

---

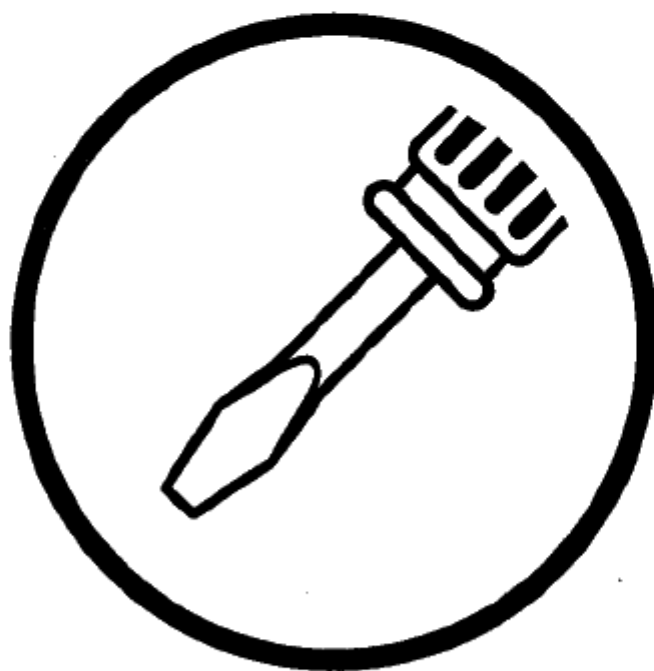
Please read this manual before making any adjustments.

---

## ELECTRONIC EYELET BUTTON HOLER

マニュアルG

速やかに返却して下さい。



This service manual is intended for B981; be sure to read the B981 instruction manual before this manual. Carefully read the "SAFETY INSTRUCTIONS" below and the whole of this manual to understand this product before you start maintenance.

As a result of research and improvements regarding this product, some details of this manual may not be the same as those for the product you purchased.



If you have any questions regarding this product, please contact a Brother dealer.

## SAFETY INSTRUCTIONS


### 1 Safety indications and their meanings

This service manual and the indications and symbols that are used on the machine itself are provided in order to ensure safe operation of this machine and to prevent accidents and injury to yourself or other people. The meanings of these indications and symbols are given below.


#### Indications

 <b>DANGER</b>	The instructions which follow this term indicate situations where failure to follow the instructions will almost certainly result in death or severe injury.
 <b>CAUTION</b>	The instructions which follow this term indicate situations where failure to follow the instructions could cause injury when using the machine or physical damage to equipment and surroundings.

#### Symbols

 ----- This symbol ( $\triangle$ ) indicates something that you should be careful of. The picture inside the triangle indicates the nature of the caution that must be taken. (For example, the symbol at left means "beware of injury".)

 ----- This symbol ( $\textcircled{/}$ ) indicates something that you must not do.

 ----- This symbol ( $\textcircled{\perp}$ ) indicates something that you must do. The picture inside the circle indicates the nature of the thing that must be done. (For example, the symbol at left means "you must make the ground connection".)

## 2 Notes on safety

### DANGER



- Wait at least 5 minutes after turning off the power switch and disconnecting the power cord from the wall outlet before opening the face plate of the control box. Touching areas where high voltages are present can result in severe injury.

### CAUTION

#### Installation



- Machine installation should only be carried out by a qualified technician.



- Contact your Brother dealer or a qualified electrician for any electrical work that may need to be done.



- The sewing machine weighs more than 87 kg. The installation should be carried out by two or more people.



- The top of the table should be 50 mm in thickness and should be strong enough to hold the weight and withstand the vibration of the sewing machine.



- Do not connect the power cord until installation is complete, otherwise the machine may operate if the start switch is pressed by mistake, which could result in injury.



- Be sure to connect the ground. If the ground connection is not secure, you run the risk of receiving a serious electric shock.



- If using a work table which has casters, the casters should be secured in such a way so that they cannot move.



- All cords should be secured at least 25 mm away from any moving parts. Furthermore, do not excessively bend the cords or secure them too firmly with staples, otherwise there is the danger that fire or electric shocks could occur.



- Install the belt covers to the machine head and motor.



- 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 can result.

Furthermore, do not drink the oil or eat the grease under any circumstances, as they can cause vomiting and diarrhoea.

Keep the oil out of the reach of children.



- Avoid setting up the sewing machine near sources of strong electrical noise such as high-frequency welding equipment. If this precaution is not taken, incorrect machine operation may result.

#### Sewing



- This sewing machine should only be used by operators who have received the necessary training in safe use beforehand.



- The sewing machine should not be used for any applications other than sewing.



- Attach all safety devices before using the sewing machine. If the machine is used without these devices attached, injury may result.



- Turn off the power switch at the following times, otherwise the machine may operate if the start switch is pressed by mistake, which could result in injury.

- When threading the needle
- When replacing the needle
- When not using the machine and when leaving the machine unattended



- Do not touch any of the moving parts or press any objects against the machine while sewing, as this may result in personal injury or damage to the machine.



- If an error occurs in machine operation, or if abnormal noises or smells are noticed, immediately turn off the power switch. Then contact your nearest Brother dealer or a qualified technician.



- If the machine develops a problem, contact your nearest Brother dealer or a qualified technician.



- If using a work table which has casters, the casters should be secured in such a way so that they cannot move.

# ⚠ CAUTION

## Cleaning



- Turn off the power switch before starting any cleaning work, otherwise the machine may operate if the start switch is pressed by mistake, which could result in injury.



- 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 can result. Furthermore, do not drink the oil or eat the grease under any circumstances, as they can cause vomiting and diarrhoea. Keep the oil out of the reach of children.

## Maintenance and inspection



- 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 pressed 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.

## 3 Warning labels

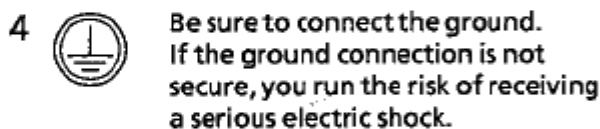
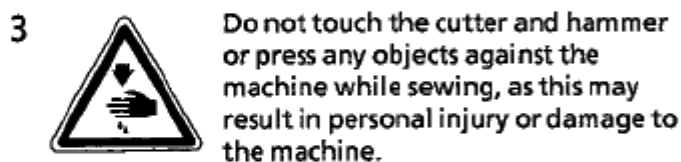
★ The following warning labels appear on the sewing machine. Please follow the instructions on the labels at all times when using the machine. If the labels have been removed or are difficult to read, please contact your nearest Brother dealer.

1

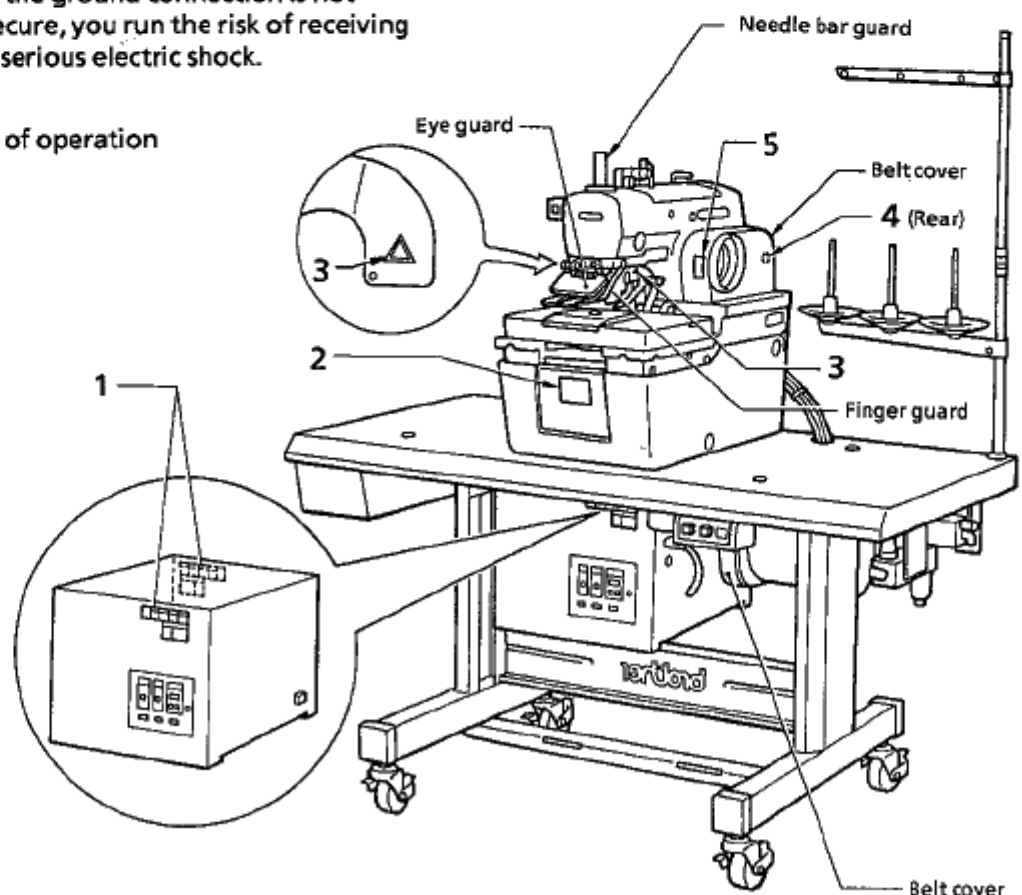
	<b>▲ DANGER</b>	<b>▲ GEFAHR</b>	<b>▲ DANGER</b>	<b>▲ PELIGRO</b>
	Hazardous voltage will cause injury. Turn off main switch and wait 5 minutes before opening this cover.	Hochspannung verletzungsgefahr! Bitte schalten sie den Hauptschalter aus und warten sie 5 minuten, bevor sie diese abdeckung öffnen.	Un voltage non adapté provoque des blessures. Eteindre l'interrupteur et attendre 5 minutes avant d'ouvrir le capot.	Un voltaje inadecuado puede provocar las heridas. Apagar el interruptor principal y esperar 5 minutos antes de abrir esta cubierta.



Safety devices:  
Eye guard,  
finger guard,  
belt cover,  
needle bar  
guard etc.



5 Direction of operation



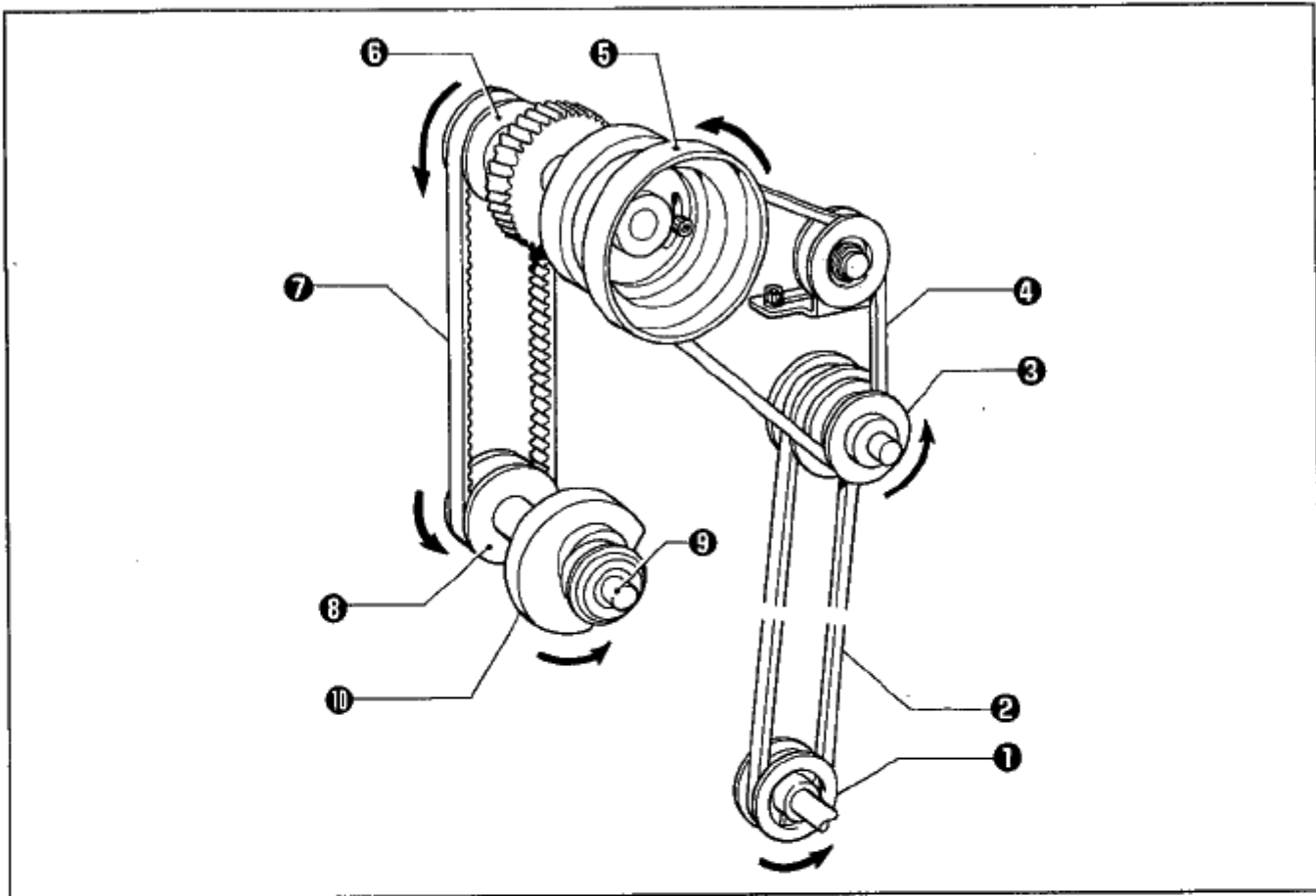
# CONTENTS

<b>1. MECHANICAL DESCRIPTIONS</b> .....	1	3-10. Needle bar rocking mechanism .....	34
1-1. Upper and lower shaft mechanisms .....	1	3-11. Looper and spreader .....	37
1-2. Needle bar and thread take-up mechanisms .....	2	3-12. Lubrication .....	40
1-3. Zigzag mechanism .....	3	3-13. Feed mechanism .....	42
1-4. Needle bar rocking mechanism .....	3	3-14. Synchronizer .....	46
1-5. Feed mechanism .....	4	3-15. Covers and work clamp mechanism ...	47
1-6. Work clamp and cloth opener .....	5	3-16. Safety switch assembly .....	47
1-7. Cutter mechanism .....	7		
1-8. Looper mechanism .....	7	<b>4. ADJUSTMENT</b> .....	48
1-9. Spreader mechanism .....	8	4-1. Adjusting the work clamp lift height ..	48
1-10. Double chain stitch looper mechanism .....	9	4-2. Adjusting the work clamp plate .....	49
		4-3. Adjusting the cloth spreading amount .....	49
<b>2. DISASSEMBLY</b> .....	10	4-4. Adjusting the position of the work clamp .....	49
2-1. Covers and work clamp plates .....	10	4-5. Adjusting the X-axis home position ...	50
2-2. Feed mechanism .....	11	4-6. Adjusting the Y-axis home position ...	50
2-3. Lubrication .....	11	4-7. Adjusting 0 position (reference line) of the needle .....	51
2-4. Looper and spreader .....	12	4-8. Adjusting the home position of the looper base .....	51
2-5. Needle bar rotating mechanism .....	13	4-9. Fine adjustment of knife position .....	52
2-6. Looper base .....	14	4-10. Adjusting the sideways movement of the cutter lever .....	53
2-7. Needle bar, thread take-up, and zigzag mechanisms .....	15	4-11. Adjusting the height of the throat plate .....	53
2-8. Knife pipe assembly .....	17	4-12. Adjusting the heights of the spreader and the looper .....	54
2-9. Lower shaft mechanism .....	17	4-13. Adjusting the loop stroke .....	55
2-10. Synchronizer .....	18	4-14. Adjusting the height of the needle bar .....	57
2-11. Upper shaft mechanism .....	18	4-15. Adjusting the clearance between the looper and the needle .....	57
2-12. Cutter mechanism .....	19	4-16. Adjusting the needle guard .....	58
2-13. Zigzag fork .....	19	4-17. Adjusting the spreader mounting position .....	58
		4-18. Adjusting the spreader timing .....	59
<b>3. ASSEMBLY</b> .....	20	4-19. Adjusting the amount to pull the upper thread and tension release .....	59
3-1. Zigzag fork .....	20	4-20. Adjusting upper thread trimming .....	60
3-2. Cutter mechanism .....	21	4-21. Adjusting the lower thread trimmer ..	61
3-3. Upper shaft mechanism .....	22	4-22. Adjusting the position of the lower thread presser .....	67
3-4. Lower shaft mechanism .....	23	4-23. Adjusting the rotating centers of the needle bar and the looper base .....	68
3-5. Upper thread trimmer mechanism .....	24	4-24. Adjusting the needle bar stop position .....	69
3-6. Attaching the knife pipe and the knife base .....	25		
3-7. Driving gear shaft mechanism .....	26		
3-8. Needle bar, thread take-up, and zigzag mechanisms .....	27		
3-9. Looper base .....	33		

<b>5. POWER SUPPLY EQUIPMENT</b> .....	70
5-1. Components inside the control box ...	70
5-2. Fuse explanation .....	72
5-3. Connectors .....	74
5-3-1. Connector positions .....	74
5-3-2. Signal names for connectors and probable symptoms due to poor contact .....	78
5-4. Specification harness connections ....	88
5-5. Summary of DIP switches .....	89
5-6. Using the memory switch .....	93
5-7. Sensors .....	94
<b>6. AIR PRESSURE MECHANISM</b> .....	98
6-1. Solenoid valves and air tubes .....	98
6-2. Air tube layout .....	99
<b>7. SOFTWARE</b> .....	102
7-1. Motion flowchart .....	102
7-2. Input check list .....	103
7-3. Output check list .....	105
7-4. Error codes .....	107
7-5. Troubleshooting .....	110
7-6. Control circuit block diagram (1) .....	117
7-7. Control circuit block diagram (2) .....	119

# 1. MECHANICAL DESCRIPTIONS

## 1-1. Upper and lower shaft mechanisms

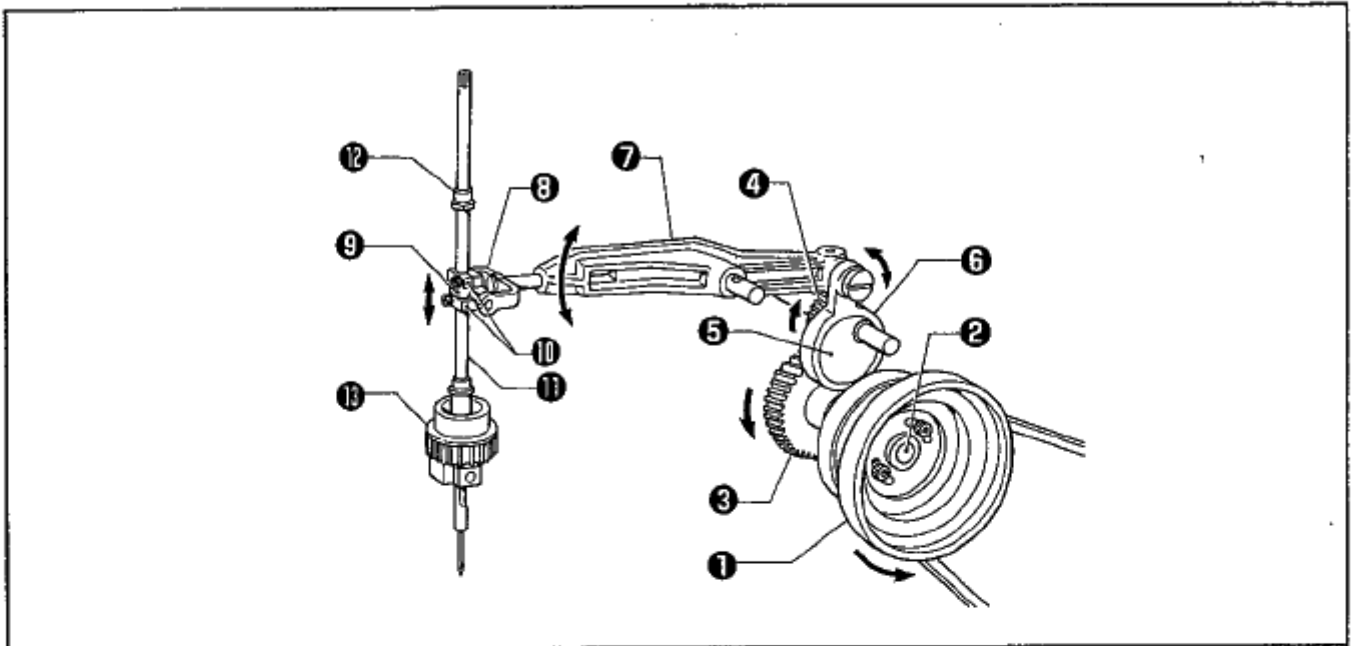


- When the motor pulley ① rotates, its motion is transmitted to the V belt ②, the idler pulley ③, and the V belt ④, and finally to the pulley ⑤.
- When the pulley ⑤ rotates in the direction of the arrow, its motion is transmitted to the upper shaft timing pulley ⑥, the timing belt ⑦, and the lower shaft tension pulley ⑧, and the lower shaft ⑨, causing the lower shaft cam ⑩ to turn in the direction of the arrow.



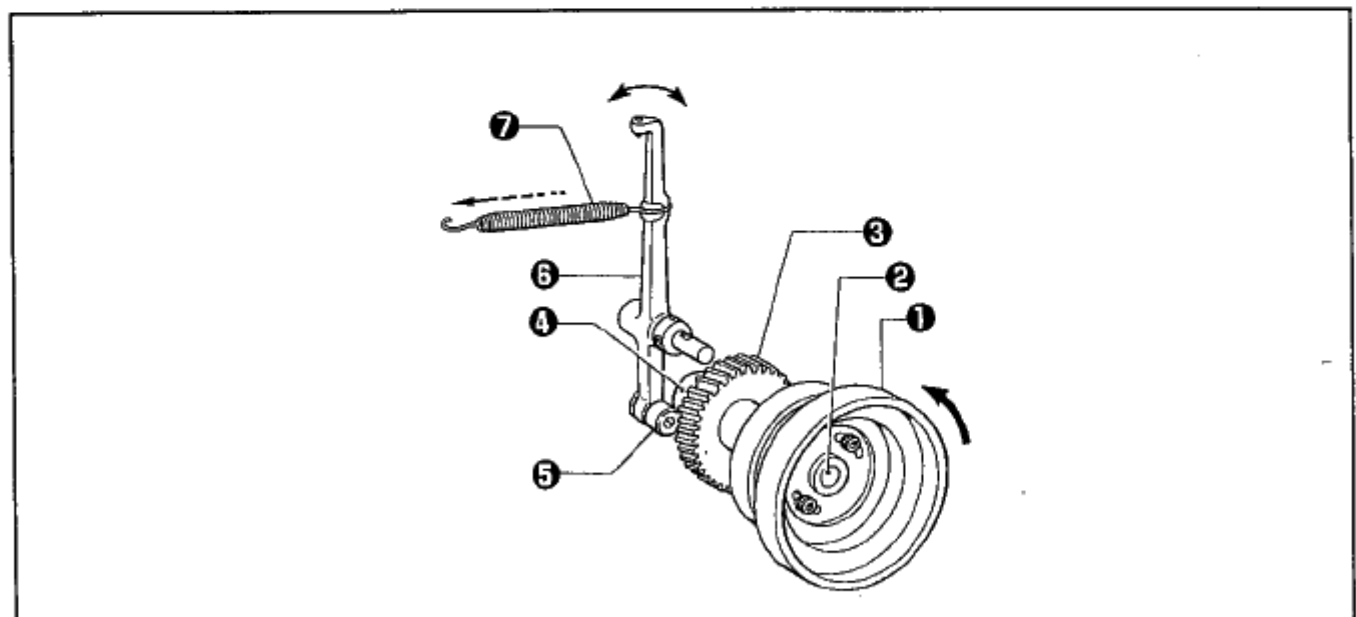
## 1-2. Needle bar and thread take-up mechanisms

## 1) Needle bar mechanism



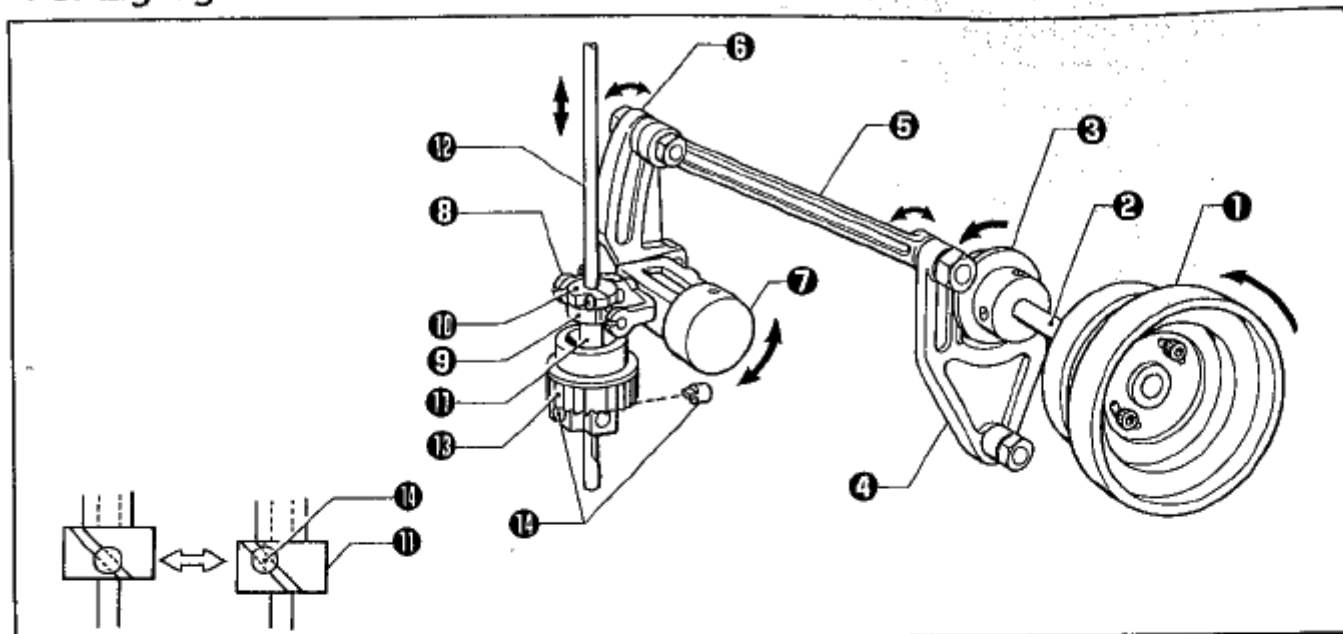
- When the pulley rotates in the direction of the arrow (towards you), its rotation is transmitted to the upper shaft ②, the needle bar gear ③, and the driving gear ④, that makes the eccentric rod ⑤ rotate.
- The driving rod ⑥, which is engaged with the eccentric rod ⑤, rocks the needle bar driving lever ⑦.
- The rocking motion of the needle bar driving lever ⑦ is transmitted to the needle bar yolk ⑧, the needle bar level feed link ⑨, and the needle bar clamp ⑩, and then the needle bar ⑪ moves up and down.
- The needle bar ⑪ is guided by needle bar bush (U) ⑫ and the needle bar block ⑬.

## 2) Thread take-up mechanism



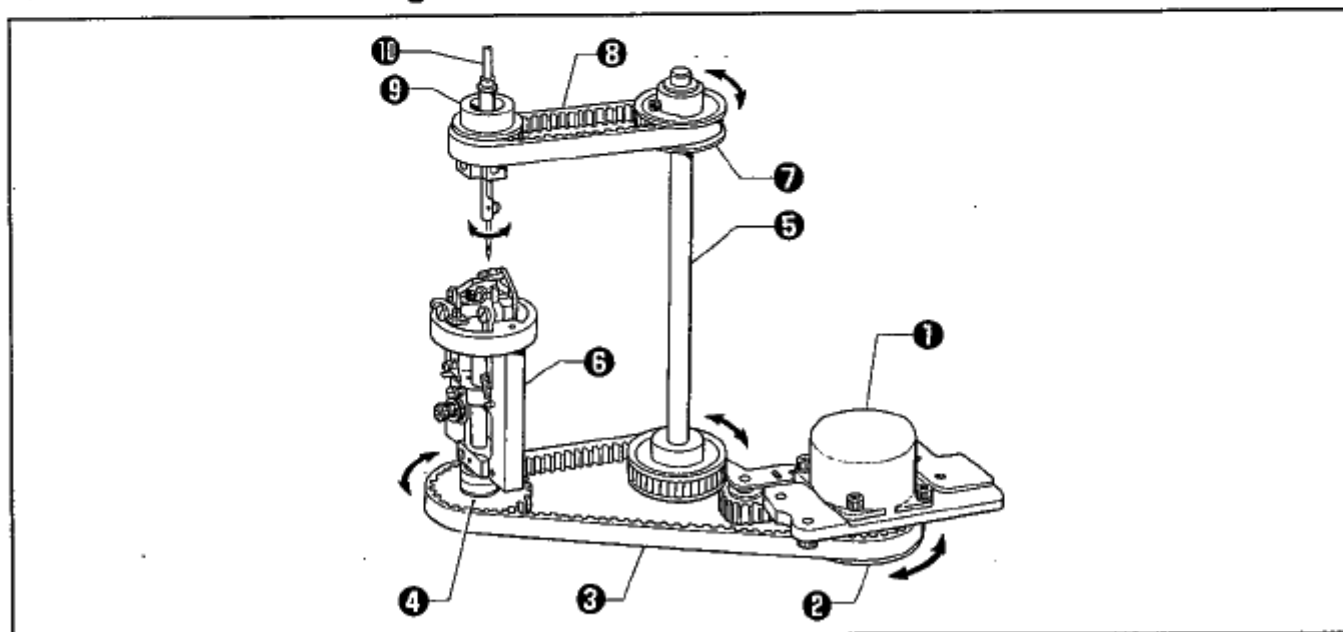
- When the pulley ① rotates in the direction of the arrow, the needle bar gear ③ rotates via the upper shaft ②.
- The thread take-up cam ④, which is attached to the needle bar gear ③, moves the thread take-up ⑥ via the thread take-up cam roller ⑤.
- The thread take-up cam roller ⑤ is always kept in contact with the cam ④ by the thread take-up spring ⑦ attached to the thread take-up ⑥.

### 1-3. Zigzag mechanism



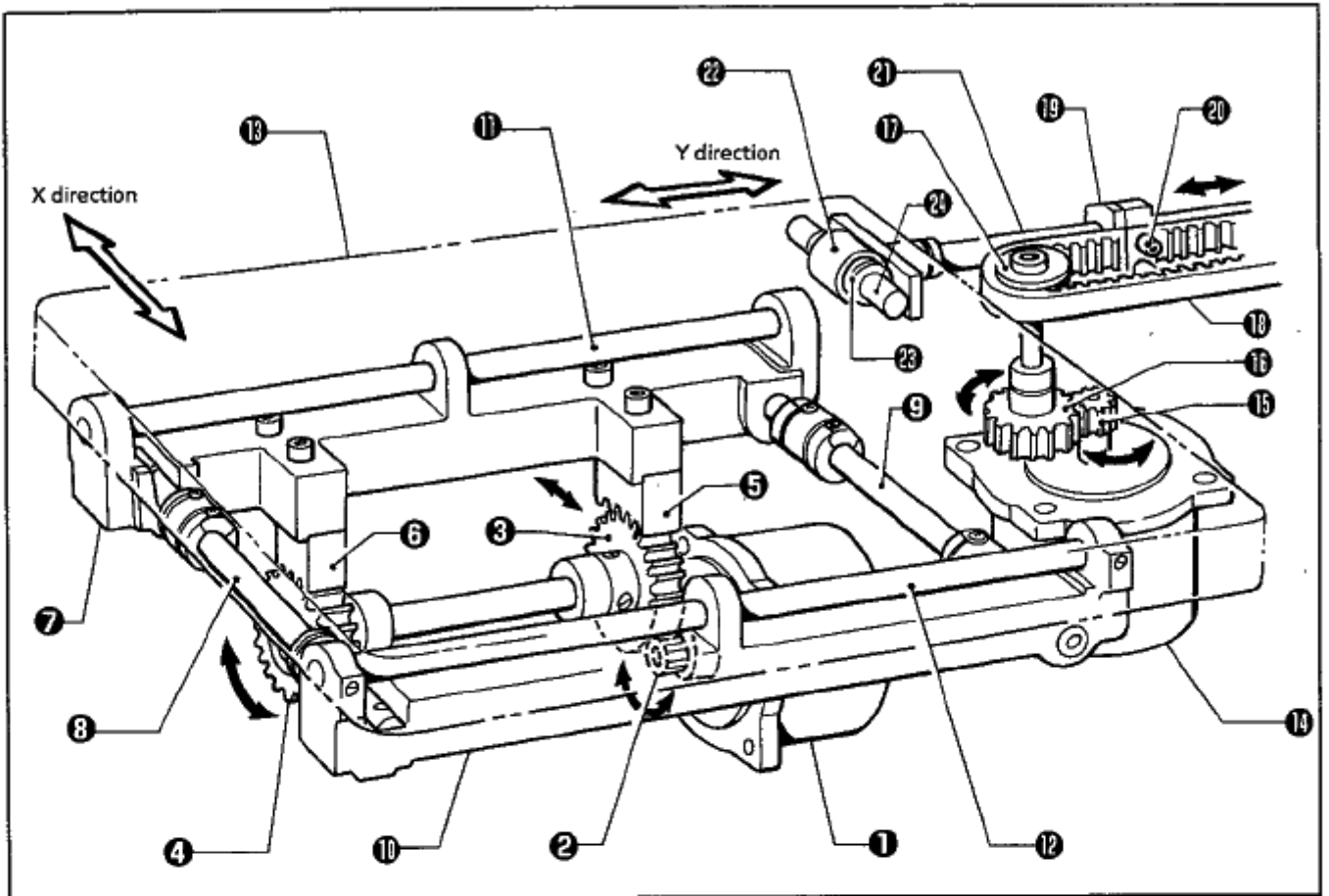
- When the pulley ① is turned in the direction of the arrow, its motion is transmitted to the upper shaft ② that rotates the zigzag cam ③, and the zigzag fork ④ rocks.
- The zigzag rock shaft ⑦ is rocked by the zigzag fork ④, via the zigzag connecting rod ⑤, and the zigzag crank ⑥.
- The rocking motion of the zigzag rock shaft ⑦ is transmitted to the zigzag lever ⑧, the needle bar lever feed link ⑨, and the needle bar block clamp ⑩, those move the needle bar block ⑪ up and down.
- The needle bar ⑫ is fitted on the needle bar block ⑪, and the needle bar guide ⑬ is fitted in the notch of the needle bar block ⑪. When the needle bar block ⑪ moves up and down, the needle bar ⑫ oscillates.

### 1-4. Needle bar rocking mechanism



- When pulse motor (R) ① operates, the motion is transmitted to the driving needle pulley assembly ②, timing belt (D) ③, and the looper pulley assembly ④, which then moves the driving looper shaft assembly ⑤.
- The looper base ⑤ is rotated by the looper pulley assembly ④.
- When the vertical shaft (T) pulley (U) assembly ⑦, which is attached to the driving looper shaft assembly ⑤, rotates, the motion is transmitted to timing belt (U) ⑧, and the needle bar block assembly ⑨ that rotates the needle bar ⑩.

## 1-5. Feed mechanism



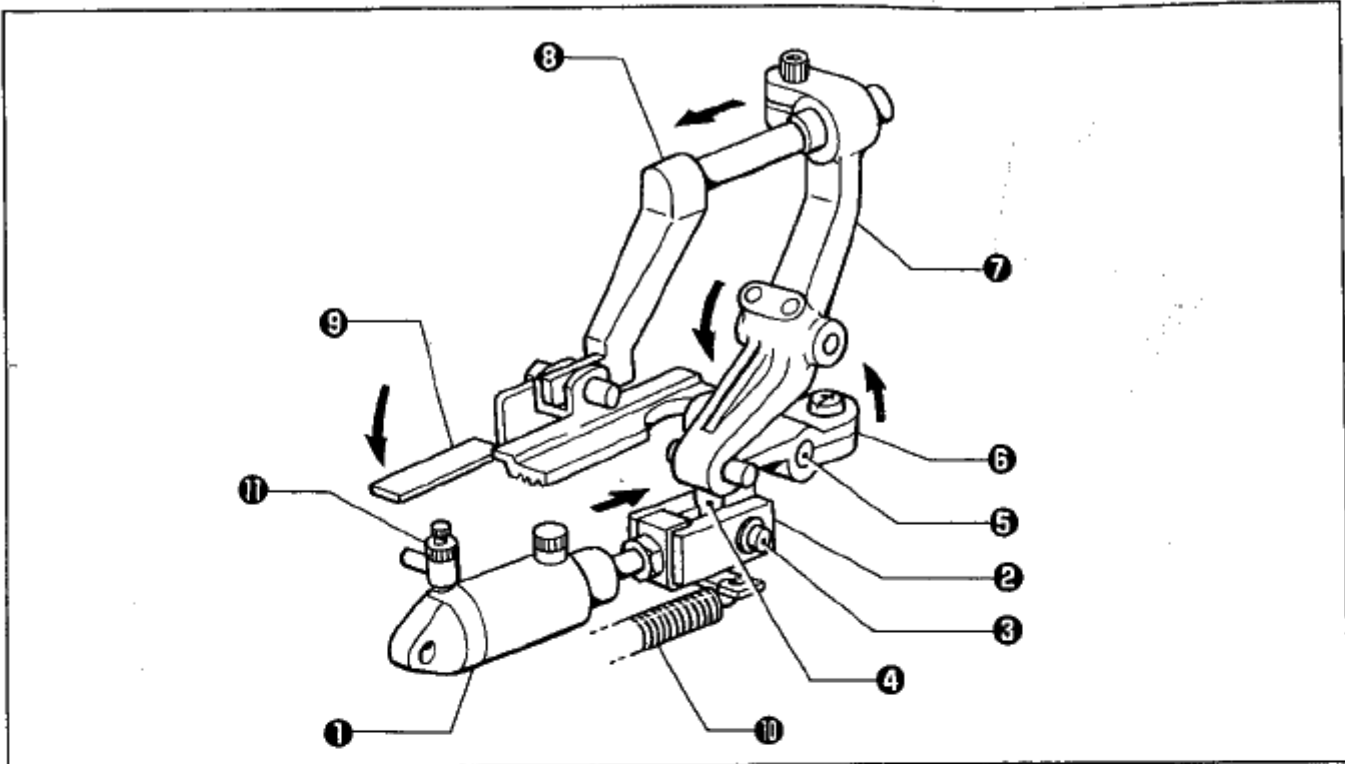
## 1) X-direction feeding

- When pulse motor (X) ① operates, its motion is transmitted to the actuating gear ②, the idle gears ③ and ④, and the X racks ⑤ and ⑥, that finally moves X-feed shaft holder (L) ⑦.
- The X-feed guide shafts (A) ⑧ and (B) ⑨, which are connected to X-feed shaft holder (L) ⑦, move X-feed shaft holder (R) ⑩.
- The Y-feed guide shafts ⑪ and ⑫, which are attached to X-feed shaft holders (L) ⑦ and (R) ⑩, move the feed bar ⑬ in the X direction.

## 2) Y-direction feeding

- When pulse motor (Y) ⑭ rotates, its motion is transmitted to the actuating gear ⑮, the idle gear ⑯, timing pulley (A) ⑰, that finally moves the Y-timing belt ⑱.
- The Y-timing belt ⑱ is secured by the Y-driving shaft holder ⑲ and the belt holder ⑳, and that moves the Y shaft ㉑.
- The linear bush ㉒, which is fitted in the ball bearing ㉓, is fitted in the Y-guide shaft ㉔ to move the feed bar ⑬ in the Y direction.

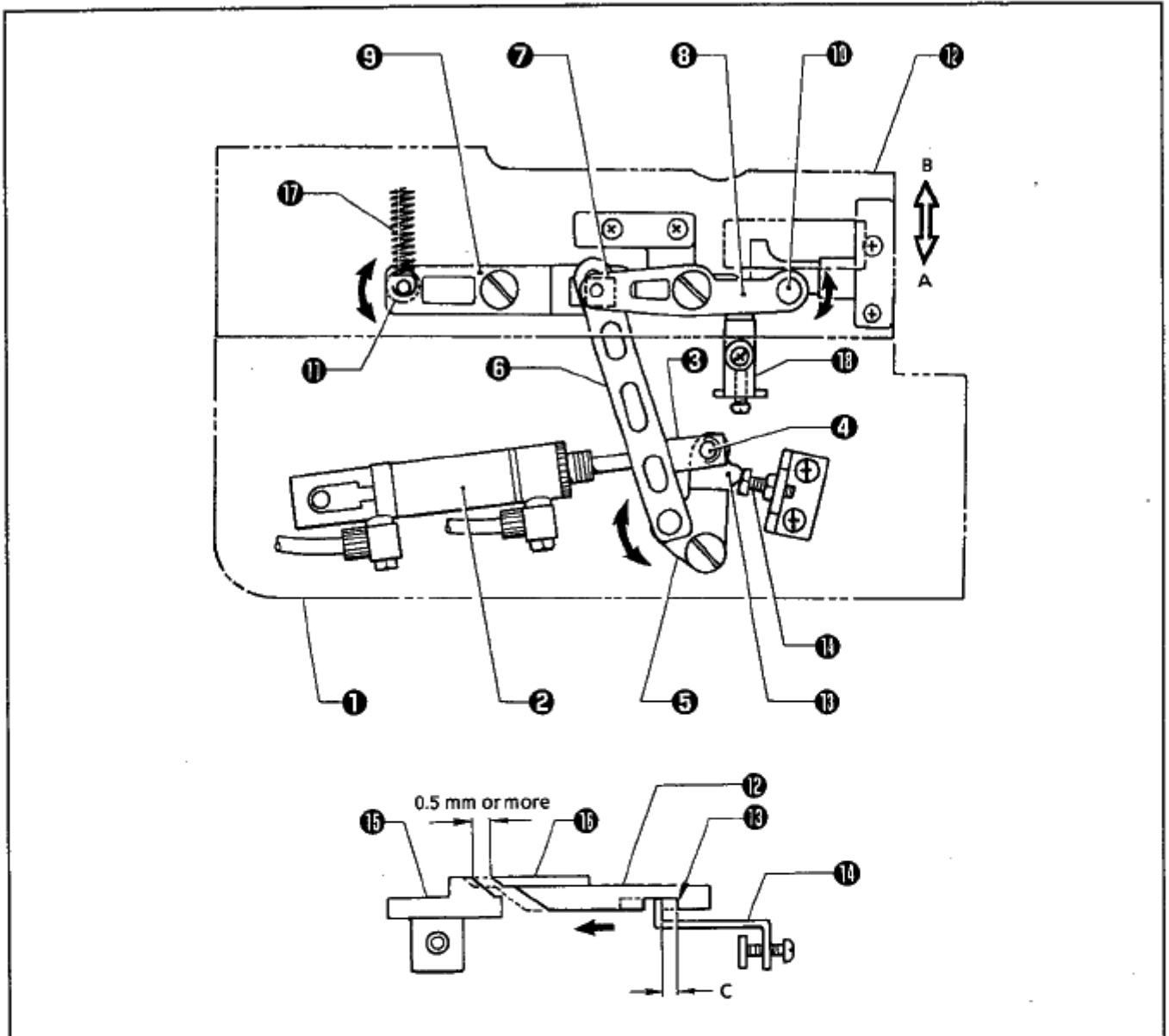
1-6. Work clamp and cloth opener



1) Work clamp mechanism

- Cylinder 16×10 ① moves clamp lever (B) ⑥ in the direction of the arrow according to the cylinder's motion, via the presser cylinder rod ②, the cylinder rod pin ③, the presser driving lever ④, and the clamp lever shaft ⑤.
- The end of clamp lever (B) ⑥ is fitted on clamp lever (L) ⑦, and the work clamp ⑨ attached to clamp arm (L) ⑧ lowers.
- When the cylinder ① is returned by the presser spring ⑩, the work clamp ⑨ rises. The speed controller ⑪ attached to the cylinder ① controls the rising speed of the work clamp ⑨.
- \* The work clamp mechanism is activated by independently-operated left and right cylinders, that can equalize the pressure of the work clamp.  
The pressure of the work clamp is always applied to the material equally even when the material thickness changes.

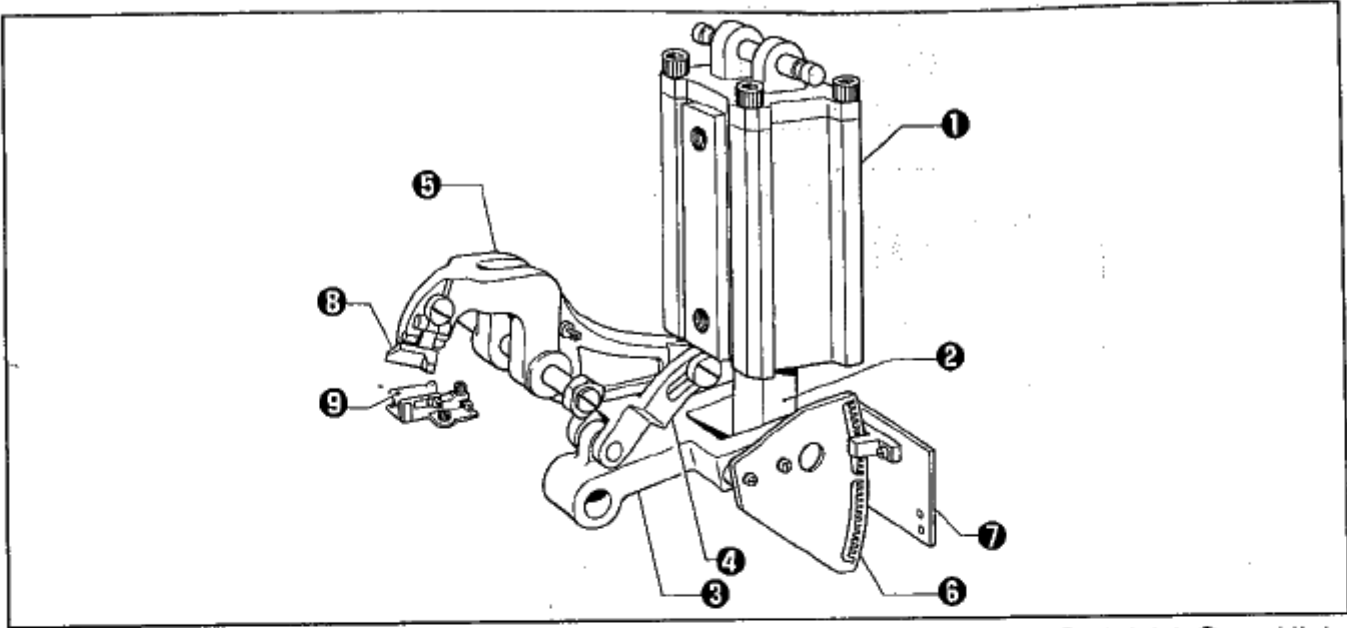
## 2) Cloth opener



1.
  - The feed bracket ① carries the cylinder 16 x 15 assembly ②, whose end is connected to the opening cylinder rod ③, cylinder rod pin (B) ④, and the opening driving lever ⑤.
  - The opening connecting rod ⑥ attached to the opening driving lever ⑤ is connected to the fulcrum lever plate ⑧ and the lever ⑨ via the slide block ⑦.
  - The projection ⑩ of the fulcrum lever plate ⑧ and the pin ⑪ of the lever ⑨ are fitted on the hole of the work clamp plate ⑫ and the slide block on it.
  - When the cylinder 16 x 15 assembly ② operates, and the stopper ⑬ of the opening driving lever ⑤ and the bolt ⑭ make contact, the work clamp plate ⑫ 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 ⑮ and the needle plate ⑯. Adjust the clearance using the bolt ⑰.
  - When the cylinder 16 x 15 assembly ② is not pressurized, the work clamp plate ⑫ is moved in the direction of B by the opening spring ⑱. At this time, the stopper ⑬ of the work clamp plate ⑫ makes contact with the stopper plate ⑰.

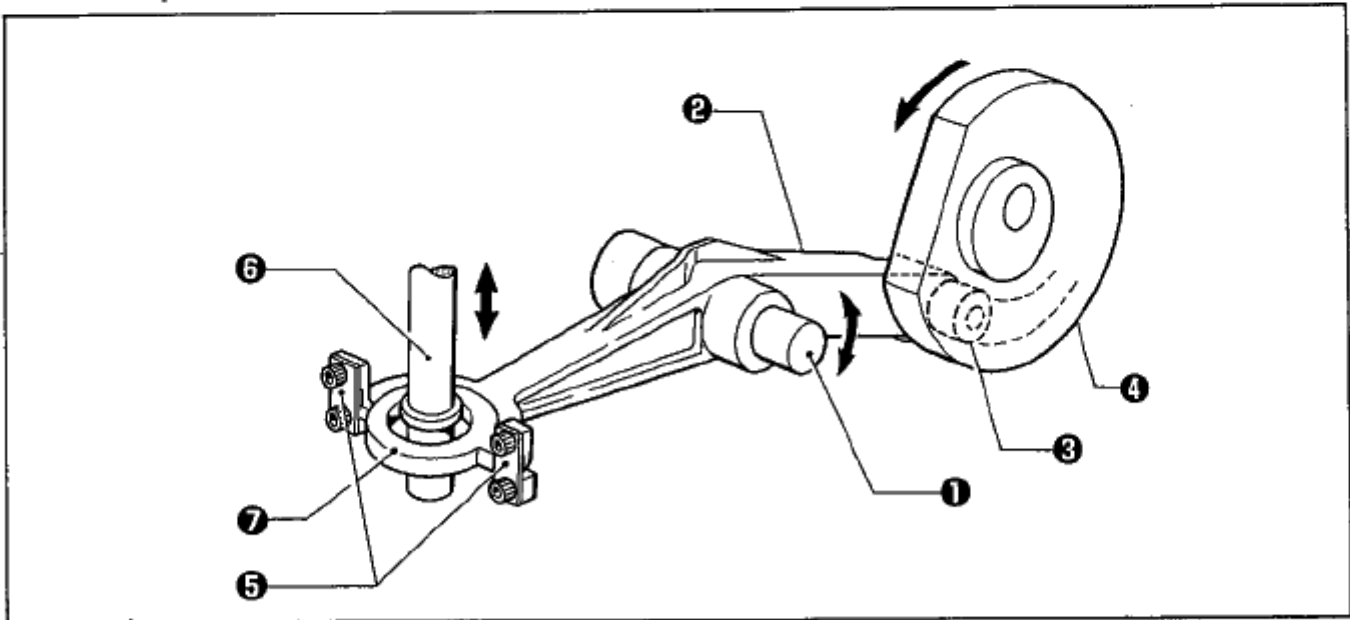
\* C indicates the movement of the work clamp plate ⑫.

1-7. Cutter mechanism



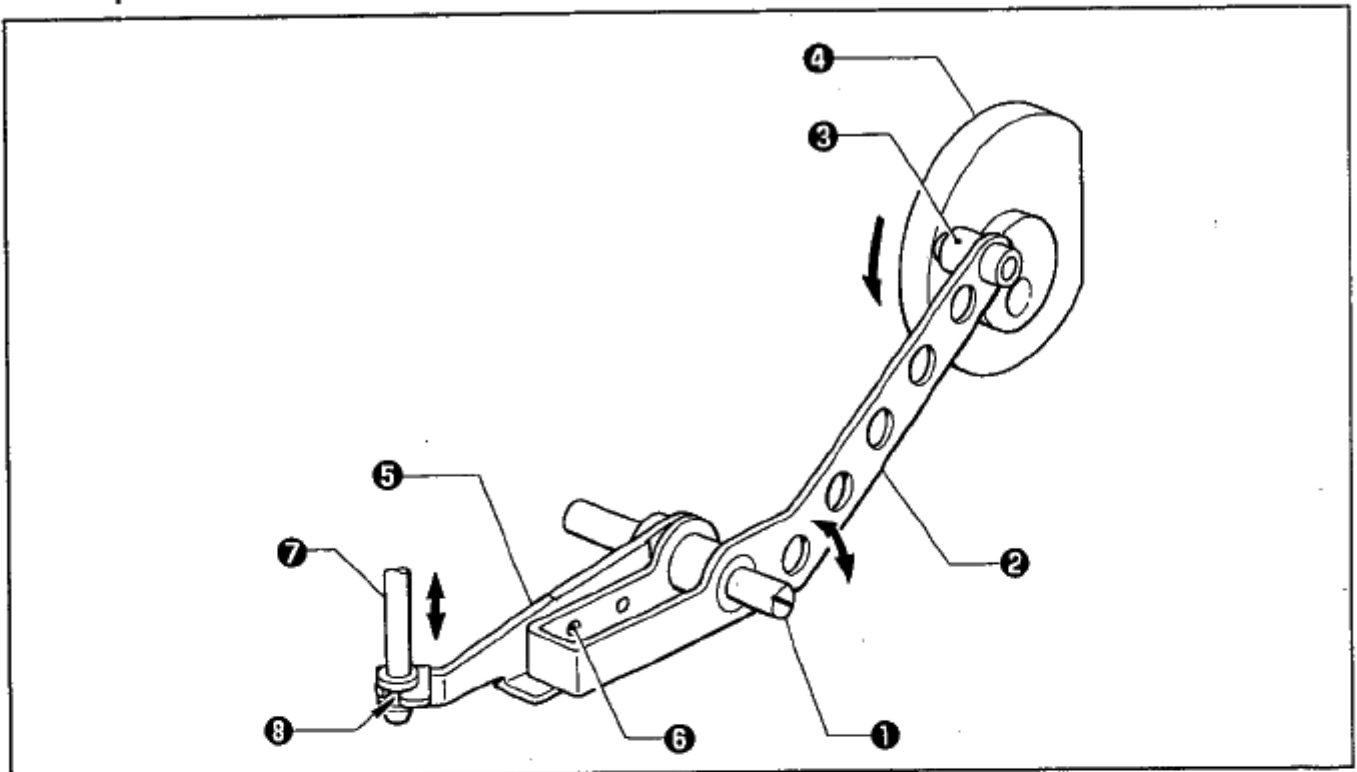
- When cylinder 63 x 100 ① operates, the motion is transmitted to the cylinder rod ②, link (C) ③, and link (A) ④, which then activates the cutter lever assembly ⑤.
- The cutter sensor partition plate ⑥ attached to link (C) ③, and the cutter sensor assembly ⑦ monitor the motion of the cutter sensor assembly ⑤.
- Engagement of the hammer ⑧ attached to the end of the cutter sensor assembly ⑤ and the cutter ⑨ attached to the bed, cuts the material requiring button eyelets.

1-8. Looper mechanism



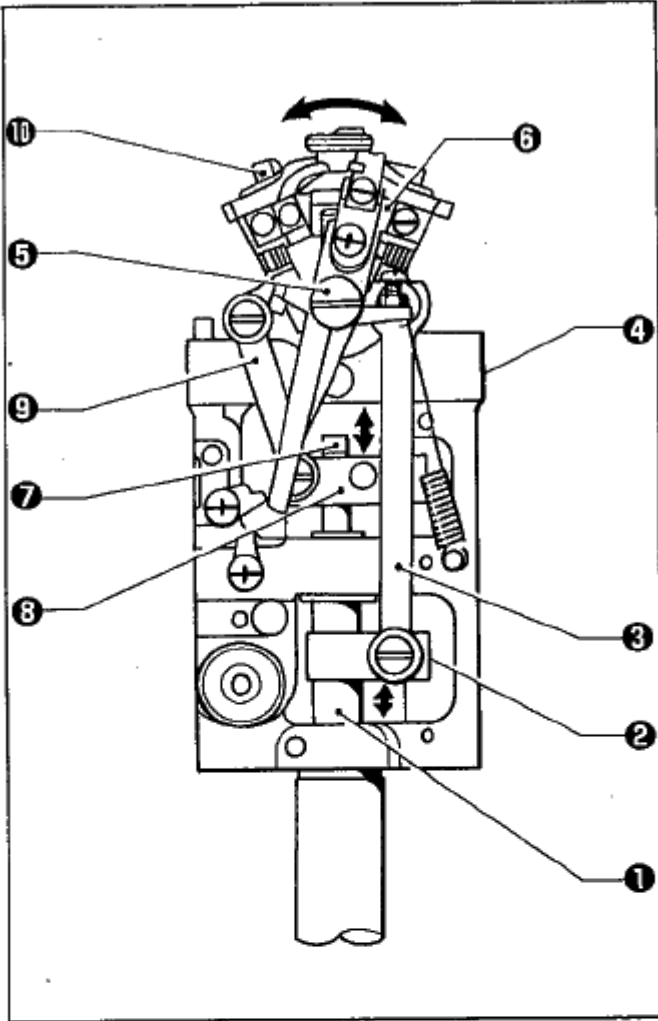
- At the end of the looper link assembly ② which has the looper link support shaft ① as the pivot of the rocking motion, the looper cam roller ③ is fitted in the groove in the lower shaft cam ④. The two looper link springs ⑤ are attached to the other end.
- The looper link springs ⑤ are secured by the looper driving plate ⑦ through which the looper driving shaft ⑥ passes.
- When the lower shaft cam ④ rotates in the direction of the arrow, the looper link assembly ② is rocked via the looper cam roller ③. The looper driving shaft ⑥ moves up and down due to the motion of the looper link assembly ②.

## 1-9. Spreader mechanism

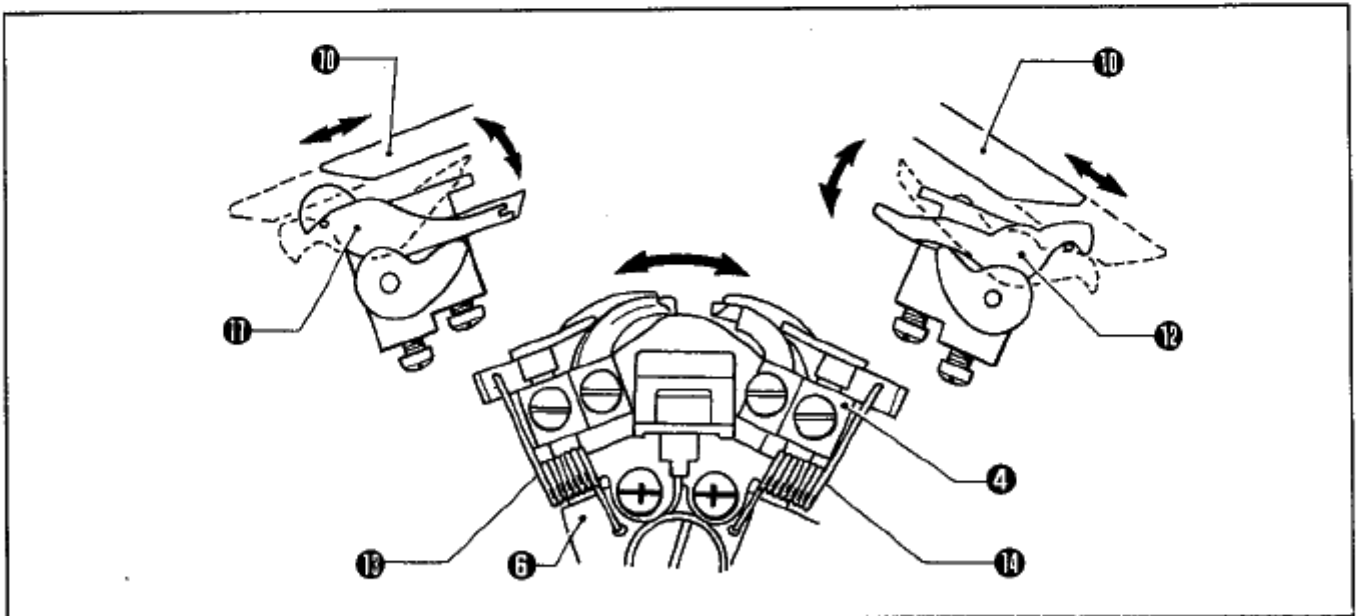


- At the end of the spreader cam lever ② which has the looper link support shaft ① as the pivot of the rocking motion, the spreader cam roller ③ makes contact with the circumference of the lower shaft cam ④, and the spreader driving lever ⑤ is attached to the other end using the screw ⑥. The forked part of the spreader driving lever ⑤ is fitted in the groove ③ of the spreader link shaft ⑦.
- When the lower shaft cam ④ rotates in the direction of the arrow, the spreader cam lever ② is rocked via the spreader cam roller ③.  
The spreader link shaft ⑦ moves up and down due to the motion of the spreader cam lever ②.

1-10. Double chain stitch looper mechanism



- When the looper driving shaft ① moves up and down, the motion is transmitted to the looper link clamp ②, and the looper link ③, which rocks LS-holder bracket ⑥ with the holder support shaft ⑤ secured to the loop base ④ regarded as the pivot.
- When the spreader link shaft ⑦ moves up and down, the motion is transmitted to the spreader link base ⑧ and the spreader cam link ⑨, which then rocks the spreader differential cam ⑩ with the holder support shaft ⑤ secured to the loop base ④ regarded as the pivot.



