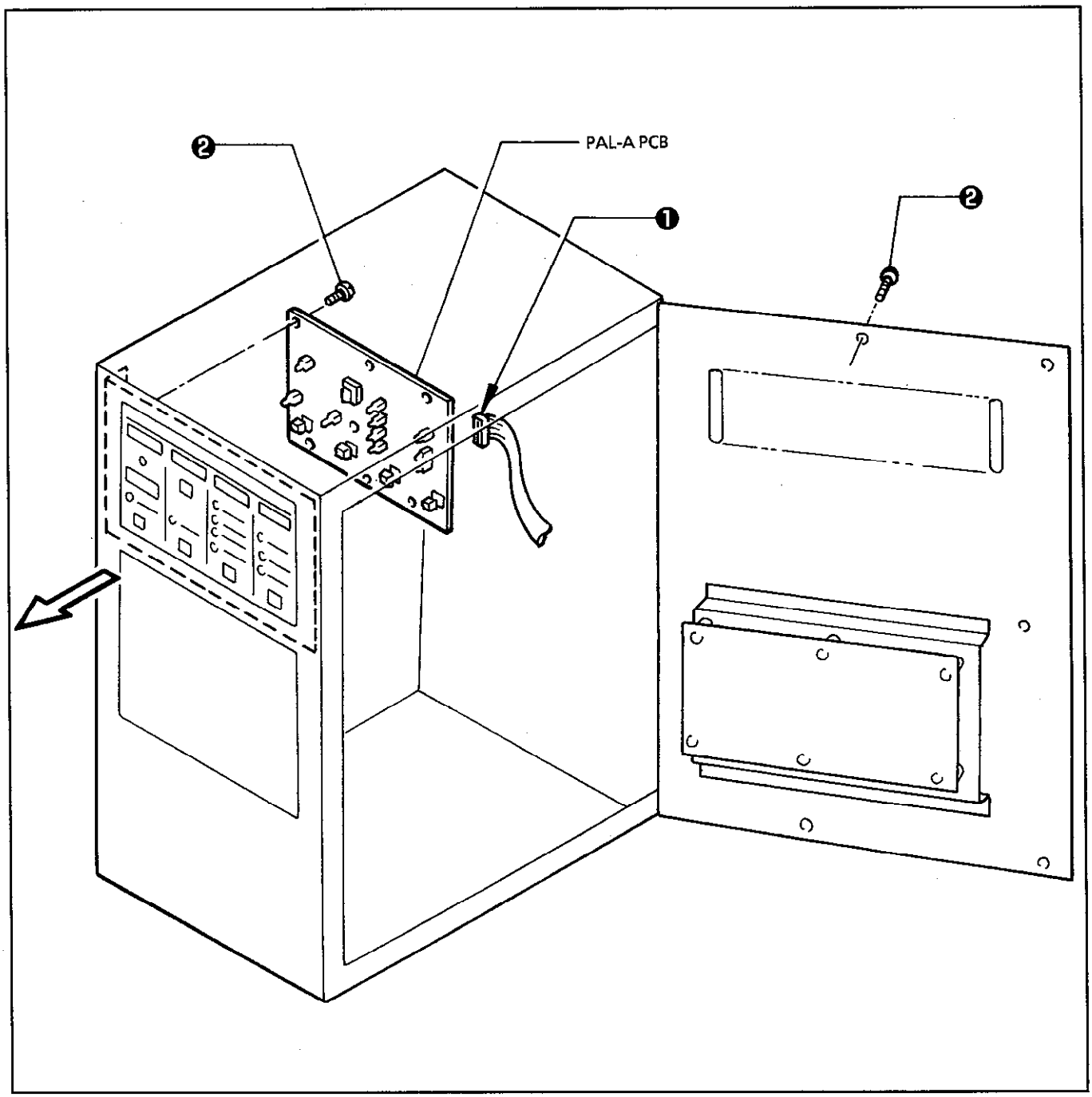
1. Remove the 5 screws, and open the side cover of the control box.
2. Remove the 15 connectors ❶ on the PCB.
3. Remove the PCB while pressing the tab of each PCB spacer ❷ (in 10 places) inward.
4. Attach a new PCB while aligning each PCB spacer ❷ with slots in the new PCB, and pressing each engagement place on the PCB.
5. Reattach the 15 connectors securely. When plugging in a connector, hold the rear of the connector with care so as not to apply excessive force to any part of the PCB.
6. Finally, retighten the 5 screws to secure the side cover.

2) Replacing the PMD PCB (PDH-A2-PMD)



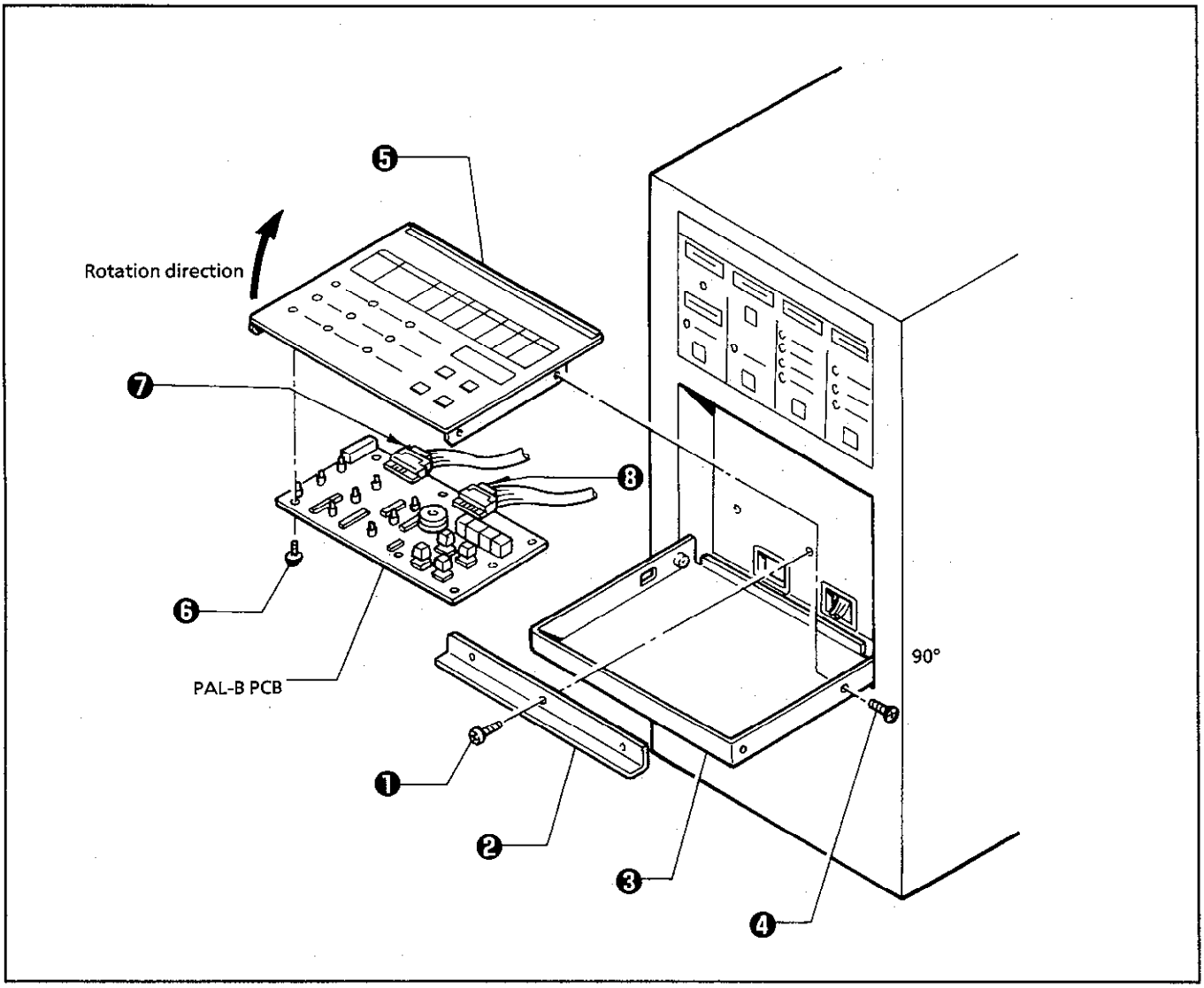
1. Remove the 5 screws, and open the side cover of the control box.
2. Remove the 7 connectors ❶ from the PMD PCB.
3. Remove the 6 screws ❷, and the PMD PCB while holding it.
4. Attach a new PCB using the 6 screws ❷.
5. Reattach the 7 connectors securely. When plugging in a connector, hold the rear of the connector with care so as not to apply excessive force to any part of the PCB.
6. Finally, retighten the 5 screws to secure the side cover.

3) Replacing the PAL-A PCB (PDH-A1A-PAL)



1. Remove the 5 screws, and open the side cover of the control box.
2. Remove the connector ❶ from the PAL-A PCB while pressing the tabs of the connector inward.
3. Remove the 7 screws ❷, and the PAL-A PCB while holding it.
4. Attach a new PCB using the 7 screws ❷.
   Securely tighten the screws so that the LEDs (in 10 places) and switches (in 4 places) are positioned to the center of each matching slot when viewed from the front. Press and release switches to make sure that they operate correctly (click).
   *The screws are apt to fall off a screwdriver. It is recommended to use a magnetic screwdriver.
5. Check the direction of the connector, and reattach the connector securely. The connector will be automatically locked.
6. Finally, retighten the 5 screws to secure the side cover.

4) Replacing the PAL-B PCB (PDH-A1B-PAL)



1. Open the front panel.
2. Remove the 3 screws ❶, and the stopper ❷.
3. Remove the 4 screws on both sides of the operation panel plate ❸.
4. Hold the rear side of the operation panel ❺ with your fingers, and raise it. There are 2 cables. Do not pull them.
5. Press the tabs of the connectors (large 7 and small 8 in 2 places) with care so as not to apply any load on the wires, and separate them from the PAL-B PCB. Remove the operation panel ❺.
6. Turn the operation panel ❺ over, and remove the 6 screws ❻ to separate the operation panel ❺ and the PAL-B PCB. Replace the PAL-B PCB with a new one.
7. Join the operation panel ❺ and a new PCB, and temporarily tighten the 6 screws ❻ while matching them with the screw holes. Adjust the position of the new PCB so that its switches are placed in the holes in the operation panel ❺ centrally. Then fully tighten the 6 screws ❻.
8. Check the direction of the connectors with care so as not to apply any load on the wires. Securely reattach the large and small connectors ❼ and ❽ to the PCB. The connectors will be automatically locked.
9. Place the operation panel ❺ in the operation panel plate ❸ so that the cables attached to the operation panel are inserted all the way into the inlet of the control box. Retighten the 4 screws ❹ to join them.
10. Reattach the stopper ❷ using the 3 screws ❶. The operation panel plate ❺ should be positioned perpendicular to the control box.
11. Close the front panel.

5-4. DIP switches

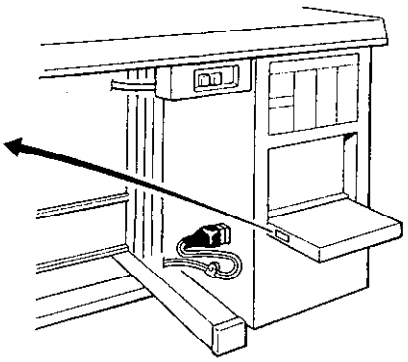
1) Panel DIP switches

The setting (on/off) of the panel DIP switches is checked once only when the power of the sewing machine is turned on.
The DIP switch setting is invalid while the power is turned on. DIP switches No. 6 and 7 are available only when No.5 is set to on.

No.	ON/OFF	Explanation
1, 2	OFF,OFF	Cutting block on time: 25 ms
	OFF,ON	Cutting block on time: 50 ms
	ON,OFF	Cutting block on time: 100 ms
	ON,ON	Cutting block on time: 200 ms
3	ON	Feed bracket front position
	OFF	Feed bracket back position
4	ON	Production counter: counting down to zero
	OFF	Production counter: counting up from zero
5	ON	Single pedal operation
	OFF	2 pedals operation
6, 7	OFF,OFF	Single pedal timer: 0 seconds
	OFF,ON	Single pedal timer: 0.1 seconds
	ON,OFF	Single pedal timer: 0.2 seconds
	ON,ON	Single pedal timer: 0.3 seconds
8		Spare

When the setting of panel DIP switch No. 4 is changed, the production counter will be reset to zero.

*The DIP switches are set before shipment from the factory as follows:



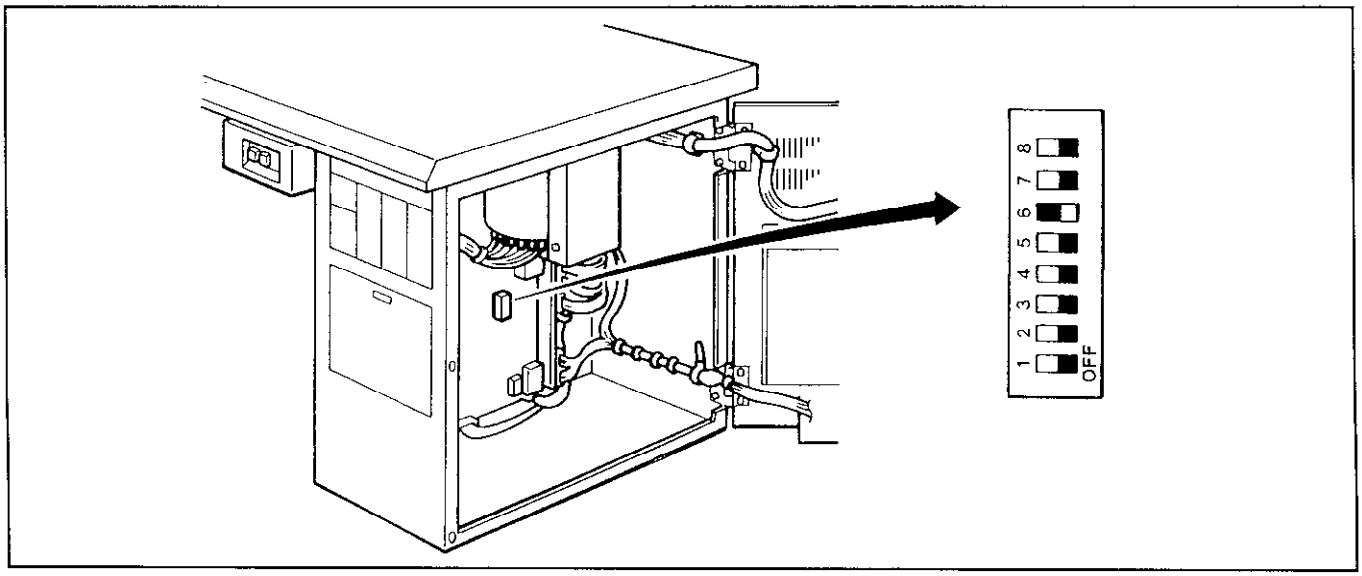
2) PCB DIP switches

The setting (on/off) of the PCB DIP switches is checked once only when the power of the sewing machine is turned on.
The DIP switch setting is invalid while the power is turned on. Only one of DIP switches Nos. 1, 2 and 3 is available at any one time. They are effective in the order 1, 2, and 3.

No.	ON/OFF	Explanation
1	ON	Data initialization
	OFF	Normal
2	ON	Input check
	OFF	Normal
3	ON	Output check
	OFF	Normal
4, 5		} Spare
6	OFF	Upper thread trimming
	ON	Upper and lower thread trimming
7	ON	Material will be still held after sewing is completed.
	OFF	Material will be release after sewing is completed.
8	ON	The home position will be detected after sewing is performed for the specified number of times.
	OFF	The home position will always be detected after sewing is completed every time.

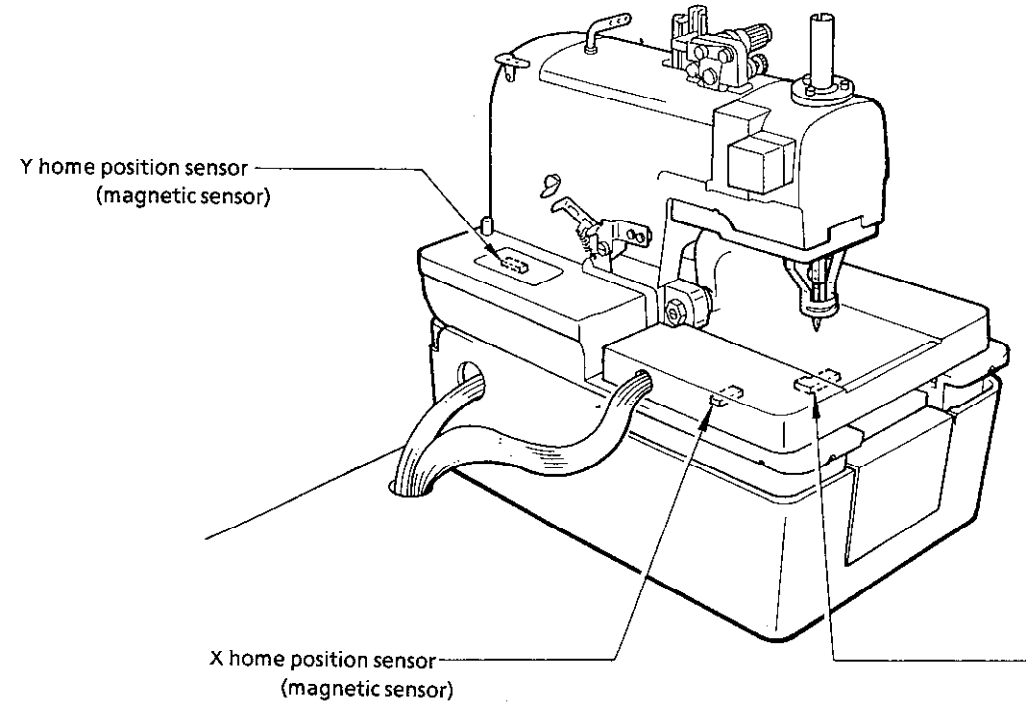
When the setting of PCB DIP switch No. 6 is changed to on, the stitch length will be automatically changed to 38 mm if it has been set to 39 mm or greater.

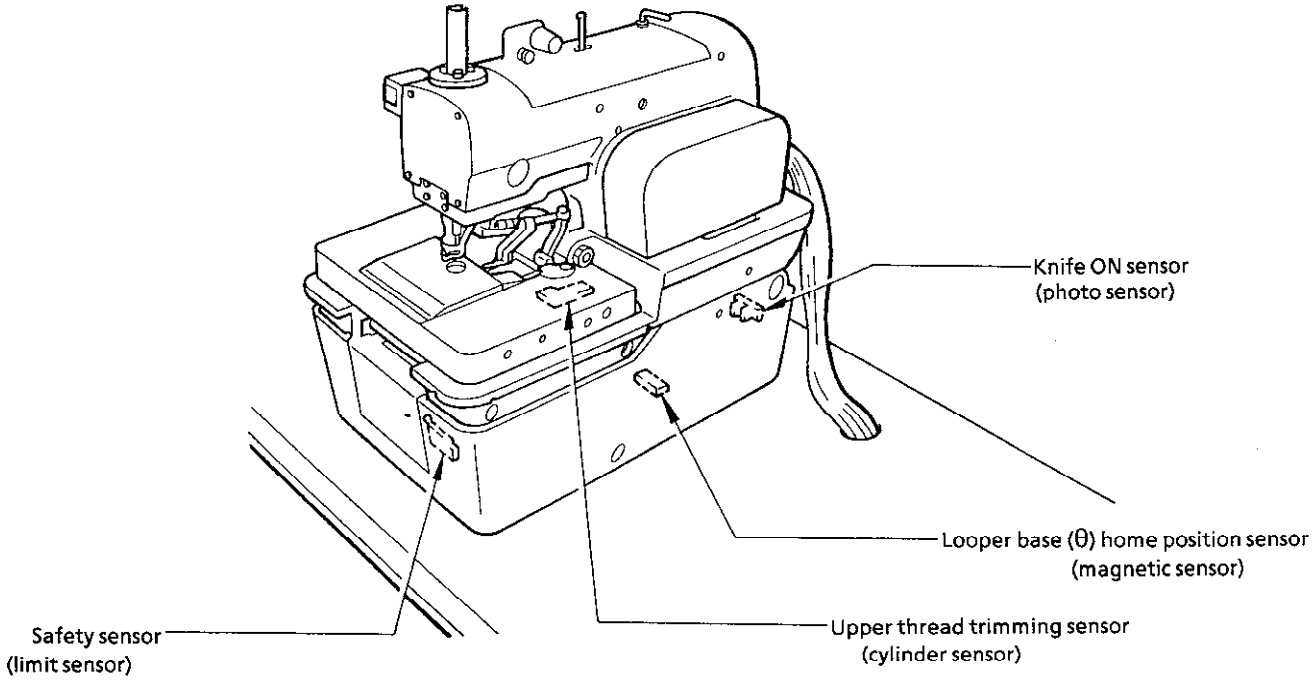
*The DIP switches are set before shipment from the factory as follows:



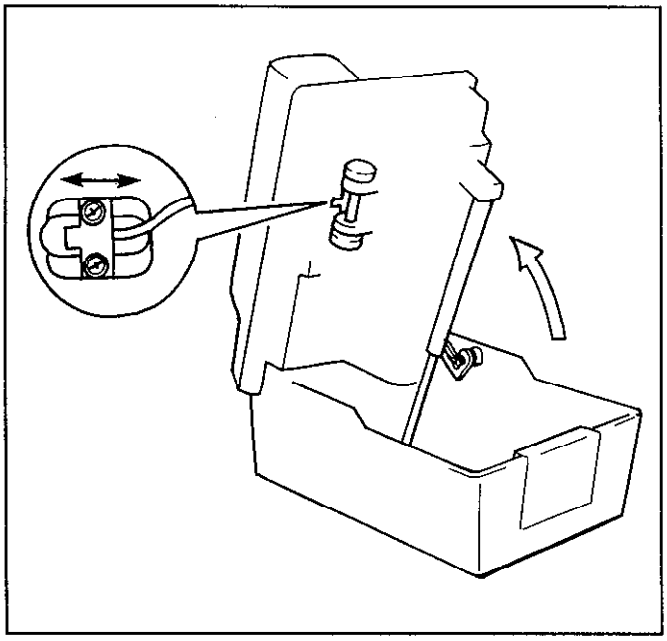
5-5. Sensors

◦ Sensors positions



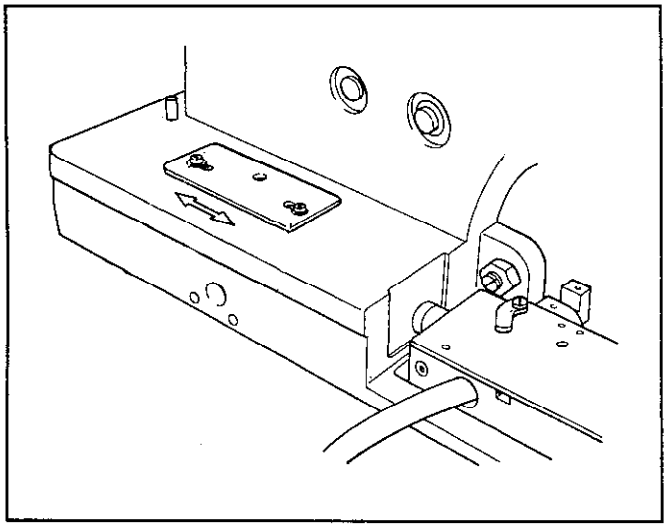


1) X home position sensor



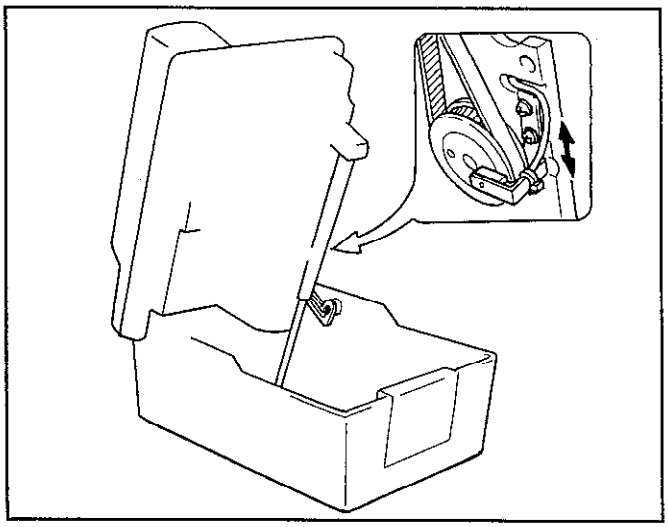
1. The X home position sensor determines the home position of the feed bracket in the X direction.
2. When the feed bracket is on the left of the head, the X home position sensor is set to off, and when right, set to on.
3. When the home position is detected, the X home position sensor is turned on.
4. If the X home position sensor is out of order, its connectors are not attached correctly, or the cord does not flow electricity, error code E-50 or E-80 will appear.

