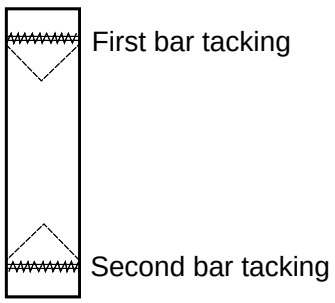
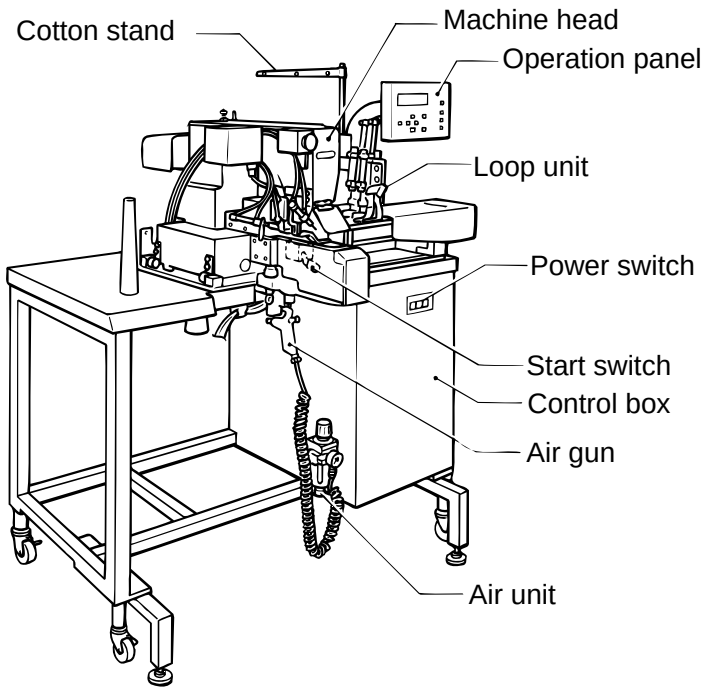
# CONTENTS

# 1. PART NAMES AND SPECIFICATIONS

## 1-1. Part names



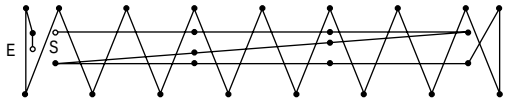
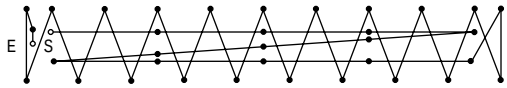
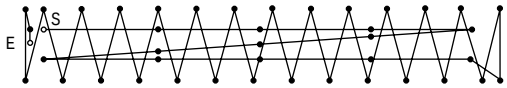




## 1-2. Specifications

| | |
|---|---|
| Max. sewing speed | 2,100 spm |
| Stitch length | Bar tacking height 1 - 3 mm bar tacking width 7 - 22 mm |
| No. of stitches | 29 , 36 , 43 needle |
| Rotary hook | Half rotation, double hook |
| Belt loop length | 48 - 78 mm (finished length) |
| Belt loop width | 9 - 16 mm (V cut) 9 - 20 mm (Flat cut) |
| Stitch interval | 40 - 70 mm |
| Belt loop thickness | 1 - 3 mm |
| Needle | DP×17NY#19 - 21 |
| Loop cutting | Flat cut, V cut (selectable) |
| Power supply | 3 phase 220V, 380V, 400V, 415V, 600VA |
| Air pressure | 0.5MPa (5kg/cm$^2$) |
| Weight | 205kg (220V), 230kg (380V, 400V, 415V) |
| Dimensions | W 1100 mm L 837 mm H 1250 - 1530 mm |
| Table height | 1000 - 1150 mm |
| Stitch length | 0.1- 10mm |

# 1-3.Program list

・The patterns given in the table below (pattern No. 1 - No. 3) are pre-programmed patterns which you can select and use. (Any pattern can be selected and used as long as you make sure that it is within the work clamp and feed plate in size.)

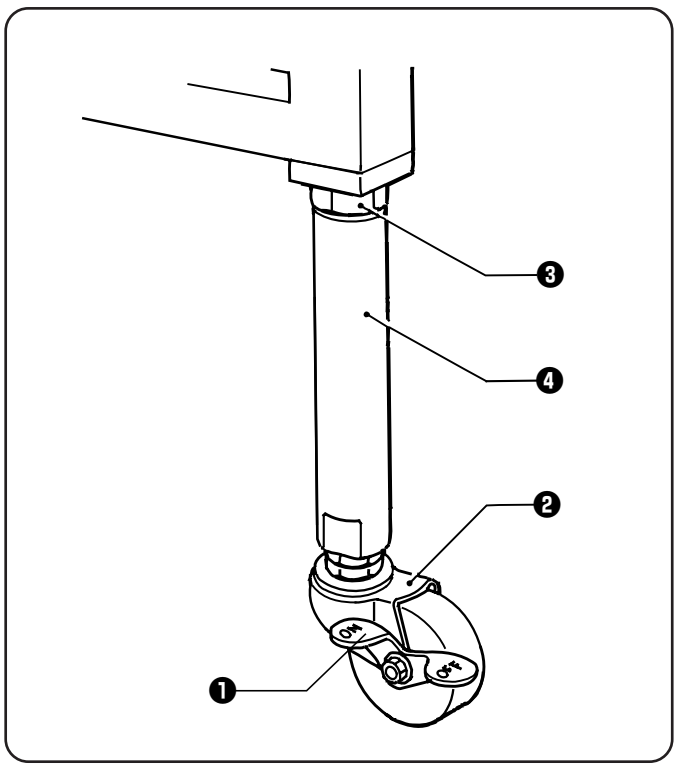
| Use | Program No, | Sewing pattern | No.of stitches | Standard bar tacking length | Standard bar tacking width |
|---|---|---|---|---|---|
| For denim | 01 |  | 29 | 16mm | 3mm |
| | 02 |  | 36 | 20mm | 3mm |
| | 03 |  | 43 | 20mm | 3mm |

# 2. PREPARATION

## ⚠ CAUTION

- 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 205 kg. The installation should be carried out by two or more people.
- 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.
- 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.

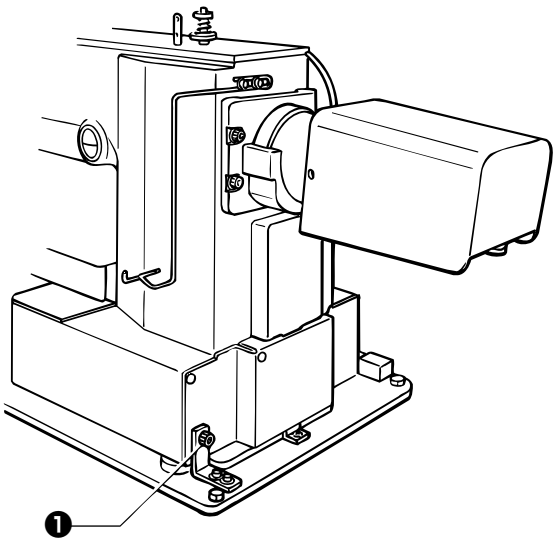
## 2-1. Installing the machine




1. Push the ON end of the lever ❶ down to secure the caster ❷.
2. The machine can be moved by pushing down the OFF end lever ❶.
3. Loosen the nut ❸ and turn the adjusting screw ❹ to adjust the height of the base.

NOTE:
After adjusting, securely tighten the nut ❸.

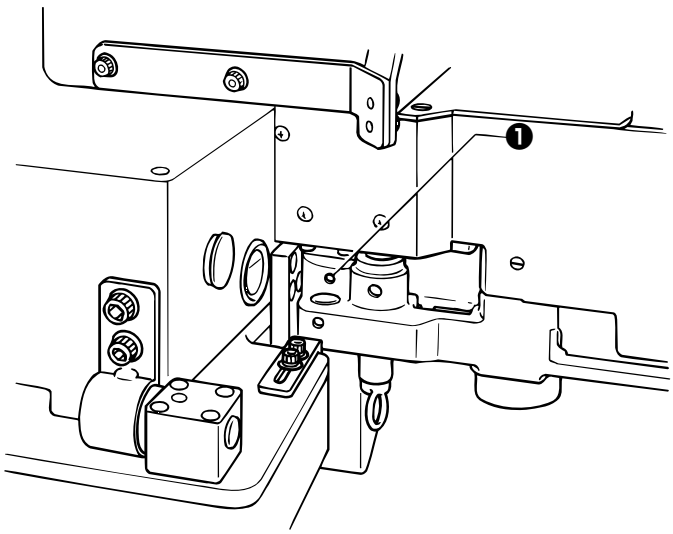
## 2-2. Removing the machine head fixing bolt




Remove the machine head fixing bolt ❶ and nut.

NOTE: To ensure safety when moving the head, firsttighten the machine head fixing bolt ❶ before moving the machine head.

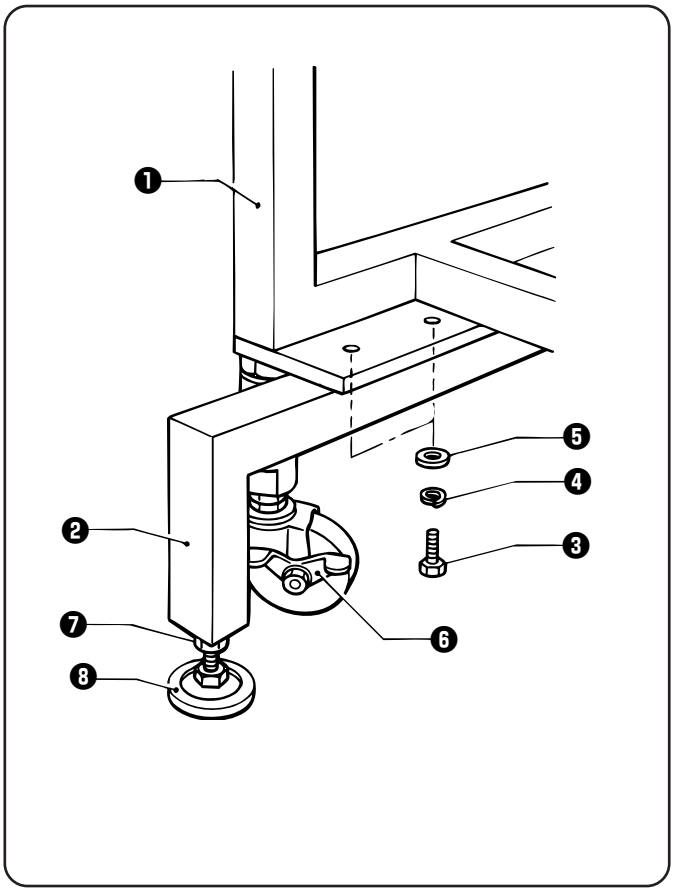
## 2-3. Removing the BM support slide shaft fixing screw




Removing the BM support slide shaft fixing screw ❶.

NOTE: To ensure safety when moving the machine head, tighten the BM support slide shaft fixing screw ❶ before moving the machine head.

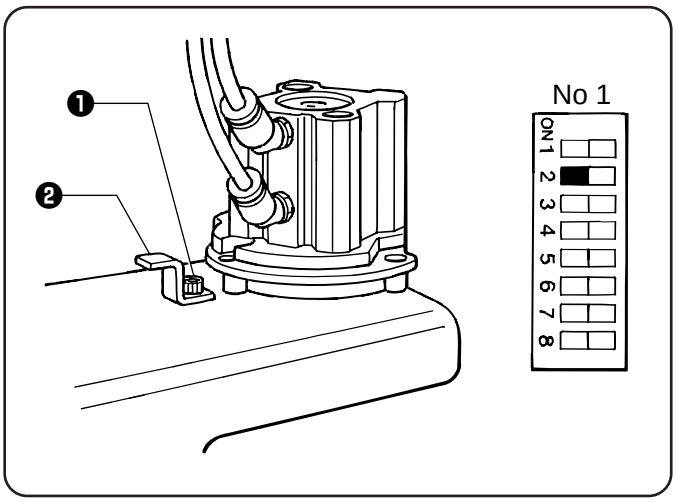
## 2-4. Installing the auxiliary legs




1. Remove the two auxiliary legs ❷ which are secured to leg frame ❶.
2. Re-install the two removed legs ❷ as shown in the illustration at left, and secure them with the bolts ❸, spring washers ❹ and flat washers ❺ which were removed before.
3. Loosen the nuts ❼ (in two places) and turn the level adjusters ❽ to adjust the height of the casters ❻ above the floor.

NOTE: After adjusting, securely tighten the nut ❼.

## 2-5. Checking the loop cutting




NOTE: At the time of shipment from the factory, the V-cutting cylinder is in the lock position (flat-end cutting).

■ Changing to V-shaped cutting

1. Remove the ❶, set the knife stopper ❷ to the position shown in the illustration at left, and then re-tighten the bolt ❶.
2. Check that DIP switch No.1-2 on the panel is set to “ON”.

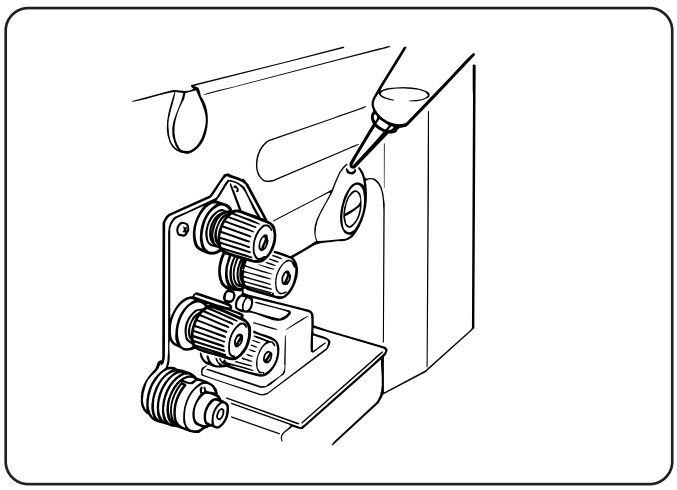
## 2-6. Lubrication

**CAUTION**

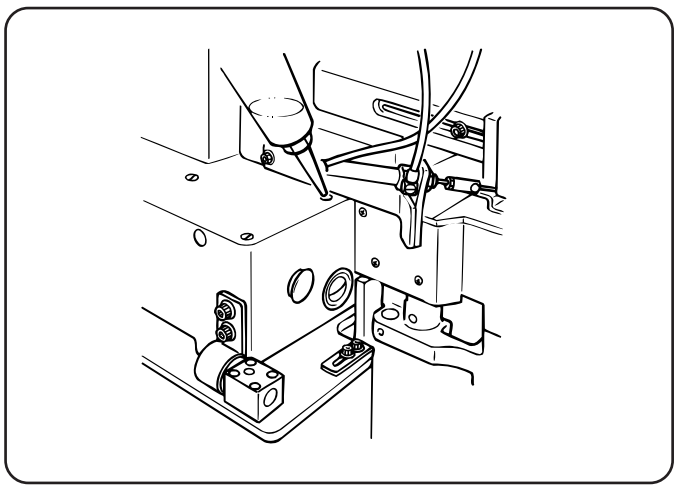
- Turn off the power switch before starting lubricating, otherwise the machine may operate if the start switch is depressed by mistake, which could result in injury.
- Be sure to wear protective goggles and gloves when handling the lubricating oil and grease, so that they do not get into your eyes or 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.

NOTE ・Fill the machine with oil when the oil level is down to about one-third full in the oil sight glass.
If oil is not added and the oil drops below this level, there is the danger that the machine may seize during operation.
・Be sure to let the machine operate for a while after adding the oil.
・Use only specified Brother oil (Nisseki Sewing Lube 10) for the machine oil.

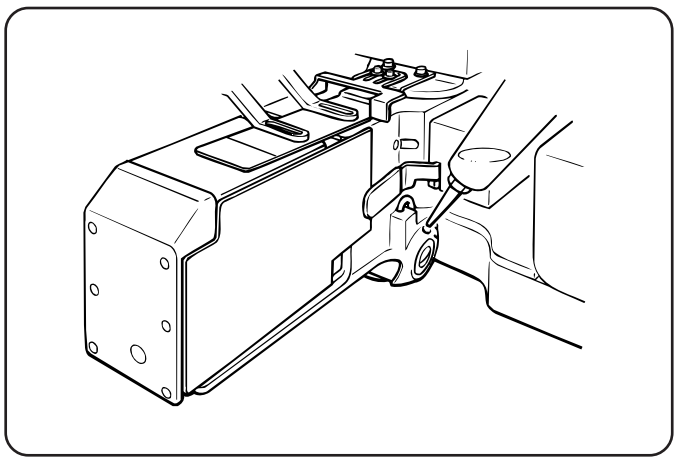
### 2-6-1. Machine mechanism



1. Fill the arm-side oil tank with oil.

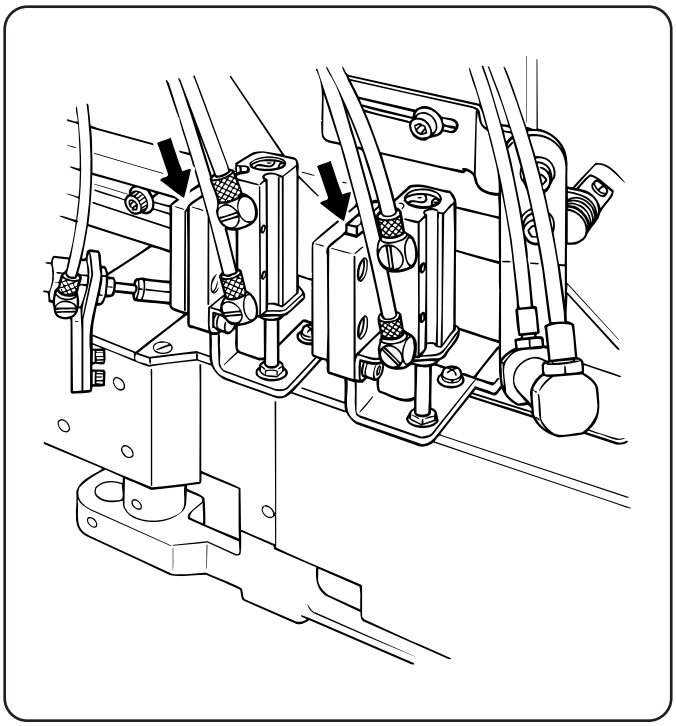


2. Fill the bed-side oil tank with oil.



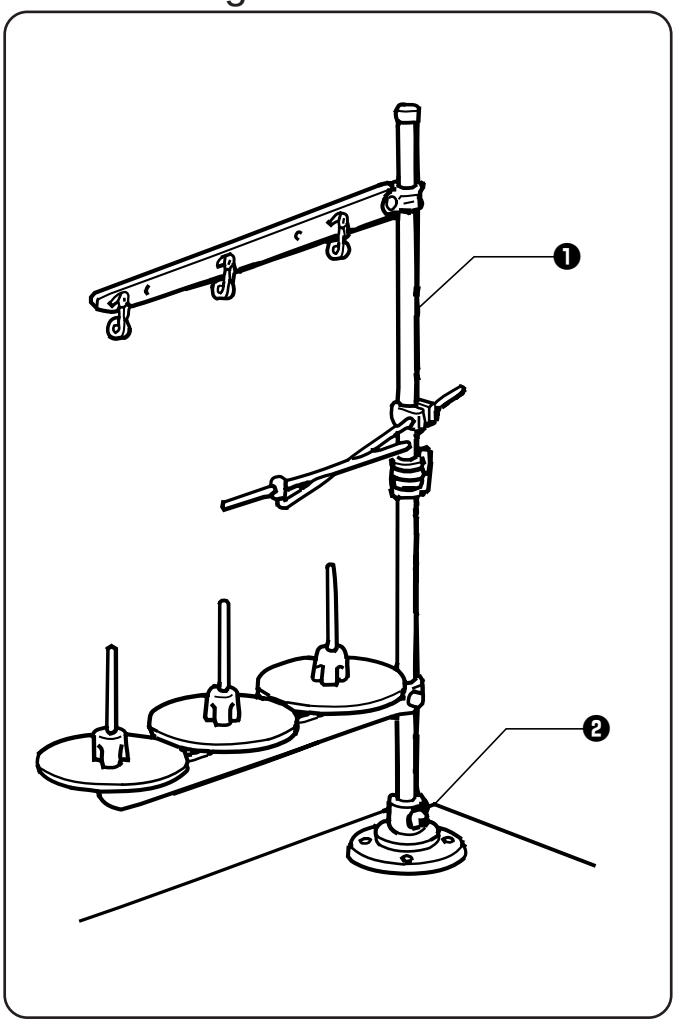
3. Fill the oil tank at the side of the lower shaft module base with oil.

### 2-6-2.Presser foot mechanism



Add 1 - 2 drops of sewing machine oil in the places shown by arrows in the illustration.

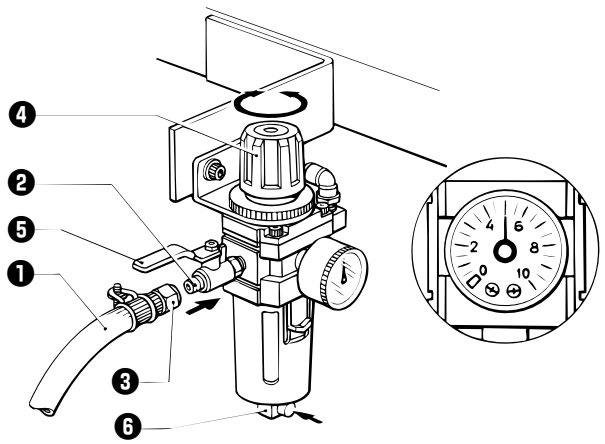
## 2-7.Installing the cotton stand




Assemble the cotton stand ❶ according to the directions given in the cotton stand instruction manual, and then install it to the work table.

NOTE: Securely tighten the screw ❷ so that the cotton stand does not move.

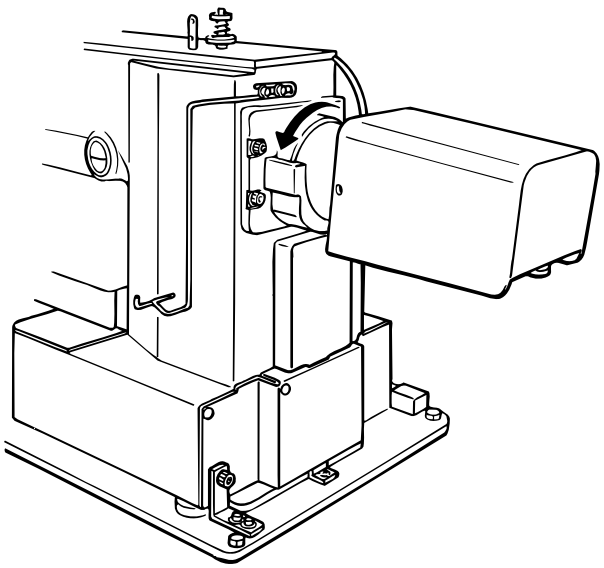
## 2-8. Using the air unit




1. Attach the air hose ❶ to the air unit connector ❷ with the nut ❸.
2. Use air pressure at 0.49 MPa - 0.54 MPa (5 - 5.5 kgf/cm$^2$).
   Pull up the cap at the top of the air unit ❹ and adjust the pressure. After adjustment, push the cap down to lock it.

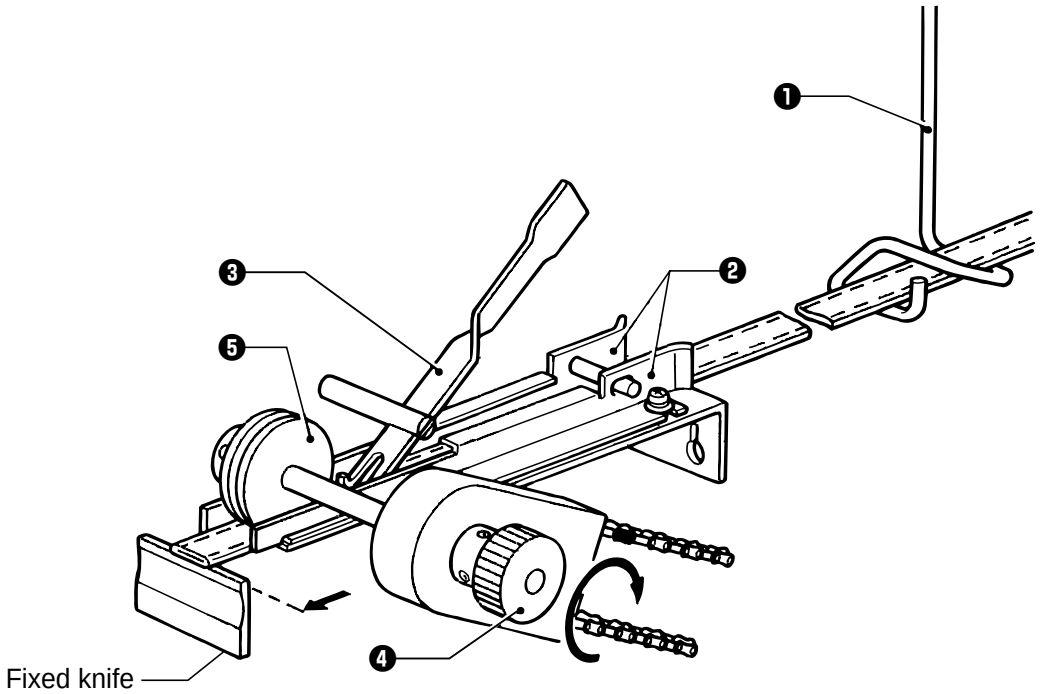
NOTE: Every day, close the air cock ❺ and push the drain cock ❻ to remove the water.

## 2-9. Pulley rotation direction



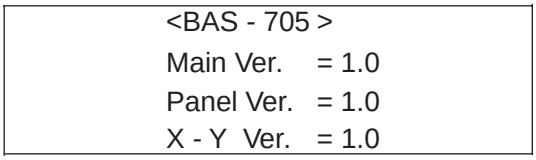
Turn on the power switch. Confirm that the pulley rotates in the direction of the arrow.

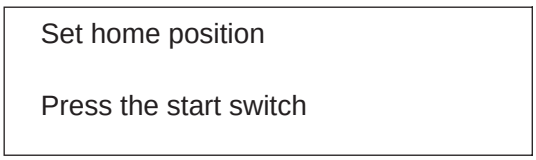
## 2-10. Threading belt loop

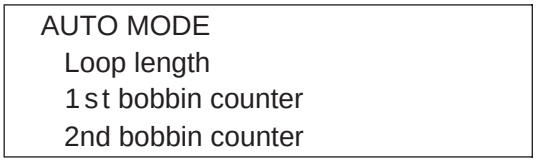


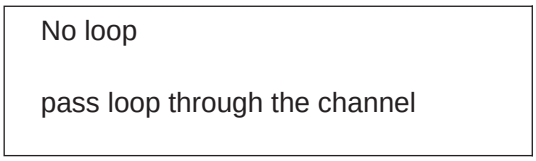

1. As shown in the figure above, thread a belt loop through the loop guide ❶, the channel guide ❷ and the actuator ❸ in that order.
2. While holding the knob ❹, raise the feed roller ❺ and insert the belt loop under the feed roller ❺.
3. Turn the knob ❹ in the direction of the arrow to fit the belt loop tip to the fixed knife.

# 2-11. Detal on standard data settings



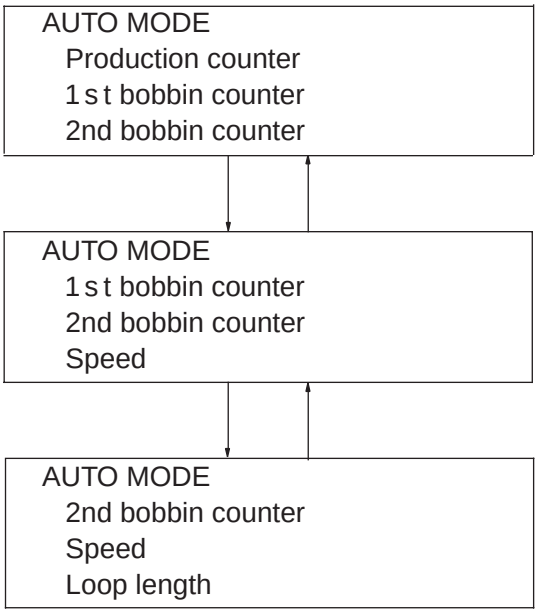




1. Check that the air is being supplied.
   * Refer to "2-7. Using the air unit" on page 8.
2. Turn on the power switch.
3. Press the START switch. The machine will then the home position for the upper shaft X-Y feed and the lower shaft.

NOTE:

- Wait for at least 10 seconds after turning off the power before turning it back on again. If you do not wait long enough, the error code "E-330"will appear on the display.
- If there is no belt loop in position under the ac tuator, the message shown at left will be displayed.
  If this happens, refer to "2-10. Passing through the belt loops" on page 9.

# 2-12. Checking the sewing data

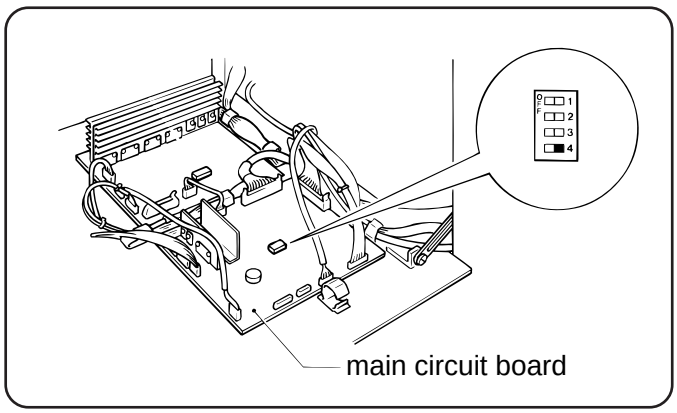



After the home position has been determined, press the SELECT switches (▲ and ▼). The screen will then start scrolling so that you can check the sewing data settings.

# 2-13. Initializing the sewing data

・Sewing data such as the bobbin thread counter and production counter settings are stored in a memory which has a battery backup.

・If the power is not turned on for a long period of time (approximately three weeks or more), the contents of the battery backup memory may become corrupted, causing the error code "E-160" to appear on the display when the machine is turned on.
If this happens, initialize the sewing data by following the procedure below.




1. Turn off the power switch.
2. Open the control box cover and set DIP switch No. 4 on the main circuit board to ON.
(Refer to "8-2. Main circuit board DIP switch funtions" on page 68.)

| |
|---|
| Initialized |
| Check sewing data |

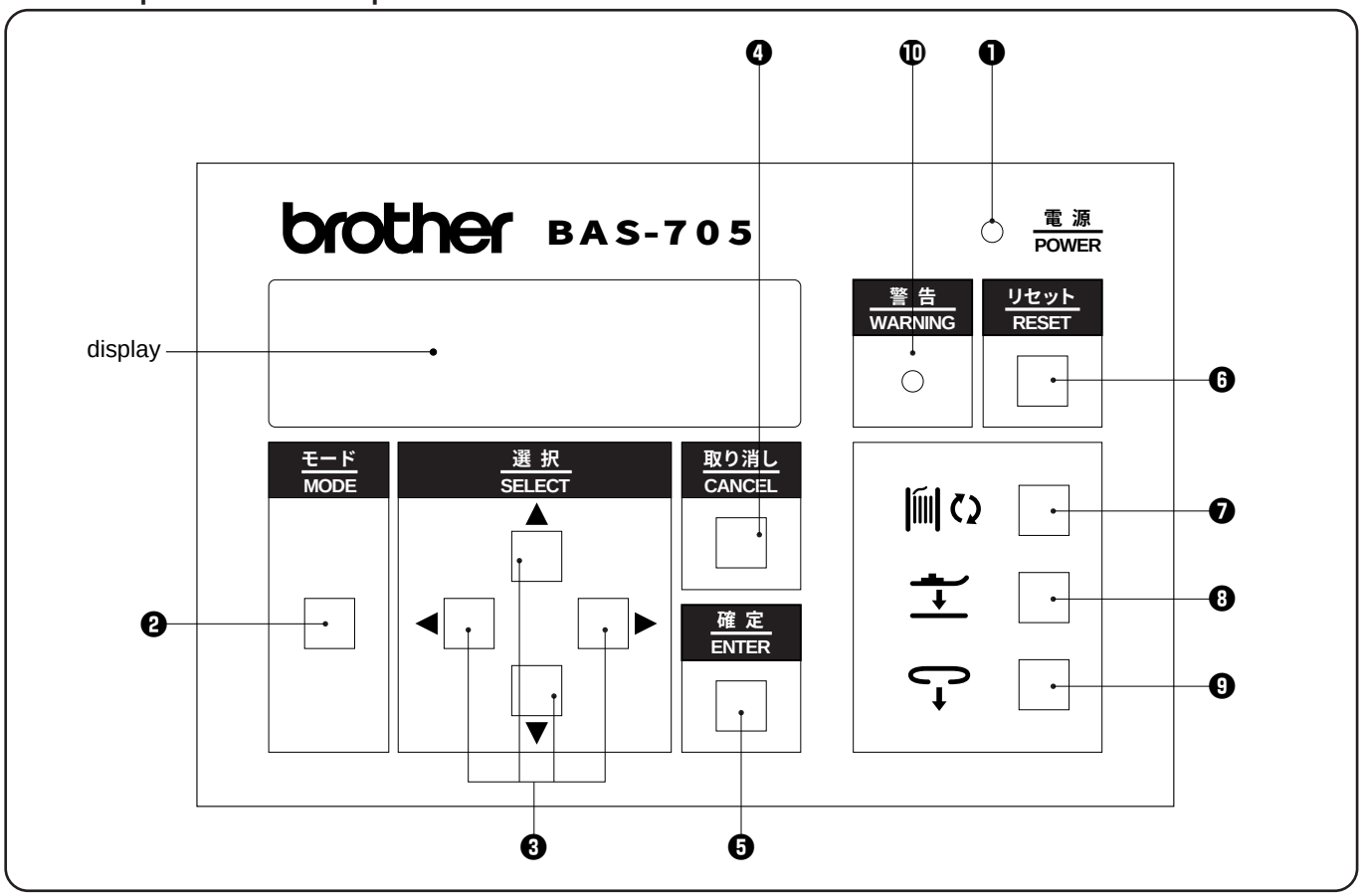
3. Turn on the power. After approximately 2 seconds have passed, "Initialized" will appear on the display.
4. Turn off the power switch, set DIP switch No. 4 on the main circuit board to ”OFF”, and then close the control box cover.

■ Sewing patterns ・・・・ 129 needle
■ Xscale・Yscale ・・・・・ 100% for all sewing patterns
■ Production counter ・・・ 0
■ 1st bobbin counter ・・・ 300
■ 2nd bobbin counter ・・ 300
■ Speed ・・・・・・・・・・ 2100 spm
■ Loop length ・・・・・・・ 100

NOTE:
・When the backup initialization is carried out, the sewing data values will be reset to the values shown at left.

# 3. PANEL OPERATION

## 3-1. Explanation of panel




❶ POWER indicator: When the power is turned on, the indicator lights to show that the power is on

❷ MODE switch: This switch is used to switch between AUTO mode, HEAD mode and PROGRAM mode.

❸ SELECT switch: During AUTO mode, the ▲ and ▼ SELECT switches are used to switch the contents of the display.
During PROGRAM mode and ADJUSTMENT mode, the SELECT switches are used to select items and to input settings.

❹ CANCEL switch: This switch is used to cancel the changing of a setting or to cancel the selection of an item.

❺ ENTER switch: This switch is used to accept changes made to any of the settings and selection of items.

❻ RESET switch: This switch is used to reset the machine when an error occurs, and to raise the presser foot when it has been lowered using the FOOT switch. In addition, it is used to lock a module which has been unlocked using the BOBBIN switch.

❼ BOBBIN switch: This switch is used to open a module when replacing a bobbin.

❽ FOOT switch: This switch is used to lower the presser foot when threading the bobbin thread.

❾ LOOP switch: This switch is used to set belt loops.

❿ WARNING indicator: This indicator illuminates when an error has occurred, and when the MODULE switch or FOOT switch has been pressed.