- The rocking motions of the LS-holder bracket ⑥ and the spreader differential cam ⑩ cause spreader (L) ⑪ to rock.
- In the same way, spreader (R) ⑫ is rocked.



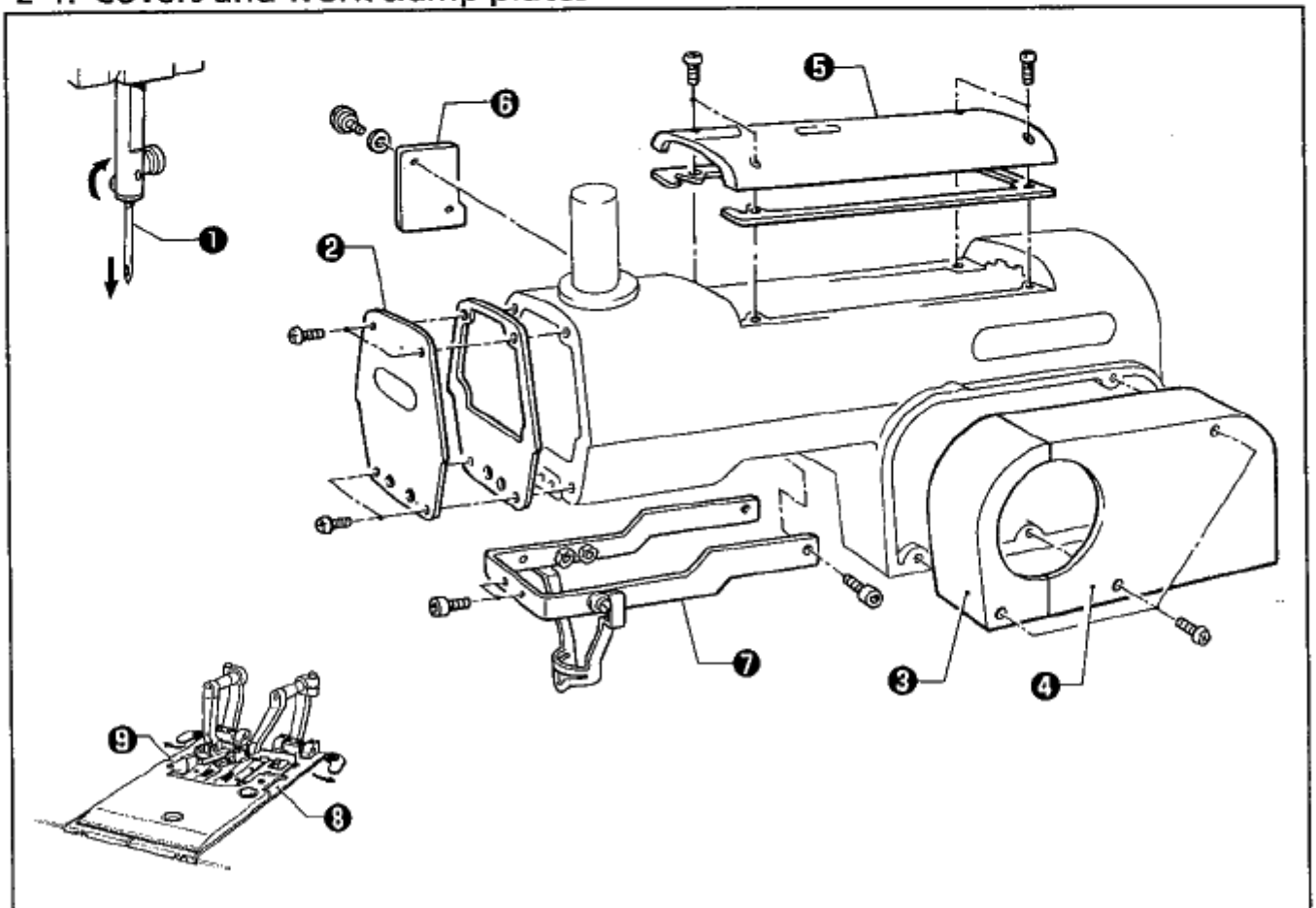
## 2. DISASSEMBLY

### ⚠ CAUTION

- ⊘ • Disassembly should only be carried out by a qualified technician.
- ⚠ • 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.
- ⚠ • 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.
- ! • Use only the proper replacement parts as specified by Brother.
- ⊘ • 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.
- ! • 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.

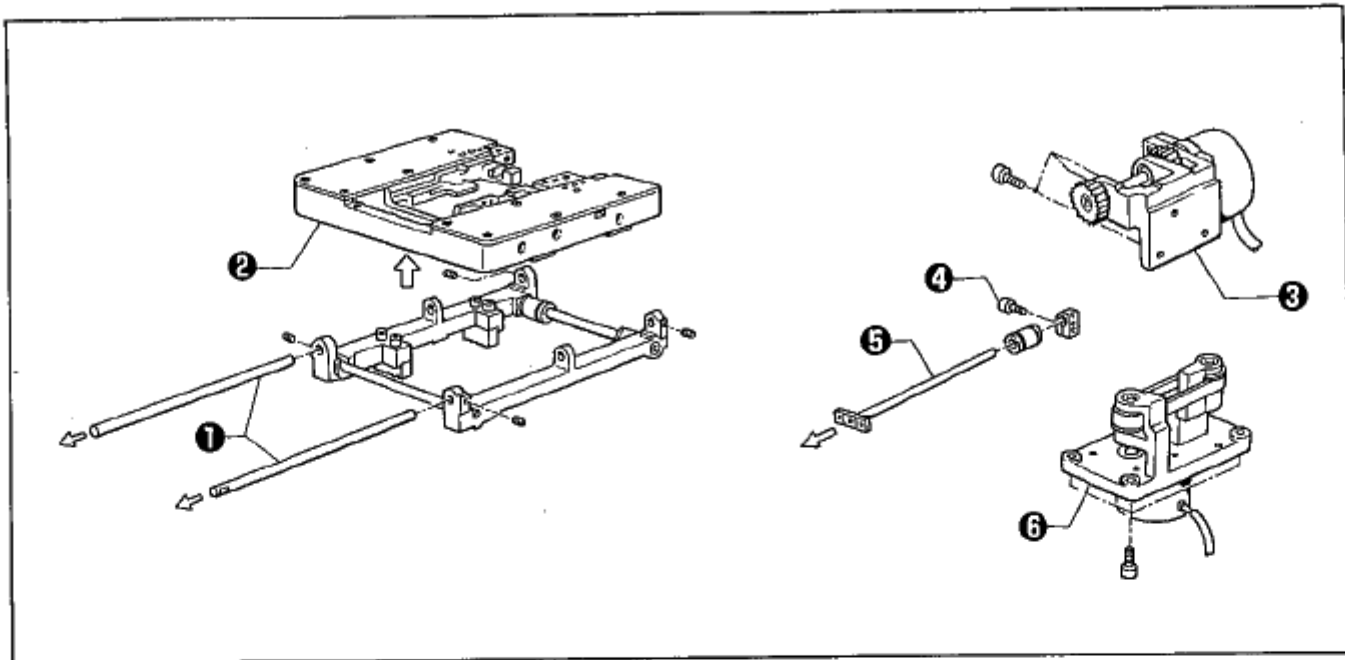
If disassembly is not performed in the correct order, it may be hard to remove parts. Disassemble as follows. The following is the main points of disassembly.

### 2-1. Covers and work clamp plates



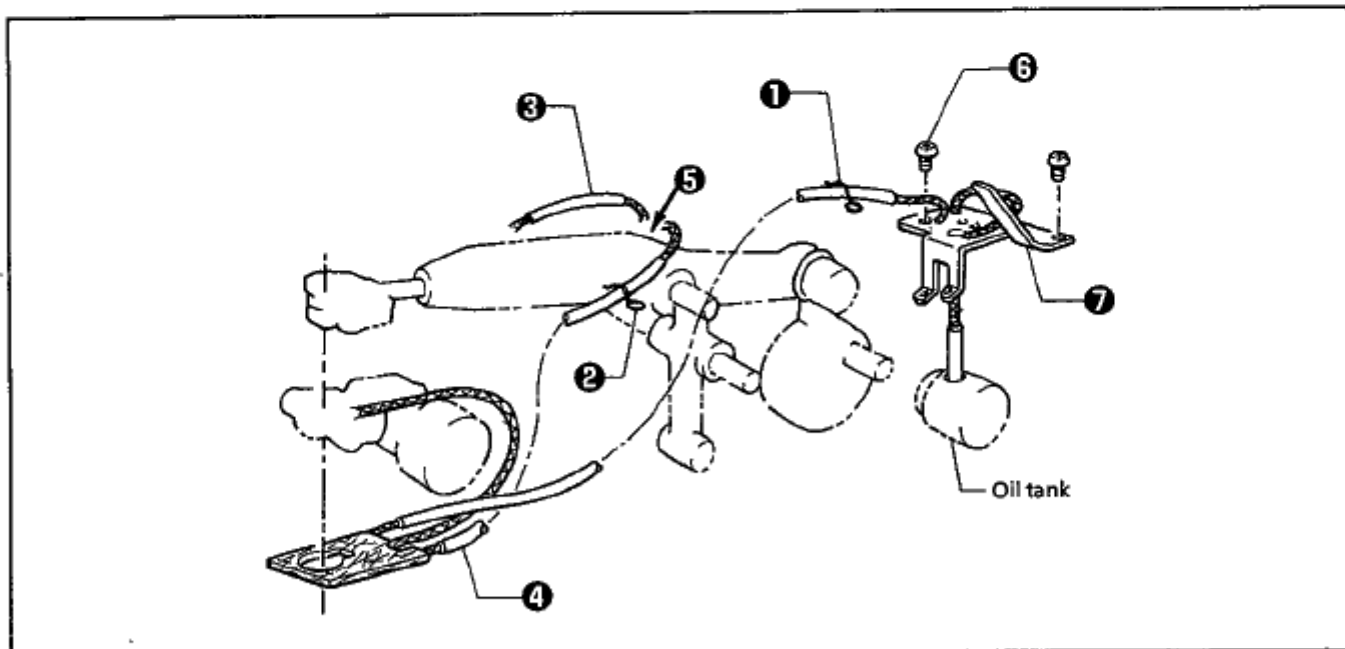
1. Remove the needle ①.
2. Remove the faceplate ②, belt covers (F) ③ and (R) ④, the top cover ⑤, the zigzag window cover ⑥, and the driving needle guard cover ⑦.
3. Remove work clamp plates (R) ⑧ and (L) ⑨.

## 2-2. Feed mechanism



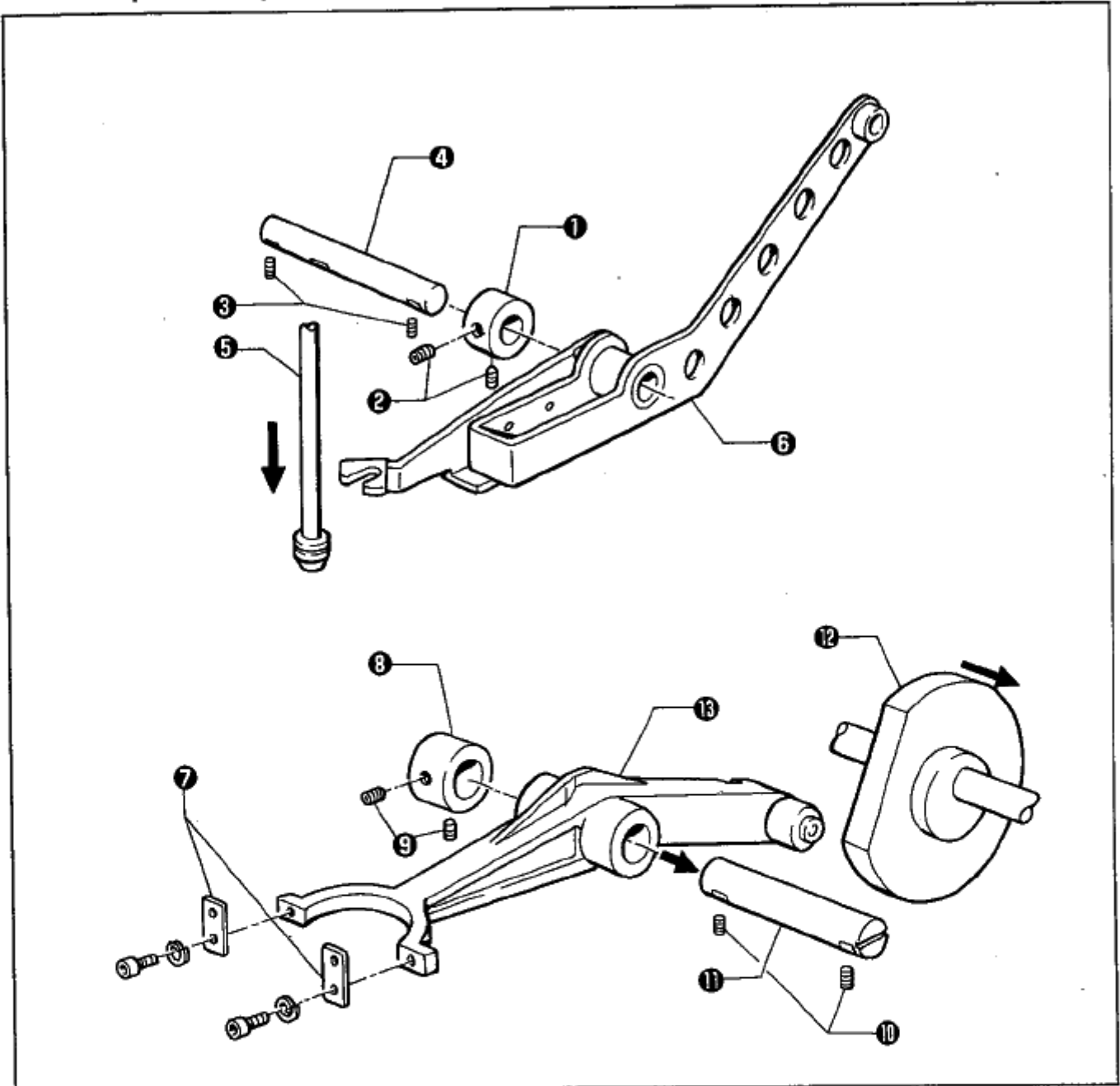
1. Feed bracket ..... Remove the two Y-feed guide shafts ① toward you. The feed bracket ② unit will come off.
2. X motor unit ..... Remove the motor support ③, which includes the X motor unit.
3. Y motor unit ..... Loosen the screw ④ of the Y driving shaft holder, pull out the Y-shaft ⑤ toward you, and remove the Y-feed base ⑥, including the Y motor unit.

## 2-3. Lubrication



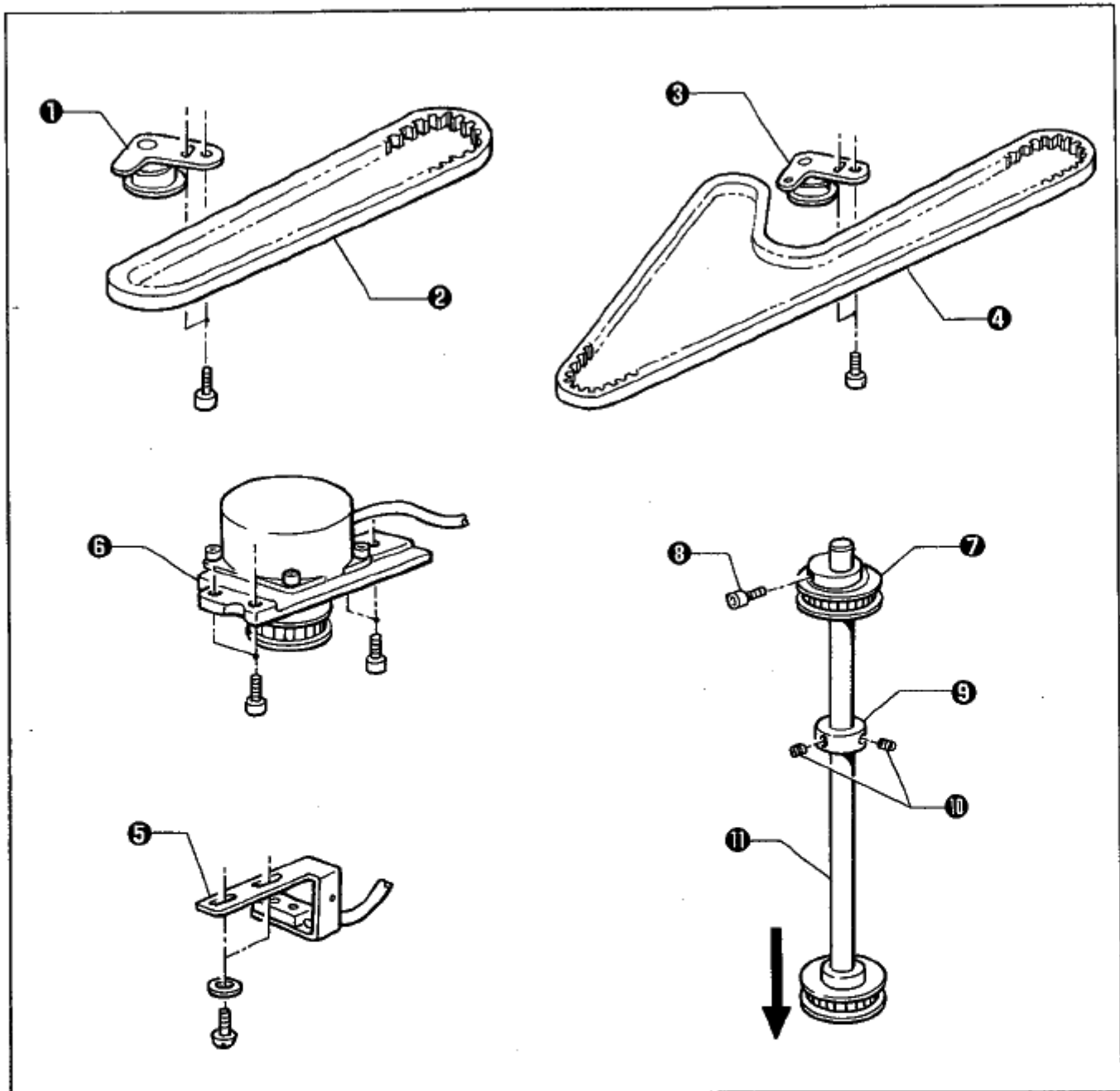
1. Remove the wick supports ① and ②.
2. Remove the wicks ③ and ④ from the hole ⑤.
3. Remove the two screws ⑥ and wick support (L) ⑦.

## 2-4. Looper and spreader



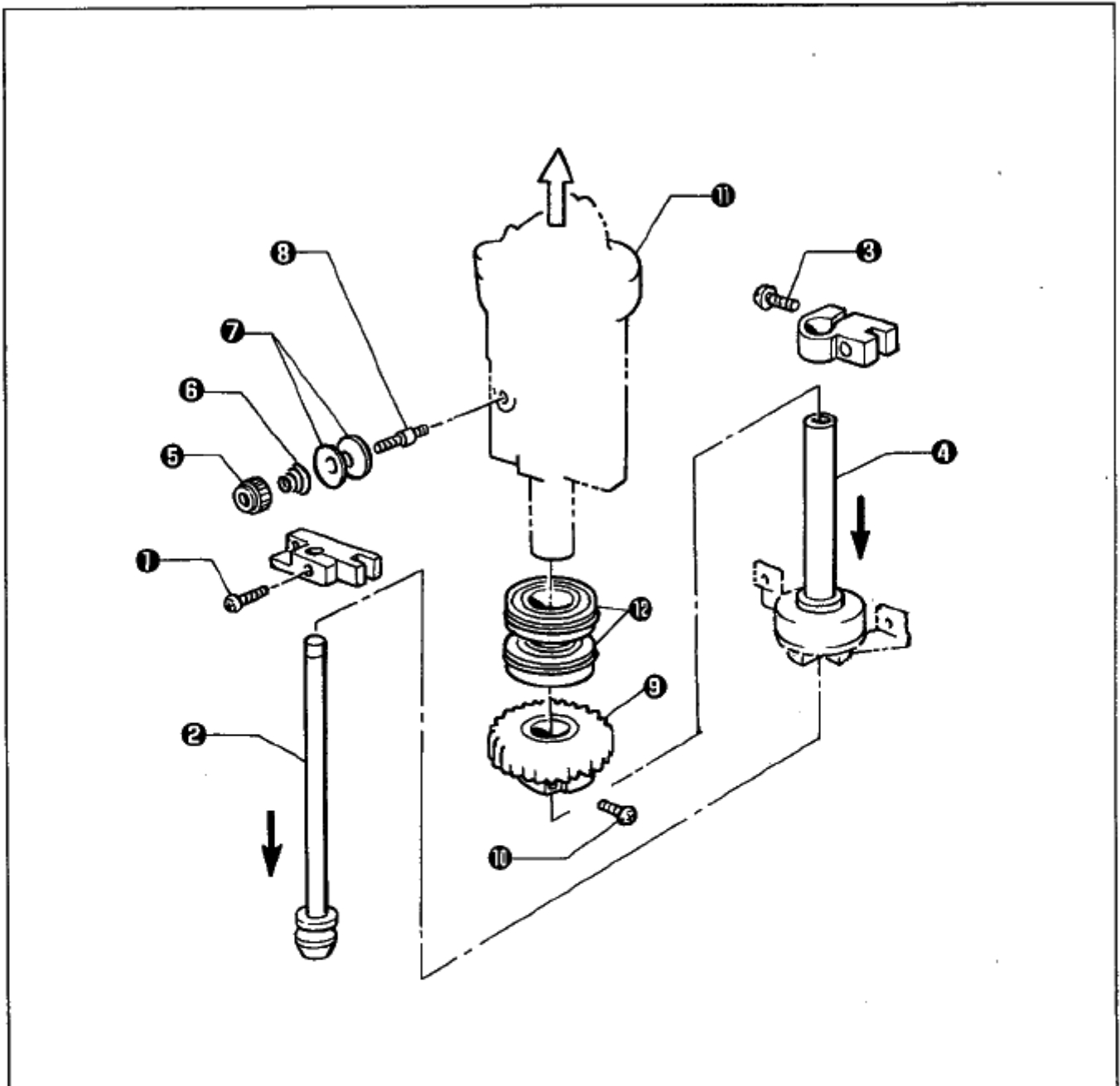
1. Loosen the set screws ② of the set collar ①, and set screws ③, and remove the looper link support shaft ④.
2. Position the needle at its lower position. Pull the spreader link shaft ⑤ downward, and remove the spreader cam lever ⑥.
3. Remove the looper link springs ⑦.
4. Loosen the set screws ③ of the set collar ⑤ and the set screws ⑩, and remove the looper link support shaft ⑪.
5. Slide the lower shaft cam ⑫ in the direction of the arrow, and remove the looper link ⑬.

## 2-5. Needle bar rotating mechanism



1. Remove the tension pulley ① and timing belt (U) ②.
2. Remove the tension pulley ③ and timing belt (D) ④.
3. Remove the R sensor set plate ⑤.
4. Remove the motor base ⑥.
5. Loosen the bolt ⑧ of the vertical shaft (T) pulley ⑦ and the set screws ⑩ of the set collar ⑨.
6. Remove the driving looper shaft ⑪ downward.

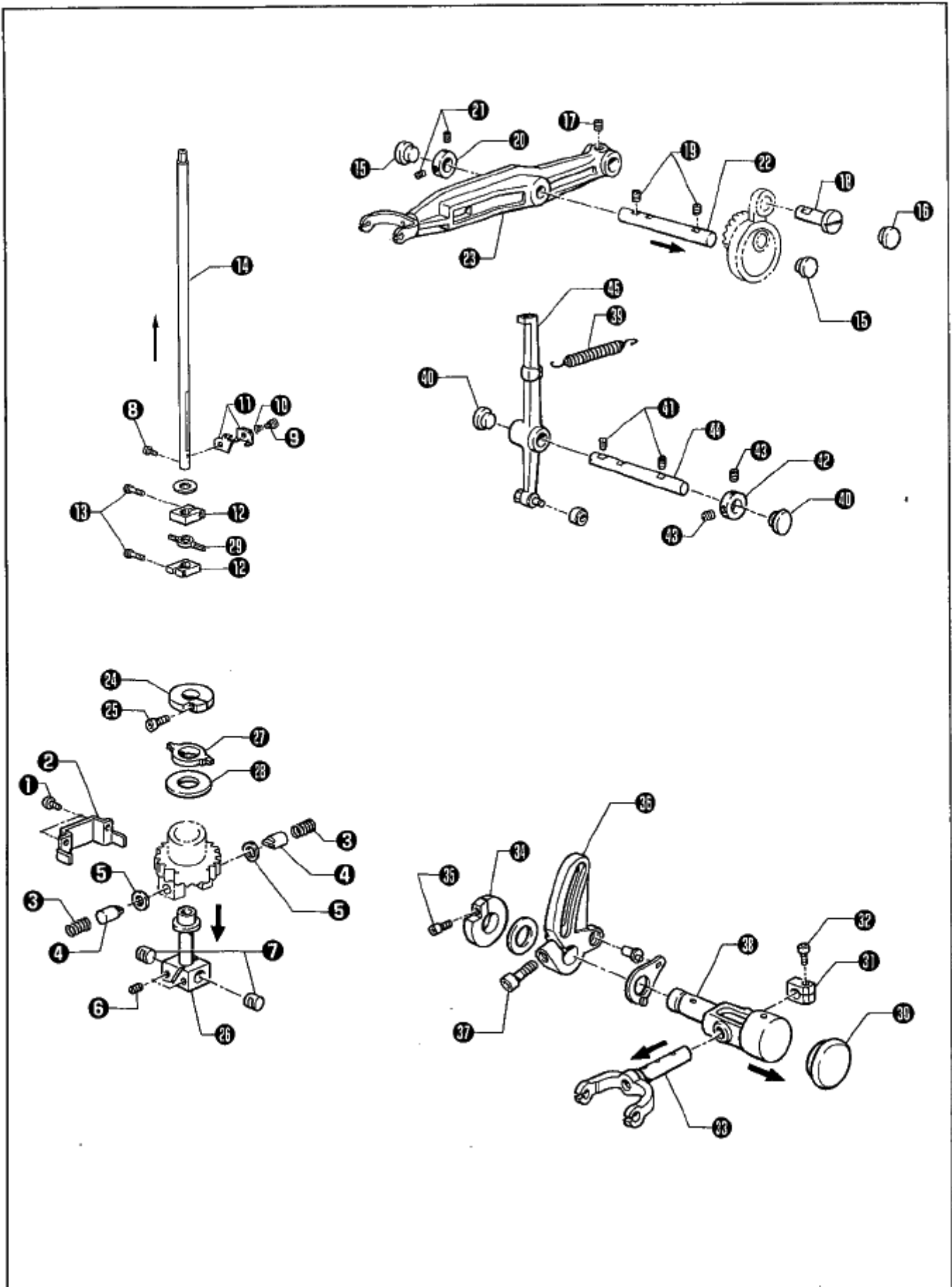
## 2-6. Loooper base



1. Loosen the screw ①, and remove the spreader link shaft ② in the direction of the arrow.
2. Loosen the screw ③, and remove the looper driving shaft ④ in the direction of the arrow.
3. Remove the tension nut ⑤, pre-tension spring (B) ⑥, the thread guide discs ⑦, and the L-tension stud ⑧. Loosen the screw ⑩ of the looper pulley assembly ⑨, and remove the looper base ⑪ in the direction of the arrow.

\*Be careful not to drop the ball bearings ⑫ when removing the looper pulley assembly ⑨.

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



## a. Needle bar mechanism

1. Remove the screw ①, the needle bar guide support plate ②, the needle bar guide spring ③, the needle bar guide ④, and the washer ⑤.
2. Loosen the set screws ⑥, and remove the needle bar guide collars ⑦.
3. Remove the set screw ⑧, the stud screw ⑨, the tension spring ⑩, and the thread guide discs ⑪. Loosen the bolts ⑫ of the needle bar clamps ⑬, and remove the needle bar ⑭ in the direction of the arrow.
4. Remove the caps ⑮ and ⑯. Loosen the set screw ⑰, and remove the driving rod pin ⑱. Loosen the set screws ⑲ and the set screws ⑳ of the set collar ㉑, pull out the driving lever shaft ㉒ in the direction of the arrow, and remove the needle bar driving lever ㉓.

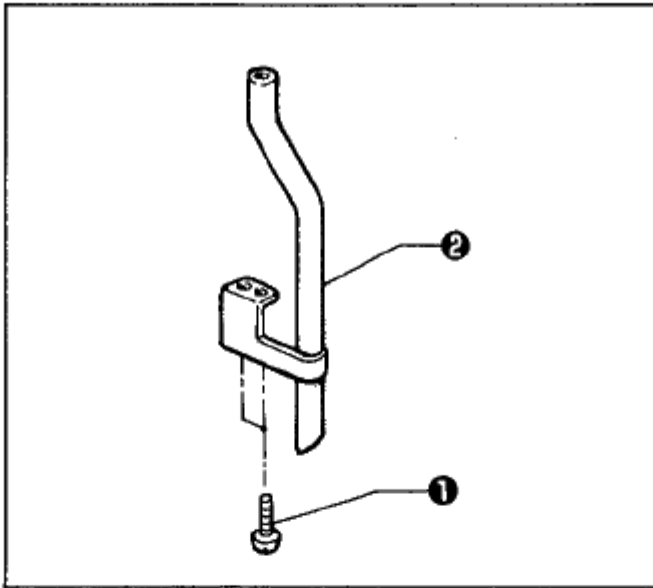
## b. Zigzag mechanism

1. Loosen the screw ㉔ of the needle bar block clamp ㉕, and remove the needle bar block ㉖ in the direction of the arrow.
2. Remove the needle bar block clamp ㉗, the needle bar level feed links ㉘ and ㉙, and the needle bar block collar ㉚.
3. Remove the cap ㉛. Loosen the screw ㉜ of the needle bar clamp ㉝, and remove the zigzag lever ㉞ in the direction of the arrow.
4. Loosen the screw ㉟ of the needle bar block clamp ㊱, and the screw ㊲ of the zigzag crank ㊳, and remove the zigzag rock shaft ㊴ in the direction of the arrow.

## c. Thread take-up mechanism

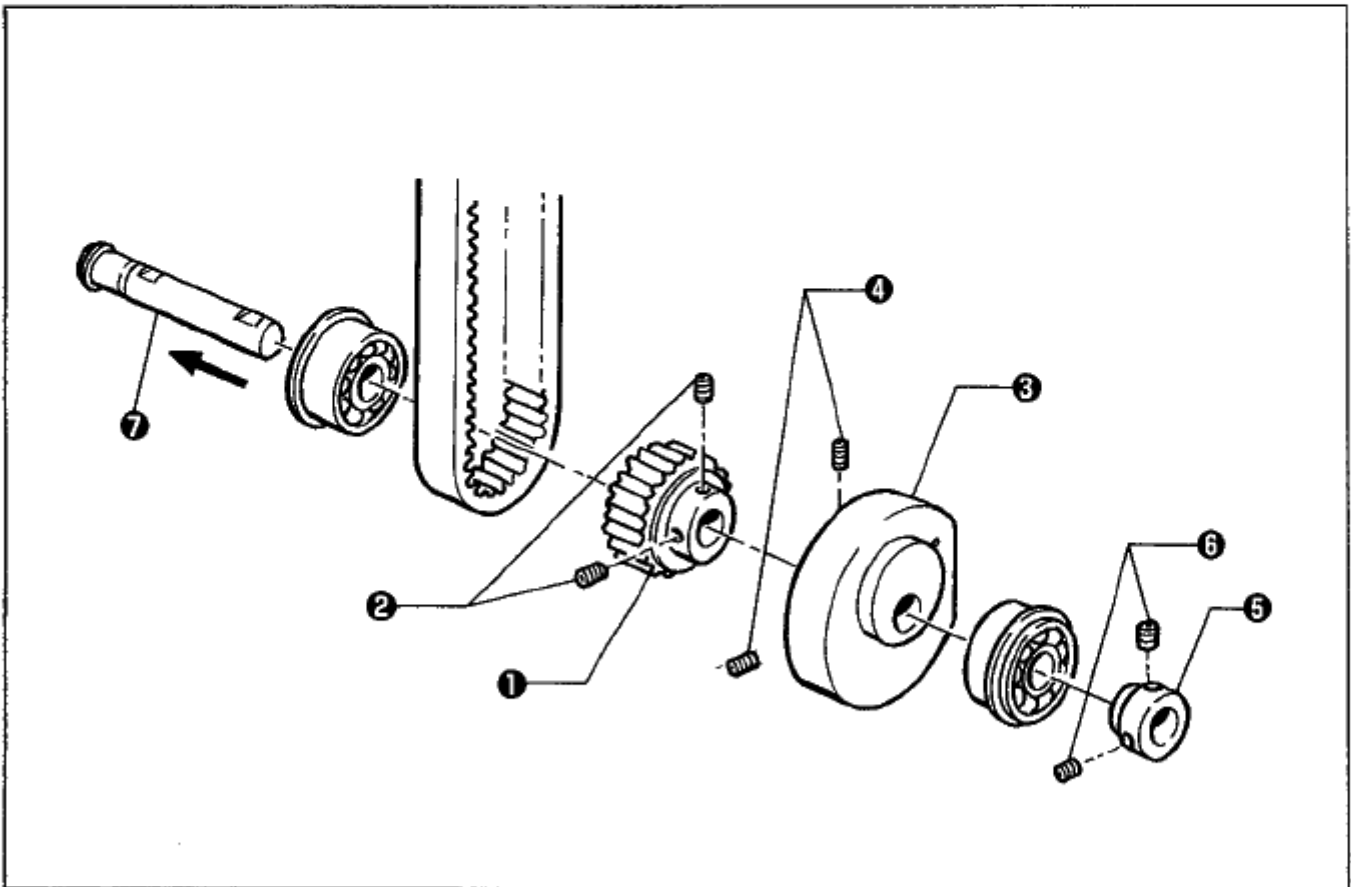
1. Remove the thread take-up spring ㊵ and the cap ㊶.
2. Loosen the set screws ㊷ and the set screws ㊸ of the set collar ㊹, and remove the thread take-up support shaft ㊺ and the thread take-up assembly ㊻.

## 2-8. Knife pipe assembly



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

## 2-9. Lower shaft mechanism

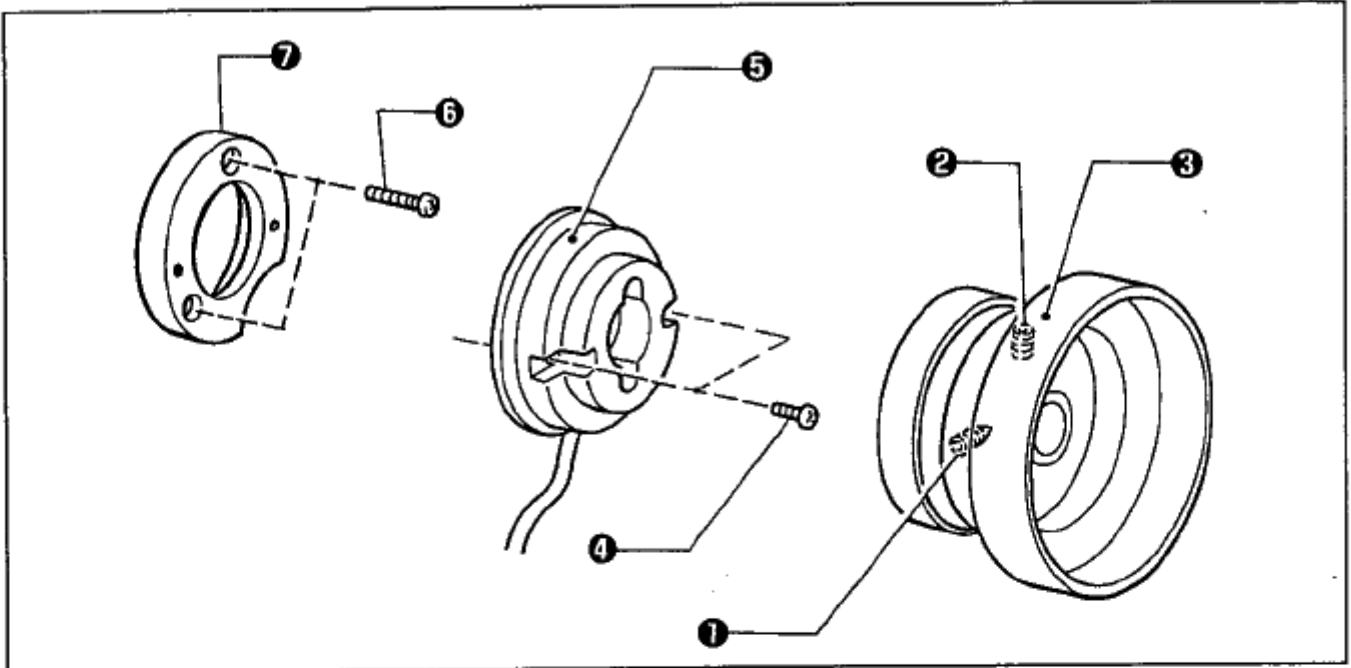


\*Before removing the lower shaft, loosen the timing belt, referring to 3-4.

1. Loosen the screws ② of the lower shaft tension pulley assembly ①.
2. Loosen the screws ④ of the lower shaft cam ③.
3. Loosen the set screws ⑥ of the set collar ⑤, and remove the lower shaft ⑦ in the direction of the arrow.

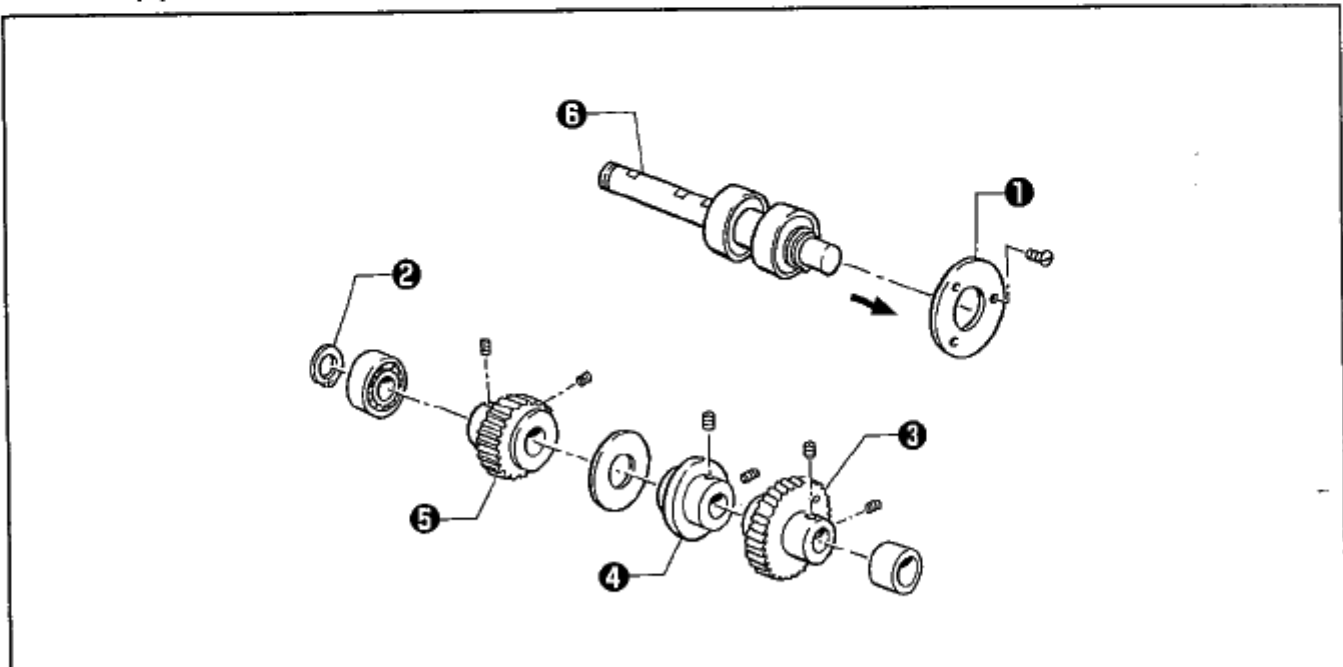


## 2-10. Synchronizer



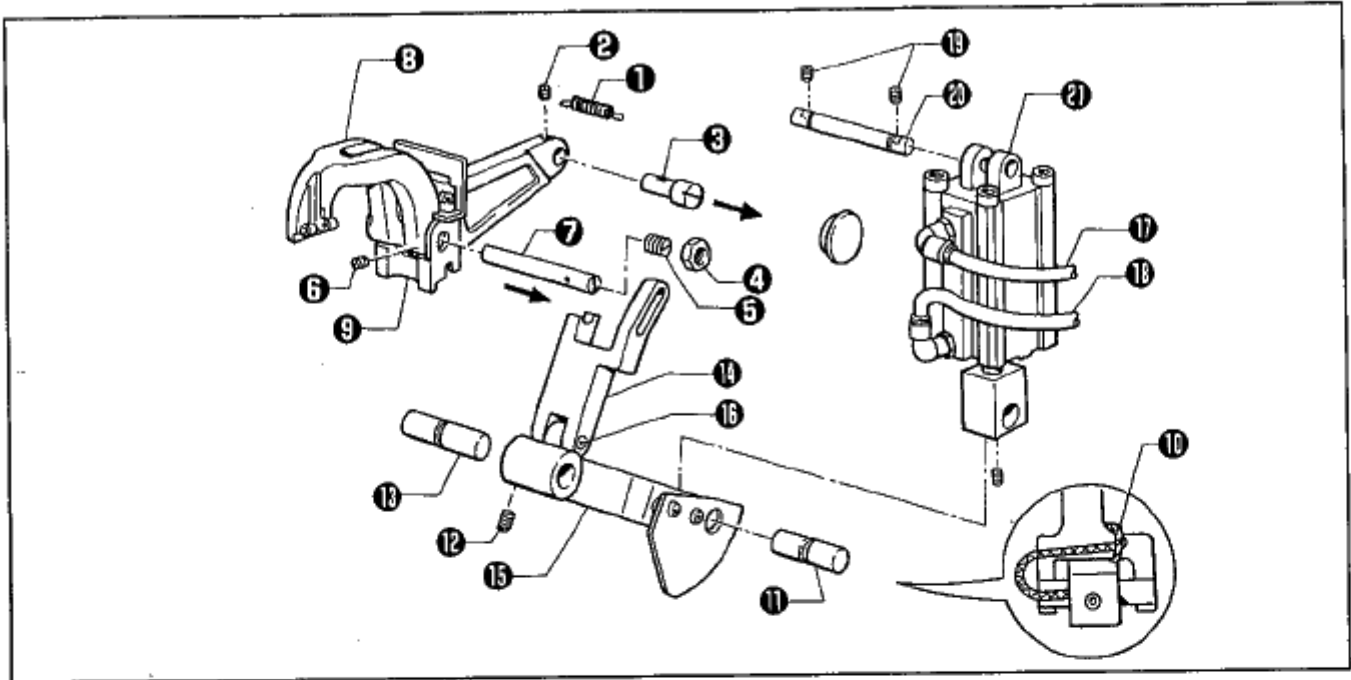
1. Loosen the two set screws ① and ②, and remove the pulley ③.
2. Loosen the two screws ④, and remove the synchronizer assembly (B) ⑤.
3. Remove the two screws ⑥, and the NP support bracket (B) ⑦.

## 2-11. Upper shaft mechanism



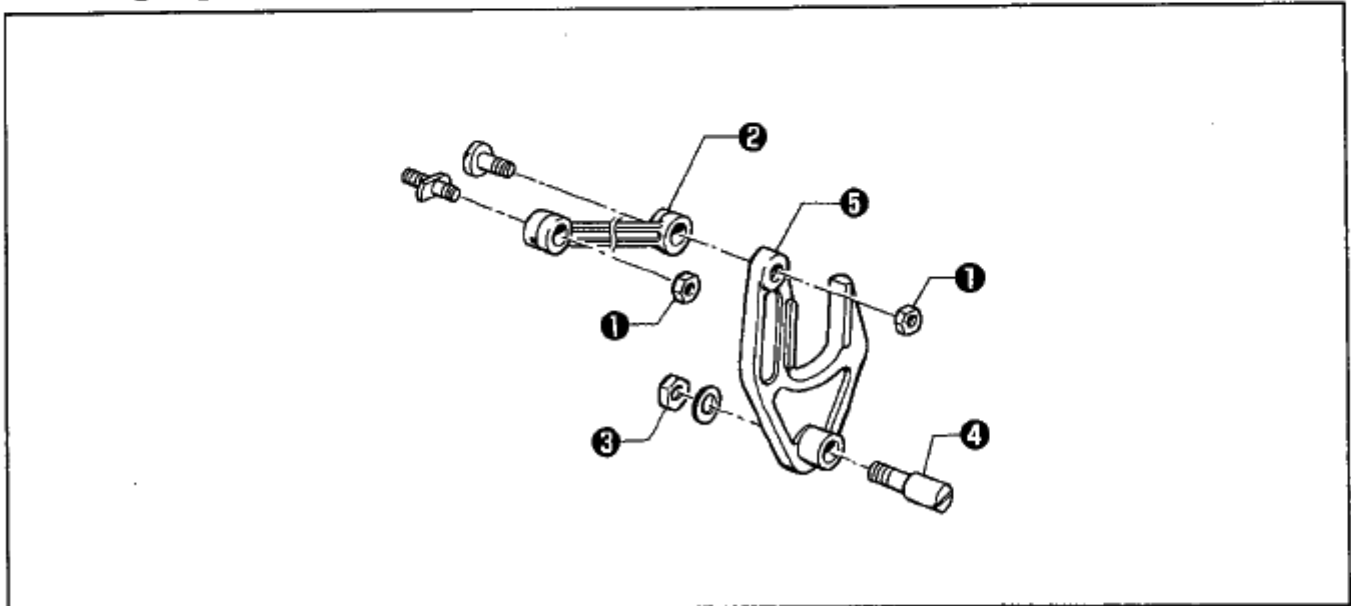
1. Remove ball bearing cap (S) ① and the retaining ring ②.
2. Loosen the set screws of the needle bar gear ③, the zigzag cam ④, and the upper shaft tension pulley assembly ⑤.
3. Pull the upper shaft ⑥ in the direction of the pulley to remove it. The upper shaft unit will come off.

## 2-12. Cutter mechanism



1. Remove the extension spring ①, loosen the set screw ②, and remove link shaft (B) ③ in the direction of the arrow.
2. Remove the two nuts ④ and the cutter arm support screw ⑤. Loosen the set screw ⑥, and remove the cutter lever shaft ⑦ in the direction of the arrow, and the cutter lever ⑧ along with the cutter lever cover ⑨.
3. Remove the wick ⑩, and loosen the set screw. Remove the cylinder rod shaft ⑪.
4. Loosen the set screw ⑫, and remove link shaft (A) ⑬, and the combination of link (A) ⑭, link (C) ⑮, and link shaft (C) ⑯.
5. Remove the air tubes ⑰ and ⑱, loosen the two set screws ⑲, and remove the cylinder support shaft ⑳ and the cutter cylinder ㉑.

## 2-13. Zigzag fork



1. Remove the two nuts ①, and the zigzag connecting rod assembly ②.
2. Remove the nut ③, the zigzag fork support pin ④, and the zigzag fork ⑤.

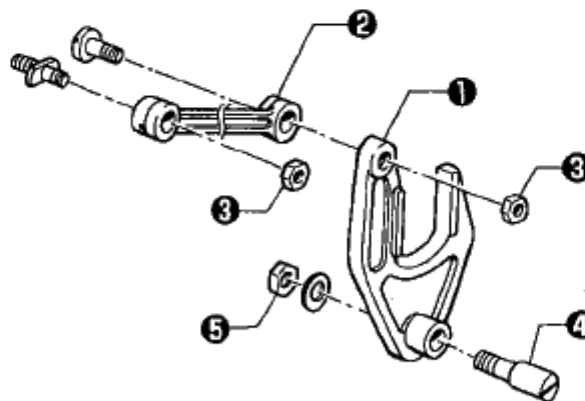
## 3. ASSEMBLY

### ⚠ CAUTION

- ⊘ • Assembly should only be carried out by a qualified technician.
- ⚠ • Turn off the power switch before assembly, otherwise the machine may operate if the foot switch is depressed by mistake, which could result in injury.
- ⚠ • 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.
- ⊘ • 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.

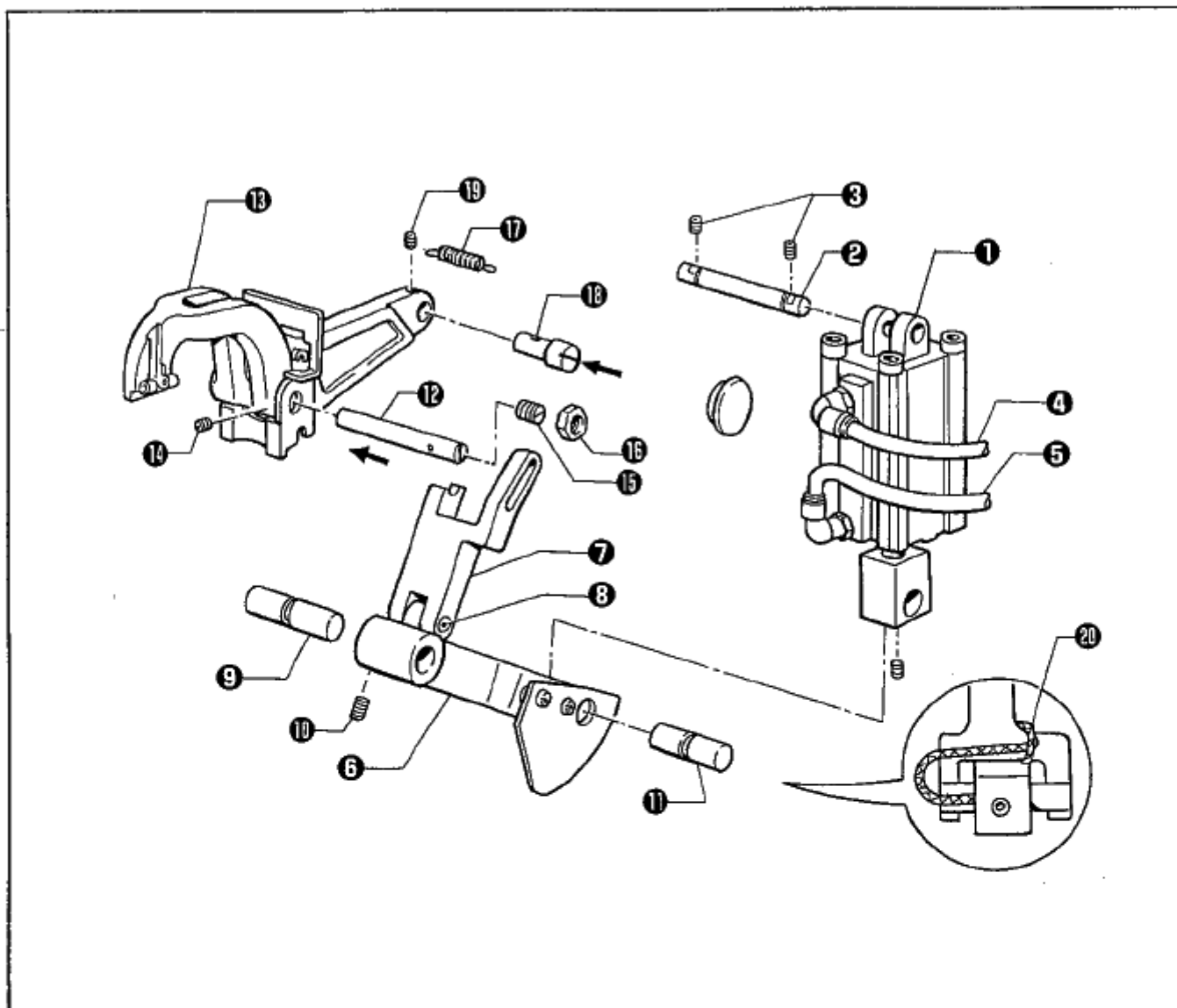
If the assembly is not performed in the correct order, it may be hard to attach parts. Assemble as follows. The following is the main points of assembly.

### 3-1. Zigzag fork



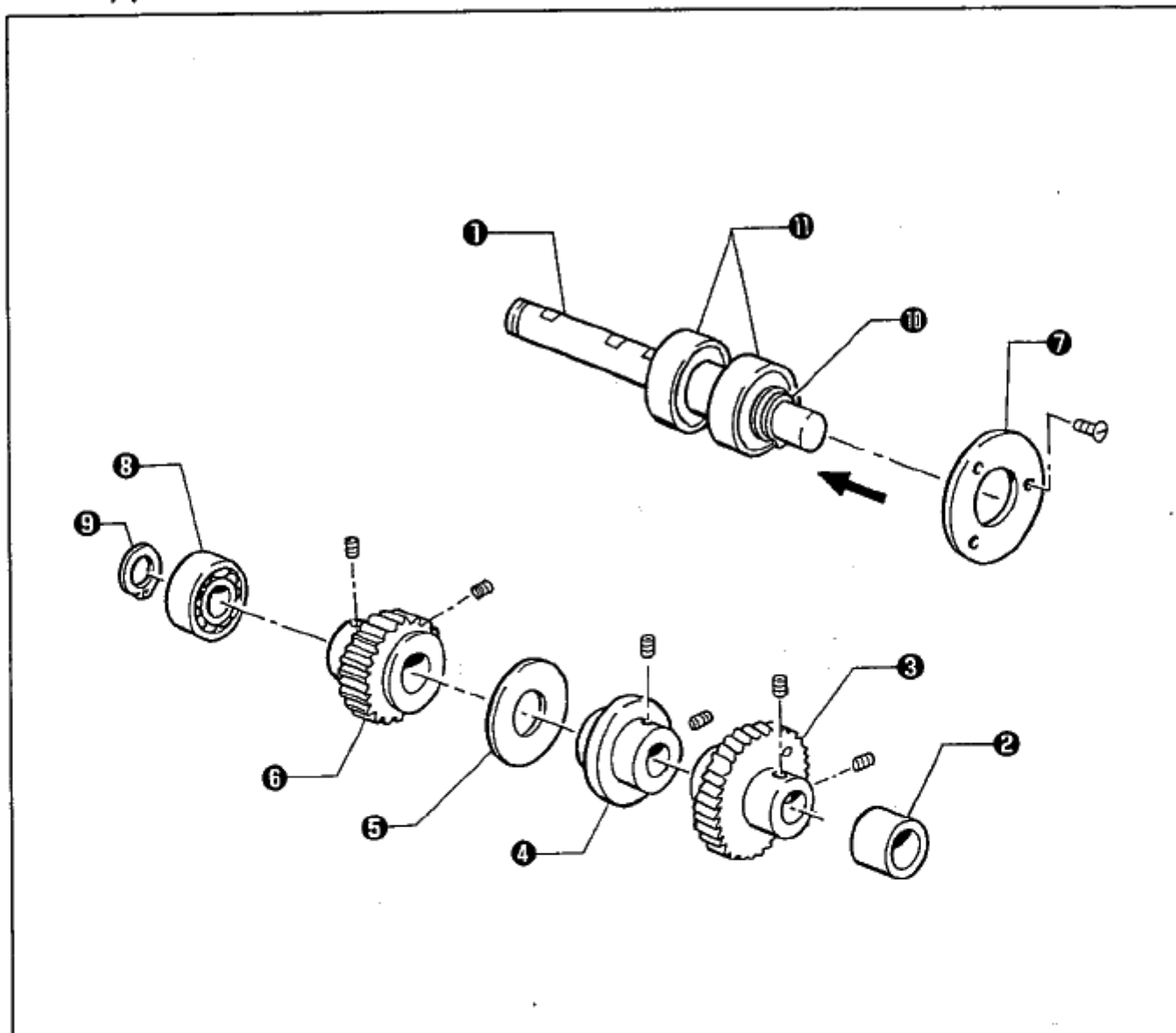
1. Combine the zigzag fork ① and the zigzag connecting rod assembly ② using the nuts ③. Insert the zigzag fork support pin ④ into the hole in the zigzag fork ①, and put them into the arm from above.
2. Insert the zigzag fork support pin ④ into the hole in the side of the arm, and secure it using the nut ③.

## 3-2. Cutter mechanism



1. Put the air cylinder for cutter ① into the arm with the joints facing the front. Insert the cylinder support shaft ② into the hole in the air cylinder ①, and secure it using the set screws ③.
2. Attach No. 18 air tube ④ to the upper tube of the cylinder.  
Attach No. 19 air tube ⑤ to the lower tube of the cylinder.
3. Combine link (C) ⑤, link (A) ⑦, and link shaft (C) ③. Position them in the bed from below, and attach link shaft (A) ③ to them using the set screw ⑩.
4. Attach the cylinder rod shaft ⑨ with the lubrication hole facing the left.
5. Insert the cutter lever shaft ⑫ with its slit facing the right, into the hole in the bed, the cutter lever ⑬, and the hole in the bed, and tighten the screw ⑪ on the screw flat of the cutter lever shaft ⑫.
6. Tighten the cutter arm support screw ⑬ on each end of the cutter lever shaft ⑫, and secure it using the nut ⑭.
7. Hook the extension spring ⑰ over the cutter lever ⑬ and the tab of the bed.
8. Pass link shaft (B) ⑧ with its slit facing the right, through the slot of link (A) ⑦, and the hole in the cutter lever ⑬, and tighten the set screw ⑮.
9. Wind the wick ⑳ around the right of link (C) ⑤, and insert the end of the wick into the lubrication hole in the cylinder rod shaft ⑨.