2) Y home position sensor



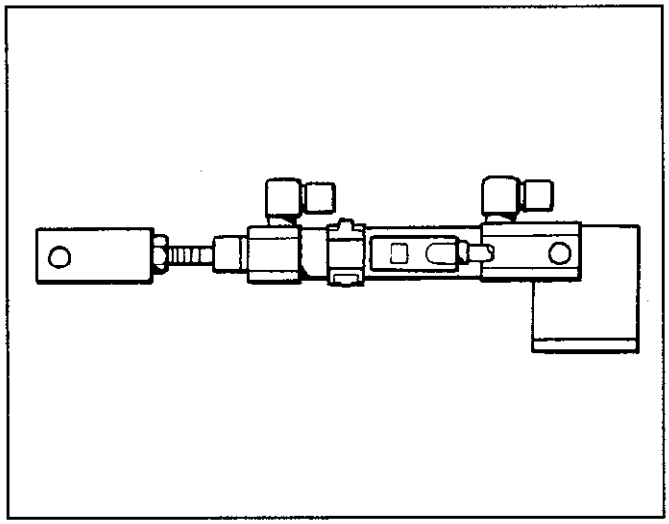
1. The Y home position sensor determines the home position of the feed bracket in the Y direction.
2. The Y home position sensor is set to on only when the feed bracket is at the home position.
3. If the Y home position sensor is out of order, its connectors are not attached correctly, or the cord does not supply electricity, error code E-51 or E-81 will appear.

3) Looper base home position sensor (θhome position sensor)



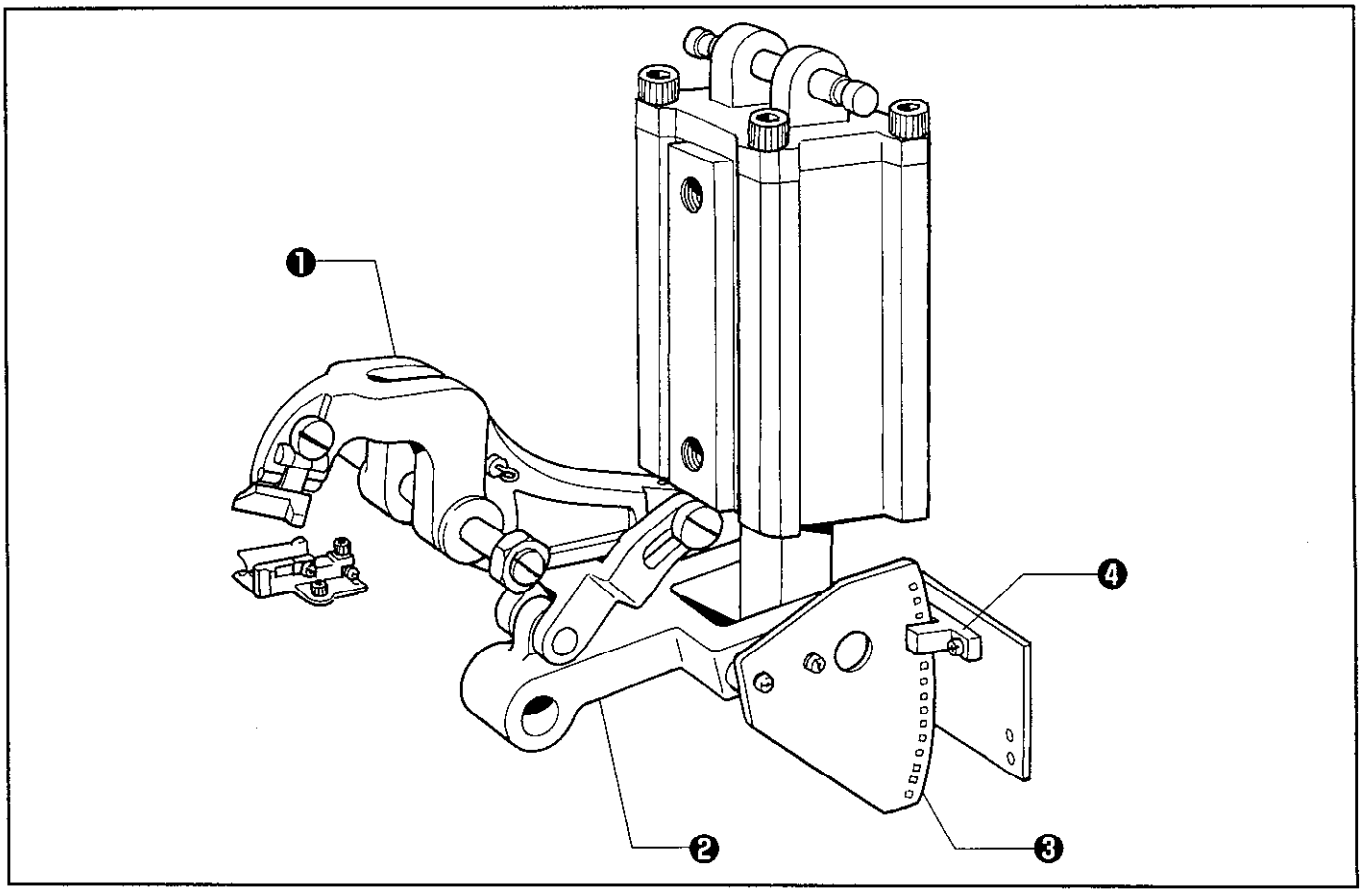
1. The looper base home position sensor determines the home position of the looper base (when it is at 0°).
2. The looper base home position sensor is set to on only when the looper base is at the home position.
3. If the looper base home position sensor is out of order, its connectors are not attached correctly, or the cord does not supply electricity, error code E-52 or E-82 will appear.

4) Upper thread trimmer OFF sensor



1. The upper thread trimmer OFF sensor is attached to the cylinder which drives upper thread trimmer.
2. The upper thread trimmer OFF sensor is intended to check that that the thread trimmer lever hammer is securely set to OFF.
3. If the upper thread trimmer OFF sensor is out of order or attached incorrectly, its connectors are not attached correctly, or the cord does not flow electricity, error code E-16, E-46, or E-76 will appear.

5) Knife ON sensor

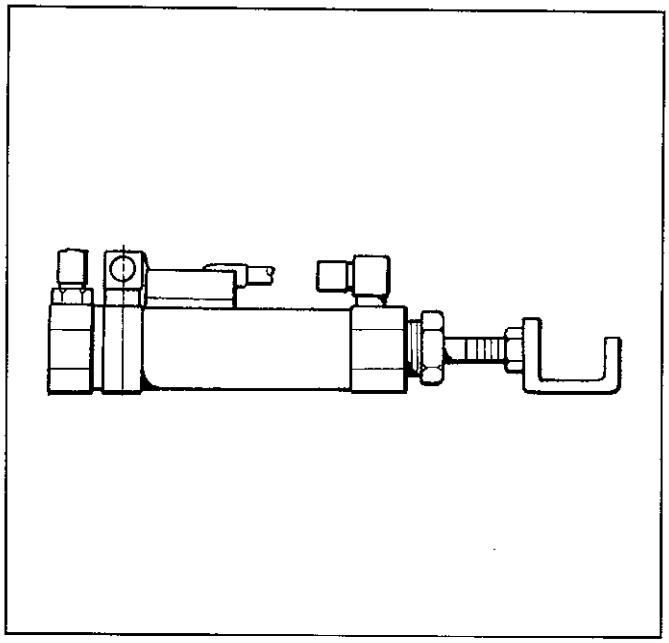


1. The knife ON sensor is intended to sense that the operation of the cutter lever ❶ has been completed, and to know the cutter lever ❶ lift stroke.
2. The cutter sensor partition plate (slit) ❸ is attached to link C ❷ which moves the cutter lever ❶. The signal is sent from the cutter sensor ❹ mounted on the bed.

A ..... The end of knife ON sensor's operation is when the knife ON signal is not cyclically changed for a fixed period. The period can be changed according to the setting of DIP switches Nos. 1 and 2.

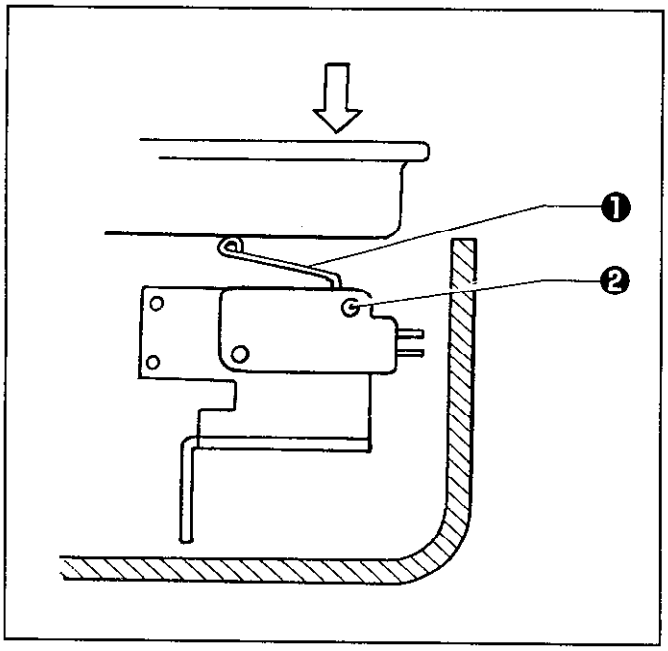
B ..... When the cutter lever is off, the number of times of switching on and off of the knife ON signal will be counted. The cutter mechanism is programmed so that after the cutter lever has risen a fixed amount, the next operation starts.

6) Lower thread trimmer OFF sensor



1. The lower thread trimmer OFF sensor is attached to the cylinder which drives the lower thread trimmer.
2. The lower thread trimmer OFF sensor is intended to make the lower thread trimmer securely set to off.
3. If the lower thread trimmer OFF sensor is out of control or attached incorrectly, its connectors are not attached correctly, or the cord does not supply electricity, error code E-15, E-45, or E-75 will appear.

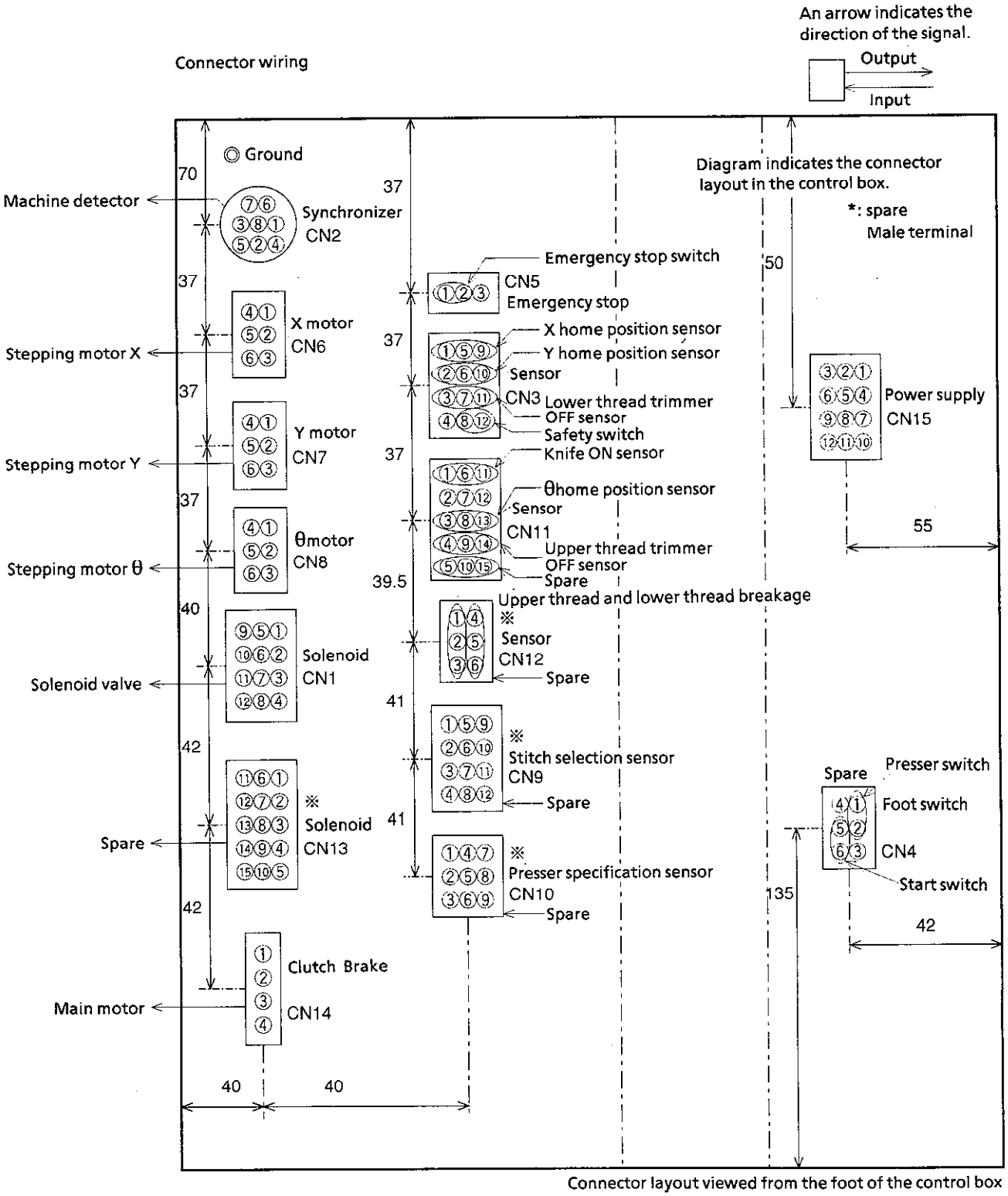
7) Safety sensor



1. The limit switch is attached to the front of the bed.
2. The safety sensor is intended to check that the machine head is positioned correctly for safe operation.
3. The safety sensor will be activated to stop all motions when the machine head is raised during sewing.
4. If the machine head is kept raised, the safety sensor is out of control, its connectors are not attached securely, or the cord does not flow electricity, error code E-02, E-32, or E-62 will appear.

5-6. Connectors in the control box

1) Connector layout



Connector layout viewed from the foot of the control box

2) Connector explanation

CN 1 (solenoid) MOLEX 5025-12P (white)

No.	Signal	Use	Terminal
1	LTRIM	Lower thread trimming	Socket
2	UTRIM	Upper thread trimming	
3	UTL	Upper thread tightening	
4	KNIFE	Knife	
5	+ 30V		
6	+ 30V		
7	+ 30V		
8	+ 30V		
9	WHLD	Cloth presser	
10	+ 30V		
11	+ 30V		
12	OPEN	Cloth stretching	

CN 2 (synchronizer) SMK S-13364#1

No.	Signal	Use	Terminal
1	–		Socket
2	VCC	+ 5V	
3	DN	Needle down position	
4	0V	0V	
5	0V	0V	
6	–		
7	UP	Needle up position	
8	PG	Synchronizer signal	

CN 3 (sensor) AMP 172162-1 (white)

No.	Signal	Use	Terminal
1	+ 12V	(for X home position sensor)	Socket
2	+ 12V	(for Y home position sensor)	
3	+ 12V	(for lower thread trimmer OFF sensor)	
4	–	–	–
5	X HOME	X home position	Socket
6	Y HOME	Y home position	
7	DTIM OFF	Lower thread trimmer OFF sensor	
8	HED SW	Safety switch	
9	0V	(for X home position sensor)	
10	0V	(for Y home position sensor)	
11	0V	(for lower thread trimmer OFF sensor)	
12	0V	(for safety switch)	

CN 4 (foot switch) AMP 770087-1 (white)

No.	Signal	Use	Terminal
1	S12	Start switch	Socket
2	0V	(for start switch)	
3	S10	Cloth presser switch	
4	0V	(for spare)	
5	S11	Spare	
6	0V	(for cloth presser switch)	

CN 5 (emergency stop) AMP 172158-1 (white)

No.	Signal	Use	Terminal
1	STOP	Emergency stop	Socket
2	0V	(for emergency stop)	
3	0V		

CN 6 (X motor) MOLEX 3191-06P (white)

No.	Signal	Use	Terminal
1	–		–
2	XAN		Pin
3	XAP		
4	–		–
5	XBP		Pin
6	XBN		

CN 7 (X motor) MOLEX 3191-06P-BU (blue)

No.	Signal	Use	Terminal
1	–		–
2	YAP		Pin
3	YAN		Socket
4	–		–
5	YBP		Pin
6	YBN		Socket

CN 8 (θmotor) MOLEX 3191-06P-BL (black)

No.	Signal	Use	Terminal
1	–		–
2	θBN		Socket
3	θBP	–	Pin
4	–		–
5	θAP		Socket
6	θAN		Pin

* CN 9 (sensor) AMP 1-172162-9 (black)

No.	Signal	Use	Terminal
1	+ 12V	+ 12V	Pin
2	+ 12V	+ 12V	Socket
3	+ 12V	+ 12V	
4	+ 12V	+ 12V	
5		Stitch type selection	
6		Stitch type selection	
7		Stitch type selection	
8		Stitch type selection	
9	0V	0V	
10	0V	0V	
11	0V	0V	
12	0V	0V	Pin

* CN 10 (sensor) AMP 172161-1 (white)

No.	Signal	Use	Terminal
1	+ 12V	+ 12V	Pin
2	+ 12V	+ 12V	Socket
3	+ 12V	+ 12V	
4		Presser specification selection	
5		Presser specification selection	
6		Presser specification selection	
7	0V	0V	
8	0V	0V	
9	0V	0V	Pin

* Spare

* CN 11 (sensor) AMP 172163-1 (white)

No.	Signal	Use	Terminal
1	+ 12V (PRU)	(for knife ON sensor)	Socket
2	+ 12V	Spare	
3	+ 12V	(for θhome position sensor)	
4	+ 12V	(for upper thread trimmer OFF sensor)	
5	+ 12V	Spare	
6	MES ON	Knife ON sensor	
7		Spare	
8	θ HOME	θhome position sensor	
9	UTIM OFF	Upper thread trimmer OFF sensor	
10		Spare	
11	0V	(for knife ON sensor)	
12	0V	Spare	
13	0V	(θhome position sensor)	
14	0V	(for upper thread trimmer OFF sensor)	
15	0V	Spare	

* CN 12 (sensor) AMP 172160-1 (white)

No.	Signal	Use	Terminal
1	+ 12V	+ 12V	Socket
2		Spare	
3	0V	0V	
4	+ 12V	+ 12V	
5		Spare	
6	0V	0V	

* CN 13 (solenoid) MOLEX 5025-15P (white)

No.	Signal	Use	Terminal
1		Spare	Socket
2	THOLD1	Upper thread nipper 1	
3	THOLD2	Upper thread nipper 2	
4	RESERVE	Spare	
5	RESERVE	Spare	
6	+ 30V	+ 30V	
7	+ 30V	+ 30V	
8	+ 30V	+ 30V	
9	+ 30V	+ 30V	
10	+ 30V	+ 30V	
11	RESERVE	Spare	
12	+ 30V	+ 30V	
13	+ 30V	+ 30V	
14	RESERVE	Spare	
15	–	–	

* Spare

CN 14 (clutch, brake, and main shaft) MOLEX 3191-04P (white)

No.	Signal	Use	Terminal
1	CL	Clutch	Socket
2	+ 30V	(for clutch)	
3	+ 30V	(for brake)	
4	BK	Brake	

CN 15 (power supply) MOLEX 3191-12P (white)

No.	Signal	Use		Terminal
1	P0	Transformer tap	P0	Socket
2	105V		105V	
3	115V		115V	
4	170V		170V	
5	210V		210V	
6	P0		P0	
7	105V		105V	
8	115V		115V	
9	210V		210V	
10	E	Ground		
11	–	–		–
12	–			

◆Sewing specifications

CN9

5, 6, 7, 8	Specifications
L, L, L, L	With bar tack
L, L, L, H	Spare
H, H, H, L	Spare
H, H, H, H	Standard (with taper bar)