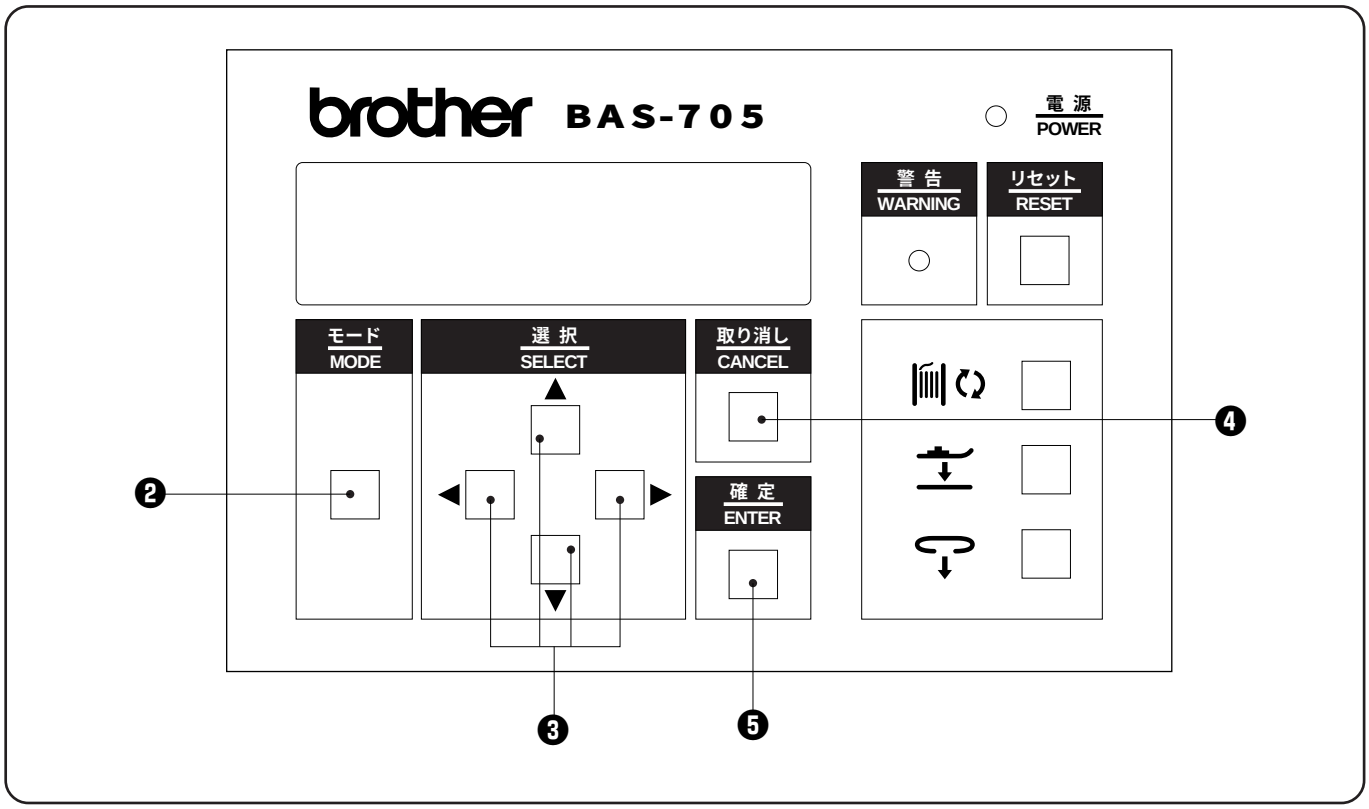
NOTE:
The machine will not start while the WARNING indicator is illuminated, even when the START switch is pressed. After turning on the power, press the START switch to determine the home position.

# 3-2. Data setting methods

PROGRAM mode

## 3-2-1. Setting the belt loop feeding-out length

- This sets the length of belt loop material to be fed out before it is cut.
- The length can be set to between 50 - 120 mm.




PROGRAM MODE
◆2nd bobbin counter
Speed
Loop length

PROGRAM MODE
2nd bobbin counter
Speed
◆Loop length

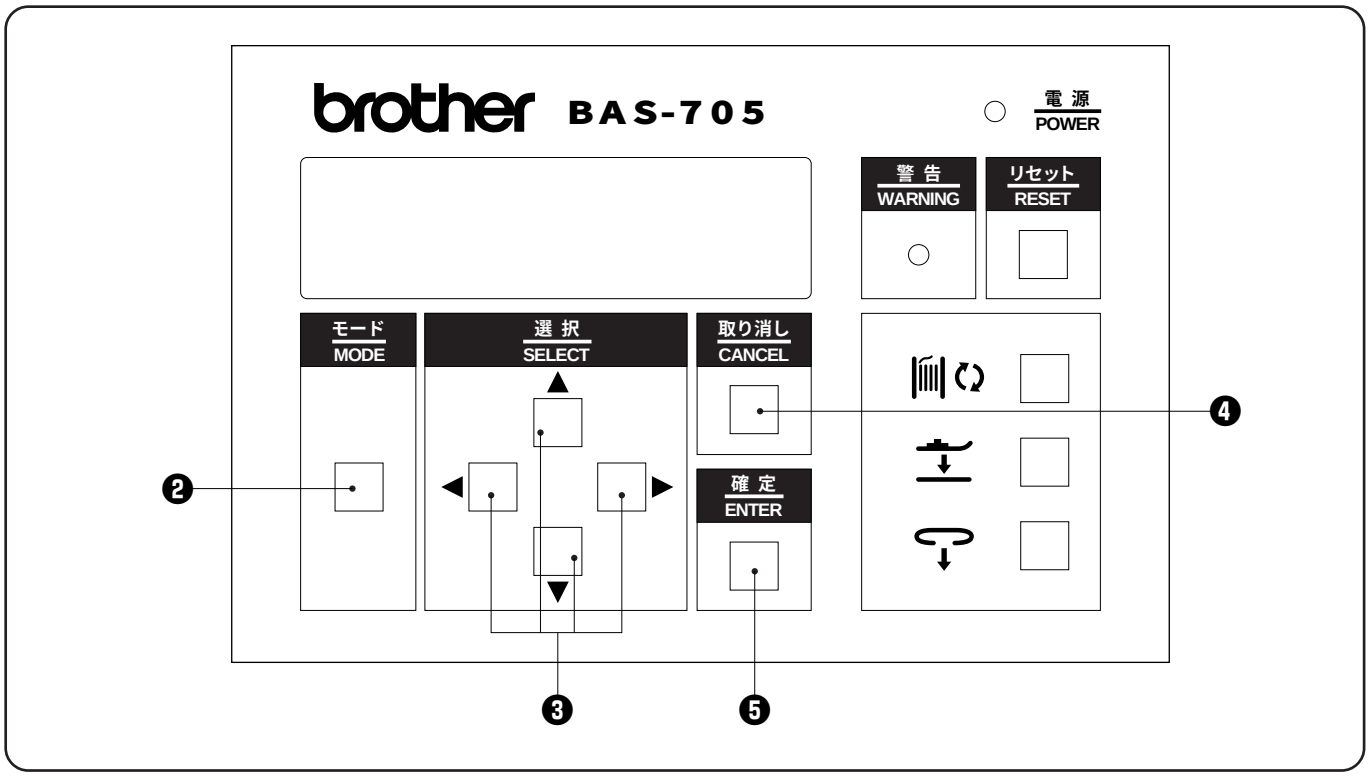
PROGRAM MODE
2nd bobbin counter
Speed
◆Loop length 1 0 0

PROGRAM MODE
2nd bobbin counter
Speed
◆Loop length 1 1 5

1. Press the MODE switch ❷ to select PROGRAM mode.
2. Use the ▲ and ▼ SELECT switches ❸ to move the pointer " ◆ " so that "Loop length" is selected.
3. While using the▶SELECT switch ❸to move the cursor "-", press the ▲and▼ SELECT switches ❸ to set the desired belt loop length.
   * If the CANCEL switch ❹ is pressed, the setting will remain at the previous length setting.
4. Press the ENTER switch ❺ to accept the new length setting. The cursor "-" will then disappear.

## 3-2-2. Setting the bobbin counter

- When the bobbin has been replaced, you need to set the number of bar tacking stitches that the new bobbin can be used for.
- The counter setting decreases by 1 each time a single bar tacking is sewn.
- The bobbin counter operation can also be disabled if required.
- The setting range is 0 - 999.




PROGRAM MODE
◆Production counter
1st bobbin counter
2nd bobbin counter

PROGRAM MODE
Production counter
◆1st bobbin counter
2nd bobbin counter

PROGRAM MODE
Production counter
◆1st bobbin counter 800
2nd bobbin counter

PROGRAM MODE
Production counter
◆1st bobbin counter 888
2nd bobbin counter

1. Press the MODE switch ❷ to select PROGRAM mode.

2. Use the ▲ and ▼ SELECT switches ❸ to move the pointer " ◆ " so that "1st bobbin counter" or "2nd bobbin counter" is selected.

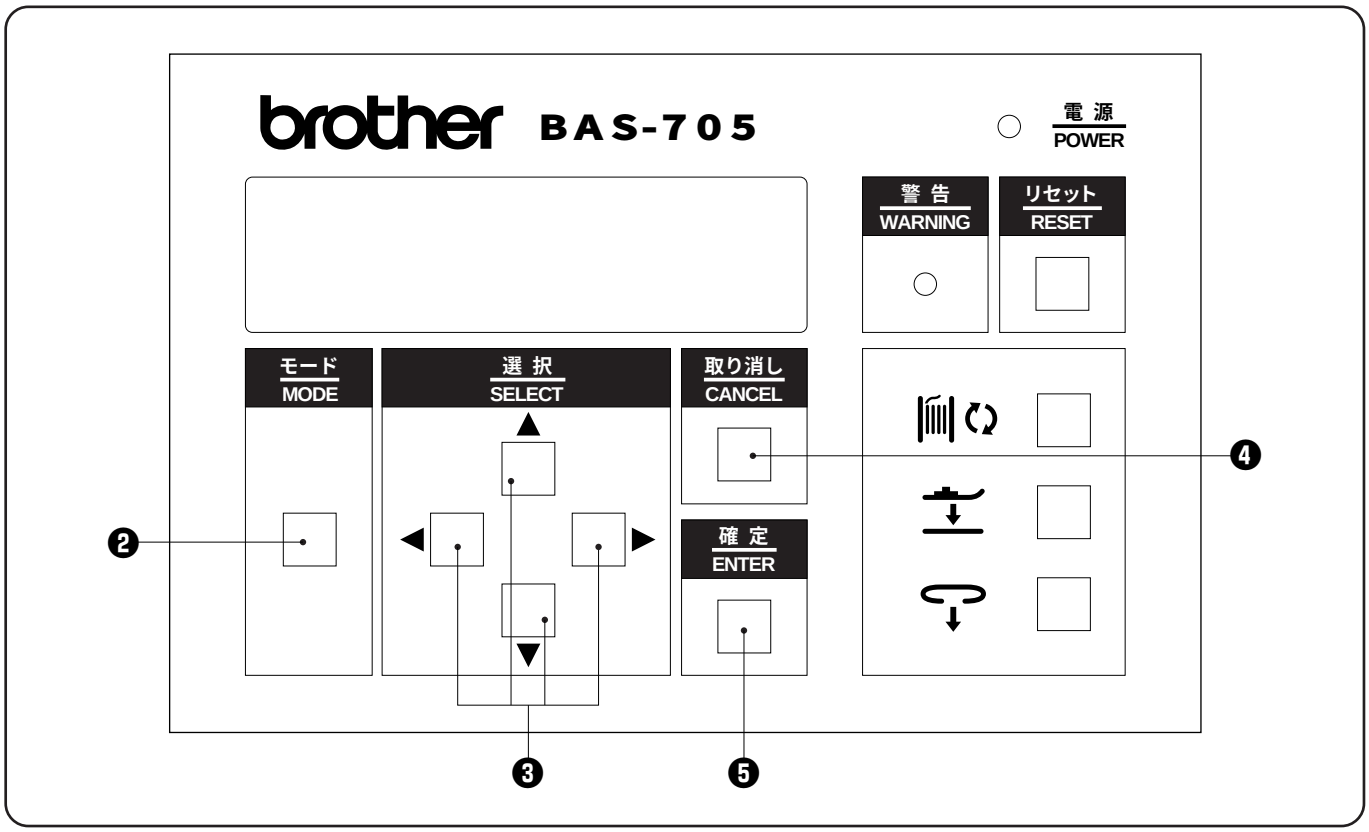
3. While using the ▶SELECT switch ❸ to move the cursor "-", press the ▲ and ▼ SELECT switches ❸ to set the desired bobbin counter setting.
   * If the CANCEL switch ❹ is pressed, the old previously-set bobbin counter setting will appear again on the display.
4. Press the ENTER switch ❺
   * The new bobbin counter setting will appear on the display.

〈To disable operation of the bobbin counter〉

* Enter "0" as the value when making the bobbin counter setting.

## 3-2-3 .Clearing production counter

- The production counter increases by one each time a single belt loop is sewn.
- The production counter can count up to a maximum of 9999.




PROGRAM MODE
Production counter
1st bobbin counter
◆2nd bobbin counter

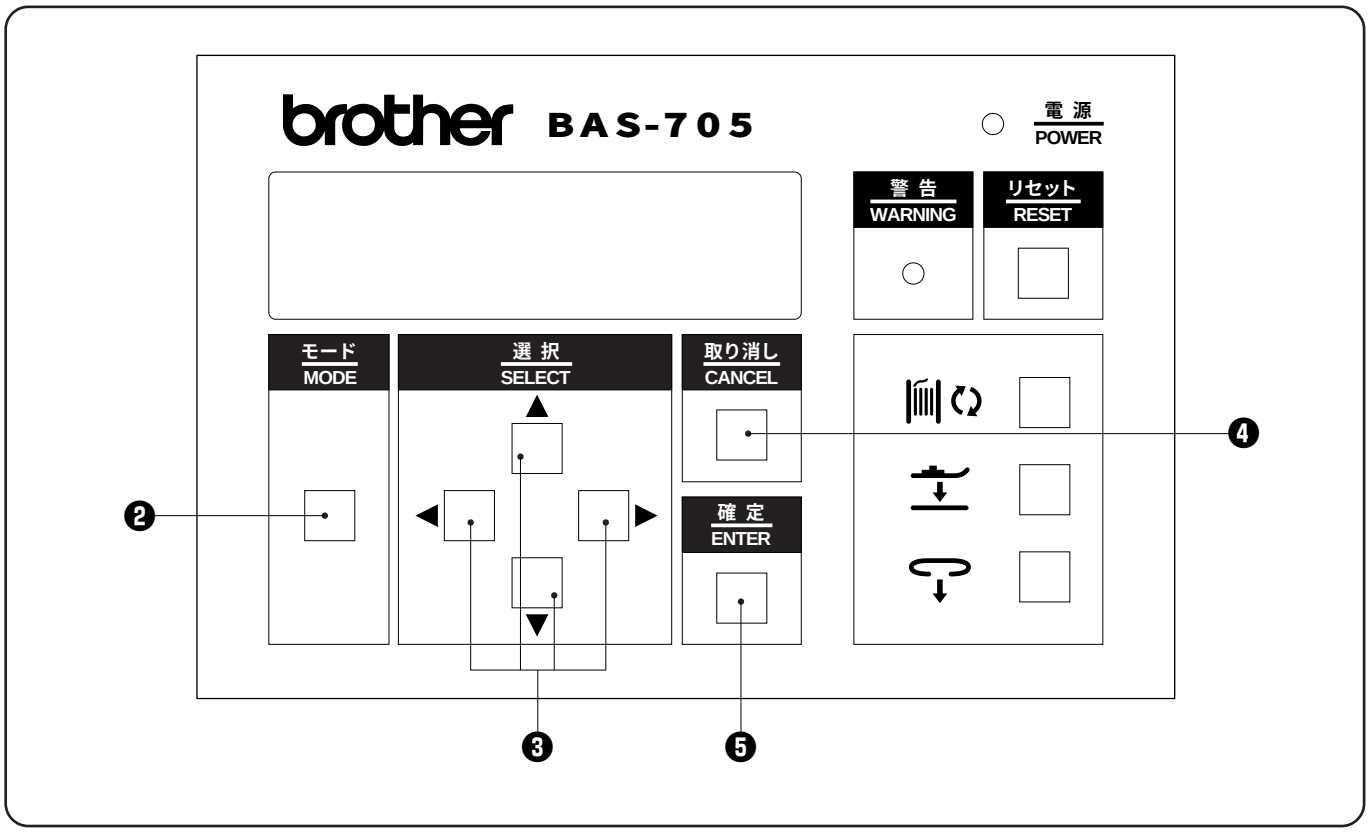
PROGRAM MODE
◆Production counter 8888
1st bobbin counter
2nd bobbin counter

PROGRAM MODE
◆Production counter 0
1st bobbin counter
2nd bobbin counter

1. Press the MODE switch ❷ to select PROGRAM mode.
2. Use the ▲ and ▼ SELECT switches ❸ to move the pointer " ◆ " so that "PRODUCTION COUNTER" is selected.
3. Press the ▶SELECT switch ❸ to change the display to "0".
   * If the CANCEL switch ❹ is pressed, the old production counter setting will appear again on the display.
4. Press the ENTER switch ❺.
   * The production counter setting will now be cleared.

## 3-2-4.Setting the machine sewing speed

- Set the machine sewing speed to the maximum sewing speed.
- The sewing speed can be set to between 1,900 - 2,100 spm in units of 100 spm.




PROGRAM MODE
◆1nd bobbin counter
2nd bobbin counter
Speed

PROGRAM MODE
1nd bobbin counter
2nd bobbin counter
◆Speed

PROGRAM MODE
1nd bobbin counter
2nd bobbin counter
◆Speed 1900

PROGRAM MODE
1nd bobbin counter
2nd bobbin counter
◆Speed 2000

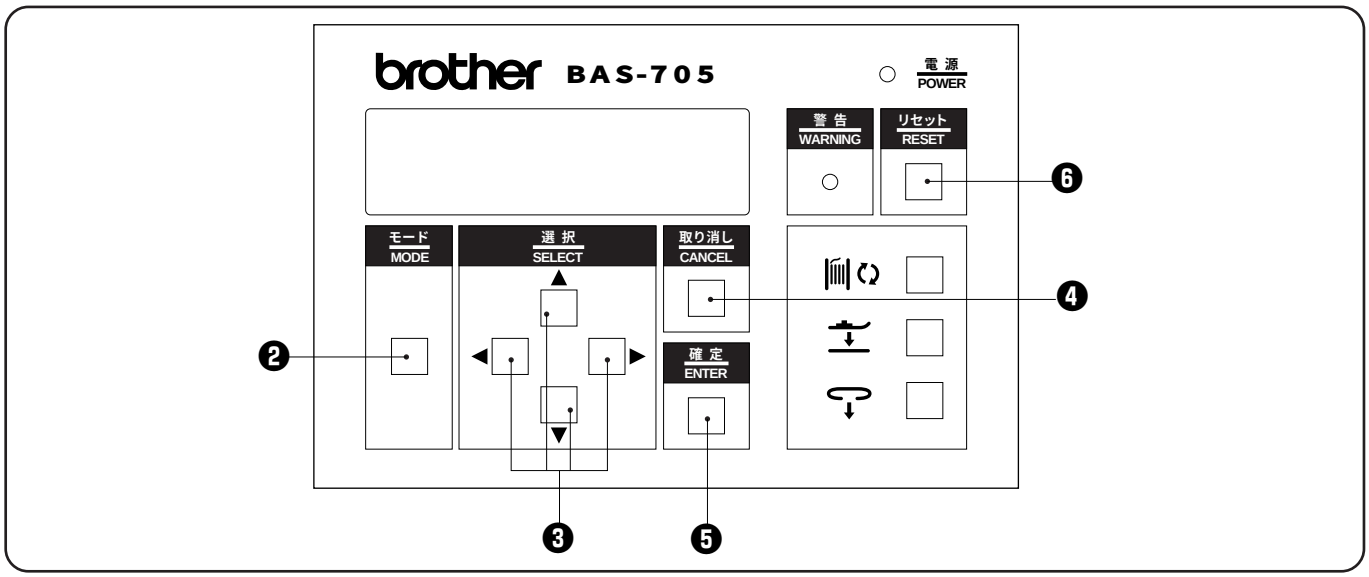
1. Press the MODE switch ❷ select PROGRAM mode.
2. Use the ▲ and ▼ SELECT switches ❸ to move the pointer "◆" so that "SEWING SPEED" is selected.
3. While using the ▶ SELECT switch ❸ to move the cursor "-", press the ▲ and ▼ SELECT switches ❸ to set the desired machine sewing speed.
   * If the CANCEL switch ❹ is pressed, the old sewing speed counter setting will appear again on the display.
4. Press the ENTER switch ❺
   * The new sewing speed setting will appear on the display.

ADJUSTMENT mode

- Adjustment of the belt loop feeder and of the X-Y feed for the machine head are carried out in this mode.
- If the MODE switch ❷ is pressed in ADJUSTMENT mode, the mode will switch to SEWING mode.

## 3-2-5. Loop feeding

- Continuous operations are carried out one step at a time.
- This is useful to use for checking adjustment and operation.




AUTO MODE
◆2nd bobbin counter
Speed
Loop length

ADJUSTMENT(/)
◆Loop/feed
X-Y/program
X-Y/test feed

LOOP/FEED/(ADJ)

▲SW Forward step
▼SW Backward step

1. Press the MODE switch ❷ to select AUTO mode.
2. While pressing the ◀ SELECT switch ❸, press the MODE switch ❷.
   * This will change the mode to ADJUSTMENT mode.
3. Use the ▲ and▼ SELECT switches ❸ to move the pointer "◆" so that "Loop/feed" is selected, and then press the ENTER switch ❺.
4. Press the ▲ or ▼ SELECT switch ❸.
   * If the ▲ SELECT switch ❸ is pressed, the machine will operate step by step in the forward direction.
   * If the ▼SELECT switch ❸ is pressed, the machine will operate step by step in the backward direction.
   * Press the CANCEL switch ❹ to resume normal operation.

NOTE: ・During step operation, one of the steps is taken up with determining the home position for the upper shaft and lower shaft.
・Note that actual sewing is also included in step operation. (Warning beeps will sound when sewing starts.)

<To return to ADJUSTMENT mode during step operation>

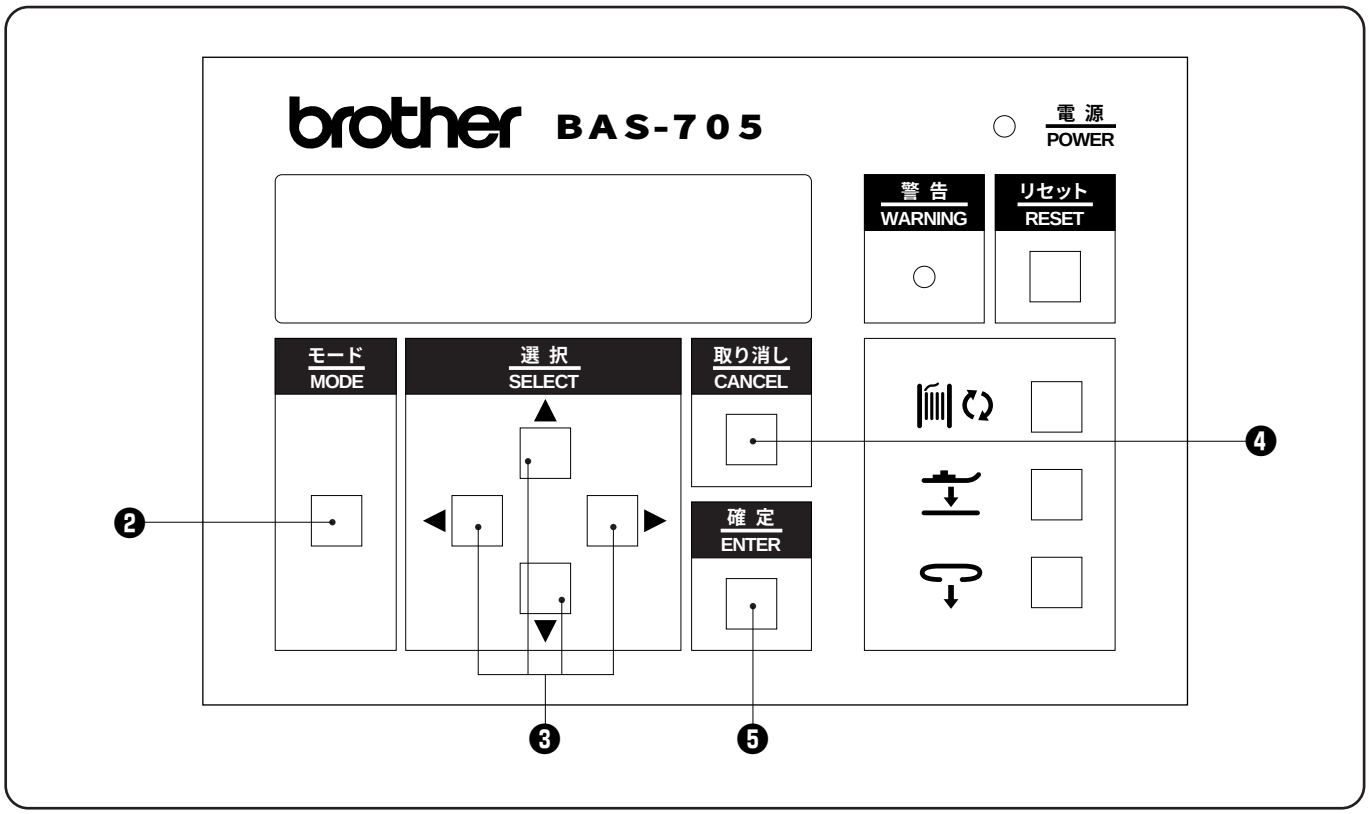
* Press the CANCEL switch ❹.

<If the upper thread breakage codes (E-181, E-182) are displayed during step operation>

- Thread the upper thread properly.
- Press the CANCEL switch ❹. The mode will then switch to ADJUSTMENT mode.

## 3-2-6. Setting the program number

- This procedure is used to set the program number for a sewing pattern.
- The standard sewing patterns are 1 (29 stitches), 2 (36 stitches) and 3 (43 stitches).




AUTO MODE
Production counter
◆1st bobbin counter
2nd bobbin counter

ADJUSTMENT(/)
Loop/feed
◆X-Y/program
X-Y/test feed

X-Y/PROGRAM/(ADJ)
◆Program No. 2
X scale (%)
Y scale (%)

1. Press the MODE switch ❷ to select AUTO mode.
2. While pressing the ◀ SELECT switche ❸ , press the MODE switch ❷.
   * This will change the mode to ADJUSTMENT mode.
3. Use the ▲ and ▼ SELECT switches ❸ to move the pointer "◆" so that "X-Y/program" is selected, and then press the ENTER switch ❺.
4. Use the ▲ and ▼ SELECT switches ❸ again to move the pointer "◆" so that "Program No." is selected.
5. While using the ▶ SELECT switch ❸ to move the cursor "-" , press the ▲ and ▼ SELECT switches ❸ to set the desired program number.
   * If the CANCEL switch ❸ is pressed, the old previously-set program number will appear again on the display.
6. Press the ENTER switch ❺.
   * The new program number setting will appear on the display.
   * At this time, the feed mechanism, will move to the sewing start position.

X-Y/PROGRAM/(ADJ)
◆Program No. 1
X scale (%)
Y scale (%)

## 3-2-6-1. Pattern selection mode

* The following procedure lets you select the stitch pattern.
There are three different basic patterns which can be selected, and these patterns are pre-programmed into the sewing machine's ROM.

```
X-Y/PROGRAM/(ADJ)
  Program No.   □□
  Xscale(%)
  Yscale(%)
```

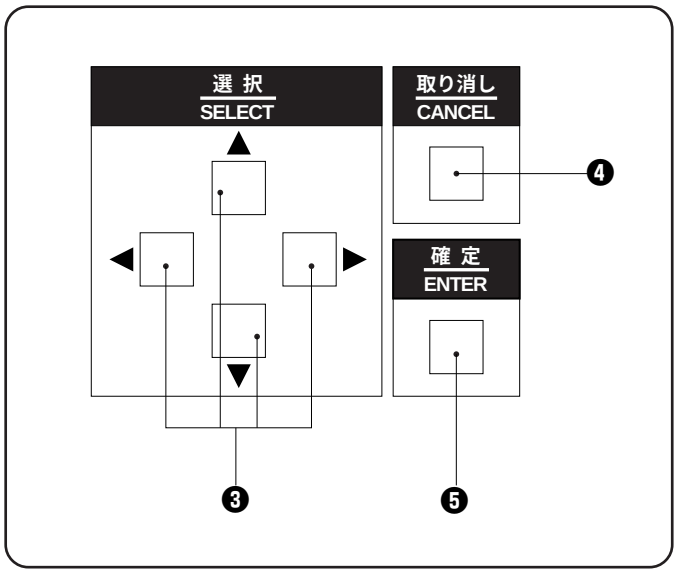
[Operation method]

* Use the ▲ and ▼ SELECT switches ❸ to change the numbers, and use the◀and ▶SELECT switches ❸ to move the cursor "-" .

* The enlargement and reduction settings can be applied to each of the patterns as described below.

```
Program No.11/21/31·····Set based on program No. 1
Program No.12/22/32·····Set based on program No. 2
Program No.13/23/33·····Set based on program No. 3
```

NOTE:
If the ENTER switch is pressed while any patterns other than the above are selected,setting will not be possible.



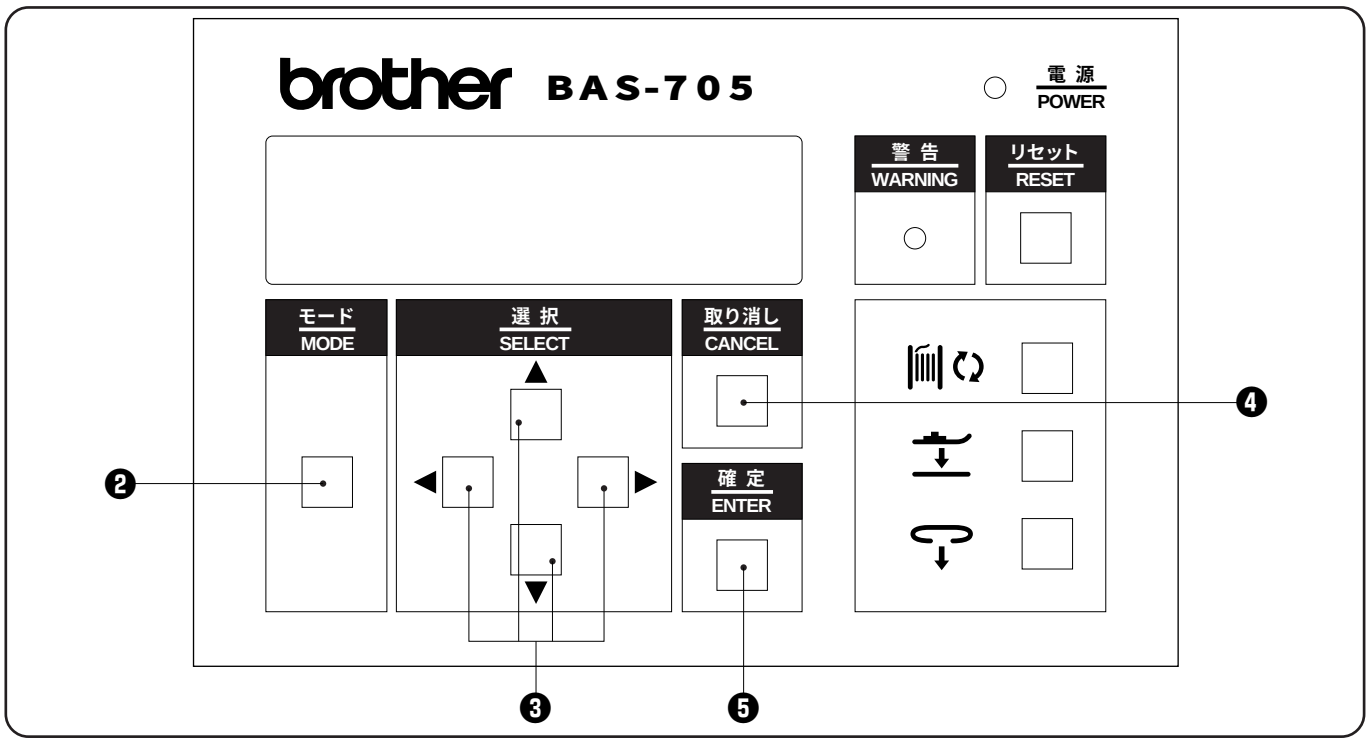

[Input method]

* The patterns that can be set are the patterns with numbers from 1 to 3.

1. Press the ENTER switch ❺ to select the second line of the display.
2. Use the ▲ and ▼ SELECT switches ❸ to change the numbers, and use the ◀and▶SELECT switches ❸ to move the cursor "-" .
3. If the CANCEL switch ❹ is pressed while the cursor "-" is displayed, the display will return to the item selection display without the setting being changed.
4. If the ENTER switch ❺ is pressed while the cursor is displayed, the setting value will be changed to the value displayed and the display will return to the item selection display.

## 3-2-7. Setting the X scale and Y scale

- This procedure is used to set the enlargement and reduction ratios for the sewing pattern in the X direction and Y direction.
- The setting ranges for both the X scale and Y scale are between 45% - 150%. However,because the size of the pattern will be checked against the sewing area, it may not be possible to set the scale to the maximum setting in this range.




AUTO MODE
◆2nd bobbin counter
Speed
Loop length

ADJUSTMENT(/)
Loop/feed
◆X-Y/program
X-Y/test feed

X-Y/PROGRAM/(ADJ)
Program No.
◆X scale (%)
Y scale (%)

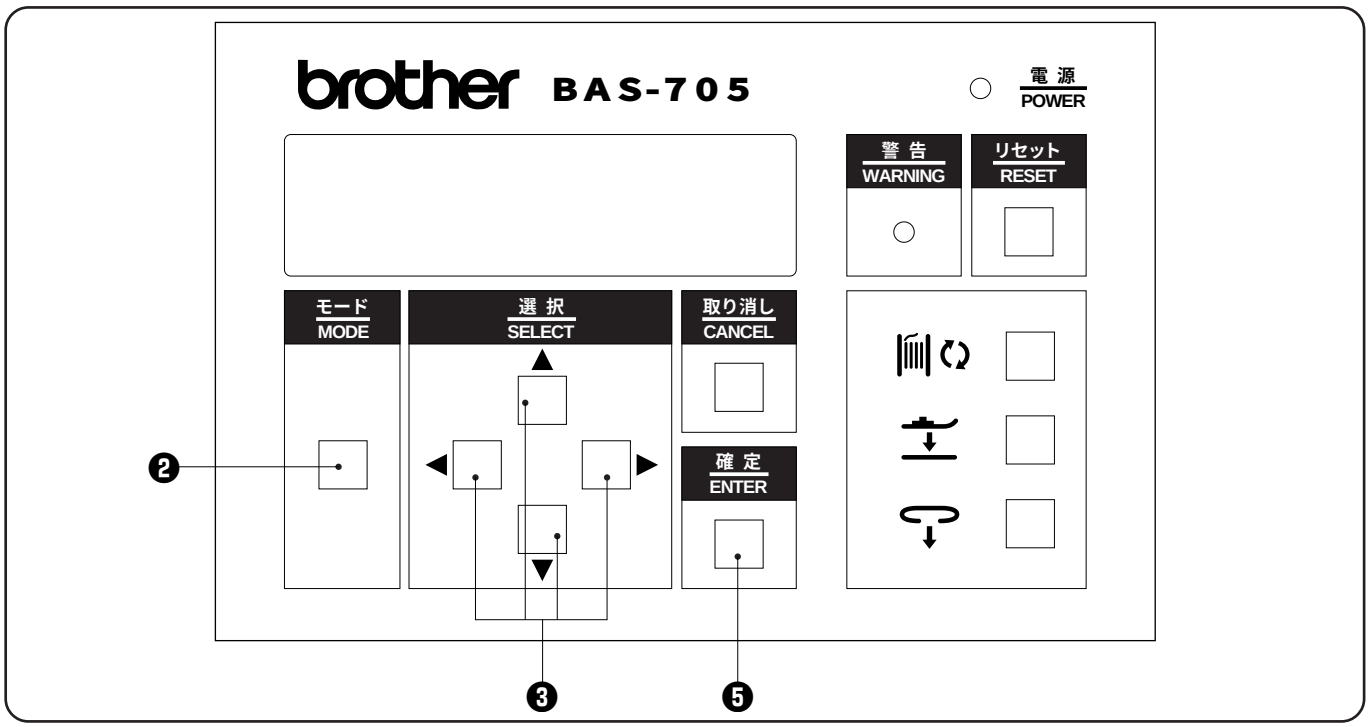
X-Y/PROGRAM/(ADJ)
Program No.
◆X scale (%) 100
Y scale (%)

X-Y/PROGRAM/(ADJ)
Program No.
◆X scale (%) 110
Y scale (%)

1. Press the MODE switch ❷ to select AUTO mode.
2. While pressing the ◀ SELECT switch ❸, press the MODE switch ❷.
   * This will change the mode to ADJUSTMENT mode.
3. Use the ▲ and ▼ SELECT switches ❸ to move the pointer "◆" so that "X-Y/program" is selected, and then press the ENTER switch ❺.
4. Use the ▲ and ▼ SELECT switches ❸ again to move the pointer "◆" so that "X scale" or "Y scale" is selected.
5. While using the ▶ SELECT switch ❸to move the cursor "-" , press the ▲ and▼SELECT switches ❸ to set the scale setting.
   * If the CANCEL switch ❹ is pressed, the old previously-set scale ratio will appear again on the display.
6. Press the ENTER switch ❺.
   * The new scale ratio setting for the X scale or Y scale will appear on the display.
   * At this time, the feed mechanism will return to the sewing home position.

## 3-2-8. X and Y step feed

・ The sewing pattern can be checked by carrying out step operation.