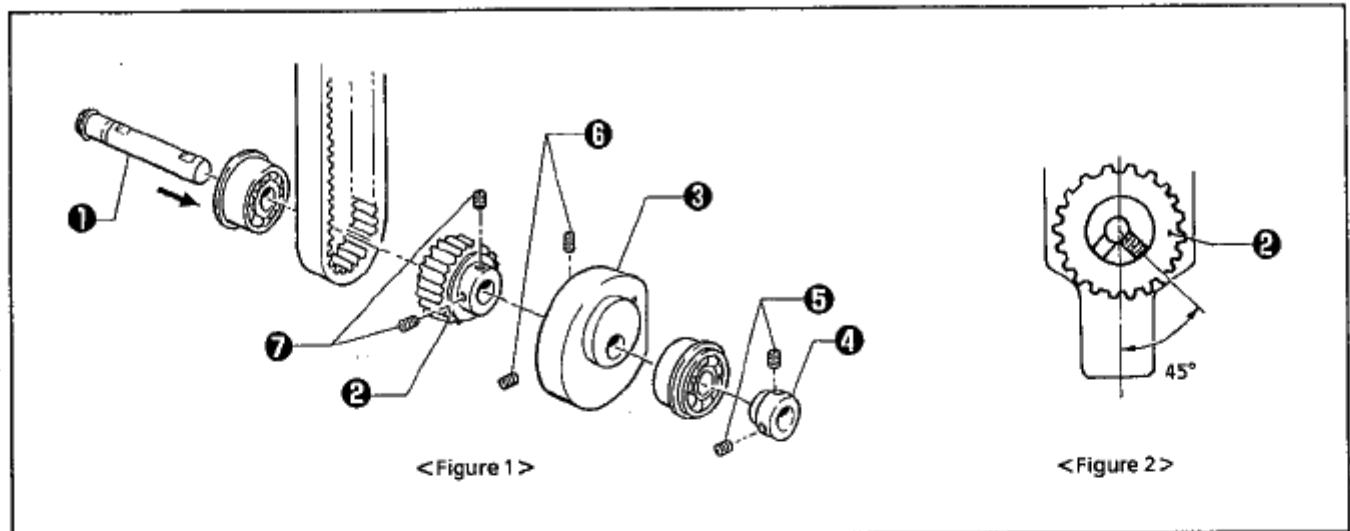
## 3-3. Upper shaft mechanism



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

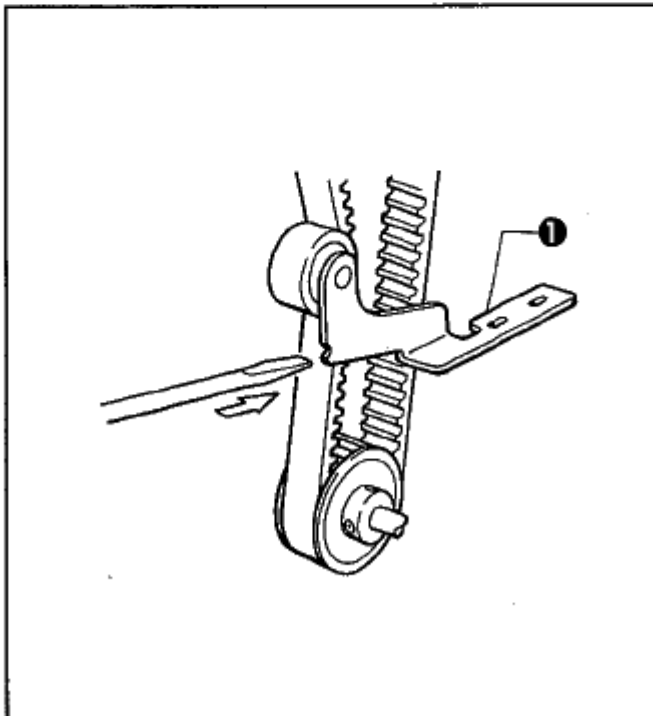
1. Insert the upper shaft unit ① into the arm from the right, and place the upper shaft collar ②, the needle bar gear ⑧, the zigzag cam ④, the thrust washer ⑤, the upper shaft tension pulley ⑥, and the timing belt on it.
2. Position the zigzag fork so that the zigzag cam ④ is between the arms.
3. Attach the ball bearing cap ⑦ using the set screws.
4. Place the ball bearing ⑨ on the upper shaft, and secure it using the retaining ring ⑩.
5. Lightly press the needle bar gear ⑧ and the zigzag cam ④ toward the pulley so that the ball bearing ⑨ is pressed between the retaining ring ⑩ of the upper shaft unit ① and the upper shaft collar ②. Tighten the set screw which comes first when the shaft is rotated in the rotation direction, against the screw flat.
6. Position the zigzag fork between the zigzag cam ④ and the thrust washer ⑤ so that there is no play between them, face the screw flat to the front, and secure the upper shaft tension pulley ⑥ 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



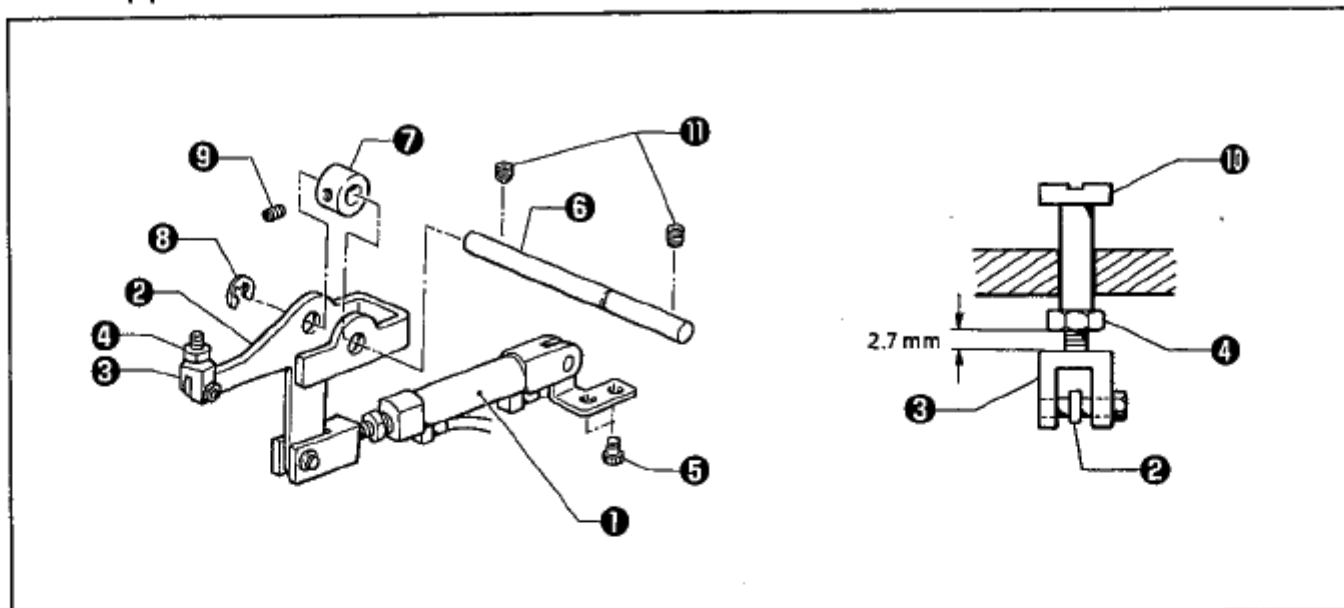
1. Fit the two ball bearings into the holes in the bed, insert the lower shaft ① from the left. Put the timing belt, the lower shaft tension pulley assembly ②, the lower shaft cam ③, and the set collar ④, in this order, on the lower shaft ①, and tighten the set screws ⑤ of the set collar ④ so that there is no play between the parts on the lower shaft ①.
2. Lightly press the lower shaft tension pulley assembly ② and the lower shaft cam ③ against the left ball bearing, and tighten the set screws ⑥ of the lower shaft cam ③.  
\*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 ⑦ of the lower shaft tension pulley assembly ② are as shown in figure 2, loop the timing belt over the lower shaft tension pulley assembly ②.

## Adjusting the timing belt



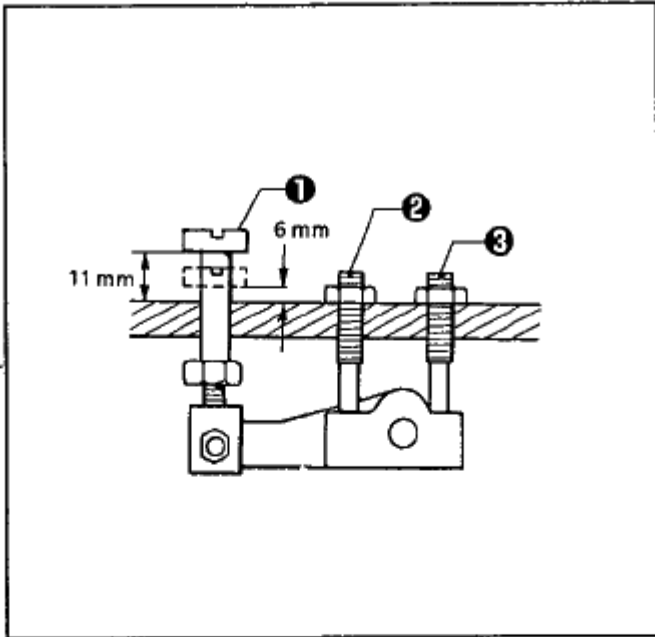
Use a screwdriver or similar tool to press the notch of the tension pulley arm assembly ① with a force of 39.2 N (4 kgf), and attach the tension pulley assembly.

## 3-5. Upper thread trimmer mechanism



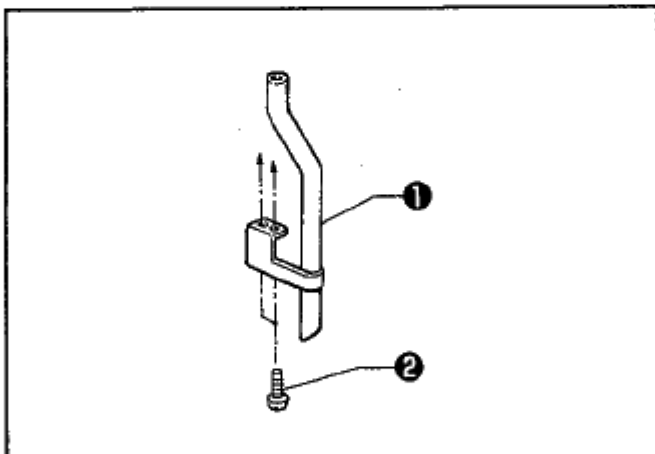
1. Assemble the thread trimmer lever ②, the thread trimmer adjust screw ③, and the nut ④, and attach them to the cylinder 10 x 15 assembly ①. Insert them into the tubular part of the bed, and temporarily tighten the bolts ⑤.
2. Insert the thread trimmer lever shaft ③ into the hole in the bed, and pass it through the thread trimmer lever ② and the set collar ⑦.
3. Secure the thread trimmer lever ② using the retaining ring ⑧ and the set collar ⑦, and tighten the set screw ⑨.
4. Insert the thread trimmer lever hammer ⑩ into the hole in the bed, and tighten the thread trimmer adjusting screw ③ and the nut ④, until there is 2.7 mm between the nut and the head of the screw ③.
5. Manually move the thread trimmer lever hammer ⑩ up and down, and tighten the set screws ⑪ where the thread trimmer hammer ⑩ motion is the smoothest.
6. Tighten the bolts ⑤ in the same way.

Adjusting the thread trimming hammer stroke

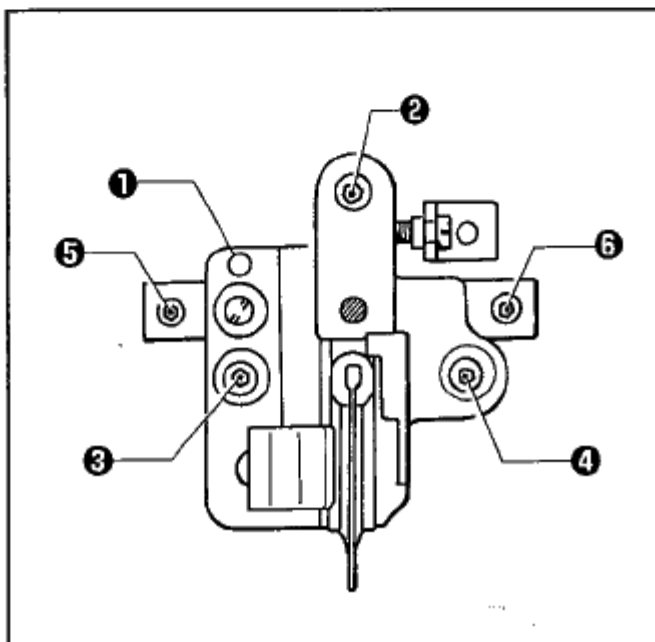


1. Raise the thread trimming hammer ①, and adjust the screw ② so that the clearance with the bed is 11 mm.
2. Lower the thread trimming hammer ①, and adjust the screw ③ so that the clearance with the bed is 6 mm.

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



- 1) Knife pipe  
Insert the knife pipe ① into the bed from below, and secure it using the screw ②.

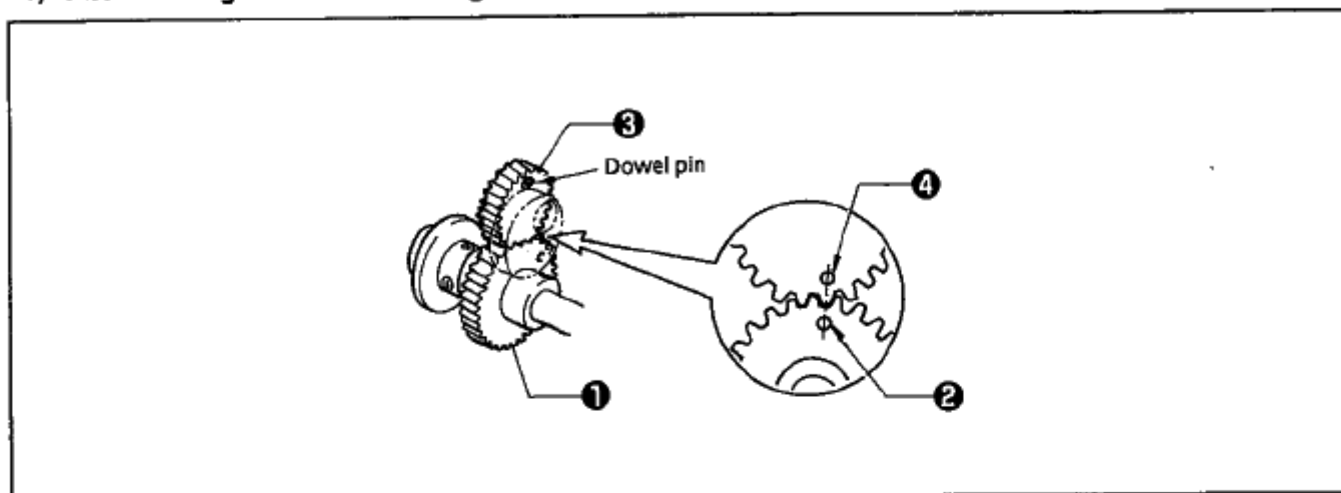


- 2) Knife base  
Insert a bar with a diameter of 4 mm into the hole ① in the knife base to fix the knife base position, and tighten the screws ② to ⑥.



### 3-7. Driving gear shaft mechanism

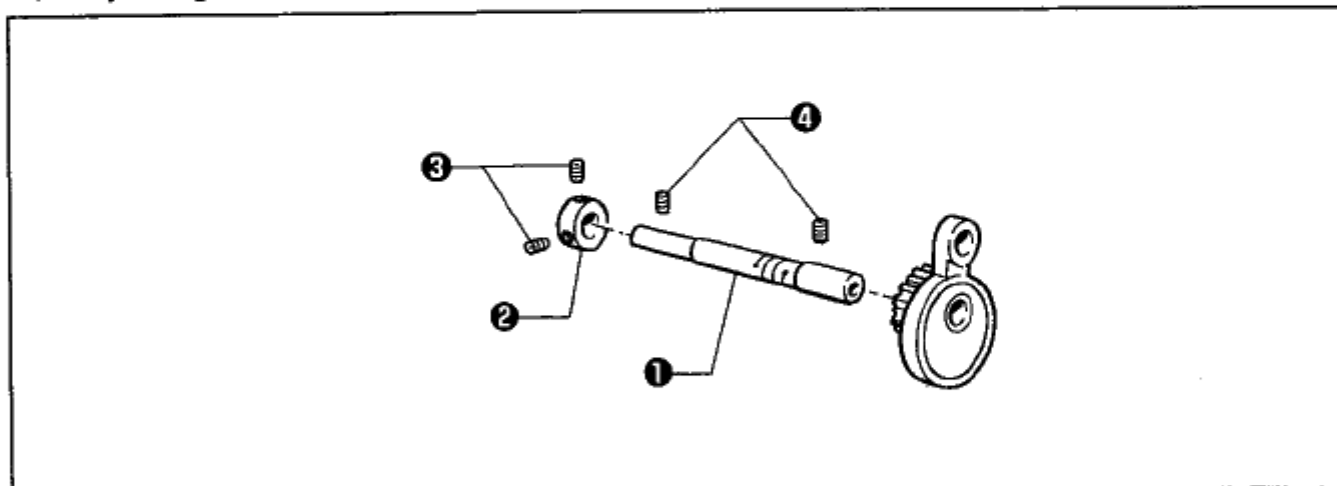
#### 1) Assembling the needle bar gear and the needle bar driving gear



Engage the needle bar gear ① with the needle bar driving gear ③ by matching their identification holes ② and ④.

Note: Do not mistake the hole ④ for the hole in which the dowel pin is inserted.

#### 2) Adjusting the set collar of the needle bar gear



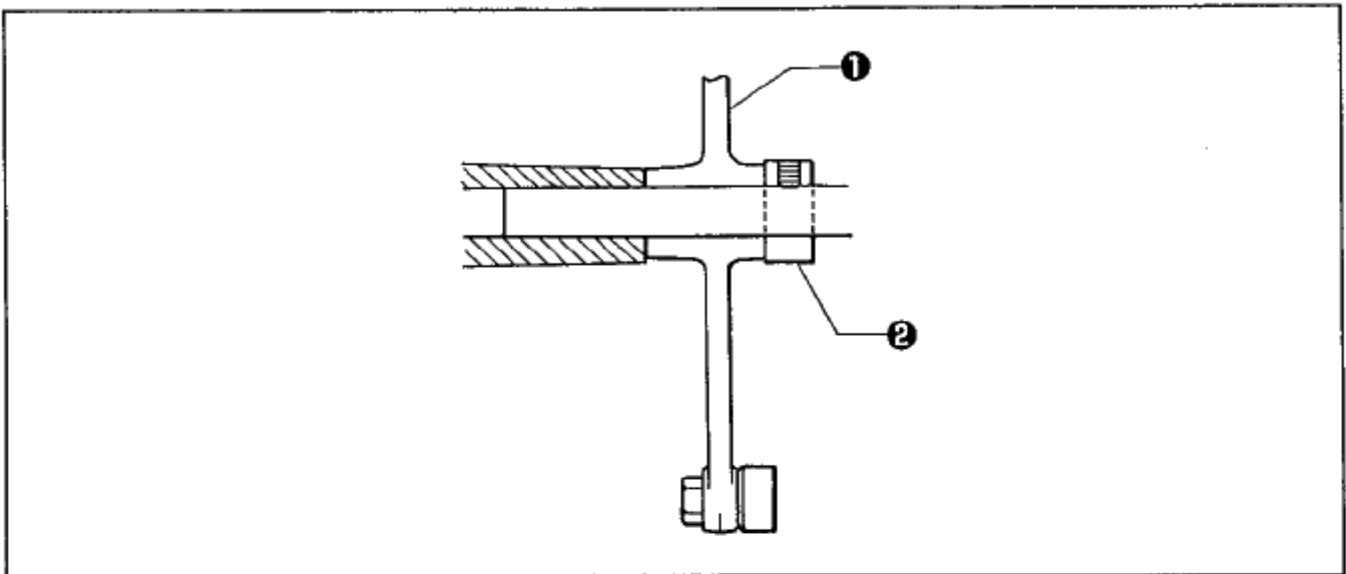
Tighten the set screws ③ of the set collar ② with either set screw at the center of the screw flat on the driving gear shaft ①.

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

- The driving gear shaft ① is eccentric. Turn it to adjust the backlash.  
\*The driving gear shaft ① should be turned in the direction where its lubrication hole is moving upward.
- While pressing the set collar ② toward the pulley so that the driving gear shaft ① has no end play, tighten the set screws ④.

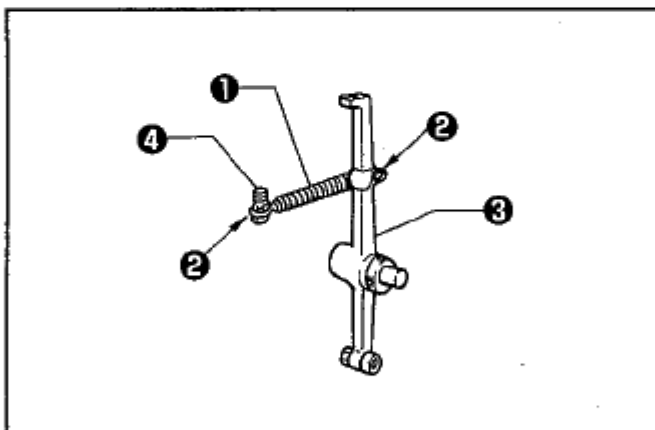
### 3-8. Needle bar, thread take-up, and zigzag mechanisms

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



Eliminate end play of the thread take-up ① on the arm by placing it between the end of the arm and the set collar ②.

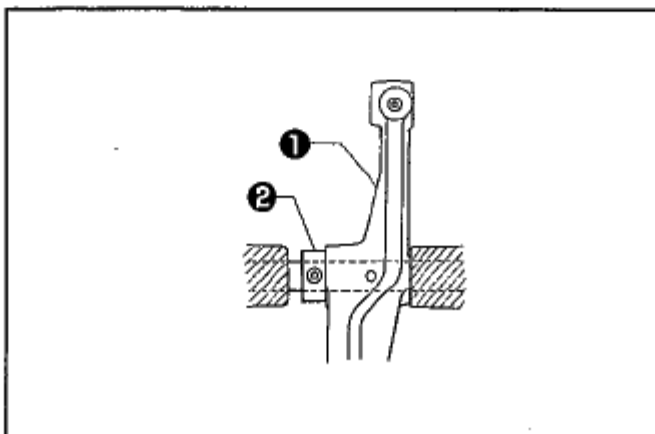
#### 2) Applying grease to the ends of the thread take-up spring



Apply grease to the ends ② of the thread take-up spring ①.

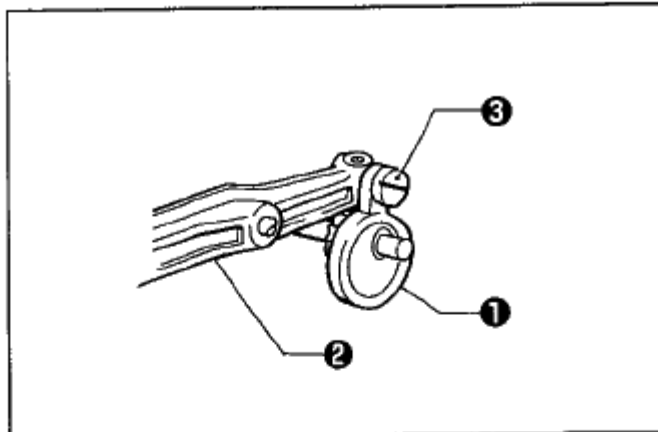
\*Apply grease to the ends of the thread take-up ③ and the spring hook ④.

#### 3) Eliminating end play of the needle bar driving lever



Adjust the position of the set collar ② to eliminate end play of the needle bar driving lever ①.

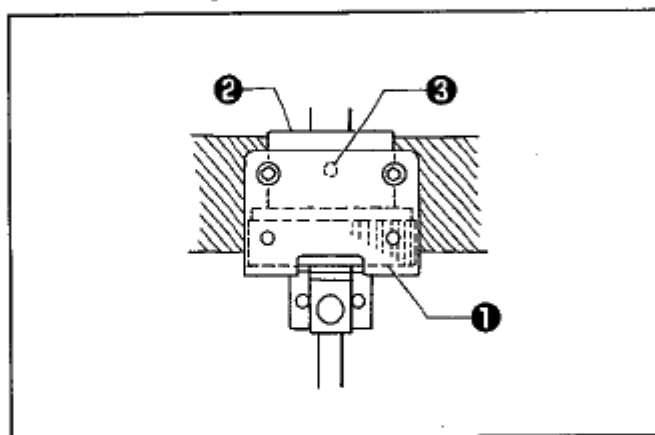
## 4) Eliminating end play of the driving rod



The driving rod ① is attached to the needle bar driving lever ② and the driving rod pin ③. The eccentric wheel of the driving rod ① is free in the thrust direction.

Place the driving rod ① between the edge of the needle bar driving lever ② and the head of the rod pin ③ to eliminate end play of the driving rod ①.

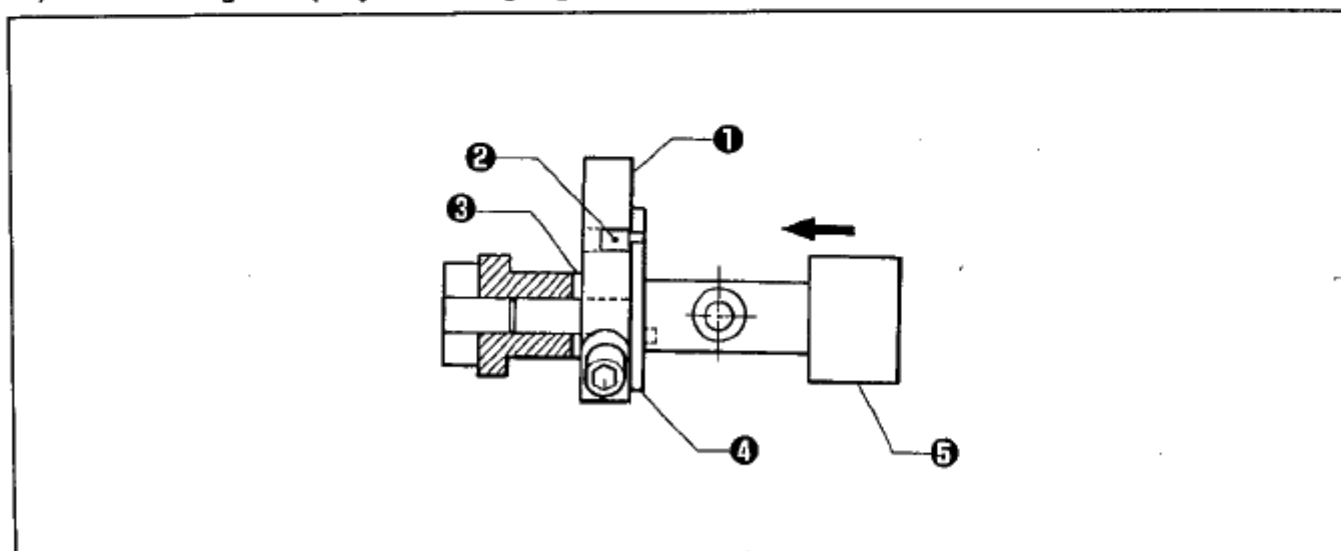
## 5) The strength to tighten the set screw of ball bearing 25/20



The set screw ③ of ball bearing 25/20 ② for the needle bar gear ① should be tightened as little as possible. If it is tightened excessively, unnecessary load may be applied to the needle bar gear ①, causing pulse motor R to go out of control.

\*Be sure to apply the screw lock to the circumference of ball bearing 25/20 ② before press fitting it.

## 6) Eliminating end play of the zigzag rock shaft

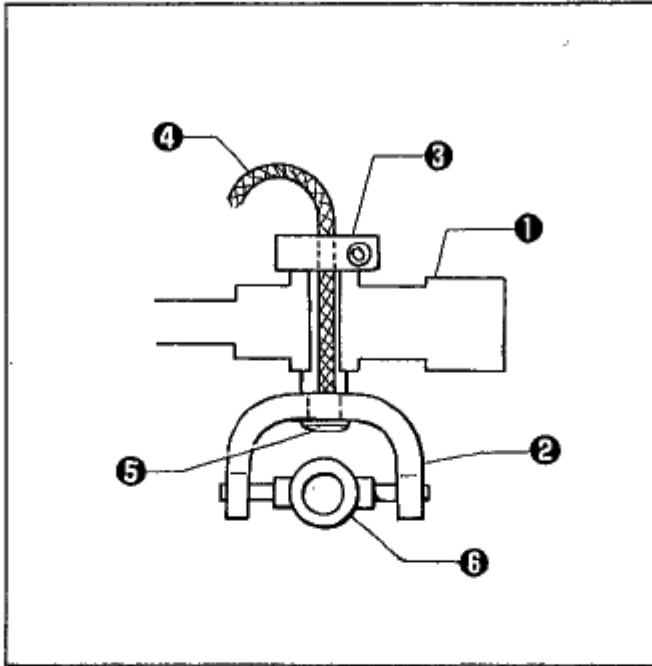


Insert the zigzag eccentric pin ② into the zigzag crank ①, attach the washer ③ and the needle position control plate ④ as shown in the above figure, and pass the zigzag rock shaft ⑤ through the arm from the right.

At this time, insert a wedge or similar tool into the split of the zigzag crank ① for easier adjustment.

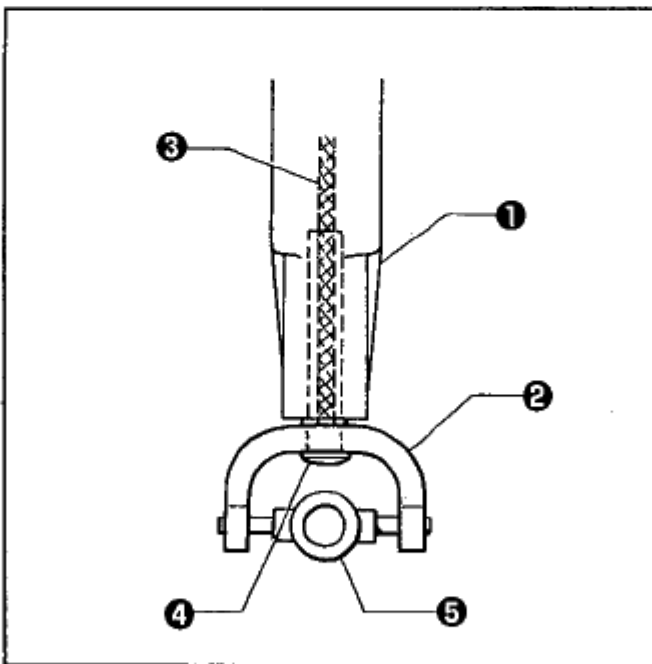
Note: Do not fail to attach the washer ③.

7) Eliminating end play of the zigzag lever



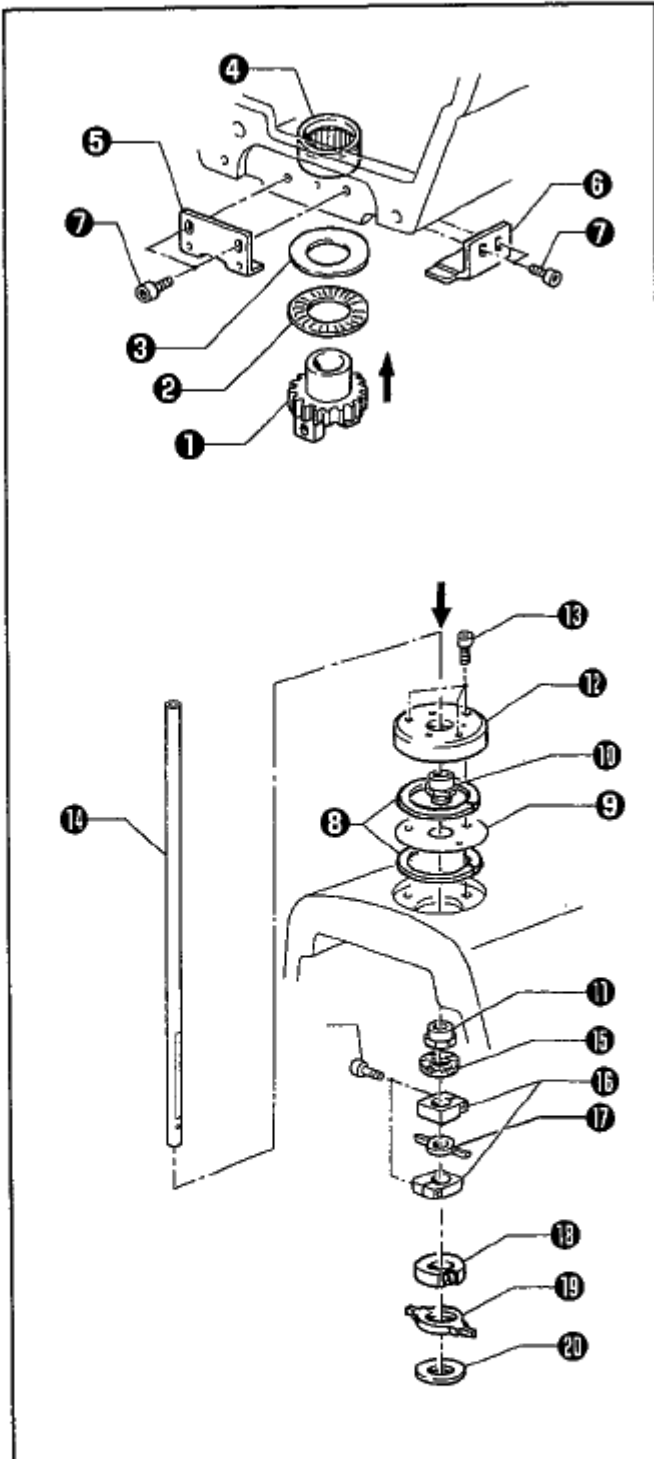
1. Adjust the needle bar clamp (set collar) ③ so that there is no end play of the zigzag lever ② which is connected to the zigzag rock shaft ①.  
The zigzag lever ② should rotate easily in the rotation direction.
2. Pass the wick ④ through the zigzag lever ②, and fit the cap ⑤.
3. Attach the needle bar level feed link ⑥ to the zigzag lever ② vertically, and turn it 90°.

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



1. Combine the needle bar ① and the needle bar yoke ②, pass the wick ③ through the needle bar ①, and fit the cap ④.
2. Attach the needle bar level feed link ⑤ to the needle bar yoke ② vertically, and turn it 90°.

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

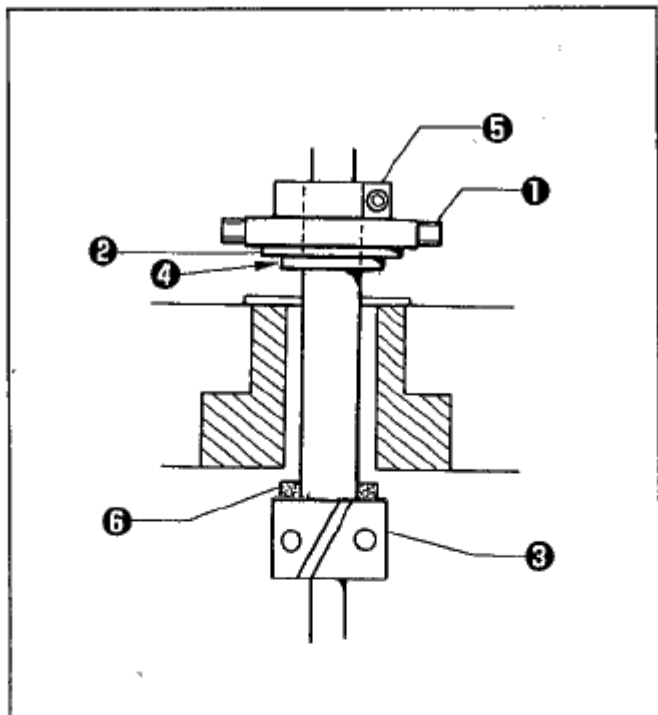


1. Put the thrust bearing ② and the thrust washer ③ on the needle bar gear ①. Attach them to bearing 25/20 ④, and secure them using needle bar gear supports (A) ⑤ and (B) ⑥ and the screws ⑦ so that the needle bar gear ① can turn easily but without any end play.

\*Do not forget to attach timing belt (U).

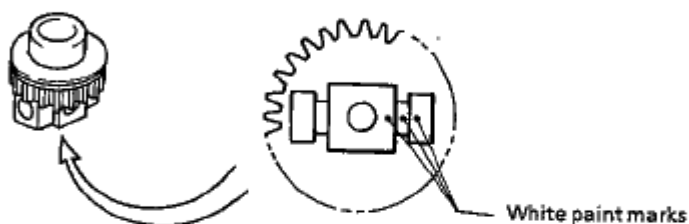
2. Insert the needle bar bush (U) rings ⑧ and the needle bar bush (U) spring ⑨ into the hole in the arm, and bind them using needle bar bush (U) ⑩ and the needle bar bush (U) nut ⑪.
3. Temporarily attach needle bar presser bracket (B) ⑫ using the bolts ⑬.
4. Pass the needle bar ⑭ through the arm from above, through the needle bar bush (U) ⑩, the needle bar felt ⑫, the needle bar clamp ⑬, the needle bar level feed link ⑮, the needle bar block clamp ⑯, the needle bar level feed link ⑰, and the needle bar block collar ⑱, in this order.

10) Eliminating end play of the needle bar block

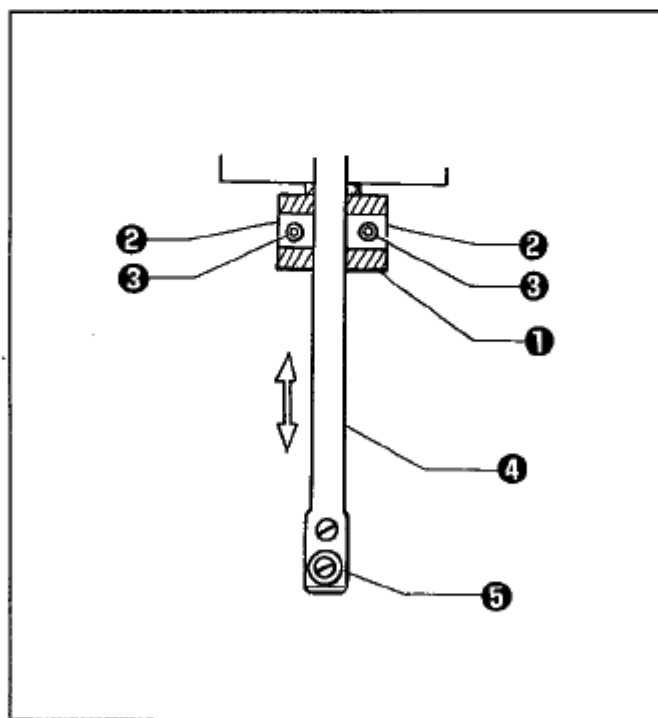


Adjust the positions of the needle bar level feed link ① and the needle bar block coliar ② using the flange ④ of the needle bar block ③ and the needle bar block clamp ⑤, so that there is no end play.

Notes: Be sure to insert the needle bar block felt ⑥.  
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

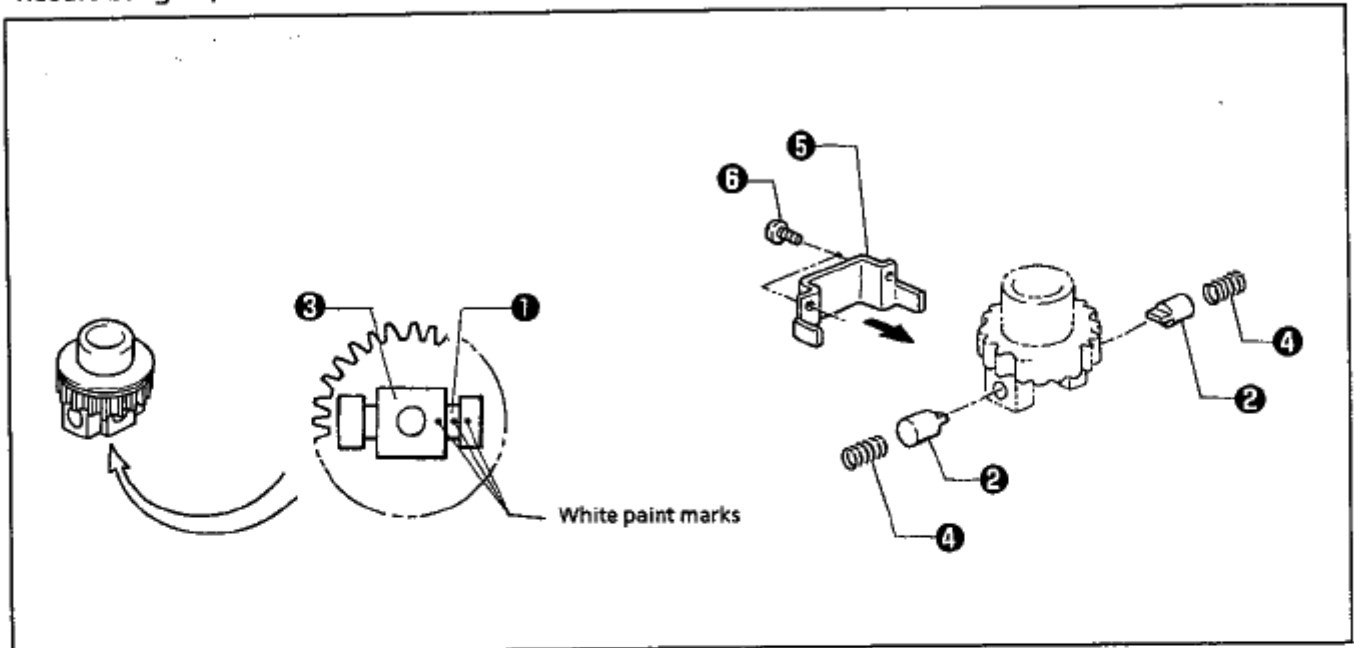


Insert the needle bar guide collars ② into the needle bar block ①, and adjust the position of the needle bar ④ using the set screws ③ so that the needle bar can move smoothly.

Note: Position the needle bar ④ so that the thread guide disc ⑤ will face the front when the set screws ③ are facing the front.

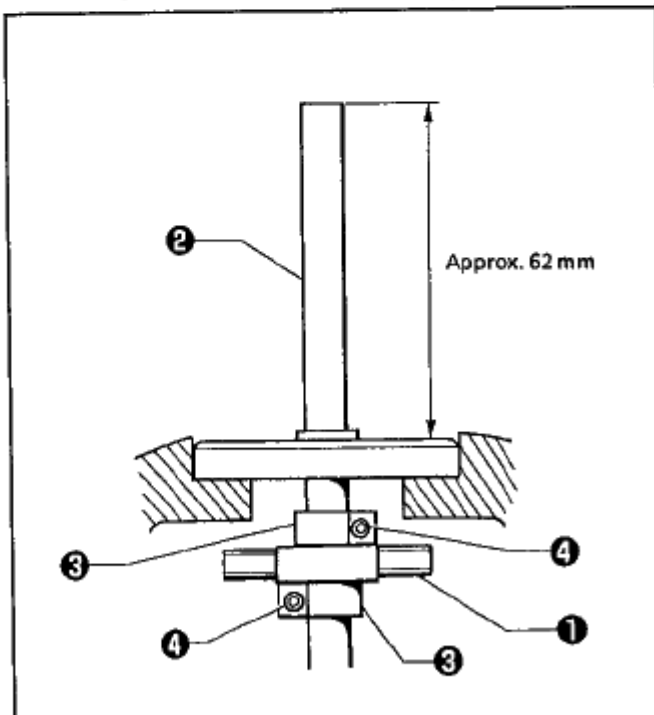
## 12) Attaching the needle bar block assembly

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.



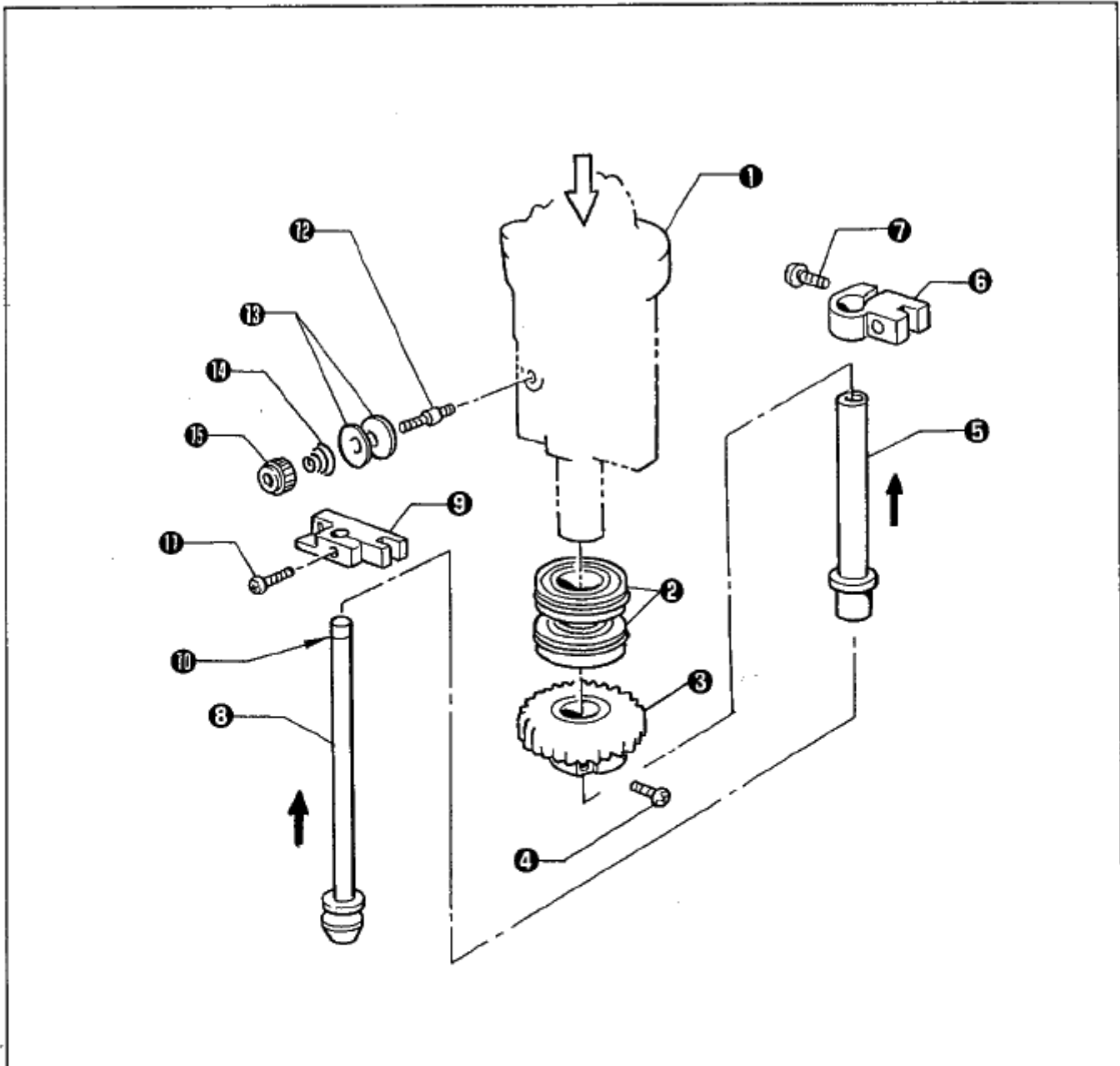
1. Insert the needle bar guides ② into the hole in the needle bar block ③ on each side, taking care of the white paint mark of the washer ①.
2. Attach the spring ④ using the needle bar guide support plate ⑤, and tighten the screw ⑥.

## 13) Adjusting the height of the needle bar



Turn the pulley to set the needle bar level feed link ① at its highest position. Set the height of the needle bar ② to approx. 62 mm, eliminate end play between the needle bar clamp ③ and the needle bar level feed link ①, and tighten the screws ④.

## 3-9. Loooper base

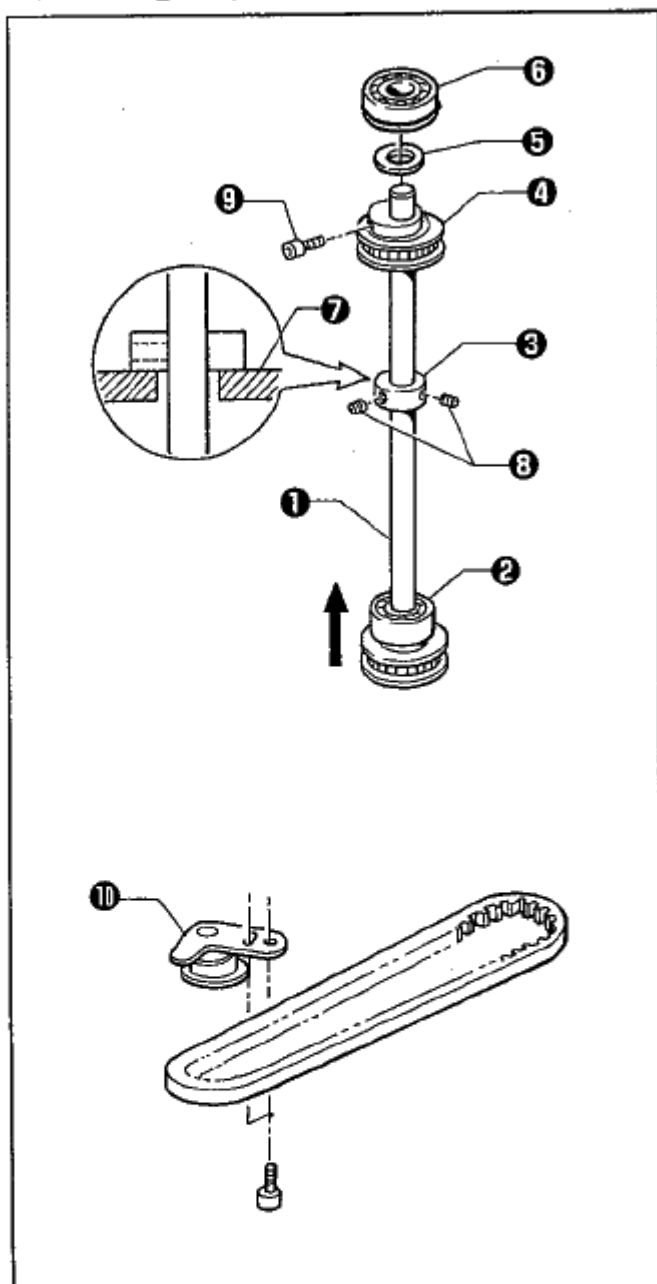


1. Insert the shaft of the looper base ① through the hole in the bed, attach the ball bearings ② and the looper pulley ③ to the shaft of the looper base ① so that there is no end play, and tighten the screw ④.
2. Insert the looper driving shaft ⑤ into the shaft of the looper base ①, then the looper link clamp ⑥ into the looper driving shaft ⑤, and tighten the screw ⑦.
3. Insert the spreader link shaft ⑧ into the hole in the looper driving shaft ⑤, then the spreader link base ⑨ into the spreader link shaft ⑧. Align the reference line ⑩ with the top surface of the spreader link base ⑨, and tighten the screw ⑪.
4. Attach the L-tension stud ⑫, the thread guide discs ⑬, pre-tension spring (B) ⑭, and the tension nut ⑮ to the looper base ①.



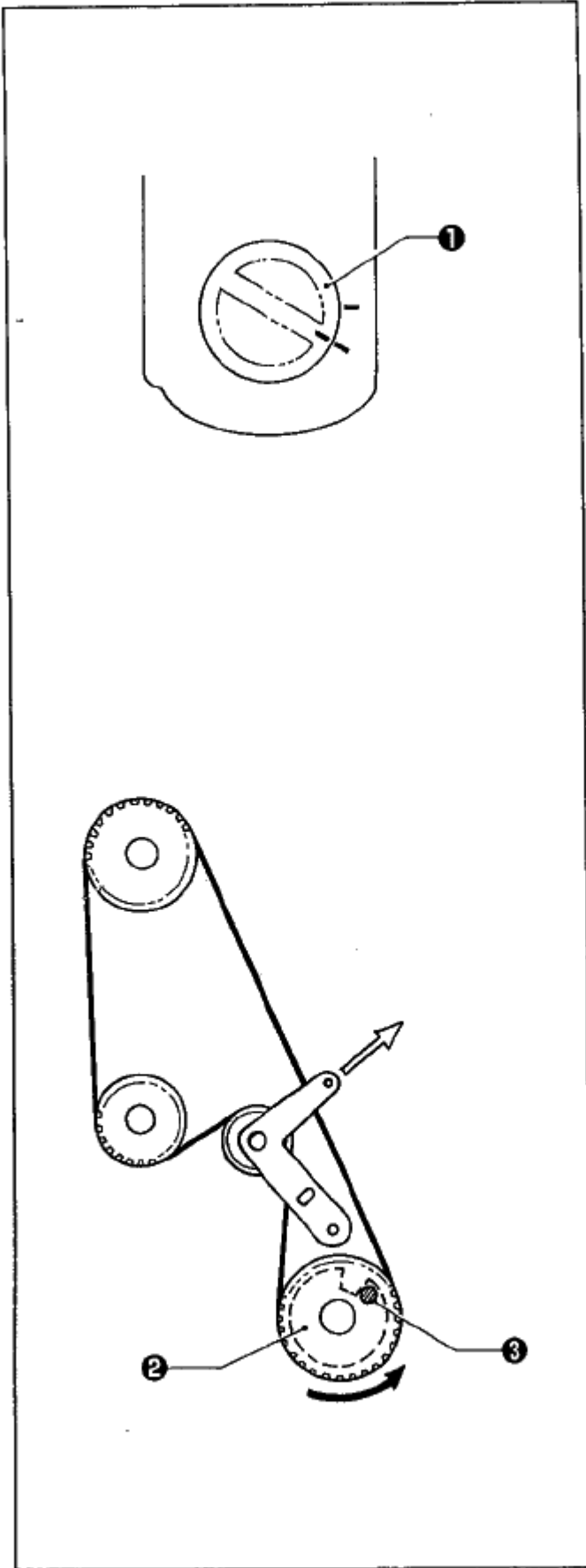
## 3-10. Needle bar rocking mechanism

## 1) Driving looper shaft



1. Insert the driving looper shaft ① through the hole in the bed from below, place the ball bearing ②, the set collar ③, the vertical shaft (T) pulley (U) assembly ④, the washer ⑤, and finally the ball bearing ⑥ on the driving looper shaft ①.
2. Set the clearance between the set collar ③ and the bed ⑦ to 0.02 - 0.03 mm in the thrust direction, and tighten the set screws ⑨.
3. Press the vertical shaft (T) pulley (U) assembly ④ and the washer ⑤ against the ball bearing ⑥, and tighten the screw ⑩.  
\*Be sure to pass the driving looper shaft ① through timing belt (U).
4. Attach the tension pulley arm (U) assembly ⑩ while it is being pulled by a force of 19.6 N (2 kgf).  
<Deflection in the center of span:  $3 \pm 0.5$  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 ① with that in the bed, as shown in the figure on the left.
2. Turn the driving needle pulley assembly ② until the pin ③ makes contact with the motor base.
3. Attach the timing belt.
4. Make sure that the looper base ① can rotate through 360° easily.

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

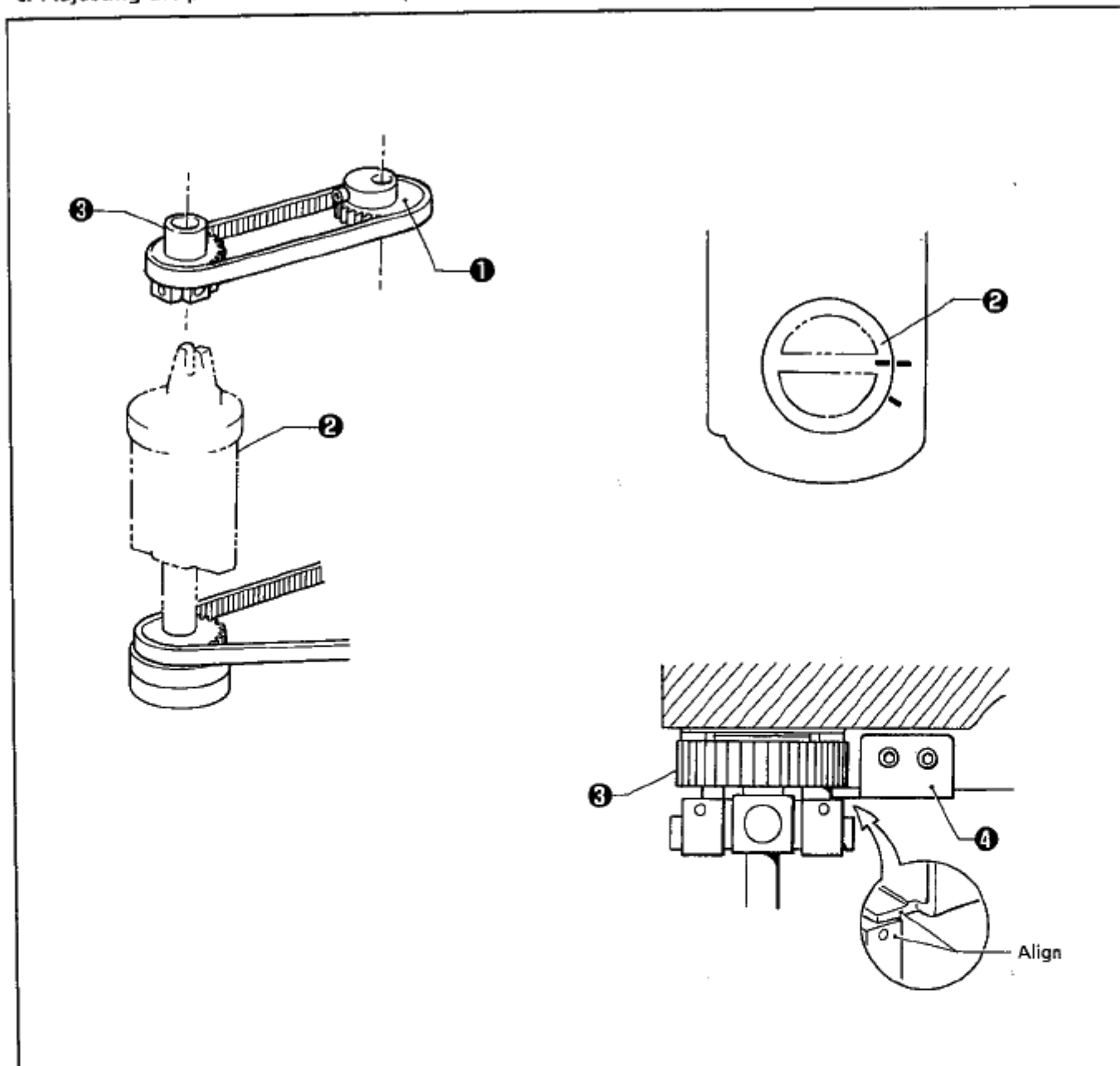
b. Adjusting the timing belt tension

Timing belt (D)

..... Attach the tension pulley arm (U) assembly while it is being pulled by a force of 68.6 N (7 kgf).