◆Presser specifications

CN10

4, 5, 6	Specifications
L, L, L	L1 (14 - 18mm)
L, L, H	L2 (18 - 22mm)
L, H, L	L3 (22 - 26mm)
L, H, H	L4 (26 - 30mm)
H, L, L	Spare
H, L, H	Spare
H, H, L	Spare
H, H, H	Standard (10 - 38mm)

5-7. Harness connection in the control box

1) Harness connection between the control box and the printed circuit boards

CN 1 (solenoid) MOLEX 5025-12P (white)

No.	Signal	CPU PCB
1	LTRIM	CON4-3
2	UTRIM	CON4-4
3	UTL	CON4-6
4	KNIFE	CON6-2
5	+30V	CON4-2
6	+30V	CON4-5
7	+30V	CON4-5
8	+30V	CON4-1
9	WHLD	CON5-1
10	+30V	CON5-2
11	+30V	CON5-2
12	OPEN	CON5-3

CN 2 (synchronizer) SMK S-13364#01

No.	Signal	CPU PCB
1	–	–
2	VCC	CON14-1
3	DN	CON14-3
4	0V	CON14-5
5	0V	CON14-5
6	–	–
7	UP	CON14-2
8	PG	CON14-4

CN 3 (sensor) AMP 172162-1 (white)

No.	Signal	CPU PCB
1	+12V	CON16-1
2	+12V	CON16-1
3	+12V	CON16-2
4	–	–
5	X HOME	CON16-3
6	Y HOME	CON16-4
7	DTIM OFF	CON16-5
8	HED SW	CON16-6
9	0V	CON16-7
10	0V	CON16-7
11	0V	CON16-7
12	0V	CON16-7

CN 4 (foot switch) AMP 770087-1 (white)

No.	Signal	CPU PCB
1	S12	CON13-3
2	0V	CON13-4
3	S10	CON13-1
4	0V	CON13-4
5	S11	CON13-2
6	0V	CON13-4

CN 5 (emergency stop) AMP 172158-1 (white)

No.	Signal	CPU PCB
1	STOP	CON15-1
2	0V	CON15-2
3	0V	CON15-3

CN 6 (X motor) MOLEX 3191-06P (white)

No.	Signal (lead color)	PMD PCB
1	–	–
2	XAN (black)	CONX-1
3	XAP (red)	CONX-2
4	–	–
5	XBP (white)	CONX-5
6	XBN (green)	CONX-6

CN 7 (Y motor) MOLEX 3191-06P-BU (blue)

No.	Signal (lead color)	PMD PCB
1	–	–
2	YAP (red)	CONY-6
3	YAN (white)	CONY-5
4	–	–
5	YBP (black)	CONY-1
6	YBN (green)	CONY-2

CN 8 (θ motor) MOLEX 3191-06P-BL (black)

No.	Signal (lead color)	PMD PCB
1	–	–
2	θBN (black)	CONθ-6
3	θBP (white)	CONθ-5
4	–	–
5	θAP (red)	CONθ-2
6	θAN (green)	CONθ-1

CN 9 (sensor) AMP 1-172162-9 (black)

No.	Signal	CPU PCB
1	+ 12V	CON2-1
2	+ 12V	CON2-1
3	+ 12V	CON2-1
4	+ 12V	CON2-1
5	θ LIMI	CON2-3
6	US CUTS	CON2-4
7	UTHRD BK	CON2-5
8	UTLS	CON2-6
9	0V	CON2-10
10	0V	CON2-10
11	0V	CON2-10
12	0V	CON2-10

CN 10 (sensor) AMP 172161-1 (white)

No.	Signal	CPU PCB
1	+ 12V	CON2-2
2	+ 12V	CON2-2
3	+ 12V	CON2-2
4	DTHRD BK	CON2-7
5	WHLDS	CON2-8
6	OPENS	CON2-9
7	0V	CON2-11
8	0V	CON2-11
9	0V	CON2-11

CN 11 (sensor) AMP 172163-1 (white)

No.	Signal	CPU PCB
1	+ 12V (PRU)	CON11-8
2	+ 12V	CON11-1
3	+ 12V	CON11-1
4	+ 12V	CON11-1
5	+ 12V	CON11-1
6	MES ON	CON11-3
7	MES OFF	CON11-4
8	θ HOME	CON11-5
9	UTIM OFF	CON11-6
10	DTIM ON	CON11-10
11	0V	CON11-7
12	0V	CON11-7
13	0V	CON11-7
14	0V	CON11-7
15	0V	CON11-7

CN 12 (sensor) AMP 172160-1 (white)

No.	Signal	CPU PCB
1	+ 12V	CON12-1
2	UTHRD HLD ON	CON12-2
3	0V	CON12-4
4	+ 12V	CON12-1
5	UTHRD HLD OFF	CON12-3
6	0V	CON12-5

CN 13 (solenoid) MOLEX 5025-15P (white)

No.	Signal	CPU PCB
1	UCUT	CON5-4
2	THOLD1	CON5-6
3	THOLD2	CON5-7
4	RESERVE	CON6-3
5	RESERVE	CON6-5
6	+ 30V	CON5-5
7	+ 30V	CON5-5
8	+ 30V	CON6-7
9	+ 30V	CON6-1
10	+ 30V	CON6-1
11	RESERVE	CON6-6
12	+ 30V	CON6-4
13	+ 30V	CON6-4
14	RESERVE	CON6-8
15	–	–

CN 14 (clutch and brake) MOLEX 3191-04P (white)

No.	Signal	CPU PCB
1	CL	CON10-1
2	+ 30V	CON10-2
3	+ 30V	CON10-3
4	BK	CON10-4

CN 15 (power supply) MOLEX 3191-12P (white)

No.	Signal
1	P0
2	105V
3	115V
4	170V
5	210V
6	P0
7	105V
8	115V
9	210V
10	E
11	–
12	–

2) Connection between printed circuit boards (PCBs)

Connection between A1A-PAL and A1B-PAL

A1A-PAL PCB	Signal	A1B-PAL PCB
CON3-1	+ 5V	CON2-1
CON3-2	+ 5V	CON2-2
CON3-3	R7	CON2-3
CON3-4	R6	CON2-4
CON3-5	R5	CON2-5
CON3-6	R4	CON2-6
CON3-7	SY1	CON2-7
CON3-8	SY4	CON2-8
CON3-9	SY5	CON2-9
CON3-10	SY6	CON2-10
CON3-11	SA3	CON2-11
CON3-12	SA2	CON2-12
CON3-13	SA1	CON2-13
CON3-14	SA0	CON2-14
CON3-15	SB3	CON2-15
CON3-16	SB2	CON2-16
CON3-17	SB1	CON2-17
CON3-18	SB0	CON2-18
CON3-19	0V	CON2-19
CON3-20	0V	CON2-20

Connection between CPU and A1B-PAL

CPU PCB	Signal	A1B-PAL PCB
CON1-1	+ 5V	CON1-1
CON1-2	+ 5V	CON1-2
CON1-3	R0	CON1-3
CON1-4	R1	CON1-4
CON1-5	R2	CON1-5
CON1-6	R3	CON1-6
CON1-7	R4	CON1-7
CON1-8	R5	CON1-8
CON1-9	R6	CON1-9
CON1-10	R7	CON1-10
CON1-11	BZ	CON1-11
CON1-12	S0	CON1-12
CON1-13	S1	CON1-13
CON1-14	S2	CON1-14
CON1-15	BD	CON1-15
CON1-16	OA0	CON1-16
CON1-17	OA1	CON1-17
CON1-18	OA2	CON1-18
CON1-19	OA3	CON1-19
CON1-20	OB0	CON1-20
CON1-21	OB1	CON1-21
CON1-22	OB2	CON1-22
CON1-23	OB3	CON1-23
CON1-24	0V	CON1-24
CON1-25	0V	CON1-25
CON1-26	0V	CON1-26

Connection between the transformer secondary side, CPU, and PMD

Transformer secondary side	Signal (lead color)	CPU PCB	PMD PCB
1	AC12V (black)	CON3-3	–
2	AC12V (black)	CON3-4	–
3	AC100V (brown)	–	CON3-7
4	AC100V (brown)	–	CON3-5
5	AC16V + (blue)	CON3-1	CON3-2
6	AC16V + (blue)	CON3-2	CON3-1
7	AC16V- (yellow)	–	CON3-4
8	AC16V- (yellow)	–	CON3-3
9	AC30V (red)	CON3-5	–
10	AC30V (red)	CON3-6	–
11	–	–	–
12	–	–	–

Connection 1 between CPU and PMD

CPU PCB	Signal	PMD PCB
CON7-1	XAP	CON1-1
CON7-2	XAN	CON1-2
CON7-3	XBP	CON1-3
CON7-4	XBN	CON1-4
CON7-5	YAP	CON1-5
CON7-6	YAN	CON1-6
CON7-7	YBP	CON1-7
CON7-8	YBN	CON1-8
CON7-9	S.M.OCT	CON1-9
CON7-10	RESET	CON1-10

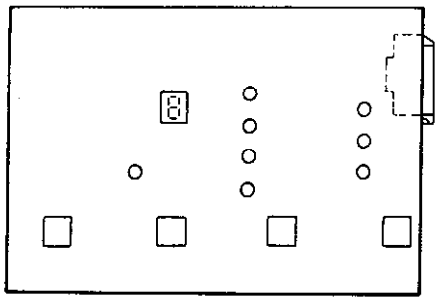
Connection 2 between CPU and PMD

CPU PCB	Signal	PMD PCB
CON8-1	θAP	CON2-1
CON8-2	θAN	CON2-2
CON8-3	θBP	CON2-3
CON8-4	θBN	CON2-4
CON8-5	XPD	CON2-5
CON8-6	YPD	CON2-6
CON8-7	θPD	CON2-7
CON8-8	+ 5V	CON2-8
CON8-9	+ 5V	CON2-9
CON8-10	0V	CON2-10
CON8-11	0V	CON2-11
CON8-12	0V	CON2-12

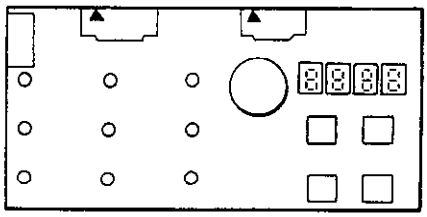
PMD (fan power supply)

No.	Signal
1	+ 12V
2	0V

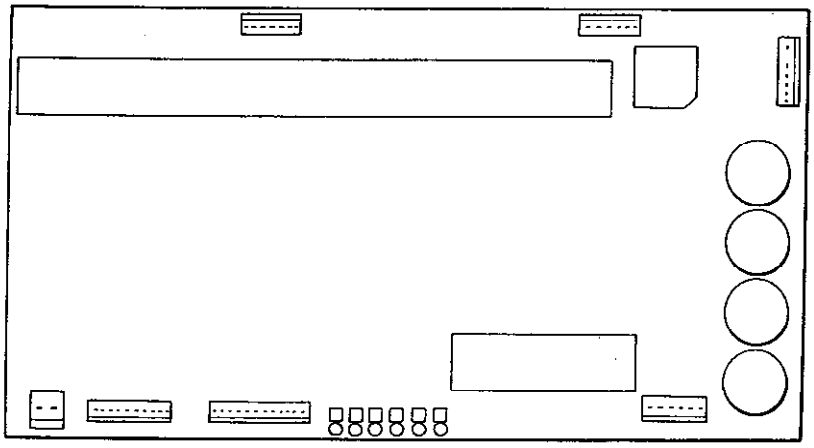
3) PCB connector pin layout



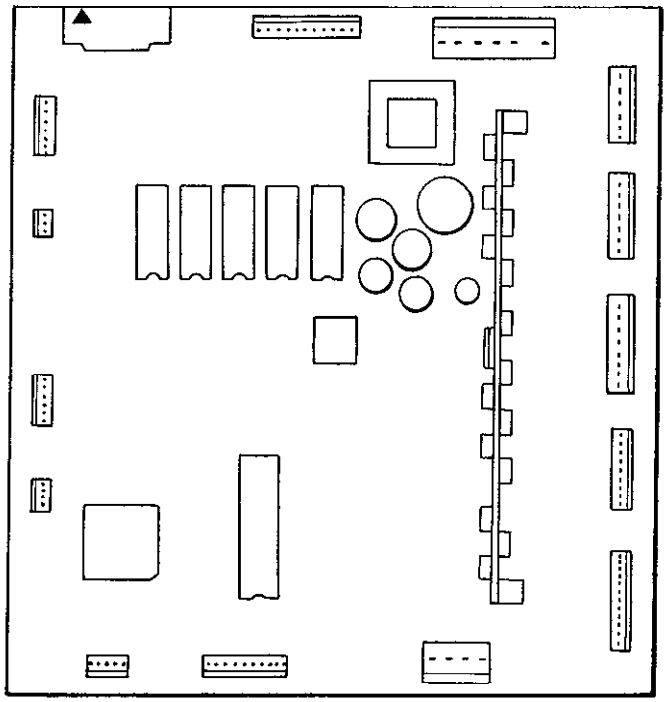
PDH-A1A-PAL



PDH-A1B-PAL

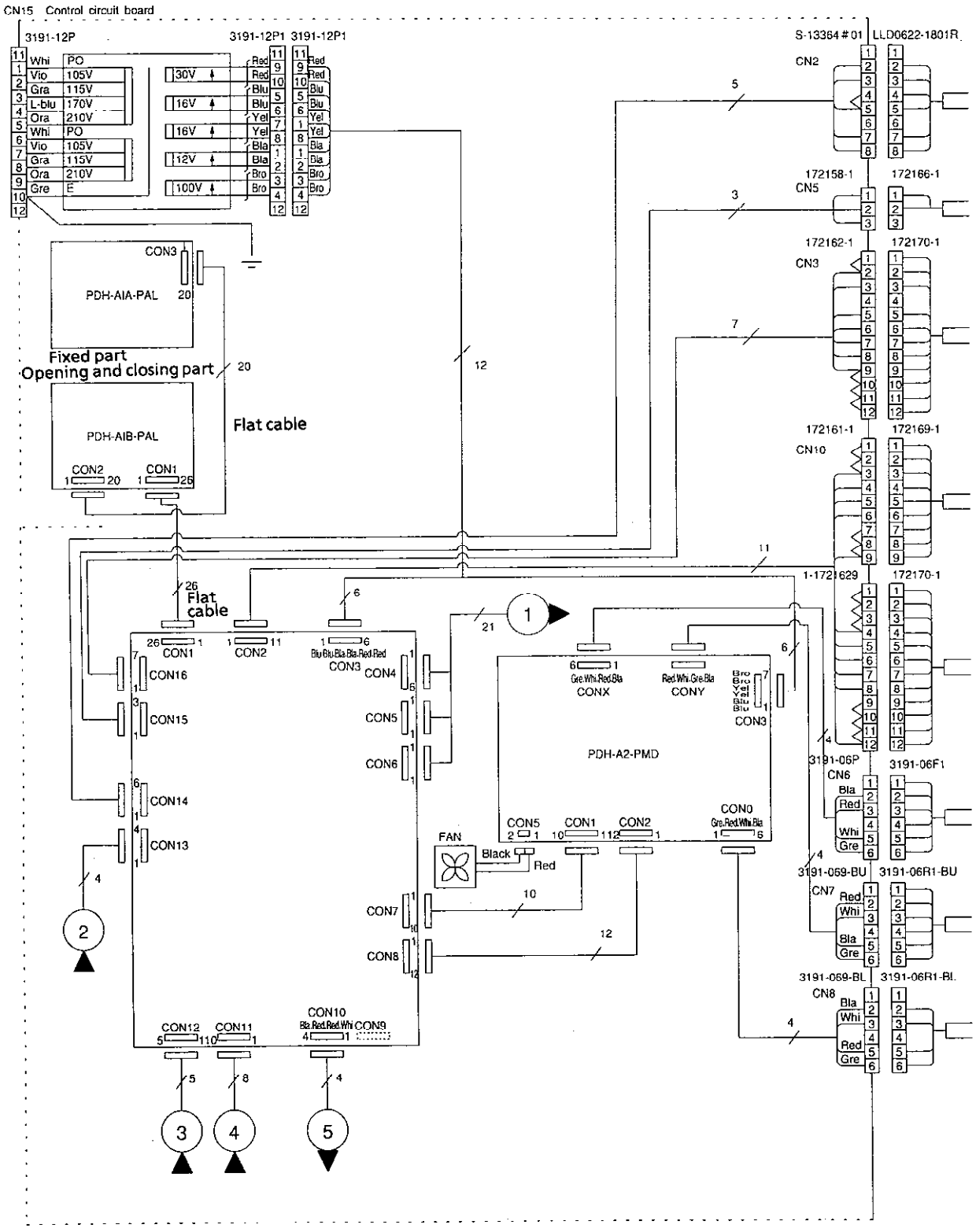


PDH-A2-PMD

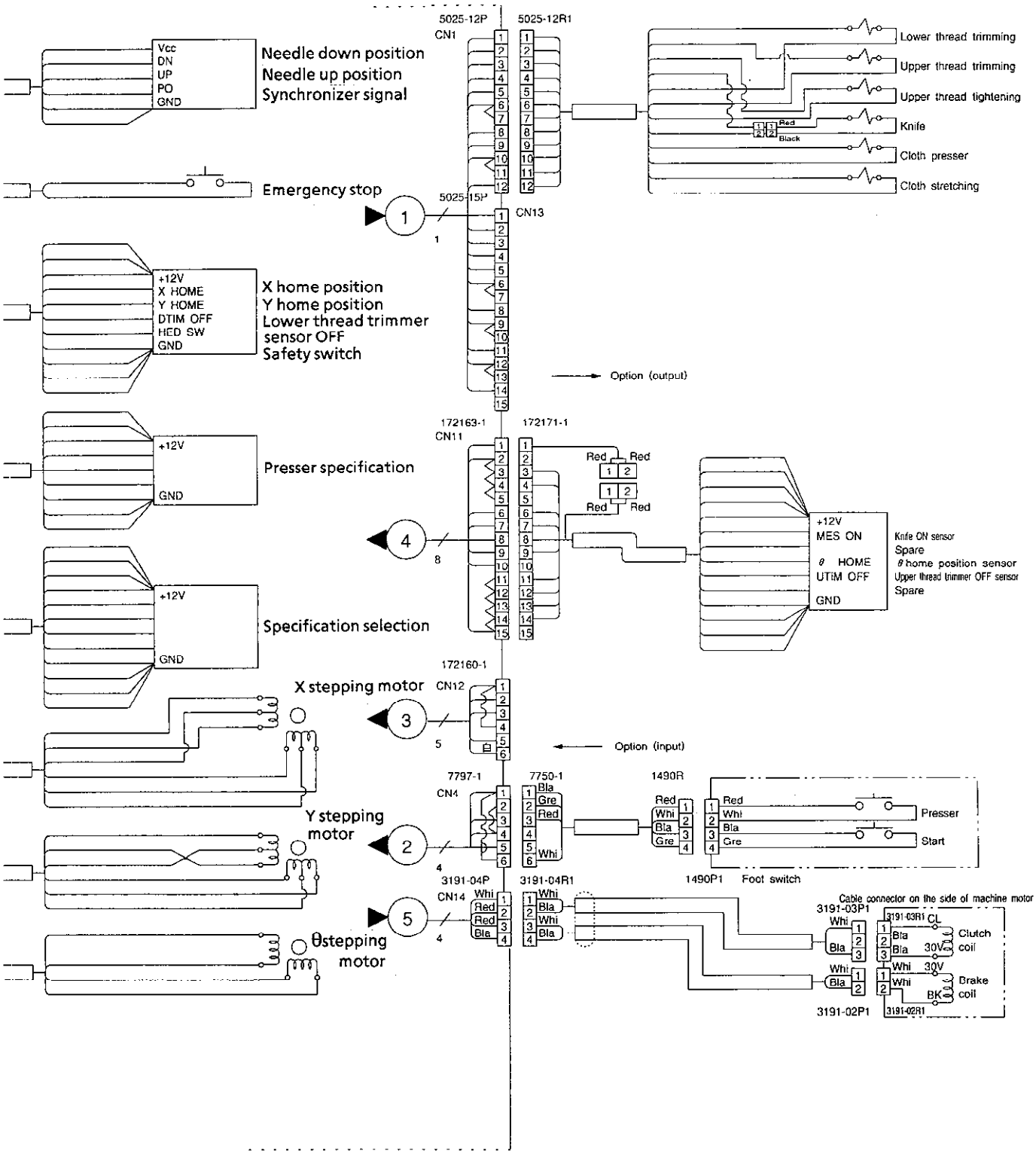


PDH-A1-CPU

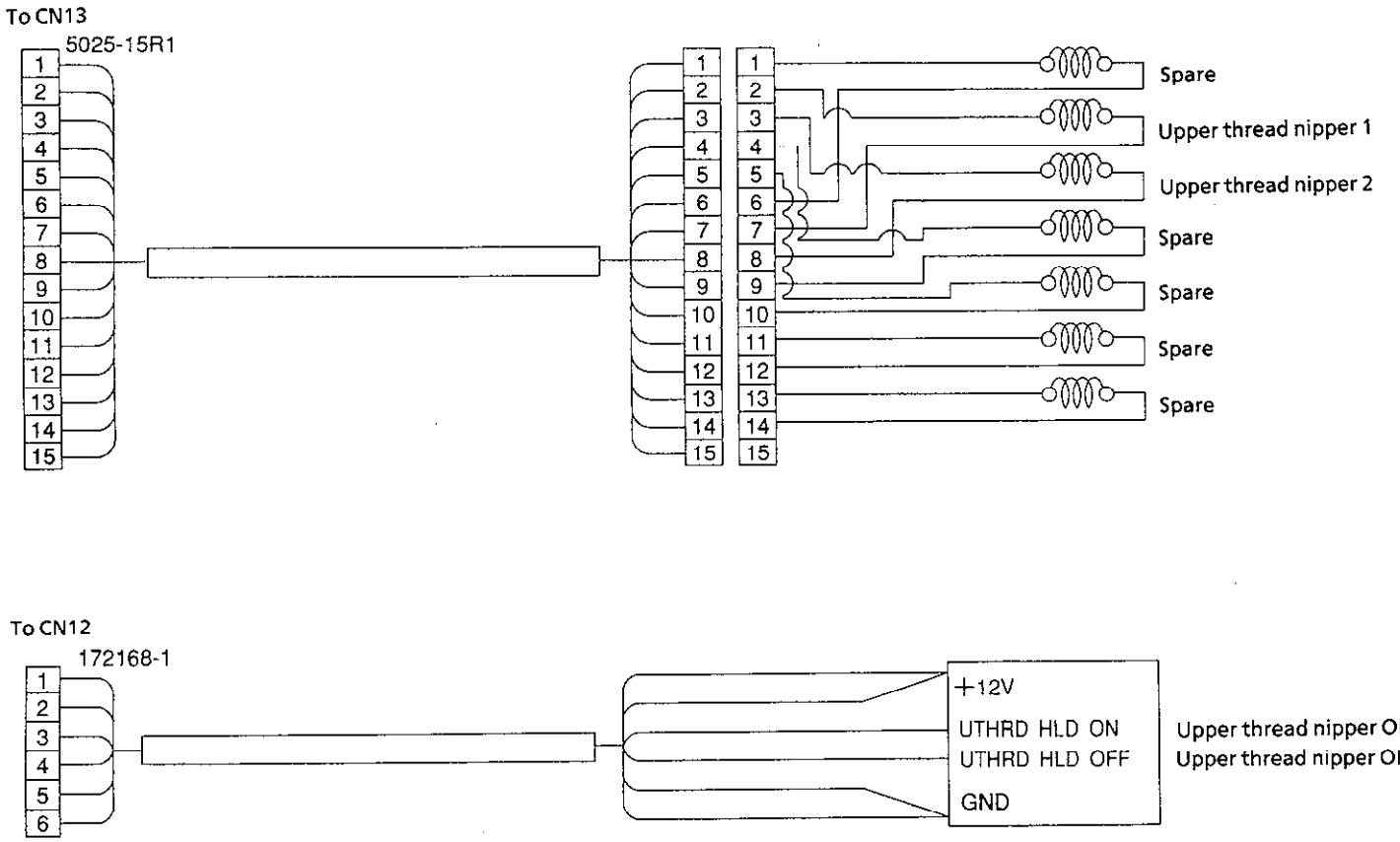
4) Wiring diagram (1/3)