AUTO MODE
◆2nd bobbin counter
Speed
Loop length

ADJUSTMENT(/)
Loop/feed
X-Y/program
◆X-Y/test feed

X-Y/TEST FEED(ADJ)

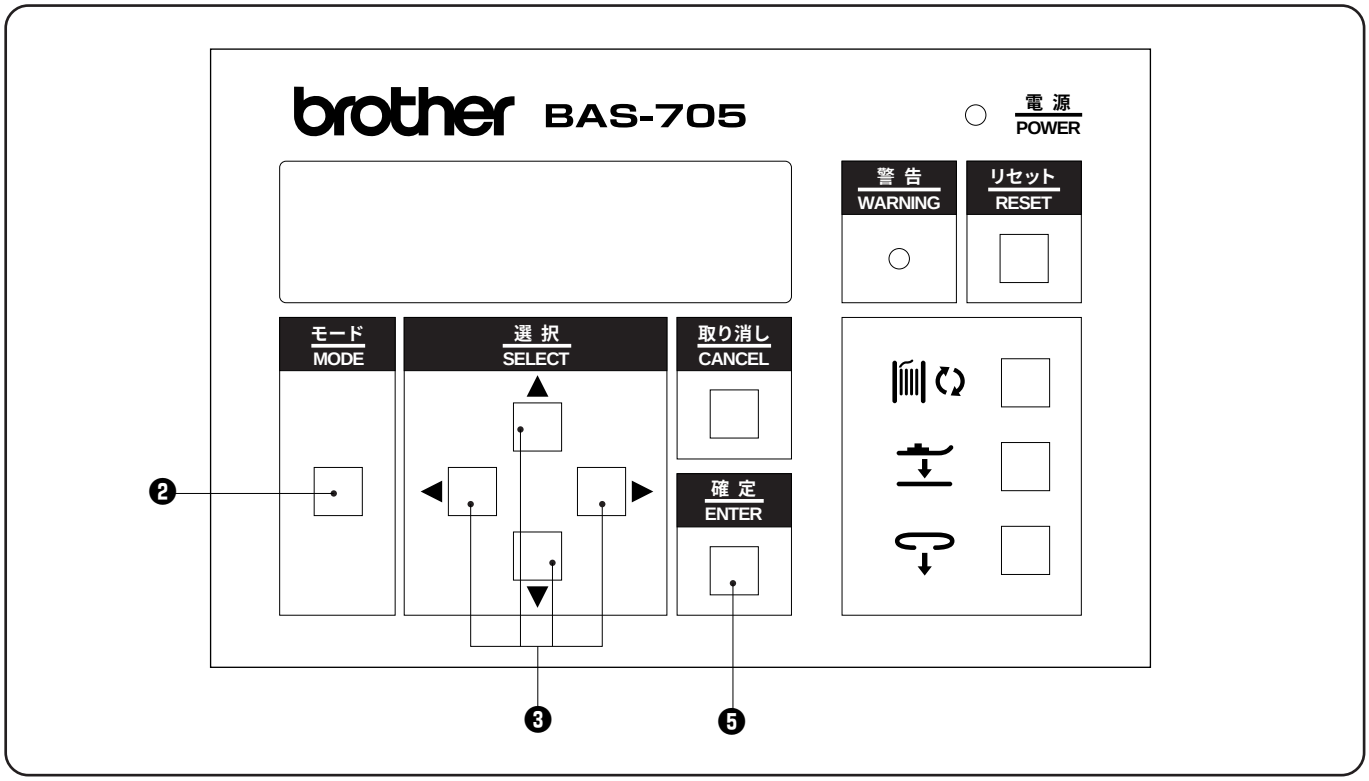
◆Step feed
Real feed

STEP FEED/(ADJ)
▲SW Forward step
▼SW Backward step
( ▶SW fast)

1. Press the MODE switch ❷ to select AUTO mode.
2. While pressing the ◀ SELECT switch ❸, press the MODE switch ❷.
   * This will change the mode to ADJUSTMENT mode.
3. Use the ▲ and ▼ SELECT switches ❸ to move the pointer "◆" so that "X-Y/test feed" is selected, and then press the ENTER switch ❺.
4. Use the ▲ and ▼ SELECT switches ❸ again to move the pointer "◆" so that "X-Y step feed" is selected, and then press the ENTER switch ❺.
5. Press the ▲ or ▼ SELECT switch ❸.
   * If the ▲ SELECT switch ❸ is pressed, the machine will operate step by step in the forward direction.
   * If the SELECT switch ❸ is pressed while the machine is sewing in the forward direction, the opera tion will switch ▼ to backward step operation.
   * If the ▲ SELECT switch ❸ is pressed while the SELECT switch ❸ is being pressed, the operation will switch ▶ to high-speed forward step operation.
   * If the ▼ SELECT switch ❸ is pressed while the ▶ SELECT switch ❸ is being pressed, the operation will switch to high-speed backward step operation.

## 3-2-9. X-Y feed at real speed

・ The sewing pattern can be checked by operating the machine at the real sewing speed.




| |
|---|
| AUTO MODE<br>◆2nd bobbin counter<br>Speed<br>Loop length |

1. Press the MODE switch ❷ to select AUTO mode.

2. While pressing the ◀ SELECT switch ❸, press the MODE switch ❷.
   * This will change the mode to ADJUSTMENT mode.

| |
|---|
| ADJUSTMENT(/)<br>Loop/feed<br>X-Y/program<br>◆X-Y/test feed |

3. Use the ▲ and ▼ SELECT switches ❸ to move the pointer "◆" so that "X-Y/feed" is selected, and then press the ENTER switch ❺.

| |
|---|
| X-Y/TEST FEED(ADJ)<br><br>Step feed<br>◆Real feed |

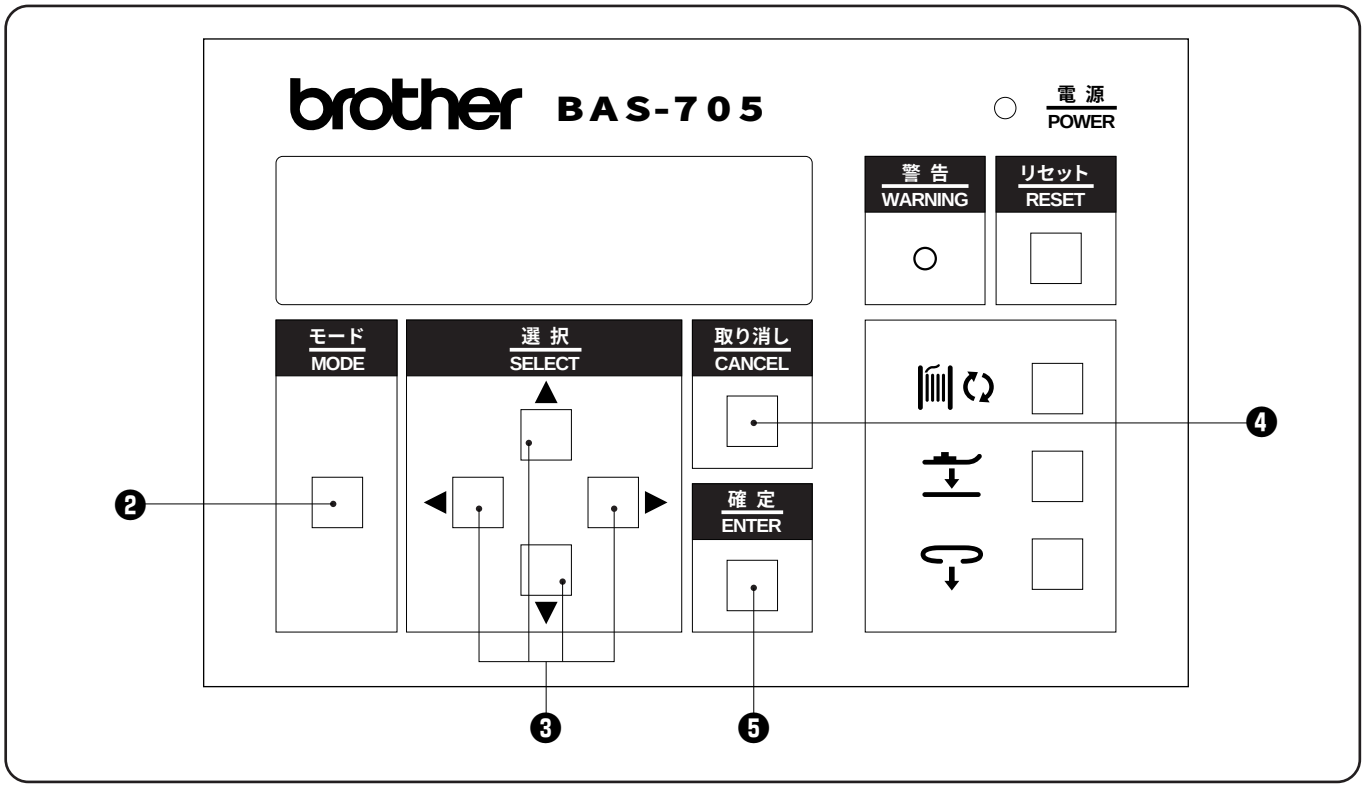
4. Use the ▲ and ▼ SELECT switches ❸ again to move the pointer "◆" so that "X-Y real feed" is selected,and then press the ENTER switch ❺.

| |
|---|
| REAL FEED (/ADJ/XYFD)<br><br>▲SW =execute |

5. Press the ▲ SELECT switch ❸.
   * Step operation will then be carried out at the real sewing speed.

## 3-2-10. X-Y movement

- This procedure lets you set the parallel movement of the pattern in the X feed direction and Y feed direction.
- The setting range is from -1 to +1 in both the X direction and Y direction. However, it may not be possible to change the setting within this range because an area check will be carried out when the setting is changed.




AUTO MODE
◆Loop length
1st bobbin counter
2nd bobbin counter

ADJUSTMENT(/)
Loop/ program
◆X-Y/ test feed
X-Y/ feed

X-Y/MOVE/ (ADJ)
Program No.
◆Xmove (mmx10) −10

X-Y/MOVE/ (ADJ)
Program No.
◆Xmove (mmx10) −10

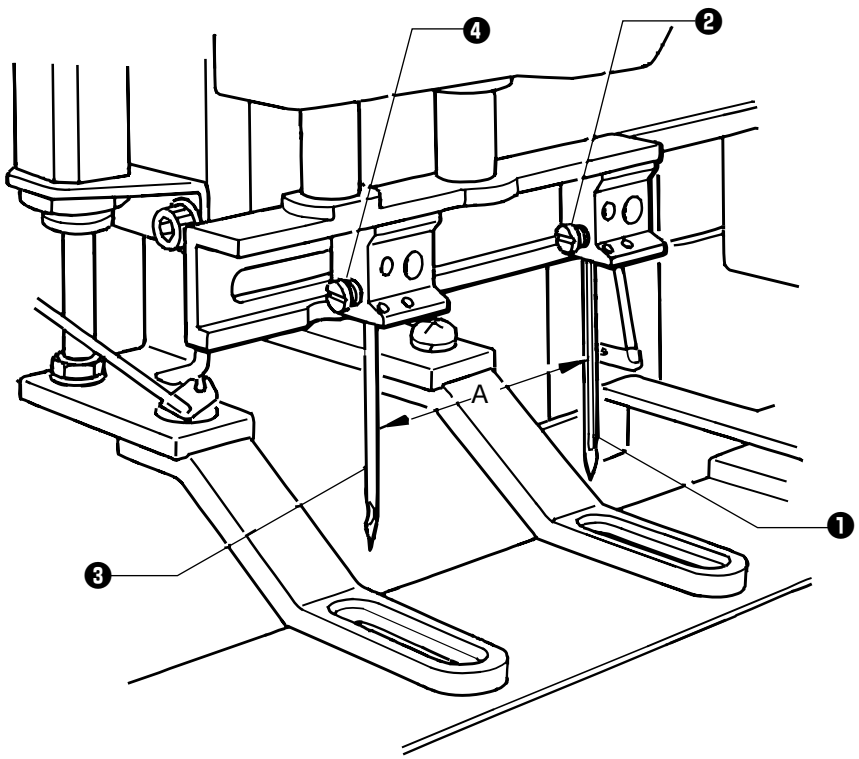
1. Press the MODE switch ❷ to select AUTO mode.
2. While pressing the ◀ SELECT switch ❸, press the MODE switch ❷.
   * This will change the mode to ADJUSTMENT mode.
3. Use the ▲ and ▼ SELECT switches ❸ to move the pointer "◆" so that "X-Y/program" is selected, and then press the ENTER switch ❺.
4. Use the ▲ and ▼ SELECT switches ❸ again to move the pointer "◆" so that "X move" or "Y move" is selected.
5. While using the ▶SELECT switch ❸ to move the cursor "−" , press the ▲and ▼SELECT switches ❸ to set the amount of movement.
   * If the CANCEL switch ❹ is pressed, the old previously-set scale ratio will appear again on the display.
6. Press the ENTER switch ❺.
   * The new scale ratio setting for the X move or Y move will appear on the display.

# 4. SEWING

## 4-1. Replacing needle

**CAUTION**

- Turn off the power switch before installing the needle, otherwise the machine may operate of the start switch is depressed by mistake and serious injury could result.




1. To install the needle ❶ for the first bar tacking, loosen the set screw ❷, insert the needle ❶ as far as it will go so that the long groove is facing toward you (side A), and then tighten the set screw ❷.
2. To install the needle ❸ for the second bar tacking, loosen the set screw r, insert the needle ❸ as far as it will go so that the groove is facing away from you (side A), and then tighten the set screw ❹.

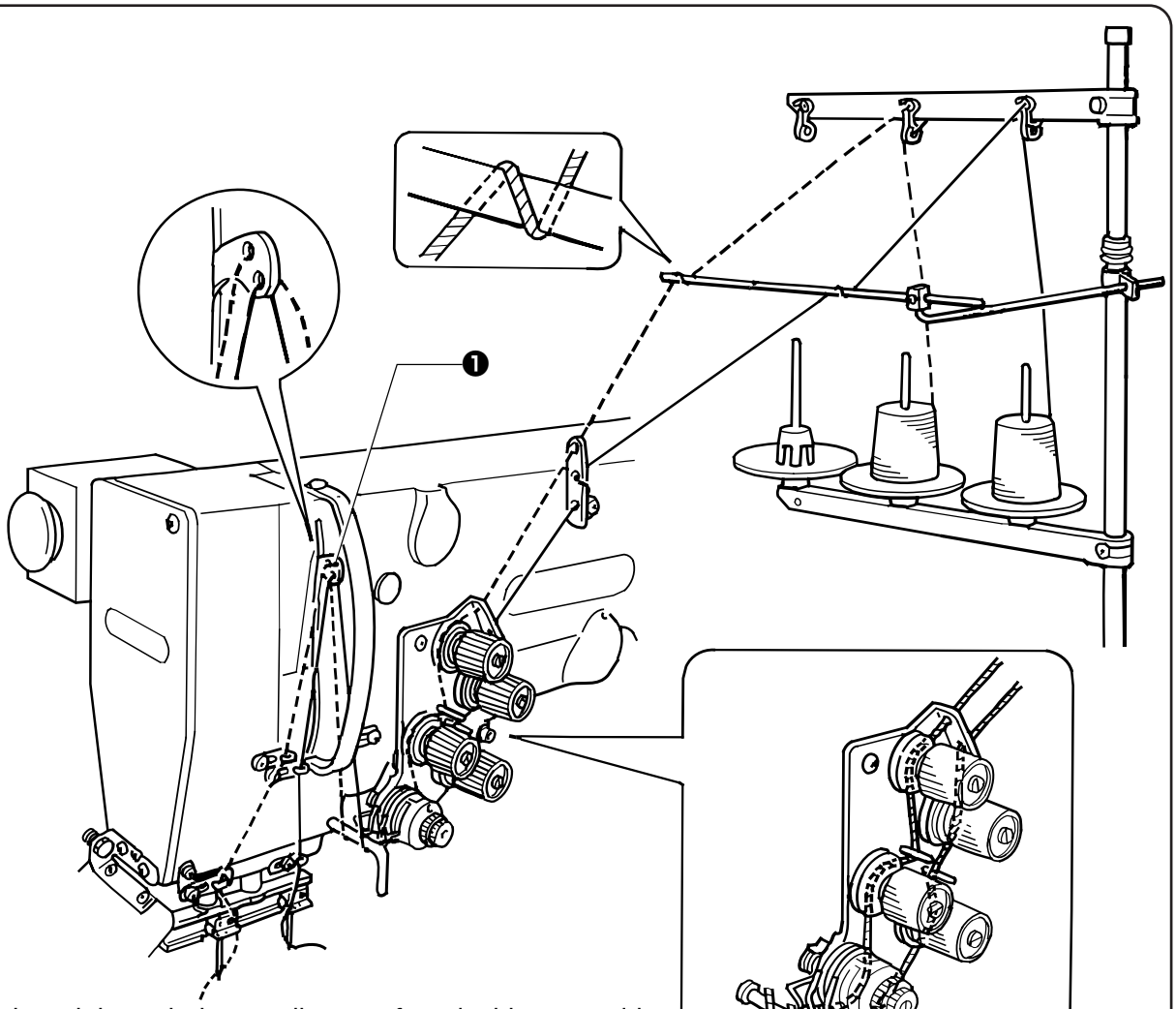
## 4-2. Threading the upper thread

**CAUTION**

- Turn off the power switch before threading the thread, otherwise the machine may operate if the start switch is depressed by mistake and serious injury could result.

[NOTE]

- Turn the machine pulley and raise the thread take-up lever ❶ before threading the upper thread. This will make threading easier and it will prevent the thread from coming out at the sewing start.
- Thread the left-side thread first.
- When threading the thread through the needle, allow a distance of approximately 45 mm between the needle hole and the end of the thread. If the trailing length of the thread is too long, it may cause the thread to become tangled.
- If the thread coming from the thread block catches loosely on the cotton stand, pass the thread through the thread guide spring when sewing.




[NOTE]

- Pass the thtead through the needle eyes from inside to outside.
- Pull out about 45mm of thead through each of the needle eyes.



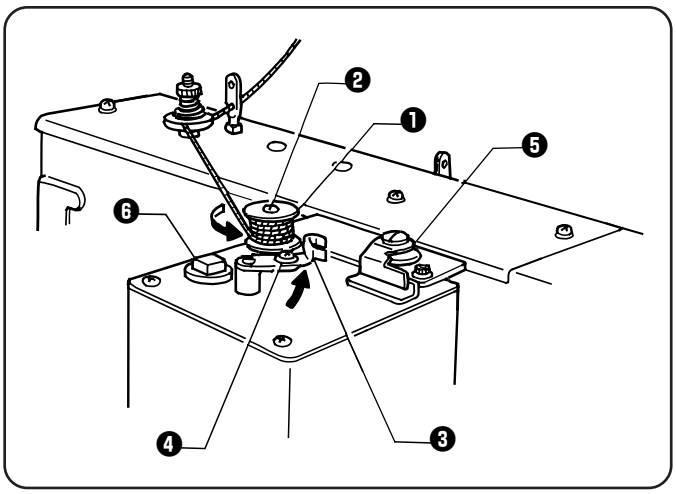
[NOTE]

- Pass the thread correctly between the tension discs.

## 4-3 Winding bobbin thread

**CAUTION**

・ Do not touch or place anything against any of the moving parts while winding the lower thread, otherwise personal injury or damage to the machine may result.

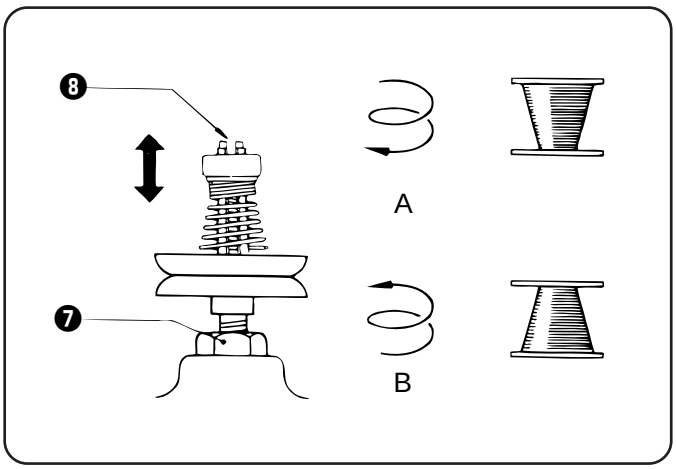



1. Turn on the power switch.
2. Place the bobbin ❶ onto the bobbin winder shaft ❷.
3. Wind the thread around the bobbin ❶ several times in the direction indicated by the arrow.
4. Push down the bobbin presser arm ❸.

NOTE ・If the thread cannot be wound on evenly, adjust by following the procedure described below.
・ To wind more thread onto the bobbin ❶, loosen the screw ❹ and move the bobbin presser arm ❸ to adjust the thread winding amount.

5. Once winding of the bobbin thread is completed, remove the bobbin ❶ from the bobbin winder shaft ❷ and trim the thread using the thread trimmer ❺.

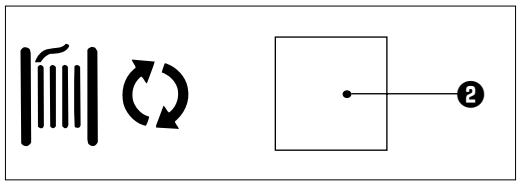
NOTE ・If the circuit protector ❻ has been activated, the bobbin winder motor will not operate. Wait 1 minute for the machine to cool down, and then pres the protector ❻.
(If the machine has not cooled down sufficiently, the protector will pop back up again.)
・If you make the bobbin winding tensio stronger than necessary, it may cause problems during sewing.




《If the thread winds onto the bobbin unevenly》
If the thread winds onto the bobbin unevenly, loosen the nut ❼ and turn the bobbin winder thread tension stud ❽ to adjust.

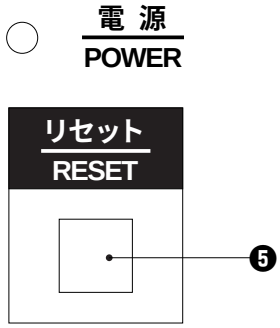
* If the thread winds on as shown in A, turn the bobbin winder thread tension stud ❽ clockwise; if it winds on as shown in B, turn the bobbin winder thread tension stud ❽ counterclockwise.

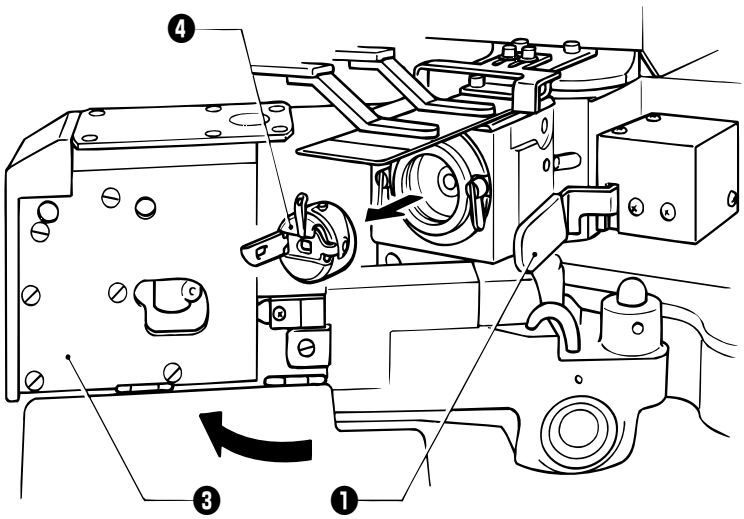
# 4-4. Replacing the bobbin case and threading the thread




Open the bobbin module,
then you can change bobbins

Close it, and press reset switch

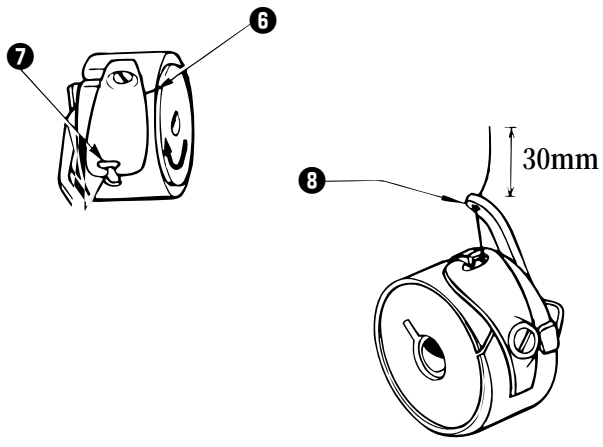



1. Turn on the power switch.
2. Press the START switch ❶ to move the mechanism to the home position.
3. Press the BOBBIN switch ❷ while the machine is in the standby condition. The presser foot will be lowered and the X-Y feed mechanism will be retracted.
   If DIP switch No. 1-4 is ON, the fork will be retracted during loop setting (when the fork is extended and the machine is in the standby condition).
4. Use the operating panel to open the bobbin thread module ❸, and then replace the bobbin case ❹.
5. Press the RESET switch ❺ to return the X-Y feed mechanism to the sewing start position. The presser foot will then rise.
   If the module is not completely closed at this time, it will not lock and the machine will not operate.

NOTE:

If replacing the bobbin case after carrying out test sewing or automatic sewing, start the above procedure from step 3.




[Threading the thread]

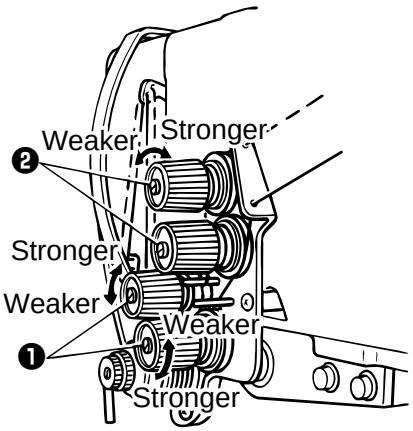
1. Place the bobbin inside the bobbin case, and then draw the thread through slot ❻ and out of the delivery eye ❼. While doing this, check that the bobbin is revolving in the direction of the arrow.
2. Pass the end of the thread through the tension bracket hole ❽ and draw it out to a length of about 30 mm.

# 4-5. Sewing conditions and thread tension

## 4-5-1. Sewing conditions

| Specifications | Denim | |
|---|---|---|
| Upper thread | #20 or equivalent | #30 or equivalent |
| Lower thread | #30 or equivalent | #50 or equivalent |
| Upper thread tension | 120 - 220 g | 100 - 150 g |
| Lower thread tension | 20 - 30 g | ← |
| Thread take-up spring height | 6 - 10 mm | ← |
| Thread take-up spring tension | 110 - 200 g | ← |
| Pre-tension | 30 - 50 g | ← |
| Needle | DP×17NY #21 | ← #19 |
| Normal sewing speed | 2100 spm | ← |

## 4-5-2. Upper thread tension

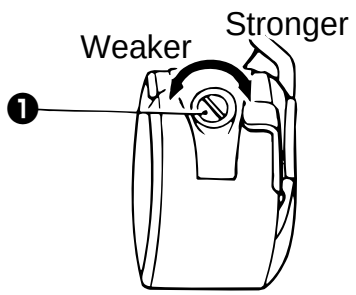



To adjust the thread tension, turn the thread tension nut ❶ (main tension) to adjust the tension in accordance with the material being sewn. In addition, turn the thread tension nut ❷ (sub-tension) to adjust so that the trailing length of the upper thread is 35 - 40 mm.

NOTE・If the upper thread tension is too weak, it will cause the thread to become tangled. If this happens, increase the upper thread tension.

・If the upper thread tailing length is long (50 mm or more), synchronization errors may occur due to the thread becoming tangled at the sewing start.

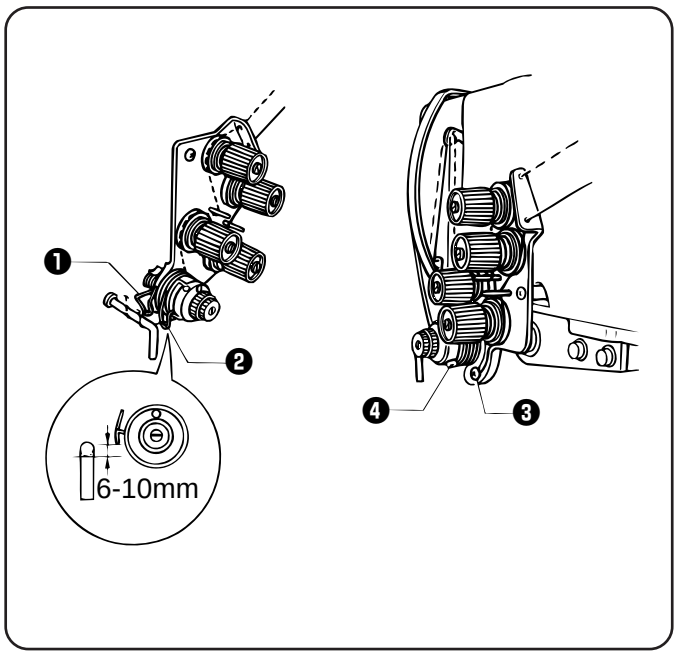
## 4-5-3. Lower thread tension




Set the lower thread tension to as weak a tension as possible and so that the bobbin case drops by its own weight when the end of the thread is held. Turn the adjusting screw ❶ to adjust the tension.

NOTE: If the lower thread tension is too weak, it may not be possible to cut the lower thread prop erly dur ing thread trimming.

## 4-5-4. Adjusting the thread tension spring




・ Operating range of thread take-up spring
The standard operating range for thread take-up spring L❶ and thread take-up spring R ❷ is 6 - 10 mmfor both springs.

<Thread take-up spring L ❶>

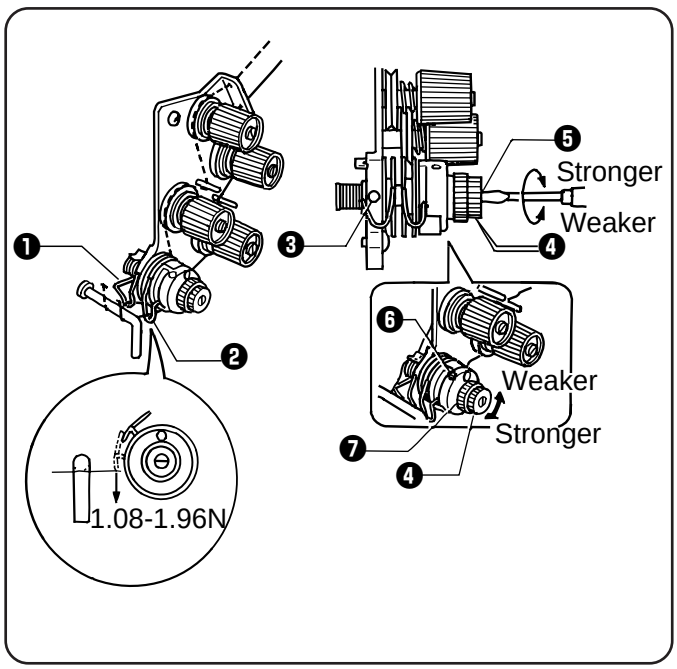
1. Loosen the left and right screws e, and then turn the left and right thread take-up spring stoppers r to adjust the operating range.

NOTE: The screws ❸ and the thread take-up spring stoppers are integrated.

2. Tighten the screws.

<Thread take-up spring R ❶>

1. Loosen the screw ❹ and then move the thread take-up spring stopper left or right to adjust.
2. After adjusting, tighten the screw ❹.




・Thread take-up spring tension
The standard tension for thread take-up spring L ❶ and thread take-up spring R ❷ is 1.08-1.96 N(110gf-200gf) for both sprnings.

NOTE: The thread take-up spring tension is the tension which is applied by the thread take-up spring when it is horizontal to the lower end of the arm thread hook.

<Thread take-up spring L❶>

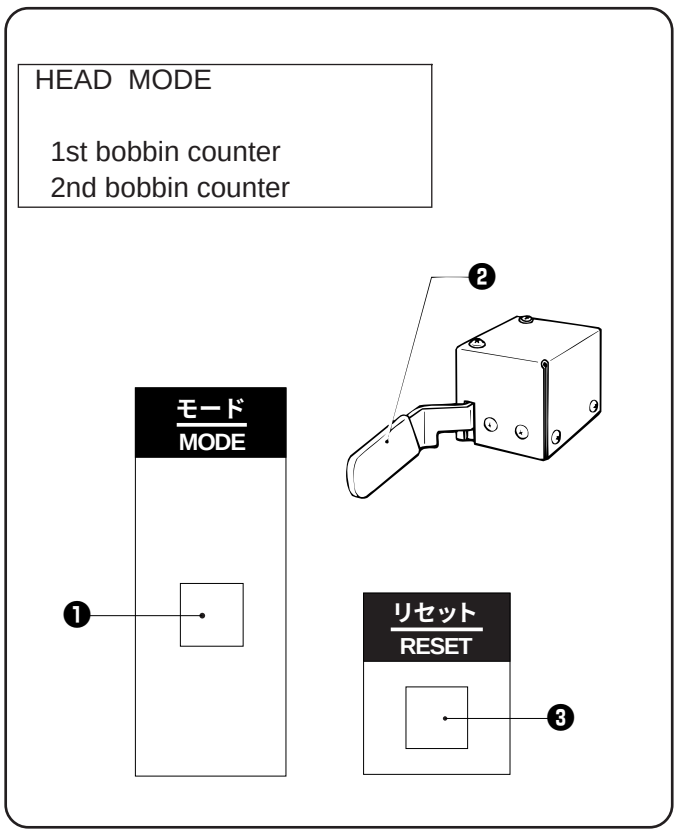
1. Loosen the set screw ❸.
2. Loosen the knob ❹, and then turn the thread tension stud ❺ to adjust the tension.
3. Tighten the set screw ❸, and then tighten the knob ❹.

<Thread take-up spring R ❷>

1 Loosen the set screw ❻.
2. Loosen the knob ❹, and then turn the thread tension stud ❼ to adjust the tension.
3. Tighten the set screw ❻, and then tighten the knob ❹.

# 4-6. Trial sewing

- This is useful for checking things such as the thread tension while sewing.



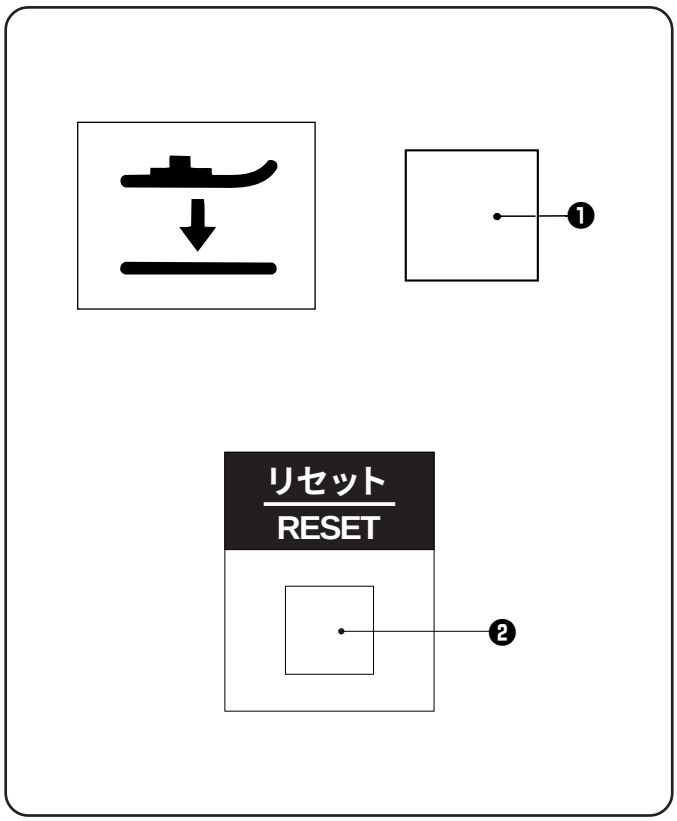

1. Press the MODE switch ❶ to select HEAD mode.

2. Press the START switch ❷.
   * Sewing will be carried out and the machine will then stop.

   [If the bobbin thread counters are at "0"]
   - If DIP switch No. 2-8 is set to OFF
     The previously-set value can be changed.
     Press the MODE switch ❶ to return to HEAD mode.
   - If DIP switch No. 2-8 is set to ON
     The bobbin can be replaced straight away.
     Moreover, the previously-set value cannot be changed.
     Press the RESET switch ❸ to return to HEAD mode.

## 4-6-1. Raising and lowering the presser foot

- Raising and lowering the presser foot can be useful when threading the thread.



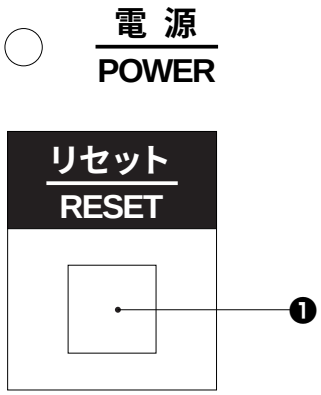

1. With the machine in sewing standby mode, press the FOOT switch ❶.
   The presser foot will be lowered.
   At this time, the main thread tension discs will be opened simultaneously.
   * If DIP switch No. 1-4 is set to ON, the fork will be retracted during loop setting (when the fork is ex tended and the machine is in the standby condition).