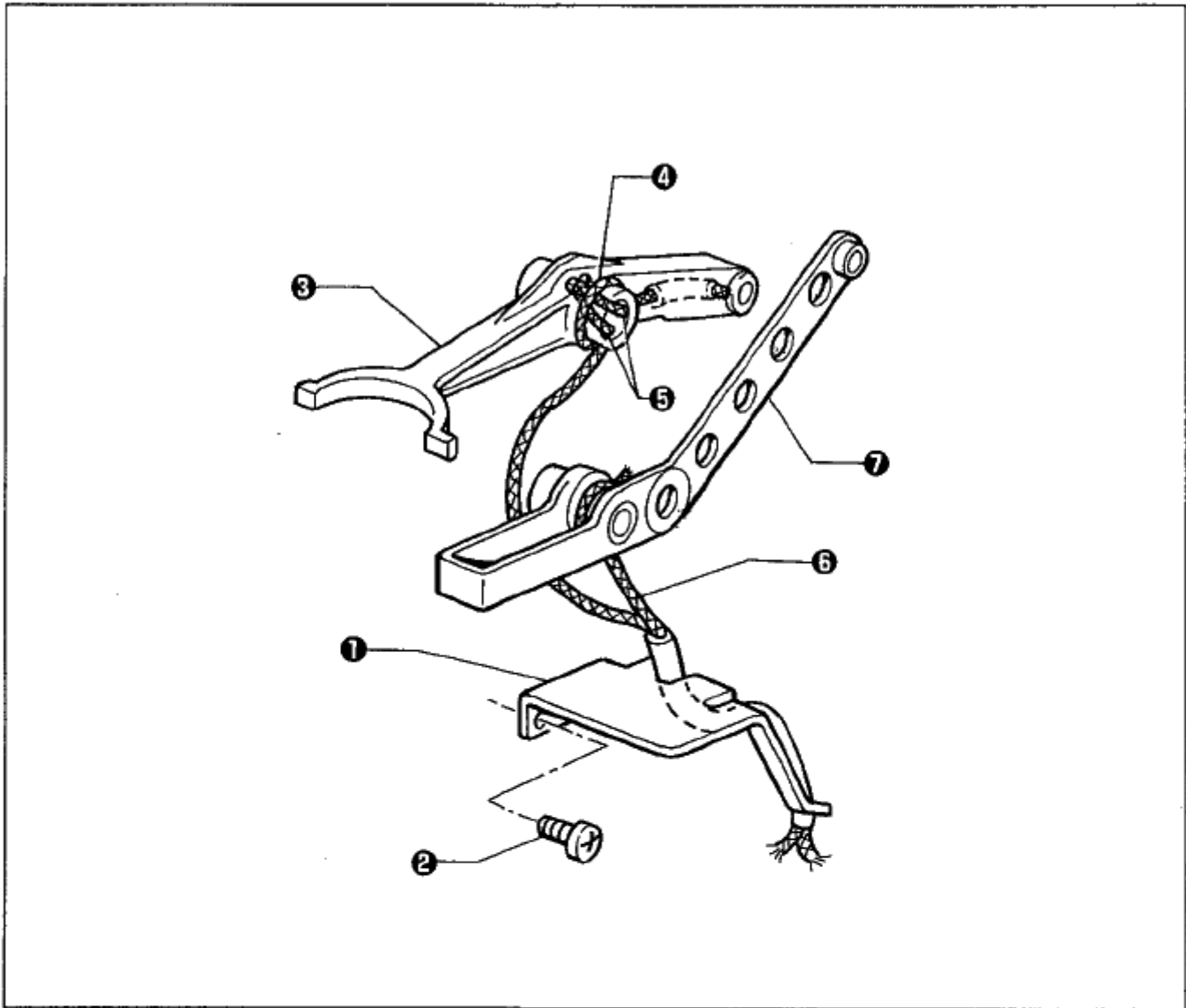
<Deflection in the center of span:  $6 \pm 0.5$  mm when 4.9 N (0.5 kgf) is applied >

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

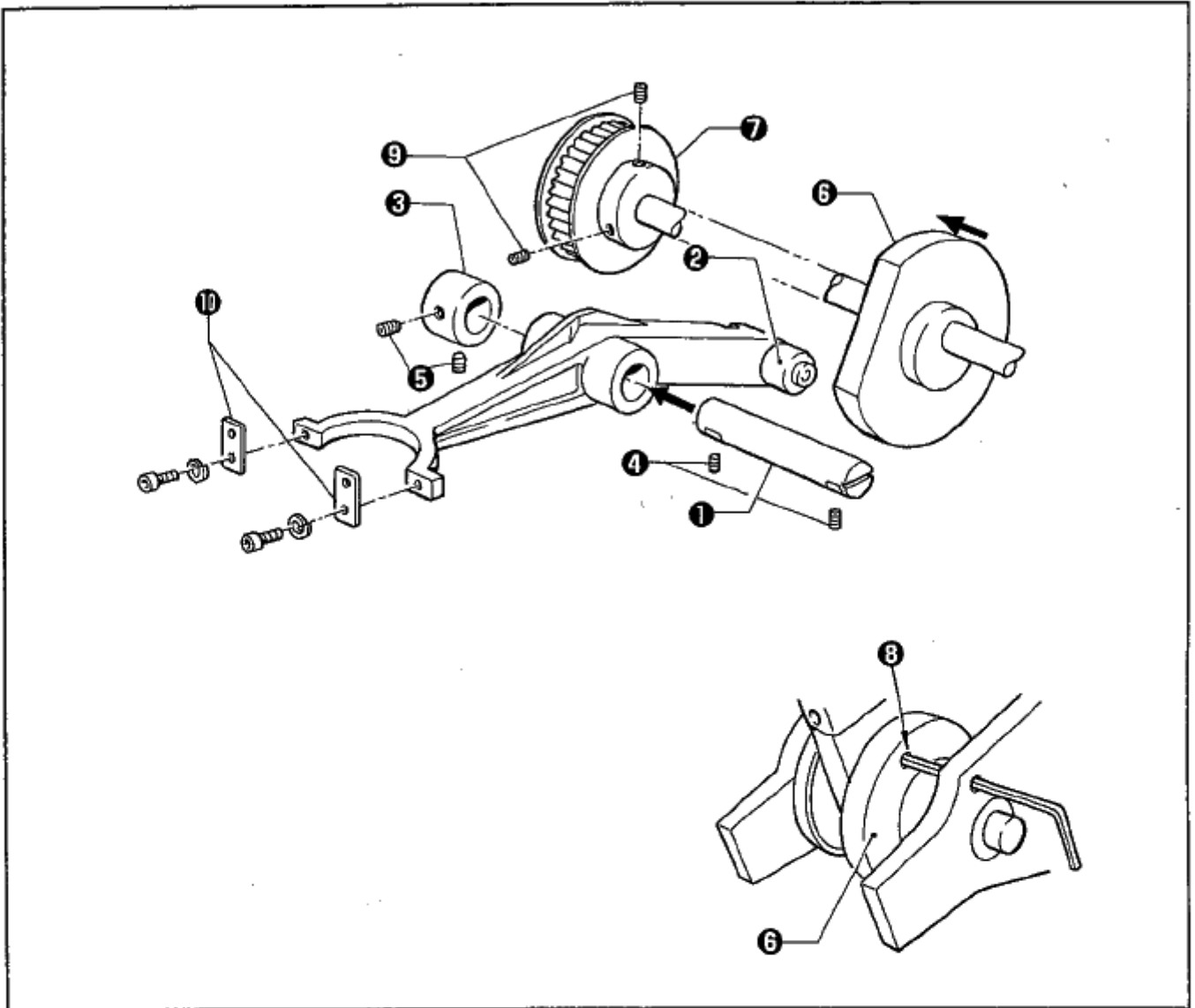


1. Loosen the screw of the vertical shaft (T) pulley (U) assembly ❶.
2. Align the match mark in the looper base ❷ with that in the bed, as shown in the figure.
3. Orient the needle bar gear ❸ in the direction shown in the figure, and align it with needle bar gear support (B) ❹.
4. Tighten the screw of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

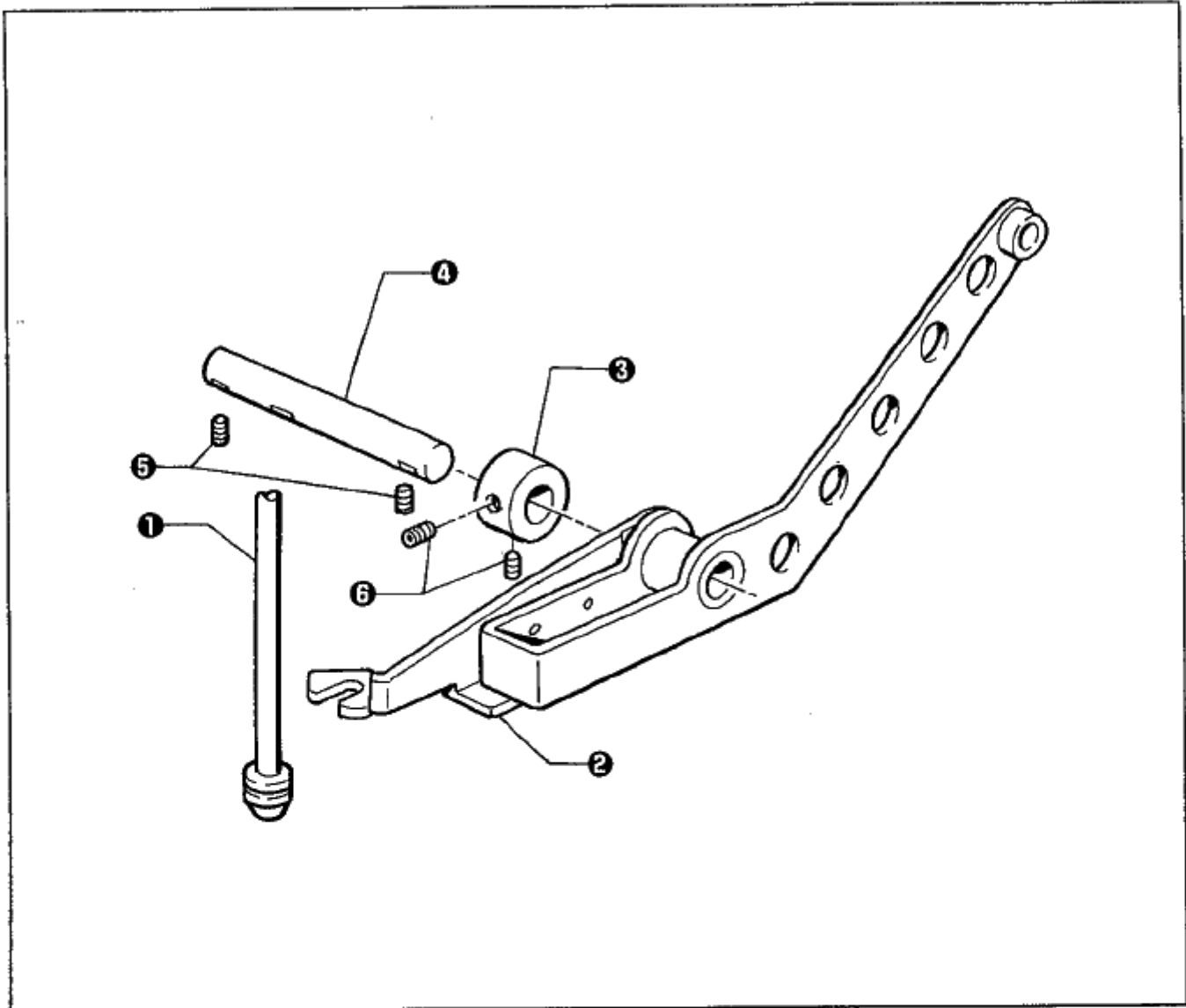
### 3-11. Looper and spreader



1. Attach the looper link support ① using the screw ②.
2. Wind the wick ④ around the boss of the looper link ③.  
Be sure to pass the two wicks ⑤ under the wick ④.  
Wind the wick ⑥ around the spreader driving lever ⑦, as shown in the figure.



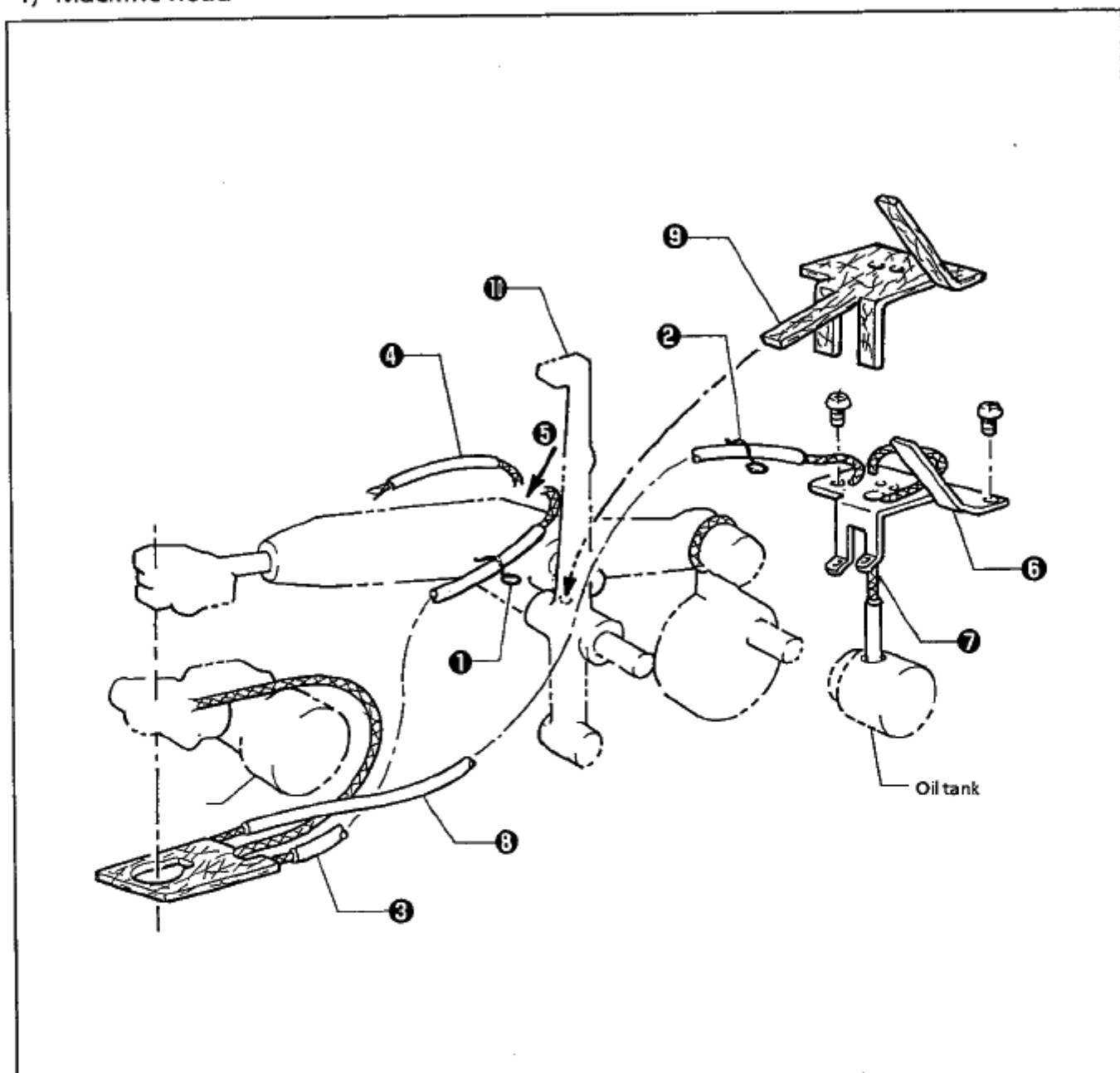
1. Place the looper link ② and the set collar ③ on the looper link shaft ①, and secure the latter using the set screws ④.
2. Tighten the set screws ⑤ of the set collar ③ to eliminate end play.
3. Position the lower shaft cam ⑥ and the timing pulley ⑦ so that they lightly make contact, then tighten the 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 ⑧ in the lower shaft cam ⑥. Position the screw flat of the upper shaft at the top (where the needle is at its lowest position), and tighten the set screws ⑤ of the timing pulley ⑦. (There is no screw flat for these set screws.)
5. Attach the looper link springs ⑩ to the looper link ② 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 ① to the forked portion of the spreader driving lever ② while pulling the former downward.
2. Pass the shaft ④ through the spreader driving lever ② and the set collar ⑤, and secure them using the set screws ⑥. (The split in the shaft should be facing the right.)
3. Tighten the set screws ⑥ of the set collar ⑤ to eliminate the end play.

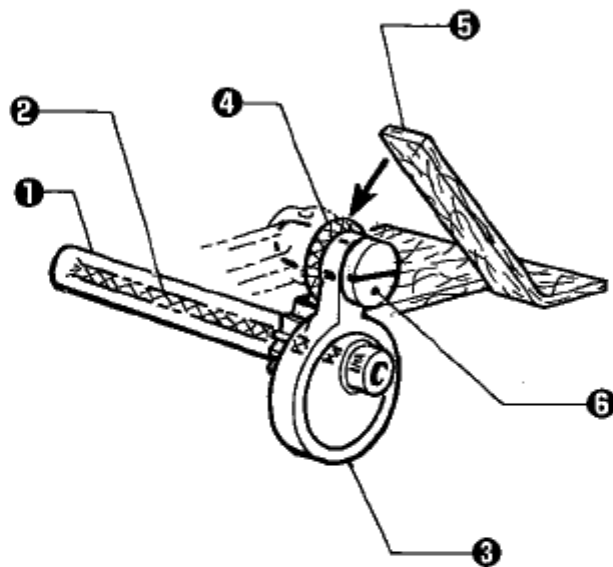
## 3-12. Lubrication

## 1) Machine head



1. Hold the wick ③ using the wick support ①.
2. Hold the wick ③ using the wick support ②.
3. Insert the wicks ③ and ④ into the hole ⑤.
4. Attach wick support (L) ⑥ using the two screws.  
At this time, the emergency stop switch cord should be routed above wick support (L) ⑥.
5. Using a pair of tweezers, insert the wick ⑦ 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 ③ under the felt ⑨ of the wick support (L) ⑥.
7. Push the felt ⑨ of the wick support (L) ⑥ into the lubrication hole in the thread take-up ⑩.

2) Driving gear shaft



\*Oil is supplied to the gear shaft, the eccentric wheel, and driving rod ⑥ through the wick ② of the driving gear shaft ①.

\*The wick ④, which is wound around the boss of the driving rod ③, makes contact with the felt ⑤, and oil is supplied to the driving rod pin ⑥.

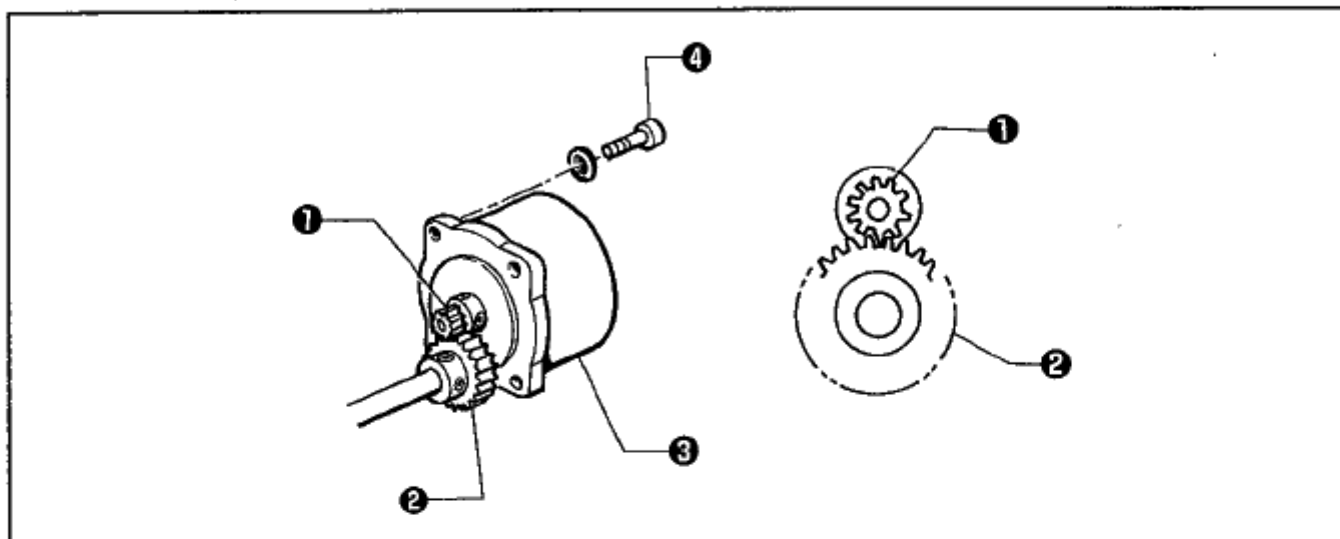


### 3-13. Feed mechanism

#### 1) X direction

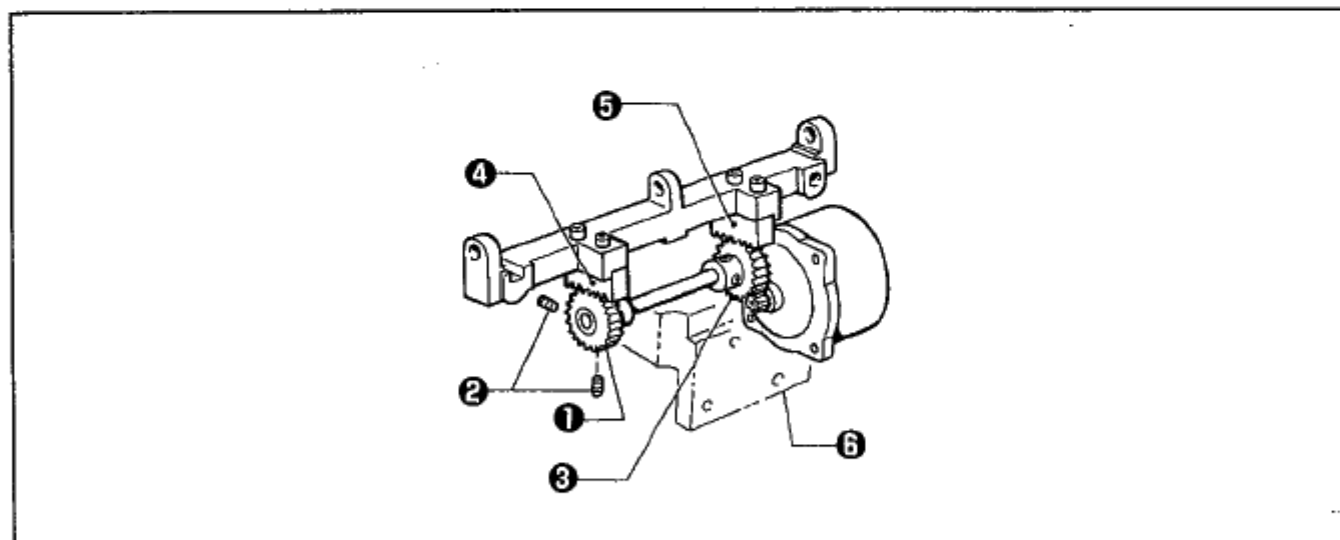
##### a. Adjusting the backlash between the driving gear and the idle gear

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) (3) (as shown in the figure above). Tighten the bolt (4).

##### b. Adjusting the idle gear



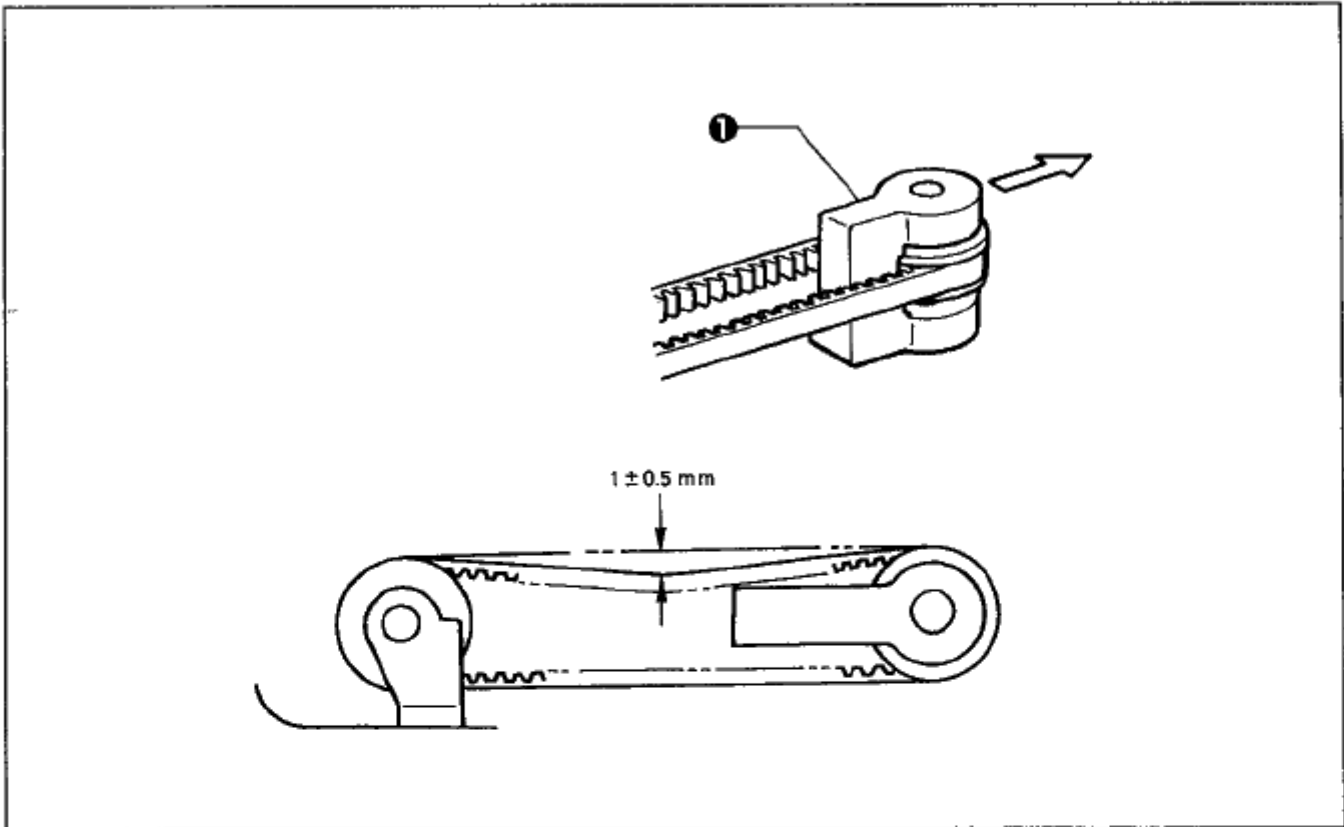
Adjust the positions of the X racks and the idle gear

1. Loosen the set screws (2) of the idle gear (1) to adjust the engagement between the X rack (4) and the idle gear (1) based on the engagement between the X rack (5) and the idle gear (3).
2. Engage the idle gears (1) and (3) with the X racks (4) and (5), respectively, and attach the motor support (6) while pressing it.
3. Tighten the set screws (2) of the idle gear (1).

\*The idle gear (1) should have no end play.

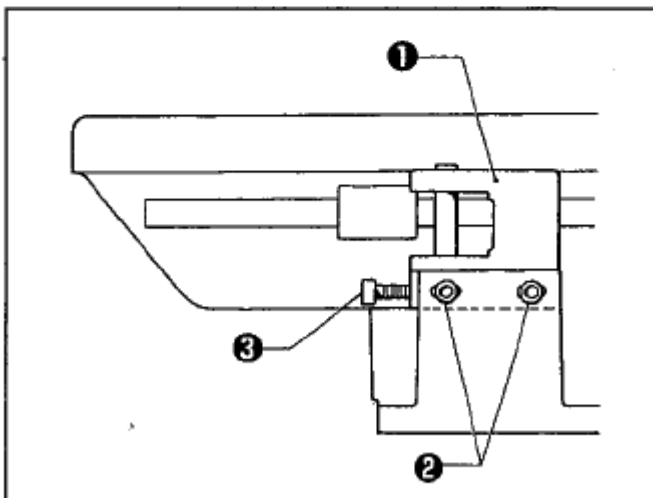
2) Y direction

a. Adjusting the tension of the Y-timing belt



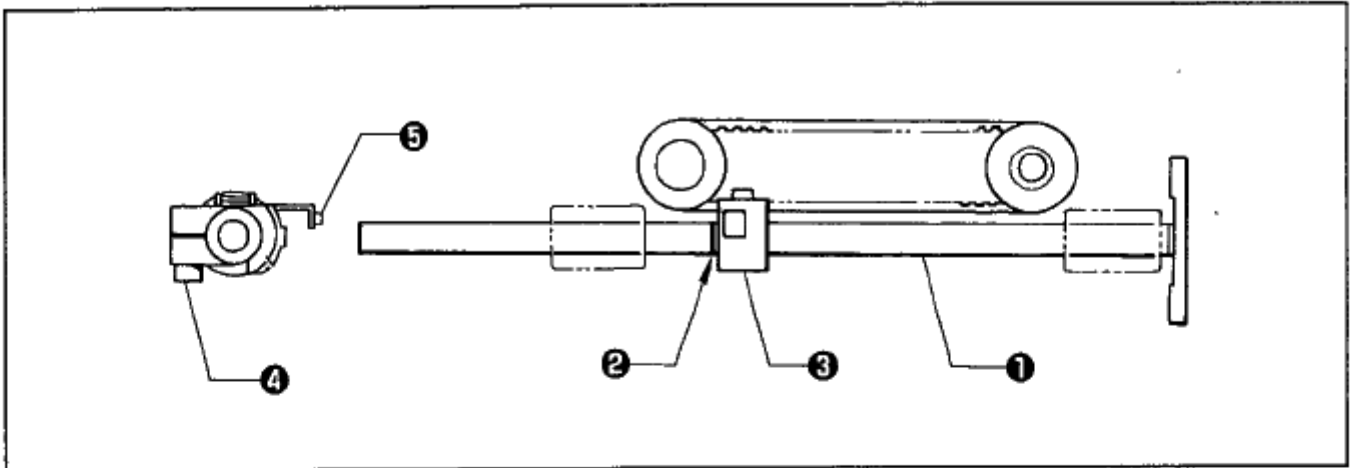
Secure Y-pulley support (L) ❶ while pulling it with a force of 117.6 N (12 kgf).  
 When the belt deflection is used instead to determine Y-pulley support (L) ❶ position, the deflection will be  $1 \pm 0.5$  mm when the belt is pressed at the center with a force of 4.9 N (0.5 kgf).

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.

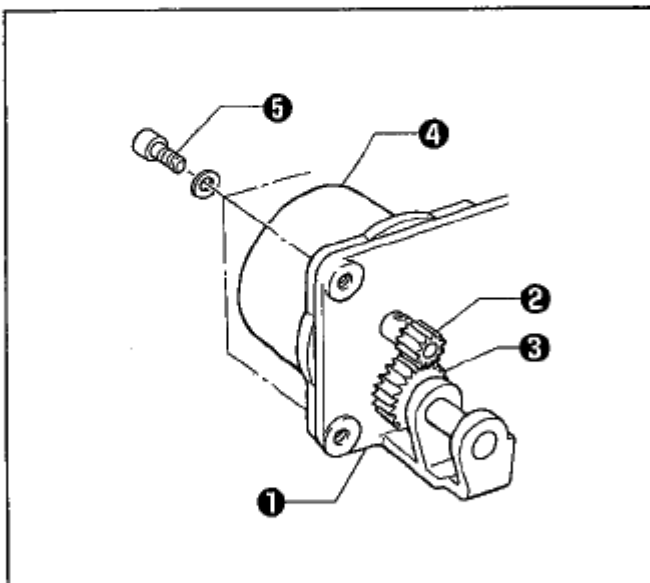
## b. Adjusting the position of the Y-driving shaft holder



Align the left end of the Y-driving shaft holder ⑤ with the reference line ② of the Y shaft ①.  
 \*When tightening the bolt ④, the sensor partition plate assembly ⑤ should face the top.

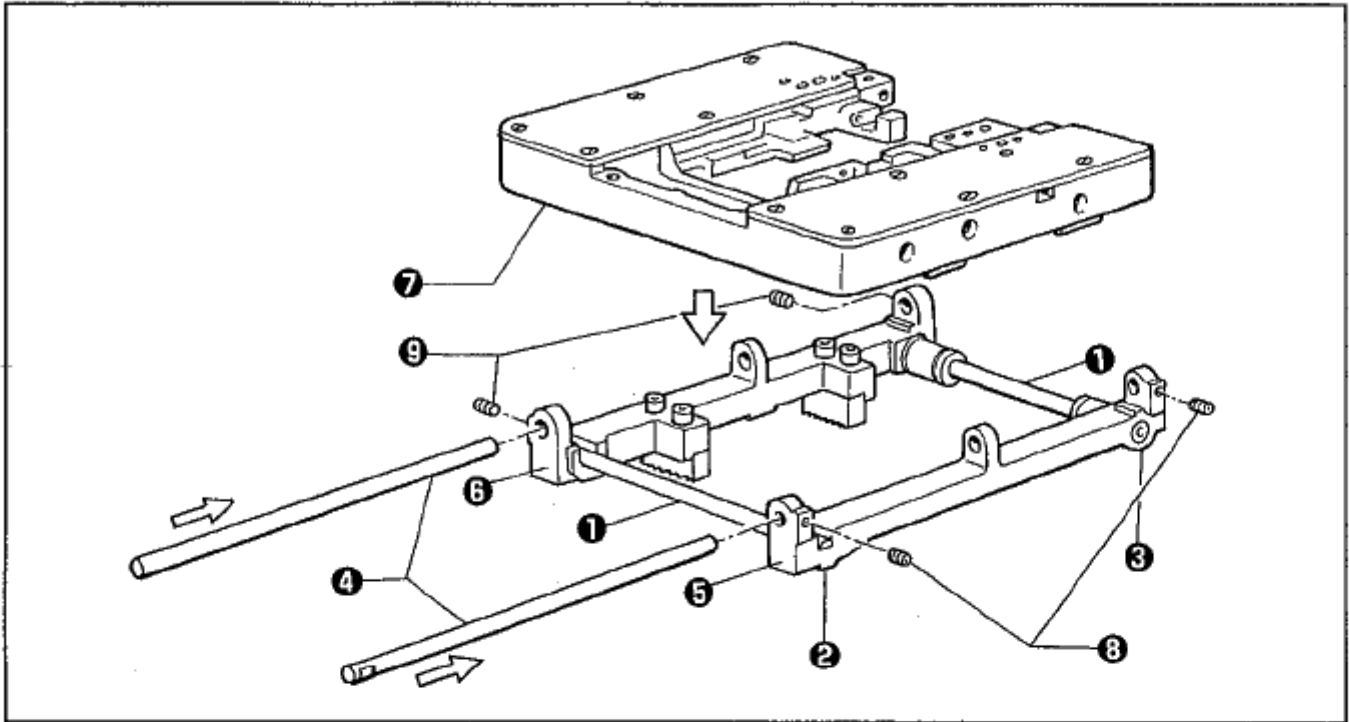
## c. Adjusting the backlash between the driving gear and the idle gear

Remove the Y feed base ①. Adjustment should be carried out with the driving gear and the idle gear treated as a unit.



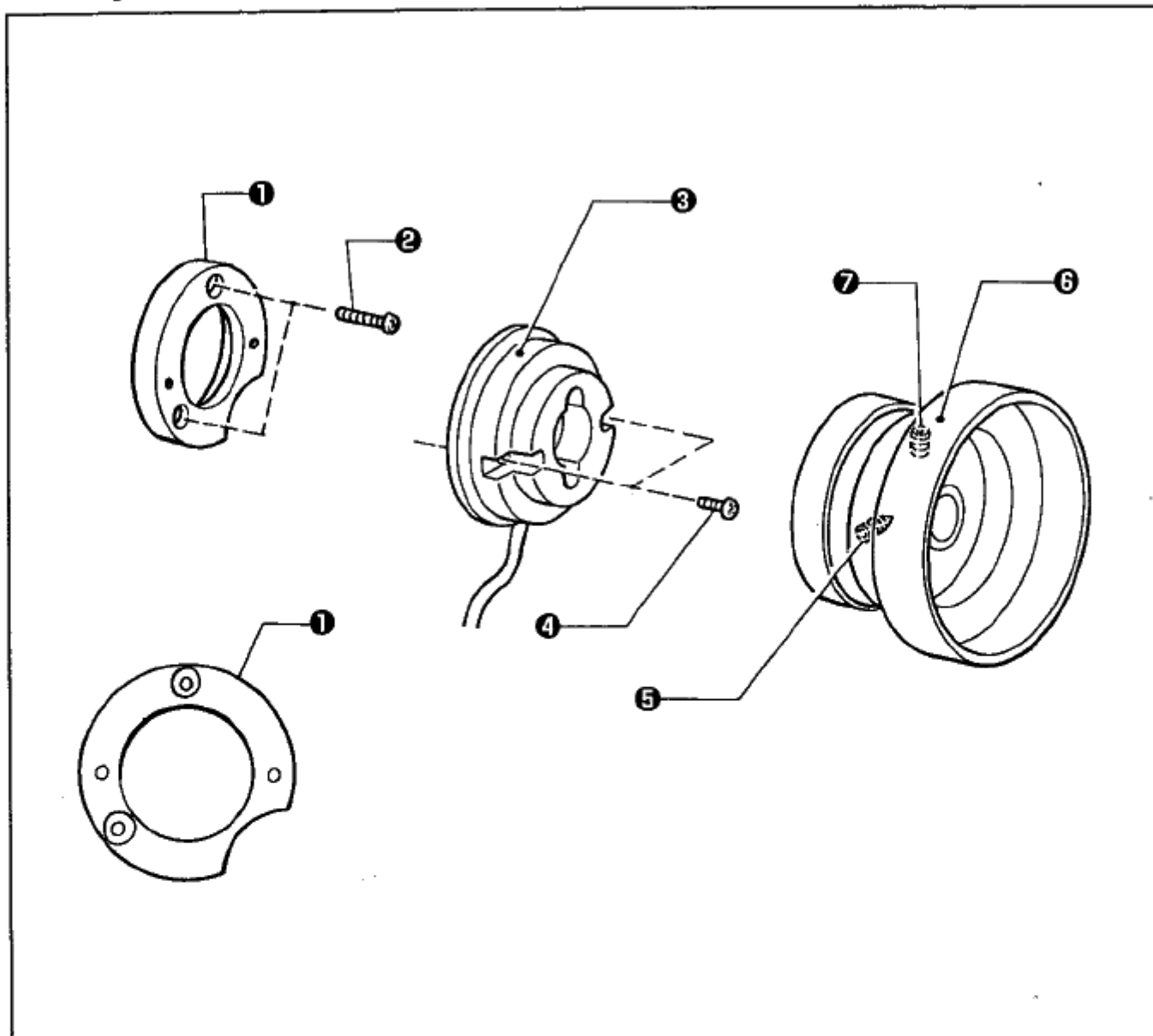
Adjust the backlash between the driving gear ② and the idle gear ③ when they are engaged under the weight of pulse motor (Y) ④ (as shown in the figure above).  
 Tighten the bolt ⑤.

3) Attaching the X-feed guide shaft



1. Loosen the screw ② and the set screw ③ of the X-feed guide shaft ① so that the shaft is still temporarily held in place.
2. Insert the Y-feed guide shafts ④ into the X-feed shaft holders ⑤ and ⑤ and the feed bracket ⑦, and tighten the set screws ⑥ and ⑥ (two each).
3. Move the feed bracket ⑦ in the X direction a few times.
4. Tighten the screw ② and the set screw ③ of the X-feed guide shaft ①.

## 3-14. Synchronizer

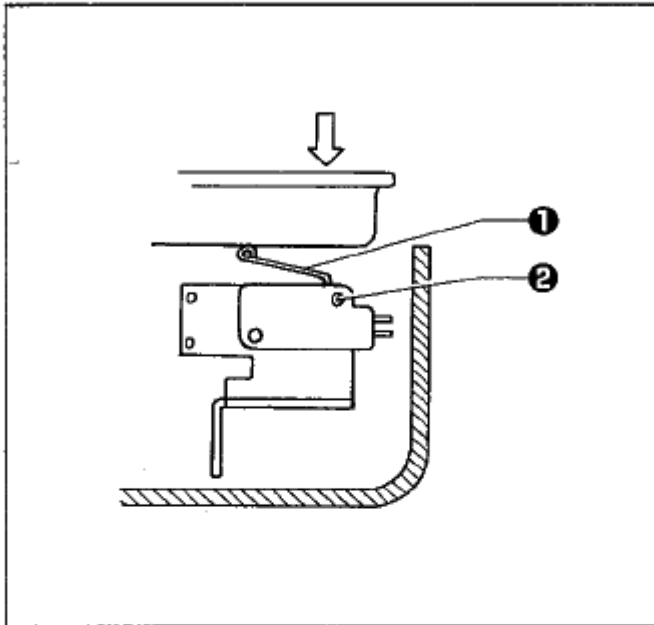


1. Attach the NP support bracket (B) ① with its notched portion facing the rear, using the screws ②.
2. Secure the synchronizer assembly (B) ③ using the two screws ④.
3. Tighten the set screw ⑤ in the V-groove in the upper shaft, and attach the pulley ⑥. Then tighten another set screw ⑦.  
The set screw ⑤ should be tightened in the front hole which comes first when the pulley is rotated in the rotation direction.
4. After attaching the synchronizer, check the machine torque.

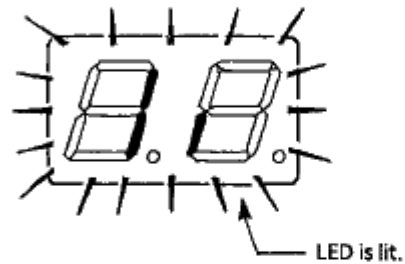
### 3-15. Covers and work clamp mechanism

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 ① using the screw ② 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

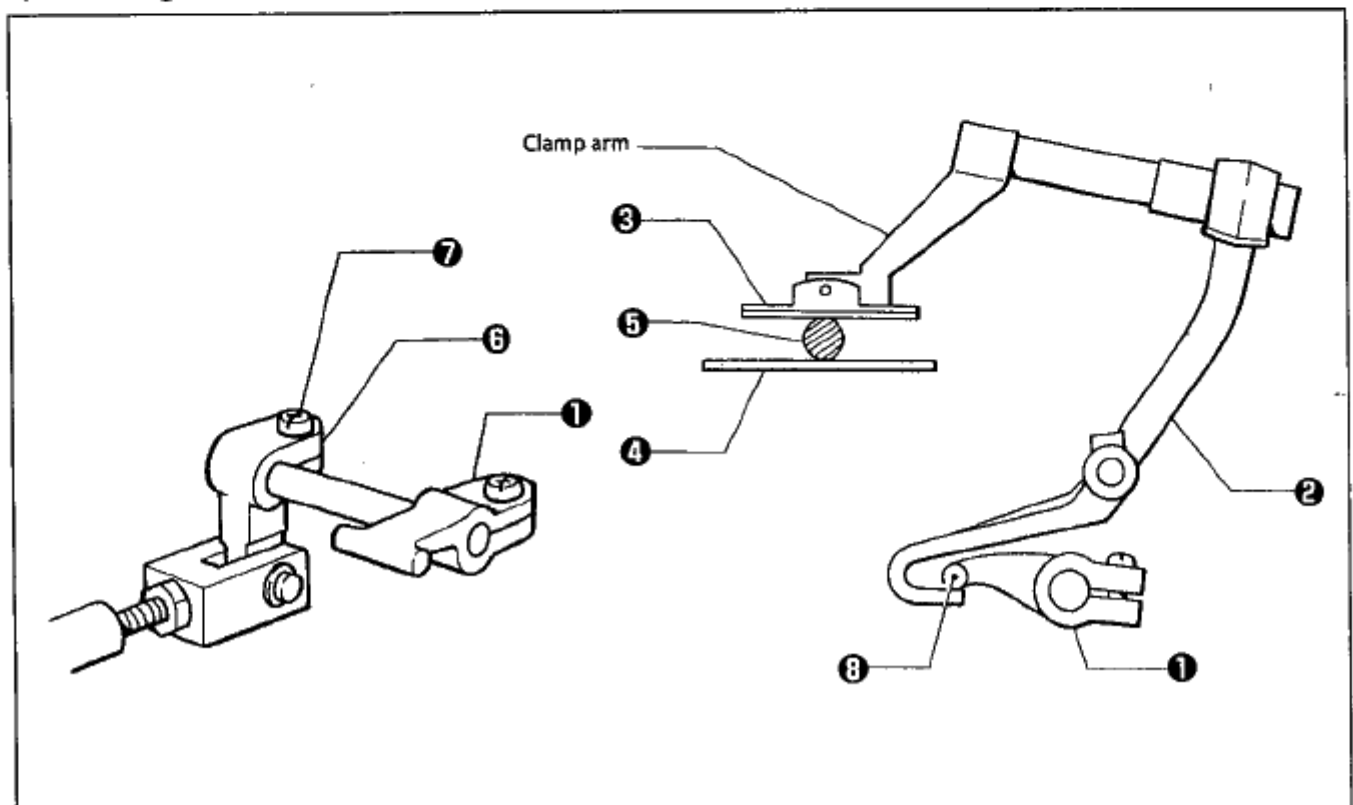
- ⊘ Maintenance and inspection of the sewing machine should only be carried out by a qualified technician.
- ❗ Ask your Brother dealer or a qualified electrician to carry out any maintenance and inspection of the electrical system.
- ⚠ Turn off the power switch and disconnect the power cord from the 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.

### ☑ Work clamp and cloth opener

#### 4-1. Adjusting the work clamp lift height

The work clamp lift height is adjusted to 16 mm.

(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 ❷ between the work clamp ❸ and the needle plate ❹.

## 4. ADJUSTMENT

- Loosen the screw ⑦ of the presser driving lever ⑥, and put the end ⑧ of clamp lever (B) ① on the end of clamp lever L (R) ②.

Note 1: Make sure that work clamp L (R) ② securely holds the block or the thickness gage ⑤.

Note 2: Make sure that work clamp cylinder is fully extended.

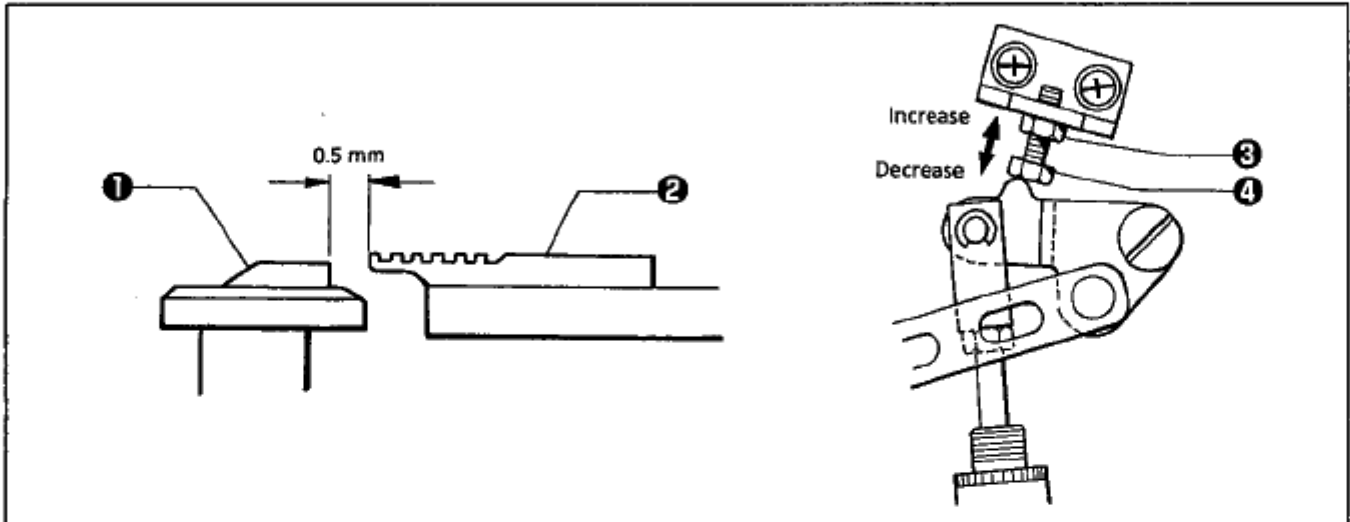
### 4-2. Adjusting the work clamp plate

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

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

\*It is necessary to adjust the throat plate ① and needle plate (R) ② so that they do not make contact during sewing.

\*The standard clearance between the throat plate ① and needle plate (R) ② is 0.5 mm (when the cutting space is set to 0).

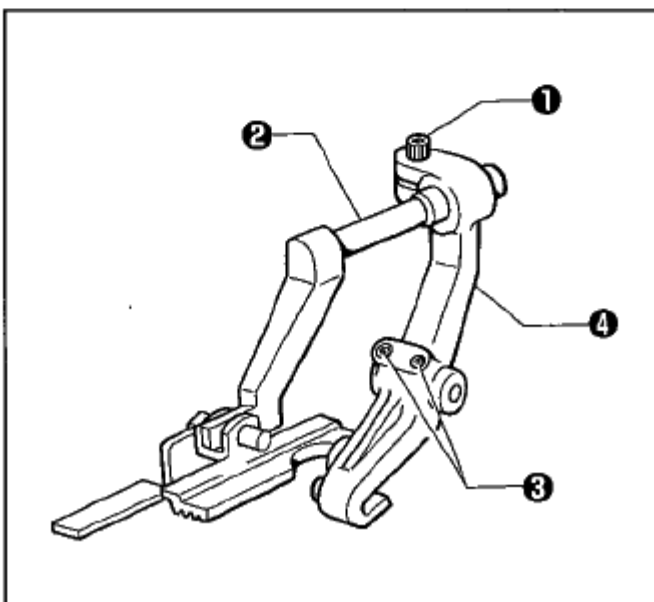


- Set CUTTING SPACE to 0 by the panel DIP switch B.
- Select the FEED mode, and press the start switch.
- Keep pressing the start switch, and make sure that the clearance between the throat plate ① and needle plate (R) ② is 0.5 mm.
- If the clearance is not 0.5 mm, loosen the nut ③, and turn the bolt ④ to adjust the clearance.  
Note: Adjust the clearance between the throat plate ① and needle plate (L) in the same manner.

### 4-3. Adjusting the cloth spreading amount

Refer to page 59 of the instruction manual.

### 4-4. Adjusting the position of the work clamp



The back and forth and sideways movement of the work clamp can be respectively adjusted.

The work clamp should be centrally positioned as to the needle movement.

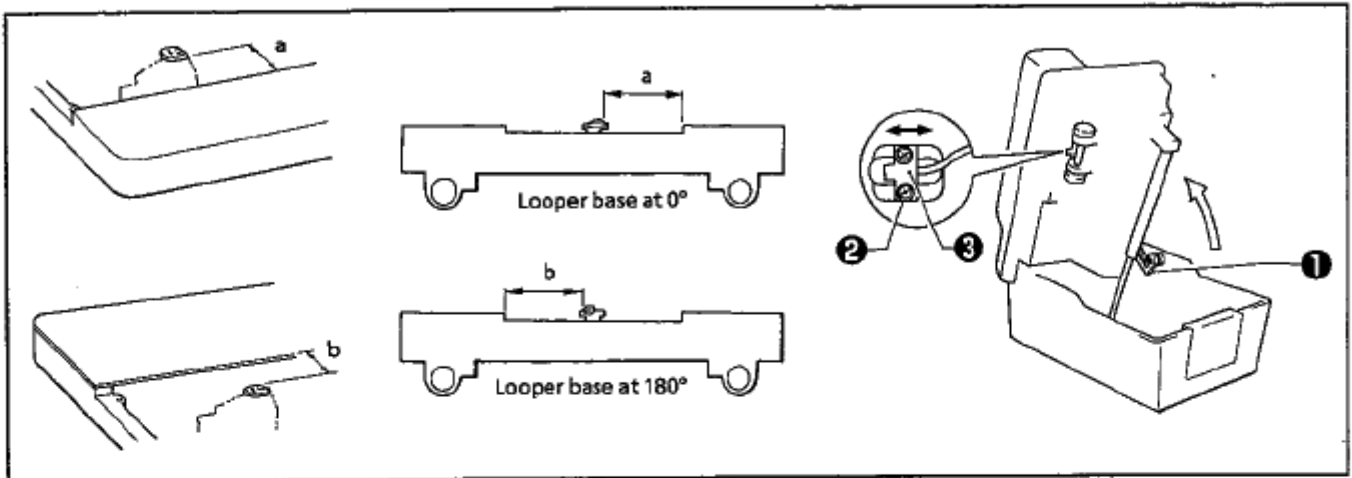
- For back and forth movement, loosen the screw ①, and adjust the position of the clamp arm ②; for sideways movement, loosen the screws ③, and adjust the position of the clamp lever ④.



## ☑ Home position

### 4-5. Adjusting the X-axis home position

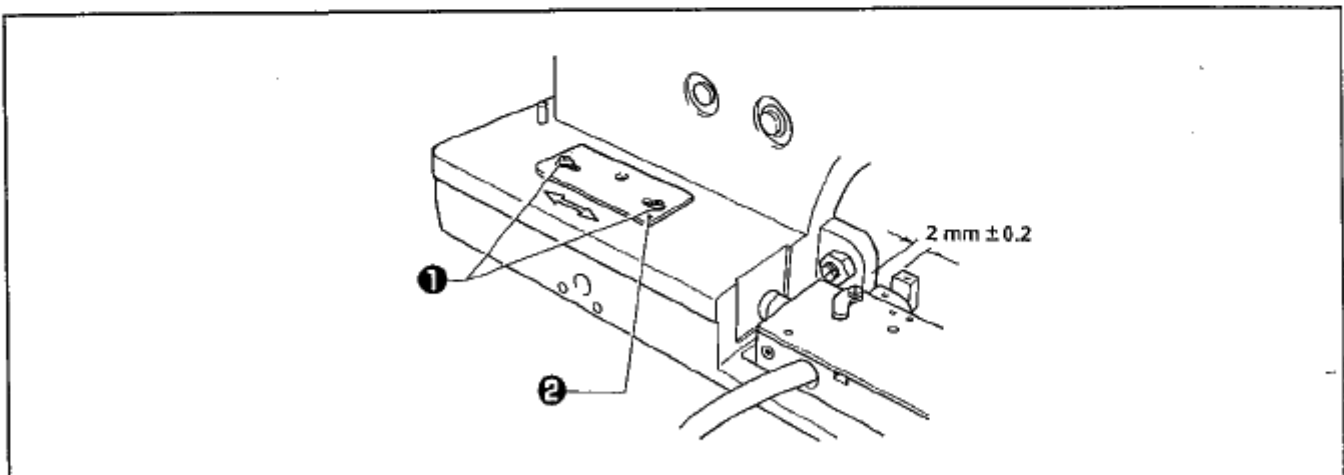
Dimension a (when the looper base is at 0°) and dimension b (when the looper base is at 180°) from the stepped portion of the throat plate to both edges of the feed bracket must be equal.



1. Set TACKING LENGTH D to 0 by the panel DIP switch A, and switch to the FEED mode.
  2. Remove the work clamp 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 ①, loosen the screw ②, and adjust the position of the X-sensor set plate ③ in the direction of the arrow.
  6. Return the machine head to its original position. Repeat the above steps from 1.
- Note: The X-axis home position can be adjusted in increments of 0.05 mm.

### 4-6. Adjusting the Y-axis home position

The clearance from the rear end surface of the feed bracket to the bed should be  $2 \text{ mm} \pm 0.2 \text{ mm}$ .



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  $2 \text{ mm} \pm 0.2 \text{ mm}$ , turn off the power.
3. Loosen the screws ①, and move the Y-sensor set plate ② in the direction of the arrow.
4. Repeat the above steps from 1.

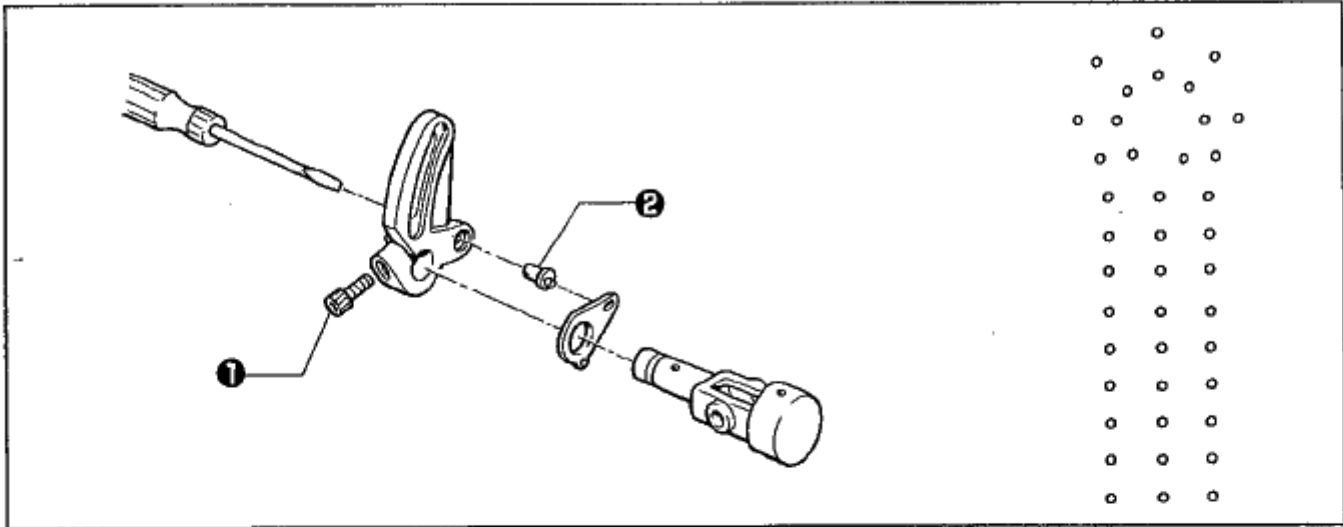
Note 1: The Y-axis home position can be adjusted in increments of 0.05 mm.

Note 2: If the clearance is too great, 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.

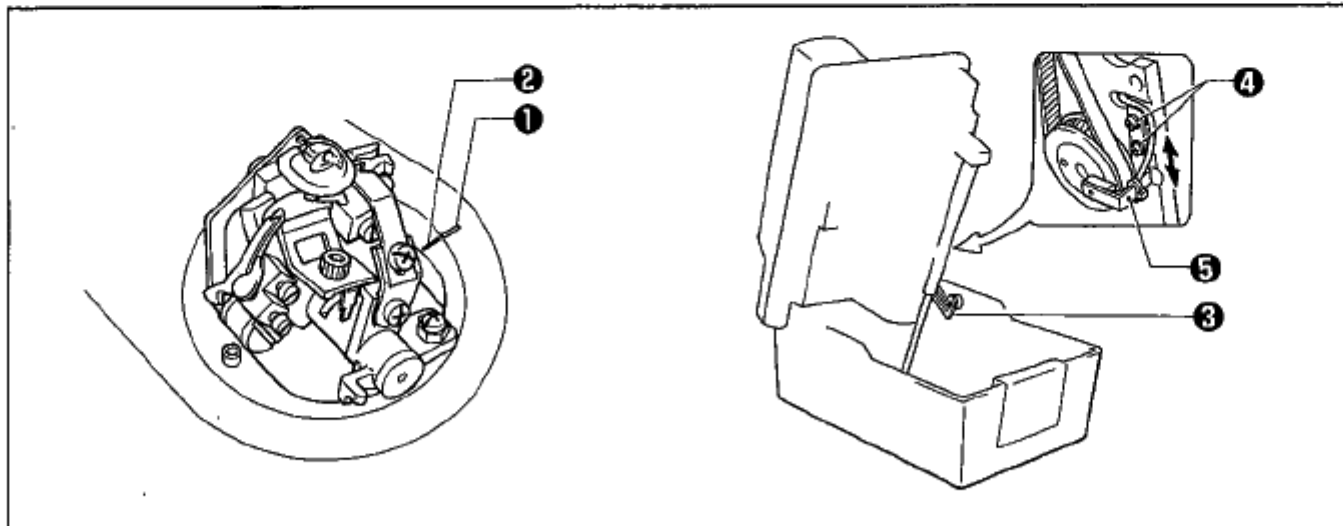
\*If the needle gage is changed, the 0 position (reference line) of the needle is not changed, only the outer needle cloth penetration positions are changed.



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 work clamp, 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 ①.
5. Insert a screwdriver into the arm from the left, and turn the zigzag eccentric pin ② 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 ① in the looper base is aligned with the match mark ② in the bed.
  2. If it is not, turn off the power.
  3. Raise the machine head, secure it using the head support lever ③, loosen the screws ④, and move the R-sensor set plate ⑤ 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 0.45°.

## ☑ Cutter

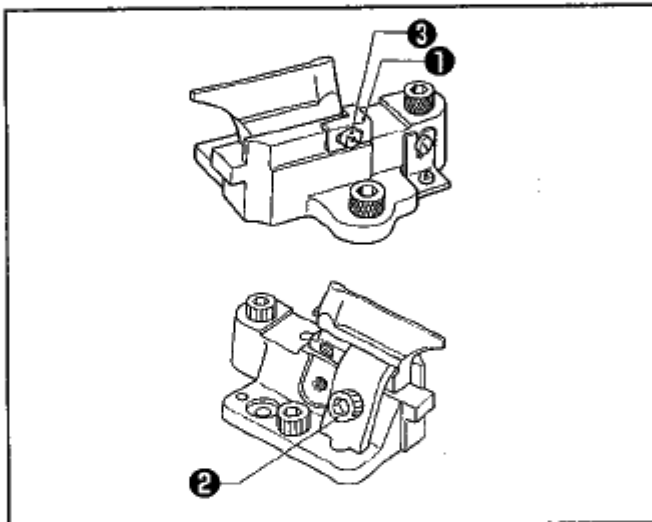
### 4-9. Fine adjustment of knife position

\*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.

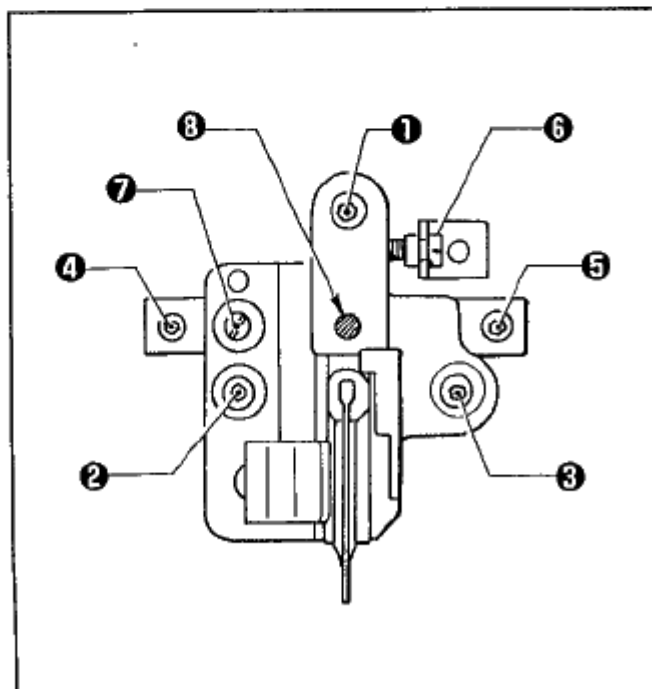
\*The back and forth and sideways movement, and inclination of the knife position can be independently adjusted.

1. Use a short needle (for adjustment).
2. Set the air pressure of the regulator under the table to 0.2 - 0.3 MPa.  
(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 work clamp, 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 CUTTING SPACE by the DIP switch B 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 ②, and adjust the position of the knife.  
After adjustment, loosen the screw ③, and press the block stopper plate ① against the knife.



[Sideways movement adjustment]

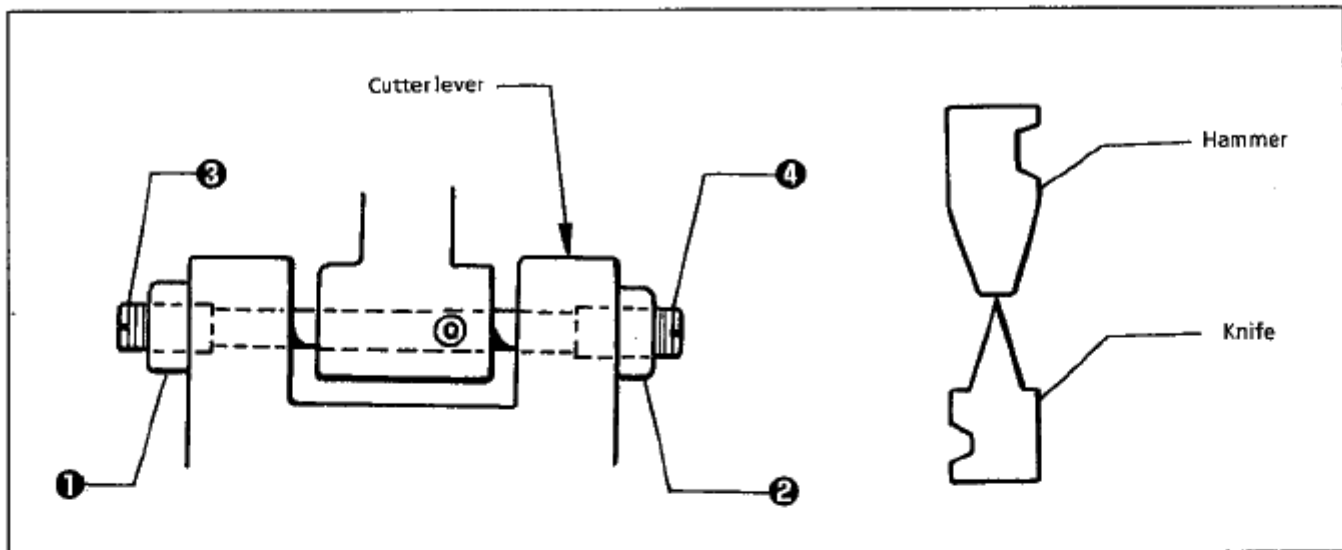
- i) Loosen the screws ①, ②, and ③, of the knife bracket.
- ii) Loosen the screws ④ and ⑤ of the knife bracket guide.
- iii) Turn the knife adjusting screw ⑥. Fine adjustment for sideways movement of the knife can be performed without removing the knife bracket and the knife bracket guide.