Wiring diagram (2/3)

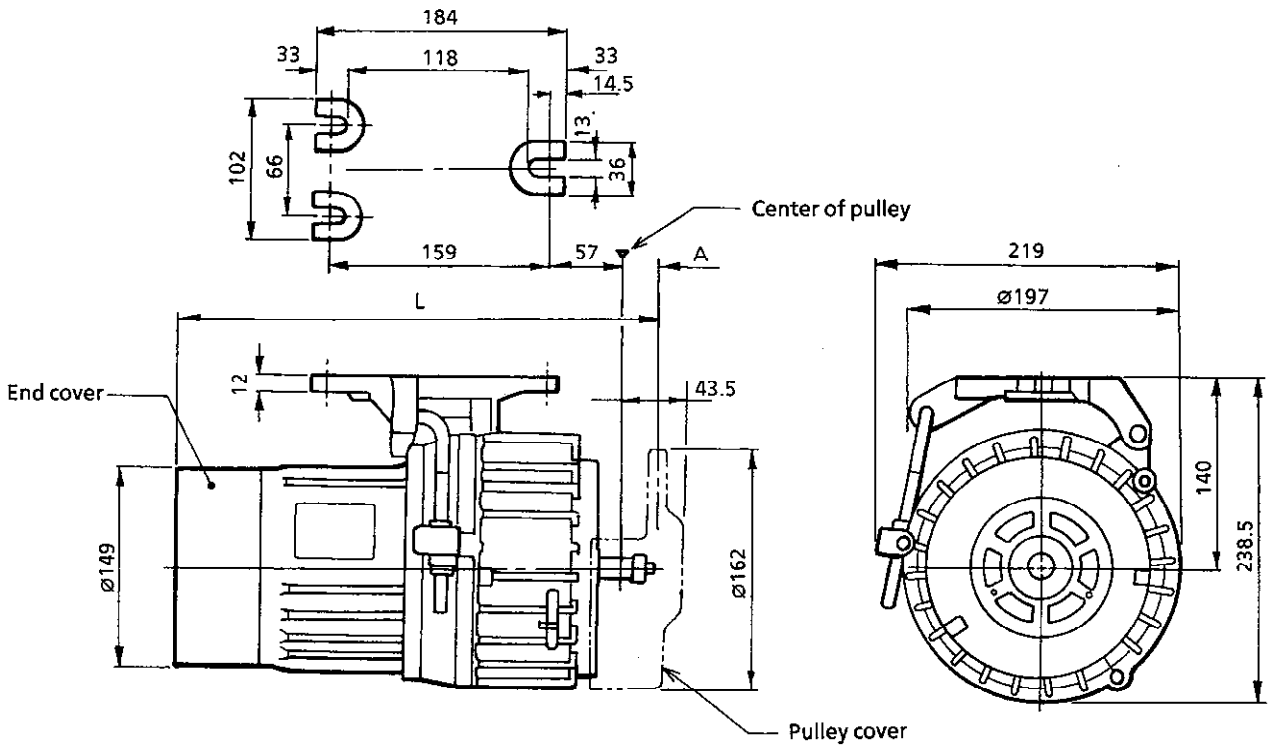


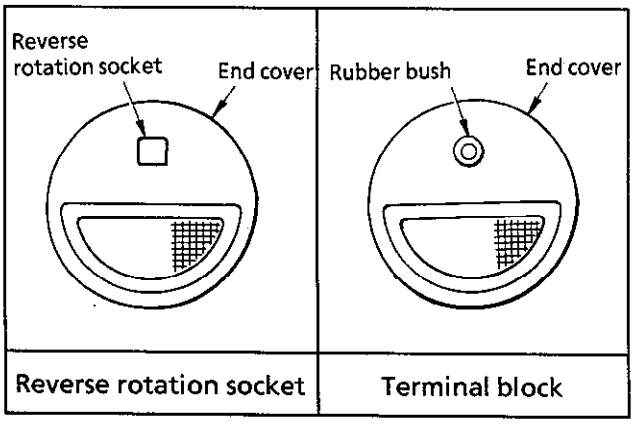
Wiring diagram (3/3)



5-8. Main motor, push button switch, and connecting wire

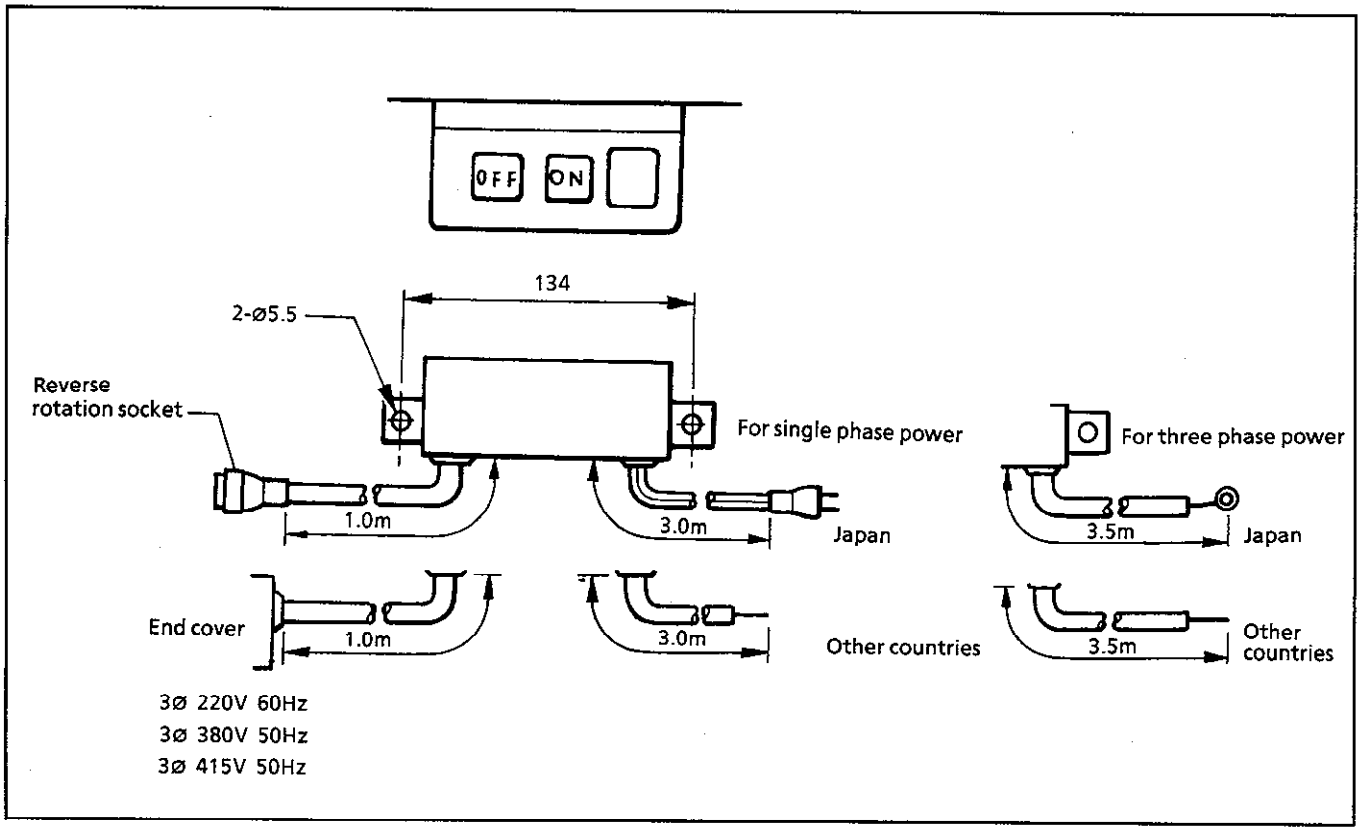
1) Main motor



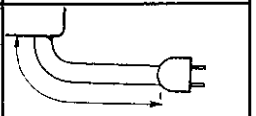
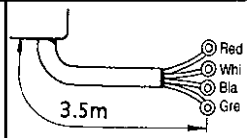
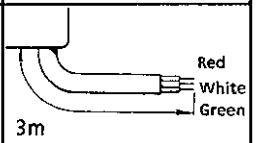
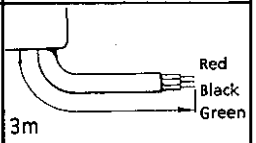
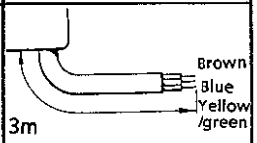
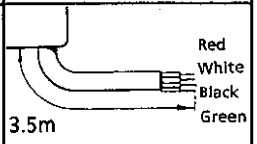
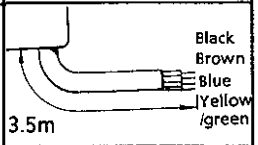
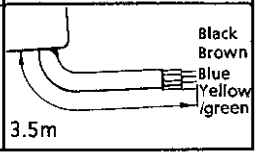


Model \ Dimension	Tapered shaft		Weight
	L	A	(kg)
CA-Z254E	350.5	28.5	28.5
CB-Z254E	350.5	28.5	28

2) Push button switch

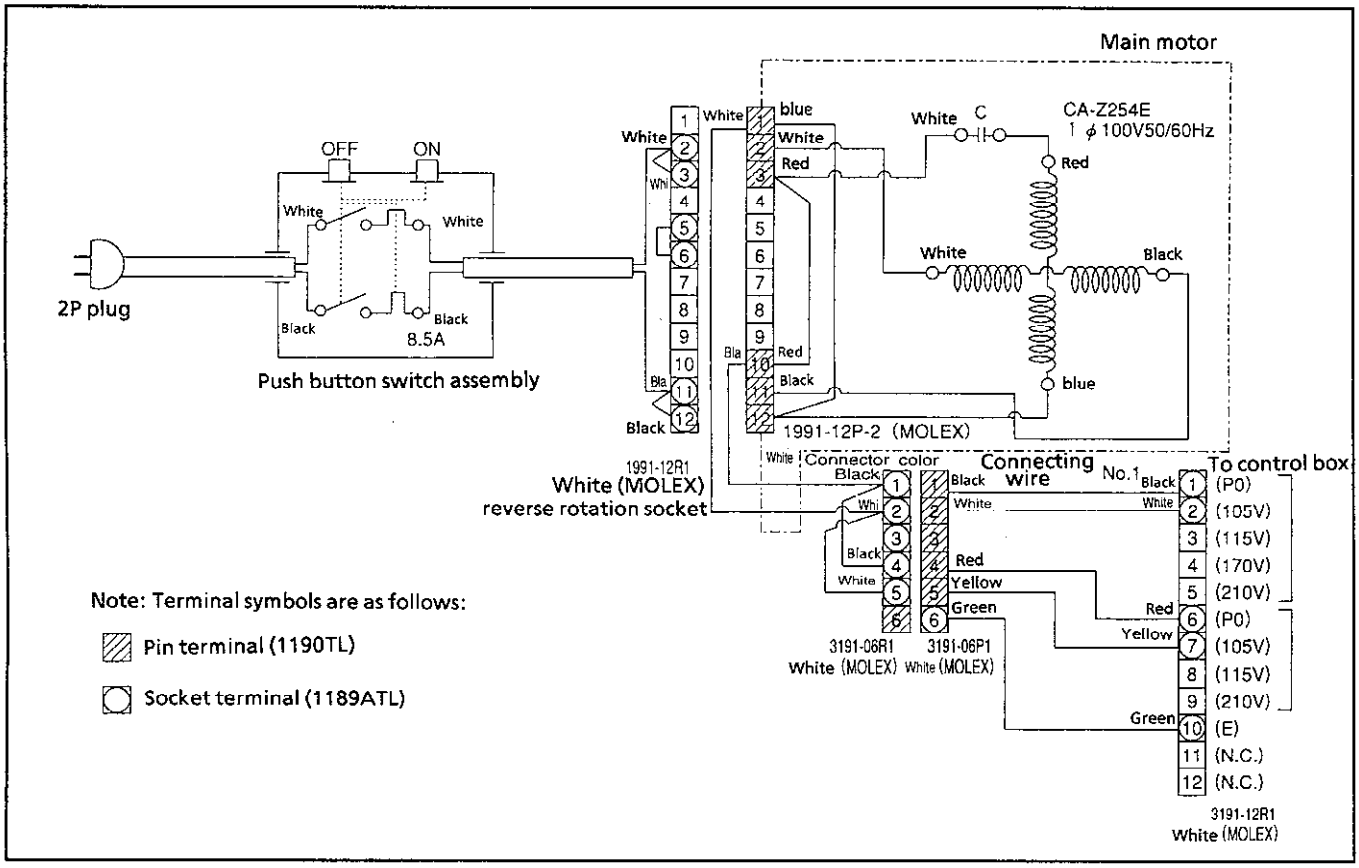


3) Specifications for main motor, push button switch and connecting wire

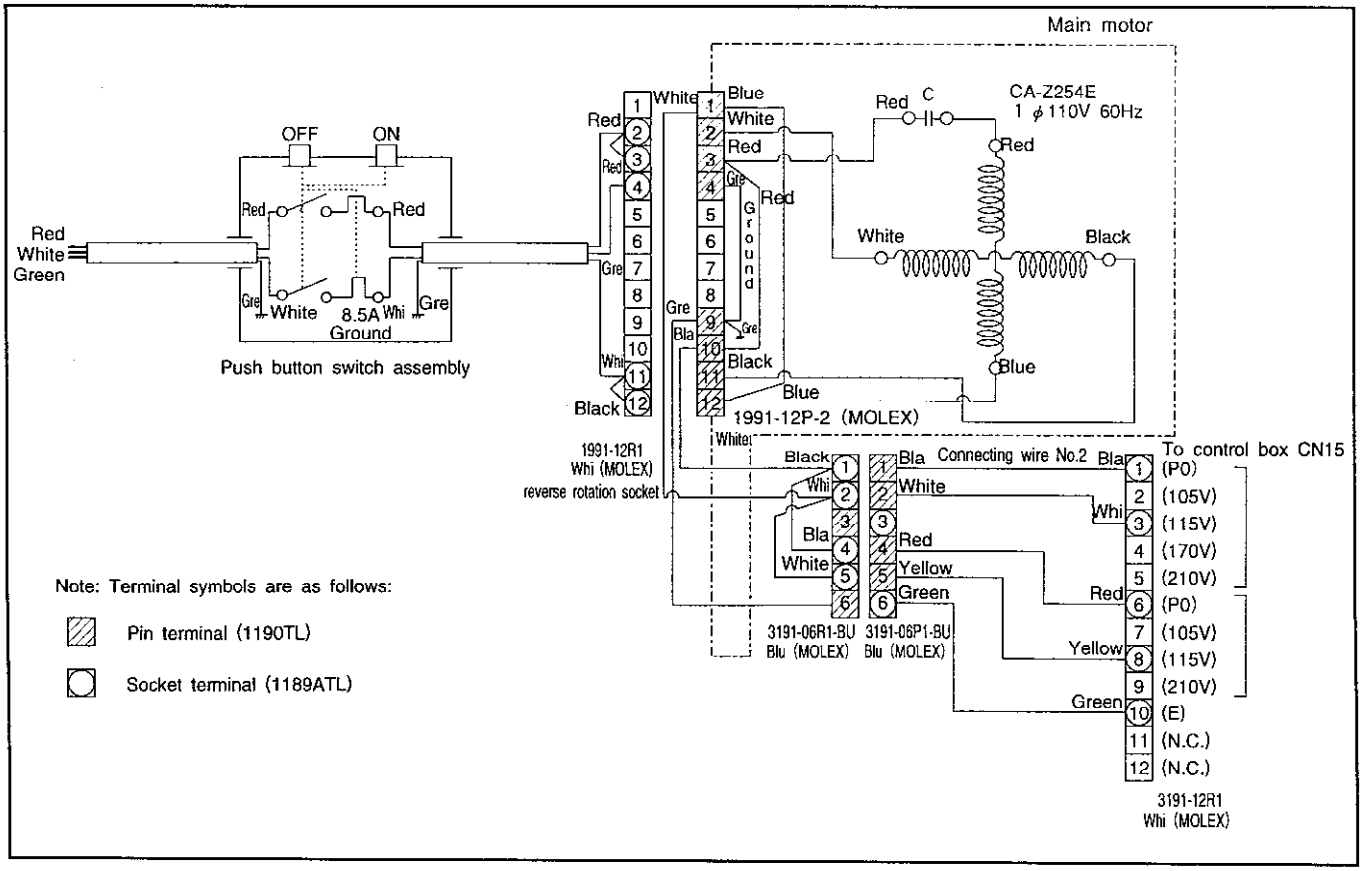
No.	Spec.	Connecting wire (including main motor, push button switch and accessories)	No. of phases	Voltage (V)	Frequency (Hz)	Main motor			Push button switch	
						Motor model	Output (W)	Connected with push button switch	Current (A)	Main power supply connection
1	Japan	A900Z974Z06S S36333-001	1	100	50/60	CA-Z254E 1Ø, 100V, 50/60Hz	250	Reverse rotation socket (12 poles)	8.5	
2	Japan	A900Z975Z06S S36337-001	3	200	50/60	CB-Z254E 3Ø, 200V, 50/60Hz	250	Reverse rotation socket (12 poles)	3.0	
3	US and Taiwan	A900Z976Z06S S36347-001	1	110	60	CA-Z254E 1Ø, 110V, 60Hz	250	Reverse rotation socket (12 poles)	8.5	
4	Hong Kong and Peru	A900Z977Z06S S36350-001	1	200 220	50 50/60	CA-Z254E 1Ø, 200/220V, 50/50/60Hz	250	Reverse rotation socket (12 poles)	4.5	
5	UK	A900Z978Z06S S36512-001	1	230 240	50	CA-Z254E 1Ø, 230/240V, 50Hz	250	Reverse rotation socket (12 poles)	4.5	
6	US and Taiwan	A900Z979Z06S S36341-001	3	220	60	CB-Z254E 3Ø, 220V, 60Hz	250	Terminal block built into the motor	3	
7	Europe	A900Z980Z06S S36344-001	3	380	50	CB-Z254E 3Ø, 380V, 50Hz	250	Terminal block built into the motor	2	
8	UK	A900Z981Z06S S36346-001	3	415	50	CB-Z254E 3Ø, 415V, 50Hz	250	Terminal block built into the motor	2	

4) Wiring diagram (1/2) (push button switch, main motor (Z-axis motor), and connecting wire)