2. Press the RESET switch ❷.
   The presser foot will be raised.

## 4-6-2. If the upper thread breakage codes (E-181, E-182) are displayed

E-181
1st needle thread breakage
Press reset switch

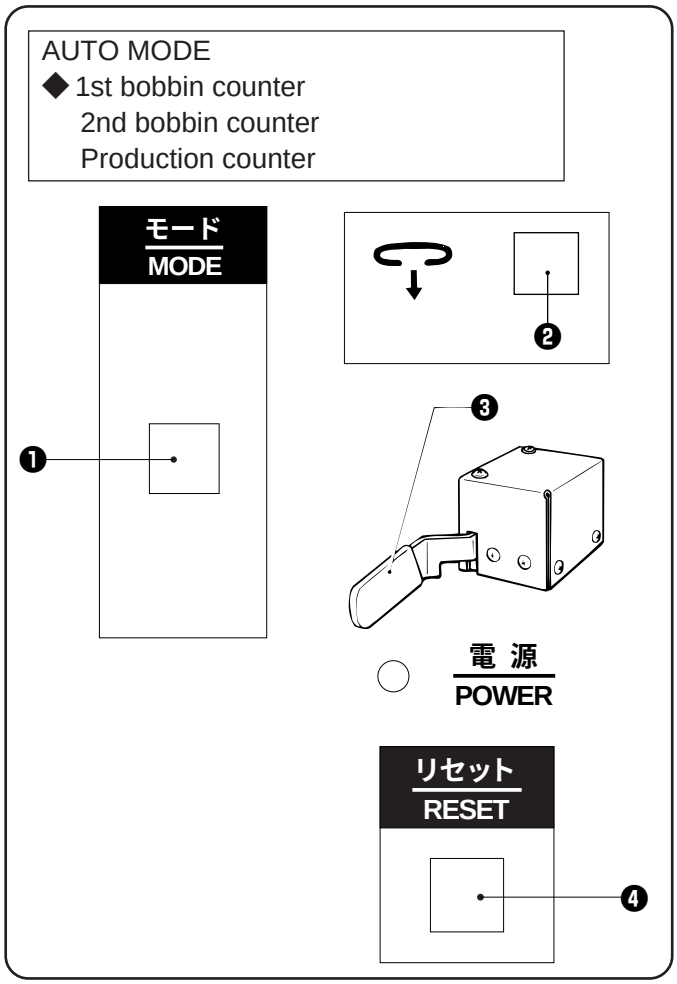
E-182
2nd needle thread breakage
Press reset switch




1. Press the RESET switch ❶. The machine will switch to standby mode.
2. Thread the upper thread properly.

NOTE: ・ Sewing will continue until the end even if an upper thread breakage has been detected during sewing.
・ Obstructions to the thread may cause the 1st needle thread breakage and 2nd needle thread breakage messages to display even when there is no actual thread breakage.

# 4-7. Automatic sewing




1. Press the MODE switch ❶ to select AUTO mode.
2. If no belt loop has been set, press the LOOP switch ❷ to set a belt loop.
3. Set the material.
4. Press the START switch ❸ to start sewing in AUTO mode.

<Correcting the production counter>

While the production counter setting is being displayed, press the ▶ SELECT switch to increase the counter setting by 1, and press the ◀ switch to decrease the setting by 1.

[If the bobbin thread counters are at "0"]

* If DIP switch No. 2-8 is set to OFF

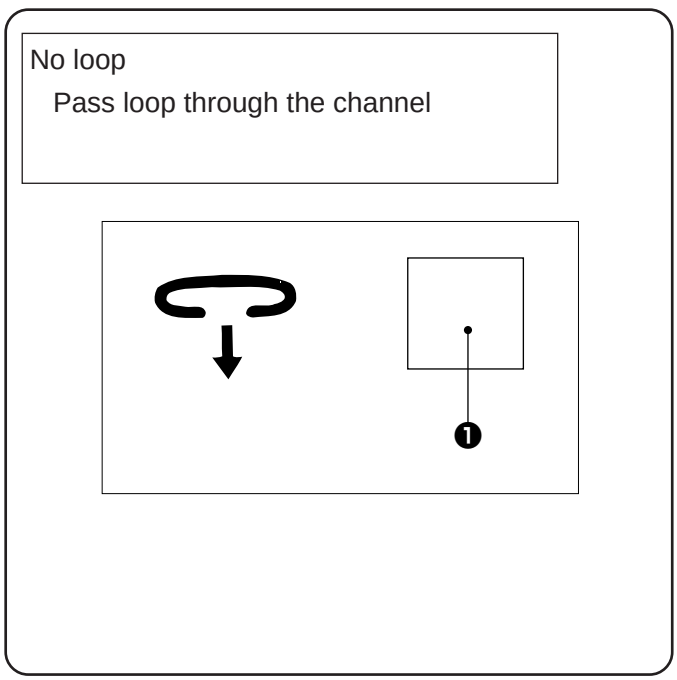
The previously-set value can be changed. Press the MODE switch ❶ to return to AUTO mode.

* If DIP switch No. 2-8 is set to ON

The bobbin can be replaced straight away. Moreover, the previously-set value cannot be changed.

Press the RESET switch ❹ to return to AUTO mode.

## 4-7-1. If the belt loops run out during automatic sewing




* A message will appear on the screen.

1. Add more belt loops. The message will disappear from the screen.
2. Press the LOOP switch ❶.
   The end of the belt loop will be automatically cut and discarded, and the belt loop material will be set.

## 4-7-2. If the machine stops during sewing

Press the EMERGENCY STOP switch. The error code (E-100) will appear on the screen and the ma chine will stop at the step where the switch was pressed.

## 4-7-3. If the EMERGENCY STOP switch is pressed (E-100)

During AUTO mode

- Before the machine head starts
  1. Unlock the EMERGENCY STOP switch.
  2. Press the RESET switch. The error will be cleared and the machine will switch to sewing standby mode.

During HEAD mode

- Before the machine head starts
  1. Unlock the EMERGENCY STOP switch.
  2. Press the RESET switch. The error will be cleared and the machine will switch to sewing standby mode.

## 4-7-4. Resetting the belt loops

If the LOOP switch is pressed when DIP switch No. 2-7 is set to OFF, the machine will be reset. If the LOOP switch is pressed once more, a new belt loop will be set.

* If the LOOP switch is pressed when DIP switch No. 2-7 is set to ON, the machine will be reset, and then a new belt loop will be set straight away.

## 4-7-5. Removing an overlapping loop while in the sewing standby condition.

- Press the CANNCEL switch.Presser block B will be raised and it will then be possible to remove the loop.

## 4-7-6. Stopping sewing when the presser foot is lowered

1. If DIP switch No. 1-8 on the panel is set to ON, the presser foot will be lowered and stay in this conditionwhenautomatic sewing is completed.
2. If the RESET switch is pressed, the presser foot will be raised.

## 4-7-7. Raising and lowering the presser foot

1. If the FOOT switch is pressed while the machine is in sewing standby mode, the presser foot will be lowered.
2. If the RESET switch is pressed, the presser foot will be raised.

Refer to "4-6-1. Raising and lowering the presser foot" on page 29.

## 4-7-8. If the upper thread breakage codes (E-181, E-182) are displayed

Press the RESET switch. The machine will switch to sewing standby mode.

Refer to "4-6-2 If the upper thread breakage codes (E-181, E-182) are displayed" on page 30.

## 4-7-9. If an error code is displayed during sewing

Refer to "Error Codes" on page 70.

## 4-7-10. Replacing the bobbin

1. Press the BOBBIN switch while the machine is in sewing standby mode. The presser foot will be lowered and the X-Y feed mechanism will be retracted.
2. Open the module and replace the bobbin.
3. Close the module, and then press the RESET switch. The X-Y feed mechanism will move back to the sewing start position and the presser foot will be raised.

Refer to "4-4. Bobbin case installation and threading" on page 26.

## 4-7-11. Altering the production counter value

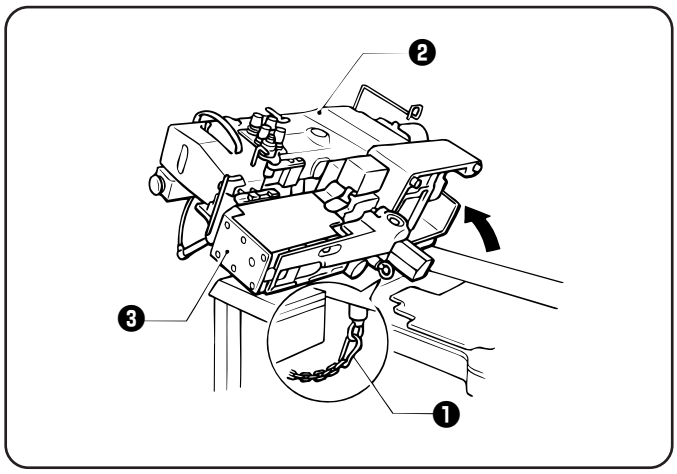
If the (▲) SELECT switch is pressed while the machine is in sewing standby mode, the production counter value will increase by 1. If the ( ▼ ) SELECT switch is pressed, the production counter value will decrease by 1.

# 5. STANDARD ADJUSTMENT（MACHINE HEAD）

## ⚠ CAUTION

- Maintenance and inspection of the sewing machine should only be carried out by a qualified technician.
- Ask your Brother dealer or a qualified electricianto 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
- 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 onwhen 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.

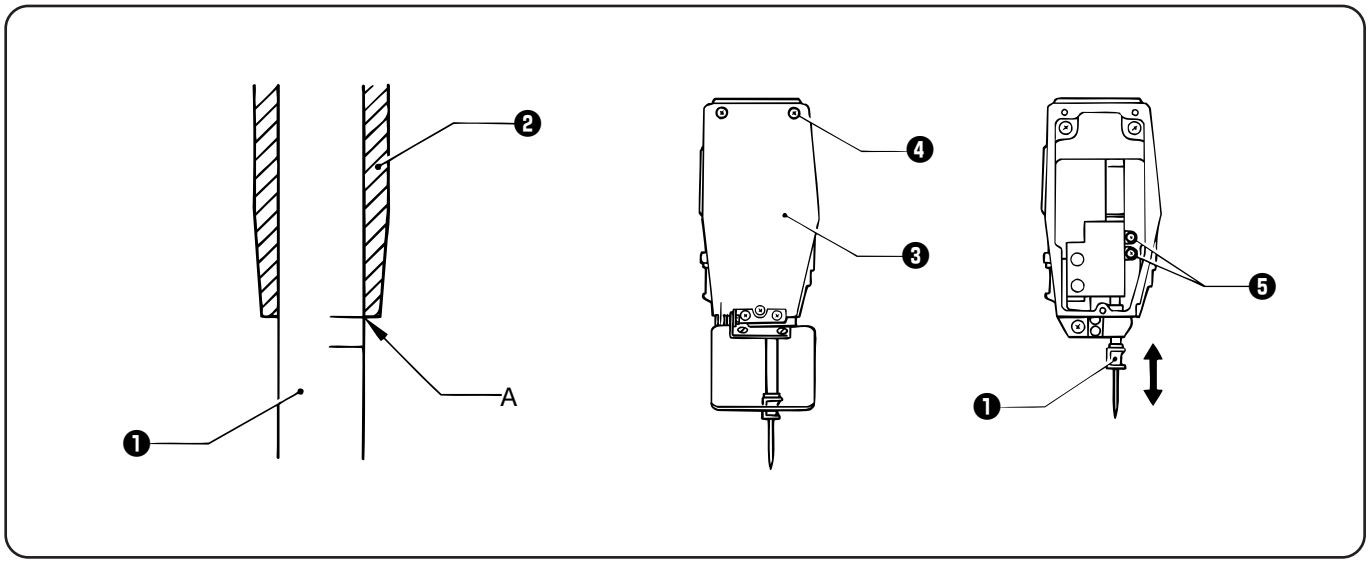
## 5-1. Tilting back the machine head




1. Remove the chain ❶ from the machine head ❷.
2. Go to the left side of the work table and tilt the machine head back while holding it with both hands.

NOTE
- Turn off the power before carrying out this operation.
- Be careful when tilting back the machine head, as the X-Y feed arm may drop down at this time.
- Be sure to have two people there when tilting back the machine head and returning it to its original position.
- Check that the machine head fixing bolts have been removed.
- If the lower shaft module is ❸ not loked, there is the danger that the lower shaft module ❸ will rotate by itself, so make sure that the lower shaft module ❸ is locked.

## 5-2. Adjusting the needle bar height



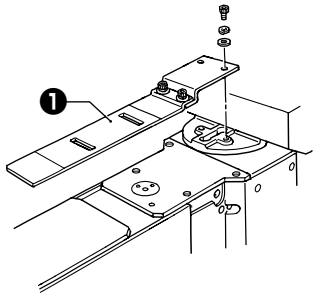

1. When the machine pulley is turned to drop the needle bar ❶ to its lowest position, the second reference line (A) from the bottom of the needle bar should be aligned with the bottom edge of the needle bar bracket ❷.
2. Remove the screw ❹ of the face plate ❸, and then remove the face plate ❸.
3. Loosen the screw ❺, and then move the needle bar ❶ up or down to adjust its height.

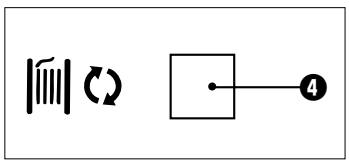
# 5-3. Needle bar lift stroke adjustment

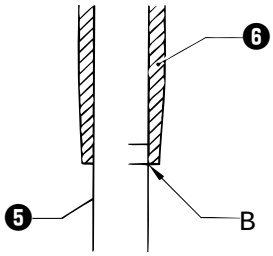
First bar tacking

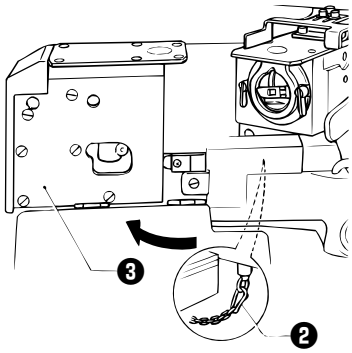
AUTO MODE
◆ Loop length
1st bobbin counter
2nd bobbin counter

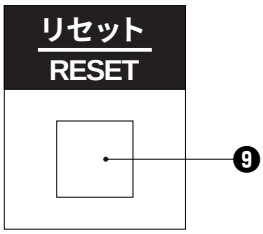
HEAD MODE
◆ 1st bobbin counter
2nd bobbin counter

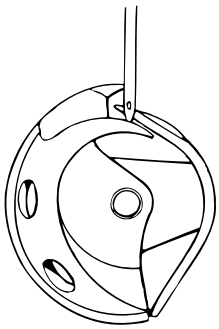


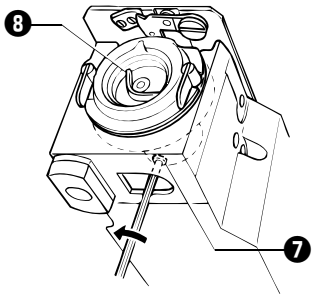



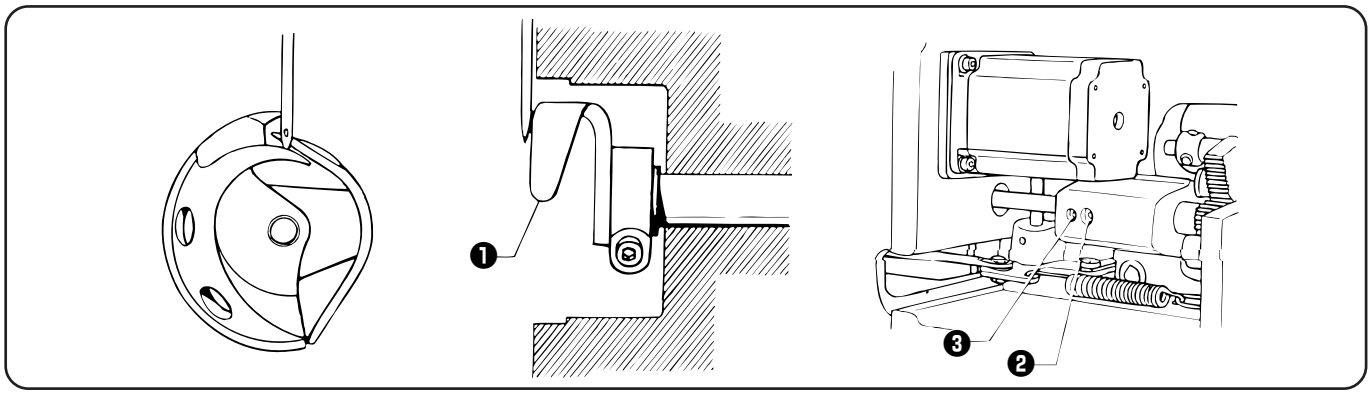






1. Remove the needle for the second bar tacking.
2. Remove the feed plate ❶ and then turn on the power switch.
3. Remove the release stopper chain ❷ of the lower shaft module ❸.
4. When "AUTO mode" or "HEAD mode" appears on the panel screen, press the BOBBIN switch ❹.
5. Gently turn the lower shaft module ❸ approximately 90 ° clockwise.
   NOTE:
   - Turn the air off at this point. (An error code will be displayed, but this can be ignored.)
     Lower the presser foot by hand so that the presser foot and needle bar guide will not obstruct each other.
6. Turn the machine pulley to lower the needle bar ❺ to its lowest point, and then loosen the screw ❼ and use a driver ❽ to adjust so that the point of the shuttle hook is aligned with the center of the needle when the lowest reference line B on the needle bar ❺ is aligned with the bottom edge of the needle bar bracket ❻.
7. After adjusting, turn on the air, press the RESET switch ❾, close return the lower shaft module ❹ to its original position and then press the RESET switch ❾ again.
   NOTE:
   - Never carry out this adjustment while the machine head is tilted.

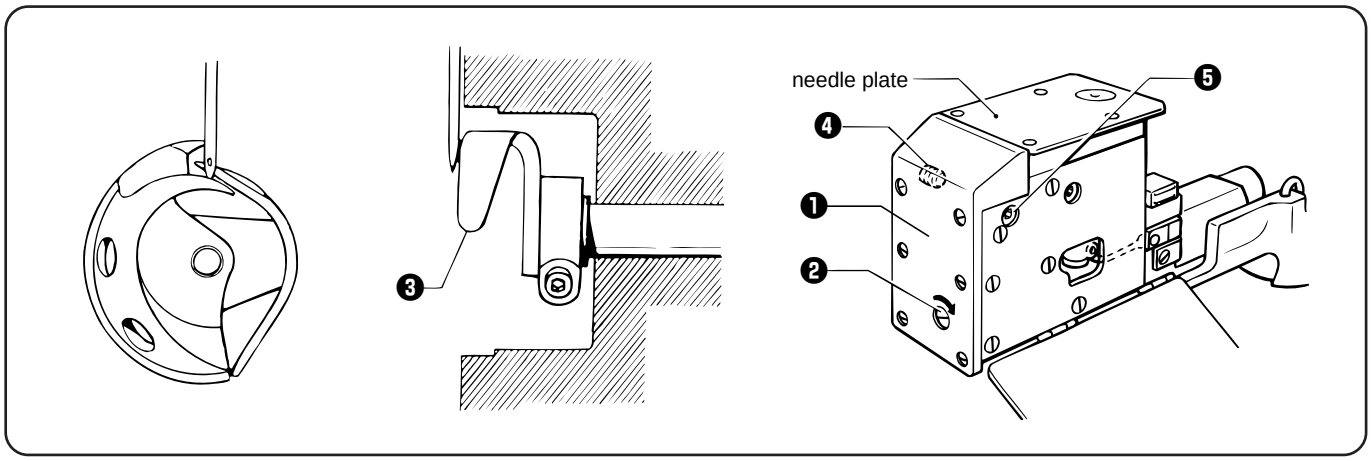
# 5-4. Shuttle driver needle contact adjustment

## 5-4-1. First bar tacking




Turn the pulley and align the shuttle hook point with the needle center. Loosen set screw ❷ and turn the eccentric connecting link stud ❸ so that the needle meets the driver ❶. Note that excessive needle to driver contact will result in skipped stitches. Also, if the needle does not sufficiently contact the shuttle driver, the shuttle hook point will interrupt the needle, resulting in abnormal abrasion.

## 5-4-2. Second bar tacking



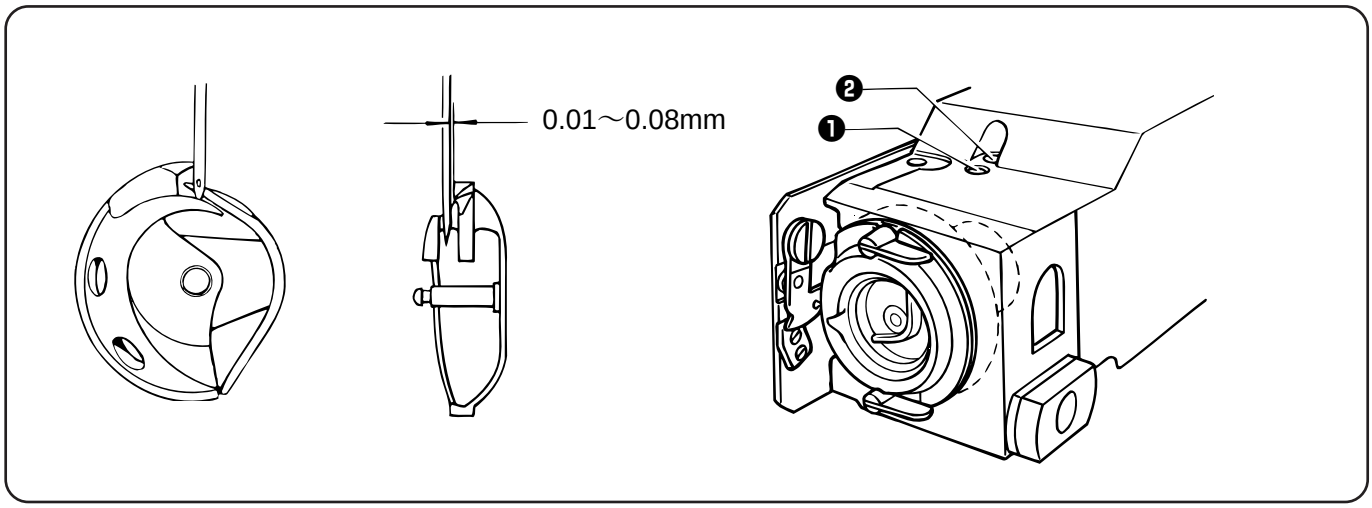

NOTE: Check that the needle is protruding from above the needle plate.

1. Turn the drive shaft ❷ w of the lower shaft module q clockwise until the point of the shuttle hook of the lower shaft module ❶ is almost at the correct timing position.
2. Turn the upper shaft pulley to raise the needle bar from its lowest position until the lowest reference line on the needle bar is aligned with the bottom edge of the needle bar bracket (needle bar timing position).
3. Turn the drive shaft ❷ of the lower shaft module ❶, and then loosen the set screw ❹ and turn the eccentric connecting link stud ❺ to adjust so that the driver ❸ needle contact touches the needle when the point of the shuttle hook of the lower shaft module ❶ is aligned with the center of the needle.

NOTE
- Excessive contact between the needle and the driver ❸ will result in skipped stitches.
- If the needle does not sufficiently contact the driver,❸ the point of the shuttle hook will interrupt the needle, resulting in abnormal abrasion.
- Because the upper shaft and lower shaft operate independently of each other, you should check that the needle does not interfere with the shuttle hook or the driver ❸ when the needle moves inside the shuttle hook of the lower shaft module.
  Also check that the needle does not interfere with the shuttle hook or the driver ❸ in the same way when the lower shaft module is rotating. Interference can result in broken or bent needles.

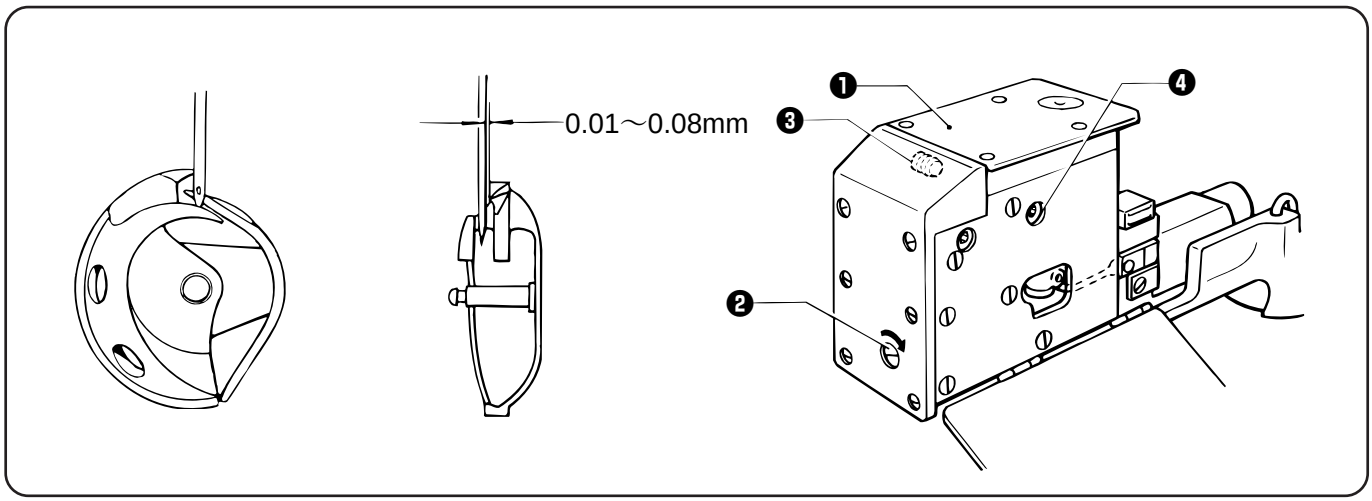
# 5-5. Needle to shuttle hook point gap adjustment

## 5-5-1. First bar tacking




2. Turn the pulley and align the shuttle hook point with the needle center. Loosen set screw ❶ and turn the eccentric connecting link stud ❷ to adjust the needle to shuttle hook point gap to 0.01 - 0.08 mm.

## 5-5-2. Second bar tacking

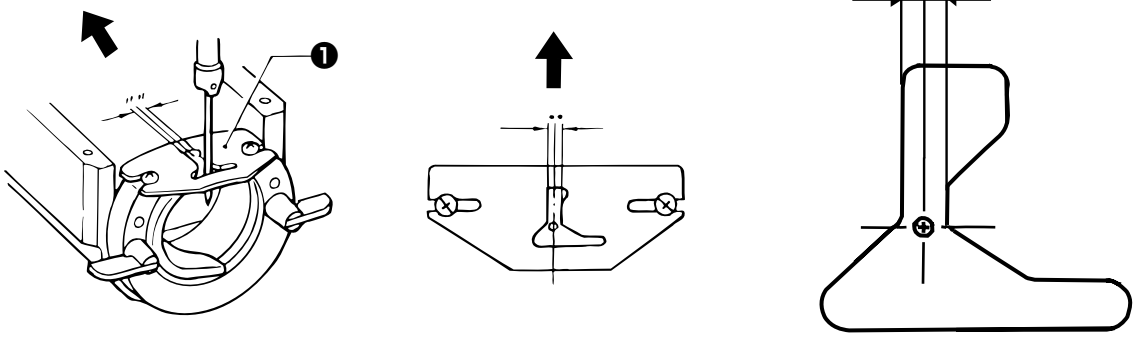



NOTE: Check that the needle is protruding from above the needle plate.

1. Turn the drive shaft ❷ of the lower shaft module ❶ clockwise until the point of the shuttle hook of the lower shaft module ❶ is almost at the correct timing position.
2. Turn the upper shaft pulley to raise the needle bar from its lowest position until the lowest reference
3. Turn the drive shaft ❷ of the lower shaft module ❶, and then loosen the set screw ❸ and turn the eccentric connecting link stud ❹ to adjust so that the clearance between the needle and the point of the shuttle hook is 0.01 - 0.08 mm when the point of the shuttle hook of the lower shaft module ❶ is aligned with the center of the needle

NOTE
- Because the upper shaft and lower shaft operate independently of each other, you should check that the needle does not interfere with the shuttle hook or the driver when the needle moves inside the shuttle hook of the lower shaft module.
- Also check that the needle does not interfere with the shuttle hook or the driver in the same way when the lower shaft module is rotating. Interference can result in broken or bent needles.

## 5-6. Adjusting the shuttle hook thread guide

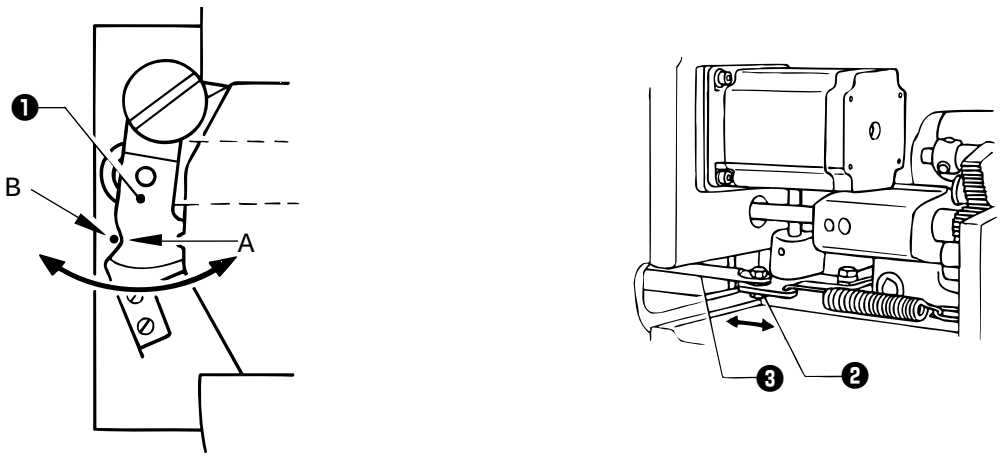



Install the shuttle race thread guide ❶ by pushing it in the direction of the arrow so that the needle groove is aligned with the center of the needle plate hole.

NOTE: If the shuttle race thread guide is in the wrong position, thread breakages, soiled thread or catching of the thread may occur.

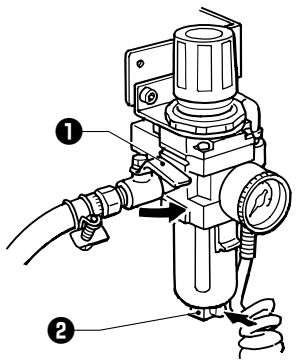
## 5-7. Adjusting the movable knife

### 5-7-1. First bar tacking

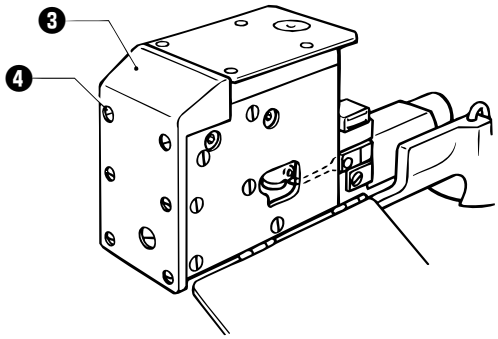



1. Tilt back the machine head. (Refer to "5-1. Tilting back the machine head.")
2. Loosen the nut ❷ and move thread trimmer rod L ❸ to the left or right to adjust so that the V section A of the movable knife ❶ is aligned with the index mark B on the needle plate when the machine is at the stop position.

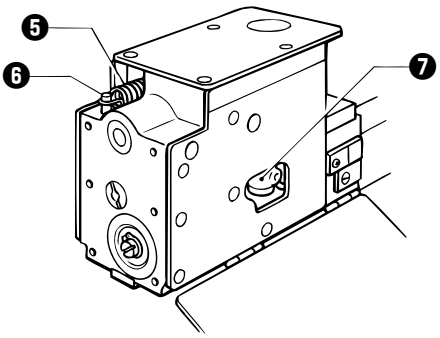
## 5-7-2. Second bar tacking



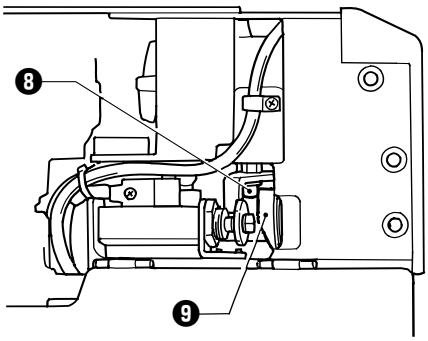

1. Close the air cock ❶.
2. Push the drain cock button ❷ to release the air.



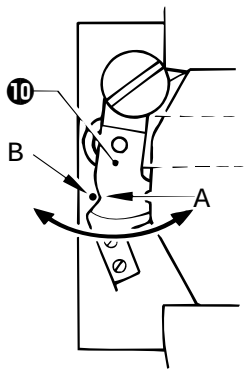

3. Remove the six screws ❹ of the BM-front cover ❸, and then remove the BM-front cover ❸.

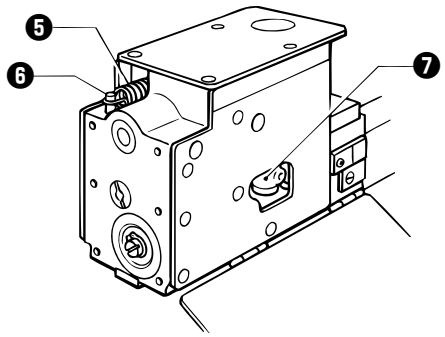



4. Remove the thread trimmer spring ❺ from the spring hook ❻.
5. Loosen the screw of the thread trimmer lever ❼.

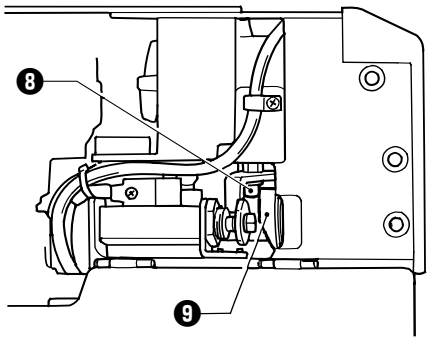



6. While the thread trimmer lever roller ❽ is touching the level surface of the thread trimmer cam ❾, move the movable knife ❿ to the left or right to adjust so that the V section A of the movable knife ❿ is aligned with the index mark B on the needle plate.

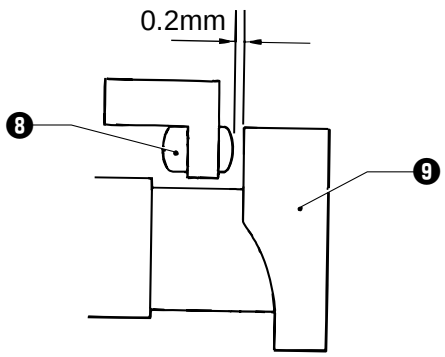





7. After adjusting, tighten the screw of the thread thread trimmer lever ❼ so that there is no vertical play in the thread trimmer lever ❼.



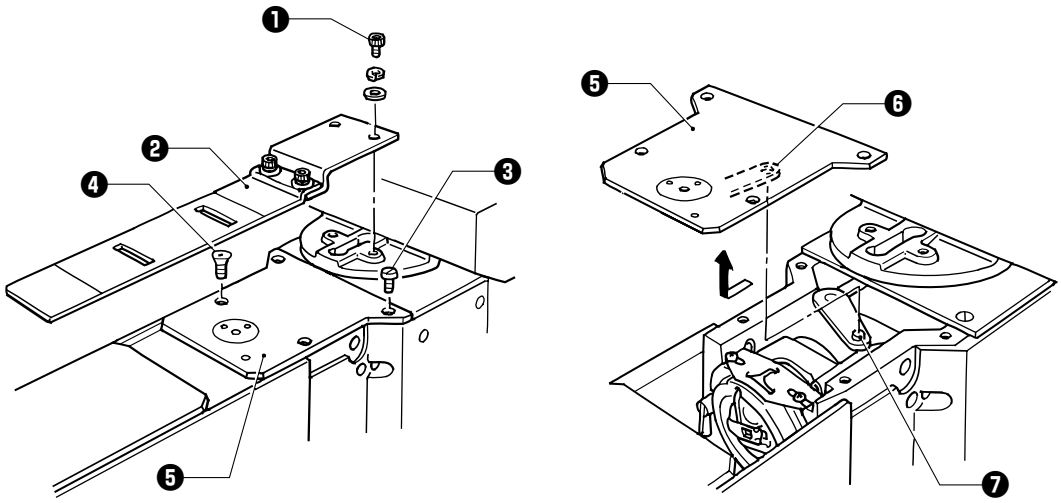

8. Let in the air and check that the clearance between the thread trimmer lever roller ❽ and the level surface of the thread trimmer cam ❾ is 0.2 mm.



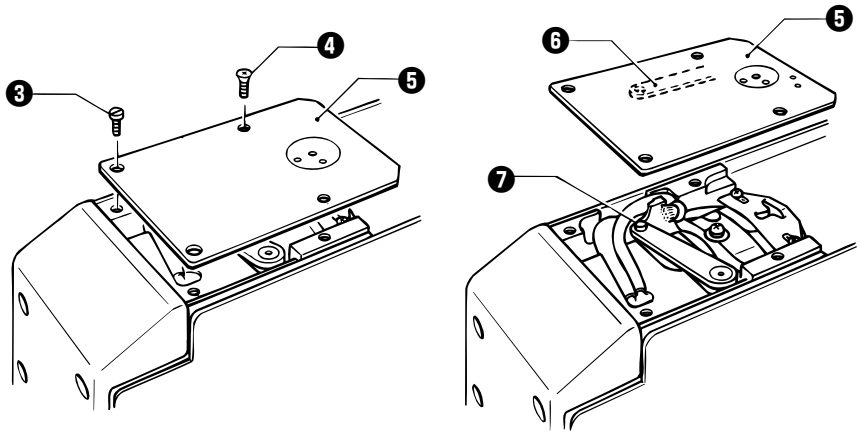

9. Place the thread trimmer spring ❺ onto the spring hook ❻, and then install the BM-front cover ❸ with the six screws ❹.