[Inclination adjustment]

- i) Loosen the screws ①, ②, and ③, of the knife bracket.
- ii) Loosen the screw ⑦, which secures the knife bracket and the knife bracket guide.
- iii) Turn the knife adjusting screw ⑧. Inclination of the knife can be adjusted by rotating the knife bracket and the knife bracket guide, regarding the pivot ⑤ 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.

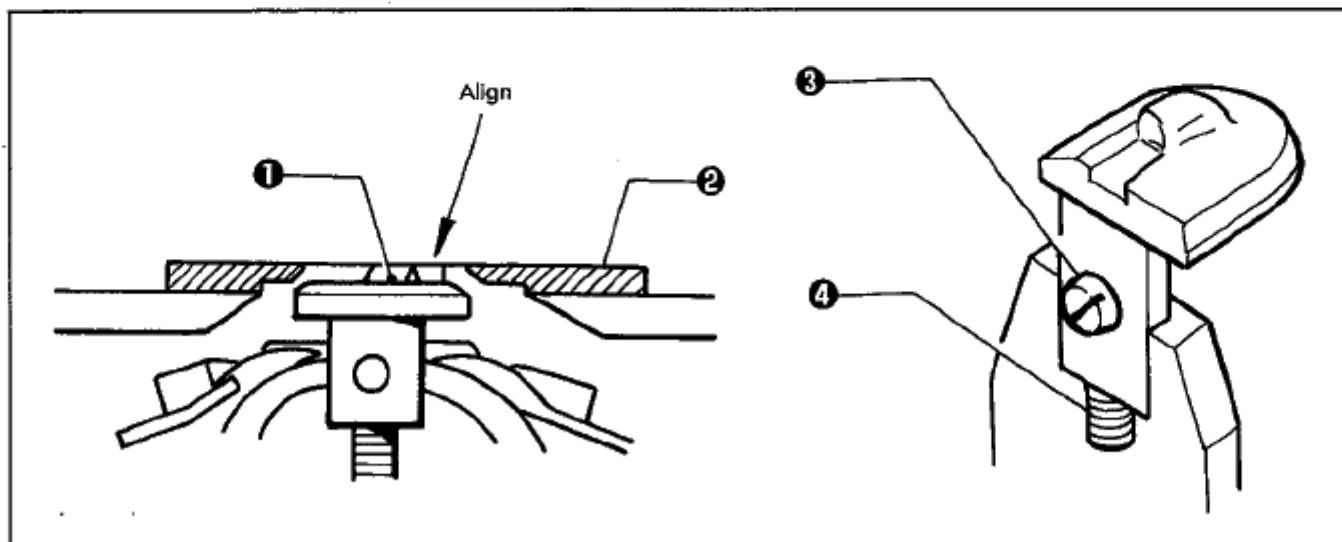


1. Loosen the nuts ① and ②.
2. Turn the cutter arm support screws ③ and ④ to adjust the sideways position of the cutter lever.
3. Tighten the nuts ① and ②.

Note: Adjust the cutter arm support screws ③ and ④ 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 ① should be flush with the top surface of the needle plate ②.



1. Loosen the screw ③, turn the set screw ④ which fits the guide, and adjust the height of the throat plate ①.

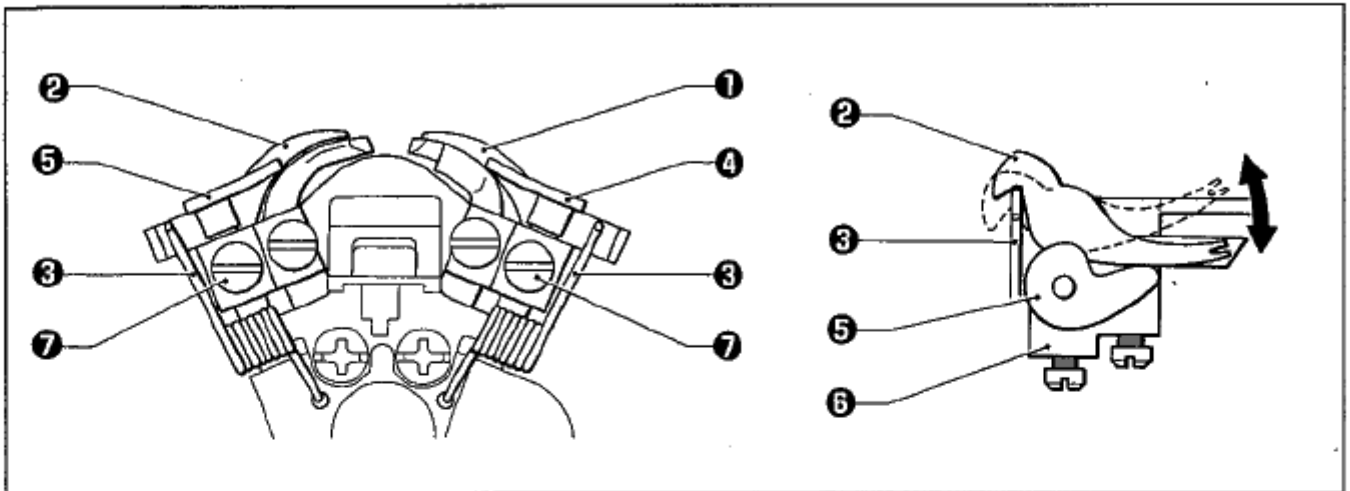
Note: The set screw ④ is adjusted to maintain the height of the throat plate when it is removed and re-installed.

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

### [Spreader height]

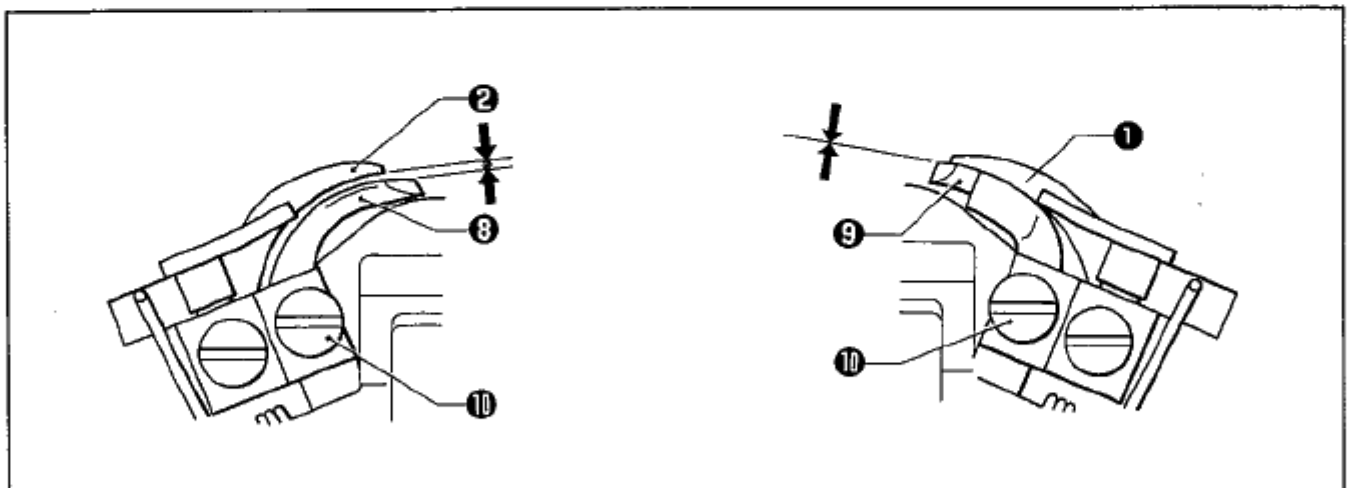
\*The clearance between spreader (L) and looper (L) must conform to the thickness of the looper thread.

\*The clearance between spreader (R) and looper (R) must be just enough that they can move.



1. Spreaders (R) ① and (L) ② move by means of the springs ③. Make sure that spreaders (R) ① and (L) ② move smoothly between the spreader stoppers (R) ④ and (L) ⑤, and the LS-holder bracket ⑥, with no looseness.
2. If adjustment is necessary, loosen the screws ⑦, and move spreaders (R) ④ and (L) ⑤ up and down.

### [Looper height]



1. Set the clearance between looper (L) ⑧ and spreader (L) ② to the same distance as the thickness of the looper (lower) thread.
2. Set the clearance between looper (R) ⑨ and spreader (R) ① to as small as possible, but make sure that they do not make contact.
3. If adjustment is necessary, loosen the set screw ⑩, and move loopers (L) ⑧ and (R) ⑨ up and down.

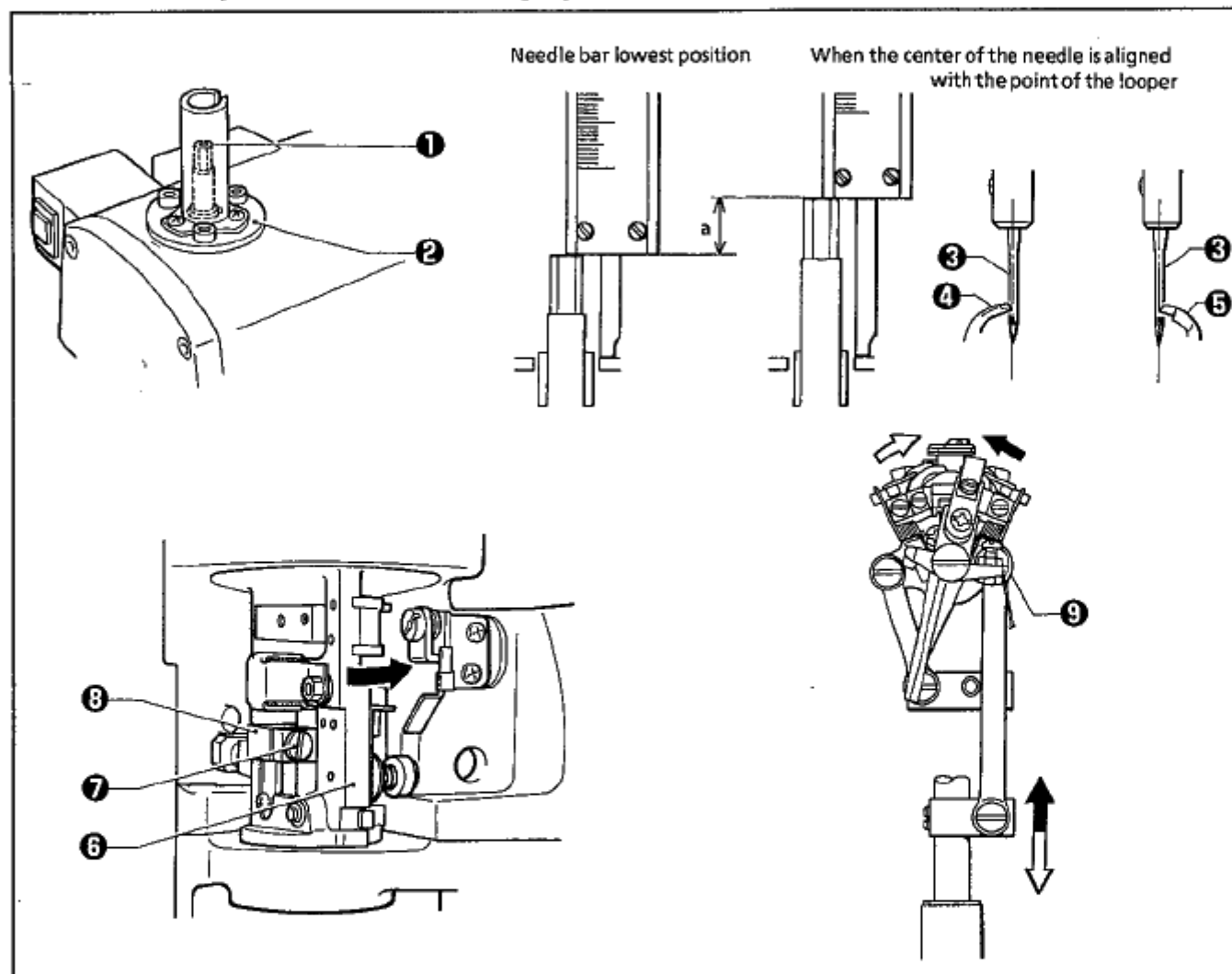
## 4-13. Adjusting the loop stroke

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. (The loop stroke may need changing depending on the material and thread being used.)

## 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.

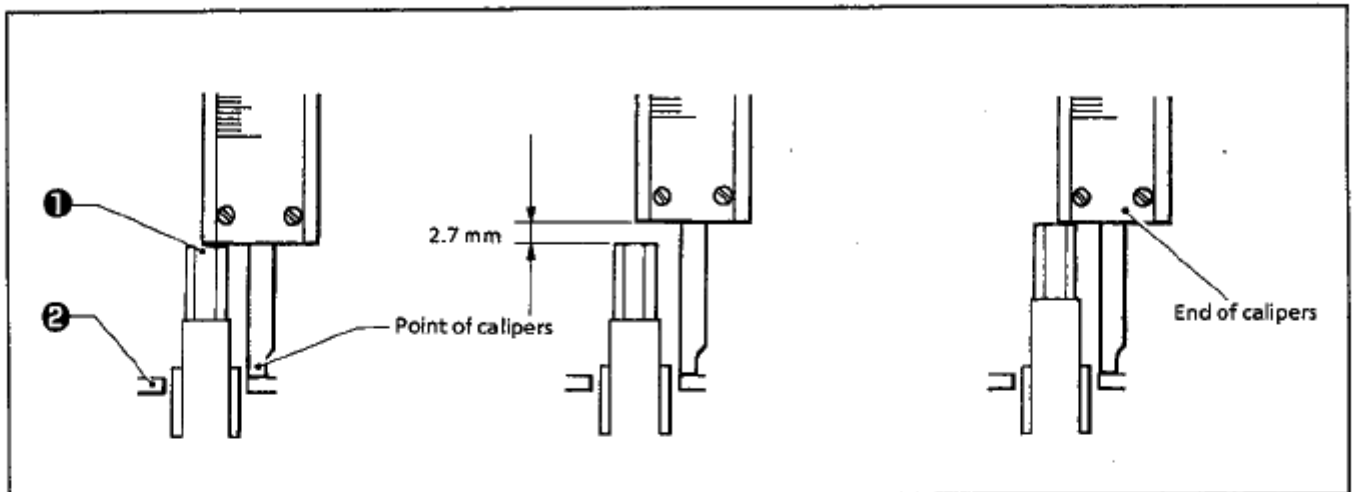
\*Before this adjustment, set the needle zigzag width to 2.5 mm (standard).



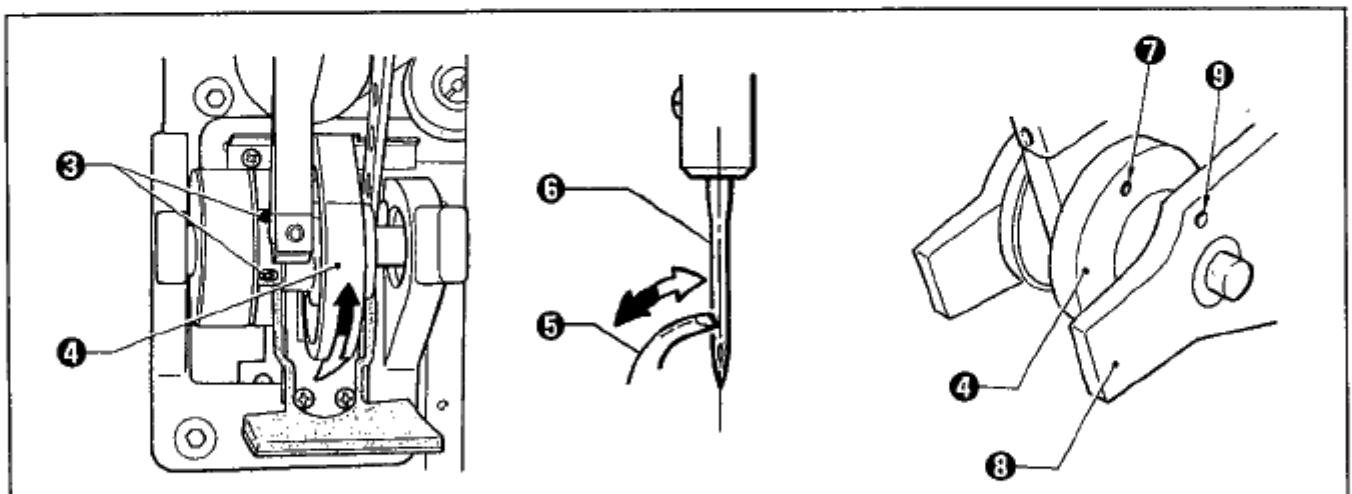
1. Set the needle bar to its lowest position.
2. Use calipers to measure the distance between the end of the needle bar ① and the top surface of needle bar presser bracket (B) ②.
3. When the needle ③ is at the inside sewing position, turn the pulley until the tip of looper (L) ④ is aligned with the center of the needle, and measure the distance between the end of the needle bar ① and the top surface of needle bar presser bracket (B) ②. Find distance *a* which is the difference between this distance and the distance obtained in step 2.
4. When the needle ③ is at the outside sewing position, find distance *a'* in the same manner as in the above steps.  
\*When the needle ③ is at the inside sewing position, the center of the needle is aligned with the tip of looper (L) ④, and at the outside sewing position, it is aligned with the tip of looper (R) ⑤.
5. Distance *a* obtained in step 3 should be equal to distance *a'* obtained in step 4.
6. Turn the looper base ⑥ in the direction of the arrow, loosen the screw ⑦, and move the looper link ⑧ up and down to adjust the LS-holder bracket ⑨ 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 ① and the top of needle bar presser bracket (B) ②.
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) ②, and then turn the pulley until the end of the needle bar ① 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.

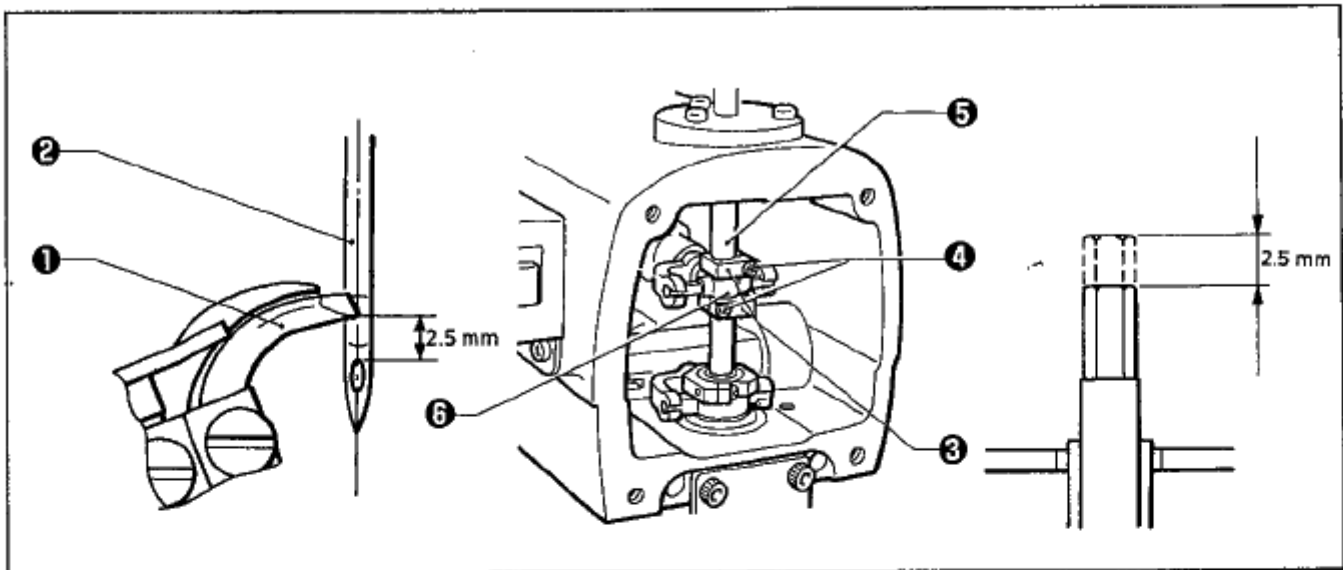


5. If the tips of loopers (L) and (R) are not aligned with the center of the needle, adjust as follows:
  - i) Raise the machine head.
  - ii) Loosen the two set screws ③ of the lower shaft tension pulley, hold the pulley so that it does not move, and then turn the lower shaft cam ④ in the direction of the arrow until the tip of looper (L) ⑤ is aligned with the center of the needle ⑥. Tighten the screws ③. After adjustment, make sure that the screws have been adequately tightened.

\*Basically, the machine is assembled so that the hole ⑦ of the lower shaft cam ④ is aligned with the hole ⑧ of the lower shaft base ③ when the needle bar is at its lowest position and at the inside sewing position.

### 4-14. Adjusting the height of the needle bar

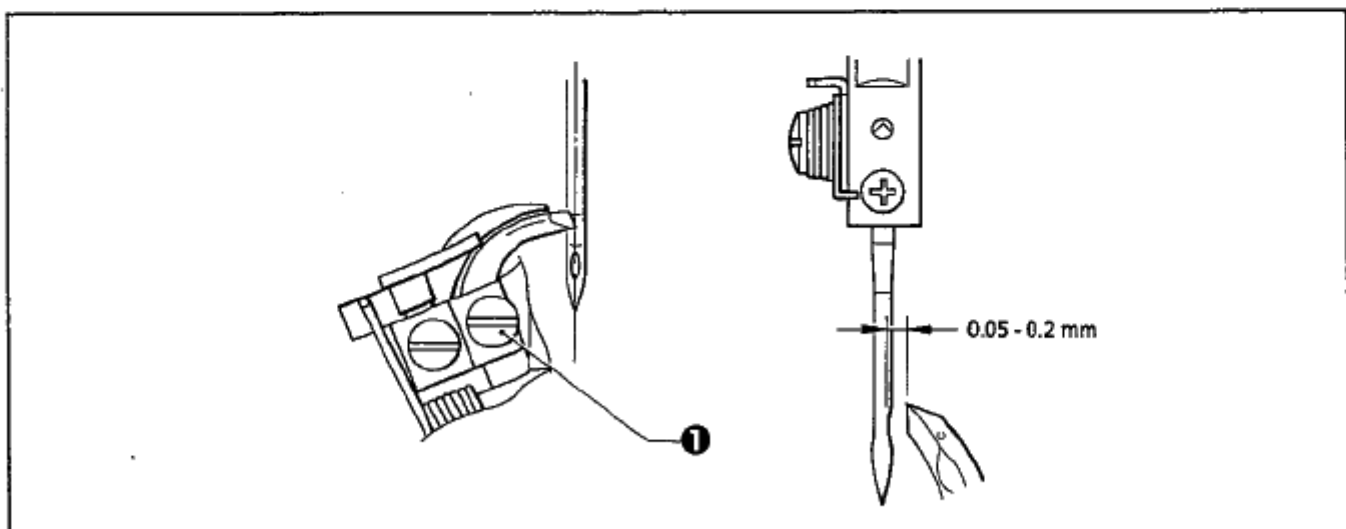
The standard height for the needle bar is 2.5 mm. (The needle bar height may need changing depending on the material and thread being used.)



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.



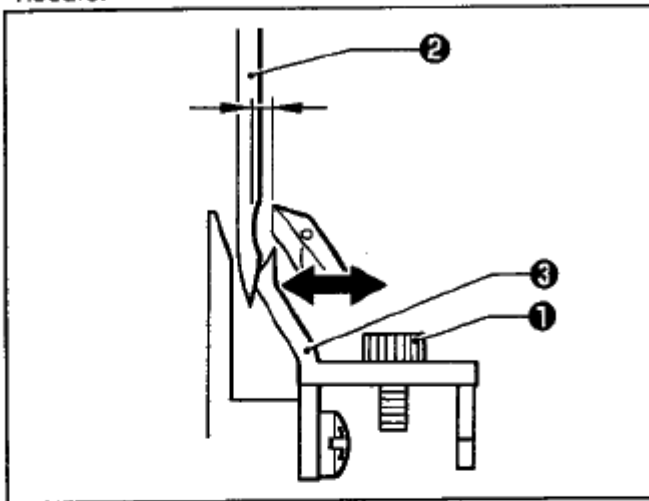
1. Loosen the set screw ❶ to adjust the clearance.  
\*The clearance must be uniform while the looper base is rotating (through 360°). If the clearance is not uniform, adjust the turning center for the needle bar. (This adjustment is performed before shipment from the factory.)



## 4-16. Adjusting the needle guard

This adjustment is necessary when the needle size is changed.

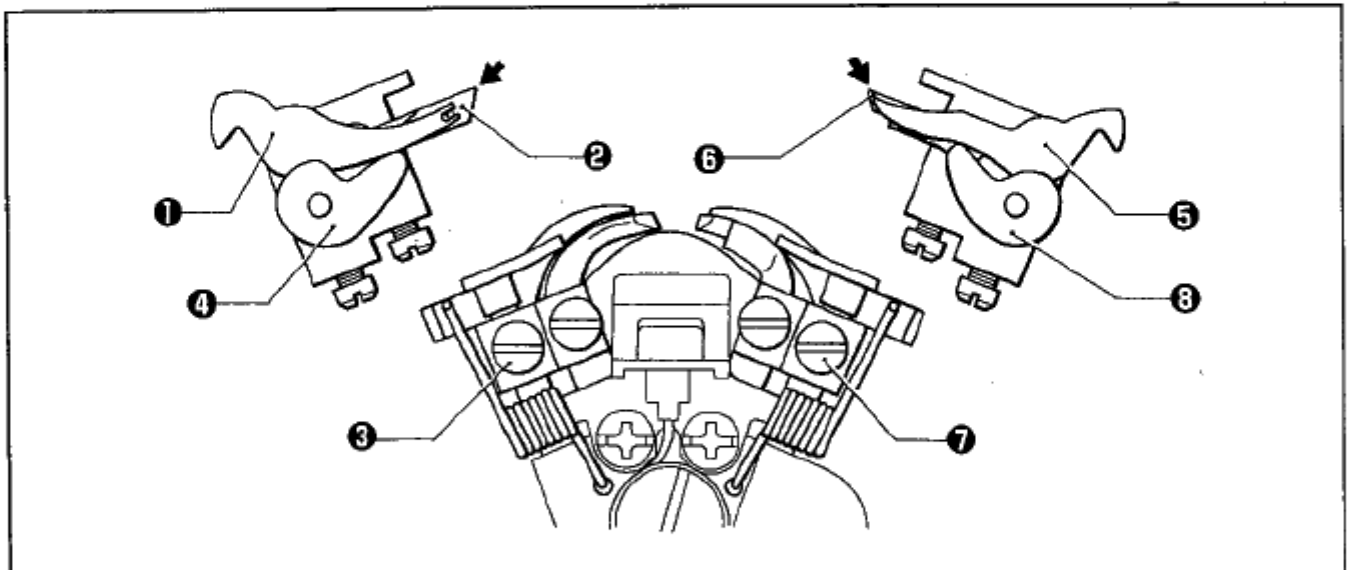
The needle must remain stationary with respect to the needle guard, until the tip of the looper reaches the needle.



1. Loosen the screw ①, and move the needle guard ③ in the direction of the arrows, by an appropriate amount in accordance with the thickness of the needle ②.

Note: The looper must securely hook the needle thread.

## 4-17. Adjusting the spreader mounting position

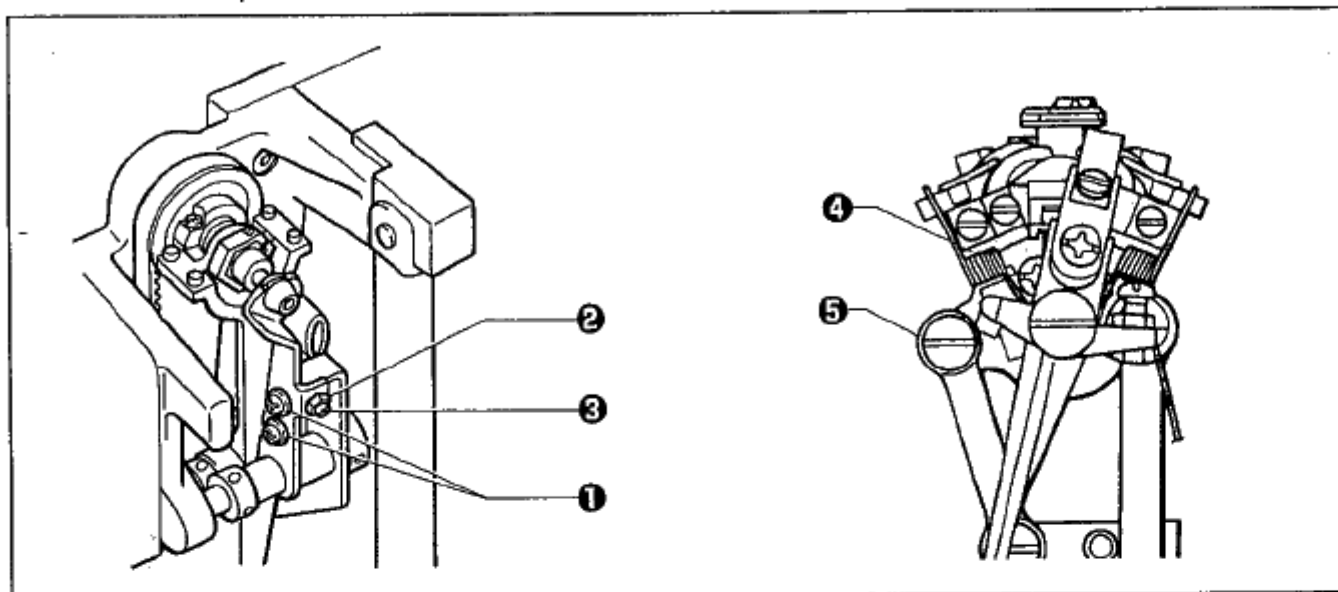


1. Loosen the screw ⑥, and adjust the position of spreader stopper (L) ④ so that the looper thread guide hole in looper (L) ② is between the forks of spreader ①.
2. Loosen the screw ⑦, and adjust the position of spreader stopper (R) ⑧ so that the tip of spreader (R) ⑤ is aligned with the tip of looper (R) ⑥.

Note: Both spreaders (L) ① and (R) ⑤ should be installed so that they do not project past the tips of loopers (L) ② and (R) ⑥, 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.



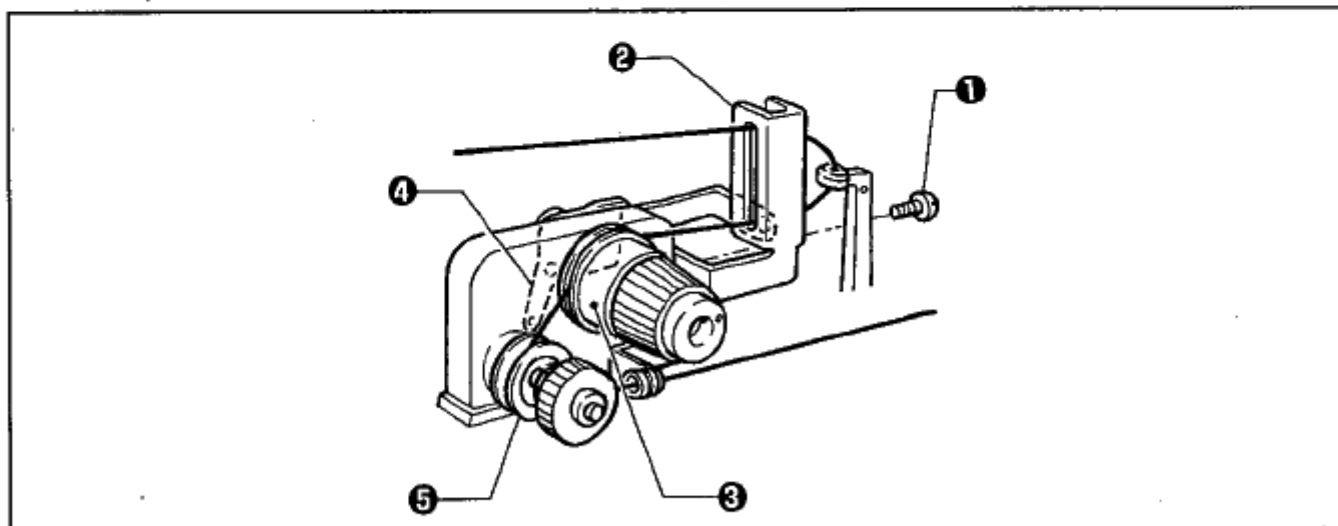
1. Raise the machine head.
2. Loosen the screws ① and the nut ②, then turn the adjust screw ③ to adjust.
3. After adjustment, tighten the screws ① and the nut ②.

Note: Make sure that the LS-holder bracket ④ does not touch the spreader cam link ⑤. 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.



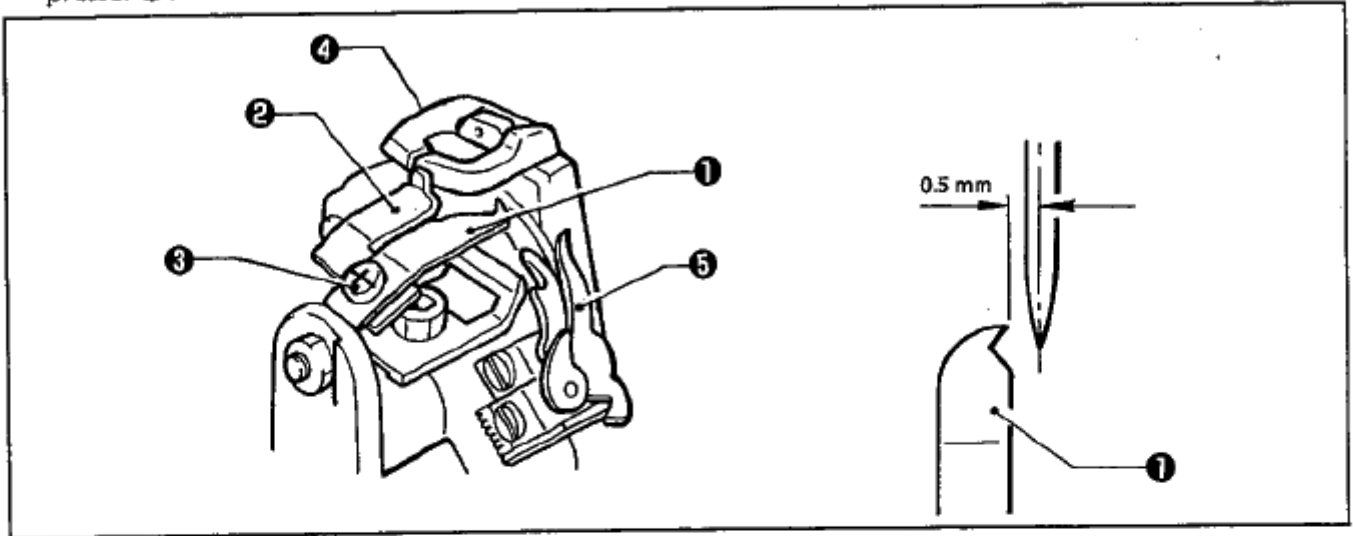
1. Loosen the screw ①, and move the upper thread take-up lever guide ② up and down to adjust the amount to pull the upper thread.
  - The upper thread tension mechanism has double tension mechanisms. The main tension disc ③ is open after sewing is completed, and closed when the start switch is pressed to move the feed bracket with the needle stopped.
  - The upper thread tension plate ④ and the upper thread take-up lever are interlocked.
  - The sub tension disc ⑤ 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

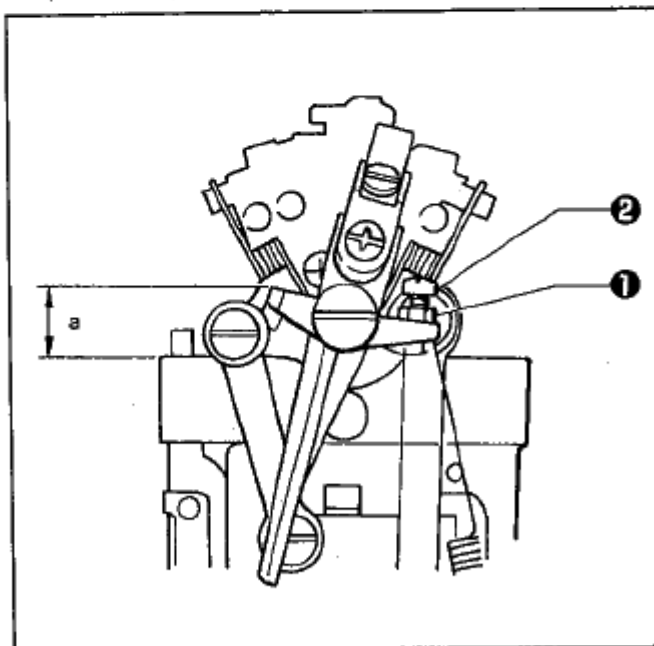
The mounting position of upper movable knife (B) ❶ is determined by the position of the lower thread presser ❷.



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.

### b. 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.

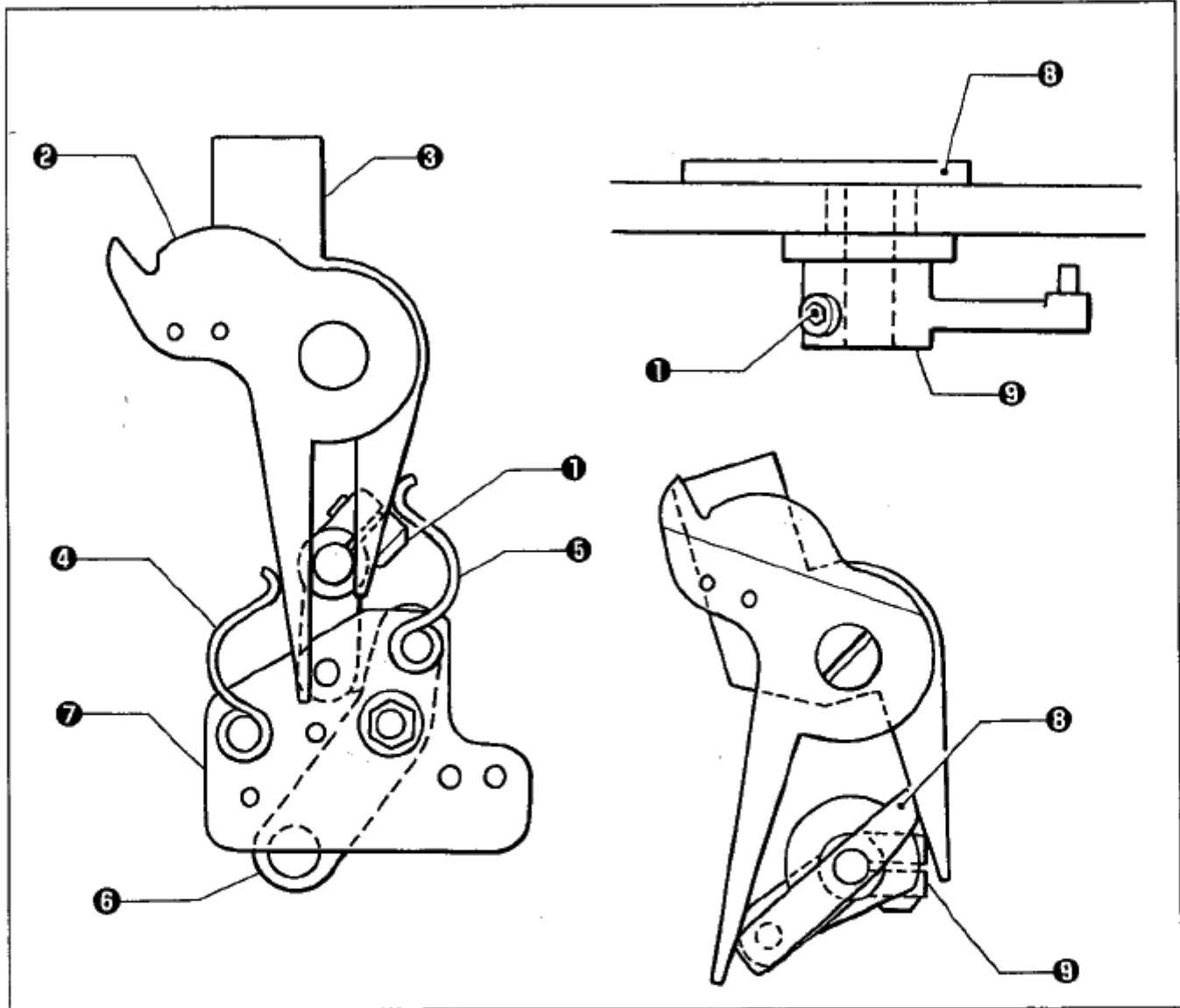
## 4-21. Adjusting the lower thread trimmer

[Adjusting the thread trimmer which can cut the lower thread and gimp, leaving them shorter]

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

## a. Adjusting the knife engagement

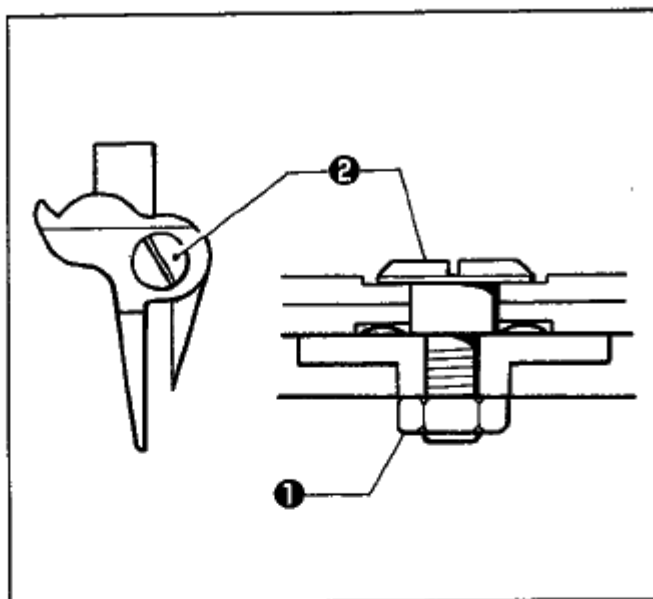
Movable knives (L) and (R) should overlap each other by approx. 1 mm.



1. Loosen the screw ①.
2. With springs (L) ④ and (R) ⑤ attached to movable knives (L) ② and (R) ③, align the end of thread trimmer link lever (J) ⑥ with the match mark on the rear of the link fulcrum plate ⑦, and tighten the screw ①.  
 Note: Make sure that the movable knife driving cam ⑧ and thread trimmer lever arm (B) ⑨ rotate smoothly without any gap.
3. Move thread trimmer link lever (J) ⑥ to check engagement between movable knives (L) ② and (R) ③. If the engagement is insufficient, return to step 2 to perform fine adjustment so that the end of thread trimmer link lever (J) ⑥ overlaps with the match mark on the rear of the link fulcrum plate ⑦.

## b. Adjusting the knife pressure

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



1. Loosen the nut ①.
2. Turn the stud screw ② to adjust the knife pressure.

Note: When the stud screw ② is fully tightened, the movable knife will not operate. Tighten the stud screw ② slowly while checking that the movable knife can operate smoothly.

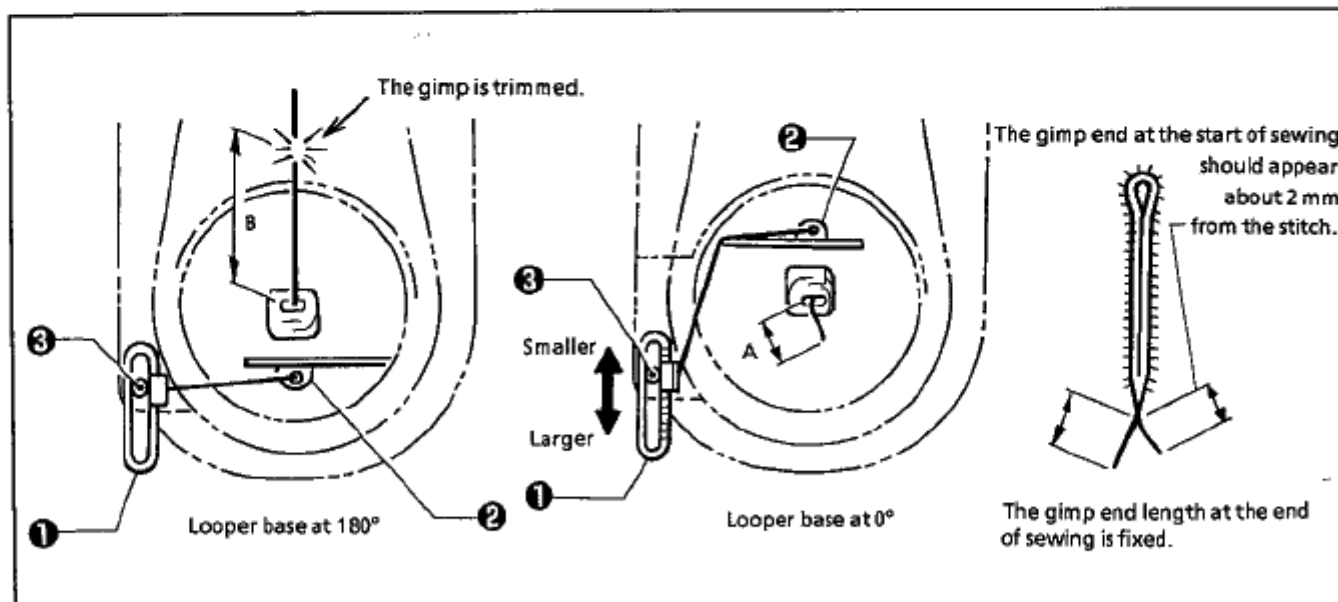
## c. Adjusting the gimp pull force and tension

\*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) ① and gimp thread guide (C-J) ② 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.

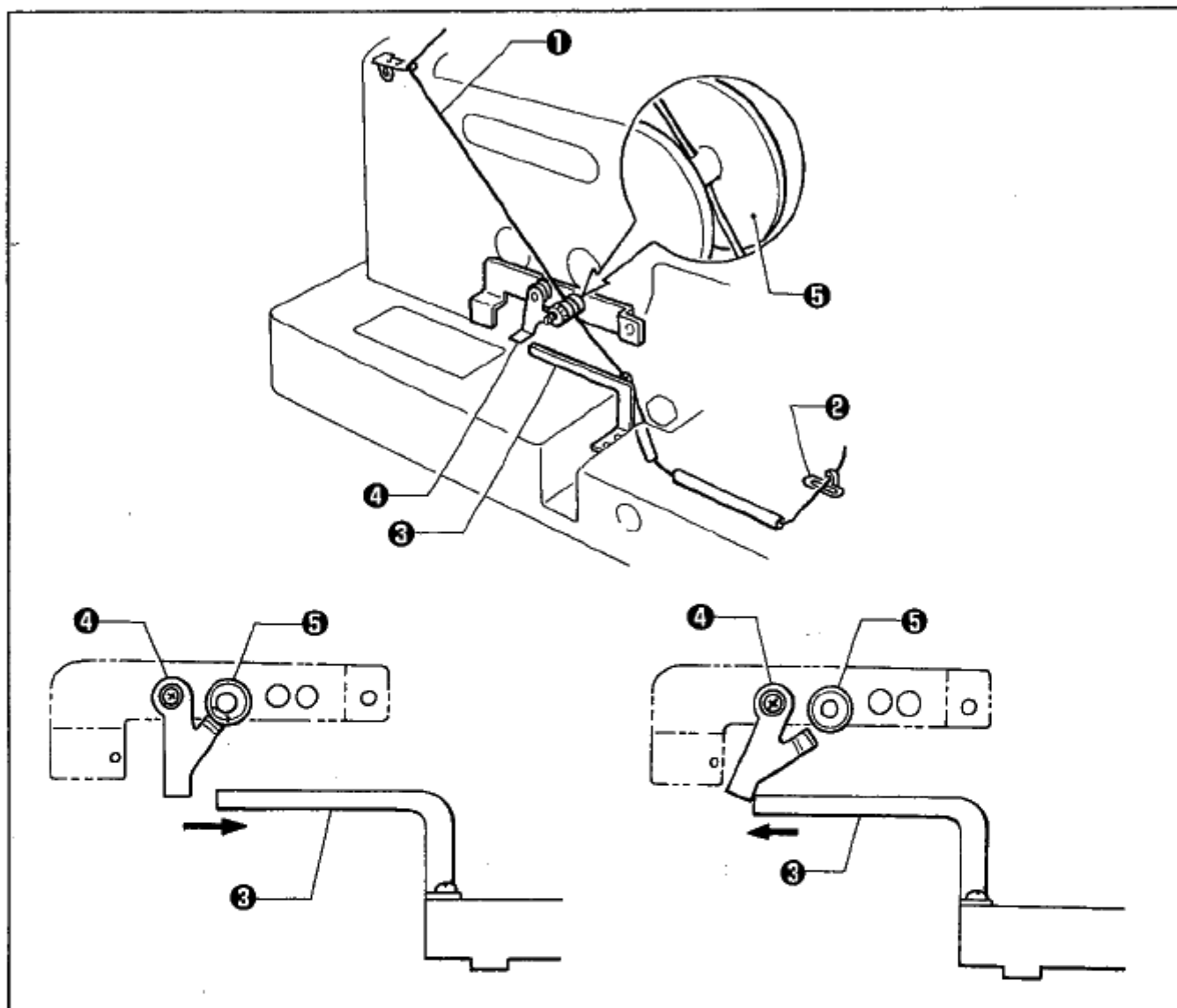


1. Loosen the screw ③, and adjust so that the gimp appears about 2 mm from the first covering stitch at the start of sewing.

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.

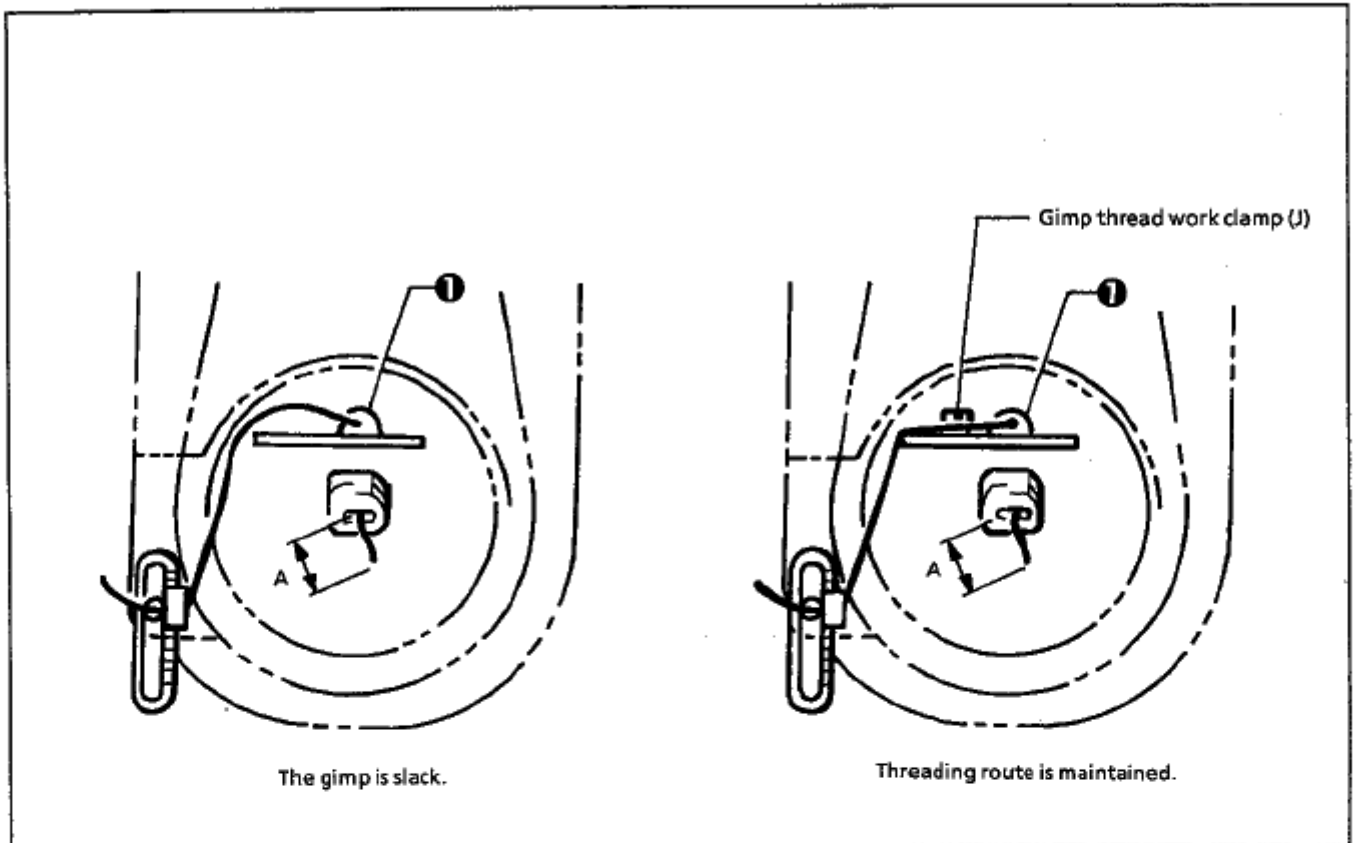
#### 4. ADJUSTMENT

When the looper base rotates and the gimp ① 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) ② 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) ③ moves toward the front in accordance with the movement of the feed bracket, and the gimp thread release plate ④ releases the thread tension disc ⑤.
2. After sewing is completed, the feed bracket moves to the home position to trim the gimp ①, gimp thread take-up guide (J) ③ pushes the gimp thread release plate ④, and the thread tension disc ⑤ is closed.

## d. Using gimp thread work clamp (J)



When the gimp is stiff, dimension A (gimp length from the throat plate) may vary.

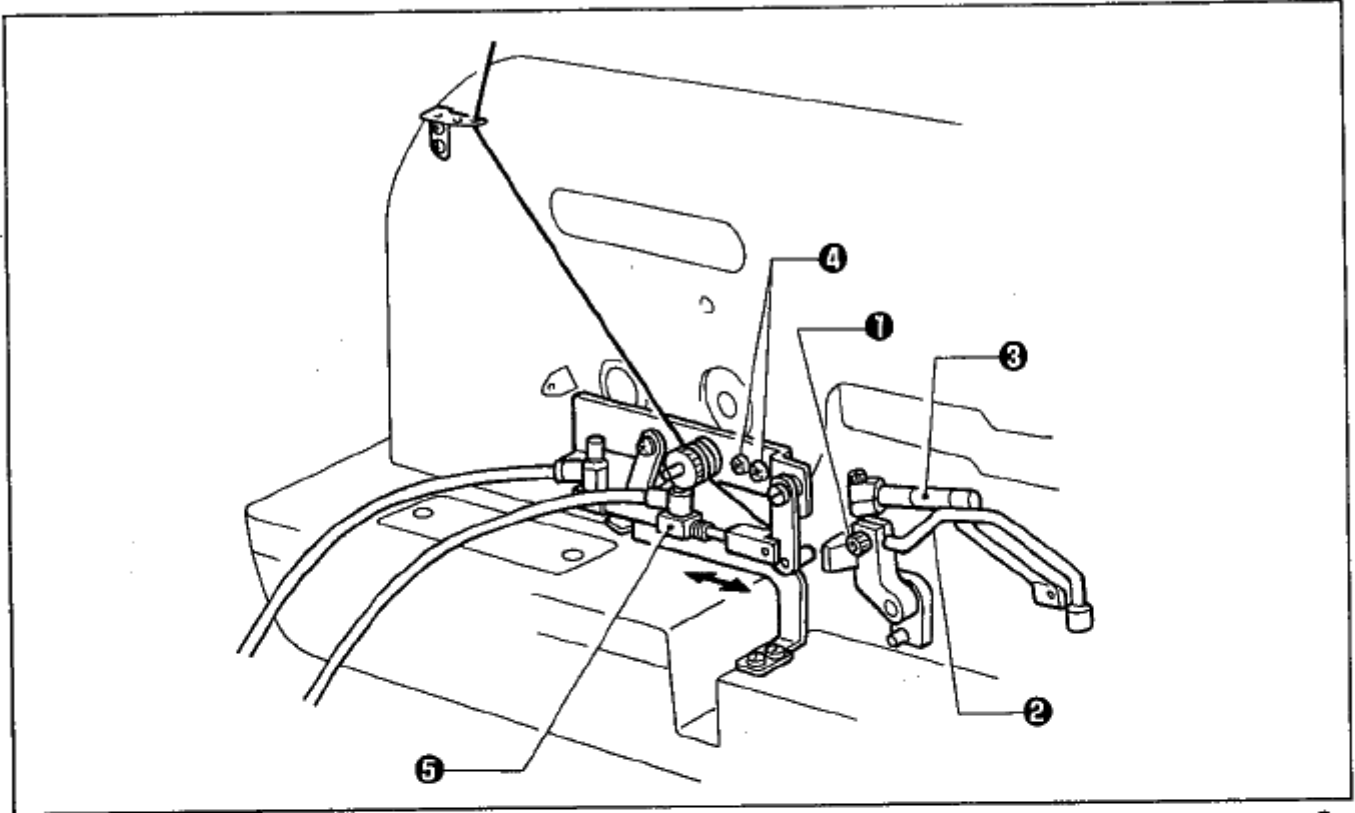
In this case, pass the gimp through gimp thread work clamp (J) attached to gimp guide (C-J) ①.

Note: When thick and soft gimp is passed through gimp thread work clamp (J), the gimp tension may be too great during sewing.

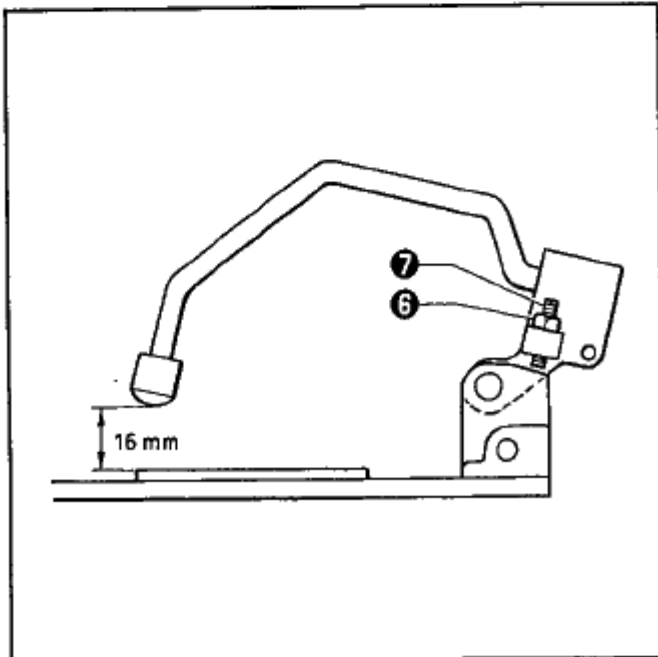
## 4. ADJUSTMENT

### 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 ①, and position the sub presser arm ② on the needle plate so that the sub presser ② can hold the material next to clamp arm (L-J) ③.  
Note: Be sure that the sub presser ② does not make contact with clamp arm (L-J) ③.
2. Turn on the power to set the home position.
3. Turn off the air, and loosen the screws ④.
4. With the rod of the sub presser cylinder ⑤ fully extended, adjust so that the sub presser ② 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.

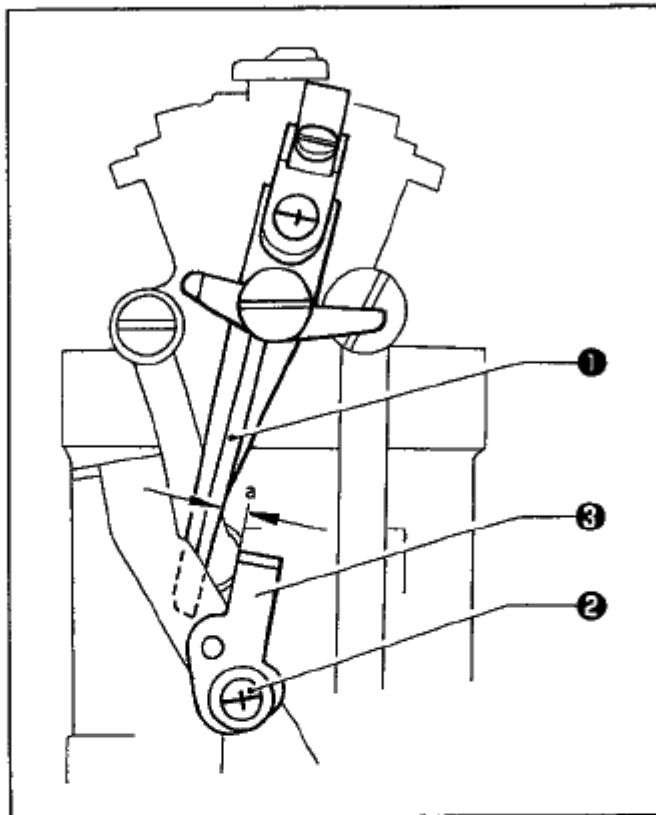
1. Loosen the nut ⑥, and turn the screw ⑦ to adjust the height.