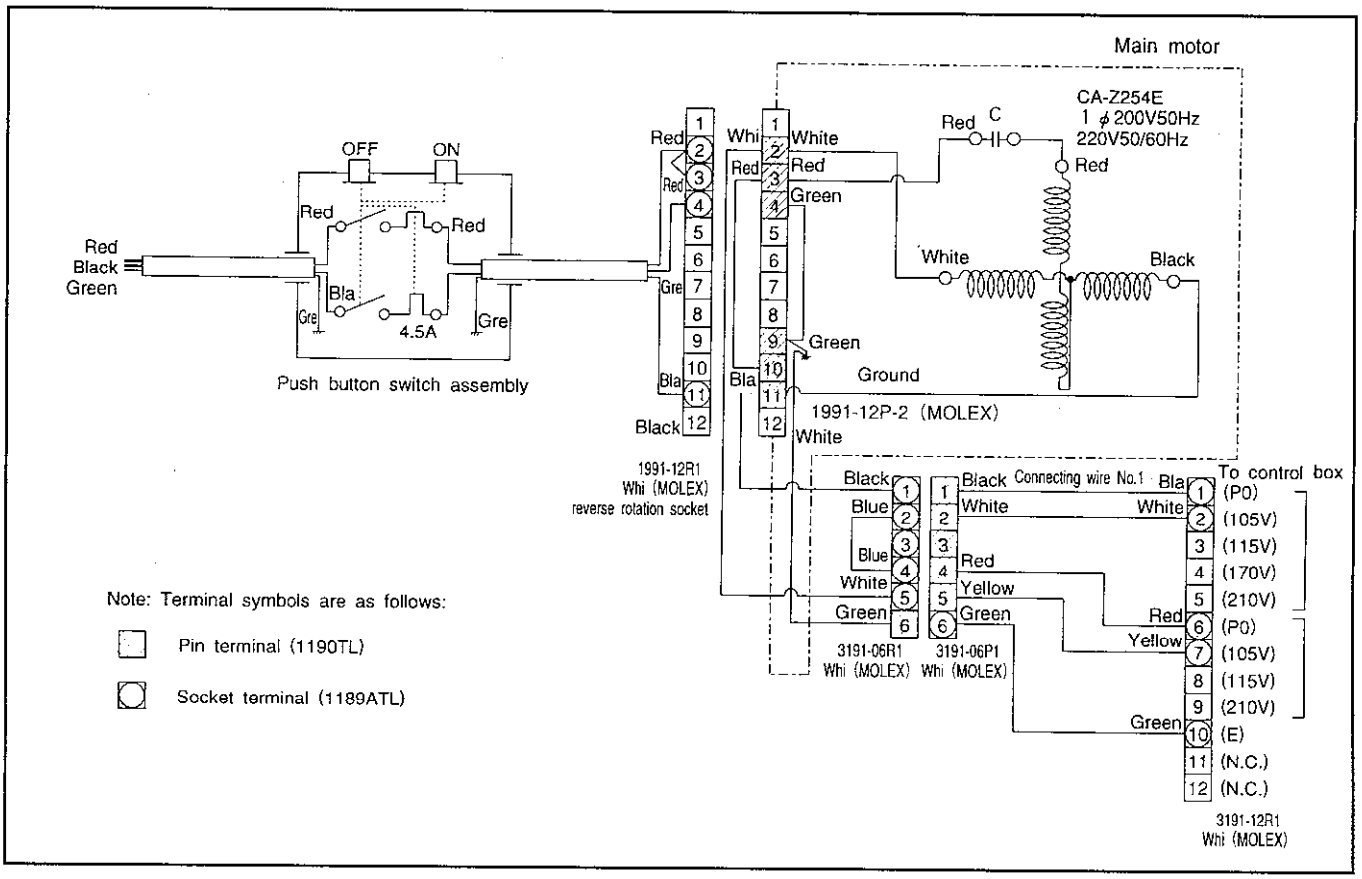
1Ø 100V 50/60Hz



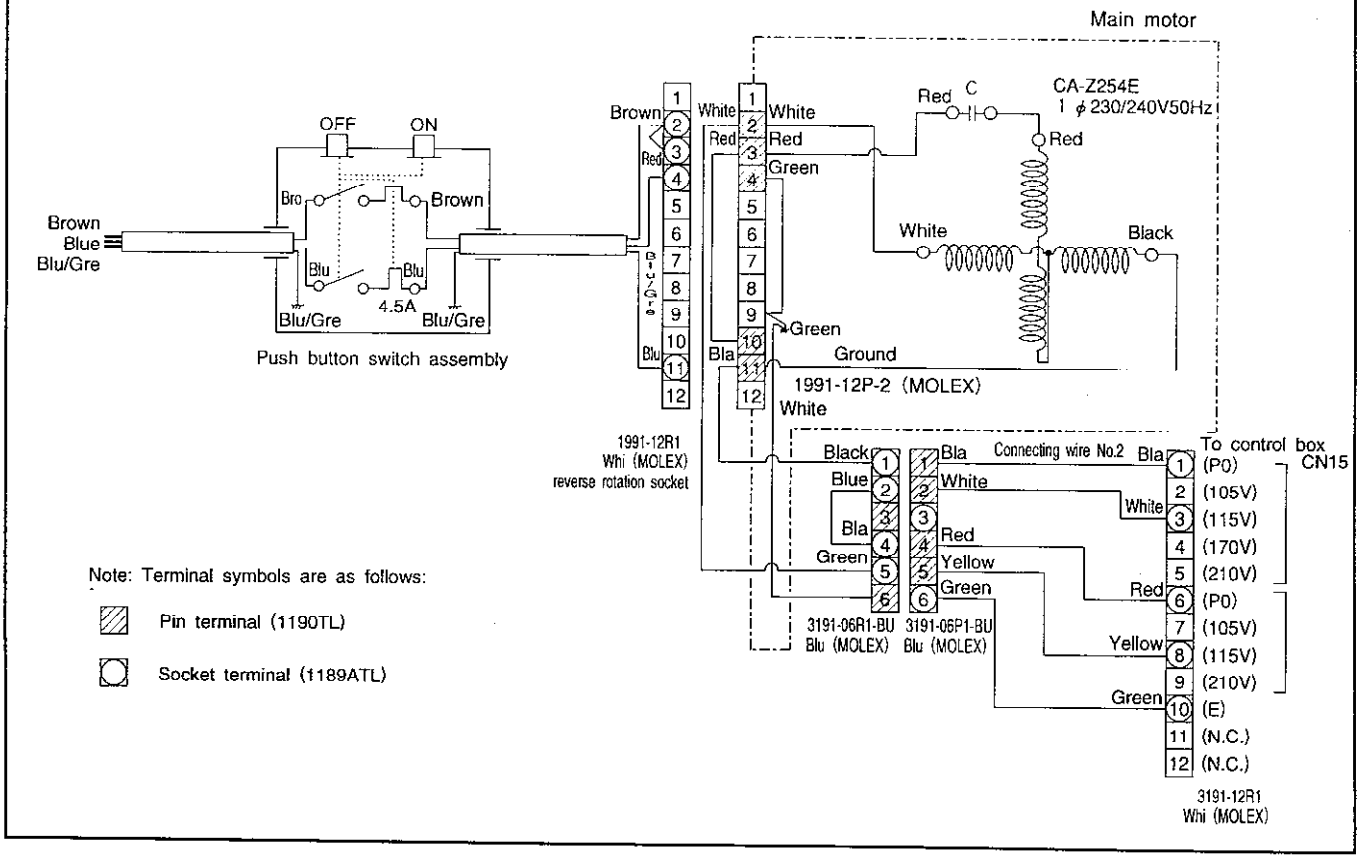
1Ø 110V 60Hz



1Ø 200V 50Hz、220V 50/60Hz

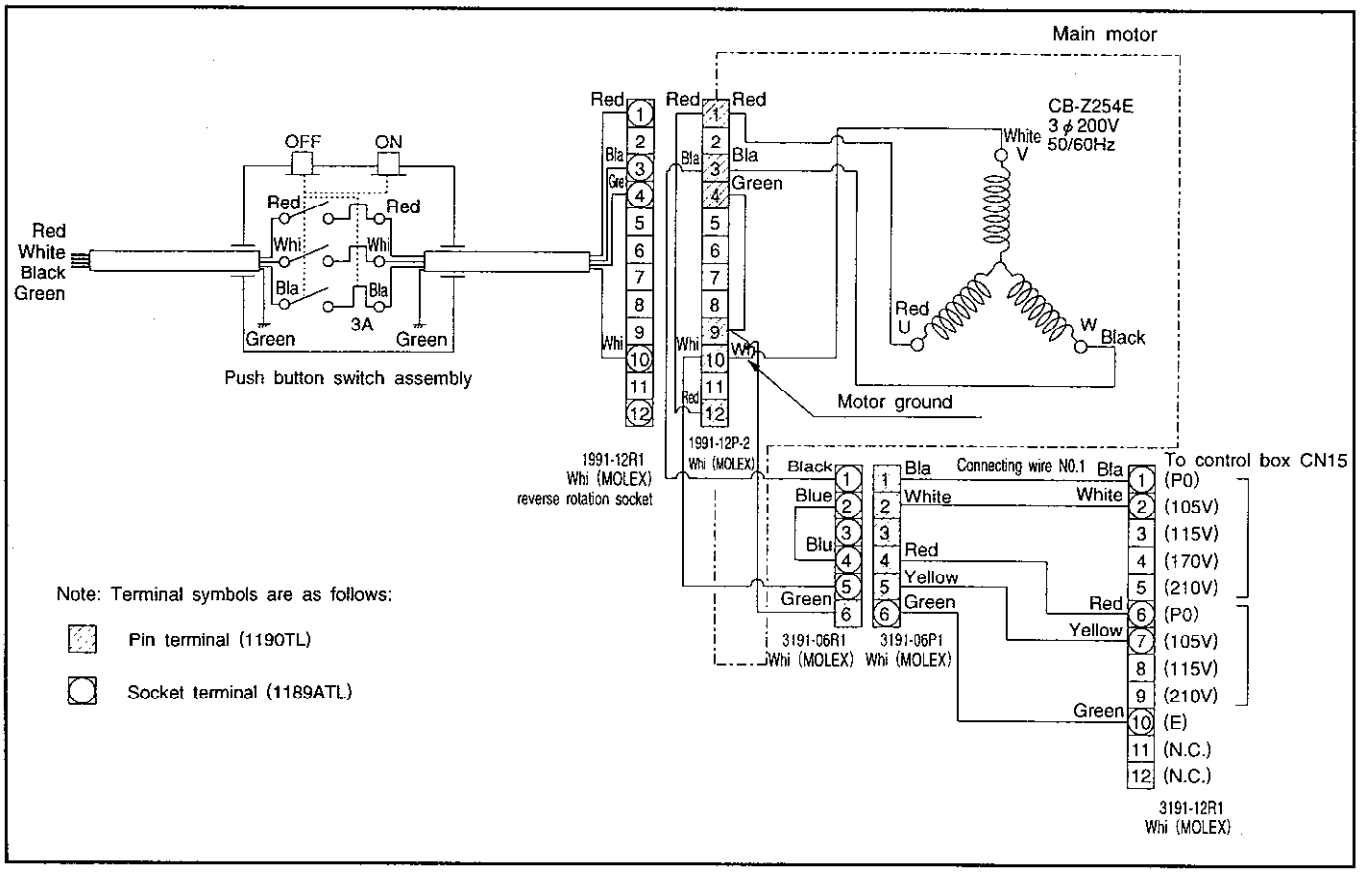


1Ø 230/240V 50Hz

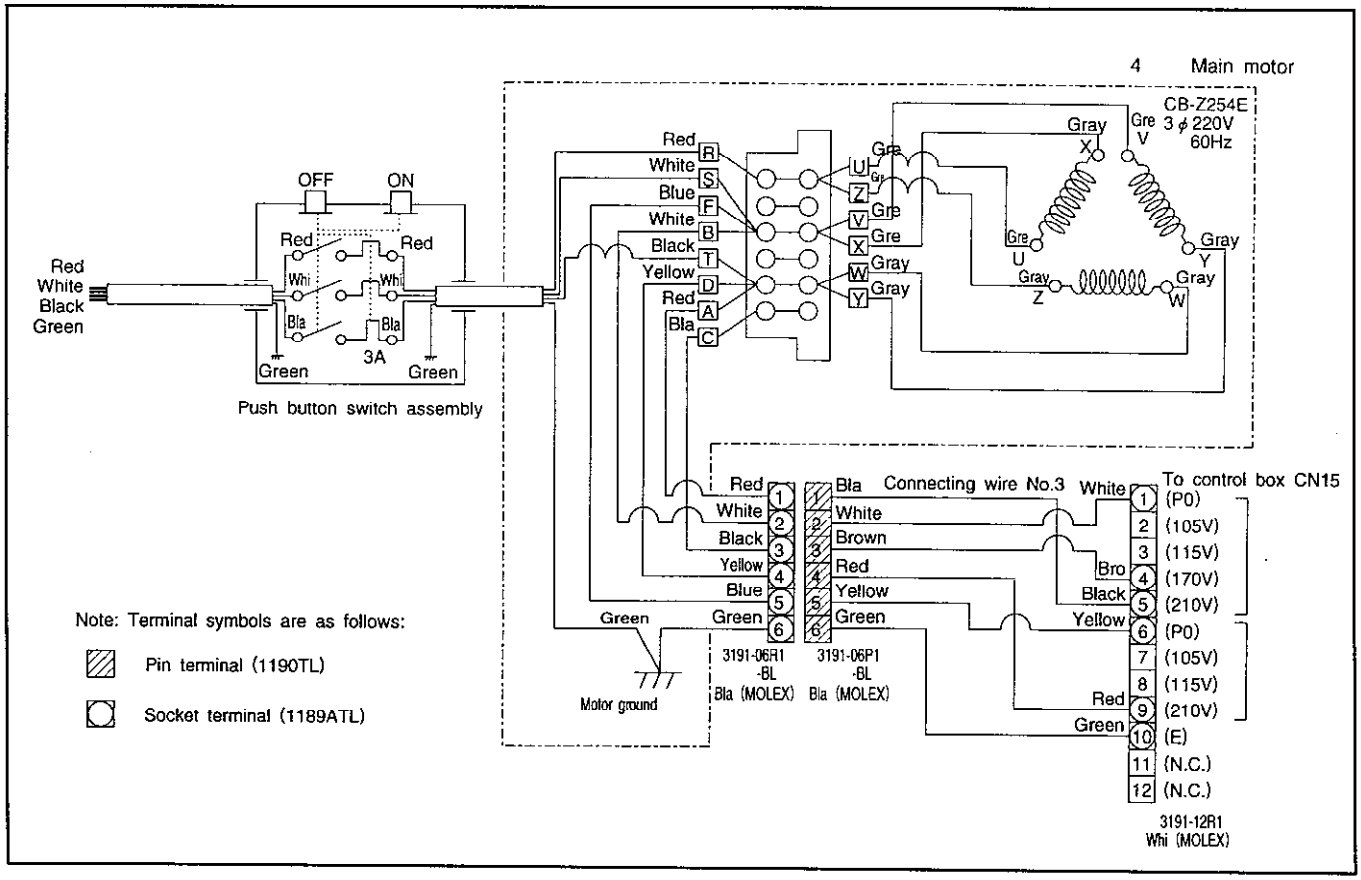


Wiring diagram (2/2) (push button switch, main motor (Z-axis motor), and connecting wire)