## 5-7-3. Replacing the movable knife and fixed knife

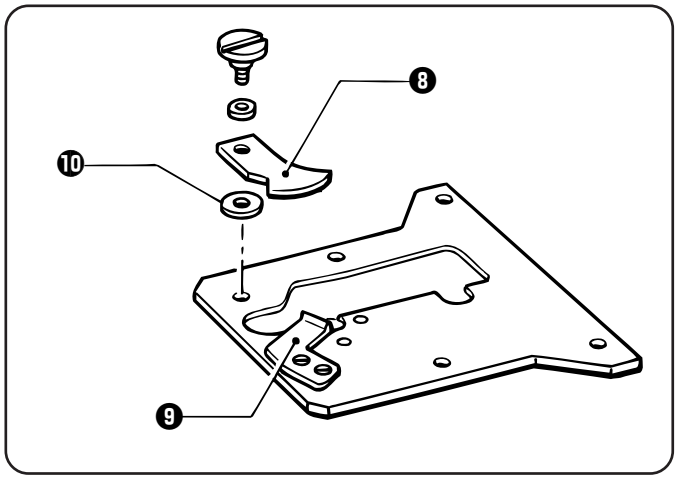
《first bar tacking》



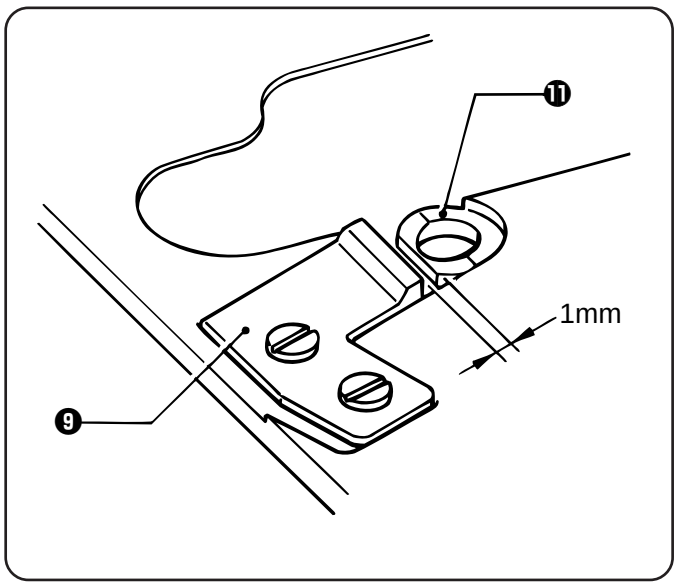

《second bar tacking》



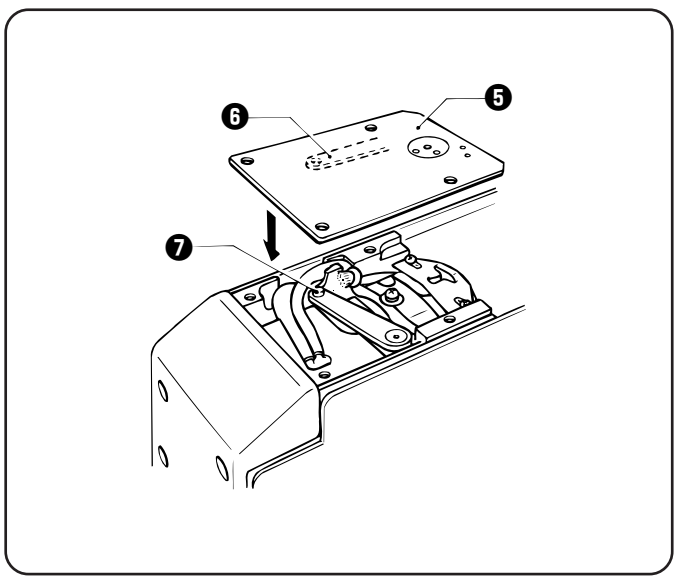

1. Open the large shuttle hook cover, remove the screw ❶, and then remove the feed plate ❷.
2. Remove the two screws ❸ and the two screws ❹, and then remove the needle plate ❺.
3. Remove the thread trimmer connecting rod ❻ from the connecting rod lever pin ❼.




4. Remove the movable knife ❽ and replace it with a new one. At this time, check that the movable knife ❽ and the fixed knife ❾ cut the thread cleanly. If necessary, adjust by using the appropriate movable knife washer ❿ (supplied as accessories).

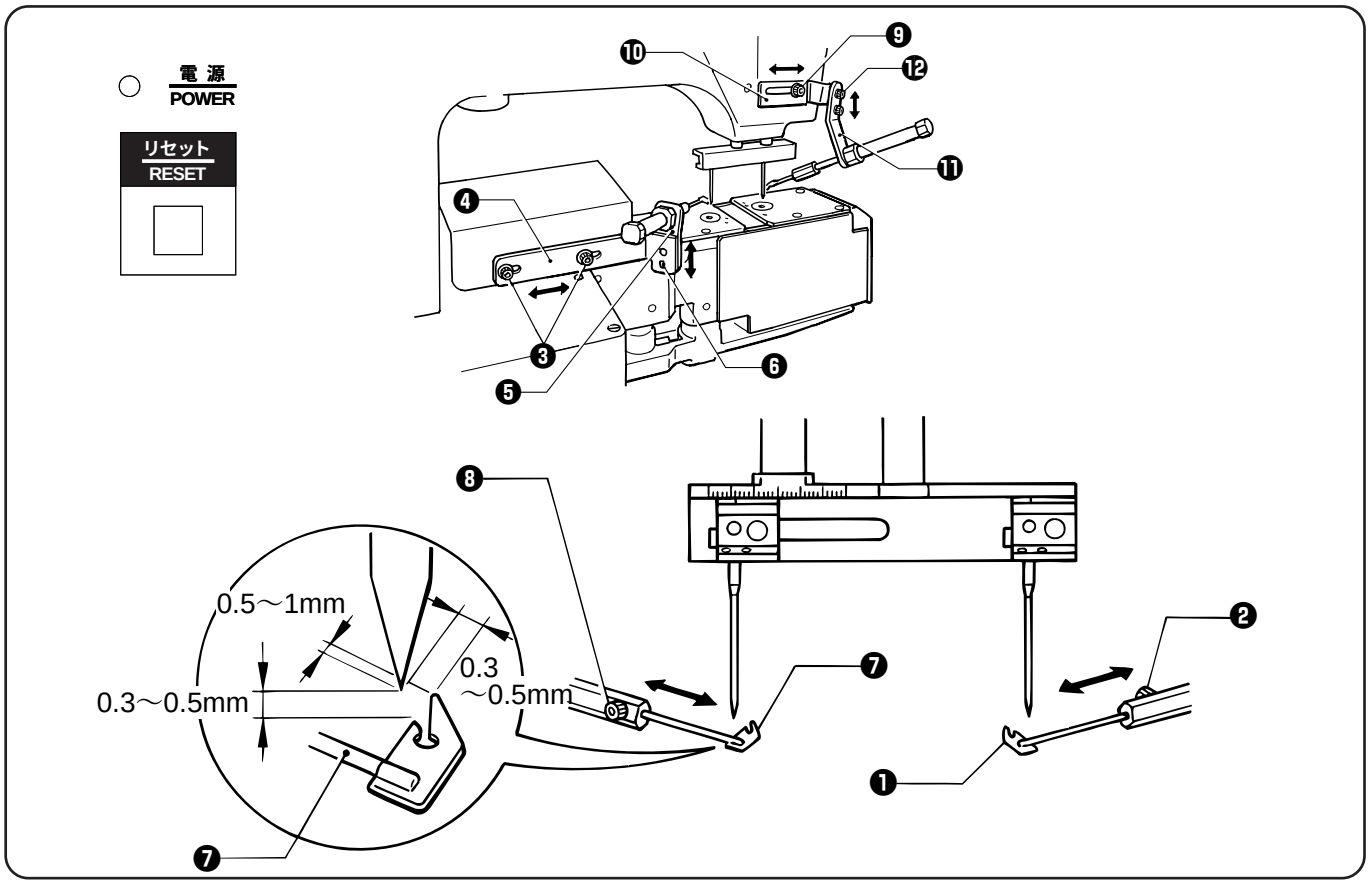



5. Install the fixed knife ❾ at a distance of 1 mm from the needle hole plate ⓫.




6. Place the thread trimming connecting rod ❻ onto the connecting rod lever pin ❼, and then install to the needle plate ❺.

# 5-8. Adjusting the thread wiper



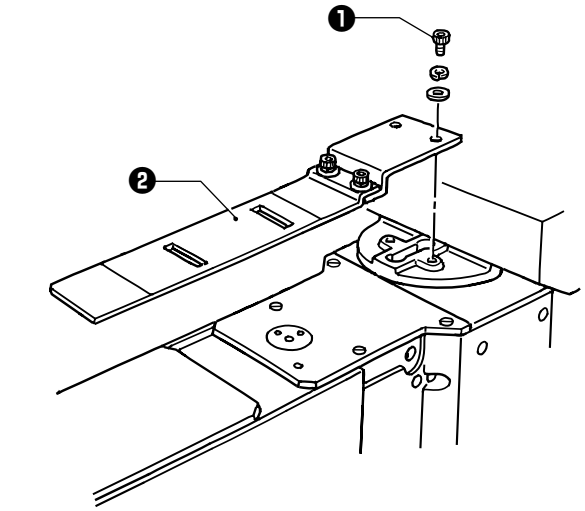

## 5-8-1. First bar tacking

1. Press the RESET switch on the operating panel to raise the needle to the needle up stop position.
2. Press the FOOT switch to lower the presser foot. (The air will be released at this point.)
3. Loosen the set screw ❷ and move the thread wiper ❶ in the direction of the arrow to adjust so that the point of the thread wiper ❶ is 0.3 - 0.5 mm from the point of the needle.
   If adjustment is not possible by moving the thread wiper ❶, adjust by loosening the bolt ❸ and moving thread wiper slide plate R ❹ in the direction of the arrow.
4. Loosen the bolt ❻ of thread wiper slide plate F ❺, and then move thread wiper slide plate F ❺ in the direction of the arrow to adjust the height of the thread wiper ❶ so that it is 0.5 - 1 mm from the point of the needle.
5. Once adjustment is completed, turn on the air and press the RESET switch. (This will clear the error resulting from abnormal air pressure.)

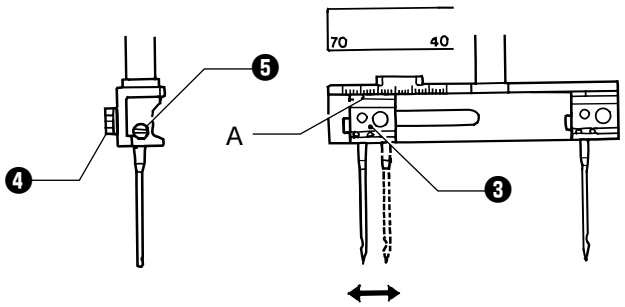
## 5-8-2. Second bar tacking

1. Press the RESET switch on the operating panel to raise the needle to the needle up stop position.
2. Press the FOOT switch to lower the presser foot. (The air will be released at this point.)
3. Loosen the set screw ❽ and move the thread wiper ❼ in the direction of the arrow to adjust so that the point of the thread wiper ❼ is 0.3 - 0.5 mm from the point of the needle.
   If adjustment is not possible by moving the thread wiper ❼, adjust by loosening the bolt ❾ and moving thread wiper slide plate F ❿ in the direction of the arrow.
4. Loosen the screw ⓬ of thread wiper slide plate F ⓫, and then move thread wiper slide plate F ⓬ in the direction of the arrow to adjust the height of the thread wiper ❼ so that it is 0.5 - 1 mm from the point of the needle.
5. Once adjustment is completed, turn on the air and press the RESET switch. (This will clear the error resulting from abnormal air pressure.)

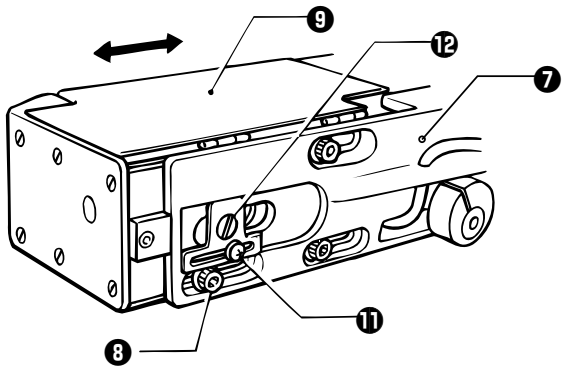
# 5-9. Adjusting the width between the needles




1. Remove the two bolts ❶, and then remove the feed plate ❷.

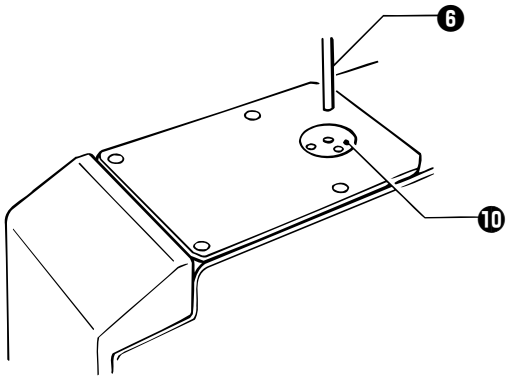



2. Loosen the screw ❹ of the needle clamp ❸, and then move the needle clamp ❸ to the left or right to align the needle clamp index mark A with the position where you would like the new width to be. After adjusting, securely tighten the screw ❹.
3. Loosen the set screw ❺ of the needle clamp ❸ and replace the needle with the accessory needle hole jig ❻.




4. Loosen the three screws ❽ and the screw ❾ of the BM support base ❼, and then move the bobbin module ❾ in the direction of the arrow until the needle hole in the needle hole plate ⓾ above the bobbin module ❾ is almost exactly in line with the needle hole jig ❻.
5. Tighten the screw ❾, and then turn the eccentric connecting link stud ⓬ to make fine adjustments.
6. Turn the upper shaft pulley and check that the needle hole jig ❻ moves smoothly into the needle hole in the needle hole plate ⓫.

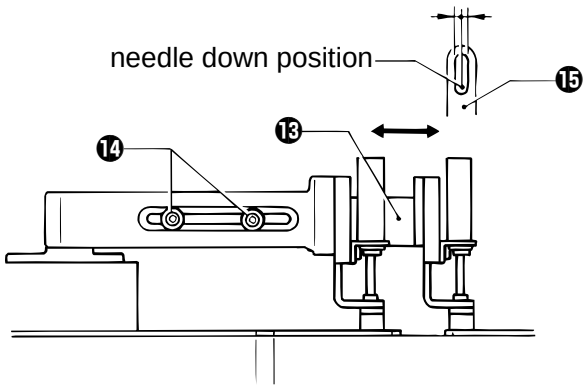
NOTE: If the needle hole jig ❻ moves too far into the needle hole, it will interfere with the shuttle hook.




7. Tighten the three screws ❽.
8. Adjust the thread wiper. (Refer to "Adjusting the thread wiper" on page 44.
9. After adjusting, install the feed plate with the two bolts.
10. After adjusting, move the feed plate to the home position and check that the window of the feed plate is aligned with the center of the needle.
    (Check using program no. "0".)

Set home position

Press the start switch




**<**Adjusting the presser foot**>**

11. Turn on the power and then press the START switch to determine the home position.

12. Loosen the screw ⓮ of the presser set arm ⓭, and then move the presser set arm ⓭ to the left or right to adjust so that the needle down position is in the center of the oval hole in the presser foot ⓯ at the second bar tacking.

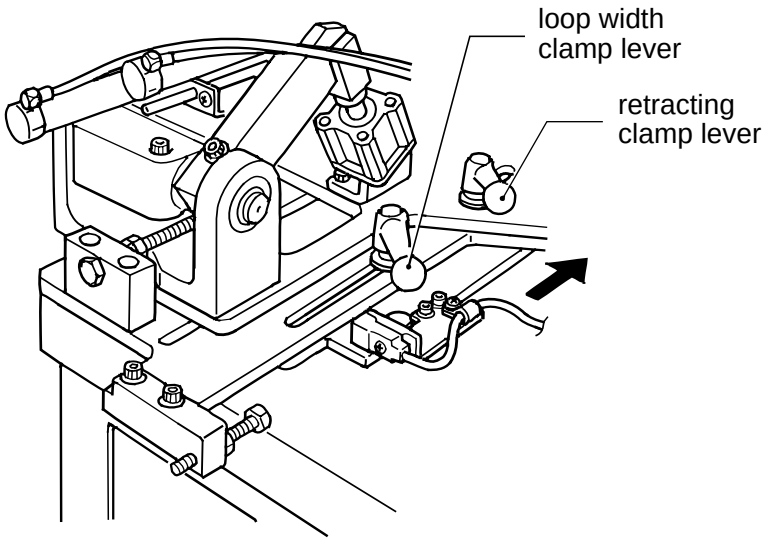
13. Remove the needle hole jig and install the needle.

# 6. STANDARD ADJUSTMENT (MECHANISMS)

## ⚠ CAUTION

- Maintenance and inspection of the sewing machine should only be carried out by a qualified technician.
- Ask your Brother dealer or a qualified electricianto 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 rotary hook and knife
- 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 onwhen 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.

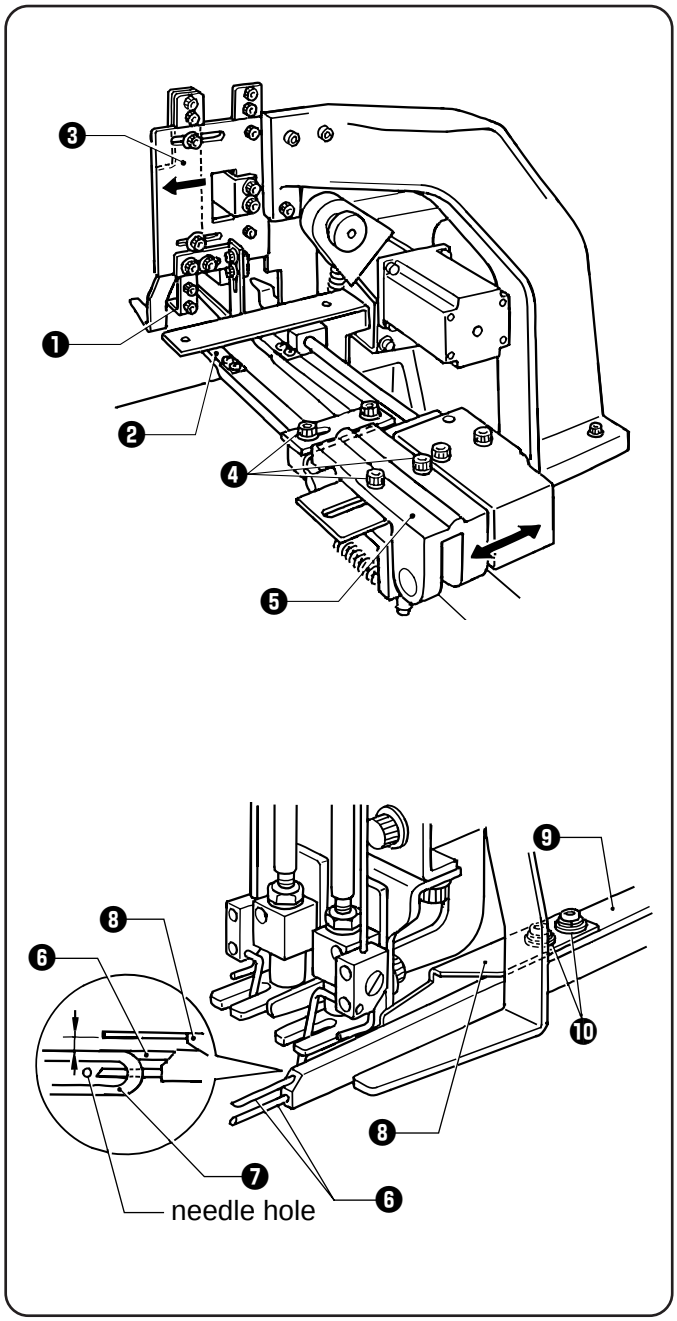
NOTE
- Loosen the retracting clamp lever and move the feeder to the right to retract it before adjusting the mechanisms.
- Take extreme care when carrying out adjustments during step operation, as the machine will be operating at this time.
- Turn the power off before carrying out any adjustments other than step operation adjustments and sensor adjustments.
- Tighten the clamp levers with a force of only about 100 N (10 kgf);do not put the weight of your body on the levers when tightening them.



# 6-1. Adjustments required when the belt loop length is changed

・ Carry out the following adjustments after changing the length of the belt loop.

## 6-1-1. Adjusting fork bracket F




NOTE ●Retract slider base F ❸ so that loop presser F ❶ does not touch the fork shaft ❷.

●Refer to "6-1-2 Adjusting slider base F" on page 50".

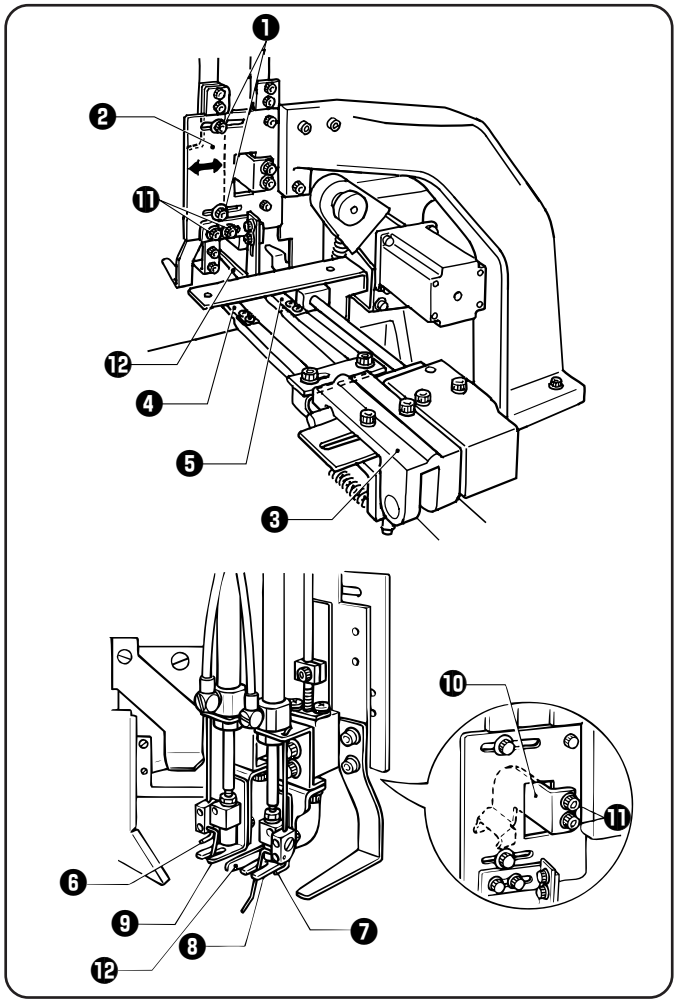
1. Loosen the two bolts ❹, and then move fork bracket F ❺ in the direction of the arrow so that it matches the width between the machine needles, and then tighten the two bolts ❹.

NOTE: It will be easier to see the position relative to the needle hole at this time if the air is released and the fork shaft ❻ is lowered so that it is below the presser foot ❼.

The diameter of the fork shaft, the loop thickness and the amount of looseness will all have slight effects on the bar tacking position, so carry out a test sewing to check the position.

2. Loosen the two screws ❿ and move the loosen loop presser plate ❽ as far as possible (approx 0.5 mm) so that it does not touch the presser foot ❼ and so that it is parallel to the loosen loop presser set plate ❾.

## 6-1-2. Adjusting slider base F




1. Loosen the two bolts ❶, move slider base F ❷ so that it is aligned with fork bracket F ❸, and then tighten the bolts ❶.

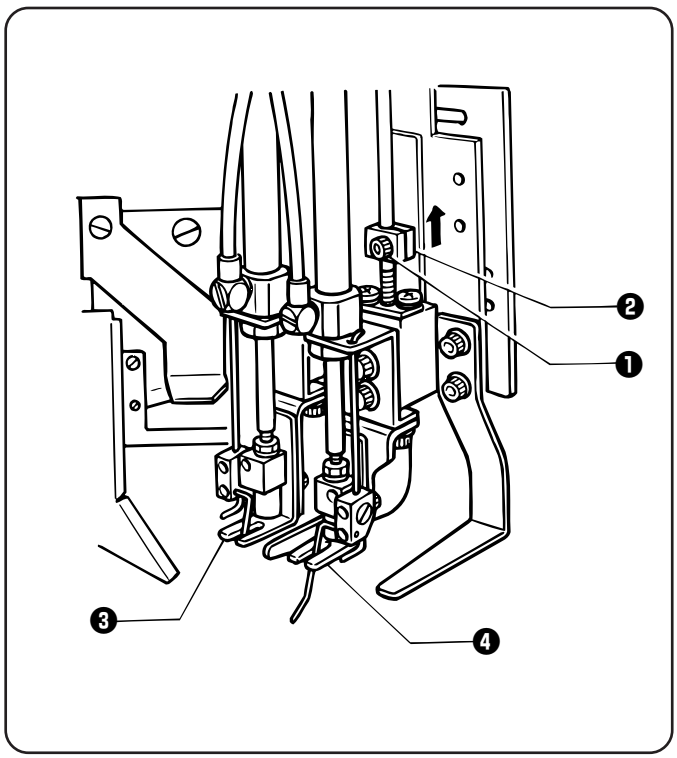
NOTE: ●Check that loosen loop presser plate B ❹ and loosen loop presser plate F ❺ do not touch loop presser UB ❻ or loop presser UF ❼ when the air has been released and the fork bracket is moved to about the middle of loop presser F ❽ and loop presser B ❾.

●If the upper guide plate ⓾ gets in the way, remove the two bolts ⓫ and then remove the upper guide plate ⓾.

●Refer to "6-1-5 Adjusting the upper guide plates" on page 50 for details on the upper guide plate.

2. Loosen the two bolts ⓫, move the loop hold plate ⓬ in between loop presser F ❽ and loop presser B ❾, and then tighten the bolt ⓫.

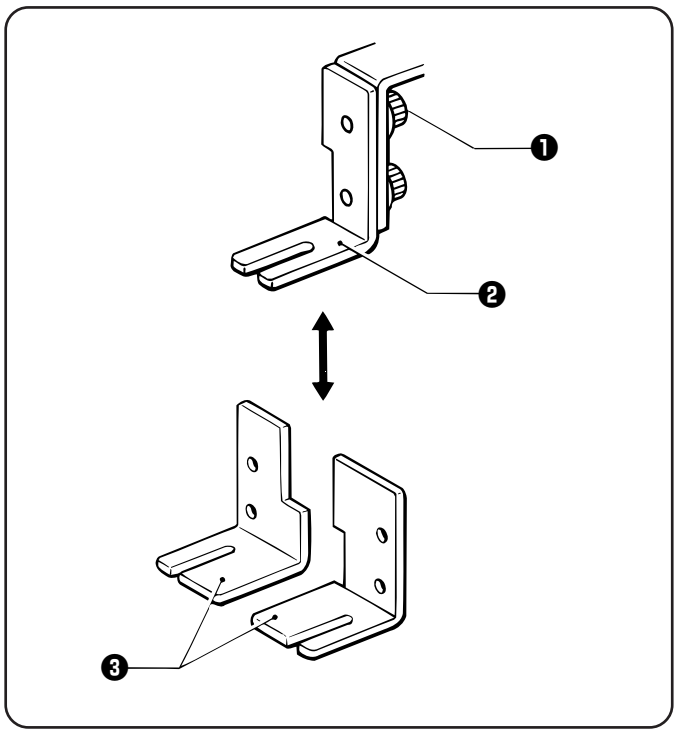
## 6-1-3. Adjusting the height of the slider bracket




1. Release the air, loosen the bolt ❶, and then move the cylinder stopper ❷ up by the amount of drop. After adjusting, tighten the bolt ❶.

NOTE: Raise the slider bracket as high as possible while ensuring that the belt loops do not go under the loop pressers B ❸ F ❹.

## 6-1-4. Replacing the loop pressers



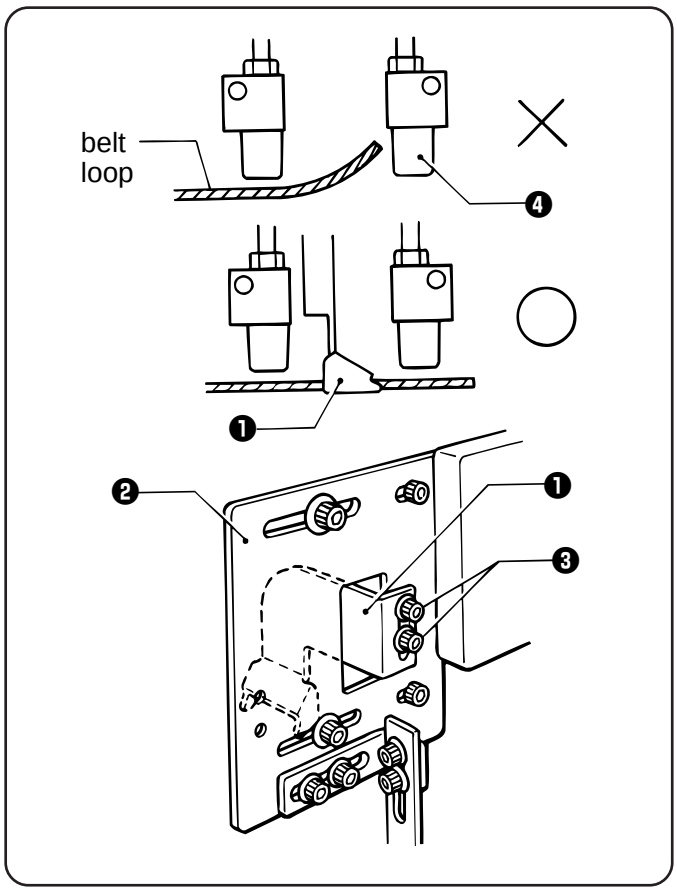

[Replacing the loop pressers with a wider type]

Remove the bolt ❶, and then replace the loop pressers ❷ with the 70B and 70F loop pressers ❸ (available as an option).

NOTE
- It can still be effective if only one of the loop pressers is replaced.
- If the distance between the forks is greater than 58 mm, the wide type of loop presser can be used on both sides.
- If the upper guide plate interferes with the loop pressers, remove the upper guide plate.

## 6-1-5. Adjusting the upper guide plates

- If the belt loops curve upward and touch presser block F, using upper guide plates A and B may be effective in preventing this.



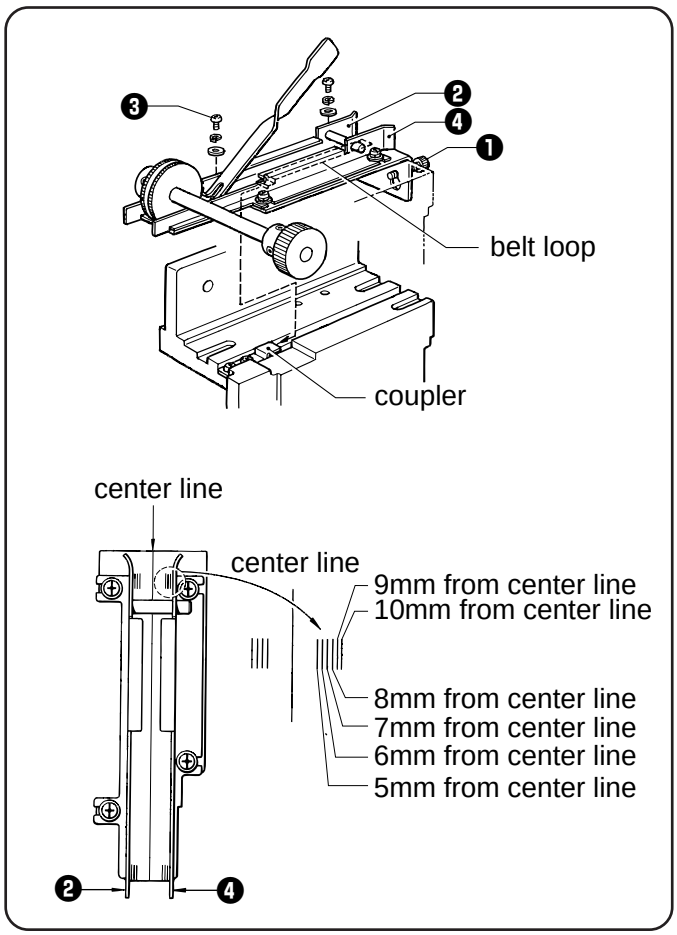

[Installation]

Provisionally install upper guide plate A ❶ or upper guide plate B to the presser unit setting plate ❷ with the two bolts ❸, adjust the upper guide plates so that the belt loops do not touch presser block F ❹, and then securely tighten the bolts ❸.

* Upper guide plate A ❶ can be used if the width between the needles is 52 mm or more, and upper guide plate B can be used if the width is 56 mm or more.

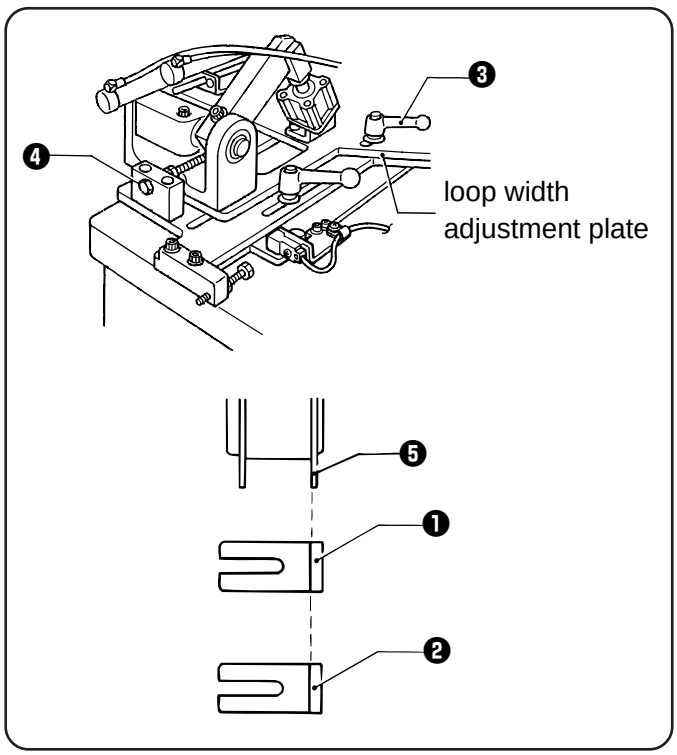
# 6-2. Adjustments required when the belt loop width is changed

## 6-2-1. Adjusting channel



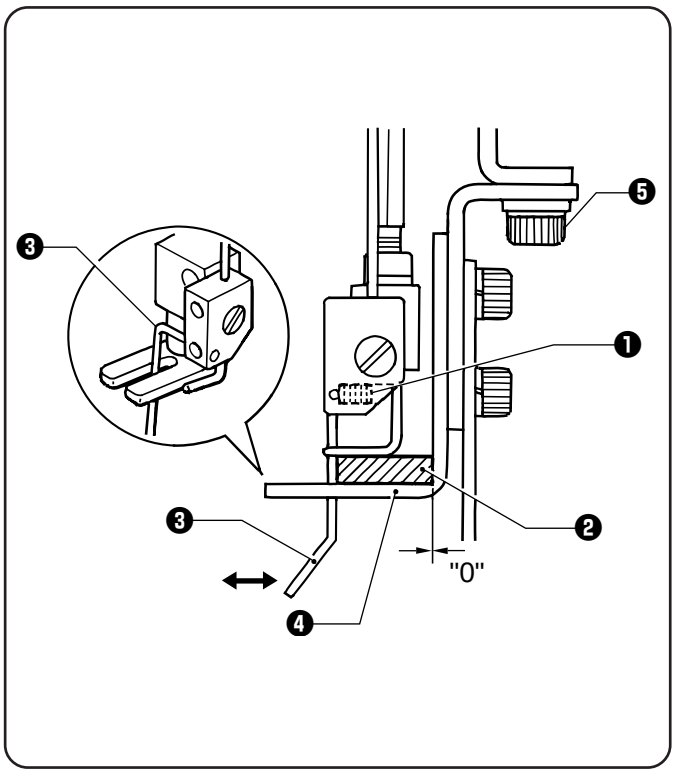

1. Loosen the two bolts ❶ up to 7 mm, and remove the channel assembly from the unit.
   NOTE: Fine adjustment of channel B (left side) ❷ should be carried out while the channel as sembly is attached.
2. Loosen the four screws ❸ and align the channel to the width of the belt loop.
   (Example)
   How to align if the belt loop width is 14 mm
   (a) Align the perpendicular surface of channel F (right side) ❹ with a line 7 mm from the cente line.
   (b) Set the position of channel B (left side) ❷ so that the belt loop joints pass through smoothly.
   NOTE: If the center of the V cut is misaligned, move channel F (right side) ❹ horizontally.
3. Position the coupler of the channel to the coupler of the unit base. Secure them using the bolt ❶.

## 6-2-2. Adjusting the width adjustment plate




1. With loop presser B ❶ and loop presser F ❷ both in the raised position, loosen the clamp lever ❸.
2. Turn the bolt ❹ so that the left edge of channel F ❺ is aligned with the edges of loop presser B ❶ and loop presser F ❷.
3. Tighten the clamp lever ❸.
   NOTE: If the belt loops run along the right edge of channel B, align the edges of loop presser B ❶ and loop presser F ❷ the end of the belt loops.