## 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.

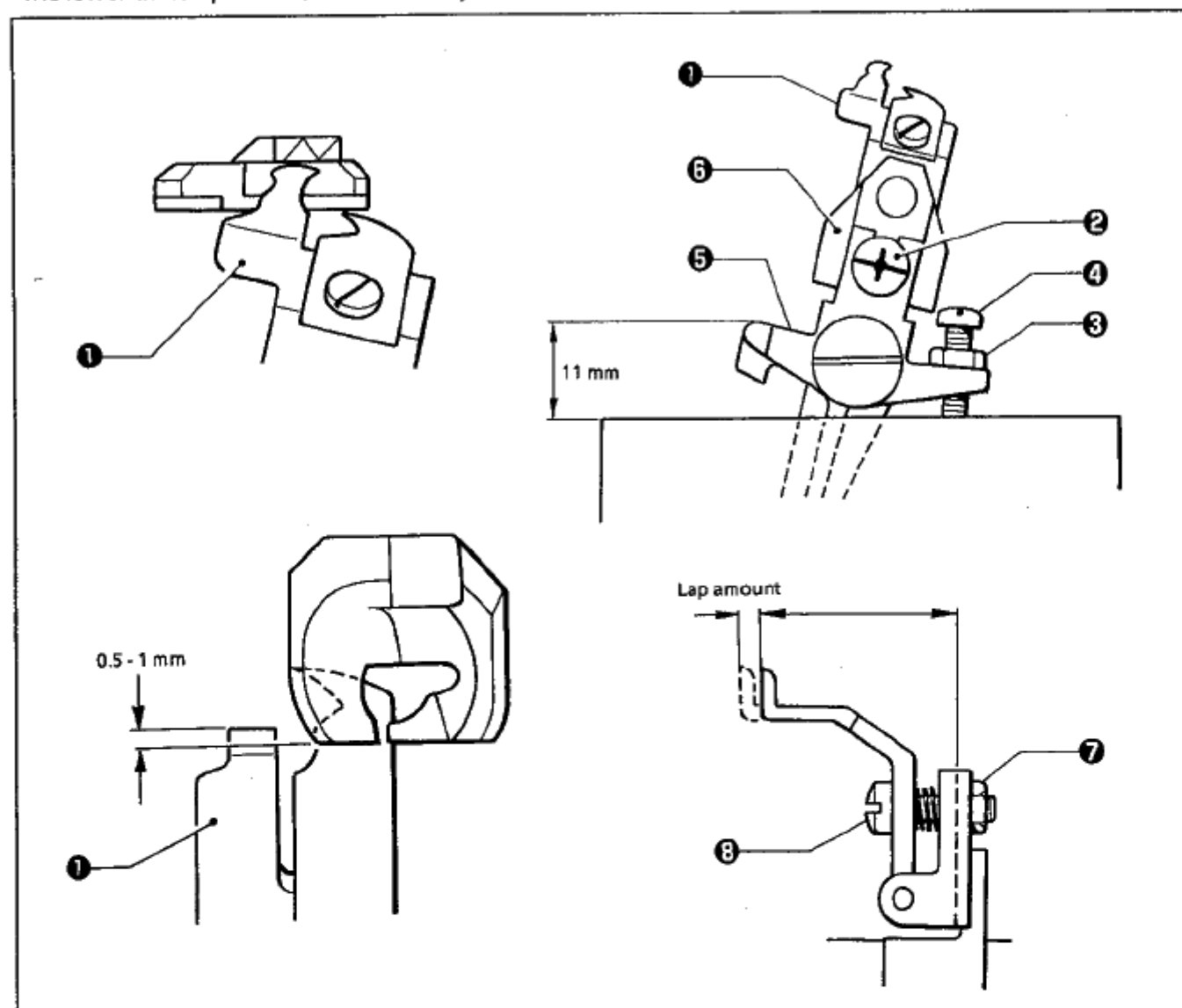
\*Thread trimmer lever bracket (B) ① is operating just before the lower thread is trimmed when the feed bracket is at the home position, and that causes the lower thread to be pulled.



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 ②, and turn the tension release plate ③ to adjust distance a between the tension release plate ③ and thread trimmer lever bracket (B) ①.

## 4-22. Adjusting the position of the lower thread presser

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



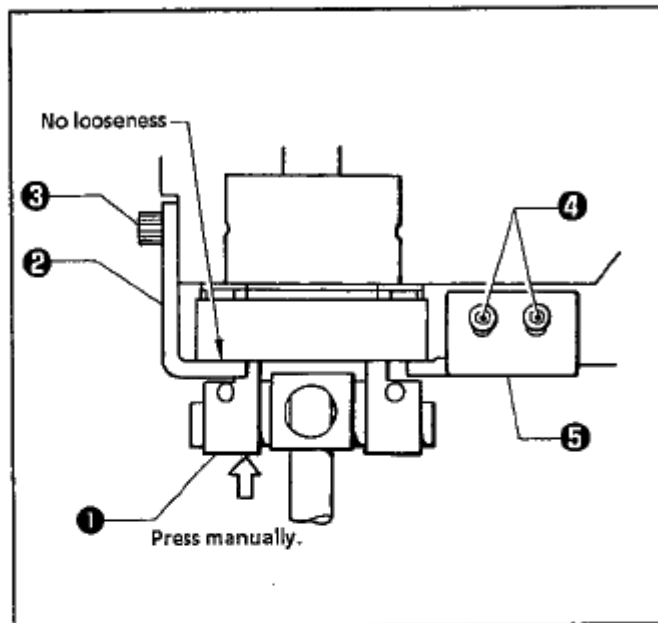
1. Loosen the screw ❷, and move the lower thread presser ❶ up and down so that its top surface is flush with the groove in the throat plate.
2. Make sure that the lower thread presser ❶ does not fill the front groove of the throat plate. If it does, loosen the nut ❸, and adjust the screw ❹.  
Note: Set the height from the stopper portion of thread trimmer lever bracket (B) ❸ 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) ❸ operates.  
If adjustment is necessary, remove the lower thread presser base ❸, loosen the nut ❷, and adjust the screw ❹.

## 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.

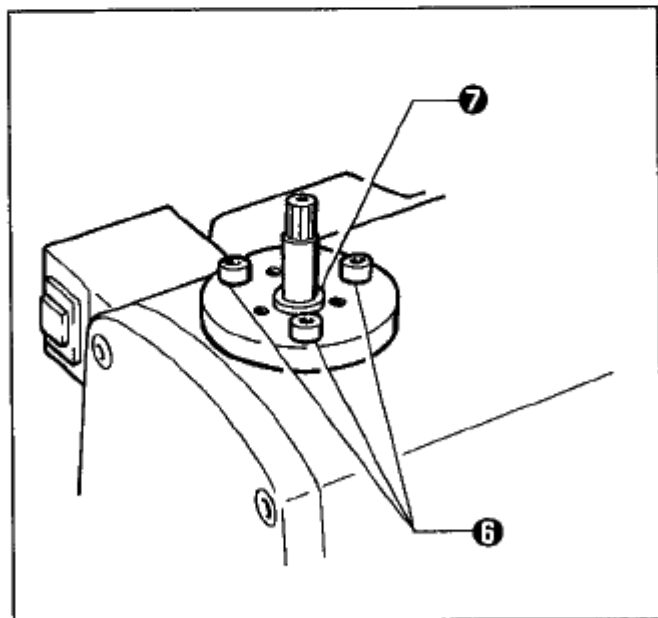
\*When disassembling the machine or exchanging parts such as the needle bar gear assembly, the needle bar, and looper base, adjust the clearance between the needle and the point of the looper so that it does not change through 360°.

\*Before adjusting the position of needle bar bush (U), be sure to check there is no gap between the needle bar gear ① and needle bar gear support (A) ②.



1. Raise the needle bar gear ① 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 ③, and adjust needle bar gear support (A) ② so that the needle bar gear assembly can rotate smoothly without gap.
3. Loosen the screws ④, and adjust needle bar gear support (B) ⑤ in the same manner as above.  
Note: When needle bar gear support (A) ② or (B) ⑤ is raised excessively, the looper base may be in an inappropriate position.

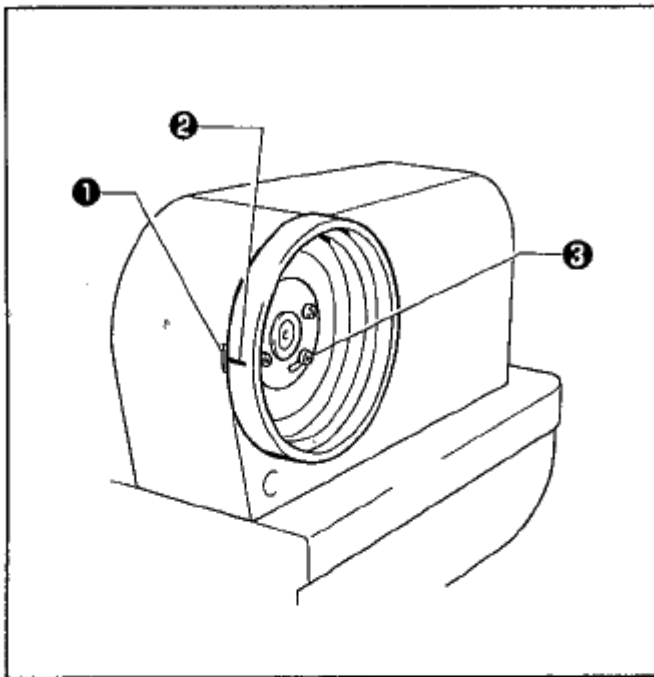
When the looper base is at 360° where the needle bar can move lightly up and down, adjust the position of needle bar bush (U) ⑦.



1. Loosen the screw ⑥ a little, and tap on the needle bar to adjust the position of needle bar bush (U) ⑦.  
Adjust the back and forth movement of needle bar bush (U) ⑦ 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) ⑦ 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 ③, and align the notch ① of belt cover (F) with the timing mark ② 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.

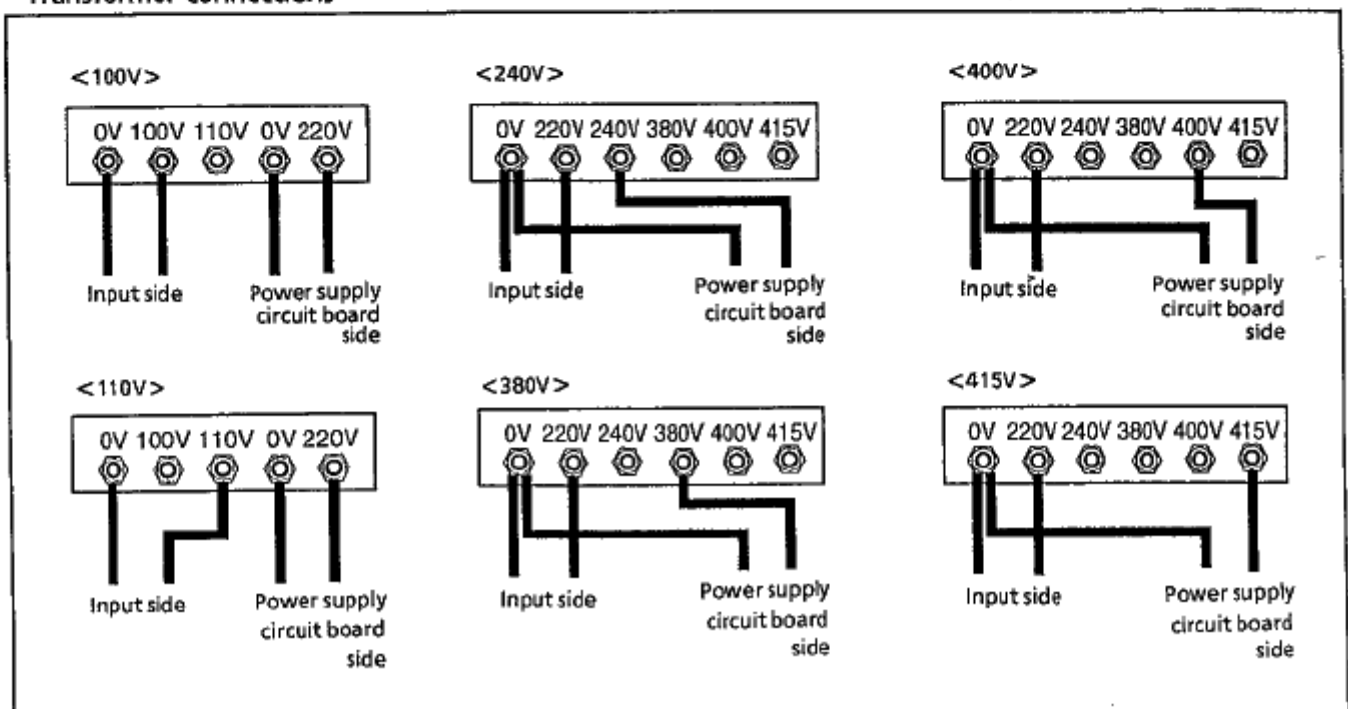
Be sure to turn off the power and disconnect the plug before replacing and adjusting the parts associated with the power supply equipment.

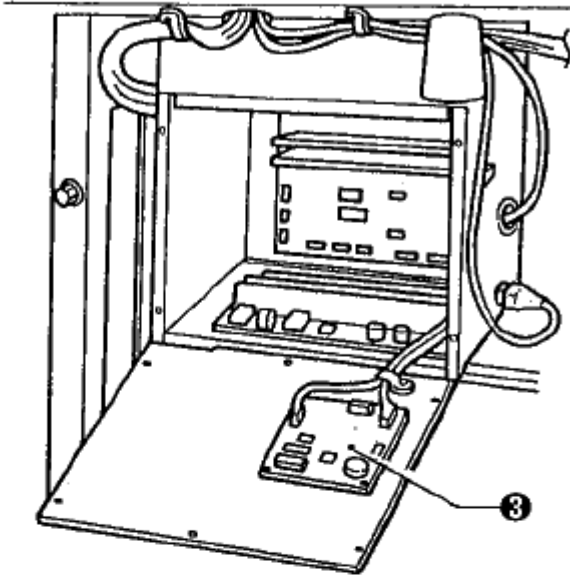
### 5-1. Components inside the control box

The following are brief explanations of components inside the control box. See control circuit block diagram at the end of this manual for the details of the connections.

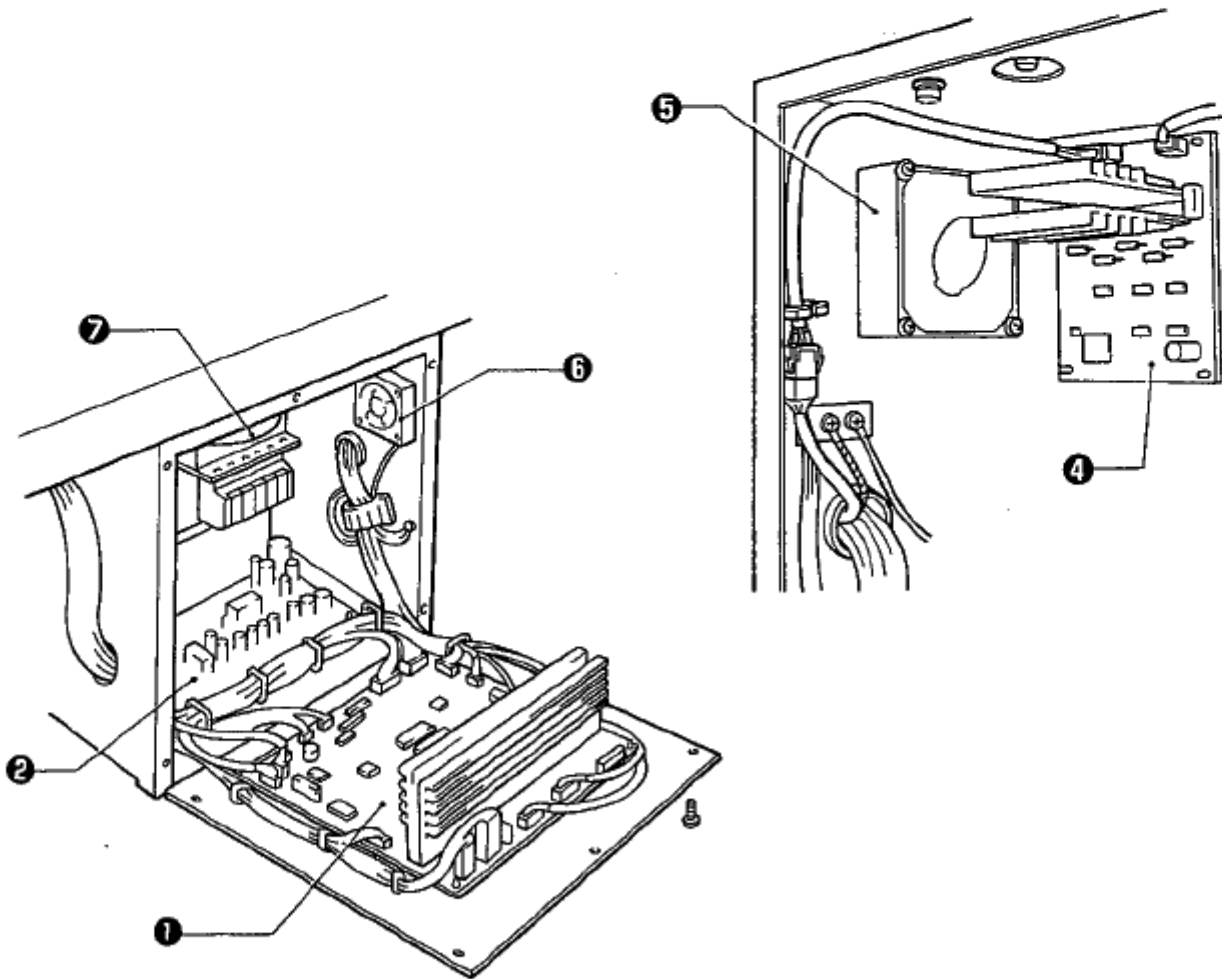
- ① Control circuit board  
Is fixed to the rear panel of the control box. This PCB serves to control machine operation.
- ② Power supply circuit board  
Is fixed at the bottom of the control box. Four fuses are mounted on this PCB.
- ③ Panel circuit board  
Is fixed to the front panel of the control box. This PCB controls indications of the machine status and the input operation.
- ④ PMD PCB for  $\theta$ -axis shaft  
Is fixed to the board on the top of the control box. This is used to run the  $\theta$ -axis pulse motor.
- ⑤ DC fan motor (large)  
Cools the heatsink on the PCB.
- ⑥ DC fan motor (small)  
Discharges air in the control box.  
Clean the inlet filter monthly.
- ⑦ Conversion transformer (depending on power supply voltage specification)  
Adjusts the power voltage so that it is that required for the PCB.  
\*There are two types of transformers: a high voltage transformer is equipped with 240V, 380V, 400V, and 415V specifications; a low voltage transformer is equipped with 100V and 110V specifications.

#### Transformer connections





<front of the control box>



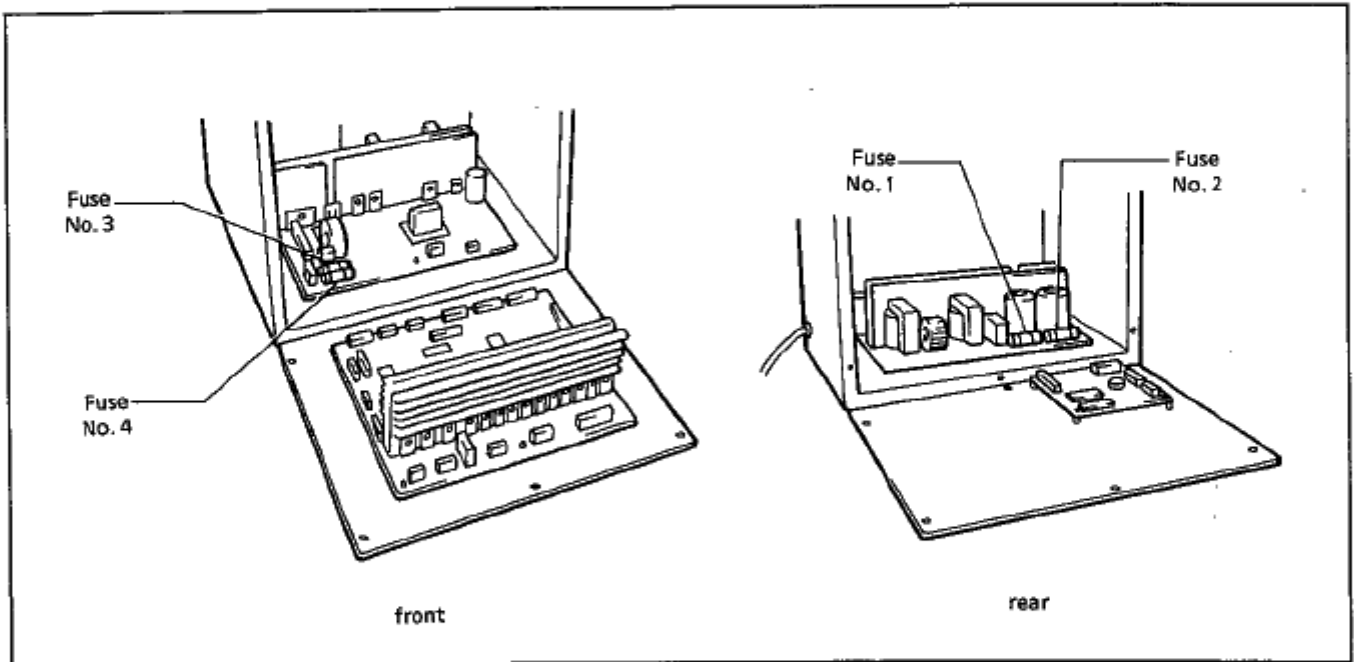
<rear of the control box>

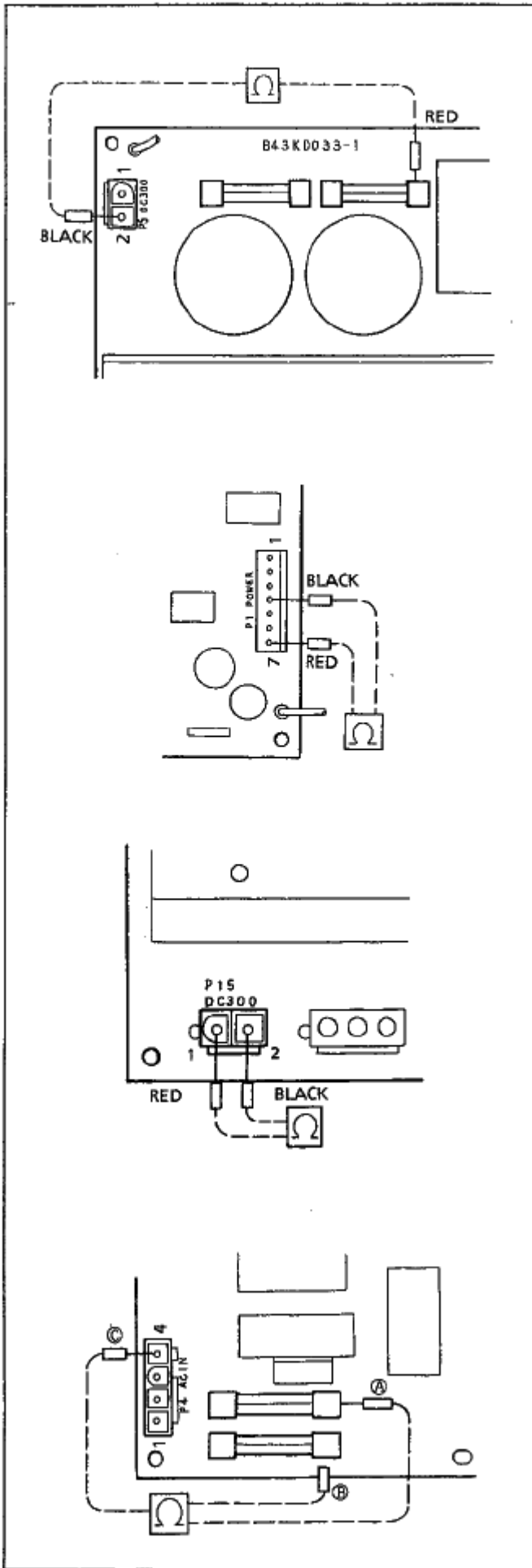
## 5-2. Fuse explanation

Before replacing a fuse, be sure to read "Before replacing a fuse" on the following page.

If a component on a PCB is damaged, a fuse may blow again immediately even when it has been replaced.  
When replacing a fuse, be sure to use the specified ones listed below.

No.	Part name	Part code	Manufacturer	When a fuse has blown
1	G fuse (SAFB) (quick melting type, 5A-250V)	508030-000	Toyo Fuse Company TOYO5A	The feed mechanism does not operate.
2	G fuse (SAFB) (quick melting type, 5A-250V)	508030-000	Toyo Fuse Company TOYO5A	The machine motor does not turn.
3	Fuse 6A (glass tube fuse, 6A-250V)	153242-000	Fuji Tanshi Company FGB0	The power lamp is not lit, and nothing operates.
4	Fuse 6A (glass tube fuse, 6A-250V)	153242-000	Fuji Tanshi Company FGB0	The power lamp is not lit, and nothing operates.





Before replacing a fuse

<If fuse No. 1 is blown>

Separate connectors P5 (DC300) on the power supply circuit board, and measure the resistance with the polarities as shown in the figure.

If the fuse has blown due to a short-circuit, replace the power supply circuit board.

Separate connectors P1 (POWER) on the power supply circuit board, and measure the resistance between pins 4 and 7 on the board with the polarities as shown in the figure.

If the fuse has blown due to a short-circuit, replace the power supply circuit board.

<If fuse No.2 is blown>

Separate connectors P15 (DC300) on the control circuit board, and measure the resistance between pins 1 and 2 on the board with the polarities as shown in the figure.

If the fuse has blown due to a short-circuit, replace the power supply circuit board.

<If fuse No. 3 or 4 is blown>

Separate connectors P1 (ACIN) on the power supply circuit board, and measure the resistance of the three places between A and B, A and C, and B and C on the board with the polarities as shown in the figure.

If the fuse has blown due to a short-circuit, or the resistance between A and C or B and C is not infinity, replace the power supply circuit board.

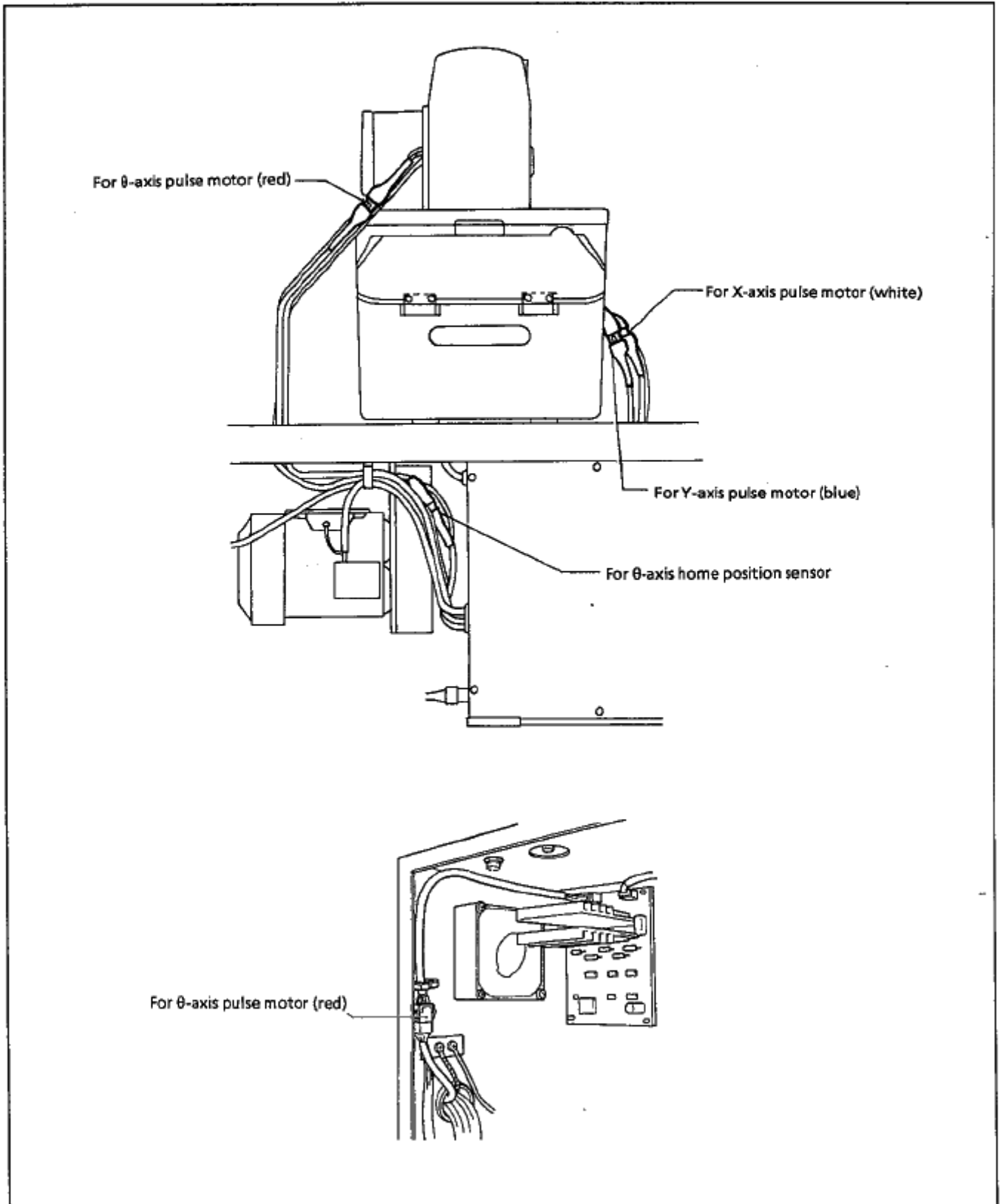


### 5-3. Connectors

Most of the machine trouble is due to connector problems including improper connection or insufficient contact. Therefore, be sure to check if each connector is correctly inserted and that there is no contact failure between pins and wires before starting troubleshooting procedures.

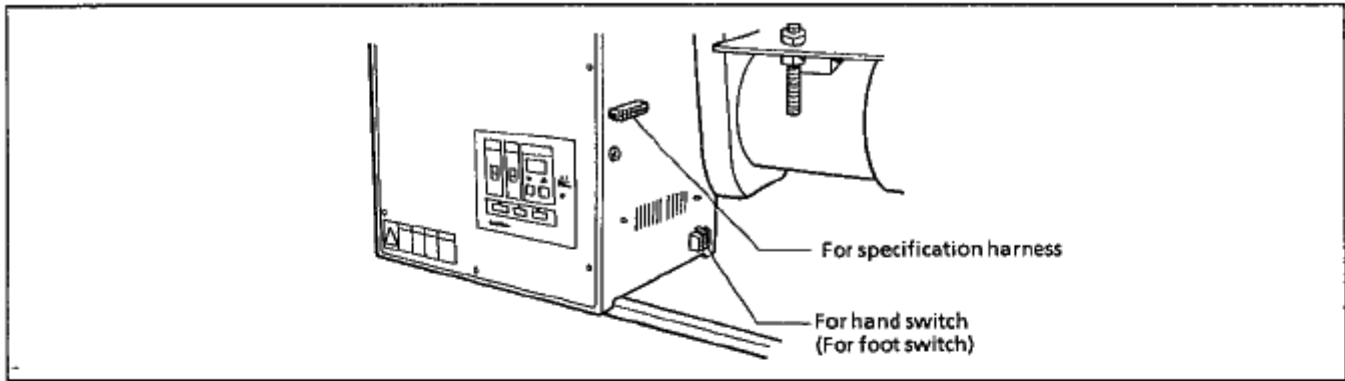
#### 5-3-1. Connector positions

##### Head harness relay

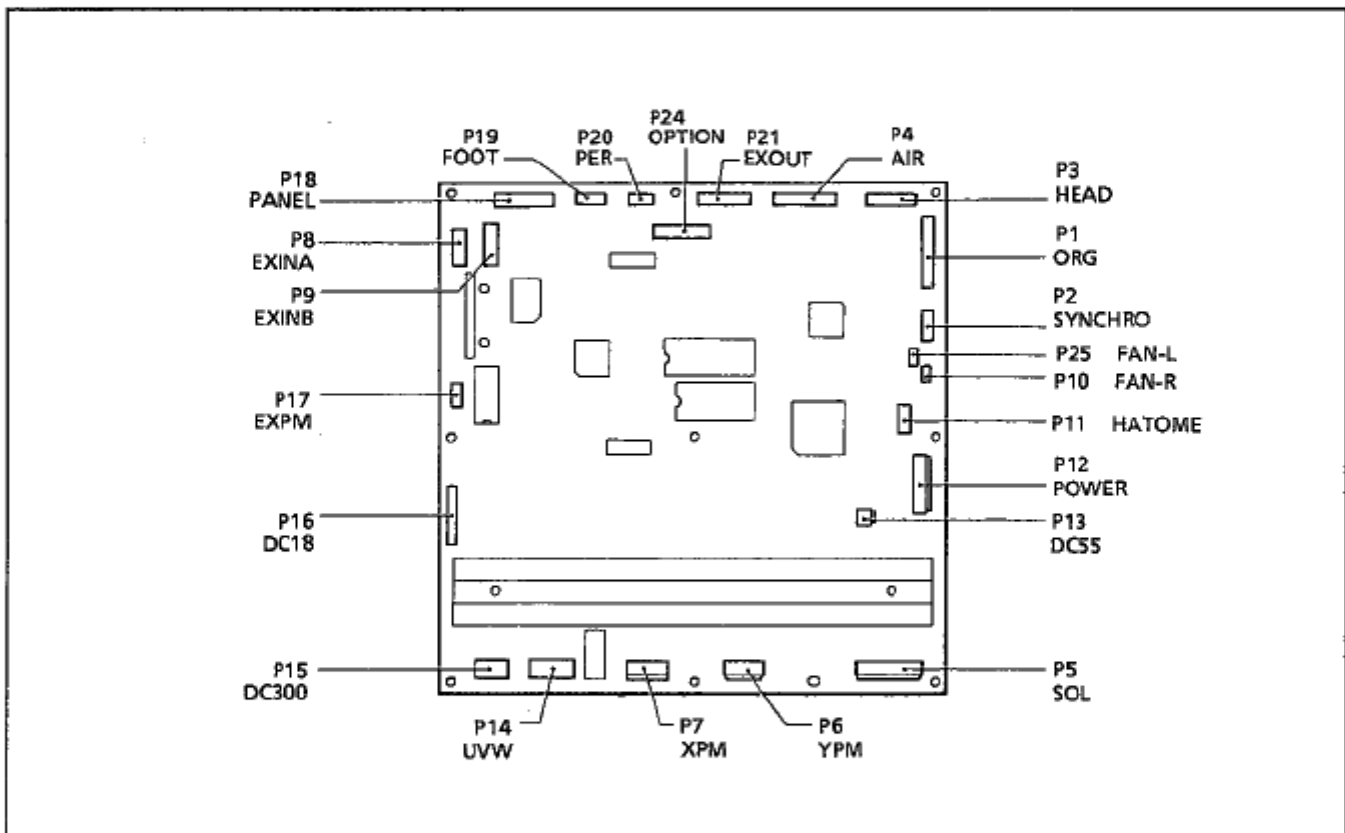


## 5. POWER SUPPLY EQUIPMENT

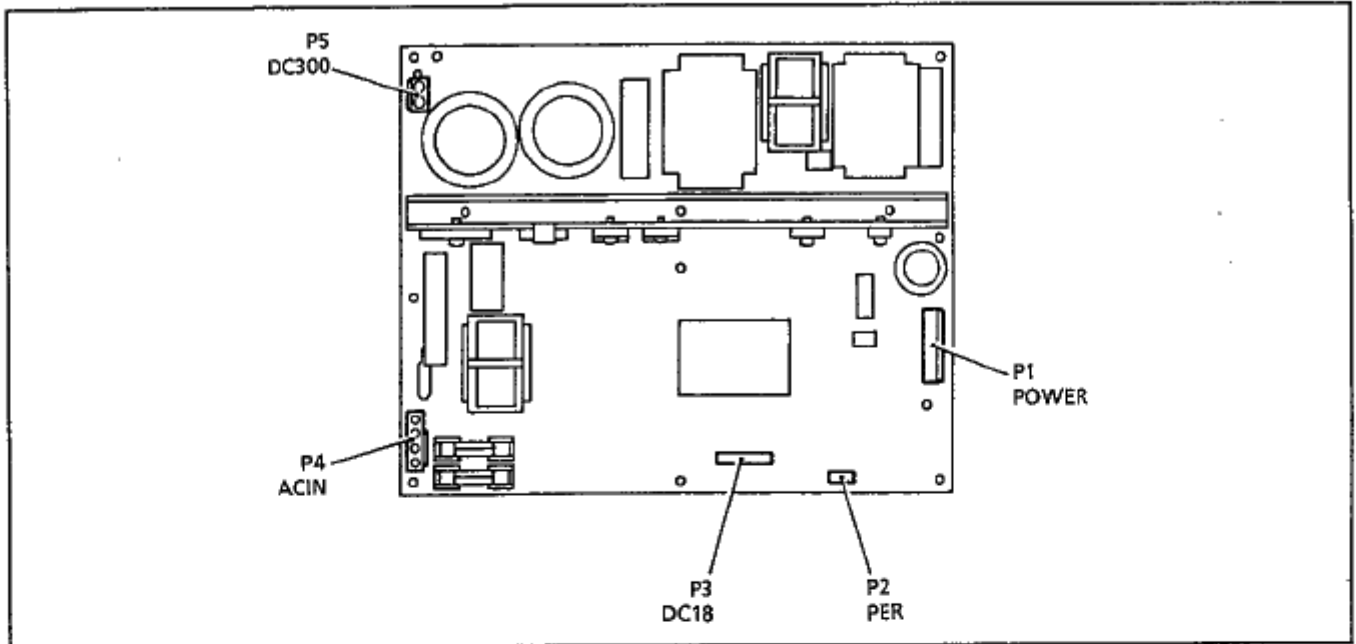
### Outside of the control box



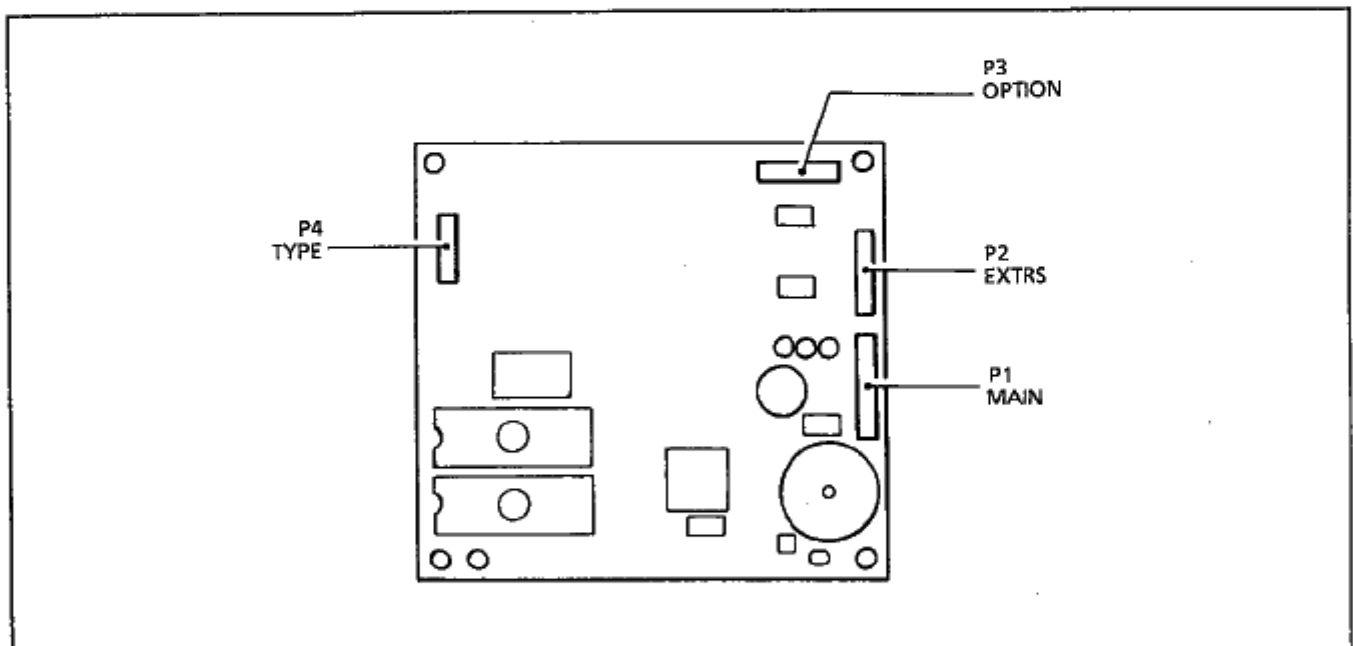
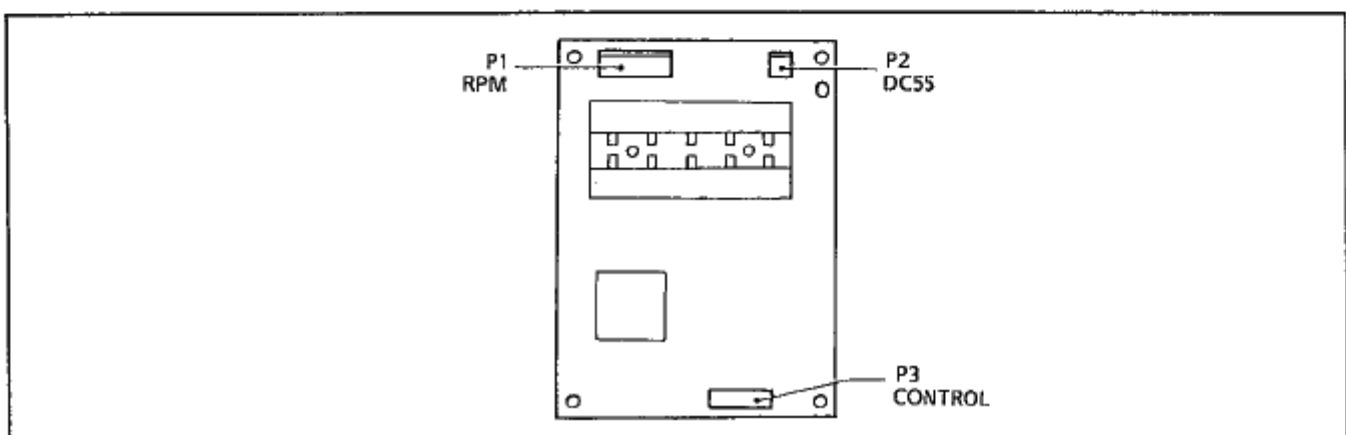
### Control circuit board



Power supply circuit board

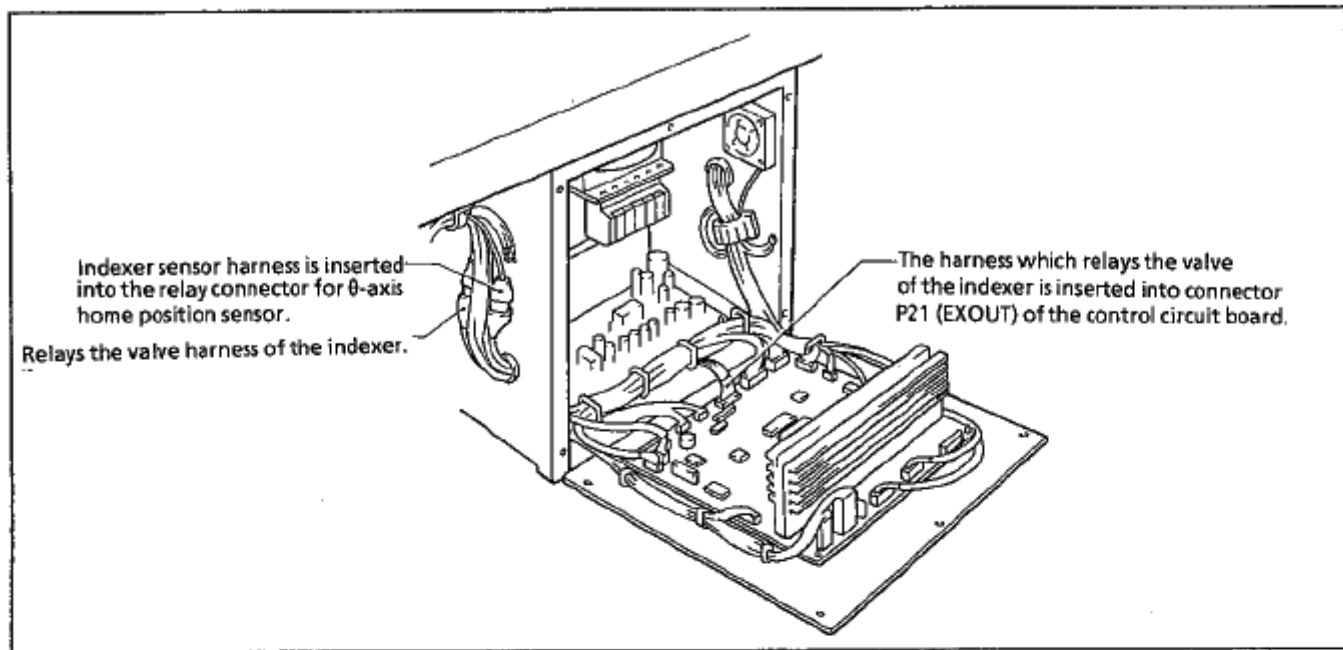


Panel circuit board

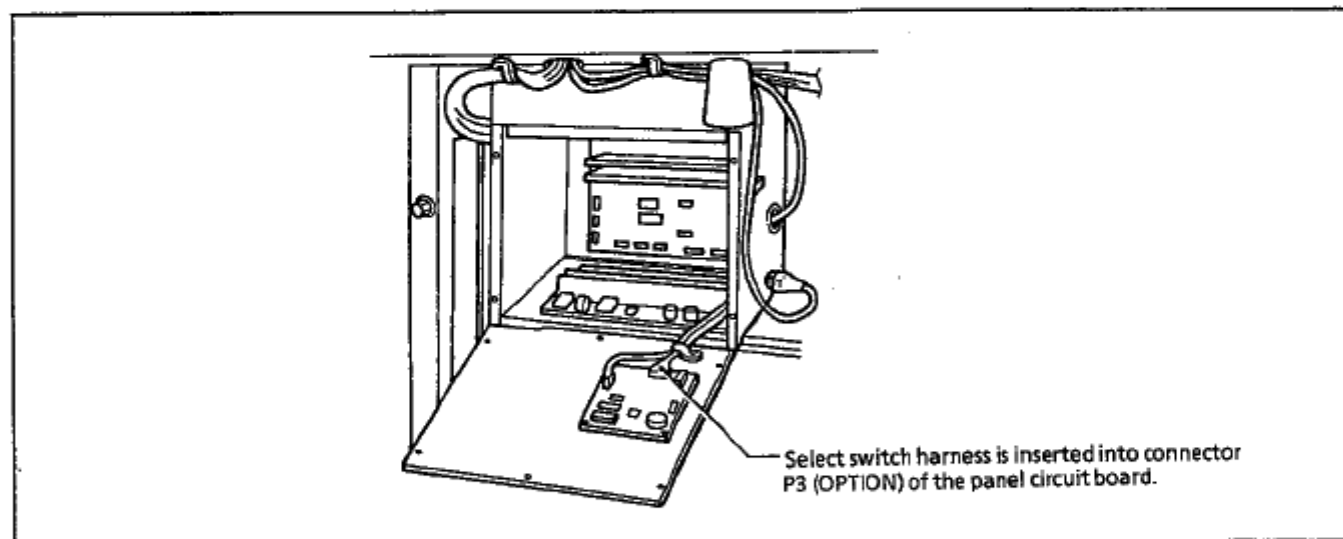
PMD PCB for  $\theta$ -axis shaft

## 5. POWER SUPPLY EQUIPMENT

### Indexer mechanism (optional)



### Select switch mechanism (optional)



## 5-3-2. Signal names for connectors and probable symptoms due to poor contact

## ◎ Relay connectors

## ● For X-axis pulse motor (MOLEX 5557-06R, 5559-06P)

Pin no.	Signal name	Probable symptoms due to poor contact
1	X-axis PM driving current (XA)	<ul style="list-style-type: none"> <li>- Left and right movement of feed bracket is not correct.</li> <li>- Home position can not be found.</li> <li>- Error E80 appears.</li> </ul>
2	X-axis PM driving current (XB)	
3	X-axis PM driving current (XC)	
4	X-axis PM driving current (XD)	
5	X-axis PM driving current (XE)	
6	—	

## ● For Y-axis pulse motor (MOLEX 5557-06R [blue], 5559-06P [blue])

Pin no.	Signal name	Probable symptoms due to poor contact
1	Y-axis PM driving current (YA)	<ul style="list-style-type: none"> <li>- Back and forth movement of feed bracket is not correct.</li> <li>- Home position can not be found.</li> <li>- Error E81 appears.</li> </ul>
2	Y-axis PM driving current (YB)	
3	Y-axis PM driving current (YC)	
4	Y-axis PM driving current (YD)	
5	Y-axis PM driving current (YE)	
6	—	

● For  $\theta$ -axis pulse motor (MOLEX 5557-06R [red], 5559-06P [red])

Pin no.	Signal name	Probable symptoms due to poor contact
1	$\theta$ -axis PM driving current (RA)	<ul style="list-style-type: none"> <li>- Needle bar motion is not correct.</li> <li>- Home position can not be found.</li> <li>- Error E82 appears.</li> </ul>
2	$\theta$ -axis PM driving current (RB)	
3	$\theta$ -axis PM driving current (RC)	
4	$\theta$ -axis PM driving current (RD)	
5	$\theta$ -axis PM driving current (RE)	
6	—	

● For  $\theta$ -axis home position sensor (AMP 172163-1, 172171-1)

Pin no.	Signal name	Probable symptoms due to poor contact
1	+5V (for $\theta$ -axis home position sensor)	<ul style="list-style-type: none"> <li>- Home position can not be found.</li> <li>- Error E52 or E82 appears.</li> <li>- Indexer does not work properly.</li> <li>- One of errors E06, E07, E36, E37, E38, E66, E67, and E68 appears.</li> </ul>
2	+5V	
3	+24V	
4	+24V (for right cylinder driving sensor) (when indexer is attached)	
5	—	
6	$\theta$ -axis home position sensor signal	
7	Feed plate home position sensor signal (when indexer is attached)	
8	Reserved	
9	Right cylinder driving sensor signal (when indexer is attached)	
10	Left cylinder driving sensor signal (when indexer is attached)	
11	0V (for $\theta$ -axis home position sensor)	
12	0V (for feed plate home position sensor) (when indexer is attached)	
13	0V	
14	0V (for right cylinder driving sensor) (when indexer is attached)	
15	0V (for left cylinder driving sensor) (when indexer is attached)	

## 5. POWER SUPPLY EQUIPMENT

### • For specification harness (MOLEX 5557-16R, 5559-16P)

Pin no.	Signal name	Probable symptom due to poor contact
1	TYPE 1 (COM)	• Error code E09 appears.
2	TYPE 2 (COM)	
3	TYPE 3 (COM)	
4	TYPE 4 (COM)	
5	TYPE 5 (COM)	
6	TYPE 6 (COM)	
7	TYPE 7 (COM)	
8	TYPE 8 (COM)	
9	TYPE 1	
10	TYPE 2	
11	TYPE 3	
12	TYPE 4	
13	TYPE 5	
14	TYPE 6	
15	TYPE 7	
16	TYPE 8	

### • For hand switch (foot switch) (AMP 172161-1, 172169-1)

Pin no.	Signal name	Probable symptom due to poor contact
1	Work clamp switch signal (common side)	• Work clamp does not work when work clamp switch is pressed. • Machine does not start.
2	Work clamp switch signal	
3	Reserved (common side)	
4	Reserved	
5	Ground	
6	—	
7	Start switch signal (common side)	
8	Start switch signal	
9	—	

### • For indexer valve (MOLEX 5025-15P1, 5025-15R1) (when indexer is attached)

Pin no.	Signal name	Probable symptom due to poor contact
1	Reserved	• Indexer does not work properly. • One of error codes E07, E37, E38, E66, E67, and E68 appears.
2	Reserved	
3	Reserved	
4	Feed plate fixing valve motion signal	
5	Chuck valve motion signal	
6	+ 24V	
7	+ 24V	
8	+ 24V	
9	+ 24V (for feed plate fixing valve)	
10	+ 24V (for chuck valve)	
11	Feed plate driving valve signal	
12	+ 24V (for feed plate driving valve)	
13	—	
14	—	
15	—	

◎ Connectors to be attached to control circuit board

● P1 [ORG] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. XHR-12)

Pin no.	Signal name	Probable symptom due to poor contact
1	—	<ul style="list-style-type: none"> <li>• Home position can not be found.</li> <li>• One of error codes E50, E51, E80, and E81 appears.</li> </ul>
2	X-axis home position sensor signal	
3	0V (for X-axis home position sensor)	
4	+5V (for X-axis home position sensor)	
5	—	
6	Y-axis home position sensor signal	
7	0V (for Y-axis home position sensor)	
8	+5V (for Y-axis home position sensor)	
9	—	
10	—	
11	—	
12	—	

● P2 [SYNCHRO] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. XHR-5)

Pin no.	Signal name	Probable symptom due to poor contact
1	+5V	<ul style="list-style-type: none"> <li>• Machine motor does not run.</li> <li>• One of error codes E10, E40, E70, E71, E76, E77, and E91 appears.</li> </ul>
2	Encoder timing signal	
3	Needle down signal	
4	Needle up signal	
5	0V	

● P3 [HEAD] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. XHR-9)

Pin no.	Signal name	Probable symptom due to poor contact
1	Emergency stop switch normal close signal	<ul style="list-style-type: none"> <li>• Error code E60 appears and machine stops.</li> <li>• One of error codes E00, E12, E30, E42, and E72 appears.</li> </ul>
2	0V (for emergency stop switch)	
3	Emergency stop switch normal open signal	
4	—	
5	—	
6	—	
7	+5V (for knife ON sensor)	
8	Knife ON sensor signal	
9	Knife ON sensor cathode	

● P4 [AIR] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. H12P-SHF-AA)

Pin no.	Signal name	Probable symptom due to poor contact
1	Upper thread adjuster valve signal	<ul style="list-style-type: none"> <li>• Upper thread adjuster does not work.</li> <li>• Upper thread can not be trimmed.</li> <li>• Lower thread can not be trimmed.</li> <li>• Knife does not work.</li> <li>• Cloth opener does not work.</li> <li>• Work clamp does not work.</li> <li>• One of error codes E12, E15, E42, E45, E72, and E75 appears.</li> </ul>
2	Upper thread trimmer valve signal	
3	Lower thread trimmer valve signal	
4	Knife driving valve signal	
5	Cloth opener valve signal	
6	—	
7	—	
8	Work damp valve	
9	—	
10	+24V (for work clamp, cloth opener, and lower thread trimmer)	
11	+24V (for upper thread adjuster, upper thread trimmer, and knife driving)	
12	—	

## 5. POWER SUPPLY EQUIPMENT

• P5 [SOL] (not connected)

• P6 [YPM] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. VHR-5N [blue] )

Pin no.	Signal name	Probable symptom due to poor contact
1	Y-axis PM driving current (YA)	<ul style="list-style-type: none"> <li>• Back and forth motion of feed bracket is not correct.</li> <li>• Home position can not be found.</li> <li>• Error code E81 appears.</li> </ul>
2	Y-axis PM driving current (YB)	
3	Y-axis PM driving current (YC)	
4	Y-axis PM driving current (YD)	
5	Y-axis PM driving current (YE)	

• P7 [XPM] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. VHR-5N)

Pin no.	Signal name	Probable symptom due to poor contact
1	X-axis PM driving current (XA)	<ul style="list-style-type: none"> <li>• Left and right motion of feed bracket is not correct.</li> <li>• Home position can not be found.</li> <li>• Error code E80 appears.</li> </ul>
2	X-axis PM driving current (XB)	
3	X-axis PM driving current (XC)	
4	X-axis PM driving current (XD)	
5	X-axis PM driving current (XE)	

• P8 [EXINA] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. PHDR-16VS)

Pin no.	Signal name	Probable symptom due to poor contact
1	0V (for head safety switch)	<ul style="list-style-type: none"> <li>• One of error codes E02, E15, E32, E45, E62, and E75 appears.</li> </ul>
2	Head safety switch signal	
3	—	
4	0V (for lower thread trimming OFF sensor)	
5	Lower thread trimming OFF sensor signal	
6	+24V (for lower thread trimming OFF sensor)	
7	—	
8	—	
9	—	
10	—	
11	—	
12	—	
13	—	
14	—	
15	—	
16	—	



• P9 [EXINB] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. PHDR-18VS)

Pin no.	Signal name	Probable symptom due to poor contact
1	0V (for left cylinder driving sensor) (when indexer is attached)	<ul style="list-style-type: none"> <li>• Home position can not be found.</li> <li>• Error code E52 and E82 appears.</li> <li>• Indexer does not work properly.</li> <li>• One of error codes E06, E07, E36, E37, E38, E66, E67, and E68 appears.</li> </ul>
2	Left cylinder driving sensor signal (when indexer is attached)	
3	+ 24V (for left cylinder driving sensor) (when indexer is attached)	
4	0V (for right cylinder driving sensor) (when indexer is attached)	
5	Right cylinder driving sensor signal (when indexer is attached)	
6	+ 24V (for right cylinder driving sensor) (when indexer is attached)	
7	—	
8	—	
9	—	
10	0V (for feed plate home position sensor) (when indexer is attached)	
11	Feed plate home position sensor signal (when indexer is attached)	
12	+ 24V (for feed plate home position sensor) (when indexer is attached)	
13	0V (for $\theta$ -axis home position sensor)	
14	$\theta$ -axis home position sensor signal	
15	+ 24V	
16	+ 5V	
17	+ 5V	
18	+ 5V (for $\theta$ -axis home position sensor)	

• P10 [FAN-R] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. PHR-3)

Pin no.	Signal name	Probable symptom due to poor contact
1	+ 24V	<ul style="list-style-type: none"> <li>• Error code E93 appears.</li> </ul>
2	Fan lock error signal	
3	0V	

• P11 [HATOME] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. PHDR-12VS)

Pin no.	Signal name	Probable symptom due to poor contact
1	—	<ul style="list-style-type: none"> <li>• Rotation motion of feed mechanism is not correct.</li> <li>• Home position can not be found.</li> <li>• Error code E52 or E82 appears.</li> </ul>
2	—	
3	—	
4	—	
5	$\theta$ -axis PM clock signal	
6	$\theta$ -axis PM direction signal	
7	$\theta$ -axis PM save signal	
8	$\theta$ -axis PM excitation signal	
9	+ 5V	
10	+ 5V	
11	0V	
12	0V	

## 5. POWER SUPPLY EQUIPMENT

### • P12 [POWER] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. VHR-7N)

Pin no.	Signal name	Probable symptom due to poor contact
1	+5V	<ul style="list-style-type: none"> <li>• Power does not come on.</li> <li>• Feed bracket does not move.</li> <li>• Machine operation becomes unstable.</li> <li>• Home position can not be found.</li> <li>• Error code E80 appears.</li> </ul>
2	+24V	
3	0V	
4	+55V	
5	+55V	
6	0V (P0V)	
7	0V (P0V)	

### • P13 [DC55] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. VHR-2N)

Pin no.	Signal name	Probable symptom due to poor contact
1	+55V	<ul style="list-style-type: none"> <li>• Feed bracket does not move.</li> <li>• Home position can not be found.</li> <li>• Error code E80 appears.</li> </ul>
2	0V (P0V)	

### • P14 [UVW] (MOLEX 3191-03R1)

Pin no.	Signal name	Probable symptom due to poor contact
1	Machine motor U phase	<ul style="list-style-type: none"> <li>• Machine motor does not run.</li> <li>• Rotation of machine motor is not correct.</li> <li>• Error code E70 or E91 appears.</li> </ul>
2	Machine motor V phase	
3	Machine motor W phase	

### • P15 [DC300] (MOLEX 3191-02R1)

Pin no.	Signal name	Probable symptom due to poor contact
1	0V (for machine motor)	<ul style="list-style-type: none"> <li>• Machine motor does not run.</li> <li>• Rotation of machine motor is not correct.</li> <li>• Error code E70 or E91 appears.</li> </ul>
2	+300V	

### • P16 [DC18] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. PHR-11)

Pin no.	Signal name	Probable symptom due to poor contact
1	+18V (A18V)	<ul style="list-style-type: none"> <li>• Machine motor does not run.</li> <li>• Rotation of machine motor is not correct.</li> <li>• Error code E70 or E91 appears.</li> </ul>
2	0V (A0V)	
3	—	
4	+18V (B18V)	
5	0V (B0V)	
6	—	
7	+18V (C18V)	
8	0V (C0V)	
9	—	
10	+18V (D18V)	
11	0V (D0V)	

### • P17 [EXPM] (not attached)

### • P18 [PANEL] (JAPAN SOLDERLESS TERMINAL MFG. CO., LTD. XHR-10)

Pin no.	Signal name	Probable symptom due to poor contact
1	0V	<ul style="list-style-type: none"> <li>• No keys on panel are activated.</li> </ul>
2	0V	
3	Send (CHO)	
4	DTR (CHO)	
5	Receive (CHO)	
6	DSR (CHO)	
7	+11V	
8	-11V	
9	+5V	
10	+5V	

## ● P19 [FOOT] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. PHR-6)

Pin no.	Signal name	Probable symptom due to poor contact
1	Start switch signal (common side)	<ul style="list-style-type: none"> <li>Work clamp does not move when work clamp switch is pressed.</li> <li>Machine does not start.</li> </ul>
2	Start switch signal	
3	Work clamp switch signal (common side)	
4	Work clamp switch signal	
5	Reserved (common side)	
6	Reserved	

## ● P20 [PER] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD PHR-5)

Pin no.	Signal name	Probable symptom due to poor contact
1	Relay condition input	<ul style="list-style-type: none"> <li>One of error codes E26, E92, E98, and E99 appears.</li> </ul>
2	Primary voltage detect	
3	Relay OFF output	
4	+55V OFF output	
5	0V	

## ● P21 [EXOUT] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. H10P-SHF-AA) (when indexer is attached)

Pin no.	Signal name	Probable symptom due to poor contact
1	Feed plate driving valve motion signal	<ul style="list-style-type: none"> <li>Indexer does not work properly.</li> <li>One of error codes E07, E37, E38, E66, E67, and E68 appears.</li> </ul>
2	Chuck valve motion signal	
3	Feed plate fixing valve motion signal	
4	Reserved	
5	Reserved	
6	Reserved	
7	—	
8	—	
9	+24V	
10	+24V	

## ● P24 [OPTION] (not attached)

## ● P25 [FAN-L] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. PHR-3)

Pin no.	Signal name	Probable symptom due to poor contact
1	+24V	<ul style="list-style-type: none"> <li>Error code E94 appears.</li> </ul>
2	Fan lock error signal	
3	0V	

## 5. POWER SUPPLY EQUIPMENT

◎ Connectors to be attached to power supply circuit board

● P1 [POWER] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. VHR-7N)

Pin no.	Signal name	Probable symptom due to poor contact
1	+ 5V	<ul style="list-style-type: none"> <li>- Power does not come on.</li> <li>- Feed bracket does not move.</li> <li>- Machine operation becomes unstable.</li> <li>- Home position can not be found.</li> <li>- Error code E80 appears.</li> </ul>
2	+ 24V	
3	0V	
4	+ 55V	
5	+ 55V	
6	0V (P0V)	
7	0V (P0V)	

● P2 [PER] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. PHR-5)

Pin no.	Signal name	Probable symptom due to poor contact
1	Relay condition input	<ul style="list-style-type: none"> <li>- One of error codes E26, E92, E98, and E99 appears.</li> </ul>
2	Primary voltage detect	
3	Relay OFF output	
4	+ 55V OFF output	
5	0V	

● P3 [DC18] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. PHR-11)

Pin no.	Signal name	Probable symptom due to poor contact
1	+ 18V (A18V)	<ul style="list-style-type: none"> <li>- Machine motor does not run.</li> <li>- Rotation of machine motor is not correct.</li> <li>- Error code E70 or E91 appears.</li> </ul>
2	0V (A0V)	
3	—	
4	+ 18V (B18V)	
5	0V (B0V)	
6	—	
7	+ 18V (C18V)	
8	0V (C0V)	
9	—	
10	+ 18V (D18V)	
11	0V (D0V)	

● P4 [ACIN] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. LP-04-2V)

Pin no.	Signal name	Probable symptom due to poor contact
1	AC input	<ul style="list-style-type: none"> <li>- Power does not come on.</li> <li>- Machine operation becomes unstable.</li> <li>- Error code E92 appears.</li> </ul>
2	AC input	
3	—	
4	Ground	

● P5 [DC300] (MOLEX 3191-02R1)

Pin no.	Signal name	Probable symptom due to poor contact
1	0V (for machine motor)	<ul style="list-style-type: none"> <li>- Machine motor does not run.</li> <li>- Rotation of machine motor is not correct.</li> <li>- Error code E70 or E91 appears.</li> </ul>
2	+ 300V	

◎ Connectors to be attached to panel circuit board

● P1 [MAIN] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. XHR-10)

Pin no.	Signal name	Probable symptom due to poor contact
1	0V	<ul style="list-style-type: none"> <li>No keys on panel are activated.</li> </ul>
2	0V	
3	Send (CHO)	
4	DTR (CHO)	
5	Receive (CHO)	
6	DSR (CHO)	
7	+11V	
8	-11V	
9	+5V	
10	+5V	

● P2 [EXTRS] (not attached)

● P3 [OPTION] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. XHR-8) (when select switch is attached)

Pin no.	Signal name	Probable symptom due to poor contact
1	LED output A	<ul style="list-style-type: none"> <li>Select switch is not activated.</li> <li>Select switch LED does not light.</li> </ul>
2	LED output B	
3	LED output C	
4	Switch input A	
5	Switch input B	
6	Switch input C	
7	Reset switch input	
8	Common input	

● P4 [TYPE] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. PHDR-16VS)

Pin no.	Signal name	Probable symptom due to poor contact
1	TYPE 1 (COM)	<ul style="list-style-type: none"> <li>Error code E09 appears.</li> </ul>
2	TYPE 1	
3	TYPE 2 (COM)	
4	TYPE 2	
5	TYPE 3 (COM)	
6	TYPE 3	
7	TYPE 4 (COM)	
8	TYPE 4	
9	TYPE 5 (COM)	
10	TYPE 5	
11	TYPE 6 (COM)	
12	TYPE 6	
13	TYPE 7 (COM)	
14	TYPE 7	
15	TYPE 8 (COM)	
16	TYPE 8	

## 5. POWER SUPPLY EQUIPMENT

◎ Connectors to be attached to PMD PCB for  $\theta$  axis

● P1 [RPM] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. VHR-6N)

Pin no.	Signal name	Probable symptom due to poor contact
1	$\theta$ -axis PM driving current (RA)	<ul style="list-style-type: none"> <li>· Needle bar motion is not correct.</li> <li>· Home position can not be found.</li> <li>· Error code E52 or E82 appears.</li> </ul>
2	$\theta$ -axis PM driving current (RB)	
3	$\theta$ -axis PM driving current (RC)	
4	$\theta$ -axis PM driving current (RD)	
5	$\theta$ -axis PM driving current (RE)	
6	—	

● P2 [DC55] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. VHR-2N)

Pin no.	Signal name	Probable symptom due to poor contact
1	+55V	<ul style="list-style-type: none"> <li>· Feed bracket does not move.</li> <li>· Home position can not be found.</li> <li>· Error code E80 appears.</li> </ul>
2	0V (P0V)	

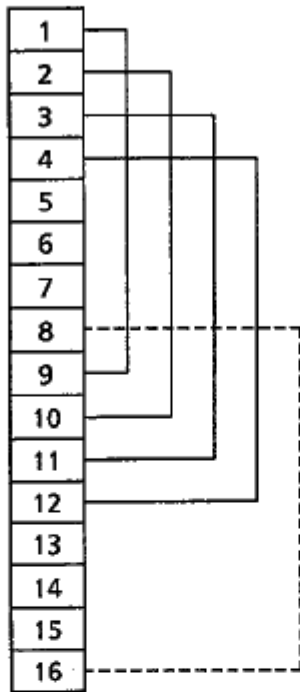
● P3 [CONTROL] (JAPAN SOLDERLESS TERMINAL MFG.CO.,LTD. H8P-SHF-AA)

Pin no.	Signal name	Probable symptom due to poor contact
1	$\theta$ -axis PM clock signal	<ul style="list-style-type: none"> <li>· Needle bar motion is not correct.</li> <li>· Home position can not be found.</li> <li>· Error code E52 or E82 appears.</li> </ul>
2	$\theta$ -axis PM direction signal	
3	$\theta$ -axis PM save signal	
4	$\theta$ -axis PM excitation signal	
5	+5V	
6	+5V	
7	0V	
8	0V	

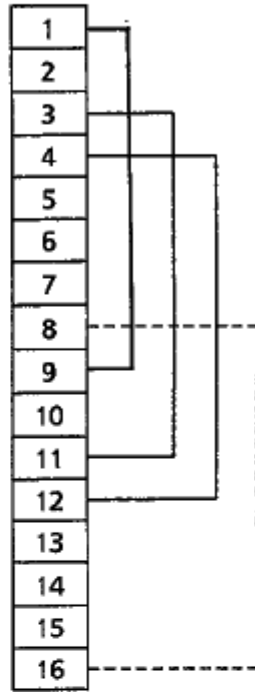
## 5-4. Specification harness connections

\*The broken lines are only for -52 specification.