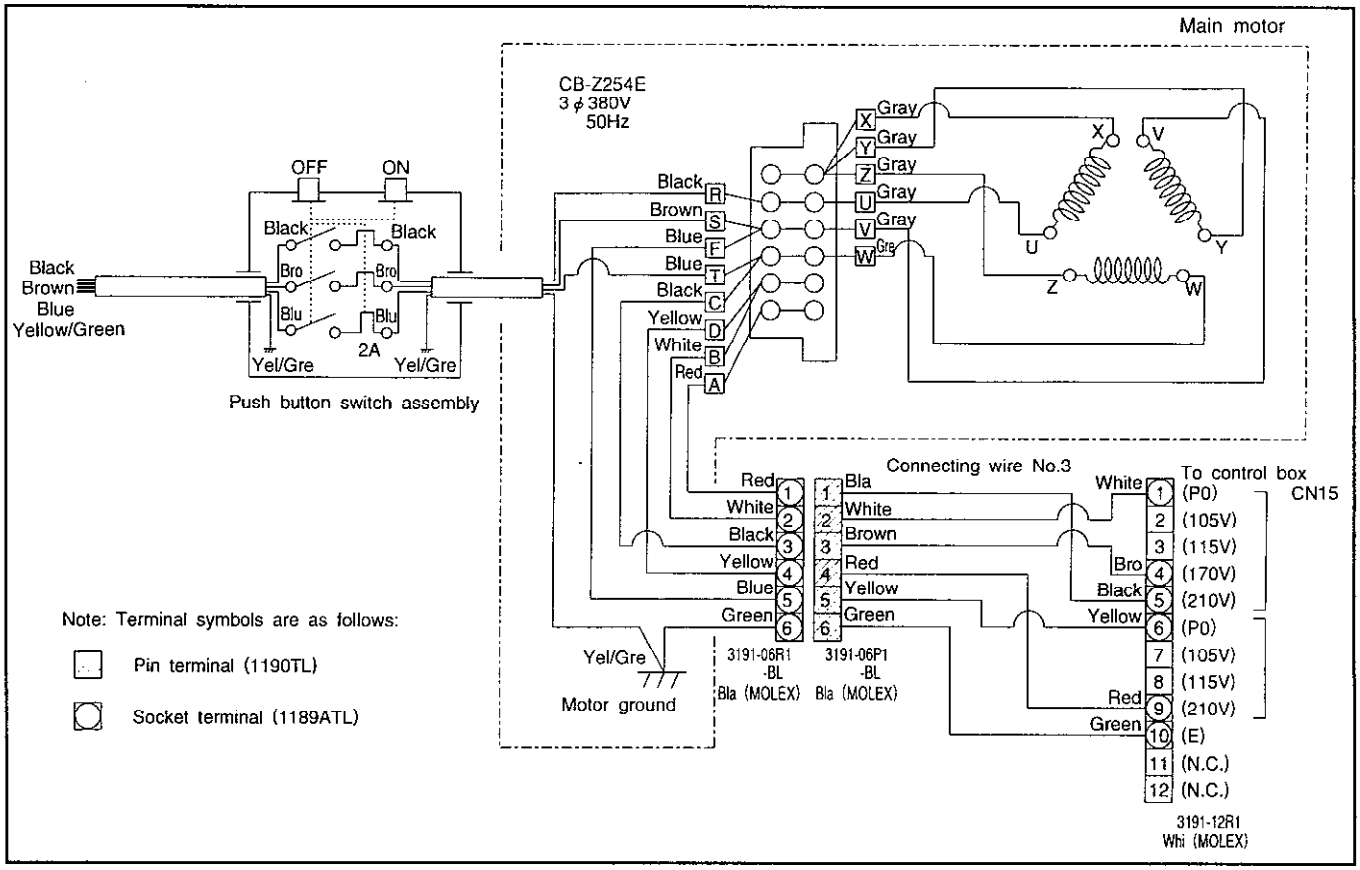
3Ø 200V 50/60Hz



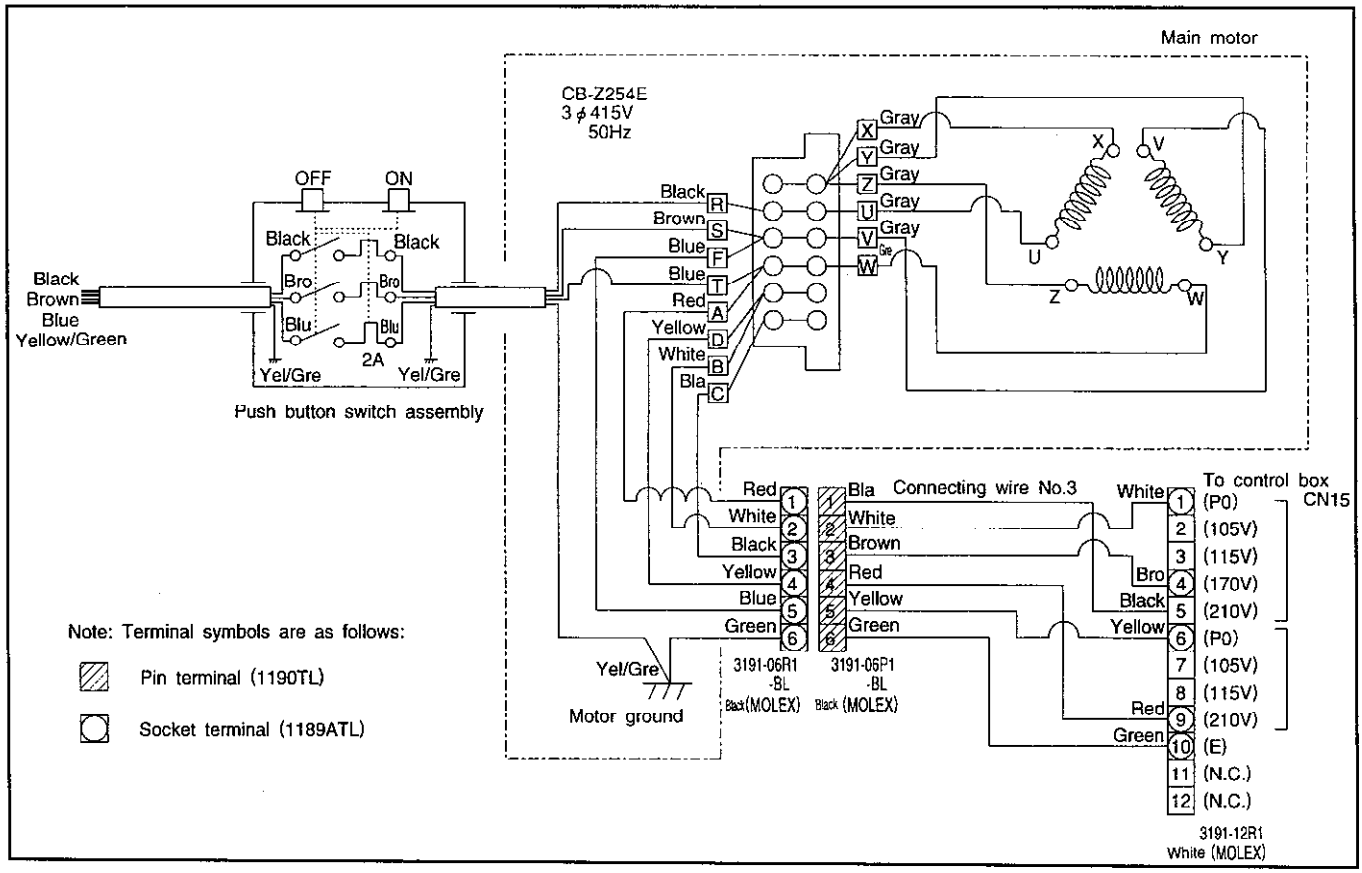
3Ø 220V 60Hz



3Ø 380V 50Hz



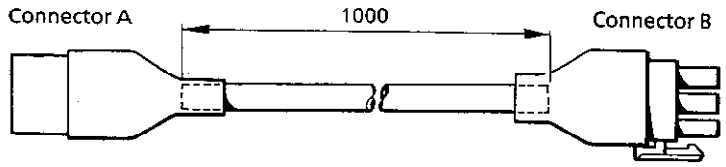
3Ø 415V 50Hz



5-9. Connection between main motor and control box

1) Connecting wire

(1) Appearance



To the main motor (6 pins)
3191-06P1

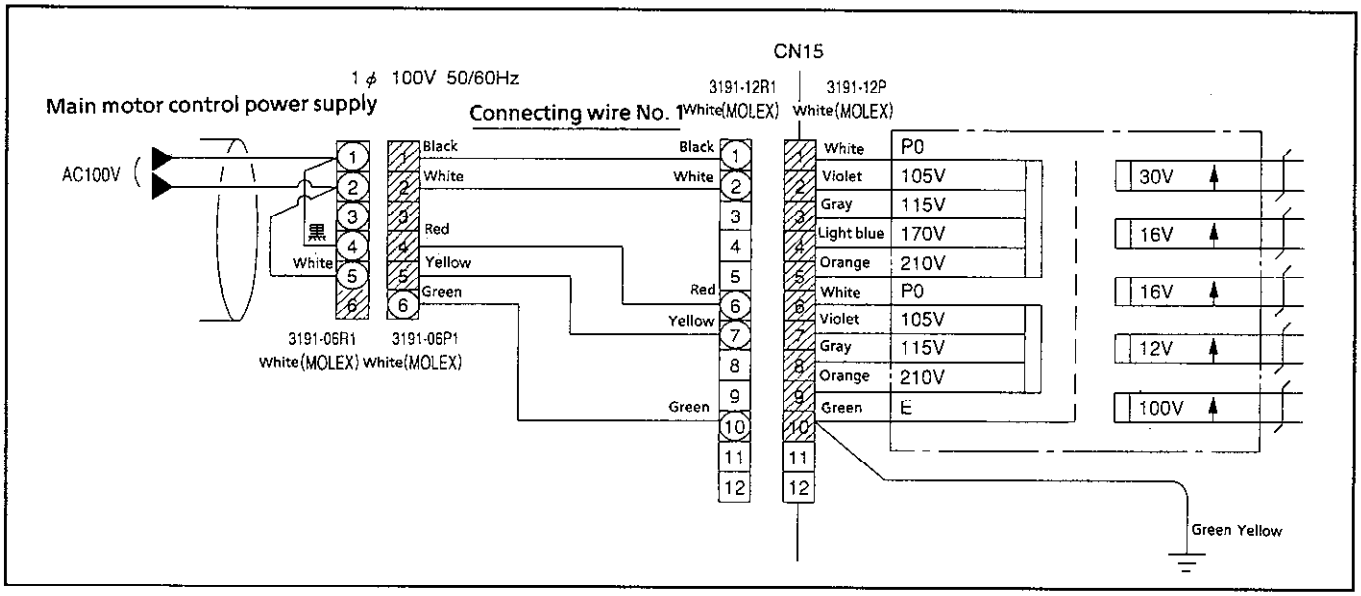
To the control box (12 pins)
3191-12R1

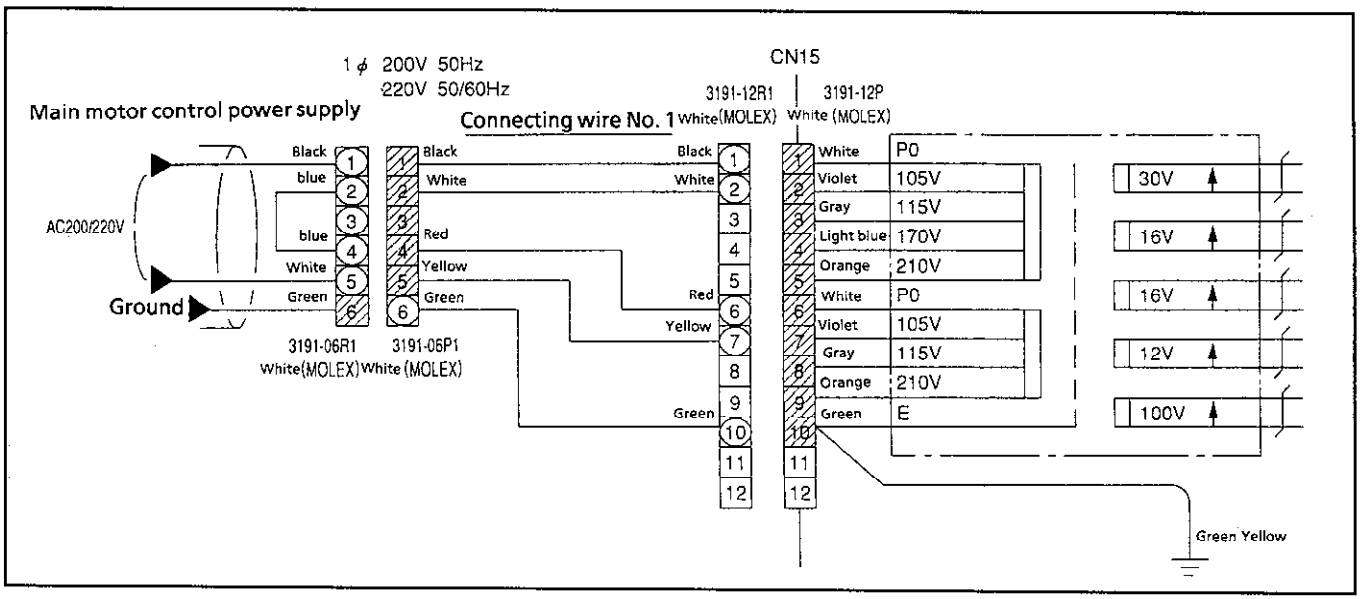
(2) Specification

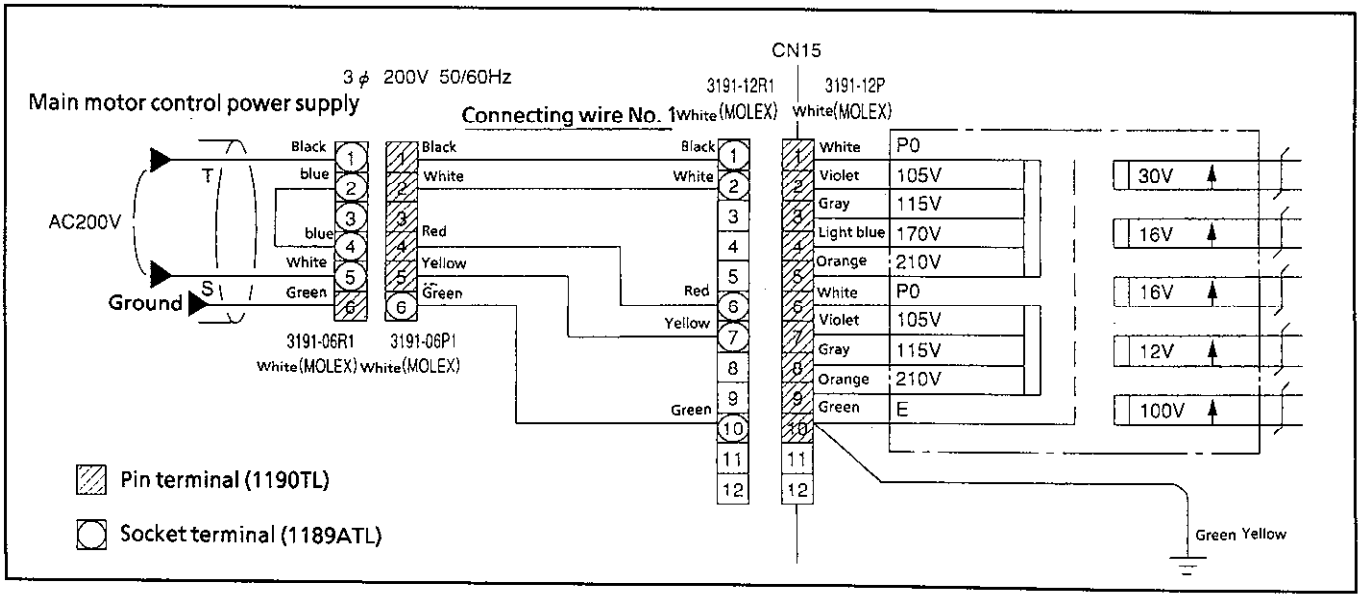
Part code	No. of phases, voltage, and frequency	Color (connector A)	Color (connector B)	Destination
Connecting wire No.1 (E737C256G30) S35985-001	1Ø 100V 50/60Hz 1Ø 200V 50Hz 220V 50/60Hz 3Ø 200V 50/60Hz	White	White	Japan Hong Kong Peru
Connecting wire No.2 (E737C257G30) S36349-001	1Ø 110V 60Hz 1Ø 230/240V 50Hz	Blue	White	US Taiwan Europe
Connecting wire No.3 (E737C258G30) S36343-001	3Ø 220V 60Hz 3Ø 380V 50Hz 3Ø 415V 50Hz	Black	White	US Taiwan Europe

2) Wiring diagram

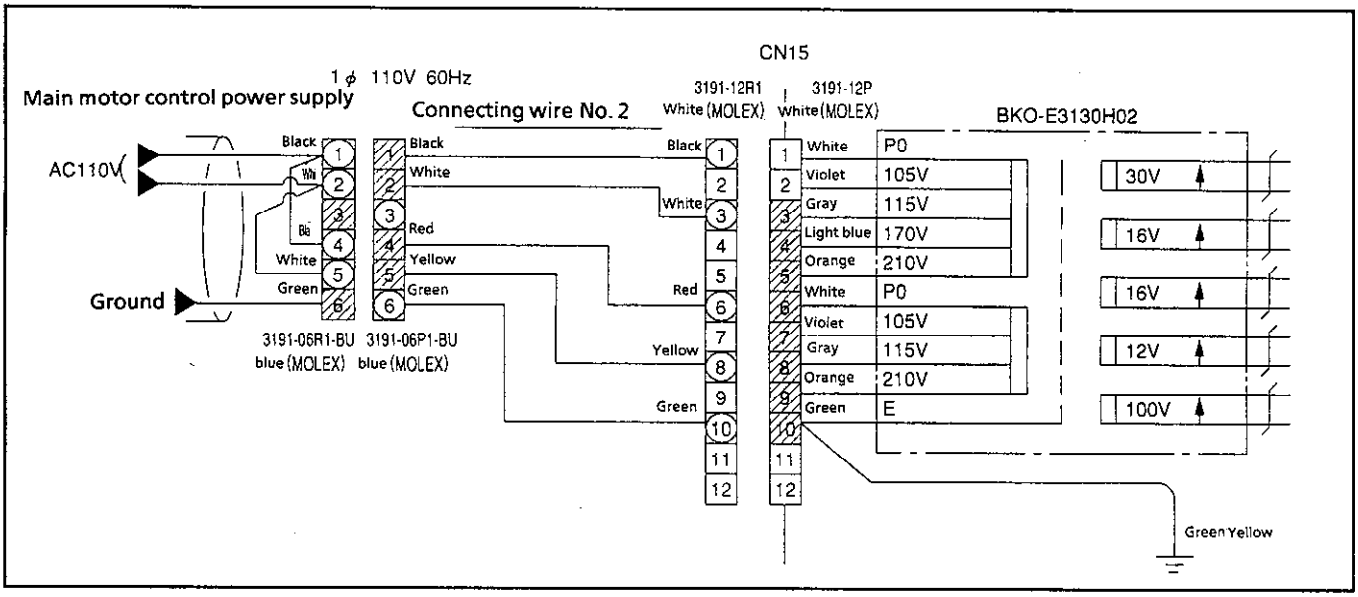
(1) Connecting wire No. 1

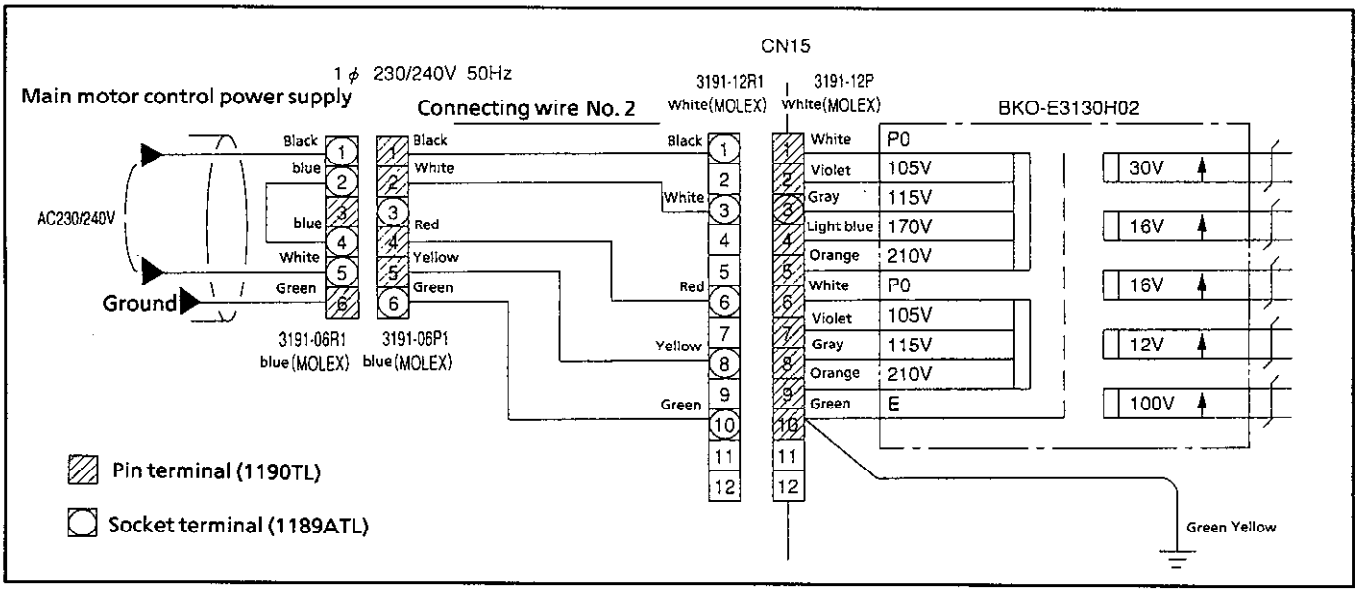




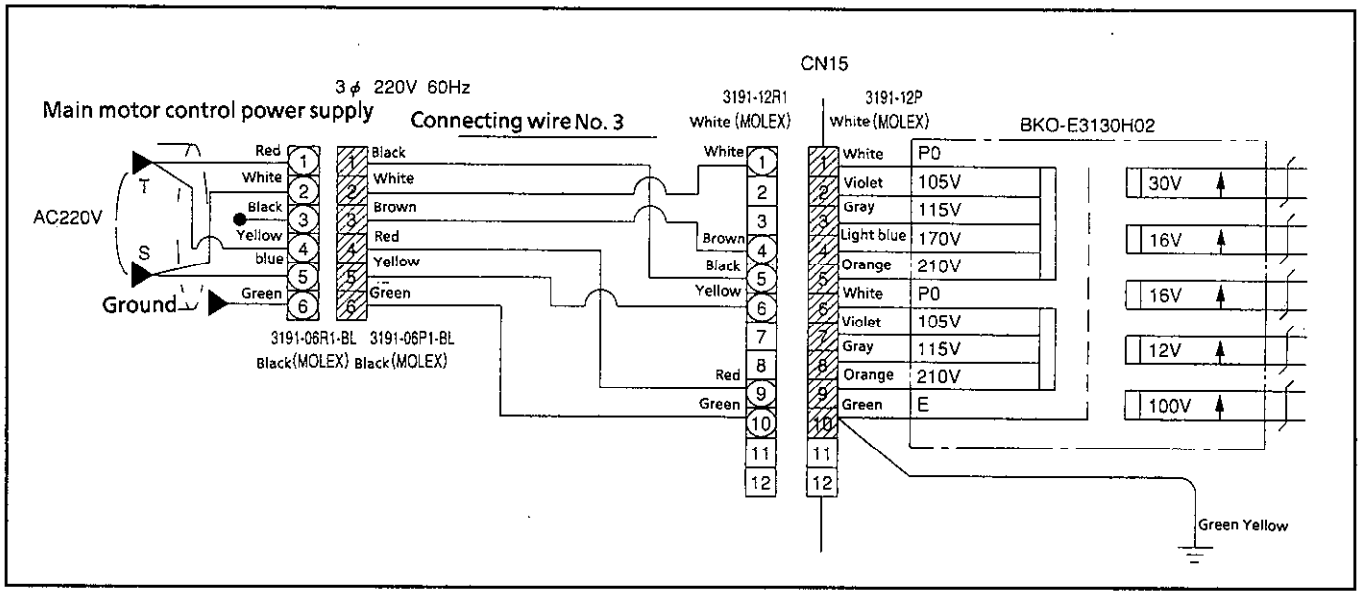


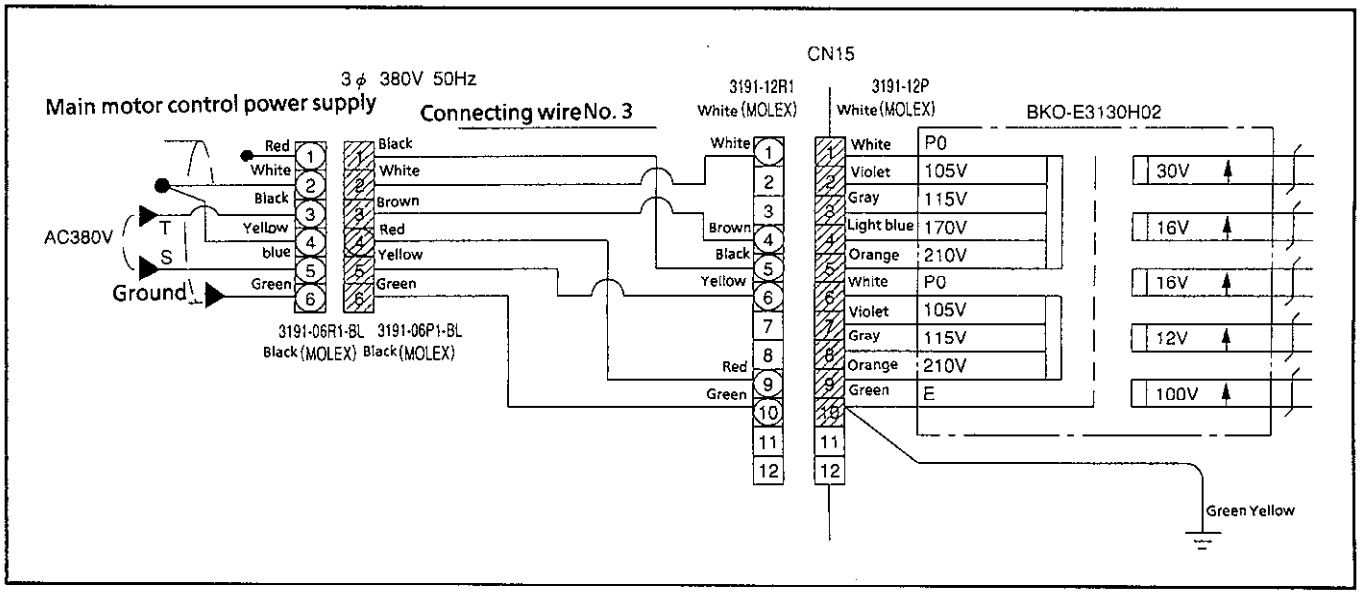
(2) Connecting wire No. 2

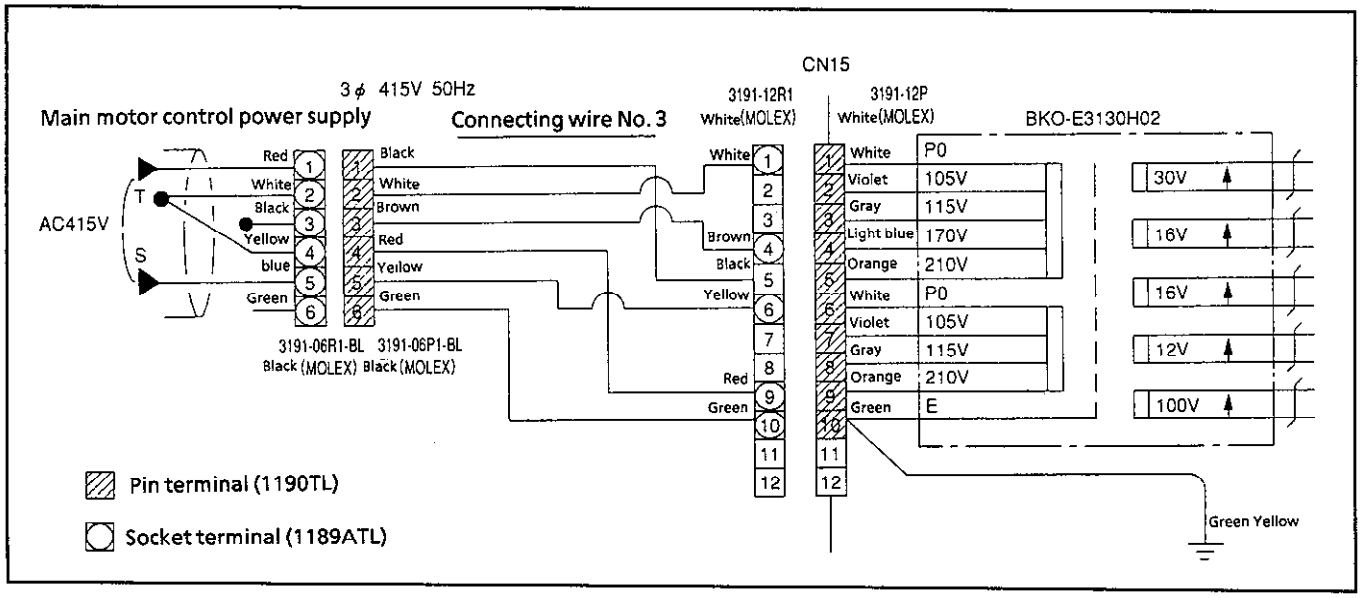




(3) Connecting wire No. 3







5-10. Z-axis motor specification list

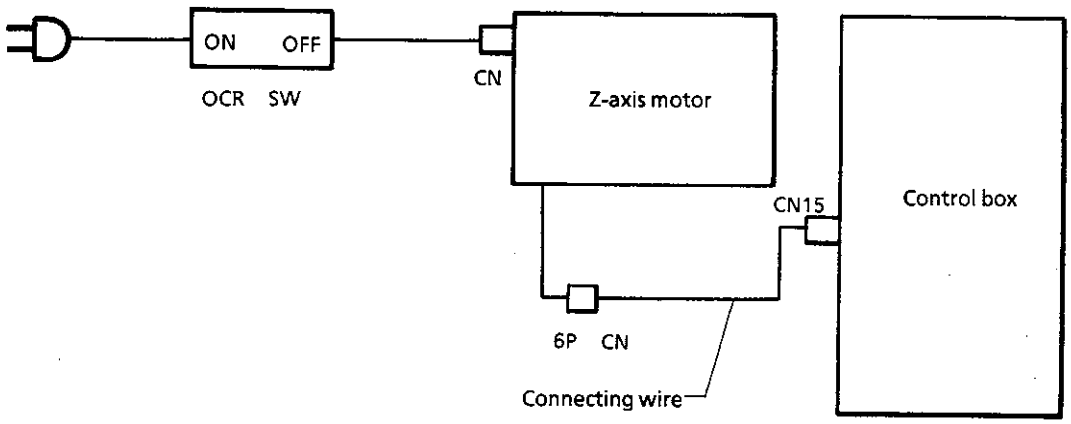
Spec. [d] [e]		Motor model	Part code	Type and color	Current for push button switch	Part code
01	Japan	CA-Z254E, 100V, 50/60Hz	S36885001	2P plug white, black	8.5A	S36336001
02	Japan	CB-Z254E, 200V, 50/60Hz	S36886001	VCTF, 0.75^2 Red, white, black, and green	3.0A	S36336001
03	US Taiwan	CA-Z254E, 110V, 60Hz	S36887001	VCTF, 1.25^2 Red, white, and green	8.5A	S36349001
04	Hong Kong Peru	CA-Z254E, 200/220V, 50/50/60Hz	S36888001	VCTF, 0.75^2 Red, black, and green	4.5A	S36349001
05	UK	CA-Z254E, 230/240V, 50Hz	S36889001	VCT, 0.75^2 Brown, blue, and yellow/green	4.5A	S36349001
06	US Taiwan	CB-Z254E, 220V, 60Hz	S36890001	VCTF, 0.75^2 Red, white, black, and green	3A	S36343001
07	Europe	CB-Z254E, 380V, 50Hz	S36891001	VCT, 0.75^2 Brown, black, blue, and yellow/green	2A	S36343001
08	UK	CB-Z254E, 415V, 50Hz	S36891001	VCT, 0.75^2 Brown, black, blue, and yellow/green	2A	S36343001