## 6-2-3. Adjusting the loop guide spring

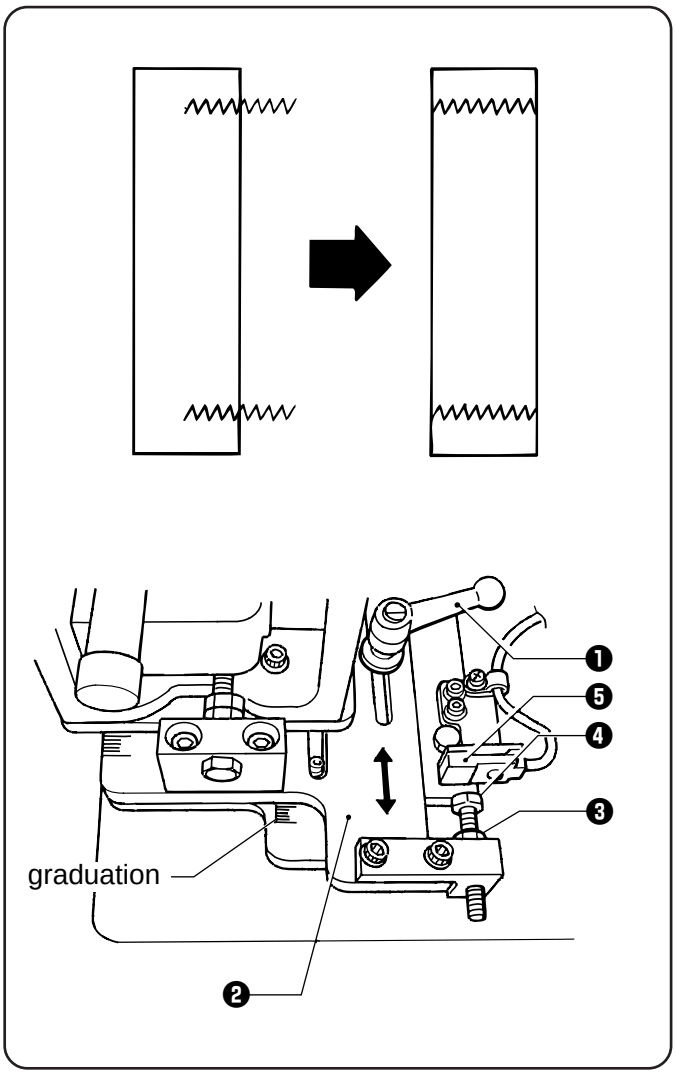



1. Loosen the set screw ❶.
2. With the air released, move the loop guide spring ❸ to adjust so that the distance A is 0 when the belt loop ❷ is being pressed.
3. After adjusting, tighten the set screw ❶ to secure the loop guide spring ❸.

NOTE ・Check that the loop guide spring ❸ does not interfere with the channel of the loop presser ❹.

・Check that the edge of the belt loop is parallel to the edge of the presser foot.
If they are at an angle, loosen the bolt ❺ and adjust as necessary.

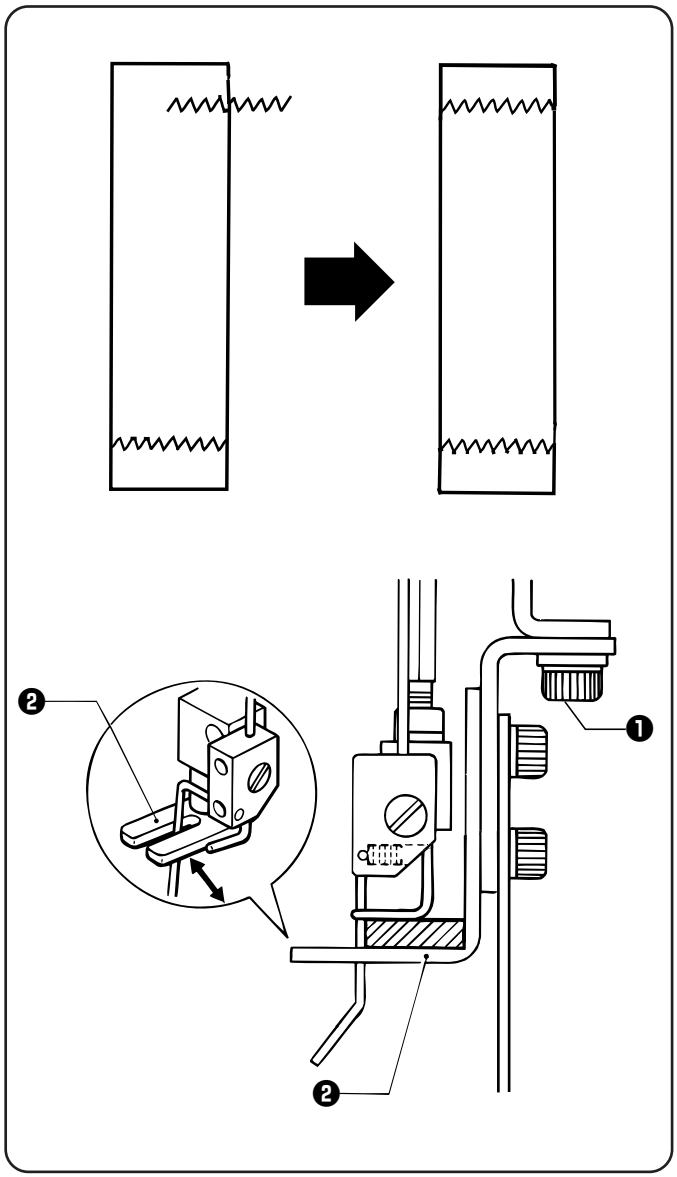
## 6-2-4. During sewing




[If the horizontal position of the belt loops or the center position of the bar tackings is incorrect]

1. Loosen the retract clamp lever ❶ and retract the feeder ❷.
2. Loosen the nut ❸.
3. Turn the bolt ❹ to adjust the transfer position of the belt loops.
4. After adjusting, tighten the nut ❸ to secure the feeder ❷.

NOTE: Check that the sensor ❺ illuminates at this time.



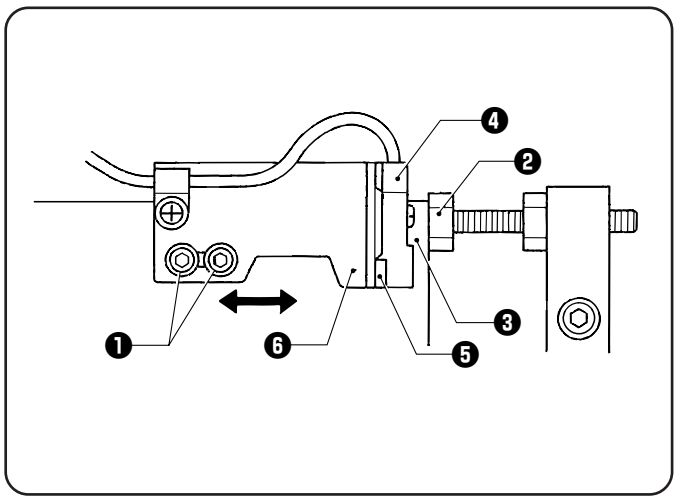

[If the 1st bar tacking position and 2nd bar tacking position are not aligned]

1. Check the items given in "6-6. Adjusting the folding".

2. If the bar tacking positions are still not aligned after carrying out the adjustment check in step 1, loosen the bolt ❶ and move the loop presser ❷ to the left or right by the amount that the bar tacking is out of alignment.

3. After adjusting, adjust the fork bracket while referring to "6-3-3. Replacing the fork bracket and fork shafts (L and S)".

## 6-2-5. During sewing

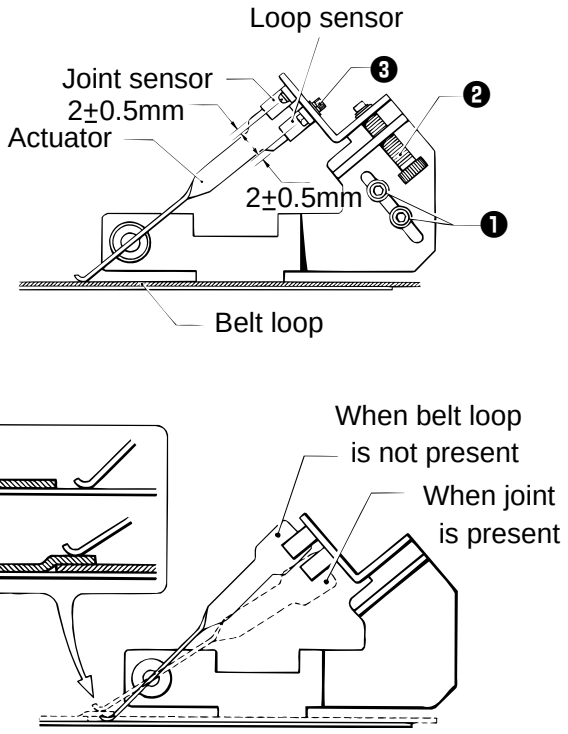



Loosen the two bolts ❶, move the sensor mounting plate ❻ so that the LED ❺ indicator of the sensor ❹ illuminates when the bolt ❷ is touching against the feeder base plate ❸, and then tighten the bolts ❶ to secure the sensor mounting plate ❻ in that position.

# 6-3. Adjustments required when the belt loop thickness is changed

・ Carry out the following adjustment if the thickness of the belt loops has been changed.

## 6-3-1. Adjusting joint sensor




1. Turn the power on.
2. Loosen the bolt ❶.
3. Adjust the dimension between the center of the joint sensor and actuator edge to 2 ± 0.5 mm using the adjusting shaft ❷.

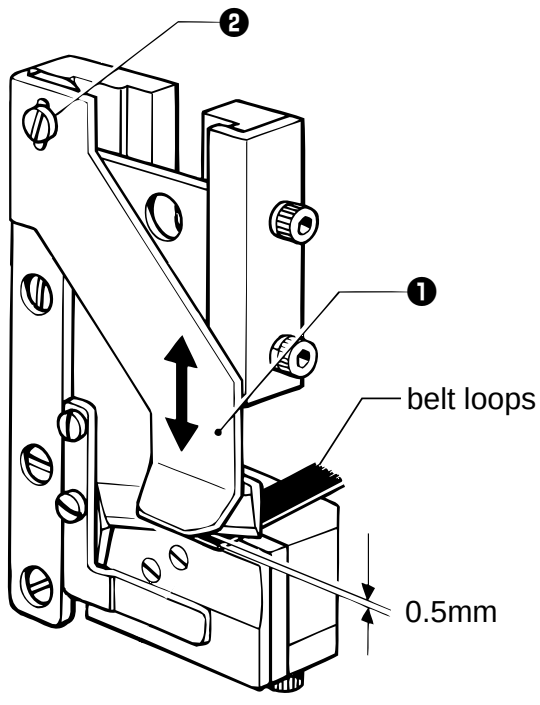
NOTE: Check that the joint sensor detects the belt loop joint. When the joint sensor detects the belt loop joint, the SEAM JOINT indicator lights.

4. Adjust the dimension between the center of the loop sensor and actuator edge to 2 ± 0.5 mm using the bolt ❸.

NOTE1: Check that the loop sensor functions properly when the belt loop is not set. When the loop sensor detects that the belt loop is not set, the LOOP EMPTY indicator lights.

NOTE2: If the belt loop is thin, adjust the dimension so that it is smaller than 2 ± 0.5 mm.

## 6-3-2. Adjusting loop support T

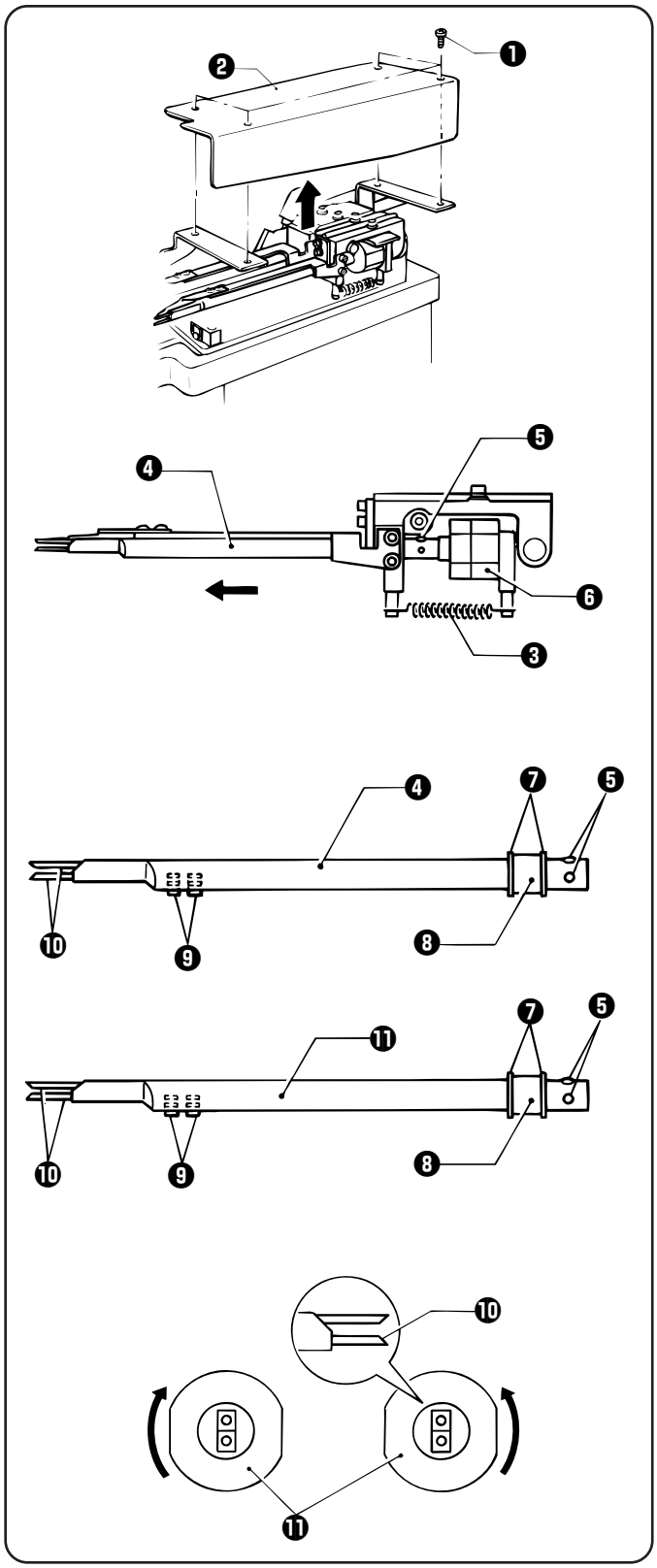



1. If belt loops with no curls are being fed during step operation, adjust so that the clearance between loop support T ❶ and the belt loops is approximately 0.5 mm.
2. Loosen the screw ❷ and move loop support T ❶ in the direction of the arrow to adjust.

## 6-3-3. Replacing the fork bracket and fork shafts (L and S)

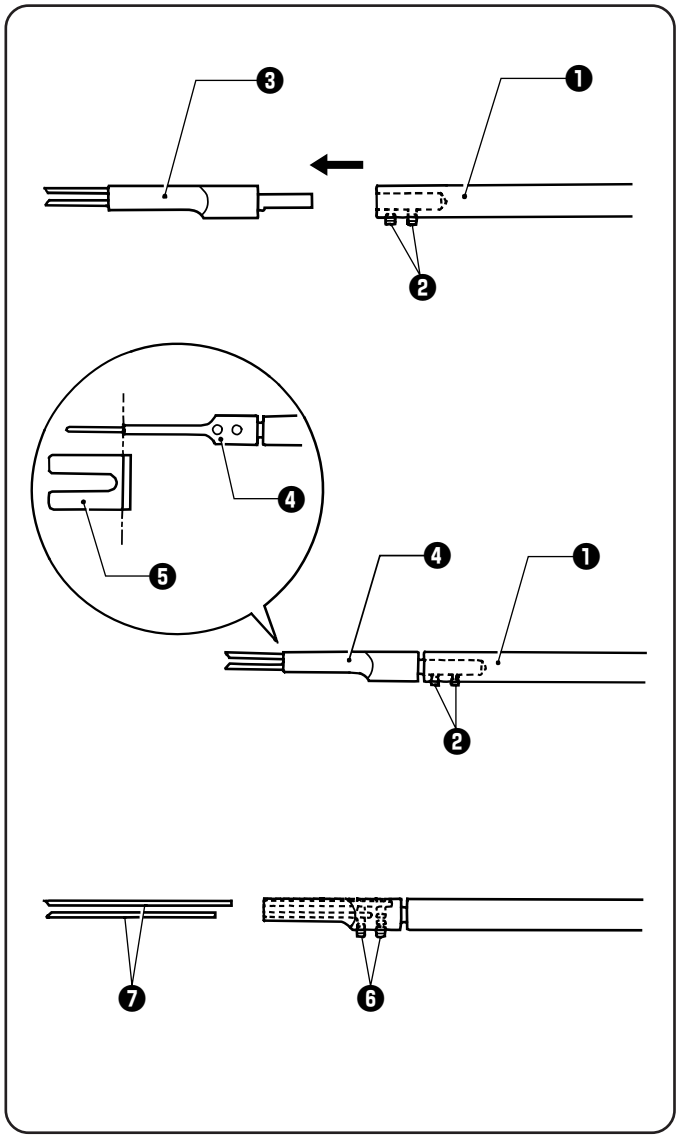
・Replace the fork in accordance with the thickness of the belt loops by referring to the table below.

| | Clearance (mm) | Belt loop thickness (mm) |
|---|---|---|
| Thin material | 1.8 | 0.7～1.3 |
| Standard | 2.6 | 1.1～2.1 |
| Thick material | 3.2 | 1.8～2.7 |




[When replacing the fork]

1. Remove the four screws ❶, and then remove the feeder cover ❷.
2. Remove the springs ❸ from the cylinder setting base and from fork bracket F and fork bracket B.
   NOTE: Be sure to use the proper tool to remove the spring.
3. Remove the two screws ❺ on the fork ❹.
4. Pull the fork ❹ out from the rotary cylinder ❻.
   NOTE: If the fork being replaced is an assembly, proceed to step 7 below.
5. Loosen the two retaining rings ❼, the two fork bushings ❽ and the two set screws ❾, and then remove fork shafts L and S ❿ from the fork ❹.
6. Install the two retaining rings ❼ and the fork bush ings ❽ to the new fork ⓫.
7. Secure the fork shafts L and S ❿ with the two set screws ❾ so that the bevelled surfaces face inward.
8. Insert the new fork ⓫ into the rotary cylinder ❻.
9. Turn the rotary cylinder ❺ as shown in the illustration until it will not turn further, and then hold fork shafts L and S ❿ vertical beside each other, and install them with the two set screws ❾.
10. Install the the springs ❸ to cylinder setting base, fork bracket F and fork bracket B.
11. Install the feeder cover ❷ with the four screws ❶.




[When replacing the fork bracket (separate type)]

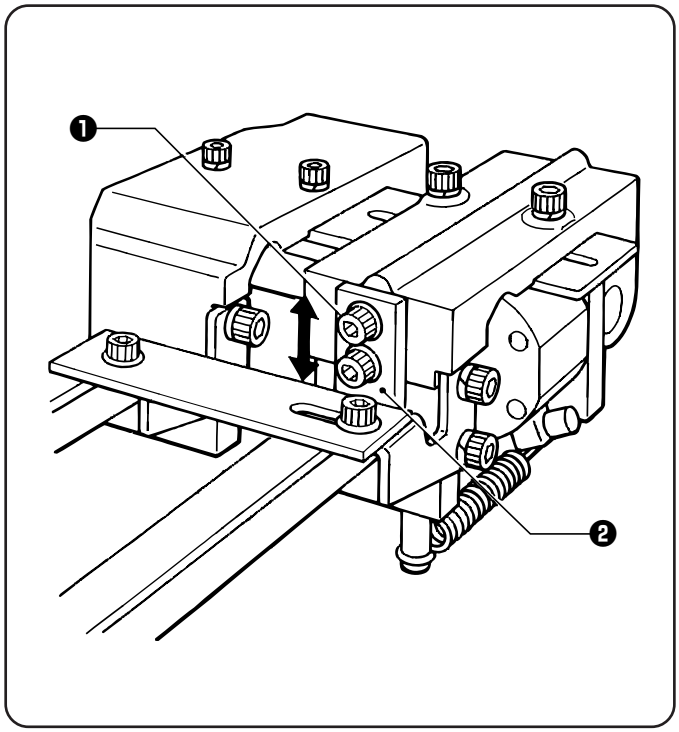
1. Loosen the two set screws ❷ of the fork bracket shaft ❶, and then remove the fork bracket ❸ from the fork bracket shaft ❶.

2. Insert the new fork bracket ❹ onto the fork bracket shaft ❶ until the end of the fork bracket ❹ is aligned with the end of the loop presser ❺, and then tighten the two set screws ❷.

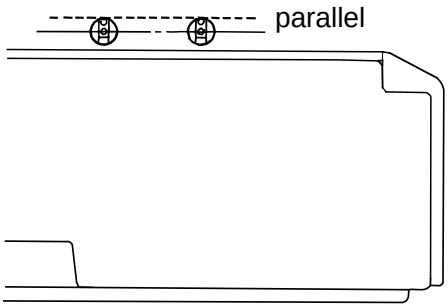
■ When replacing fork shaft L and fork shaft S

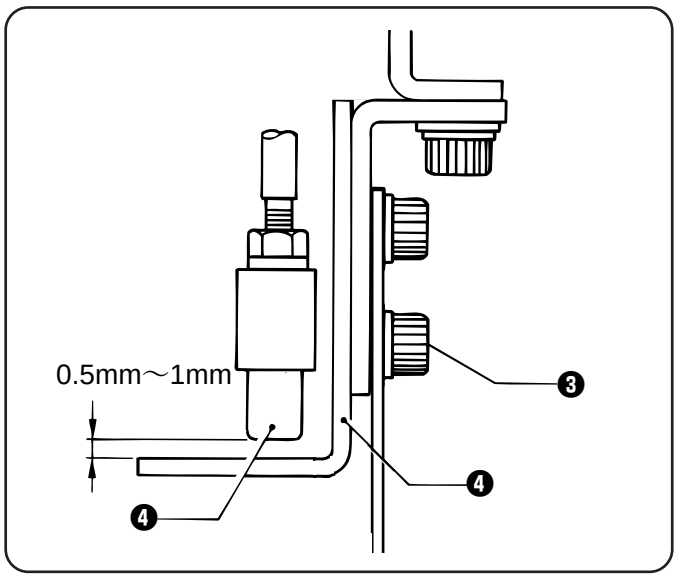
Loosen the set screw ❻ and then replace for shaft L and fork shaft S ❼.

## 6-3-4. Adjusting the fork shaft and the belt loop transfer height

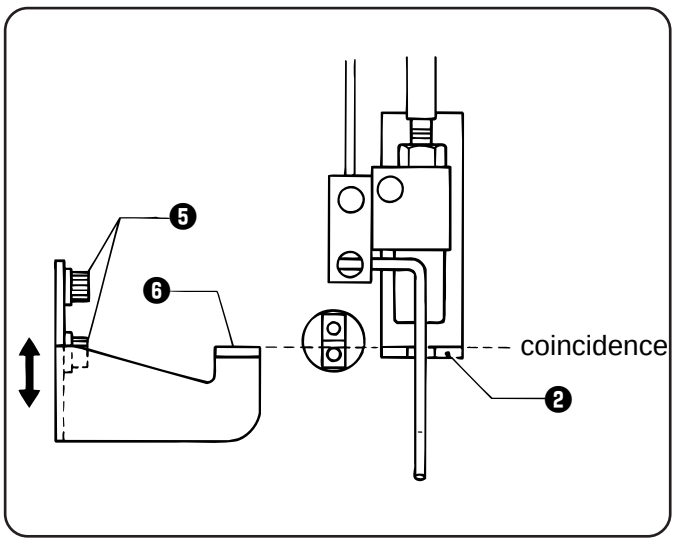



1. If the 1st bar tacking position and 2nd bar tacking position are not aligned. Loosen the two bolts ❶ and then move the fork bracket stopper ❷ to adjust the position of the fork bracket so that the heights are the same. After adjusting, tighten the two bolts ❶. It is possible to determine whether the fork bracket is parallel to the top of the needle plate.

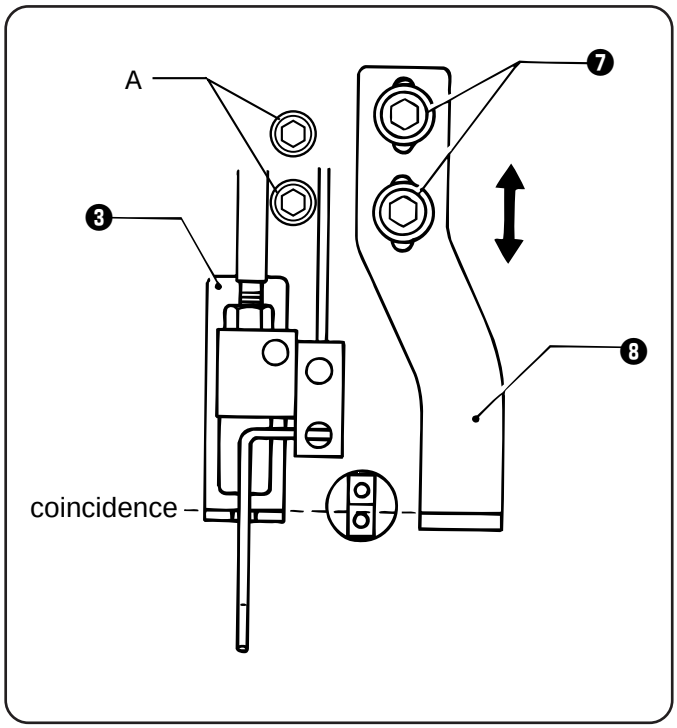


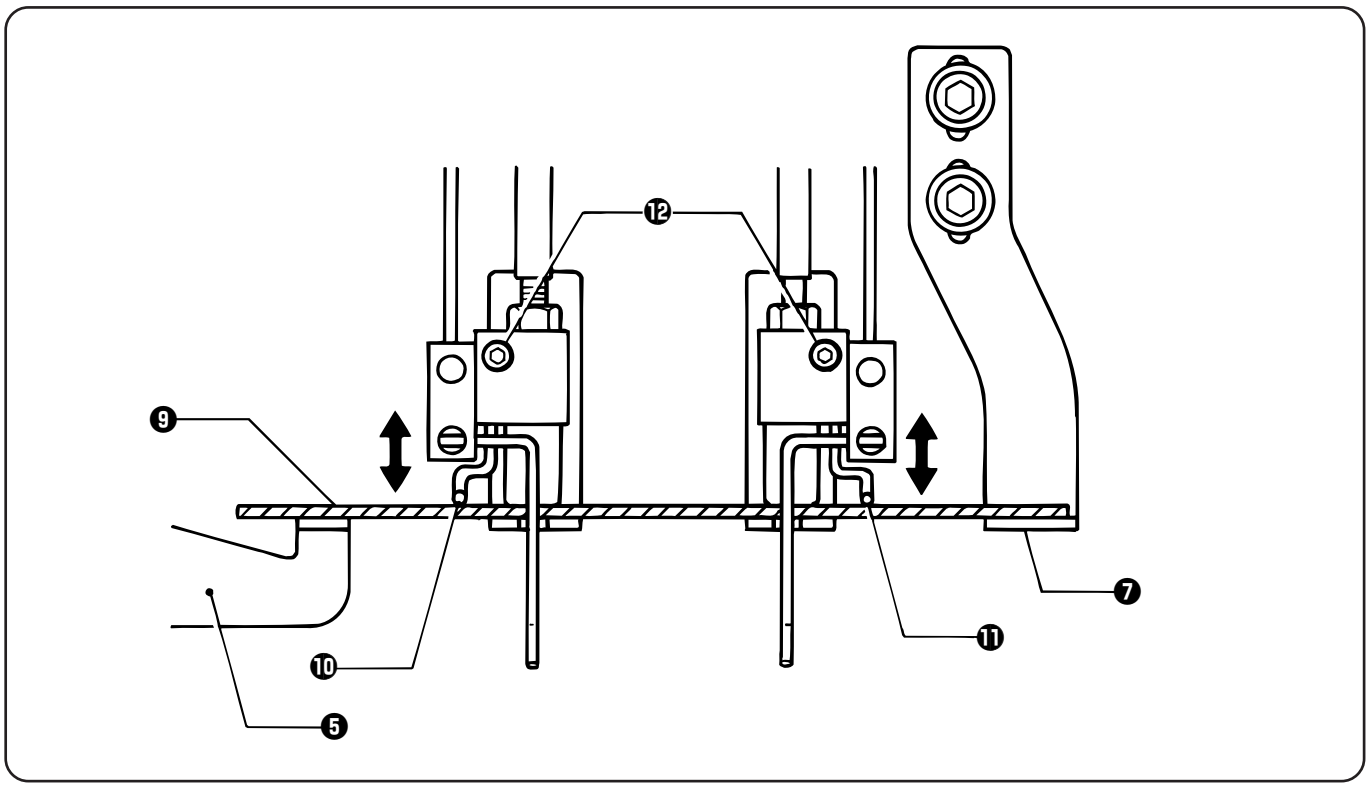

2. If not enough pressure is applied for the thickness of the belt loops, loosen the two bolts ❸ and move loop pressers B ❹ and F ❺ up or down to adjust the distance between them and button presser A ❻.
   * As a guide, the distance should be 0.5 - 1 mm less than the thickness of the belt loops.



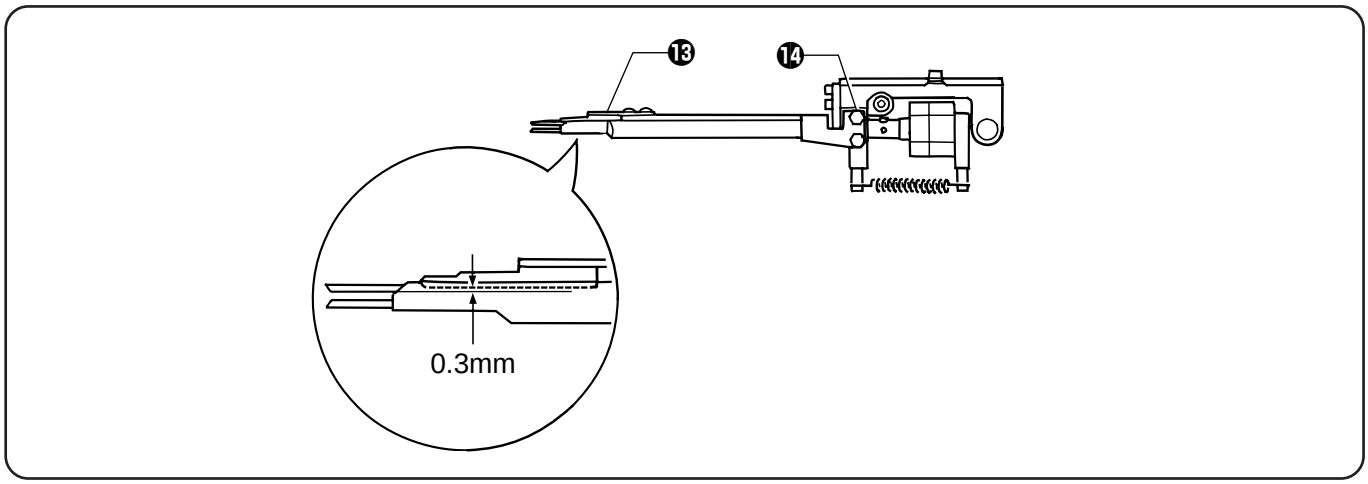

3. Loosen the two bolts ❺ of loop support B ❻, and then align loop support B ❻ with the top of loop presser B ❷.



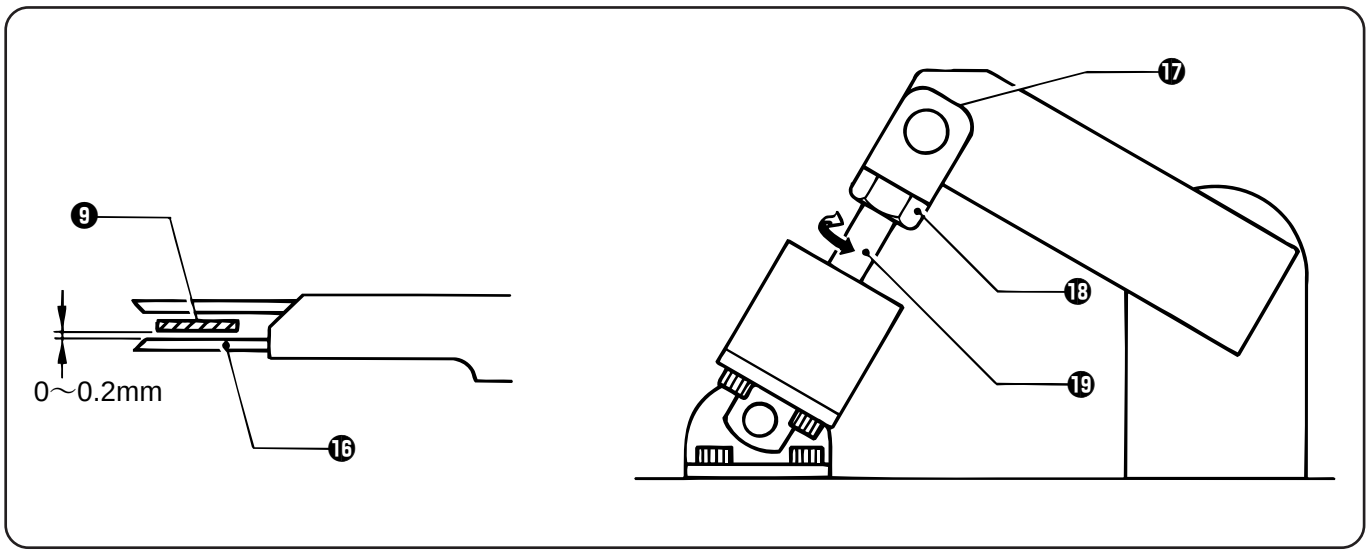

4. Loosen the two bolts A and then adjust so that the top of loop presser F ❸ and the top of loop presser B ❷ are aligned.
5. Loosen the two bolts ❼ of loop support F ❽, and then align loop support F ❽ with the top of loop presser F ❸.




6. Loosen the screw ⓬ and move loop presser UB ⓾ and loop presser UF ⓫ up and down to adjust so that the belt loops ❾ lie gently on top of loop support B ❺ and loop support F ❼ when the belt loops ❾ are being pressed during step operation.

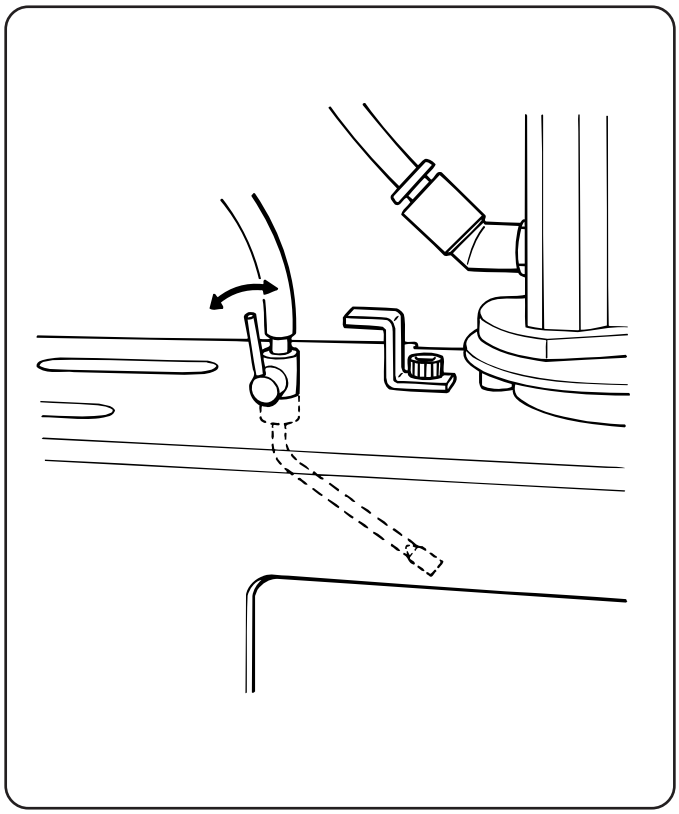



7. Loosen the two bolts ⓮ and adjust so that there is a slight distance (about 0.3 mm) between the belt loops ❾ and loosen loop presser foot B ⓭ and loosen loop presser foot F ⓭ at this time.