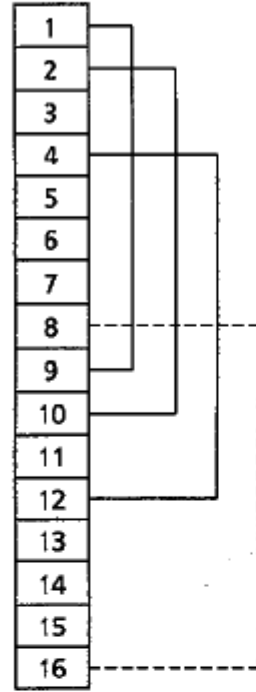
&lt;L1&gt;



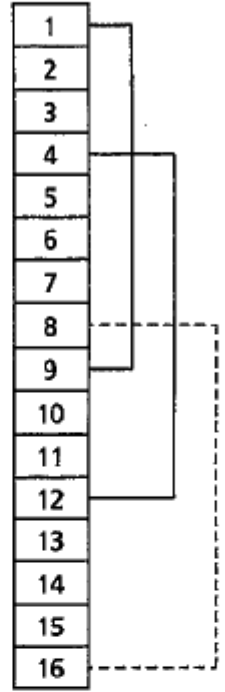
&lt;L2&gt;



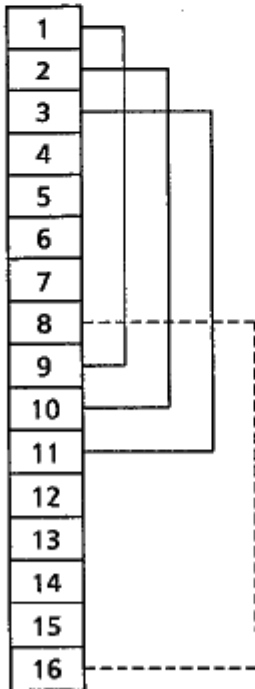
&lt;L3&gt;



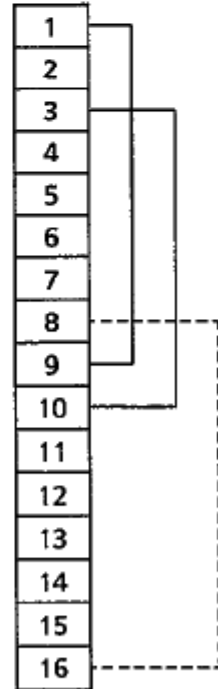
&lt;L4&gt;



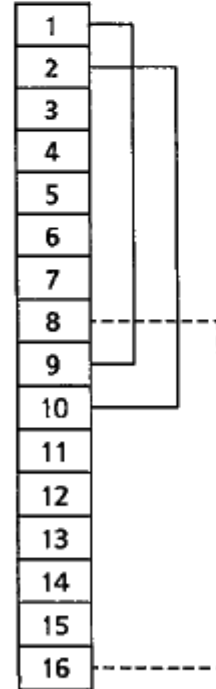
&lt;L5&gt;



&lt;L6&gt;



&lt;L7&gt;



## 5-5. Summary of DIP switches

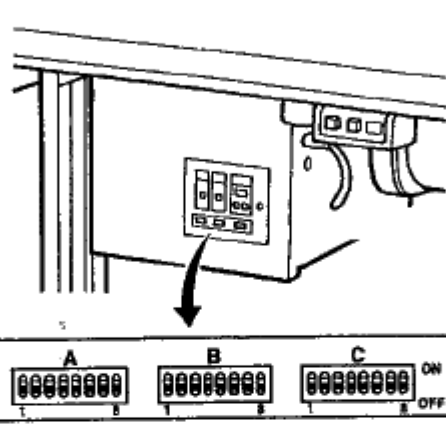
Always turn off the power supply before changing any of the DIP switch settings.

## 1) Front panel DIP switches

The ON/OFF positions of the DIP switches inside the front panel are checked only once when the power is turned on.

Any changes to the DIP switch positions will not be effective until the power is switched off and back on again.

Factory default settings  
(all switches are set to OFF)



Stitch pitch	1.2 mm
No. of eyelet stitches	Standard no. of stitches
Taper bar tacking length	6 mm
Knife operation method	Cutting after sewing
Eyelet shape	Eyelet hole (No. 2)
Offset	1.5 mm
Cutting space	0.2 mm
Sewing speed	1,800 spm
Mode	Automatic mode
Panel protection	Changing cutting on/off, stitch length settings allowed
Cloth setting position (-52 specifications)	Horizontal setting
No. of eyelet holes (-52 specifications)	4

## Panel DIP switch A

No.	ON/OFF	Description
1, 2, 3	ON, ON, ON	Stitch pitch = 1.8 mm
	ON, ON, OFF	Stitch pitch = 1.6 mm
	ON, OFF, ON	Stitch pitch = 1.4 mm
	ON, OFF, OFF	Stitch pitch = 1.3 mm
	OFF, OFF, OFF	Stitch pitch = 1.2 mm
	OFF, ON, ON	Stitch pitch = 1.1 mm
	OFF, ON, OFF	Stitch pitch = 1.0 mm
	OFF, OFF, ON	Stitch pitch = 0.9 mm
4, 5	ON, ON	No. of eyelet stitches = Standard no. of stitches + 1
	OFF, OFF	No. of eyelet stitches = Standard no. of stitches
	ON, OFF	No. of eyelet stitches = Standard no. of stitches - 1
	OFF, ON	No. of eyelet stitches = Standard no. of stitches - 2
6, 7, 8	ON, ON, ON	Taper bar tacking length = 10 mm
	ON, ON, OFF	Taper bar tacking length = 9 mm
	ON, OFF, ON	Taper bar tacking length = 8 mm
	ON, OFF, OFF	Taper bar tacking length = 7 mm
	OFF, OFF, OFF	Taper bar tacking length = 6 mm
	OFF, ON, ON	Taper bar tacking length = 5 mm
	OFF, ON, OFF	Taper bar tacking length = 4 mm
	OFF, OFF, ON	Taper bar tacking length = 0 mm



## Panel DIP switch B

No.	ON/OFF	Description
1	ON	Cutting after sewing
	OFF	Cutting before sewing
2, 3	ON, ON	Straight buttonhole (No. 5)
	ON, OFF	Eyelet buttonhole (No. 3)
	OFF, OFF	Eyelet buttonhole (No. 2)
	OFF, ON	Eyelet buttonhole (No. 1)
4	ON	Offset = 1.2 mm
	OFF	Offset = 1.5 mm
5, 6	ON, ON	Cutting space = -0.1 mm
	ON, OFF	Cutting space = 0 mm
	OFF, ON	Cutting space = 0.1 mm
	OFF, OFF	Cutting space = 0.2 mm
7, 8	ON, ON	Sewing speed = 2,000 spm
	OFF, OFF	Sewing speed = 1,800 spm
	ON, OFF	Sewing speed = 1,600 spm
	OFF, ON	Sewing speed = 1,400 spm

## Panel DIP switch C

No.	ON/OFF	Description
1, 2	ON, ON	Spare
	ON, OFF	Feed mode
	OFF, ON	Manual mode
	OFF, OFF	Automatic mode
3	ON	Changing cutting on/off, stitch length settings prohibited
	OFF	Changing cutting on/off, stitch length settings allowed
4	ON	Spare
	OFF	Spare
5	ON	Spare
	OFF	Spare
6※	ON	Left setting
	OFF	Horizontal setting
7, 8※	ON, ON	No. of holes per cycle = 6
	ON, OFF	No. of holes per cycle = 5
	OFF, OFF	No. of holes per cycle = 4
	OFF, ON	No. of holes per cycle = 3

※ Valid only for -52 specifications

2) Circuit board DIP switches

**⚠ DANGER**



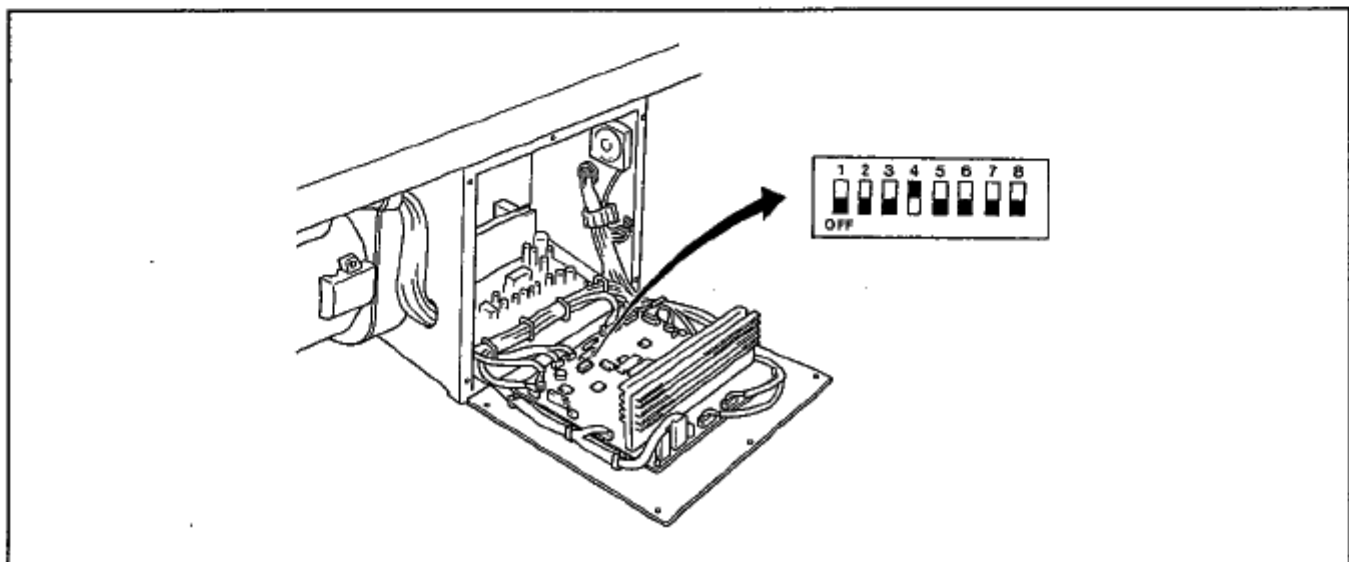
- Wait at least 5 minutes after turning off the power switch and disconnecting the power cord from the wall outlet before opening the face plate of the control box. Touching areas where high voltages are present can result in severe injury.

The ON/OFF positions of the DIP switches inside the front panel are checked only once when the power is turned on. Any changes to the DIP switch positions will not be effective until the power is switched off and back on again.

Circuit board DIP switch C

No.	ON/OFF	Description
1	ON	1 pedal (for start switch)
	OFF	2 pedals (for cloth presser switch and start switch)
2	ON	Front position setting (reduces cycle time when cutting after sewing and no lower thread trimming are set)
	OFF	Back position setting (reduces cycle time when cutting before sewing and no lower thread trimming are set)
3	ON	Cloth presser ON after sewing
	OFF	Cloth presser OFF after sewing
4	ON	Upper and lower thread trimming
	OFF	Upper thread trimming
5	ON	Spare
	OFF	Spare
6	ON	Spare
	OFF	Spare
7	ON	Spare
	OFF	Spare
8	ON	Spare
	OFF	Spare

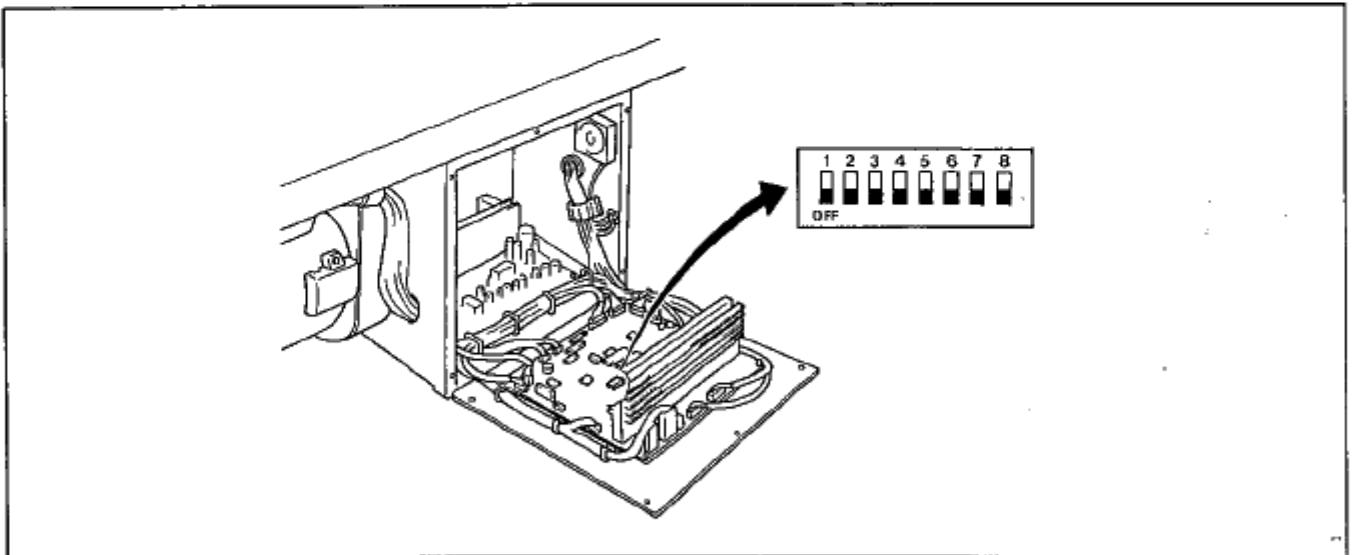
The machine is shipped from the factory with the DIP switches set as follows.



## Circuit board DIP switch D

No.	ON/OFF	Description
1	ON	Spare
	OFF	Spare
2	ON	Spare
	OFF	Spare
3	ON	Spare
	OFF	Spare
4	ON	Spare
	OFF	Spare
5	ON	Spare
	OFF	Spare
6	ON	Spare
	OFF	Spare
7	ON	Spare
	OFF	Spare
8	ON	Spare
	OFF	Spare

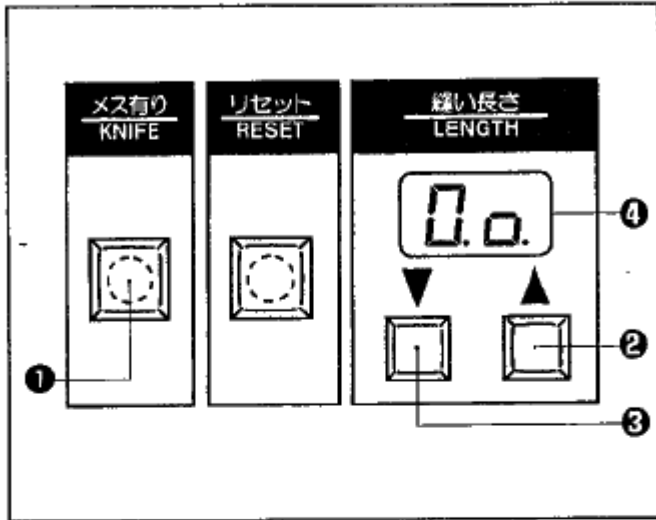
The machine is shipped from the factory with the DIP switches set as follows.





### 5-6. Using the memory switch

The condition of the memory switch is memorized even if the power is OFF, however, if data of the memory switch is initialized, the memory switch will become OFF.

The memory switch is OFF at shipment.



1. Turn on the power, while pressing the KNIFE switch ①.
2. Set the desired memory switch number at the left of the Number display window ④ by pressing the "Up" switch ② or "Down" switch ③.
3. Set the knife to ON ("  ") or OFF ("  ") by pressing the KNIFE switch ①.  
\*This is indicated at the right of the Number display window ④.
4. The contents of the memory switch are entered by pressing the start switch, and the normal starting condition will be ready (" -- " is displayed).

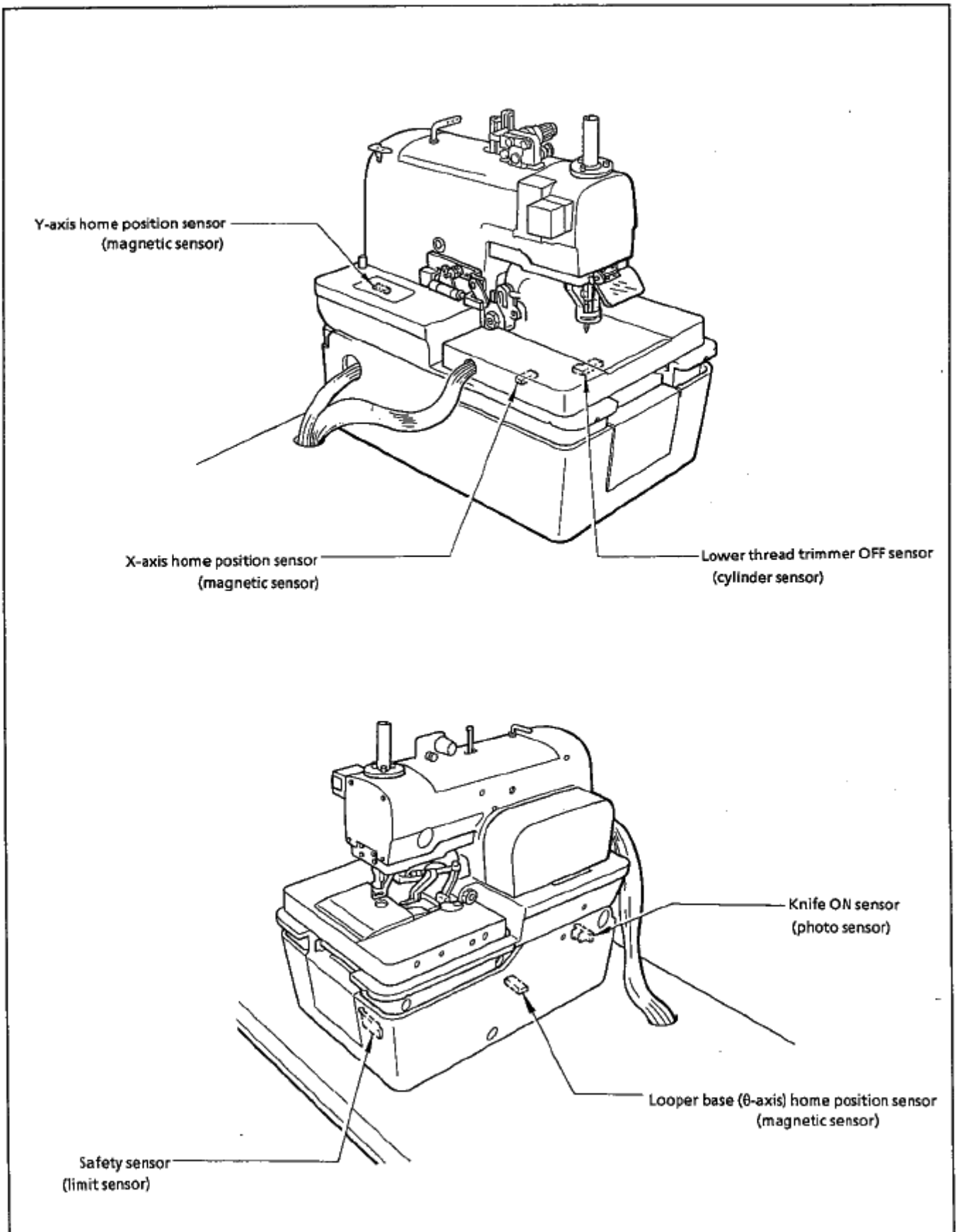
No.	ON/OFF	Description
0 *1	ON	Adds 0.3 mm to normal setting value of cutting space.
	OFF	Normal
1 *1	ON	Moves feed bracket forward with work clamp kept raised when workpiece is placed forward.
	OFF	Normal
2 *2	ON	Setting range of stitch length for L7 = 36 - 42 mm (Taper bar length should be 4 mm or more.)
	OFF	Setting range of stitch length for L7 = 36 - 40 mm
3, 4 5, 6 7, 8 9 A, B C, D E, F	ON	Spare
	OFF	

\*1 The version of the PROM is given as "B" or later.

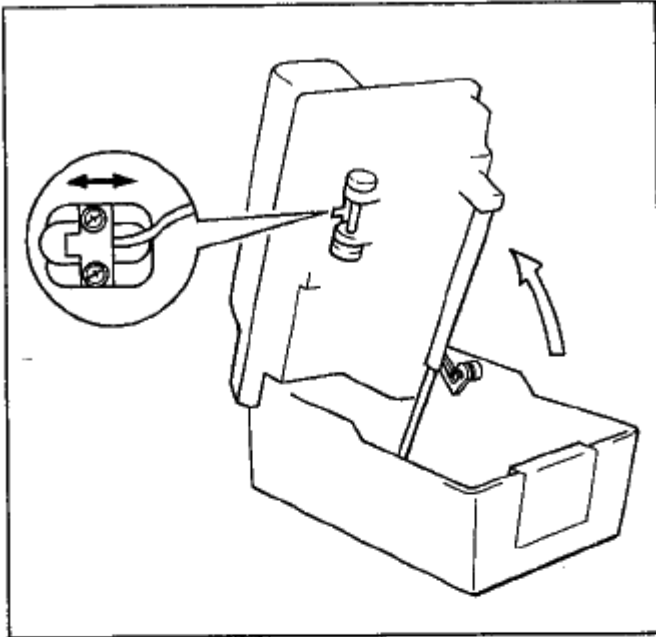
\*2 The version of the PROM is given as "C" or later.

## 5-7. Sensors

### Sensors positions

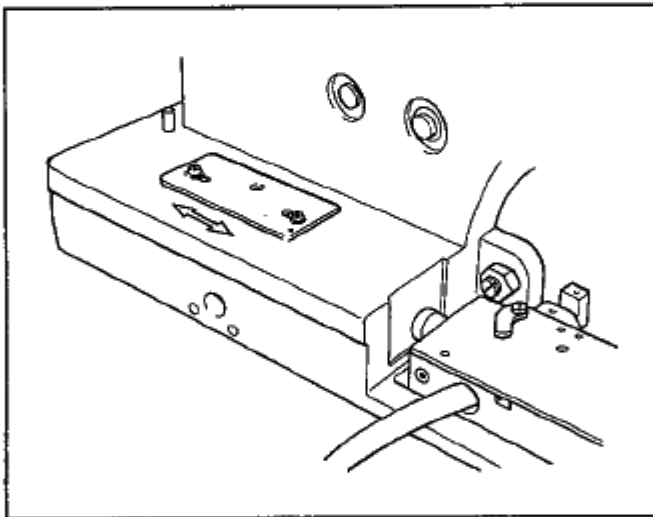


1) X-axis home position senso



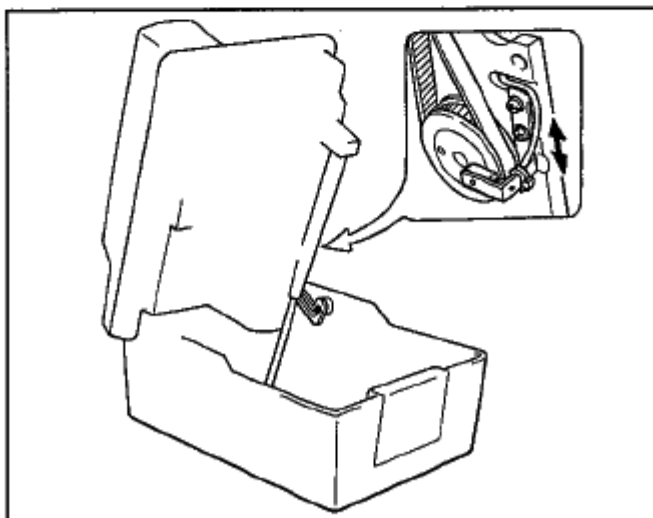
1. The X-axis home position sensor determines the home position of the feed bracket in the X direction.
2. When the feed bracket is on the left of the head, the X-axis home position sensor is set to off, and when right, set to on.
3. When the home position is detected, the X-axis home position sensor is turned on.
4. If the X-axis 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-axis home position sensor



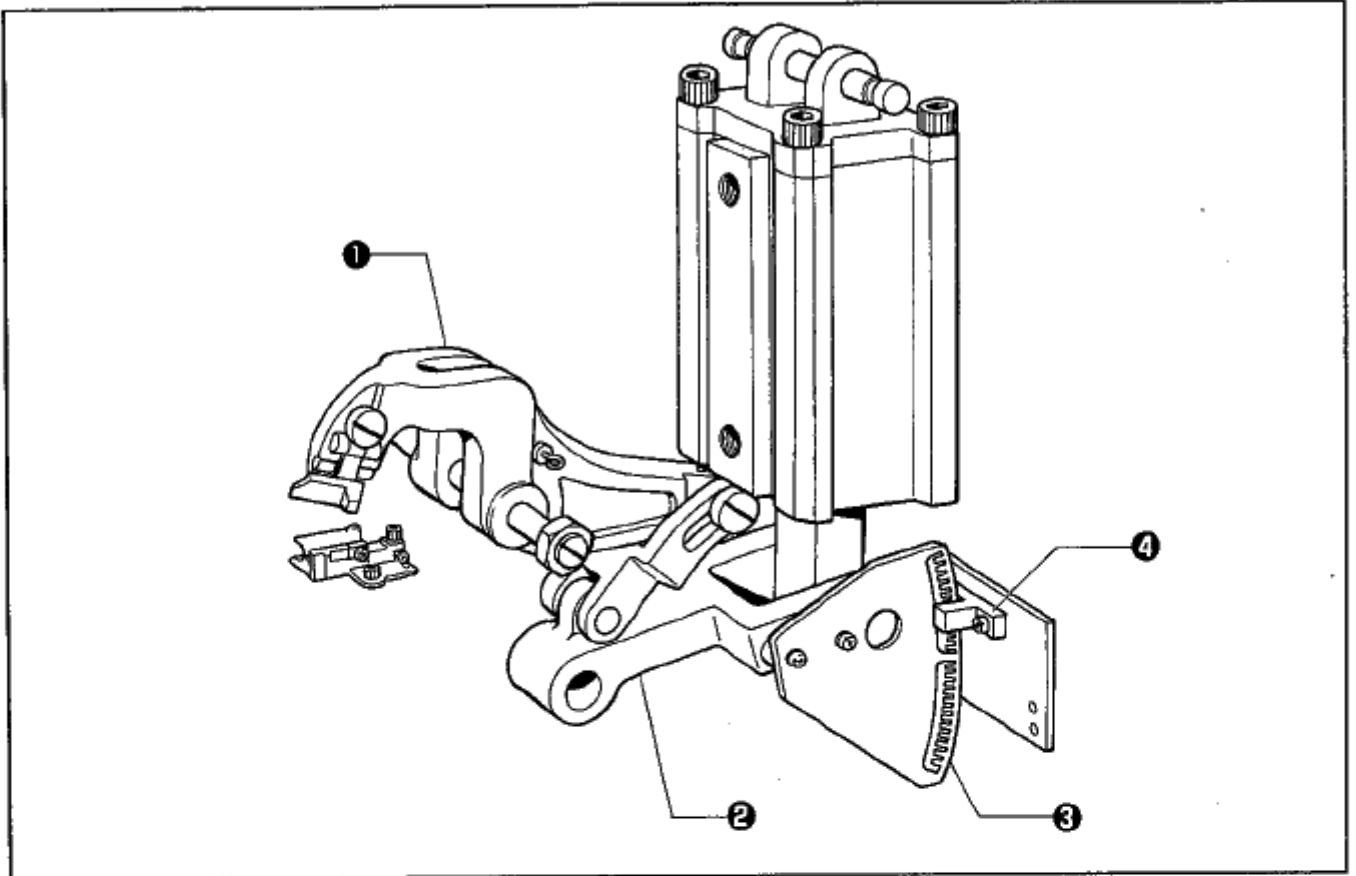
1. The Y-axis home position sensor determines the home position of the feed bracket in the Y direction.
2. The Y-axis home position sensor is set to on only when the feed bracket is at the home position.
3. If the Y-axis home position sensor is out of order, its connectors are not attached correctly,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

3) Looper base home position sensor ( $\theta$ -axis home position sensor)



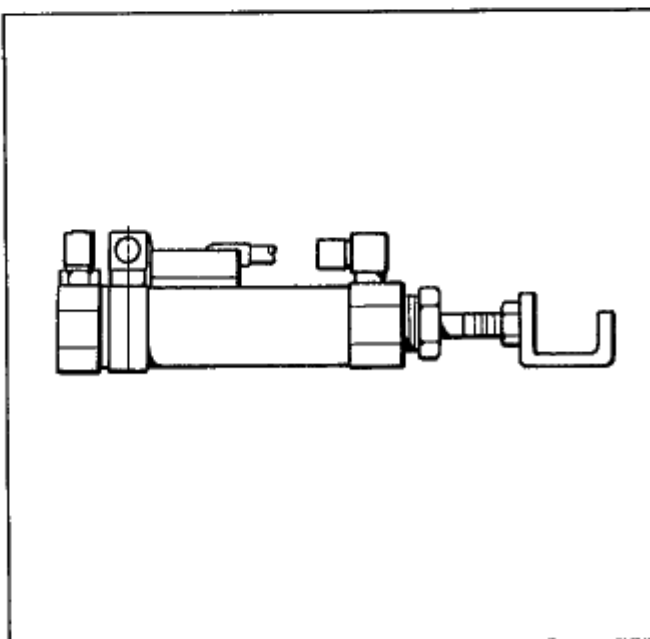
1. The looper base home position sensor determines the home position of the looper base (when it is at 0°).
2. The looper base home position sensor is set to on only when the looper base is at the home position.
3. If the looper base home position sensor is out of order, its connectors are not attached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

## 4) Knife ON sensor



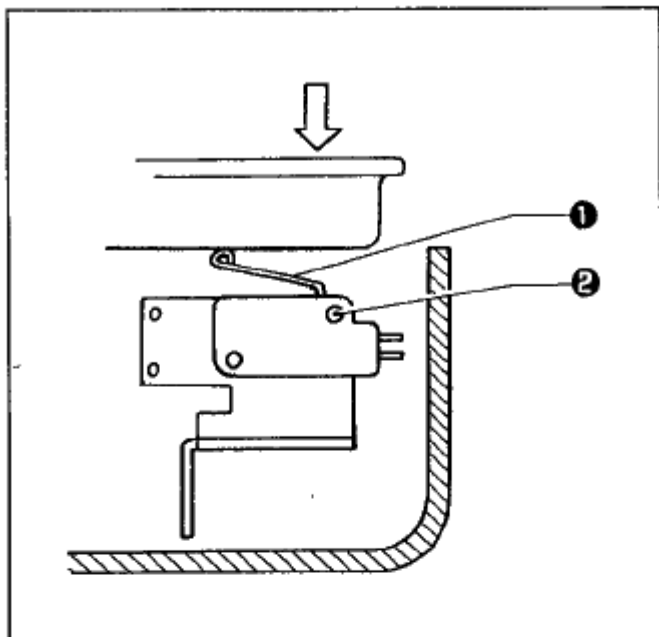
1. The knife ON sensor is intended to sense that the operation of the cutter lever ① has been completed, and to know the cutter lever ① lift stroke.
2. The cutter sensor partition plate (slit) ③ is attached to link (C) ② which moves the cutter lever ①. The signal is sent from the cutter sensor ④ mounted on the bed.

## 5) 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.

6) 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.



## 6. AIR PRESSURE MECHANISM

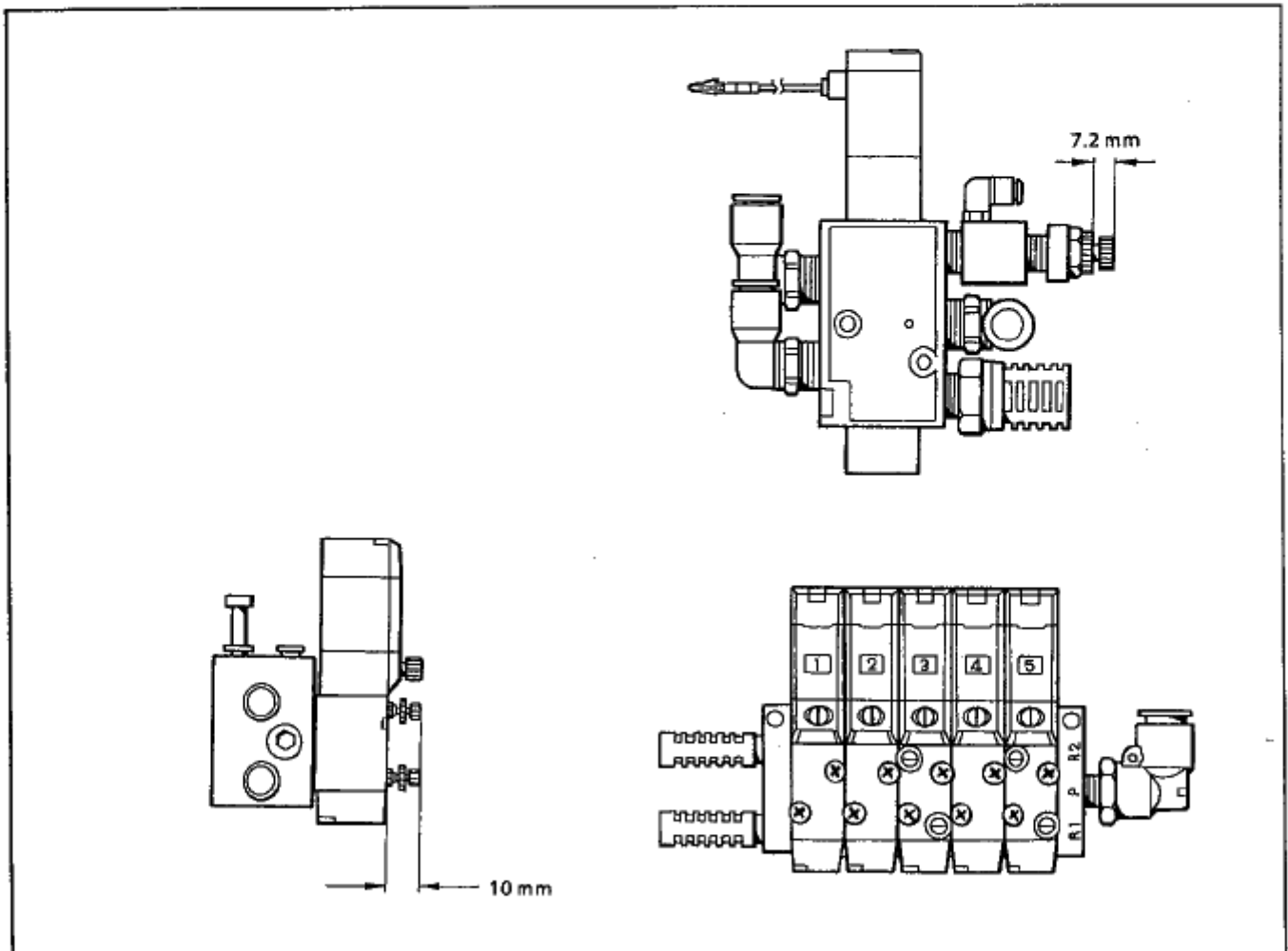
### ⚠ CAUTION

- ⊘ Machine installation should only be carried out by a qualified technician.
- ⚠ 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.
- ⚠ 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

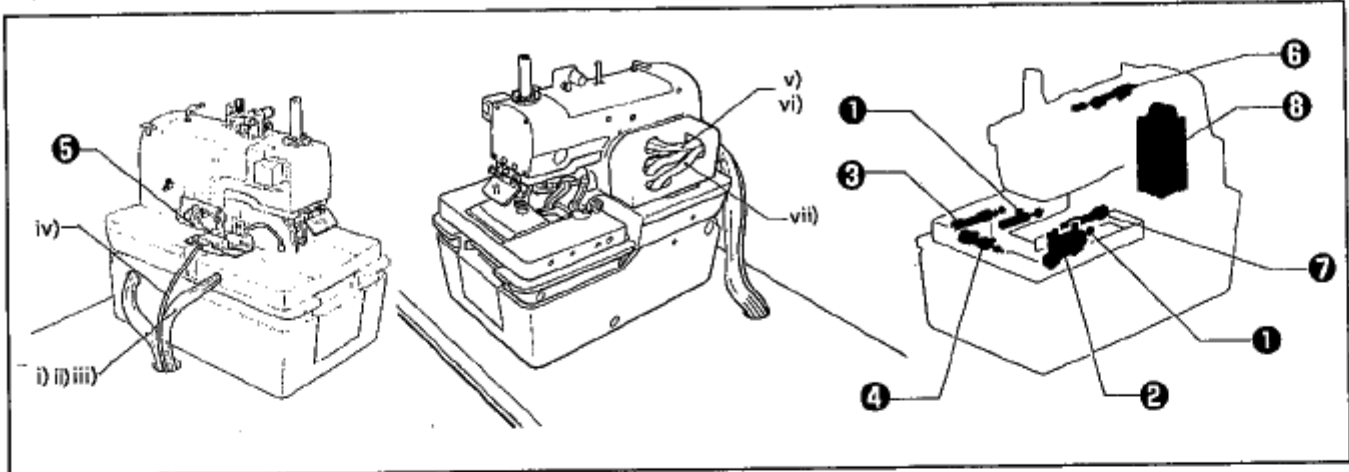
#### 1) Adjusting the solenoid valve speed controllers

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



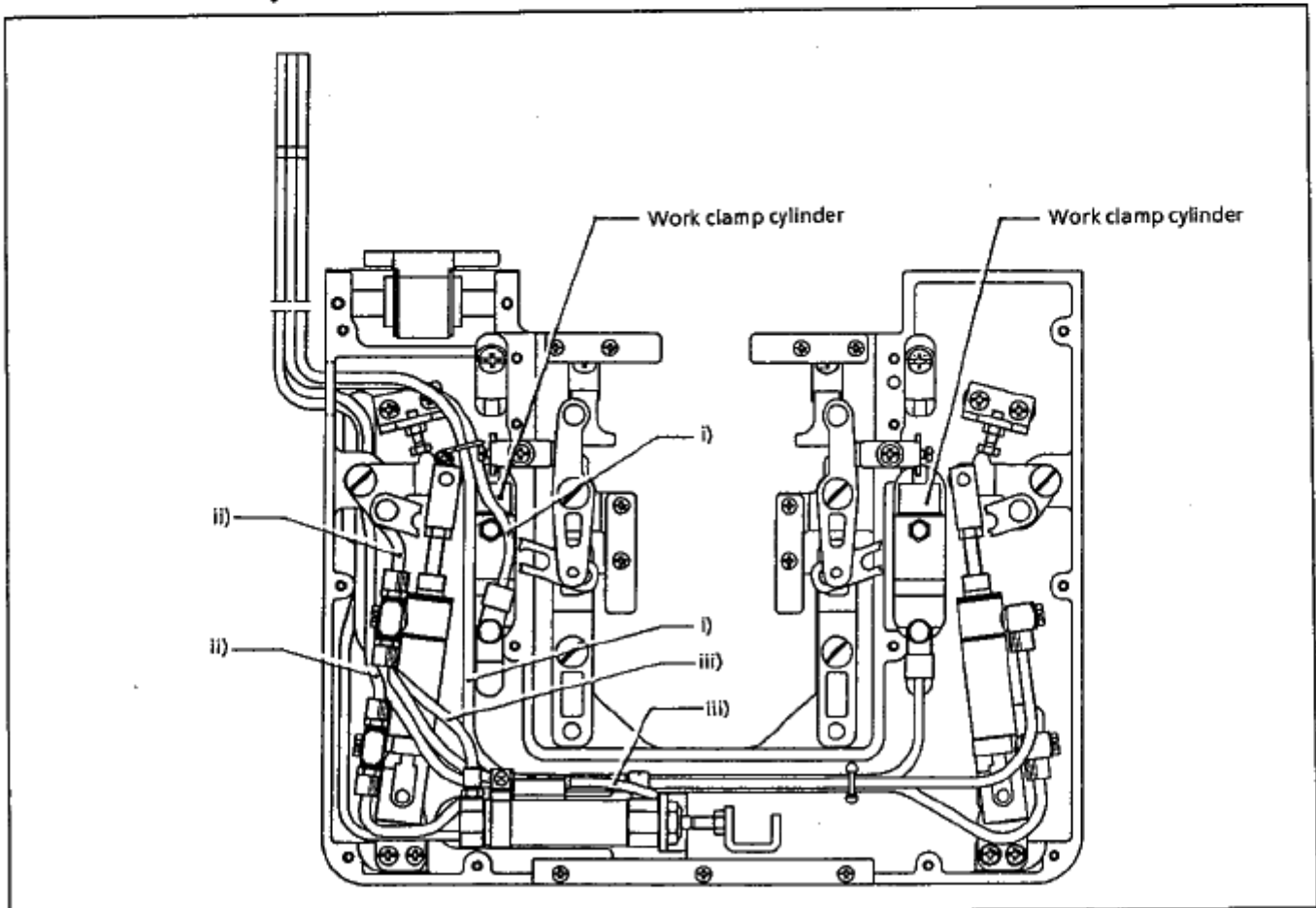
1. As for the No. 3 and No. 5 speed controllers, adjust their heights to 10 mm.  
Note: If the speed controllers are excessively throttled, error codes including E-75 (lower thread and operations are incorrect) and E-76 (upper thread operation is incorrect), may appear.
2. The exhaust throttle valve is only attached to the OFF side of the knife valve. Adjust the protrusion of the speed controller to 7.2 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) Airtubes



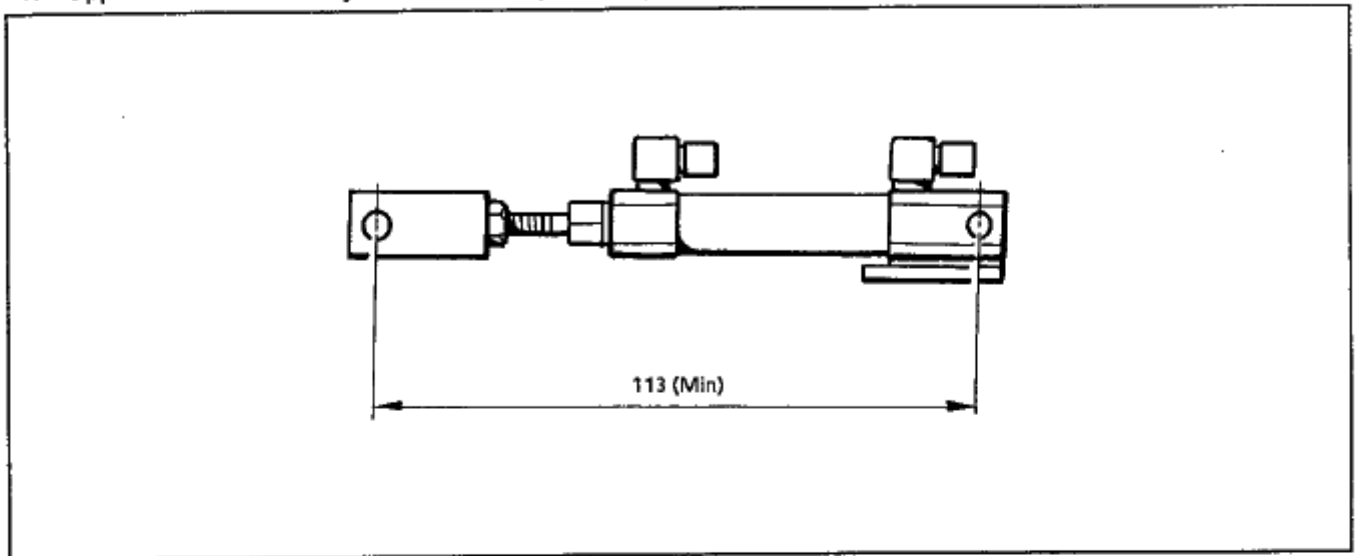
1. Air tubes coming out from the left of feed bracket and cylinders
  - i) Work clamp \_\_\_\_\_ Cylinder, 16 x 10 ①
  - ii) Cloth opener \_\_\_\_\_ Cylinder assy, A 16 x 15 ②, Cylinder assy, B 16 x 15 ③
  - iii) Lower thread trimming \_\_\_\_\_ Cylinder assy, B 16 x 30 ④
  - iv) Sub presser \_\_\_\_\_ Cylinder assy, 10 x 15 J ⑤
  
2. Air tubes coming out from the rear of belt cover R and cylinders
  - v) Upper thread tightening \_\_\_\_\_ Cylinder assy, 10 x 15 ⑥
  - vi) Upper thread trimming \_\_\_\_\_ Cylinder assy, 10 x 15 ⑦
  - vii) Knife \_\_\_\_\_ Cylinder assy, 63 x 100 ⑧

6-2. Air tube layout

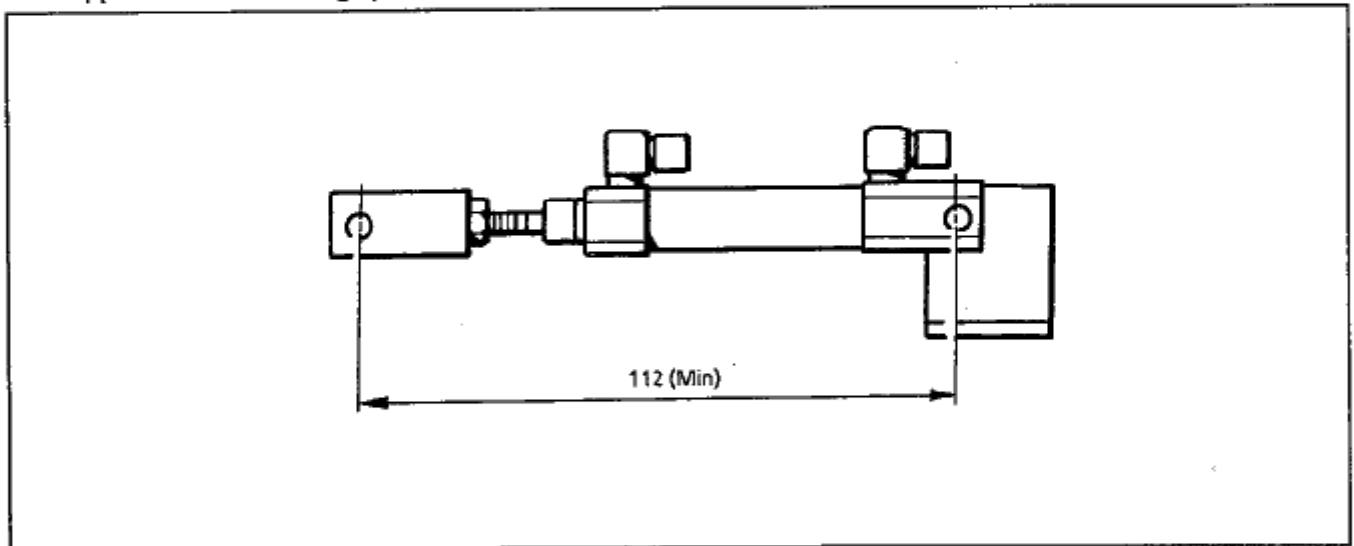


[Reference] Dimensions for cylinder rod assembly

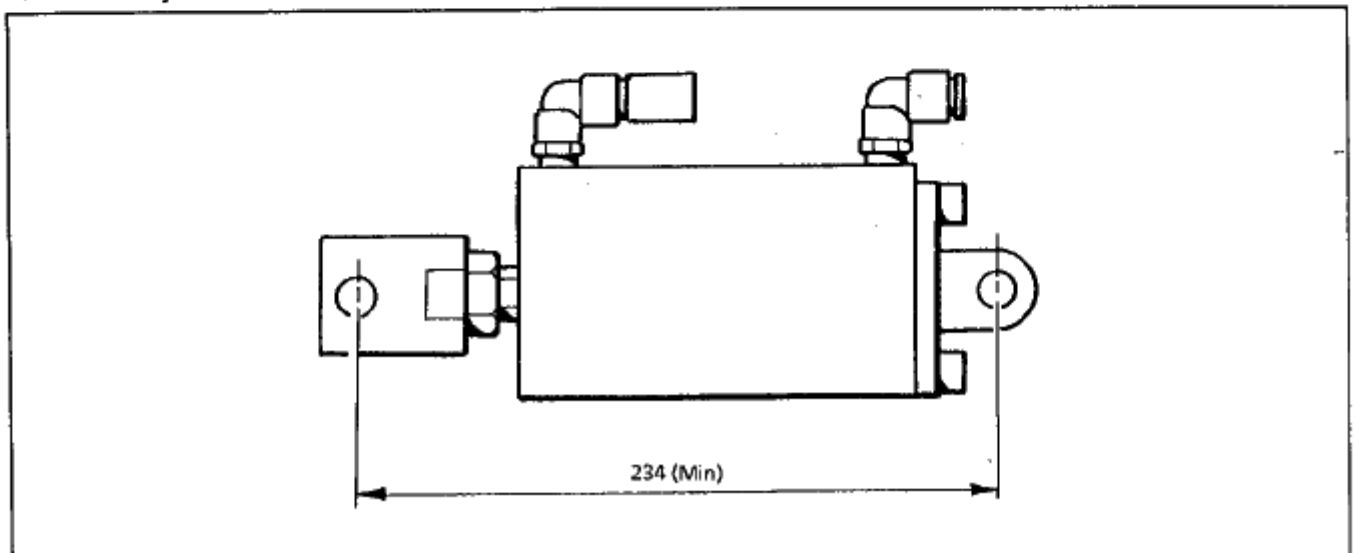
1. Upper thread release cylinder and sub presser cylinder