Specification code for control box and Z-axis motor

138 - 980 - [a] [b] - [c] [d] - [e]

5-11. Connection between Z-axis motor and control box

1) Wiring diagram



2) Connection between control box and Z-axis motor

Connection between CN 15 and Z-axis motor

CN15	Signal	Z-axis motor	Z-axis motor	Z-axis motor
1	P0	1	1	2
2	105V	2	–	–
3	115V	–	2	–
4	170V	–	–	3
5	210V	–	–	1
6	P0	4	4	5
7	105V	5	–	–
8	115V	–	5	–
9	210V	–	–	4
10	E	6	6	6
11	–	–	–	–
12	–	–	–	–
		Single phase AC100V 3 phase AC200V	Single phase AC110 - 120V AC200 - 240V	3 phase AC220/380/415V

6. AIR PRESSURE MECHANISM

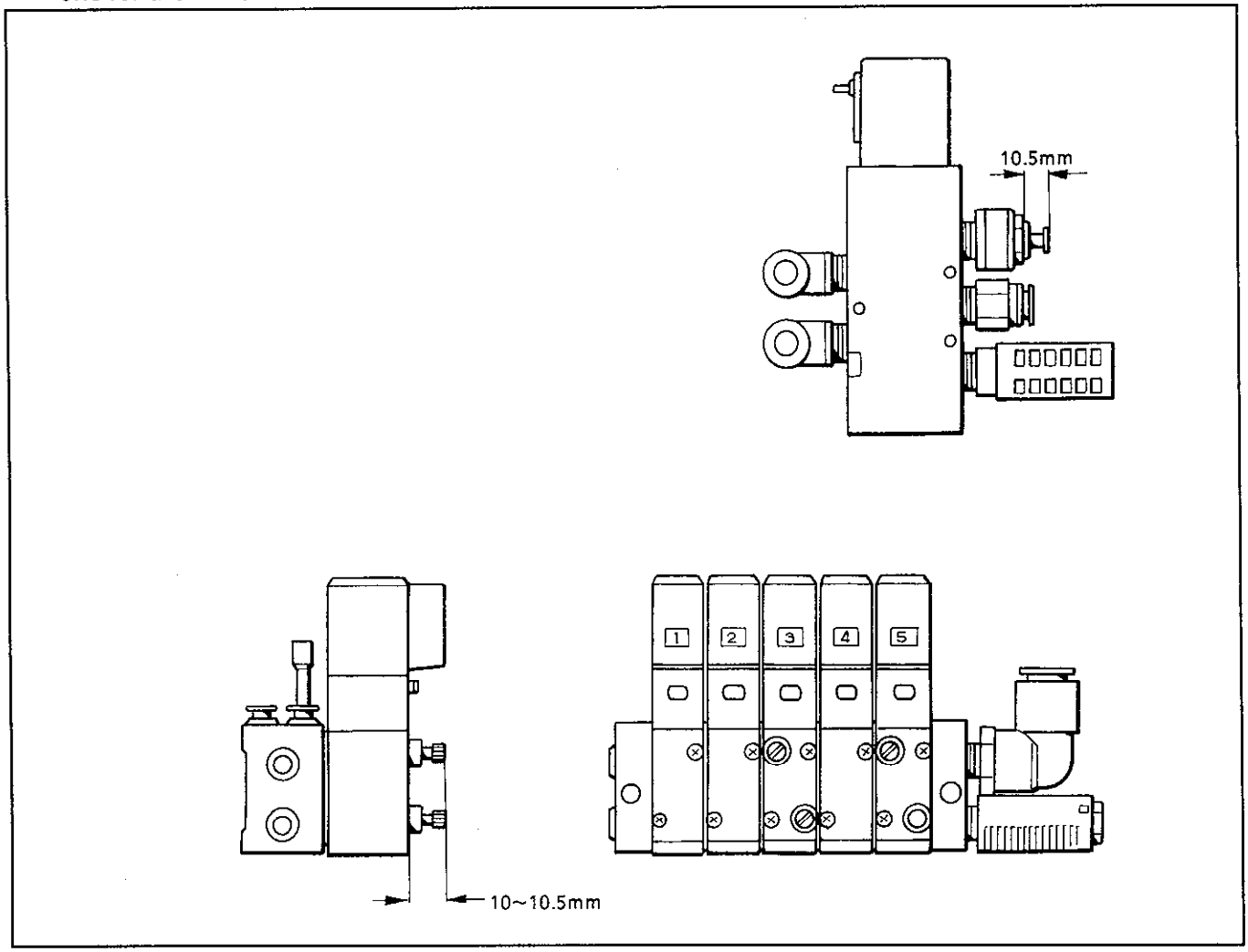
⚠ CAUTION

- Turn off the power switch at the following times, otherwise the machine may operate if the start switch is depressed by mistake, which could result in injury.
- Machine installation should only be carried out by a qualified technician.
- Disconnect the air hoses from the air supply and wait for the needle on the pressure gauge to drop to "0" before carrying out inspection, adjustment and repair of any parts which use the pneumatic equipment.
- If the power switch and air need to be left on when carrying out some adjustment, be extremely careful to observe all safety precautions.

6-1. Solenoid valves and air tubes

1) Adjusting the solenoid valve speed controllers

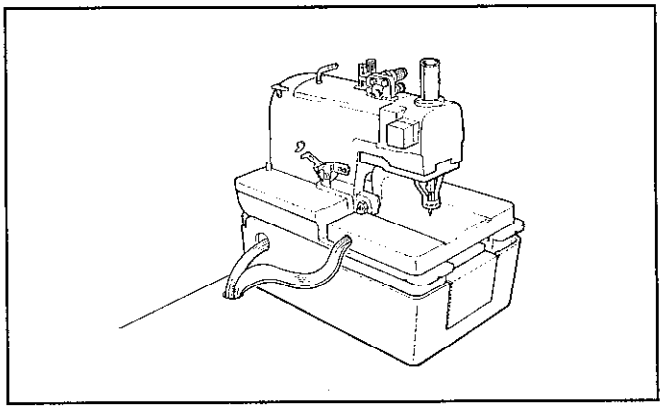
There are 3 speed controllers: No.3 (for lower thread trimming), No. 5 (for upper thread trimming), and one for the knife.



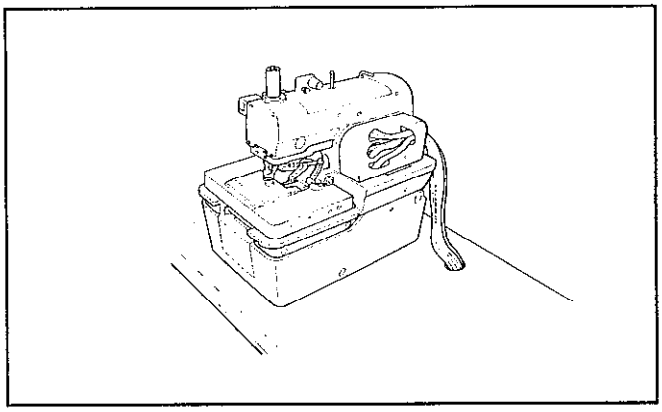
1. As for the No. 3 and No. 5 speed controllers, adjust their heights to 10 - 10.5 mm.
   Note: If the speed controllers are excessively throttled, error codes including E-75 (lower thread and operations are incorrect) and E-76 (upper thread operation is incorrect), may appear.
2. The exhaust throttle valve is only attached to the OFF side of the knife valve. Adjust the protrusion of the speed controller to 10.5 mm.
   Note: If the speed controllers are excessively throttled, error codes including E-72 (cutting block operation is incorrect), may appear. If excessively opened, abnormal noise may be emitted when the knife cylinder returns.

2) Air tubes

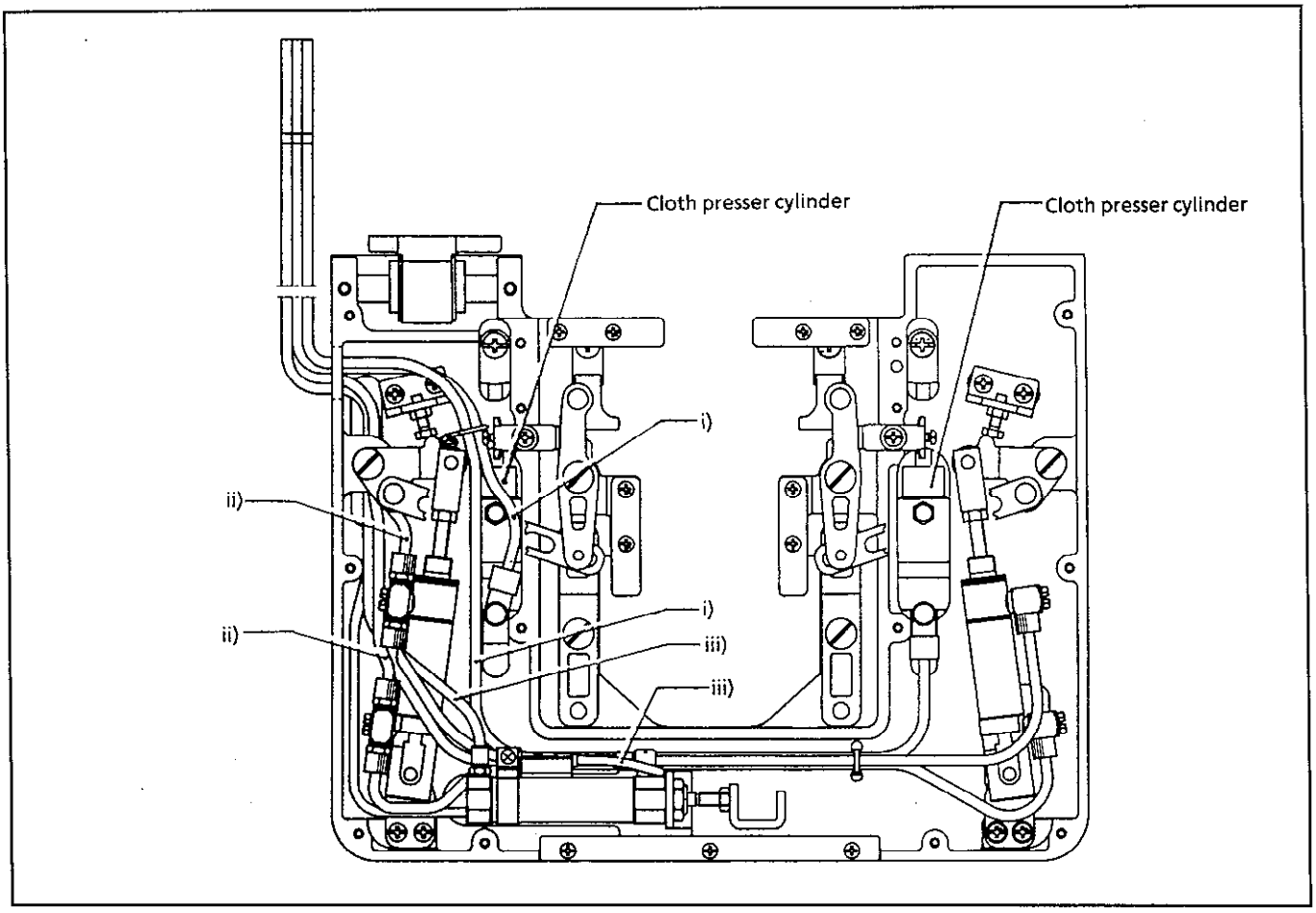
1. Air tubes which come from the left of the feed bracket are intended for:
   i) Cloth presser
   ii) Cloth stretching mechanism
   iii) Lower thread trimming



2. Air tubes which come from the rear of belt cover (R) are intended for:
   iv) Upper thread tightening
   v) Upper thread trimming
   vi) Knife

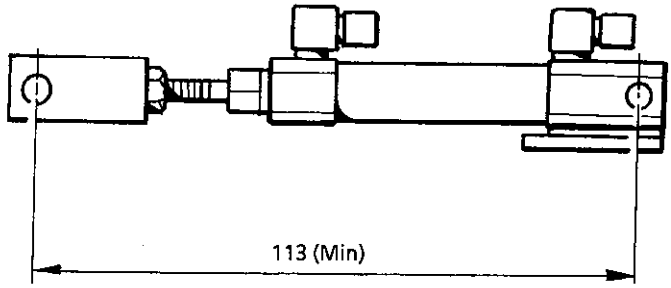


6-2. Air tube layout

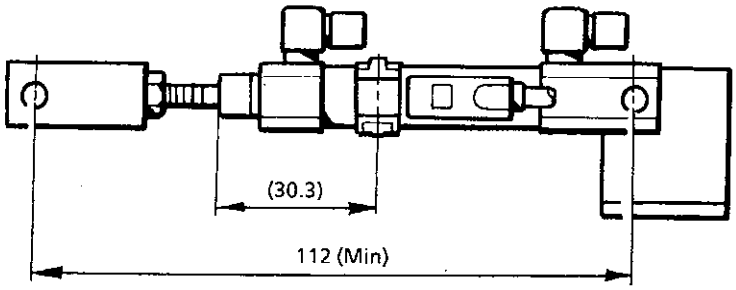


[Reference] Dimensions for cylinder rod assembly

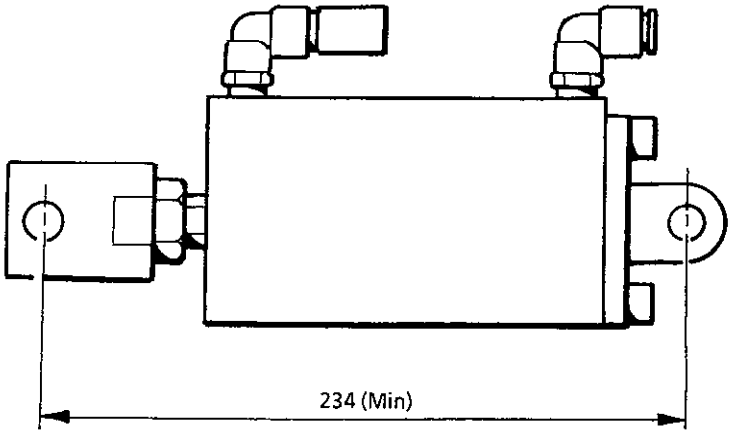
1. Upper thread release cylinder and sub presser cylinder



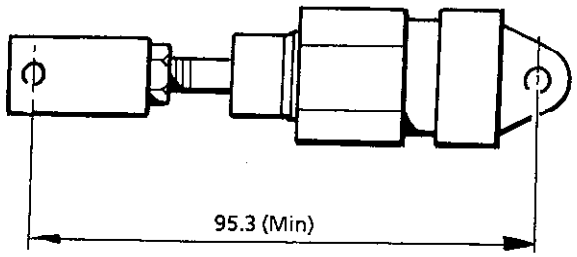
2. Upper thread trimming cylinder



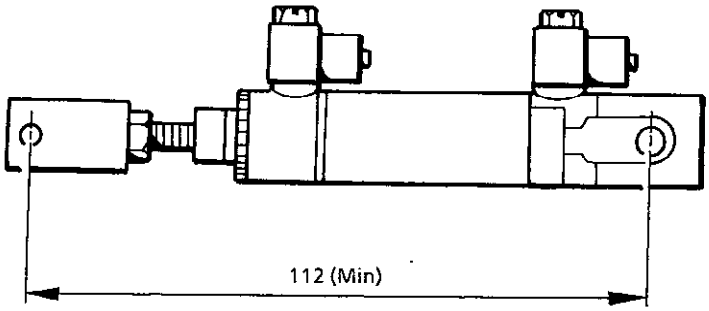
3. Cutter cylinder



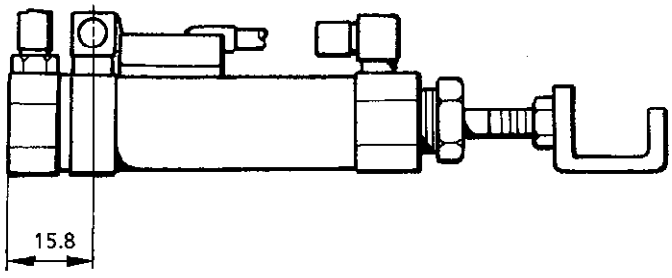
4. Cloth presser cylinder



5. Cloth stretching cylinder



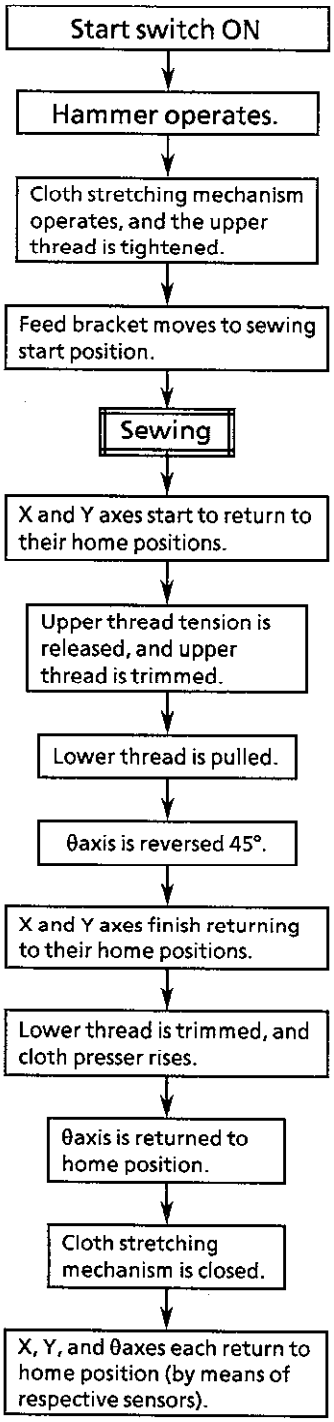
6. Lower thread trimming cylinder



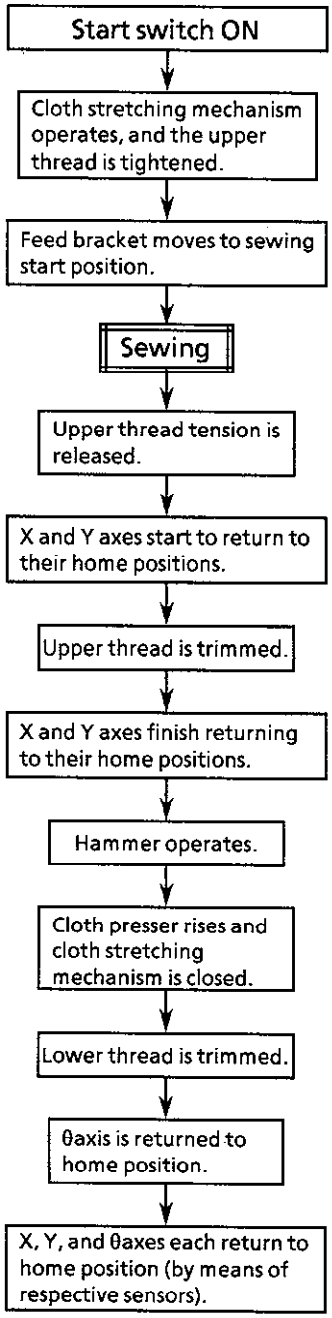
7. SOFTWARE

7-1. Motion flowchart

1. [-01 specification (thread trimmer cuts upper and lower threads, leaving them long), cutting before sewing, back position]



2. [-02 specification (thread trimmer which cuts upper and lower threads, leaving them short), cutting after sewing, back position]

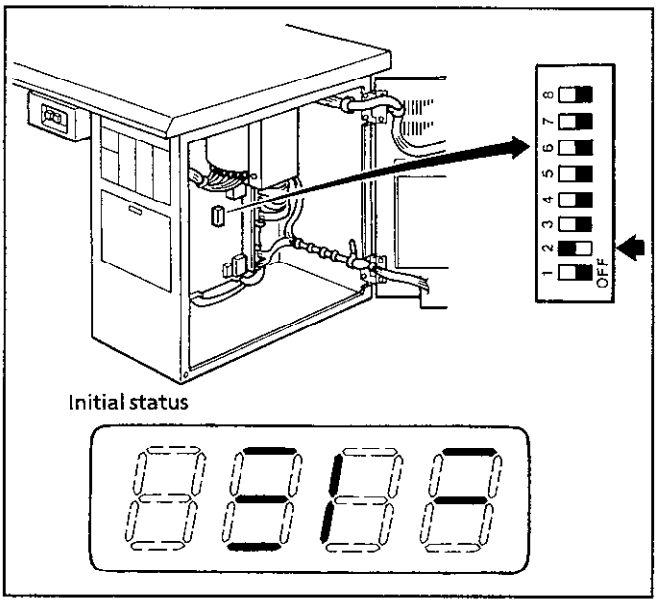


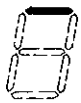
7-2. Input check list

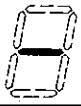
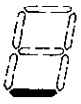
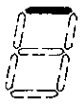
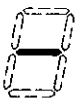
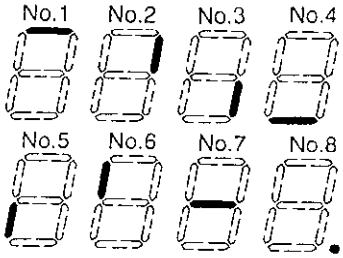
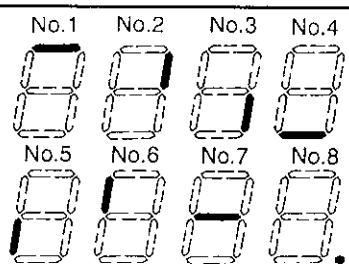
The CPU can be checked as to whether it has correctly interpreted signals from switches and sensors.
Use the following procedure when checking for switch and sensor breakdown, cord breakage, and adjusting the sensor positions.