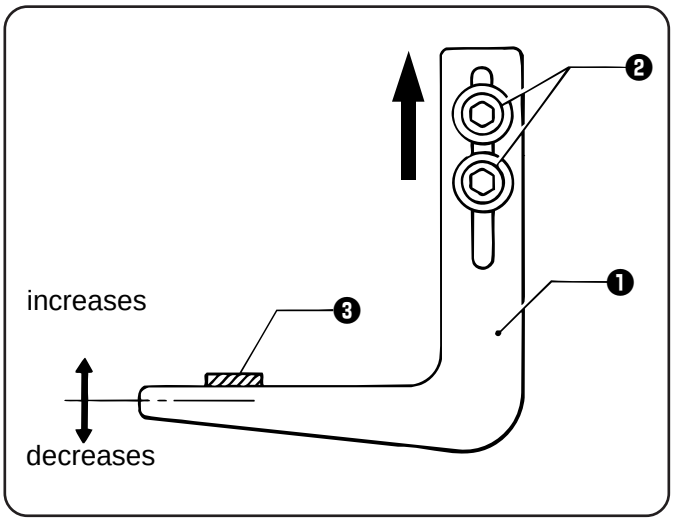

8. Loosen the nut ⓲ which holds the knuckle joint ⓱ and turn the cylinder rod ⓳ to adjust so that the lower surface of the belt loops and the top of fork shaft S ⓰ are aligned but with a slight space (0 - 0.2 mm) when the fork shaft on the first bar tacking side picks up the belt loop ❾ during step operation.
9. After adjusting, tighten the nut ⓲.
   NOTE: After adjusting the 1st bar tacking side, check that there is the same amount of clearance at the 2nd bar tacking side. If the clearances are different, re-check the adjustments given in steps 4- 6.

## 6-3-5. Adjusting the air pressure for cleaning away belt scraps (during V cutting)



* Adjust the air pressure using the air adjusting lever.If it is parallel to the air tubes, the air pressure will be greatest, and if it is turned either way from this position, the air pressure will become less.
* Make the air pressure strong enough so that the belt loop joints are disposed of properly.

## 6-4. Adjusting the looseness of the belt loops



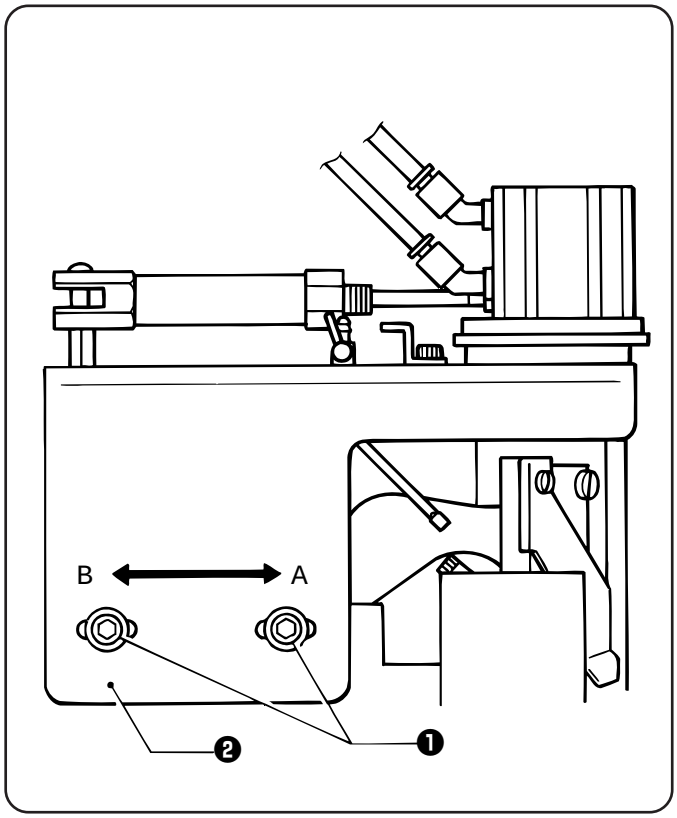

1. Loosen the two bolts ❷ of the loop hold plate ❶, and then move the loop hold plate ❶ in the direction of the arrows to adjust the looseness.

* If the loop hold plate is raised ... looseness increases
* If the loop hold plate is lowered ... looseness de creases

2. After adjusting, tighten the two bolts ❷ of the loop hold plate ❶.

NOTE: Install so that the contact surface of the belt loops ❸ is parallel to the surface which lays the belt loops ❸ onto the loop presser.

## 6-5. Adjusting the folding margin




Adjusting the folding margin at the first bar tacking

1. Loosen the two bolts ❶ ,and then move the cut ter unit base ❷ in the direction of the arrows to adjust the folding margin.
   * To shorten the folding margin: Move the cutter unit base ❷ in the direction of A.
   * To lengthen the folding margin: Move the cutter unit base ❷ in the direction of B.
2. After adjusting, tighten the two bolts ❶ of the cutter unit base ❷.

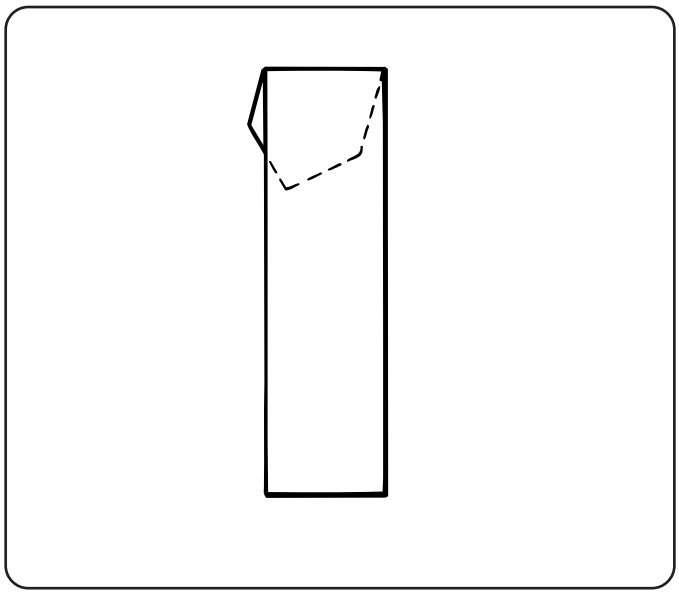
NOTE: Check that the cutter and the presser foot unit (presser block,etc.) do not interfere with each other.

Adjusting the folding margin at the second bar tacking

Change the feeding-out length setting for the belt loops using the operating panel.

* Refer to "3-2-1 Setting the belt loop feeding-out length" on page 13.

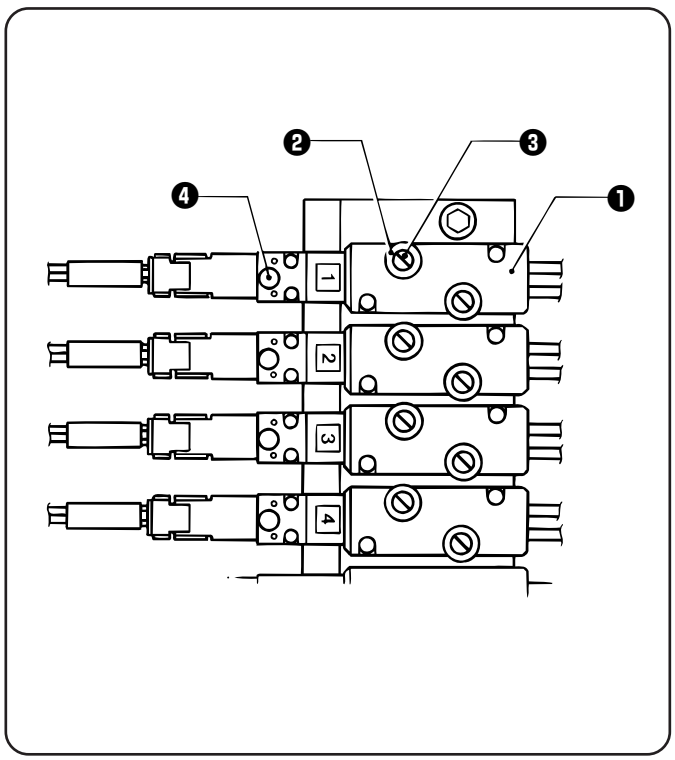
# 6-6. Adjusting the folding



* If the fold is misaligned as shown in the illustration at left

[Cause and adjustment method]

1. There is too much pressure in the loop guide spring, or there is some space between the belt loops and the loop presser.
   * Adjust while referring to "6-2-3 Adjusting the loop guide spring" on page 52.
2. The fork shaft is hitting the belt loops too strongly when picking them up.
   * Adjust while referring to "6-3-4 Adjusting the fork shaft and the belt loop transfer height" on page 55.
3. The cutter and the loop presser are not aligned properly.
   * Adjust while referring to "6-2-2 Adjusting the width adjustment plate" on page 51.
4. The loop guide plate is installed at an angle.
   * Adjust while referring to "6-4 Adjusting the loose ness of the belt loops" on page 58.
5. The machine head presser foot is touching the belt loop.
   * Adjust while referring to "6-9 Adjusting the height of the belt loop and presser foot" on page 62.
6. The loop presser foot is at an angle to the belt loop.
   * Adjust while referring to "6-2-3 Adjusting the loop spring guide" on page 52.
7. The forward speed of the fork bracket is too fast, so that it hits the belt loops and moves them when picking them up.

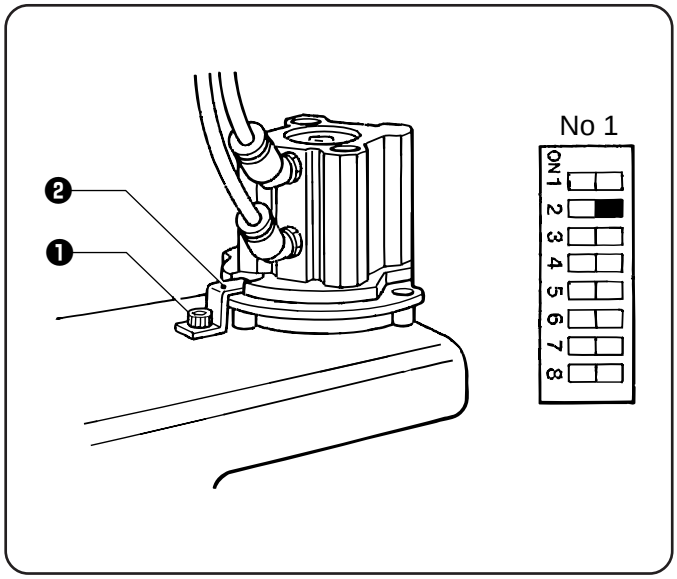



[Adjustment procedure]

1. Close the speed control joint on top of the forward valve ❶ to adjust the speed so that the fork bracket does not hit the belt loops so strongly.
2. Loosen the nut ❷ and turn the knob ❸ clockwise to slow the speed.
3. After adjusting, tighten the nut ❷.
4. Press the manual button ❹ to check the operation.

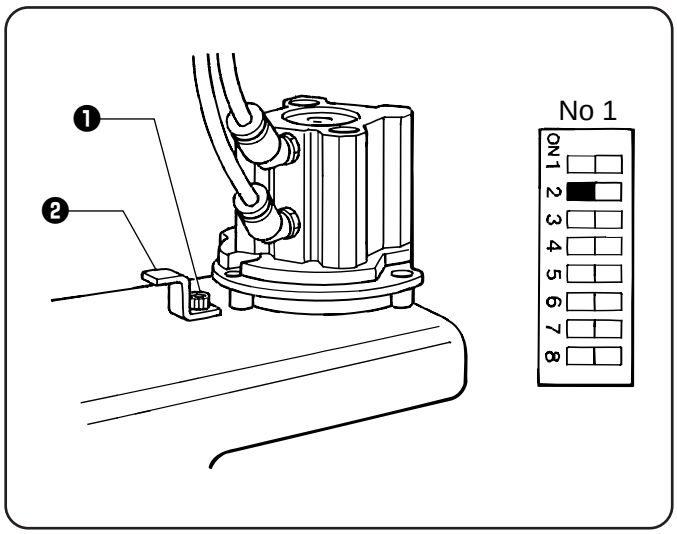
# 6-7. Changing the loop cutting shape (V cut or flat cut)

NOTE: Be sure to turn off the power switch and release the air before carrying out this operation.




Changing to flat cut

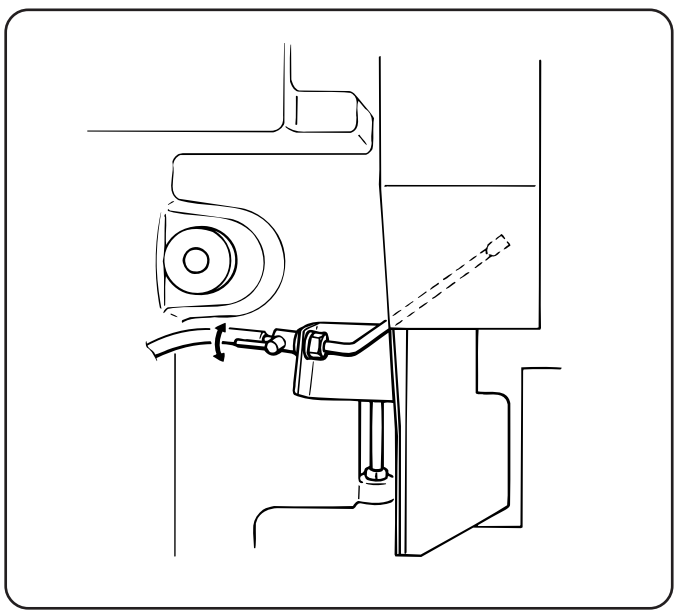
1. Remove the bolt ❶, remove the knife stopper ❷, and then change the direction of the knife stopper ❷ as shown in the illustration at left. Then install it again and tighten the bolt ❶.
2. Set panel DIP switch No. 1-2 to OFF.




Changing to V cut

1. Remove the bolt ❶, remove the knife stopper ❷, and then change the direction of the knife stopper ❷ as shown in the illustration at left. Then install it again and tighten the bolt ❶.
2. Set panel DIP switch No. 1-2 to ON.

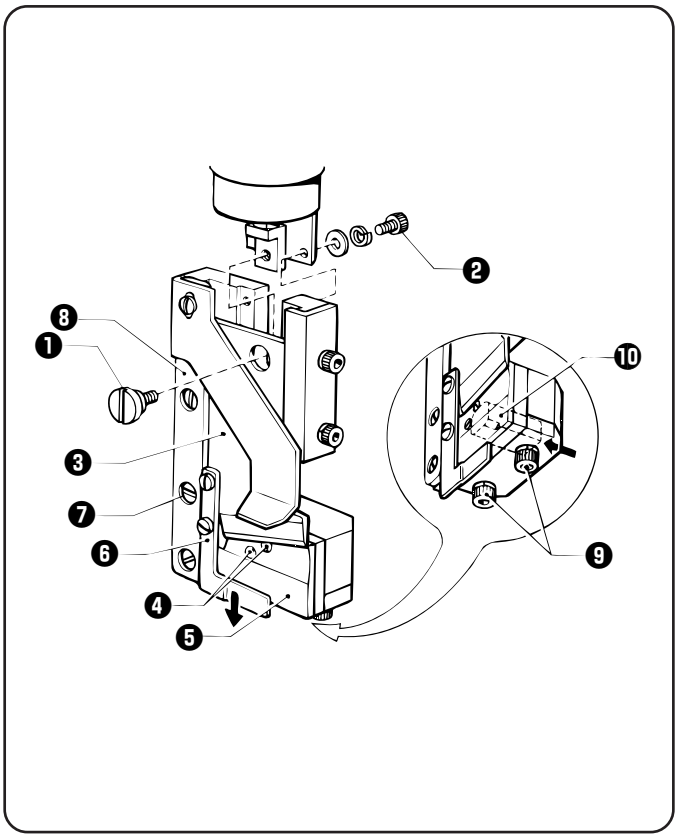
## 6-7-1. Adjusting the air pressure for cleaning away belt scraps (during V cutting)



* Adjust the air pressure using the air adjusting lever. If it is parallel to the air tubes, the air pressure will be greatest, and if it is turned either way from this position, the air pressure will become less.

* Make the air pressure strong enough so that the belt loop joints are disposed of properly.

## 6-8. Replacing the movable knife and fixed knife




1. Remove the stud screw ❶ and bolt ❷, and remove the knife unit.
2. If the movable knife ❸ is slid downwards, it can be removed.

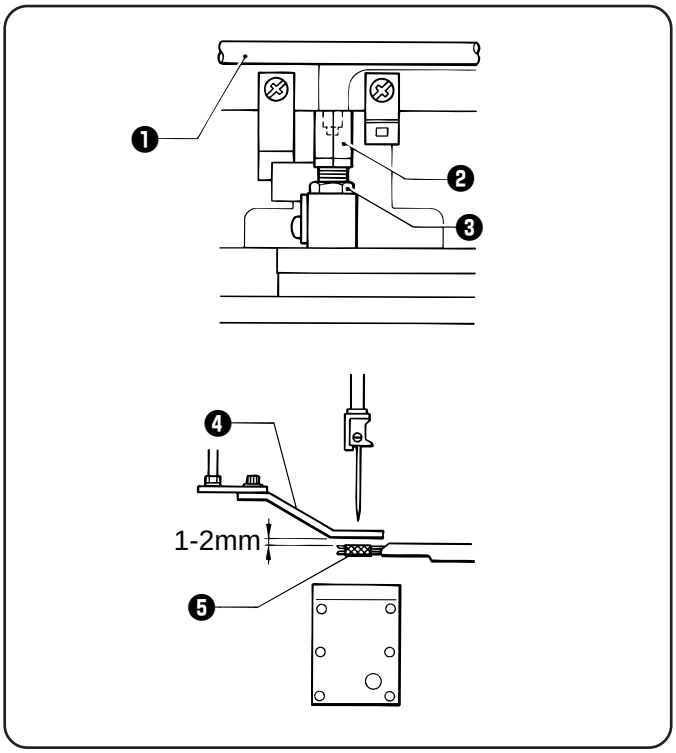
NOTE: Remove all dust from the cutter unit.

3. If the two screws ❹ are removed, the fixed knife ❺ can be removed.
4. Install by carrying out the above procedure in reverse.

NOTE
- When replacing the movable knife, connect the loop support ❻ to the new knife.
- After replacing the movable knife, if the movable knife does not move smoothly, or if it has a large amount of looseness, loosen the four screws ❼ and adjust the position of the movable knife guide ❽ so that there is no looseness and the movable knife moves up and down smoothly.
- Loosen the two bolts ❾ and move the fixed knife shaft backwards and forwards to adjust the meshing so that #80 cotton or spun rayon thread can be cut.

## 6-9. Adjusting the belt loop and presser foot height

Make this adjustment at the point where the belt loop is under the presser foot during step operation.




1. Loosen the nut ❸ of the shock absorber ❷ underneath the driving cylinder arm ❶, and then turn the shock absorber ❷ to adjust so that the space between the presser foot ❹ and the belt loop ❺ is 1 - 2 mm.
2. After adjusting, tighten the nut ❸ to secure the shock absorber ❷.

NOTE: If the amount of looseness in the belt loops is too great, the loose section may touch the presser foot ❹. In such a case, lower the fork enough so that the belt loops do not touch the presser foot ❹.

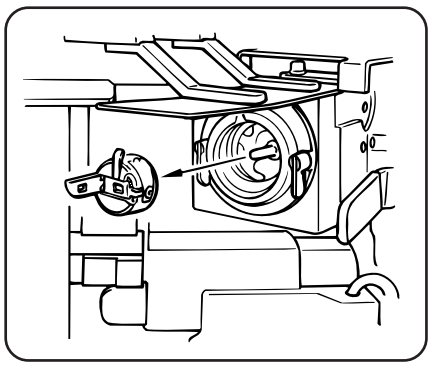
# 7. MAINTENANCE AND INSPECTION

## ⚠ CAUTION

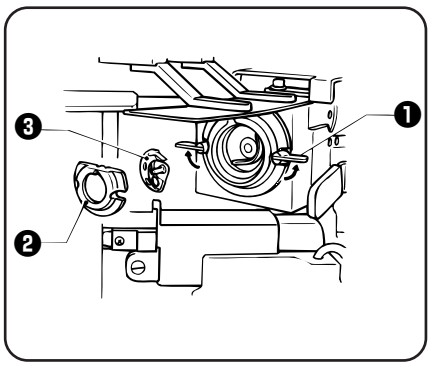
- Turn off the power switch before starting any cleaning work, otherwise the machine may operate if the start switch is depressed by mistake, which could result in injury.
- Be sure to wear protective goggles and gloves when handling the lubricating oil and grease, so that they do not get into your eyes 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.

## 7-1. Cleaning the rotary hook

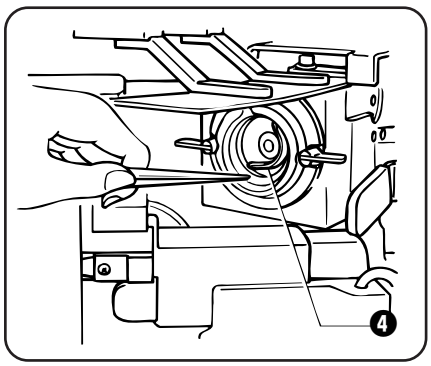
NOTE: If there are scraps of thread sticking to the rotary hook, it will cause a synchronization error (code E-320) to be displayed. Clean the rotary hook at least once per day to avoid this.



1. Open the lower shaft module and remove the bobbin case.




2. Open the large shuttle hook set claw ❶in the direction indicated by the arrow, and then remove the large shuttle hook ❷ and the inner rotary hook ❸.



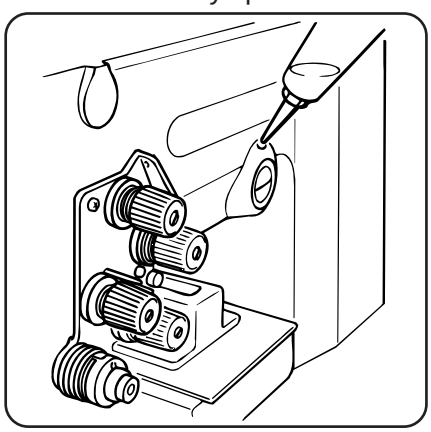

3. Clean all the dust and thread ends from around the driver ❹, the top of the rotary hook thread guide and the shuttle race.

## 7-2. Lubrication

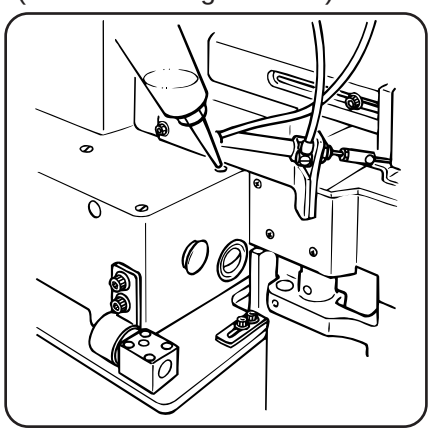
NOTE ・Fill the machine with oil when the oil level is down to about one-third full in the oil sight glass. If oil is not added and the oil drops below this level, there is the danger that the machine may seize during operation.

・Be sure to let the machine operate for a while after adding the oil.

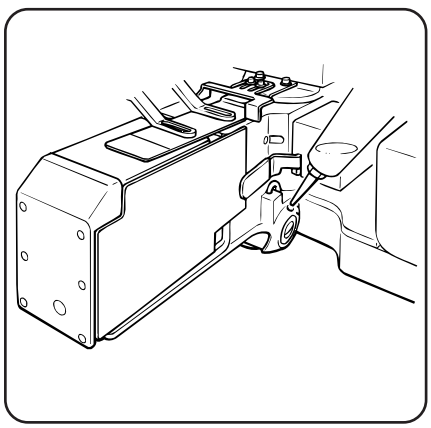
・Use only specified Brother oil (Nisseki Sewing Lube 10) for the machine oil.



1. Fill the arm-side oil tank with oil.

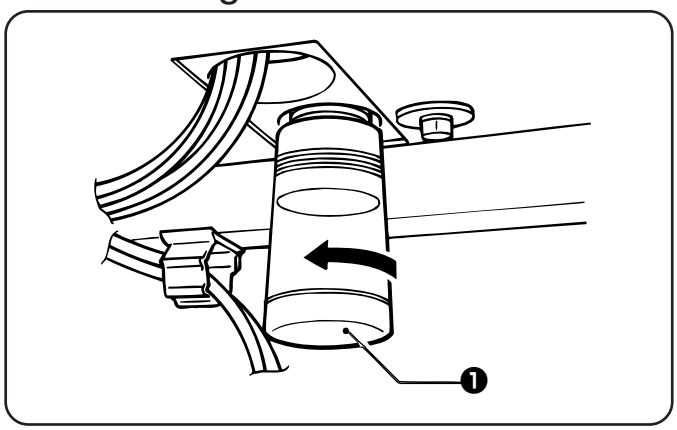


2. Fill the bed-side oil tank with oil.



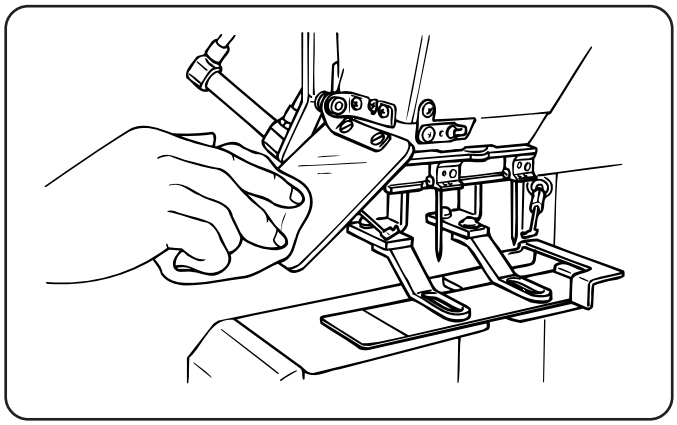
3. Fill the oil tank at the side of the lower shaft module base with oil.

## 7-3. Draining the oil




1. Remove and empty the waste oil container ❶ when ever it is full.
2. After emptying the waste oil container ❶ , screw it back into its original position.

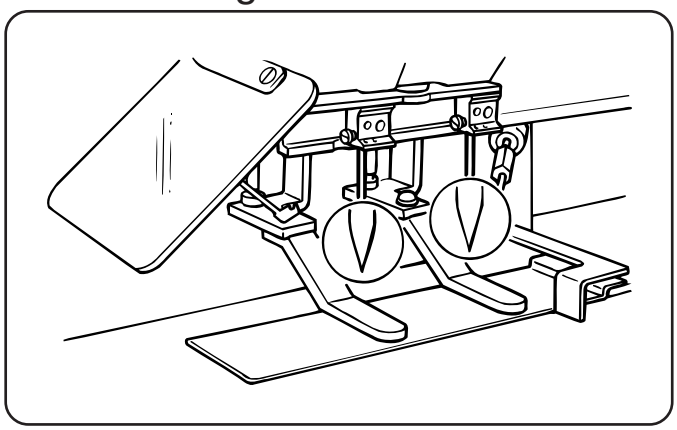
## 7-4. Cleaning the eye guard



Wipe the eye guard clean with a soft cloth.

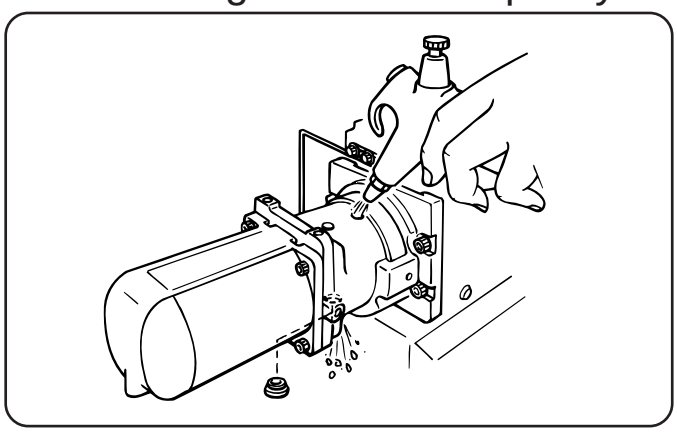
NOTE: Do not use solvents such as kerosene or thinner to clean the eye guard.

## 7-5. Checking the needle



Always check that the tip of the needle is not broken before starting sewing.

## 7-6. Cleaning the machine pulley



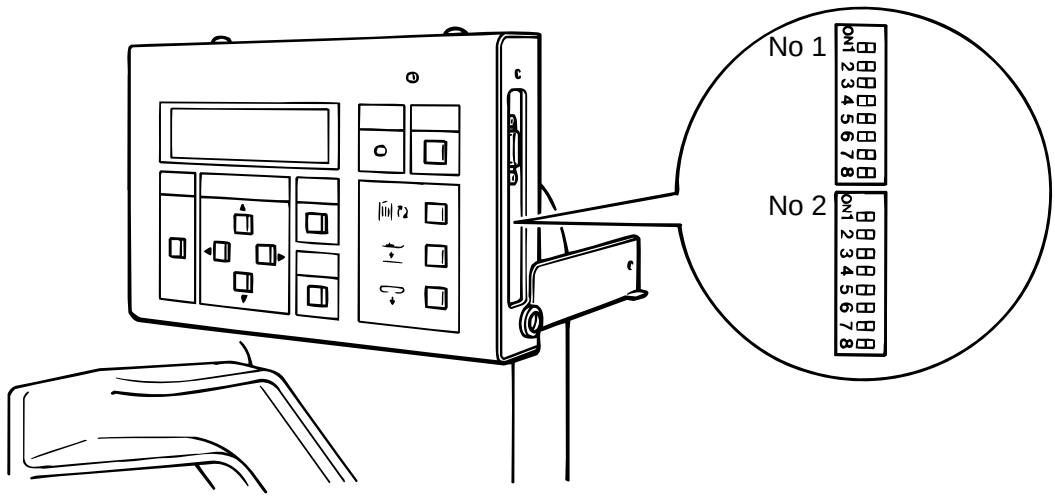
1. Remove the rubber plug at the bottom of the motor installation base.
2. Use an air gun to blow air in through the four holes on the top of the machine head in order to clean the area around the machine pulley.

# 8. DIP SWITCH

NOTE ・ When changing a DIP switch, the power must be off.

・ The power must be off when changing the position of a DIP switch.
After the position of a DIP switch has been changed, the altered function will not take effect until the power is turned off and then turned back on again.

## 8-1. Panel DIP switch functions




| | ON | OFF |
|---|---|---|
| SW1-1 | To activate the thread breakage detector | To deactivate the thread breakage detector |
| SW1-2 | To V-cut a belt loop | To flat cut a belt loop |
| SW1-3 | To display Japanese | To display English |
| SW1-4 | The fork is retracted when the FOOT switch or BOBBIN switch is pressed. | The fork is not retracted when the FOOT switch or BOBBIN switch is pressed. |
| SW1-5 | To activate loop set sensor | To deactivate loop set sensor |
| SW1-6 | Loops are fed at low speed. | Loops are fed at normal speed. |
| SW1-7 | To activate folding switch | To deactivate folding switch |
| SW1-8 | After automatic sewing, the presser foot remains down. Pressing the RESET switch will raise the presser foot. | After automatic sewing, the presser foot rises. |

| | ON | OFF |
|---|---|---|
| SW2-1 | Operation in cold climates *1 | Normal operation |
| SW2-2 | Not available (Should be set to OFF) | |
| SW2-3 | Slow start up to the second stitch | Normal operation |
| SW2-4 | If the thread tangles at the sewing start, the machine automatically resets and starts sewing again.*2 | Normal operation |
| SW2-5 | Not available (Should be set to OFF) | |
| SW2-6 | Not available (Should be set to OFF) | |
| SW2-7 | LOOP switch: continuous setting<br>resetting setting | Normal operation |
| SW2-8 | When bobbin counters reach "0", they are reset. | When bobbin counters reach "0", they are reset and sewing resumes. |

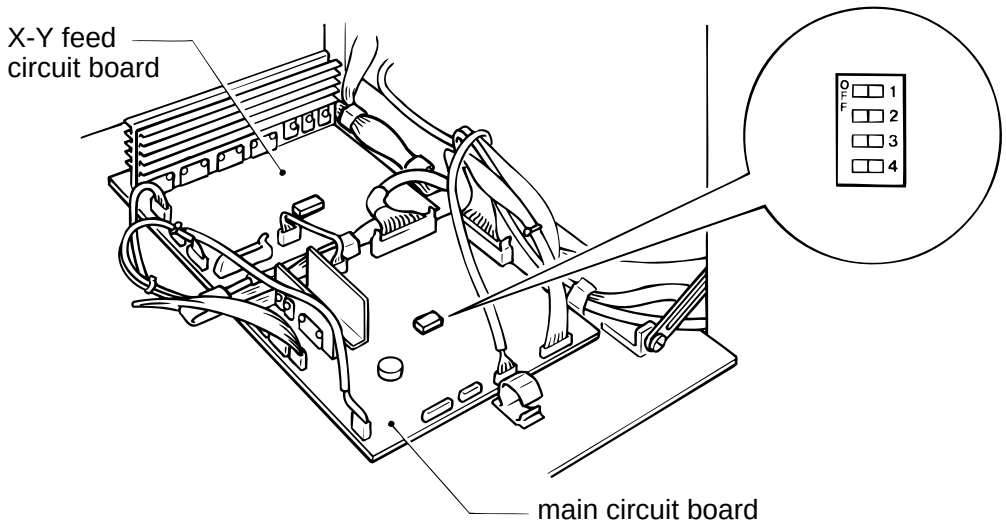
*1 The thread wiper operates when the power is turned on.

*2 If the thread becomes tangled within the first three stitches after sewing starts, the machine will return automatically to the sewing start position and sewing will then start again.

## 8-2. Main circuit board DIP switch functions

**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 volt ages are present can result in severe injury.




| | ON | OFF |
|---|---|---|
| SW1 | Setup function | Normal operation |
| SW2 | Not available (Should be set to OFF) | |
| SW3 | Not available (Should be set to OFF) | |
| SW4 | Sewing data is initialized on startup. | Normal operation |

NOTE: The DIP switches on the X-Y feed circuit board should all be set to OFF.