2. Upper thread trimming cylinder

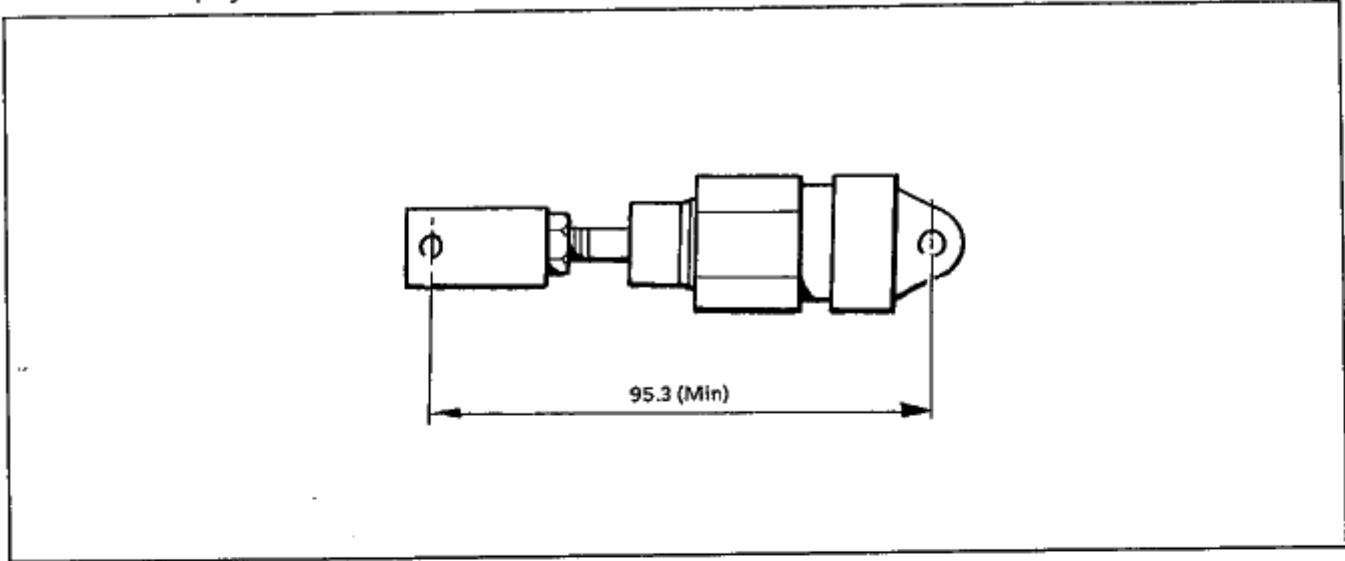


3. Cutter cylinder

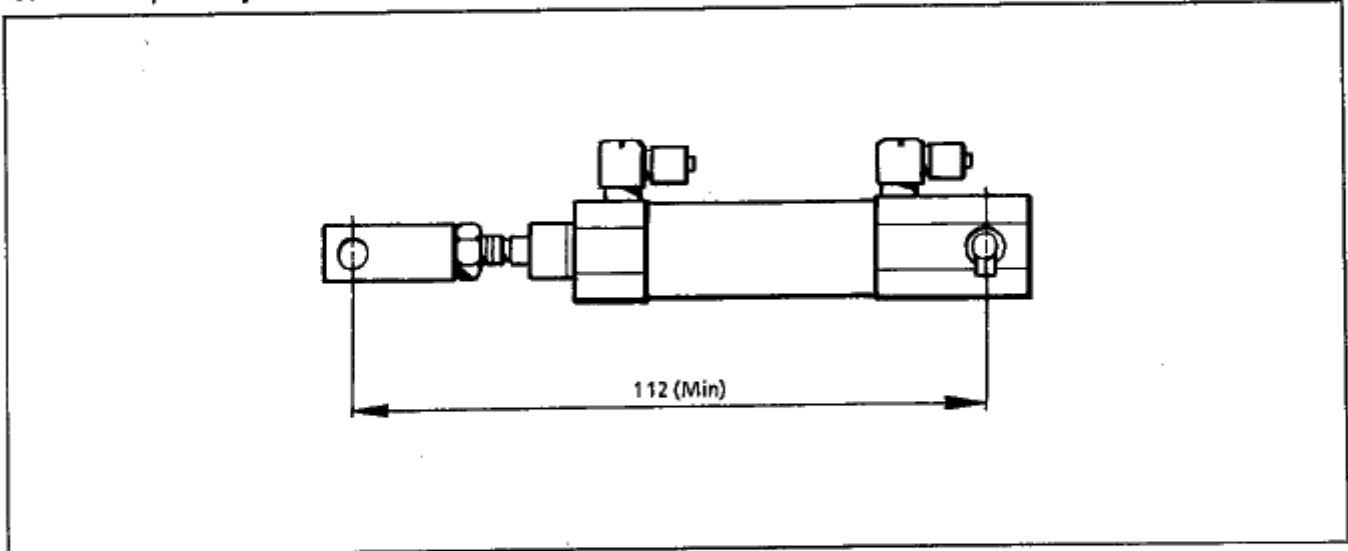


## 6. AIR PRESSURE MECHANISM

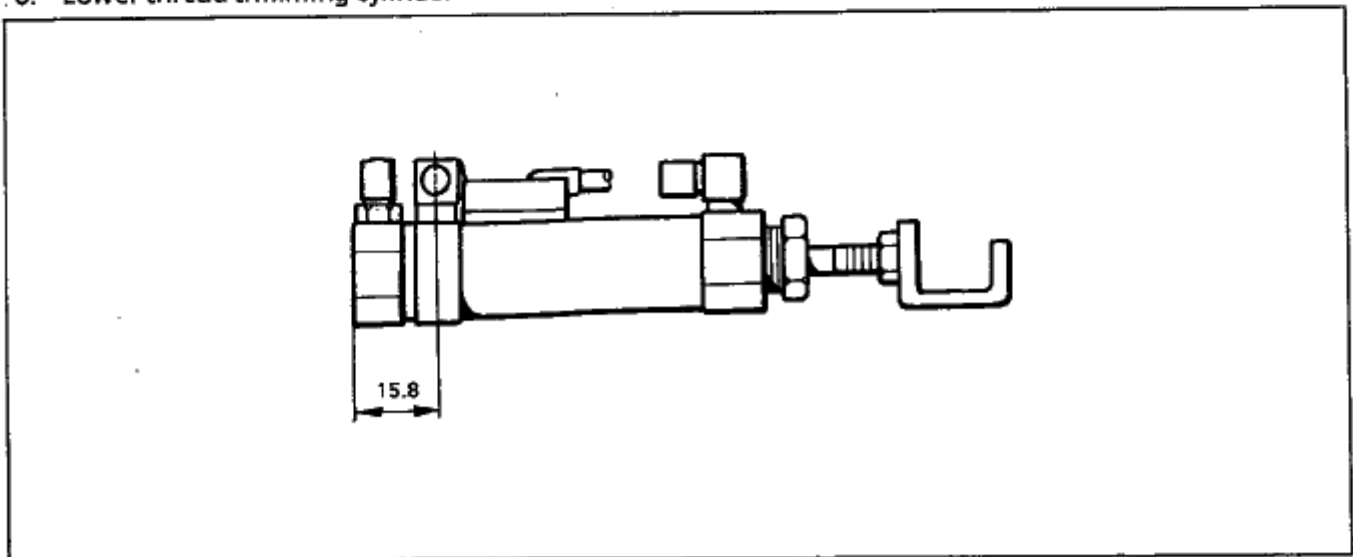
### 4. Work clamp cylinder



### 5. Cloth opener cylinder



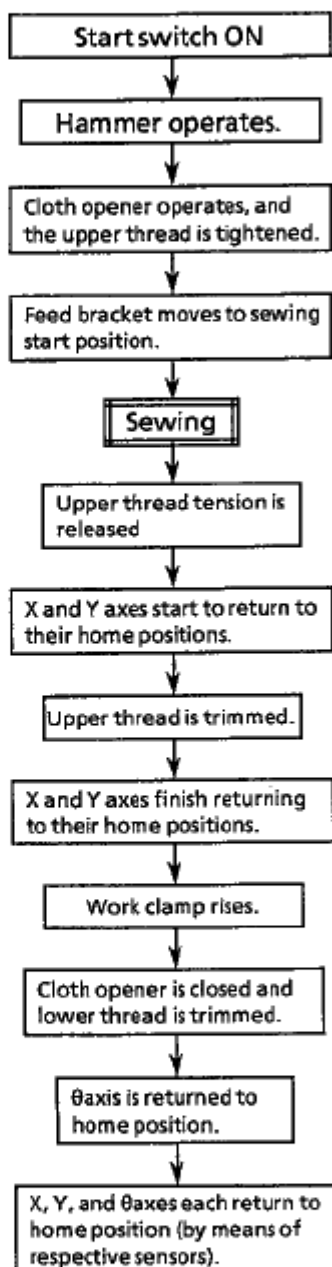
### 6. Lower thread trimming cylinder



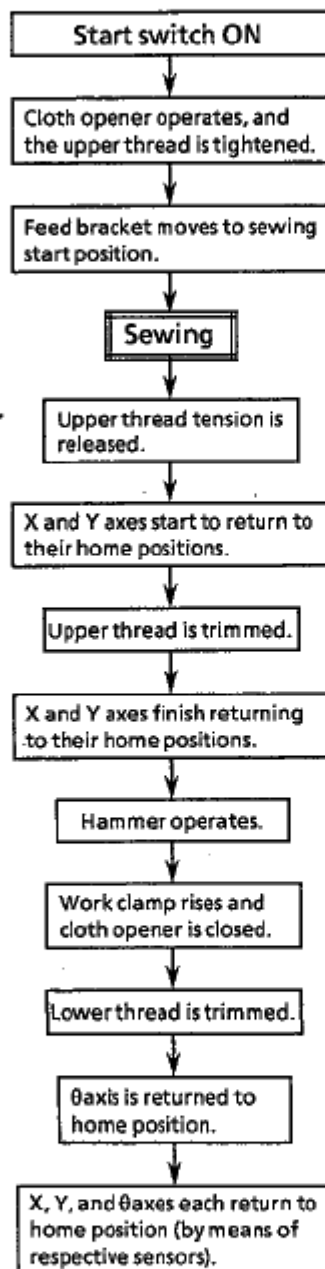
# 7. SOFTWARE

## 7-1. Motion flowchart

### 1. Cutting before sewing, back position



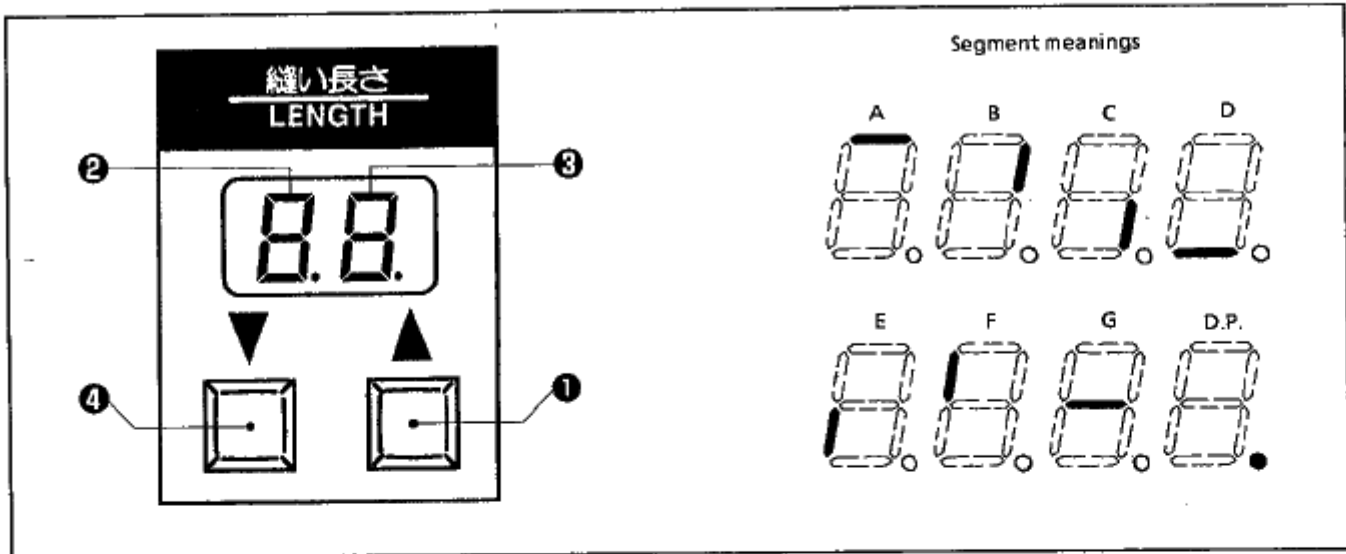
### 2. Cutting after sewing, back position



## 7-2. Input check list

Use the following procedure when checking for switch and sensor breakdown, cord breakage, and adjusting the sensor positions.

The CPU can be checked as to whether it has correctly interpreted signals from switches and sensors.



1. Turn off the power.
  2. Turn on the power while pressing the "Up" switch ①.
    - \*The check mode number will appear as the tens digit ② on the number display window.
    - \*The check result will appear as the units digit ③ on the number display window.
  3. Press the "Up" switch ① or "Down" switch ④ to select a desired check mode number.
  4. When the switch or sensor is turned on, the corresponding segment will appear as the units digit ③ on the number display.
    - Turn the desired switch on and off.
    - When checking a sensor, move the part being monitored manually.
- \*When returning to normal operation, turn power off and then on again.

Check mode	Segment	Check items
1	A B C D E F G D.P.	X-axis home position sensor Y-axis home position sensor θ-axis home position sensor Lower thread trimming OFF sensor Head sensor Knife ON sensor
2	A B C D E F G D.P.	Start switch Work clamp switch  EMERGENCY STOP switch  Needle up signal Needle down signal Speed detecting sensor
3	A B C D E F G D.P.	KNIFE switch RESET switch  Switch A (select switch) Switch B (select switch) Switch C (select switch) RESET switch (select switch) } *1

Check mode	Segment	Check items
4	A B C D E F G D.P.	Limit switch R (feed plate home position) Limit switch L (left feed plate) Cylinder sensor (right feed plate) } *2
5	A B C D E F G D.P.	Specification harness No. 1 Specification harness No. 2 Specification harness No. 3 Specification harness No. 4 Specification harness No. 5 Specification harness No. 6 Specification harness No. 7 Specification harness No. 8
6	A B C D E F G D.P.	Panel DIP switch A No. 8 Panel DIP switch A No. 7 Panel DIP switch A No. 6 Panel DIP switch A No. 5 Panel DIP switch A No. 4 Panel DIP switch A No. 3 Panel DIP switch A No. 2 Panel DIP switch A No. 1
7	A B C D E F G D.P.	Panel DIP switch B No. 8 Panel DIP switch B No. 7 Panel DIP switch B No. 6 Panel DIP switch B No. 5 Panel DIP switch B No. 4 Panel DIP switch B No. 3 Panel DIP switch B No. 2 Panel DIP switch B No. 1
8	A B C D E F G D.P.	Panel DIP switch C No. 8 Panel DIP switch C No. 7 Panel DIP switch C No. 6 Panel DIP switch C No. 5 Panel DIP switch C No. 4 Panel DIP switch C No. 3 Panel DIP switch C No. 2 Panel DIP switch C No. 1
9	A B C D E F G D.P.	Circuit board DIP switch C No. 8 Circuit board DIP switch C No. 7 Circuit board DIP switch C No. 6 Circuit board DIP switch C No. 5 Circuit board DIP switch C No. 4 Circuit board DIP switch C No. 3 Circuit board DIP switch C No. 2 Circuit board DIP switch C No. 1

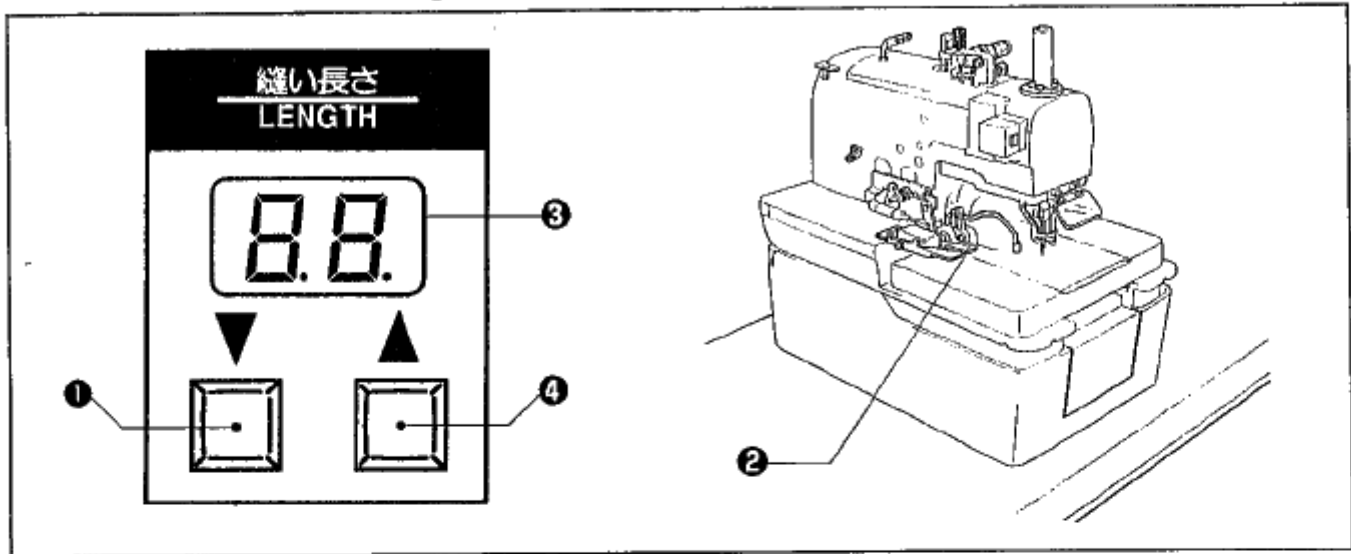
\*1 Available only when select switch (optional) is attached.

\*2 Available only when indexer is attached.

### 7-3. Output check list

Use the following procedure when checking for PCB-related failures, mechanism breakdown, and cord breakage.


It can be checked as to whether signals that the CPU correctly output have been received.



1. Turn off the power.
  2. Turn on the power with the "Down" switch ① simultaneously pressed.
  3. Press the start switch ②.  
\*The machine will start to detect the home position.  
\*The check code number will appear on number display window ③.
  4. Press the "Up" switch ④ or the "Down" switch ① to find the desired check code.
  5. Press the start switch ②.  
While the switch is kept pressed, the machine will work as it is specified by each check code.
- \*When returning to normal operation, turn power off and then on again.

Check code	Function
01	After activating the buzzer for a second, X-, Y-, and $\theta$ -home positions are detected when the machine stops with the needle at its upper limit. Head sensor will not conduct any error check.
02	The machine will hold the material.
03	The machine will open the material.
04	After activating the buzzer for a second, the machine opens the material, turns 180° ( $\theta$ ), and activates lower thread and lower gimp trimmers.
05	After activating the buzzer for a second, turns 180° ( $\theta$ ), and the upper thread trimmer will be activated.
06	After activating the buzzer for a second, the machine will hold the material and activate the knives.
07	After activating the buzzer for a second, the machine will hold the material, and operate the machine motor at 700 spm. Turn off the start switch to stop the machine.
10	Upper thread will be tightened.
11	After activating the buzzer for a second, the X feed mechanism will reciprocate in the range of -6 mm to + 6 mm. *Be sure to remove the work clamp and check the motion of the X feed mechanism.
12	After activating the buzzer for a second, the Y feed mechanism will reciprocate in the range of -1 mm to + 65 mm. *Be sure to remove the work clamp and check the motion of the Y feed mechanism.



Check code	Function
13	After activating the buzzer for a second, the $\theta$ feed mechanism will reciprocate in the range of $-2.7^\circ + 362.7^\circ$ . *Be sure to remove the work clamp and check the motion of the $\theta$ -axis feed mechanism.
16 *1	Feed plate is temporarily fixed. (Fixing cylinder on)
17 *1	Feed plate is fixed. (Chuck cylinder on)
18 *1	Feed plate is moved to the right. (Cloth feed driving cylinder on)
31	The buzzer sounds.
32	<p>All two display tubes will be lit.</p> <p>RESET indicator will be lit.            KNIFE indicator will be lit.            Indicator A will be lit.            Indicator B will be lit.            Indicator C will be lit. } *2</p> 

\*1 Available only when indexer is attached.

\*2 Available only when select switch (optional) is attached.

## 7-4. Error codes

## 1. Errors when the power is turned on

Error code	Contents	Resetting	① Input check ② Output check
E-00	Emergency stop switch is still activated.	Turn off emergency stop switch, and press RESET switch.	① 2-D
E-02	Machine head falls down.	Turn off the power.	① 1-E
E-03	Cloth presser switch is still being pressed.	Turn off cloth presser switch, and press RESET switch.	① 2-B
E-04	Start switch is still being pressed.	Turn off start switch, and press RESET switch.	① 2-A
E-06	Feed plate home position sensor remains off.	Set it to on.	① 4-A
E-07	Left feed plate sensor remains off.	Turn off the power.	① 4-B ② 18
E-09	Specification that machine does not support is set.	Turn off the power.	① 5-A - D.P.
E-10	Needle up signal remains off.	Set it to on.	① 2-F
E-12	Cutter sensor remains on.	Turn off the power.	① 1-F ② 06
E-15	Lower thread trimmer OFF sensor remains off.	Turn off the power.	① 1-D ② 04
E-26	PER terminal connection error	Turn off the power.	———
E-27	External RAM error	Turn off the power.	———
E-28	Panel communication start error	Turn off the power.	———
E-29	Machine motor communication start error	Turn off the power.	———

## 2. Errors before any operation is performed

Error code	Contents	Resetting	① Input check ② Output check
E-30	Emergency stop switch is still activated.	Turn off emergency stop switch, and press RESET switch.	① 2-D
E-31	Program whose specification is different from that of machine (work clamp and indexer specifications) is selected.	Press RESET switch.	———
E-32	Machine head is raised.	Turn off the power.	① 1-E
E-36	Feed plate home position sensor remains off.	Turn off the power.	① 4-A
E-37	Left feed plate sensor remains off.	Turn off the power.	① 4-B ② 18
E-38	Right feed plate sensor remains off.	Turn off the power.	① 4-C ② 18

Error code	Contents	Resetting	① Input check ② Output check
E-40	Needle up signal remains off.	Turn on needle up signal, and press RESET switch.	① 2-F
E-42	Cutter sensor remains on.	Turn off the power.	① 1-F ② 06
E-45	Lower thread trimmer OFF sensor remains off.	Turn off the power.	① 1-D ② 04
E-50	X-axis home position sensor remains off.	Turn off the power.	① 1-A
E-51	Y-axis home position sensor remains off.	Turn off the power.	① 1-B
E-52	$\theta$ -axis home position sensor remains off.	Turn off the power.	① 1-C
E-59	Sewing data is damaged.	Turn off the power.	—

### 3. Errors during operation

Error code	Contents	Resetting	① Input check ② Output check
E-60	Emergency stop switch is pressed.	Press RESET switch or start switch.	—
E-62	Machine head falls down. (Head sensor is off.)	Turn off the power.	① 1-E
E-66	Feed plate home position sensor is not activated within a specified time.	Turn off the power.	① 4-A
E-67	Left feed plate sensor is not activated within a specified time.	Turn off the power.	① 4-B ② 18
E-68	Right feed plate sensor is not activated within a specified time.	Turn off the power.	① 4-C ② 18
E-70	Needle up signal is not activated within a specified time.	Turn off the power.	① 2-F ② 07
E-71	Needle down signal is not activated within a specified time.	Turn off the power.	① 2-G ② 07
E-72	Knife ON sensor is not activated within a specified time.	Turn off the power.	① 1-F ② 06
E-75	Lower thread trimming OFF sensor is not activated within a specified time.	Turn off the power.	① 1-D ② 04
E-76	Needle up signal turned off	Turn off the power.	① 2-F
E-77	Synch signal is not activated within a specified time.	Turn off the power.	① 2-D.P.
E-80	X-axis home position sensor is not set to on within a specified time of searching home position.	Turn off the power.	① 1-A

Error code	Contents	Resetting	<input type="radio"/> Input check <input type="radio"/> Output check
E-81	Y-axis home position sensor is not set to on within a specified time of searching home position.	Turn off the power.	<input type="radio"/> 1-B
E-82	$\theta$ -axis home position sensor is not set to on within a specified time of searching home position.	Turn off the power.	<input type="radio"/> 1-C

## 4. Hardware errors

Error code	Contents	Resetting	<input type="radio"/> Input check <input type="radio"/> Output check
E-90	Communication error	Turn off the power.	—
E-91	Machine motor rotation error	Turn off the power.	<input type="radio"/> 2-E 2-G 2-D.P. <input type="radio"/> 07
E-92	Abnormal voltage error	Turn off the power.	—
E-93	Fan (L) lock error	Turn off the power.	—
E-94	Fan (S) lock error	Turn off the power.	—
E-95	X motor overcurrent error	Turn off the power.	—
E-96	Y motor overcurrent error	Turn off the power.	—
E-97	Control PCB temperature rise error	Turn off the power.	—
E-98	Power supply relay error	Turn off the power.	—
E-99	Power supply circuit board overcurrent error	Turn off the power.	—

## 7-5. Troubleshooting

Error code	Countermeasure
E-00 E-30	<ol style="list-style-type: none"> <li>1. Turn off emergency stop switch.</li> <li>2. Check if connector P3 (HEAD) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>3. With the power turned off, separate connectors P3 (HEAD), and check if continuity between the following pairs of pins 1 to 3 in the connector on the harness is as follows: <ul style="list-style-type: none"> <li>• When emergency stop switch is activated, between pins 1 and 2 is opened, and between pins 2 and 3 is short-circuited.</li> <li>• When emergency stop switch is not activated, between pins 1 and 2 is short-circuited, and between pins 2 and 3 is opened.</li> </ul> </li> <li>* If the result of continuity test is not acceptable in either case, replace the emergency stop switch and its harness.</li> <li>* Even if the result of continuity test is acceptable, harness may be broken or short-circuited. It may appear when oscillation occurs.</li> <li>4. If there is still an error even after replacing the emergency stop switch, replace the control circuit board.</li> </ol>
E-02 E-32 E-62	<ol style="list-style-type: none"> <li>1. Return machine head to original position.</li> <li>2. Adjust safety switch so that it is turned on when machine head is returned to its original position.</li> <li>3. Check if connector P8 (EXINA) on control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. With the power turned off, separate connectors P8 (EXINA), and check if continuity between pins 1 and 2 in the connector on the harness is as follows: <ul style="list-style-type: none"> <li>• When machine head is raised, between pins 1 and 2 is opened.</li> <li>• When machine head is in position, between pins 1 and 2 is short-circuited.</li> </ul> </li> <li>* If the result of continuity test is not acceptable in either case, replace the head safety switch and its harness.</li> <li>* Even if the result of continuity test is acceptable, harness may be broken or short-circuited. It may appear when oscillation occurs.</li> <li>5. If there is still an error even after replacing the head safety switch, replace the control circuit board.</li> </ol>
E-03	<ol style="list-style-type: none"> <li>1. Release work clamp switch. (Turn it off.)</li> <li>2. Check if hand switch connector which is outside the control box is securely inserted.</li> <li>3. Check if connector P19 (FOOT) on control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. With the power turned off, separate connectors P19 (FOOT), and check if continuity between pins 3 and 4 in the connector on the harness is as follows: <ul style="list-style-type: none"> <li>• When work clamp switch is activated, between pins 3 and 4 is short-circuited.</li> <li>• When work clamp switch is not activated, between pins 3 and 4 is opened.</li> </ul> </li> <li>* If the result of continuity test is not acceptable in either case, replace the hand switch (or foot switch) and its harness.</li> <li>* Even if the result of continuity test is acceptable, harness may be broken or short-circuited. It may appear when oscillation occurs.</li> <li>5. If there is still an error even after replacing the hand switch and foot switch harness (which is connected to control circuit board and control box), replace the control circuit board.</li> </ol>
E-04	<ol style="list-style-type: none"> <li>1. Release start switch. (Turn it off.)</li> <li>2. Check if hand switch connector which is outside the control box is securely inserted.</li> <li>3. Check if connector P19 (FOOT) on control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. With the power turned off, separate connectors P19 (FOOT), and check if continuity between pins 1 and 2 in the connector on the harness is as follows: <ul style="list-style-type: none"> <li>• When start switch is activated, between pins 1 and 2 is short-circuited.</li> <li>• When start switch is not activated, between pins 1 and 2 is opened.</li> </ul> </li> <li>* If the result of continuity test is not acceptable in either case, replace the hand switch (or foot switch) and its harness.</li> <li>* Even if the result of continuity test is acceptable, harness may be broken or short-circuited. It may appear when oscillation occurs.</li> <li>5. If there is still an error even after replacing the hand switch and foot switch harness (which is connected to control circuit board and control box), replace the control circuit board.</li> </ol>

Error code	Countermeasure
E-06 E-36 E-66	<ol style="list-style-type: none"> <li>1. Turn on the feed plate home position sensor (limit switch R) of the indexer. (Place the cloth feed bar at the left position.)</li> <li>2. Check and adjust the position of the feed plate home position sensor of the indexer. (Refer to the instruction manual.)</li> <li>3. Of connectors relayed to head harness, check if the harness for the feed plate home position sensor is correctly attached to the connector for the <math>\theta</math>-axis home position sensor. (The white harness should be attached to pin 7, and the black one to pin 12. Refer to the instruction manual.) <ul style="list-style-type: none"> <li>* Check if there is a harness in the control box that is broken or short-circuited.</li> </ul> </li> <li>4. Check if connector P9 (EXINB) on the panel circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>5. With the power turned off, separate connectors P9 (EXINB), and check if continuity between pins 10 and 11 in the connector on the harnesses is as follows: <ul style="list-style-type: none"> <li>• When feed plate home position sensor is activated, between pins 10 and 11 is short-circuited.</li> <li>• When feed plate home position sensor is not activated, between pins 10 and 11 is opened.</li> </ul> <ul style="list-style-type: none"> <li>* If the result of continuity test is not acceptable in either case, replace the feed plate home position sensor and its harness.</li> <li>* Even if the result of continuity test is acceptable, harness may be broken or short-circuited. It may appear when oscillation occurs.</li> </ul> </li> <li>6. If there is still an error even after replacing the feed plate home position sensor and the sensor relay cord (attached to the control circuit board and the relay connector), replace the control circuit board.</li> </ol>
E-07 E-37 E-67	<ol style="list-style-type: none"> <li>1. Make sure that the valve unit of the indexer is supplied with air or wiring is correct.</li> <li>2. Check and adjust the position of the left feed plate driving sensor (limit switch L) of the indexer. (Refer to the instruction manual.)</li> <li>3. Of connectors relayed to head harness, check if the harness for the feed plate home position sensor is correctly attached to the connector for the <math>\theta</math>-axis home position sensor. (The white harness should be attached to pin 10, and the black one to pin 15. Refer to the instruction manual.) <ul style="list-style-type: none"> <li>* Check if there is a harness in the control box that is broken or short-circuited.</li> </ul> </li> <li>4. Check if connector P9 (EXINB) on the panel circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>5. With the power turned off, separate connectors P9 (EXINB), and check if continuity between pins 1 and 2 in the connector on the harnesses is as follows: <ul style="list-style-type: none"> <li>• When left feed plate driving sensor is activated, between pins 1 and 2 is short-circuited.</li> <li>• When left feed plate driving sensor is not activated, between pins 1 and 2 is opened.</li> </ul> <ul style="list-style-type: none"> <li>* If the result of continuity test is not acceptable in either case, replace the left feed plate driving sensor and its harness.</li> <li>* Even if the result of continuity test is acceptable, harness may be broken or short-circuited. It may appear when oscillation occurs.</li> </ul> </li> <li>6. If there is still an error even after replacing the left feed plate driving sensor and the sensor relay cord (attached to the control circuit board and the relay connector), replace the control circuit board.</li> </ol>
E-09	<ol style="list-style-type: none"> <li>1. Connect the specification harness that conforms to machine's specification.</li> <li>2. Check if all pins are inserted into the connector of the specification harness.</li> <li>3. Check if the connector for the specification harness which is outside the control box is securely inserted.</li> <li>4. Check if connector P4 (TYPE) on the panel circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>5. Replace the type cord (harness connected to panel circuit board and the control box).</li> <li>6. Replace the panel circuit board with a new one.</li> </ol>
E-10 E-40 E-76	<ol style="list-style-type: none"> <li>1. Turn the pulley manually to set the needle to its highest position. ("UP" will appear on the display.)</li> <li>2. Check if connector P2 (SYNCHRO) is securely inserted and any harness is broken or short-circuited.</li> <li>3. With connector P2 (SYNCHRO) inserted into the PCB in the input check mode, check the voltage across pins 4 and 5 from the harness as follows: <ul style="list-style-type: none"> <li>• Considering pin 5 as 0V (standard), measure the voltage of pin 4 while turning the pulley manually. It is normal if the voltage is 0V with the needle at its highest position, and 4 - 5V everywhere but that position.</li> </ul> <ul style="list-style-type: none"> <li>* If the result is not acceptable, check how the magnet of the pulley is attached, and if it is correct, replace the synchronizer.</li> <li>* Even if the result is acceptable, the harness may be broken or short-circuited. It may appear when oscillation occurs.</li> </ul> </li> <li>4. When there is no problem with the above, replace the control circuit board.</li> </ol>

Error code	Countermeasure
E-12 E-42	<ol style="list-style-type: none"> <li>1. Position knife correctly.</li> <li>2. Make sure that knife driving valve is supplied with air and wiring is correct.</li> <li>3. Make sure that knife ON sensor and neighboring parts are attached correctly.</li> <li>4. Check if connector P3 (HEAD) of the control circuit board is inserted and if any harness is broken or short-circuited.</li> <li>5. Replace knife ON sensor and its harness.</li> <li>6. Replace the control circuit board with a new one.</li> </ol>
E-15 E-45 E-75	<ol style="list-style-type: none"> <li>1. Check if cylinder is in place. (Check if air is supplied normally, position is correct, nothing caught on the cylinder, and so on.)</li> <li>2. Check if connector P8 (EXINA) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>3. Replace lower thread trimming OFF sensor and its harness.</li> <li>4. Replace the control circuit board with a new one.</li> </ol>
E-26	<ol style="list-style-type: none"> <li>1. Check if connector P20 (PER) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>2. Check if connector P2 (PER) on the power supply circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>3. Replace the power supply circuit board with a new one.</li> <li>4. Replace the control circuit board with a new one.</li> </ol>
E-27	<ol style="list-style-type: none"> <li>1. Check if ROM chips of the control circuit board or panel circuit board are correctly inserted. (Check position, orientation, lead clinching, etc.)</li> <li>2. Replace the panel circuit board with a new one.</li> <li>3. Replace the control circuit board with a new one.</li> </ol>
E-28	<ol style="list-style-type: none"> <li>1. Check if ROM chips of the control circuit board or panel circuit board are correctly inserted. (Check position, orientation, lead clinching, etc.)</li> <li>2. Check if connector P1 (MAIN) on the panel circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>3. Check if connector P18 (PANEL) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Replace the panel circuit board with a new one.</li> <li>5. Replace the control circuit board with a new one.</li> </ol>
E-29	<ol style="list-style-type: none"> <li>1. Make sure that ROM chips of the control circuit board are correctly inserted. (Check position, orientation, lead clinching, etc.)</li> <li>2. Replace the control circuit board with a new one.</li> </ol>
E-31	<ol style="list-style-type: none"> <li>1. If you want to select other available data, press reset switch.</li> <li>2. To avoid this error, create a program whose specification conforms to the machine's specification, or change the machine's specification so as to conform to the program specification.</li> </ol>
E-38 E-68	<ol style="list-style-type: none"> <li>1. Check if air is supplied to valve unit of the indexer or wiring is correct.</li> <li>2. If the cloth feed bar of the indexer works correctly, skip to step 5 below. (This is because the place to be checked is different if the failure is with the sensor or driving system.)</li> <li>3. Check if the valve harness of the indexer is connected to the indexer relay cord and connector P21 (EXOUT) on the control circuit board. (Check if there is no pin that is out of place in either of indexer relay connector and P21.)</li> <li>4. Check if feed plate works in output check.</li> <li>5. Of connectors relayed to head harness, check if the harness for the right feed plate driving sensor (cylinder sensor) is correctly attached to the connector for the <math>\theta</math>-axis home position sensor. (The brown harness should be attached to pin 4, the black one to pin 9, and the blue one to pin 14. Refer to the instruction manual.)</li> <li>* Check if there is no harness in the control box that is broken or short-circuited.</li> <li>6. Check if connector P9 (EXINB) is securely inserted and if any harness is broken or short-circuited.</li> <li>7. Replace the right feed plate driving sensor and its harness.</li> <li>8. Replace the control circuit board with a new one.</li> </ol>
E-50	<ol style="list-style-type: none"> <li>1. Turn power off and then on again. Press start switch to search home position again.</li> <li>2. Make sure that X-axis home position sensor and X-axis home position sensor magnet are correctly attached.</li> <li>3. Check if connector P1 (ORG) on the control circuit board is correctly inserted and if any harness is broken or short-circuited.</li> <li>4. Replace X-axis home position sensor and its harness.</li> <li>5. Replace the control circuit board with a new one.</li> </ol>

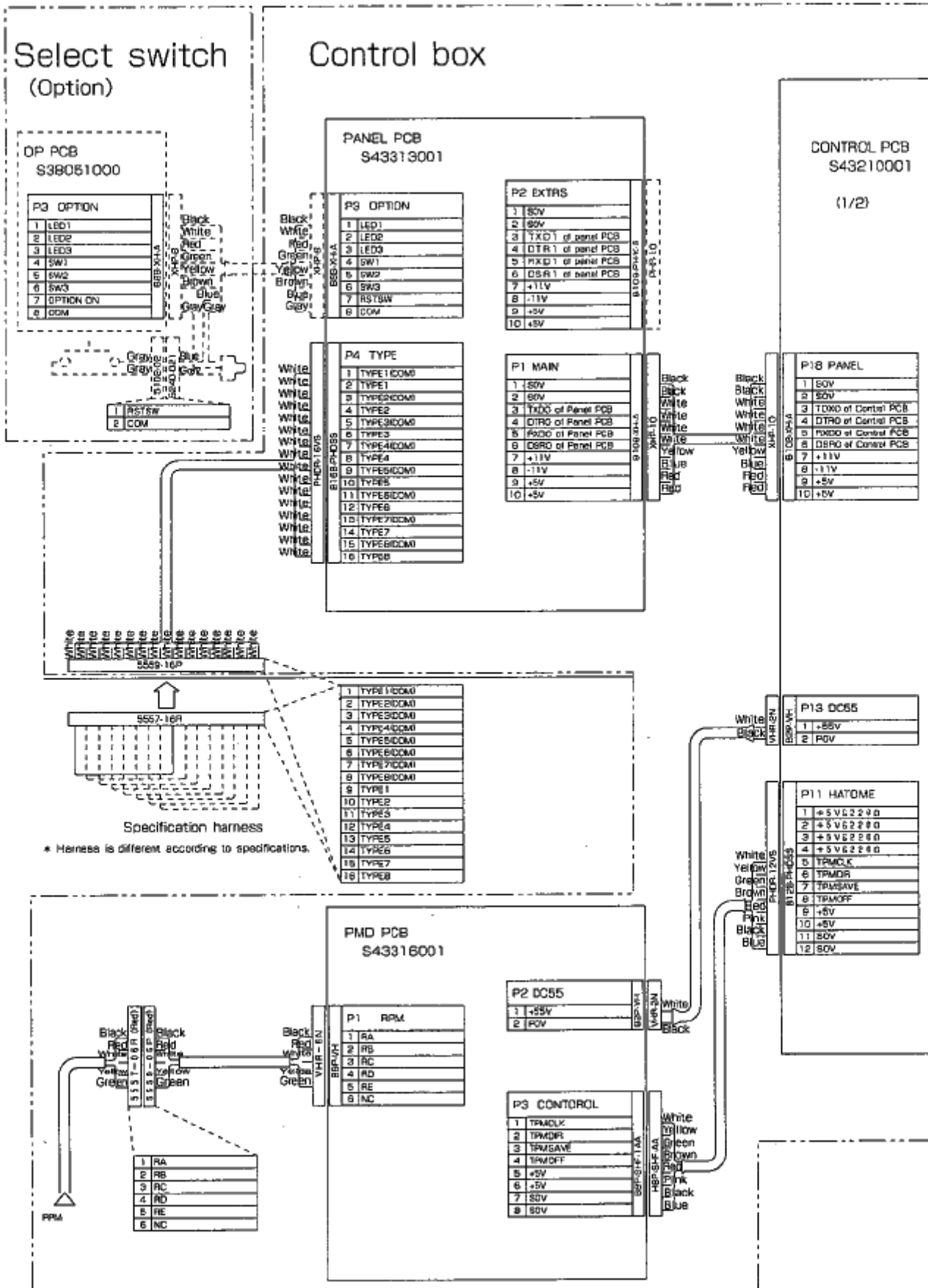
Error code	Countermeasure
E-51	<ol style="list-style-type: none"> <li>1. Turn power off and then on again. Press start switch to search home position again.</li> <li>2. Make sure that Y-axis home position sensor and Y-axis home position sensor magnet are correctly attached.</li> <li>3. Check if connector P1 (ORG) on the control circuit board is correctly inserted and if any harness is broken or short-circuited.</li> <li>4. Replace Y-axis home position sensor and its harness.</li> <li>5. Replace the control circuit board with a new one.</li> </ol>
E-52	<ol style="list-style-type: none"> <li>1. Turn power off and then on again. Press start switch to search home position again.</li> <li>2. Make sure that <math>\theta</math>-axis home position sensor and <math>\theta</math>-axis home position sensor magnet are correctly attached.</li> <li>3. Check if the <math>\theta</math>-axis home position sensor pulley is loosened.</li> <li>4. Of connectors relayed to head harness, check if the harness for the <math>\theta</math>-axis home position sensor is correctly attached to the connector for the <math>\theta</math>-axis home position sensor. (The brown harness should be attached to pin 1, the black one to pin 6, and the blue one to pin 11. Refer to the instruction manual.) <ul style="list-style-type: none"> <li>* Check if there is a harness in the control box that is broken or short-circuited.</li> </ul> </li> <li>5. Check if connector P9 (EXINB) on the control circuit board is correctly inserted and if any harness is broken or short-circuited.</li> <li>6. Replace the <math>\theta</math>-axis home position sensor and its harness with a new one.</li> <li>7. Replace the control circuit board with a new one.</li> </ol>
E-59	<ol style="list-style-type: none"> <li>1. Turn on the power again.</li> <li>2. Make sure that ROM chips of the panel circuit board are correctly inserted. (Check position, orientation, lead clinching, etc.)</li> <li>3. Initialize memory.</li> <li>4. Replace the panel circuit board with a new one.</li> </ol>
E-60	<ol style="list-style-type: none"> <li>1. This is not an error. This code indicates machine operation is being suspended due to emergency stop.</li> <li>2. Refer to the instruction manual, "Using the EMERGENCY STOP switch." (Press the reset switch to return to home position, and the start switch to resume sewing.)</li> </ol>
E-70	<ol style="list-style-type: none"> <li>1. Turn the pulley manually to see if the upper shaft is not locked.</li> <li>2. In input mode, turning the pulley manually, check the machine detects needle up signal. If not, refer to E10. Even if it does, synchronizer harness may be broken or short-circuited. It may appear when oscillation occurs.</li> <li>3. With the power turned off, separate connectors P15 (DC300) on the control circuit board, and check if between pins 1 and 2 in the connector on the board is short-circuited. If it is short-circuited, replace the control circuit board. At this time, if fuse No.2 on the power supply circuit board has been blown, replace it.</li> </ol>
E-71	Refer to E70. (In input mode, check if the machine detects needle down signal.)
E-72	<ol style="list-style-type: none"> <li>1. If the knife works correctly, refer to E12. If not, proceed the following steps to check the knife driving system. (This is because the place to be checked is different if the failure is with the sensor or driving system.)</li> <li>2. Make sure that air is supplied to knife valve unit.</li> <li>3. Check if there is a broken valve cord around valve unit.</li> <li>4. Check if connector P4 (AIR) of the control circuit board is correctly inserted and if valve cord is broken or short-circuited.</li> <li>5. Replace valve cord with a new one.</li> <li>6. Replace valve unit with a new one.</li> <li>7. Replace the control circuit board with a new one.</li> </ol>
E-77	Refer to E70. (In input mode, check if the machine detects synchronizer signal.)

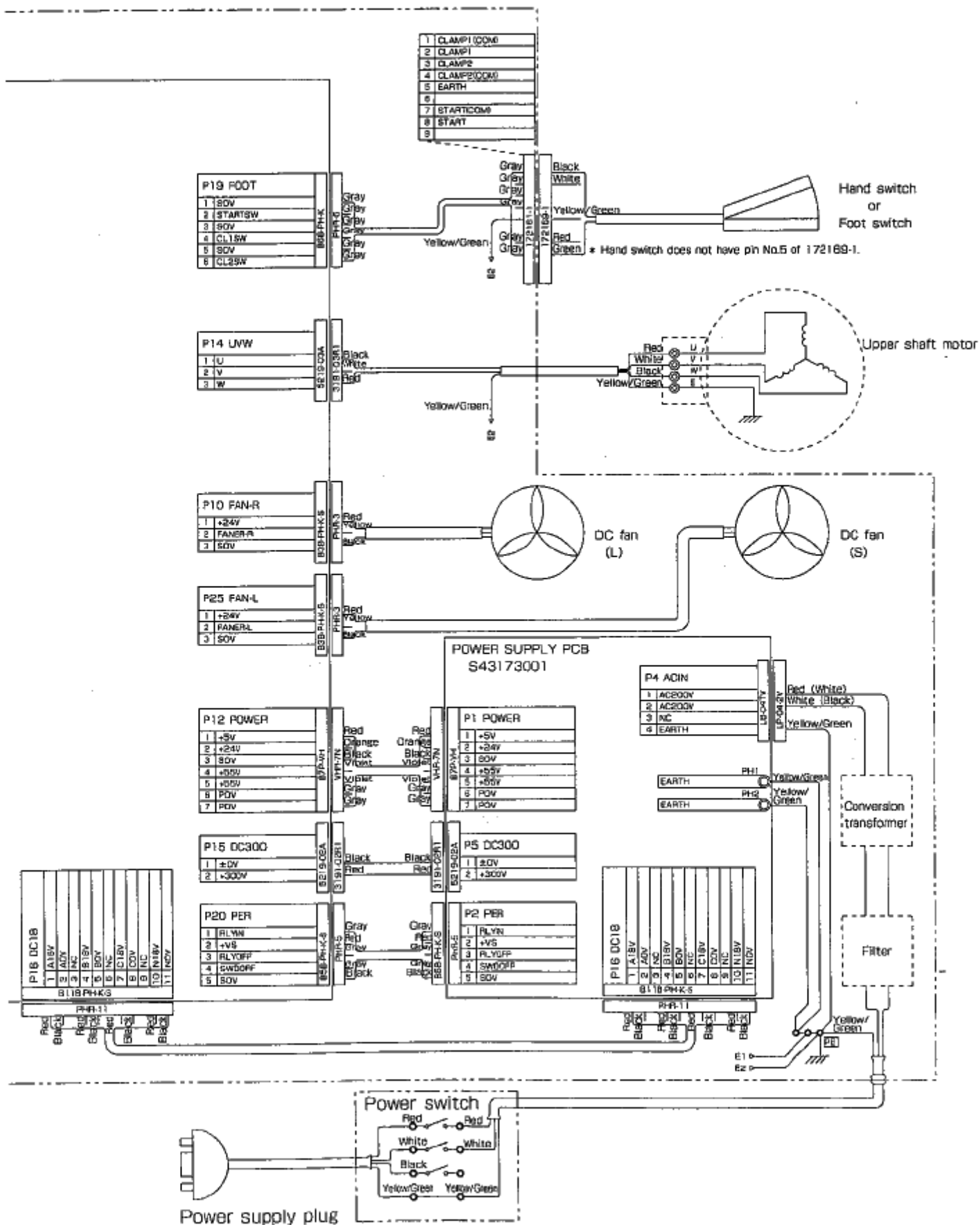


Error code	Countermeasure
E-80	<ol style="list-style-type: none"> <li>1. If X-axis pulse motor works, refer to E50. If not, proceed with the following steps to examine the driving system of the X-axis pulse motor. (This is because the place to be checked is different if the failure is with the sensor or driving system.)</li> <li>2. With the power turned off, check if there is a loose screw in a belt or gear around the X-axis pulse motor and that the feed bracket can move to the left and right.</li> <li>3. Of the connectors relayed to the head harness, check if the connector for the X-axis pulse motor is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Check if connector P7 (XPM) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>5. While E80 is displayed, measure the voltage across pins 5 and 7 of connector P12 (POWER) without removing P12, from the harness, as follows: <ul style="list-style-type: none"> <li>• Considering pin 7 as 0V (standard), measure the voltage of pin 5. It is normal if the voltage is +55V. (Be careful not to touch any other place when measuring voltage.)</li> <li>* If the voltage is +55V, the cause of the error is the X-axis pulse motor or its harness is broken.</li> <li>* If the voltage is not +55V, turn off the power, remove connector P12 (POWER), and then turn on the power again, measure the voltage across pins 5 and 7 in the harness with connector P1 (POWER) inserted in the same manner as above.</li> <li>• If the voltage is not +55V, replace the power supply circuit board.</li> <li>* If the voltage is +55V, the control circuit board or PMD circuit board for <math>\theta</math>-axis may be damaged or X-, Y-, or <math>\theta</math>-axis pulse motor or its harness may be short-circuited.</li> </ul> </li> </ol>
E-81	<ol style="list-style-type: none"> <li>1. If the Y-axis pulse motor works, refer to E51. If not, proceed the following steps to examine the driving system of Y-axis pulse motor. (This is because the place to be checked is different if the failure is with the sensor or driving system.)</li> <li>2. With the power turned off, check if there is a loose screw in a belt or gear around Y-axis pulse motor and if the feed bracket can move back and forth.</li> <li>3. Of the connectors relayed to the head harness, check if the connector for the Y-axis pulse motor is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Check if connector P6 (YPM) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>5. While E81 is displayed, measure the voltage across pins 5 and 7 of connector P12 (POWER) on the control circuit board without removing P12, from the harness, as follows: <ul style="list-style-type: none"> <li>• Considering pin 7 as 0V (standard), measure the voltage of pin 5. It is normal if the voltage is +55V. (Be careful not to touch any other place when measuring voltage.)</li> <li>* If the voltage is +55V, the cause of the error is the Y-axis pulse motor or its harness is broken.</li> <li>* If the voltage is not +55V, turn off the power, remove connector P12 (POWER) from the control circuit board, and then turn on the power again, and measure the voltage across pins 5 and 7 in the harness with connector P1 (POWER) inserted in the power supply circuit board in the same manner as above.</li> <li>• If the voltage is not +55V, replace the power supply circuit board.</li> <li>* If the result is acceptable, the control circuit board or PMD circuit board for <math>\theta</math>-axis may be damaged or X-, Y-, or <math>\theta</math>-axis pulse motor or its harness may be short-circuited.</li> </ul> </li> </ol>
E-82	<ol style="list-style-type: none"> <li>1. If the <math>\theta</math>-axis pulse motor works, refer to E52. If not, proceed the following steps to examine the driving system of <math>\theta</math>-axis pulse motor. (This is because the place to be checked is different if the failure is with the sensor or driving system.)</li> <li>2. With the power turned off, check if there is a loose screw in a belt or gear around <math>\theta</math>-axis pulse motor and if the feed bracket can move back and forth.</li> <li>3. Of the connectors relayed to the head harness, check if the connector for the <math>\theta</math>-axis pulse motor is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Check if connectors P1 (RPM), P2 (DC55), and P3 (CONTROL) on the PMD circuit board for the <math>\theta</math>-axis are securely inserted and if any harness is broken or short-circuited.</li> <li>5. Check if connectors P11 (HATOME) and P13 (DC55) on the control circuit board are securely inserted and if any harness is broken or short-circuited.</li> <li>6. While E82 is displayed, measure the voltage across pins 5 and 7 of connector P12 (POWER) on the control circuit board without removing P12, from the harness, as follows: <ul style="list-style-type: none"> <li>• Considering pin 7 as 0V (standard), measure the voltage of pin 5. It is normal if the voltage is +55V. (Be careful not to touch any other place when measuring voltage.)</li> <li>* If the voltage is +55V, the cause of the error is the <math>\theta</math>-axis pulse motor or its harness is broken.</li> <li>* If the voltage is not +55V, turn off the power, remove connector P12 (POWER), and then turn on the power again, and measure the voltage across pins 5 and 7 in the harness with connector P1 (POWER) inserted in the power supply circuit board in the same manner as above.</li> <li>• If the voltage is not +55V, replace the power supply circuit board.</li> <li>* If the result is acceptable, the control circuit board or PMD circuit board for <math>\theta</math>-axis may be damaged or X-, Y-, or <math>\theta</math>-axis pulse motor or its harness may be short-circuited.</li> </ul> </li> </ol>

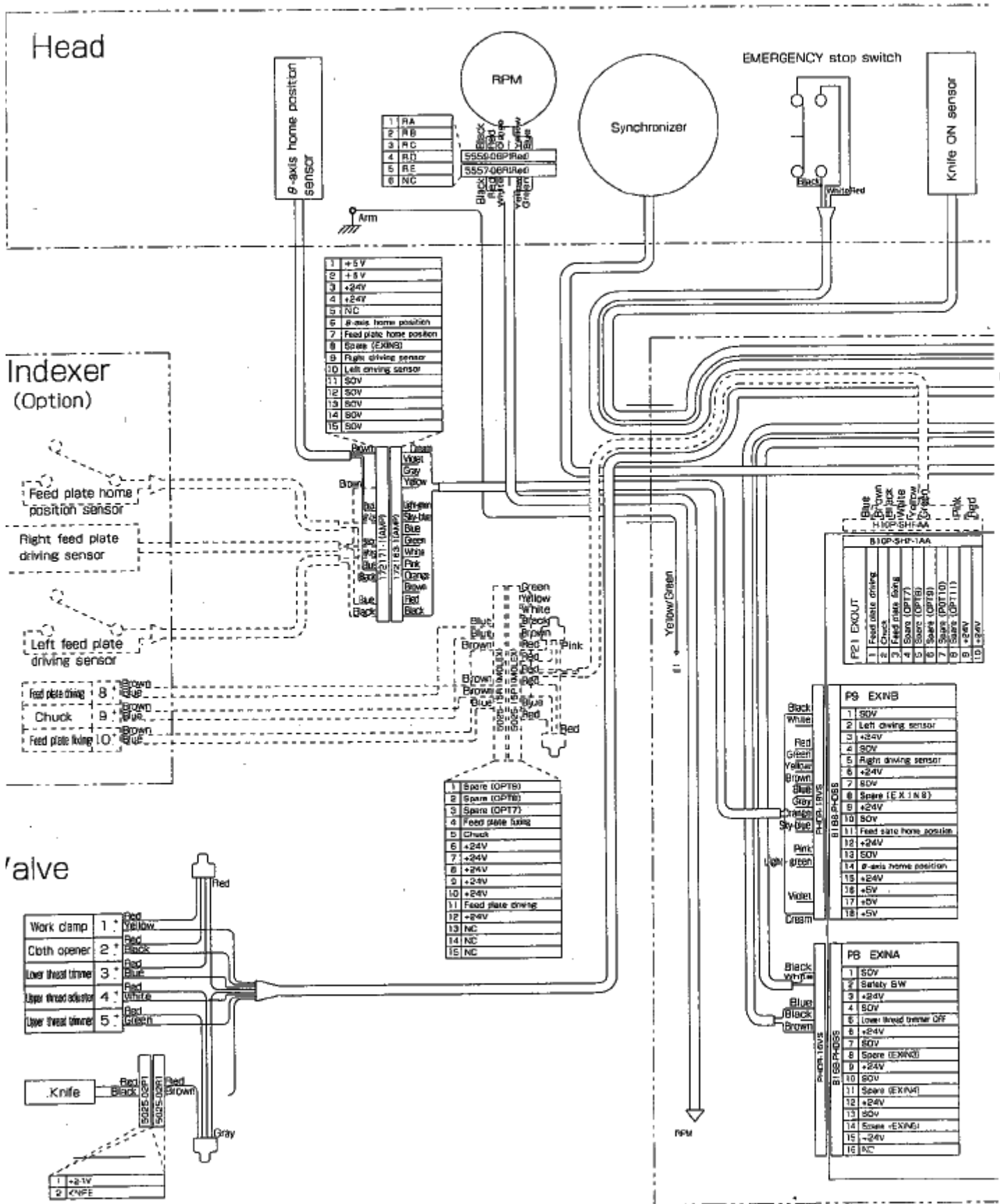
Error code	Countermeasure
E-90	<ol style="list-style-type: none"> <li>1. Check if connector P1 (MAIN) on the panel circuit board is securely inserted and if any connector is broken or short-circuited.</li> <li>2. Check if connector P18 (PANEL) on the control circuit board is securely inserted and if any connector is broken or short-circuited.</li> <li>3. Replace the panel circuit board with a new one.</li> <li>4. Replace the control circuit board with a new one.</li> </ol>
E-91	Refer to E70. (In input mode, check if the machine detects synchronizer signal.)
E-92	<ol style="list-style-type: none"> <li>1. Make sure that power supply voltage is the same as the specification voltage.</li> <li>2. If the conversion transformer is installed, check if terminals connections are correct.</li> <li>3. Check if connector P20 (PER) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Check if connector P2 (PER) on the power supply circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>5. Replace the power supply circuit board with a new one.</li> <li>6. Replace the control circuit board with a new one.</li> </ol>
E-93	<ol style="list-style-type: none"> <li>1. Make sure that the large cooling fan is normally running.</li> <li>2. Clean the large cooling fan. (Remove dust.)</li> <li>3. Check if connector P10 (FAN-R) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Replace the large cooling fan with a new one.</li> <li>5. Replace the control circuit board with a new one.</li> </ol>
E-94	<ol style="list-style-type: none"> <li>1. Make sure that the small cooling fan is normally running.</li> <li>2. Clean the small cooling fan. (Remove dust.)</li> <li>3. Check if connector P25 (FAN-L) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Replace the small cooling fan.</li> <li>5. Replace the control circuit board with a new one.</li> </ol>
E-95	<ol style="list-style-type: none"> <li>1. With the power turned off, check if the feed bracket moves to the left and right.</li> <li>2. Of the connectors relayed to the head harness, check if the connector for the X-axis pulse motor is securely inserted and if any harness is broken or short-circuited.</li> <li>3. Check if connector P7 (XPM) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Replace the X-axis pulse motor with a new one.</li> <li>5. Replace the control circuit board with new one.</li> </ol>
E-96	<ol style="list-style-type: none"> <li>1. With the power turned off, check if the feed bracket moves back and forth smoothly.</li> <li>2. Of the connectors relayed to the head harness, check if the connector for the Y-axis pulse motor is securely inserted and if any harness is broken or short-circuited.</li> <li>3. Check if connector P6 (YPM) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Replace the Y-axis pulse motor with a new one.</li> <li>5. Replace the control circuit board with new one.</li> </ol>
E-97	<ol style="list-style-type: none"> <li>1. Make sure that the control box is normally ventilated.</li> <li>2. Clean the filter of the air intake. (Remove dust.)</li> <li>3. Clean the small and large cooling fans. (Remove dust.)</li> <li>4. Make sure that cooling fans are attached correctly. <ul style="list-style-type: none"> <li>• Large cooling fan: The wind blows toward the control circuit board and the PMD circuit board for <math>\theta</math>-axis.</li> <li>• Small cooling fan: The wind blows in the direction that it can discharge the air in the control box.</li> </ul> </li> </ol>
E-98	<ol style="list-style-type: none"> <li>1. Check if connector P20 (PER) on the control circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>2. Check if connector P2 (PER) on the power supply circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>3. Replace the power supply circuit board with a new one.</li> </ol>
E-99	<ol style="list-style-type: none"> <li>1. Check if connectors P12 (POWER) and P13 (DC55) on the control circuit board are securely inserted and if any harness is broken and short-circuited.</li> <li>2. Check if connector P1 (POWER) on the power supply circuit board is securely inserted and if any harness is broken or short-circuited.</li> <li>3. Check if connector P2 (DC55) on the PMD circuit board for <math>\theta</math>-axis is securely inserted and if any harness is broken or short-circuited.</li> <li>4. Replace the power supply circuit board with a new one.</li> <li>5. Replace the PMD circuit board for <math>\theta</math>-axis with a new one.</li> <li>6. Replace the control circuit board with a new one.</li> </ol>

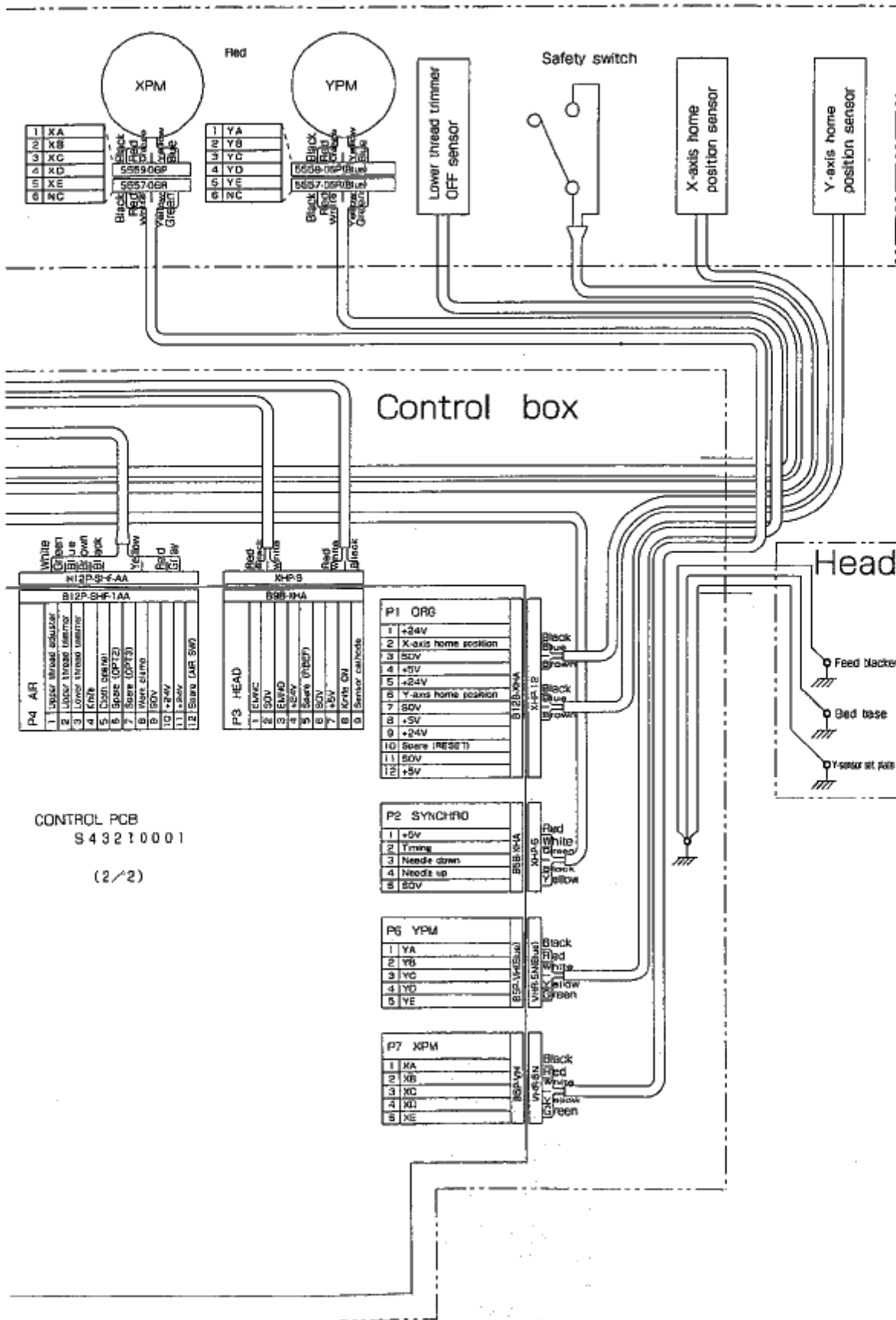
7-6. Control circuit block diagram (1)





7-7. Control circuit block diagram (2)





**brother.**



**SERVICE MANUAL**

**BROTHER INDUSTRIES,LTD. NAGOYA,JAPAN**

---

Printed in Japan

118-981  
18070743 H  
1998.09. ①