1. Turn off the power.
2. Set DIP switch 2 to on.
3. Turn on the power. If the power is turned on with the up switch simultaneously pressed, the checking of internal functions will be enabled.
4. Turn the desired switch on and off. When checking a sensor, move the part being monitored manually. (The step motor is not excited.)

* To return to ordinary operation, turn off the power, set DIP switch 2 to off, then turn on the power again.



Items to be checked	Machine's operations
EMERGENCY STOP switch	The buzzer will sound.
PROGRAM NUMBER switch	The CYCLE PROGRAM LED indicator will be lit.
MODE switch	Four mode LED indicators will be lit; AUTO, FEED, MANUAL, and PROGRAM.
Knife switch	Three LED indicators will be lit; BEFORE, OFF, and AFTER.
RESET switch	TROUBLE LED indicator will be lit.
SELECT switch	Nine LED indicators will be lit; SPEED, EYELET PATTERN, LENGTH, TACKING LENGTH, OFFSET, STITCH PITCH, No.OF STITCHES indicator, CUTTING SPACE, and KNIFE POSITION.
ENTER switch	Thousands' digit segment of the front panel display will be lit as shown on the right: 
Down switch	Thousands' digit segment of the front panel display will be lit as shown on the right: 
Up switch	Thousands' digit segment of the front panel display will be lit as shown on the right: 
Cloth presser switch	Thousands' digit segment of the front panel display will be lit as shown on the right: 
Start switch	Thousands' digit segment of the front panel display will be lit as shown on the right: 
Speed detecting sensor	Thousands' digit segment of the front panel display will be lit as shown on the right: 

	Items to be checked	Machine's operations
	X-home position sensor	Hundreds' digit segment of the front panel display will be lit as shown on the right: 
	Y-home position sensor	Hundreds' digit segment of the front panel display will be lit as shown on the right: 
	θ-home position sensor	Hundreds' digit segment of the front panel display will be lit as shown on the right: 
	Needle thread trimming OFF sensor	Tens' digit segment of the front panel display will be lit as shown on the right: 
	Knife ON sensor	Tens' digit segment of the front panel display will be lit as shown on the right: 
	Bobbin thread trimming OFF sensor	Tens' digit segment of the front panel display will be lit as shown on the right: 
	Needle up sensor	Units' digit segment of the front panel display will be lit as shown on the right: 
	Needle down sensor	Units' digit segment of the front panel display will be lit as shown on the right: 
	Safety switch	Units' digit segment of the front panel display will be lit as shown on the right: 
	Up and down switches	All digit segments of the front panel display will be lit as shown on the right: Program number display window of the operation panel will be lit. 
#	Panel DIP switch	Units digit segment of the front panel display will be lit as shown on the right: 
#	PCB DIP switch	Tens digit segment of the front panel display will be lit as shown on the right: 
#	Count borrow rotary switch	Value (0 to F) count borrow rotary switch indicates will appear on the hundreds digit of the front panel display.

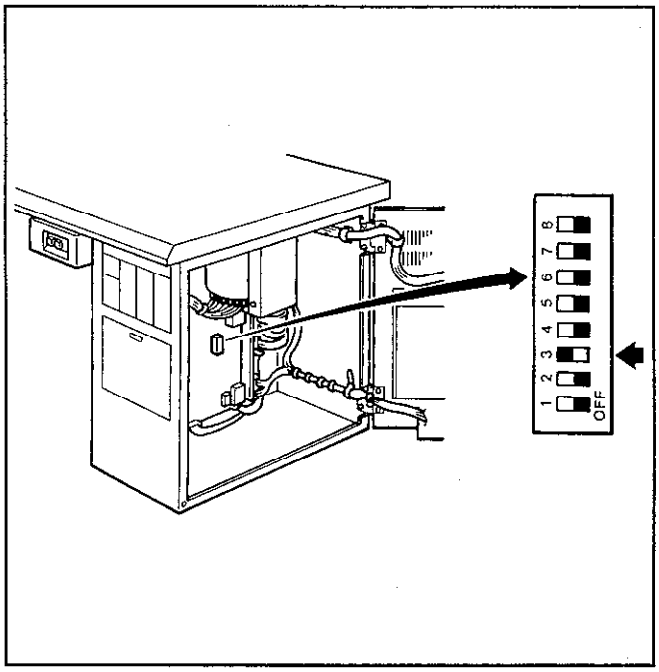
(Those indicated by # on the left, are internal settings.)

7-3. Output check list

*It can be checked as to whether signals that the CPU correctly output have been received.
*Use the following procedure when checking for PCB-related failures, mechanism breakdown, and cord breakage.

1. Turn off the power.
2. Set DIP switch 3 to on.
3. Turn on the power to detect home position.
   If the power is turned on with the up switch simultaneously pressed, the codes of hidden functions (indicated by # at the left and outside the table below) can be checked.
4. Press the <▲> or <▼> key to find the desired check code.
5. Press the start switch. While the switch is kept pressed, the machine will work as it is specified by each check code.

* To return to ordinary operation, turn off the power, set PCB DIP switch 3 to off, then turn on the power again.



(Those indicated by # are the codes of hidden functions.)

	Check code	Function
#	C-00	Version number appears. If the start and cloth presser switches are simultaneously pressed, the internal version number will appear.
	C-01	X-, Y-, and θ-home positions are detected when the machine stops with the needle at its upper limit. (Safety switch does not monitor this action.)
#	C-01	X-, Y-, and θ-home positions are detected when the machine stops with the needle at its upper limit or not. (Safety switch does not monitor this action.)
	C-02	The machine will hold the material.
	C-03	The machine will open the material.
	C-04	Standard: The machine holds and opens the material, turns 135° (θ), and activates lower and gimp thread trimmers. L specification: The machine opens the material, turns 135° (θ), and activates looper and lower gimp thread trimmers.
	C-05	After turning 180° (θ), the upper thread trimmer will be activated.
	C-06	After activating the buzzer for a second, the machine will hold the material and activate the knives.
	C-07	After activating the buzzer for a second, the machine will hold the material, and operate the machine motor at 200 spm, then indicate the sewing speed measured on the front panel display. Turn off the start switch to stop the machine. (Error code E-89 will be checked for.)
	C-08	After activating the buzzer for a second, the machine will hold the material, and operate the machine motor at 200 spm, then indicate the sewing speed measured on the front panel display.

Check code	Function
C-09	The machine will check the speed using the detecting sensor, which counts the number of slot edges in the speed command plate that passes it, every 100 stitches when operating at 1000 - 2000 spm. If an error is found, the machine will immediately stop and indicate the number of edges of slots in the sensor. Normally, the number of edges of slots in the sensor will be measured until the sewing speed reaches 2,000 spm, and then the machine will stop. * Normal value (1 sewing cycle: 128 edges, 10 sewing cycles: 1280 edges) If the number of edges is indicated as 1260 then: 1280-1260 = 20 edges (undetected after the sensor is checked 10 times) In this case, error code E-89 will be monitored for.
C-10	Upper thread will be tightened.
C-11	The machine will hold the material and the X feed mechanism will reciprocate in the range of -6 mm to + 6 mm (until the start switch is turned off).
C-12	The machine will hold the material and the Y feed mechanism will reciprocate in the range of -6 mm to + 6 mm (until the start switch is turned off).
C-13	θ will reciprocate in the range of -3.375° to + 363.375° (until the start switch is turned off).
C-31	The buzzer sounds.
C-32	All four display tubes will be lit. 
C-33	CYCLE PROGRAM indicator will be lit.
C-34	Program number LED will be lit. 
C-35	AUTO mode LED indicator will be lit.
C-36	FEED mode LED indicator will be lit.
C-37	MANUAL mode LED indicator will be lit.
C-38	PROGRAM mode LED indicator will be lit.
C-39	BEFORE LED indicator will be lit.
C-40	OFF LED indicator (related to KNIFE) will be lit.
C-41	AFTER LED indicator will be lit.
C-42	TROUBLE LED indicator will be lit.
C-43	SPEED LED indicator (A) will be lit.
C-44	EYELET PATTERN LED indicator (B) will be lit.
C-45	LENGTH LED indicator (C) will be lit.
C-46	TACKING LENGTH LED indicator (D) will be lit.
C-47	OFFSET LED indicator (E) will be lit.
C-48	STITCH PITCH LED indicator (F) will be lit.
C-49	No. OF STITCHES LED indicator (G) will be lit.
C-50	CUTTING SPACE LED indicator (H) will be lit.
C-51	KNIFE POSITION LED indicator (I) will be lit.

7-4. Error codes and countermeasures

1. Errors when the power is turned on

When buzzer sounds continuously, turn off the power.
When buzzer sounds intermittently, take appropriate measure for discrepancy , and then press the reset switch.

Error code	Contents	Resetting	(I) Input check (O) Output check	Countermeasure
E-00	① Emergency stop switch is still activated. ② Emergency stop switch is malfunctioning. ③ Wire for emergency stop switch is short-circuited.	Press reset switch.	(I) Buzzer on	① Turn off emergency stop switch. ② Check continuity between pins 1 and 2 of CN5. ③ Check continuity between pins 1 and 2 of CN5.
E-02	① Machine head is raised. ② Safety switch is not correctly adjusted. ③ Safety switch not supplied power.	Turn off the power.	(I)	① Return machine head to original position. ② Adjust safety switch so that it is turned on when machine head is returned to its original position. ③ Check continuity between pins 8 and 12 of CN3.
E-03	① Cloth presser switch is still being pressed. ② Cloth presser witch is malfunctioning. ③ Cloth presser switch not supplied power.	Press reset switch.	(I)	① Release cloth presser switch. (Turn it off.) ② Check continuity between pins 3 and 4 of CN4. ③ Check continuity between pins 3 and 4 of CN4.
E-04	① Start switch is still being pressed. ② Start switch is malfunctioning. ③ Start switch not supplied power.	Press reset switch.	(I)	① Release start switch. (Turn it off.) ② Check continuity between pins 1 and 2 of CN4. ③ Check continuity between pins 1 and 2 of CN4.
E-05	① Reset switch is still being pressed. ② Reset switch is malfunctioning.	Turn off the power.	(I) Trouble indicator is lit.	① Release reset switch. (Turn it off.) ② Replace PDH-A1A-PAL with a new one.
E-10	① Needle up signal remains off. ② Synchronizer is malfunctioning. ③ Synchronizer not supplied power.	Press reset switch.	(I)	①-1 Align timing mark on pulley with that on belt cover. ①-2 If the above is impossible, turn pulley until buzzer stops, and press reset switch. Align timing mark on pulley with that on belt cover again. ② Replace synchronizer with a new one. ③ CN 2 pin 2: 5V, pins 4 and 5: 0V, pin 7: signal
E-12	① Cutter sensor remains on. ② Sensor is not correctly installed. ③ Sensor is malfunctioning. ④ Wire is short-circuited.	Turn off the power.	(I)	① Position knife correctly. ② Adjust sensor position. ③ CN11 pin 1: +12V (red), pin 11: 0V (black), pin 6: signal (white) ④ CN11 pin 1: +12V (red), pin 11: 0V (black), pin 6: signal (white)
E-15	① Lower thread trimmer OFF sensor remains off. ② Sensor is not correctly installed. ③ Sensor is malfunctioning. ④ Sensor not supplied power.	Turn off the power.	(I)	① Return cylinder to correct position. ② Adjust sensor position. ③ CN3 pin 3: +12V (red), pin 11: 0V (black), pin 7: signal (white) ④ CN3 pin 3: +12V (red), pin 11: 0V (black), pin 7: signal (white)
E-16	① Upper thread trimmer OFF sensor remains off. ② Sensor is not correctly installed. ③ Sensor is malfunctioning. ④ Sensor not supplied power.	Turn off the power.	(I)	① Return cylinder to correct position. ② Adjust sensor position. ③ CN11 pin 4: +12V (red), pin 14: 0V (black), pin 9: signal (white)

2. Error codes when the start switch is depressed

Error code	Contents	Resetting	(I) Input check (O) Output check	Countermeasure
E-30	Emergency stop switch is still activated. See E-00.	——	——	——
E-32	Machine head is raised. See E-02.	——	——	——
E-35	Reset switch is still pressed. See E-05.	——	——	——
E-40	Needle up signal remains off. See E-10.	——	——	——
E-42	Cutter sensor remains on. See E-12.	——	——	——
E-45	Lower thread trimmer OFF sensor remains off. See E-15.	——	——	——
E-46	Upper thread trimmer OFF sensor remains off. See E-16.	——	——	——
E-50	① X home position sensor remains off. ② X home position sensor is malfunctioning after feed bracket returns to home position. ③ X home position sensor not supplied power after feed bracket returns to home position. ④ X home position sensor is not securely attached. ⑤ Sensor partition plate is not securely attached.	Turn off the power.	(I)	① Turn power off and then on again. Feed bracket will return to home position. ② Replace sensor with a new one. ③ CN3 pin 1: 12V (brown), pin 9: 0V (blue), pin 5: signal (black) ④ Adjust position. ⑤ Adjust position.
E-51	① Y home position sensor is off. ② Y home position sensor is malfunctioning after feed bracket returns to home position. ③ Y home position sensor not supplied power after feed bracket returns to home position. ④ Y home position sensor is not securely attached. ⑤ Sensor partition plate is not securely attached.	Turn off the power.	(I)	① Turn power off and then on again. Feed bracket will return to home position. ② Replace sensor with a new one. ③ CN3 pin 2: 12V (brown), pin 10: 0V (blue), pin 6: signal (black) ④ Adjust position. ⑤ Adjust position.
E-52	① θ home position sensor is off. ② θ home position sensor is malfunctioning after feed bracket returns to home position. ③ θ home position sensor not supplied power. ④ θ home position sensor is not securely attached. ⑤ Driving needle pulley is not securely attached.	Turn off the power.	(I)	① Turn power off and then on again. Feed bracket will return to home position. ② Replace sensor with a new one. ③ CN11 pin 3: 12V (brown), pin 13: 0V (blue), pin 8: signal (black) ④ Adjust position. ⑤ Adjust position.
E-59	Sewing data is damaged.	Turn off the power.	——	Turn off power, set DIP SW 1 in control box to on, then turn on power again. Check buzzer sounds intermittently, and turn off power. Set DIP SW 1 in control box to off, and turn on power again.

3. Recovery errors after emergency stop

Error code	Contents	Resetting	(I) Input check (O) Output check	Remarks
E-30	Emergency stop switch is still on. See E-00.	——	——	This code may appear when RESET, START, UP (▲) and DOWN (▼) switches are pressed in this order after E-60 appears.
E-32	Machine head is raised. See E-02.	——	——	
E-35	Reset switch is still pressed. See E-05.	——	——	This code may appear when START, UP (▲) and DOWN (▼) switches are pressed in this order after E-60 appears.
E-40	Needle up signal remains off. See E-10.	——	——	This code may appear when RESET, START, UP (▲) and DOWN (▼) switches are pressed in this order after E-60 appears.
E-42	Cutter sensor remains on. See E-12.	——	——	
E-45	Lower thread trimmer OFF sensor remains off. See E-15.	——	——	
E-46	Upper thread trimmer OFF sensor is off. See E-16.	——	——	
E-59	Sewing data is damaged.	Turn off power.		Turn off power, set DIP SW 1 in control box to on, then turn on power again. Check buzzer sounds intermittently, and turn off power. Set DIP SW 1 in control box to off, and turn on power again.

4. Errors during operation

Error code	Contents	Resetting	(I) Input check (O) Output check	Countermeasure
E-60	Emergency stop switch is pressed. (This is not an error. This code indicates machine operation is being suspended due to emergency stop.)	Press reset switch.	———	① To return feed bracket to home position. Press RESET switch. ② To return one stitch without sewing. Press DOWN (▼) switch. ③ To proceed one stitch without sewing. Press UP (▲) switch. ④ To start sewing again. Press START switch.
E-62	Machine head is raised during sewing. See E-02.	Turn off power.	———	———
E-69	Machine does not stop with the needle at its upper position. ① BK signal from main motor is interrupted. ② Speed for low speed sewing is too fast.	Align timing mark of pulley with that of belt cover, and press start switch.	(O) C-07 (C-25)	Adjust manually. ① CN14 pin 3: +30V, pin 4: signal ② For output check C-25, check 200 s/min.
E-70	Needle up signal is not switched on and off during operation. ① Synchronizer is not correctly adjusted. ② Synchronizer is malfunctioning. ③ Synchronizer not supplied power.	Turn off power.	(I)	① Adjust synchronizer. ② Replace synchronizer with a new one. ③ CN2 pin 2: 5V, pins 4 and 5: 0V, pin 7: signal
E-71	Needle down signal is not switched on and off during operation. ① Synchronizer is not correctly adjusted. ② Synchronizer is malfunctioning. ③ Synchronizer not supplied power. ④ Machine head is locked. ⑤ Synchronizer signal is interrupted.	Turn off power.	(I) (O) C-09 (C-37)	① Adjust synchronizer. ② Replace synchronizer with a new one. ③ CN2 pin 2: 5V, pins 4 and 5: 0V, pin 3: signal (down position) ④ Unlock machine head. ⑤-1 Synchronizer is malfunctioning. ⑤-2 CN2 pin 2: 5V, pins 4 and 5: 0V, pin 8: signal (PG: speed position)
E-72	Knife does not operate. ① Air pressure ② Mechanical trouble ③ Solenoid is malfunctioning. ④ Solenoid not supplied power. Knife operates, but cutter sensor is not still switched on. ① Sensor is not correctly installed. ② Sensor partition plate is not correctly adjusted. ③ Sensor is malfunctioning. ④ Sensor not supplied power. Same as above when sensor is not still switched off.	Turn off power.	(O) C-06 (C-28) (I)	① Adjust air pressure. ② Adjust motion of thread trimmer mechanism. ③ Replace solenoid with a new one. ④ CN1 pin *: +30V, pin 4: signal ① Adjust sensor. ② Adjust sensor partition plate. ③ Replace sensor with a new one. ④ CN11 pin 1: +12V (red), pin 11: 0V (black), pin 6: signal (white)

* ( ) Ver. A1, A2 only

Error code	Contents	Resetting	(I) Input check (O) Output check	Countermeasure
E-75	Lower thread trimmer does not operate. ① Air pressure ② Mechanical trouble ③ Solenoid is malfunctioning. ④ Solenoid not supplied power.	Turn off power.	(O) C-04 (C-30)	① Adjust air pressure. ② Adjust motion of lower thread trimming mechanism. ③ Replace solenoid with a new one. ④ CN1 pin *: +30V, pin 1: signal
	Lower thread trimmer operates, but sensor is not switched off. ① Sensor position is not correctly adjusted. ② Sensor is malfunctioning. ③ Sensor not supplied power.		(I)	① Adjust sensor position. ② Replace sensor with a new one. ③ CN3 pin 3: 12V (red), pin 11: 0V (black), pin 7: signal (white)
E-76	Upper thread trimmer does not operate. ① Air pressure ② Mechanical trouble ③ Solenoid is malfunctioning. ④ Solenoid not supplied power.	Turn off power.	(O) C-05 (C-31)	① Adjust air pressure. ② Adjust motion of upper thread trimming mechanism. ③ Replace solenoid with a new one. ④ CN1 pin *: +30V, pin 2: signal
	Upper thread trimmer operates, but sensor is not switched off. ① Sensor position is not correctly adjusted. ② Sensor is malfunctioning. ③ Sensor not supplied power.		(I)	① Adjust sensor position. ② Replace sensor with a new one. ③ CN11 pin 4: 12V (red), pin 14: 0V (black), pin 9: signal (white)
E-80 :X E-81 :Y E-82 :θ	Home position sensor is not switched on when feed bracket returns to home position. ① Sensor position is not correctly adjusted. ② Sensor partition plate is not correctly adjusted. ③ Sensor not supplied power. ④ Sensor is malfunctioning.	Turn off power.	(I) X Y θ	① Adjust sensor position. ② Adjust sensor partition plate position. ③ X: CN3 pin 1: +12V (brown), pin 9: 0V (blue), pin 5: signal (black) Y: CN3 pin 2: +12V (brown), pin 10: 0V (blue), pin 6: signal (black) θ: CN11 pin 3: +12V (brown), pin 13: 0V (blue), pin 8: signal (black) ④ Replace sensor with a new one.
	Stepping motor does not operate normally. ① Improper mechanical adjustment ② Stepping motor not supplied power. ③ Stepping motor is malfunctioning. ④ PDH-A1-PMD is malfunctioning. ⑤ Disconnection of connecting wire between PDH-A1-PMD and PDH-A1-CPU ⑥ PDH-A1-CPU is malfunctioning.		(O) X; C-11 (C-22)	① Adjust belts and gears so that there is no end play between parts. ② X: CN6, Y:CN7, θ:CN8 ③ Replace stepping motor with a new one. ④ Replace PDH-A1-PMD with a new one. ⑤ Check connection of connecting wire. ⑥ Replace PDH-A1-CPU with a new one.
E-89	Machine runs with pulley rotated reversely.	Turn off power.	———	① Remove reverse rotation socket, and attach it again. Wait a few minutes before turning on power. (For 3-phase power supply, it is possible to turn on power immediately.)
E-91	Overcurrent in pulse motor	Turn off power.	———	

* ( ) Ver. A1, A2 only

7-5. Setting special specification

Note: This setting should only be carried out by an authorized person who understands the contents of the special specification; otherwise, there is the danger the machine will operate in a different way to usual.
Generally, the contents of the special PROM will be built into the standard PROM when the latter is upgraded. When the standard PROM is normally used, the machine's operation is controlled in the standard mode, naturally. If you want to operate the machine with the special specification using the standard PROM, set the special specification as follows:

1. While pressing the ENTER switch, turn on the power.
   "SP.**" will appear on the display. The code in ** positions indicates the special specification code. When 00 appears in ** positions, it indicates standard specification code.
2. Select a desired special specification code using UP and DOWN switches.
3. Press the ENTER switch. The special specification code will be memorized.
4. Press the reset switch. The home position will be detected, and the program assigned for the special specification code will run.

*The backup of the special specification code you specified will be made as well as that of sewing data. There is no need to repeat the same operation again.
However, after data has been initialized, and the ROM or PCB replaced, the machine will return to standard mode; it is then necessary to set the special specification code again.

*For more information, please contact our nearest dealer.