# 9. ERROR CODES

NOTE : Wait 10 seconds or more after turning the power off before turning it back on again.

| Error code | Problem | Solution |
|---|---|---|
| E-100 | EMERGENCY STOP switch selected during automatic sewing. | Refer to pages 31. |
| E-101 | START switch on when power turned on. | ① Turn off START switch.<br>② Press the RESET switch. |
| E-102 | MERGENCY STOP switch on when power turned on. | ① Turn off EMERGENCY STOP switch.<br>② Press the RESET switch. |
| E-104 | The second bar tacking lower shaft module was open when the power was turned on. | ① Turn off the power.<br>② Release the air, close the second bar tacking lower shaft module, and then press the RESET switch. |
| E-105 | The cover of the second bar tacking lower shaft module. | ① Close the cover of the second bar tacking lower shaft module.<br>② Press the RESET switch. |
| E-106 | The second bar tacking lower shaft unit is open or the air pressure is insufficient. | ① Check the air pressure.<br>② Press the RESET switch. |
| E-107 | Abnormal power supply voltage. | ① Turn off power switch.<br>② Check the power supply voltage. |
| E-110 | Malfunction of loop feed 1 sensor | ① Check the operation of loop feed 1 sensor.<br>② Press the RESET switch. |
| E-111 | Malfunction of loop feed 2 sensor | ① Check the operation of loop feed 2 sensor.<br>② Press the RESET switch. |
| E-112 | Malfunction of loop feed 3 sensor | ① Check the operation of loop feed 3 sensor.<br>② Press the RESET switch. |
| E-113 | Malfunction of loop feed 4 sensor | ① Check the operation of loop feed 4 sensor.<br>② Press the RESET switch. |
| E-118 | Malfunction of loop down sensor | ① Check the operation of the loop down sensor.<br>② Press the RESET switch. |
| E-120 | Loop feeder retracted | ① Check that the loop feeder is not retracted.<br>② Check if the loop feeder retract position sensor is illuminated.<br>③ Press the RESET switch. |
| E-150 | Two joints were detected in succession. | ① Check the condition of the belt loops.<br>② Press the RESET switch. |

| Error code | Problem | Solution |
|---|---|---|
| E-160 | Loop length data, bobbin thread counter data, production counter data or sewing speed data is corrupted. | ① Turn off power switch.<br>② Initialize the sewing data. |
| E-170 | Lower shaft module was open when sewing started. | ① Close the lower shaft.<br>② Press the RESET switch. |
| E-171 | Lower shaft module locking error | ① Check the lock cylinder and sensor.<br>② Press the RESET switch. |
| E-181<br>182 | Upper thread breaks at the first and second bar tacking. | Refer to pages 29. |
| E-190 | Loop setting error | ① Remove the belt loop which was set incorrectly.<br>② Press the RESET switch.<br>③ Press the LOOP switch and then set a new belt loop. |
| E-1A0 | Communication error between main circuit board and X-Y feed circuit board. | Press the RESET switch. |
| E-1A1 | Communication error between main circuit board and panel circuit board. | Press the RESET switch. |
| E-202 | Motor does not operate, or problem with synchronizer signal. | ① Turn the machine pulley to check that it is not locked.<br>② Press the RESET switch. |
| E-203 | The pattern was found to be outside the sewing area during a scale check. | Press the RESET switch and then reset the scale. |
| E-204 | The pattern was found to be over the maximum pitch during a scale check. | Press the RESET switch and then reset the scale. |
| E-20A | Error detecting X or Y home position for X-Y feed. | Check the operation at the X or Y home position. |
| E-20D | Overheating of X-Y feed circuit board | Turn off the power and check the operation of the fan inside the box. |
| E-20E | Reading or writing error of EEPROM on in X-Y feed circuit board | ① Turn off power switch.<br>② Wait 10 seconds or more, and then turn the power back on again. |

| Error code | Problem | Solution |
|---|---|---|
| E-302 | Errors reading to and writing from EEPROM on main circuit board | ① Turn off power switch.<br>② Wait 10 seconds or more, and then turn the power back on again. |
| E-320 | Synchronizati error | ① Upper shaft motor and lower shaft motor synchronizati error<br>② Open the second bar tacking lower shaft unit and clean away the thread scraps, etc.<br>③ Press the RESET switch. |
| E-323 | Upper shaft sensor detection error | ① Check the operation of the upper shaft sensor and the upper shaft lock.<br>② Turn off power switch. |
| E-324 | Start position error | Press the RESET switch to determine the home position. |
| E-325 | Incorrect upper shaft installation position | ① Turn off power switch.<br>② Check the installation position of the upper shaft. |
| E-330 | Malfunction of upper shaft motor or lower shaft motor, or tripped driver | ① Turn off power switch.<br>② Wait 15 seconds, and then torn the power back on.<br>③ Check the connection of the servo motor connector. |

# 10. TROUBLESHOOTING

## 10-1. Machine Head

| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Presser does not rise. | Presser lifter air tube is bent or damaged. | Presser lifter air tube | Straighten the bend in the tube or replace the tube. | 7 |
| | Presser lifter air tube is bent or damaged. | Presser lifter air tube | Straighten the bend in the tube or replace the tube. | 7 |
| | Presser is contacting thread wiper. | Thread wiper standby position | Adjust the position of the thread wiper. | 45 |
| Thread wiper does not operate correctly. | The thread wiper is obstructing the needle. | Clearance between thread wiper and needle tip | Adjust the height of the thread wiper. | 45 |
| | Thread wiper position is incorrect. | Thread wiper position | Adjust the operating distance of the thread wiper. | 45 |
| Lower thread winds to one side. | Bobbin winder thread tension stud height is incorrect. | Bobbin winder thread tension stud height | Adjust the height of the thread tension stud. | 26 |
| Lower thread winding amount is incorrect. | Bobbin presser position is incorrect. | Thread winding amount | Adjust the position of the bobbin presser. | 26 |
| Threads comes unthreaded. | Stitches being skipped at the sewing start. | Refer to "Skipped stitches occur". | Refer to "Skipped stitches occur". | |
| | Uneven upper thread length. | Upper thread length | Adjust the sub-tension. | 28 |
| | Needle is too thick for the thread. | Thread and needle | Select a needle that matches the thread. Check that the thread path. gives the correct amount of resistance to the thread. | 28 |
| | Incorrect height or tension of thread take-up spring. | Tension and height of thread take-up spring | Increase the tension or lower the height of the thread take-up pring. | 29 |
| Lower thread breaks. | Lower thread tension is too strong. | Lower thread tension | Adjust the lower thread tension. | 28 |
| | Damaged or burred needle hole plate, bobbin case corner, shuttle race thread guide or shuttle race. | Damage | File smooth or replace the affected part. | |
| | Tension of bobbin presser spring in bobbin case is too strong. | Bending amount of bobbin presser spring | Reduce the tension of the bobbin presser spring. | 28 |
| | Lower thread winding method is incorrect. | Lower thread tension | Adjust the lower thread tension. | 26.28 |

| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Upper thread breaks. | Upper thread tension is too strong. | Upper thread tension | Adjust the upper thread tension. | 28 |
| | Needle is installed incorrectly. | Needle direction | Install the needle so that the groove is facing forward. | 24 |
| | Thread is too thick for the needle. | Thread and needle | Use the correct thread for the needle. | 28 |
| | Thread take-up spring tension and height are incorrect. | Thread take-up spring tension and height | Adjust the tension and height of the thread take-up spring. | 29 |
| | Damaged or burred rotary hook, needle hole plate or needle. | Damage or burring | File smooth or replace the affected part. | |
| | Thread path is incorrect. | Thread | Pass the thread correctly along the thread path.<br>Increase the thread amount. | |
| Skipped stitches occur. | Clearance between needle and rotary hook tip is too great. | Needle clearance | Adjust the needle clearance. | |
| | Incorrect needle and rotary hook timing. | Needle bar lift amount | Adjust the needle bar lift amount. | |
| | Driver is contacting needle more than is necessary. | Clearance between driver and needle | Adjust the driver needle guard. | |
| | Needle is bent. | Bent needle | Replace the needle. | |
| | Needle is installed incorrectly. | Needle direction | Install the needle so that the groove is facing forward. | |
| | Thread is twisted too strongly. | Winding direction of thread along thread path. | Set the correct thread winding direction for the thread path. | |
| Needle breaks. | Needle is touching the rotary hook. | Needle clearance | Adjust the needle clearance. | 39 |
| | | Needle bar lift amount | Adjust the needle bar lift amount. | 37 |
| | Needle is bent. | Bent needle | Replace the needle. | |
| | Needle is too thin. | Needle and thread | Use the correct needle for the material. | |
| | Needle moves about. | Needle and thread | Select the correct needle for the sewing conditions.<br>Reduce the sewing speed. | |
| | Feed plate fixing screw is not correctly tightened. | Feed plate | Install the feed plate securely. | |

| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Upper thread is not trimmed. | Fixed knife is blunt. | Fixed knife blade | Sharpen or replace the fixed knife. | |
| | Movable knife does not pick up the thread. | Shuttle race thread guide position | Adjust the position of the shuttle race thread guide. | 40 |
| | | Needle bar lift amount | Adjust the needle bar lift amount. | 37 |
| | The movable knife does not pick up the thread because of skipped stitches at the sewing end. | Skipped stitches at sewing end | Refer to "Skipped stitches occur". | |
| | Movable knife position is incorrect. | Movable knife position | Adjust the position of the movable knife. | 40 |
| | Sub-tension is too weak. | Sub-tension | Turn the sub-tension nut to adjust the tension. | 28 |
| Thread jamming. | Thread trailing length is too long. | Sub-tension | Thread resistance along thread path is too small. | 28 |
| | | | Adjust the thread trailing length to 45 mm. | 28 |
| | Thread take-up spring tension and height are incorrect. | Thread take-up spring tension and height | Adjust the tension and height of the thread take-up spring. | 29 |
| | Incorrect needle and rotary hook timing. | Needle bar lift amount | Adjust the needle bar lift amount. | 37 |
| | Shuttle race thread guide is not separating the threads. | Shuttle race thread guide position | Adjust the position of the shuttle race thread guide. | 40 |
| | Thread scraps sticking to surface of race. | Surface of shuttle hook | Clean all thread scraps and dust from the race | 66 |
| | Upper tension is too weak. | Upper tension | Make the upper tension stronger. | 28 |
| Thread jamming at the final stitch. | Too much thread. | Thread amount | Reduce the thread amount. | 28 |
| | Incorrect height or tension of thread take-up spring. | Tension and height of thread take-up spring | Decrease the tension or raise the height of the thread take-up spring. | 29 |
| Upper thread breaks at the final stitch. | Incorrect thread release cylinder operation. | Thread release cylinder operation | Adjust the thread release cylinder so that it operates smoothly. | |
| | Sub-tension is too strong. | Sub-tension | Decrease the subtension. | 28 |
| | Thread take-up spring tension and height are incorrect. | Thread take-up spring tension and height | Decrease the tension or raise the height of the thread take-up spring. | 29 |
| | Damaged or burred shuttle race, needle hole plate, needle, movable knife or shuttle race thread guide. | Damage or burring | File smooth or replace the affected part. | |

| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Poor seam finish on reverse side of material. | Shuttle race thread guide is not separating the threads. | Shuttle race thread guide position | Adjust the position of the shuttle race thread guide. | 40 |
| | Upper thread is not properly tight. | Upper thread tension | Adjust the upper thread tension. | 28 |
| | Uneven upper thread length. | Upper thread length | Adjust the sub-tension. | 28 |
| Incorrect thread tightness. | Upper thread tension is too weak. | Upper thread tension | Adjust the upper thread tension. | 28 |
| | Lower thread tension is too weak. | Lower thread tension | Adjust the lower thread tension. | 28 |
| | Thread take-up spring tension and height are incorrect. | Thread take-up spring tension and height | Adjust the tension and height of the thread take-up spring. | 29 |
| The synchronizing error code (E-320) is being displayed. | The thread to become tangled. | Refer to the "Thread to become tangled" section. | Refer to the "Thread to become tangled" section. | |
| | Thread scraps on surface of race. | Surface of shuttle hook race | Clean away the thread scraps and dust. | 66 |
| | Bobbin case is not installed correctly. | Bobbin case | Install the bobbin case correctly. | 27 |
| Upper shaft motor does not operate.<br>Motor abnormality error code (E-330) is displayed.<br>Lower shaft motor does not operate | Disconnected harness connector or open circuit in connector | Upper shaft motor harness | Insert the connector securely or repair the harness. | |
| | Upper shaft servo driver has been tripped.* | Upper shaft servo driver | Turn the power off, wait 15 seconds and then turn it on again. | |
| | | Surface of shuttle hook race | Turn the power off and clean away the thread scraps and dust from the shuttle hook surface. | |
| | Disconnected harness connector or open circuit in connector | Lower shaft motor harness | Turn the power off and clean away the thread scraps and dust from the shuttle hook surface. | |
| | Lower shaft servo driver has been tripped.* | Lower shaft servo driver | Turn the power off and clean away the thread scraps and dust from the shuttle hook surface. | |
| | | Lower shaft servo driver | Turn the power off and clean away the thread scraps and dust from the shuttle hook surface. | |
| Feed mechanism cannot return to home position. | Oil adhering to home position sensor | Home position sensor and sensor dog | Clean off the oil. | |

NOTE: Tripping of the servo driver can be checked by the flashing of the servo driver LED.

| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Lower thread breaks at the final stitch. | Fixed knife installation position is too close to needle hole. | Fixed knife position | Adjust the fixed knife installation position to the correct | 44 |
| Double cutting during thread trimming. | Thread take-up amount is too large. | Thread amount | Reduce the thread amount. | |
| | Incorrect height or tension of thread take-up spring. | Tension and height of thread take-up spring | Decrease the tension or raise the height of the thread take-up spring. | 29 |

# 10-2. Mechanisms

| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Belt loops are curved over front of loop presser F. | Loop presser F is too low. | Relative heights of loop presser B and loop presser F | Adjust the height of the loop presser F slider bracket. | 50 |
| | Belt loops are lifted up when fed out. | Upper guide plates are not installed. | Install the upper guide plates. | 51 |
| | Belt loops are too curled. | Belt loop curl | Replace with belt loops which are not so curled. | |
| Belt loops are lifted up when coming out from cutter. | Loop support T is too high. | Distance between loop support T and the belt loops | Adjust loop support T. | 55 |
| | Belt loops are too curled. | Belt loop curl | Replace with belt loops which are not so curled. | |
| Belt loops are fed underneath loop presser B. | Loop support T is too low. | Distance between loop support T and the belt loops | Adjust loop support T. | 55 |
| | Loop presser B is too high. | Distance between cutter outlet and loop presser B | Adjust the height of the loop presser B slider bracket. | 50 |
| | Belt loops are too curled. | Belt loop curl | Replace with belt loops which are not so curled. | |
| Belt loops are fed underneath loop presser F. | Loop presser F is too high. | Relative heights of loop presser B and loop presser F | Adjust the height of the loop presser F slider bracket. | 50 |
| | Widths of loop pressers F and B are too narrow. | Width of loop pressers being used | Replace the lop pressers with wider ones. | 51 |
| | Belt loops are too curled. | Belt loop curl | Replace with belt loops which are not so curled. | |

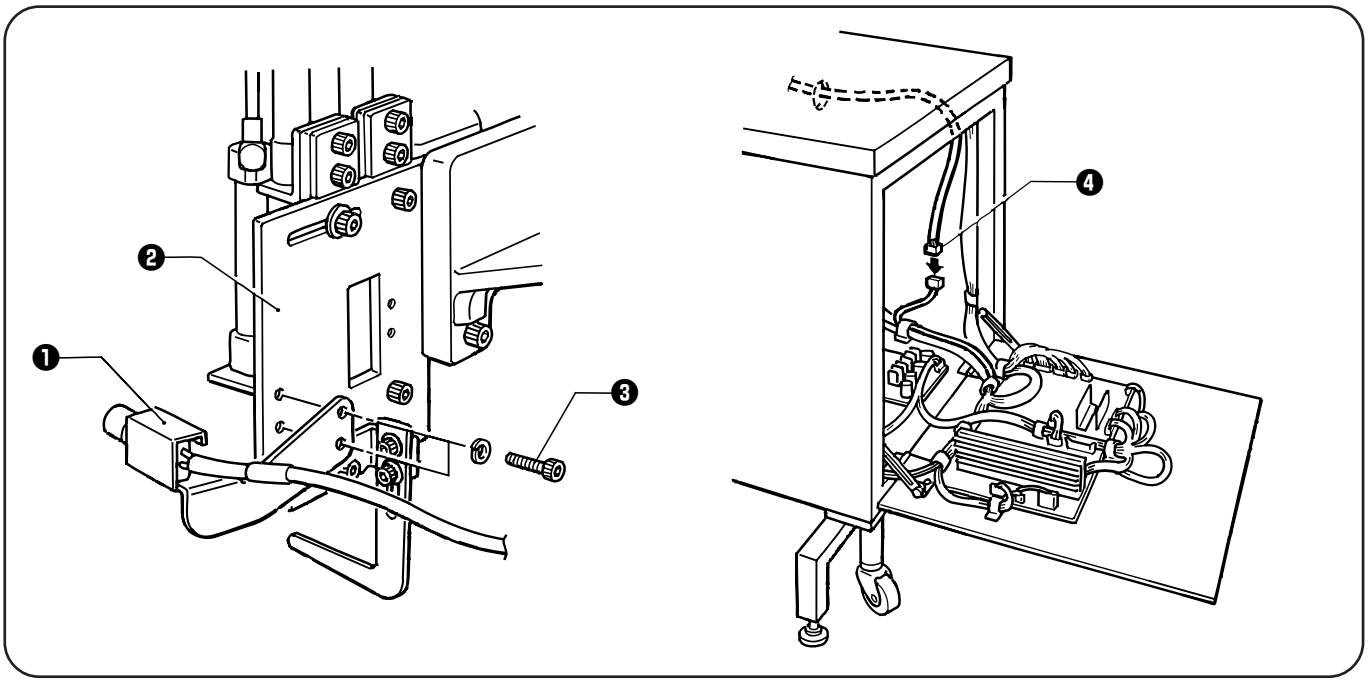
| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Belt loops are not being fed. | A joint is caught in the channel. | Channel width | Adjust the channel width. | 52 |
| Joints are not being detected. | Incorrect joint sensor position. | Joint sensor position | Adjust the joint sensor. | 55 |
| Joints are not removed. | Air pressure is too low. | Air pressure check | Adjust the air pressure. | 64 |
| The belt loops are not being held properly by the fork shafts. | Distance between fork shafts is not suitable for belt thickness. | Distance between fork shafts and belt loop thickness | Replace with an appropriate fork bracket. | 56 |
| The belt loops are not being held properly by the loop pressers. | Distance between button presser A and the loop pressers is not correct. | Distance between button presser A and loop pressers | Adjust the positions of the loop pressers. | 58 |
| Belt loops are not being picked up correctly. | Incorrect belt loop and fork shaft alignment position. | Belt loop and fork shaft timing during belt loop pick-up | Adjust the belt loop transfer height. | 58 |
| | Distance between fork shafts is not suitable for belt thickness. | Distance between fork shafts and belt loop thickness | Replace the fork bracket (assembly). | 56 |
| V cutting does not occur. | Knife stopper is stopping knife rotation base 2. | Tilt of knife stopper | Change the tilt of the knife stopper. | 64 |
| | DIP switch has not been changed before power was turned on. | DIP switch | Turn the power back on. | 64 |
| Cutter does not cut properly. | Worn cutter knife | Cutting surface of belt loops | Replace the knife. | 65 |
| Loops are not fed at joints. | Loops are riding over feed roller guide. | Feed roller guide position | Raise the rear of the feed roller guide. | |

| Problem | Cause | Check | Remedy | Page |
|---|---|---|---|---|
| Belt loops are getting caught on presser foot. | Distance between belt loops and presser foot is too small. | Distance between belt loops and presser foot | Adjust the height of the shock absorber underneath the driving cylinder arm. | 65 |
| | Position of release presser plate is incorrect. | Distance between loosen loop presser plate and belt loops | Adjust the height of the loosen loop presser set plate. | 49 |
| | Vertical sensor dog height is too low. | Vertical sensor dog is dropping too far. | Adjust the height of the sensor dog. | 65 |
| Belt loop folding position is incorrect. | Belt loops are not being guided properly. | Belt loop and loop guide spring timing | Adjust the loop guide spring. | 53 |
| | Fork is hitting belt loops when belt loops are being picked up. | Pick-up speed is too fast. | Adjust the valve. | 63 |
| | Belt loop and fork height is incorrect during belt loop pick-up. | Belt loop and fork timing during belt loop pick-up | Adjust the height of the fork. | 58 |
| | Cutter and loop pressers are not aligned correctly. | Distance between loop pressers and belt loops when belt loops are being fed | Adjust the width adjustment plate. | 52 |
| | Loop hold plate is tilted. | Tilt of loop hold plate | Install correctly. | 61 |
| | Belt loops are too curled. | Belt loops | Replace with belt loops which are not so curled. | |
| | Machine head presser foot is touching belt loop. | Machine head presser foot and belt loop | Adjust the height of the belt loops when they are placed. | 65 |
| | Loop presser foot is at an angle to belt loop. | Loop presser foot and belt loop | Adjust the tilt of the loop presser foot. | 58 |
| Bar tacking position is incorrect. | Loop delivery position is incorrect. | Loop position during delivery | Check process from folding to delivery. | 53 |
| Changed bar tacking position for 1st bar | Drive cylinder arm position is incorrect. | Sewing finish | Move the drive cylinder arm back and forth to adjust. | 65 |
| Changed bar tacking position for 2nd bar tacking | Fork bracket F position is incorrect. | Sewing finish | Move fork bracket F to adjust. | 49 |

# 11. OPTIONS

## 11-1. Hand set switch unit ·····(S41639-001)

- Use the hand set switch when you wish to sew in a cycle that is different from standard automatic sewing (as far as operation of the belt loop guide).




<Attachment>

1. Attach the hand set switch ❶ to the fold unit mounting plate ❷ with the bolt ❸.
2. Open the control box and disconnect the connector ❹.

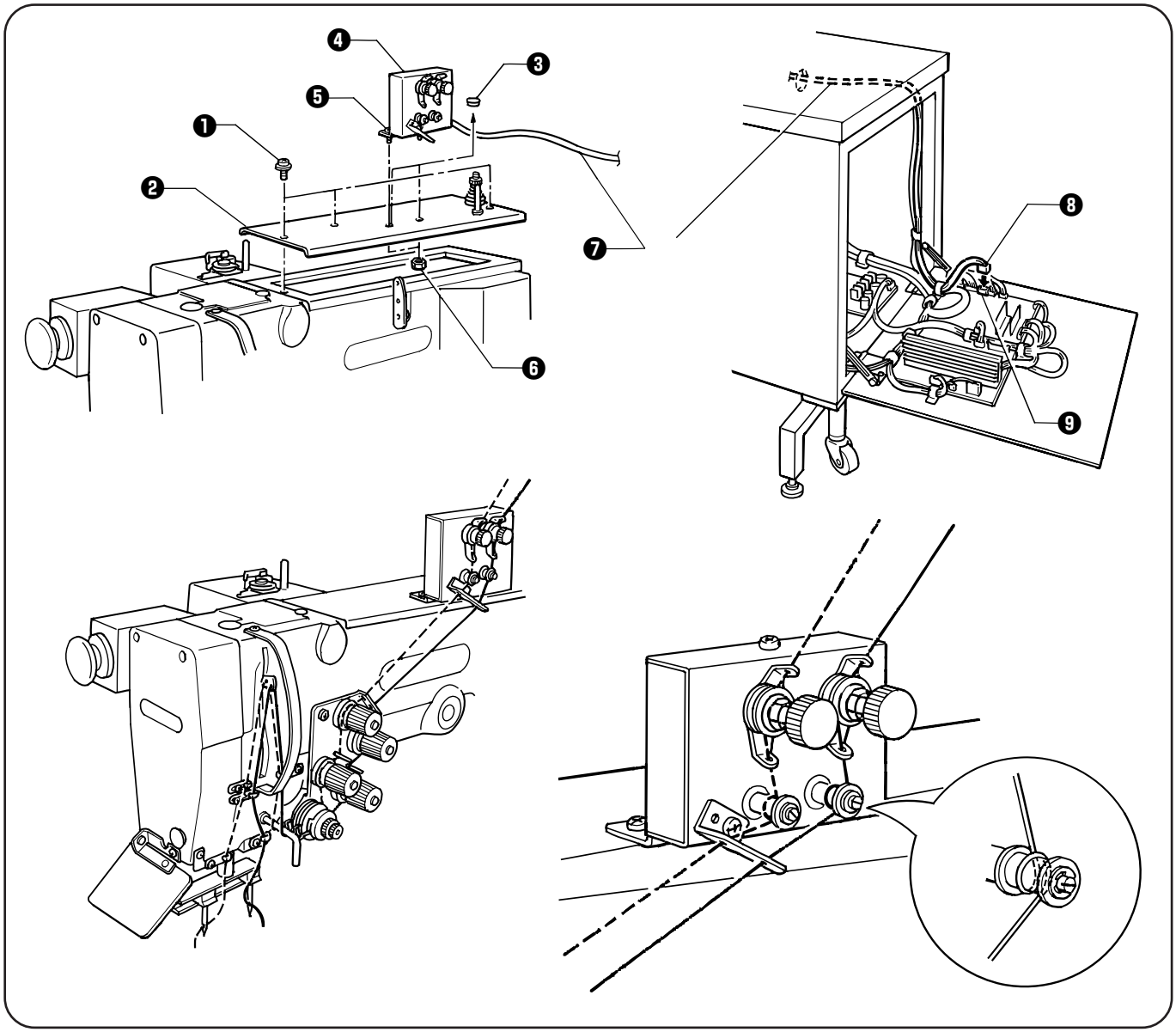
<Use>

1. Set DIP switch 17 to ON and then turn on the power. (Refer to page 68 for operation of the DIP switch.)
   - The belt loop guide will operate.

   NOTE: Always be sure to return the DIP switch to RESET when turning off the power.
2. Put the cut off belt loop on loop presser foot B and loop presser foot F .
3. Press the hand set switch ❶.
   - The belt loop will be folded.

   NOTE: At this time, if the hand set switch is pressed once more, the belt loop will be released.
4. Press the START switch.
   - After sewing, the belt loop guide will operate.

# 11-2. Upper thread breakage detector assembly ..... (S40520-009)




<Attachment>

1. Remove the screw ❶, and then remove the upper cover ❷.
2. Remove the upper cover cap ❸, and then install the thread breakage detector ❹ to the upper cover ❷ with the screw ❺ and nut ❻.
3. Install the upper cover ❷ with the screw ❶.
4. Bind the cord ❼ of the thread breakage detector ❹ with the band in the same way as the other cords, and pass it inside the control box.
5. Insert the connector ❽ into the 16-pin connector ❾ on the main circuit board.

<When using the upper thread breakage detector assembly>

- Set panel DIP switch No. 1-1 to ON and then turn on the power.

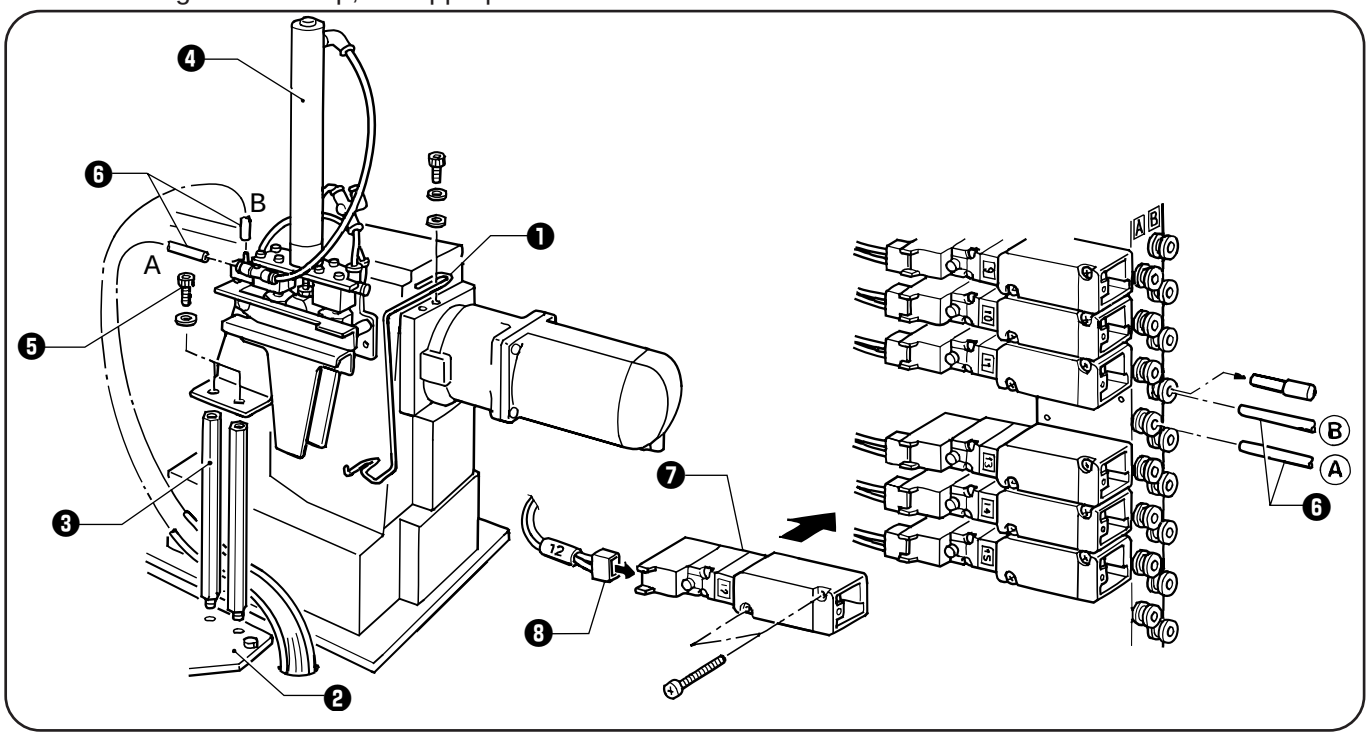
<When not using the upper thread breakage detector assembly>

- Set panel DIP switch No. 1-1 to OFF and then turn on the power.

NOTE: Refer to "8. Using the DIP switches" on page 66 for details of the panel DIP switches.

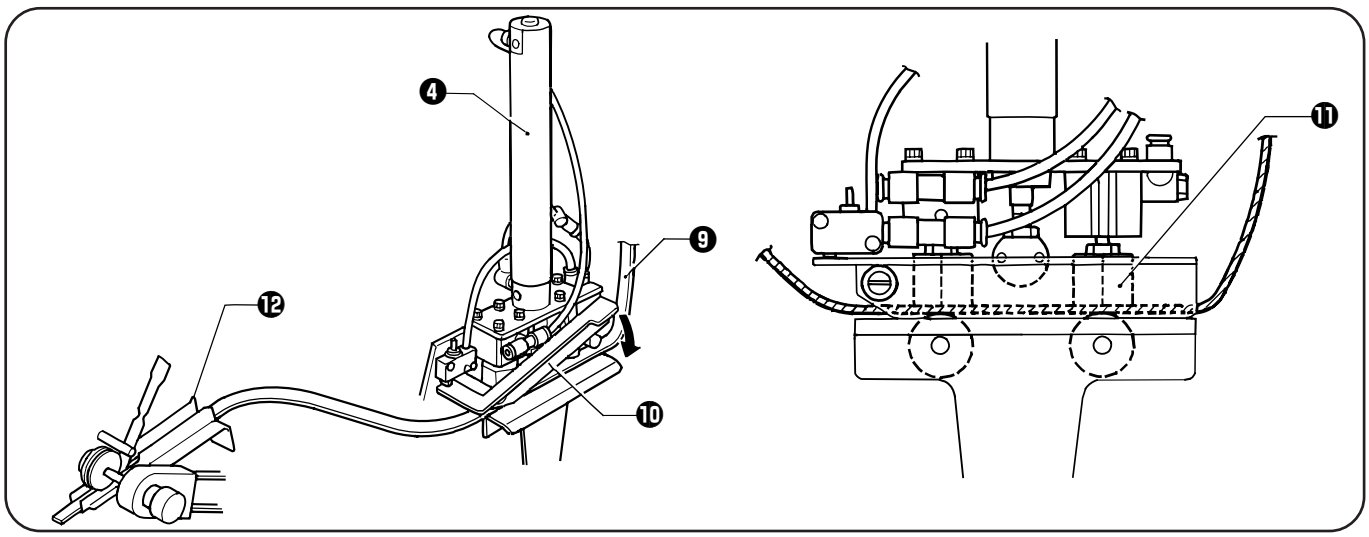
## 11-3. Belt loop slackener ····· (S43632-001)

● When setting the belt loop, the appropriate belt flexion can be maintained.




<Attachment>

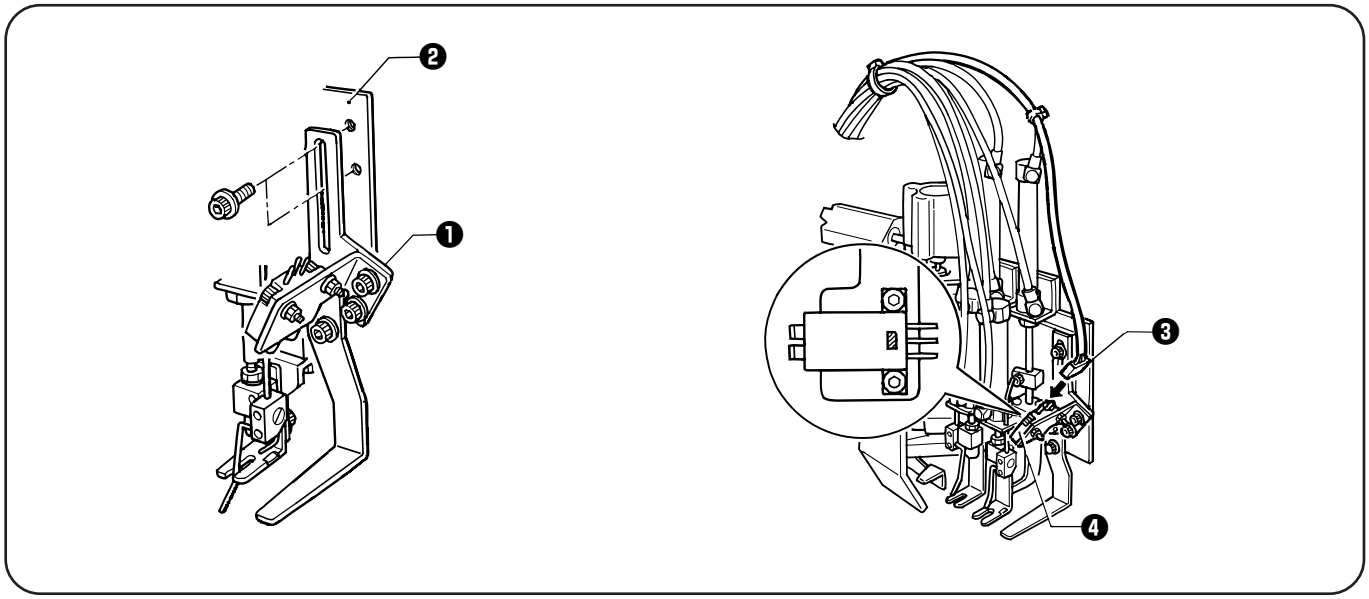
1. Remove the two bolts, and then remove the loop guide ❶ from the sewing machine.
2. Install the two posts ❸ to the feeder base plate ❷.
3. Install the belt slack device ❹ to the posts ❸ with the two bolts ❺.
4. Connect the two air tubes.
5. Install the solenoid valve ❼ with the two screws, and then connect the connector ❽.
6. Connect the air tubes ❻.




<Passing through the belt loops>

7. Set the belt loops ❾ into the belt slack device ❹, and then lower the guide lever ❿.
8. Pass the belt loops ❾ through from the cylinder ⓫ to the channel guide ⓬.

## 11-4. Loop setting sensor ····· (S41959-001)

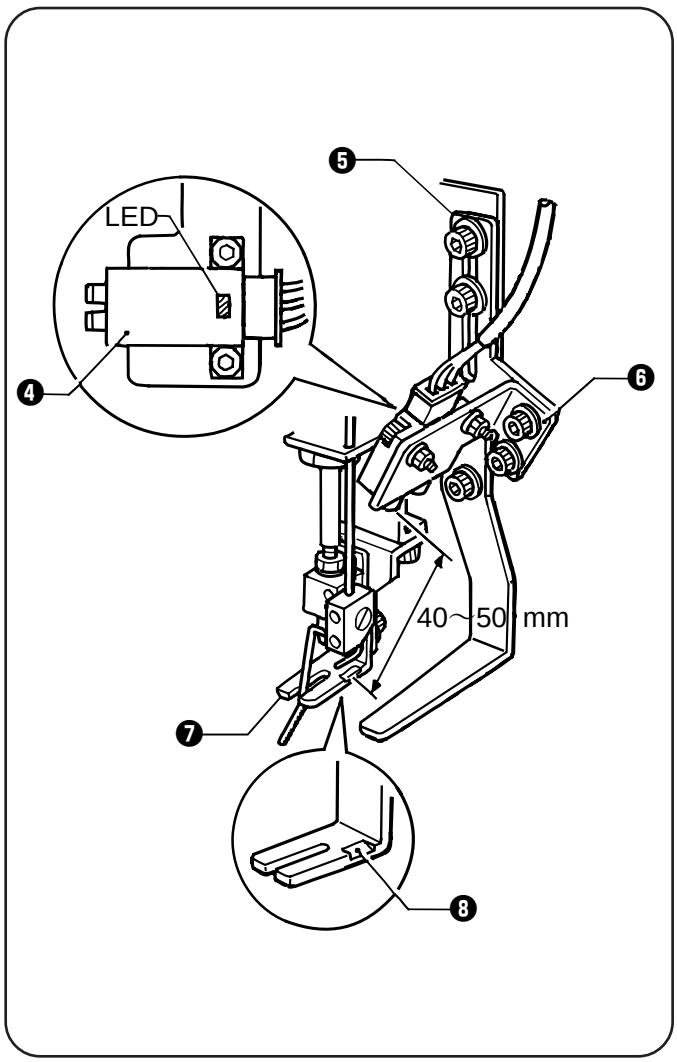



<Installation>

1. Install the loop setting sensor assembly ❶ to slider base F ❷ with the two bolts.
2. Insert the 3-pin connector ❸ coming out from the control box to the loop setting sensor ❹.

<Adjustment>

NOTE: Carry out this adjustment while loop presser foot F is raised.



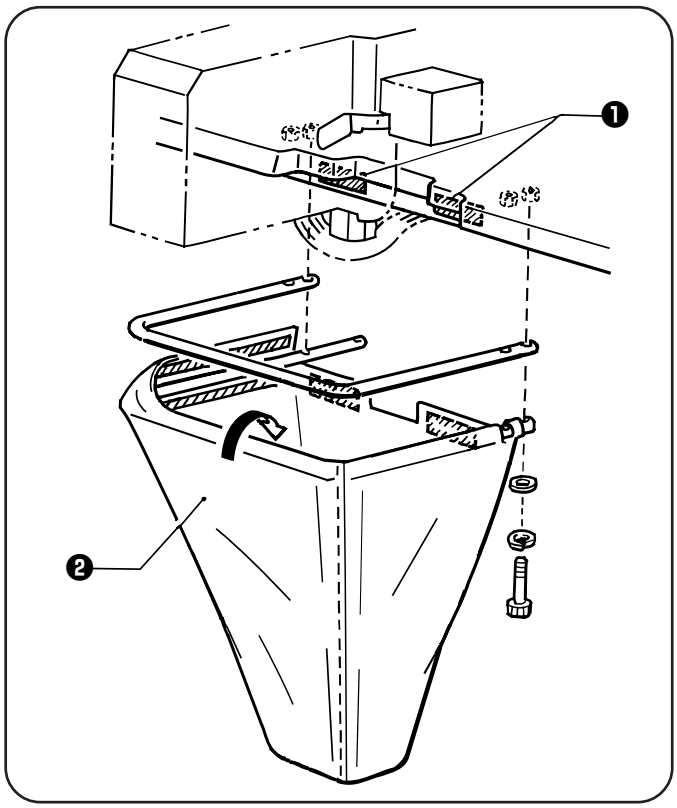

1. Loosen the bolts of loop sensor plate 1 ❺, loop sen sor plate 2 ❻ and the sensor ❹.
2. Move the sensor ❹ up and down so that the sensor light beam is aligned with the reflective surface ❽ of loop presser foot F ❼, and then find the position where the LED of the sensor ❹ illuminates steadily.

NOTE:

The appropriate distance between the reflective sur face ❽ of loop presser foot F ❼ and the sensor ❹ is 40 - 45 mm.

3. After adjusting, tighten the bolts.
4. Carry out actions such as setting and removing the belt loops and moving loop presser foot F ❼, and check that the LED illuminates steadily.

## 11-5. Clipping disposal funnel assembly ····· (S41906-001)




1. Cut the magic tape ❶ into three pieces, and attach them to the power table.
2. Set the clipping disposal funnel ❷, then attach as shown in the figure.